Wetland Evaluation Report
for Luce Bayou Interbasin Transfer Project

Harris and Liberty Counties, Texas

Prepared for

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Chapter 1 - Introduction

The Luce Bayou Interbasin Transfer Project (Project) is a proposed 26-mile surface water conveyance project located in Liberty and Harris Counties, Texas. The project would be designed to transfer surface water from the Trinity River to Lake Houston. The purpose of this project would be to increase available water capacity that could be used to supply Harris County with potable water. The projected demand for this valuable resource continues to increase due to the pressures of an expanding population within the Houston Metropolitan Area. Water from Lake Houston, supplemented with additional capacity from the Trinity River, through the proposed Luce Bayou Project, could also meet future water demands in Montgomery County. It is anticipated that Montgomery County will eventually convert from primarily a groundwater supply to a surface water supply.

Wetlands are anticipated to be impacted as a result of the construction of the proposed project. In accordance with Section 404 of the Clean Water Act, authorization from the U.S. Army Corps of Engineers (USACE) is required prior to the placement or discharge of fill materials into these wetlands. The project will avoid and minimize impacts to wetlands to the greatest extent practicable. For unavoidable impacts, compensatory mitigation to offset these impacts must be developed. In order to address the need for this mitigation, several alternatives were considered. The preferred alternative includes the purchase of, and the preservation and enhancement of, the Harrison Tract. The Harrison tract is an approximately 3,000 acre tract of land located adjacent to the Trinity River in central Liberty County, Texas. The proposed Harrison Tract mitigation site contains approximately 1,202 acres of wetlands that have been previously delineated by natural resource professionals.

The purpose of this Wetland Evaluation Report is to provide an assessment of three different wetland evaluation models that could be used to analyze and compare the functions and services of preservation and enhancement of the proposed Harrison Tract mitigation site wetlands to those wetlands proposed to be impacted by construction of the surface water conveyance system along the proposed project alignment. This assessment will aid in establishing whether the preservation and enhancement of the proposed Harrison Tract mitigation site is acceptable compensation for the anticipated wetland impacts associated with the proposed project. Three different wetland evaluation models are discussed in this report: Wetland Evaluation Technique (WET) 2.0 Methodology, Hydrogeomorphic (HGM) Approach, and Modified Charleston Method. Wetland evaluation models determined to be adequate for evaluating the functions and values of the impacted wetlands and the proposed Harrison Tract mitigation site will be run to compare functions and values lost due to project construction to functions and values gained from compensatory mitigation. A brief summary each of these methodologies can be found below.

1.1 WET 2.0 Methodology

The WET 2.0 Methodology was developed by the Wetlands Research Program of the Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi (Adamus et al. 1987). The objective of the WET 2.0 Methodology is to provide an evaluation technique that:

(1) Assesses most of the recognized wetland functions and values;

(2) Is applicable to a wide variety of wetland types;

(3) Is reproducible and rapid (completed in one day or less); and

(4) Has a sound technical basis in the scientific literature.

The eleven wetland functions and services assessed in the WET 2.0 Methodology include: groundwater recharge, groundwater discharge, flood flow alteration, sediment stabilization, sediment/toxicant retention, nutrient removal/transformation, production export, wildlife diversity/abundance, aquatic diversity/abundance, recreation, and uniqueness/heritage. According to the model methodology, these functions and values are scored in terms of social significance and effectiveness and opportunity. Descriptions of the two evaluation types follow:

(1) Social Significance: This evaluation is comprised of two levels of assessment, Level 1 and Level 2. These levels assess the value of a wetland to society due to its special designations, potential economic value, and strategic location. Level 1 determines if the wetland is beneficial to society. Level 2 refines the probability rating for the uniqueness/heritage value assigned during the Level 1 assessment. This refinement is based on the relationship of the evaluated wetland to all other wetlands in the context region. For the purposes of this evaluation, only the Level 1 assessment was completed.

(2) Effectiveness and Opportunity: This evaluation has three levels of assessment, Level 1, Level 2, and Level 3. Effectiveness assesses the capability of a wetland to perform a function due to its physical, chemical or biological characteristics. Opportunity assesses the opportunity of a wetland to perform a function to its level of capability. The three successive levels of assessment build on previous levels to develop an increasingly detailed characterization of the wetland. Level 1 can be conducted in the office using publicly available natural resources data. Level 2 requires visiting the wetland site for observation and data collection. Level 3 requires detailed physical, chemical, and biological monitoring data from wetland sites.

Each function and value is assigned a qualitative probability rating of LOW, MEDIUM, or HIGH from which a quantitative quality point score (QPS) is calculated for the existing wetlands to be impacted by a project. The WET 2.0 Methodology has been used previously to determine quantitative values that could be used to establish compensatory mitigation by wetland mitigation banks in the USACE, Galveston District.

1.2 Hydrogeomorphic Approach

A hydrogeomorphic wetland classification system was first introduced by the USACE in 1993 (Brinson, 1993). The original work by Brinson was limited to the development of a wetland classification system. Based upon this hydrogeomorphic wetland classification system, the USACE later expanded it to include wetland functional assessments (Smith et al., 1995), or what is currently known as the HGM Approach. The HGM Approach assesses three main functions: hydrogeomorphic classification, reference wetlands/reference domain, and collection of scientific data for verification of models. Hydrogeomorphic classification encompasses four sub-areas: hydrogeomorphic setting, water source and transport vector, hydrodynamics/water chemistry, and soil properties. The main distinguishing characteristics of the HGM Approach are that it is one of the few methods currently designed for non-experts (Carletti et al. 2004) and it uses reference wetlands, which are parts of the landscape that can be continuously referenced. This acts to provide an educational setting to others performing the same assessment procedure. The HGM method is both quantitative and objective.

Two factors need special consideration when instituting the HGM method in a new region:

1) the time necessary to establish the reference wetlands, and

2) the amount of reference wetlands needed in areas with many regional subclasses.

Currently, the USACE Galveston District (SWG) has developed interim HGM methods designed specifically for wetlands found within the SWG, which includes all of Harris County. These interim HGM models are reduced versions of HGM that are more rapid and easily implemented than the more comprehensive HGM models. This interim HGM model also encompasses reference wetlands.

Benefits of the reduced interim HGM models are the regional and type-specificity of assessments. In addition, models can theoretically be run together when different wetland types exist within the area to be impacted. This is a vast improvement over other functional assessments both reviewed and discussed within this report. Interim HGM models also can be run on individual wetlands or groups of wetlands that have the same characteristic features. This gives flexibility in the assessment and allows the evaluator to determine the appropriateness of either “lumping or splitting” wetlands into group dependent upon their

dominant features. This is another feature of the interim HGM models that is not present in other assessment methods and is particularly useful in determining appropriate compensatory mitigation.

One negative aspect of the interim HGM model developed by the SWG is the lack of acceptability primarily due to the interim HGM's novelty. Currently, interim HGM models are still being finalized for wetlands within the SWG and not all models have been run to establish compensatory mitigation ratios. The appropriate interim HGM model to use is determined by the dominant hydrologic influence of the wetland system. The interim HGMs for Riverine systems are divided into models for herbaceous/shrub systems and forested systems. An interim HGM model has also been developed for Tidal Fringe systems.

1.3 Modified Charleston Method

The Modified Charleston Method is a standardized protocol developed by the USACE, Charleston District (Department of the Army, 2002) that is applicable to regulatory actions requiring compensatory mitigation. This method allows rapid calculation of credit value for proposed wetland mitigation plans and/or banks. The Modified Charleston Method is an evaluation technique considered appropriate when more rigorous, detailed studies are not considered practical or necessary. The Modified Charleston Method assesses eleven variables: type and duration of impacts, type and condition of impacted site, rarity of the impacted ecosystem, magnitude of impacts (cumulative effects), alterations to aquatic characteristics (soils, hydrology, vegetation), changes in functions and values (net improvement), monitoring and contingencies plans, kind of ecosystem compared to impacts, location (i.e. watershed and ecoregion) relative to impacts, preservation methods (i.e. restrictive covenenants, easements) and the degree of threat for preservation proposals.

The Standard Operating Procedure document for the Modified Charleston Method provides the user with ample guidance. The user is required to determine the most applicable qualitative description from a number of established criteria. Positive aspects of the Modified Charleston Method include simplicity and rapidity. Calculations also are well defined and relatively simple, as they only require filling out a standardized form and performing simple, pre-defined mathematical calculations to determine the final compensatory mitigation ratio. The Modified Charleston Method provides a reliable tool that developers and planners can use to compare mitigation options. This assessment method results in a credit calculation. Negative aspects of the Modified Charleston Method are that it does not truly address or assess any of the standard accepted wetland functions and values evaluated by other methods such as the WET 2.0 Methodology. Factors such as success criteria, monitoring plans, contingencies, and locations have little or no affect on the ratio.

The Modified Charleston Method, like the WET 2.0 Methodology, lacks regional specificity and has a more generalized approach to interpreting wetland functions and values. One shortcoming of the Modified Charleston Method is that it is not yet been designed to address preservation mitigation. An advantage of the Modified Charleston Method is that it includes credits for buffer habitat that is integral to functionality of adjacent wetlands. For the purposes of this report, the impacted wetland project credits were evaluated and then compared to wetland credits that would be impacted by potential silviculture activities on the proposed Harrison Tract mitigation site.

Chapter 2 - Methods

The relative value of the wetland areas within the proposed Harrison Tract mitigation site (Table 1) and the wetland areas proposed to be impacted within the proposed project alignment (Table 2) were evaluated using each of the three evaluation methodologies referenced above. In order to apply these methodologies to a scenario wherein the proposed mitigation was preservation and enhancement of existing wetland habitats, it was necessary to make several assumptions. A description of how each methodology was applied to the proposed project can be found in the sections below.

Table 1 – Wetland Types on the Proposed Harrison Tract Mitigation Site

Wetland Type	Size (Acres)
Forested (PFO)	1035
Emergent (PEM)	86
Scrub-Shrub (PSS)	81
TOTAL	1,202

*Wetland Type Classification is based on the United States Fish and Wildlife Deepwater Classification System (Cowardin, et. al, 1979)

Table 2 – Anticipated Project Impacts along the Proposed Alignment per Wetland Type

Wetland Type	Size (Acres)
PFO	117.01
PEM	56.12
PSS	25.55
Other	2.15
TOTAL	200.83

*Wetland Type Classification is based on the United States Fish and Wildlife Deepwater Classification System (Cowardin, et. al, 1979)

2.1 WET 2.0 Methodology

The WET 2.0 methodology was utilized in order to evaluate the relative value of the wetland areas within the proposed mitigation area against those that would be impacted by the project alignment. Typical wetlands within the proposed Harrison Tract mitigation site and along the project alignment were evaluated using the WET 2.0 methodology and then compared against one another. The regional priority for each function/value assessment was determined using the values established for the Greens Bayou Wetlands Mitigation Bank. While these figures may not accurately reflect the regional priorities for the actual project alignment and the Harrison Tract, they should provide a baseline from which the relative values of the wetland areas can be compared.

The Quality Point Scores (QPS) for each wetland area is calculated by dividing the sum of the total scores for Social Significance and Effectiveness derived from the WET 2.0 methodology by the sum of the maximum possible score for the wetlands, given their regional priorities. Wetland credits are calculated by multiplying the QPS by the impact acreage. It is anticipated that 200.83 acres of wetlands will be impacted by construction activities along the proposed alignment. The proposed Harrison Tract mitigation site contains 1,202 acres of wetlands that are anticipated to be preserved and enhanced. The QPS and calculated wetland credits for the proposed Luce Bayou alignment and the proposed Harrison Tract mitigation site can be found in Tables 3 and 4 below. Detailed datasheets depicting WET 2.0 methodology calculations are located in Appendix A.

Table 3 – Proposed Alignment Wetlands QPS and Wetland Credits using WET 2.0 Methodology

Function Value	Actual Score	Maximum Score	QPS (= Actual Score/Maximum Score)	Proposed Impacts (Acres)	Wetland Credits (= Impact Acerage x QPS)
Social Significance	49	63			
Effectiveness	42	78			
TOTAL	91	141	**0.645**	**200.83**	**129.54**

Table 4 – Proposed Harrison Tract Mitigation Site Wetlands QPS and Wetland Credits using WET 2.0 Methodology

Function Value	Actual Score	Maximum Score	QPS (= Actual Score/Maximum Score)	Acreage	Wetland Credits (= Impact Acreage x QPS)
Social Significance	53	63			
Effectiveness	42	78			
TOTAL	95	141	**0.674**	**1,202**	**810.15**

2.2 Interim Hydrogeomorphic Approach

In order to assess the function and value of the wetlands present within the proposed Harrison Tract mitigation site, the Interim HGM Riverine Model was used for each of the three wetland types identified within the project area (herbaceous, scrub/shrub, and forested). For the purposes of this evaluation, it was assumed that all wetlands within the proposed Harrison Tract mitigation site were within the 100-year Floodplain (Jayson Hudson, USACE, personal communication). Data collected for each of the wetland types (i.e. herbaceous, scrub/shrub and forested) was averaged together in order to provide a "typical" assessment of each wetland type. The functional capacity index (FCI) coefficient calculated for these averages was then multiplied by the acreage for each wetland type within the proposed Harrison Tract mitigation site in order to calculate the functional capacity units (FCUs) for the existing wetland habitats (wetland acreages were provided by AECOM). Wetland types and their associated acreages that are located on the proposed Harrison Tract mitigation site are depicted in Table 1.

Once the FCUs had been established for the existing wetland habitats, the interim HGM models for the same wetland areas were calculated again assuming that the areas had been impacted by silviculture. The FCUs that resulted from this hypothetical scenario were subtracted from the original FCUs in order to calculate the potential "Lift" that would result from preserving the proposed Harrison Tract mitigation site. The wetland-type specific results of this analysis can be found in the Tables 5 through 8 below:

Table 5 – Herbaceous Wetlands Interim HGM Analysis

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.76	65.36	0.74	63.64	**1.72**	**0.02**
Maintenance	0.50	43.00	0.45	38.70	**4.30**	**0.05**
Removal	0.65	55.90	0.63	54.18	**1.72**	**0.02**

Table 6 – Scrub/Shrub Wetlands Interim HGM Analysis

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.65	52.65	0.32	25.92	**26.73**	**0.33**
Maintenance	0.83	67.23	0.15	12.15	**55.08**	**0.68**
Removal	0.65	52.65	0.52	42.12	**10.53**	**0.13**

Table 7 – Forested Wetlands Interim HGM Analysis

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.87	900.45	0.55	569.25	**331.20**	**0.32**
Maintenance	0.74	765.90	0.13	134.55	**631.35**	**0.61**
Removal	0.91	941.85	0.68	703.80	**238.05**	**0.23**

A comparison of the existing FCUs and the impacted FCUs, depicted in Table 9, yields the total "Lift" associated with theoretical impacts of silvicultural activities to the wetlands at the proposed Harrison Tract mitigation site. The total "Lift", in terms of percentage, is also examined.

Table 8 – Total Lift (FCU) Gained Using Interim HGM Analysis

	FCU Existing (Total)	FCU Impacted (Total)	Total Lift (FCU)	Total Lift (%)
Storage	1,018.46	658.81	**359.65**	**35.3**
Maintenance	876.13	185.40	**690.73**	**78.8**
Removal	1,050.40	800.10	**250.30**	**23.8**
Total	2,944.99	1,644.31	**1,300.68**	**44.2**

2.3 Modified Charleston Method

The Modified Charleston Method was used to compare the quality of wetland areas within the proposed Harrison Tract mitigation site against those identified along the project alignment. Impacted wetland credits were then calculated based on the most recently estimated project impacts per wetland type as displayed in Table 2.

The dominant impact for the wetland areas along the alignment was assumed to be fill activities over duration of 10 years, a likely scenario given the construction of a conveyance channel and access roads. An average cumulative impact was assumed given the habitat fragmentation that would result from the proposed project.

The wetland acreages used for the area within the proposed Harrison Tract mitigation site were provided by AECOM and are identical to those used during the interim HGM analysis. The dominant impact for wetlands within the proposed Harrison Tract mitigation site was assumed to be clearing activities over a duration of 10 years, a likely scenario assuming silvicultural activities on the property. A minimal cumulative impact was assumed for these areas. The results of the Modified Charleston Method can be seen in Table 9. Detailed datasheets depicting Modified Charleston Method are located in Appendix C.

Table 9 – Calculated Impacted Wetland Area Credits using Modified Charleston Method

Alignment Impacts		**Harrison Tract – Silvicultural Impacts**	
Wetland Type	Credits	Wetland Type	Credits
PEM	365.06	PEM	515.14
PSS	166.20	PSS	532.98
PFO	1,158.98	PFO	11,281.50
Other	13.99	Other	0.00
Total	**1,704.23**	**Total**	**12,329.62**

*Wetland Type Classification is based on the United States Fish and Wildlife Deepwater Classification System (Cowardin, et. al, 1979)

Chapter 3 - Results and Conclusions

All three of the methodologies utilized in this preliminary evaluation of wetland quality within the project area illustrate the relative value of the proposed Harrison Tract mitigation site. The threat of silvicultural activities to the proposed Harrison Tract mitigation site is likely, given the sites past silvicultural activities. The proposed Harrison tract mitigation site has been logged in the past and properties directly adjacent to the proposed Harrison Tract mitigation site, including areas within the proposed alignment, are currently logged. The ""Lift"" calculated, assuming this threat, demonstrates the potential loss of wetland function and value within this area and highlights the prospective benefit of preserving and enhancing wetlands in this area.

The WET 2.0 methodology results suggest the relative importance of the wetlands on the proposed Harrison Tract mitigation site when compared to those within the project alignment. There is a direct correlation between credits and wetland functions and services. Wetlands that are proposed for preservation and enhancement on the proposed Harrison Tract mitigation site were calculated to contain more than 6.25 times more credits than those wetlands that are proposed to be impacted along the alignment. Although the assessment areas designated for each of these calculations were not wetland case-specific, calculations should provide for a fairly accurate representation of the wetlands within both the proposed Harrison Tract mitigation site and the project alignment. The difference in the QPS between the wetlands within the project alignment (0.64) and those within proposed Harrison Tract mitigation site (0.67) suggest an increased Social Significance and Effectiveness of the proposed Harrison Tract mitigation site wetlands. This further demonstrates that the proposed Harrison Tract mitigation site wetlands exhibit higher functions and services to those wetlands located along the proposed project alignment.

The interim HGM analysis was utilized to exhibit the importance of preserving and enhancing the wetlands on the proposed Harrison Tract mitigation site. Analysis was conducted assuming that silvicultural activities were likely to impact the wetlands on the Harrison Tract if it was not utilized for compensatory mitigation as part of this project. The total "Lift" associated with the existing conditions of the wetlands on the proposed Harrison Tract mitigation site is 44.2% higher than the value associated with wetland impacts due to the inherent threat of silvicultural activities. This evaluation demonstrates the relative importance of the wetlands on the proposed Harrison Tract mitigation site. Preservation and enhancement of these wetlands would provide high ecological functions and services to the surrounding ecosystem.

The wetland credits calculated using the Modified Charleston Method indicated that the wetlands located within the proposed Harrison Tract mitigation site provide increased functions and services than those located along the project corridor. The calculated value of silvicultural impacts to wetlands within the proposed Harrison Tract mitigation site (12,329.62 credits) is approximately 7.2 times greater than those permanent wetland impacts proposed along the alignment (1,704.23 credits). Based upon preliminary discussions with the USACE, the Modified Charleston Method would not be utilized as the primary methodology to determine the suitability of the proposed mitigation. Application of the Modified Charleston Method demonstrates that the anticipated compensatory mitigation at the proposed Harrison Tract mitigation site would provide higher ecological functions and services than the proposed impacts within the project alignment.

In summary, the results of this preliminary evaluation indicate that all three wetland assessment methodologies that were examined for this report agree that the wetlands within the proposed Harrison tract mitigation site are likely of higher quality and of more Social and Ecological Significance than those located along the proposed project alignment. While the results of each method cannot be directly compared to one another, each individually contributes to the argument that preservation and enhancement of wetlands on the proposed Harrison Tract mitigation site are of greater value than those proposed to be impacted by the project alignment. Further analysis and agency coordination is required in order to establish whether preservation and enhancement of the proposed Harrison Tract mitigation site is acceptable compensation for the impacts to wetlands that will result from the proposed project.

Chapter 4 - Literature Cited

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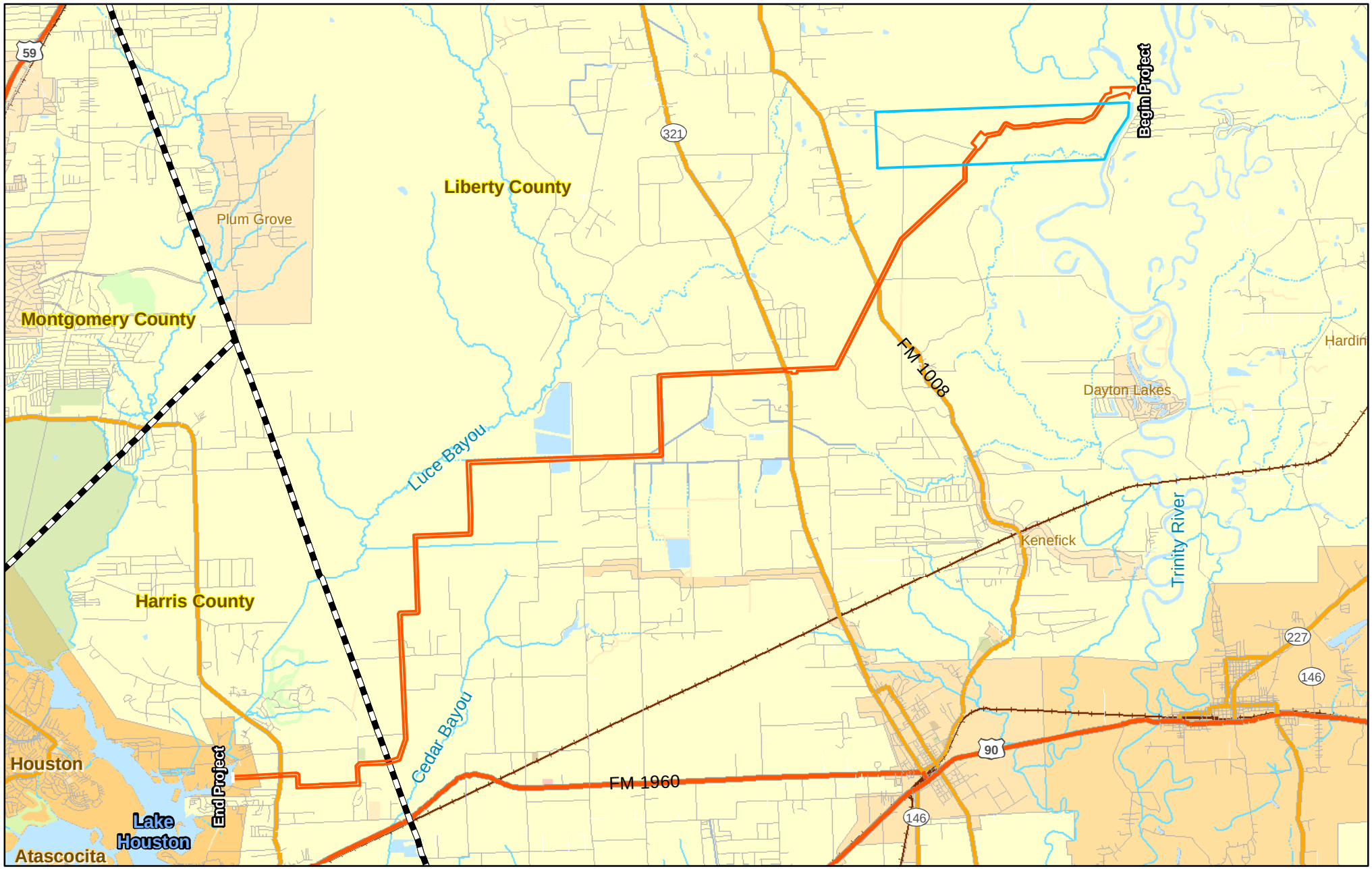
Exhibits



N

0 6,250 12,500 Feet

Proposed Project Alignment
Proposed Harrison Tract Mitigation Site
County Line

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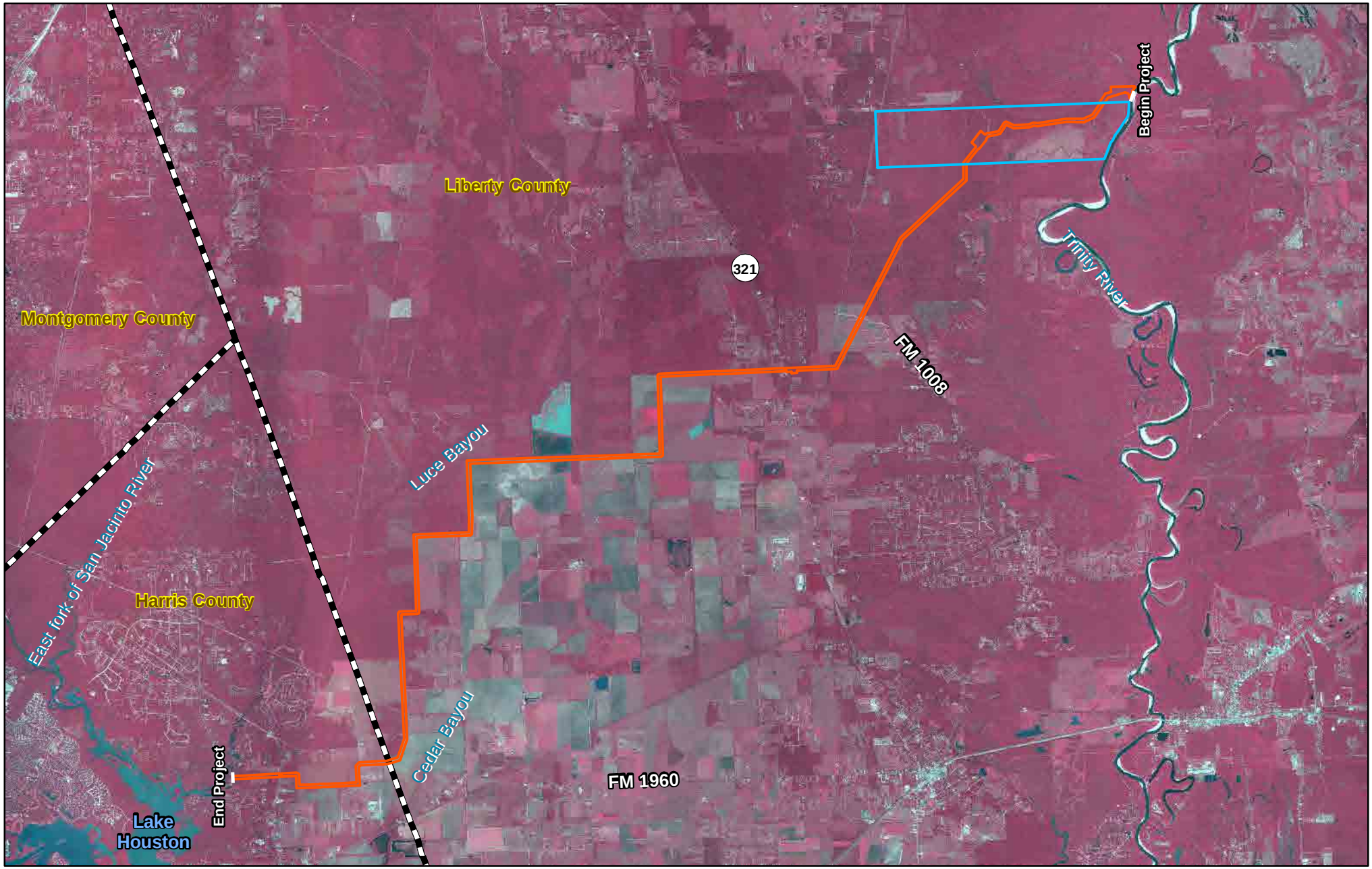
1/28/2010

AECOM
Luce Bayou Interbasin Transfer Project

VICINITY
MAP

Harris, Liberty, and Montgomery Counties, Texas



N

0 6,250 12,500 Feet

Proposed Project Alignment
Proposed Harrison Tract Mitigation Site
County Line

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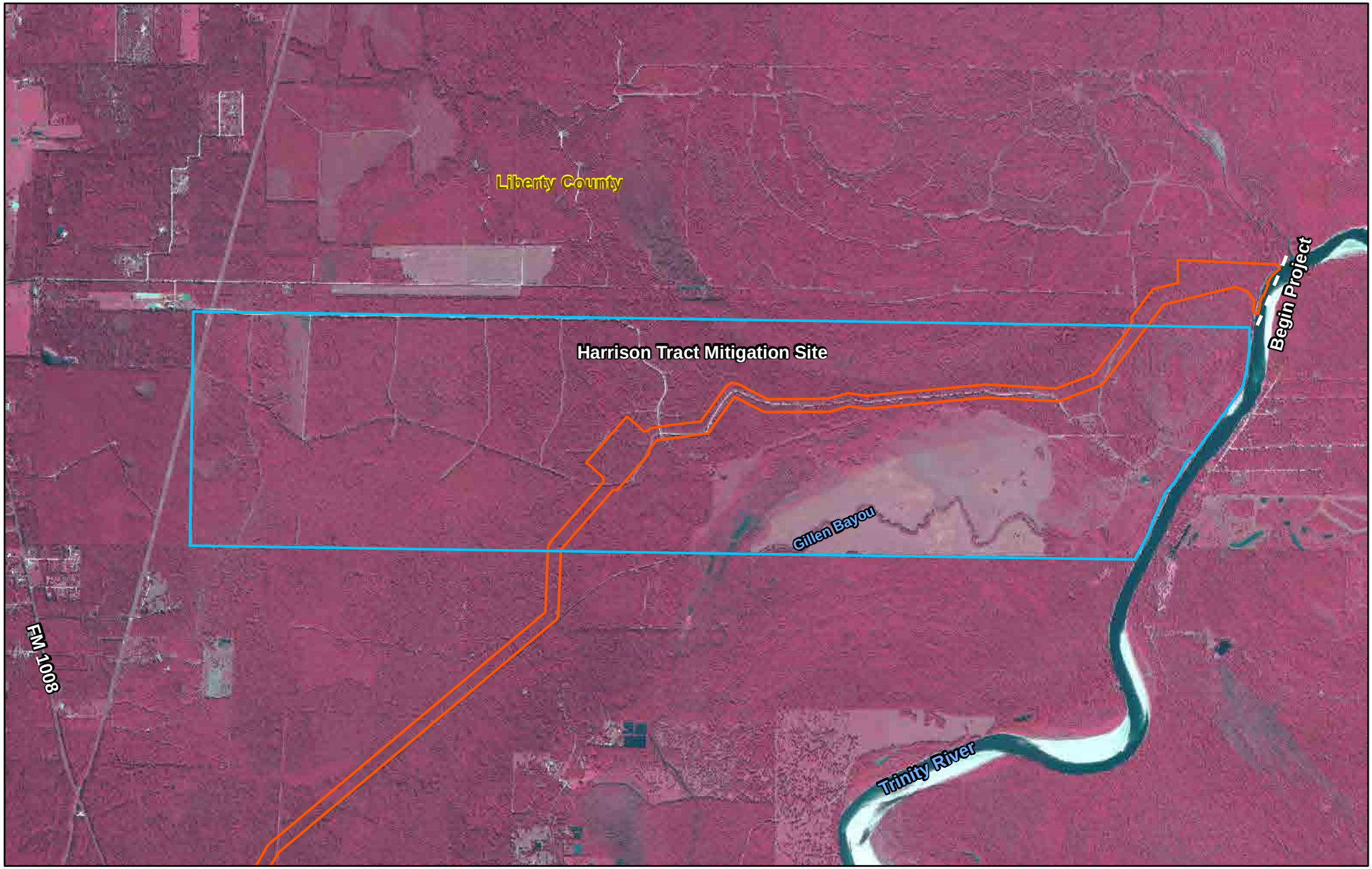
2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY AND HARRISON TRACT DATA OVERLAYS

Harris, Liberty, and Montgomery Counties, Texas
1 of 5



N

0 1,500 3,000 Feet

Proposed Project Alignment
Proposed Harrison Tract Mitigation Site

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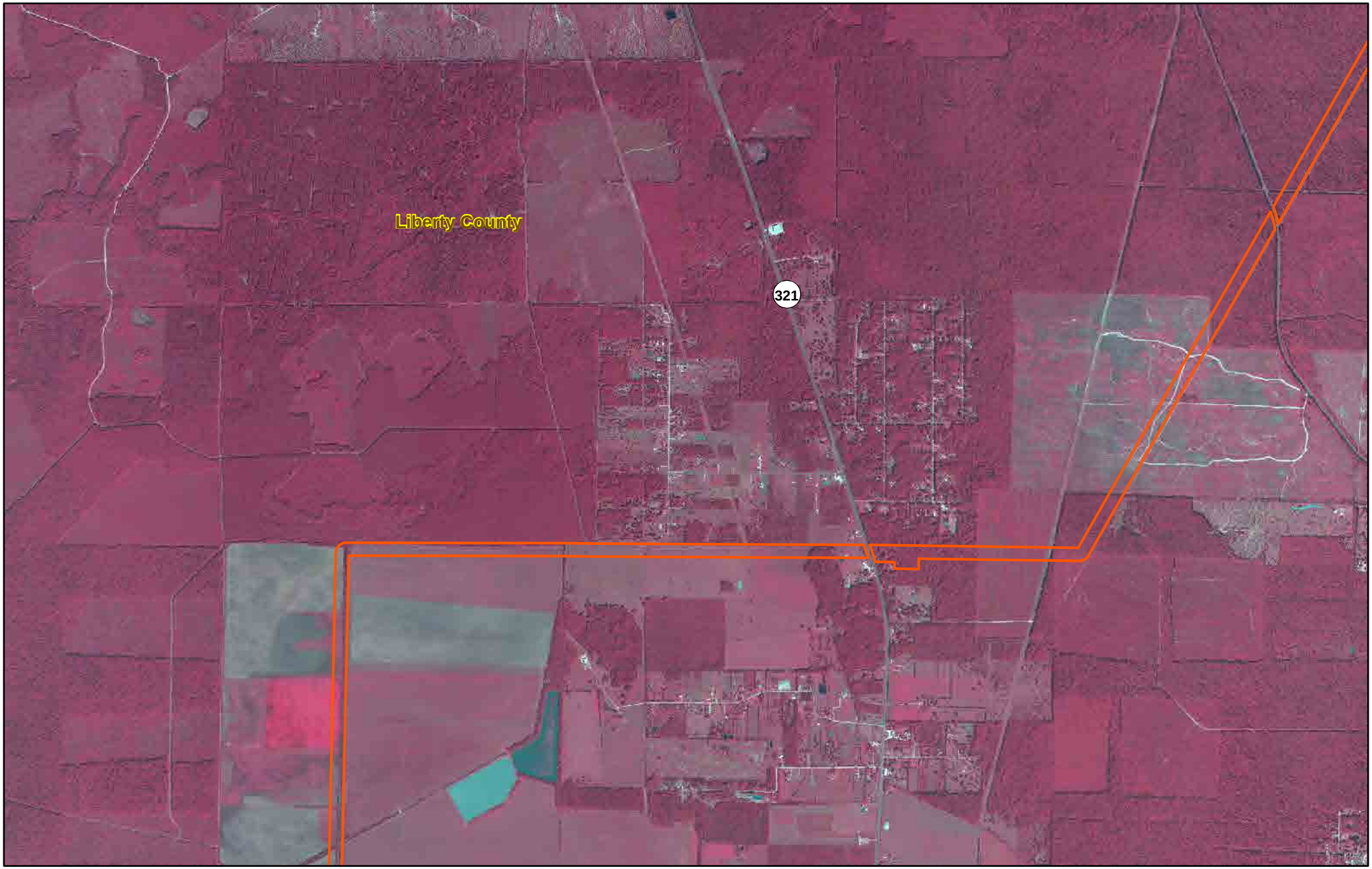
2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY AND HARRISON TRACT DATA OVERLAYS

Harris and Liberty Counties, Texas
2 of 5



N

0 1,500 3,000 Feet

Proposed Project Alignment
Proposed Harrison Tract Mitigation Site

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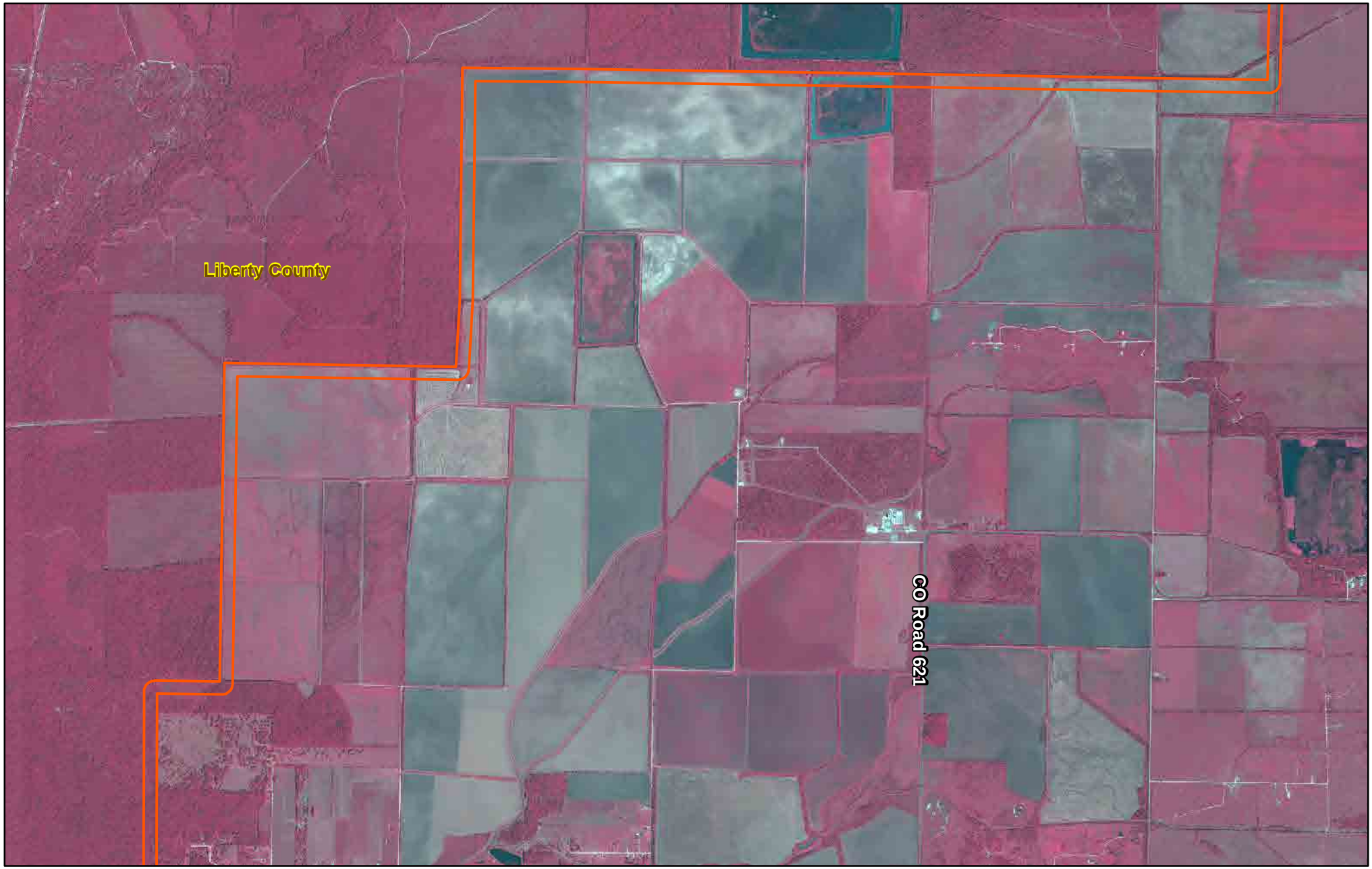
2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY AND HARRISON TRACT DATA OVERLAYS

Harris and Liberty Counties, Texas
3 of 5



N

0 1,500 3,000 Feet

Proposed Project Alignment
Proposed Harrison Tract Mitigation Site

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Luce Bayou Interbasin Transfer Project

2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY AND HARRISON TRACT DATA OVERLAYS

Harris and Liberty Counties, Texas
4 of 5

N

0 1,500 3,000 Feet

Proposed Project Alignment
Proposed Harrison Tract Mitigation Site
County Line

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1/28/2010

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Luce Bayou Interbasin Transfer Project

2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY AND HARRISON TRACT DATA OVERLAYS

Harris and Liberty Counties, Texas
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Appendix A

WET 2.0 Methodology Datasheets

WET 2.0 Methodology
Quality Point Score/Credit Calculation Worksheet
Alignment Impacts

Social Significance

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Moderate	2
Groundwater Discharge (GWD)	1	3	High	3
Flood Flow Alteration (FFA)	3	9	Moderate	6
Sediment Stabilization	3	9	Moderate	6
Sediment Toxicant Removal	3	9	Moderate	6
Nutrient/Removal Transformation (NRT)	2	6	Moderate	4
Wildlife Divirsity/Abundance (WDA)	3	9	High	9
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	6
Uniqueness/Heritage (UH)	2	6	High	6
Recreational	1	3	Low	1
Total Significance score		63		49

Effectiveness

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Low	1
Groundwater Discharge (GWD)	1	3	Low	1
Flood Flow Alteration (FFA)	3	9	Moderate	6
Sediment Stabilization	3	9	Moderate	6
Sediment Toxicant Removal	3	9	Low	3
Nutrient/Removal Transformation (NRT)	2	6	Low	2
Production Export (PE)	2	6	Moderate	4
Wildlife Divirsity/Abundance for Breeding (WDAB)	3	9	Low	3
Wildlife Divirsity/Abundance for Migration (WDAM)	3	9	Moderate	6
Wildlife Divirsity/Abundance for Wintering (WDAW)	3	9	Moderate	6
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	4
Total Effectiveness score		78		42

Quality Point Score (QPS)

Function Value	Actual Score	Maximum Score	QPS
Social Significance	49	63	
Effectiveness	42	78	
Total	91	141	**0.645**

* Uncertain values are scored the same as Low values.

Wetland Credits

QPS	Impact Acreage	Wetland Credits
0.645	200.83	**129.54**

WET 2.0 Methodology
Quality Point Score/Credit Calculation Worksheet
Proposed Harrison Tract Mitigation Site

Social Significance

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Moderate	2
Groundwater Discharge (GWD)	1	3	High	3
Flood Flow Alteration (FFA)	3	9	High	9
Sediment Stabilization	3	9	High	9
Sediment Toxicant Removal	3	9	Moderate	6
Nutrient/Removal Transformation (NRT)	2	6	Moderate	4
Wildlife Divirsity/Abundance (WDA)	3	9	High	9
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	4
Uniqueness/Heritage (UH)	2	6	High	6
Recreational	1	3	Low	1
Total Significance score		63		53

Effectiveness

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Low	1
Groundwater Discharge (GWD)	1	3	Low	1
Flood Flow Alteration (FFA)	3	9	Moderate	6
Sediment Stabilization	3	9	Moderate	6
Sediment Toxicant Removal	3	9	Low	3
Nutrient/Removal Transformation (NRT)	2	6	Low	2
Production Export (PE)	2	6	Moderate	4
Wildlife Divirsity/Abundance for Breeding (WDAB)	3	9	Low	3
Wildlife Divirsity/Abundance for Migration (WDAM)	3	9	Moderate	6
Wildlife Divirsity/Abundance for Wintering (WDAW)	3	9	Moderate	6
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	4
Total Effectiveness score		78		42

Quality Point Score (QPS)

Function Value	Actual Score	Maximum Score	QPS
Social Significance	53	63	
Effectiveness	42	78	
	95	141	**0.674**

* Uncertain values are scored the same as Low values.

