



ECONOMIC ANALYSIS OF  
CRITICAL HABITAT  
DESIGNATION FOR THE  
HINE'S EMERALD DRAGONFLY

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prepared for:

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## EXECUTIVE SUMMARY

1. The purpose of this report is to identify and analyze the potential economic impacts associated with the proposed critical habitat designation for the Hine's Emerald Dragonfly (*Somatochlora hineana*, hereafter referred to as the dragonfly). This report was prepared by Industrial Economics, Incorporated (IEC), under contract to the U.S. Fish and Wildlife Service's (Service) Division of Economics.
2. The Service has identified 27,490 acres in Illinois, Michigan, Missouri, and Wisconsin as potential critical habitat for the dragonfly.<sup>1</sup> Of this acreage, the Service proposes to exclude from critical habitat designation approximately 14,269 acres, comprising two units in Michigan and all proposed units in Missouri. In the remainder of this report, the entire 27,490 acres are referred to as the study area.
3. Most of the study area is located in wetlands. Exhibits ES-8 and ES-9 at the end of the executive summary show the location of the Illinois units, which have the highest forecast costs. Appendix F contains full maps for the entire study area. The units proposed for designation are comprised of a mix of public and private lands, which account for 79 percent and 21 percent of the total area, respectively. Public land consists of Federal (e.g., U.S. Forest Service (USFS)), State (e.g., Wisconsin Department of Natural Resources) and local (e.g., Will County Forest Preserve District) land. Ninety-six percent of the land considered for exclusion is owned by the Federal government.
4. This analysis quantifies economic impacts of dragonfly conservation efforts associated with the following activities: (1) development, (2) water use, (3) utility and infrastructure maintenance, (4) road and railway use, (5) species management, and (6) recreation. The Key Findings are highlighted below. Exhibit ES-1 summarizes the quantitative results of this analysis. The relative magnitude of impacts to each type of affected activity are shown in Exhibits ES-2 through ES-4

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<sup>1</sup> For a description of the species and the primary constituent elements of its habitat, see the proposed rule. IEC and the Service have revised the acreage of Wisconsin Unit 1 from 503 acres (as reported in 71 FR 42442) to 157 acres, which reduces the total acreage reported in 71 FR 42442 from 27,689 acres to 27,343 acres. An additional unit, Wisconsin unit 11, was added since the publication of the proposed rule and brings the total acreage to 27,490.

## KEY FINDINGS

**Total future impacts:** The draft economic analysis forecasts future costs associated with conservation efforts for the dragonfly in areas proposed for designation ranging from \$16.8 million to \$47.9 million (undiscounted) over the next 20 years. The present value of these impacts, applying a three percent discount rate, is \$13.4 million to \$35.6 million (\$0.9 million to \$2.4 million on an annualized basis); or \$10.7 million to \$26.0 million, applying a seven percent discount rate (\$1.0 million to \$2.5 million on an annualized basis). For past costs, see Appendix B.

**Quantified Impacts:** Because the types of conservation measures that will be implemented to mitigate threats posed by quarrying, ground and surface water depletion, and vehicle strikes are uncertain, this analysis presents a range of impact estimates. The high estimate assume that no quarrying will be allowed, water depletion will be mitigated by the construction of deep aquifer (municipal) wells, and speed limits will be imposed on local roads and railroads to reduce vehicular impacts. These activities account for 96 percent of the high total cost estimates. The low estimate assumes that quarrying is allowed as part of a Habitat Conservation Plan (HCP) and that neither deep aquifer wells nor vehicle slowing are instituted. Lost property values due to foregone residential development and expected expenditures to institute the HCP account for 77 percent of low total cost estimates.

**Development:** The cost of mitigating direct development threats, including residential, commercial (except quarrying), utilities, and roadway construction, are estimated to be \$4.0 million (undiscounted) based on current land values. Quarrying mitigation costs are estimated to be \$8.0 million. Preparation and implementation of the HCP is estimated to cost an additional \$1.1 million (undiscounted, low estimate). If quarrying is not allowed within the HCP, foregone quarry development values in Illinois Unit 2 are an estimated \$17.6 million (undiscounted, high estimate).

**Water use:** Water related administration costs are expected to be \$29,000 (undiscounted, low estimate). Costs of obtaining alternate sources of water are estimated to be \$7.0 million if water depletion is mitigated by new, deep aquifer wells (undiscounted, high estimate).

**Utility and road maintenance:** Costs are estimated for extra care that must be taken to protect against habitat degradation during routine maintenance; the majority of the \$1.5 million (undiscounted) costs are for this extra care in Illinois Units 1-5 and 7.

**Road and railway use:** The low estimate of \$1.8 million (undiscounted) primarily results from measures to restore degraded habitat and mitigate for the hydraulic pumping of sediment into habitat. The high estimate of \$16.2 million (undiscounted) would result from vehicle slowing measures to prevent vehicular collisions with adult dragonflies.

**Species management:** Activities required to manage invasive species, and other specific biological threats (feral hogs and beaver dams), are estimated to be \$474,000 (undiscounted) and are primarily for enclosure construction around habitat units.

**Recreation:** Habitat protection costs related to recreation activities are estimated to be \$19,000.

**Critical Habitat Units with the Highest Impacts:** The units with the largest projected impacts (low estimate, undiscounted dollars) are Illinois Units 2, 4, and 1, which together account for approximately 82 percent of the total costs. The units with the largest projected impacts (high estimate, undiscounted dollars) are Illinois Units 2, 7, and 1, which together account for approximately 86 percent of the total costs. (see Exhibit ES-8 and ES-9). These units contain activities potentially impacted by:

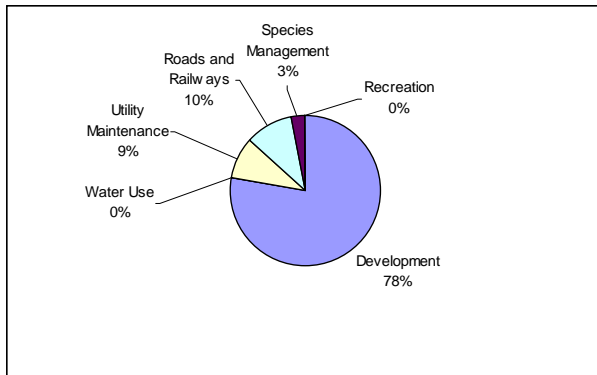
- Illinois Unit 2 contains a quarry owned by Material Services Corporation; quarrying mitigation will generate substantial costs. Higher costs will be incurred if quarrying is prohibited (see Chapter 2).
- Illinois Units 1 and 2 contain a railroad owned by Midwest Generation, and Com Ed power lines, which will incur high costs for maintenance and upgrading (see Chapters 4 and 5).
- Illinois Unit 4 is bisected by the new Illinois Tollway Authority interstate 355 extension, where substantial conservation costs have been and will continue to be incurred (see Chapter 2).
- Illinois Unit 7 contains a heavily traveled county road and a passenger rail line. The costs of the lost value of time due to vehicle slowing (speed limits) would be substantial.

EXHIBIT ES-1 SUMMARY OF FUTURE IMPACTS (2007 - 2026)

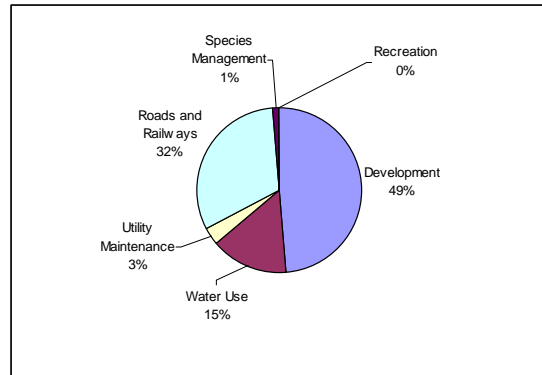
CATEGORY	UNDISCOUNTED		3% DISCOUNT RATE		7% DISCOUNT RATE	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
<b>Proposed for Designation</b>						
Total Economic Impacts	\$16,846,000	\$47,894,000	\$13,355,000	\$35,552,000	\$10,650,000	\$26,025,000
Annualized Impacts	\$842,000	\$2,395,000	\$898,000	\$2,390,000	\$1,005,000	\$2,457,000
<b>Considered for Exclusion</b>						
Total Economic Impacts	\$1,209,000		\$933,000		\$702,000	
Annualized Impacts	\$60,000		\$63,000		\$66,000	

EXHIBIT ES-2 RELATIVE MAGNITUDE OF FUTURE IMPACTS IN PROPOSED CRITICAL HABITAT (UNDISCOUNTED)

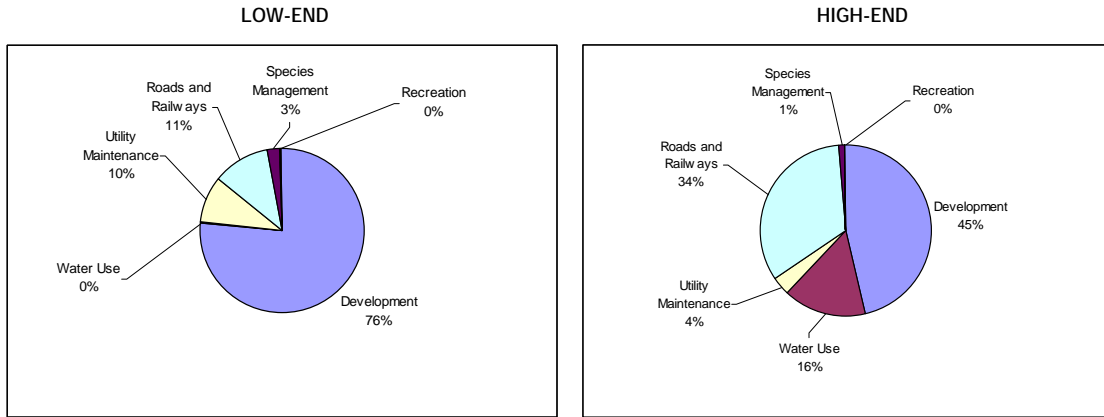
LOW-END



HIGH-END

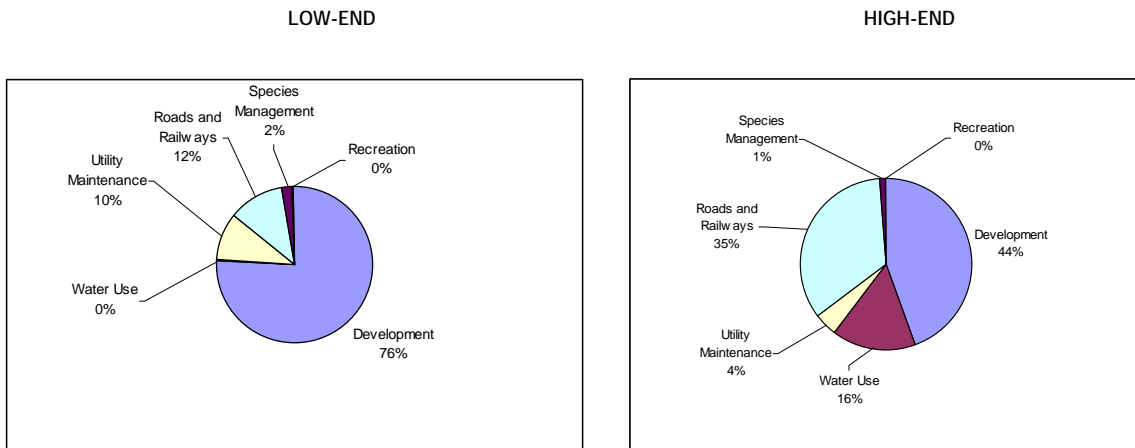


**EXHIBIT ES-3 RELATIVE MAGNITUDE OF FUTURE IMPACTS IN PROPOSED CRITICAL HABITAT (DISCOUNTED AT THREE PERCENT)**



Source: IEc analysis.

