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5.20 Forest Impacts

Since the Draft Environmental Impact Statement (DEIS), the calculation of impacts to forested areas including forested fragments and core forest have been updated to add impacts associated with the Refined Preferred Alternative (RPA).

5.20.1 Introduction

Forests are a large and important resource in Indiana. Indiana's forests make significant environmental and economic contributions, including: timber, outdoor recreation, protection of soil and water resources, and habitat for many plant and animal species. This chapter describes forest impacts that are likely to occur from construction of the I-69 Section 6 mainline, interchanges, and local service roads, both within and outside the existing right of way of SR 37 and other transportation facilities. The mainline impacts are to forests that were previously affected by the construction of SR 37.

5.20.2 Methodology

All impacts in this chapter are evaluated within the I-69 Section 6 field survey study area unless otherwise stated (see **Section 4.1**). The field survey study area is a boundary that includes the right of way of all alternatives, including the RPA, plus an approximate 50-foot buffer outside the right of way of these alternatives.

5.20.2.1 Direct Impacts to Forest

The I-69 Tier 1 study used the geographic information system (GIS) developed for southwest Indiana to estimate impacts to forests. Alternative alignments were overlain on the 1992 United States Geological Survey (USGS) Land Cover data layer (published in 1998) in the GIS, as described in Tier 1 FEIS Section 5.21, Forest Impacts. The total forest acreages included the right of way needed for the mainline of I-69 from the intersection of SR 37 just south of SR 39 to I-465, as well as the potential interchanges identified in Tier 1: SR 39, Ohio Street, SR 252, Egbert Road, SR 144, Smith Valley Road, County Line Road, Southport Road, and I-465.

During the Tier 2 study for I-69 Section 6, potential impacts to forested areas were identified using Year 2015 aerial photography supported by field surveys to create a GIS layer of forest land. Total Tier 2 acreages include the right of way needs for the mainline and interchanges in addition to overpasses and underpasses, and new local service roads.

Forests identified in the field and through aerial photography were digitized and given a specific reference number with current aerial photographs as a backdrop. Field investigations and review of aerial photography resulted in the identification of five United States Department of

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Agriculture (USDA) forest classification types in the I-69 Section 6 field survey study area. As described in Section 5.20.3, these forest areas were outlined and color-coded by forest type, and the acres of each type within the field survey study area were calculated.

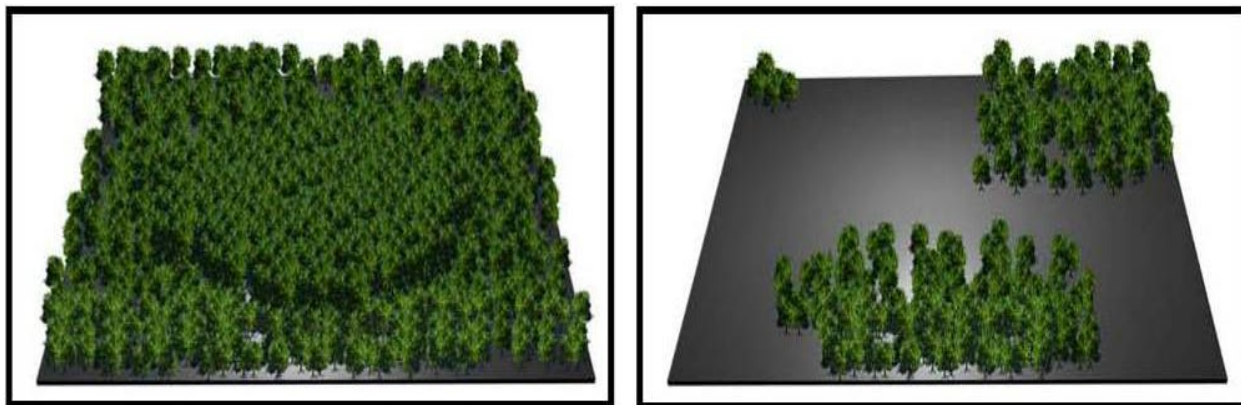
The USDA defines forest land as an area with at least 10 percent live tree canopy cover, or an area that formerly had 10 percent live tree canopy cover (as evidenced by stump, snags, etc.), that is not currently developed for non-forest use. These areas must be at least one acre in size, and roadside, streamside, and/or windbreak strips of trees must have a crown width of at least 120 feet. Within areas initially identified as forests, unimproved roads, trails, and/or clearings less than 120 feet wide are classified as forest land. Water bodies that are less than 30 feet in width are classified the same as the surrounding forest.

The forest dataset was used to determine potential direct impacts to forested land within the I-69 Section 6 alternatives. The proposed right of way of each alternative was placed over the aerial mapping showing the outlined field verified USDA forest classification types, and the affected forest areas were calculated for each alternative.

5.20.2.2 Forest Fragmentation and Core Forest Impacts

In addition to impacts from the direct impact to forested land, forest may be adversely affected by fragmentation. Fragmentation can be defined as the steady transformation of once large and continuous tracts of natural landscape into smaller and more isolated patches or fragments surrounded by disturbed areas (Temple and Wilcox, 1984). Figure 5.20-1 shows a forest before and after fragmentation occurs.

Figure 5.20-1: Forest Fragmentation



Forest Prior to Fragmentation

Forest after Fragmentation

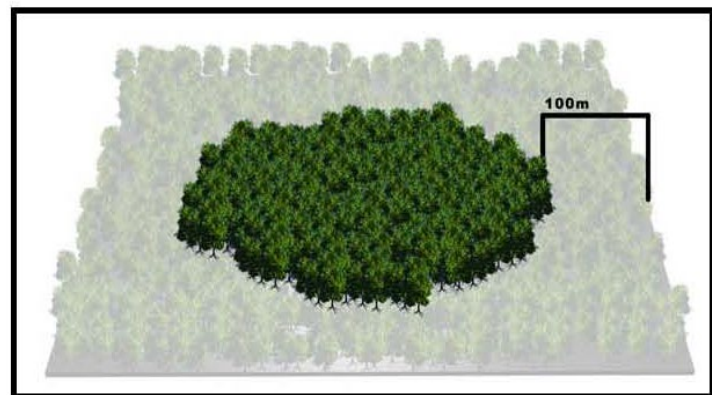
Fragmentation can affect the forest by removing the core (see discussion below) and by increasing the likelihood of invasive species entering the remaining habitat of an area. Invasive plant species can cause ecological damage by displacing native plant species, eliminating food

and cover for wildlife, and threatening rare plant and animal species. The Invasive Plant Species Assessment Working Group (IPSAWG) was formed to address invasive species in Indiana. A number of agencies and organizations, including INDOT, participate in this group.¹

Core habitat is the interior portion of any particular habitat. Core habitat can be associated with different ecosystem types, such as forest and prairies. In southern Indiana, most core habitat is generally associated with forests. Core habitat is particularly important to forest because some tree species can out compete others in the core rather than the edge and vice versa. Core forest is generally accepted to be the portion of the forest that is 100 meters (328 feet) from the edge (Temple, 1986). The outer portion of forest is considered the edge habitat. **Figure 5.20-2** illustrates core forest habitat in relation to edge habitat.

Core forest can be affected directly by impacting the core area or indirectly by altering the edge of the forest, which in turn redefines the core area. Some game species, such as deer, successfully use edge habitat. However, many species require core habitat to flourish, and a loss of core habitat can cause or worsen stress to those species. For example, fragmentation and/or redefinition of core forest habitat can affect migratory birds in several ways. Some birds require large blocks of forest to successfully nest and fledge their young. Nests deep in a forest tract are often less susceptible to cowbird parasitism and predation by edge species such as raccoons. Fragmentation and/or redefinition also can affect bird use by separating habitat blocks so that they no longer function as one habitat unit.

