Table B1. Project deconstruction, anticipated direct and indirect environmental consequences, and likely responses of exposed bats (2013).

Project Element	Associated Direct and Indirect Environmental Consequences	Likely Responses of Exposed Bats/Colonies/Pops.	Is Take Reasonably Certain to Occur?
CONSTRUCTION			
Site Preparation: clearing, blasting, cutting, filling,	Permanent direct loss of suitable roosting and foraging habitat in SAA (summer habitat)	0,4,5,6,7,9,10,11,12	yes
grading, and surfacing for interstate, interchanges,	Permanent direct loss of suitable roosting and foraging habitat in WAA (swarming habitat)	0,4,5,6,7,8,12	yes
connector roads, frontage roads, and rest areas.	Variable loss/reduction of forested connectivity/travel corridors	0,4,5,6,7,9	yes
	Introduction of novel day/night-time construction noise,light, and dust (e.g., heavy equip. and blasting)	0,1,3,4,5,6,7,9,10,11,12	yes
	Direct degradation of surface water quality (e.g., increased siltation/turbidity) in streams	0,6,7	no
	Direct loss and/or degradation of 20 acres of existing non-forested wetlands	0,5,6,7,	no
	Direct impacts or degradation of non-hibernacula, karst features and ground water resources	0,6	no
	Potential forest loss from borrow areas, rock quarries, and sand/gravel pits used for road materials	0-7,9,10,11,12	yes
Demolition of existing bridges in SAA	Potential loss of roost sites beneath bridges	0,1,3,4,6	no
Construction of bat-friendly bridges in SAA	Potential net gain in day/night roost sites for bats	0,6,8,13,14	no
Revegetation of disturbed areas	Long-term protection against erosion, some insect production	0,6	no
Relocation of homes & businesses/Demo. of old	Addtnl. habitat loss/degradation and disturbances of bats during construction of new and demo. of old	0-7,9,10,11,12	yes
Landowner tree clearing prior to selling to INDOT	Addtnl. Roosting & foraging habitat loss/degradation and disturbances of bats; direct take	0-7,9,10,11,12	yes
Relocation of utilities crossing over/under I-69	Additional habitat loss/degradation and disturbances of bats (e.g., powerlines)	0-7,9,10,11,13	yes
OPERATION			
Vehicles driving on Interstate	Increased high-speed traffic through bat population centers leading to increased risk of roadkill	0,2,11,12	yes
(toll or non-toll)	Increased litter and noise/air/soil/light pollution from vehicles using I-69	0,6	no
	New and/or increased risk of accidental spills of hazardous materials occuring in action area	0,2,7,9,15	no
Stormwater diversion and retention	Degraded water quality from road runoff	0,15	no
Induced development	Degraded water quality from induced development (e.g., faulty septic systems, more NPDS dischargers)	0,5,6,7,9,	no
	Habitat loss/fragmentation/degradation near hibernacula/mat.colonies from induced development	0-7,9,10,11,12	yes
	Induced human population growth increases risk of human visitation and vandalism at hibernacula	0,1,2,3,4,6,7,12,15	yes
High-mast lighting at interchanges and urban areas	Increased light pollution	0,5,6	no
I-69 Community Planning Grant Progam	I-69 induced growth is managed under local land-use plans designed to be protective of environment	0-15	no
MAINTENANCE			
Annual winter applications of salt	Degradation of surface and ground water and potential reduction in aquatic insect abundance/diversity	0,5,6,7,9,	no
Annual summer mowing and herbicide use	Periodic noise, reduced vegetation and minimal reduction in insect abundance	0,1	no
Periodic resurfacing	Increased noise, night-time lighting, and dust	0,6	no
CONSERVATION MEASURES			
Purchase/protect existing forest in SAA	Permant protection of some important forest lands benefiting local maternity colonies	0,8,13,14	no
Plant and permanently protect new forest in SAA	Insures no net loss of forest habitat from direct impacts of I-69 (no mitigation of indirect impacts)	0,8,13,14	no
Purchase/protect swarming habitat in WAA	Permant protection of some important forest lands benefiting local swarming/hibernating populations	0,8,14	no
Plant and permanently protect new forest in WAA	Insures no net loss of forest habitat from direct impacts of I-69 (no mitigation of indirect impacts)	0,8,14	no
Purchase/protection of hibernacula in WAA	Permant protection of important caves used by local hibernating populations	0,8,14	no
Install gates and signs at hibernacula in WAA	Reduces risk of unauthorized visitation/disturbance/vandalism of hibernacula and hibernating bats	0,8,14	no
Conduct additional bat research and monitoring	Knowledge gained will improve current management of hibernacula and maternity habitats	0,8,13,14	no
Protective fencing put beneath bridge/roost site	Reduced incidence of vandalism and human disturbance	0,8,13,14	no
Wetland mitigation and Wetland MOU	Insures no net loss of wetlands from direct impacts from I-69 (no mitigation of indirect impacts)	0,8,13,14	no
Karst studies and implementation of Karst MOU	Insures protection of sensitive karst resources	0,8,13,14	no
Creation of educational materials and displays	Increased protection of Indiana bats stemming from impoved public awareness/education	0,8,13,14	no
GIS data made available to public and agencies	Greater awareness/protection of sensitive resources identified during I-69 planning	0,8,13,14	no