Wetland Credits

QPS	Acreage	Wetland Credits
0.674	1,202	**810.15**

Appendix B

Interim HGM Approach Datasheet

Interim HGM Analysis
Proposed Harrison Tract Mitigation Site (Silviculture Impacts)

Summary

Vegetation Type	Acreage	FCI Existing			FCI Impacted		
		Storage	Maintanence	Removal	Storage	Maintanence	Removal
Herbaceous	86	0.76	0.50	0.65	0.74	0.45	0.63
Scrub Shrub	81	0.65	0.83	0.65	0.32	0.15	0.52
Forested	1035	0.87	0.74	0.91	0.55	0.13	0.68

Herbaceous Wetlands In Floodplain

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.76	65.36	0.74	63.64	**1.72**	**0.02**
Maintanence	0.50	43.00	0.45	38.70	**4.30**	**0.05**
Removal	0.65	55.90	0.63	54.18	**1.72**	**0.02**

Scrub/Shrub Wetlands In Floodplain

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.65	52.65	0.32	25.92	**26.73**	**0.33**
Maintanence	0.83	67.23	0.15	12.15	**55.08**	**0.68**
Removal	0.65	52.65	0.52	42.12	**10.53**	**0.13**

Forested Wetlands In Floodplain

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.87	900.45	0.55	569.25	**331.20**	**0.32**
Maintanence	0.74	765.90	0.13	134.55	**631.35**	**0.61**
Removal	0.91	941.85	0.68	703.80	**238.05**	**0.23**

Total Lift (FCU)

Storage	**359.65**
Maintanence	**690.73**
Removal	**250.30**
Total	**1300.68**

Appendix C

Modified Charleston Method Datasheets

Modified Charleston Method
Alignment Impacts
Mitigation Credits Worksheet

Factor	Area 1 - PEM	Area 2 - PSS	Area 3 - PFO	Area 4 - Other
Priority Category Primary: r = 3.0 Secondary: r = 2.0 Tertiary: r = 1.0 Low: r = 0.5	1	1	3	1
Existing Vegetative Condition Class 1: r = 3.0 Class 2: r = 2.4 Class 3: r = 1.0 Class 4: r = 0.5 Class 5: r = 0.1	1	1	2.4	1
Existing Hydrologic Condition Class 1: r = 3.0 Class 2: r = 2.4 Class 3: r = 1.0 Class 4: r = 0.5 Class 5: r = 0.1	1	1	1	1
Duration 0 to 1 yr: r = 0.0 1 to 3 yr: r = 0.1 3 to 5 yr: r = 0.5 5 to 10 yr: r = 0.5 Over 10 yr: r = 1.0	1	1	1	1
Dominant Impact Clear: r = 0.5 Draining: r = 2.0 Dredge: r = 2.5 Fill: r = 2.5 Impound: r = 1.5 Shading: r = 1 Beneficial Alteration: r = 0	2.5	2.5	2.5	2.5
Cumulative Impact High: y = 0.025 Medium: y = 0.005 Low: y = 0.001	0.005	0.005	0.005	0.005
Sum of R Factors	6.505	6.505	9.905	6.505
Size in Acres	56.12	25.55	117.01	2.15
Credits = R * AA =	365.06	166.20	1158.98	13.99

Credits Impacted By Project = 1704.23

Modified Charleston Method

Proposed Harrison Tract Mitigation Site (Silviculture Impacts)

Mitigation Credits Worksheet

Factor	Area 1 - PEM	Area 2 - PSS	Area 3 - PFO
Priority Category Primary: r = 3.0 Secondary: r = 2.0 Tertiary: r = 1.0 Low: r = 0.5	1	1	3
Existing Vegetative Condition Class 1: r = 3.0 Class 2: r = 2.4 Class 3: r = 1.0 Class 4: r = 0.5 Class 5: r = 0.1	1	1	2.4
Existing Hydrologic Condition Class 1: r = 3.0 Class 2: r = 2.4 Class 3: r = 1.0 Class 4: r = 0.5 Class 5: r = 0.1	2.4	3	3
Duration 0 to 1 yr: r = 0.0 1 to 3 yr: r = 0.1 3 to 5 yr: r = 0.5 5 to 10 yr: r = 0.5 Over 10 yr: r = 1.0	1	1	1
Dominant Impact Clear: r = 0.5 Draining: r = 2.0 Dredge: r = 2.5 Fill: r = 2.5 Impound: r = 1.5 Shading: r = 1 Beneficial Alteration: r = 0	0.5	0.5	0.5
Cumulative Impact High: y = 0.025 Medium: y = 0.005 Low: y = 0.001	0.09	0.08	1
Sum of R Factors	5.99	6.58	10.9
Size in Acres	86	81	1035
Credits = R * AA =	515.14	532.98	11281.50

Credits Impacted By Silviculture = 12,329.62

Preliminary Threatened and Endangered Species Evaluation and Habitat Assessment

Luce Bayou Interbasin Transfer Project
Liberty and Harris County, Texas

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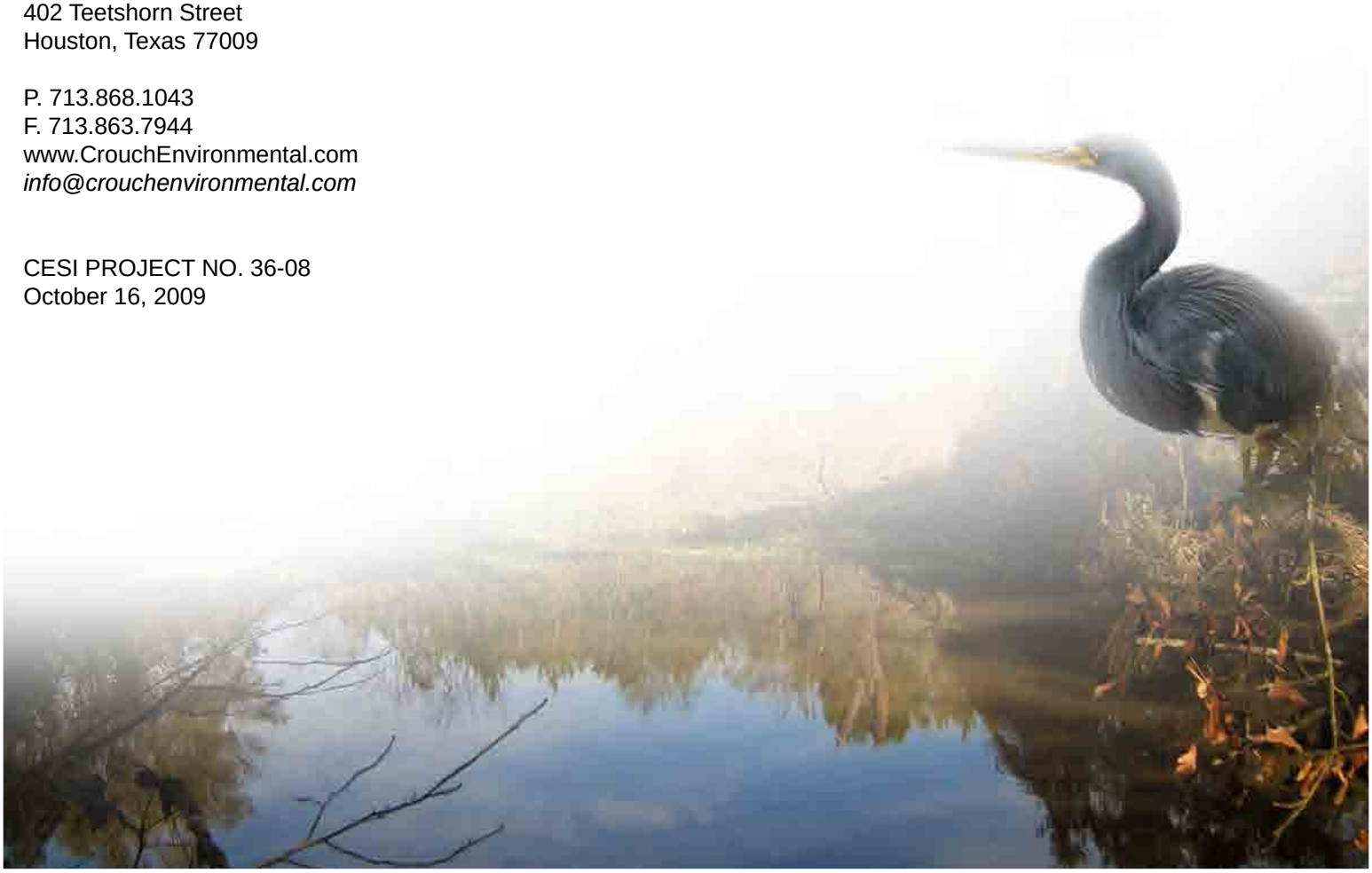
CESI PROJECT NO. 36-08
October 16, 2009



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1.1 Purpose of Proposed Project

The Luce Bayou Interbasin Transfer Project (LBITP) is a proposed 26-mile long conveyance project designed to transfer surface water from the Trinity River to Lake Houston. The proposed project will include approximately three miles of underground pipelines and approximately 26 miles of exposed conveyance channel within a 300-foot wide right-of-way (ROW). The purpose of this project is to increase the available potable water supply for Harris County as demand increases over time. In addition, water from Lake Houston, supplemented with supply from the Trinity River through the LBITP, may also play a role in providing for future demands in Montgomery County, as this area converts from primarily a groundwater supply to a surface water system.

Currently, the proposed project alignment will affect several different habitat types and vegetative communities. In accordance with the Endangered Species Act (ESA) and the National Environmental Policy Act (NEPA), an evaluation of these areas to establish the presence or likely presence of threatened and endangered species and/or species of concern must be performed prior to construction.

The purpose of this Memorandum of Findings (MOF) is to provide an assessment of the habitat types, vegetative communities, and presence or likely presence of threatened and endangered species and/or critical habitat along the proposed LBITP alignment. The results presented in this MOF represent data collected during field investigations, obtained from publically available databases and Geographic Information Systems (GIS) based analysis.

1.2 Methodology

The approximately 26-mile long project area was inspected by two qualified biologists throughout the spring and summer of 2009. The project area includes the proposed Capers Ridge Pump Station and the Harrison Tract located near the proposed project terminus at the Trinity River. The entire project area is located within the Austroriparian biotic province (Blair, 1950). Analysis/characterization of habitat and habitat impacts, species specific habitat analysis/characterization, and presence/absence surveys for threatened and/or endangered species were performed in a manner consistent with that utilized by other firms conducting similar activities. The United States Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD) threatened and endangered species lists were reviewed prior to the project study. Plant identification resources utilized for this project are identified in the References section of this report.

During the project survey, all habitats and vegetation observed within and adjacent to the project boundaries were analyzed and recorded. Any areas identified as potential habitat for threatened and/or endangered species were mapped using Global Positioning System (GPS)/GIS technology. These areas are described in more detail below. A map of these areas with vegetation type overlays can be found in the Exhibits.

1.3 Habitat Types with the Proposed Project

Nine dominant habitat types were observed within and along the project alignment. The following describes these habitat types and the dominant vegetation observed in these areas. The acreages listed include habitats within the Capers Ridge Pump Station and the Harrison Tract. A graphic depiction of the location of these habitats can be found in the Exhibits.

Hardwood Forests – 1,979.96 acres total
These areas are located throughout the project area and area characterized by dense vegetation (greater than 60 percent relative cover) with moderate (between 30 and 60 percent relative cover) scrub/shrub and herbaceous cover. The typical dominant vegetation found within these areas consists of willow oak

(*Quercus phellos*), water oak (*Quercus nigra*), swamp chestnut oak (*Quercus michauxii*), common hackberry (*Celtis occidentalis*), sweetgum (*Liquidambar styraciflua*), cedar elm (*Ulmus crassifolia*), American elm (*Ulmus americana*), yaupon (*Ilex vomitoria*), overcup oak (*Quercus lyrata*), Chinese tallow (*Triadica sebifera*), green ash (*Fraxinus pennsylvanica*), green hawthorn (*Crataegus viridis*) , and water hickory (*Carya aquatica*). The herbaceous and vine strata were dominated by dwarf palmetto (*Sabal minor*), Cherokee sedge (*Carex cherokeensis*), saw greenbrier (*Smilax bona-nox*), trumpet creeper (*Campsis radicans*), Japanese climbing fern (*Lygodium japonicum*), muscadine (*Vitis rotundifolia*), Canadian blacksnakeroot (*Sanicula canadensis*), Indian strawberry (*Duchesnea indica*), and Indian woodoats (*Chasmanthium latifolium*).

Tallow Dominated Forests – 96.28 acres total
These areas are characterized by dense Chinese tallow mid-story and canopy coverage with moderate herbaceous cover. These areas are typically found along the alignment in sites that have either been exposed to silviculuture or other activities that disturbed the natural vegetation within the area. Dominant vegetation within these areas consists of Chinese tallow, water oak, willow oak, Cherokee sedge, spikerush (*Eleocharis* sp.), shortbristle horned beaksedge (*Rhynchospora corniculata*), anglestem beaksedge (*Rhynchospora caduca*), southern dewberry (*Rubus trivialis*), and woodrush flatsedge (*Cyperus entrerianus*).

Scrub/Shrub Areas – 17.22 acres total
These areas are characterized by dense scrub/shrub and herbaceous cover with limited to no (less than ten percent relative cover) tree species. These areas have typically been impacted or forested in the past and then allowed to revegetate to a point where a dense mid-story is now present. Typical dominant vegetation within these areas consists of Chinese tallow, poisonbean (*Sesbania drummondii*), buttonbush (*Cephalanthus occidentalis*), woodrush flatsedge, yaupon, anglestem beaksedge, common rush (*Juncus effusus*), Canadian blacksnakeroot, and poison ivy (*Toxicodendron radicans*).

Pine Dominated Forests – 485.76 acres total
These areas are characterized by a dense canopy cover of greater than 50 percent loblolly pine (*Pinus taeda*). These areas typically have a moderate mid-story and herbaceous coverage and may occupy areas that have been forested in the past. The dominant vegetation within these areas consists of loblolly pine, yaupon, water oak, saw greenbrier, southern dewberry, trumpet creeper, poison ivy, buttonbush, and dwarf palmetto.

Pasture/Cropland – 468.39 acres total
These areas have been impacted to some degree by agriculture within the past 10 years. They are characterized by dense herbaceous cover with little to no upper and mid-story coverage. Dominant species observed within these areas consists of brownseed paspalum (*Paspalum plicatulum*), dallisgrass (*Paspalum dilatatum*), common carpetgrass (*Axonopus fissifolius*), Bermudagrass (*Cynodon dactylon*), Vasey's grass (*Paspalum urvillei*), turkey tangle fogfruit (*Phyla nodiflora*), Indian strawberry, woodrush flatsedge, Cherokee sedge, Indian woodoats, broomsedge bluestem (*Andropogon virginicus*), switchgrass (*Panicum virgatum*), and white clover (*Trifolium repens*).

Herbaceous Uplands – 337.75 acres total
These areas are characterized by little or no canopy cover, little to no mid-story and dense herbaceous coverage. These areas may have been agricultural fields or pastureland, but have been left fallow for at least 5 years. The dominant species observed within these areas consists of brownseed paspalum, southern dewberry, erect centella (*Centella erecta*), turkey tangle fogfruit, broomsedge bluestem, dwarf palmetto, field burrweed (*Soliva sessilis*), anglestem beaksedge, switchgrass, woodrush flatsedge, smut grass (*Sporobolus indicus*), Vasey's grass, forked rush (*Juncus dichotomus*), Brazilian vervain (*Verbena brasiliensis*), white clover, Bermudagrass, dogfennel (*Eupatorium capillifolium*), and annual bluegrass (*Poa annua*).

Herbaceous Wetlands – 53.35 acres total

These areas are characterized by little or no canopy cover with a little to no mid-story and a dominance of herbaceous vegetation. They are primarily found within wetland areas that have been cleared for pastureland, agricultural fields, or silviculture. The dominant species observed within these areas consists of sand spikerush (*Eleocharis montevidensis*), needlegrass rush (*Juncus roemerianus*), common rush, needlepod rush (*Juncus scirpoides*), bulltongue arrowhead (*Sagittaria lancifolia*), narrowleaf cattail (*Typha angustifolia*), erect centella, woodrush flatsedge, swamp smartweed (*Polygonum hydropiperoides*), shortbristle horned beaksedge, redtop panicgrass (*Panicum rigidulum*), marsh seedbox (*Ludwigia palustris*), and herb of grace (*Bacopa monnieri*).

Forested Wetlands – 544.56 acres total
Forested wetlands within the project areas are categorized by dense canopy coverage with little to no midstory and herbaceous vegetation. Pockets of open water may be present in these areas. The dominant vegetation observed within these areas consists of bald cypress (*Taxodium distichum*), willow oak, water oak, green ash, cedar elm, sweetgum, water locust (*Gleditsia aquatica*), water hickory, river birch (*Betula nigra*), black willow (*Salix nigra*), Chinese tallow, red maple (*Acer rubrum*), overcup oak, and swamp chestnut oak.

Aquatic Areas – 13.85 acres total
Aquatic areas within the project area are characterized by the absence of vegetation and the presence of standing and/or flowing throughout the year. The aquatic areas identified within the project area include the Trinity River, Luce Bayou, Gillen Bayou, unnamed creeks, and man-made features.

1.4 Vegetation Types within the Proposed Project

Based on the *Vegetation Types of Texas* (McMahan, et.al. 1984), the LBITP is located within two different ecological areas of Texas: the Pineywoods and Gulf Prairies and Marshes. Seven vegetation types, *Water Oak-Elm-Hackberry Forest, Bald Cypress-Water Tupelo Swamp, Willow Oak-Water Oak-Blackgum Forest, Young Forest-Grassland, Pine-Hardwood Forest,* and *Crops* were identified within the project limits. A description of these vegetation types can be found below.

Water Oak-Elm-Hackberry Forests occur in the upper floodplains of the Sulphur, Neches, Angelina, Trinity and Sabine Rivers in the Pineywoods of east Texas (McMahan, et.al. 1984). The dominant plant species for this vegetation type are cedar elm, American elm, willow oak, southern red oak, white oak (*Quercus alba*), black willow, cottonwood (*Populus deltoides*), red ash, sycamore, pecan (*Carya* sp.), Osage orange (*Maclura pomifera*), flowering dogwood (*Cornus florida*), southern dewberry, coralberry (*Symphoricarpos orbiculatus*), dallisgrass, switchgrass, rescuegrass (*Bromus catharticus*), Bermudagrass, eastern gamagrass (*Tripsacum dactyloides*), Virginia wildrye (*Elymus virginiana*), Johnsongrass (*Sorghum halepense*), great ragweed (*Ambrosia trifida*), and yankeeweed (*Eupatorium compositifolium*).

Bald Cypress-Water Tupelo Swamps occur in swampy flatlands of the Pineywoods. The dominant plant species for this vegetation type are water oak, water hickory, swamp tupelo (*Nyssa aquatica*), red maple, swampprivet (*Forestiera* sp.), buttonbush, possomhaw (*Ilex decidua*), water elm (*Ulmus* sp.), black willow, Alabama supplejack (*Berchemia scandens*), trumpet creeper, climbing hempweed (*Mikania scandens*), bog hemp (*Boehmeria* sp.), water fern (*Ceratopteris* sp.), duckweed (*Lemna* sp.), water hyacinth (*Eichhornia* sp.), bladderwort (*Utricularia* sp.), beggarticks (*Bidens* sp.), water papspalum (*Paspalum hydrophilum*), and St. Johnswort (*Hypericum* sp.).

Willow Oak-Water Oak-Blackgum Forests occur in the lower floodplains of the Sulphur, Neches, Angelina, Trinity and Sabine Rivers in the Pineywoods. The dominant plant species for this vegetation type are beech (*Fagus* sp.), overcup oak, cherry bark oak (*Quercus pagoda*), elm, sweetgum, sycamore, southern magnolia (*Magnolia grandiflora*), white oak, black willow, bald cypress, swamp laurel oak (*Quercus laurifolia*), hawthorn, palmetto (*Sabal* sp.), common elderberry (*Sambucus* sp.), southern arrowwood (*Viburnum dentatum*), poison oak (*Toxicodendron* sp.), Alabama supplejack, trumpet creeper, crossvine,

saw greenbrier, blackberry (*Rubus* sp.), copperleaf (*Acalypha* sp.), and St. Andrews cross (*Hypericum hypericoides*).

Young Forest-Grasslands occur throughout the Pineywoods. The plant communities commonly associated with this vegetation type consist of various combinations and classes of pine and regrowth southern red oak, sweetgum, post oak, white oak, black hickory (*Carya texana*), blackgum (*Nyssa sylvatica*), elm, hackberry, and water oak resulting from recent harvesting of pine or pine-hardwood forest and subsequent establishment of young pine plantation or young pine hardwood forest. Shrubs include hawthorn, poison oak, sumac (*Rhus* sp.), holly (*Ilex* sp.), wax myrtle (*Morella cerifera*), blueberry (*Vaccinium* sp.), blackberry, and red bay (*Persea borbonia*).

Pine-Hardwood Forests occur throughout the Pineywoods. The dominant plant species for this vegetation type are loblolly pine, water oak, white oak, southern red oak, winged elm, beech, blackgum, southern magnolia, American beautyberry (*Callicarpa americana*), American hornbeam (*Carpinus caroliniana*), flowering dogwood, yaupon, hawthorn, Alabama supplejack, Virginia creeper (*Parthenocissus quinquefolia*), wax myrtle, sassafrass (*Sassafras albidum*), southern arrowwood, poison oak, saw greenbrier, and blackberry.

Crops occur throughout Texas and are characterized as cultivated cover crops or row crops providing food and/or fiber for either man or domestic animals. This vegetation type may also portray grasslands associated with crop rotations.

1.5 Wildlife

Vegetation and habitat types described in this document could support various wildlife species, such as small birds and mammals, amphibians, and reptiles. Periodically inundated wetlands and riparian habitats along Gillen Bayou and Luce Bayou are used by mammals as evidenced by the observance of whitetail deer (*Odocoileus virginianus*) and feral hogs (*Sus scrofa*) during the field investigations. Other mammals that may occur within the project area include Virginia opossum (*Didelphis virginiana*), house mouse (*Mus musculus*), common raccoon (*Procyon lotor*), hispid cotton rat (*Sigmodon hispidus*), and eastern cottontail (*Sylvilagus floridanus*).

Reptiles and amphibians are common within the project area. Amphibians include the cricket frog (*Acris crepitans*), Gulf coast toad (*Bufo valliceps*), Cope's gray treefrog (*Hyla versicolor*) and southern leopard frog (*Rana sphenocephala*). Common reptiles include the green anole (*Anolis carolinensis*), little brown skink (*Scincella lateralis*), broad-banded water snake (*Nerodia fasciata*), western ribbon snake (*Thamnophis proximus*), and rough earth snake (*Virginia striatula*).

The proposed project would provide new barriers to wildlife movement. Temporary effects to wildlife habitat that would result from the proposed project would include the decreased attractiveness of habitat adjacent to the project corridor, as well as possible disturbances to normal behavior patterns of wildlife as a result of increased noise levels from construction activities.

The build alternative would result in temporary impacts on wildlife habitat, including habitat loss through its conversion to surface water conveyance infrastructure and maintained ROW. The majority of the habitat areas listed above would remain unaffected by the proposed project due to the fact that the entire Harrison Tract is proposed to be preserved in perpetuity and incorporated into the Trinity River National Wildlife Refuge (TRNWR). Wildlife in the project area has and would continue to be dominated by species that are better able to adapt to a disturbed physical environment and could tolerate possible disturbances from the proposed project. Although construction of the build alternative would remove and/or convert habitat and therefore displace wildlife in certain areas, habitat loss and the resulting effects on wildlife would be expected to be minor. Impacts to habitat utilized by local wildlife would be limited to the proposed project ROW.

1.6 Threatened and Endangered Species

1.6.1 Federal Regulations

Since 1973, the Endangered Species Act (ESA) has regulated a wide range of activities affecting flora and fauna classified as endangered or threatened. Reauthorized in 1988, provisions of the act apply only to species listed in the Federal Register as endangered or threatened. Under the provisions of the ESA, all federal agencies are required to undertake programs for conservation of threatened and endangered species and are prohibited from authorizing, funding, or carrying out any action that would jeopardize a listed species or destroy or alter its critical habitat.

Specifically, the ESA prohibits acts, *by anyone or any organization*, such as:

- The importation and exportation of endangered species from the United States.
- Taking (killing, capturing, collecting, harming, harassing, pursuing, hunting, trapping) listed species within the United States and territorial waters.
- Taking listed species on the high seas.
- Possessing, delivering, selling, delivering, carrying, transporting, or shipping any such species unlawfully taken within the United States or on the high seas.
- Selling or offering for sale any such species in interstate or foreign commerce.

Individuals killed or harmed during the construction or operation of any type of facility would be considered “a take”. The act also provides for the protection of habitat critical to the survival and recovery of the species and creation of a recovery plan for each listed species.

A species may be classified as “endangered” when it is in danger of extinction within the foreseeable future in all or a significant portion of its range. A “threatened” classification is assigned to a species likely to become endangered within the foreseeable future in all or a significant portion of its range. A “species” includes any species or subspecies of fish, wildlife, or plant. It also includes any variety of plant or any distinct population segment of any vertebrate species that interbreeds when mature. Excluded are those species of the Class Insecta deemed by the Secretary to be pests presenting an overwhelming and overriding risk to man. Additionally, actions affecting species proposed for listing would require the same coordination with state and federal agencies as those actions affecting listed species.

The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibility for administration of the ESA. In general, the USFWS is responsible for terrestrial and freshwater species and migratory birds, while the NMFS regulates and protects marine species and anadromous fish. Additionally, the Animal and Plant Health Inspection Service, U.S. Department of Agriculture, oversees importation and exportation of listed terrestrial plants.

1.6.2 State Regulations

In 1973, the Texas Legislature authorized the Texas Parks and Wildlife Department (TPWD) to establish a list of endangered and threatened animals in the state. Laws pertaining to these endangered and threatened animal species are contained in Chapters 67 and 68 of the Texas Parks and Wildlife Code and Sections 65.171-65.176 of Title 31 of the Texas Administrative Code. An “endangered” species is a species named by the Executive Director of TPWD as being threatened with statewide extinction. “Threatened” species are those species deemed by TPWD as likely to become endangered in the future.

In 1988, the Texas legislature authorized TPWD to create a list of threatened and endangered plant species for the state. Laws and regulations pertaining to endangered or threatened plant species are contained in Chapter 88 of the Texas parks and Wildlife Code and Sections 69.01-69.14 of the Texas Administrative Code. An "endangered" plant is one that is in danger of extinction throughout all or a significant portion of its range. A "threatened" plant is one likely to become endangered within the foreseeable future.

TPWD regulations prohibit the "taking", possession, transportation, or sale of any species designated by state law as endangered or threatened without a permit. State laws and regulations prohibit commerce in threatened and endangered plants and the collection of listed species on public land without a permit issued by TPWD. These laws apply to individuals, municipalities, and all organizations.

1.6.3 Database Analysis

Databases of sensitive species maintained by the United States Fish and Wildlife Service (USFWS) and TPWD were reviewed to determine state and/or federally listed threatened or endangered species that occur or historically have occurred in Harris and Liberty Counties. Potential effects of the proposed project on these species were determined by reviewing the TPWD-Natural Diversity Database (NDD) Element of Occurrence Records and by conducting on-site habitat assessments. A species list for both counties outlining the species and habitat potentially present in the proposed project area is found in *Table 1*. No unique, critical, designated, or proposed designated habitat exists in or near the proposed project.

According to TPWD-NDD Element of Occurrence Records search conducted September 18, 2009 and in conjunction with GIS-based analysis and field surveys conducted by Crouch Environmental Services, Inc. (CESI), no documented occurrences of state and/or federally listed threatened or endangered species are known within the limits of the proposed project. However, the TPWD-NDD revealed documented occurrences for the Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) within 10 miles of the project site. A list of all elements of occurrence for this species of concern with EOID numbers can be found in Appendix B. Optimal habitat for these documented species is not present within the proposed project. Qualified biologists conducted surveys of the entire proposed project and observed no occurrences of these species. This project would have no affect on any federally listed species, its habitat, or designated critical habitat, nor would it adversely affect any state listed species.

Table 1. Potential Effects to Listed Species Potentially Occurring Within the Project Area (Harris and/or Liberty County)

Common Name (Scientific Name)	State Status	Federal Status	Description of Suitable Habitat	Harris County	Liberty County	Habitat Present	Affect on Species
Amphibians							
Houston toad (Bufo houstonensis)	E	E†	Sandy soil, breeds in ephemeral pools	Yes	Yes	No	No Effect
Birds							
American peregrine falcon (Falco peregrinus anatum)	T	DL†	Year-round resident and local breeder in west Texas, nests in tall cliff eyries	Yes	Yes	Yes; transitory migrant to site	No Effect

Common Name (Scientific Name)	State Status	Federal Status	Description of Suitable Habitat	Harris County	Liberty County	Habitat Present	Affect on Species
Birds							
Arctic Peregrine falcon (Falco peregrinus tundrius)	*	DL†	Occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands	Yes	Yes	Yes; transitory migrant to site	No Effect
Bachman's sparrow (Aimophila aestivalis)	T	*	Open pine woods with scattered bushes and grassy understory in Pineywoods region	No	Yes	Yes; habitat present not to be impacted	No Effect
Bald eagle (Haliaeetus leucocephalus)	T	DL	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water	Yes	Yes	No	No Effect
Black Rail (Laterallus jamaicensis)	SOC	*	Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps	Yes	No	No	No Effect
Brown pelican (Pelecanus occidentalis)	SOC	LE/PDL †	Largely coastal and near shore areas, where it roosts and nests on islands and spoil banks	Yes	No	No	No Effect
Henslow's sparrow (*Ammodramus henslowii*)	SOC	*	Wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles	Yes	Yes	No	No Effect
Mountain plover (Charadrius montanus)	SOC	*	Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression;	Yes	No	No	No Effect

Common Name (Scientific Name)	State Status	Federal Status	Description of Suitable Habitat	Harris County	Liberty County	Habitat Present	Affect on Species
Birds							
Red-cockaded woodpecker (*Picoides borealis*)	E	LE	Cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly	Yes	Yes	No	No Effect
Swallow-tail kite (*Elanoides forficatus*)	T	*	Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along river and lakes	No	Yes	Yes; habitat present not to be impacted	No Effect
Snowy plover (Charadrius alexandrines)	SOC	*	Formerly an uncommon breeder in the Panhandle; potential migrant; winters along coast	Yes	No	No	No Effect
Southeastern snowy plover (Charadrius alexandrinus tenuirostris)	SOC	*	Wintering migrant along the Texas Gulf Coast beaches and bayside mud or salt flats	Yes	No	No	No Effect
White-faced ibis (*Plegadis chihi*)	T	*	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats	Yes	Yes	Yes; habitat present not to be impacted	No Effect
White-tailed hawk (*Buteo albicaudatus*)	T	*	Near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral	Yes	No	Yes; transitory to site	No Effect
Whooping crane (*Grus americana*)	E	LE†	Migrant via plains throughout most of state to coast;	Yes	No	No	No Effect

Common Name (Scientific Name)	State Status	Federal Status	Description of Suitable Habitat	Harris County	Liberty County	Habitat Present	Affect on Species
Birds							
Wood stork (Mycteria Americana)	T	*	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags	Yes	Yes	No	No Effect
Fishes							
Creek chubsucker (*Erimyzon oblongus*)	T	*	Variety of small rivers and creeks, prefers headwaters	Yes	Yes	Yes	No Effect
American eel (Anguilla rostrata)	SOC	*	Coastal waterways below reservoirs to gulf.	Yes	Yes	No	No Effect
Paddlefish (Polyodon spathula)	T	*	Large, free-flowing rivers and impoundments	No	Yes	Yes	No Effect
Smalltooth sawfish (*Pristus pectinata*)	E	LE†	Juveniles found in shallow, muddy, brackish waters, adults prefer a variety of saltwater habitats	Yes	No	No	No Effect
Insects							
Gulf Coast clubtail (*Gomphus modestus*)	*	*	Medium sized rivers and streams with silty sand or rocky bottoms; adults forage in trees.	No	Yes	Yes; habitat present not to be impacted	No Effect
Mammals							
Louisiana black bear (Ursus americanus luteolus)	T	T†	Bottomland hardwoods; large, undisturbed forested areas	Yes	Yes	Yes	May affect, not likely to adversely affect
Plains spotted skunk (Spilogale putorius interrupta)	SOC	SOC†	Open fields, prairies, croplands, fencerows, farmyards and woodlands.	Yes	Yes	Yes	May affect, not likely to adversely affect
Rafinesque's big-eared bat (*Corynorhinus rafinesqui*)	T	*	Cavity trees in hardwood forest, concrete culverts, abandoned buildings	Yes	Yes	Yes	May affect, not likely to adversely affect

Common Name (Scientific Name)	State Status	Federal Status	Description of Suitable Habitat	Harris County	Liberty County	Habitat Present	Affect on Species
Mammals							
Red wolf (Canis rufus)	E	LE†	Extirpated; formerly eastern Texas in brushy/forested areas, coastal prairies	Yes	Yes	No, extirpated	No Effect
Southeastern Myotis bat (*Myotis austroriparius*)	SOC	SOC†	Cavity trees in hardwood forest, concrete culverts, abandoned buildings.	Yes	Yes	Yes	May affect, not likely to adversely affect
Mollusks							
Creeper (squawfoot) (*Strophitus undulatus*)	SOC	*	Small to large streams with gravel or gravel and mud substrates	No	Yes	Yes; habitat present not to be affected.	May affect, not likely to adversely affect
Fawnsfoot (Truncilla donaciformis)	SOC	*	Small and large rivers with sand, mud, rocky mud and sand and gravel substrates	No	Yes	Yes; habitat present not to be affected.	May affect, not likely to adversely affect
Little spectaclecase (*Villosa lienosa*)	SOC	*	Creeks, rivers and reservoirs with sandy substrates and moderate currents.	Yes	Yes	No	No Effect
Louisiana Pigtoe (*Pleurobema riddelli*)	SOC	*	Streams and moderate-size rivers with mud, sand and gravel substrates.	Yes	Yes	No	No Effect
Pistolgrip (Trigonia verrucosa)	SOC	*	In aquatic habitats with stable substrates and/or soft bottoms	Yes	Yes	No	No Effect
Rock pocketbook (Arcidens confragosus)	SOC	*	Medium and large rivers with mud, sand and gravel substrates.	Yes	Yes	No	No Effect
Sandbank pocketbook (*Lampsilis satura)*	SOC	*	Small to large rivers with swift flows.	Yes	Yes	No	No Effect
Mollusks							

Common Name (Scientific Name)	State Status	Federal Status	Description of Suitable Habitat	Harris County	Liberty County	Habitat Present	Affect on Species
Texas heelsplitter (Potamilus amphichaenus)	SOC	*	Quiet waters in mud or sand and also in reservoirs.	No	Yes	No	No Effect
Texas pigtoe (Fusconaia askewi)	SOC	*	Rivers with mixed mud, sand and fine gravel	Yes	Yes	No	No Effect
Wabash Pigtoe (*Fusconaia flava*)	SOC	*	Creeks to large rivers on mud, sand, and gravel.	Yes	Yes	Yes; habitat present not to be affected.	May affect, not likely to adversely affect
Reptiles							
Alligator snapping turtle (*Macroclemys temminckii*)	T	*	Deep water of rivers, canals, lakes, swamps, and bayous	Yes	Yes	Yes; habitat present not to be impacted.	May affect, not likely to adversely affect
Green sea turtle (*Chelonia mydas*)	T	LT†	Gulf and bay system	Yes	No	No	No Effect
Kemp's ridley sea turtle (*Lepidochelys kempii*)	E	LE†	Gulf and bay system	Yes	No	No	No Effect
Leatherback sea turtle (*Dermochelys coriacea*)	E	LE†	Gulf and bay system	Yes	No	No	No Effect
Loggerhead sea turtle (*Caretta caretta*)	T	LT†	Gulf and bay system	Yes	No	No	No Effect
Smooth green snake (Liochlorophis vernalis)	T	*	Gulf coastal plain, mesic coastal shortgrass prairies	Yes	No	No	No Effect
Texas horned lizard (*Phrynosoma cornutum*)	T	SOC†	Open, semi-arid regions, with sparse vegetation,	Yes	Yes	No	No Effect
Louisiana pine snake (*Pituophis ruthveni*)	T	C†	Mixed deciduous-longleaf pine woodlands.	No	Yes	Yes; habitat present not to be impacted	May affect, not likely to adversely affect
Northern scarlet snake (*Cemophora coccinea copei*)	T	*	Mixed hardwood scrub on sandy soils.	No	Yes	Yes; habitat present not to be impacted	No Affect
Timber/canebrake rattlesnake(*Crotalus horridus*)	T	*	Swamps/floodplains of hardwood/upland pine.	Yes	Yes	Yes; habitat present not to be impacted	May affect, not likely to adversely affect

Common Name (Scientific Name)	State Status	Federal Status	Description of Suitable Habitat	Harris County	Liberty County	Habitat Present	Affect on Species
Plants							
Texas prairie dawn (*Hymenoxys texana*)	E	LE	Poorly drained areas in open grasslands; pimple mounds.	Yes	No	No	No Effect
Coastal gay-feather (*Liatris bracteata*)	SOC	*	Coastal prairie grasslands of various types.	Yes	No	No	No Effect
Giant Sharpstem umbrella-(*Cyperus cephalanthus*)	SOC	*	Saturated, fine sandy loam soils along nearly level fringes of prairie depressions.	Yes	No	No	No Effect
Houston daisy (Rayjacksonia aurea)	SOC	*	On and around naturally barren or sparsely vegetated slick spots or pimple mounds.	Yes	No	No	No Effect
Texas meadow-rue (*Thalictrum texanum*)	SOC	*	Mostly found in woodlands margins on sandy loams	Yes	No	No	No Effect
Texas windmill-grass (*Chloris texensis*)	SOC	*	Sandy loam soils on bare areas on coastal prairie grasslands	Yes	No	No	No Effect
Threeflower broomweed (*Thurovia triflora*)	SOC	*	Near gulf coast on a veneer of light colored silt or fine sand over saline clay.	Yes	No	No	No Effect

Note: *These species occur on the TPWD listing of threatened or endangered species (date September 2009); however, they are not federally listed by the Clear Lake office of the USFWS (accessed September 2009).

† These species are listed by the USFWS; however, they are not listed to occur within Liberty or Harris County by the Clear Lake office of the USFWS (accessed September 2009).

E	Endangered
LE	Listed Endangered by USFWS
T	Threatened
LT	Listed Threatened by USFWS
C	Candidate for Listing
SOC	Species of Concern
PDL	Candidate for Delisting
DL	Delisted Taxon, recovered, being monitored first five years

1.7 Species Habitat and Potential Effects Analysis

Birds

The American and Arctic peregrine falcons are year-round residents and local breeders in west Texas and throughout the state. They nest in tall cliff eyries or other tall structures. They have been known as transitory migrants across state from their more northern breeding areas in U.S. and Canada. These species winter along coast and farther south, occupying a wide range of habitats during migration including urban development. This species also tends to concentrate along coast and barrier islands. No nesting habitat was observed within the Harrison tract or along the proposed project ROW. Any individuals observed during the proposed project will be transitory in nature and the proposed project will have no affect on either of these species.

The Bachman's sparrow prefers open piney woods with scattered bushes and grassy understory in Pineywoods region and remnant grasslands in Post Oak Savannah region of Texas. This species forages in brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, and grassy orchards. This species nests on ground against grass tufts or under low shrubs. A portion of the Harrison tract contains sub-optimal foraging and nesting habitat for this species. However, since the Harrison tract will remain largely unaffected, the proposed project will have no affect on the Bachman's sparrow.

The swallow-tail kite prefers lowland forested regions, especially swampy areas, and transitions into open woodland. This species also prefers marshes, river corridors, lakes, ponds, and other riparian habitat. The swallow-tail kite nests high in tall trees on a clearing or in forest edge communities, usually in pine, cypress, or various deciduous trees. A portion of the Harrison tract contains sub-optimal foraging and nesting habitat for this species. However, since the Harrison tract will remain largely unaffected, the proposed project will have no affect on the swallow-tail kite.

The white-faced ibis prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats. They nest in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats in similar habitat. A portion of the Harrison tract contains sub-optimal foraging and nesting habitat for this species in large to the agricultural practices on and adjacent. However, since the Harrison tract and surrounding properties will remain largely unaffected, the proposed project will have no affect on the white-faced ibis.

The white-tailed hawk prefers coastal prairies, cordgrass flats, and scrub-live oak as optimal habitat. Further inland, this species forages on prairies, in mesquite and oak savannas, and mixed savanna-chaparral vegetative communities. The typical breeding seasons lasts from March through mid-May. No nesting habitat was observed within the Harrison tract or along the proposed project ROW. Any individuals observed during the proposed project will be transitory in nature and the proposed project will have no affect on the white-tailed hawk.

Fish

The creek chubsucker is known to inhabit tributaries of the Red, Sabine, Neches, Trinity and San Jacinto Rivers as well as small streams and creeks of various types. Habitat for this species may be present within Gillens Bayou and Luce Bayou within the project alignment. Gillen Bayou is not anticipated to be affected by the proposed project as it is within the portion of the Harrison Tract to be incorporated into the TRNWR. The portion of Luce Bayou anticipated to be affected by the proposed project is limited to the area within the proposed 300' ROW that will discharge into the bayou. The proposed project will have no affect on the creek chubsucker.

The paddlefish prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites. This species spawns in fast, shallow water over gravel bars and larvae may drift from reservoir to reservoir until optimal conditions are met. Gillen Bayou is not anticipated to be affected by the proposed

project as it is within the portion of the Harrison Tract to be incorporated into the TRNWR. The portion of Luce Bayou anticipated to be affected by the proposed project is limited to the area within the proposed 300' ROW that will discharge into the bayou. The proposed project will have no affect on the paddlefish.

Insects

The Gulf Coast clubtail prefers medium-sized (second order) rivers with a moderate gradient, and streams with silty sand or rocky bottoms. Adult individuals forage in trees and small saplings. Males perch near riffles to wait for females during breeding. Larvae mature over the winter months. After maturation, adult individuals generally take flight from late April - late June. Gillen Bayou, the most suitable habitat within the proposed project, is not anticipated to be affected as it is within the portion of the Harrison Tract to be incorporated into the TRNWR. The portion of Luce Bayou anticipated to be affected by the proposed project is limited to the area within the proposed 300' ROW that will discharge into the bayou. The proposed project will have no affect on the Gulf Coast clubtail.

Mammals

The Louisiana black bear listed as a possible transient in Liberty County and is known to inhabit bottomland hardwoods and large tracts of inaccessible forested areas. Due to managed nature of the property, sub-optimal habitat for this species may be present within the bottomland hardwoods located on the Harrison Tract. It should be noted that due to field characteristics, the TPWD mandates that all black bears of east Texas be treated as federal and state listed species regardless of their genetic identity as the Louisiana subspecies. The only potential habitat for these species within the project area is confined within an area to remain undisturbed and incorporated into the TRNWR. The proposed project may affect, but not likely adversely affect the Louisiana black bear. Figures depicting the possible habitats for this species can be found in the Exhibits.

The plains spotted skunk has been known to inhabit open fields, prairies, croplands, fence rows, farmyards, forest edges and woodlands. This species is thought to prefer bushy areas and tall grass prairies. Habitat for this species is present within the herbaceous uplands and shrub/shrub habitats located on the Harrison Tract along the proposed project alignment. The proposed project may provide for an additional barrier to mobility for this species. The proposed project may affect, but is not likely to adversely affect this species. Figures depicting the possible habitats for the plains potted skunk can be found in the Exhibits.

The Rafinesque's big-eared bat roots in tree cavities in bottomland hardwoods, concrete culverts and abandoned man-made structures. Habitat for this species is present within the hardwood forests along the project alignment and within the various concrete culverts located within or adjacent to the project alignment. All optimal habitat for this species is located within areas that are not anticipated to be affected by the proposed project. The proposed project may affect, but is not likely to adversely affect the Rafinesque's big-eared bat. Figures depicting the possible habitats for the Rafinesque's big-eared bat can be found in the Exhibits.

The southeastern myotis roosts in tree cavities in bottomland hardwoods, concrete culverts, and abandoned man-made structures. Habitat for this species is present within the hardwood forests along the project alignment and within the various concrete culverts located within or adjacent to the project alignment. All optimal habitat for this species is located within areas that are not anticipated to be affected by the proposed project. The proposed project may affect, but is not likely to adversely affect the southeastern myotis. Figures depicting the possible habitats for the southeastern myotis can be found in the Exhibits.

Mollusks

The creeper (squawfoot) prefers small to large streams with gravel and/or mud substrates in flowing water. This species has been documented in the Trinity River basin and habitat for this species is present within the project area. However, impacts to the Trinity River are anticipated to be minimal and the proposed project may affect, but will not adversely affect the creeper (squawfoot).

The fawnsfoot prefers small to large streams with sand, mud, rocky mud, and sand and gravel substrates in flowing water. This species has been documented in the Trinity (historic) River basin and as such, habitat for this species is present within the project area within the Trinity River. However, impacts to the Trinity River are anticipated to be minimal and proposed project may affect, but will not adversely affect the fawnsfoot.

The Wabash pigtoe prefers creeks to large rivers with sand, mud, and gravel substrates in flowing water. This species has been documented in the Trinity River basins and habitat for this species is present within the project area within the Trinity River. However, impacts to the Trinity River are anticipated to be minimal and proposed project may affect, but will not adversely affect the Wabash pigtoe.

Reptiles

The alligator snapping turtle prefers perennial waters bodies within the deep water of rivers, canals, lakes, and oxbows. This species has also been known to occur in swamps, bayous, and ponds near deep running water. Habitat for this species is present within the project area at the Trinity River and Luce Bayou confluences. However, impacts to the Trinity River and Luce Bayou are anticipated to be minimal and the proposed project may affect, but will not adversely affect the alligator snapping turtle. Figures depicting the possible habitats for this species can be found in the Exhibits.

The Louisiana pine snake prefers mixed deciduous-longleaf pine woodlands in sandy, well-drained areas. This snake species is known for its exceptionally large eggs, and small clutch sizes. This snake also utilizes various tunnel systems built by other species including gophers. This snake generally breeds from mid-April to September. The majority of the habitat for this species within the project area is confined to portions of the Harrison Tract not anticipated to be affected by the proposed project. The proposed project may affect, but will not adversely affect the Louisiana pine snake.

The Northern scarlet snake prefers mixed hardwood scrub/shrub vegetative communities growing in sandy soils. This species feeds on eggs of other reptile species. The North scarlet snake is semi-fossorial and prefers to remain hidden and buried, only coming out to feed. This snake is active from April through mid-September. All of the habitat for this species within the project area is confined to portions of the Harrison Tract not anticipated to be affected by the proposed project. The proposed project will not affect the Northern scarlet snake.

The timber/canebrake rattlesnake prefers swamps, floodplains, upland pine and deciduous woodlands, riparian zones, and abandoned farmland. This species prefers dense ground cover similar to that provided by grapevines and/or dwarf palmetto. Habitat for this species is located throughout the project area, including those areas within the floodplain and along Gillen Bayou on the Harrison tract. The majority of the habitat for this species within the project area is confined to the portion of the Harrison Tract not anticipated to be affected by the proposed project. The proposed project may affect, but will not adversely affect the timber/canebrake rattlesnake. Figures depicting the possible habitats for this species can be found in the Exhibits.

1.8 Potential Effects to Listed Species and Conclusions

The project study area was visually inspected by two qualified biologists throughout the spring and summer of 2009 to determine the presence or likely presence of any state or federally listed species, candidate species, or species of concern. Photographs of the site are included in Appendix C.

No state or federally listed threatened, endangered, or species of concern were observed on the project site. CESI received Element of Occurrence data from TPWD which stated that the Rafinesque's big-eared bat within ten miles of the project study area. Habitat for this listed species was found on the project site. However, the majority of this habitat was located on the Harrison Tract, as portion of the project not anticipated to be impacted by the proposed project. Other potential habitat does exist along the project alignment. Construction activities associated with the proposed project may affect, but not adversely affect this species.

Figures are included in the Exhibits for the following species:

1. Louisiana black bear
2. Plains spotted skunk
3. Rafinesque's big-eared bat
4. Southeastern myotis
5. Alligator snapping turtle
6. Louisiana pine snake
7. Timber/canebrake rattlesnake

In conclusion, the proposed project will have no permanent adverse affects on any federally listed species based on site surveys by biologists, a review of listed species habitat requirements, and an investigation of available habitats on-site. The seven species referenced above may be affected, but will not be adversely affected by the proposed project. However, these species are able to utilize a variety of habitats, including those that have been disturbed by human interaction. Therefore, no permit impacts to these species are anticipated.

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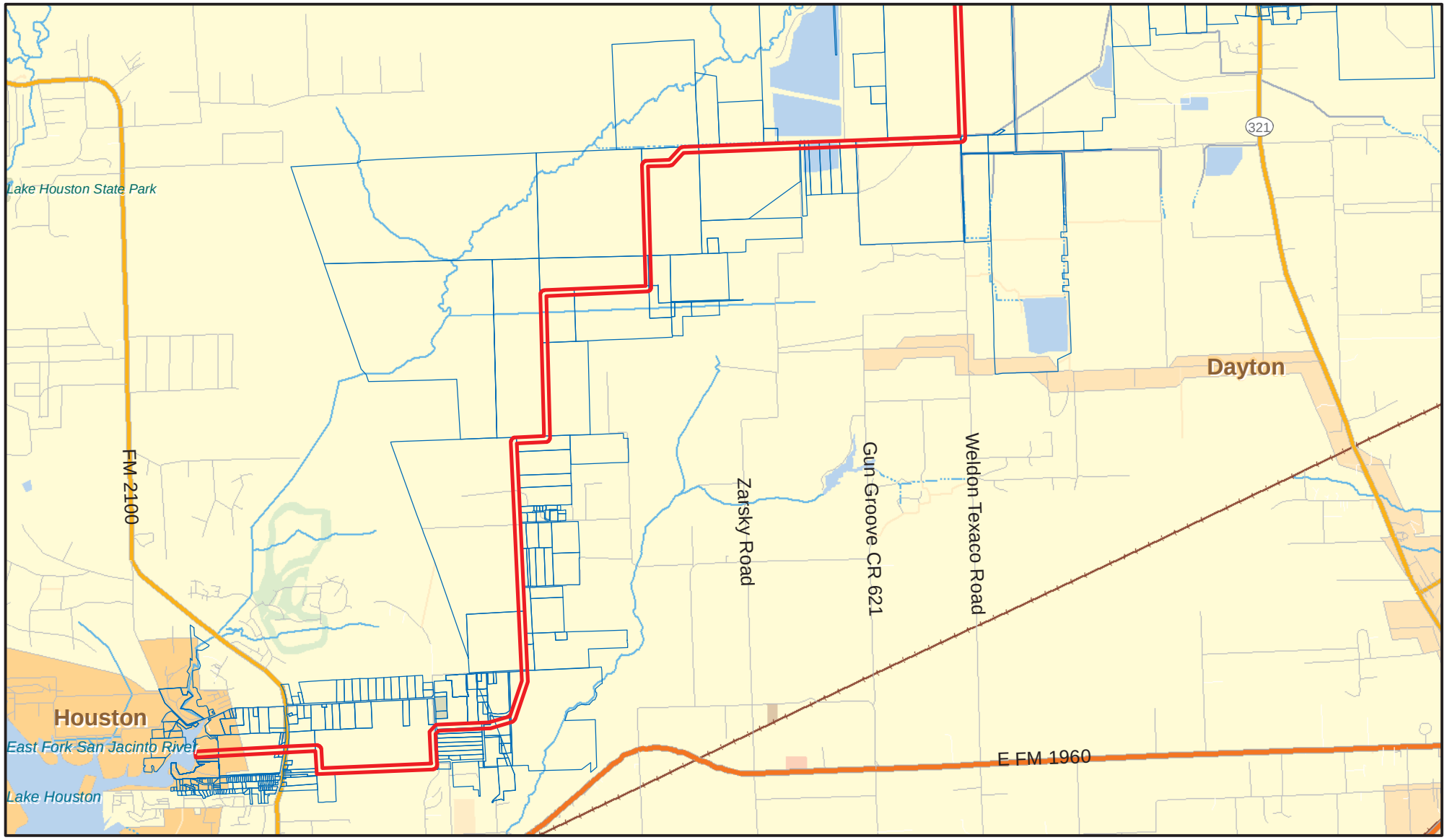
Appendix A

Vicinity Map



ProposedROW
Property Owners Parcels

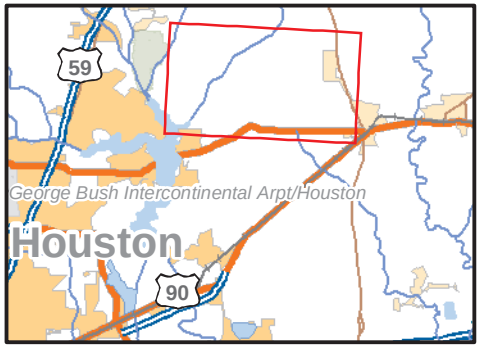
6,000 3,000 0
Feet

CROUCH ENVIRONMENTAL SERVICES, INC.