**EXHIBIT ES-4 RELATIVE MAGNITUDE OF FUTURE IMPACTS IN PROPOSED CRITICAL HABITAT (DISCOUNTED AT SEVEN PERCENT)**



Source: IEc analysis.

- Exhibit ES-5 ranks the units proposed for critical habitat designation in order of magnitude of expected impact under the low-end estimate. Exhibit ES-6 ranks the units in order of magnitude of expected impact under the high-end estimate. For more detailed information regarding present value and annualized impacts in each unit, see Exhibit ES-7 (for units where high and low estimates are not applicable, a single cost estimate is provided). Exhibits ES-8 and ES-9 follow; these maps show the units with the largest impacts for the low and high estimates, respectively. Past and future estimated impacts by unit and activity are provided in Appendices B and C, respectively.

EXHIBIT ES-5 UNITS RANKED BY LEVEL OF IMPACT (LOW-END ESTIMATE)

UNDISCOUNTED			3 PERCENT			7 PERCENT		
UNIT	IMPACTS	% OF TOTAL	UNIT	IMPACTS	% OF TOTAL	UNIT	IMPACTS	% OF TOTAL
IL2	\$9,585,000	56.90%	IL2	\$6,669,000	49.94%	IL2	\$4,526,000	42.50%
IL4	\$2,515,000	14.93%	IL4	\$2,360,000	17.67%	IL4	\$2,195,000	20.61%
IL1	\$1,571,000	9.33%	IL1	\$1,387,000	10.39%	IL1	\$1,199,000	11.26%
WI5	\$1,023,000	6.07%	WI5	\$1,009,000	7.56%	WI5	\$999,000	9.38%
WI4	\$524,000	3.11%	WI4	\$489,000	3.66%	WI4	\$460,000	4.32%
IL3	\$439,000	2.61%	IL3	\$393,000	2.94%	IL7	\$349,000	3.28%
IL7	\$433,000	2.57%	IL7	\$390,000	2.92%	IL3	\$349,000	3.27%
MI6	\$170,000	1.01%	MI6	\$164,000	1.23%	MI6	\$160,000	1.50%
WI2	\$138,000	0.82%	IL5	\$104,000	0.78%	WI1	\$94,000	0.88%
IL5	\$129,000	0.77%	WI2	\$103,000	0.77%	IL5	\$81,000	0.76%
WI1	\$94,000	0.56%	WI1	\$94,000	0.70%	WI2	\$74,000	0.69%
MI5	\$67,000	0.40%	MI5	\$61,000	0.46%	MI5	\$57,000	0.53%
WI10	\$57,000	0.34%	MI3	\$45,000	0.34%	MI3	\$41,000	0.38%
MI3	\$51,000	0.30%	MI4	\$45,000	0.34%	MI4	\$40,000	0.38%
MI4	\$50,000	0.30%	WI10	\$41,000	0.31%	WI10	\$28,000	0.26%
IL6	\$0	0.00%	IL6	\$0	0.00%	IL6	\$0	0.00%
WI3	\$0	0.00%	WI3	\$0	0.00%	WI3	\$0	0.00%
WI6	\$0	0.00%	WI6	\$0	0.00%	WI6	\$0	0.00%
WI7	\$0	0.00%	WI7	\$0	0.00%	WI7	\$0	0.00%
WI8	\$0	0.00%	WI8	\$0	0.00%	WI8	\$0	0.00%
WI9	\$0	0.00%	WI9	\$0	0.00%	WI9	\$0	0.00%
WI 11	\$0	0.00%	WI 11	\$0	0.00%	WI 11	\$0	0.00%
<b>Total</b>	<b>\$16,846,000</b>	<b>100.00%</b>	<b>Total</b>	<b>\$13,355,000</b>	<b>100.00%</b>	<b>Total</b>	<b>\$10,650,000</b>	<b>100.00%</b>

Notes: Totals may not sum due to rounding.



EXHIBIT ES-6 UNITS RANKED BY LEVEL OF IMPACT (HIGH-END ESTIMATE)

UNDISCOUNTED			3 PERCENT			7 PERCENT		
UNIT	IMPACTS	% OF TOTAL	UNIT	IMPACTS	% OF TOTAL	UNIT	IMPACTS	% OF TOTAL
IL2	\$20,802,000	43.51%	IL2	\$13,672,000	38.46%	IL7	\$9,984,000	38.36%
IL7	\$17,433,000	36.46%	IL7	\$13,416,000	37.74%	IL2	\$8,661,000	33.28%
IL1	\$3,171,000	6.63%	IL1	\$2,613,000	7.35%	IL4	\$2,365,000	9.09%
IL4	\$2,815,000	5.89%	IL4	\$2,590,000	7.29%	IL1	\$2,106,000	8.09%
WI5	\$1,582,000	3.31%	WI5	\$1,438,000	4.04%	WI5	\$1,316,000	5.06%
IL3	\$739,000	1.55%	IL3	\$622,000	1.75%	IL3	\$519,000	1.99%
WI4	\$595,000	1.24%	WI4	\$544,000	1.53%	WI4	\$500,000	1.92%
MI6	\$170,000	0.36%	MI6	\$164,000	0.46%	MI6	\$160,000	0.61%
WI2	\$138,000	0.29%	IL5	\$104,000	0.29%	WI1	\$94,000	0.36%
IL5	\$129,000	0.27%	WI2	\$103,000	0.29%	IL5	\$81,000	0.31%
WI1	\$94,000	0.20%	WI1	\$94,000	0.26%	WI2	\$74,000	0.28%
MI5	\$67,000	0.14%	MI5	\$61,000	0.17%	MI5	\$57,000	0.22%
WI10	\$57,000	0.12%	MI3	\$45,000	0.13%	MI3	\$41,000	0.16%
MI3	\$51,000	0.11%	MI4	\$45,000	0.13%	MI4	\$40,000	0.15%
MI4	\$50,000	0.10%	WI10	\$41,000	0.12%	WI10	\$28,000	0.11%
IL6	\$0	0.00%	IL6	\$0	0.00%	IL6	\$0	0.00%
WI3	\$0	0.00%	WI3	\$0	0.00%	WI3	\$0	0.00%
WI6	\$0	0.00%	WI6	\$0	0.00%	WI6	\$0	0.00%
WI7	\$0	0.00%	WI7	\$0	0.00%	WI7	\$0	0.00%
WI8	\$0	0.00%	WI8	\$0	0.00%	WI8	\$0	0.00%
WI9	\$0	0.00%	WI9	\$0	0.00%	WI9	\$0	0.00%
WI 11	\$0	0.00%	WI 11	\$0	0.00%	WI 11	\$0	0.00%
<b>Total</b>	<b>\$47,894,000</b>	100.00%	<b>Total</b>	<b>\$35,552,000</b>	100.00%	<b>Total</b>	<b>\$26,025,000</b>	100.00%

Notes: Totals may not sum due to rounding.

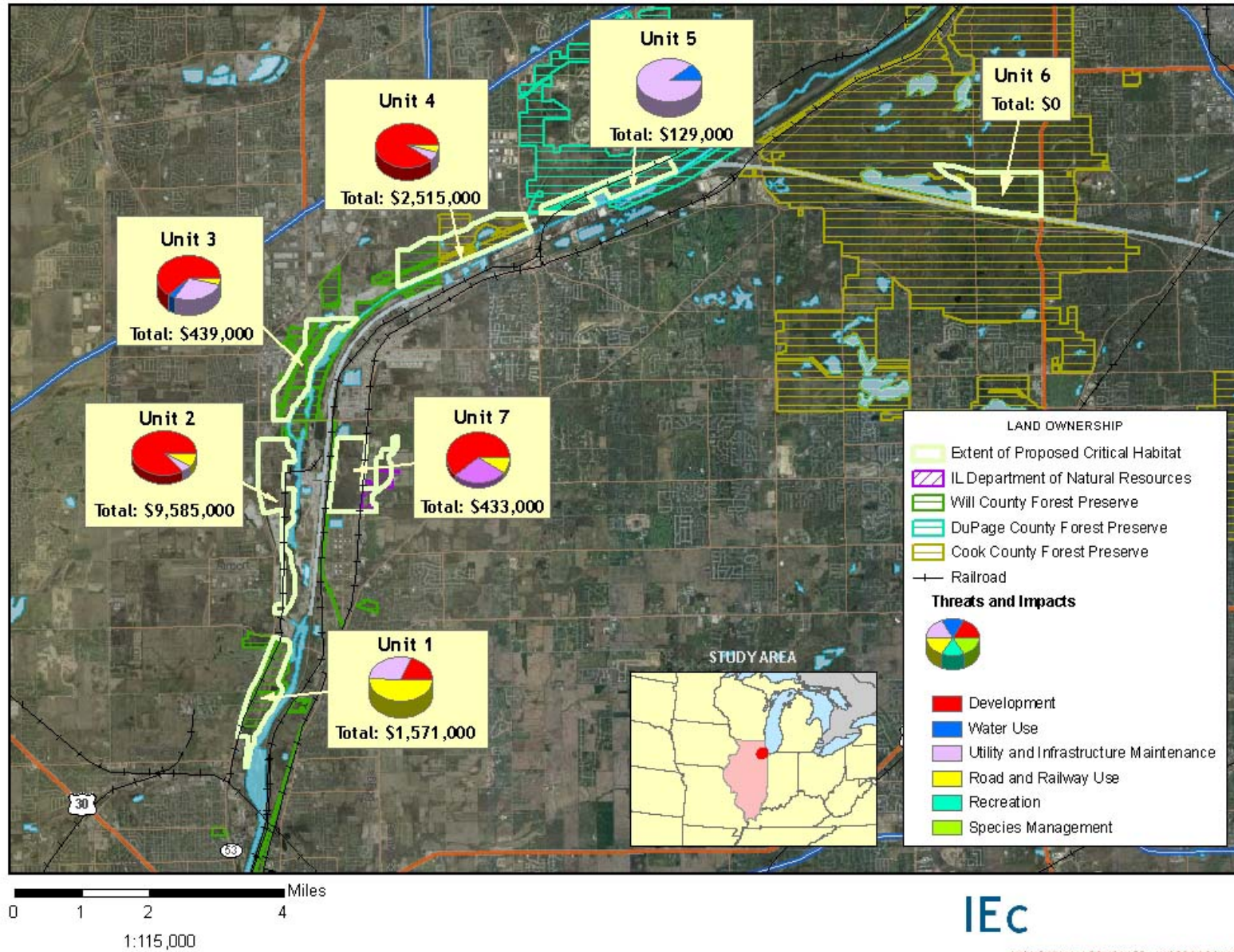
EXHIBIT ES-7 DETAILED FUTURE IMPACTS BY UNIT (2007 - 2026)