Key

0. no response
1. startled: increased respiration/heart rate
2. death/injury of adults and/or offspring
3. flees from roost during daylight / ↑predation risk
4. abandons roost site(s)
5. abandons foraging areas
6. shifts focal roosting and/or foraging areas
7. ↑ energy expenditures / ↓ fitness (short-term)
8. ↓ energy expenditures / ↑ fitness (long-term)
9. aborted pregnancy/repro. failure
10. ↑torpor, delayed development/partuition, and/or delayed sexual maturation of offspring
11. short-term ↓ colony reproductive rate (3-4 seasons)
12. short-term ↓ in colony/hibernaculum size (3-4 seasons)
13. long-term ↑ colony reproductive rate
14. long-term ↑ in colony/hibernaculum size/fitness level
15. long-term ↓ in colony/hibernaculum size/fitness level

n/a not applicable

Table B2. Updated Impacts to Tree Cover in the Summer and Winter Action Areas - 2013 (bold font indicates higher levels of concern; grey shading indicates updated information).

Area Name	Existing Amount of Tree Cover (acres)	Current % of Tree Cover[1]	Updated (Sec. 1-5) Direct Loss of Tree Cover (acres)	Net change since Tier 1	Indirect Loss of Tree Cover (acres)	Sum of I-69 related Losses to Tree Cover (acres)	% of Tree Cover after I-69	Net Loss in Existing Tree Cover caused by I-69	Estimated Cumulative Loss of Tree Cover (acres)	Total Loss of Tree Cover from I-69 and Cumulative Impacts by 2030 (acres)	Total % Tree Cover Left after I-69 and Cumulative Impacts by 2030[2]	Net Decrease in % Tree Cover by 2030
Source:	Tier 1 BA Addendum Table 7 and Tier 2 BAs if applicable					calculated	calculated	calculated	BAA T- 7/Tier 2 BA	calculated	calculated	calculated
Pigeon Creek	1,944	**15.5%**	10	-19	1	11	15.4%	0.1%	279	290	**13.2%**	**2.3%**
Patoka River	3,982	31.7%	20	1	0	20	31.5%	0.2%	24	44	31.3%	0.4%
Flat Creek[7]	5,426	43.2%	76	-16	0	76	42.6%	0.6%	6	82	42.5%	0.7%
East Fork	3,116	**24.8%**	42	-8	0	42	24.5%	0.3%	5	47	24.4%	0.4%
Veale Creek	2,437	**19.4%**	20	0	2	22	19.2%	0.2%	6	28	**19.2%**	0.2%
West Fork (Elnora)	1,319	**10.5%**	0	-3	1	1	10.5%	0.0%	25	26	**10.3%**	0.2%
Doans Creek	8,099	64.5%	84	-11	3	87	63.8%	0.7%	3	90	63.7%	0.7%
Plummer Creek	8,550	68.0%	**207**	**14**	1	208	66.4%	**1.7%**	5	213	66.3%	1.7%
Little Clifty Branch[8] (2010)	8,825	70.2%	252		8	260	68.2%	2.1%	16	276	68.0%	2.2%
Indian Creek	7,549	60.1%	**315**	**-44**	9	324	57.5%	**2.6%**	26	350	57.3%	2.8%
Beanblossom Creek NP[8] (2012)	8,371	66.6%	**0**		0	0	66.6%	**0.0%**	62	62	66.1%	0.5%
W. Fork (Bryant Creek)[9]	4,710	37.5%	66.4	40.6	0.9	67	36.9%	0.5%	6	73	36.9%	0.6%
Lambs Creek[8] (2012)	5,058	40.3%	7.1		0.1	7	40.2%	0.1%	36	43	39.9%	0.3%
W. Fork (Clear Creek)	5,375	42.8%	99		0	99	42.0%	0.8%	26	125	41.8%	1.0%
W. Fork (Crooked Creek)	3,722	**29.6%**	**170**		0	170	28.3%	**1.4%**	44	214	**27.9%**	**1.7%**
W. Fork (Pleasant Run)	2,276	**18.1%**	29		4	33	17.8%	0.3%	83	116	**17.2%**	0.9%
Totals[6]:	80,759		1,368	-45	30	1,398			652	2,050		
Averages:	5,047.4	40.2%	87.3		1.9	89.2	39.5%	0.7%	40.8	130.0	39.1%	1.0%
Expanded Remaining Summer Action Area[4] (excluding WAA overlap)	62,307	17.6%	862		58	920	17.6%	0.0%	798	1,718	17.4%	0.2%
Expanded Winter Action Area[5]	148,182	60.4%	1,267		70	1,337	60.5%	-0.1%	1,563	2,900	59.9%	0.5%

