

PRELIMINARY ALTERNATIVES ANALYSIS AND SCREENING

For Tier 2, Section 4 (US 231 to SR 37)

of the I-69 Evansville-to-Indianapolis Project

July 26, 2006

This report describes the analysis and screening of preliminary alternatives for Section 4 of the I-69 Evansville-to-Indianapolis Tier 2 Studies. It is provided as part of the second formal agency coordination milestone per the FHWA-Indiana Division's *Indiana's Streamlined EIS Procedures* (July 6, 2001).

Section 1.0 of this report presents a summary of Section 4's stated purpose and need for the project. This is followed in Section 2.0 by an overview of key factors considered during the development of Tier 2 alternatives. Since this is a tiered study, the development of alternatives differs significantly from what is typical in a non-tiered NEPA study. In section 3.0, the scoping process and development of Tier 2 preliminary alternatives are discussed. Lastly, Section 4.0 presents the analysis and screening of the preliminary alternatives and identifies alternatives that will be carried forward for detailed study.

1.0 Summary of Purpose and Need

The Section 4 Draft Purpose and Need Statement, Draft Preliminary Alternatives, and exhibits showing the preliminary alternatives were submitted to resource agencies on November 11, 2005. The statement of purpose and need and the preliminary alternatives were reviewed by resource agencies during a web cast meeting with the Section 4 project team on December 19, 2005. This meeting is summarized in Section 3.1.1 of this report.

The purpose of the project for Section 4 is to advance the overall goals of the I-69 Evansville-to-Indianapolis project in a manner consistent with the commitments in the Tier 1 Record of Decision (ROD) while also addressing local needs identified in the Tier 2 process. The identified Tier 2 local needs for Section 4 are:

- Complete Section 4 of I-69 between US 231 in Greene County and SR 37 near Victor Pike south of Bloomington in Monroe County
- Increase personal accessibility for area residents
- Reduce existing and forecasted traffic congestion
- Improve safety
- Support local economic development initiatives

The goals and performance measures associated with the purpose and need for Section 4 are summarized in Table 1. These goals, and how they are measured, were described in greater

detail in the Draft Purpose and Need Statement (November 15, 2005), which was the subject of a previous agency review process. Tier 1 core goals are shown in *bold italics*.

Table 1: Section 4 Goals and Performance Measures		
TIER 1	TIER 2 Section 4	
	Section 4 Goals	Section 4 Performance Measures
<p><i>GOAL 1—Improve the transportation linkage between Evansville and Indianapolis (Core Goal)</i></p> <p><i>GOAL 8—Facilitate interstate and international movement of freight (Core Goal)</i></p> <p>GOAL 9— Connect I-69 to major intermodal facilities in Southwest Indiana</p>	<p>GOAL 1—Complete Section 4 of I-69 between US 231 in Southern Greene County and SR 37 southwest of Bloomington</p>	<p>G1-A Development of a freeway which meets current design standards</p>
<p><i>GOAL 2 – Improve personal accessibility for Southwest Indiana residents (Core Goal)</i></p>	<p>GOAL 2—Enhance the transportation network in the Section 4 Study Area to improve personal accessibility for residents</p>	<p>G2-A Increase in access of area communities to the Interstate system</p> <p>G2-B Reduction in travel time to regional destinations (Evansville, Bloomington and Indianapolis)</p>
<p>GOAL 3 —Reduce existing and forecasted traffic congestion on the highway network in Southwest Indiana</p>	<p>GOAL 3—Reduce existing and forecasted traffic congestion on the highway network in the Section 4 Study Area</p>	<p>G3-A Reduction in congestion on rural roadways.</p>
<p>GOAL 4 —Improve safety levels in Southwest Indiana</p>	<p>GOAL 4—Reduce crashes on local and state roads in the Section 4 Study Area</p>	<p>G4-A Reduction in the number of crashes in the Section 4 Study Area</p>
<p>GOAL 5 - Increase accessibility for Southwest Indiana businesses to labor, suppliers, and consumer markets</p> <p>GOAL 6 — Support sustainable, long-term economic growth.</p> <p>GOAL 7 — Support economic development to benefit a wide spectrum of area residents.</p>	<p>GOAL 5—Support local economic development initiatives</p>	<p>G5-A Increase in access of area businesses to the Interstate system</p> <p>G5-B Reduction in travel time to regional business destinations (especially Evansville, Crane NSWC, Bloomington and Indianapolis)</p>

2.0 Alternative Development Overview

The range of alternatives in the second tier of a tiered NEPA study is circumscribed by the decisions reached in Tier 1. In a typical NEPA study, these constraints do not exist. In non-tiered studies the project termini, along with a general routing (which may include alternative choices for communities to be served) are used in the scoping process to specify a range of alternatives. Even in a relatively small non-tiered NEPA study, the locations of alternatives may

differ by many miles. Section 2.1 describes how the range of alternatives is affected by the tiered nature of this study.

The selection of a corridor in Tier 1 also requires an innovative approach to traffic forecasting for Tier 2 alternatives. The range of alternatives is much more constrained than in the typical NEPA study. Accordingly, more detailed modeling tools are needed to evaluate alternatives. The traffic forecasts for this study are provided by a hierarchy of traffic models. Both Version 4 of the Indiana Statewide Travel Demand Model (ISTDM) and a more detailed corridor model are used.¹ The corridor model is “fed” by the results of the ISTDM. The corridor model includes the counties through which the approved corridor for I-69 passes, as well as all or part of other nearby counties. Section 2.2 describes this hierarchy of modeling tools.

Quantm is an engineering alignment optimization tool. It was used to help generate alternatives within the selected I-69 corridor. Section 2.3 describes the use and application of Quantm to generate alternatives in the scoping phase of this study.

2.1 Scoping of Alternatives in a Tiered Study

The Tier 1 ROD approved a corridor for I-69 between I-64 north of Evansville and I-465 south of Indianapolis. This corridor generally is 2,000 feet in width. It narrows in some places to as little as 420 feet near the Patoka National Wildlife Refuge. In other locations, it widens to as much as 6,400 feet in northern Daviess County. The Tier 2 studies will determine an exact alignment for I-69 within this corridor. As provided in the Tier 1 Record of Decision (p. 8), the flexibility exists to consider alternatives outside the selected corridor to avoid significant impacts within the selected corridor.

The selection of a corridor in Tier 1 limits the range of Tier 2 alternatives. The Tier 1 decision determined which communities will be served, and the general route for the highway.

The Tier 1 ROD specified that the following would be key issues for distinguishing alternatives in Tier 2 studies. Additional details on the range of alternatives are included in Section 2.3.4 of the Tier 1 ROD.

- Interchange location and design
- Access to abutting properties
- Location of grade separations and intersecting roads

Because the alignments themselves are constrained by a narrow corridor, variations in alignment may not be as significant in distinguishing alternatives as the issues cited above. Variations in alignments will be considered to minimize costs and impacts.

¹ In the urban areas of Bloomington, Martinsville, and Indianapolis (in Tier 2 Sections 5 and 6) a microsimulation model also is used. The use of this model will be described in the DEIS documents for these sections.

2.2 Traffic Modeling

As discussed above, a distinguishing feature of alternatives in this study is that they are much more similar than is typical in a non-tiered NEPA study. Accordingly, the tools used to compare the performance of these alternatives also must be more focused. The Indiana Statewide Travel Demand Model (ISTDM) is a very robust tool for comparing the alternatives in a typical NEPA study. However, with the alignments confined to a corridor that generally is less than one-half mile in width, tools to evaluate alternatives on a more minute scale were needed.

To prepare for Tier 2 studies, the ISTDM was refined to provide a more detailed highway network throughout the state². The results of this upgrade are illustrated in Figures 1 and 2. Figure 1³ shows the highway network for the previous version (Version 3) of the ISTDM. It had 18,000 links, with 23,000 miles of highway network. Figure 2 shows the highway network for Version 4 of the ISTDM. It has 35,000 links, with 29,000 miles of highway network.

Figure 1: ISTDM Version 3 Network

Figure 2: ISTDM Version 4 Network

Figures 3 and 4 further illustrate the updates made to Version 4 of the ISTDM. Figure 3 shows the 844 Traffic Analysis Zones⁴ (TAZs) used in Version 3. Figure 4 shows the 4,720 TAZs used in Version 4. In Version 4 of the ISTDM, its zonal structure (number of TAZs) is five times more detailed than the zonal structure for Version 3.

Figure 3: ISTDM Version 3 Traffic Analysis Zones

Figure 4: ISTDM Version 4 Traffic Analysis Zones

Once the ISTDM was updated to Version 4, an even more detailed model was created for the region proximate to the I-69 corridor. This “corridor model” included the counties in which the selected I-69 corridor is located, as well as all or part of other nearby counties. Figure 5 shows the network associated with the Tier 2 corridor model. The greatest density of lines shows the location of the selected corridor for I-69, as well as nearby roads. In the vicinity of the I-69 corridor, the corridor model includes all roads down to the functional classification⁵ of minor

² The Indiana Statewide Travel Demand Model (ISTDM) is regularly updated by INDOT to incorporate the most current data and transportation planning practices. ISTDM Version 3 was used for the Tier 1 Study; ongoing Tier 2 Studies are using ISTDM Version 4.

³ Figures 1 – 5 are intended to communicate, in a schematic manner, the relative level of detail of the modeled highway network and Traffic Analysis Zones (TAZs). Other maps provided in the DEIS and FEIS will be much more detailed, consistent with the resource or impacts under discussion.

⁴ A “traffic analysis zone” (TAZ) is a geographic area which conforms to US Census geography, is consistent with the highway network, and is relatively homogeneous with respect to population demographics and land use. The transportation model regards trips on the highway network as originating and terminating within these TAZs.

⁵ “Functional classification is the process by which streets and highways are grouped into classes, of systems, according to the character of the service they are intended to provide. Basic to this process is the recognition that individual roads and streets do not serve travel independently in any major way. Rather, most travel involves movement through a network of roads.” Quoted from *Highway Functional Classification: Concepts, Criteria and Procedures*. FHWA, Revised March, 1989, p. II-1.

collector (in rural areas)⁶ and collector (in urban areas)⁷. In addition, those local roads that possibly could be affected by I-69 (e.g., be considered for closure or grade separations) are included. The corridor model also is designed to be suitable for considering alternative interchange locations.⁸

Figure 5: I-69 Tier 2 Corridor Model Network

The TAZ structure in the corridor model also is more detailed than in the ISTDM. There are over 4,300 TAZs in the corridor model that covers only the corridor in southwestern Indiana, as compared with only 4,700 for the entire modeled area (which consists of Indiana and portions of Michigan, Ohio, Kentucky, and Illinois) in Version 4 of the ISTDM.

To provide Tier 2 forecasts, the results obtained from the ISTDM are “fed into” the corridor model. The auto and truck trip tables⁹ that are provided by the ISTDM traffic assignment¹⁰ are disaggregated using TransCAD’s¹¹ built-in proportionate disaggregation procedure to provide trip tables corresponding to the TAZ structure in the corridor model.¹² In this process, many of the trips assigned to a TAZ in the ISTDM are assigned to an external station¹³ in the corridor model. The corridor model is then run using these trip tables to obtain a traffic assignment that

⁶ In rural areas, collectors are defined as routes which “... generally serve travel of primarily intracounty rather than statewide importance and constitute those routes on which (regardless of traffic volume) predominant travel distances are shorter than on arterial routes. Consequently, more moderate speeds may be typical.” Rural minor collectors are described as routes which should “... (1) Be spaced at intervals, consistent with population density, to collect traffic from local roads and bring all developed areas within a reasonable distance of a collector road; (2) provide service to the remaining smaller communities (not served by major collectors); and (3) link the locally important traffic generators with their rural hinterlands.” (*Ibid*, p. II-10).

⁷ In urban areas, collectors are defined as routes which provide, “... both land access service and traffic circulation within residential neighborhoods, commercial and industrial areas. It (the collector street system) differs from the arterial system in that facilities on the collector system may penetrate residential neighborhoods, distributing trips from the arterials through the area to the ultimate destination.” (*Ibid*, p. II-13). In urban areas, there is no distinction between major and minor collectors.

⁸ As noted in Section 2.1, grade separations, treatment of intersecting roads, and locations of interchanges are major issues that will define Tier 2 alternatives. The scale of the corridor model is such that it can be used to provide a meaningful comparison of such alternative treatments.

⁹ A “trip table” is a matrix listing the number of trips made between any two zones.

¹⁰ A traffic assignment is the simulation of traffic flows within the transportation network provided by a travel model (such as TransCAD). The traffic assignment provides forecasts of the number of vehicles on each road within the highway network, as well as turning movements at intersections and freeway interchanges.

¹¹ TransCAD ® is the modeling platform produced by Caliper Corp. that is used by INDOT for the ISTDM.

¹² For example, in the ISTDM, the trip table may show 420 trips between two zones x and y . The corridor model has a more refined zone structure. Zone x in the ISTDM may be subdivided into 5 zones ($x_1, x_2, x_3, x_4,$ and x_5) in the corridor model. Similarly, zone y in the ISTDM may be subdivided into 5 zones ($y_1, y_2, y_3, y_4,$ and y_5) in the corridor model. The TransCAD procedure referenced here breaks down the 420 trips between zone x and zone y into the 25 possible categories (e.g., trips from x_1 to y_1 , trips from x_2 to y_1 , etc.). The total number of trips between all combinations of zones x_n and y_n would total 420. This procedure takes into account the characteristics of each zone x_n and y_n (e.g., population and employment) in allocating trips to that zone.

¹³ An “external station” is a special kind of zone on the boundary of a modeled area. Unlike TAZs, these special external zones do not have demographic or land use data associated with them. Trips that enter or leave the modeled area are shown as originating or ending at that zone. For example, if the boundary of the modeled area were at I-70 west of US 231, all trips entering or leaving the modeled area via I-70 would be shown with their origin or destination at that external station. Such trips may begin or end far beyond the external station. In this example, trips modeled as originating at an external station on I-70 west of US 231 may originate at St. Louis, Terre Haute, and various other points west.

is detailed enough to support decisions regarding Tier 2 alternatives. The corridor model produces assignments for the AM peak hour, the PM peak hour, and total weekdays (24 hour). The AM and PM peak percentages and directional splits in the corridor model traffic assignments were calibrated against actual traffic counts along SR 37¹⁴ and other rural corridors in Southwest Indiana, as appropriate.

The traffic forecasts used in the engineering analysis of alternatives are provided by the corridor model. In addition, the performance measures, which will be used in the alternatives analysis will be calculated using post-processors¹⁵ that analyze the traffic assignments provided by the corridor model.

2.3 Use of Quantm

Quantm is a relatively new computer-aided tool that facilitates the development and analysis of alternative horizontal and vertical roadway alignments. It imitates the otherwise manual function of developing and assessing route alignments for transportation projects. Quantm has the capability to generate a set of alignments that minimize construction costs and negative impacts to important environmental resources. Based on parameters provided, Quantm will generate a set of alignments, illustrate those alignments within a digital terrain model, superimpose them on aerial photographic images, track key statistics (e.g., wetland acreage impacted) for each alternative, and allow alternatives to be compared according to a variety of attributes including construction cost.¹⁶

Quantm develops a graphic representation of alternative horizontal and vertical roadway alignments and computes the cost of each based upon the input of geographic, topographic, and geologic information; geometric design criteria; unit cost data; and environmental constraint information. The program processes a large volume of data and generates a large number of alignment possibilities in a relatively short period of time. However, results are constrained by the quality and quantity of data provided. The actual development of alternative horizontal and vertical alignments requires consideration of more detailed information and judgment factors than can be cost-effectively and reasonably input into the program. Within the constraints of a 2,000-foot-wide corridor, it is valuable for obtaining first cut alignment definitions and conducting “what if” scenario analyses. This process provides a reasonable number of alignments to develop with conventional geometric design programs.

¹⁴ SR 37 is the principal transportation facility whose existing traffic counts were used, because it is the most significant transportation facility which is included within the confines on the corridor model. Recent traffic counts (taken within the last several years) on this and other major facilities were used to ensure that the base year traffic assignment (for the year 2000) could adequately “predict the present.”

¹⁵ A “post processor” is a computer program that analyzes a traffic assignment to compute measures of transportation performance. For example, an accessibility postprocessor may compare the travel times between any number of location pairs in the “no-build” and “build” networks in order to assess the improvement in accessibility provided by a particular alternative.

¹⁶ Costs identified by Quantm are appropriate for comparing mainline construction costs components, but do not include all costs. Cost that Quantm does not estimate include: interchanges, some drainage structures, local road improvements, right-of-way, design engineering, construction engineering, utility relocation, and environmental mitigation. The costs presented in Tables 4 – 11 are based upon a more detailed engineering analysis which do account for these cost components.

Quantm was initially used to establish possible mainline alignments. These Quantm-generated alignments were then refined using conventional design practices to develop the alternative mainline alignments.

The combination of terrain and natural resource constraints in Section 4 are more pronounced than in other I-69 Tier 2 sections. Accordingly, Quantm software was applied differently than in other Tier 2 Sections. The methodology described below would not be suitable for application in most other Tier 2 Sections.

Various Quantm scenarios were run to test different sets of inputs and constraints imposed by the “key resources”. Generally, each scenario imposed progressively greater constraints. Each scenario was analyzed and compared to previous scenario results to identify changes in costs and “trends.” Trends were identified as possible mainline alignments, or areas that offered the least-costly, lowest impact alignments through the corridor. In other words, if 10 out of the 20 Quantm alignments were clustered along the same general path, then that route tends to be the least-costly. If no alignments were developed through a particular area of the corridor, it generally meant that there is some topographic constraint that increases the cost or a key resource that should be avoided.

Following is a short description of the Quantm scenarios and how they were used to develop alternative mainline alignments for Section 4.

Scenario 1

Scenario 1 generated mainline alignments using highway design criteria, topographic data from the corridor digital terrain model (at 2-foot contour intervals), and bridge clearances for major waterways based upon estimated flood elevations. No constraints for key resources were used. This scenario defined the least-costly¹⁷ alignments and trends that minimize earthwork and structural quantities.

Scenario 2

Scenario 2 generated mainline alignments that avoided identified historic properties and cemeteries. The estimated costs were in the same range as Scenario 1. This scenario illustrated that avoiding a small, isolated community and natural resources will not substantially affect costs.

Scenario 3

Scenario 3 generated mainline alignments that avoided identified historic properties and cemeteries and also avoided (or minimized) impacts upon wetlands. While all wetlands could not be avoided, including the wetlands along Black Ankle Creek, this scenario demonstrated that costs are not substantially affected by avoiding and minimizing wetland impacts.

Scenarios 4 and 5

¹⁷ Costs identified by Quantm are appropriate for comparing mainline construction cost components, but do not include all costs. Costs which Quantm does not estimate include interchanges, some drainage structures, local road improvements, right-of-way, design engineering, construction engineering, utility relocation, and environmental mitigation.

Scenarios 4 and 5 generated alignments with differing horizontal stiffness factors. Quantm's "stiffness" factor is a variable that controls the rate of change of horizontal and vertical curvature of the alignments. When the stiffness parameters are close to 0, the alignments follow the natural surface as closely as geometric design criteria permit. When the stiffness parameters are close to 1, the alignments minimize changes in curvature as much as possible. Rerunning scenarios with varying stiffness factors illustrated that higher stiffness factors result in higher construction costs. In general, higher stiffness results in higher construction costs because there is more earthwork (i.e., cut/fill) due the fact that the alignment cannot follow the natural terrain as closely when a higher stiffness factor is used.

Scenario 6

Scenario 6 generated alignments based on avoidance of identified historic properties, cemeteries, caves, major springs and most wetlands. Using the results of Scenarios 4 and 5, it was decided that a horizontal stiffness factor of 0.75 represents the optimal input for Quantm to provide a balance between mainline construction costs and flexibility to avoid key community and natural resources. A stiffness factor of 0.75 is also considered adequate to meet all travel speed and safety requirements for highway design. Conventional geometric design adjustments are then made to meet design criteria or to further avoid and minimize impacts to key community and natural resources.

3.0 Development of Preliminary Alternatives

This section describes the scoping process and the development of preliminary alternative roadway alignments within the approved corridor for Section 4. This corridor, including the termini for Section 4, was approved in the Tier 1 ROD on March 24, 2004.

Any Section 4 alternative alignment which provides a comparable level of access to that assumed for the selected corridor in the Tier 1 Study will fulfill the overall project purpose and need. Further, the degree to which local purpose and need goals are satisfied will not be affected to any significant degree by alignment variations. Interchange options will be analyzed as part of the alignment alternatives carried forward for detailed study. Their ability to affect performance on local purpose and need goals will be assessed at that time. Accordingly, the screening of alternatives is based upon an analysis of potential impacts and construction costs.

3.1 Scoping Process

3.1.1 Resource Agency Coordination

The scoping process included the definition of the range of alternatives to be considered and the process to be used to address potential environmental impacts. The Tier 1 ROD limited the range of alternatives to freeways within the defined corridor with termini at US 231 and SR 37. Many of the issues to be addressed are mandated by various laws, regulations, and agency guidelines. To ensure the scope of study for these issues would be adequate, two general meetings have been held to date between environmental resource agencies, FHWA, INDOT, the Project Management Consultant, and all consultants working on specific Tier 2 sections. They are:

- **August 12, 2004 Kick-Off Meeting.** This meeting was held with federal and state review agencies in order to familiarize the environmental review agencies with the scope and status of environmental survey activities associated with the Tier 2 studies; to introduce the Project Management Team, agency representatives, and consultants responsible for each of the six sections; acquaint agency representatives with the Tier 2 project corridor, overall project Purpose and Need, public involvement efforts, and project schedules; and identify major issues to be addressed in the Tier 2 studies.
- **February 23-24, 2005 Two-Day Environmental Resource Agency Meeting.** The first day's agenda included a general meeting involving all participants followed by breakout sessions to discuss specific topics. The general session focused on explaining the steps in the formal agency coordination process that each Tier 2 study will follow, identifying project schedules and timeframes, explaining how local needs and goals will be identified and incorporated into the Purpose and Need Statements of each section, and discussing how preliminary alternatives will be developed and evaluated. Each section's consultant project manager gave a brief presentation summarizing activities to date and future planned activities. These presentations were followed by questions and comments from the agencies. In the afternoon three breakout sessions were held: (1) the Interagency Water Resources Coordination Team discussed issues related to wetlands, water quality, floodplains, floodways and stream crossings; (2) the Interagency Karst Geology Team discussed issues related to sink holes; and (3) a demonstration and training session was provided for the Quantm program. The second day of the agency coordination activities was primarily devoted to a bus tour to provide agency representatives with an overview of notable features in Sections 1, 2, and 3.