UNIT	UNDISCOUNTED		PRESENT VALUE 3%		PRESENT VALUE 7%		ANNUALIZED 3%		ANNUALIZED 7%	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
<b>PROPOSED CRITICAL HABITAT</b>										
IL1	\$1,571,000	\$3,171,000	\$1,387,000	\$2,613,000	\$1,199,000	\$2,106,000	\$93,000	\$176,000	\$113,000	\$199,000
IL2	\$9,585,000	\$20,802,000	\$6,669,000	\$13,672,000	\$4,526,000	\$8,661,000	\$448,000	\$919,000	\$427,000	\$818,000
IL3	\$439,000	\$739,000	\$393,000	\$622,000	\$349,000	\$519,000	\$26,000	\$42,000	\$33,000	\$49,000
IL4	\$2,515,000	\$2,815,000	\$2,360,000	\$2,590,000	\$2,195,000	\$2,365,000	\$159,000	\$174,000	\$207,000	\$223,000
IL5	\$129,000	\$129,000	\$104,000	\$104,000	\$81,000	\$81,000	\$7,000	\$7,000	\$8,000	\$8,000
IL6	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
IL7	\$433,000	\$17,433,000	\$390,000	\$13,416,000	\$349,000	\$9,984,000	\$26,000	\$902,000	\$33,000	\$942,000
MI3	\$51,000	\$51,000	\$45,000	\$45,000	\$41,000	\$41,000	\$3,000	\$3,000	\$4,000	\$4,000
MI4	\$50,000	\$50,000	\$45,000	\$45,000	\$40,000	\$40,000	\$3,000	\$3,000	\$4,000	\$4,000
MI5	\$67,000	\$67,000	\$61,000	\$61,000	\$57,000	\$57,000	\$4,000	\$4,000	\$5,000	\$5,000
MI6	\$170,000	\$170,000	\$164,000	\$164,000	\$160,000	\$160,000	\$11,000	\$11,000	\$15,000	\$15,000
WI1	\$94,000	\$94,000	\$94,000	\$94,000	\$94,000	\$94,000	\$6,000	\$6,000	\$9,000	\$9,000
WI2	\$138,000	\$138,000	\$103,000	\$103,000	\$74,000	\$74,000	\$7,000	\$7,000	\$7,000	\$7,000
WI3	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI4	\$524,000	\$595,000	\$489,000	\$544,000	\$460,000	\$500,000	\$33,000	\$37,000	\$43,000	\$47,000
WI5	\$1,023,000	\$1,582,000	\$1,009,000	\$1,438,000	\$999,000	\$1,316,000	\$68,000	\$97,000	\$94,000	\$124,000
WI6	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI7	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI8	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI9	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI10	\$57,000	\$57,000	\$41,000	\$41,000	\$28,000	\$28,000	\$3,000	\$3,000	\$3,000	\$3,000
WI11	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$16,846,000</b>	<b>\$47,894,000</b>	<b>\$13,355,000</b>	<b>\$35,552,000</b>	<b>\$10,650,000</b>	<b>\$26,025,000</b>	<b>\$898,000</b>	<b>\$2,390,000</b>	<b>\$1,005,000</b>	<b>\$2,457,000</b>

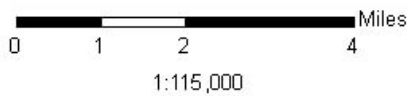
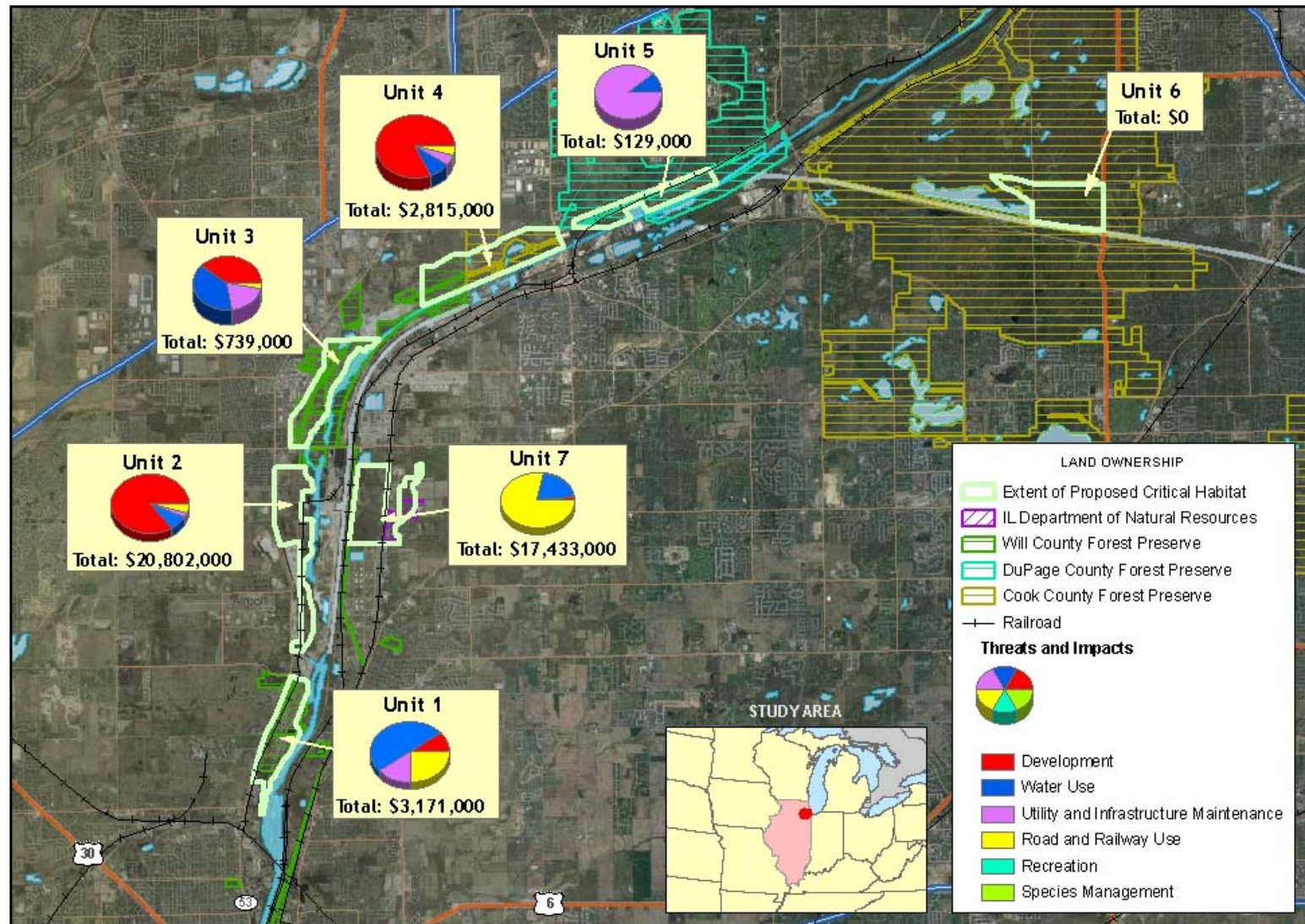
UNIT	UNDISCOUNTED		PRESENT VALUE 3%		PRESENT VALUE 7%		ANNUALIZED 3%		ANNUALIZED 7%	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
<b>CONSIDERED FOR EXCLUSION</b>										
MI1	\$26,000		\$19,000		\$13,000		\$1,000		\$1,000	
MI2	\$35,000		\$25,000		\$16,000		\$2,000		\$2,000	
MO1	\$51,000		\$39,000		\$28,000		\$3,000		\$3,000	
MO2	\$50,000		\$38,000		\$28,000		\$3,000		\$3,000	
MO3	\$49,000		\$36,000		\$26,000		\$2,000		\$2,000	
MO4	\$48,000		\$36,000		\$26,000		\$2,000		\$2,000	
MO5	\$99,000		\$72,000		\$49,000		\$5,000		\$5,000	
MO6	\$25,000		\$21,000		\$17,000		\$1,000		\$2,000	
MO7	\$104,000		\$77,000		\$55,000		\$5,000		\$5,000	
MO8	\$44,000		\$37,000		\$31,000		\$2,000		\$3,000	
MO9	\$44,000		\$37,000		\$31,000		\$2,000		\$3,000	
MO10	\$44,000		\$37,000		\$31,000		\$2,000		\$3,000	
MO11	\$38,000		\$31,000		\$25,000		\$2,000		\$2,000	
MO12	\$22,000		\$17,000		\$14,000		\$1,000		\$1,000	
MO13	\$26,000		\$21,000		\$16,000		\$1,000		\$1,000	
MO14	\$21,000		\$17,000		\$13,000		\$1,000		\$1,000	
MO15	\$30,000		\$23,000		\$17,000		\$2,000		\$2,000	
MO16	\$19,000		\$15,000		\$11,000		\$1,000		\$1,000	
MO17	\$29,000		\$25,000		\$21,000		\$2,000		\$2,000	
MO18	\$29,000		\$25,000		\$21,000		\$2,000		\$2,000	
MO19	\$24,000		\$20,000		\$16,000		\$1,000		\$2,000	
MO20	\$24,000		\$20,000		\$16,000		\$1,000		\$2,000	
MO21	\$29,000		\$22,000		\$16,000		\$1,000		\$2,000	
MO22	\$25,000		\$20,000		\$17,000		\$1,000		\$2,000	
MO23	\$84,000		\$63,000		\$46,000		\$4,000		\$4,000	
MO24	\$84,000		\$63,000		\$46,000		\$4,000		\$4,000	
MO25	\$76,000		\$56,000		\$38,000		\$4,000		\$4,000	
MO26	\$29,000		\$22,000		\$16,000		\$1,000		\$2,000	
<b>Total:</b>	<b>\$1,209,000</b>		<b>\$933,000</b>		<b>\$702,000</b>		<b>\$63,000</b>		<b>\$66,000</b>	

Notes: Totals may not sum due to rounding

LOW-END UNDISCOUNTED FUTURE IMPACTS OF PROPOSED HINE'S EMERALD DRAGONFLY CRITICAL HABITAT: ILLINOIS UNITS 1-7



**HIGH-END UNDISCOUNTED FUTURE IMPACTS OF PROPOSED HINE'S EMERALD DRAGONFLY CRITICAL HABITAT: ILLINOIS UNITS 1-7**



6. The purpose of this report is to estimate the economic impact of actions taken to protect the federally listed Hine's Emerald dragonfly and its habitat. It attempts to quantify the economic effects associated with the proposed designation of critical habitat. It does so by taking into account the costs of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat. The analysis looks retrospectively at costs incurred since the dragonfly was listed, and it attempts to predict future costs likely to occur after the proposed critical habitat designation (CHD) is finalized.
7. This information is intended to assist the Secretary of the Interior (hereafter referred to as the Secretary) in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.<sup>2</sup> In addition, this information allows the Service to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).<sup>3</sup> This report also complies with direction from the U.S. Court of Appeals for the 10th Circuit that “co-extensive” effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.<sup>4</sup>
8. This chapter provides background information on the species and the proposed designation. Next, it describes the regulatory alternatives considered by the Service. Then, it describes the approach to estimating impacts and lays out the scope of the analysis. Information sources relied upon are summarized in the next section. The chapter concludes with a description of the organization of the remainder of this report.