1. 12,566 acres in a 2.5-mile radius maternity circle.
2. proposed forest mitigation acreages or other potential gains in forest have not been included here.
3. This relative ranking is largely based on current and predicted levels of forest habitat, connectivity of existing habitat, and proximity to rapidly developing areas.
4. A total of 353,574 acres comprise the Expanded Remaining SAA (minus the WAA overlap and maternity colony areas);

   Numbers in this row are derived from Tier 1 and Tier 2 Forest Data (i.e., not "Tree Cover"). Sections 1,5,and 6 do not have "Expanded" remaining SAA forest acreage calculated, so Tier 1 info was used.
5. A total of 245,484 acres comprise the collective Expanded Winter Action Area; acreages for the Expanded WAA are in Tree Cover. Tree cover impacts include new utility info for Sec. 4 & 5 and billboard impacts. Updated 5/2013.
6. Overlap areas for four maternity colonies have been subtracted from the direct forest impact totals; there may be very minimal double-counting in the cumulative impacts total due to these overlap areas.
7. The interchange in the Flat Creek maternity area is no longer proposed, so indirect impacts have been reduced in Tier 2.
8. New maternity colonies; habitat impacts in the area of these colonies were already accounted for in Tier 1, but are now addressed at the maternity colony level instead of part of the Remaining Summer Action Area.
9. Updates to the Bryant Creek colony impacts include 11.5 acres of utility impacts

Table B3. Summary of impacts to Indiana bat maternity colonies (n=16) along I-69. (Updated April 2013)