Figure 5.20-2: Diagram of Core Forest Habitat



To assess the impacts on core forests within the field survey study area, spatial analysis was done on the forest dataset, beginning with identification of the forest edge. A buffer of 100 meters (328 feet) was created inside the areas classified as forested land. The area within the buffer was erased from the forest dataset, and this was exported to create a core forest dataset. A second core forest dataset was created after forest impacted from each alternative was removed from the overall forest dataset. The difference between the two core forest datasets is the impact to the core forest for each alternative. This allows for the calculation of both direct impacts to core

¹ Partners in IPSAWG include the United States Fish and Wildlife Service (USFWS), the National Park Service (NPS), the United States Forest Service (USFS), The Nature Conservancy, the Wildlife Society Indiana Chapter, Purdue Cooperative Extension Service, the Indiana Department of Natural Resources (IDNR), the Indiana Department of Environmental Management (IDEM), the Indiana Chapter of the American Society of Landscape Architects, Indiana Forage Council, Indiana Wildlife Federation, Indiana Seed Trade Association, Indiana State Beekeepers Association, Indiana Native Plant and Wildflower Society, Indiana Farm Bureau, Indiana State Chemist, White River Gardens, Grazing Lands Conservation Initiative, Green Industry Alliance, Indiana Academy of Science, Indianapolis Landscapers Association, and the Indianapolis Zoo.



forest as well as indirect impacts that occur when the forest edge is impacted. When the calculation of impacts to core forest result in the remaining core forest acreage being less than one acre, the entire core forest is considered to be impacted.

Indirect Impacts to Forest

The Council on Environmental Quality (CEQ) Regulation 1508.8 defines indirect impacts as “effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.” Indicators of potential indirect effects on forest resources was obtained from many sources, including coordination with local county offices and staff (several of whom served on the I-69 Section 6 Expert Land Use Panel²), as well as private industry development experts in the area. The analyses used the TREDIS model to calculate projected induced population and employment resulting from the construction of I-69 Section 6.

Induced growth was estimated for the four-county purpose and need study area as a whole and then a manual process (not computer based) was used to sub-allocate the induced growth to Hendricks, Johnson, Marion, and Morgan counties. Growth for each county was assigned to Traffic Analysis Zones (TAZs) based on input from the Expert Land Use Panel. The indirect impacts to forests are summarized in **Section 5.20.3**. Indirect impacts to forests other key resources in the I-69 Section 6 study area are described in detail in **Section 5.24**.

5.20.3 Analysis

Field investigations and review of aerial photography resulted in the identification of five USDA forest classification types in the I-69 Section 6 field survey study area. **Table 5.20-1** lists the five types and describes the species associated with each type.

The total forest area in the I-69 Section 6 field survey study area is 295 acres. **Table 5.20-2** lists the forest types, the acres of each within the field survey study area, the area within the proposed right of way of the build alternatives, and the degree of impact anticipated (i.e., edge, fragment, or total). All forest areas within the field survey study area are depicted in **Figure 5.20-3** through **Figure 5.20-7**.

The total potential impacts to forests with the RPA would be 160 acres. Impacts to forest resulting from Alternative C1 would be 138 acres, Alternative C2 would be 148 acres, Alternative C3 would be 103 acres, and Alternative C4 would be 146 acres. This equates to

² According to a United States Department of Transportation (USDOT) report, “Expert panels can be a very effective way to organize input and gain general consensus on the range of impacts that might be expected. The use of expert panels seems to be an effective way to determine what is ‘reasonably foreseeable’ since it utilized the judgments of reasonable people.” The Section 6 Expert Land Use Panel included representatives from Indianapolis Department of Metropolitan Development, Develop Indy, Mooresville Redevelopment Commission, Morgan County Planning and Zoning, Johnson County Planning and Zoning, Indianapolis Metropolitan Planning Organization (MPO), Morgan County Economic Development Corporation, Johnson County Economic Development Corporation, Hendricks County Planning and Zoning, Mid-Indiana Board of Realtors (MIBOR), and Bargersville Planning and Development.



approximately 54 percent of the total forest area in the I-69 Section 6 field survey study area for the RPA, 47 percent for Alternative C1, 50 percent for Alternative C2, 35 percent for Alternative C3, and 49 percent for Alternative C4. These impacts do not account for impacts due to relocation of utilities or billboards, since the specific location of such impacts cannot be identified until project design.

Table 5.20-1: Forest Types and Associated Plant Species in the I-69 Section 6 Corridor

USDA Forest Classifications	Representative Plant Species
Elm-Ash-Cottonwood	Forests in which lowland elm, ash, red maple, silver maple, and cottonwood, singly or in combination, comprise a plurality of the stocking. Species commonly associated with the elm-ash-cottonwood forest type in Indiana include sycamore, yellow-poplar, red oak, and black walnut.
Maple-Beech-Birch	Forests in which hard maple, beech, American elm, and red maple, singly or in combination, comprise a plurality of the stocking. Species commonly associated with the maple-beech forest type in Indiana include white oaks, red oaks, hickories, yellow-poplar, and ash.
Oak-Hickory	Forests in which upland oaks and hickories, singly or in combination, comprise a plurality of the stocking. Species commonly associated with the oak-hickory forest type in Indiana include yellow-poplar, ash, black cherry, cottonwood, and black walnut.
White-Red-Jack Pine	Forests in which eastern white pine, red pine, or jack pine, singly or in combination, comprise a plurality of the stocking. This type of forest appears planted in the field survey study area.
Non-Native Dominant Stand	Forests dominated by non-native species including white mulberry and honeysuckle.

The total potential impacts to forested wetlands (included in the above totals) would be 1.70 acres for the RPA, 2.17 acres for Alternative C1, 2.00 acres for Alternative C2, 1.87 acres for Alternative C3, and 1.82 acres for Alternative C4.

Upland habitat and forested wetlands are included in **Table 5.20-2**. Impact types are defined as edge, fragment, or total. An "edge" impact type is identified where an alternative would affect one side of the forest, leaving the remaining forest on one side of the right of way. Edge type impacts would be 72 percent of the total forest impact for the RPA, 57 percent for Alternative



C1, 66 percent for Alternative C2, 58 percent for Alternative C3, and 66 percent for Alternative C4.

A "fragment" impact type is identified where an alternative would split the forest such that one or more forest areas remain on each side of the right of way. Fragment type impacts to forests would be 19 percent of the total forest impact for the RPA, 29 percent for Alternatives C1 and C3, and 21 percent for Alternatives C2 and C4.

A "total" type impact is identified where the entire forest would be affected or less than 1 acre would remain. Total type impacts would be 9 percent the RPA, 14 percent with Alternative C1, and 13 percent with Alternatives C2, C3, and C4.

The Revised Programmatic Biological Opinion (BO)³ for Tier 1 (see **Appendix W**) lists thresholds of forest impacts for each I-69 section. If these thresholds are exceeded, Section 7 consultation with the U.S. Fish and Wildlife Service for Tier 1 may need to be reinitiated. For the RPA, the total forest impacts are 160 acres. This is approximately 106 acres less than the 266 acres estimated for I-69 Section 6 in the Revised Programmatic BO for Tier 1. These impacts do not account for relocation of utilities or billboards, since the specific location of such impacts cannot be identified until project design. These impact estimates for I-69 Section 6 are included in the Biological Assessment (BA) for the Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) for Tier 2 (see **Appendix GG1**).

Some of the forests affected by I-69 Section 6 alternatives would extend beyond the field survey study area boundary. Forests that extend outside the field survey study area boundary are indicated with an "†" in the "Forest ID" column of **Table 5.20-2**.