### 1.1 BACKGROUND

9. On January 26, 1995, the Service published the final rule listing the dragonfly as endangered.<sup>5</sup> On February 4, 2004, the Service received a complaint from the Center for

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<sup>2</sup> 16 U.S.C. §1533(b)(2)

<sup>3</sup> Executive Order 12866, Regulatory Planning and Review, September 30, 1993; Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use, May 18, 2001; 5.U.S.C. §601 et seq; and Pub Law No. 104-121.

<sup>4</sup> In 2001, the U.S. Court of Appeals for the 10th Circuit instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (New Mexico Cattle Growers Ass'n v. U.S.F.W.S., 248 F.3d 1277 (10th Cir. 2001)).

<sup>5</sup> 60 FR 5267.

Biodiversity *et al.*, for failure to designate critical habitat for the species.<sup>6</sup> The Service agreed to publish a final rule by May 7, 2007. For a description of the species and the primary constituent elements that are essential to the conservation of the species, refer to the proposed rule to designate critical habitat, dated July 26, 2006.<sup>7</sup>

10. The Service identified 27,490 acres in Illinois, Michigan, Missouri, and Wisconsin as potential critical habitat for the dragonfly.<sup>8</sup> Of this amount, the Service is considering excluding from critical habitat designation approximately 14,269 acres; two units in Michigan and all of the proposed critical habitat units in Missouri. Of the 14,269 acres currently considered for exclusion, over 97 percent of that land is in Federal or State ownership. Portions of some of the other units (units not under consideration for exclusion as a whole) are also being considered for exclusion. In the remainder of this report, the entire 27,490 acres are referred to as the study area. For maps of the study area, see Appendix F.

## 1.2 REGULATORY ALTERNATIVES

11. Executive Order 12866 directs Federal agencies to evaluate regulatory alternatives. The Service identifies 50 units of potential habitat, and proposes 22 units for designation as critical habitat. An alternative to the proposed rule is the designation of all 50 units, and the potential impacts of all are estimated in this report. In addition, section 4(b)(2) of the Act allows the Service to exclude additional areas proposed for designation based on economic impact and other relevant impact. As a result, the impacts of multiple combinations of potential habitat are also available to the Service.

## 1.3 APPROACH TO ESTIMATING ECONOMIC EFFECTS

12. This economic analysis considers both the economic efficiency and distributional effects that may result from efforts to protect the dragonfly and its habitat (hereinafter referred to collectively as “dragonfly conservation efforts”). Economic efficiency effects generally reflect “opportunity costs” associated with the commitment of resources required to accomplish species and habitat conservation. For example, if activities that can take place on a parcel of land are limited as a result of the designation or the presence of the species, and thus the market value of the land is reduced, this reduction in value represents one measure of opportunity cost or change in economic efficiency. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of dragonfly conservation efforts.
13. This analysis also addresses the distribution of impacts associated with the designation, including an assessment of any local or regional impacts of habitat conservation and the

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<sup>6</sup> See 71 FR 42442.

<sup>7</sup> *Ibid.*

<sup>8</sup> For a description of the species and the primary constituent elements of its habitat, see the proposed rule. IEC and FWS have revised the acreage of Wisconsin Unit 1 from 503 acres (as reported in 71 FR 42442) to 157 acres, which reduces the total acreage reported in 71 FR 42442 from 27,689 acres to 27,343 acres.

potential effects of conservation efforts on small entities and the energy industry. This information may be used by decision-makers to assess whether the effects of dragonfly conservation efforts unduly burden a particular group or economic sector. For example, while conservation efforts may have a small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience relatively greater impacts. The difference between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

#### 1.3.1 EFFICIENCY EFFECTS

14. At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action. In the context of regulations that protect dragonfly habitat, these efficiency effects represent the opportunity cost of resources used or benefits foregone by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surpluses in affected markets.<sup>9</sup>
15. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a Federal land manager, such as the U.S. Forest Service, may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The effort required for the consultation is an economic opportunity cost because the landowner or manager's time and effort would have been spent in an alternative activity had the parcel not been included in the designation. When compliance activity is not expected to significantly affect markets -- that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price -- the measurement of compliance costs can provide a reasonable estimate of the change in economic efficiency.
16. Where habitat protection measures are expected to significantly impact a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, a designation that precludes the development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the market.

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<sup>9</sup> For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see: Gramlich, Edward M., A Guide to Benefit-Cost Analysis (2nd Ed.), Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, Guidelines for Preparing Economic Analyses, EPA 240-R-00-003, September 2000, available at <http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html>.



## CALCULATING PRESENT VALUE AND ANNUALIZED IMPACTS

For each land use activity, this analysis compares economic impacts incurred in different time periods in present value terms. The present value represents the value of a payment or stream of payments in common dollar terms. That is, it is the sum of a series of past or future cash flows expressed in today's dollars. Translation of economic impacts of past or future costs to present value terms requires the following: a) past or projected future costs of dragonfly conservation efforts; and b) the specific years in which these impacts have been or are expected to be incurred. With these data, the present value of the past or future stream of impacts ( $PV_c$ ) of dragonfly conservation efforts from year  $t$  to  $T$  is measured in 2007 dollars according to the following standard formula:<sup>a</sup>

$$PV_c = \sum_t^T \frac{C_t}{(1+r)^{t-2007}}$$

$C_t$  = cost of dragonfly conservation efforts in year  $t$

$r$  = discount rate<sup>b</sup>

Impacts of conservation efforts for each activity in each unit are also expressed as annualized values. Annualized values are calculated to provide comparison of impacts across activities with varying forecast periods ( $T$ ). For this analysis, however, all activities employ a forecast period of 20 years, 2007 through 2026. Annualized impacts of future dragonfly conservation efforts ( $APV_c$ ) are calculated by the following standard formula:

$$APV_c = PV_c \left[ \frac{r}{1 - (1+r)^{-N}} \right]$$

$N$  = number of years in the forecast period (in this analysis, 20 years)

<sup>a</sup> To derive the present value of past conservation activities for this analysis,  $t$  is 1995 and  $T$  is 2007; to derive the present value of future conservation efforts,  $t$  is 2007 and  $T$  is 2026.

<sup>b</sup> To discount and annualize costs, guidance provided by the OMB specifies the use of a real rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates such as three percent, which some economists believe better reflects the social rate of time preference. (U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, February 3, 2003.)

17. This analysis begins by measuring costs associated with efforts undertaken to protect the dragonfly and its habitat. As noted above, in some cases, compliance costs can provide a reasonable estimate of changes in economic efficiency. However, if the cost of conservation efforts is expected to significantly impact markets, the analysis will consider potential changes in consumer and/or producer surplus in affected markets.

#### 1.3.2 DISTRIBUTIONAL EFFECTS

18. This analysis also considers how small entities, including small businesses, organizations, and governments, as defined by the Regulatory Flexibility Act, might be affected by future conservation activities for the dragonfly.<sup>10</sup> In addition, in response to Executive Order 13211 "Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the future impacts of conservation activities on the energy industry and its customers.<sup>11</sup>

#### 1.4 SCOPE OF THE ANALYSIS

19. This analysis identifies those economic activities believed to most likely threaten the listed species and its habitat and, where possible, quantifies the economic impact to avoid, mitigate, or compensate for such threats within the boundaries, or adjacent to, the study area. In instances where critical habitat is being proposed after a species is listed, some future impacts may be unavoidable, regardless of the final designation and exclusions under 4(b)(2). However, due to the difficulty in making a credible distinction between listing and critical habitat effects within critical habitat boundaries, this analysis considers all future conservation-related impacts to be co-extensive with the designation.<sup>12,13</sup>
20. Coextensive effects may also include impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. In past instances, some of these measures have been precipitated by the listing of the species and impending designation of critical habitat. Because habitat conservation efforts affording protection to a listed species likely contribute to the efficacy of the Endangered Species Act (ESA), the impacts of these actions are considered relevant for understanding the full effect of the proposed CHD. Enforcement actions taken in response to violations of the Act, however, are not included.

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<sup>10</sup> 5 U.S.C. § 601 *et seq.*

<sup>11</sup> Executive Order 13211, *Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use*, May 18, 2001.

<sup>12</sup> In 2001, the U.S. Court of Appeals for the 10th Circuit instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Assn v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

<sup>13</sup> In 2004, the U.S. Ninth Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat (*Gifford Pinchot Task Force v. United States Fish and Wildlife Service*). The Service is currently reviewing the decision to determine what effect it (and to a limited extent *Center for Biological Diversity v. Bureau of Land Management* (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

## SECTIONS OF THE ACT RELEVANT TO THE ANALYSIS

21. This analysis focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act.
- Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as CHD. In this section, the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."<sup>14</sup> Section 4 also requires the Secretary to designate critical habitat "on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat."<sup>15</sup>
  - Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat.<sup>16</sup>
  - Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm, pursue, or collect, or to attempt to engage in any such conduct."<sup>17</sup>
  - Under section 10(a)(1)(B) of the Act, an entity (e.g., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for an endangered animal species in order to meet the conditions for issuance of an incidental take permit in connection with the development and management of a property.<sup>18</sup>

## OTHER RELEVANT PROTECTION EFFORTS

22. The protection of listed species and habitat is not limited to the Act. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction.<sup>19</sup> For the purpose of this analysis, such protective efforts are considered to be co-extensive with the protection offered by critical habitat, and costs associated with these efforts are included in this report. In addition, under

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<sup>14</sup> 16 U.S.C. 1533.