Colony Name	Percent of the MA* that is currently tree covered/ forested	Percent of existing tree cover that is "core forest"	Size of the biggest, connected forest patch within the MA (acres)	In general, how well connected are all the existing forest patches in the MA?	In general, how well connected are the existing patches of Core Forest in the MA?	What is the FWS's overall perceived adequacy of this colony's current habitat?	How much tree cover will be lost to direct/ indirect/ cumulative impacts? (acres)	Will I-69 run through the center of a known or likely roosting area within the MA?	Will any of the identified roosts (n=36) be directly destroyed by I-69?	Is it likely that a primary roost tree(s) will be directly lost?	Is it likely that a primary roost tree(s) will be indirectly lost?	Is a proposed interchange within the MA? If so, is it near the center of the MA?	Once I-69 is operational, are most forested areas in the MA likely to remain for another 50 years?	Is this colony likely to persist into the reasonably foreseeable future once I-69 and forest mitigation are done?	If displaced by I-69 &/or other development, is additional maternity habitat available nearby?
Pigeon Creek	15%	7%	1,139	POOR	FAIR	FAIR	10 / 1 / 279	NO	NO	NO	NO	YES/NO	UNCERTAIN	YES	YES
Patoka River	32%	17%	3,855	GOOD	GOOD	GOOD	20 / 0 / 24	NO	NO	NO	NO	NO	YES	YES	YES
Flat Creek	43%	34%	5,385	GOOD	GOOD	GOOD	76 / 0 / 6	NO	NO	UNK.	NO	NO	YES	YES	YES
East Fork	25%	7%	1,748	FAIR	POOR	FAIR	42 / 0 / 5	NO	NO	UNK.	NO	NO	YES	YES	YES
Veale Creek	19%	6%	1,423	FAIR	FAIR	FAIR	20 / 2 / 6	VERY CLOSE	NO	NO	NO	YES/NO	YES	YES	YES
West Fork (Elnora)	10%	2%***	303	GOOD	FAIR	FAIR	0 / 1 / 25	NO	NO	NO	NO	YES/NO	YES	YES	YES
Doans Creek	64%	33%	8,088	GOOD	GOOD	GOOD	84 / 3 / 3	NO	NO	NO	NO	NO	YES	YES	YES
Little Clifty Branch**	70%	26%	8,824	GOOD	GOOD	GOOD	252 / 8 / 16	YES	YES	YES	NO	YES/YES	YES	YES	YES
Plummer Creek	68%	34%	8,542	GOOD	GOOD	GOOD	207 / 1 / 5	NO	NO	NO	NO	NO	YES	YES	YES
Indian Creek	60%	22%	7,540	GOOD	GOOD	GOOD	315 / 9 / 26	CLOSE	NO	UNK.	NO	YES/NO	YES	YES	YES
Beanblossom Nature Preserve***	67%	39%	8,354	EXCELLENT	GOOD	GOOD	0 / 0 / 62	NO	NO	NO	NO	NO	YES	YES	YES
W. Fork (Bryant Creek)	37%	18%	4,091	GOOD	GOOD	GOOD	66 / 1 / 6	NO	NO	NO	NO	YES/NO	YES	YES	YES
Lambs Creek***	40%	19%	4,449	GOOD	GOOD	GOOD	7 / 0 / 36	NO	NO	NO	NO	YES/NO	YES	YES	YES
W. Fork (Clear Creek)	43%	18%	4,944	GOOD	GOOD	GOOD	99 / 0 / 26	YES	NO	UNK.	NO	YES/NO	YES	YES	YES
W. Fork (Crooked Creek)	30%	9%	3,046	GOOD	POOR	FAIR	170 / 0 / 44	NO	NO	NO	NO	NO	YES	YES	YES
W. Fork (Pleasant Run)	18%	2%	1,533	FAIR	POOR	FAIR	29 / 4 / 83	NO	NO	NO	NO	YES/NO	UNCERTAIN	YES	YES

* MA = maternity area

** New maternity colony found in 2010

***New colony found in 2012

Table B4. Updated Estimated levels of Incidental Take by stressor for Indiana bats during the Summer (2013).