Multiple Encroachments

Impacts on multiple locations of a forest result in greater fragmentation of that forest. An example of multiple encroachments on a forest could include the widening of the mainline as well as construction of a new local access road at a different location within the same forest. Of the 103 forests potentially affected by the I-69 Section 6 alternatives, 25 would have multiple encroachments. Multiple encroachments result where an alternative impacts a forest in more than one location. Forests with multiple encroachments are indicated with an "*" in the "Forest ID" column in **Table 5.20-2**.

³ The BO for Tier 2 establishes limits on the maximum amount of forest impacts for Tier 2 sections in Tier 1.



Table 5.20-2: Potential Direct Impacts to Forested Areas, by Alternative

Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F001†	Elm-Ash-Cottonwood	1.6	0.7	Edge	0.7	Edge	0.5	Edge	0.7	Edge	0.7	Edge
F002†	Elm-Ash-Cottonwood	1.4	0.6	Edge	0.6	Edge	0.4	Edge	0.6	Edge	0.8	Edge
F003†	Elm-Ash-Cottonwood	1.1	0.5	Edge	0.4	Edge	0.1	Edge	0.4	Edge	0.5	Edge
F004†	Elm-Ash-Cottonwood	1.1	0.5	Edge	0.5	Edge	0.1	Edge	0.5	Edge	0.6	Edge
F005†*	Elm-Ash-Cottonwood	0.9	0	-	0.3	Edge	0	-	0	-	0.1	-
F006	Elm-Ash-Cottonwood	0.2	0.2	Total	0.2	Total	0	-	0.1	Total	0.1	Edge
F007†*	Elm-Ash-Cottonwood	2.2	0.3	Edge	0.3	Edge	0.1	Edge	0.1	Edge	1.0	Edge
F008	Elm-Ash-Cottonwood	0.2	0.1	Total	0.1	Total	0.2	Total	0.2	Total	0.2	Total
F009†	Maple-Beech-Birch	6.6	5.0	Edge	3.8	Edge	3.8	Edge	5.0	Edge	5.6	Edge
F010†	Oak-Hickory	1.6	0.8	Edge	0.3	Edge	0.3	Edge	0.8	Edge	0.9	Edge
F011†	Maple-Beech-Birch	3.3	0.9	Edge	0.6	Edge	0.6	Edge	0.9	Edge	1.1	Edge
F012†	Maple-Beech-Birch	0.2	0	-	0	-	0	-	0	-	0.0	-
F013†*	Maple-Beech-Birch	8.2	3.0	Edge	1.9	Edge	1.8	Edge	3.0	Edge	3.1	Edge



Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F014†*	Elm-Ash-Cottonwood	4.3	2.8	Edge	2.9	Edge	3.3	Edge	2.8	Edge	2.7	Edge
F015†	Maple-Beech-Birch	1.1	0.6	Edge	0.6	Edge	0.6	Edge	0.6	Edge	0.6	Edge
F016†	Maple-Beech-Birch	13.3	9.2	Fragment	9.6	Fragment	4.4	Fragment	9.2	Fragment	7.8	Fragment
F017†	Maple-Beech-Birch	0.2	0	-	0	-	0	-	0	-	0.0	-
F018†	Maple-Beech-Birch	3.1	0	-	0	-	2.2	Fragment	0	-	0.0	-
F019†	Elm-Ash-Cottonwood	0.1	0	-	0	-	0	-	0	-	0.0	-
F020†*	Maple-Beech-Birch	11.6	3.9	Edge	3.4	Edge	4.5	Fragment	3.9	Edge	3.6	Edge
F021†	Maple-Beech-Birch	1.4	0.9	Edge	0.9	Edge	0.1	Edge	0.9	Edge	0.9	Edge
F022†	Maple-Beech-Birch	5.3	0	-	0	-	3.2	Fragment	0	-	0.0	-
F023†*	Maple-Beech-Birch	2.6	0.8	Edge	0.8	Edge	0.6	Edge	0.8	Edge	0.9	Edge
F024†	Maple-Beech-Birch	1.2	0.8	Edge	0.7	Edge	0	-	0.8	Edge	0.1	Edge
F025†	Maple-Beech-Birch	1.4	0.4	Edge	0.4	Edge	0.4	Edge	0.4	Edge	0.8	Edge
F026†*	Maple-Beech-Birch	5.5	3.8	Fragment	3.1	Edge	3.2	Fragment	3.2	Edge	3.9	Edge
F027*	White-Red-Jack Pine	0.9	0.4	Total	0.5	Total	0.2	Total	0.5	Total	0.9	Total



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Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F028*	White-Red-Jack Pine	0.1	0.1	Total	0.1	Total	0	-	0.1	Total	0.1	Total
F029†	Elm-Ash-Cottonwood	0.6	0	-	0	-	0	-	0	-	0.3	Edge
F030	White-Red-Jack Pine	0.2	0.2	Total	0.2	Total	0.2	Total	0.2	Total	0.2	Total
F031†	White-Red-Jack Pine	6.6	6.0	Total	6.0	Total	6.0	Total	6.0	Total	6.2	Fragment
F032†	Oak-Hickory	1.8	0.7	Edge	0.7	Edge	0.7	Edge	0.7	Edge	1.3	Edge
F033†	Elm-Ash-Cottonwood	1.7	1.4	Total	1.4	Total	1.4	Total	1.4	Total	1.5	Total
F034	Maple-Beech-Birch	0	-	0	-	0	-	0	-	-	0.0	-
F035	Elm-Ash-Cottonwood	0.8	0.7	Total	0.8	Total	0.8	Total	0.8	Total	0.8	Total
F036†	Elm-Ash-Cottonwood	2.5	1.5	Edge	1.5	Edge	1.5	Edge	1.5	Edge	2.0	Edge
F037†	Maple-Beech-Birch	2.3	2.1	Total	2.1	Total	2.1	Total	2.1	Total	2.1	Total
F038†	Maple-Beech-Birch	1	0.8	Edge	0.8	Edge	0.8	Edge	0.8	Edge	0.8	Total
F039†*	Maple-Beech-Birch	2.8	1.6	Edge	1.7	Edge	1.7	Edge	1.7	Edge	2.1	Edge
F040†*	Maple-Beech-Birch	1.9	1.0	Edge	0.1	Edge	0	-	1.1	Edge	1.1	Edge
F041†	Maple-Beech-Birch	1.5	0.8	Edge	0.5	Edge	0.4	Edge	0.8	Edge	0.8	Edge



Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F042†	Maple-Beech-Birch	10.4	7.5	Fragment	6.8	Fragment	2.0	Edge	7.3	Fragment	6.0	Edge
F043†	Maple-Beech-Birch	6.7	3.5	Fragment	4.7	Fragment	2.4	Fragment	3.5	Fragment	3.4	Edge
F044†	Elm-Ash-Cottonwood	0.2	0.1	Total	0.1	Total	0	-	0.1	Total	0.1	Edge
F045†	Elm-Ash-Cottonwood	0.1	0.0	-	0.0	Total	0	-	0.1	Total	0.0	-
F046	Elm-Ash-Cottonwood	0.2	0.1	Total	0.1	Total	0	-	0.1	Total	0.1	Total
F047†	Elm-Ash-Cottonwood	0.3	0.2	Edge	0.2	Edge	0.1	Edge	0.2	Edge	0.2	Edge
F048†	Elm-Ash-Cottonwood	0.5	0.3	Total	0.3	Total	0.1	Total	0.3	Total	0.1	Total
F049†	Elm-Ash-Cottonwood	0.3	0	-	0	-	0.2	Edge	0	-	0.0	-
F050†	Elm-Ash-Cottonwood	3.1	1.8	Edge	1.8	Edge	0.3	Edge	1.8	Edge	1.6	Edge
F051	Elm-Ash-Cottonwood	0.2	0.1	Total	0.1	Total	0	-	0.1	Total	0.1	Total
F052†*	Elm-Ash-Cottonwood	1.7	0.9	Edge	0.9	Edge	0.6	Edge	0.9	Edge	0.9	Edge
F053	Maple-Beech-Birch	1.6	1.2	Total	1.2	Total	0.5	Edge	1.2	Total	0.9	Total
F054*	Elm-Ash-Cottonwood	5.5	0	-	0.1	Edge	2.6	Fragment	0	-	0.0	-
F055	Elm-Ash-Cottonwood	0.3	0	-	0.2	Total	0.3	Total	0	-	0.0	-