Luce Bayou Interbasin Transfer Project
Coastal Waterway Authority

VICINITY MAP

Liberty County, Texas



Appendix B

Element of Occurrence Record – TPWD

Occurrence List for Surrounding Quads

Scientific Name:	Common Name:	Occurrence Number:	State Status:	Federal Status:	Eo Id:
Bufo houstonensis	Houston Toad	8	E	LE	3224
Chloris texensis	Texas windmill-grass	21			4284
Haliaeetus leucocephalus	Bald Eagle	47	T		1808
Haliaeetus leucocephalus	Bald Eagle	59	T		7972
Haliaeetus leucocephalus	Bald Eagle	82	T		6039
Haliaeetus leucocephalus	Bald Eagle	123	T		472
Haliaeetus leucocephalus	Bald Eagle	129	T		5988
Hymenoxys texana	Texas prairie dawn	32	E	LE	6856
Hymenoxys texana	Texas prairie dawn	52	E	LE	2110
Physostegia correllii	Correll's false dragon-head	3			4512
Picoides borealis	Red-cockaded Woodpecker	151	E	LE	916
Picoides borealis	Red-cockaded Woodpecker	157	E	LE	7624
Picoides borealis	Red-cockaded Woodpecker	158	E	LE	2769
Picoides borealis	Red-cockaded Woodpecker	159	E	LE	1480
Picoides borealis	Red-cockaded Woodpecker	424	E	LE	6952
Picoides borealis	Red-cockaded Woodpecker	425	E	LE	6244
Picoides borealis	Red-cockaded Woodpecker	426	E	LE	3571
Picoides borealis	Red-cockaded Woodpecker	514	E	LE	1228
Pinus taeda-quercus alba-quercus falcata series	Loblolly Pine-white Oak-southern Red Oak Series	15			5487
Pituophis ruthveni	Louisiana Pine Snake	5	T	C	308
Quercus nigra-quercus phellos series	Water Oak-willow Oak Series	17			7332

Scientific Name:	Common Name:	Occurrence Number:	State Status:	Federal Status:	Eo Id:
Quercus nigra-quercus phellos series	Water Oak-willow Oak Series	19			1095
Quercus nigra-quercus phellos series	Water Oak-willow Oak Series	20			1092
Rayjacksonia aurea	Houston daisy	27			5448
Rookery		176			5599
Rookery		179			1170
Rookery		187			4957
Rookery		205			5633
Rookery		206			3783
Rookery		209			950
Rookery		212			3485
Rookery		213			6695
Rookery		214			1864
Rookery		219			582
Rookery		408			4689
Rookery		579			5879
Schizachyrium scoparium-paspalum plicatulum series	Little Bluestem-brownseed Paspalum Series	31			7726
Thurovia triflora	threeflower broomweed	11			7357

Element Occurrence Record

Scientific Name: Corynorhinus rafinesquii

Occurrence #: 1 **Eo Id:** 7831

Track Status: Track all extant and selected historical EOs

Common Name: Rafinesque's Big-eared Bat

TX Protection Status: T

Global Rank: G3G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name:	State:	Mapsheet:
Liberty	TX	30094-C7, Davis Hill

Directions:

3.75 AIR MILES NORTHWEST OF STATE ROUTE 105 ABOVE TRINITY RIVER; 0.2 AIR MILE WEST OF LAKE BOWIE; DAVIS HILL STATE PARK

Survey Information:

First Observation: 1994-07-21 **Survey Date:** 1994-07-21 **Last Observation:** 1994-07-21

Eo Type: **Eo Rank:** B **Eo Rank Date:** 1994-07-21

Observed Area:

Comments:

General Description: PARK CONSISTS OF PINE/HARDWOODS AND BOTTOMLAND HARDWOODS, MARSHES, AND SWAMPS; THIS BAT CAUGHT IN NET PLACED AT INTERFACE WITH POWERLINE RIGHT-OF-WAY AND ATV TRAIL GOING INTO THE FOREST; DENSE UNDERSTORY; FULL MOON; NO OTHER BATS CAUGHT THIS EVENING

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: 1 ADULT MALE CAPTURED IN MIST NET

Managed Area:

Managed Area Name

DAVIS HILL STATE PARK

Reference:

Citation:

HORNER, M.A. 1994. EAST TEXAS RARE BAT SURVEY: 18-22 JULY 1994 (VILLAGE CREEK AND DAVIS HILL STATE PARKS).

Specimen:

Element Occurrence Record

Scientific Name: Corynorhinus rafinesquii

Occurrence #: 12 **Eo Id:** 5412

Common Name: Rafinesque's Big-eared Bat

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Global Rank: G3G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12040103 - East Fork San Jacinto

County Name: Harris

State: TX

Mapsheet: 30095-A2, Moonshine Hill

Directions:

LAKE HOUSTON STATE PARK; CA. 0.2 MILE SOUTHEAST OF ISABELL LAKE; JUST WEST OF EAST FORK SAN JACINTO RIVER

Survey Information:

First Observation: 1996-05-22 **Survey Date:** **Last Observation:** 1999-06

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: ABANDONED CONCRETE HOUSE IN MIXED PINE AND OAK UPLAND

Comments: BAT ROOST #13 EAST TEXAS BAT SURVEYS

Protection Comments:

Management Comments:

Data:

EO Data: 22 MAY 1996, ONE ADULT FEMALE, NOT LACTATING OR PREGNANT; JUNE-DECEMBER 1997 - 0; JUNE 1999 - ONE

Managed Area:

Managed Area Name

LAKE HOUSTON STATE PARK

Reference:

Citation:

HORNER, M.A. 1996. EAST TEXAS RARE BAT SURVEY: 18-28 MAY 1996--BAT WORKSHOP; VILLAGE CREEK STATE PARK, TNC SANDYLANDS PRESERVE, MARTIN DIES JR. STATE PARK, LAKE HOUSTON STATE PARK

LINAM, LEE ANN. 2002. FINAL REPORT PROJECT WER09(72): IMPLEMENTATION OF CANDIDATE SPECIES MONITORING. GRANT NO. E-9. NOVEMBER 1, 2002.

KEELEY, ANNIKA. 2000. REPORT ON EAST TEXAS BAT ROOST MONITORING: 1998-1999. MARCH 14, 2000.

HORNER, PEGGY AND RICKY MAXEY. 1998. EAST TEXAS RARE BAT SURVEY: 1997. TEXAS PARKS AND WILDLIFE DEPARTMENT ANNUAL REPORT. AUSTIN, TEXAS. 14 PP.

Specimen:

Element Occurrence Record

Scientific Name: Haliaeetus leucocephalus

Occurrence #: 21 **Eo Id:** 3329

Common Name: Bald Eagle

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Global Rank: G4 **State Rank:** S3B,S3N **Federal Status:**

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-B7, Capers Ridge

Directions:

TERRITORY ON TRINITY RIVER SOUGH OF KNIGHTS FOREST

Survey Information:

First Observation: 1986 **Survey Date:** **Last Observation:** 2001

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: RIPARIAN FOREST (?) NEAR WATER

Comments: TPWD NEST #146-1A/B

Protection Comments:

Management Comments:

Data:

EO Data: ACTIVE NEST SITE; NEST #146-1A: 1986 ACTIVE NEST PRODUCED 1 YOUNG, 1987-1988 ACTIVE NEST PRODUCED 2 YOUNG, 1989 ACTIVE NEST PRODUCED 1 YOUNG, 1990 ACTIVE NEST PRODUCED 0 YOUNG, 1991 ACTIVE NEST PRODUCED 2 YOUNG, 1992 ACTIVE NEST PRODUCED 0 YOUNG, 1993 ACTIVE NEST PRODUCED 2 YOUNG, 1994 NEST FELL; NEST #146-1B: 1994 ACTIVE NEST PRODUCED 1 YOUNG, 1995 ACTIVE NEST PRODUCED 2 YOUNG, 1996-2000 ACTIVE NEST PRODUCED 1 YOUNG, 2001 ACTIVE NEST PRODUCED 2 YOUNG

Managed Area:

Managed Area Name

Reference:

Citation:

MITCHELL, MARK. 1999. PROJECT NO. 30: BALD EAGLE NEST SURVEY AND MANAGEMENT. PERFORMANCE REPORT. AUGUST 31, 1999.

MITCHELL, MARK. 1997. MEMO TO SHANNON BRESLIN OF 30 JULY 1997 PROVIDING BALD EAGLE NESTING DATA, INCLUDING COUNTY MAPS WITH ESTIMATED TERRITORIES.

POLASEK, LEN G. 2000. PERFORMANCE REPORT. PROJECT NO. 10: BALD EAGLE NEST SURVEY AND MANAGEMENT. FEDERAL AID GRANT NO. W-125-R-11. AUGUST 31, 2000.

ORTEGO, BRENT. 2001. PERFORMANCE REPORT. PROJECT NO. 10: BALD EAGLE NEST SURVEY AND MANAGEMENT. FEDERAL AID GRANT NO. W-125-R-12. SEPTEMBER 30, 2001.

Specimen:

Element Occurrence Record

Scientific Name: Haliaeetus leucocephalus

Occurrence #: 59 **Eo Id:** 7972

Common Name: Bald Eagle

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Global Rank: G4 **State Rank:** S3B,S3N **Federal Status:**

Location Information:

Watershed:

12040101 - West Fork San Jacinto

12040104 - Buffalo-San Jacinto

County Name:

Harris

State:

TX

Mapsheet:

29095-H1, Crosby

30095-A1, Huffman

30095-A2, Moonshine Hill

29095-H2, Harmaston

Directions:

TERRITORY ON LAKE HOUSTON

Survey Information:

First Observation: 1990 **Survey Date:** **Last Observation:** 2000

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description:

Comments: TPWD NEST #101-1A/B

Protection Comments:

Management Comments:

Data:

EO Data: NEST #101-1A: 1990 ACTIVE NEST PRODUCED 0 YOUNG, 1991-1992 NEST INACTIVE; NEST #101-1B: 1993 NEST ACTIVE?, 1994-1996 ACTIVE NEST PRODUCED 1 YOUNG, 1997 ACTIVE NEST PRODUCED 2 YOUNG, 1998 ACTIVE NEST PRODUCED 1 YOUNG, 1999 NEST INACTIVE, 2000 ACTIVE NEST PRODUCED 0 YOUNG, 2001 NEST FELL

Managed Area:

Managed Area Name

Reference:

Citation:

MITCHELL, MARK. 1999. PROJECT NO. 30: BALD EAGLE NEST SURVEY AND MANAGEMENT. PERFORMANCE REPORT. AUGUST 31, 1999.

MITCHELL, MARK. 1997. MEMO TO SHANNON BRESLIN OF 30 JULY 1997.

POLASEK, LEN G. 2000. PERFORMANCE REPORT. PROJECT NO. 10: BALD EAGLE NEST SURVEY AND MANAGEMENT. FEDERAL AID GRANT NO. W-125-R-11. AUGUST 31, 2000.

ORTEGO, BRENT. 2001. PERFORMANCE REPORT. PROJECT NO. 10: BALD EAGLE NEST SURVEY AND MANAGEMENT. FEDERAL AID GRANT NO. W-125-R-12. SEPTEMBER 30, 2001.

Specimen:

Element Occurrence Record

Scientific Name: Haliaeetus leucocephalus

Occurrence #: 61 **Eo Id:** 2631

Common Name: Bald Eagle

Track Status: Track all extant and selected historical EOs

TX Protection Status: T

Global Rank: G4 **State Rank:** S3B,S3N **Federal Status:**

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-C7, Davis Hill

Directions:

TERRITORY ON TRINITY RIVER IN VICINITY OF TRINITY RIVER NATIONAL WILDLIFE REFUGE

Survey Information:

First Observation: 1991 **Survey Date:** **Last Observation:** 2001

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description:

Comments: TPWD NEST #146-2A

Protection Comments:

Management Comments:

Data:

EO Data: NEST #146-2A: 1991 ACTIVE NEST PRODUCED 0 YOUNG, 1992-1993 ACTIVE NEST PRODUCED 1 YOUNG, 1994-1995 ACTIVE NEST PRODUCED 0 YOUNG, 1996-1999 ACTIVE NEST PRODUCED 1 YOUNG, 2000 ACTIVE NEST PRODUCED 2 YOUNG, 2001 ACTIVE NEST PRODUCED 1 YOUNG

Managed Area:

Managed Area Name

TRINITY RIVER NATIONAL WILDLIFE REFUGE

Reference:

Citation:

MITCHELL, MARK. 1999. PROJECT NO. 30: BALD EAGLE NEST SURVEY AND MANAGEMENT. PERFORMANCE REPORT. AUGUST 31, 1999.

MITCHELL, MARK. 1997. MEMO TO SHANNON BRESLIN OF 30 JULY 1997 PROVIDING BALD EAGLE NESTING DATA, INCLUDING COUNTY MAPS WITH ESTIMATED TERRITORIES.

POLASEK, LEN G. 2000. PERFORMANCE REPORT. PROJECT NO. 10: BALD EAGLE NEST SURVEY AND MANAGEMENT. FEDERAL AID GRANT NO. W-125-R-11. AUGUST 31, 2000.

ORTEGO, BRENT. 2001. PERFORMANCE REPORT. PROJECT NO. 10: BALD EAGLE NEST SURVEY AND MANAGEMENT. FEDERAL AID GRANT NO. W-125-R-12. SEPTEMBER 30, 2001.

Specimen:

Element Occurrence Record

Scientific Name: Physostegia correllii

Occurrence #: 3 **Eo Id:** 4512

Common Name: Correll's false dragon-head

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G2 **State Rank:** S2

Federal Status:

Location Information:

Watershed:

12040101 - West Fork San Jacinto

County Name: Montgomery

State: TX

Mapsheet: 30095-A2, Moonshine Hill

Directions:

6 MILES NORTH OF HUMBLE

Survey Information:

First Observation: 1943-07-02

Survey Date:

Last Observation: 1943-07-02

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description:

Comments: REPORT AND HERBARIUM SPECIMEN LABEL GIVE HARRIS AS THE COUNTY OF OCCURRENCE; HOWEVER, 6 MILES NORTH OF HUMBLE MAPS TO SOUTHERN MONTGOMERY COUNTY. COLLECTOR OF THIS 1943 SPECIMEN MAY OR MAY NOT HAVE KNOWN WHERE COUNTY LINE WAS LOCATED.

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

IRVING, R.S. 1980. STATUS REPORT ON PHYSOSTEGIA CORRELLII.

Specimen:

University of Texas at Austin Herbarium. 1943. E. Boon #108, Specimen # 125270 TEX. 2 July 1943.

Element Occurrence Record

Scientific Name: Pinus taeda-quercus alba-quercus falcata series

Occurrence #: 11 **Eo Id:** 3739

Common Name: Loblolly Pine-white Oak-southern Red Oak Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S4

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-C7, Davis Hill

Directions:

UPPER FOURTH OF DAVIS HILL DOME, DAVIS HILL SP

Survey Information:

First Observation:

Survey Date: 1989-08-15

Last Observation: 1989

Eo Type:

Eo Rank: CD

Eo Rank Date: 1989-08-15

Observed Area:

Comments:

General Description: PINE-OAK FOREST ON TOP OF SALT DOME, OVER WILLIS FORMATION; SELECTIVE CUTTING HAS OCCURRED

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: DESCRIPTION AND PLANT LIST IN DLI REPORT, SITE 3

Managed Area:

Managed Area Name

DAVIS HILL STATE PARK

Reference:

Citation:

TEXAS PARKS & WILDLIFE DEPARTMENT. 1990. DAVIS HILL STATE PARK. SUMMARY OF REPRESENTATIVE PLANT COMMUNITIES.

Specimen:

Element Occurrence Record

Scientific Name: Pinus taeda-quercus alba-quercus falcata series

Occurrence #: 17 **Eo Id:** 6318

Track Status: Track all extant and selected historical EOs

Common Name: Loblolly Pine-white Oak-southern Red Oak Series

TX Protection Status:

Global Rank: G4 **State Rank:** S4

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name:	State:	Mapsheet:
Liberty	TX	30094-C7, Davis Hill

Directions:

SLOPES ALONG SOUTH-DRAINING RAVINE, SOUTHEAST FLANK OF DAVIS HILL DOME, DAVIS HILL SP

Survey Information:

First Observation: **Survey Date:** 1989-08-15 **Last Observation:** 1989

Eo Type: **Eo Rank:** B **Eo Rank Date:** 1989-08-15

Observed Area:

Comments:

General Description: MESIC PHASE OF LOBLOLLY PINE-OAK SERIES OR SOME OTHER MESIC RAVINE FOREST

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: DESCRIPTION AND PLANT LIST IN DLI REPORT, SITE 5

Managed Area:

Managed Area Name

DAVIS HILL STATE PARK

Reference:

Citation:

TEXAS PARKS & WILDLIFE DEPARTMENT. 1990. DAVIS HILL STATE PARK. SUMMARY OF REPRESENTATIVE PLANT COMMUNITIES.

Specimen:

Element Occurrence Record

Scientific Name: Pinus taeda-quercus alba-quercus falcata series

Occurrence #: 18 **Eo Id:** 1489

Track Status: Track all extant and selected historical EOs

Common Name: Loblolly Pine-white Oak-southern Red Oak Series

TX Protection Status:

Global Rank: G4 **State Rank:** S4

Federal Status:

Location Information:

Watershed:

12040103 - East Fork San Jacinto

County Name:	State:	Mapsheet:
Harris	TX	30095-A2, Moonshine Hill

Directions:

SLOPES AND TERRACES NEAR CONFLUENCE OF CANEY CREEK AND EAST FORK SAN JACINTO RIVER, SOUTH END OF LAKE HOUSTON SP

Survey Information:

First Observation: **Survey Date:** 1989-08-17 **Last Observation:** 1989

Eo Type: **Eo Rank:** CD **Eo Rank Date:** 1989-08-17

Observed Area:

Comments:

General Description: SANDY RIVER TERRACE FOREST ORIGINALLY DOMINATED BY BROADLEAF EVERGREENS; LOBLOLLY NOW IMPORTANT; UNDERLAIN BY DEWEYVILLE FORMATION

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: DESCRIPTION AND PLANT LIST IN DLI REPORT, SITE 3

Managed Area:

Managed Area Name

LAKE HOUSTON STATE PARK

Reference:

Citation:

TEXAS PARKS & WILDLIFE DEPARTMENT. 1990. LAKE HOUSTON STATE PARK. SUMMARY OF REPRESENTATIVE PLANT COMMUNITIES.

Specimen:

Element Occurrence Record

Scientific Name: Quercus nigra-quercus phellos series

Occurrence #: 17 **Eo Id:** 7332

Common Name: Water Oak-willow Oak Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name:	State:	Mapsheet:
Liberty	TX	30094-C7, Davis Hill
		30094-D7, Romayor
		30094-C6, Arizona Creek
		30094-D8, Rayburn
		30094-C8, Tarkington Prairie

Directions:

EAST [WEST] SIDE OF TRINITY RIVER; FROM 162 [ALSO KNOWN AS 105] CROSSING UPSTREAM (NORTH) ABOUT 10 MILES

Survey Information:

First Observation: **Survey Date:** **Last Observation:**

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area: 20,000.00

Comments:

General Description: PROBABLY INCLUDES CYPRESS AREAS ALONG WITH ELM-OAK, PINE-OAK AND BOTTOMLAND HARDWOODS; PERHAPS WITH LIVE OAKS AND PECANS

Comments: BASED ON JIM NEAL'S USF& WS BOTTOMLAND PRESERVATION PROGRAM REPORT; CRUDE BOUNDARIES GIVEN

Protection Comments:

Management Comments:

Data:

EO Data: TRINITY RIVER SYSTEM

Managed Area:

Managed Area Name

TRINITY RIVER NATIONAL WILDLIFE REFUGE

Reference:

Citation:

USF& WS, U. S. DEPARTMENT OF THE INTERIOR. 1985-05. TEXAS BOTTOMLAND HARDWOOD PRESERVATION PROGRAM: FINAL CONCEPT PLAN. USF& WS, ALBUQUERQUE, NM.

Specimen:

Element Occurrence Record

Scientific Name: Quercus nigra-quercus phellos series

Occurrence #: 18 **Eo Id:** 5913

Common Name: Water Oak-willow Oak Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-B7, Capers Ridge

Directions:

INCLUDES TRINITY RIVER SOUTH OF HIGHWAY 162 CROSSING, FROM CONFLUENCE OF GREEN'S BAYOU TO CONFLUENCE WITH TANNER BAYOU

Survey Information:

First Observation: 1985 **Survey Date:** 1985-09-27 **Last Observation:** 1985-09-27

Eo Type: **Eo Rank:** C **Eo Rank Date:**

Observed Area: 5,000.00

Comments:

General Description: PATCHY BOTTOMLAND; SOME CURRENTLY BEING CUT (9-86); SOME 80 YEARS + OLD; SHUMARD-WHITE-SWAMP CHESTNUT-ELM-CHERRYBARK-ASH

Comments: EXTENSIVE AREA WITH GOOD POTENTIAL FOR RECOVERY IF PROTECTED

Protection Comments:

Management Comments:

Data:

EO Data: TRINITY RIVER SYSTEM

Managed Area:

Managed Area Name

Reference:

Citation:

USF& WS, U. S. DEPARTMENT OF THE INTERIOR. 1985-05. TEXAS BOTTOMLAND HARDWOOD PRESERVATION PROGRAM: FINAL CONCEPT PLAN. USF& WS, ALBUQUERQUE, NM.

Specimen:

Element Occurrence Record

Scientific Name: Quercus nigra-quercus phellos series

Occurrence #: 34 **Eo Id:** 2072

Common Name: Water Oak-willow Oak Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12040103 - East Fork San Jacinto

County Name:

Liberty

State:

TX

Mapsheet:

30094-C7, Davis Hill

30094-B7, Capers Ridge

Directions:

NORTH AND SOUTH OF HIGHWAY 162 ALONG TRINITY RIVER

Survey Information:

First Observation:

Survey Date: 1986-06-20

Last Observation: 1986-06

Eo Type:

Eo Rank: B

Eo Rank Date:

Observed Area: 10,000.00

Comments:

General Description: VERY DIVERSE AND GOOD QUALITY, BOTTOMLAND HARDWOOD SITE WITH INCLUSIONS OF CYPRESS STANDS, "PIN OAK" FLATS, AND OPEN WATER; SOUTHERN MAGNOLIA OCCURS ON HIGHER GROUND

Comments: ONLY ROUGH BOUNDARIES PROVIDED

Protection Comments: PROBLEMATIC DUE TO LARGE AMOUNT OF RESIDENTIAL DEVELOPMENT

Management Comments:

Data:

EO Data: TRINITY RIVER SYSTEM

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

HUDGINS, BILLIE. TPWD, P.O. BOX 135, ROMAYOR, TEXAS 77368.

DIAMOND, D.D., I. BUTLER, N.J. CRAIG, AND T. FOTI. 1986. A SURVEY OF THE POTENTIAL NATIONAL NATURAL LANDMARKS OF THE WEST GULF COASTAL PLAIN: BIOTIC THEMES. USDOI, NPS, WASHINGTON, D.C.

Specimen:

Element Occurrence Record

Scientific Name: Quercus nigra-quercus phellos series

Occurrence #: 44 **Eo Id:** 1910

Common Name: Water Oak-willow Oak Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12040103 - East Fork San Jacinto

County Name: Harris

State: TX

Mapsheet: 30095-A2, Moonshine Hill

Directions:

INTERDISTRIBUTARY FLAT, EAST OF CANEY CREEK, WEST OF MAIN PARK ROAD, CA. THREE-QUARTER MILE WEST-NORTHWEST OF ISABELL LAKE, LAKE HOUSTON SP

Survey Information:

First Observation:

Survey Date: 1989-08-17

Last Observation: 1989

Eo Type:

Eo Rank: BC

Eo Rank Date: 1989-08-17

Observed Area:

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: DESCRIPTION AND PLANT LIST IN DLI REPORT, SITE 2

Managed Area:

Managed Area Name

LAKE HOUSTON STATE PARK

Reference:

Citation:

TEXAS PARKS & WILDLIFE DEPARTMENT. 1990. LAKE HOUSTON STATE PARK. SUMMARY OF REPRESENTATIVE PLANT COMMUNITIES.

Specimen:

Element Occurrence Record

Scientific Name: Quercus nigra-quercus phellos series

Occurrence #: 47 **Eo Id:** 7810

Common Name: Water Oak-willow Oak Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-C7, Davis Hill

Directions:

OLD TRINITY RIVER TERRACES, EAST SIDE OF DAVIS BAYOU, NEAR CENTER, DAVIS HILL SP

Survey Information:

First Observation:

Survey Date: 1989-08-15

Last Observation: 1989

Eo Type:

Eo Rank: C

Eo Rank Date: 1989-08-15

Observed Area:

Comments:

General Description: BOTTOMLAND HARDWOOD FOREST WITH DURAND OAK, CHERRYBARK OAK, SWAMP CHESTNUT OAK, ETC.; SELECT CUTTING HAS OCCURRED

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: DESCRIPTION AND PLANT LIST IN DLI REPORT, SITE 1

Managed Area:

Managed Area Name

DAVIS HILL STATE PARK

Reference:

Citation:

TEXAS PARKS & WILDLIFE DEPARTMENT. 1990. DAVIS HILL STATE PARK. SUMMARY OF REPRESENTATIVE PLANT COMMUNITIES.

Specimen:

Element Occurrence Record

Scientific Name: Quercus stellata-carya texana series

Occurrence #: 8 **Eo Id:** 7110

Common Name: Post Oak-black Hickory Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S4

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-C7, Davis Hill

Directions:

MODERATELY STEEP EAST-FACING SLOPES, EAST SIDE OF DAVIS HILL DOME, DAVIS HILL SP

Survey Information:

First Observation:

Survey Date: 1989-08-15

Last Observation: 1989

Eo Type:

Eo Rank: CD

Eo Rank Date: 1989-08-15

Observed Area:

Comments:

General Description: MIXED FOREST OVER FLEMING FORMATION; SOME OPENINGS SUPPORT CALCIPHILIC FORBS

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: DESCRIPTION AND PLANT LIST IN DLI REPORT, SITE 4

Managed Area:

Managed Area Name

DAVIS HILL STATE PARK

Reference:

Citation:

TEXAS PARKS & WILDLIFE DEPARTMENT. 1990. DAVIS HILL STATE PARK. SUMMARY OF REPRESENTATIVE PLANT COMMUNITIES.

Specimen:

Element Occurrence Record

Scientific Name: Rookery

Occurrence #: 206 **Eo Id:** 3783

Common Name:

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: GNR **State Rank:** SNR

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name:	State:	Mapsheet:
Liberty	TX	30094-A7, Liberty

Directions:

SLOUGH NEAR TRINITY RIVER; ADJACENT TO RAILROAD RIGHT-OF-WAY; NORTH-NORTHWEST OF LIBERTY CA 4 MILES

Survey Information:

First Observation: 1979 **Survey Date:** **Last Observation:** 1985

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: BUTTON WILLOW AND CYPRESS TREES, 2-10 METERS; HUMAN DISTURBANCE MODERATE

Comments: COLONY NUMBER 587-061

Protection Comments:

Management Comments:

Data:

EO Data: NESTING COLONY OF THE CATTLE EGRET, LITTLE BLUE HERON, GREAT EGRET

Managed Area:

Managed Area Name

Reference:

Citation:

TEXAS COLONIAL WATERBIRD SOCIETY AND TEXAS PARKS & WILDLIFE DEPARTMENT. 1981-1985. TEXAS COLONIAL WATERBIRD CENSUS SUMAMRY.

MULLINS, L.M. ET.AL. 1982. ET.SEQ. ATLAS & CENSUS OF TEXAS WATERBIRD COLONIES, 1973-1980. TX COLONIAL WATERBIRD SOCIETY.

Specimen:

Element Occurrence Record

Scientific Name: Rookery

Occurrence #: 208 **Eo Id:** 1495

Common Name:

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: GNR **State Rank:** SNR

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-B7, Capers Ridge

Directions:

SLOUGH NEAR TRINITY RIVER; NORTHERN PORTION OF KNIGHTS FOREST

Survey Information:

First Observation: 1979

Survey Date:

Last Observation: 1979

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description: BUTTON WILLOW IN SHALLOW WATER, 2-4 METERS

Comments: COLONY NUMBER 587-060

Protection Comments:

Management Comments:

Data:

EO Data: NESTING COLONY OF THE CATTLE EGRET, LITTLE BLUE HERON

Managed Area:

Managed Area Name

Reference:

Citation:

MULLINS, L.M. ET.AL. 1982. ET.SEQ. ATLAS & CENSUS OF TEXAS WATERBIRD COLONIES, 1973-1980. TX COLONIAL WATERBIRD SOCIETY.

Specimen:

Element Occurrence Record

Scientific Name: Rookery

Occurrence #: 209 **Eo Id:** 950

Common Name:

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: GNR **State Rank:** SNR

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name:	State:	Mapsheet:
Liberty	TX	30094-B6, Hardin
		30094-C6, Arizona Creek
		30094-C7, Davis Hill
		30094-B7, Capers Ridge

Directions:

SMALL, SHALLOW SLOUGH IN MOSS HILL

Survey Information:

First Observation: 1973 **Survey Date:** **Last Observation:** 1979

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: BUTTON WILLOW IN SHALLOW WATER, 2-4 METERS

Comments: COLONY NUMBER 587-059

Protection Comments:

Management Comments:

Data:

EO Data: NESTING COLONY OF THE CATTLE EGRET, LITTLE BLUE HERON, WHITE IBIS

Managed Area:

Managed Area Name

Reference:

Citation:

MULLINS, L.M. ET.AL. 1982. ET.SEQ. ATLAS & CENSUS OF TEXAS WATERBIRD COLONIES, 1973-1980. TX COLONIAL WATERBIRD SOCIETY.

Specimen:

Element Occurrence Record

Scientific Name: Rookery

Occurrence #: 210 **Eo Id:** 951

Common Name:

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: GNR **State Rank:** SNR

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name:	State:	Mapsheet:
Liberty	TX	30094-C7, Davis Hill

Directions:

OXBOW NEAR TRINITY RIVER WEST-NORTHWEST OF MOSS HILL; (CADE LAKE); SOUTH-SOUTHEAST OF RAYBURN LAKE CA. 2.25 MILES

Survey Information:

First Observation: 1979 **Survey Date:** **Last Observation:** 1984

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: BUTTON WILLOW AND CYPRESS TREES IN SHALLOW SLOUGH, 2-10 METERS

Comments: COLONY NUMBER 587-058

Protection Comments:

Management Comments:

Data:

EO Data: NESTING COLONY OF THE TRICOLORED HERON, CATTLE EGRET, GREAT EGRET

Managed Area:

Managed Area Name

Reference:

Citation:

TEXAS COLONIAL WATERBIRD SOCIETY AND TEXAS PARKS & WILDLIFE DEPARTMENT. 1981-1985. TEXAS COLONIAL WATERBIRD CENSUS SUMAMRY.

MULLINS, L.M. ET.AL. 1982. ET.SEQ. ATLAS & CENSUS OF TEXAS WATERBIRD COLONIES, 1973-1980. TX COLONIAL WATERBIRD SOCIETY.

Specimen:

Element Occurrence Record

Scientific Name: Rookery

Occurrence #: 211 **Eo Id:** 6025

Common Name:

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: GNR **State Rank:** SNR

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-C7, Davis Hill

Directions:

SLOUGH NEAR TRINITY RIVER NORTHWEST OF MOSS HILL; INCLUDES MUD LAKE (OXBOW)

Survey Information:

First Observation: 1979

Survey Date:

Last Observation: 1979

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description: BUTTON WILLOW IN SHALLOW WATER, 2-4 METERS

Comments: COLONY NUMBER 587-057

Protection Comments:

Management Comments:

Data:

EO Data: NESTING COLONY OF THE CATTLE EGRET, LITTLE BLUE HERON

Managed Area:

Managed Area Name

Reference:

Citation:

MULLINS, L.M. ET.AL. 1982. ET.SEQ. ATLAS & CENSUS OF TEXAS WATERBIRD COLONIES, 1973-1980. TX COLONIAL WATERBIRD SOCIETY.

Specimen:

Element Occurrence Record

Scientific Name: Taxodium distichum-nyssa aquatica series

Occurrence #: 12 **Eo Id:** 7535

Common Name: Baldcypress-water Tupelo Series

Track Status: Track all extant and selected historical EOs

TX Protection Status:

Global Rank: G4 **State Rank:** S3

Federal Status:

Location Information:

Watershed:

12030203 - Lower Trinity

County Name: Liberty

State: TX

Mapsheet: 30094-C7, Davis Hill

Directions:

DAVIS BAYOU AND ADJACENT DEPRESSIONS ON TRINITY RIVER TERRACE, CENTER OF DAVIS HILL SP

Survey Information:

First Observation:

Survey Date: 1989-08-15

Last Observation: 1989

Eo Type:

Eo Rank: C

Eo Rank Date: 1989-08-15

Observed Area:

Comments:

General Description: DECIDUOUS SWAMP FOREST IN FREQUENTLY FLOODED OR INUNDATED SOILS

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: DESCRIPTION AND PLANT LIST IN DLI REPORT, SITE 2

Managed Area:

Managed Area Name

DAVIS HILL STATE PARK

Reference:

Citation:

TEXAS PARKS & WILDLIFE DEPARTMENT. 1990. DAVIS HILL STATE PARK. SUMMARY OF REPRESENTATIVE PLANT COMMUNITIES.

Specimen:

Appendix C

Photograph Log

Site Photographs

Facing northeast, this is a view of a forested wetland typical of the project site located on the Harrison Tract near the Trinity River. This area was dominated by bald cypress (*Taxodium distichum*).

Facing southwest, this is a view of a forested wetland typical of the project site located on the Harrison Tract near the Trinity River. This area was dominated by multiple hydrophytic species.

Site Photographs

Facing south, this is a view of a forested wetland typical of the project site located on the Harrison Tract near the Trinity River. This area was dominated by bald cypress (*Taxodium distichum*).

Facing north, this is a view of a forested wetland typical of the project site located on the Harrison Tract near the Trinity River. This area was dominated by water locust (*Gleditsia aquatica*).

Site Photographs

Facing northwest, this is a view of a forested wetland typical of the project site located on the Harrison Tract near the Trinity River. This area was dominated by oak, sugarberry, and elm.

Facing west, this is a view of a forested upland wetland of the project site located on the Harrison Tract and project ROW. This area was dominated by oaks and elms.

Site Photographs

Facing northwest, this is a view of upland scrub/shrub and forested communities typical of the Harrison Tract. Dominant species include sugarberry (*Celtis laevigata*), oak (*Quercus* sp.), and elm (*Ulmus* sp.).

Facing north, this is a view of upland forested communities typical of the Harrison Tract. Dominant species include maple (*Acer* sp.), sugarberry (*Celtis laevigata*), oak (*Quercus* sp.), and elm (*Ulmus* sp.).

Site Photographs

Facing southeast, this is a view of a forested upland typical of the project site located on the Harrison Tract and project ROW.

Facing southeast, this is a view of a forested upland typical of the project site located on the Harrison Tract and project ROW. This area was dominated by loblolly pine (*Pinus taeda*).

Site Photographs

Facing southeast, this is a view of a forested upland typical of the project site located on the Harrison Tract and project ROW.

Facing northeast, this is a view of a forested upland typical of the project site located on the Harrison Tract and project ROW. This area was dominated by loblolly pine.

Site Photographs

Facing west, this is a view of a forested upland typical of the project site located on the Harrison Tract and project ROW. This area was dominated by oaks and elms.

Facing northeast, this is a view of a forested upland typical of the project site located on the Harrison Tract and project ROW. This area was dominated by loblolly pine.

Site Photographs

Facing northeast, this is a view of a forested upland typical of the project site located on the Harrison Tract and project ROW. This area was dominated by loblolly pine.

Facing south, this is a view of herbaceous uplands utilized as pastureland typical of the Harrison Tract and project ROW.

Site Photographs

Facing east, this is a view of herbaceous uplands utilized as pastureland typical of the Harrison Tract and project ROW.

Facing east, this is a view of herbaceous uplands utilized as pastureland typical of the Harrison Tract and project ROW.

Site Photographs

Facing east, this is a view of herbaceous uplands utilized as pastureland typical of the Harrison Tract and project ROW.

Facing west, this is a view of herbaceous uplands utilized as pastureland typical of the Harrison Tract and project ROW.

Site Photographs

Facing south, this is a view of herbaceous uplands utilized as agricultural fields typical of the Harrison Tract and project ROW.

Facing south, this is a view of herbaceous uplands utilized as agricultural fields typical of the Harrison Tract and project ROW.

Site Photographs

Facing west, this is a view of undisturbed herbaceous uplands typical of the Harrison Tract and project ROW.

Facing south, this is a view of herbaceous uplands utilized as pastureland typical of the Harrison Tract and project ROW.

Site Photographs

Facing north, this is a view of herbaceous wetlands typical of the Harrison Tract and the project ROW.

Facing north, this is a view of herbaceous wetlands typical of the Harrison Tract and the project ROW.

Site Photographs

Facing south, this is a view of herbaceous wetlands typical of the Harrison Tract and the project ROW.

Facing west, this is a view of herbaceous wetlands typical of the Harrison Tract and the project ROW.

Site Photographs

Facing northeast, this is a view of herbaceous uplands utilized as pastureland typical of the Harrison Tract and project ROW.

Facing northeast, this is a view of an aquatic habitat (pond) on the Harrison Tract and its associated vegetation.

Site Photographs

Facing northeast, this is a view of an aquatic habitat (pond) on the Harrison Tract and its associated vegetation.

Facing northeast, this is a view of an aquatic habitat (pond) on the Harrison Tract and its associated vegetation.

Exhibits

Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Harrison Tract

N

0 500 1,000 Feet

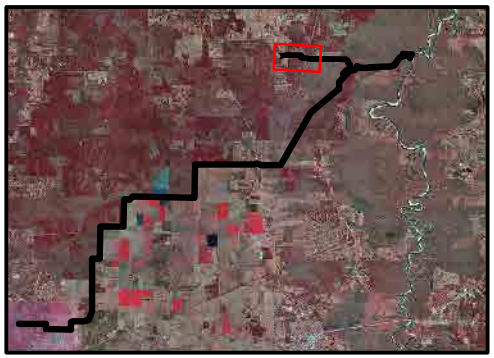
CROUCH ENVIRONMENTAL SERVICES, INC.

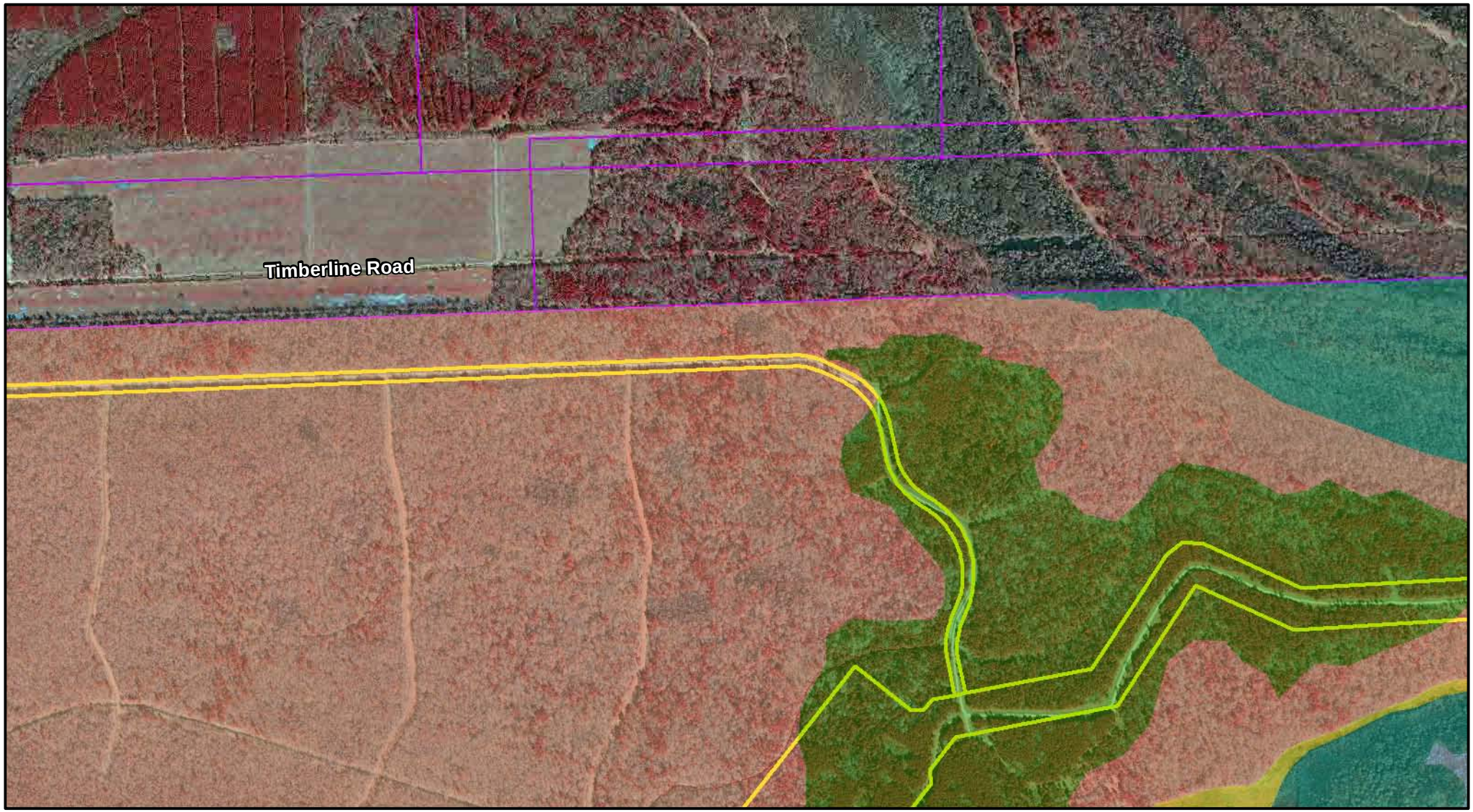
10/6/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, AND VEGETATION TYPES DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Harrison Tract

N

0 500 1,000 Feet

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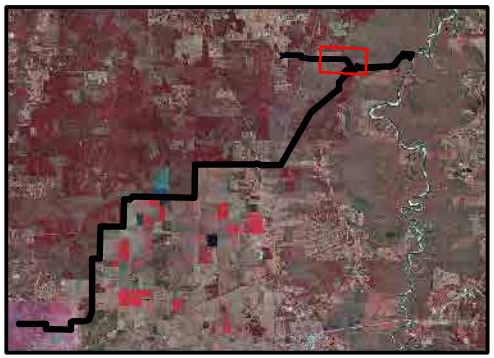

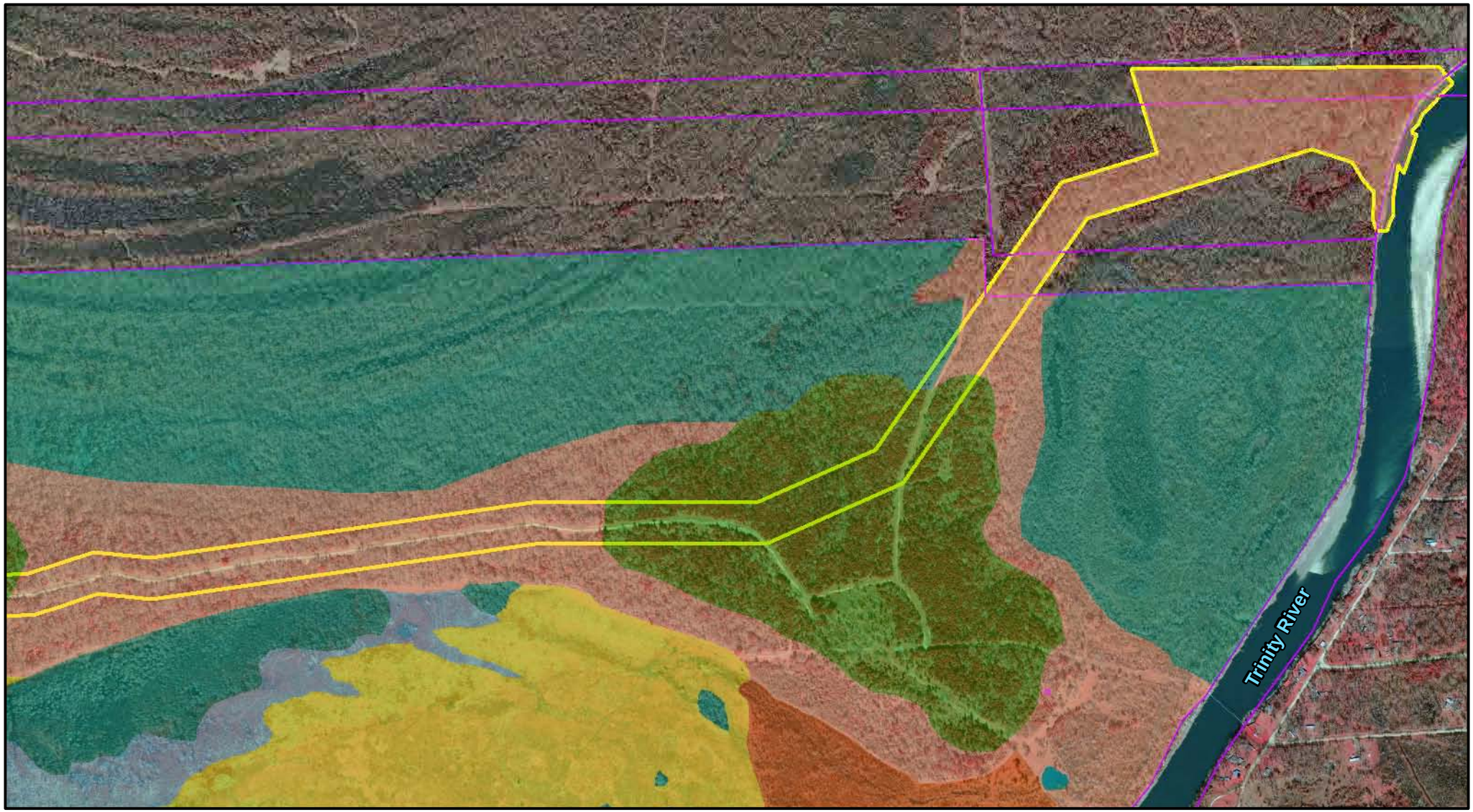

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N

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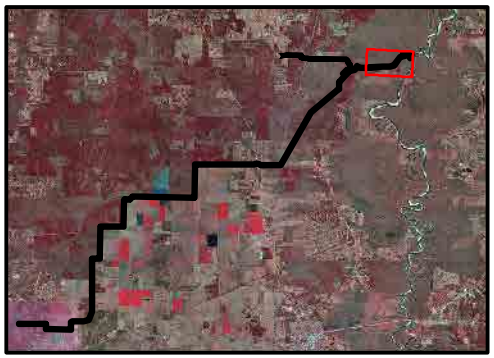