A resource agency coordination meeting/web cast was conducted on December 19, 2005 to review and receive resource agencies' comments on the Section 4 Purpose and Need and Preliminary Alternatives package that had been submitted to the agencies on November 11, 2005. In addition to FHWA and INDOT, agencies represented were U.S. Environmental Protection Agency, District 5 (USEPA); and, U.S. Fish and Wildlife Service, Bloomington Field Office (USFWS). The discussion focused primarily on the local goals that comprise the Section 4 Purpose and Need Statement. It was noted that the needs identified for Section 4 were identified through extensive public involvement activities and that they support the Tier 1 goals while providing the local focus required of the Tier 2 Studies. Regarding the analysis of alternatives within the selected corridor, it was noted that all alternatives would likely satisfy the Tier 1 Purpose and Need equally. Also, the potential environmental impacts and cost of each alignment would be key determinants in evaluating and comparing alternatives. Updates on completed and on-going field work and public involvement activities were also presented. Questions and comments from USEPA and USFWS focused on the following:

- Local transportation and land use planning relative to the proposed Greene County/Monroe County line interchange
- Recently proposed toll road option for I-69
- Wetland fieldwork and delineations including the area along Black Ankle Creek
- Proposed Greene County/Monroe County line interchange

- Karst features
- Core forests
- Wildlife crossings (corridors)

Written comments on the Section 4 Purpose and Need and Preliminary Alternatives package were received from the following agencies:

- U.S. Department of Agriculture, Forest Service (January 13, 2006) – Comments noted that “The Purpose and Need for Section 4...is consistent with the Tier 1 FEIS and seems to reflect local concerns. The range of alternatives seems adequate.”
- Indiana Department of Natural Resources, Division of Water (February 17, 2006) – Comments were provided on forested habitat; light and noise effects; stream, wetland and riparian impacts; habitat connectivity; and, karst impacts. Concerns were expressed about the potential loss of canopy forest and interior forest habitat especially with regards to the effects upon neotropical migrant songbirds. The value of wooded riparian corridors which are used for travel between larger habitat areas was noted. Concerns about water quality effects upon the subterranean ecosystem associated with karst features were also noted.
- Indiana Department of Natural Resources, Division of Historic Preservation & Archaeology (December 16, 2005) – Comments indicated no particular concerns on the purpose and need statement. The Division did indicate concerns about potential direct and indirect effects upon the Dowden Farm (located along Preliminary Alternatives 4A-1 and 4A-2 should this property subsequently be determined eligible for the National Register) and potential indirect effects upon the John May House, a National Register eligible property located near Preliminary Alternatives 4G-1 and 4G-2.

3.1.2 Local Government and Public Input

Formal opportunities for community input have included two local public officials meetings, a Section 4 Project Office open house; meetings with the Greene County Commissioners, Greene County Council, and Monroe County Plan Commission; four meetings with the Section 4 Community Advisory Committee (CAC); and various small group meetings. In addition to these formal meetings, local governments and the general public have submitted comments on the Tier 2 purpose and need and preliminary alternatives. Input was provided by letters, comments via the project website, public meeting comment forms, and visits and phone calls to the Section 4 project office.

Extensive input was received through coordination with local governments and the general public. The numerous comments regarding the perceived need for an interchange along the Greene County/Monroe County line were a major consideration in the development of the Preliminary Alternatives. Other important comments included suggestions on additional grade separations of local roads and information on community and natural resources for specific properties along the Section 4 corridor.

3.2 Methodology

The development of alternatives under the NEPA process requires the consideration of multiple criteria. These include satisfying highway design standards, avoiding and/or minimizing

environmental impacts, minimizing cost, and satisfying project purposes. These diverse and often conflicting criteria typically are not quantifiable in similar terms. Developing alternatives requires input from affected parties and resource agencies, environmental analyses, and highway engineering, all conducted in an open partnership environment to develop a range of solutions.

Section 4 contains a diverse range of social, economic, environmental and ecological resources. Of these, certain resources have attained a high level of Federal and State importance as demonstrated by their regulatory protection. As such, avoiding impacts to these “key resources” was established as a primary objective for the development of the Section 4 Preliminary Alternatives. The following community and natural resources located within the Section 4 corridor were identified as “key resources” for avoidance and minimization of impact during the development of the Preliminary Alternatives.

- **Historic Properties.** These properties were identified by a comprehensive historic site survey that identified properties currently listed on the National Register or determined to be eligible for listing on the National Register. Boundaries for each historic property were established for avoidance by the preliminary alignments. Per the Tier 1 data, there are no known archaeological sites listed on or eligible for listing on the National Register.
- **Wetlands.** These sites were based upon a comprehensive corridor reconnaissance and subsequent preliminary wetland determinations.
- **Cemeteries.** Cemeteries were identified by a comprehensive corridor reconnaissance. A 100 foot buffer was established around each cemetery for avoidance by the preliminary alignments.
- **Caves.** Caves were identified by a comprehensive field inventory of geologic/karst features. The mapping of the caves included a 200 foot buffer from each cave entrance as an avoidance area for the development of the preliminary alignments.
- **Major Springs.** Springs that have 20 gallons per minute (gpm) or greater estimated discharge were classified as major springs. A 200 foot buffer around each spring was established as an avoidance area for development of the preliminary alignments.

Preliminary information about these key resources was used to develop the Preliminary Alternatives. This information was obtained from the Tier 1 database, coordination with resource agencies, additional research, and technical field inventories. This information was then used in the Quantm analysis as “constraints” for the development of the alternative mainline alignments.

The development of the Preliminary Alternative mainline alignments was an iterative process that made substantial use of Quantm. The process involved the consideration of route adjustments based on a range of possible constraints. The interchange locations used in the Preliminary Alternatives analysis were based upon the Tier 1 study recommendations as well as input received during Tier 2 from the public involvement program.

3.3 Preliminary Alternatives

3.3.1 Mainline Alignments

Preliminary alternatives were developed that are consistent with both the *Indiana Department of Transportation Design Manual* and the American Association of Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets*.

Scenario 6 from the Quantm analysis (see Section 2.3) was the primary basis for developing preliminary alternative mainline alignments. Using the results of this scenario, alignments were chosen that followed the lowest cost routes and predominant trends. Two or three alignments were identified in each subsection of the corridor and were retained for further development of end-to-end alignments extending the full length of the corridor. At various locations along the corridor, the Quantm analysis showed a convergence of alignments. The points where alignments tended to converge were chosen as subsection boundaries, in order to allow alternatives from different subsections to be “mixed and matched.” There are eight subsections along the corridor.

Conventional geometric design criteria (applying both the *Indiana Department of Transportation Design Manual* and *A Policy on Geometric Design of Highways and Streets* (AASHTO)) were applied to the Quantm mainline alignments. Additional minor adjustments were also made to add tangents (straight sections) and provide appropriate curve radii, while avoiding wetlands, ponds, and minor springs (5 to 20 gpm discharges). Adjustments were also made to the termini approaches to coordinate with Section 3 to the south and Section 5 to the north. For the purposes of reference and analysis, the Section 4 Corridor was divided into eight subsections. A naming convention was established as follows:

- “4”, which represents Section 4 of the I-69 Tier 2 corridor
- “A, B, C” etc., which represents the subsections beginning with “A” at US 231 and ending with “H” at SR 37
- “1, 2, or 3” which represents alternative mainline alignments within the particular subsection

For example, the first subsection of Section 4 beginning at US 231 has two alternative alignments, 4A-1 and 4A-2.

As stated earlier in this section, the subsection termini were at locations where the mainline alignments converged. Alternative mainline alignments within one subsection may be connected to any of those in adjoining subsections to form alternatives extending the full length of the corridor.

Each subsection alignment is represented by the centerline of the mainline alignment. No right of way or construction limits are proposed for the preliminary alternative mainline alignments. It is anticipated that a minimum 300 foot right of way will be required to design this rural freeway. The undulating terrain in much of Section 4 may require a right of way of up to 500 feet to accommodate earthwork cuts and fills. It is also likely that a wider median may be needed along portions of the Section 4 mainline alignment to further avoid and minimize community and natural resource impacts and/or to implement context sensitive design solutions.

The Section 4 Preliminary Mainline Alternative Alignments are presented in Table 2 and attached as Figure 1. Subsection 4A begins at US 231 north of the SR 58 junction in Greene County.

Subsection and Alignment		Length (miles)	Subsection North (East) Terminus	Description
4A	1	1.69	0.27 miles east of Greene County Road 215 East	4A runs in an easterly direction, north of the unincorporated community of Scotland.
	2	1.67		
4B	1	2.28	0.25 miles north of Bogard Creek & 0.25 miles West of Greene County Road 440 East	4B curves northeast toward the unincorporated community of Koleen and includes a crossing of Dowden Branch Creek.
	2	2.45		
4C	1	1.86	0.13 miles west of Black Ankle Creek	4C curves back to the east crossing Flyblow Branch Creek with alignments north & south of Taylor Ridge Cemetery.
	2	1.72		
4D	1	2.86	300 ft. east of Greene County Road 360 South	Segment 4D runs in an easterly direction crossing Black Ankle Creek, Dry Branch Creek, & Plummer Creek with alignments north of Ashcraft & Shoptaw Cemeteries and south of Casper Cemetery & a major spring.
	2	2.88		
4E	1	4.58	800 ft. east of SR 54	4E runs in a northeasterly direction and begins to curve northward at the east end of the segment. Along its route it crosses the Little Clifty Branch, SR 45, the Mitchell Branch, & SR 54.
	2	4.62		
	3	4.64		
4F	1	7.61	0.8 miles east of Burch Road (Monroe County) & 300 ft. west of Evans Lane (Monroe County)	4F runs in a northerly direction, east of Hobbieville, along the Greene County/Monroe County line & turns easterly south of Stanford. It crosses the meandering Indian Creek 3 times with alignments running east of Carmichael Cemetery and Adams Cemetery.
	2	7.45		
	3	7.50		
4G	1	3.12	150 ft. east of Lodge Road (Monroe County)	4G runs in an easterly direction between high density karst areas with alignments avoiding identified cave locations and major springs.
	2	3.13		
4H	1	3.22	SR 37 (Monroe County)	4H turns to the northeast, crossing two branches of Clear Creek & through a high density karst area with alignments running around several identified caves and springs.
	2	3.33		
	3	3.42		

The shortest preliminary alternative mainline alignment from the south terminus at US 231 to the north terminus at SR 37 is 26.9 miles. This alignment consists of Subsections 4A-2, 4B-1, 4C-2, 4D-1, 4E-2, 4F-2, 4G-1 and 4H-1. The longest preliminary alternative mainline alignment, consisting of Subsections 4A-1, 4B-2, 4C-1, 4D-2, 4E-3, 4F-1, 4G-2 and 4H-3, is 27.68 miles.

These alternative mainline alignments are preliminary. Minor shifts in the alignments are anticipated as the alternative development process continues. Shifts of up to approximately 200 feet to either side of the current alignment centerlines may be considered to further avoid and minimize impacts upon community and natural resources, to optimize connections between

alignment subsections, or for the connections with Section 3 to the south (west) and Section 5 to the north.

Grade separations are also a component of the Preliminary Alternatives. Potential locations for grade separations of local roads crossing the corridor are proposed at the following locations in Greene County:

- County Road 215 East (CR 625 South)
- County Road 600 South
- County Road 475 East (Taylor Ridge Road)
- County Road 600 East
- County Road 750 East (Dry Branch Road)
- County Road 360 South (Koleen Road)
- County Road 920 East/County Road 975 East (Old Clifty Road)
- County Road 1250 East
- County Road 1260 East/County Road 190 South (Hobbieville Road)
- County Road 35 North (Monroe County Carmichael Road, extended)
- County Road 150 North (Monroe County Carter Road, extended)

Potential grade separations in Monroe County are proposed at the following local roads:

- Breeden Road
- Burch Road
- Harmony Road
- Rockport Road
- Lodge Road
- Tramway Road
- Bolin Lane

Potential grade separations at CR 920 East/CR 975 East (Old Clifty Road) and CR 1250 East in Greene County and Lodge Road in Monroe County were not included in the Tier 1 FEIS Environmental Atlas. These potential grade separations were added during Tier 2 based upon field review of travel patterns, accessibility considerations, and/or input from local government officials, the Section 4 CAC, and the general public. No final decisions have been made regarding grade separations, interchanges, or other access issues; a range of access-control options are being considered as part of the alternatives analysis during Tier 2.

3.3.2 Preliminary Interchange Options

Potential interchanges shown the Tier 1 FEIS Environmental Atlas and retained for further study during the Tier 2 project development are at US 231, SR 45, and SR 54 in Greene County and SR 37 in Monroe County. An additional potential interchange along the Greene County/Monroe County line has been added to the Preliminary Alternatives. Per commitments made in Tier 1,

this interchange will be entirely located within Greene County.¹⁸ The interchange would include an access-controlled connector road that will intersect SR 45 in Center Township (Greene County). This potential interchange was added to the list of potential interchanges that will be further evaluated during the project development at the request of representatives from Greene County, Monroe County, the Section 4 CAC, and the general public. Coordination with USFWS has identified concerns about this interchange and secondary development that may result. Consultation is ongoing regarding this issue.

Seven interchange options consisting of various combinations of potential interchanges will be studied during the Alternatives Analysis phase of the project. No configurations for these potential interchanges are proposed during the Preliminary Alternatives phase. No option will be considered that includes potential interchanges at all three intermediate interchange locations – SR 45, SR 54, and Greene County/Monroe County Line). The seven interchange options are listed in Table 3.

Potential Interchange Locations	Preliminary Interchange Options						
	1	2	3	4	5	6	7
US 231	X	X	X	X	X	X	X
SR 45		X		X		X	
SR 54			X	X			X
Greene/Monroe County Line					X	X	X
SR 37	X	X	X	X	X	X	X

Should interchanges not be developed at SR 45 and/or SR 54, grade separations will be developed at these state highway crossings of I-69. The potential interchange along the Greene County/Monroe County line would be located in the vicinity of Greene County Road 35 North/Carmichael Road (Monroe County) and Greene County Road 150 North/Carter Road (Monroe County); however, no direct access from the potential interchange to these two local roads or to properties adjacent to the road that will connect the potential interchange with SR 45 will be provided.

4.0 Description of Alternatives Carried Forward

The “Alternatives Carried Forward” represent the alternatives that will be studied in detail in the Tier 2 Draft EIS. Section 4.1 presents the results of the screening analysis of the preliminary alignments along each of the eight subsections. Initial recommendations are presented for those alternatives to be carried forward for detailed study along with any possible modifications of the recommended alignments that will be considered in the subsequent project development to further avoid and minimize potential impacts. Section 4.2 presents the Alternatives Carried Forward including any alignment modifications recommended by the screening analysis.

¹⁸ The Tier 1 FEIS, in the context of minimizing and mitigating for water quality impacts due to new residential development in rural areas of Monroe County, states on p. 7-18, “No interchange will be provided in Monroe County where I-69 is on new alignment.”

Section 4.2 also presents initial interchange configurations at SR 45, SR 54, Greene County/Monroe County Line, and SR 37.

The Alternatives Carried Forward will be presented for review by Federal and state resource agencies, local public agencies, and the general public. Following the receipt of comments, additional development of the Alternatives Carried Forward and detailed assessment of potential impacts will be performed for inclusion in the Tier 2 Draft EIS.

4.1 Mainline Alternatives Screening

The preliminary alternatives were developed with no right of way. The presentation of the preliminary alternatives to resource agencies and the public did, however, indicate that the anticipated total right of way width would generally range between 300 feet and 500 feet. Continued development of the preliminary alignments indicated that a 400-foot wide construction “footprint” would accommodate the highway development along most of the Section 4 corridor. Accordingly, the mainline alternatives screening used a screening zone extending 200 feet to each side of the centerline. In some locations, the construction “footprint” may need to be wider in order to accommodate highway sections that may require more extensive cuts and fill. Thus, a secondary screening zone extending 300 feet to each side of the centerline (a total of 600 feet in width) was also used to identify potential impacts for the preliminary alternatives screening.

The screening of the preliminary alignments included an analysis of potential impacts upon several resources, along with input on the preliminary alternatives from resource agencies, public agencies, and the general public. Where appropriate, environmental, engineering and planning judgment were also used for the screening. The resources considered in the preliminary alternatives screening were:

- **Subsection Lengths and Construction Cost Estimates.** Construction cost estimates were developed using Quantm¹⁹. Since each Quantm construction cost estimate is based upon development of the highway along the entire length of Section 4, such cost estimates were not used in the screening analysis and are presented for information purposes only.
- **Wetland.** The development of the preliminary alternatives avoided many wetlands within the Section 4 corridor. Some wetlands, however, could not be completely avoided. These wetlands included those located in the Black Ankle Creek floodplain (Subsection 4D), some very small (< 0.1 ac) isolated wetlands, and riparian wetlands along streams that cross the entire corridor. The preliminary alternatives screening includes identification of potential wetland impacts and recommendations for possible alignment shifts to further avoid and minimize wetland impacts.
- **Forests and Core Forest.** Forest impacts were calculated per the forest land cover mapping unit of the upland habitat land use category. Forested wetland is not included in the forest

¹⁹ Costs identified by Quantm are appropriate for comparing mainline construction cost components, but do not include all costs. Costs which Quantm does not estimate include interchanges, some drainage structures, local road improvements, right-of-way, design engineering, construction engineering, utility relocation, and environmental mitigation. These costs which are not provided by Quantm will be included in the Draft EIS for this section.

land cover. The screening analysis also includes direct impacts upon core forests. Indirect core forest impacts that will occur due to changes in the core forest buffer zones were not determined but will be assessed in the DEIS for the alternatives carried forward for detailed study. It is noted that the total forest acres shown in the summary tables for each subsection also include the core forest acreage.

- **Agricultural Lands and Prime Farmland.** The agricultural land use classification consists of row crops, pasture, orchards, groves, nurseries, specialty crops and agricultural operations. Farming (row crops and pasture) is a primary land use in the Greene County portion of the corridor between US 231 and Black Ankle Creek. Pasture is a secondary agricultural activity along and near the Greene County/Monroe County line and near the north (east) end of the corridor in Monroe County. Potential impacts to prime farmland were determined for those lands being used for agricultural crop production and which have prime agricultural soils. It is noted that the total farmland acres shown in the summary tables for each subsection also include the prime farmland acreage.
- **Managed Properties.** Classified forests and classified wildlife habitats were identified per information received from the Indiana DNR (classified forest) and field signage designating classified wildlife habitats.
- **Floodplains.** Indiana DNR 100-year floodplain mapping was available for Doans Creek, Black Ankle Creek, Dry Branch Creek, Plummer Creek, Mitchell Branch of Indian Creek, Indian Creek and an unnamed tributary of Clear Creek.
- **Streams.** Streams were identified by the number of streams (or stream segments) and the total linear feet of the streams occurring within each subsection analysis area. The stream information is categorized by perennial, intermittent and ephemeral stream classifications. No determinations were made at this planning phase for the total number or linear feet of stream crossings and stream relocations that may be required.
- **Ponds.** All ponds within the Section 4 corridor are man-made. “Major” pond impacts were identified where ponds will be filled for the highway development. “Partial” pond impacts were identified where a portion of the pond may be filled. No jurisdictional determinations of these ponds as “Waters of United States” were made at this phase of the project development.
- **Subsurface Drainage Features.** The preliminary alternatives avoided all cave entrances and major springs (> 20 gpm discharge) including the buffer zones extending 200 feet (radius) from the center of the caves and major springs. Other subsurface drainage features that were evaluated during the screening were minor springs (5 – 20 gpm discharge), small springs (< 5 gpm discharge), sinkholes, swallets, and sinking streams as identified by the geology/karst inventory.
- **Historic Properties.** The development of the preliminary alternatives avoided all historic properties within Section 4; however, indirect effects may occur. Distances for historic properties, as identified by the historic property survey, were determined from the edge of both the 200 foot and 300 foot screening limits to the edge of each historic boundary.
- **Cemeteries.** The centerlines for the preliminary alignments avoided the 100 foot buffer around all cemeteries; however, the 200 foot or 300 screening limits may extend close to or inside the 100 foot cemetery buffer. In order to identify any possible encroachment of the buffer, distances were calculated from the edge of both the 200 foot and 300 foot screening limits to the edge of the 100 foot buffer around each cemetery. A negative value indicates that the screening limits for an alignment will encroach into the cemetery buffer.

- **Residential and Business Displacements.** Potential residences and businesses were considered a displacement if located within the 200 foot screening limits, 300 foot screening limits, or if access to the property may be eliminated and no alternative means of access were apparent at the time of the screening analysis.

Potential impacts were identified using the GIS mapping of resources, the digital terrain mapping (including contour elevations), aerial photographs, and the engineering development modeling. Most of the potential impacts are shown as ranges which occur when the particular resource is located within 200 feet of the alignment centerline and 300 feet from the alignment centerline. For example, 1 – 3 resource impacts indicate 1 resource impact within a 400 foot construction “footprint” and 3 resource impacts within a 600 foot construction “footprint”.

The preliminary alternatives were developed as alignment centerlines with no right of way or construction “footprints”. Possible minor shifts (up to 200 feet) of the centerlines and possible variable median widths were noted at the presentations of the preliminary alternatives to resource agencies and public. The alternatives screening includes, where applicable, recommendations for possible minor alignment shifts to avoid and minimize resource impacts. Most of the alignment shifts are less than 200 feet and thus are consistent with the stated project development approach.