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Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F056†	Elm-Ash-Cottonwood	0	0.2	Total	0.2	Total	0.2	Total	0.2	Total	0.0	-
F057	Elm-Ash-Cottonwood	0	0	-	0.1	Total	0	-	0.1	Total	0.0	-
F058†	Maple-Beech-Birch	10.9	1.9	Edge	8.8	Edge	1.2	Edge	8.8	Edge	9.3	Edge
F059	Maple-Beech-Birch	0	-	0	-	0	-	0	-	-	0.0	-
F060	Maple-Beech-Birch	0.1	0.1	Total	0.1	Total	0.1	Total	0.1	Total	0.1	Total
F061	Elm-Ash-Cottonwood	0.3	0.3	Total	0	-	0.3	Total	0	-	0.0	-
F062†	Elm-Ash-Cottonwood	0.4	0.2	Edge	0.2	Edge	0.1	Edge	0.2	Edge	0.2	Edge
F063†*	Elm-Ash-Cottonwood	2.5	1.3	Edge	1.2	Edge	0.8	Edge	1.2	Edge	1.4	Edge
F064	Elm-Ash-Cottonwood	1.9	1.2	Total	1.2	Total	0.8	Edge	1.2	Total	1.6	Total
F065†	Maple-Beech-Birch	4.1	2.1	Edge	2.0	Edge	1.1	Edge	2.0	Edge	2.1	Edge
F066†	Oak-Hickory	3.7	2.2	Edge	2.2	Edge	1.3	Edge	2.2	Edge	2.4	Edge
F067†*	Maple-Beech-Birch	4.7	2.0	Edge	2.0	Edge	1.9	Edge	2.0	Edge	3.1	Edge
F068†*	Maple-Beech-Birch	9.8	5.1	Edge	5.1	Edge	2.6	Edge	5.1	Edge	5.5	Edge
F069†	Elm-Ash-Cottonwood	2.4	1.2	Edge	1.2	Edge	1.2	Edge	1.2	Edge	1.7	Edge
F070*	Oak-Hickory	2	1.7	Total	1.7	Total	0.5	Edge	1.7	Total	1.9	Total



Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F071†*	Oak-Hickory	4.3	2.2	Edge	2.2	Edge	0.3	Edge	2.2	Edge	2.7	Edge
F072†	Elm-Ash-Cottonwood	0.5	0.4	Total	0.4	Total	0.2	Total	0.4	Total	0.4	Total
F073†	Elm-Ash-Cottonwood	1.1	0.6	Edge	0.6	Edge	0.2	Edge	0.6	Edge	0.7	Edge
F074†*	Elm-Ash-Cottonwood	6.6	3.0	Fragment	3.0	Fragment	3.2	Fragment	3.0	Fragment	5.0	Fragment
F075†	Oak-Hickory	0.8	0.4	Edge	0.4	Edge	0	-	0.4	Edge	0.4	Edge
F076†*	Maple-Beech-Birch	10.5	6.6	Edge	6.6	Edge	1.2	Edge	6.6	Edge	6.7	Edge
F077†	Maple-Beech-Birch	1	0.5	Edge	0.5	Edge	0.1	Edge	0.5	Edge	0.5	Edge
F078†	Elm-Ash-Cottonwood	1.3	0.6	Total	0.6	Total	0.1	Edge	0.6	Total	0.8	Total
F079†	Elm-Ash-Cottonwood	3	2.1	Edge	2.0	Edge	2.1	Edge	2.0	Edge	0.2	Edge
F080†	Maple-Beech-Birch	1.7	1.0	Edge	1.0	Edge	0.1	Edge	1.0	Edge	1.0	Edge
F081†	Maple-Beech-Birch	1.1	0.6	Edge	0.6	Edge	0.2	Edge	0.6	Edge	0.7	Edge
F082†	Maple-Beech-Birch	3.8	2.3	Edge	2.2	Edge	1.0	Edge	2.2	Edge	3.0	Edge
F083†	Maple-Beech-Birch	3.5	2.1	Edge	2.3	Edge	1.2	Edge	2.3	Edge	2.4	Edge
F084†	Elm-Ash-Cottonwood	2.6	2.2	Edge	2.1	Edge	2.1	Edge	2.1	Edge	2.2	Edge
F085	Oak-Hickory	1.5	1.5	Total	1.5	Total	1.5	Total	1.5	Total	1.5	Total



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Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F086†*	Elm-Ash-Cottonwood	3.4	1.2	Fragment	1.3	Fragment	1.4	Fragment	1.2	Fragment	2.8	Fragment
F087†	Elm-Ash-Cottonwood	0.1	0	-	0.1	Edge	0	-	0.1	Edge	0.0	-
F088†	Elm-Ash-Cottonwood	0.4	0	-	0	-	0	-	0	-	0.2	Edge
F089†	Elm-Ash-Cottonwood	10.1	7.1	Fragment	6.0	Edge	3.7	Edge	6.0	Edge	5.7	Edge
F090†	Elm-Ash-Cottonwood	10.2	0	-	1.7	Fragment	0	-	1.7	Fragment	1.5	Fragment
F091†	Elm-Ash-Cottonwood	3.4	0.1	Edge	2.0	Edge	1.9	Edge	0.1	Edge	0.5	Edge
F092†	Elm-Ash-Cottonwood	0.9	0.8	Edge	0.6	Edge	0.7	Edge	0.8	Edge	0.7	Edge
F093†	Elm-Ash-Cottonwood	0.8	0	-	0.6	Edge	0	-	0.6	Edge	0.0	-
F094†	Elm-Ash-Cottonwood	0.6	0.1	Edge	0.3	Edge	0.3	Edge	0.1	Edge	0.2	Edge
F095†	Elm-Ash-Cottonwood	0.5	0	-	0.2	Edge	0.2	Edge	0	-	0.0	-
F096†*	Elm-Ash-Cottonwood	3.5	1.9	Fragment	1.3	Fragment	1.2	Fragment	1.9	Fragment	2.5	Fragment
F097†*	Elm-Ash-Cottonwood	7	2.9	Fragment	2.1	Fragment	2.1	Fragment	2.9	Fragment	3.8	Fragment
F098†	Elm-Ash-Cottonwood	4.3	3.1	Edge	3.0	Edge	2.9	Edge	3.1	Edge	3.7	Edge
F099†*	Elm-Ash-Cottonwood	2.9	0.1	Edge	2.3	Edge	0.1	Edge	0	-	0.0	-



Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F100†	Elm-Ash-Cottonwood	4.6	2.5	Edge	4.3	Edge	3.5	Edge	2.5	Edge	3.4	Edge
F101†	Non-Native Dominant Stand	0.7	0.2	Edge	0.2	Edge	0.2	Edge	0.2	Edge	0.4	Edge
F102†	Elm-Ash-Cottonwood	1.4	0.7	Edge	0.7	Edge	0.7	Edge	0.7	Edge	0.8	Edge
F103†	Elm-Ash-Cottonwood	0.4	0	-	0.1	Edge	0.1	Edge	0.1	Edge	0.0	-
F104†	Elm-Ash-Cottonwood	1.2	0	-	0.2	Edge	0.2	Edge	0.2	Edge	0.2	Edge
F105†	Elm-Ash-Cottonwood	0.6	0	-	0.2	Edge	0.2	Edge	0.2	Edge	0.2	Edge
F106†	Elm-Ash-Cottonwood	1.7	0.3	Edge	0.3	Edge	0.3	Edge	0.3	Edge	0.3	Edge
F107†	Non-Native Dominant Stand	1.6	1.2	Edge	1.2	Edge	1.2	Edge	1.2	Edge	1.2	Edge
F108†*	Elm-Ash-Cottonwood	2.9	0.8	Edge	0.8	Edge	0.8	Edge	0.8	Edge	0.8	Edge
F109†	Elm-Ash-Cottonwood	2.3	1.0	Edge	1.0	Edge	1.0	Edge	1.0	Edge	1.0	Edge
F110†	Elm-Ash-Cottonwood	4.3	0.1	Edge	1.1	Edge	0.1	Edge	1.1	Edge	1.1	Edge
F111	Elm-Ash-Cottonwood	2.6	0	-	0	-	0	-	0	-	1.7	Fragment
F112	Elm-Ash-Cottonwood	0.6	0	-	0	-	0	-	0	-	0.2	Edge



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Forest ID	Forest Type	Total Acres of Forest ID in Field Survey Study Area	Alternative C1		Alternative C2		Alternative C3		Alternative C4		RPA	
			Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact	Acres Impact	Type Impact
F113	Elm-Ash-Cottonwood	0.6	0	-	0	-	0	-	0	-	0.2	Edge
F114	Elm-Ash-Cottonwood	0.2	0	-	0	-	0	-	0	-	0.1	Edge
Total Forest		295	138		148		103		146		160	
Total, Forested Wetlands		3.0	2.17		2.00		1.87		1.82		1.70	
Total, All Upland Forests		292	136		146		102		145		159	
Total Impact Type			Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
Edge			80	57%	99	66%	60	58%	97	66%	114	72%
Fragment			40	29%	31	21%	30	29%	31	21%	30	19%
Total			20	14%	20	13%	14	13%	20	13%	14	9%

† Indicates forest tract with some portion of the tract located outside the I-69 Section 6 study area boundary.

* Includes multiple encroachments upon forests.

Notes: An "edge" impact means the alternative impacts one side of the forest leaving the remaining forest on one side of the right-of-way. "Fragment" means the alternative splits the forest such that one or more forest areas remain on each side of the right-of-way. "Total" means the entire forest will be impacted by the alternative or less than 1 acre, which is the USDA size criterion for forest, will remain.

Forests F012, F017, F019, F029, F034, F059, and F088 were avoided by all alternatives and are not included in Table 5.20-2.



The Indiana Wetland Rapid Assessment Protocol (INWRAP) was used to assess the quality of forested wetlands within the right of way of alternatives. Forested wetland impacts are shown in. These impacts are also included in numbers displayed in **Table 5.20-2. Section 5.19** describes water resources impacts, including a detailed description of wetlands in the I-69 Section 6 field survey study area. It describes potential impacts to wetlands as a result of each alternative and identifies potential mitigation of these impacts. **Section 5.19.2.2** provides the INWRAP methodology and **Section 5.19.2.3** provides the results of the INWRAP assessment. For mitigation purposes, forested wetlands are treated as wetlands. **Chapter 7, Mitigation and Commitments**, includes further discussion of mitigation of impacts to forested wetlands.

Table 5.20-3: Wetland Impacts in Forested Areas (Forested Wetlands)

Impacts (Acres)	Alt C1	Alt C2	Alt C3	Alt C4	RPA
Total Forest	138	148	103	146	160
F006 wetland impact acres	0.2	0.2		0.1	0.1
F008 wetland impact acres	0.1	0.1	0.2	0.2	0.2
F035 wetland impact acres	0.7	0.8	0.8	0.8	0.8
F044 wetland impact acres	0.1	0.1	0.0	0.1	0.1
F045 wetland impact acres	0.0	0.0		0.0	0.0
F048 wetland impact acres	0.3	0.3	0.1	0.3	0.2
F051 wetland impact acres	0.1	0.1		0.1	0.1
F055 wetland impact acres		0.2	0.3		0.0
F056 wetland impact acres	0.0	0.0	0.0	0.0	
F057 wetland impact acres		0.0		0.0	0.0
F059 wetland impact acres		0.0		0.0	0.0
F060 wetland impact acres	0.1	0.1	0.0	0.1	0.1
F061 wetland impact acres	0.3		0.3		
F062 wetland impact acres	0.3	0.2	0.1	0.2	0.2
Total Forested Wetland Impact Acres	2.17	2.00	1.87	1.82	1.70
Non-Wetland Forest Acres Affected*	136.3	146.2	101.6	144.7	158.6

*Totals may not match this number exactly due to rounding.

Core Forest Impacts

The I-69 Section 6 alternatives would affect five core forest habitats. The potential impact on each of these core forests is shown in **Table 5.20-4** and their locations are shown in **Figure 5.20-3** through **Figure 5.20-7**, included at the end of this section. All forests within 150 meters (492 feet) of the I-69 Section 6 field survey study area were included in the analysis to make sure all direct and indirect impacts to core forests were identified. Core forest impacts were analyzed to 100 meters (328 feet) beyond the right of way of each alternative. In some cases, the total core forest area and the remaining core forest area is larger than forested impacts. This is because core



forest impacts are analyzed to 100 meters (328 feet) beyond the edge of the right of way, while forested impacts are only assessed and limited to impacts within the right of way.

Potential impacts to core forests would be 11.5 acres with the RPA, 7.7 acres with Alternative C1, 11.7 acres with Alternative C2, 2.5 acres with Alternative C3, and 11.8 acres with Alternative C4.

Table 5.20-4: Summary of Impacts to Core Forest Habitat

Impacts (Acres)	Alt C1	Alt C2	Alt C3	Alt C4	RPA
Core Forest F020 (39.49 acres) - Maple-Beech-Birch					
Forest Acres Affected	3.9	3.4	4.5	3.9	3.6
Total Core Forest Area	6.2	6.2	6.2	6.2	6.2
Remaining Core Forest Area	5.9	6.0	6.2	5.9	6.2
Impact on Core Forest	0.3	0.2	0	0.3	0
Core Forest F042 (29.46 acres) – Maple-Beech-Birch					
Forest Acres Affected	7.5	6.8	2.0	7.3	6
Total Core Forest Area	2.1	2.1	2.1	2.1	2.1
Remaining Core Forest Area	0	0	1.7	0	0
Impact on Core Forest	2.1	2.1	0.4	2.1	2.1
Core Forest F058 (25.95 acres) – Maple-Beech-Birch					
Forest Acres Affected	1.9	8.8	1.2	8.8	9.3
Total Core Forest Area	5.2	5.2	5.2	5.2	5.3
Remaining Core Forest Area	4.1	0	4.4	0	0
Impact on Core Forest	1.1	5.2	0.8	5.2	5.3
Core Forest F065 (22.41 acres) – Maple-Beech-Birch					
Forest Acres Affected	2.1	2.0	1.1	2.0	2.1
Total Core Forest Area	6.1	6.1	6.1	6.1	6.1
Remaining Core Forest Area	5.0	5.0	5.5	5.0	5.1
Impact on Core Forest	1.1	1.1	0.6	1.1	1.0
Core Forest F076 (36.78 acres) – Maple-Beech-Birch					
Forest Acres Affected	6.6	6.6	1.2	6.6	6.7
Total Core Forest Area	15.7	15.7	15.7	15.7	15.8
Remaining Core Forest Area	12.6	12.6	15.0	12.6	12.7
Impact on Core Forest	3.1	3.1	0.7	3.1	3.1
Total Impact on Core Forest Habitat Acres	7.7	11.7	2.5	11.8	11.5
Total Remaining Core Forest Habitat Acres	27.6	23.6	32.8	23.5	23.8

Note: "Impact on Core Forest" was obtained by subtracting the "Remaining Core Forest" from the "Total Core Forest Area."
 "0" values for Core Forests F042 and F058 reflect remaining core forest acreage of less than one acre.