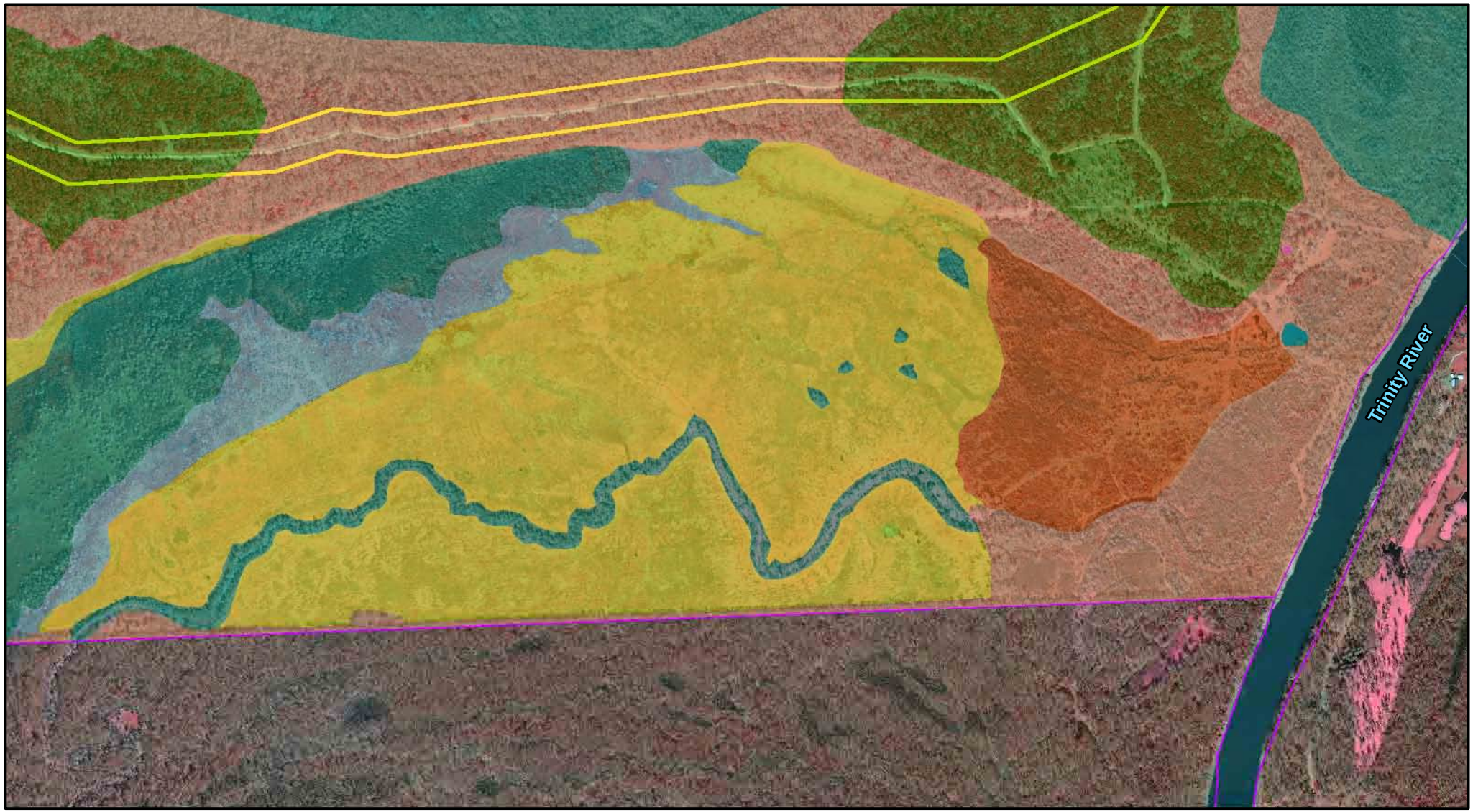

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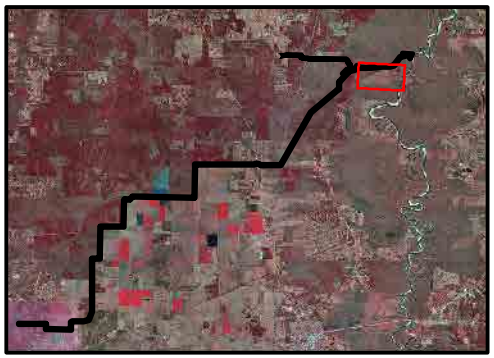

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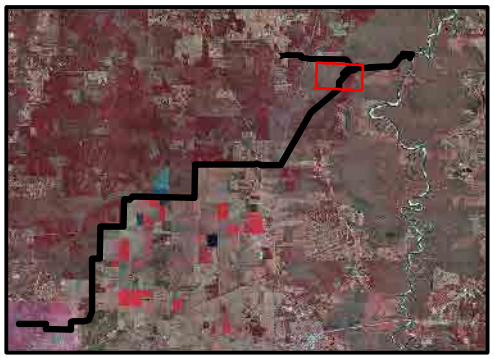

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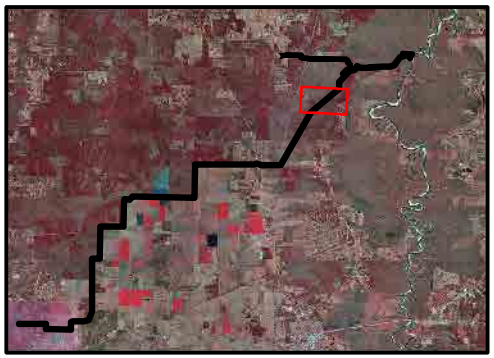

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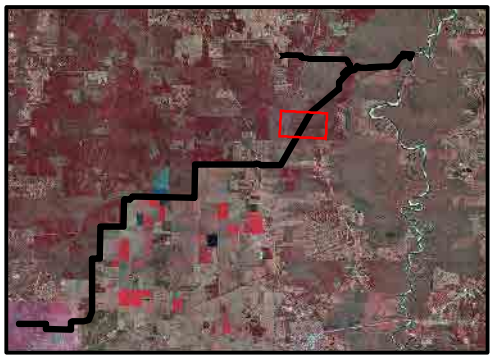

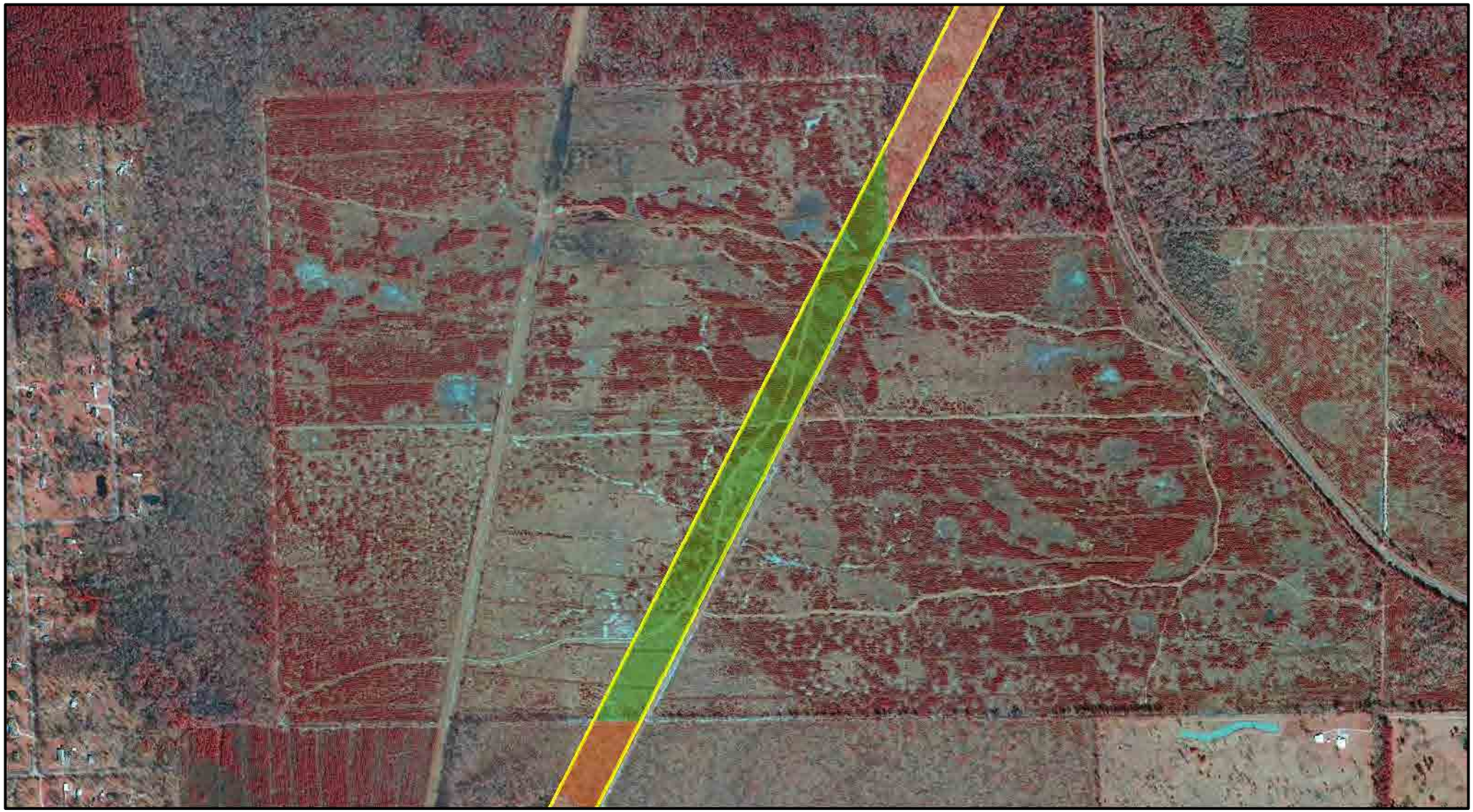

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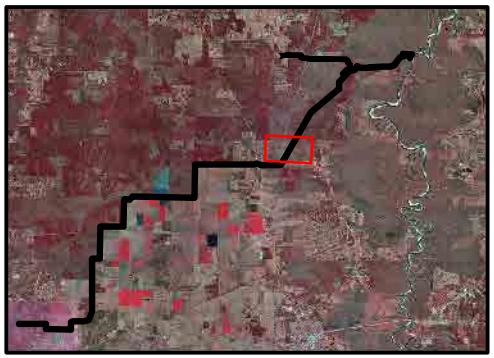

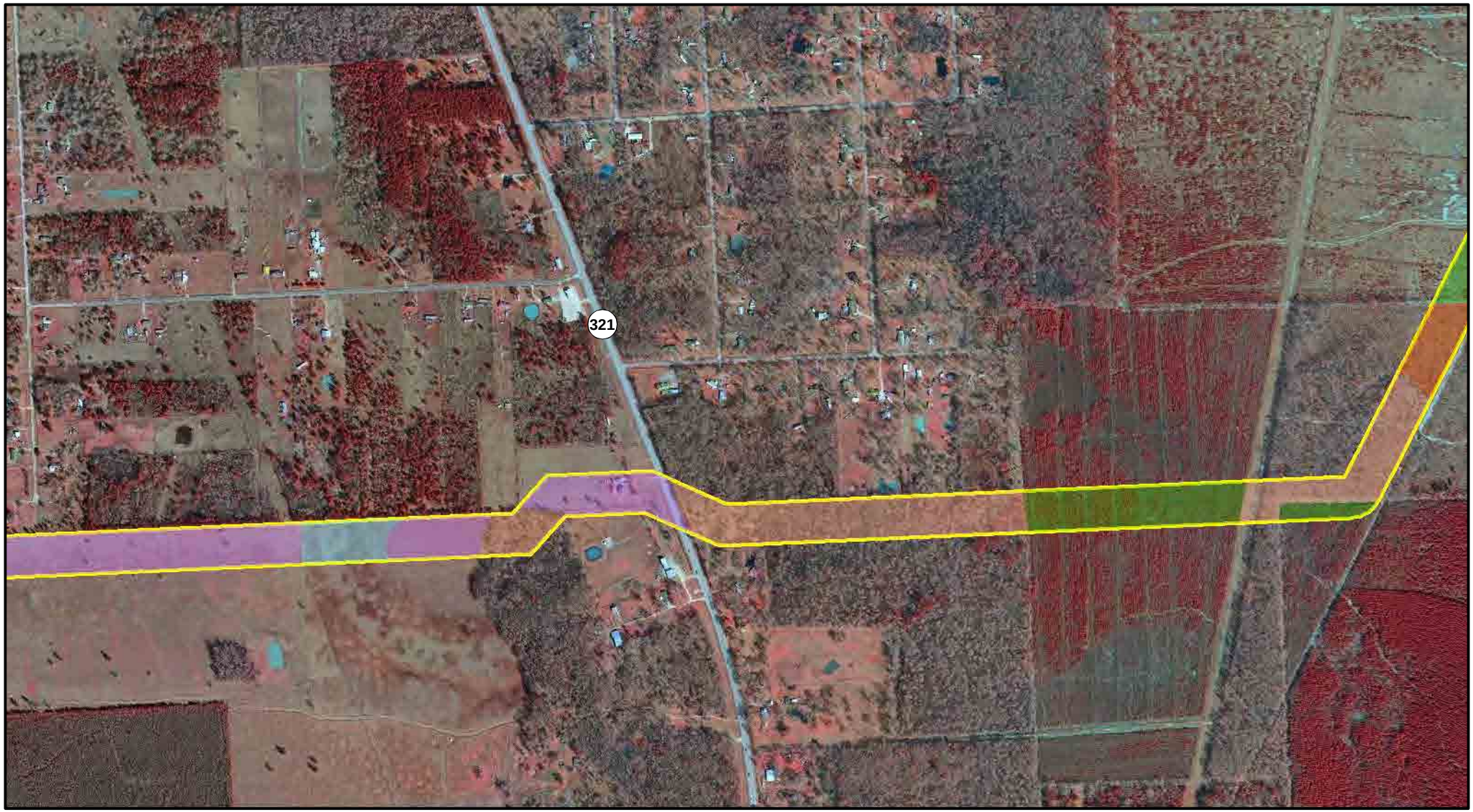

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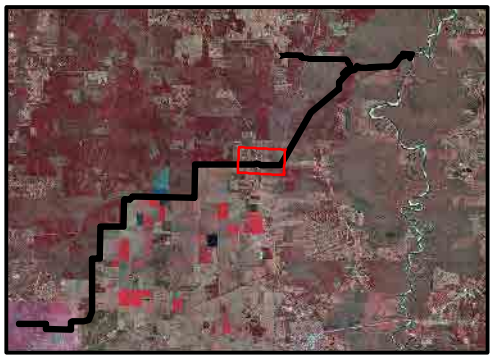

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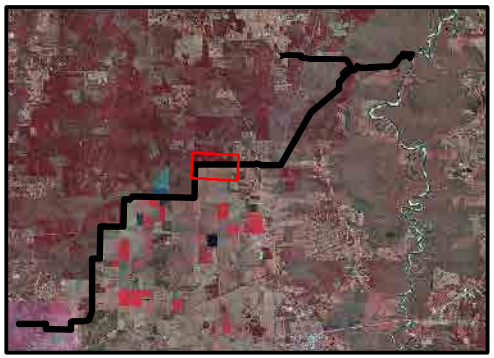

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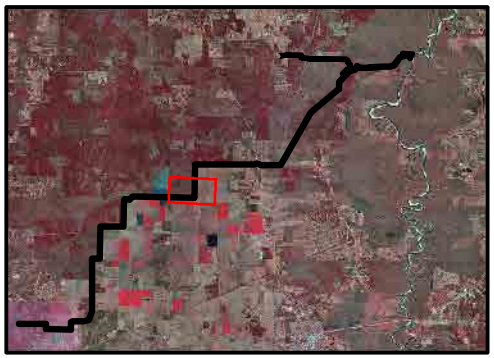

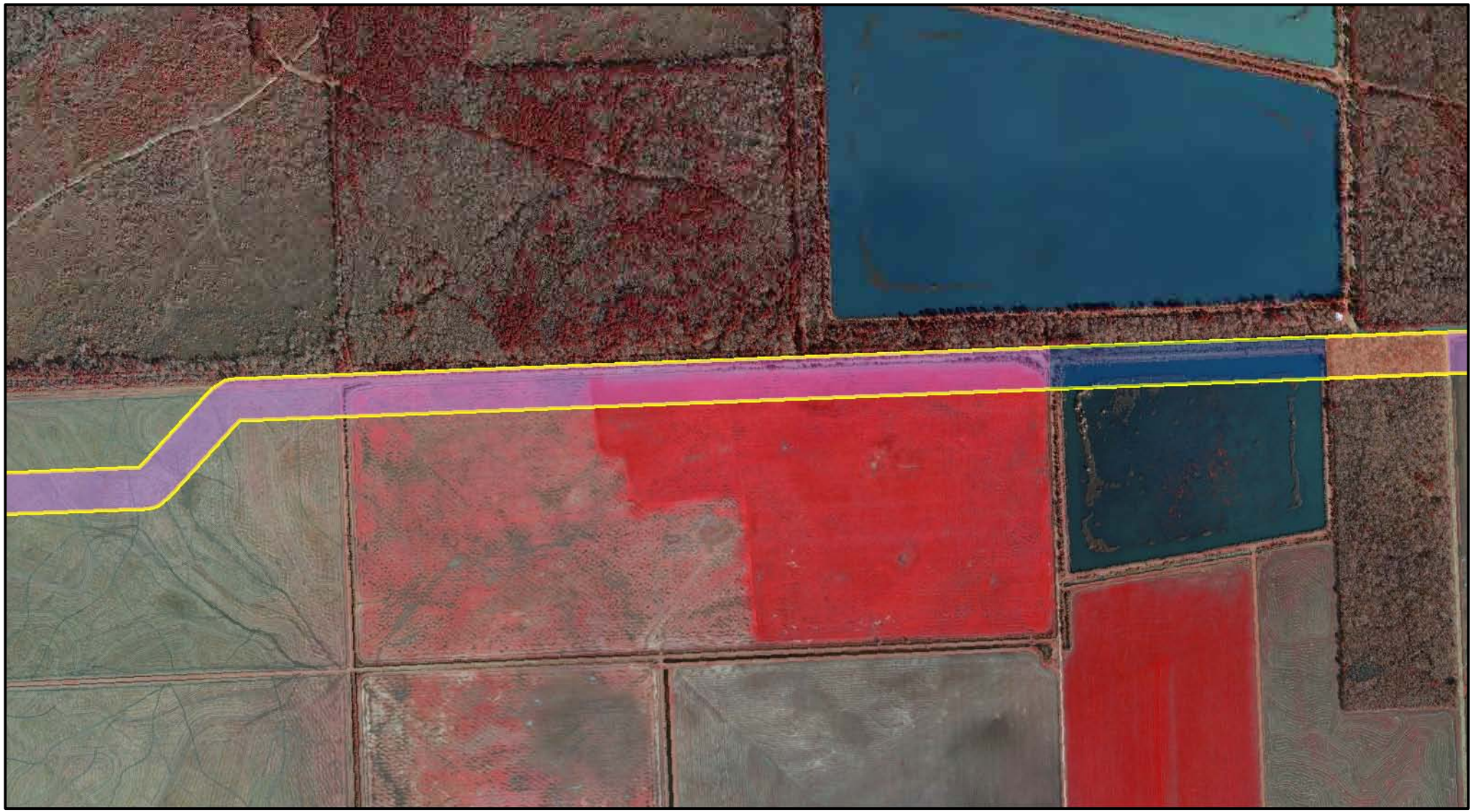

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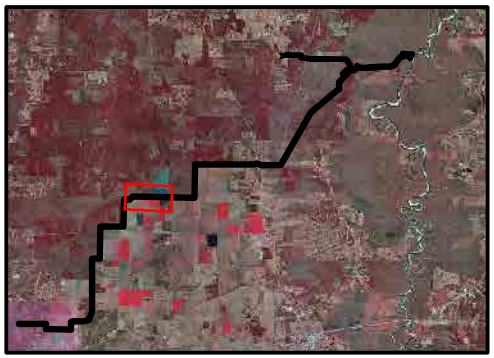

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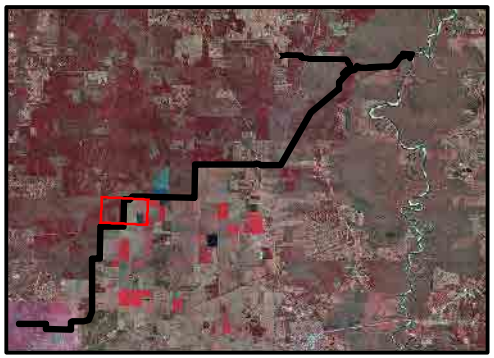

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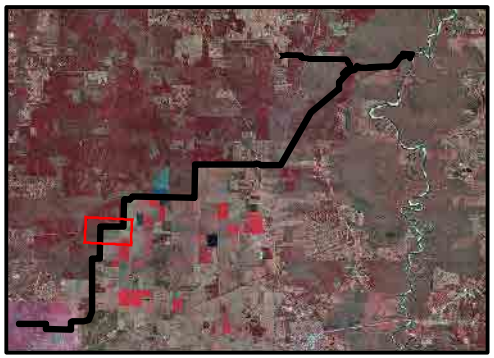

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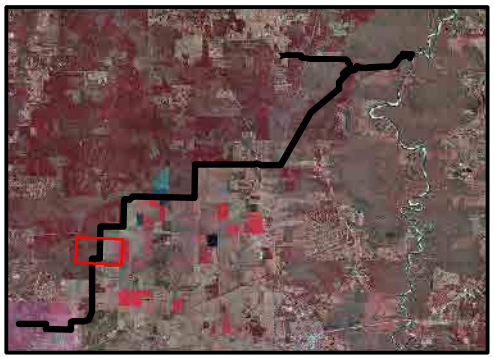

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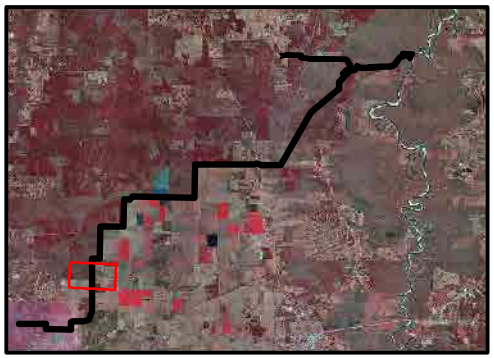

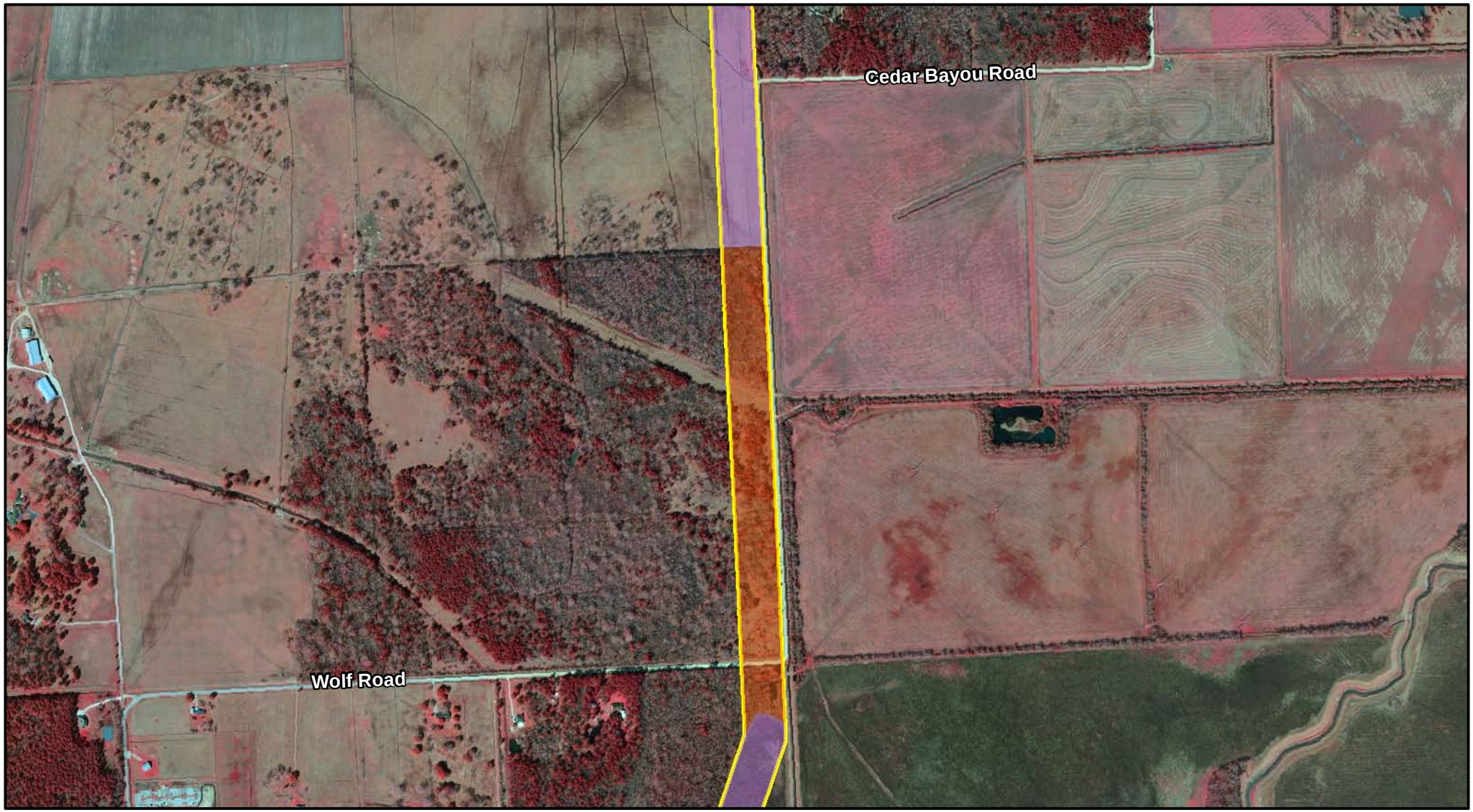

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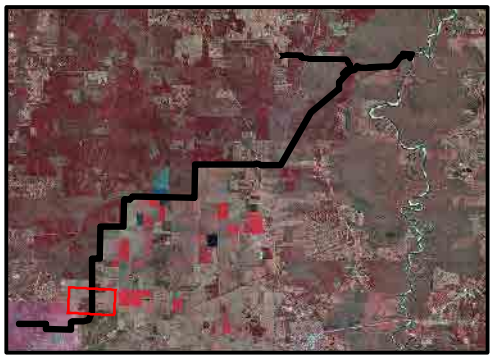

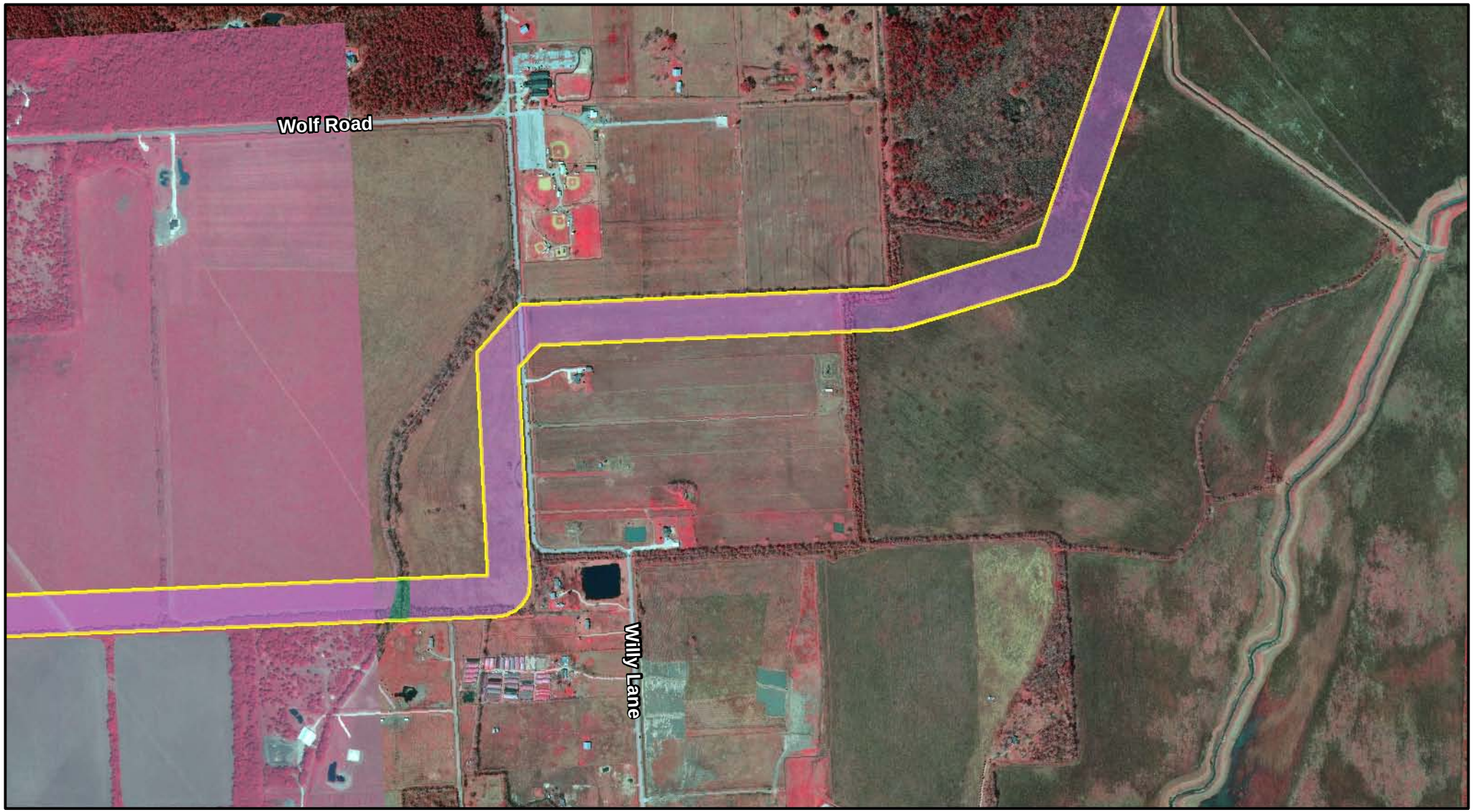

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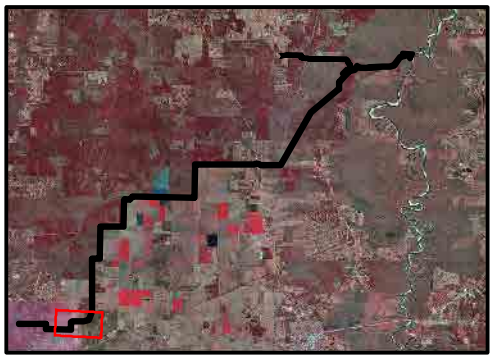
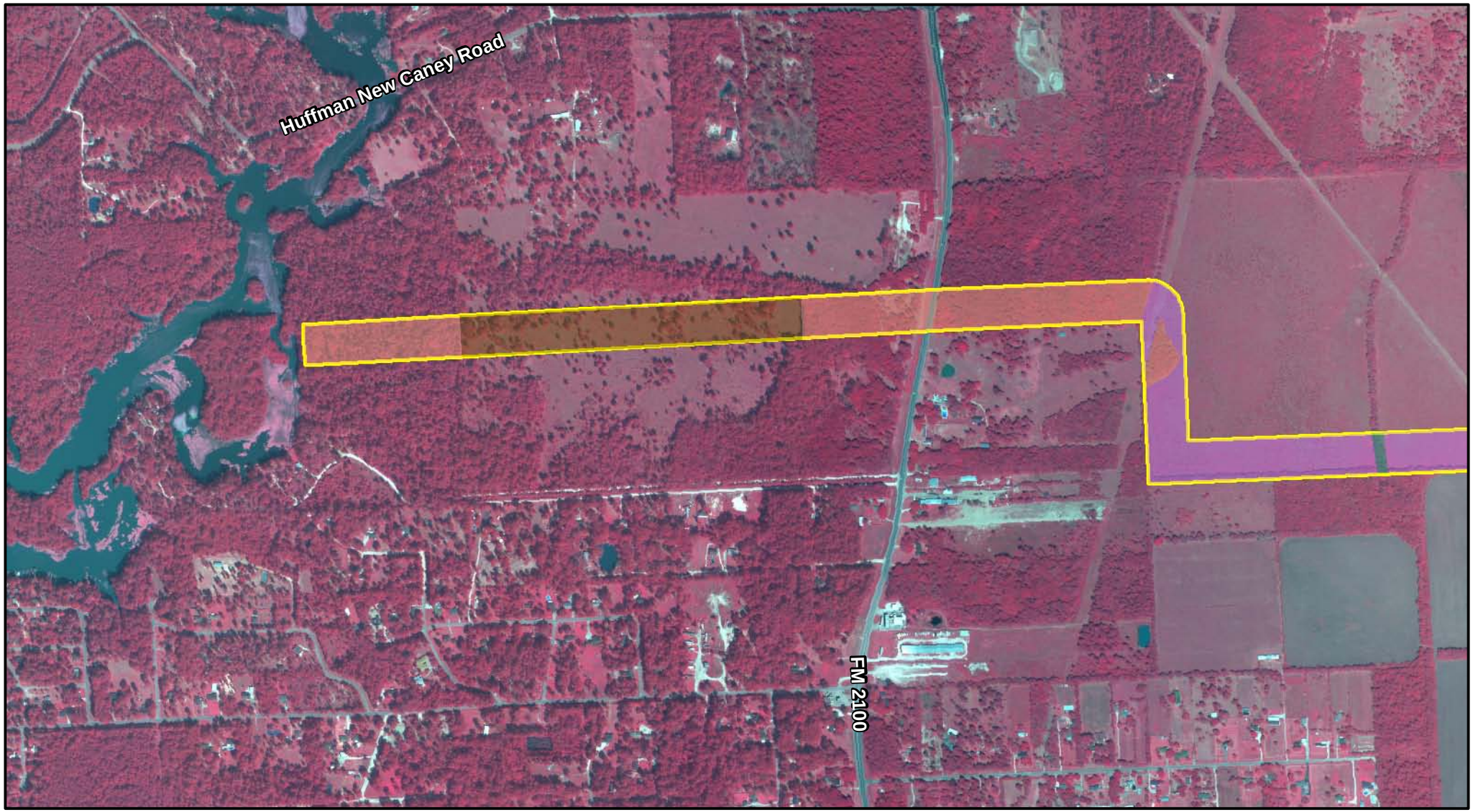
2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, AND VEGETATION TYPES DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Harrison Tract

N

0 500 1,000 Feet

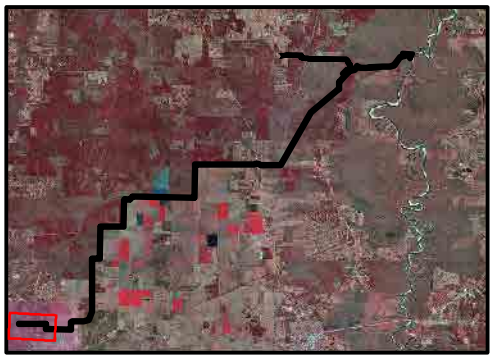
CROUCH ENVIRONMENTAL SERVICES, INC.

10/6/2009

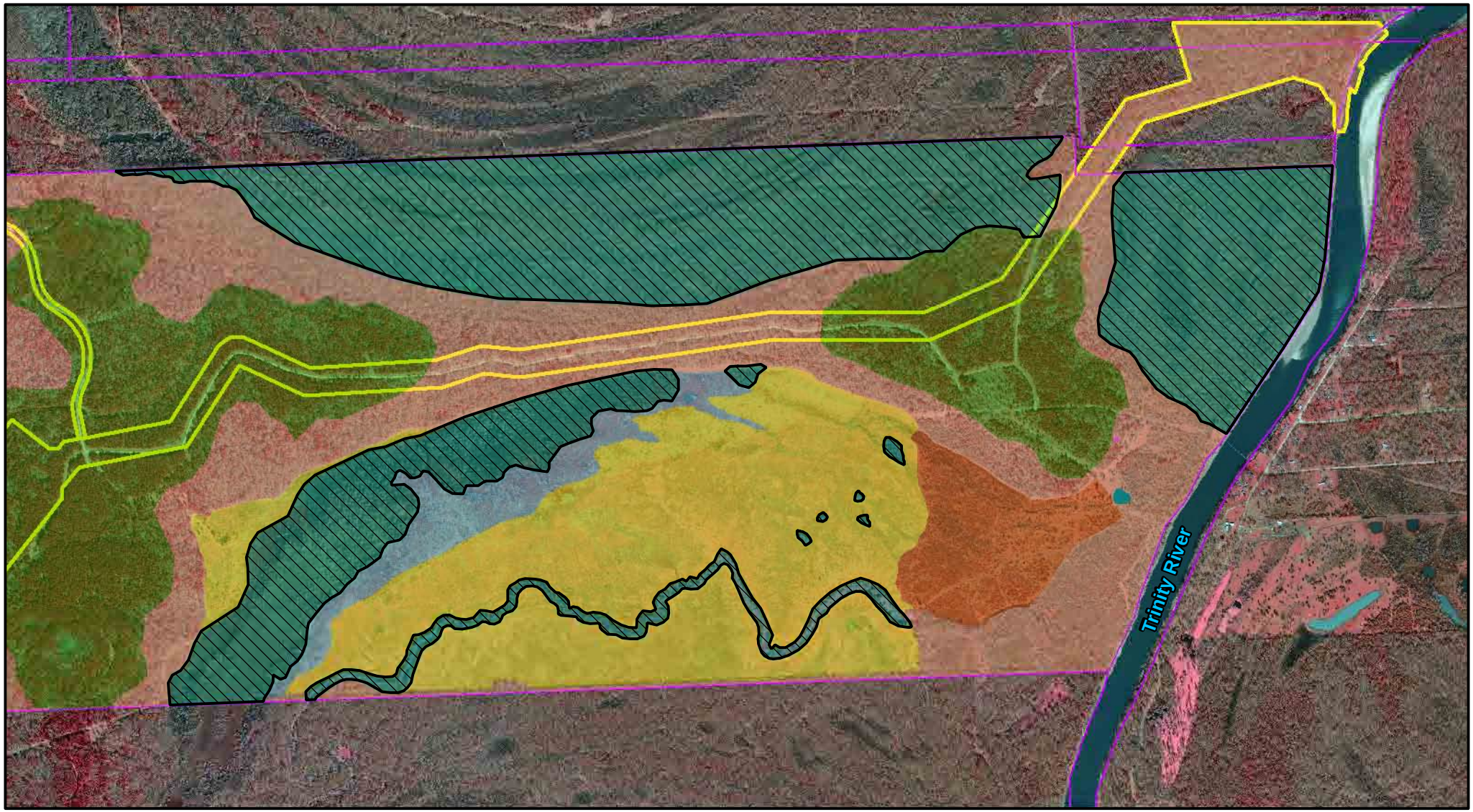
AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, AND VEGETATION TYPES DATA OVERLAYS

Liberty and Harris County, Texas



Louisiana Black Bear



Proposed ROW | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pine | Tallow Dominated | Louisiana Black Bear/Texas Black Bear | Harrison Tract

N

0 750 1,500 Feet

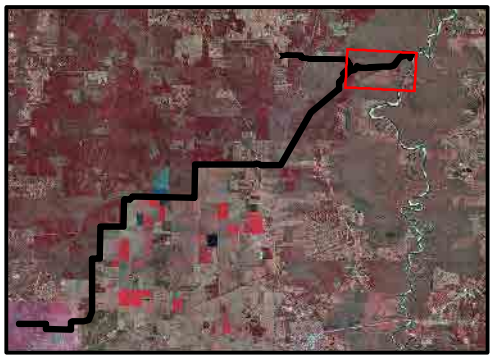
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

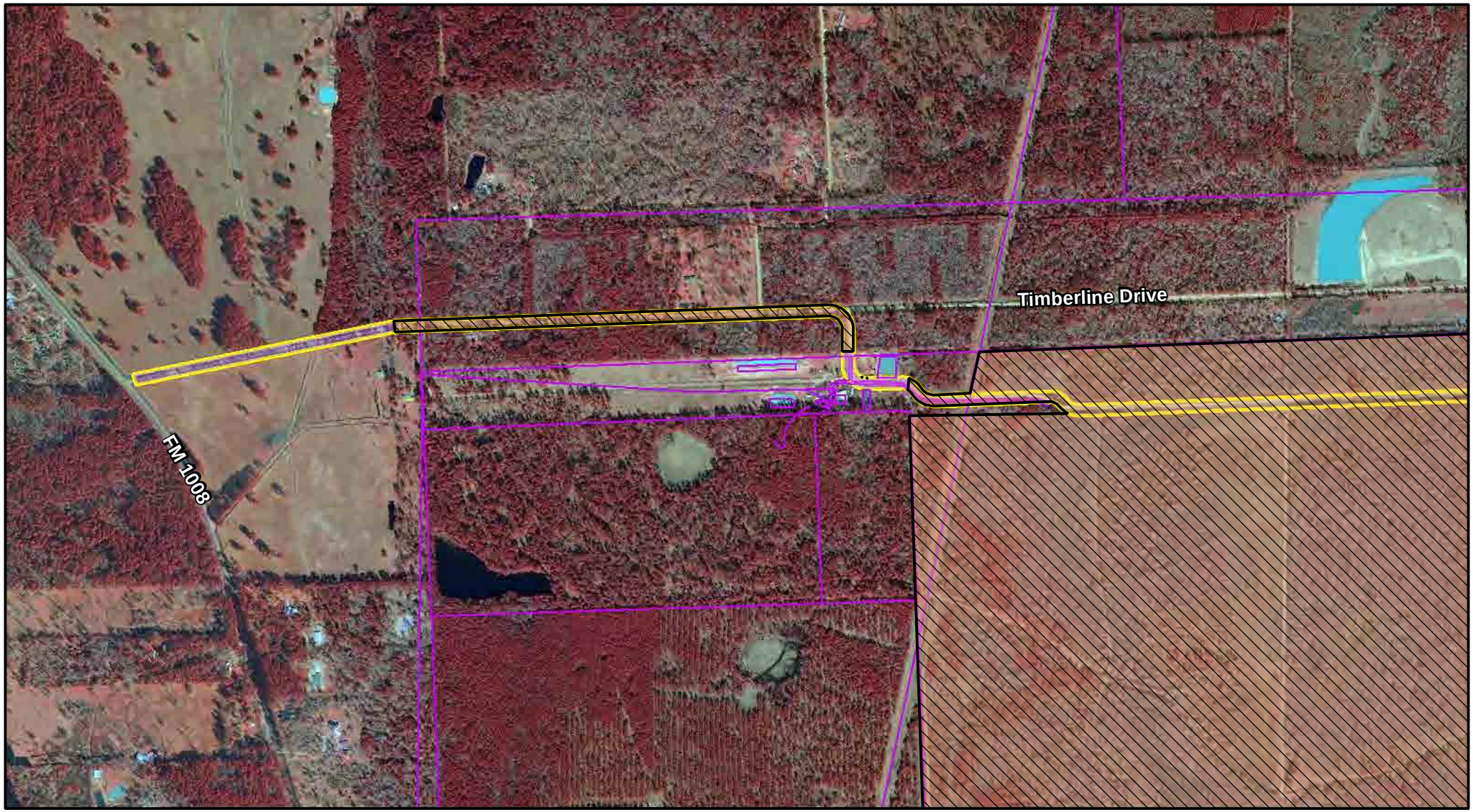
AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND LOUISIANA BLACK BEAR/TEXAS BLACK BEAR DATA OVERLAYS

Liberty and Harris County, Texas



Plains Spotted Skunk



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

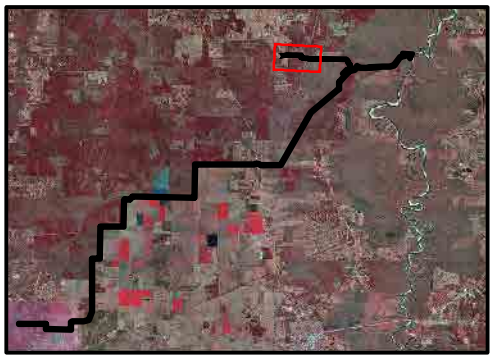
CROUCH ENVIRONMENTAL SERVICES, INC.

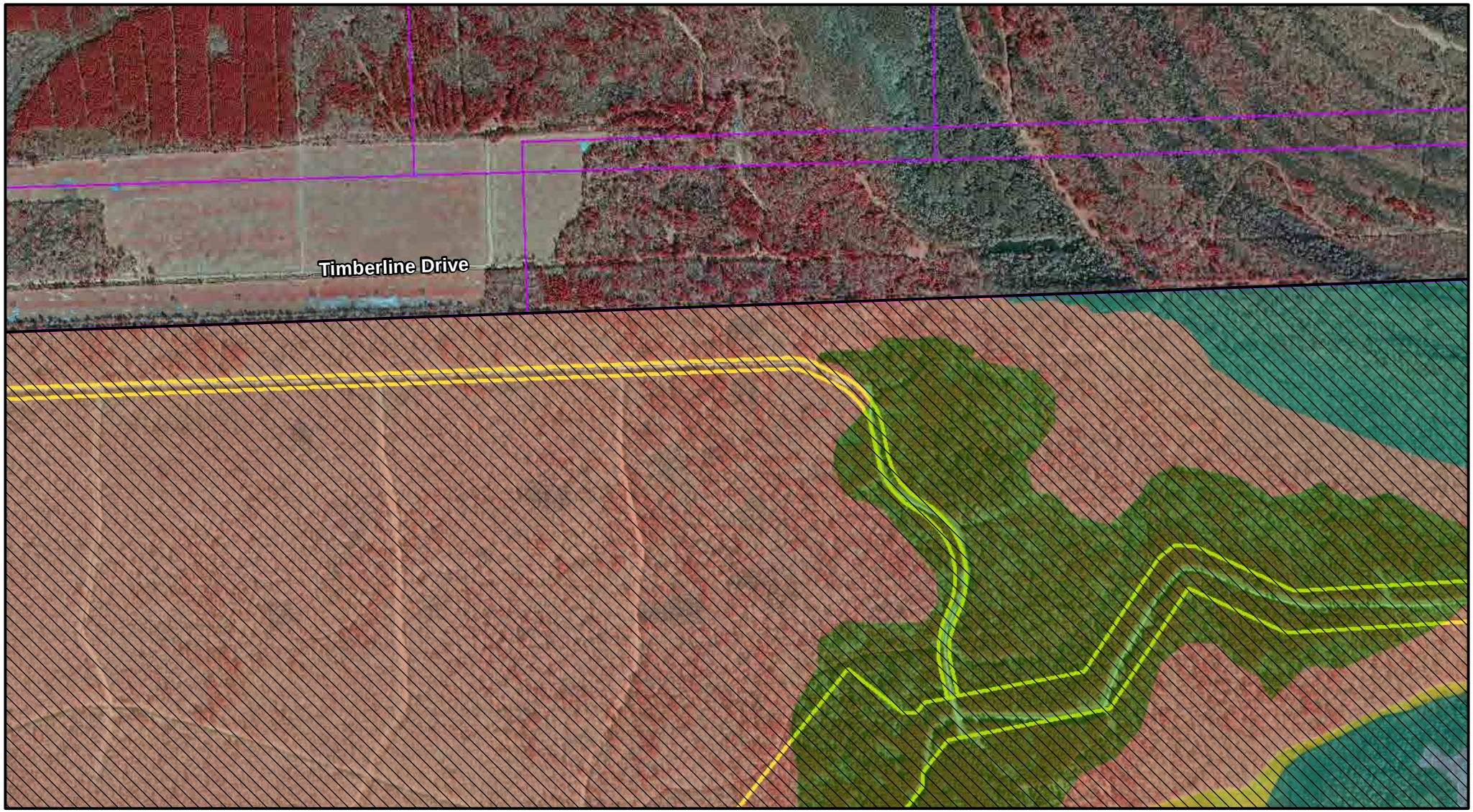
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

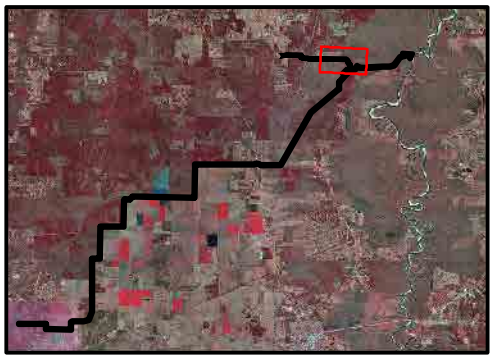
CROUCH ENVIRONMENTAL SERVICES, INC.