<sup>15</sup> 16 U.S.C. 1533.

<sup>16</sup> The Service notes that the Ninth Circuit judicial opinion, *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, invalidated the Service's regulation defining destruction or adverse modification of critical habitat. The Service is currently reviewing the decision to determine what effect it (and to a limited extent *Center for Biological Diversity v. Bureau of Land Management* (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

<sup>17</sup> 16 U.S.C. 1532.

<sup>18</sup> U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at <http://endangered.fws.gov/hcp/>.

<sup>19</sup> For example, the Sikes Improvement Act (Sikes Act) of 1997 requires Department of Defense (DoD) military installations to develop Integrated Natural Resources Management Plans (INRMPs) that provide for the conservation, protection, and management of wildlife resources (16 U.S.C. §§ 670a - 670o). These plans must integrate natural resource management with the other activities, such as training exercises, taking place at the facility.

certain circumstances, the critical habitat may provide new information to a community about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other state or local laws. In cases where these costs would not have been triggered absent the designation of critical habitat, they are included in this economic analysis.

#### ADDITIONAL ANALYTIC CONSIDERATIONS

23. This analysis also considers the potential for other types of economic impacts that can be related to section 7 consultations in general and critical habitat in particular, including time delay, regulatory uncertainty, and stigma impacts.

##### Time Delay and Regulatory Uncertainty Impacts

24. Time delay impacts are costs resulting from project delays associated with the consultation process or compliance with other regulations. Regulatory uncertainty costs occur in anticipation of having to modify project parameters (e.g., retaining outside experts or legal counsel to better understand responsibilities with regard to critical habitat). No stakeholders questioned about delay costs in the preparation of this report provided cost estimates for such delays.

##### Stigma Impacts

25. Stigma refers to the change in economic value of a particular project or activity due to negative (or positive) perceptions of the role critical habitat will play in developing, implementing, or conducting that policy. For example, changes to private property values associated with public attitudes about the limits and costs of implementing a project in critical habitat are known as "stigma" impacts. Section 2.1 considers stigma effects as the loss of all land value.

#### BENEFITS

26. Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.<sup>20</sup> OMB's Circular A-4 distinguishes two types of economic benefits: *direct benefits and ancillary benefits*. Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.<sup>21</sup>
27. In the context of critical habitat, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to

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<sup>20</sup> Executive Order 12866, *Regulatory Planning and Review*, September 30, 1993.

<sup>21</sup> U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

conduct new research.<sup>22</sup> *Rather than rely on economic measures, the Service believes that the direct benefits of the proposed rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*

28. Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications, such as the preservation of open space in a region. While they are not the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat.
29. It is often difficult to evaluate the ancillary benefits of CHD. To the extent that the ancillary benefits of the rulemaking may be captured by the market through an identifiable shift in resource allocation, they are factored into the overall economic impact assessment. For example, if habitat preserves are created to protect a species, the value of existing residential property adjacent to those preserves may increase, resulting in a measurable positive impact. Ancillary benefits that affect markets are not anticipated in this case and therefore are not quantified.

#### GEOGRAPHIC SCOPE OF THE ANALYSIS

30. The geographic scope of the analysis includes areas proposed for CHD and areas considered for exclusion under section 4(b)(2) of the Act. The economic impacts of potential designation are estimated for each of these two categories of land identified in the proposed rule. The analysis focuses on activities within or affecting these areas.
31. Impacts are presented at the finest level of resolution feasible, given available data. For this proposed critical habitat designation, impacts are reported for each unit identified in the proposed rule. The Executive Summary presents maps showing the location of the units relative to major cities, national forest land, and wilderness lands.

#### ANALYTIC TIME FRAME

32. The analysis estimates impacts based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. This analysis estimates economic impacts to activities from 1995 (year of the species' final listing) to 2026 (20 years from the final rule anticipated in 2007). Forecasts of economic conditions and other factors beyond the next 20 years would be speculative.

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<sup>22</sup> Ibid.

## 1.5 INFORMATION SOURCES

33. The primary sources of information for this report were communications with and data provided by personnel from the Service, Federal action agencies, affected private parties, and local and State governments. Specifically, the analysis relies on data collected in communication with personnel from the following entities:
- U.S. Forest Service (USFS);
  - State Departments of Natural Resources/Conservation/Environmental Protection;
  - State Departments of Transportation;
  - County and city planning departments; and
  - Private parties affected by proposed CHD.
34. In addition, this analysis relies upon the Service's section 7 consultation records, public comments, and published journal sources. The reference section at the end of this document provides a full list of information sources.

## 1.6 STRUCTURE OF THE REPORT

35. The remainder of this report is organized as follows:
- Section 2: Impacts to Development Activities;
  - Section 3: Impacts to Water Use;
  - Section 4: Impacts to Utility and Infrastructure Maintenance;
  - Section 5: Impacts to Road and Railway Use;
  - Section 6: Impacts to Species Management Activities;
  - Section 7: Impacts to Recreation;
  - Appendix A: Small Entity and Energy Impacts Analysis;
  - Appendix B: Summary of Past Impacts to all Activities by Unit;
  - Appendix C: Detailed Future Impacts by Activity, by Unit;
  - Appendix D: Administrative Consultation Costs;
  - Appendix E: Best Management Practices;
  - Appendix F: Study Area Maps; and
  - References.

## CHAPTER 2 | POTENTIAL ECONOMIC IMPACTS TO DEVELOPMENT ACTIVITIES

36. According to the proposed rule, various categories of development activity may result in long-term or permanent destruction or fragmentation of habitat that contains the primary constituent elements for the dragonfly. These activities can reduce the amount of available habitat and increase the extirpation probability of dragonfly populations. This section considers whether conservation activities for the dragonfly may impact development within the study area. Several categories of development are considered. These are:

- Residential Development
- Commercial Development (including quarrying and logging)
- Utility and Road Construction
- Changes in Ownership and Management Practices

These categories are constructed to isolate the effects of development activities that take place within the habitat footprint and directly affect habitat quality. Development that occurs in adjacent areas and affects habitat indirectly by impacting surface and/or groundwater quantity and/or quality are considered separately in Chapter 3. Maintenance of existing facilities is considered separately in Chapter 4. Several habitat units, such as MI 1, MI 2 and MO 1,2,4,5, 7-11, are completely or almost entirely under Federal management; thus development-related costs are not anticipated in these units.

37. Exhibit 2-1 provides past cost estimates for each unit and lists the development activities associated with each cost estimate. Exhibit 2-2 provides projected estimates of future costs associated with the listed development activities. These include opportunity costs associated with land use restrictions and added costs incurred for preservation of the dragonfly and dragonfly habitat. Both Exhibits 2-1 and 2-2 include the costs for Habitat Conservation Plan (HCP) preparation within the study area. Exhibits 2-1 and 2-2 are summary tables; detailed explanations of impact estimates are presented later in the chapter.

EXHIBIT 2-1 SUMMARY OF PAST DEVELOPMENT COSTS BY UNIT

UNIT	IMPACTED DEVELOPMENT ACTIVITIES	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3 PERCENT)	PRESENT VALUE (7 PERCENT)
IL 1	Road Construction, Commercial Development, HCP	\$193,000	\$203,000	\$216,000
IL 2	Quarrying, HCP Commercial Development, Surveys	\$1,253,000	\$1,496,000	\$1,913,000
IL 3	Commercial Development, HCP	\$179,000	\$188,000	\$200,000
IL 4	Road Construction, Commercial Development	\$1,845,000	\$1,994,000	\$2,236,000
IL 5	Commercial Development	\$2,000	\$2,000	\$2,000
IL 6	Commercial Development	\$1,000	\$1,000	\$1,000
IL 7	HCP, Commercial Development	\$554,000	\$722,000	\$1,044,000
MI 3	Commercial Development	\$14,000	\$16,000	\$19,000
MO 5	Ownership Changes	\$5,000	\$5,000	\$5,000
MO 8	Ownership Changes	\$11,000	\$11,000	\$11,000
MO 9	Ownership Changes	\$11,000	\$11,000	\$11,000
MO 10	Ownership Changes	\$11,000	\$11,000	\$11,000
MO 11	Ownership Changes	\$11,000	\$11,000	\$11,000
MO 13	Ownership Changes	\$11,000	\$11,000	\$11,000
MO 14	Ownership Changes	\$5,000	\$5,000	\$5,000
MO 15	Ownership Changes	\$11,000	\$11,000	\$11,000
WI 5	Ownership Changes, Utility Construction	\$50,000	\$55,000	\$63,000
WI 9	Road Construction	\$24,000	\$27,000	\$30,000
<b>Total</b>		<b>\$4,187,000</b>	<b>\$4,778,000</b>	<b>\$5,803,000</b>

Note: Totals may not sum due to rounding

38. Past development costs are \$4.2 million in undiscounted dollars. In present value terms, costs range from \$4.8 million to \$5.8 million, assuming discount rates of three percent and seven percent, respectively. The majority of these costs are attributable to the interstate highway extension being built through Illinois Unit 4.
39. Future development related costs range from low end estimates of \$13.0 million to high end estimates of \$22.6 million in undiscounted dollars. Present value costs range from \$10.1 (low) to \$15.9 (high) million at a three percent discount rate. Discounted at seven percent, costs range from \$8.0 (low) to \$11.2 (high) million. The highest costs are anticipated in Illinois Unit 2 (site of a dolomite quarry owned by Material Services Corporation {MSC}), Illinois Unit 4 (Illinois I-355 Tollway extension construction), and Wisconsin Units 4 and 5, (opportunity costs foregone if residential development does not take place). Low and high cost estimates are included for Unit 2 because policy on potential quarrying of dolomite within the unit has not yet been decided.