Maps of the alternatives in the various subsections are included in Figure 6. In the discussion which follows, references are provided to specific pages of Figure 6 which depict the alternatives in each subsection. The Figure 6 maps show the centerline for each preliminary alternative. The maps also show an approximate right of way footprint that incorporates alignment shifts recommended for the alternatives carried forward by the screening analysis. The right of way footprints were developed using Quantum after completion of the screening analysis and selection of the Alternatives Carried Forward.

4.1.1 Subsection 4A

Subsection 4A begins at US 231 and ends approximately 0.3 miles east of CR 215 East in Greene County. This subsection is primarily farmland with interspersed woodlots.

Two preliminary mainline alternatives were proposed. Alternative 4A-1 intersects US 231 north of the midpoint of the corridor while Alternative 4A-2 intersects US 231 south of the midpoint of the corridor. These intersection points at US 231 were established based upon the preliminary alternatives proposed by the Section 3 Project Team. Page 1 of Figure 6 shows the alternatives in Subsection 4A.

Figure 6: Page 1

Table 4: Subsection 4A Analysis		
Resource	Subsection Impacts by Alternative	
	4A-1	4A-2
Length (mi)	1.69	1.67
Construction Cost Estimate (\$M)	15.5	17.1
Wetlands (ac)	None	0.8 – 1.9

Resource		Subsection Impacts by Alternative	
		4A-1	4A-2
Forest (ac)		30 – 48	47 – 70
Core Forest (ac)		2 – 3	None
Agricultural Land (ac)		36 – 51	20 – 30
Prime Farmland (ac)		13 – 19	6 – 10
Managed Properties (ac)		8 – 13	0 – 1
Floodplain (ac)		1.3 – 2.1	5.0 – 7.1
Streams (no./ft)	Perennial	0/0 – 1/214	1/1,091 – 1/1,614
	Intermittent	2/940 – 2/1,536	9/2,495 – 10/3,640
	Ephemeral	4/1,859 – 5/2,483	7/2,200 – 9/2,909
Ponds (ac)	Major Impact	0.5	None
	Partial Impact	1.0	1.0
Subsurface Drainage Features	Small Springs	None	3 – 5
	Minor Springs	None	None
	Sinkholes	None	None
	Swallets	None	None
	Sinking Streams	None	None
Historic Properties (ft)	Blackmore Store	3,300 – 3,400	2,250 – 2,350
	Scotland Hotel	3,450 – 3,550	2,400 – 2,500
Cemeteries (ft)		None	None
Residential Displacements		1 – 2	0 – 1
Business Displacements		None	None

Subsequent to the development of the preliminary alternatives for Subsection 4A and prior to the screening of these alternatives, the Section 3 Project Team completed its preliminary alternatives screening and recommended an alternative that intersects US 231 south of the midpoint of Corridor 3C. Consequently, Alternative 4A-1 does not have a direct connection with the mainline alternative and the US 231 interchange recommended for detailed study by the Section 3 Project Team.

Alternative 4A-1 has more potential impacts to prime farmland and managed properties. It also impacts core forest, will require filling of a 0.5 acre pond, and will have either one or two residential displacements.

Alternative 4A-2 will have possible impacts to wetlands located along CR 215 East and may impact three to five small springs. Dowden Farm abuts the south edge of Alternative 4A-2 along the west side of CR 215 East. This property is noted because some Section 106 consulting party members suggested that this farm may be a historic site. The Section 106 evaluation of potential historic properties, however, did not recommend this farm as being eligible for listing in the National Register. An unconfirmed infant burial site is also purported to be located on this property.

Recommendation: Alternative 4A-2 is recommended to be carried forward for detailed study. In order for Alternative 4A-1 to intersect the mainline alternative and the US 231 interchange recommended for detailed study by the Section 3 Project Team, approximately one-third to one-half of the preliminary alternative would need to be shifted. This is considered a major change in

the preliminary alternative as previously presented to resource agencies and the public during the project development process. A cursory review of such potential shift indicated that prime farmland impacts may increase and more impacts to core forest may occur. Such shift will also cause a farm operation impact.

The recommendation to carry Alternative 4A-2 forward for detailed study includes a recommendation to shift the alternative to the north between CR 200 East and CR 215 East along with any minor alignment adjustments to match the Section 3 alternative at the west terminus of the subsection. The shift east of CR 200 East will minimize potential wetland impacts and potential impacts to the small springs. Additionally, a shift to the north will avoid the house and outbuildings on the Dowden Farm and the reported location of the unconfirmed infant burial.

Page 1 of Figure 6 shows the centerlines for preliminary Alternatives 4A-1 and 4A-2, and a preliminary footprint for Alternative 4A-2, which reflects the alignment shift described above.

4.1.2 Subsection 4B

Subsection 4B extends from just east of CR 215 East to 0.25 miles north of Bogard Creek. This subsection is primarily farmland with interspersed woodlots. Pages 2 and 3 of Figure 6 show the alternatives in Subsection 4B.

Figure 6: Pages 2 and 3

Table 5: Subsection 4B Analysis			
Resource		Subsection Impacts by Alternative	
		4B-1	4B-2
Length (mi)		2.28	2.45
Construction Cost Estimate (\$M)		15.1	14.4
Wetlands (ac)		0 – 0.1	0.1 – 0.3
Forest (ac)		44 – 66	60 – 91
Core Forest (ac)		8 – 12	14 – 22
Agricultural Land (ac)		51 – 79	48 – 71
Prime Farmland (ac)		30 – 45	19 – 28
Managed Properties (ac)		None	22 – 32
Floodplain (ac)		None	None
Streams (no./ft)	Perennial	None	None
	Intermittent	2/917 – 2/1,216	3/1,184 – 3/1,540
	Ephemeral	10/3,310 – 13/5,058	16/5,451 – 19/8,166
Ponds (ac)		None	None
Subsurface Drainage Features	Small Springs	None	None
	Minor Springs	None	None
	Sinkholes	None	None
	Swallets	None	None
	Sinking Streams	None	None
Historic Properties (ft)		None	None
Cemeteries (ft)	Hasler	200 – 300	750 – 850
Residential Displacements		None	1
Business Displacements		None	None

Alternative 4B-1 has more potential impacts to prime farmland. Alternative 4B-2 will have greater potential impacts to core forest and managed properties. It also will have one residential displacement. Both alternatives have minimal wetland impacts.

Recommendation: Alternative 4B-1 is recommended to be carried forward for detailed study. The wetland that may be impacted by this alternative is located near the edge of the construction limits and can be avoided by a slight alignment shift.

Pages 2 and 3 of Figure 6 show the centerlines for preliminary Alternatives 4B-1 and 4B-2, and a preliminary footprint for Alternative 4B-1.

4.1.3 Subsection 4C

Subsection 4C begins about 0.25 miles north of Bogard Creek and ends about 0.1 miles west of Black Ankle Creek. The subsection has a mix of farmland and forest. The major geographic feature in this subsection is Taylor Ridge. Pages 3 and 4 of Figure 6 show the alternatives in Subsection 4C.

Figure 6: Pages 3 and 4

Table 6: Subsection 4C Analysis			
Resource		Subsection Impacts by Alternative	
		4C-1	4C-2
Length (mi)		1.86	1.72
Construction Cost Estimate (\$M)		14.5	13.5
Wetlands (ac)		None	None
Forest (ac)		61 – 91	62 – 92
Core Forest (ac)		27 – 39	17 – 24
Agricultural Land (ac)		23 – 34	15 – 23
Prime Farmland (ac)		11 – 19	9 – 15
Managed Properties (ac)		9 – 13	3 – 5
Floodplain (ac)		None	None
Streams (no./ft)	Perennial	None	None
	Intermittent	3/1,556 – 4/2,049	None
	Ephemeral	10/3,831 – 12/4,592	12/3,585 – 15/5,498
Ponds (ac)	Major Impact	0.25	None
	Partial Impact	None	None
Subsurface Drainage Features	Small Springs	3 – 4	1
	Minor Springs	None	None
	Sinkholes	None	None
	Swallets	None	None
	Sinking Streams	None	None
Historic Properties (ft)		None	None
Cemeteries (ft)	Taylor Ridge	-50 – 50	0 – 100
	Ruth (Old 16)	1,100 – 1,200	2,300 – 2,400

Resource	Subsection Impacts by Alternative	
	4C-1	4C-2
Residential Displacements	1	1
Business Displacements	None	None

Alternative 4C-1 has slightly more potential impacts to core forest, prime farmland, managed properties, and some small springs as compared to Alternative 4C-2. It is located very close to or possibly within the 100 foot buffer around Taylor Ridge Cemetery.

Overall, Alternative 4C-2 has less potential resource impacts, however, it does have a significant engineering issue where the alternative crosses the ‘T’ intersection of CR 475 East and CR 450 South. Both of these roads are important for local travel, and a grade separation is recommended which keeps both roads open. This alternative is also located near to the 100 foot buffer around Taylor Ridge Cemetery. Access to the cemetery could be impacted.

Recommendation: Alternatives 4C-1 and 4C-2 are both recommended to be carried forward for detailed study. This recommendation will include an evaluation of a slight shift for Alternative 4C-1 to the north near Taylor Ridge Cemetery and a southerly shift of this alternative east of CR 475 East in order to avoid a possible major terrain conflict along the north edge of the construction limits. Additional engineering evaluation will be performed for the CR 475 East/CR 450 South intersection along Alternative 4C-2. Such evaluation will need to maintain the alternative within the approved corridor while at the same time avoiding the 100 foot buffer around Taylor Ridge Cemetery and maintaining access to the cemetery. The engineering evaluation of Alternative 4C-2 will also assess the effects of maintaining travel south along CR 440 East.

Pages 3 and 4 of Figure 6 show the centerlines for preliminary Alternatives 4C-1 and 4C-2, and a preliminary footprint for Alternatives 4C-1 and 4C-2. The preliminary footprint for Alternative 4C-1 reflects the alignment shifts described above.

4.1.4 Subsection 4D

Subsection 4D extends from just west of Black Ankle Creek to CR 360 South (Mineral-Koleen Road). It is dominated by the Black Ankle Creek floodplain and extensive forest. The subsection includes crossings of Black Ankle Creek, Dry Branch Creek, and Plummer Creek. This subsection has the greatest amount of elevation variance within Section 4. Rankin Spring, located along the south edge of the corridor near the junction of CR 580 East and CR 600 East, is a significant spring. Pages 5 and 6 of Figure 6 show the alternatives in Subsection 4D.

Figure 6: Pages 5 and 6

Resource	Subsection Impacts by Alternative	
	4D-1	4D-2
Length (mi)	2.86	2.88

Resource		Subsection Impacts by Alternative	
		4D-1	4D-2
Construction Cost Estimate (\$M)		43.0	43.6
Wetlands (ac)		5.3 – 9.2	5.6 – 8.5
Forest (ac)		113 – 169	119 – 177
Core Forest (ac)		79 – 120	76 – 115
Agricultural Land (ac)		12 – 20	11 – 18
Prime Farmland (ac)		None	None
Managed Properties (ac)		21 – 30	21 – 30
Floodplain (ac)		8.3 – 12.4	5.8 – 8.2
Streams (no./ft)	Perennial	2/1,861 – 2/2,513	2/1,814 – 2/2,383
	Intermittent	5/3,637 – 5/4,912	3/2,953 – 3/3,621
	Ephemeral	10/3,381 – 11/4,742	8/5,227 – 9/6,593
Ponds (ac)		None	None
Subsurface Drainage Features	Small Springs	2	3 – 5
	Minor Springs	None	None
	Sinkholes	None	None
	Swallets	1	0 – 1
	Sinking Streams	None	None
Historic Properties (ft)		None	None
Cemeteries (ft)	Cooper	400 – 500	1,150 – 1,250
	Old Ashcraft	900 – 1,000	900 – 1,000
Residential Displacements		1 – 2	1 – 2
Business Displacements		None	None

Potential resource impacts are very comparable along both alternatives. Wetland impacts will occur within the Black Ankle Creek floodplain. Other potential wetland impacts may occur along the riparian corridors associated with Dry Branch Creek and Plummer Creek. Due to the extensive forested nature of the subsection, substantial core forest impacts will occur. With most potential resource impacts along Alternatives 4D-1 and 4D-2 being comparable, the screening analysis focused primarily upon potential impacts to subsurface drainage and engineering considerations.

Recommendation: Alternative 4D-1 is recommended to be carried forward for detailed study. This alternative is preferred due to its greater avoidance of the recharge area of Rankin Spring and its potential for development of independent lane group alignments which may reduce the extent of cut and fill and thus possibly reduce construction costs.

On-going geology studies being performed at the time of the screening indicated that the primary recharge area for Rankin Springs is located along the south edge of the corridor and further to the south/southwest. Portions of Alternative 4D-2 may impact this recharge area. Conversely, Alternative 4D-1 is located on slightly lower elevations to the north of Alternative 4D-2. The subsurface drainage along portions of this alternative is believed to be more closely associated with several small springs and minor springs near Plummer Creek and thus may not be a primary recharge area for Rankin Spring.

Because a portion of Alternative 4D-1 is located on slightly lower hilltops and ridgelines as compared to parallel segments of Alternative 4D-2, and because part of Alternative 4D-1 is also situated along some sideslopes, it may be possible to develop some of this alternative with variable median widths and differing elevations for the highway lane groups. Such potential engineering developments could minimize cuts and fills along a portion of the alignment and enable the highway grade to more closely follow the terrain and thus possibly reduce construction costs. The potential use of variable median widths along Alternative 4D-1 will be further evaluated during subsequent development of this alternative. If a variable median width is not feasible, the amount of cut and fill along Alternative 4D-1 is still expected to be less than Alternative 4D-2.

Pages 5 and 6 of Figure 6 show the centerlines for preliminary Alternatives 4D-1 and 4D-2, and a preliminary footprint for Alternative 4D-2.

4.1.5 Subsection 4E

Subsection 4E begins at CR 360 South (Mineral-Koleen Road) and ends just east of SR 54. Possible interchanges are being considered at SR 45 and SR 54. The subsection has considerable elevation variances and is primarily forested. Mitchell Branch of Indian Creek is located just west of SR 54. Some small farm parcels are located near the northern (eastern) end of the subsection. The subsection passes through the south edge of the Clifty Hills Subdivision which is generally located between CR 600 South and CR 975 East (Old Clifty Road). Subsurface drainage features typically associated with karst begin to appear along Subsection 4E. Pages 6 through 9 of Figure 6 show the alternatives in Subsection 4E.

Figure 6: Pages 6, 7, 8 and 9

Table 8: Subsection 4E Analysis				
Resource		Subsection Impacts by Alternative		
		4E-1	4E-2	4E-3
Length (mi)		4.58	4.62	4.64
Construction Cost Estimate (\$M)		68.4	34.3	32.4
Wetlands (ac)		0.2 – 0.3	0.3	0.1 – 0.2
Forest (ac)		165 – 245	161 – 245	155 – 236
Core Forest (ac)		74 – 108	82 – 121	70 – 100
Agricultural Land (ac)		34 – 53	43 – 61	26 – 39
Prime Farmland (ac)		20 – 33	22 – 32	4 – 6
Managed Properties (ac)		59 – 88	70 – 103	68 – 92
Floodplain (ac)		0.9 – 1.3	0.8 – 1.4	0.8 – 1.4
Streams (no./ft)	Perennial	1/515 – 1/735	1/477 – 1/706	1/983 – 1/1,536
	Intermittent	6/2,072 – 8/3,292	6/4,585 – 7/5,999	6/2,357 – 21/8,910
	Ephemeral	18/6,558 – 23/10,023	15/6,080 – 22/9,182	21/8,910 – 22/11,805
Ponds (ac)	Major Impact	0.25	0.25	2.75

Resource		Subsection Impacts by Alternative		
		4E-1	4E-2	4E-3
	Partial Impact	0.75 at 300 ft	0.5 at 300 ft	None
Subsurface Drainage Features	Small Springs	None	1 – 2	3 – 4
	Minor Springs	None	None	None
	Sinkholes	3 – 4	1 – 3	0 – 1
	Swallets	None	None	None
	Sinking Streams	None	1	1
Historic Properties (ft)	Clifty Church	2,300 – 2,400	2,950 – 3,050	3,600 – 3,800
Cemeteries (ft)	Shoptaw	100 – 200	50 – 150	50 – 150
	Ashcraft	450 – 550	350 – 450	350 – 450
	Dobbins	800 – 900	1,400 – 1,500	1,700 – 1,800
Residential Displacements		5 – 9	7 – 10	9 – 12
Business Displacements		None	None	None

All three preliminary alternatives have comparable potential impacts upon core forests and managed lands. Minor wetland impacts may also occur along all three alternatives.

Each of the alternatives has specific resource concerns. These include conflicts with a sinking stream and other karst features along Alternatives 4E-2 and 4E-3, a major spring-fed pond located along Alternative 4E-3, and prime farmland along Alternatives 4E-1 and 4E-2. Constructability relative to the terrain and potential residential displacements are also primary factors that differentiate these three preliminary alternatives.

Similar to Subsection 4D, the undulating terrain along this subsection is prominent, especially between the south (west) terminus and CR 1200 East. Alternatives 4E-2 and 4E-3 have potential engineering issues due to the terrain and some intermittent drainageways in the area between CR 600 South and CR 975 East (Old Clifty Road). Unlike the transverse crossing of most intermittent drainageways along Subsection 4D, the intermittent drainageways near the south (west) end of this subsection are located longitudinally to these two alternatives. Alternatives 4E-2 and 4E-3 are very close to the 100 foot buffer around Shoptaw Cemetery though access to the cemetery will not be impacted. In this same general area of Subsection 4E, Alternative 4E-1 is considered to be more desirable relative to constructability in the extant terrain. It also is located slightly further from Shoptaw Cemetery. All three alternatives will cross some developed and undeveloped lots within the Clifty Hills Subdivision.

The majority of the potential residential displacements along this subsection will occur at the crossings of SR 45 and SR 54. It appears that the least number of potential displacements at SR 45, either as an interchange or as a grade separation (should an interchange be discarded), will occur along Alternative 4E-2. At SR 54, all three alternatives are converging near the north (east) end of the subsection and will have comparable residential displacements.

Recommendation: A hybrid alternative using portions of Alternative 4E-1 and 4E-2 is recommended for development. Hybrid Alternative 4E-1/4E-2 will be carried forward for detailed study.

The hybrid alternative will follow Alternative 4E-1 from the south (west) terminus at CR 360 South (Mineral-Koleen Road) to a point near a major electric transmission corridor west of SR 45. The use of Alternative 4E-1 in this area is preferred due to constructability concerns and a probable impact to a sinking stream along the parallel portions of Alternatives 4E-2 and 4E-3. Alternative 4E-3 will also require filling a large spring-fed pond in this area of the Subsection 4E.

Between the electric transmission corridor and SR 45, the recommended hybrid alternative will shift to the alignment of Alternative 4E-2. This shift will avoid and/or minimize potential wetland impacts and residential displacements that may occur along the parallel portion of Alternative 4E-1.

East of SR 45, the recommended hybrid alternative will generally follow the preliminary alignment depicted by Alternative 4E-2. Near the midpoint of this alternative, between SR 45 and SR 54, consideration will be made to shift the hybrid alternative slightly to the north towards or along Alternative 4E-1 in order to minimize potential impacts upon a large farm. The alignments for Alternatives 4E-1 and 4E-2 in this area are approximately 400 feet apart or less and thus remain consistent with the intent of the preliminary alternative development. The hybrid alternative will follow the preliminary alignment for Alternative 4E-2 across SR 54 to the subsection terminus.

Pages 6 through 9 Figure 6 show the centerlines for preliminary Alternatives 4E-1, 4E-2 and 4E-3, and a preliminary footprint for hybrid alternative 4E-1/E-2.

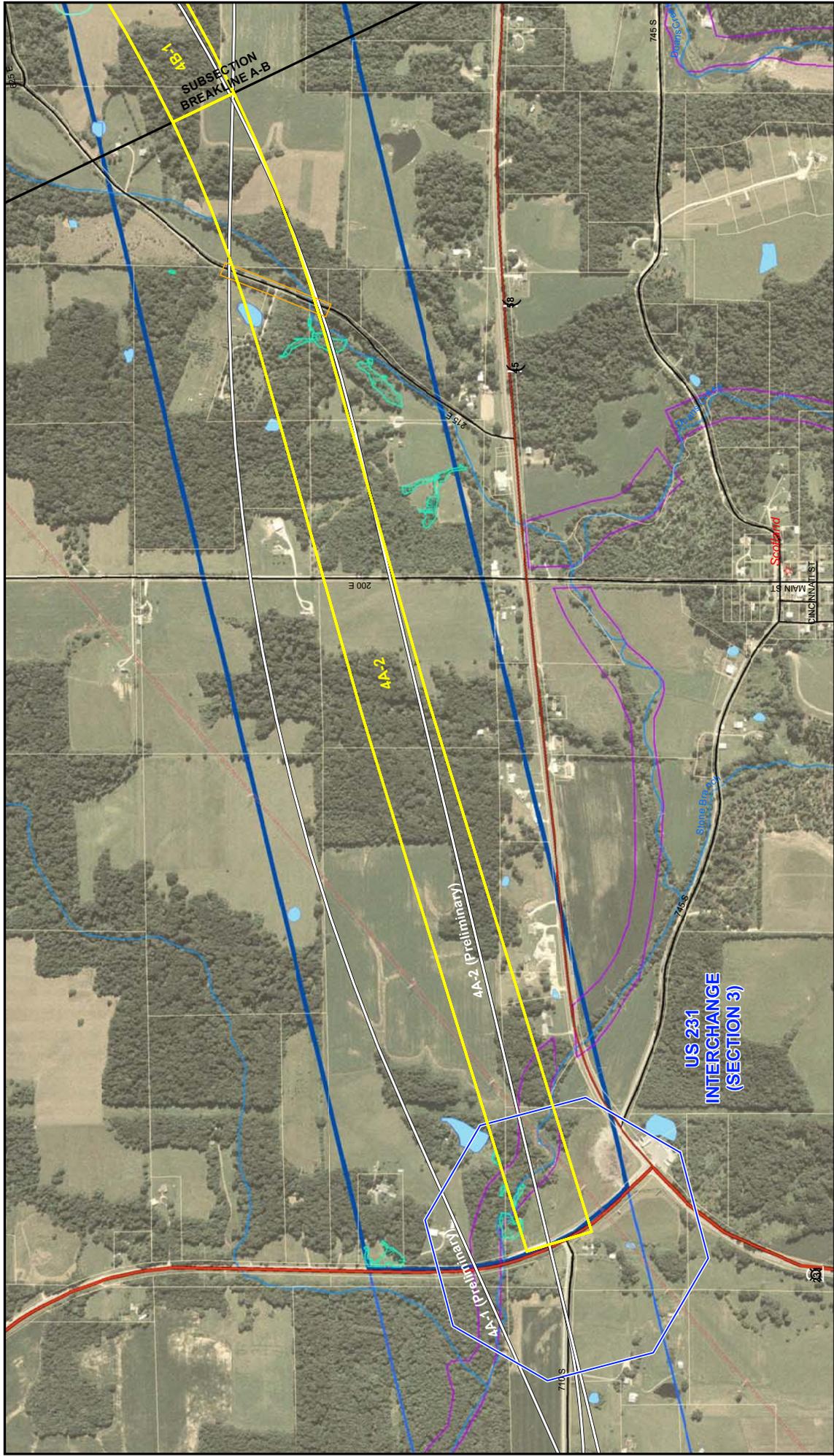
4.1.6 Subsection 4F

Section 4 of the approved corridor turns north and follows the Greene County/Monroe County line along Subsection 4F. This is the longest subsection of Section 4 and extends from just east of SR 54 in Greene County to a point just east of Burch Road in Monroe County.