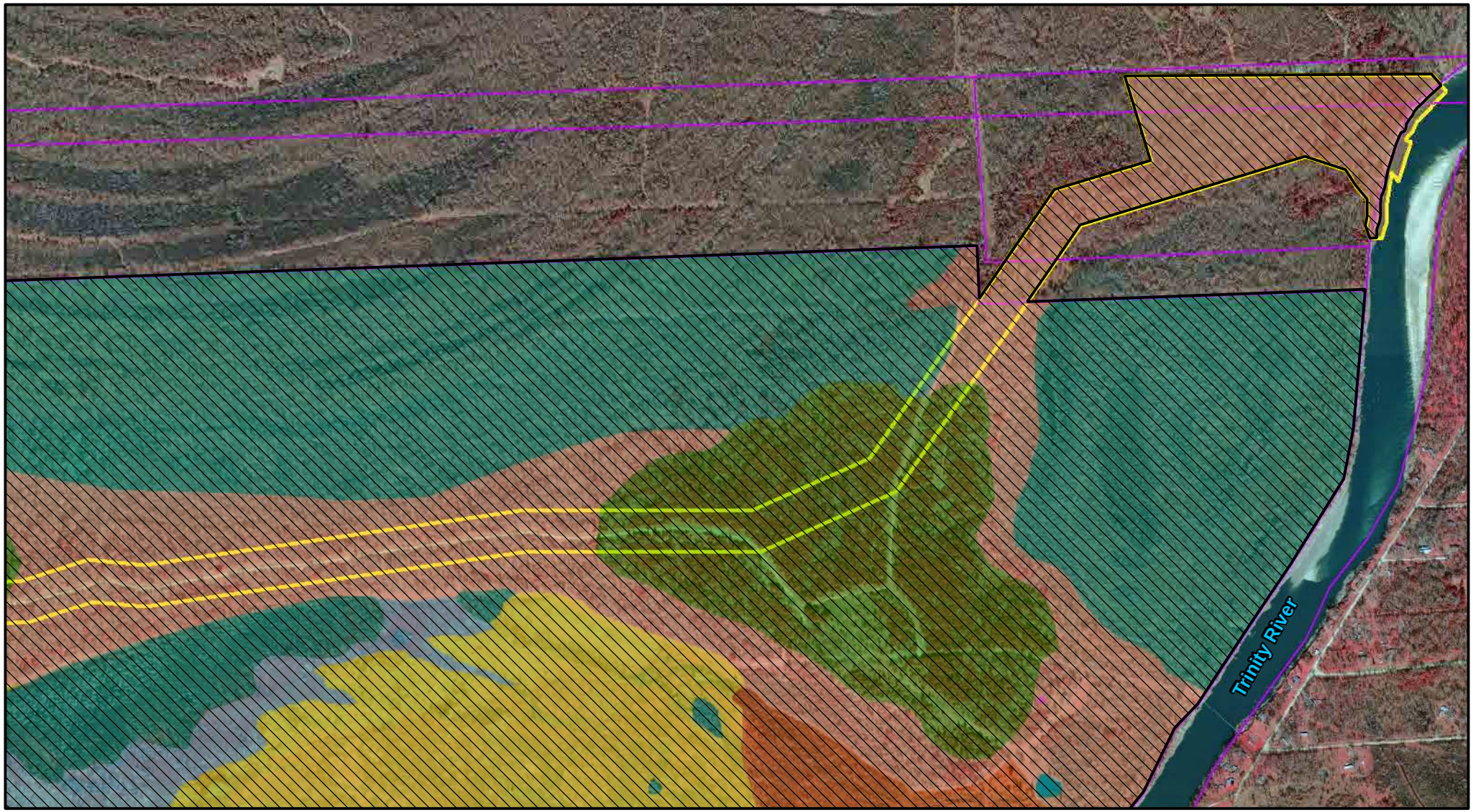
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

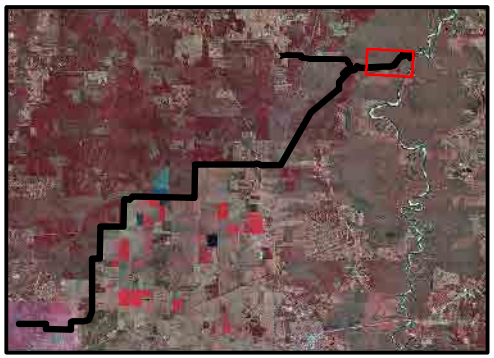
CROUCH ENVIRONMENTAL SERVICES, INC.

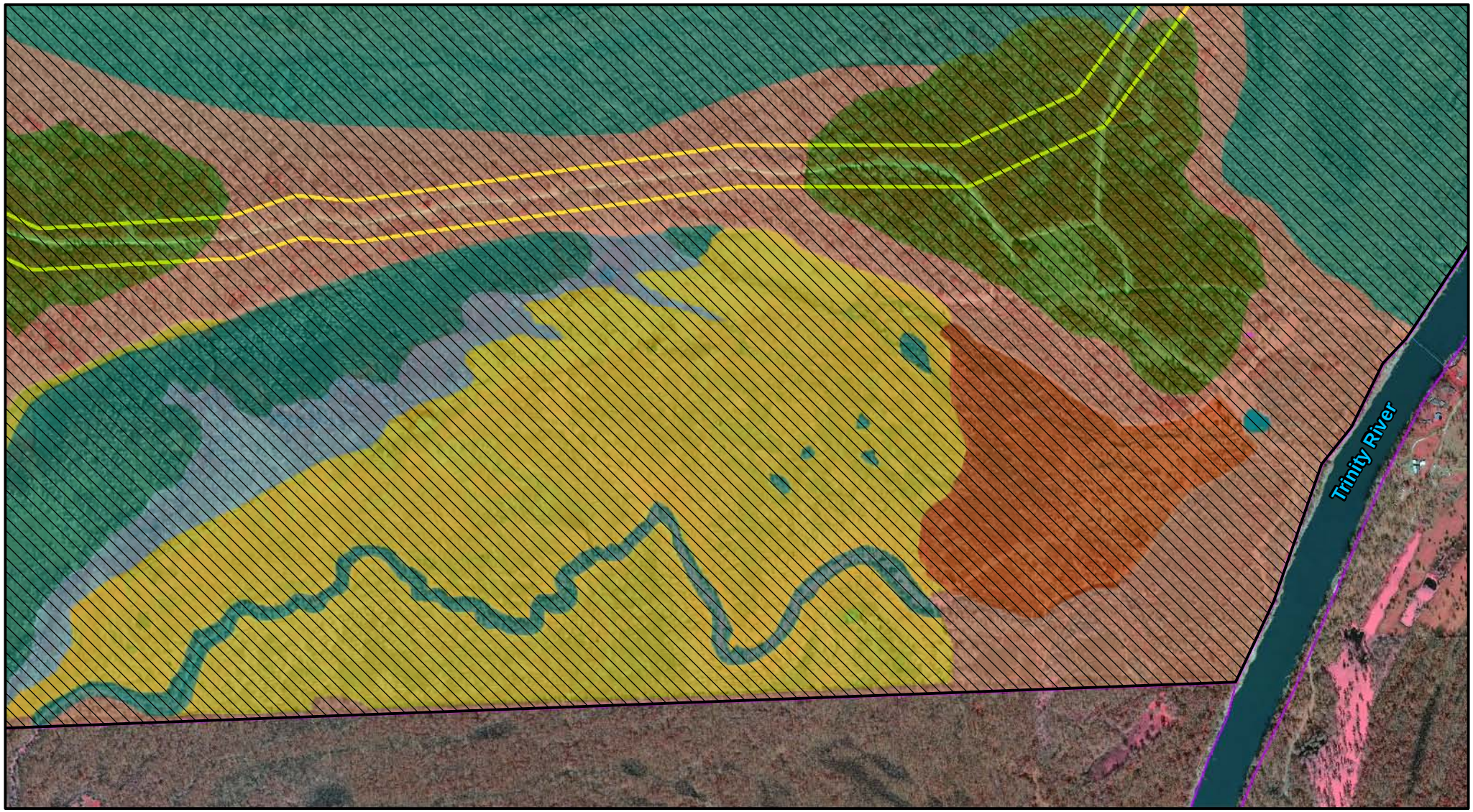
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

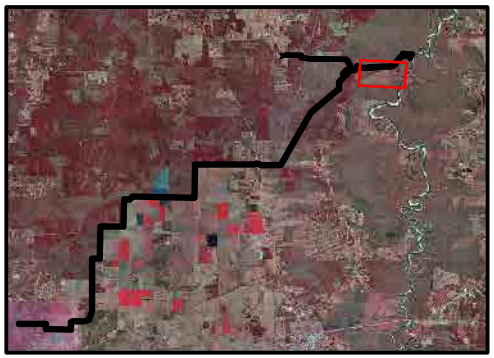
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

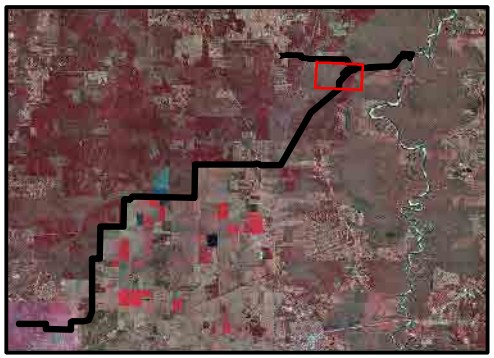
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

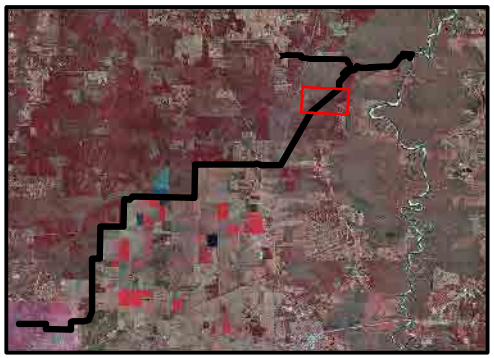
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

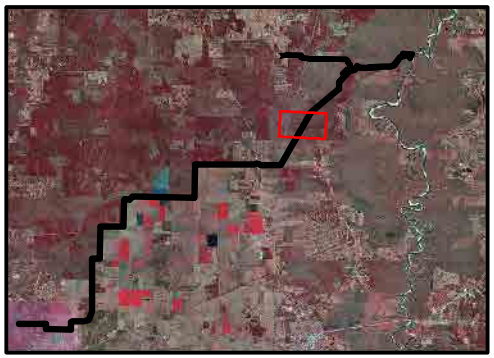
CROUCH ENVIRONMENTAL SERVICES, INC.

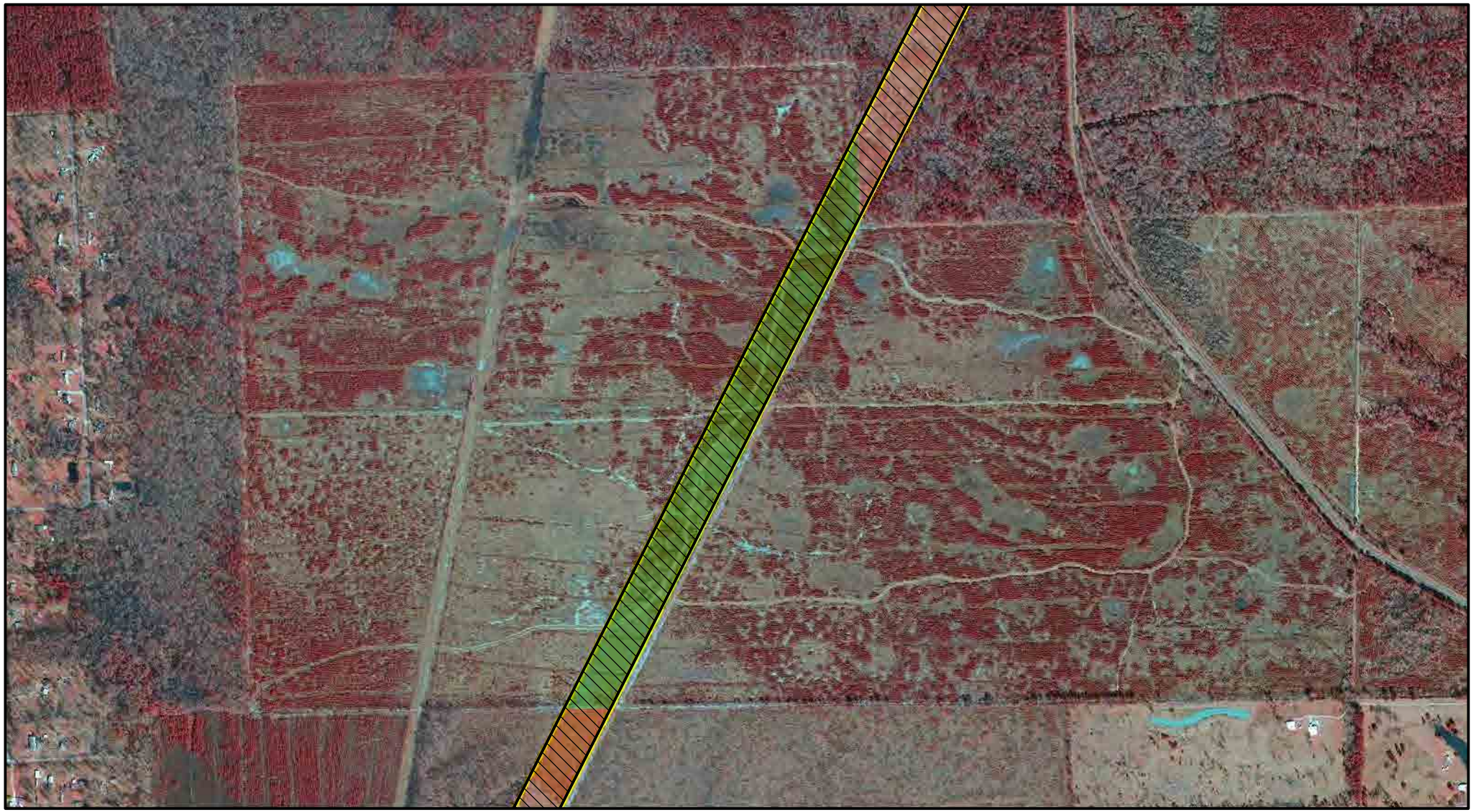
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

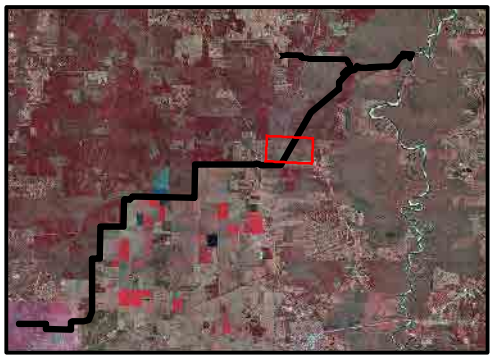
CROUCH ENVIRONMENTAL SERVICES, INC.

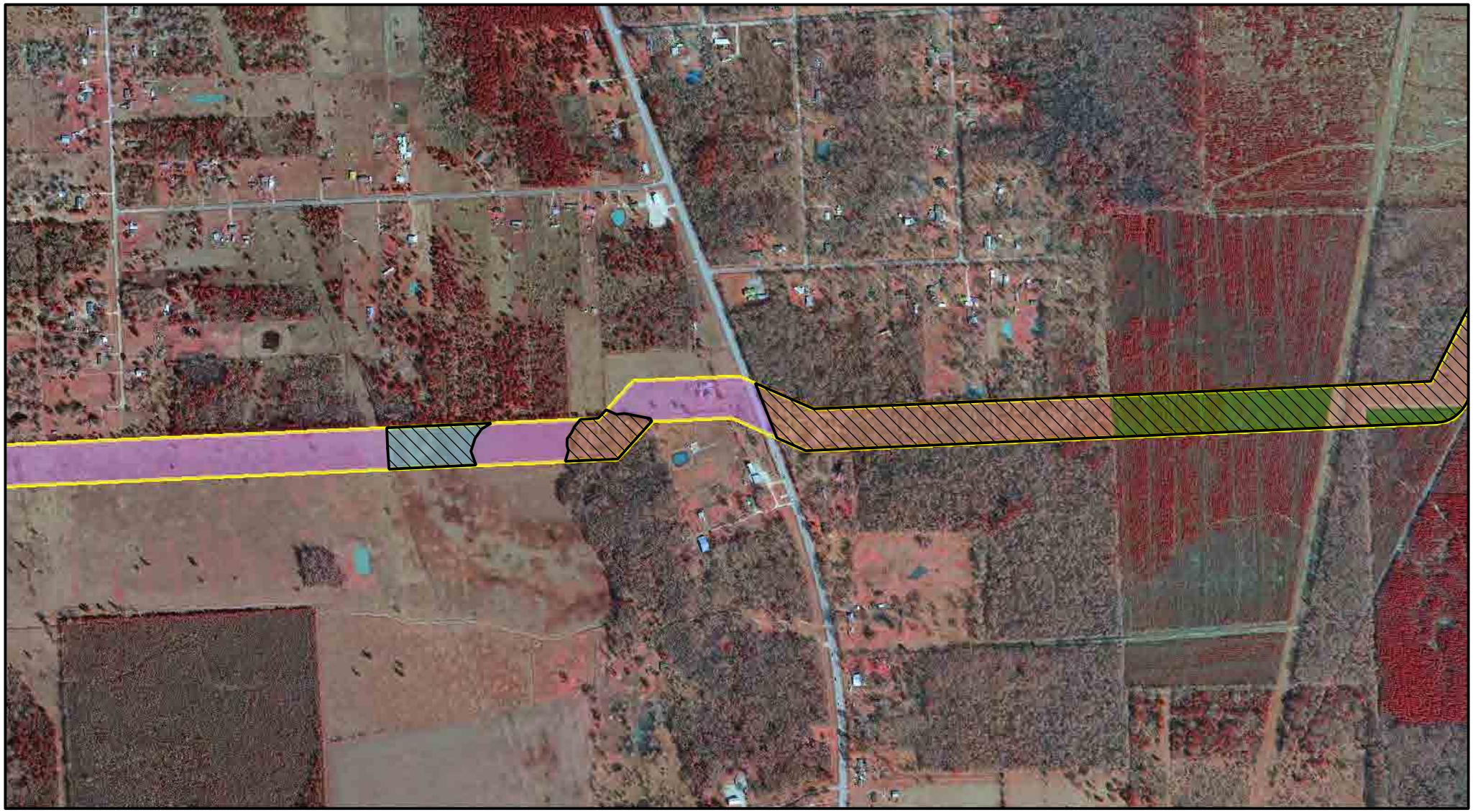
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

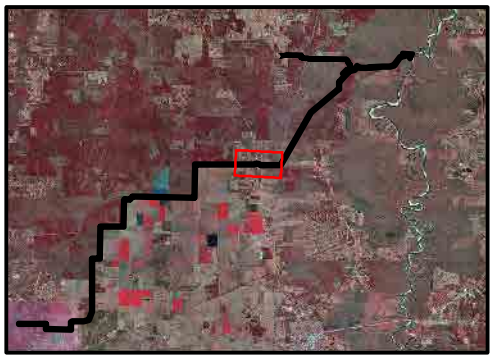
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

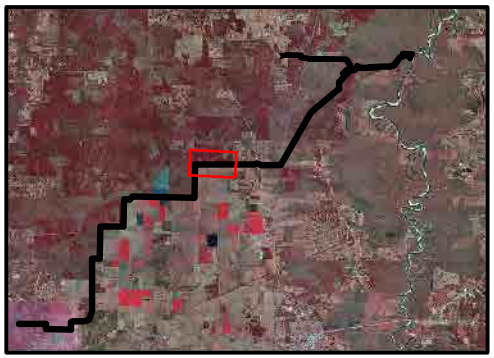
CROUCH ENVIRONMENTAL SERVICES, INC.

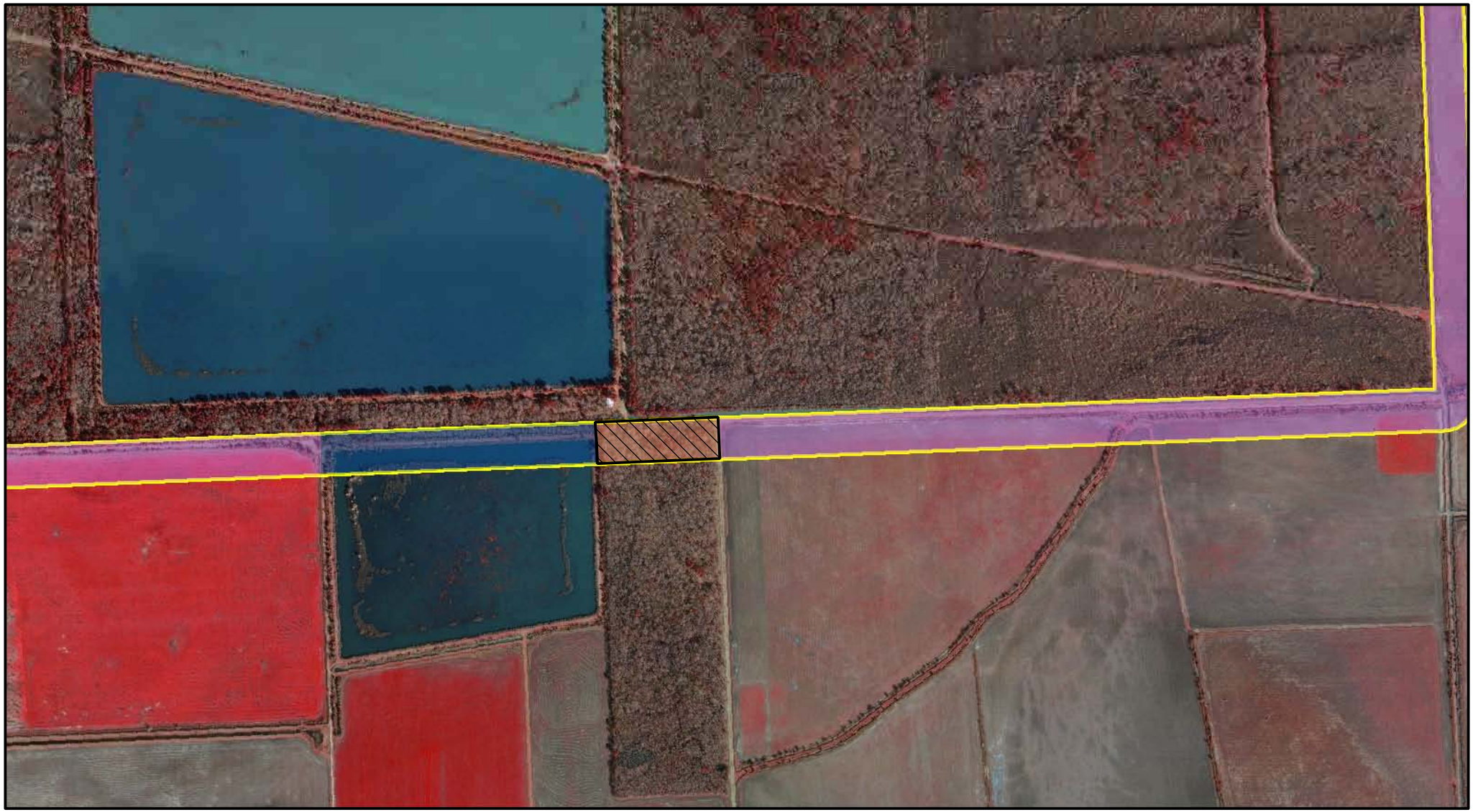
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

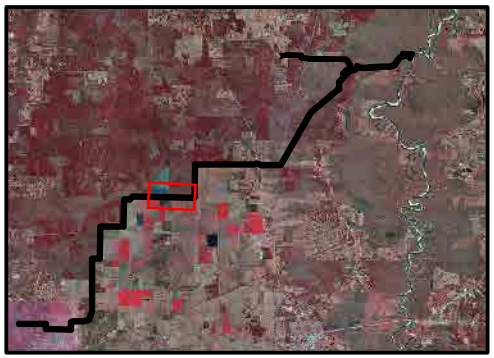
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

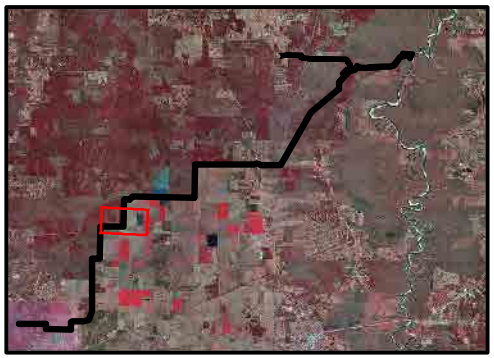
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

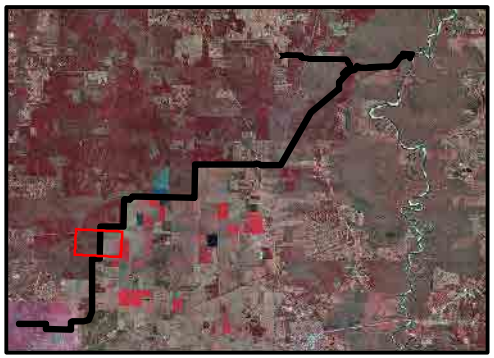
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

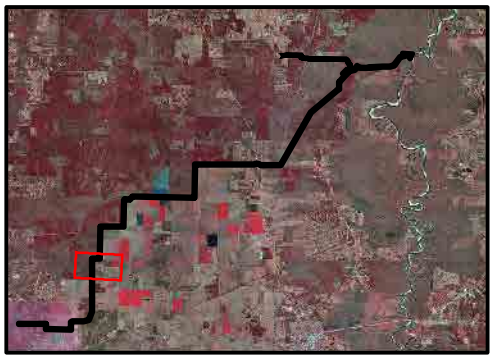
CROUCH ENVIRONMENTAL SERVICES, INC.

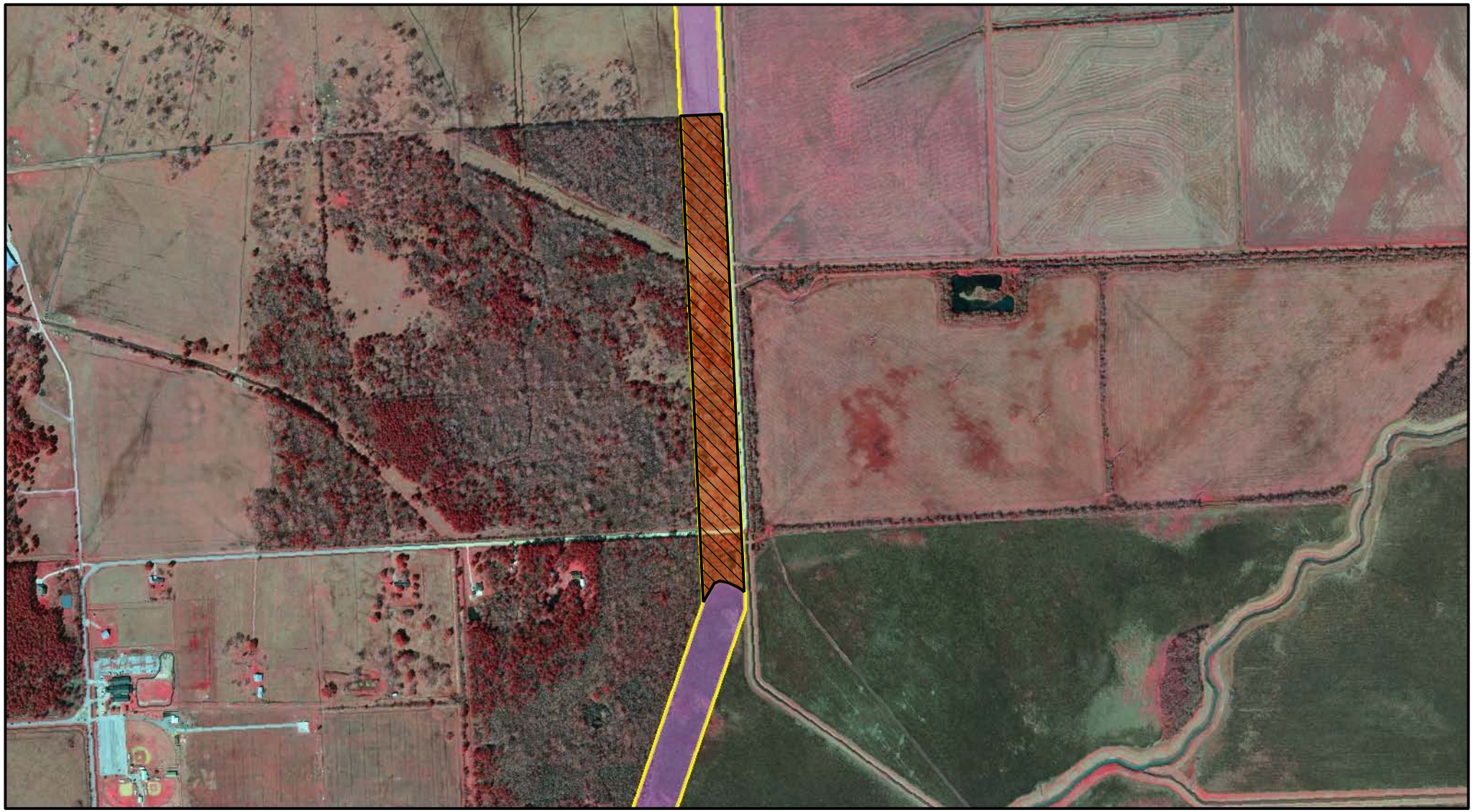
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

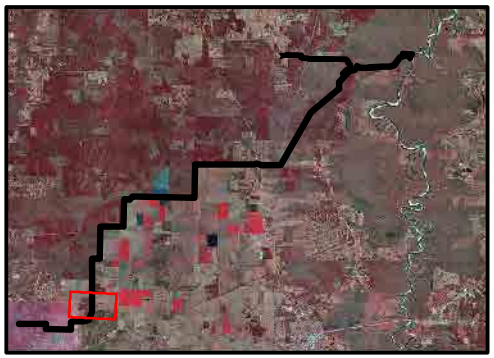
CROUCH ENVIRONMENTAL SERVICES, INC.

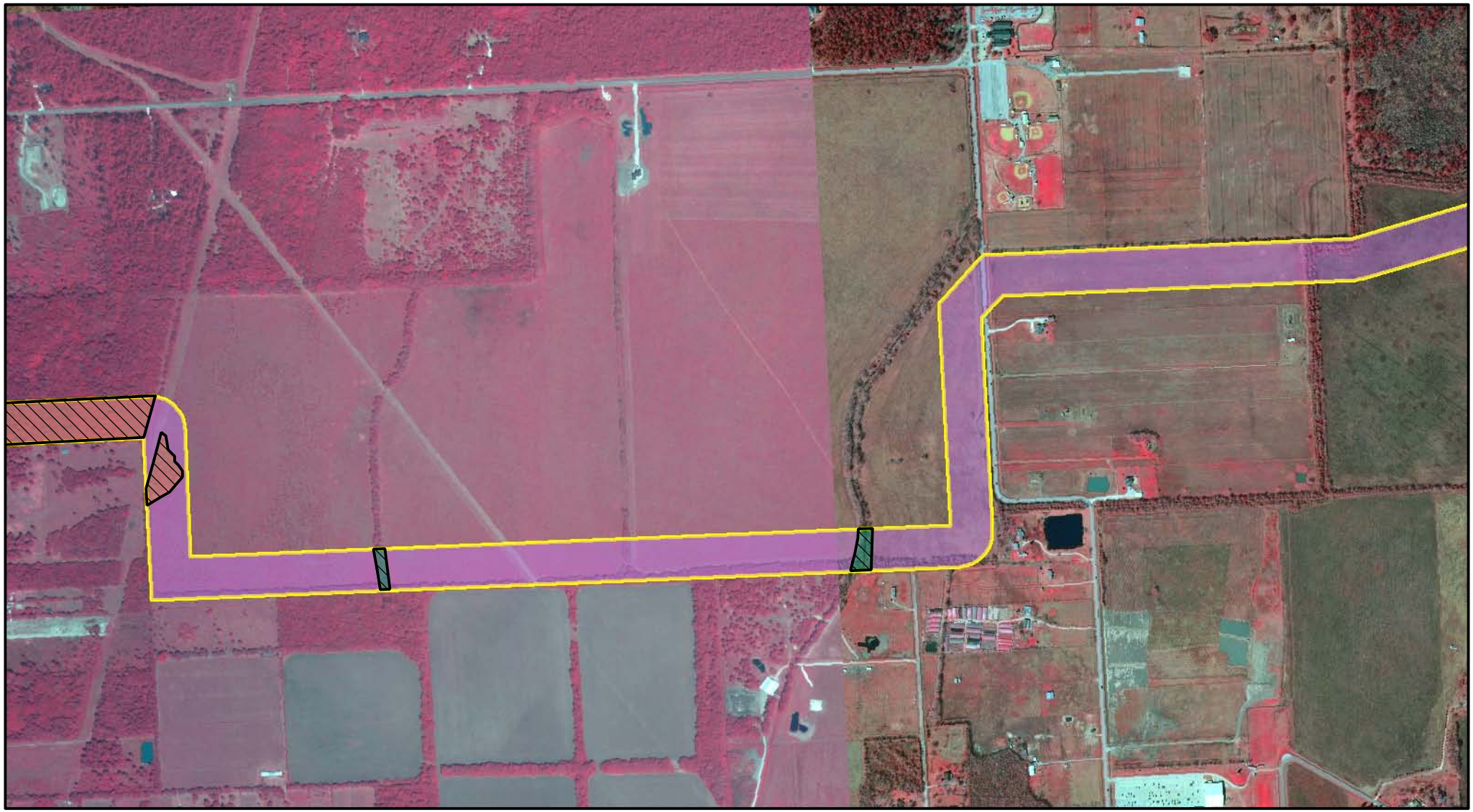
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

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Luce Bayou Interbasin Transfer Project

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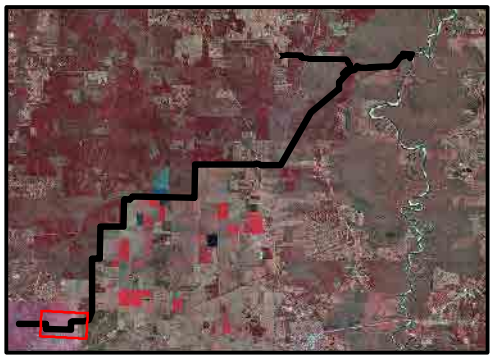
Liberty and Harris County, Texas



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Plains Spotted Skunk | Harrison Tract

N

0 500 1,000 Feet

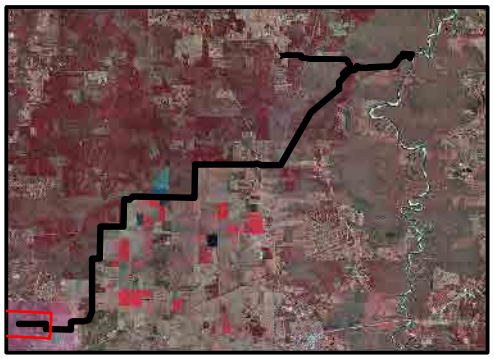
CROUCH ENVIRONMENTAL SERVICES, INC.

10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND PLAINS SPOTTED SKUNK DATA OVERLAYS

Liberty and Harris County, Texas



Rafinesque's Big-eared Bat

Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Rafinesque's Big-Eared Bat | Harrison Tract

N

0 500 1,000 Feet

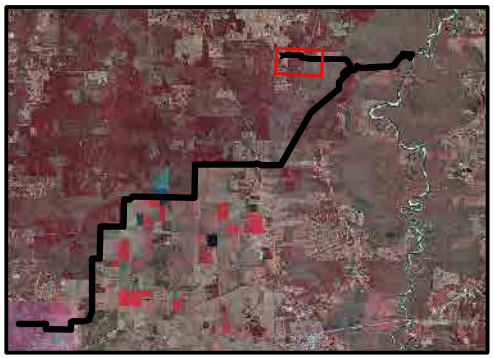
CROUCH ENVIRONMENTAL SERVICES, INC.

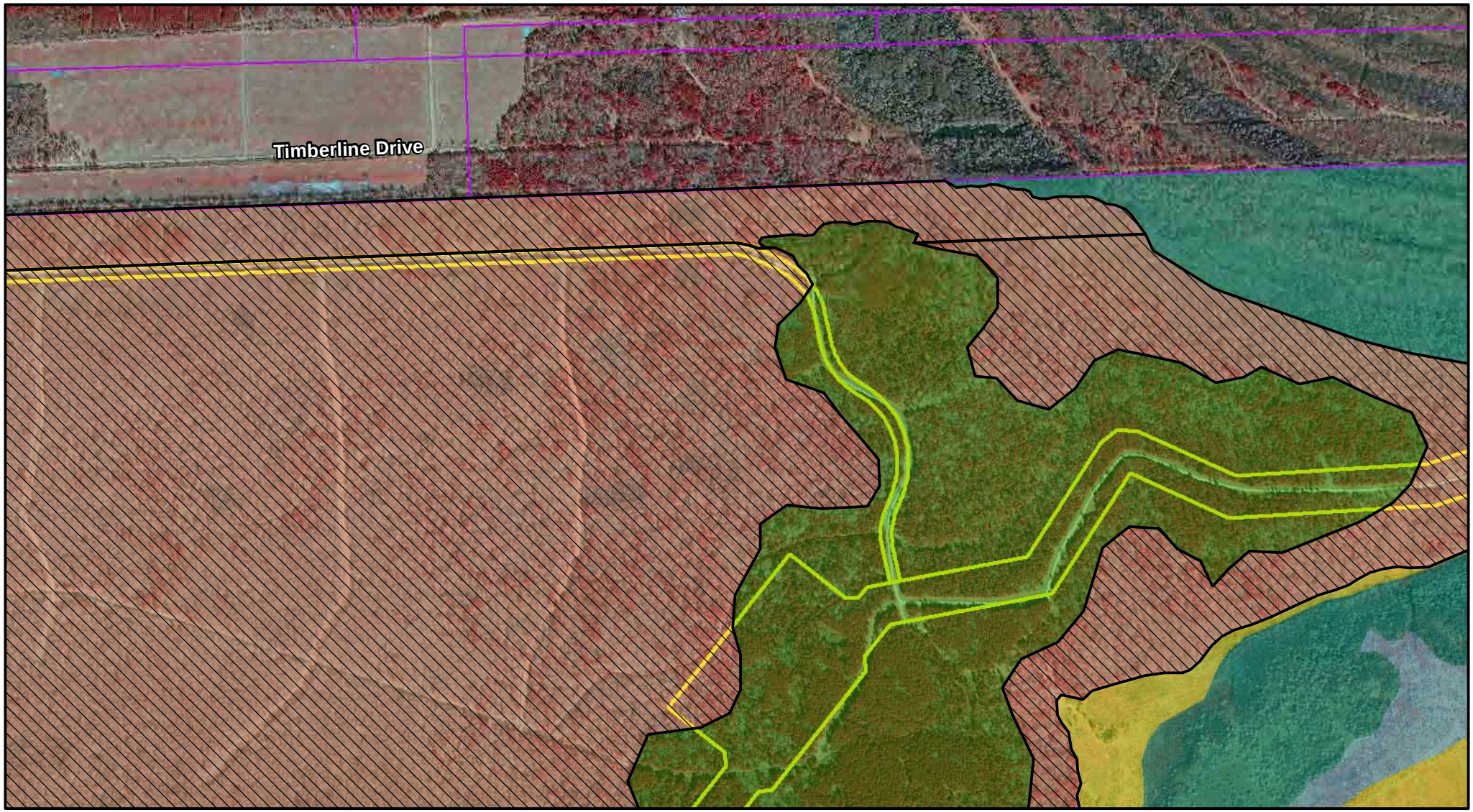
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND RAFINESQUE'S BIG-EARED BAT DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Rafinesque's Big-Eared Bat | Harrison Tract

N

0 500 1,000 Feet

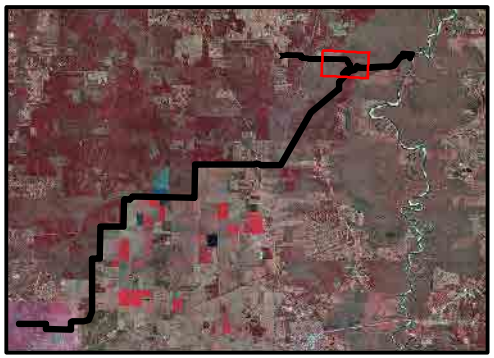
CROUCH ENVIRONMENTAL SERVICES, INC.