Relevant Stressors to Bats in SAA (estimated through year 2030)	Estimated Amount or Area under Stress*	FEMALE AND JUVENILE BATS IN MATERNITY COLONY AREAS (160 bats/colony/year)																																MALES						
		Pigeon Creek		Patoka River		Flat Creek		East Fork		Veale Creek		W. Fork (Elnora)		Doans Creek		Plummer Creek		Little Clifty Branch[4]		Indian Creek		Beanblossom Nature Preserve		W. Fork (Bryant Creek)		Lambs Creek		W. Fork (Clear Creek)		W. Fork (Crooked Creek)		W. Fork (Pleasant Run)		Take Subtotal	In WAA in summer		In remaining SAA*		Take Subtotal	Total Take	Likely Form(s) of Take[3]
		E[1]	T[2]	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T		E	T	E	T			
I-69 Direct Impacts/Loss of Roosting Habitat (seasonal cutting restrictions observed so no direct killing anticipated)	1973 ac.	80	2	60	2	80	4	120	2	80	2	0	0	40	2	60	4	160	6	160	10	0	0	40	2	20	0	160	2	160	10	80	2	50	190	0	65	0	0	50	h
I-69 Direct Impact/Loss of Foraging Habitat/Connectivity	1973 ac.	80	2	60	2	80	1	120	2	60	2	0	0	40	0	60	1	160	2	160	4	0	0	40	0	20	0	160	1	160	2	80	0	19	190	3	65	1	4	23	h
Construction Noise/Vibrations causing bats to stress and flee roosts, ↑ risk of predation (while bats are present in adjacent areas)	-	80	1	60	1	160	2	120	2	160	3	0	0	40	1	60	1	160	2	160	2	0	0	40	0	20	0	160	1	160	2	80	1	19	190	3	65	1	4	23	H
Disturbance & Habitat Loss associated w/ Demolition and Relocation of 390 Homes & 76 Businesses (no timing restrictions)	unk.																																	40					5	45	H,w,k,h
Habitat loss from I-69 related Utility Relocations (seasonal restrictions will be in place so no direct mortality expected)[5]	Est. 225 ac. total for Sec. 1-3	0	0	80	0	80	0	80	0	80	0	0	0	80	1	80	1	80	1	80	1	0	0	80	1	20	0	80	1	80	1	80	1	8	6	0	6	0	0	8	H,h
Additional High-speed traffic / Roadkill (total roadkill/maternity colony from 2013 through 2030)	5% risk over 17 years	160	8	160	8	160	8	160	8	160	8	0	0	160	8	160	8	160	8	160	8	0	0	160	8	160	8	160	8	160	8	160	8	112	380	19	130	7	26	138	k
I-69 Indirect/Induced Loss of Roosting and Foraging Habitat (no restrictions/bats present)	29 ac. in MAs	40	1	20	0	80	1	0	0	80	1	0	0	60	1	80	1	80	3	80	3	0	0	20	0	20	0	0	0	0	0	80	2	13	21	1	8	1	2	15	H,w,k,h
Increased levels of Disturbance/Vandalism of Roosting Bats in ungated Hibernacula during the summer	unk.																																	0	500	5	0	0	5	5	H, w, k
TOTAL of Direct and Indirect from I-69			14		13		16		14		16		0		13		16		22		28		0		11		8		13		23		14	**261**		31		10	**46**	**307**	
TOTAL Cumulative Effects (all sources through 2030)	692 ac in MAs	160	0	160	0	160	0	120	0	160	0	160	0	160	0	160	0	160	2	160	2	160	2	160	1	160	1	160	2	160	4	160	8	**22**	130	2	58	2	**4**	**26**	H,w,k,h
TOTALS Direct and Indirect + Cumulative			14		13		16		14		16		0		13		16		24		30		2		12		9		15		27		22	**283**		33		12	**50**	**333**	

Updated based on revised Appendix D of Sec. 3 BA

* with billboard impacts added in for Sec.5.

[1] E = estimated annual # of exposed bats (for colonies the maximum number exposed = 160/year; for adult males, densities were used to estimate potential exposure…with 0.17 males/impacted acre in the WAA and 0.085 males/acre in the SAA; density of males exposed was adjusted using 2009 population estimates, although these numbers are expected to fluctuate some from year to year.)

[2] T = maximum estimated number of exposed bats that may be taken from 2008-2030.

[3] H = harrass, w = wound, k = kill, and h = harm, which includes significant habitat modification or degradation resulting in death, or injury by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.

[4] Gray shading = New maternity colony area identified in 2010 & 2012

[5] Utility locations have been confirmed for Sections 1 and 3 and will not occur within the maternity colony areas for those Sections

Table B5. Updated Estimated levels of Incidental Take by stressor for Indiana bats during spring, fall, and winter (2013).