In general, the subsection has rolling hills with large forest tracts, small farms and rural residences. All three preliminary alternatives will cross meandering Indian Creek at three locations (south, middle and north crossings). A potential interchange along the Green County/Monroe County line that will connect with SR 45 is under consideration in Greene County in the vicinity of CR 150 North (Carter Road in Monroe County). Timber Trace Subdivision is located along the west edge of the corridor near the point where the subsection alternative turns east into Monroe County. Whippoorwill Estates is located in the center of the corridor just west of the county line along CR 35 North (Carmichael Road in Monroe County). Pages 9 through 15 of Figure 6 show the alternatives in Subsection 4F.

Figure 6: Pages 9, 10, 11, 12, 13, 14 and 15

Table 9: Subsection 4F Analysis			
Resource	Subsection Impacts by Alternative		
	4F-1	4F-2	4F-3





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Section 4 Corridor

Alternatives Carried Forward

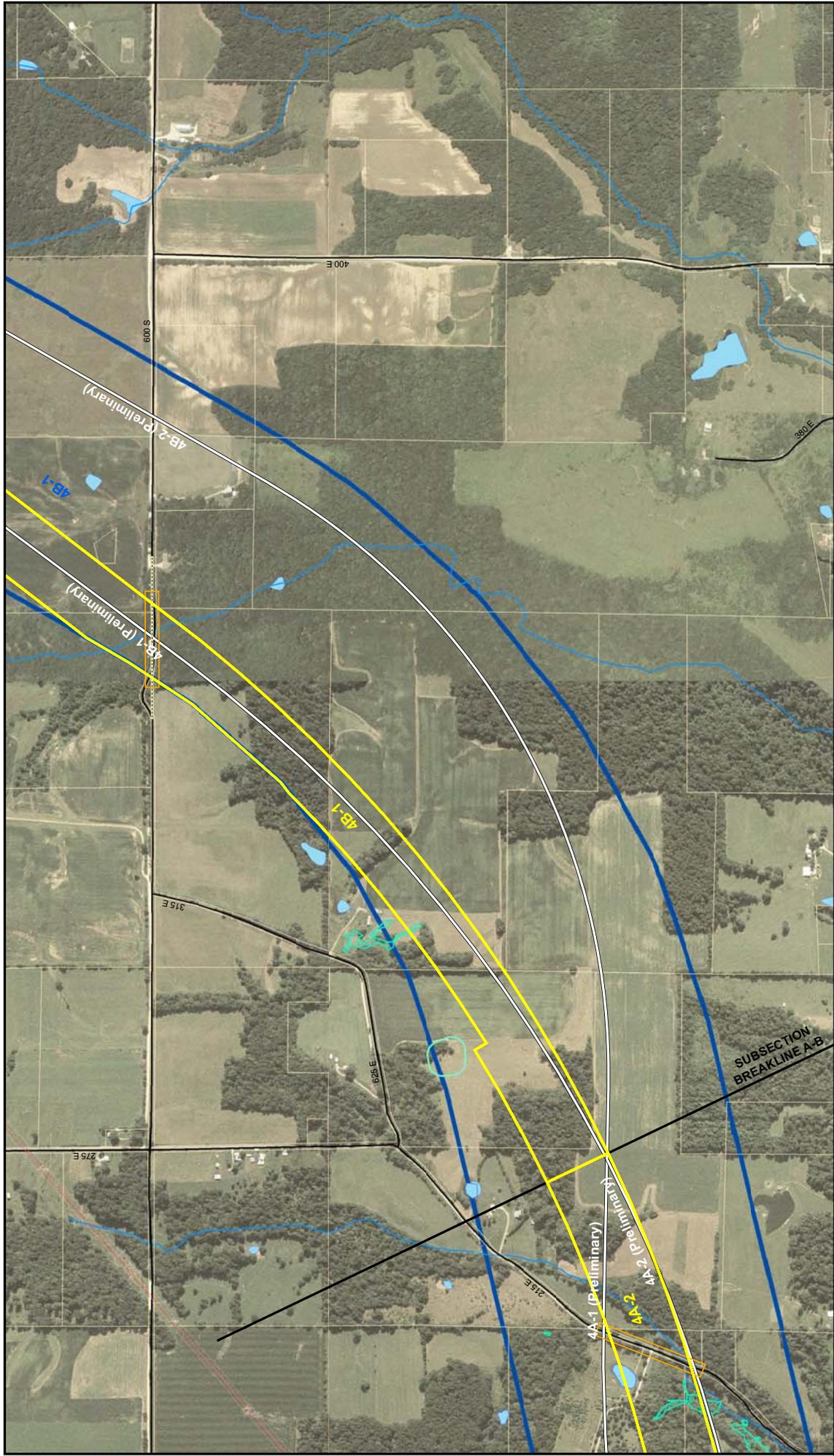
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Legend:

- Preliminary Alternative
- State Highway
- US Highway
- County Road
- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road
- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer
- Property Line
- Floodplain
- Rivers / Streams

Alternatives Carried Forward
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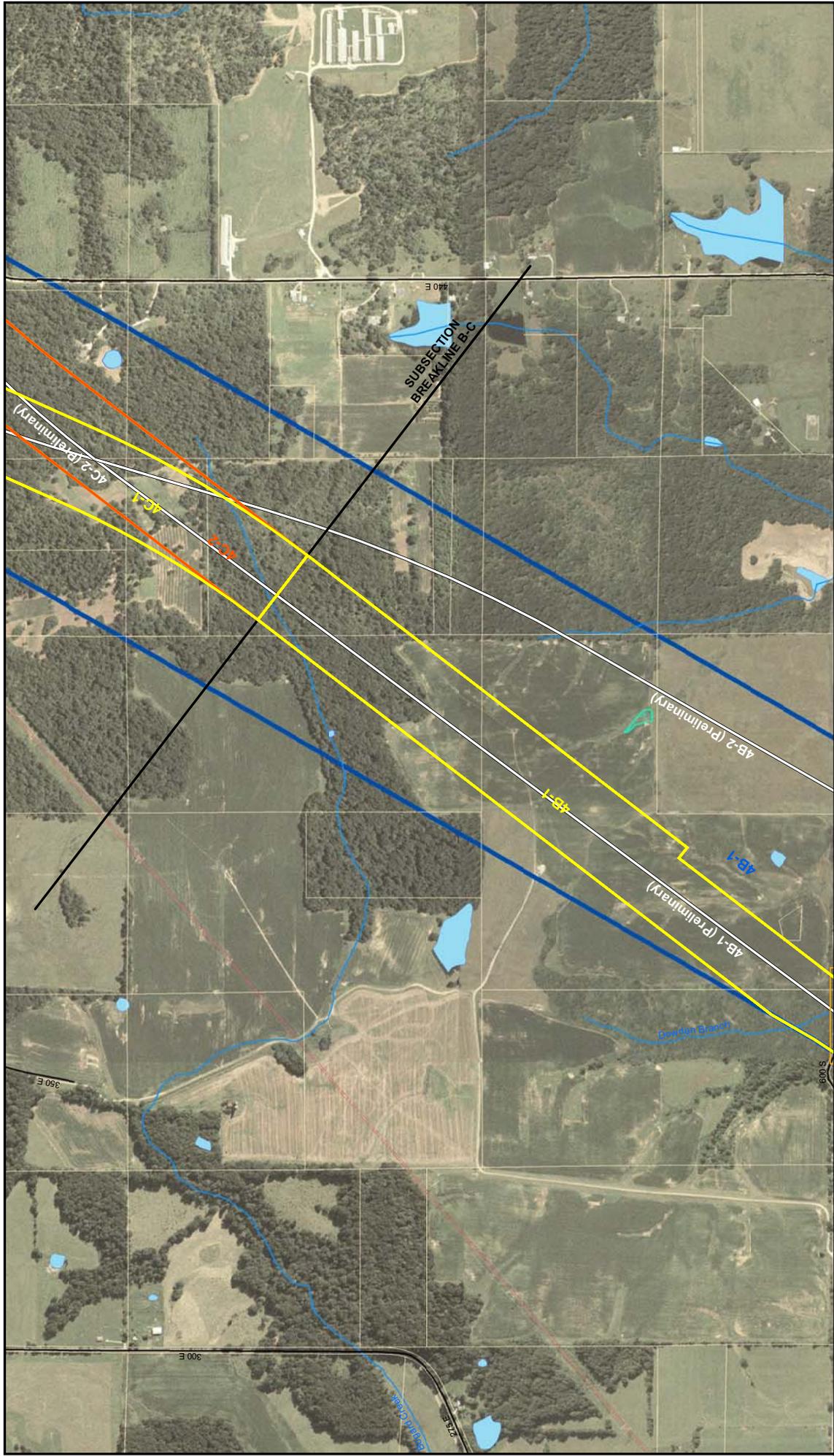


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Alternatives Carried Forward

	Section 4 Corridor		Preliminary Alternative		Potential Grade Separation		Wetland Boundary		Property Line
	State Highway		State Highway		Subsection Breakline		Man-made Pond		Floodplain
	US Highway		US Highway		High Tension Power Line		Abandoned Quarry		Rivers / Streams
	County Road		County Road		Proposed Related Road		100-ft Cemetery Buffer		





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Section 4 Corridor

Alternatives Carried Forward



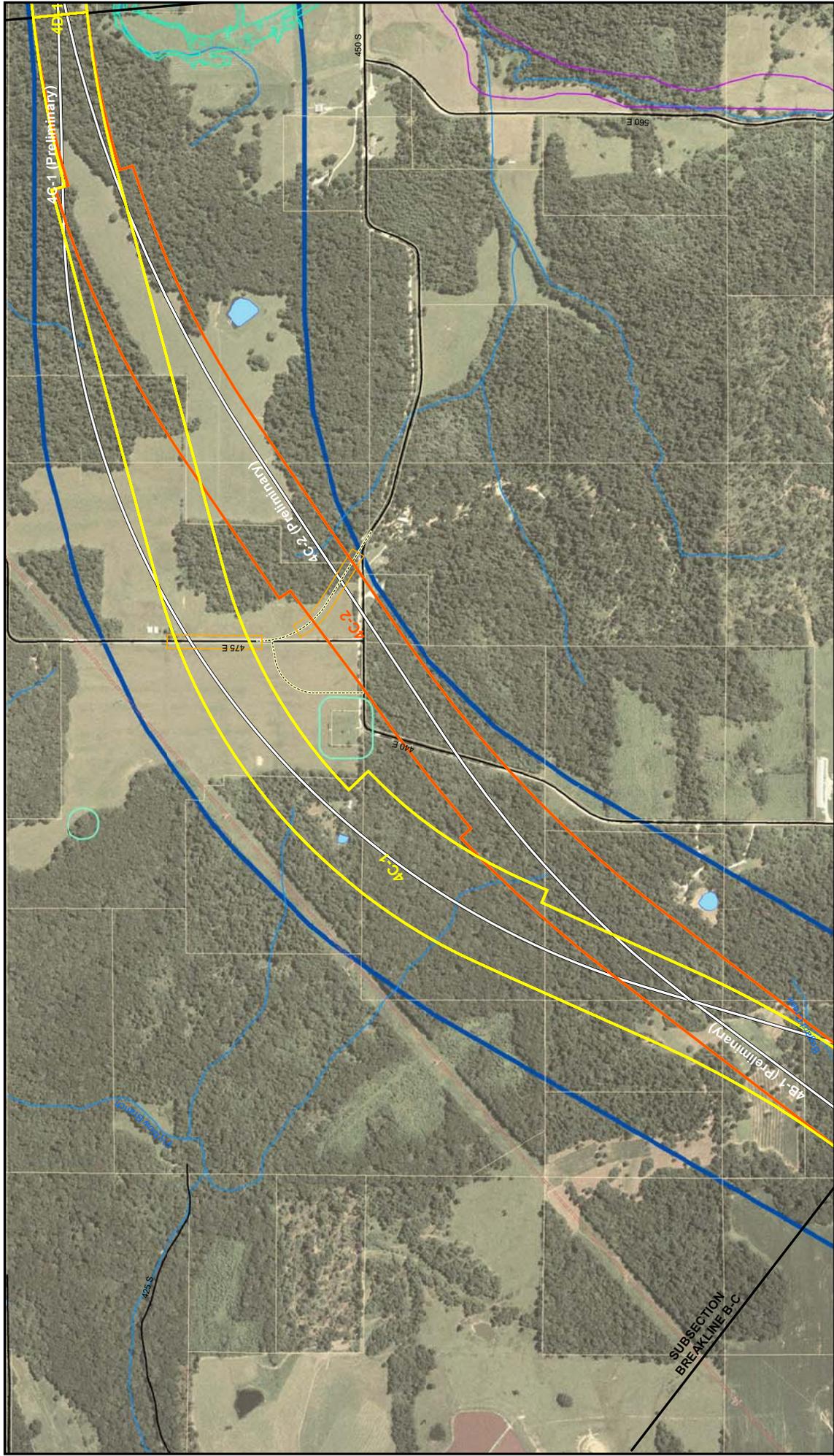
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Alternatives Carried Forward

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Preliminary Alternative	Wetland Boundary	Property Line
State Highway	Man-made Pond	Floodplain
US Highway	Abandoned Quarry	Rivers / Streams
County Road	100-ft Cemetery Buffer	
Section 4 Corridor	Potential Grade Separation	
Alternatives Carried Forward	Subsection Breakline	
	High Tension Power Line	
	Proposed Related Road	



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Section 4 Corridor
Alternatives Carried Forward

Preliminary Alternative
 State Highway
 US Highway
 County Road

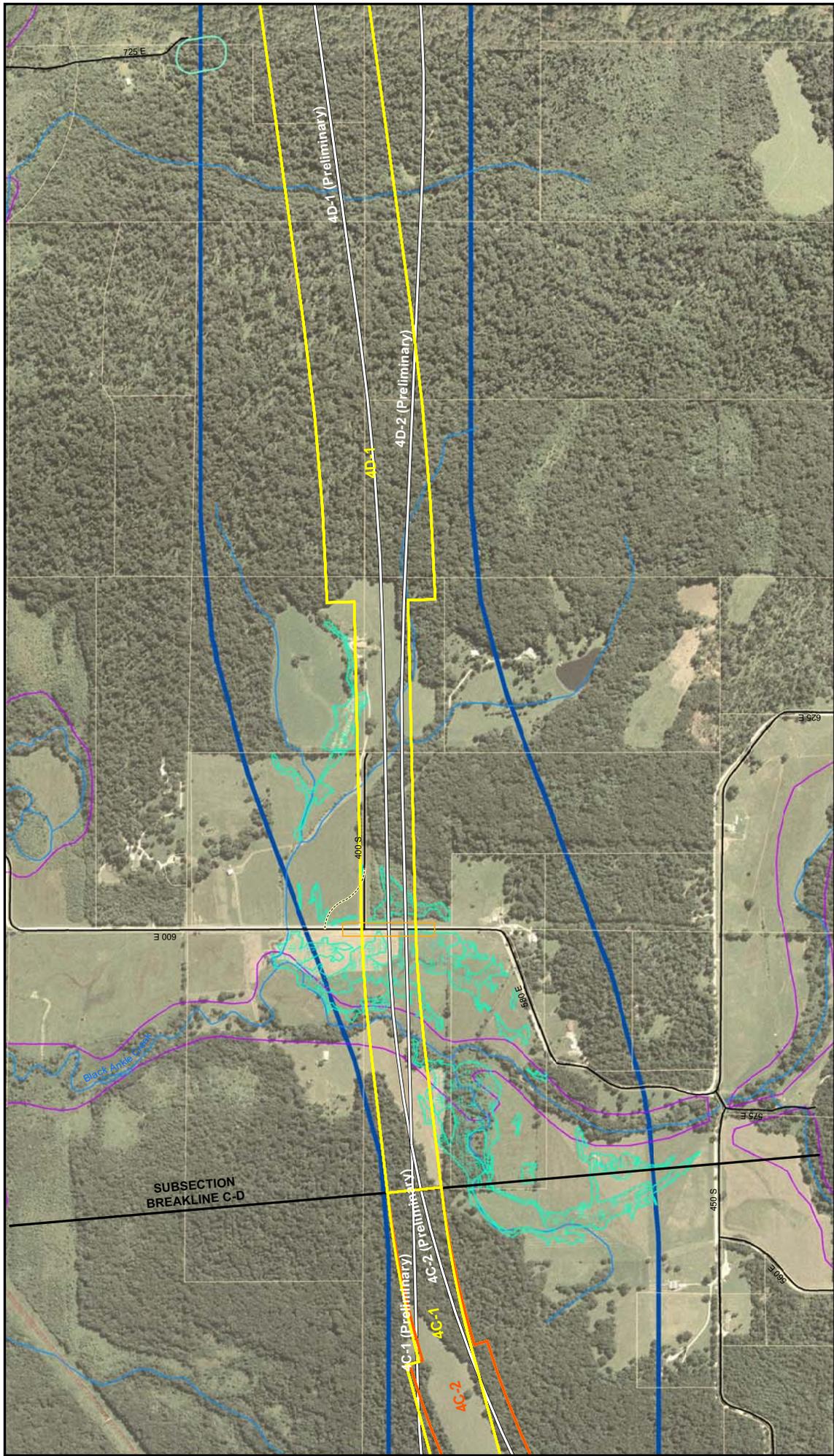
Potential Grade Separation
 Subsection Breakline
 High Tension Power Line
 Proposed Related Road

Wetland Boundary
 Man-made Pond
 Abandoned Quarry
 100-ft Cemetery Buffer

Property Line
 Floodplain
 Rivers / Streams

0 400 800 Feet

Alternatives Carried Forward
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Section 4 Corridor

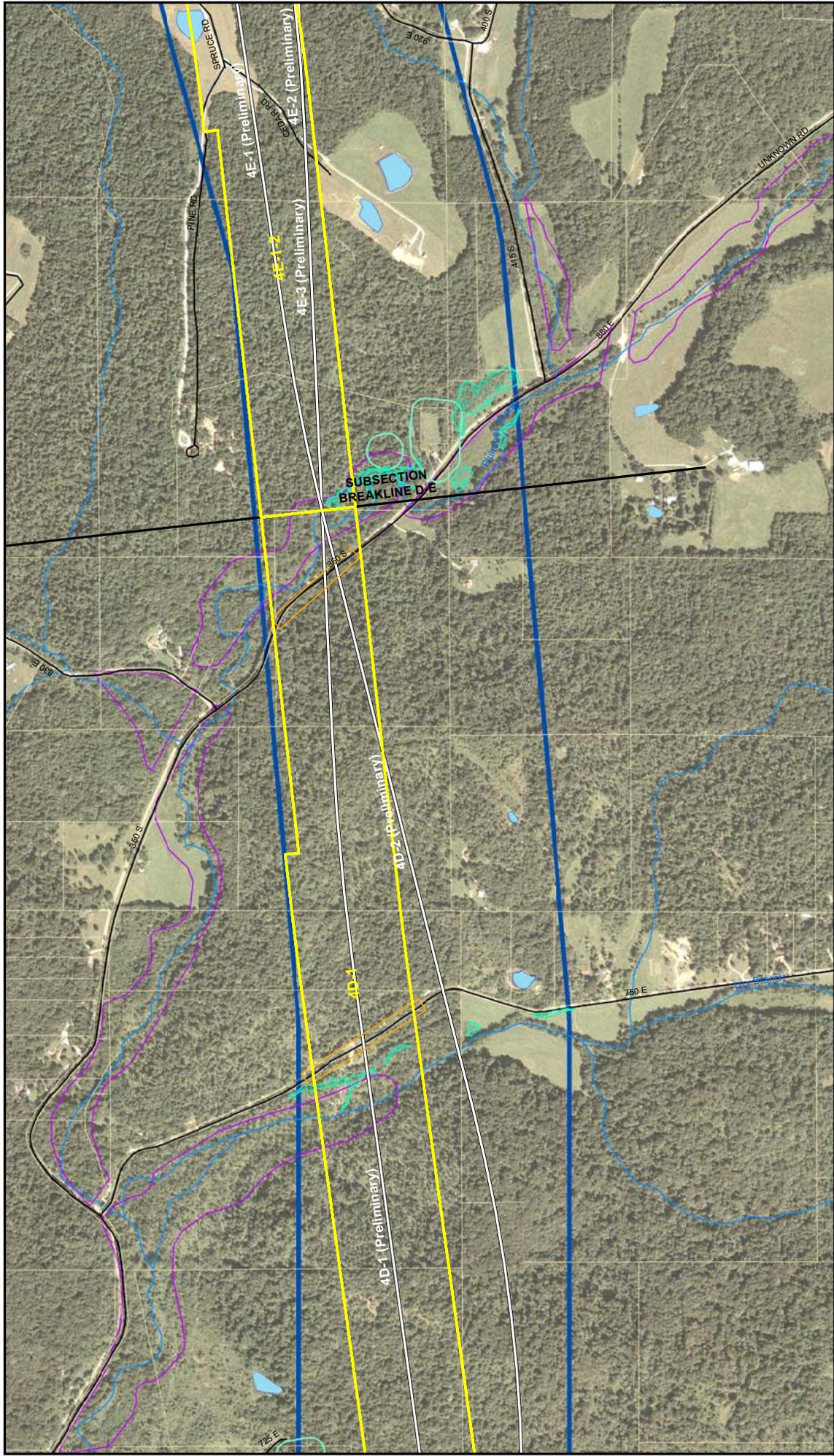
Alternatives Carried Forward

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Alternatives Carried Forward