EXHIBIT 2-2 SUMMARY OF FUTURE DEVELOPMENT COSTS BY UNIT

UNIT	IMPACTED DEVELOPMENT ACTIVITIES	TOTAL COSTS					
		UNDISCOUNTED		PRESENT VALUE (3 PERCENT)		PRESENT VALUE (7 PERCENT)	
		LOW	HIGH	LOW	HIGH	LOW	HIGH
IL 1	Road Construction, Commercial Development, HCP	\$265,000		\$256,000		\$246,000	
IL 2	Quarrying, HCP, Commercial Development	\$8,265,000	\$17,882,000	\$5,528,000	\$11,305,000	\$3,565,000	\$6,794,000
IL 3	Commercial Development, HCP	\$265,000		\$256,000		\$246,000	
IL 4	Road Construction	\$2,284,000		\$2,178,000		\$2,056,000	
IL 7	HCP	\$265,000		\$256,000		\$246,000	
MI 3	Residential Development	\$32,000		\$32,000		\$32,000	
MI 4	Residential Development	\$32,000		\$32,000		\$32,000	
MI 5	Residential Development	\$42,000		\$42,000		\$42,000	
MI 6	Residential Development	\$139,000		\$139,000		\$139,000	
WI 1	Road Construction, Residential Development	\$94,000		\$94,000		\$94,000	
WI 4	Road Construction, Residential Development	\$386,000		\$386,000		\$386,000	
WI 5	Residential Development, Commercial Development	\$980,000		\$980,000		\$980,000	
<b>Total</b>		<b>\$13,048,000</b>	<b>\$22,665,000</b>	<b>\$10,178,000</b>	<b>\$15,955,000</b>	<b>\$8,061,000</b>	<b>\$11,290,000</b>

Note: Totals may not sum due to rounding

40. This chapter considers several types of development. However, the emphasis is on new construction and/or activities within the study area. This approach is followed to link costs directly to actions that take place within the study area footprint in order to separate the direct effects of development from ancillary effects of development that affect areas outside the study area boundaries (such as groundwater recharge areas). This chapter investigates:

- Residential Development Land Uses
- Commercial Development Land Uses (quarrying, logging, etc)
- Utility and Road Construction
- Changes in Ownership and Land Management
- A Proposed Habitat Conservation Plan (for Illinois)

Both historical (before 2007) and prospective (2007 to 2026) costs are presented.

## 2.1 RESIDENTIAL DEVELOPMENT

41. Residential development is listed as a threat for several units in the study area.<sup>23</sup> However, in many cases, the specific threat that prompted inclusion of residential development was actually a threat to surface or groundwater depletion or contamination.<sup>24</sup> This chapter distinguishes between the direct threat of habitat displacement and fragmentation due to the construction of new residences within the units from threats to surface and/or groundwater through the drilling of wells, construction of impermeable surfaces, and installation of septic systems in or near the study area (addressed in Chapter 3). Direct displacement due to residential development is not a widespread threat; coincident with the fact that much of dragonfly habitat is in wetlands, many areas with essential habitat have been deemed too wet or marshy for development.<sup>25</sup>
42. For some units, residential development is anticipated, but the timing of that development is unpredictable. If there were some residential project being considered for a set number “X” years in the future and habitat designation would limit that development, the appropriate opportunity cost for that project would be its anticipated future value of the

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<sup>23</sup> see 71 FR 42442

<sup>24</sup> Personal communications from Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, September 19, 2006; written communication from U.S. Fish and Wildlife Service Chicago Field Office Endangered Species Coordinator, September 27, 2006; written communication from Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, October 17, 2006.

<sup>25</sup> Personal communication with Joan Shroka (October 18, 2006), Bois Blanc Island tax assessor. Additionally, a GIS analysis incorporating zoning, land-use, surficial geology, septic limitations, and slope and erosion potential was employed to ascertain areas unsuitable for residential development.

development rights, discounted by the “X” years. When no prediction is possible, the best measure of anticipated opportunity costs is to look at present land values.<sup>26</sup>

43. If real estate markets clear and are competitive, the value of undeveloped residential land should capture the market’s current best predictions of the future value of residential developments given the uncertain probabilities of the development occurring, and the uncertainty concerning its timing.<sup>27</sup> For example, if there is some chance that a residential sub-division will be located on a parcel in the future, the price of that parcel will rise today in anticipation of the future construction relative to the prices of other parcels. Furthermore, if there are two parcels that have some likelihood of being developed in the future, then the parcel that is likely to be developed sooner will have a higher price in the present. In this way the price of current undeveloped real estate will capture, in expectation, the predicted, discounted stream of benefits that will accrue to development on that real estate. This attribute of land markets allows estimation of future opportunity costs based on current prices.
44. Exhibit 2-3 presents the habitat units under threat of habitat displacement or fragmentation due to the construction of new residences. This analysis proceeds with the assumption that the construction of residences within the borders of proposed critical habitat would not be undertaken, because equally good substitute properties are available outside of the study area. Anticipating additional regulatory costs associated with the presence of the species and designated critical habitat, developers will choose non-critical habitat parcels over designated parcels. As a result, the opportunity costs associated with dragonfly conservation efforts are reductions in land value resulting from reduced development potential.<sup>28</sup>

**EXHIBIT 2-3 FUTURE OPPORTUNITY COSTS OF FOREGONE RESIDENTIAL DEVELOPMENT**

UNIT	ACRES	RESIDENTIAL LAND VALUE (\$)
WI 1	7.43	\$94,000
WI 4	6.63	\$386,000
WI 5	14.93	\$980,000
MI 3	21.21	\$32,000
MI 4	7.48	\$32,000
MI 5	29.29	\$42,000
MI 6	97.01	\$139,000
<b>TOTAL</b>	<b>183.98</b>	<b>\$1,704,000</b>

Note: Totals may not sum due to rounding

<sup>26</sup> O’Sullivan, Arthur *Urban Economics*, 5<sup>th</sup> ed., (New York, New York: McGraw-Hill/Irwin: 2003).

<sup>27</sup> Freeman, A. Myrick III (2003) *The Measurement of Environmental and Resource Values*, 2<sup>nd</sup> ed.: Washington: Resources for the Future

<sup>28</sup> We explored the possibility that land not used for residential purposes might be used for agricultural purposes. However, given current zoning laws, such an alternative use is prohibited.

45. This analysis synthesizes zoning and land use geospatial data to identify areas within proposed critical habitats that are suitable for residential development. For Wisconsin units, the value of the land is directly derived from geospatial data from tax parcels. A Geographic Information Systems (GIS) model was created that calculates the value per square foot of undeveloped land,<sup>29</sup> which then overlays the units with zoning information, and removes all resulting polygons that are unsuitable for residential or commercial development (e.g., conservation or wetlands).<sup>30</sup> Additionally, all Wisconsin and Michigan public and private conservation designated land, such as Department of Natural Resources land, parks, and Nature Conservancy land are excluded from the analysis, as these areas have no assessed value and will not be developed for residential or commercial purposes.
46. GIS tax parcel data were unavailable for all Michigan units. Therefore, the value of land suitable for residential development is derived using a two step process. First, employing GIS overlay functions, areas within proposed critical habitat that are unsuitable for development (e.g. wetlands and non-private property) are removed from the analysis. Second, remaining areas that are acceptable for development, based upon land use data and land ownership data, are assigned the average market value per acre for the county.<sup>31</sup>
47. Exhibit 2-3 shows that absent an alternative use for designated parcels, the total cost of foregone future development is \$1,704,000. These values are not discounted; the analysis assumes the impact on property value occurs immediately upon designation. Numerous economic studies have shown that land prices respond rapidly to regulatory changes.<sup>32</sup>
48. Limitation of eligible land for housing construction can have repercussions that are greater than simply reducing the amount of potential housing. If the limitations produce a substantial change in the amount of locally available developable land, then the building prohibition may affect the entire market for housing, hence causing price changes as well as losses of consumer surplus. However, if there are many substitute parcels available, the removal of a small quantity of those parcels will not have an impact on the market;

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<sup>29</sup> Employing Door County GIS data, undeveloped land was derived and assumed to be land with no improved value (improved values would denote developed land with structures).

<sup>30</sup> Land values are accurate as of 2006. Land values are assessed at fair market value. David Sautebin, Door County Zoning Administrator, Personal Communication, November 22, 2006. Dave Gibson and John Sturdy, Property Tax Office Equalization Section, Door County Wisconsin. Personal and Written Communications on October 16, 2006 and October 20, 2006.

<sup>31</sup> Because data for Michigan is not as complete as Door County GIS data, the above method was employed. The average market value for undeveloped land in Michigan was provided by Linda Taylor, Zoning Administrator for Presque Isle Township, Personal Communication on September 12, 2006; Joan Shroka, Bois Blanc Island Tax Assessor, Personal Communication on October 18, 2006; Les Klimaszewski, Zoning Administrator for Alpena Township, Personal Communication September 8, 2006.

<sup>32</sup> See Kiel, Katherine A. (2005) "Environmental Regulations and the Housing Market: A Review of the Literature," *Cityscape*, vol. 8, no.1, pp.187-207; Guttery, Randall S., Stephen L. Poe, and C.F. Sirmans (2000) "Federal Wetlands Regulation: Restriction on the Nationwide Permit Program and the Implications for Residential Property Owners," *American Business Law Journal*, vol. 37, no. 2, pp. 299-341; and Quigley, John M. and Larry A. Rosenthal (2005) "The Effects of Land Use Regulation on the Price of Housing: What Do We Know? What Can We Learn?," *Cityscape*, vol. 8, no.1, pp.69-137.

prices will not change and there will be no external welfare changes.<sup>33</sup> In the case of the amounts of residential land being considered, the impact on the market is of a sufficiently small magnitude to not affect the entire market.

49. Results from sampling multiple listing services in Michigan and Wisconsin indicate that limiting residential development in the study area is very unlikely to have a substantial impact on the local land markets. That is, prices of surrounding parcels are unlikely to change and it is unlikely that there will be welfare changes as a result of designation. There are many comparable substitute parcels available in those counties.<sup>34</sup>

## 2.2 COMMERCIAL DEVELOPMENT

50. Commercial development of proposed critical habitat encompasses potential commercial applications within the study area footprint that could displace the dragonfly or alter its habitat. The most substantial commercial development concern is the quarrying of surface and sub-surface dolomite deposits, which are generally found in dragonfly habitat. Logging in forested dragonfly habitat could also degrade habitat quality. This section also considers other forms of commercial development that could take place within the proposed critical habitat units. As with the previous section on residential development, this section separates the effects of direct action that would displace or degrade habitat from water uses related to commercial development which could change local hydrological conditions through depletion or contamination (water uses are addressed in Chapter 3).

### 2.2.1 QUARRYING

51. Dolomite is used for making concrete for home and highway construction. Dolomite is often present underneath dragonfly habitat because the fractured nature of most dolomite deposits allows relatively easy transmission of ground to surface water, which can create wetlands. Since dolomite underlies wetlands, quarrying dolomite deposits may pose threats to dragonfly habitat. Quarrying is considered a threat for the study area in Illinois and Wisconsin.

#### Dolomite Quarrying in Illinois

52. Substantial dolomite deposits are located in Illinois Unit 2. MSC owns these deposits, which are particularly valuable due to their proximity to the MSC Romeoville facilities.

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<sup>33</sup> Quigley, John M. and Aaron M. Swoboda (2006), "The Urban Impacts of the Endangered Species Act: A General Equilibrium Analysis," *Journal of Urban Economics*, vol. 61, pp. 299-318.