Indirect Impacts

Indirect impacts could occur if forested land is used for commercial or residential development that is induced as a result of I-69 Section 6. The primary induced land use changes were identified by a Land Use Panel consisting of planning officials and economic development specialists. See **Appendix Y**, which describes the work of the Land Use Panel. Indirect and cumulative impacts are addressed in detail in **Section 5.24**. **Appendix V** documents the induced growth forecasts in the I-69 Section 6 study area as part of the indirect impact analysis.

The total estimated induced growth impacts for this project are 337 acres for Alternatives C1, C3, C4, and the RPA, and 356 acres for Alternative C2. Of this, 65 to 83 acres are estimated to be increased densities on developed land, 207 to 209 acres are agricultural land, and 63 to 66 acres are forest land. See **Table 5.24-3**.

5.20.4 Mitigation

All I-69 Section 6 alternatives follow the existing SR 37 corridor, which has previously been disturbed by transportation use. The use of an existing transportation facility minimizes the direct impacts and fragmentation to forests when compared to new terrain alternatives. In addition, where possible, efforts were made to minimize impacts to forests in the development of interchanges and local service roads.

Forests are not a regulated resource and do not generally require mitigation. However, mitigation for forests may be required if there is a connection to another regulatory requirement. For example, forested wetlands require mitigation as part of the Clean Water Act. In addition, forest serves as habitat for endangered bat species and impacts to forest act as a surrogate to measure potential impacts to these bats.

In the Tier 1 Record of Decision (ROD), INDOT committed to mitigate upland forest impacts at a 3 to 1 ratio for the I-69 Evansville to Indianapolis project. This commitment considers upland forests as all those not classified as wetlands. INDOT and FHWA offered this level of mitigation as environmental stewardship to assure adequate habitat for the Indiana bat and northern long-eared bat as well as other species. The implementation of this commitment was required under the Terms and Conditions of the I-69 Revised BO for Tier 1 issued by the USFWS under the authority of Section 7 of the Endangered Species Act (ESA).

INDOT and FHWA committed to mitigate impacts to upland forests at a 3 to 1 ratio averaged over the entire length of the I-69 study area, which includes a 1 to 1 ratio of replacement plus a 2 to 1 ratio of forest preservation (see **Section 7.2**). Actual ratios within each individual section may vary from the overall average. Areas converted to mitigation land will no longer be available for timbering activities. Therefore, these lands will be taken out of production for forest products. Mitigation of forest impacts is discussed in further detail in **Chapter 7, Mitigation and Commitments**.



For purposes of this analysis, reforestation would be at a 1 to 1 ratio, and preservation of existing forest at a 2 to 1 ratio within I-69 Section 6. Reforestation required for each alternative would be approximately 159 acres for the RPA, 136 acres for Alternative C1, 146 acres for Alternative C2, 102 acres for Alternative C3, and 145 acres for Alternative C4. This reforestation would be accomplished by the conversion of agricultural land to forested land.

Conversion of agricultural land is anticipated for mitigation of direct impacts to wetlands, including forested wetlands, within I-69 Section 6. Some forested areas are also classified as wetlands. Wetlands would be replaced in accordance with the Memorandum of Understanding (MOU) between INDOT, USFWS, and the Indiana Department of Natural Resources (IDNR), dated January 28, 1991, or any successor agreement entered into by these agencies. A copy of the MOU is provided in **Appendix S**. Under the 1991 MOU, emergent and scrub/shrub wetlands would be mitigated at a ratio of 2 to 1 or 3 to 1 and forested wetlands would be mitigated at a ratio of 3 to 1 or 4 to 1. Ratios used to determine mitigation would depend upon the quality of the resource. In the case of any forested wetlands, it is anticipated that a 3 to 1 ratio would apply. These mitigation requirements for forested wetlands are detailed in **Section 5.19**.

An IDNR Construction in a Floodway permit would require mitigation of forested habitat within the floodway. If the forests are identified as non-wetland forests in a floodway, a 2 to 1 replacement or 10 to 1 preservation ratio would apply. If needed, the necessary permit would be secured before or during the design phase of the project.

During the Tier 1 studies, potential mitigation sites were identified which offered opportunities for habitat restoration and/or preservation. Large, existing forest and wetland complexes may be used as potential mitigation sites with the goal of increasing core forest and reducing fragmentation. The *Revised Tier 1 Conceptual Forest and Wetland Mitigation Plan & Comparison of Tier 1 Plans* in **Appendix Q** identify the general location of potential mitigation sites for the design and planting of upland forest.

In the vicinity of I-69 Section 6, the White River (Clear Creek), White River (Crooked Creek), and White River (Pleasant Run) were identified as potential mitigation sites. Potential mitigation sites are being investigated in these focus areas and within the White River floodplain. Mitigation in these areas would increase the amount of core forest and provide habitat for the Indiana bat, northern long-eared bat, and other species. Additional mitigation sites may be identified during the remaining stages of project development.

An overall I-69 mitigation tracking method has been developed in consultation with permitting agencies and the United States Environmental Protection Agency (USEPA). The tracking is accomplished using a database with a GIS component. INDOT has coordinated with agencies to identify agency-specific information to be included in the database for tracking. Information on purchased, constructed, and potential mitigation sites, as well as the anticipated natural resource mitigation required and available credits of I-69, are continually being updated within the tracking system.



5.20.5 Summary

Impacts of alternatives to upland forests vary from approximately 102 acres (Alternative C3) to 159 acres (RPA). Upland forest impacted would be mitigated at a 3 to 1 ratio (with the goal of 1 to 1 replacement and 2 to 1 preservation). Therefore, the range of impacts would require mitigation of approximately 306 acres to 477 acres, depending on the alternative selected. The Revised Tier 1 Conceptual Forest and Wetland Mitigation and Enhancement Plan, located in **Appendix Q**, identifies the general location of potential mitigation sites for the design and construction of wetlands and upland forest. For I-69 Section 6, the primary sites are along the floodplain of the White River and its tributaries. Other areas may also be identified.

Five forests containing core forest habitat were identified as being impacted by the I-69 Section 6 Alternatives. Impacts to core forest habitat range from 2.5 acres (Alternative C3) to 11.8 acres (Alternative C4). **Table 5.20-5** summarizes the potential direct impacts to forest areas for each alternative, and provides the approximate acres of forest mitigation associated with the impacts of each alternative.

Table 5.20-5: Summary of Forest Impacts and Potential Mitigation, by Forest Classification and Alternative

USDA Forest Classification	Acres of Forest in Study Area	Acres in Right of Way				
		Alt C1	Alt C2	Alt C3	Alt C4	RPA
Elm-Ash-Cottonwood	125	50	58	46	52	60
Maple-Beech-Birch	144	72	75	46	78	80
Oak-Hickory	16	10	9	5	10	11
White-Red-Jack Pine	8	7	7	6	7	7
Non-Native Dominant Stand	2	1	1	1	1	2
Total Forest Acres in Study Area*	295	138	148	103	146	160
Percent of Forest Acres in Study Area	100%	47%	50%	35%	49%	54%
Forested Wetland Impacts** (included in Total Forest Impacts)	3.30	2.17	2.00	1.87	1.82	1.70
Upland Forest Impacts*** (included in Total Forest Impacts)	292	136	146	102	145	159
Approximate Upland Forest Mitigation (acres) - 3 to 1 ratio		408	438	306	435	477
Core Forest: Acres of Reduction		7.7	11.7	2.5	11.8	11.5

* Total acres of forest in study area include wetland forests and upland forests.