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Preliminary Alternative	State Highway	US Highway	County Road	Wetland Boundary	Man-made Pond	Abandoned Quarry	100-ft Cemetery Buffer
Potential Grade Separation	Subsection Breakline	High Tension Power Line	Proposed Related Road	Wetland Boundary	Man-made Pond	Abandoned Quarry	100-ft Cemetery Buffer
Property Line	Floodplain	Rivers / Streams					



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Section 4 Corridor
 Alternatives Carried Forward

- Preliminary Alternative
- State Highway
- US Highway
- County Road

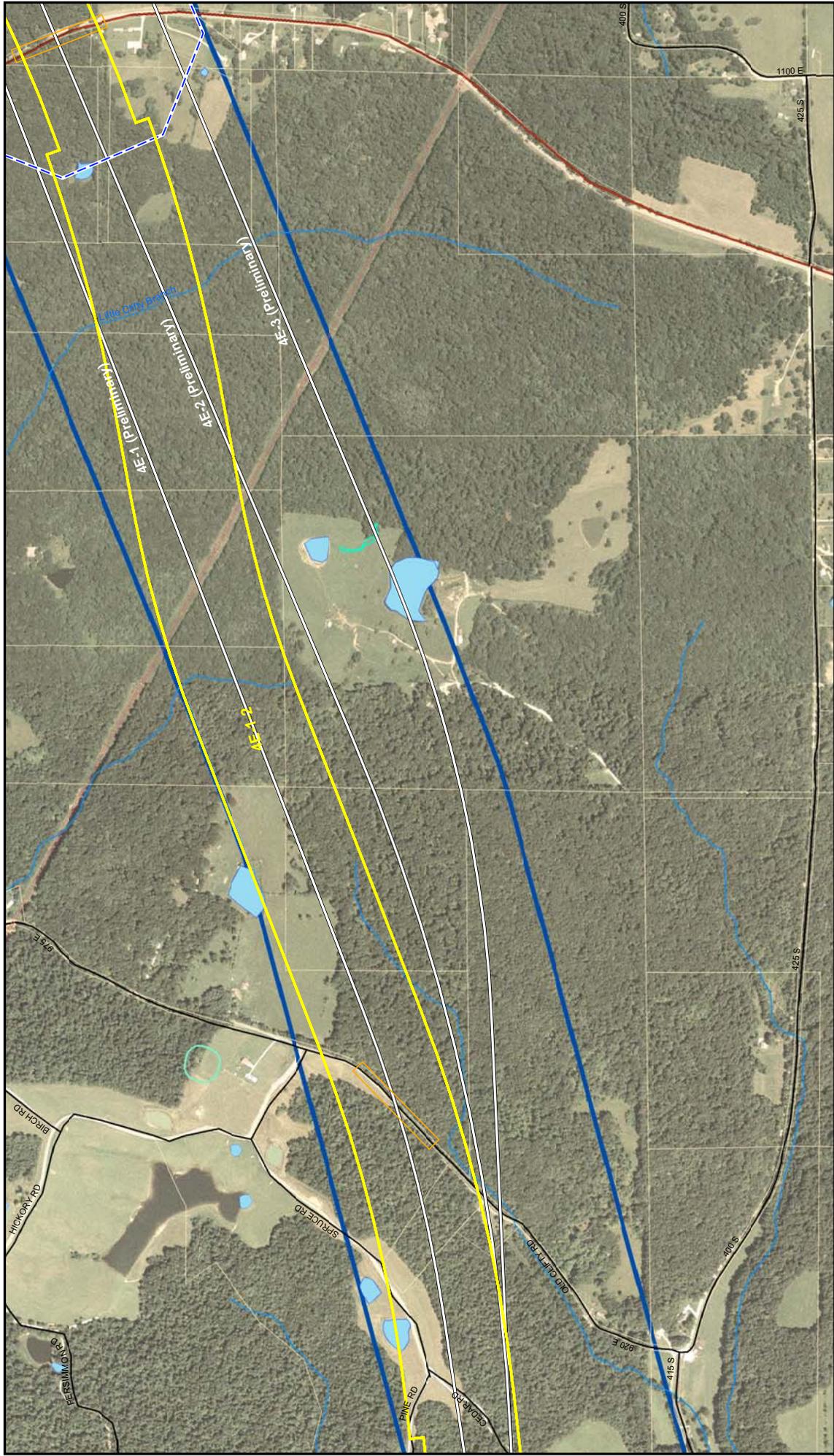
- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road

- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer

- Property Line
- Floodplain
- Rivers / Streams

0 400 800 Feet

Alternatives Carried Forward
 June 12, 2006
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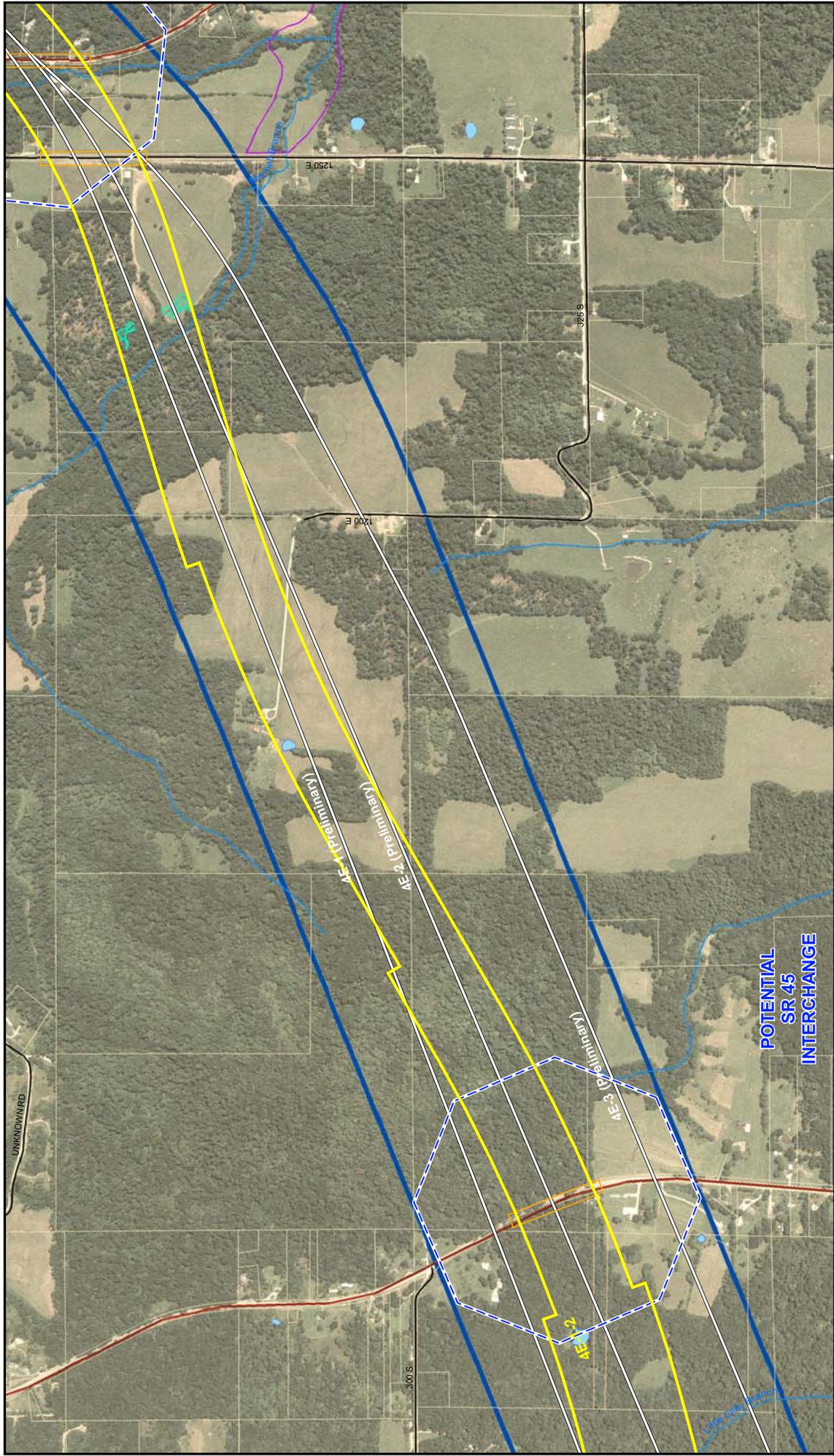


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Alternatives Carried Forward
June 12, 2006
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	Section 4 Corridor		Preliminary Alternative		Wetland Boundary		Property Line		Rivers / Streams
	State Highway		Subsection Breakline		Man-made Pond		Floodplain		Rivers / Streams
	US Highway		High Tension Power Line		Abandoned Quarry		Rivers / Streams		Rivers / Streams
	County Road		Proposed Related Road		100-ft Cemetery Buffer		Rivers / Streams		Rivers / Streams

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Alternatives Carried Forward
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Section 4 Corridor

Alternatives Carried Forward

0 400 800 Feet

Preliminary Alternative

State Highway

US Highway

County Road

Wetland Boundary

Man-made Pond

Abandoned Quarry

100-ft Cemetery Buffer

Potential Grade Separation

Subsection Breakline

High Tension Power Line

Proposed Related Road

Property Line

Floodplain

Rivers / Streams

Section 4 Corridor

Alternatives Carried Forward

0 400 800 Feet

Preliminary Alternative

State Highway

US Highway

County Road

Wetland Boundary

Man-made Pond

Abandoned Quarry

100-ft Cemetery Buffer

Potential Grade Separation

Subsection Breakline

High Tension Power Line

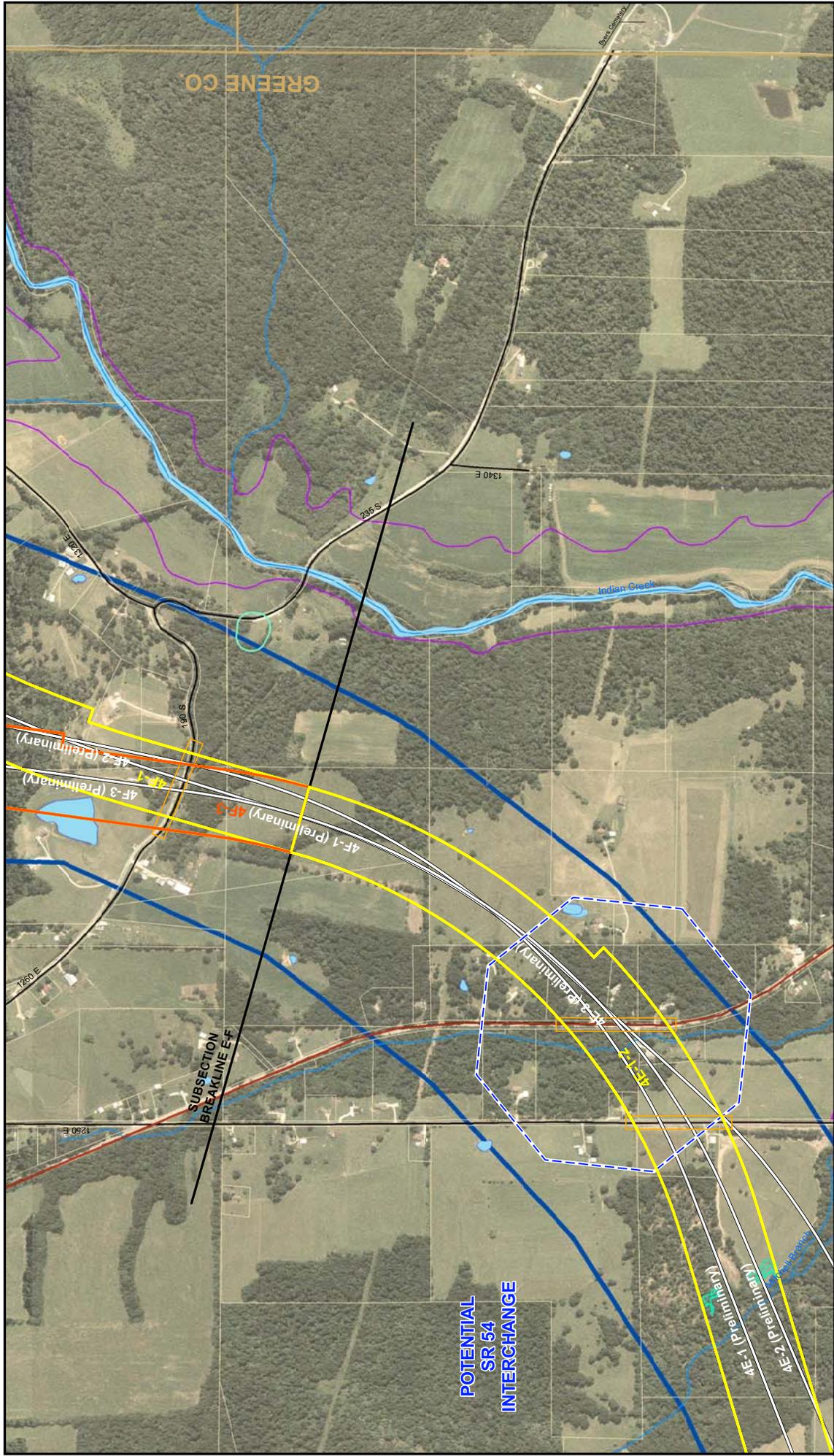
Proposed Related Road

Property Line

Floodplain

Rivers / Streams







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Section 4 Corridor

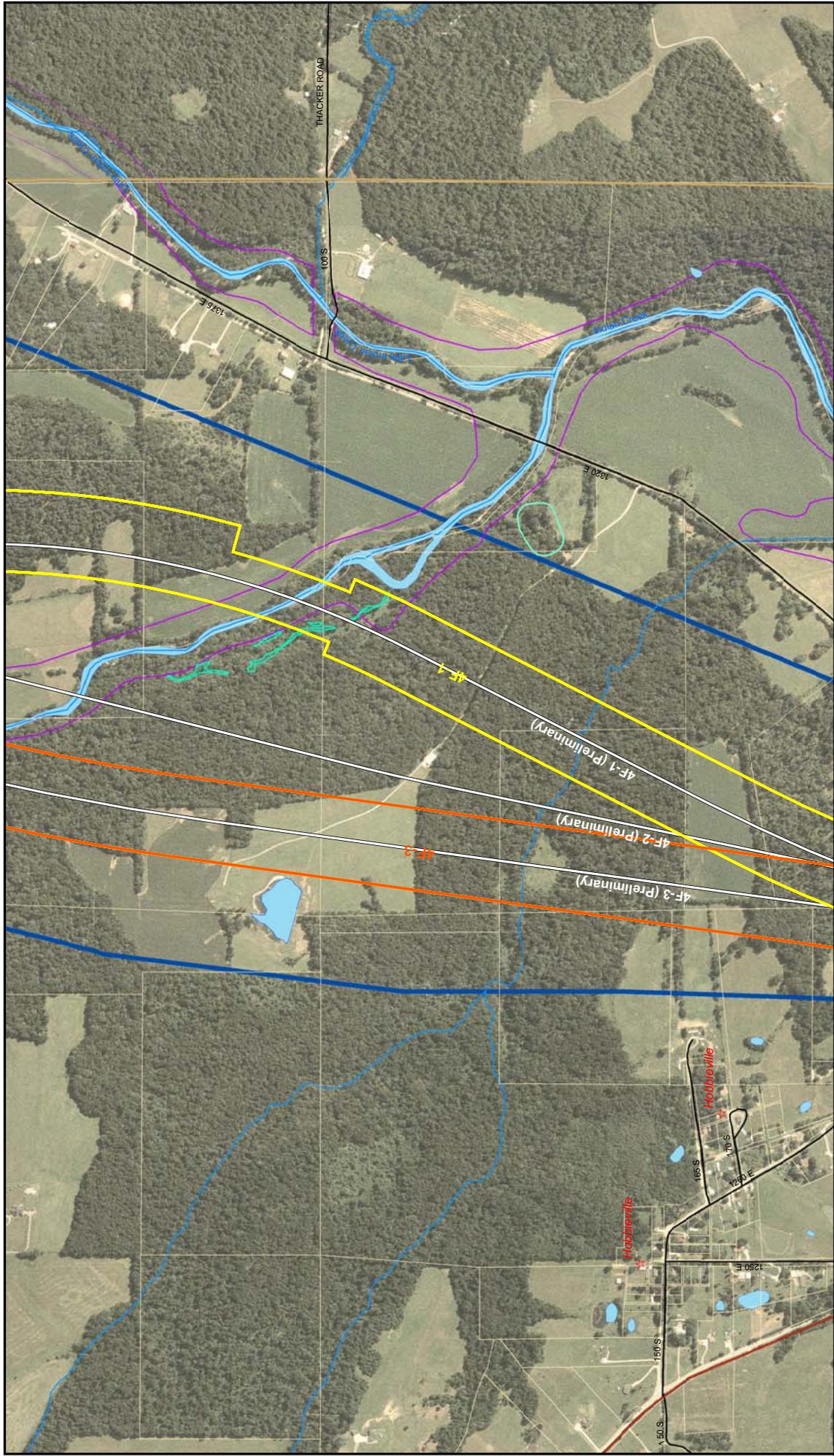
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Alternatives Carried Forward
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Preliminary Alternative	Potential Grade Separation	Wetland Boundary	Property Line
State Highway	Subsection Breakline	Man-made Pond	Floodplain
US Highway	High Tension Power Line	Abandoned Quarry	Rivers / Streams
County Road	Proposed Related Road	100-ft Cemetery Buffer	





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Section 4 Corridor

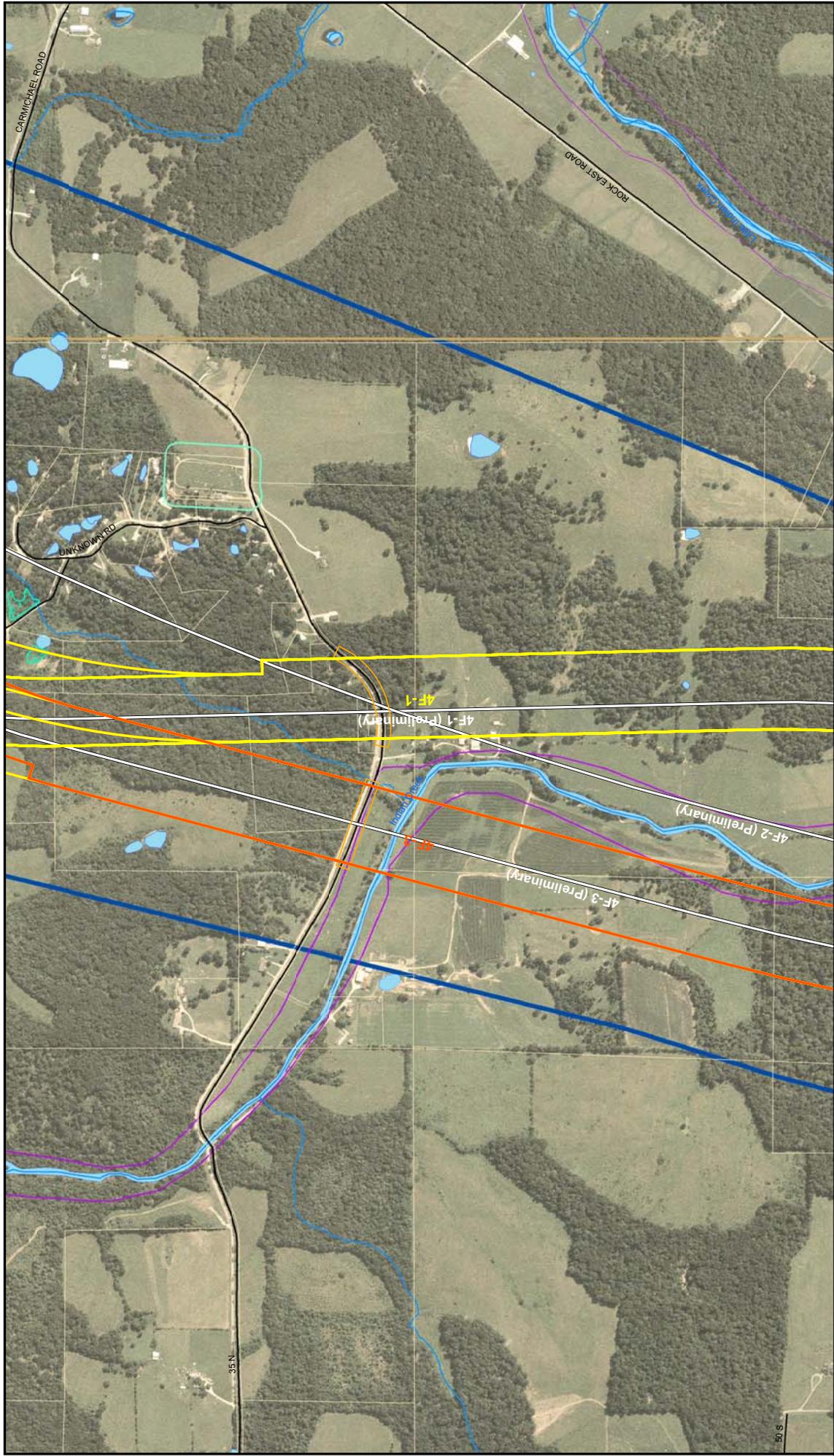
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Alternatives Carried Forward
June 12, 2006
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<ul style="list-style-type: none"> Property Line Floodplain Rivers / Streams 		