<sup>34</sup> Sampling of the Alpena County, Michigan multiple listing service found 146 total parcels; the 50 sampled parcels had an average size of 24.5 acres, and an average asking price of approximately \$68,000. Sampling of the Mackinac County, Michigan multiple listing service found a total of 229 parcels; the 50 sampled parcels had an average size of 5.8 acres, and an average asking price of approximately \$90,000. Sampling of the Presque Isle County, Michigan multiple listing service found a total of 255 parcels; the 50 sampled parcels had an average size of 23 acres, and an average asking price of approximately \$81,000. The Michigan samples were taken from <http://realestate-mls.com/> on July 16, 2007. Sampling of the Door County (Wisconsin) Realtors multiple listing service was performed July 17, 2007. The sampling found a total of approximately 550 vacant parcels of various sizes; the 50 sampled properties had an average size of 4.15 acres and an average asking price of approximately \$66,000.

Products made from dolomite can be shipped from this facility by road, rail, or water. The operation there represents between 20 and 25 percent of the company's operating revenue.<sup>35</sup> MSC estimates that it spent approximately \$1.1 million (undiscounted) on surveys and other studies of the dragonfly and its habitat between 1995 and 2006.<sup>36</sup> Net present values for these costs are \$1.3 million at a three percent discount rate and \$1.7 million at a seven percent discount rate.

53. MSC anticipates incurring costs for dragonfly threat mitigation in order to mine the quarry in Illinois Unit 2. These mitigation efforts include "on-site" creation, restoration, and enhancement of dragonfly wetland habitat in Illinois Unit 2, and in Illinois Unit 7, in order to offset potential losses of habitat in Illinois Unit 2 due to mining activities. MSC has predicted future mitigation costs may range from \$4 to \$8 million for the duration of quarry operation.<sup>37</sup> This analysis assumes that if these efforts are sufficient to mitigate the threat to the dragonfly, then the impact to MSC will be \$8 million (undiscounted). The net present value of the mitigation costs is \$5.3 million using a three percent discount rate and \$3.3 million using a seven percent discount rate.
54. If MSC is not permitted to mine their quarry in Illinois Unit 2, then they would lose the value of that resource. MSC has provided estimates of net revenues (sales revenues less production costs) from the mine in Illinois Unit 2, for its projected years of operation, 2009 through 2035.<sup>38</sup> While the rest of the analysis undertaken in this report focuses on a 20 year forecasting period, the 26 year projections are included in this particular cost estimate, because the decision of whether to mine in Illinois Unit 2 will be made within the timeframe of this analysis. The total undiscounted value of the stream of projected net revenues attributable to the mine in Illinois Unit 2 is \$17.6 million (undiscounted).<sup>39</sup> The net present value of the opportunity costs foregone is \$11.0 million using a three percent discount rate and \$6.5 million using a seven percent discount rate.
55. The dolomite contained in the deposit in Illinois Unit 2 is to be mined and combined with materials from other local deposits that are not in the study area to produce an aggregated construction product. MSC reports that there are no good substitutes for the dolomite in Illinois Unit 2, in part because the transportation costs associated with shipping the final product from the Romeoville facility by rail, road, or barge are much lower than elsewhere. While there are other dolomite mines in Illinois, MSC claims that there are no mines close enough to their Romeoville facility to make production of the aggregate

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<sup>35</sup> Meeting with Michael Melton and Joshua Quinn, MSC, at Illinois Tollway Facility in Lockport, Illinois, August 16, 2006. The estimate of 20 to 25 percent of revenue refers to MSC operations in Illinois, not Hanson PLC, the multinational firm which acquired MSC in 2006.

<sup>36</sup> Written communication from Michael Melton, Environmental Services Department Project Manager, Hanson Material Service, December 20, 2006.

<sup>37</sup> Ibid.

<sup>38</sup> Ibid.

<sup>39</sup> The MSC projected net revenues included an adjustment for inflation. Because net present values estimated elsewhere in this report are calculated using a real discount rate, the inflation adjustment is removed from the MSC projections.

profitable, given the transportation costs that would be incurred to ship raw material in or finished product out.

56. If MSC is unable to mine the dolomite deposit, they would have to produce other products with the materials they would have used to make the dolomite aggregate. As such, MSC would lose the value of the product (the aggregate) attributable to the dolomite produced from the mine in Illinois Unit 2. Because the product has a relatively low value to weight ratio, local transportation costs prohibit the use of substitute dolomite from other locations in Will County or the State of Illinois. In this case the lost value to MSC would be the total resource loss and not simply the cost of accessing the next best substitute.
57. The volume of the deposit and the yearly value of that deposit is estimated to be a small fraction of the entire Illinois dolomite market, which, in 1996 constituted 65 million tons of stone sold at a value at \$470 million (2006 dollars).<sup>40</sup> Therefore, although losses to MSC resulting from restrictions on mining in Illinois Unit 2 may be \$506,000 annually, it is unlikely that the lost stone would change the price of dolomite in the Illinois market, or cause a loss in consumer surplus.<sup>41</sup> In 2004, 16.5 million tons were mined from seven quarries in Will County alone, for gross revenues of \$94 million (production from these mines was not uniformly distributed among the mines).<sup>42</sup>

#### Regional Impact Analysis

58. Apart from economic efficiency losses to the economy as a whole, it may be important to consider the immediate regional impacts from the potential change in economic activity caused by not mining the dolomite deposit. These regional impacts are distributional in nature and do not represent the same type of efficiency losses presented in the rest of this analysis. However, since potential limitations to MSC's ability to mine in Illinois Unit 2 could cause regional distributional impacts, these impacts are presented here.
59. If MSC is unable to mine the dolomite deposit in Illinois Unit 2 a reduction in regional economic activity related to this sector may result. Changes would manifest primarily through decreased spending on fuel and power, wholesale trade, trucking, and machinery. Decreased expenditures in these industries would also result in secondary effects in sectors where expenditures by MSC are linked to purchases by workers, such as housing, trade, and professional services.
60. This analysis relies on regional economic modeling to estimate the economic impacts of these initial and secondary effects. In particular, it utilizes a software package called IMPLAN to estimate the total regional impact of not mining the dolomite deposit in

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<sup>40</sup> Illinois State Geological Survey, General Geology FAQs: Mining of Coal, Fluorite, and Limestone in Illinois, accessed on October 21, 2006. <http://www.isgs.uiuc.edu/faq/gg-faqs/GGQ23.html>

<sup>41</sup> When changes within a market do not constitute a substantial portion of that market, there are unlikely to be external welfare effects. See Just, Richard E., Darrell L. Hueth, and Andrew Schmitz, *The Welfare Effects of Public Policy: A Practical Approach to Project and Policy Evaluation*, (Edward Elgar Publishing, Inc., Cheltenham, UK, 2004)

<sup>42</sup> Personal communication with Zakaria Lasemi, Head, Industrial Minerals and Resource Economics Energy and Earth Resources Center< Illinois State Geological Survey, on December 1, 2006.

Illinois Unit 2. IMPLAN is commonly used by State and Federal agencies for policy planning and evaluation purposes. The model draws upon data from several Federal and State agencies, including the Bureau of Economic Analysis and the Bureau of Labor Statistics.<sup>43</sup> To group related industries into sectors, IMPLAN utilizes the categories defined by the U.S. Office of Management and Budget's North American Industry Classification System (NAICS) code.

61. IMPLAN translates initial changes in expenditures into changes in demand for inputs to affected industries. These effects can be described as direct, indirect, or induced,
  - **Direct effects** represent changes in output attributable to a change in demand or a supply shock. These are specified initially by the modeler (e.g., the change in mining expenditures on goods and services, by sector).<sup>44</sup>
  - **Indirect effects** are changes in output of industries that supply goods and services to those that are directly affected by the initial change in expenditures.
  - **Induced effects** reflect changes in household consumption, arising from changes in employment (which in turn are the result of direct and indirect effects). For example, changes in employment in a region may affect the consumption of certain goods and services.
62. These categories are calculated for all industries and aggregated to determine the regional economic impact of reduced dolomite mining potentially associated with dragonfly conservation efforts.
63. There are two important caveats relevant to the interpretation of IMPLAN model estimates, generally, and within the context of this analysis. The first is that the model is static in nature and measures only those effects resulting from a specific policy change (or the functional equivalent specified by the modeler) at one point in time. Thus, IMPLAN does not account for posterior adjustments that may occur, such as the subsequent re-employment of workers displaced by the original policy change. In this analysis, this caveat suggests that the long-run net output and employment effects resulting from changes in dragonfly conservation efforts are smaller than those estimated in the model, which will lead to an upward bias in the estimates. A second caveat to the IMPLAN analyses is related to the model data. The IMPLAN analysis relies upon input/output relationships derived from 2002 data. Thus, this analysis assumes that this characterization of the affected county's economy are a reasonable approximation of current conditions. If significant changes have occurred in the structure of the economy of Will County over the previous five years, the results may be sensitive to this assumption. However, the magnitude and direction of any such bias are unknown.

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<sup>43</sup> The IMPLAN model is owned and maintained by the Minnesota IMPLAN Group, Inc. (MIG). Information in this section is compiled in part from: *IMPLAN Professional, Social Accounting, and Impact Analysis Software, User's Guide, Analysis Guide, Data Guide*, Minnesota IMPLAN Group, Inc., 1997.

<sup>44</sup> Output is the value of all good and services produced.



64. IMPLAN starts with the change in local expenditures and estimates the effects that follow such a change by using multipliers for different industries. Multipliers calculate how primary changes can cause secondary and tertiary effects. For example, if MSC were unable to mine the dolomite in Unit 2, some of the value lost would result in a decrease in expenditures on power generation and supply. This loss in power company revenues could then result in a decrease in power company expenditures on labor, and workers in turn could have less money to spend on housing. Each step in this relationship contains an incremental change (less than the direct effect) which is prompted by the initial change. Multipliers quantify the magnitude of changes across the different steps in these relationships. IMPLAN uses multipliers in several sectors and computes these changes across relevant sectors, then aggregates them. IMPLAN may overstate the results because the model is not able to take into account some indirect effects, such as subsequent employment in other industries of workers displaced by the original change. In this way, IMPLAN models regional effects, which will tend to be higher than efficiency effects. These results are not included in the total of costs considered in other parts of this report since they represent only immediate regional impacts which may be ameliorated by other changes in the economy. However, these impacts may be important when considering policy effects in a particular location at a specific time.
65. The direct effect of not being able to mine the dolomite in Illinois Unit 2 would be an annual net loss of \$506,479.<sup>45</sup> IMPLAN estimates that there would be two jobs lost as a result of the direct effects. IMPLAN estimates indirect impacts to be \$106,413 and the loss of one job. Induced effects are estimated by IMPLAN to be \$101,959 and the loss of one job. The total regional loss, summing direct, indirect, and induced effects is \$714,851, and a total loss of four jobs. This loss represents 0.0032 percent of the annual baseline economy of Will county, where Illinois Unit 2 is located. These impacts would occur once and persist for some period of time until the economy adjusts to the change.<sup>46</sup>

#### Dolomite Quarrying in Wisconsin

66. In Wisconsin, between 2,000 to 3,000 sites exist where quarrying is performed for limestone and dolomite.<sup>47</sup> Dolomite is found in areas within Door County, Wisconsin, where several other proposed critical habitat units are located (WI Units 1-9 and 11); however, no known dolomite deposits have been identified in these units.<sup>48</sup> The amount

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<sup>45</sup> Written communication from Michael Melton, Environmental Services Department Project Manager, Hanson Material Service, December 20, 2006.