**Forested wetland impacts will be mitigated per the Wetlands MOU and are discussed in Section 5.19, Water Resources.

***Totals may not match this number exactly due to rounding.

Figure 5.20-3: Impacts to Core Forest F020

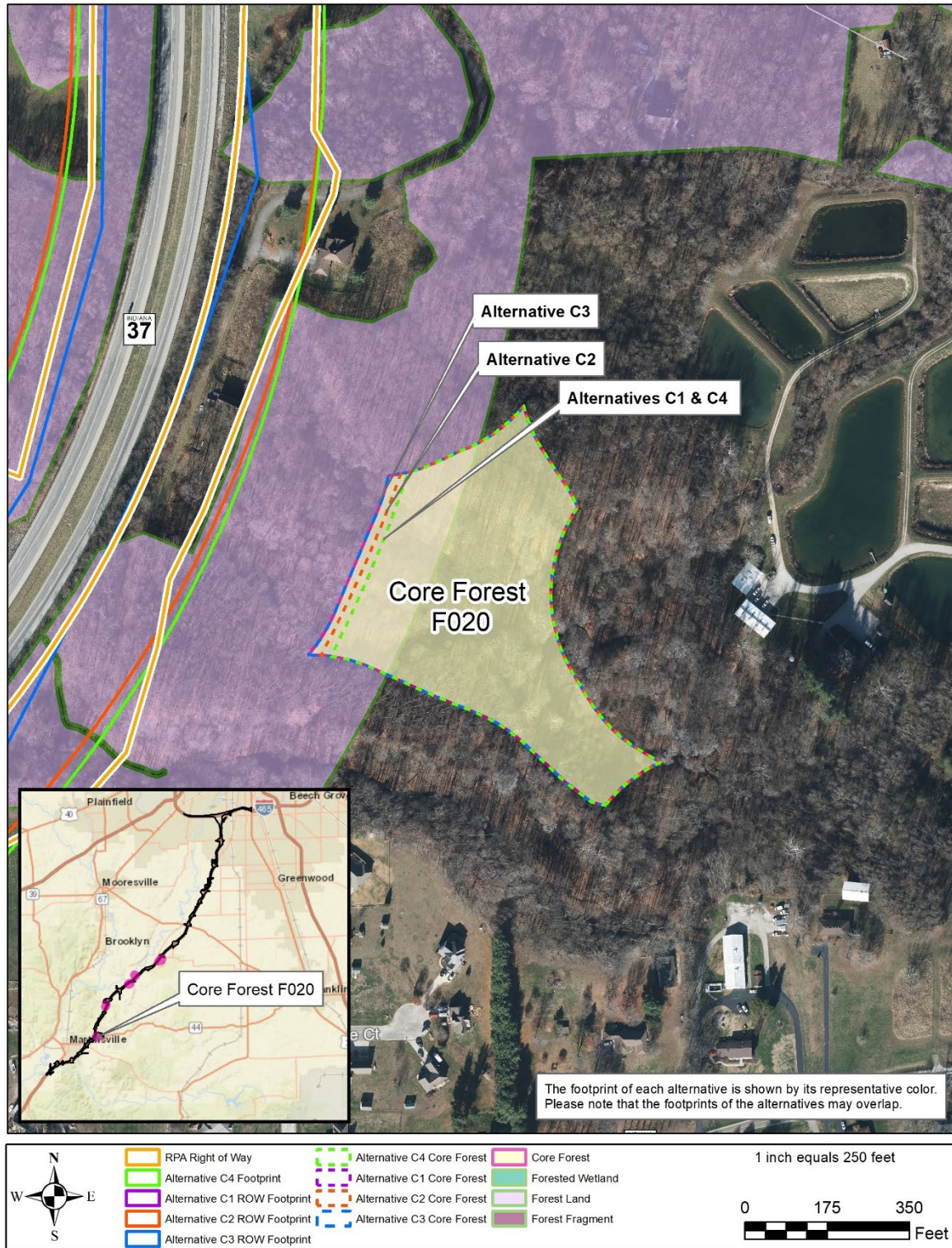