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Alternatives Carried Forward

Legend

- Preliminary Alternative
- State Highway
- US Highway
- County Road
- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road
- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer
- Property Line
- Floodplain
- Rivers / Streams

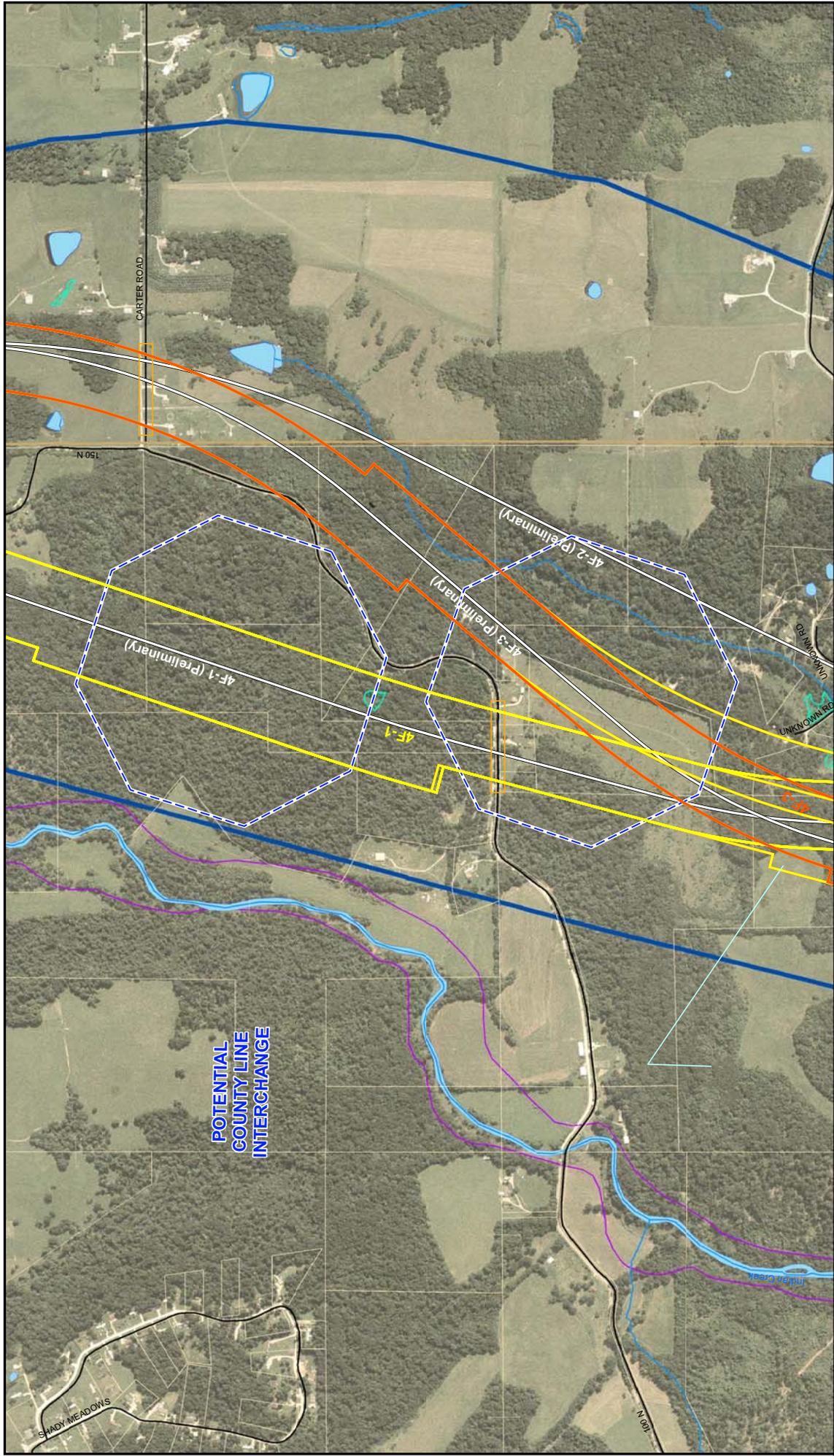
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Alternatives Carried Forward

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Alternatives Carried Forward

- Preliminary Alternative
- State Highway
- US Highway
- County Road
- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer
- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road

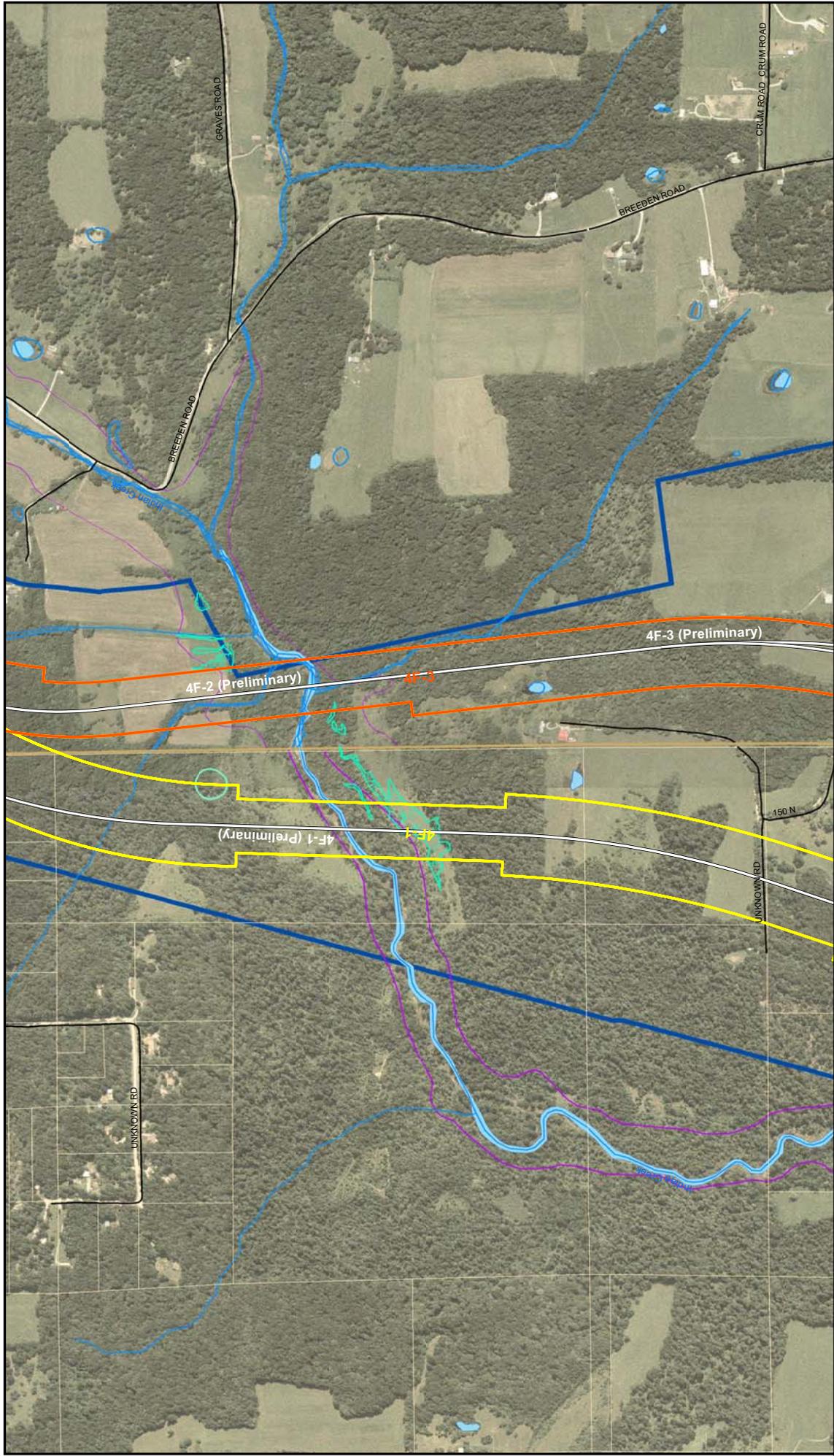
- Property Line
- Floodplain
- Rivers / Streams

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Alternatives Carried Forward

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Section 4 Corridor

- Section 4 Corridor
- Alternatives Carried Forward

Alternatives Carried Forward

- Preliminary Alternative
- State Highway
- US Highway
- County Road

Other Features

- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road

Environmental Features

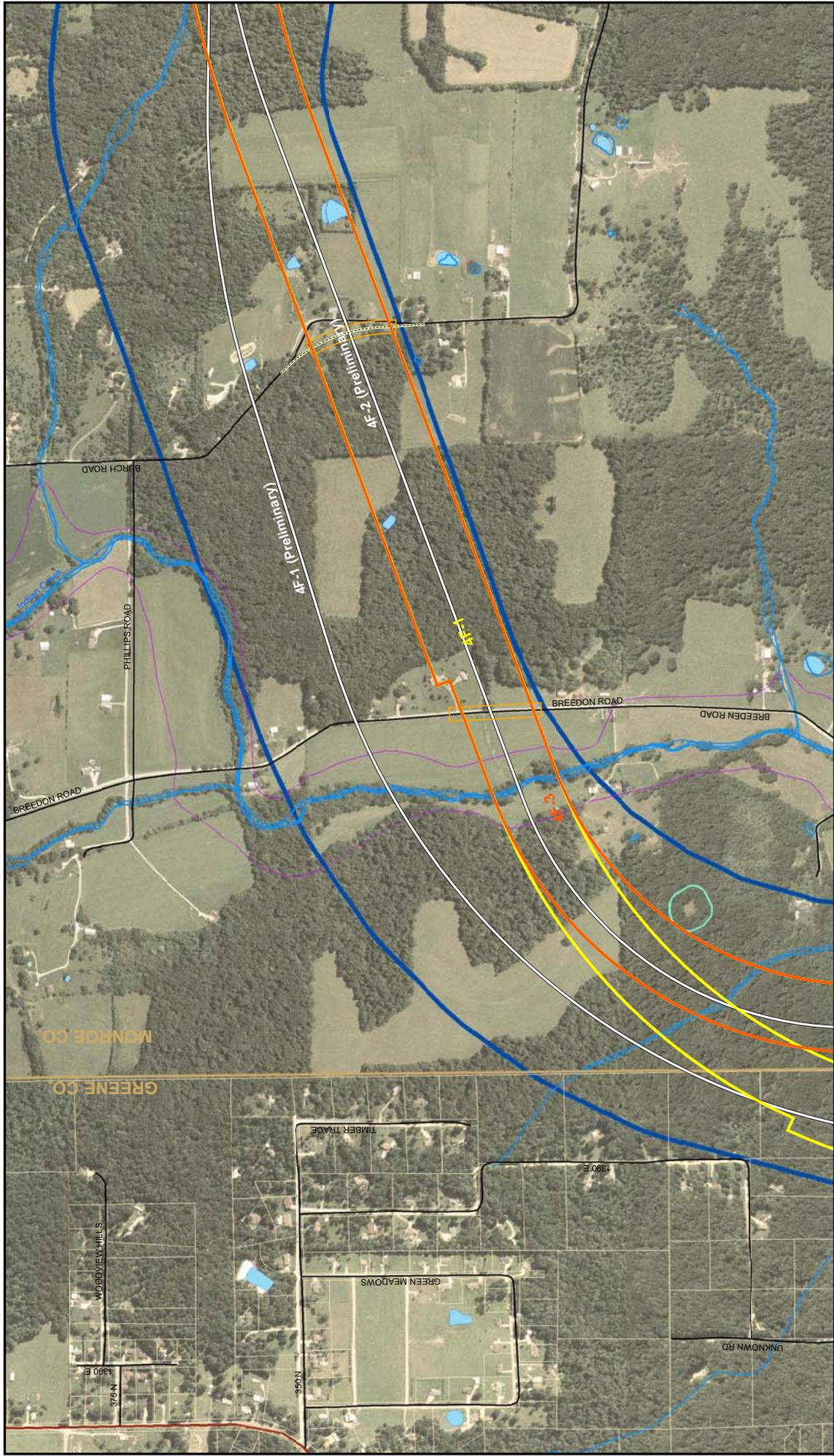
- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer

Scale

- Property Line
- Floodplain
- Rivers / Streams

0 400 800 Feet

Alternatives Carried Forward
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Alternatives Carried Forward

Legend

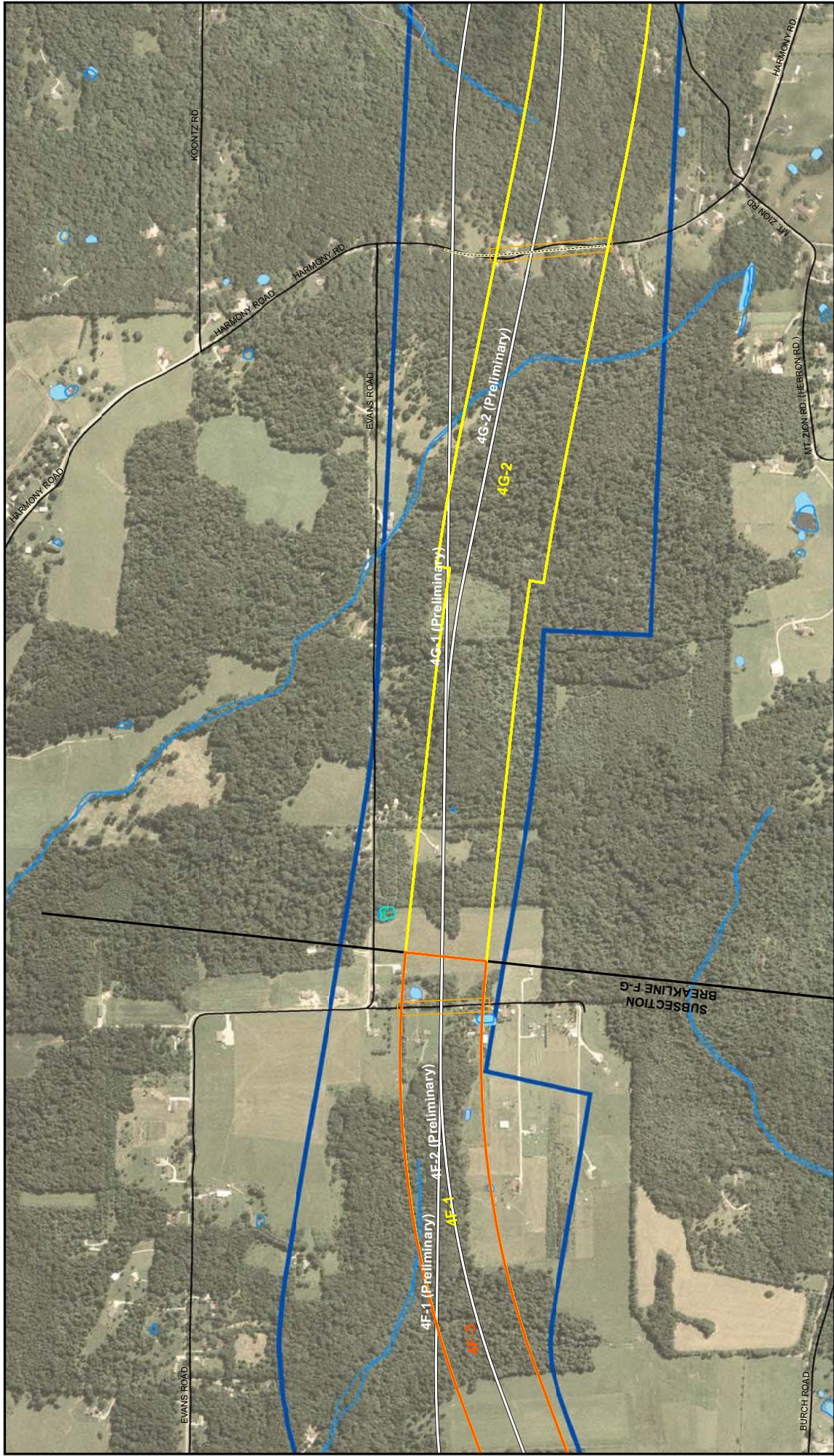
- Preliminary Alternative
- State Highway
- US Highway
- County Road
- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road
- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer
- Property Line
- Floodplain
- Rivers / Streams

0 400 800 Feet

Alternatives Carried Forward

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Section 4 Corridor

Alternatives Carried Forward

- Preliminary Alternative
- State Highway
- US Highway
- County Road
- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road
- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer

- Property Line
- Floodplain
- Rivers / Streams

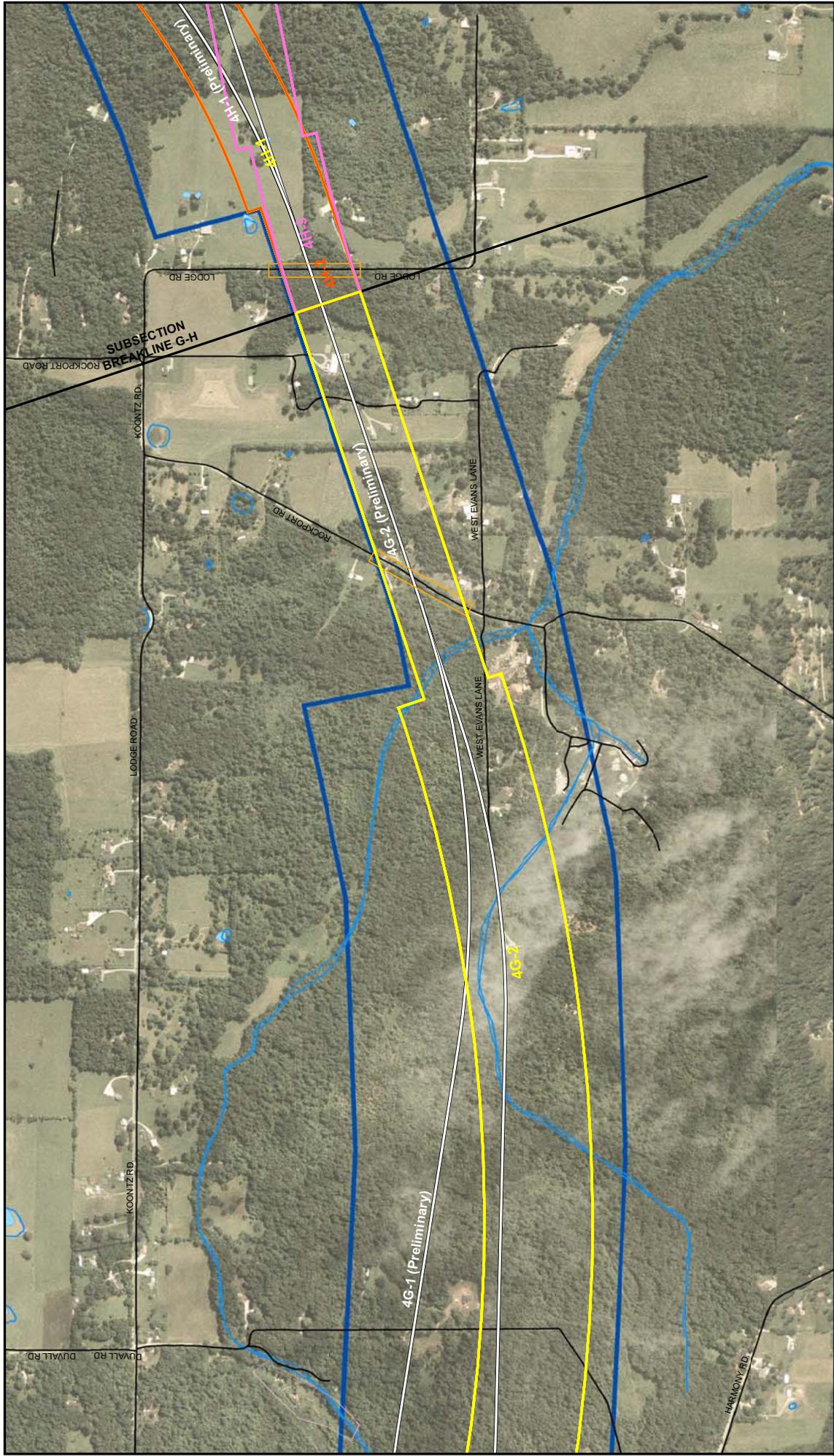
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Alternatives Carried Forward