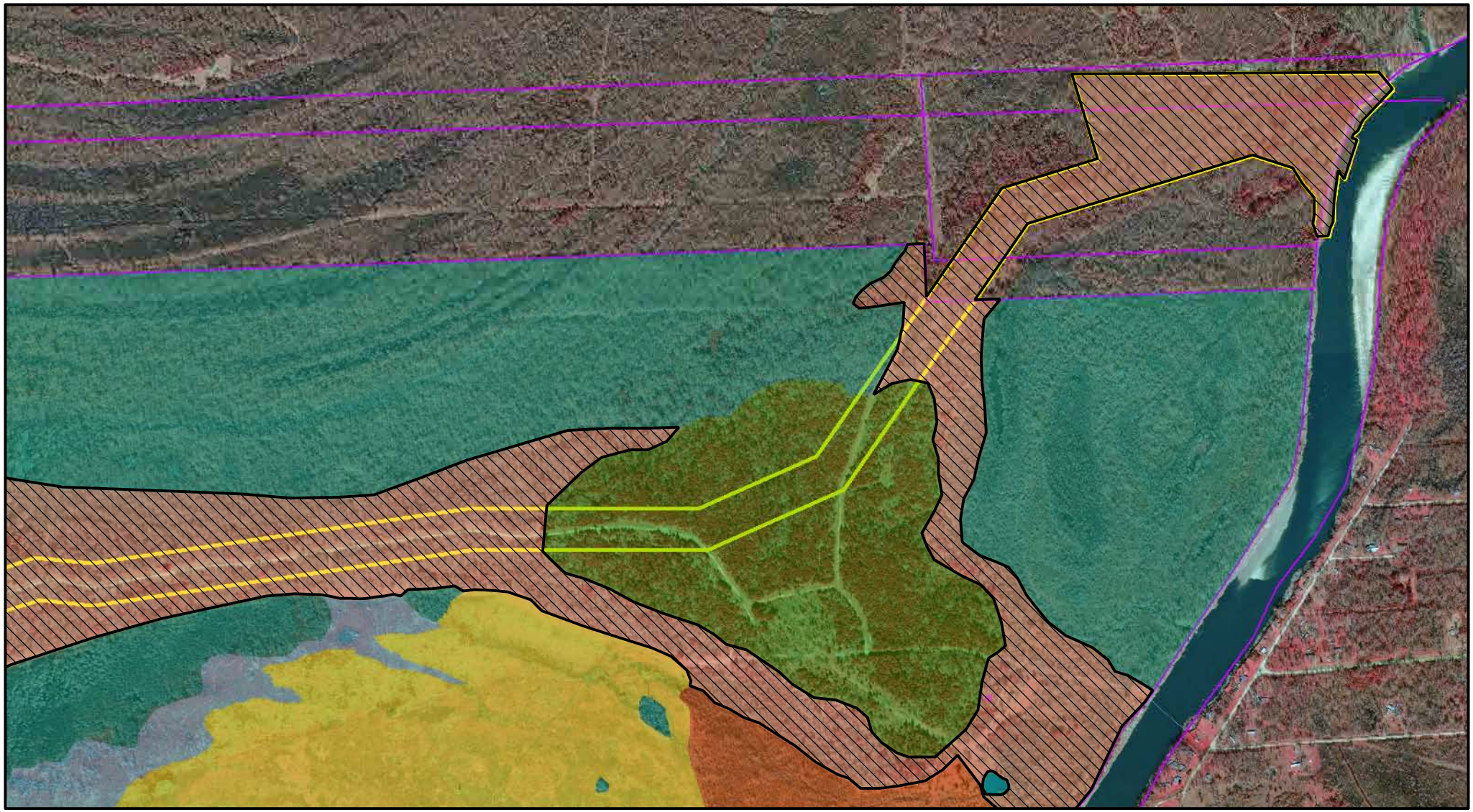
10/8/2009

AECOM
Luce Bayou Interbasin Transfer Project

2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND RAFINESQUE'S BIG-EARED BAT DATA OVERLAYS

Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Rafinesque's Big-Eared Bat | Harrison Tract

N

0 500 1,000 Feet

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10/8/2009

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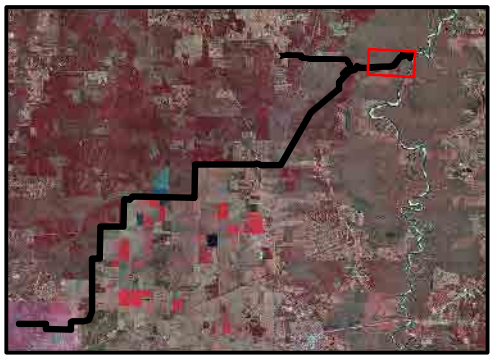
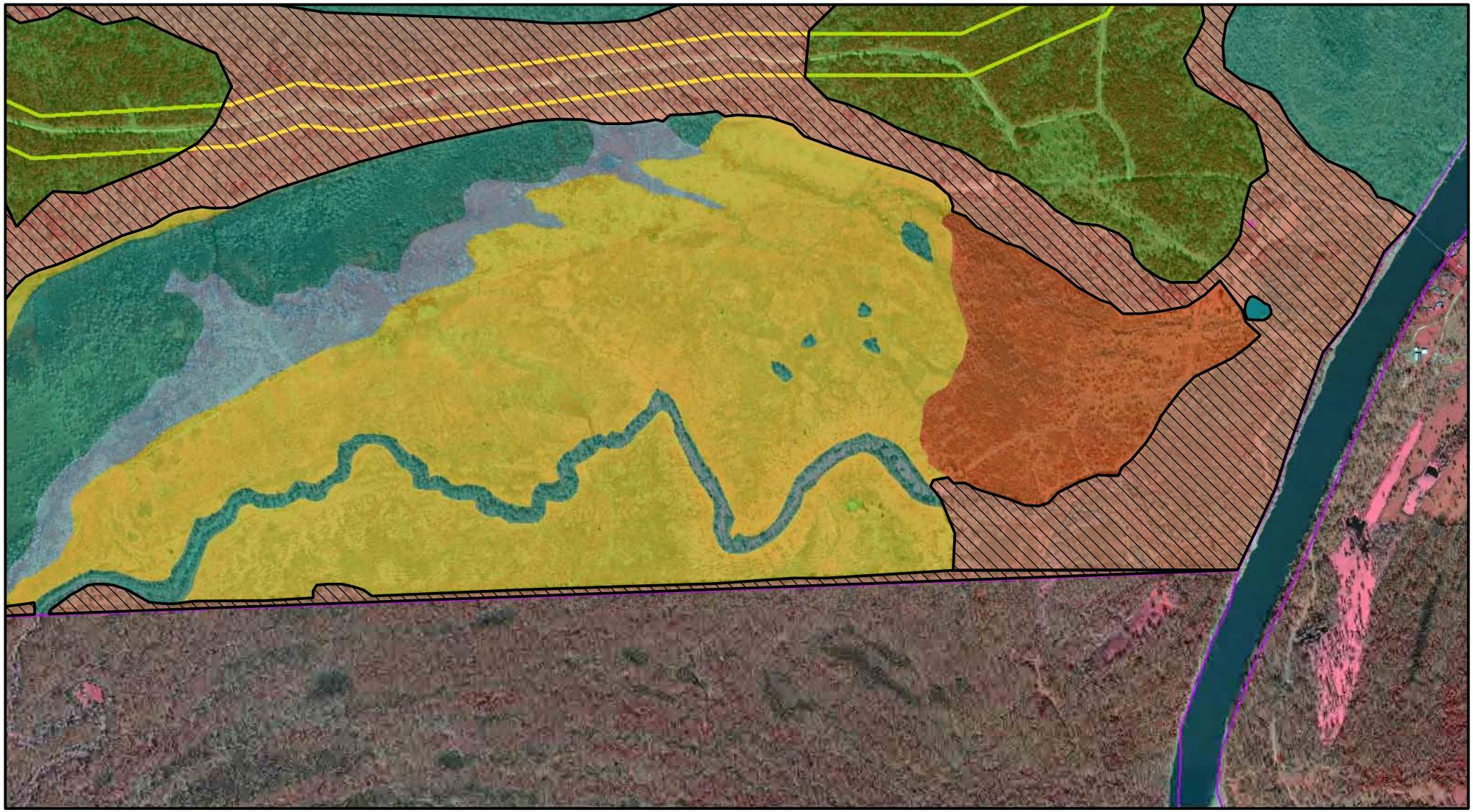
Liberty and Harris County, Texas





Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Rafinesque's Big-Eared Bat | Harrison Tract

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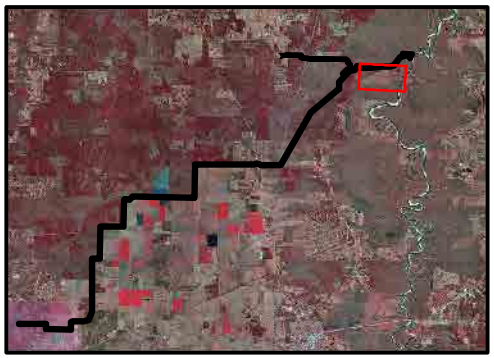

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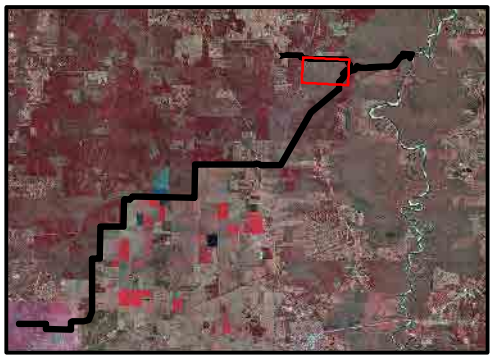

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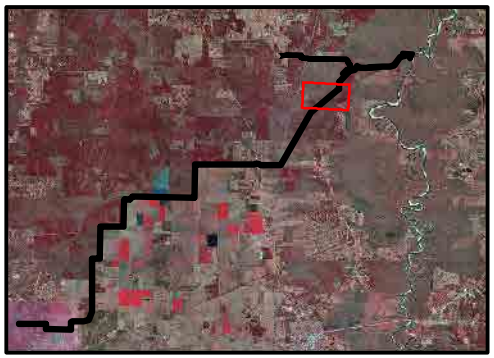

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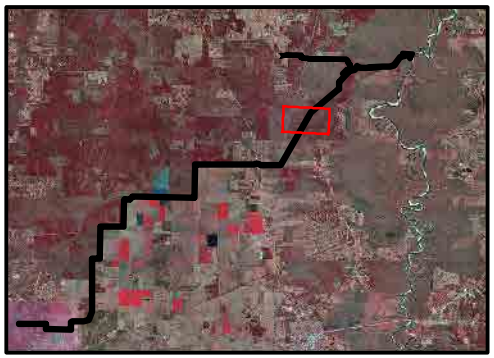

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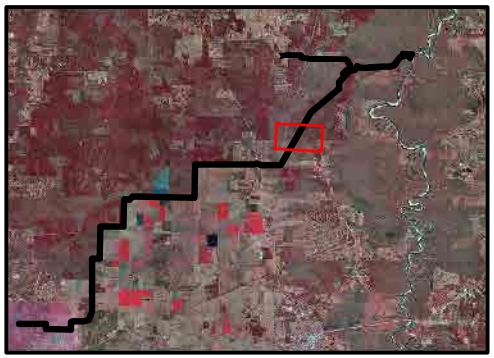

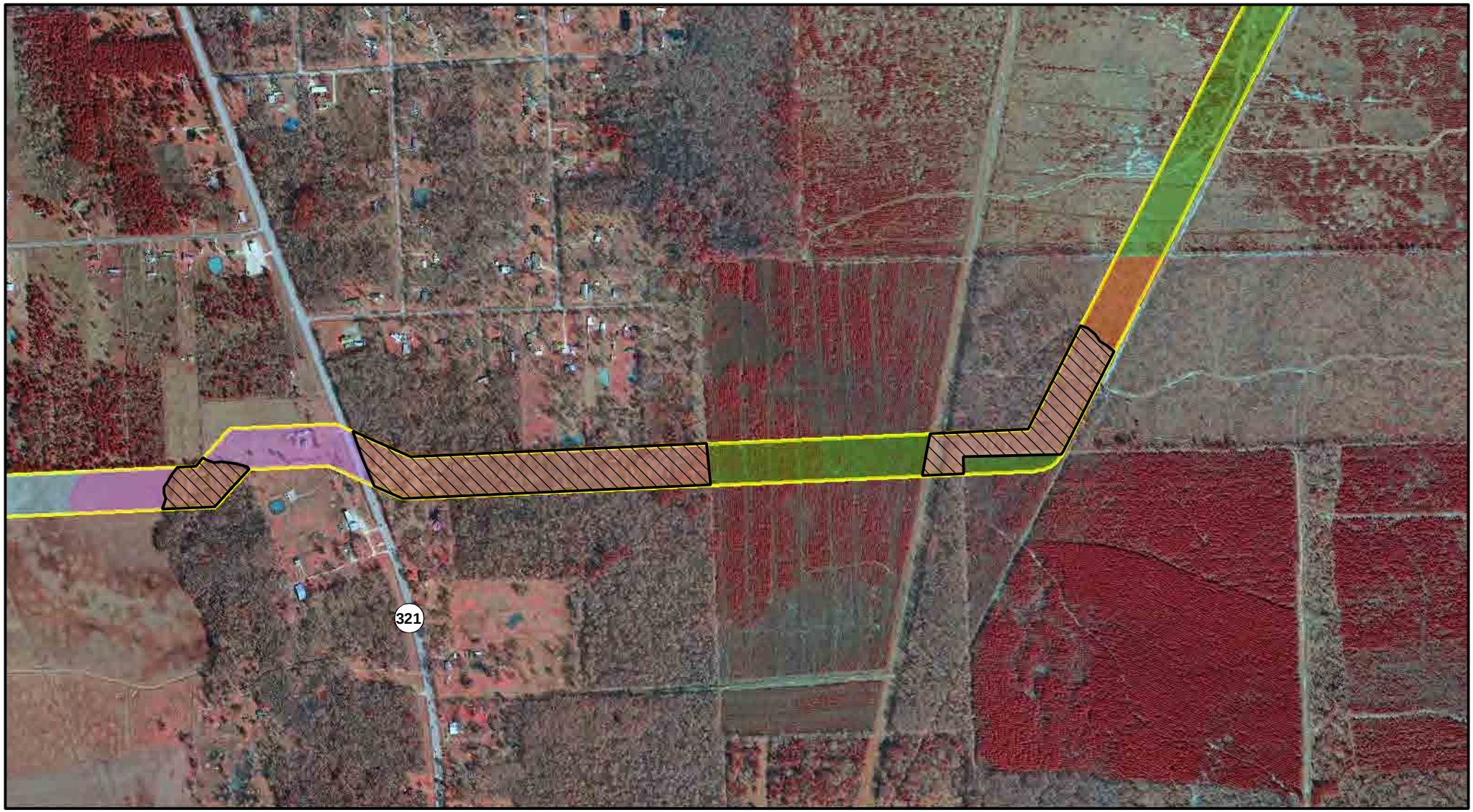

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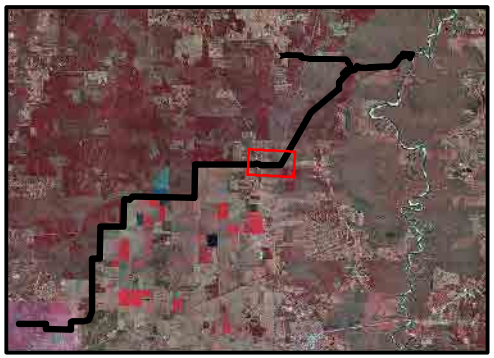

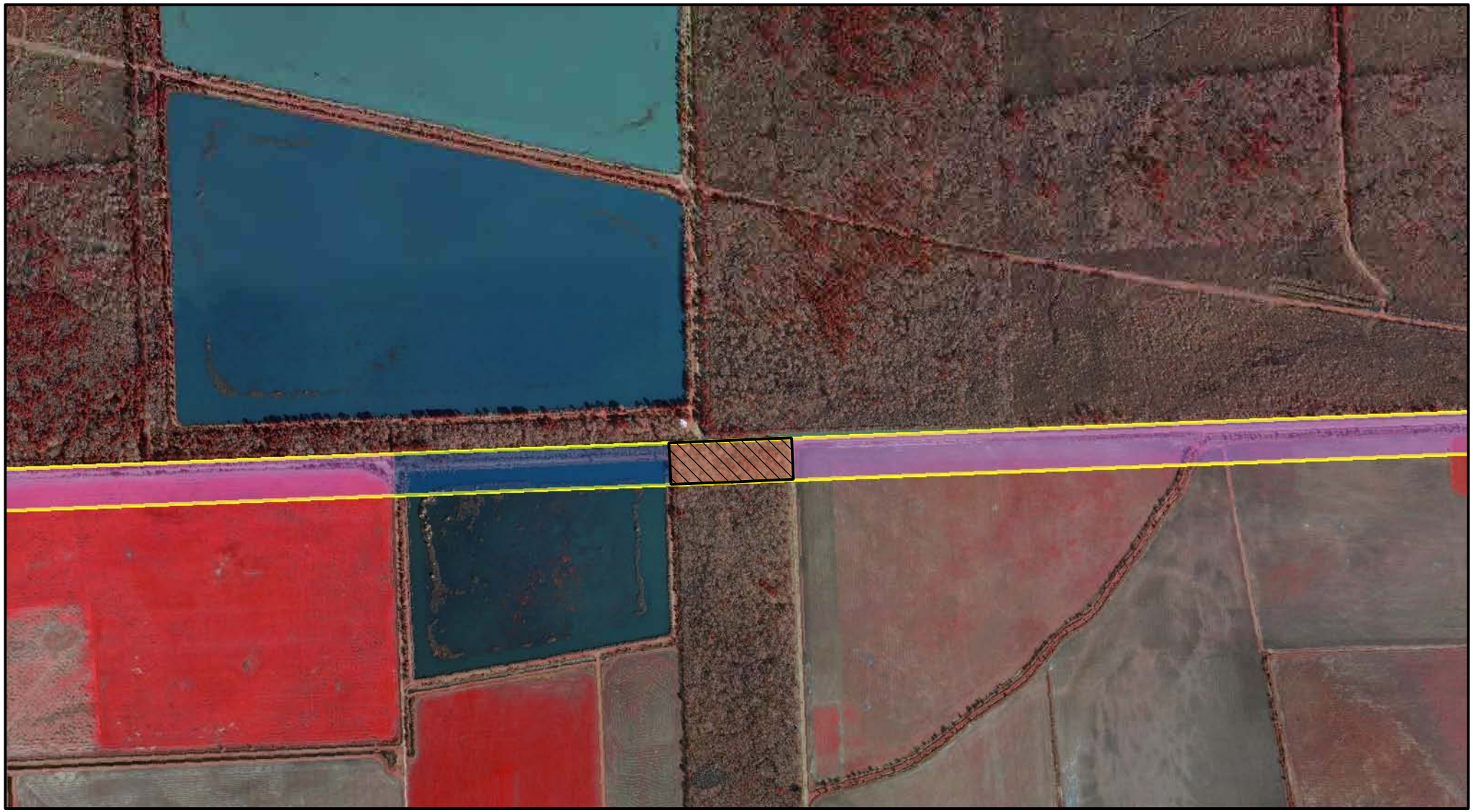

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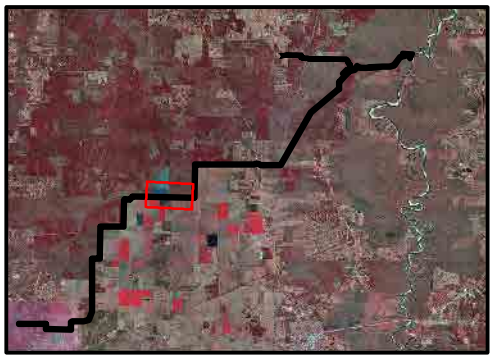

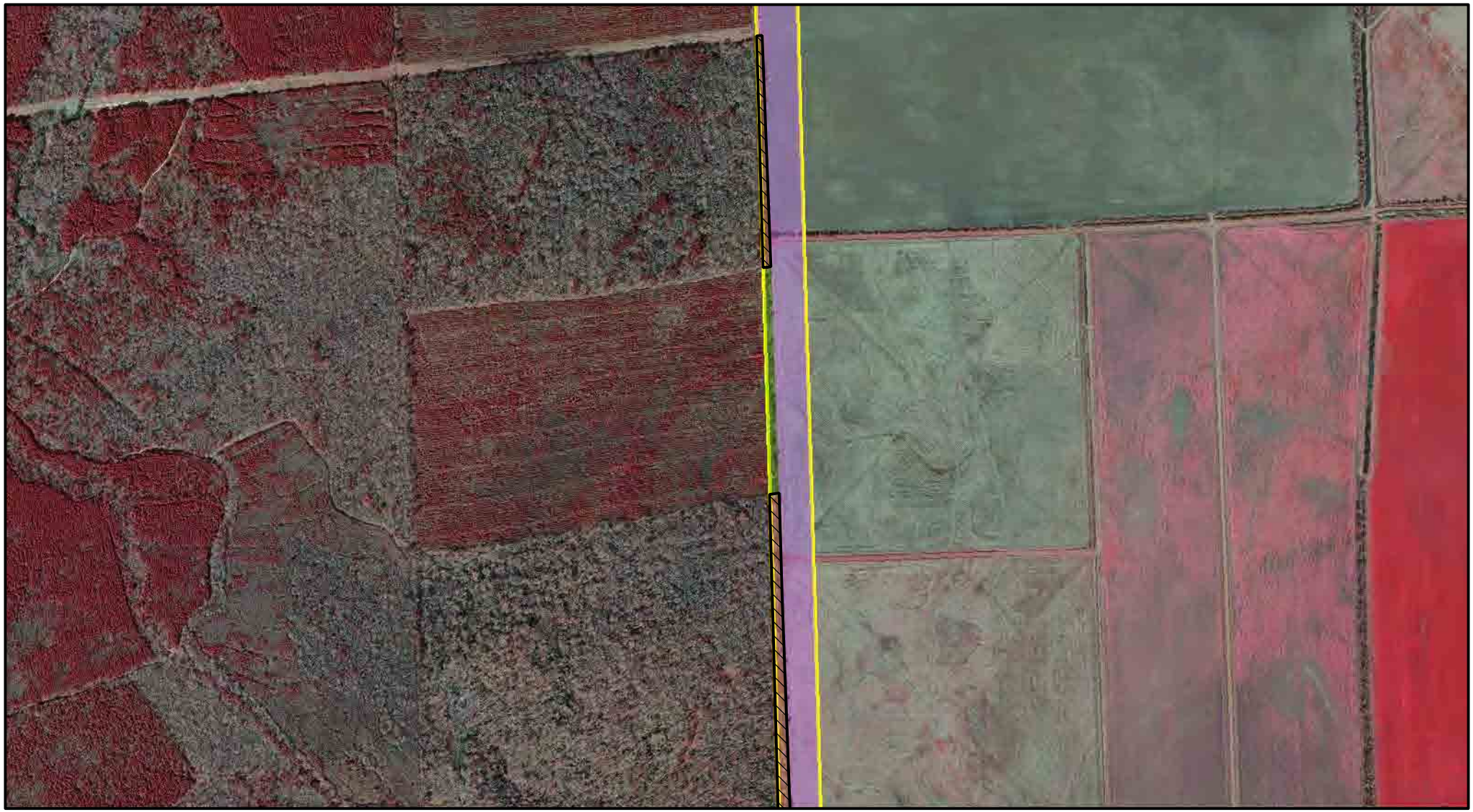

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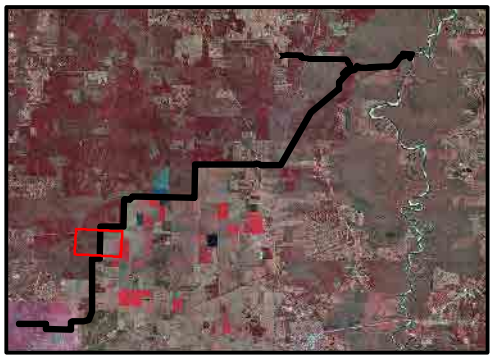

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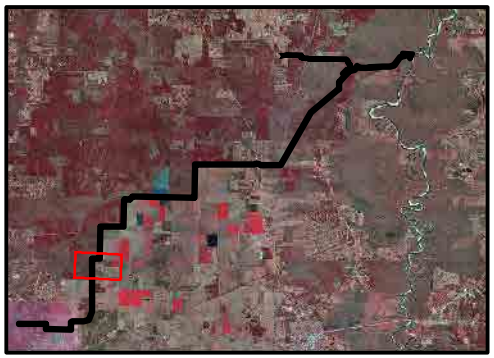

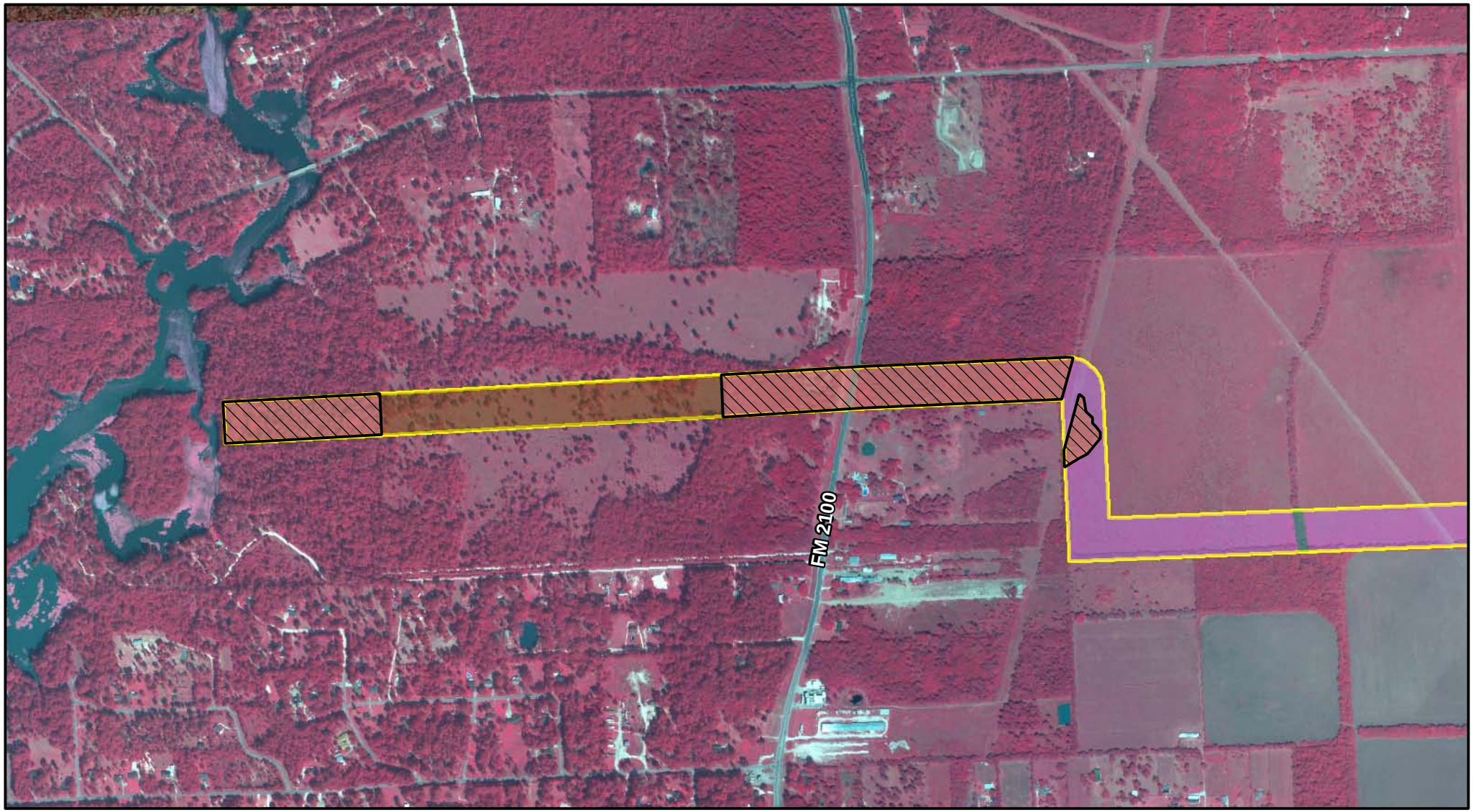

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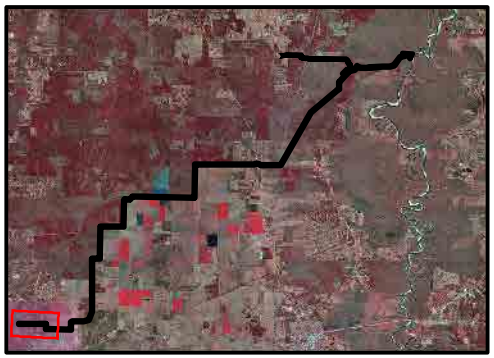

Southeastern Myotis

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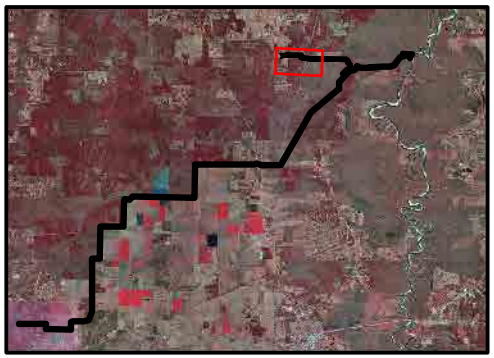

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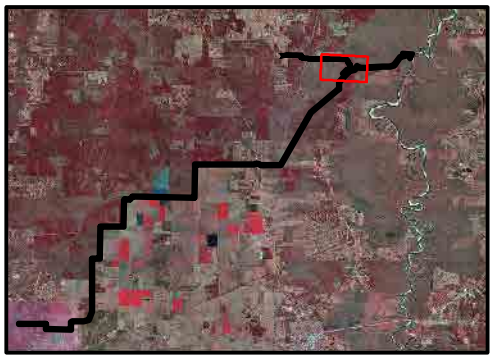

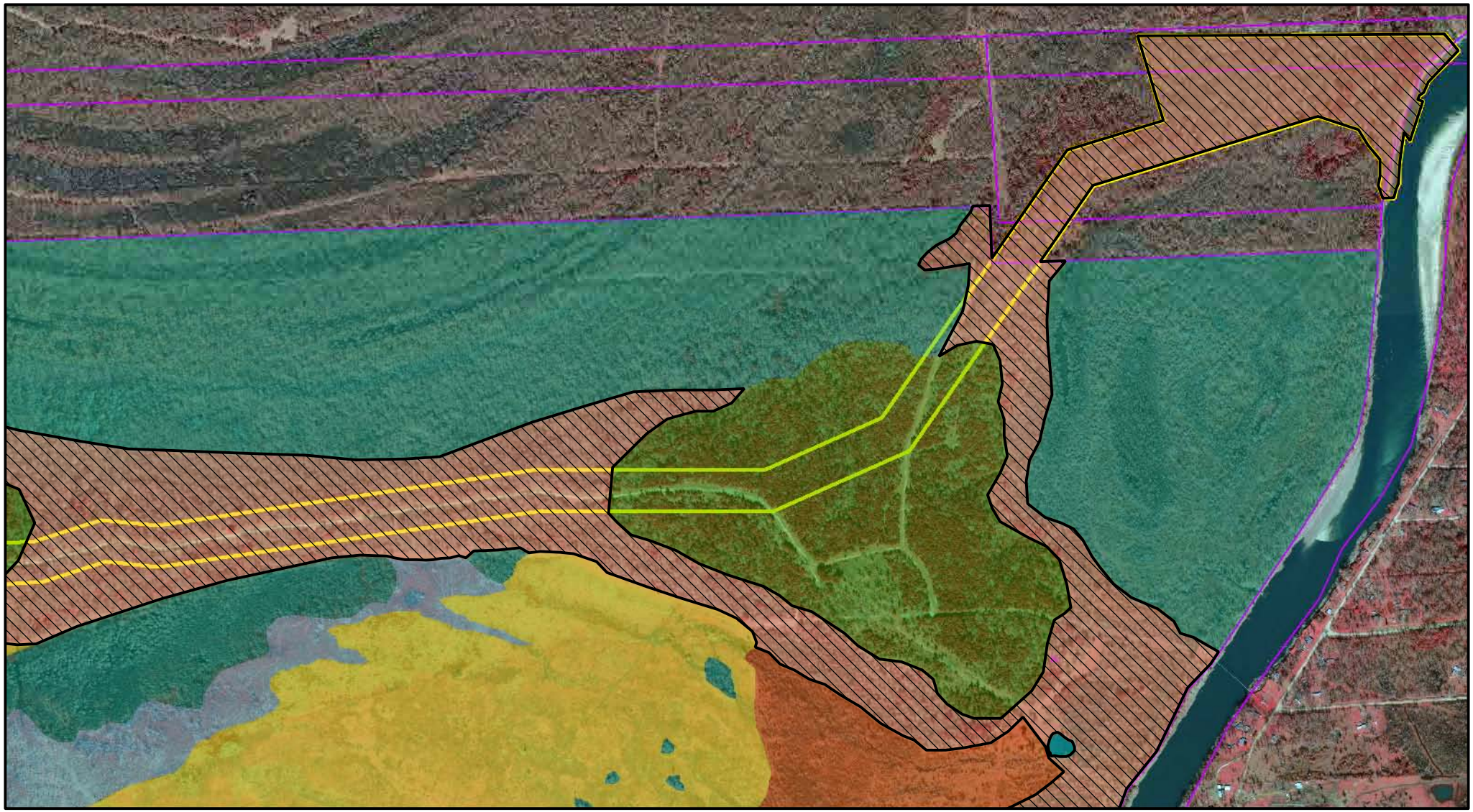

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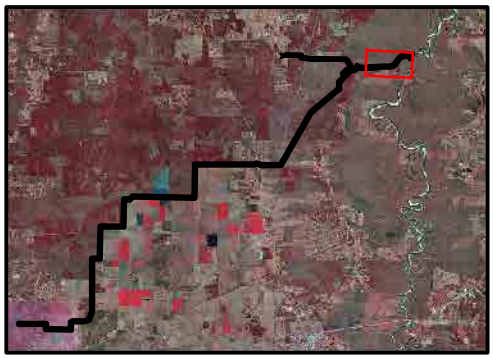

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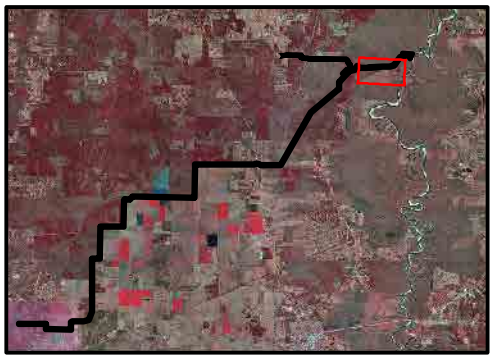

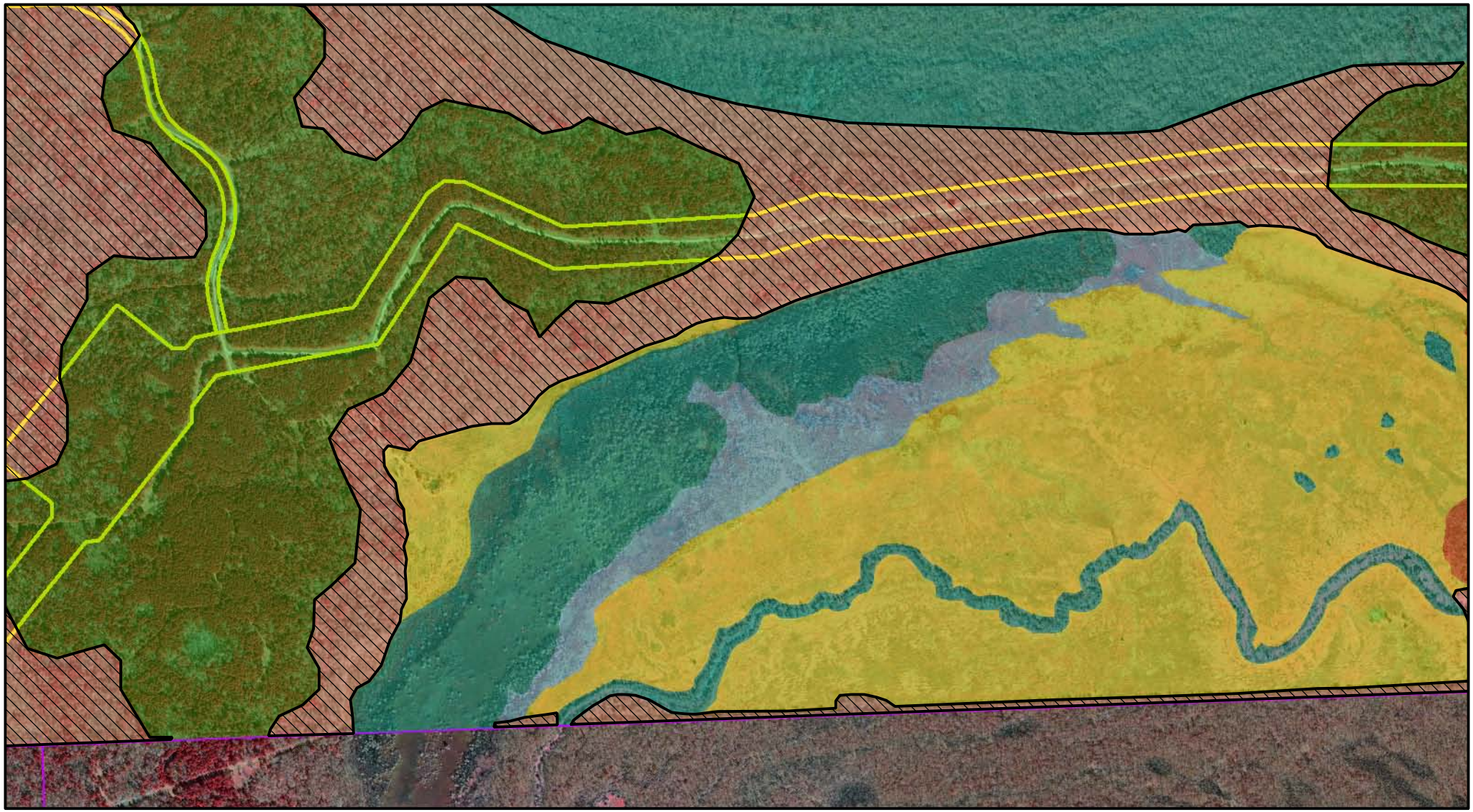

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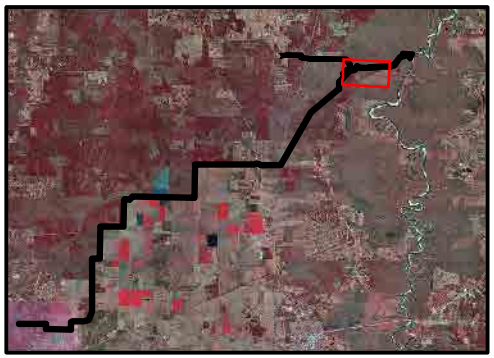

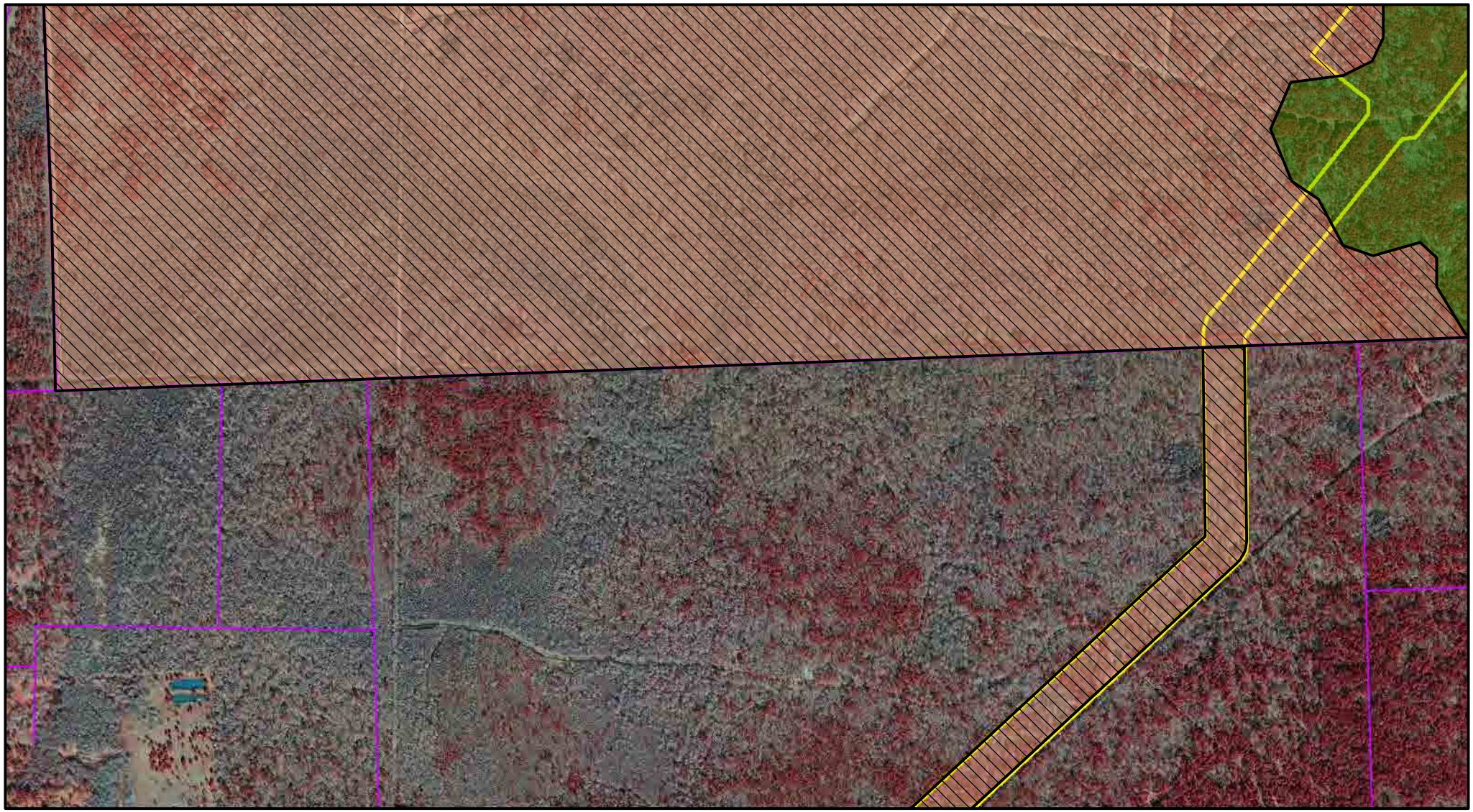

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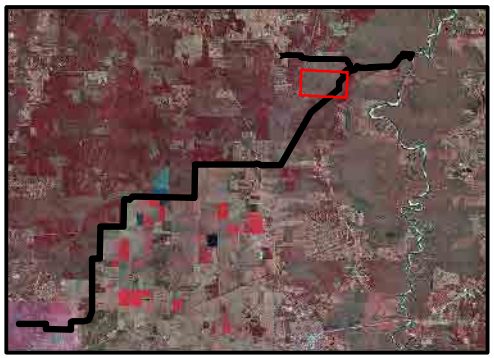

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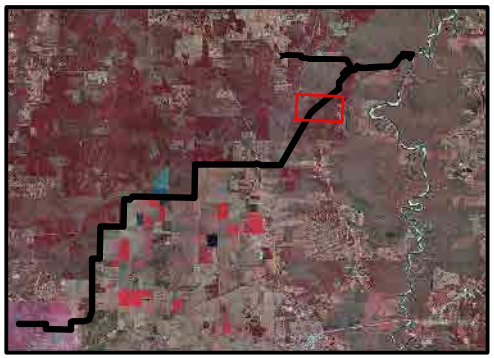

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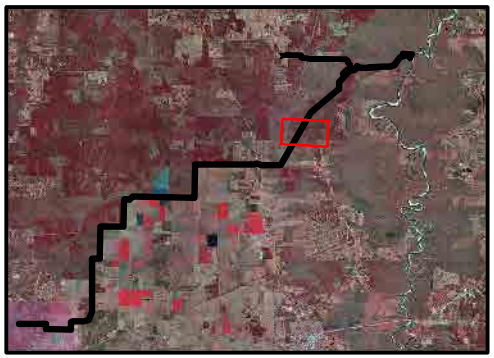

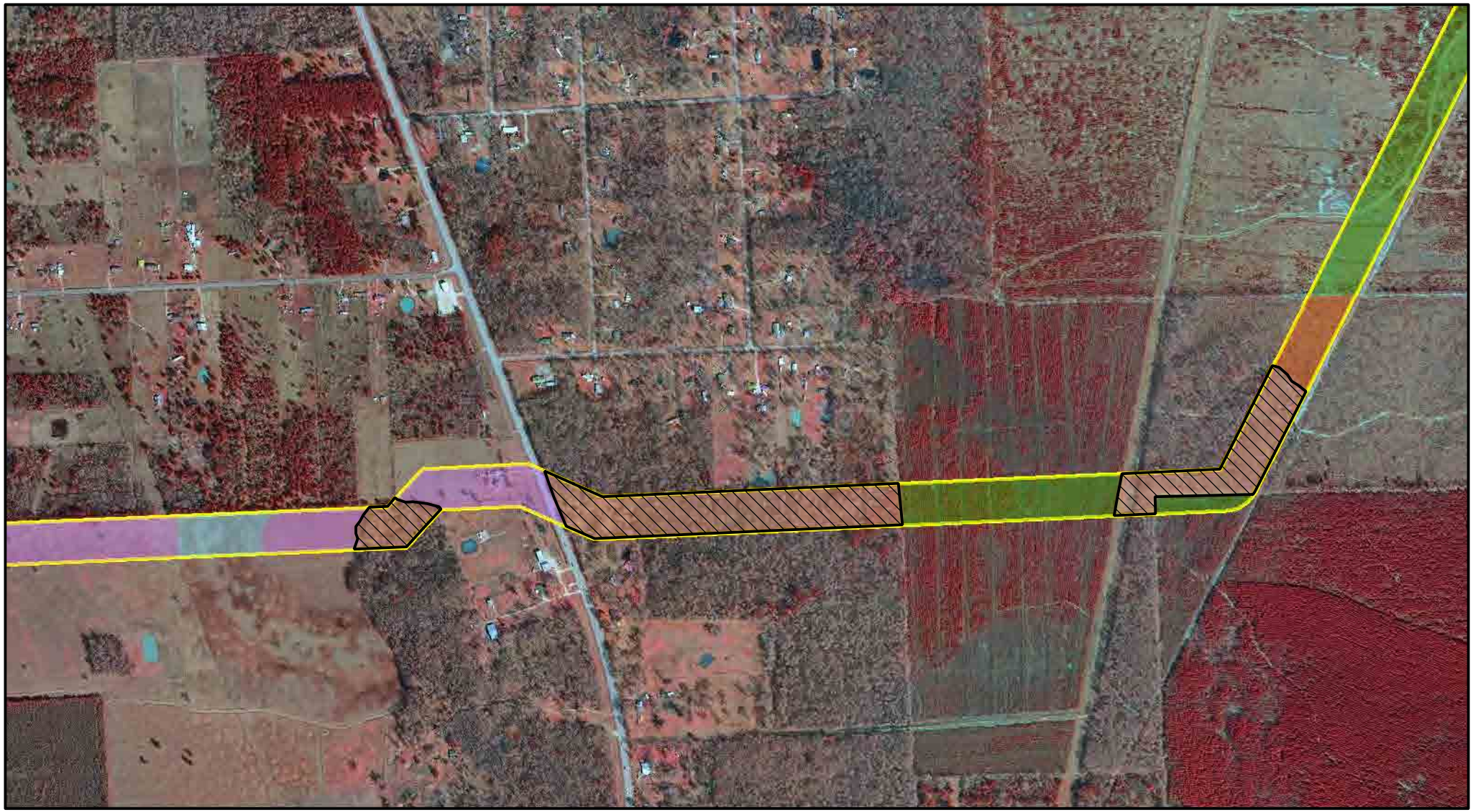

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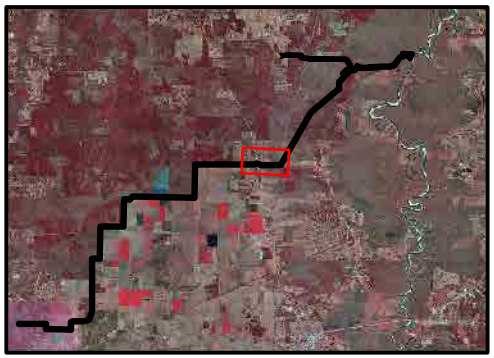

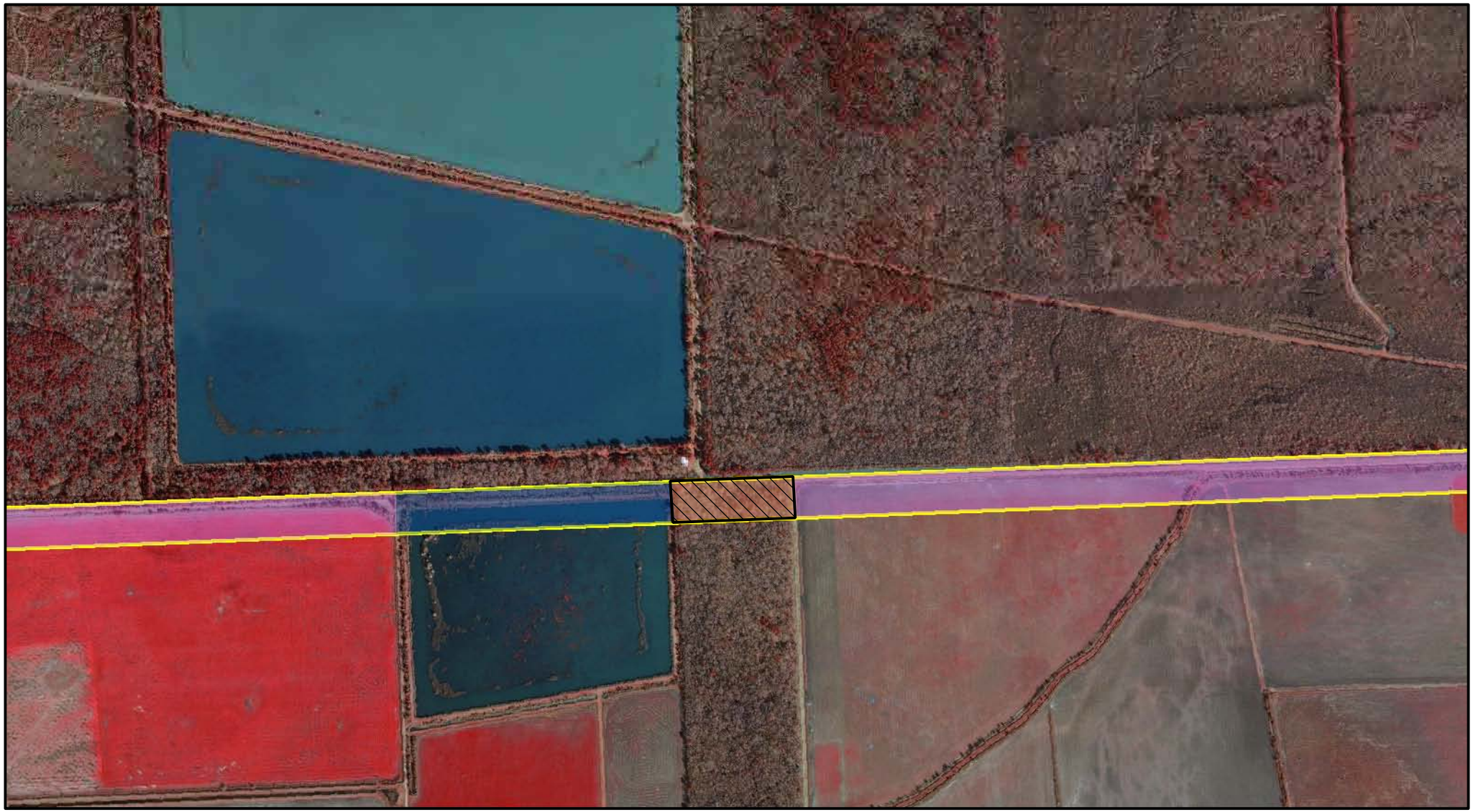

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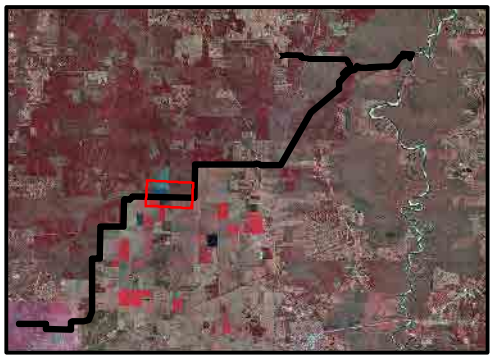

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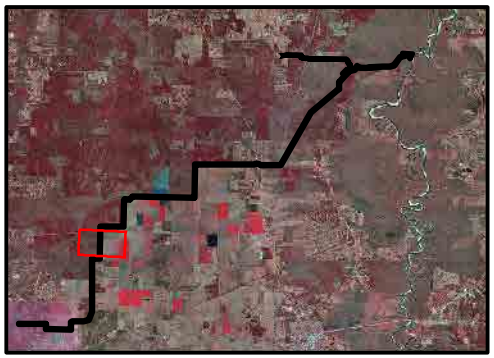

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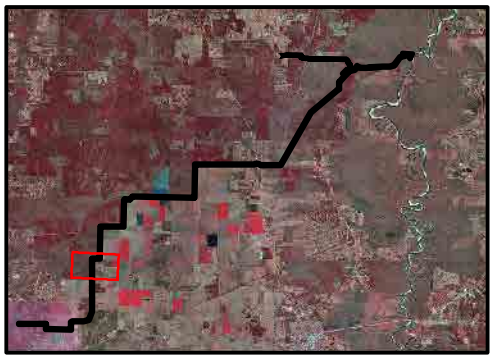