Figure 5.20-4: Impacts to Core Forest F042

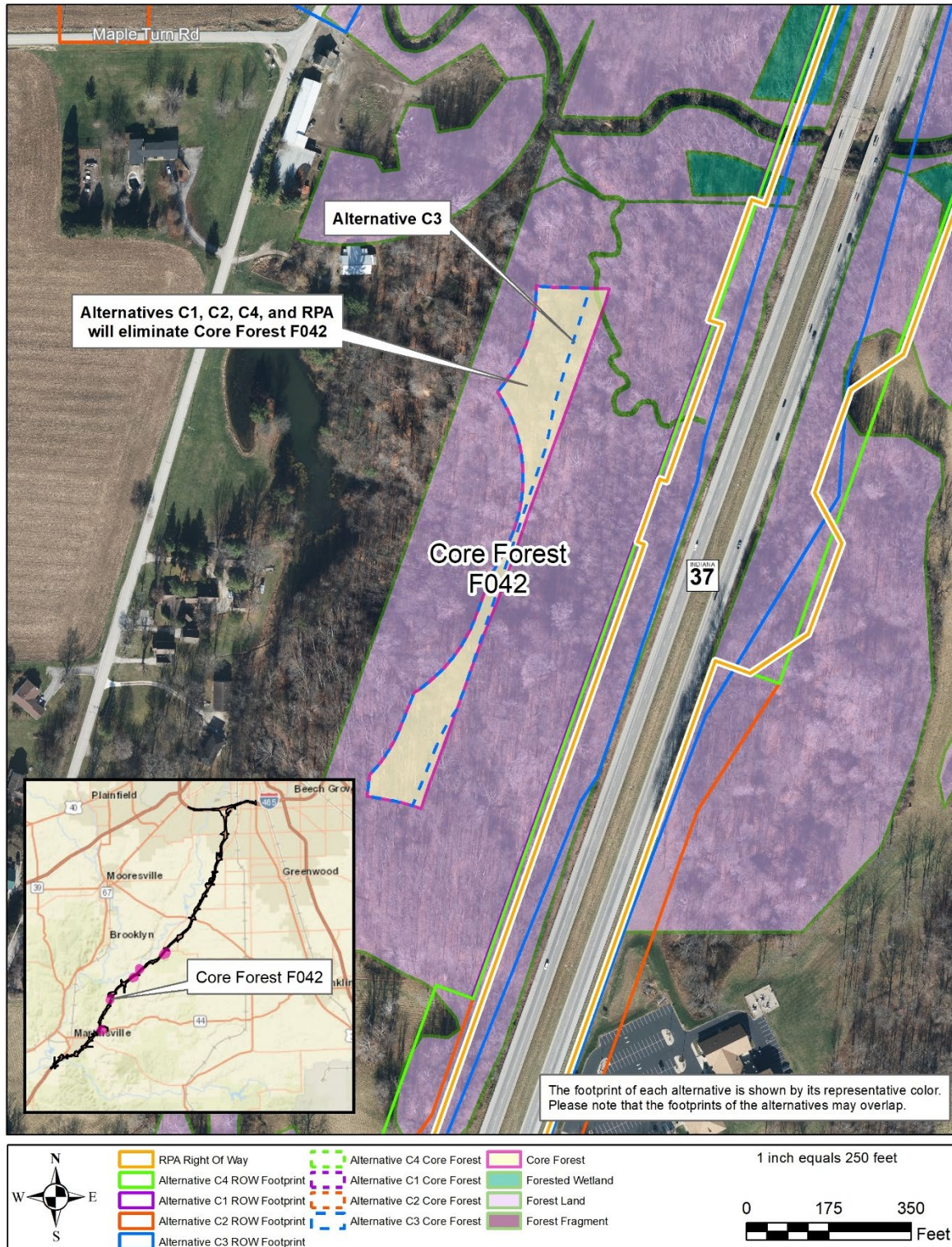


Figure 5.20-5: Impacts to Core Forest F058

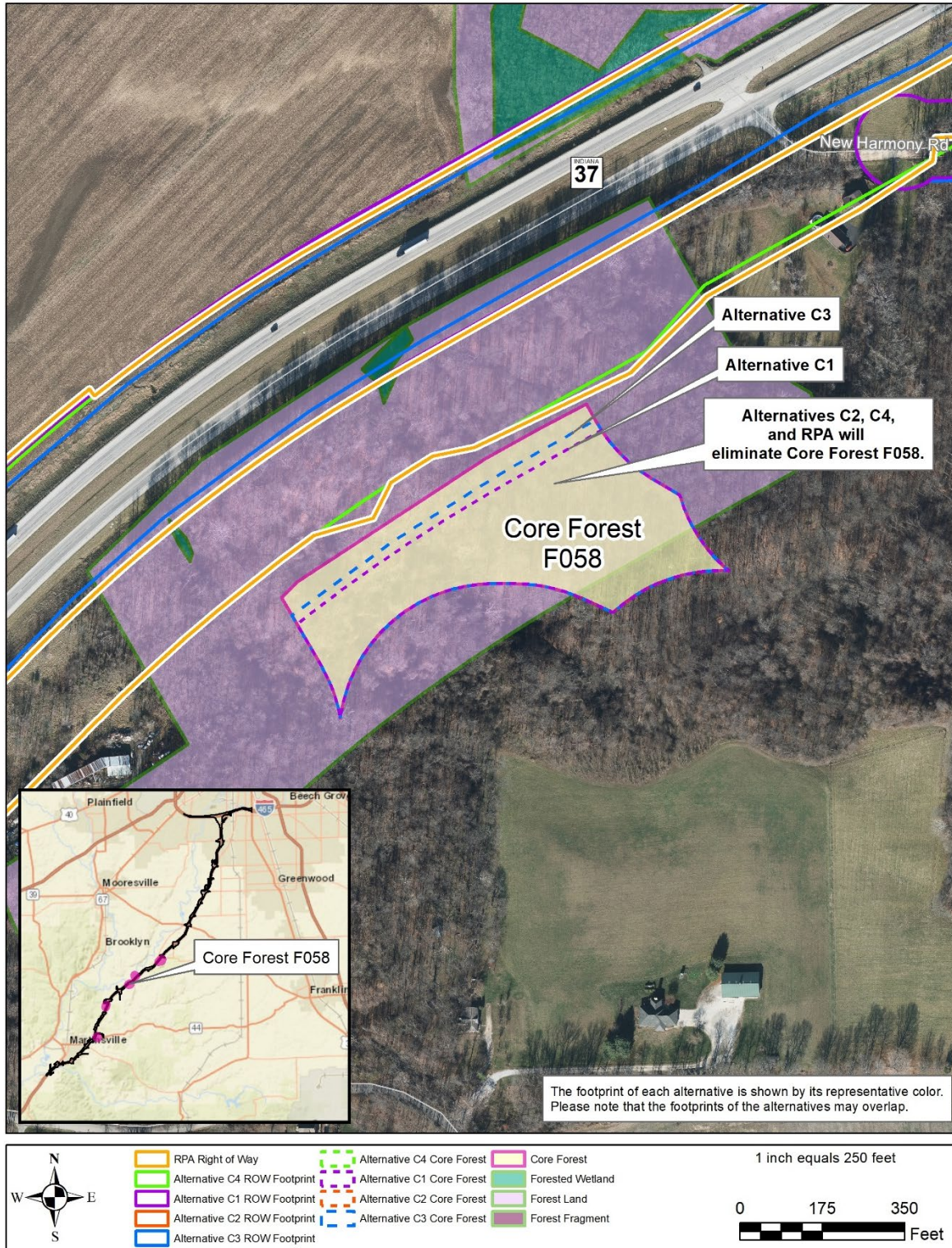




Figure 5.20-6: Impacts to Core Forest F065

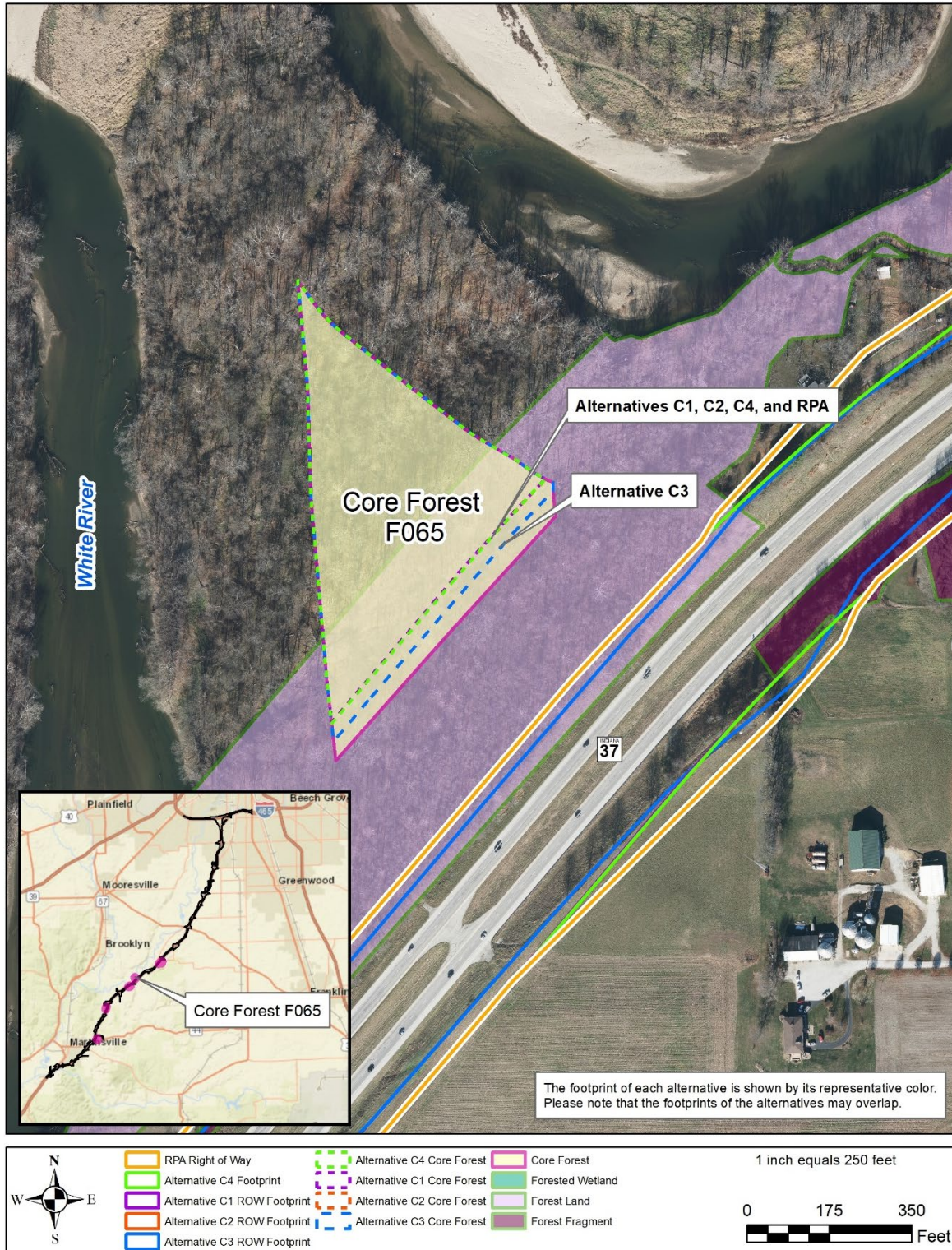


Figure 5.20-7: Impacts to Core Forest F076