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Section 4 Corridor

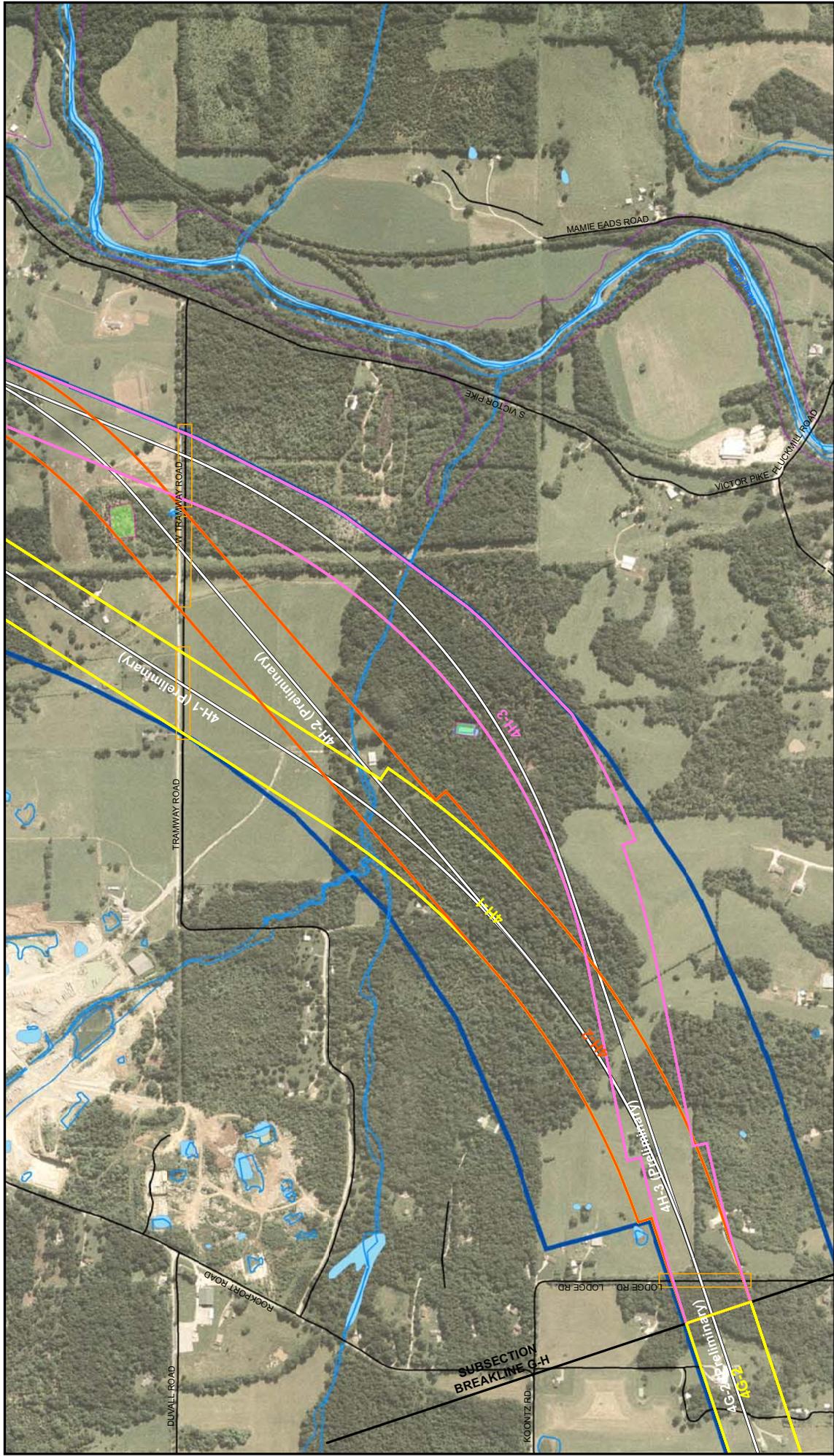
	Section 4 Corridor
	Alternatives Carried Forward
	Alternatives Carried Forward
	Alternatives Carried Forward

Scale: 0 400 800 Feet

Alternatives Carried Forward
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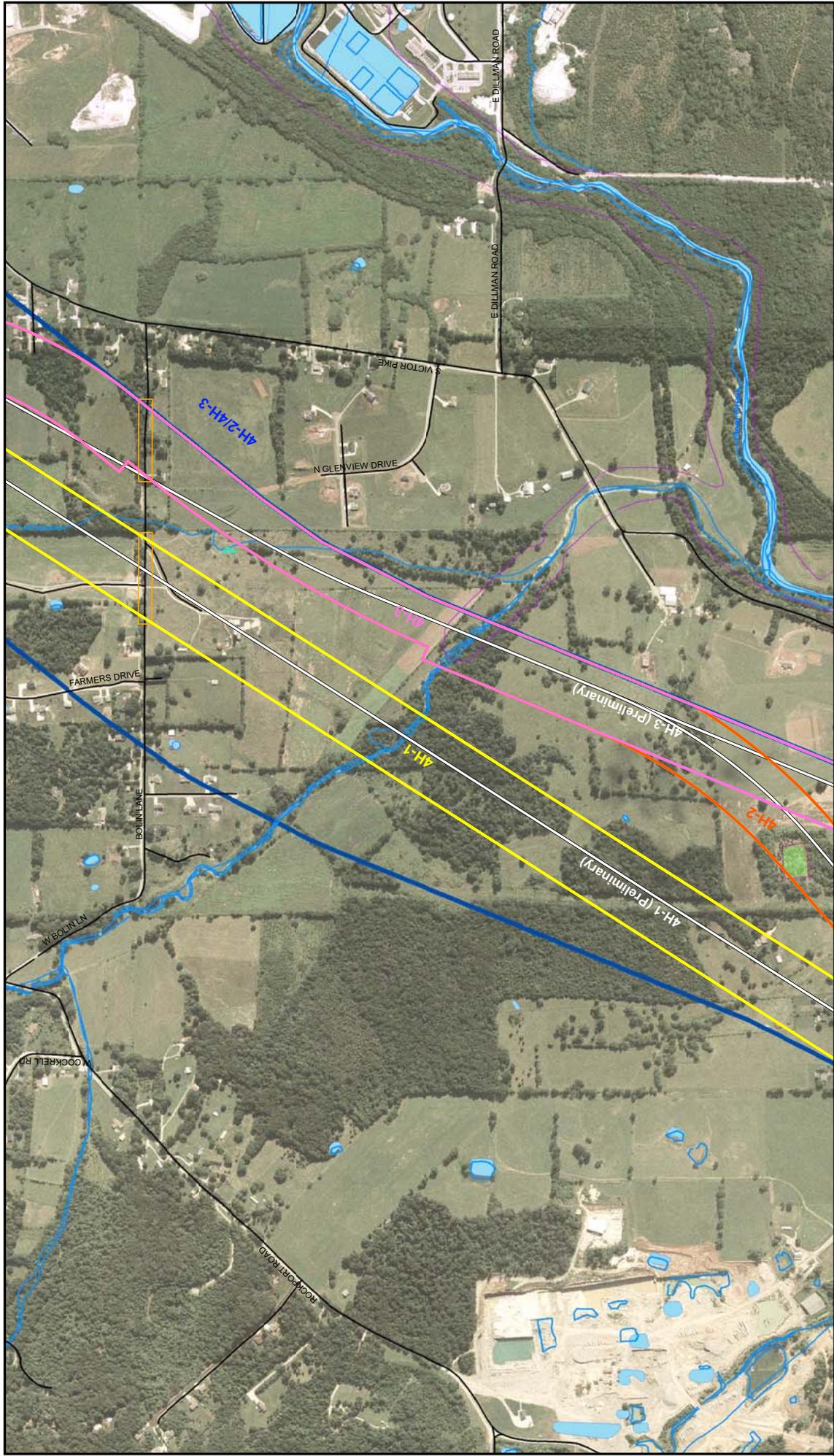


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Alternatives Carried Forward
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	Section 4 Corridor		Preliminary Alternative		Wetland Boundary		Property Line		0 400 800 Feet
	Alternatives Carried Forward		State Highway		Man-made Pond		Floodplain		
			US Highway		Abandoned Quarry		Rivers / Streams		
			County Road		100-ft Cemetery Buffer				
			High Tension Power Line						
			Proposed Related Road						
			Potential Grade Separation						
			Subsection Breakline						



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Alternatives Carried Forward

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Section 4 Corridor

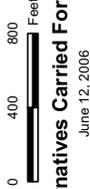
- Preliminary Alternative
- State Highway
- US Highway
- County Road

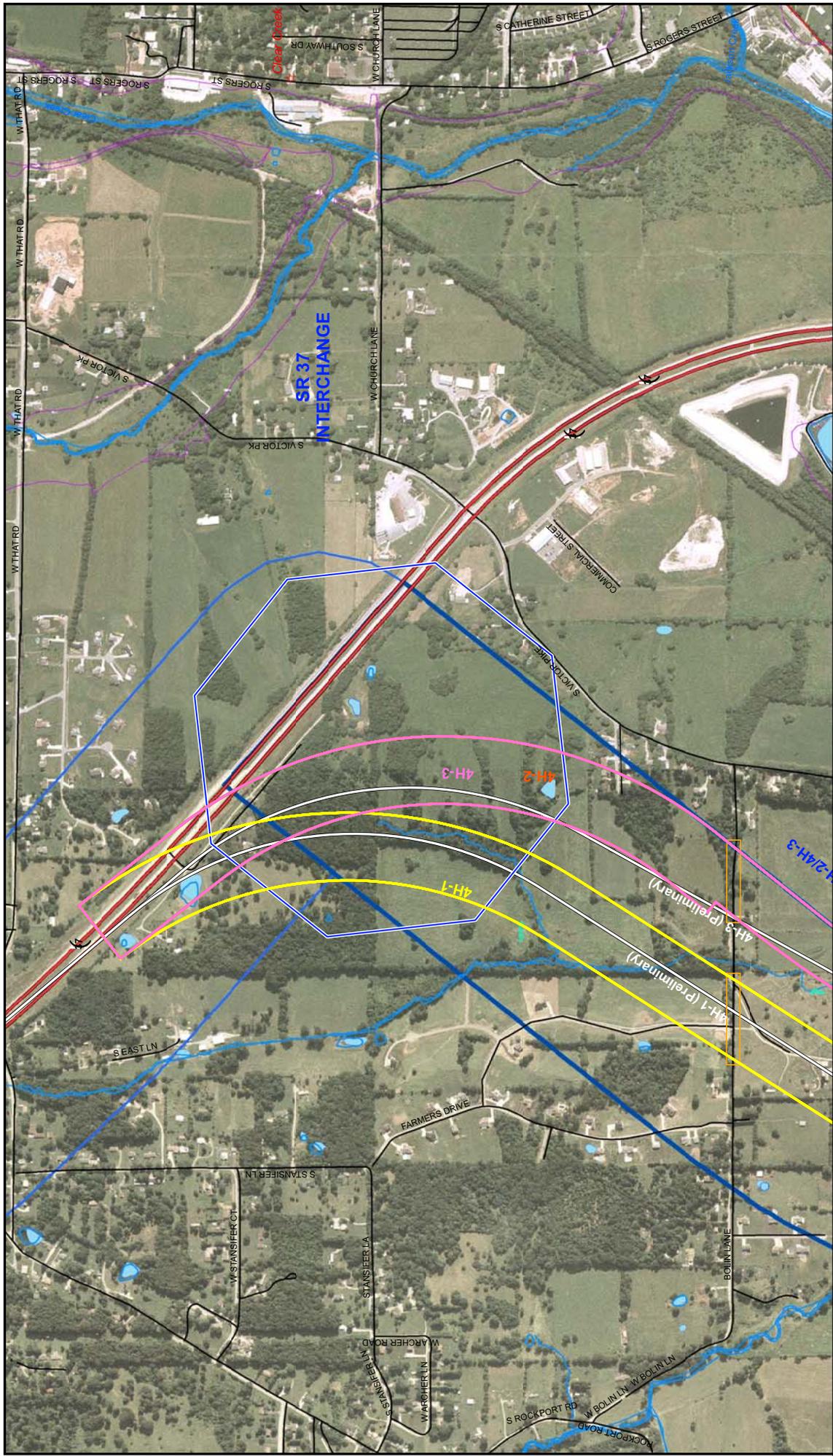
Legend

- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road
- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer
- Property Line
- Floodplain
- Rivers / Streams

Scale

0 400 800 Feet





0 400 800 Feet

Alternatives Carried Forward
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Section 4 Corridor

- Preliminary Alternative
- State Highway
- US Highway
- County Road

Alternatives Carried Forward

- Section 4 Corridor
- State Highway
- US Highway
- County Road

- Preliminary Alternative
- State Highway
- US Highway
- County Road
- Potential Grade Separation
- Subsection Breakline
- High Tension Power Line
- Proposed Related Road

- Wetland Boundary
- Man-made Pond
- Abandoned Quarry
- 100-ft Cemetery Buffer
- Floodplain
- Rivers / Streams

Resource		Subsection Impacts by Alternative		
		4F-1	4F-2	4F-3
Length (mi)		7.61	7.45	7.50
Construction Cost Estimate (\$M)		65.1	57.4	58.0
Wetlands (ac)		2.2 – 2.8	0.1 – 0.7	0.1 – 0.5
Forest (ac)		264 – 386	219 – 318	212 – 313
Core Forest (ac)		86 – 131	52 – 84	41 – 64
Agricultural Land (ac)		63 – 99	76 – 115	94 – 145
Prime Farmland (ac)		24 – 38	37 – 56	40 – 64
Managed Properties (ac)		28 – 44	23 – 35	24 – 38
Floodplain (ac)		15.8 – 23.7	33.9 – 49.1	18.0 – 28.0
Streams (no./ft)	Perennial	3/1,528 – 3/2,372	3/2,505 – 4,728	3/1,307 – 3/1,890
	Intermittent	6/3,718 – 6/4,894	8/6,716 – 8/9,893	7/5,947 – 8/8,178
	Ephemeral	49/16,423 – 57/24,011	49/17,956 – 63/27,602	43/16,683 – 54/25,375
Ponds (ac)	Major Impact	1.0	1.0	0.5
	Partial Impact	None	0.25 at 300 ft	2.25 at 300 ft
Subsurface Drainage Features	Small Springs	4	None	None
	Minor Springs	None	2	None
	Sinkholes	10 – 13	9 – 12	7 – 10
	Swallets	2 – 3	0 – 1	0 – 1
	Sinking Streams	None	1	0 – 1
Historic Properties (ft)		None	None	None
Cemeteries (ft)	Freeman	750 – 850	300 – 400	900 – 1,000
	Storm	750 – 850	1,500 – 1,600	2,000 – 2,100
	Carmichael	1,200 – 1,300	500 – 600	1,650 – 1,750
	Fodrill	5,900 – 6,000	4,900 – 5,000	5,860 – 5,950
	Hardy Sparks	-100 – 0	200 – 300	200 – 300
	Adams	600 – 700	50 – 150	50 – 150
Residential Displacements		6 – 14	15 – 20	4 – 10
Business Displacements		None	None	None

Alternative 4F-1 has the greatest potential core forest impacts of the subsection. The core forest impacts are offset by the lowest amount of potential prime farmland impacts. Potential wetland impacts will occur at the south and middle crossings of Indian Creek. Alternative 4F-1 passes very close to or possibly within the 100 foot buffer around Hardy Sparks Cemetery which is located just north of the middle crossing of Indian Creek. Access to the cemetery may be impacted. An approximately 1.0 acre pond will be impacted.

Alternative 4F-2 has small potential wetland impacts and has a potential impact upon a major sinking stream that is believed to have the greatest inflow volume of any sinking stream within Section 4. It also has the highest potential residential displacements, most of which will occur in Whippoorwill Estates and along Carter Road. The southernmost crossing of Indian Creek is skewed to the creek and the alternative will be located within the 100-year floodplain for approximately 0.5 to 0.75 miles. The alignment for Alternative 4F-2 is close to Adams

Cemetery but will not encroach into the 100 foot buffer around the cemetery. An approximate 1.0 acre pond will be impacted.

Alternative 4F-3 has small potential wetland impacts. This alternative has the lowest potential impacts to core forests and the lowest number of potential residential displacements. The greatest potential impacts to prime farmland will occur along Alternative 4F-3. This alternative may impact the same sinking stream located along Alternative 4F-2. Also like Alternative 4F-2, this alternative is close to Adams Cemetery but will not encroach into the 100 foot buffer around the cemetery. An approximate 0.5 acre pond will be impacted.

Recommendation: Alternatives 4F-1 and 4F-3 are recommended to be carried forward for detailed study. Alternative 4F-2 was discarded due to the potential impact upon a major sinking stream, highest number of potential residential displacements, possible neighborhood impacts in Whippoorwill Estates, the skewed crossing of Indian Creek near the south end of the subsection, and construction in a floodplain.

The alignments for Alternatives 4F-1 and 4F-3 cross just south of CR 150 North. Thus the alignment options for Subsection F consist of:

- Alternative 4F-1 along the entire subsection
- Alternative 4F-3 along the entire subsection
- Alternative 4F-1 south of the crossover and Alternative 4F-3 north of the crossover
- Alternative 4F-3 south of the crossover and Alternative 4F-1 north of the crossover

The alternatives that will be carried forward for detailed study also include recommendations for two minor shifts along Alternative 4F-1 and a minor shift along Alternative 4F-3. The first shift along Alternative 4F-1 will be to avoid Hardy Sparks Cemetery just north of the middle crossing of Indian Creek. The second shift will merge Alternative 4F-1 with Alternative 4F-3 just west of Breeden Road. This shift is proposed in order to minimize potential indirect impacts to Timber Trace Subdivision. The shift for Alternative 4F-3 is proposed so as to completely avoid the major sinking stream.

Pages 9 through 15 of Figure 6 show the centerlines for preliminary Alternatives 4F-1, 4F-2 and 4F-3, and preliminary footprints for Alternatives 4F-1 and 4F-3. The preliminary footprint for Alternatives 4F-1 and 4F-3 also reflect the alignment shifts described above.

4.1.7 Subsection 4G

Subsection 4G extends from east of Burch Road to Lodge Road in Monroe County. This subsection is primarily forest with rural residences. Subsection 4G has extensive karst features. However, all cave entrances and major springs are avoided by the preliminary alternatives. Pages 15 and 16 of Figure 6 show the alternatives in Subsection 4G.

Figure 6: Pages 15 and 16

Table 10: Subsection 4G Analysis	
Resource	Subsection Impacts by Alternative

		4G-1	4G-2
Length (mi)		3.12	3.13
Construction Cost Estimate (\$M)		16.4	18.4
Wetlands (ac)		None	None
Forest (acres)		117 – 171	117 – 174
Core Forest (ac)		37 – 58	42 – 68
Agricultural Land (ac)		4 – 8	3 – 6
Prime Farmland (ac)		3 – 5	3 – 5
Managed Properties (ac)		None	None
Floodplain (ac)		None	None
Streams (no./ft)	Perennial	None	None
	Intermittent	7/3,756 – 7/5,754	7/4,017 – 8/5,285
	Ephemeral	21/4,516 – 25/11,616	27/10,974 – 29/14,627
Ponds (ac)	Major	0.25	0.25
	Minor	None	None
Subsurface Drainage Features	Small Springs	1	2 – 3
	Minor Springs	None	None
	Sinkholes	12 – 15	2 – 4
	Swallets	4	2 – 3
	Sinking Streams	None	None
Historic Properties (ft)	John May House	0 – 100	700 – 800
	Koontz House	1,850 – 1,950	1,150 – 1,250
Cemeteries (ft)		None	None
Residential Displacements		14	14 – 15
Business Displacements		1	1

Most of the potential impacts in this subsection are comparable. Alternative 4G-1, however, will impact the greatest number of sinkholes and is located very close to the boundary for the National Register eligible John May House.

Recommendations: Alternative 4G-2 is recommended to be carried forward for detailed study. It appears that slight adjustments to the alignment may be possible so as to avoid some of the potential impacts to karst features. Also, Alternative 4G-2 is located a greater distance from the John May House which will help minimize any potential adverse effects to this National Register eligible property.

Pages 15 and 16 of Figure 6 show the centerlines for preliminary Alternatives 4G-1 and 4G-2, and a preliminary footprint for Alternative 4G-2.

4.1.8 Subsection 4H

Subsection 4H is located between Lodge Road and SR 37. An interchange will be constructed at SR 37. This subsection is a mix of forest, open field, farmland, rural residences, and small remnant limestone quarries. It has the most extensive karst formations found in Section 4. Farmers Field Subdivision and Rolling Glen Subdivision are located along Bolin Lane near the north end of the subsection. Pages 16 through 19 of Figure 6 show the alternatives in Subsection 4H.

Figure 6: Pages 16, 17, 18 and 19

Resource		Subsection Impacts by Alternative		
		4H-1	4H-2	4H-3
Length (mi)		3.22	3.33	3.42
Construction Cost Estimate (\$M)		30.7	27.3	25.0
Wetlands (ac)		None	None	None
Forest (ac)		69 – 99	53 – 84	69 – 105
Core Forest (ac)		15 – 22	15 – 22	16 – 24
Agricultural Land (ac)		58 – 86	81 – 111	68 – 91
Prime Farmland (ac)		11 – 18	25 – 33	14 – 21
Managed Properties (ac)		None	None	None
Floodplain (ac)		None	2.7 – 3.5	2.7 – 3.5
Streams (no./ft)	Perennial	2/991 – 2/1,614	2/1,292 – 2/1,610	2/878 – 2/1,153
	Intermittent	4/1,591 – 6/2,634	4/1,915 – 5/3,205	1/499 – 3/5,235
	Ephemeral	15/7,989 – 20/10,182	8/1,996 – 12/4,993	9/2,509 – 14/5,235
Ponds (ac)	Major Impact	None	1.0	0.25
	Partial Impact	None	None	None
Subsurface Drainage Features	Small Springs	3	4 – 7	4 – 8
	Minor Springs	1 – 2	1 – 2	1 – 2
	Sinkholes	43 – 61	47 – 67	45 – 62
	Swallets	None	1	1
	Sinking Streams	None	1	1
Historic Properties (ft)	Stipp-Bender Farm	2,350 – 2,450	1,950 – 2,050	1,950 – 2,050
	Harris Ford Bridge	4,350 – 4,450	4,000 – 4,100	4,000 – 4,100
	Murphy-May House	4,450 – 4,550	4,550 – 4,650	4,550 – 4,650
Cemeteries (ft)		None	none	None
Residential Displacements		6 – 7	3 – 5	3 – 5
Business Displacements		None	None	None

Potential impacts along this subsection are comparable for all three subsection alternatives. Cave entrances and major springs were avoided by the development of the preliminary alternatives; however, a considerable number of sinkholes will be impacted by each alternative. A low inflow volume sinking stream will be impacted along Alternatives 4H-2 and 4H-3. The greatest potential residential displacements and a farm displacement will occur along Alternative 4H-1. This alternative may also impact several undeveloped lots in the Farmers Field Subdivision. Some undeveloped lots in the Rolling Glen subdivision may be impacted by Alternatives 4H-2 and 4H-3.

Recommendations: Alternatives 4H-1, 4H-2 and 4H-3 are recommended to be carried forward for detailed study. Additional detailed study of each alternative is necessary to further evaluate potential impacts upon karst features. Also, all three alternatives are being carried forward in order to evaluate the SR 37 interchange configurations and potential impacts associated with this interchange.