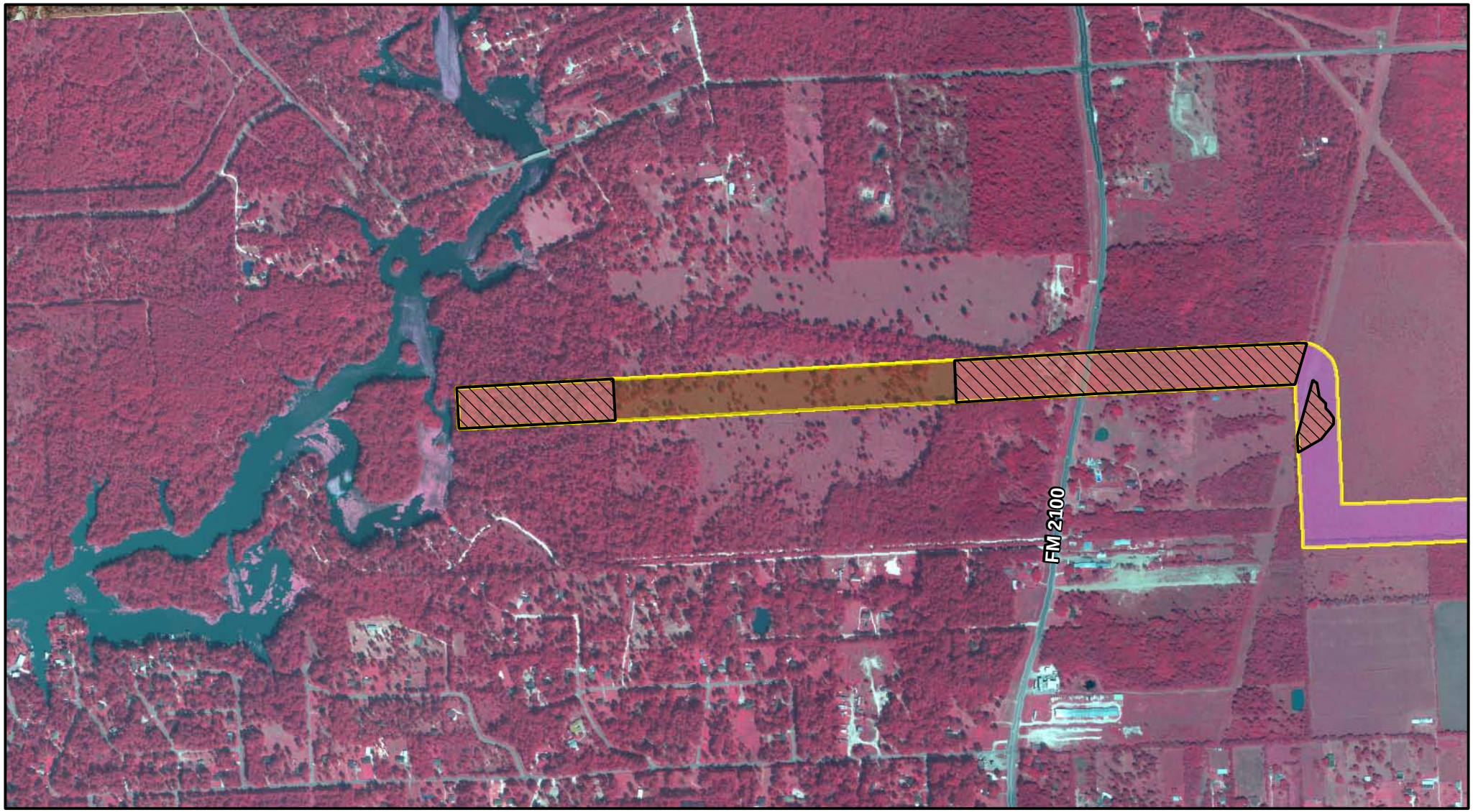

Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Southeastern Myotis | Harrison Tract

N

0 500 1,000 Feet

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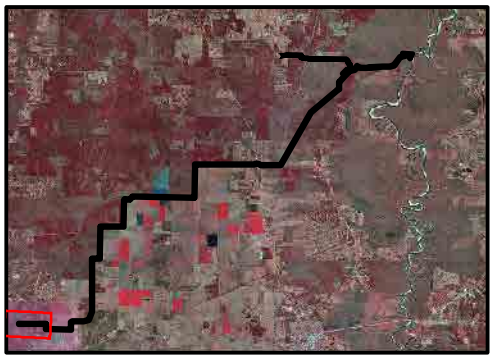
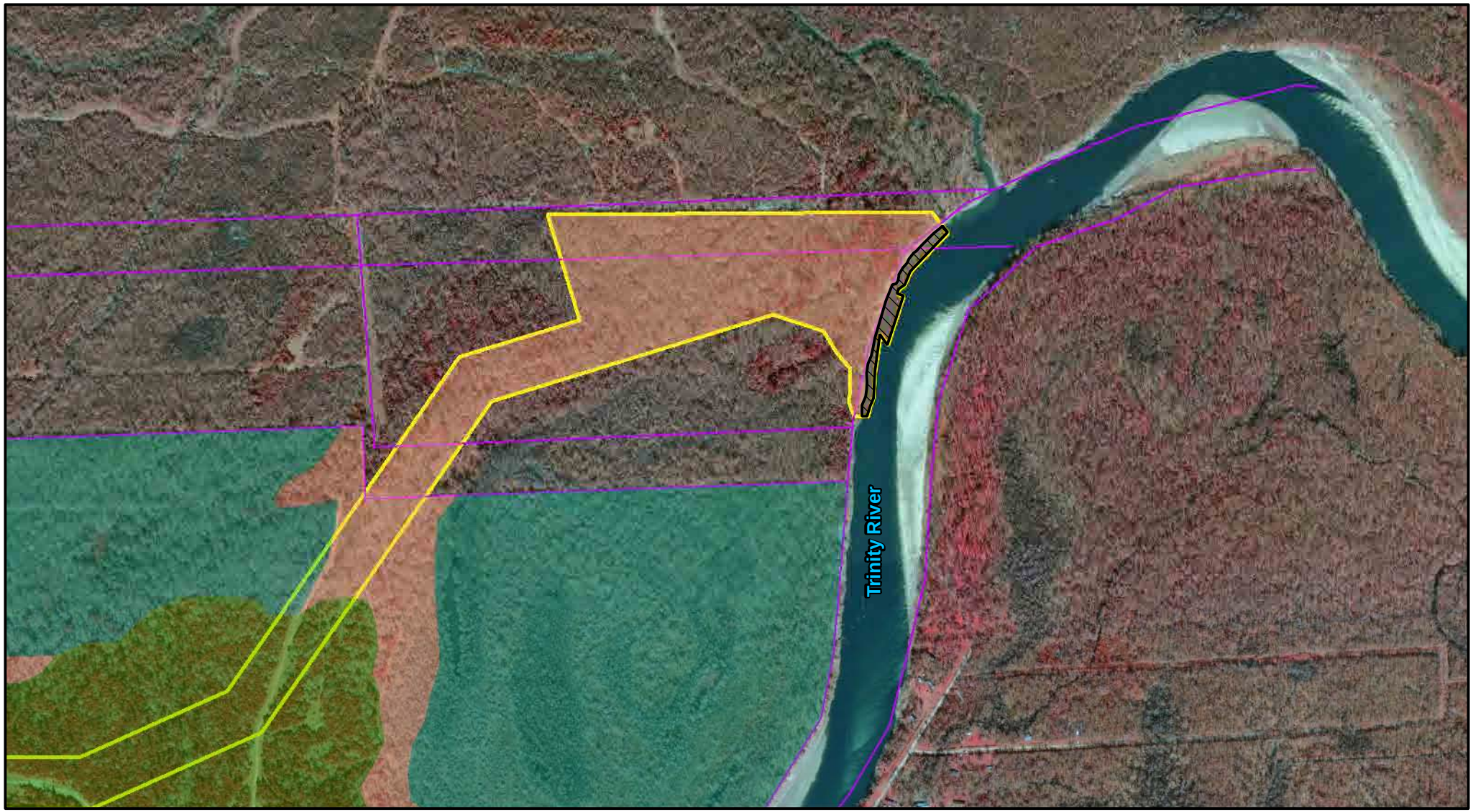
2008 AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY, HARRISON TRACT, VEGETATION TYPES, AND SOUTHEASTERN MYOTIS DATA OVERLAYS

Liberty and Harris County, Texas



Alligator Snapping Turtle



Proposed ROW | Forested Wetlands | Hardwood Forest | Pine | Alligator Snapping Turtle | Harrison Tract

N

0 400 800 Feet

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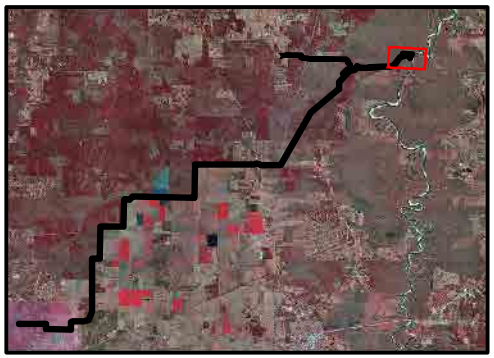
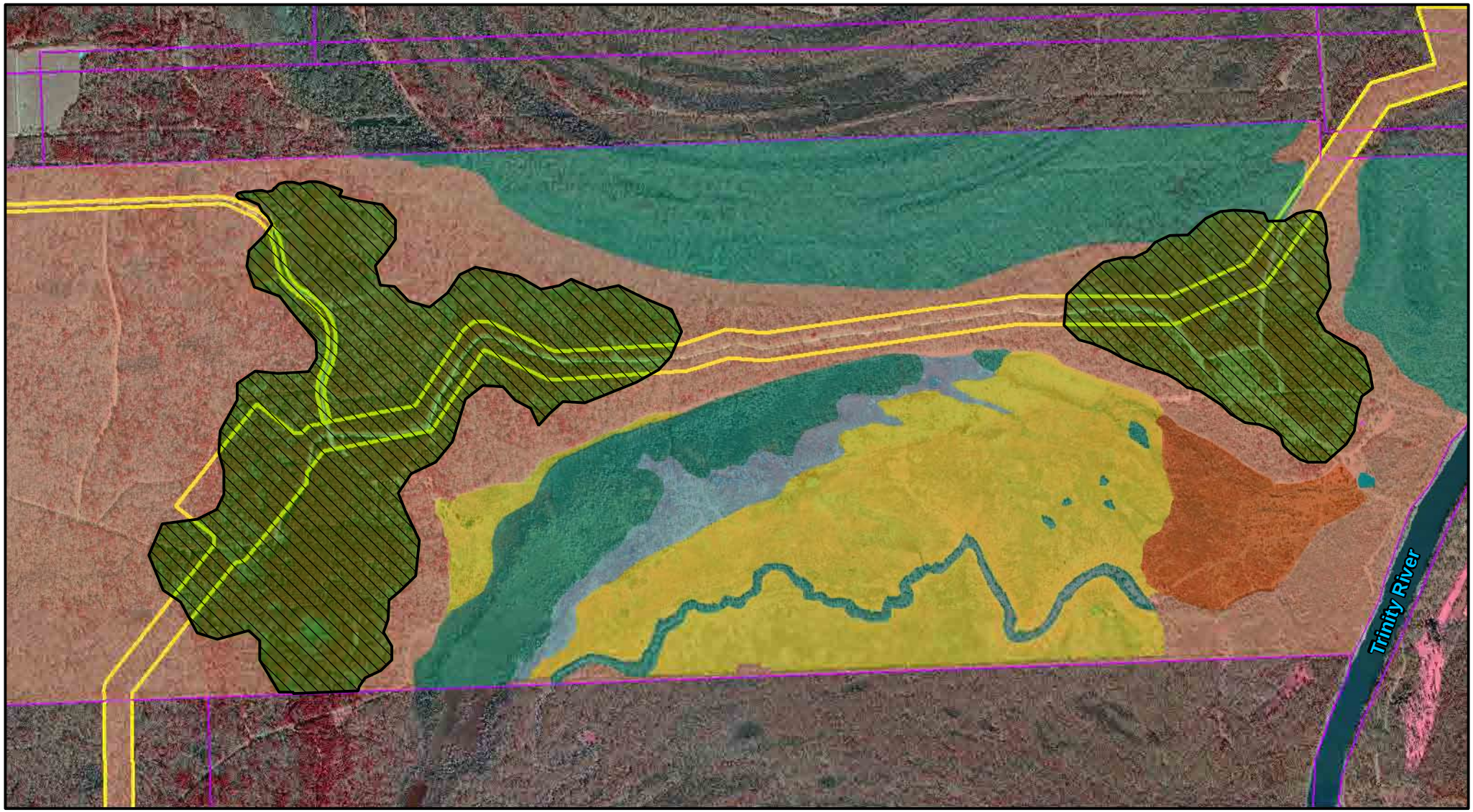


Louisiana Pine Snake



Proposed ROW | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pine | Tallow Dominated | Louisiana Pine Snake | Harrison Tract

N

0 750 1,500 Feet

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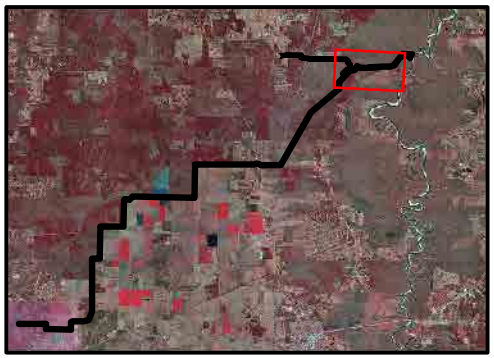
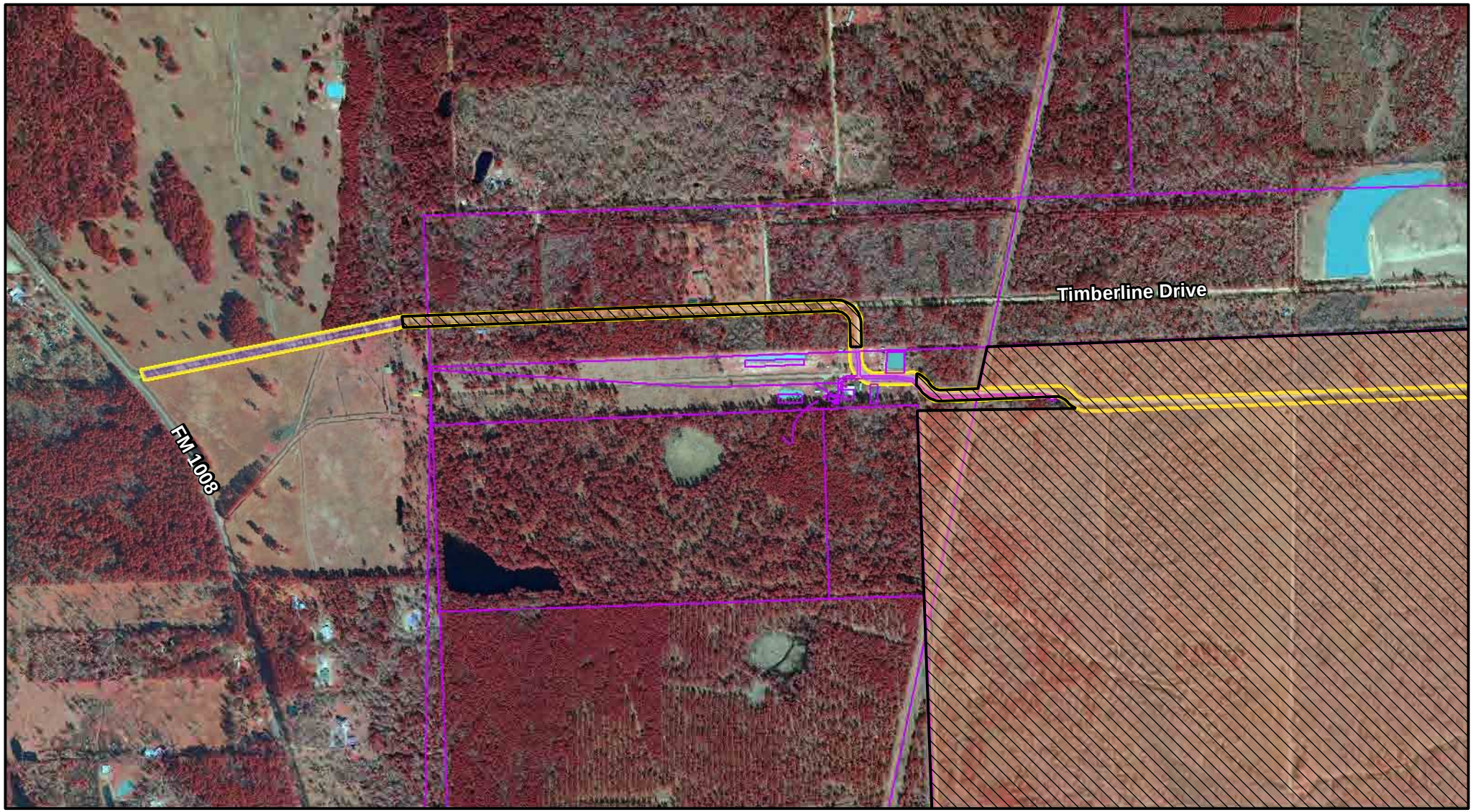


Timber/Canebrake Rattlesnake



Proposed ROW | Aquatic Areas | Forested Wetlands | Hardwood Forest | Herbaceous Uplands | Herbaceous Wetlands | Pasture/Cropland | Pine | Scrub Shrub | Tallow Dominated | Timber/Canebreak Rattlesnake | Harrison Tract

N

0 500 1,000 Feet

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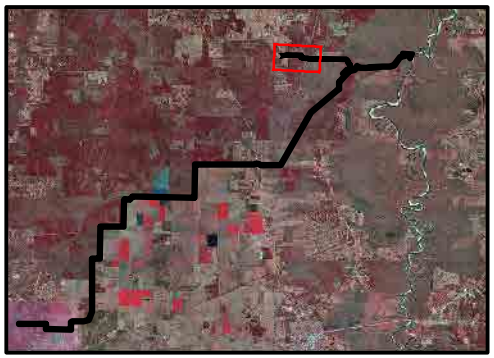

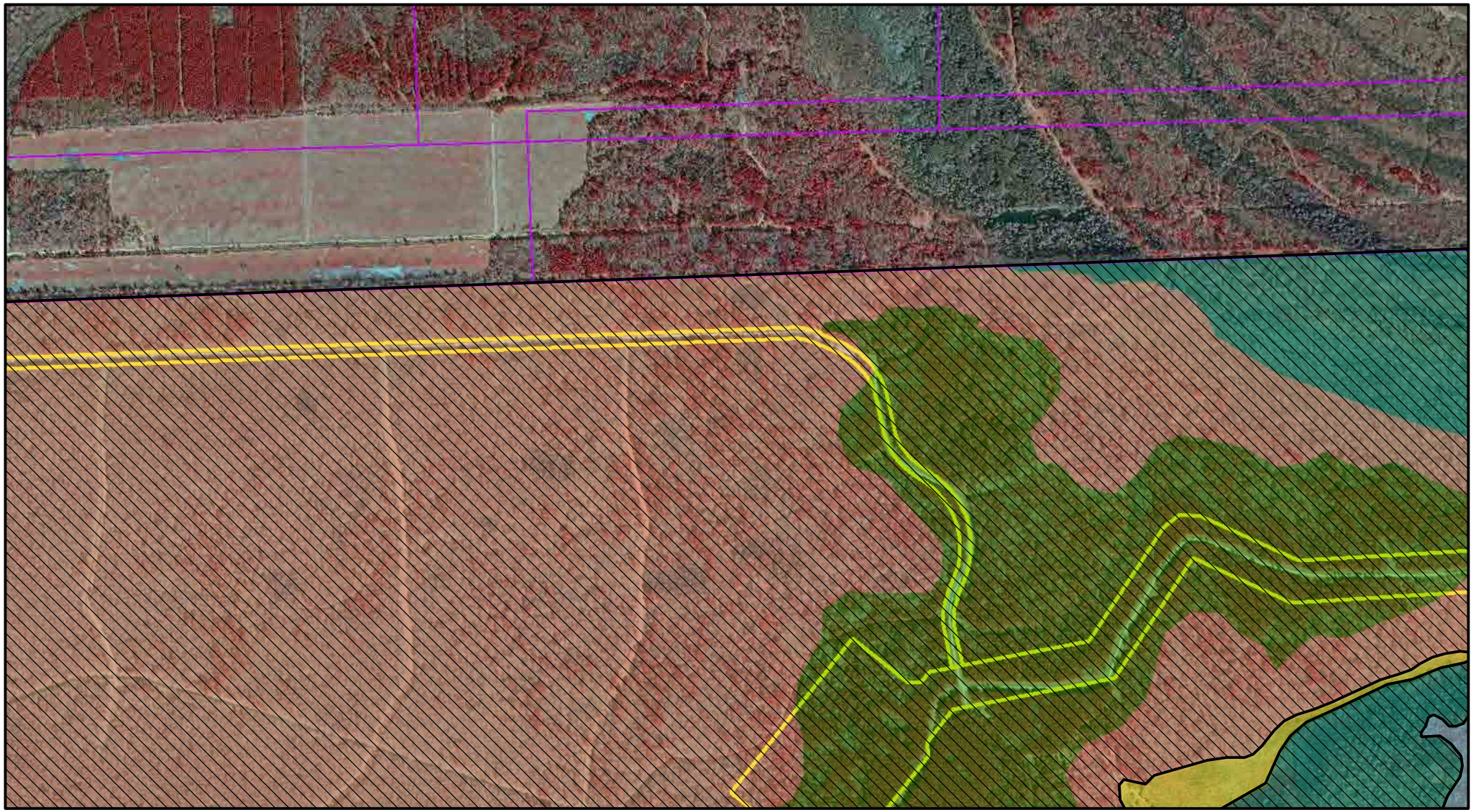

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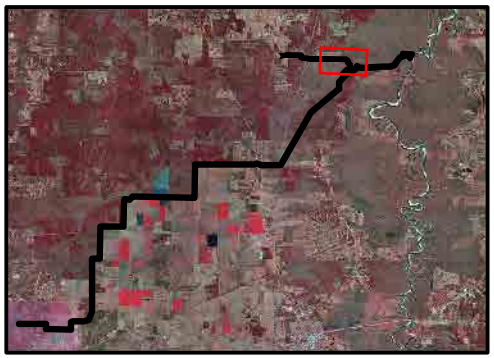

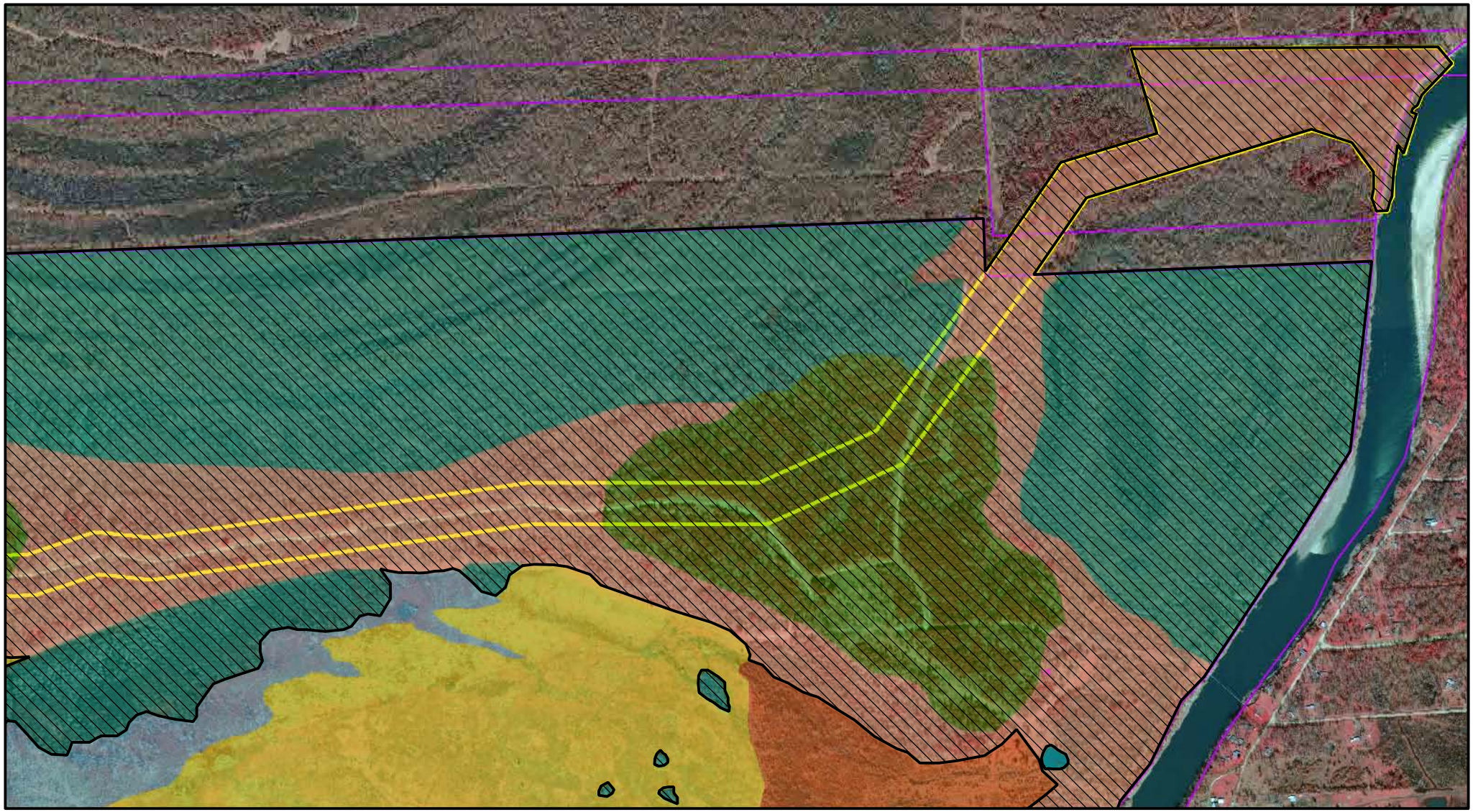

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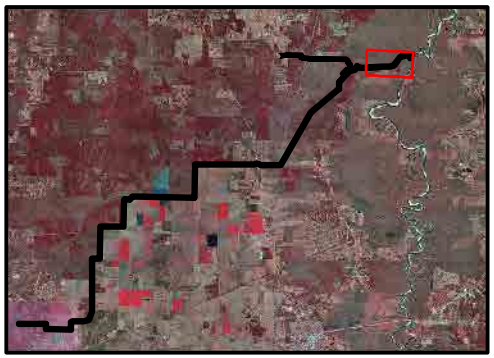

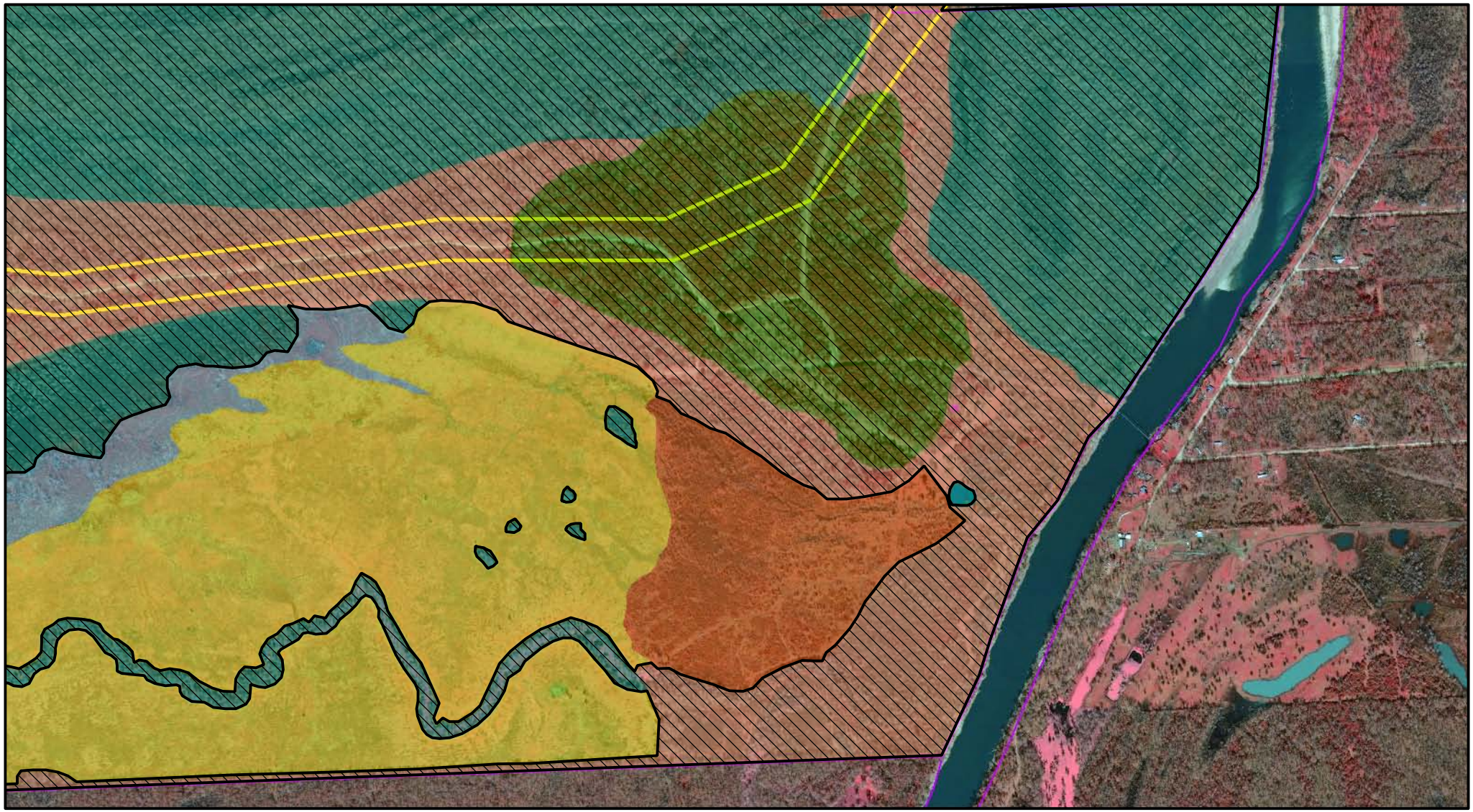

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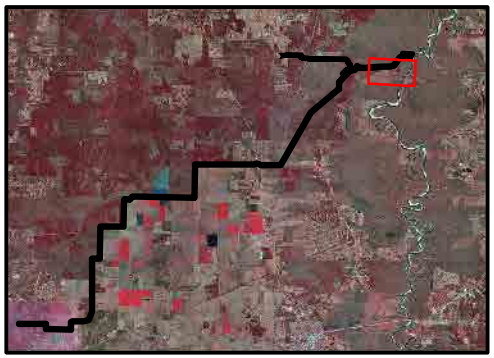

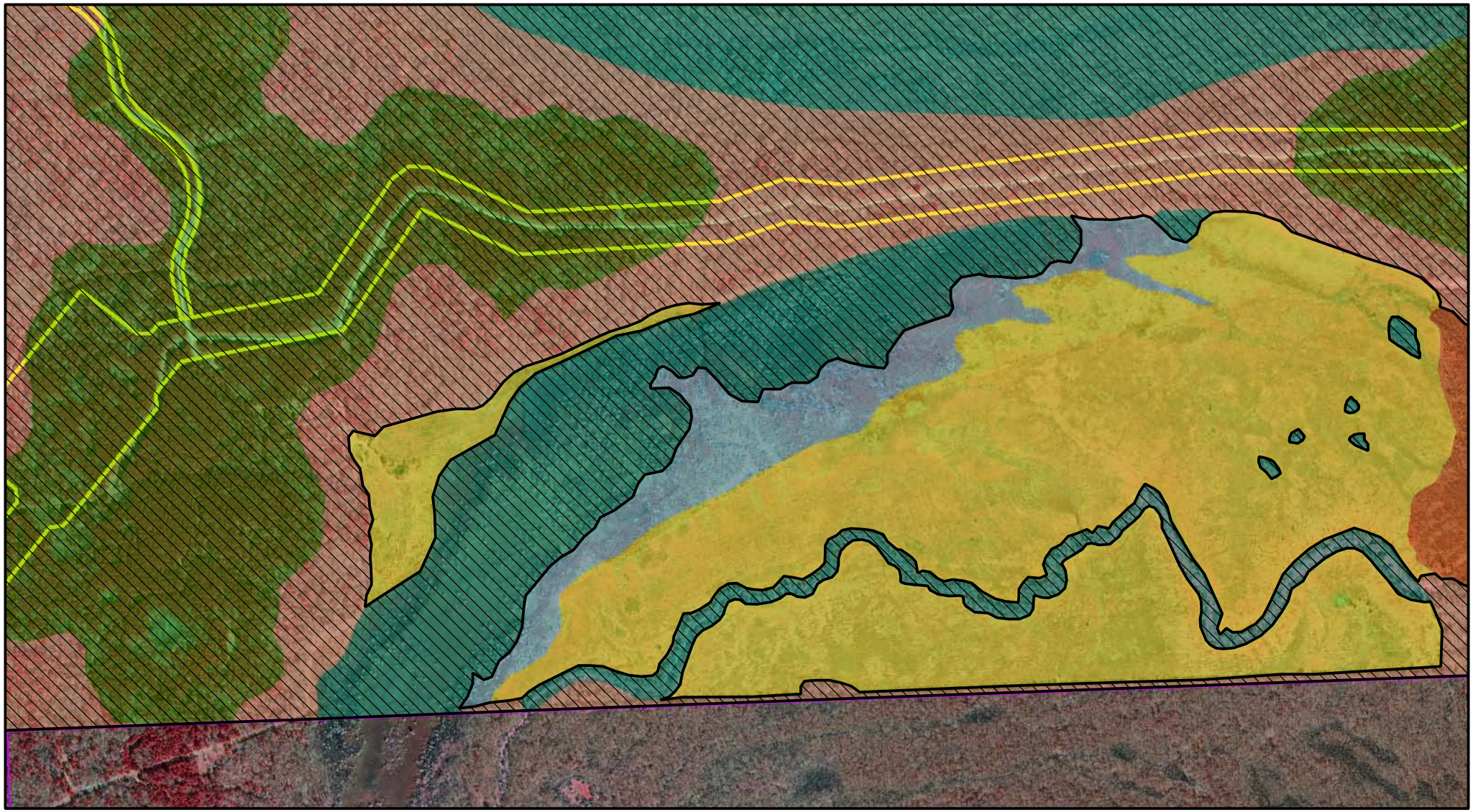

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N

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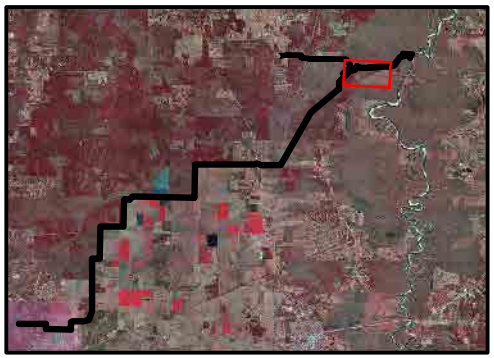

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N

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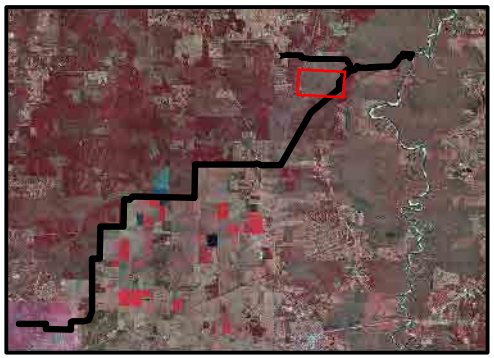

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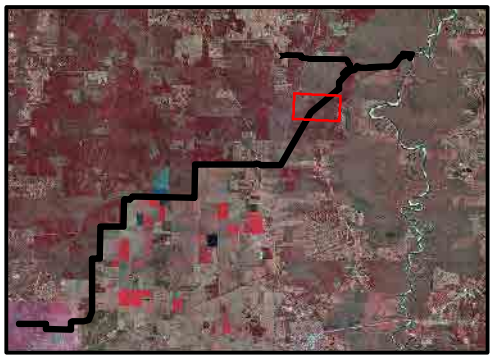

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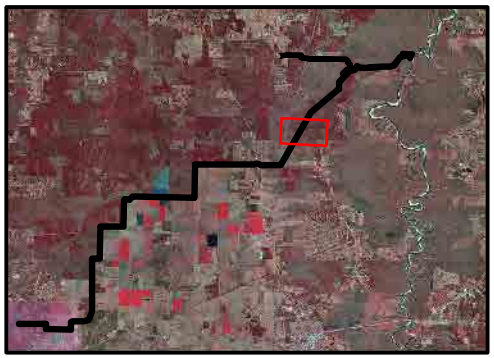

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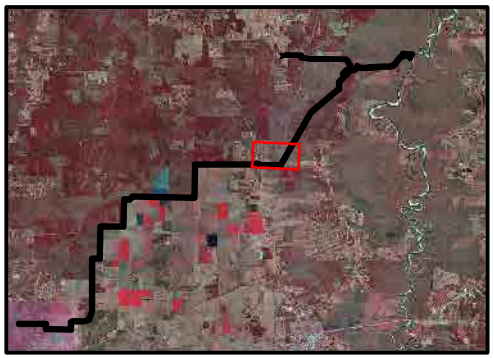

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N

0 500 1,000 Feet

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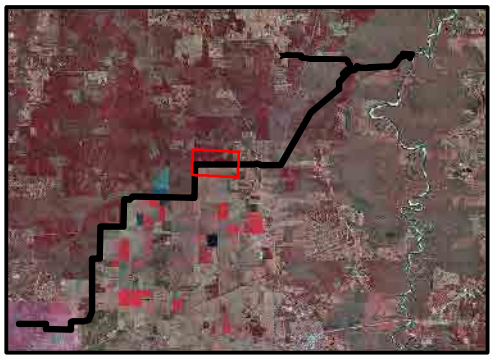

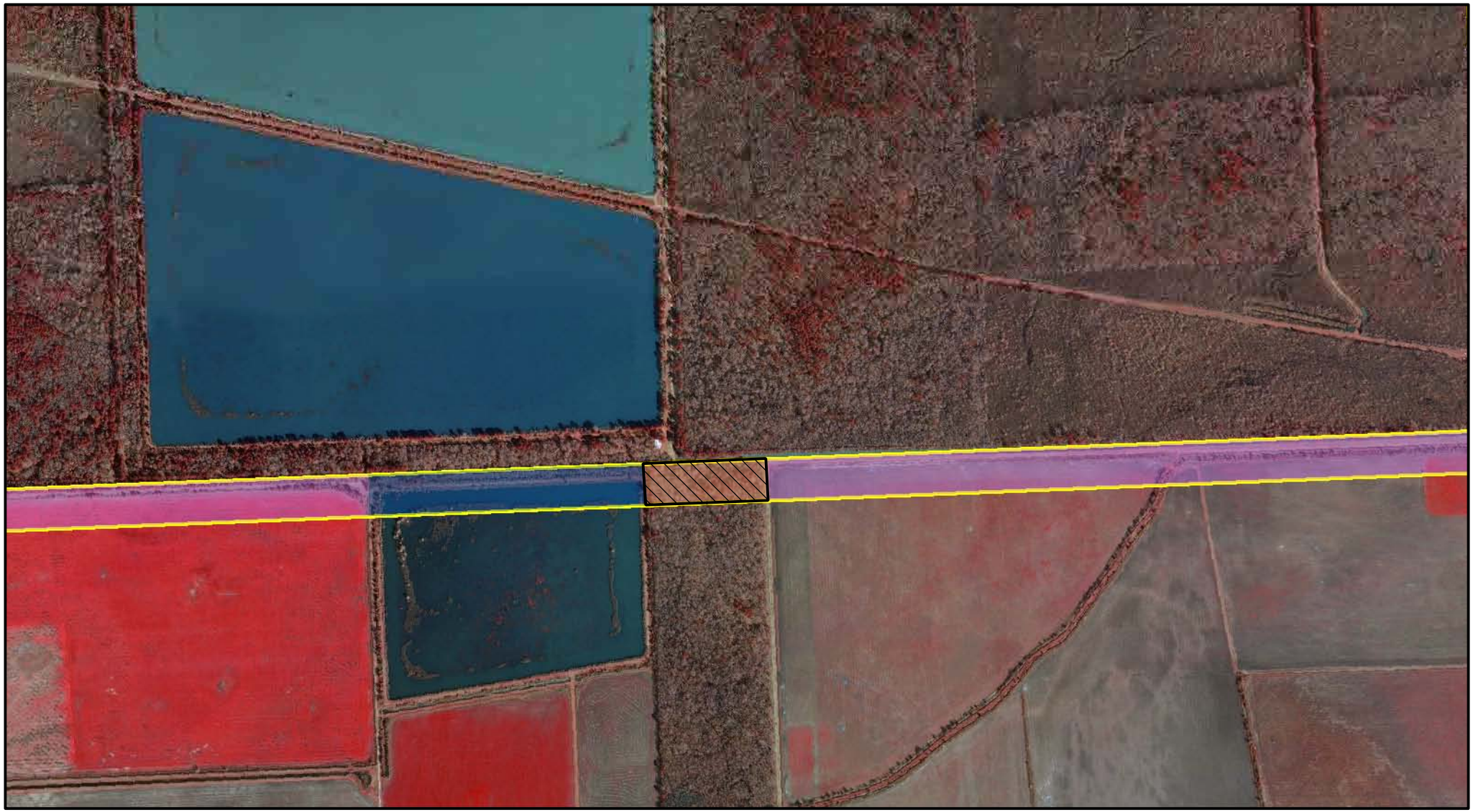

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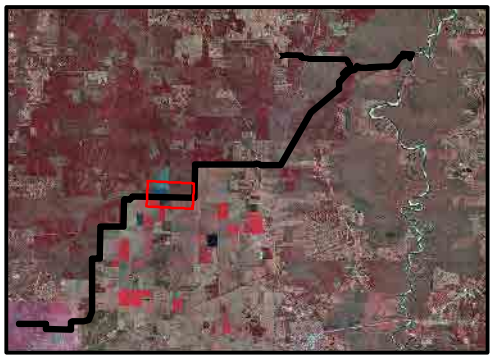

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0 500 1,000 Feet

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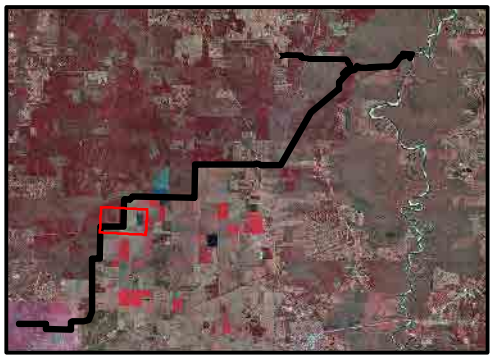

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N

0 500 1,000 Feet

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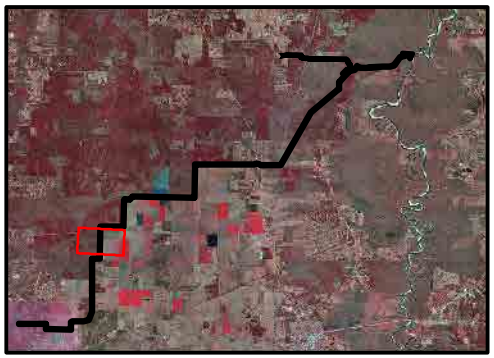

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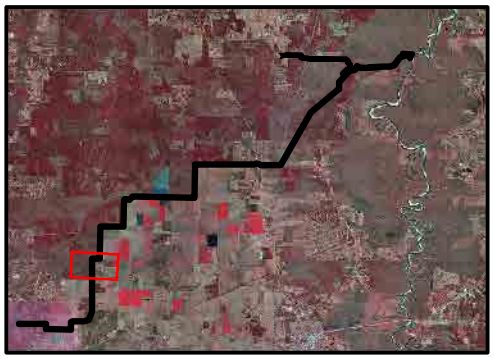

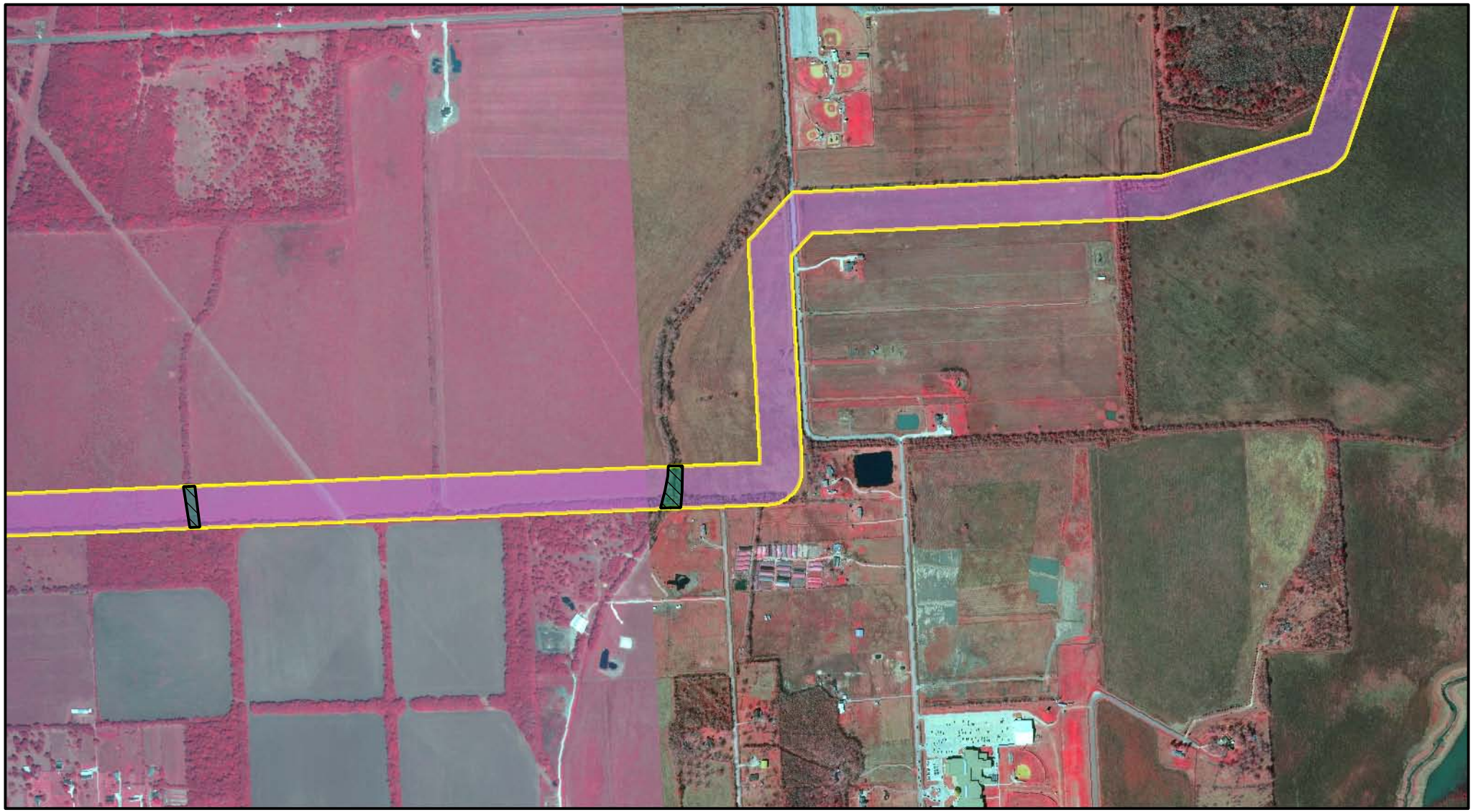

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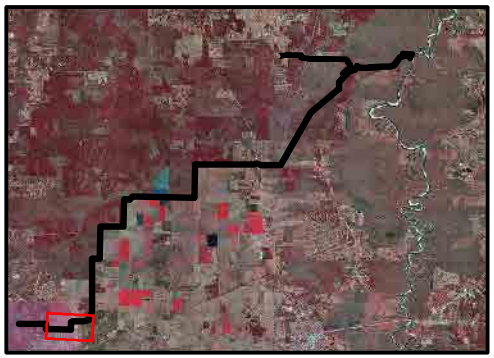