Project Phase	Relevant Stressors to Bats in WAA (estimated through year 2030)	Estimated Amount or Area of Stressor	HIBERNACULA* in WAA																						Total Take of Bats†	Likely Form(s) of Take[3]
			Buckner		Coon		Grotto		King Blair		Leonard Springs		Saltpeter		Sexton Springs		Sullivan		Reeves		Primitive Baptist		Storm's Pit		Ray's			
			E[1]	T[2]	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T		
	I-69 Direct Impacts/Loss of Roosting Habitat (seasonal cutting restrictions observed so no direct killing anticipated)	1234 ac.	58	0	30,496	16	7,849	4	218	0	31	1	48	1	86	1	18	0	17	0	1	0	48	0	49,617	0	23	h
	I-69 Direct Impact/Loss of Foraging Habitat/Connectivity	1234 ac.	58	0	30,496	0	7,849	0	218	0	31		48		86		18		17	0	1	0	48	0	49,617	0	0	h
	Construction Noise/Vibrations causing bats to stress and flee roosts, ↑ risk of predation (while bats are present in adjacent areas)	1234 ac.	58	0	30,496	0	7,849	0	218	0	31		48		86		18		17	0	1	0	48	0	49,617	0	0	H
	Disturbance & Habitat Loss from Demo. & Relocation of 390 Homes & 76 Businesses	unk.																									15	H,w,k,h
	Habitat loss from I-69 related Utility Relocations (seasonal restrictions/no direct take anticipated)	unk.	58	0	30,496	0	7,849	0	218	0	31	0	48	0	86	0	18	0	17	0	1	0	48	0	49,617	0	0	H,w,h
	Additional High-speed traffic / Roadkill (total from 2013 through 2030)	.25% risk over 17 years	58	0	30,496	76	7,849	20	218	1	31	0	48	0	86	0	18	0	17	0	1	0	48	0	49,617	124	221	k
	I-69 Indirect/Induced Loss of Roosting and Foraging Habitat (no restrictions/bats present)	70 ac.	58	0	30,496	0	7,849	0	218	0	31		48		86		18		17	0	1	0	48	0	49,617	1	1	H,w,k,h
	Increased risk levels of Winter Disturbance/Vandalism of Hibernating Bats in vulnerable Hibernacula[4]	1% increase in risk	58	1	30,496	0**	7,849	0**	218	2	31	0	48	0	86	1	18	0	17	0	1	0	48	0	49,617	496	501	H, w, k
	TOTAL of Direct and Indirect from I-69			1		92		24		3		1		2		2		0		0		0		1		621	**761**	
	Cumulative Effects of Winter Disturbance/Vandalism of Hibernating Bats in vulnerable Hibernacula	1% over the span of 20+ years	58	1	30,496	0**	7,849	0**	218	2	31	1	48	1	86	1	18	0	17	0	1	0	48	0	49,617	496	502	H, w, k
	Cumulative Effects of ongoing Roadkill (total roadkill/hibernating pop. from 2013 through 2030)	.25% risk over 17 years	58	0	30,496	76	7,849	20	218	1	31	0	48	0	86	0	18	0	17	0	1	0	48	0	49,617	124	221	H, w, k
	Cumulative Effects of Forest Habitat Loss/Degradation, surrounding Hibernacula associated (through 2030)	1563 ac.	58	5	30,496	10	7,849	19	218	16	31	4	48	7	86	13	18	1	17	5	1	1	48	2	49,617	9	92	H,w,k,h
	TOTAL of Cumulative			6		86		39		19		5		8		14		1		5		1		2		629	**815**	
	TOTALS Direct and Indirect + Cumulative			7		178		62		22		6		10		16		1		5		1		3		1,250	**1,577**	

***** Ashcraft and Salamander caves were not included as they did not contain winter populations in 2009. Similarly, Ozzy's Hole Cave was not included as it was not analyzed in the BA Addendum since it was recently found and only contained 1 Indiana bat.

****** Permanent conservation easements have been placed on the property and these caves are no longer considered vulnerable to human disturbances

† We are assuming that half of the take would involve adult males and half adult females (i.e., 50:50 sex ratio and no sexual bias in probability of occurrence).

[1] E = estimated annual # of exposed bats (used updated winter population numbers from 2011 and 2013 where available)

[2] T = maximum estimated number of exposed bats that may be taken from 2008-2030.

[3] H = harrass, w = wound, k = kill, and h = harm, which includes significant habitat modification or degradation resulting in death, or injury by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.

[4] Assumes worst-case scenario that cave owners will not allow their vulnerable caves to be gated.