Pages 1 through 19 of Figure 6 show the centerlines for preliminary Alternatives 4H-1, 4H-2 and 4H-2, and preliminary footprint for Alternatives 4H-1, 4H-2 and 4H-3.

4.2 Alternatives Carried Forward

The preliminary alternatives screening provided initial recommendations for the alternatives along each of the eight subsections that will be carried forward for detailed study in the Tier 2 Draft EIS. The Alternatives Carried Forward also include the preliminary interchange configurations at SR 45, SR 54, Greene County/Monroe County Line, and SR 37.

4.2.1 Mainline Alternatives

The eight subsection mainline alternatives recommended as Alternatives Carried Forward are:

- Alternative 4A-2
- Alternative 4B-1
- Alternatives 4C-1 and 4C-2
- Alternative 4D-1
- Hybrid Alternative 4E-1/4E-2
- Alternatives 4F-1 and 4F-3
- Alternative 4G-2
- Alternatives 4H-1, 4H-2 and 4H-3

Following the preliminary alternatives screening as presented in Section 4.1, the alignments were modified based upon screening recommendations. An optimization of these alternatives using Quantm was then performed. Preliminary right of way limits at 200 feet, 300 feet or 400 feet from the alternative centerlines were then defined based upon the identified construction “footprint”. These alternatives are depicted in Figure 6, as described above.

It is noted that continued engineering development of these mainline alternatives will be performed to further reduce and avoid potential impacts and for compliance with the engineering design criteria. Potential grade separations remain consistent with those identified for the preliminary alternatives (see Section 3.3.1).

4.2.2 Interchange Alternatives

Preliminary interchange configurations at SR 45, SR 54, Greene County/Monroe County Line and SR 37 are shown in Figure 7. Potential impacts associated with these proposed interchanges were not determined at this phase of the project development and thus are not included in the screening of the mainline alternatives included in Sections 4.1.1 through 4.1.8.

Preliminary interchanges at SR 45 and SR 54 are rural diamond configurations along Hybrid Alternative 4E-1/4E-2. The location of the on-ramps and off-ramps may be modified to avoid and minimize potential resource impacts and to accommodate the extant terrain. These are shown on page 1 of Figure 7.

Preliminary interchanges along the Greene County/Monroe County Line for Alternative 4F-1 (Interchange Alternate #1A) and Alternative 4F-3 (Interchange Alternate #1B) are proposed as trumpet (3-legged) configurations. These are shown on page 2 of Figure 7. No access to local roads or adjacent properties will be allowed for these interchanges. Both interchanges will cross Indian Creek. The two connector road corridors to SR 45 are initially presented as a 400-foot wide corridor. No environmental or engineering studies of these two corridors have been performed. The impacts associated with this interchange will be presented in the DEIS.

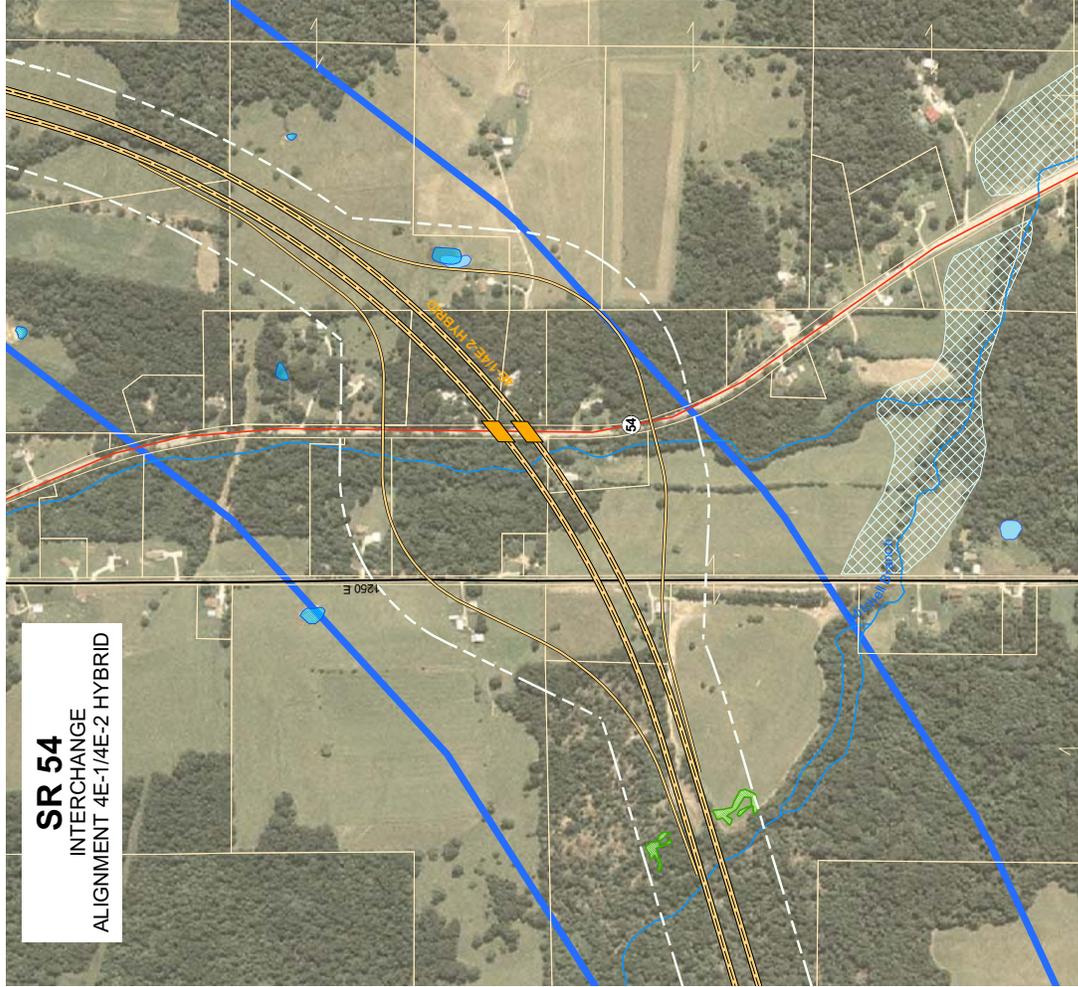
Four preliminary interchange configurations are proposed at SR 37. These are shown on pages 3 and 4 of Figure 7. The presented configurations can be adapted for development with Alternative 4H-1, 4H-2 or 4H-3. Interchange Alternates #1 and #5 are full directional configurations. Interchange Alternates #4 and #6 are non-traditional configurations in which the two minor ramp movements (NB I-69 to SB SR 37 and NB SR 37 to SB I-69) involve travel through traffic controlled intersection on SR 37. The intent of these interchange configuration is to explore options for maintaining travel along Victor Pike which is a truck route for a major limestone quarry. Additional engineering analysis of these interchange configurations and possible variations of these configurations will be performed and included in the Tier 2 Draft EIS.

Figure 7, Pages 1, 2, 3 and 4

SR 45 & SR 54 INTERCHANGE ALTERNATIVES



SR 45
INTERCHANGE
ALIGNMENT 4E-1/4E-2 HYBRID



SR 54
INTERCHANGE
ALIGNMENT 4E-1/4E-2 HYBRID



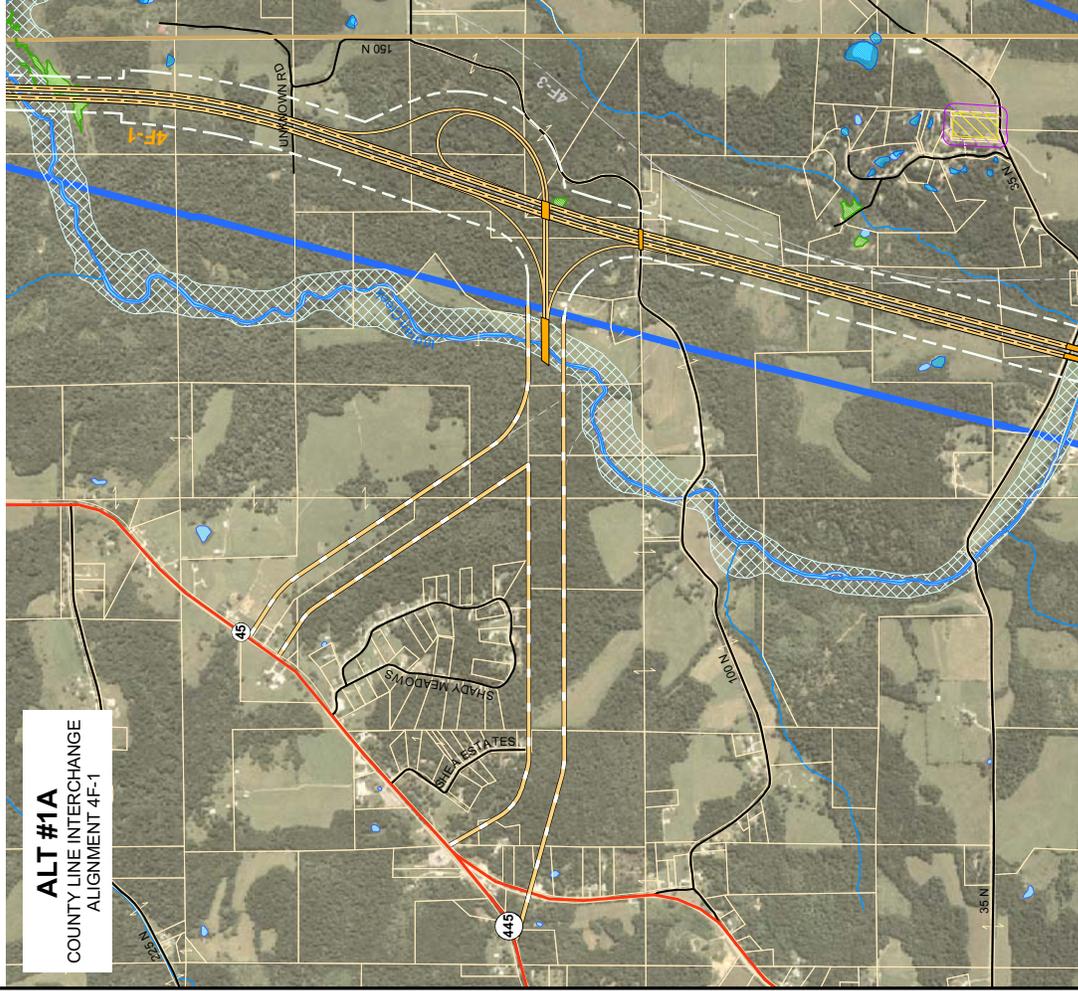
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- I-69 Approved Corridor
- Potential Right-of-Way Limits
- Proposed Mainline
- Proposed Ramps
- Property Line
- State Hwy
- County Road
- Grade Separation

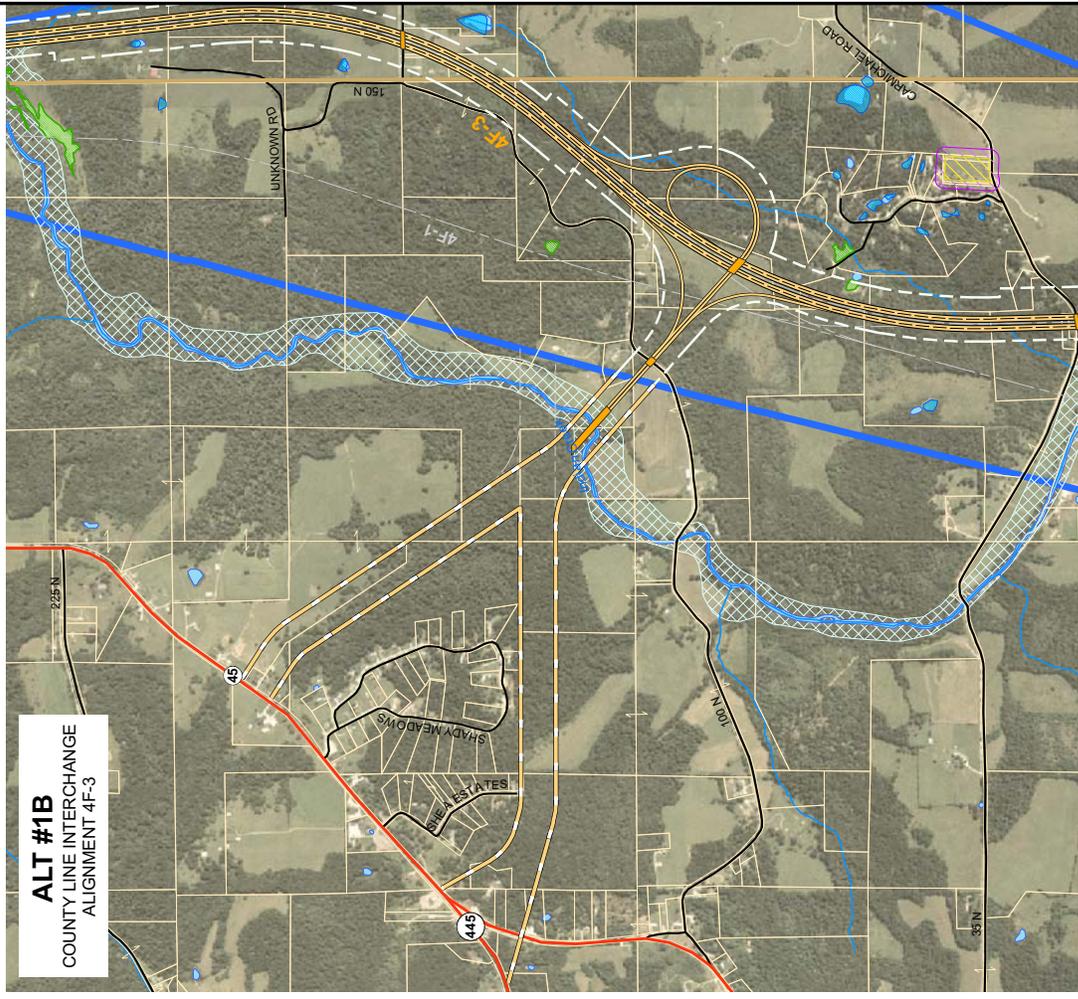
0 300 600 1,200 Feet
Alternatives Carried Forward:
Proposed Interchanges
Page 1 / Figure 7



COUNTY LINE - INTERCHANGE ALTERNATIVES



ALT #1A
COUNTY LINE INTERCHANGE
ALIGNMENT 4F-1



ALT #1B
COUNTY LINE INTERCHANGE
ALIGNMENT 4F-3



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Section 4 - US 231 to SR 37**
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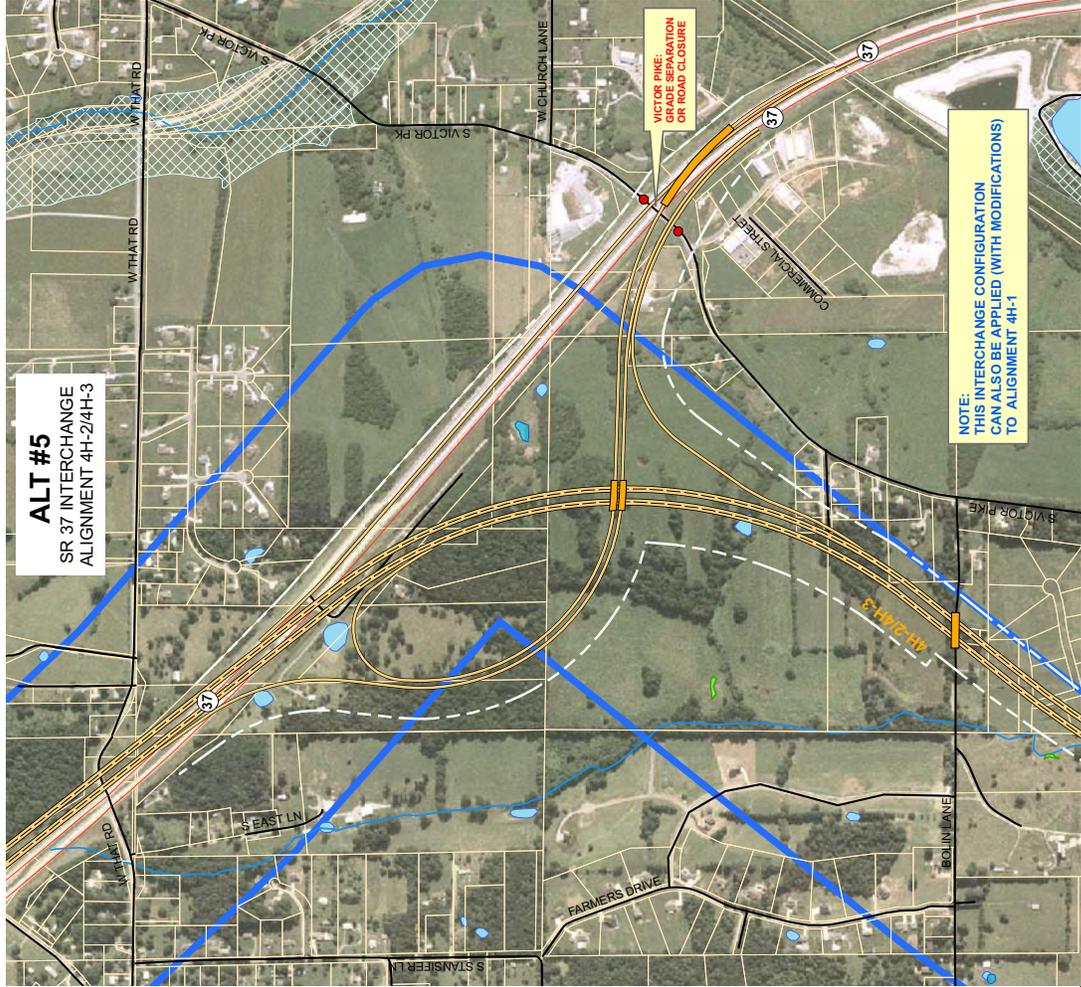
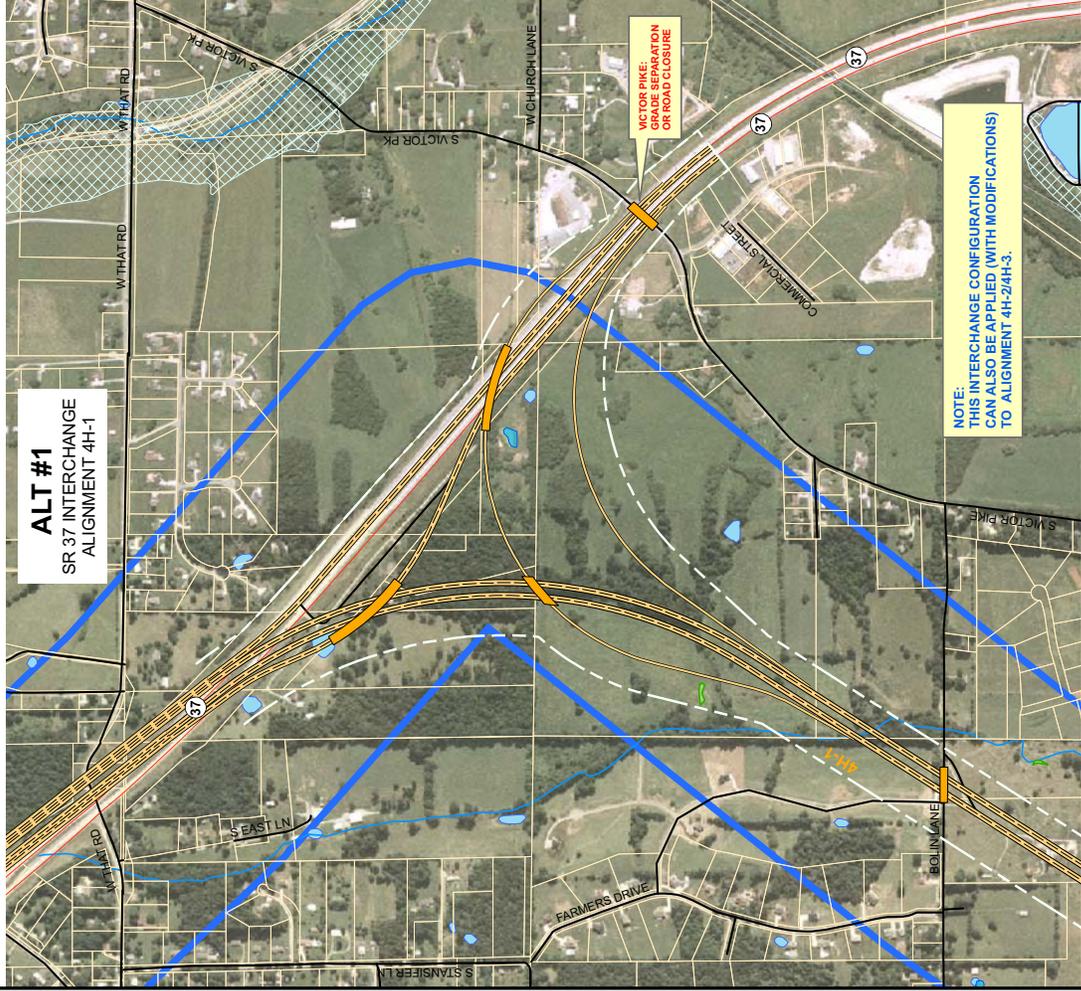
- I-69 Approved Corridor
- Proposed/Access Road Corridor
- Grate Separation
- Potential Right-of-Way Limits
- Proposed Mainline
- Proposed Ramps
- Property Line
- State Hwy
- County Road



Alternatives Carried Forward:
Proposed Interchanges
Page 2 / Figure 7



SR 37 - INTERCHANGE ALTERNATIVES



	I-69 Approved Corridor		Potential Right-of-Way Limits		Property Line
	Grade Separation		Proposed Mainline		State Hwy
	Proposed Ramps		Proposed 2-lane Ramp		County Road

0 400 800 1,600 Feet

Alternatives Carried Forward:
Proposed Interchanges
Page 3 / Figure 7

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