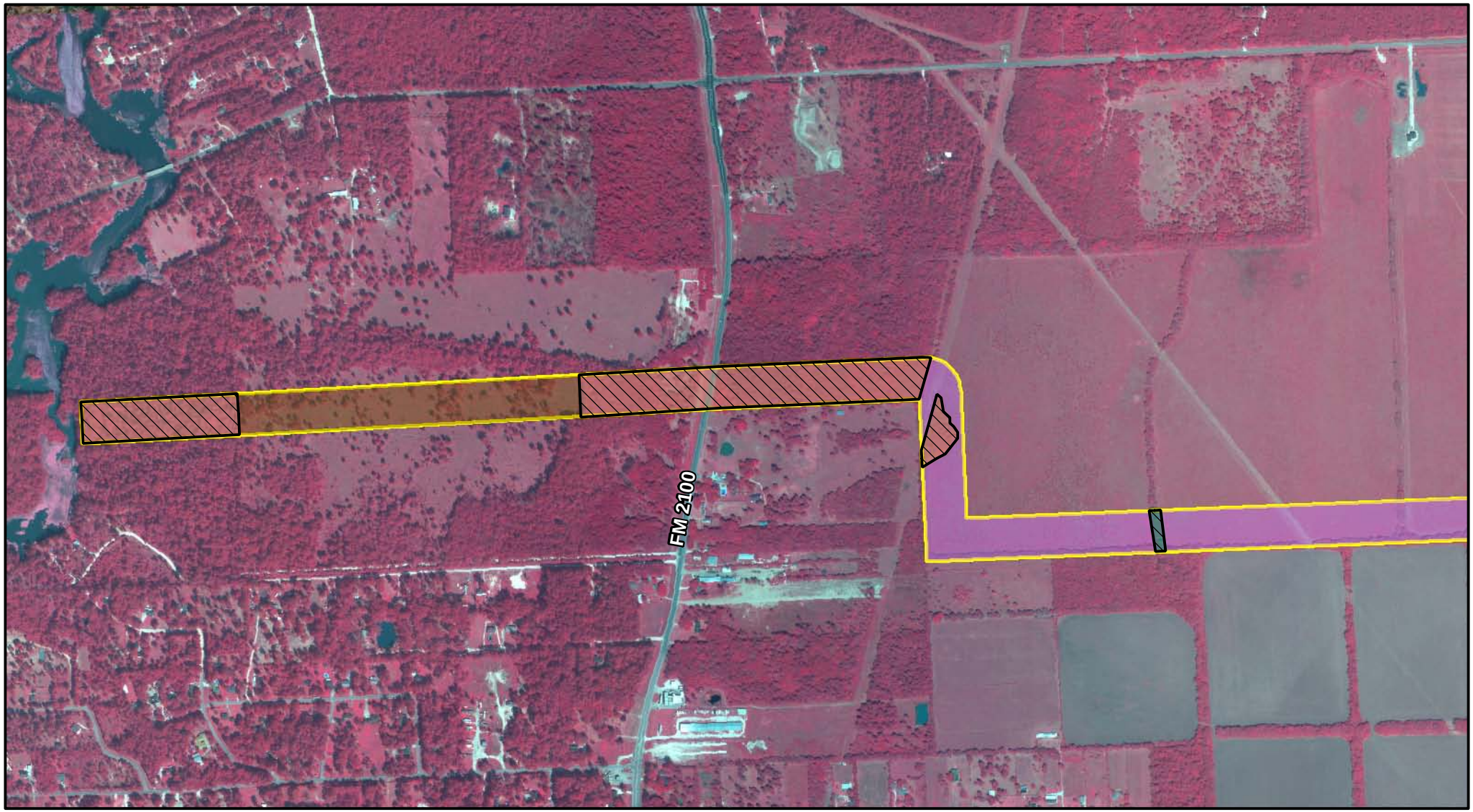

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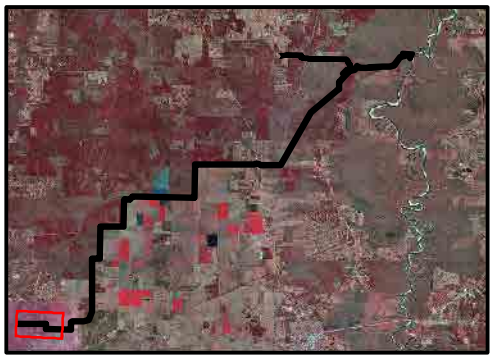


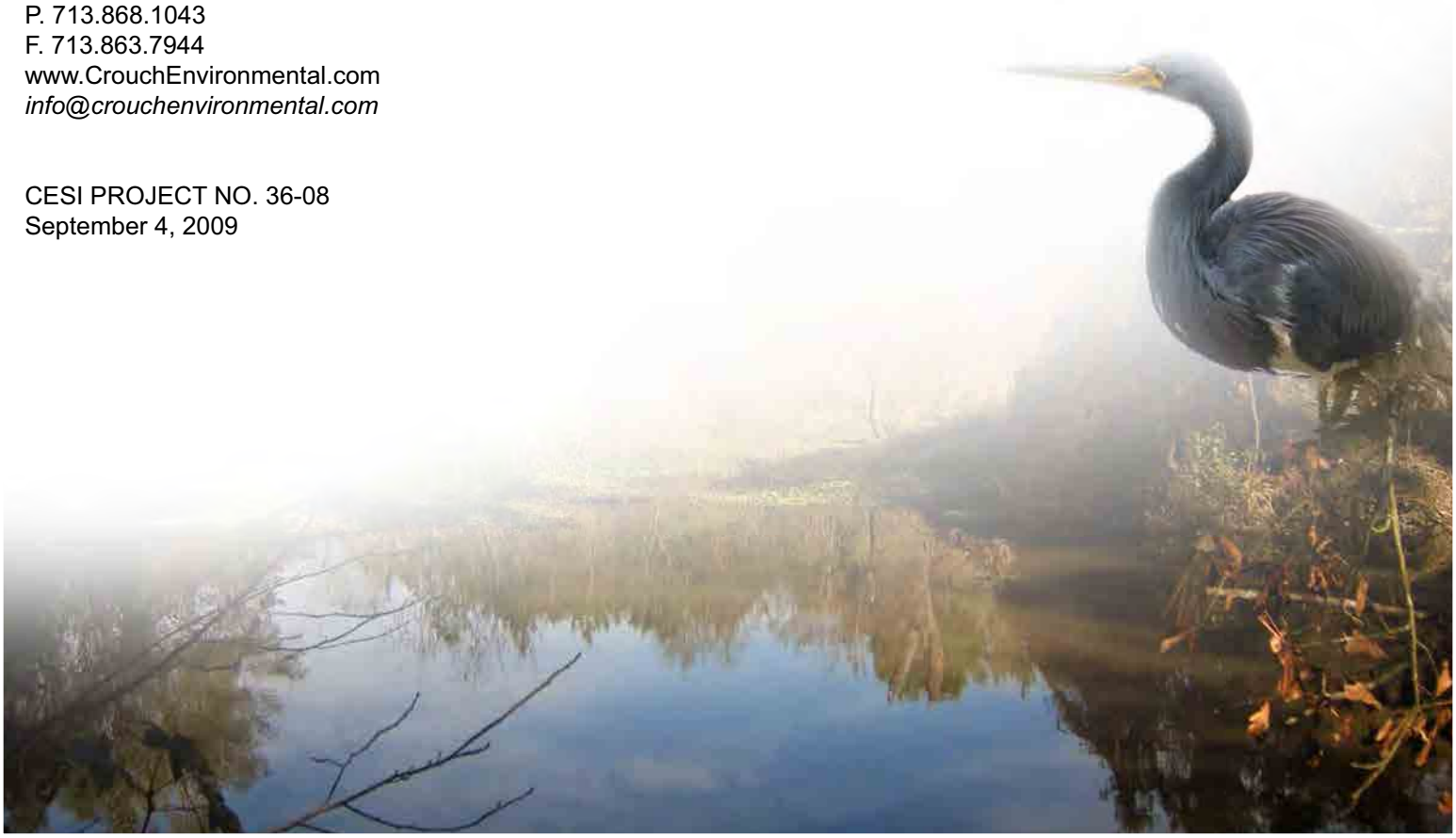
Preliminary Draft
Wetland Evaluation Report

Luce Bayou Interbasin Transfer Project
Liberty and Harris County, Texas

Prepared By:
Crouch Environmental Services, Inc.
402 Teetshorn Street
Houston, Texas 77009

P. 713.868.1043
F. 713.863.7944
www.CrouchEnvironmental.com
info@crouchenvironmental.com

CESI PROJECT NO. 36-08
September 4, 2009



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2.0 Methods 4

3.0 Results and Conclusions **6**

Appendix A – HGM Interim Data Sheets

Appendix B – WET 2.0 Program and Datasheets

Appendix C – Modified Charleston Method Datasheets

Exhibits

2004 Historical Infrared Photograph with Proposed ROW and Parcels Data Overlays

WET 2.0 Manual

Modified Charleston Method Manual

1.0 Introduction

The Luce Bayou Interbasin Transfer Project is a proposed 23-mile conveyance project designed to transfer surface water from the Trinity River to Lake Houston. The purpose of this project is to increase the available water capacity that can be used to supply Harris County with potable water as demand for this resource increases over time. In addition, water from Lake Houston, supplemented with supply from the Trinity River through the Luce Bayou Project, may also play a role in providing for future demands in Montgomery County as this area converts from what is today primarily a groundwater supply to a surface water system.

Currently, the proposed project alignment will impact wetlands and as such, in accordance with Section 404 of the Clean water Act, these wetland areas must be mitigated for. In order to address the need for this mitigation, several alternatives have been considered. The preferred alternative to date involves the purchase and preservation of a tract of land, the Harrison Tract, which contains approximately 1202 acres of delineated wetlands.

The purpose of this report is to provide a preliminary assessment of potential wetland evaluation methodologies that could be used to evaluate the value of the Harrison Tract wetlands as well as those wetlands located along the proposed project alignment. This assessment will aid in establishing whether the preservation of the Harrison Tract alone is acceptable compensation for the wetland impacts that will result from the proposed project. Three different wetland evaluation methodologies are discussed in this report. A brief summary each of these methodologies can be found below.

WET 2.0 Assesment Methodology

The objective of the WET 2.0 is to provide an evaluation technique that (1) assesses most of the recognized wetland functions and values, (2) is applicable to a wide variety of wetland types, (3) is reproducible and rapid (completed in one day or less), and (4) has a sound technical basis in the scientific literature. The eleven wetland functions and values assessed in WET 2.0 include: ground water recharge, ground water discharge, flood flow alteration, sediment stabilization, sediment/toxicant retention, nutrient removal/transformation, production export, wildlife diversity/abundance, aquatic diversity/abundance, recreation, and uniqueness/heritage.

According to the WET 2.0 Manual, these functions and values are scored in terms of Social Significance and Effectiveness and Opportunity using three evaluation types. The three evaluation types are:

(1) Social Significance Levels 1 and 2: These levels assess the value of a wetland to society due to its special designations, potential economic value, and strategic location. Level 1 determines if the wetland is beneficial to society. Level 2 refines the probability rating for the uniqueness/heritage value assigned during the Level 1 assessment. This refinement is based on the relationship of the evaluated wetland to all other wetlands in the context region. For the purposes of this evaluation, only the Level 1 assessment was completed.

(2) Effectiveness and Opportunity Levels 1 to 3: Effectiveness assesses the capability of a wetland to perform a function due to its physical, chemical or biological characteristics. Opportunity assesses the opportunity of a wetland to perform a function to its level of capability. The three successive levels of assessment build on previous levels to develop an increasingly detailed characterization of the wetland.

(3) Habitat Suitability: Habitat Suitability assesses the suitability of a wetland habitat for groups of waterfowl species and fish species exhibiting similar habitat requirements as well as wetland dependent

bird species, freshwater fish species, and saltwater fish and invertebrate species. The assessment relies on the characterization of the physical, chemical, and biological attributes of the wetland developed for the effectiveness and opportunity evaluation.

Each function and value is assigned a qualitative probability rating of LOW, MEDIUM, or HIGH from which a quantitative quality point score (QPS) is calculated for the existing wetlands to be impacted by a project. However, the WET 2.0 was never intended to be a quantitative value, which could be used to establish compensatory mitigation (Adamus et al. 1987).

Modified Charleston Method Assessment Methodology

The Modified Charleston Method is a standardized protocol developed by the United States Army Corps of Engineers (USACE) Charleston District that is applicable to regulatory actions requiring compensatory mitigation. This method allows rapid calculation of credit value for proposed wetland mitigation plans and/or banks. The Modified Charleston Method is a evaluation technique considered appropriate when more rigorous, detailed studies are not considered practical or necessary. The Modified Charleston Method assesses eleven variables: type and duration of impacts, type and condition of impacted site, rarity of the impacted ecosystem, magnitude of impacts (cumulative effects), alterations to aquatic characteristics (soils, hydrology, vegetation), changes in functions and values (net improvement), monitoring and contingencies plans, kind of ecosystem compared to impacts, location (i.e. watershed and ecoregion) relative to impacts, preservation methods (i.e. restrictive covenenants, easements) and the degree of threat for preservation proposals.

As with the WET 2.0, the Modified Charleston Method is somewhat subjective, but with ample guidance. The assessor is required to determine the most applicable qualitative description from a number of established criteria. Positive aspects of the Modified Charleston Method include simplicity and rapidity. Calculations also are well defined and relatively simple, as they only require filling out a standardized form and performing simple, pre-defined mathematical calculations to determine the final mitigation ratio. The Modified Charleston Method provides a reliable tool that developers and planners can use to compare mitigation options. This assessment method results in a credit calculation. Negative aspects of the Charleston Method are that it does not truly address or assess any of the standard accepted wetland functions and values evaluated by other methods such as the WET 2.0. Additionally, factors such as success criteria, monitoring plans, contingencies, and locations have little or no affect on the ratio. The Charleston Method, like the WET 2.0, also lacks regional specificity and has a more generalized approach to interpreting wetland functions and values. One shortcoming of the Modified Charleston Method is that it is not yet been designed to address preservation mitigation. As such, for the purposes of this report, only the impacted wetland credits were evaluated and then compared against one another.

Hydrogeomorphic Approach Assessment Methodology

The Hydrogeomorphic (HGM) Approach assesses three main functions: hydrogeomorphic classification, reference wetlands/reference domain, and collection of scientific data for verification of models. Hydrogeomorphic classification encompasses four sub-areas: hydrogeomorphic setting, water source and transport vector, hydrodynamics/water chemistry, and soil properties. The main distinguishing characteristics of the HGM Approach are that it is one of the few methods currently designed for non-experts (Carletti et al. 2004) and it uses reference wetlands, which are parts of the landscape that can be continuously referenced. This acts to provide an educational setting to others performing the same assessment procedure. The HGM method is both quantitative and objective.

Two factors need special consideration when instituting the HGM method in a new region 1) the time necessary to establish the reference wetlands and 2) the amount of reference wetlands needed in areas with many regional subclasses. Currently, the USACE Galveston District (SWG) has developed interim HGM methods designed specifically for wetlands found within the SWG, which includes all of Harris County. These interim HGM models are reduced versions of HGM that are more rapid and easily implemented than the more comprehensive HGM models. Further, this interim HGM model encompasses reference wetlands within the context of the questions, as the model was specifically developed for the SWG region.

Benefits of the reduced interim HGM models are the regional and type-specificity of assessments. In addition, models can theoretically be run together when differing wetland types exist within the area to be impacted. This is a vast improvement over other functional assessments both reviewed and discussed in this manuscript. Interim HGM models also can be run on individual wetlands or groups of wetlands that have the same characteristic features. This gives flexibility in the assessment and allows the evaluator to determine the appropriateness of either "lumping or splitting" wetlands into groups dependent upon their dominant features. This is another feature of the interim HGM models that is not present in other assessment methods and is particularly useful in determining appropriate compensatory mitigation.

The most obvious negative aspect of the interim HGM model developed by the SWG is the lack of acceptability primarily due to the interim HGM's novelty. At the time of writing, interim HGM models are still being finalized for wetlands within the SWG and not all models have been run to establish compensatory mitigation to date. The appropriate interim HGM model to use is determined by the dominant hydrologic influence of the wetland system. The interim HGMs for Riverine systems are divided into models for herbaceous/shrub systems and forested systems. An interim HGM model has also been developed for Tidal Fringe systems.

2.0 Methods

The relative value of the wetland areas within the proposed Harrison Tract Mitigation area were evaluated using each of the three evaluation methodologies referenced above. In order to apply these methodologies to a scenario wherein the proposed mitigation was preservation of existing wetland habitats, it was necessary to make several assumptions. A description of how each methodology was applied to the proposed project can be found in the sections below.

HGM-Interim

In order to assess the function and value of the wetlands present within the Harrison Tract, the HGM Interim Riverine Model was used for each of the three wetland types identified within the project area (herbaceous, scrub/shrub and forested). For the purposes of this initial evaluation, it was assumed that all wetlands within the Harrison tract were within the 100-year Floodplain. Data collected for each of the wetland types (i.e. herbaceous, scrub/shrub and forested) was averaged together in order to provide a "typical" assessment of each wetland type. The FCI coefficient calculated for these averages was then multiplied by the acreage for each wetland type within the Harrison Tract in order to calculate the FCUs for the existing wetland habitats (wetland acreages were provided by AECOM). Once the FCUs had been established for the existing wetland habitats, the HGM models for the same wetland areas were calculated again assuming that the areas had been impacted by silviculture. The FCUs that resulted from this hypothetical scenario were subtracted from the original FCUs in order to calculate the

potential "lift" that would result from preserving the Harrison Tract Mitigation area. The results of this analysis can be found in the Tables 1-3 below.

Table 1 – Herbaceous Wetlands HGM-Interim Analysis

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.76	65.36	0.74	63.64	**1.72**	**0.02**
Maintenance	0.50	43.00	0.45	38.70	**4.30**	**0.05**
Removal	0.65	55.90	0.63	54.18	**1.72**	**0.02**

Table 2 – Scrub/Shrub Wetlands HGM-Interim Analysis

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.65	52.65	0.32	25.92	**26.73**	**0.33**
Maintenance	0.83	67.23	0.15	12.15	**55.08**	**0.68**
Removal	0.65	52.65	0.52	42.12	**10.53**	**0.13**

Table 3 – Forested Wetlands HGM-Interim Analysis

	FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
Storage	0.87	900.45	0.55	569.25	**331.20**	**0.32**
Maintenance	0.74	765.90	0.13	134.55	**631.35**	**0.61**
Removal	0.91	941.85	0.68	703.80	**238.05**	**0.23**

WET 2.0

The WET 2.0 methodology was utilized in order to evaluate the relative value of the wetland areas within the proposed mitigation area against those that would be impacted by the project alignment. As such, "Lift" was not calculated as it was using HGM-Interim. Rather, typical wetlands within the Harrison Tract and along the project alignment were evaluated using the WET 2.0 program and then compared against one another. The regional priority for each function/value assessment was determined using the values established for the Greens Bayou Wetlands Mitigation Bank. While these figures may not accurately reflect the regional priorities for the actual project alignment and the Harrison Tract, they should provide a baseline from which the relative values of the wetland areas can be compared. The Quality Point Scores (QPS) for each wetland area is calculated by dividing the score derived from th WET 2.0 program by the maximum possible score for the wetland given the regional priorities. The preliminary WET 2.0 quality point scores for the Luce Bayou Alignment and the Harrison Tract can be found in Table 4 and 5 below.

Table 4 – Alignment Wetlands Quality Point Score

Function Value	Actual Score	Maximum Score	QPS (= Actual Score/Maximum Score)
Social Significance	49	63	
Effectiveness	42	78	
TOTAL	91	141	**0.64**

Table 5 – Harrison Tract Wetlands Quality Point Score

Function Value	Actual Score	Maximum Score	QPS (= Actual Score/Maximum Score)
Social Significance	53	63	
Effectiveness	42	78	
TOTAL	95	141	**0.67**

Modified Charleston Method

As with WET 2.0, the Modified Charleston Method was used in order to compare the quality of wetland areas within the Harrison Tract against those identified along the project alignment. In order to calculate the impacted wetland credits within each area, several assumptions were made. First, a total acreage for the proposed alignment was assumed to be 1050 acres. Impacted wetland credits were then calculated assuming 20%, 30% and 40% wetland coverage within the project alignment. The relative acreages for each type of wetland (herbaceous, scrub/shrub and forested) within the alignment were assumed to be identical (1/3 of the total wetland area each). The dominant impact for the wetland areas along the alignment was assumed to be fill activities over duration of 10 years, a likely scenario given the construction of a conveyance channel and access roads. A medial Cumulative Impact was assumed given the habitat fragmentation that would result from the proposed project.

The wetland acreages used for the area within the Harrison tract were provided by AECOM and are identical to those used during the HGM analysis. The dominant impact was assumed to be clearing activities over a duration of 10 years, a likely scenario assuming silviculture on the property. A minimal cumulative impact was assumed for these areas. The preliminary results of the Modified Charleston Method can be seen in the Tables below.

Table 6 – Calculated Impacted Wetland Area Credits

Wetland Area	Credits Impacted
Harrison Tract – Existing Condition	9644.40
Alignment - 20% Wetlands	1676.50
Alignment - 30% Wetlands	2965.88
Alignment - 40% Wetlands	3500.00

3.0 Results and Conclusions

All three of the methodologies utilized in this preliminary evaluation of wetland quality within the project area illustrate the relative value of the proposed Harrison Tract mitigation area. The demonstrable threat to the Harrison Tract as a result of silviculture is both precedented and probable. The Harrison tract has been logged in the past and properties directly adjacent to the Harrison Tract, including areas within the proposed alignment, are actively logged today. The “lift” calculated assuming this threat demonstrates the potential loss of wetland function and value within this area and thereby highlights the prospective benefit of preserving this area. The FCI and FCU units for these wetlands are shown in Tables 1-3 above.

The WET 2.0 results suggest the relative importance of the wetlands on the Harrison Tract when compared to those within the project alignment. Though the assessment areas designated for each of

these calculations were not wetland case-specific, each should provide for a fairly accurate representation of the wetlands within both the Harrison tract and the project alignment. The difference in the Quality Point Score between the wetlands within the project area (0.64) and the Harrison Tract (0.67) suggest an increased Social Significance and Effectiveness of the Harrison tract wetlands. This further demonstrates the importance of the Harrison Tract wetlands when compared to those located along the proposed project alignment.

The Impacted Wetland Credits calculated using the Modified Charleston Method also indicates that the wetlands located within the Harrison tract are of greater value than those located along the project corridor. It should be noted here that the calculated impacted wetland credits includes the acreage of the wetlands within the assessment area. Assuming a worst case scenario wherein 40% of the entire project alignment is composed of wetlands, the calculated value of the wetlands within the Harrison Tract is roughly 2.75 times greater than those along the alignment. This difference would be magnified if a dominant and cumulative impacts were assumed for the wetlands within the Harrison Tract.

In summary, the results of this preliminary evaluation indicate that all three wetland assessment methodologies that were examined for this report agree that the wetlands within the Harrison tract are likely of higher quality and of more social and ecological significance than those located along the proposed project alignment. While the results of each method cannot be directly compared to one another, each individually contributes to the argument that preservation of wetlands on the Harrison Tract are of greater value than those proposed to be impacted by the project alignment. Further analysis and USACE coordination is required in order to establish whether preservation of the Harrison Tract alone is acceptable compensation for the impacts to wetlands that will result from the proposed project.

Appendix A

HGM Interim Data Sheets

...terim Analysis - Draft Preliminary Evaluation

...s Table ONLY

	FCI Existing			FCI Impacted		
Acreage	Storage	Maintanence	Removal	Storage	Maintanence	Removal
86	0.76	0.50	0.65	0.74	0.45	0.63
81	0.65	0.83	0.65	0.32	0.15	0.52
1035	0.87	0.74	0.91	0.55	0.13	0.68

...ds In Floodplain

...FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
0.76	65.36	0.74	63.64	**1.72**	**0.02**
0.50	43.00	0.45	38.70	**4.30**	**0.05**
0.65	55.90	0.63	54.18	**1.72**	**0.02**

...nds In Floodplain

...FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
0.65	52.65	0.32	25.92	**26.73**	**0.33**
0.83	67.23	0.15	12.15	**55.08**	**0.68**
0.65	52.65	0.52	42.12	**10.53**	**0.13**

...In Floodplain

...FCI Existing	FCU Existing	FCI Impacted	FCU Impacted	Lift (FCU)	Lift (FCI)
0.87	900.45	0.55	569.25	**331.20**	**0.32**
0.74	765.90	0.13	134.55	**631.35**	**0.61**
0.91	941.85	0.68	703.80	**238.05**	**0.23**

Appendix B

WET 2.0 Program and Datasheets

Quality Point Score Calculation Worksheet - Alignment

Social Significance

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Moderate	2
Groundwater Discharge (GWD)	1	3	High	3
Flood Flow Alteration (FFA)	3	9	Moderate	6
Sediment Stabilization	3	9	Moderate	6
Sediment Toxicant Removal	3	9	Moderate	6
Nutrient/Removal Transformation (NRT)	2	6	Moderate	4
Wildlife Divirsity/Abundance (WDA)	3	9	High	9
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	6
Uniqueness/Heritage (UH)	2	6	High	6
Recreational	1	3	Low	1
Total Significance score		63		49

Effectiveness

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Low	1
Groundwater Discharge (GWD)	1	3	Low	1
Flood Flow Alteration (FFA)	3	9	Moderate	6
Sediment Stabilization	3	9	Moderate	6
Sediment Toxicant Removal	3	9	Low	3
Nutrient/Removal Transformation (NRT)	2	6	Low	2
Production Export (PE)	2	6	Moderate	4
Wildlife Divirsity/Abundance for Breeding (WDAB	3	9	Low	3
Wildlife Divirsity/Abundance for Migration (WDAM	3	9	Moderate	6
Wildlife Divirsity/Abundance for Wintering (WDAV	3	9	Moderate	6
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	4
Total Effectiveness score		78		42

Quality Point Score (QPS)

Function Value	Actual Score	Maximum Score	QPS
Social Significance	49	63	
Effectiveness	42	78	
	91	141	**0.645390071**

Quality Point Score Calculation Worksheet - Harrison

Social Significance

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Moderate	2
Groundwater Discharge (GWD)	1	3	High	3
Flood Flow Alteration (FFA)	3	9	High	9
Sediment Stabilization	3	9	High	9
Sediment Toxicant Removal	3	9	Moderate	6
Nutrient/Removal Transformation (NRT)	2	6	Moderate	4
Wildlife Divirsity/Abundance (WDA)	3	9	High	9
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	4
Uniqueness/Heritage (UH)	2	6	High	6
Recreational	1	3	Low	1
Total Significance score		63		53

Effectiveness

Function Value	Regional Priority	Maximum Score	Rating	Score
Groundwater Recharge (GWR)	1	3	Low	1
Groundwater Discharge (GWD)	1	3	Low	1
Flood Flow Alteration (FFA)	3	9	Moderate	6
Sediment Stabilization	3	9	Moderate	6
Sediment Toxicant Removal	3	9	Low	3
Nutrient/Removal Transformation (NRT)	2	6	Low	2
Production Export (PE)	2	6	Moderate	4
Wildlife Divirsity/Abundance for Breeding (WD	3	9	Low	3
Wildlife Divirsity/Abundance for Migration (WD	3	9	Moderate	6
Wildlife Divirsity/Abundance for Wintering (WD	3	9	Moderate	6
Aquatic Divirsity/Abundance (ADA)	2	6	Moderate	4
Total Effectiveness score		78		42

Quality Point Score (QPS)

Function Value	Actual Score	Maximum Score	QPS
Social Significance	53	63	
Effectiveness	42	78	
	95	141	**0.673758865**

Appendix C

Modified Charleston Method Datasheets

e 1 - Required Mitigation Credits Worksheet

Factor	Area 1 - PEM	Area 2 - PSS	Area 3 - PFO	Area 4 - PSS out	Area 5 - PFO out	Ar
Priority Category Primary - r = 3.0 Secondary - r = 2.0 Tertiary - r = 1.0 Low - r = 0.5	1	1	3			
Existing Vegetative Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	2.4			
Existing Hydrologic Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	1			
Duration 0 to 1 yr - r = 0.0 1 to 3 yr - r = 0.1 3 to 5 yr - r = 0.5 5 to 10 yr - r = 0.5 Over 10 yr - r = 1.0	1	1	1			
Dominant Impact Clear - r = 0.5 Draining - r = 2.0 Dredge - r = 2.5 Fill - r = 2.5 Impound - r = 1.5 Shading - r = 1 Beneficial Alteration - r = 0	2.5	2.5	2.5			
Cumulative Impact High - y = 0.025 Medium - y = 0.005 Low - y = 0.001	0.7	0.7	0.7			
Sum of R Factors	7.2	7.2	10.6	0	0	
Size in Acres	140	140	140			
R * AA =	1008	1008	1484	0	0	

Credits Impacted By Project 3500

e 1 - Required Mitigation Credits Worksheet

Factor	Area 1 - PEM	Area 2 - PSS	Area 3 - PFO	Area 4 - PSS out	Area 5 - PFO out	Ar
Priority Category Primary - r = 3.0 Secondary - r = 2.0 Tertiary - r = 1.0 Low - r = 0.5	1	1	3			
Existing Vegetative Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	2.4			
Existing Hydrologic Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	1			
Duration 0 to 1 yr - r = 0.0 1 to 3 yr - r = 0.1 3 to 5 yr - r = 0.5 5 to 10 yr - r = 0.5 Over 10 yr - r = 1.0	1	1	1			
Dominant Impact Clear - r = 0.5 Draining - r = 2.0 Dredge - r = 2.5 Fill - r = 2.5 Impound - r = 1.5 Shading - r = 1 Beneficial Alteration - r = 0	2.5	2.5	2.5			
Cumulative Impact High - y = 0.025 Medium - y = 0.005 Low - y = 0.001	0.525	0.525	0.525			
Sum of R Factors	7.025	7.025	10.425	0	0	
Size in Acres	105	105	105			
R * AA =	737.625	737.625	1094.625	0	0	

Credits Impacted By Project 2569.875

e 1 - Required Mitigation Credits Worksheet

Factor	Area 1 - PEM	Area 2 - PSS	Area 3 - PFO			
Priority Category Primary - r = 3.0 Secondary - r = 2.0 Tertiary - r = 1.0 Low - r = 0.5	1	1	3			
Existing Vegetative Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	2.4			
Existing Hydrologic Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	1			
Duration 0 to 1 yr - r = 0.0 1 to 3 yr - r = 0.1 3 to 5 yr - r = 0.5 5 to 10 yr - r = 0.5 Over 10 yr - r = 1.0	1	1	1			
Dominant Impact Clear - r = 0.5 Draining - r = 2.0 Dredge - r = 2.5 Fill - r = 2.5 Impound - r = 1.5 Shading - r = 1 Beneficial Alteration - r = 0	2.5	2.5	2.5			
Cumulative Impact High - y = 0.025 Medium - y = 0.005 Low - y = 0.001	0.35	0.35	0.35			
Sum of R Factors	6.85	6.85	10.25	0	0	
Size in Acres	70	70	70			
R * AA =	479.5	479.5	717.5	0	0	

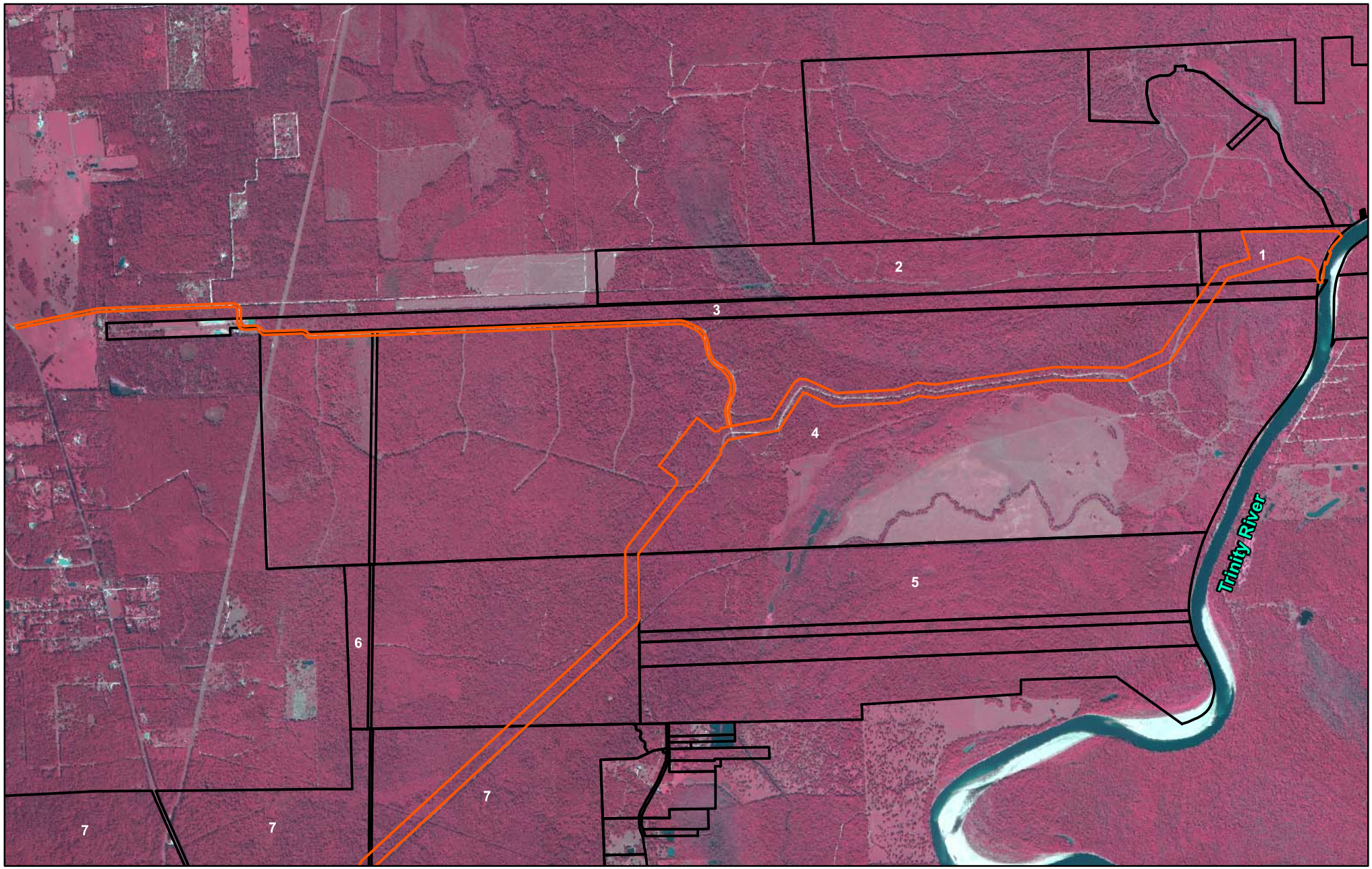
Credits Impacted By Project 1676.5

e 1 - Required Mitigation Credits Worksheet

Factor	Area 1 - PEM	Area 2 - PSS	Area 3 - PFO	Area 4 - PSS out	Area 5 - PFO out	Ar
Priority Category Primary - r = 3.0 Secondary - r = 2.0 Tertiary - r = 1.0 Low - r = 0.5	1	1	3			
Existing Vegetative Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	2.4			
Existing Hydrologic Condition Class 1- r = 3.0 Class 2 - r = 2.4 Class 3 - r = 1.0 Class 4 - r = 0.5 Class 5 - r = 0.1	1	1	1			
Duration 0 to 1 yr - r = 0.0 1 to 3 yr - r = 0.1 3 to 5 yr - r = 0.5 5 to 10 yr - r = 0.5 Over 10 yr - r = 1.0	1	1	1			
Dominant Impact Clear - r = 0.5 Draining - r = 2.0 Dredge - r = 2.5 Fill - r = 2.5 Impound - r = 1.5 Shading - r = 1 Beneficial Alteration - r = 0	2.5	2.5	2.5			
Cumulative Impact High - y = 0.025 Medium - y = 0.005 Low - y = 0.001	0.7	0.7	0.7			
Sum of R Factors	7.2	7.2	10.6	0	0	
Size in Acres	140	140	140			
R * AA =	1008	1008	1484	0	0	

Credits Impacted By Project 3500

Exhibits



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Proposed ROW

Parcels

CROUCH ENVIRONMENTAL SERVICES, INC.

09/03/2009

AECOM

Luce Bayou Interbasin Transfer Project

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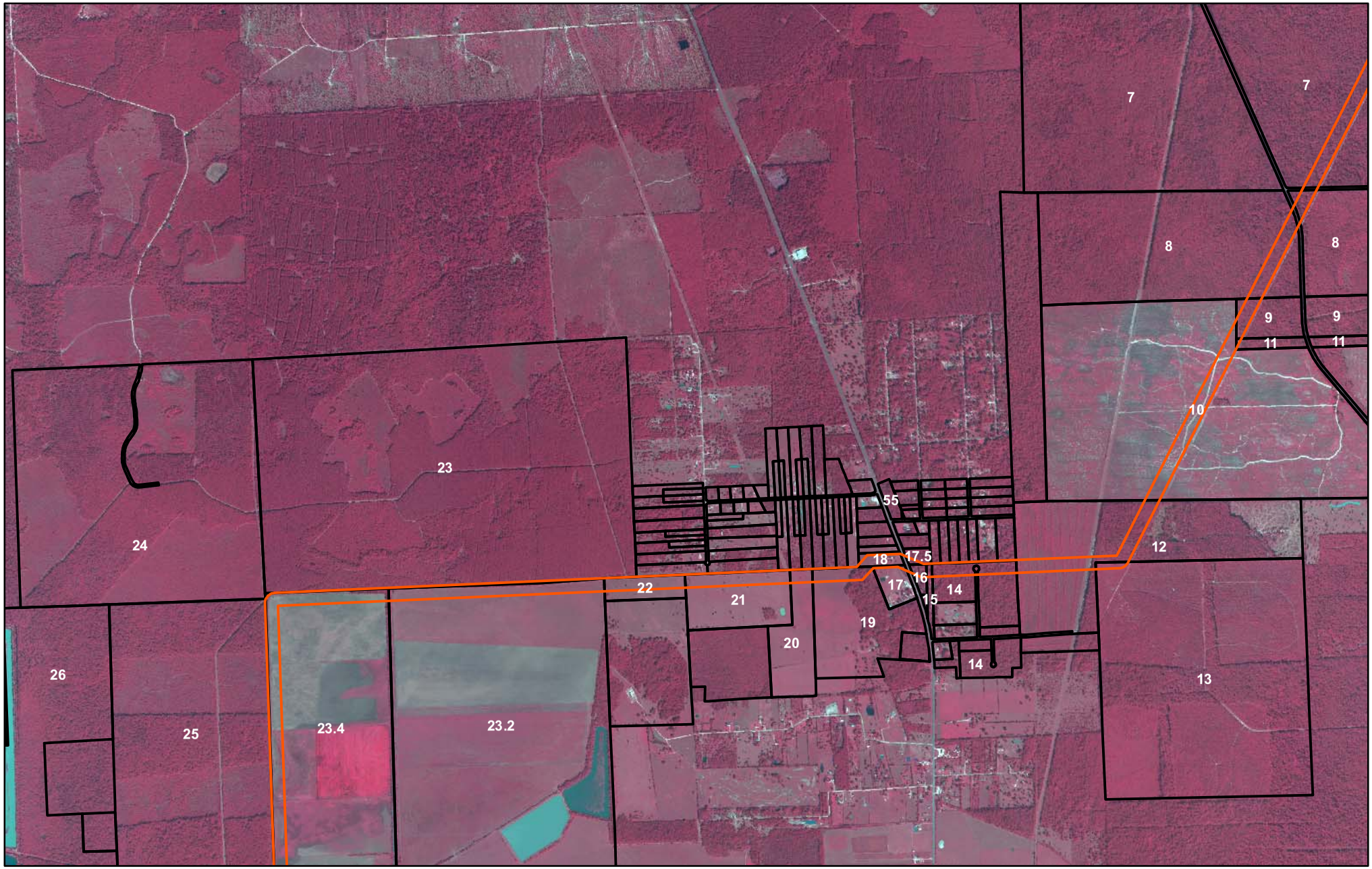
Liberty County, Texas

1 of 4



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Proposed ROW

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CROUCH ENVIRONMENTAL SERVICES, INC.

09/03/2009

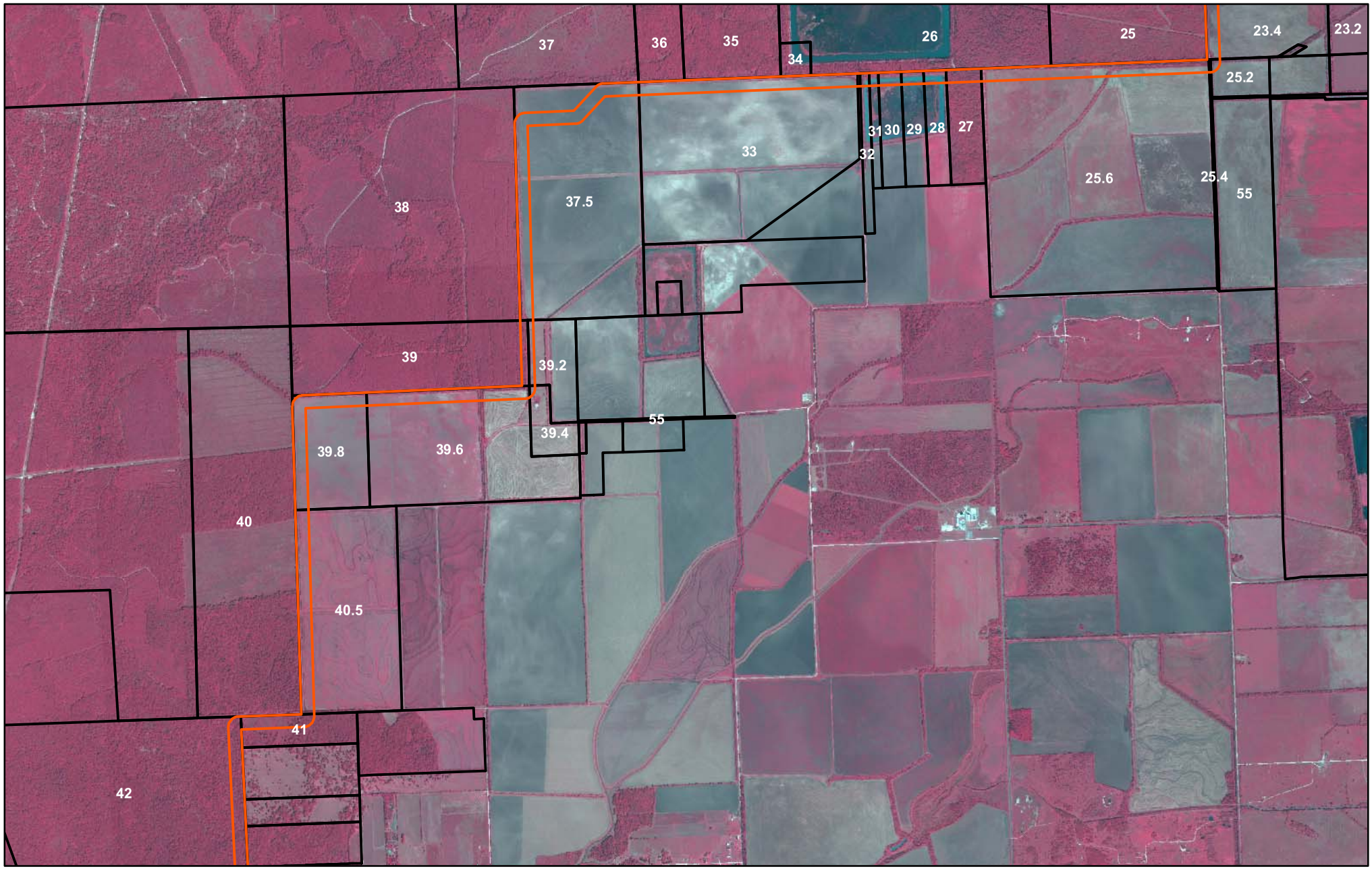
AECOM

Luce Bayou Interbasin Transfer Project

2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY AND PARCELS DATA OVERLAYS

Liberty County, Texas

2 of 4



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CROUCH ENVIRONMENTAL SERVICES, INC.

09/03/2009

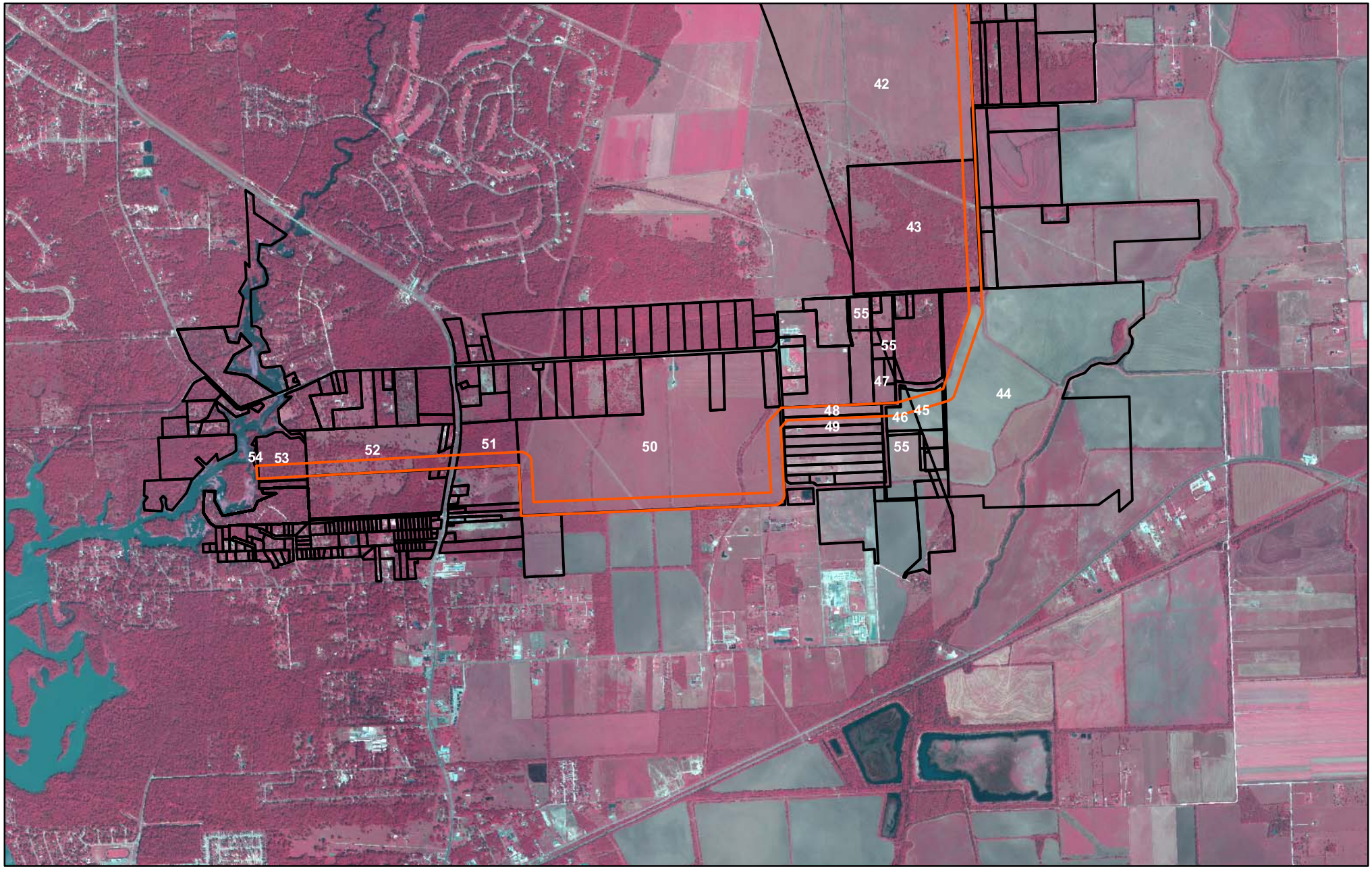
AECOM

Luce Bayou Interbasin Transfer Project

2004 HISTORICAL AERIAL INFRARED PHOTOGRAPH WITH PROPOSED RIGHT OF WAY AND PARCELS DATA OVERLAYS

Liberty County, Texas

3 of 4



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0 1,500 3,000 Feet

Proposed ROW

Parcels

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