<sup>46</sup> Changes in output and employment are not annual losses. That is, if 4 jobs are lost in 2007, an additional 4 jobs are not lost in 2008 and each year thereafter. IMPLAN does not account for long-term adjustments made by the regional economy in response to the initial change in expenditures.

<sup>47</sup> Wisconsin Department of Natural Resources, "A Brief Summary of Wisconsin's Non-metallic Mining Reclamation Program," PUB-WA-828 2000, obtained at: <http://www.dnr.state.wi.us/org/aw/wm/publications/mining/WA-828-00.pdf>

<sup>48</sup> IEC has confirmed that there are not dolomite deposits in Wisconsin units in Door County. Written communication with Dean Graff, Door County Soil and Water Conservation Department, November 17, 2006. Additionally, there are not dolomite deposits in Wisconsin Unit 11, and following 2000, no future mining can take place within the unit. Personal Communication with Dean Graff December 20, 2006.

of dolomite in Door County is a small fraction of the available dolomite in the State.<sup>49</sup> If deposits are discovered in the future, but mining is limited as a result of the presence of the dragonfly or its habitat, local prices are unlikely to be affected due to the small fraction of dolomite in Door County relative to the rest of the State.

### 2.2.2 LOGGING

67. Logging may also take place in the study area, specifically in Michigan Units one and two, and in Wisconsin Units one through ten. Logging has the potential to reduce habitat by clearing areas where adult dragonfly have been known to forage and take shelter. However, clearance of forested areas, especially dense forested areas near dolomite wetlands may actually create additional habitat for the dragonfly.
68. The Service has determined that logging should not necessarily be prohibited within the study area, but that it should be done in an environmentally sensitive manner.<sup>50</sup> The Michigan units of proposed critical habitat that are threatened by logging are within the Hiawatha National Forest and as such are governed by National Forest best management practices (BMPs) for timber harvesting including access road construction.<sup>51</sup> Wisconsin also has established BMPs for these activities. The BMPs in both Michigan and Wisconsin contain special, restrictive procedures for activity near wetlands. These BMPs are consulted and applied according to the unique restraints and working conditions of potential project areas.<sup>52</sup> Appendix E addresses wetland BMPs that are used in dragonfly habitat. These costs will be incurred by land owners in potential dragonfly habitat irrespective of the presence of the dragonfly, and thus are not considered here. As a result, this report does not forecast costs associated with silvicultural activities.

### 2.2.3 OTHER COMMERCIAL DEVELOPMENT

69. Other commercial development activities that may impact dragonfly habitat could include many different types of new facilities or land uses. The units where development may be a threat (where threats were identified by the Service and where there is developable private land) are Illinois Units 1 through 3, 4, and 7, and Wisconsin Units 3 through 7. Several of these units are partially held by the public, which reduces the available area for development. At the present time, there is no further information regarding specific future plans for commercial development within these units.

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<sup>49</sup> Correspondence with Thomas J. Evans, Assistant Director of the Wisconsin Geological and Natural History Survey, University of Wisconsin (10/4/06) and William S. Cordua, Professor of Geology/Mineralogy, University of Wisconsin (October 2, 2006).

<sup>50</sup> Personal communication with Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, September 19, 2006.

<sup>51</sup> The majority of land within Michigan units 1 and 2 is not suitable for timber harvesting. Personal communication with Kirk Piehler. US Forest Service. November 21, 2006

<sup>52</sup> Correspondence with Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office (October 17, 2006) and Biologist, U.S. Fish and Wildlife Service, Marquette, Michigan Field Office. (October 18, 2006). Michigan BMPs produced by the Michigan Department of Natural Resources and the Michigan Department of Environmental Quality. [http://www.mi.gov/dnr/0,1607,7-153-30301\\_31154\\_31261---,00.html](http://www.mi.gov/dnr/0,1607,7-153-30301_31154_31261---,00.html). Wisconsin BMPs produced by the Wisconsin Department of Natural Resources, Forestry Division: <http://www.dnr.state.wi.us>

70. As discussed earlier in this chapter, the value of undeveloped land should capture the market's current best predictions of the future value of developments given the uncertain probabilities of that development. Thus an upper bound estimate on the impact of dragonfly conservation efforts would be to assume that all value of commercially zoned land is removed (that all value goes to zero).
71. Investigation of land use zoning across critical habitat units in Michigan and Wisconsin revealed that exclusively commercial zoning was only found in Wisconsin Unit 5. In this unit, 14.54 acres are zoned for commercial/recreational use next to Bailey's Harbor Ridges Park (run by the Door County Parks Department). A restroom facility/interpretive center/gift shop that serves the park occupies this area. However, because this multi-purpose facility is currently operating, and is not considered a threat, and because there are no indications that this parcel will be used for other purposes, future impacts are not anticipated.
72. Private land zoned for rural mixed-use development in Wisconsin was considered in the GIS analysis. However, these areas are intended to maintain the rural qualities of the Door County Landscape.<sup>53</sup> Accordingly, these areas allow for very low density residential, rural commercial, or agriculture uses. Any inability to develop these parcels for residential or commercial uses would not result in a loss in land value. These areas can still be used for agricultural purposes, and they are therefore not considered to be a complete loss of value that can be attributed to the designation of dragonfly habitat.

#### Section 7 Consultations

73. There have been several instances where agencies have sought consultation with the Service, as required by section 7(a)(2) of the Act, to pursue a development related action. Exhibit 2-4 provides cost information for these consultations. Exhibit 2-4 indicates the unit of concern, a summary description of the activity evaluated, the year of the consultation, and the total undiscounted and discounted costs associated with that consultation. When consultations involve more than one unit, the cost is divided evenly across the affected units.

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<sup>53</sup> Chapter 2 Door County Zoning Ordinance. Personal communication with David Sautebin, Zoning Administrator of Door County, November 22nd, 2006

EXHIBIT 2-4 PAST SECTION 7 CONSULTATION COSTS FOR OTHER DEVELOPMENT ACTIVITIES

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	US ACE Regional Permit Program	2004	\$1,000	\$1,000	\$1,000
IL 2	US ACE Regional Permit Program	2004	\$1,000	\$1,000	\$1,000
IL 3	US ACE Regional Permit Program	2004	\$1,000	\$1,000	\$1,000
IL 4	US ACE Regional Permit Program, RCRA Permitting Action	2004, 2000	\$2,000	\$2,000	\$3,000
IL 5	US ACE Regional Permit Program, RCRA Permitting Action	2004, 2000	\$2,000	\$2,000	\$3,000
IL 6	US ACE Regional Permit Program	2004	\$1,000	\$1,000	\$1,000
IL 7	US ACE Regional Permit Program	2004	\$1,000	\$1,000	\$1,000
MI 3	Bois Blanc Waste Transfer Shelter Construction	2003	\$14,000	\$16,000	\$19,000
<b>Total</b>			<b>\$20,000</b>	<b>\$23,000</b>	<b>\$27,000</b>

Note: Totals may not sum due to rounding

**2.3 UTILITY AND ROAD CONSTRUCTION**

74. Road and utility (electrical and gas pipeline) construction has been discussed, planned, and in some cases executed in several of the proposed critical habitat units.

**2.3.1 UTILITY CONSTRUCTION**

75. Utility construction on or near dragonfly habitat has been discussed in several situations. In Wisconsin Unit 5, one section 7 consultation and three Technical Assistances (TA) were conducted to evaluate and discuss potential effects on construction of new utilities, primarily new electrical lines and power poles. Exhibit 2-5 provides cost information from these reviews.

EXHIBIT 2-5 PAST SECTION 7 CONSULTATION COSTS FOR UTILITY CONSTRUCTION

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
WI 5	Placement of Overhead Electric Lines (section 7)	2001	\$14,000	\$17,000	\$21,000
	Lime Kiln Road Power Pole Project (TA)	2005	\$2,000	\$2,000	\$3,000
	Power pole project, Grove road (TA)	2005	\$2,000	\$2,000	\$3,000
	Proposed Utility route pioneer road (TA)	2006	\$2,000	\$2,000	\$2,000
<b>TOTAL</b>			<b>\$21,000</b>	<b>\$24,000</b>	<b>\$29,000</b>

76. Most of the rest of the habitat units in Michigan, Missouri, and Wisconsin are in low population density areas and occupy wetlands that do not intersect primary corridors used by utility infrastructure. In the few cases where such construction may be considered, there are multiple State and county ordinances governing such construction, which make such development difficult.<sup>54</sup> The exception to this generalization is Illinois, where there are multiple power transmission and distribution lines through the study area units. Currently, replacement of existing transmission lines in Illinois Units 1 and 2 is being considered by Com Ed. However, no final determination has been made regarding replacement. Costs for maintenance activities, an alternative action to line replacement, are presented in Chapter 4.<sup>55</sup>

2.3.2 ROAD CONSTRUCTION

77. Consultations were conducted for several highways, roads, and road extension projects in or near dragonfly habitat. These projects involve the construction of high volume public roads; logging or forestry management road construction is considered part of Forest Management (see Section 6.4).

78. Exhibit 2-6 provides cost information for road construction consultations. Exhibit 2-6 indicates which proposed habitat units were concerned, a summary description of the activity evaluated, the year of the consultation, and the undiscounted and discounted costs associated with that consultation.

<sup>54</sup> An example of this is the attempt of Wisconsin Public Service Corporation to place power lines in an area proximate to dragonfly habitat. The Wisconsin Department of Natural Resources opposed the action and purchased a conservation easement from the landowner which precluded the extension of utilities to the property. See written communication from US Fish and Wildlife Service Wisconsin Field Supervisor to Russ Senso, Wisconsin Public Service Corporation, September 11, 2001; and written communication from Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, September 29, 2006.

<sup>55</sup> Written communication from Sara Race, Environmental Services Department, Exelon Energy Delivery, ComEd, November 3, 2006.

EXHIBIT 2-6 PAST SECTION 7 CONSULTATIONS COSTS FOR ROAD CONSTRUCTION

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	Potential Caton Farm Road Bridge Construction	2005	\$15,000	\$15,000	\$17,000
WI 9	Bridge Construction, State Highway 57	2004	\$24,000	\$27,000	\$30,000
<b>TOTAL</b>			<b>\$39,000</b>	<b>\$42,000</b>	<b>\$46,000</b>

Note: Totals may not sum due to rounding

79. The highest cost road construction involved the construction of an elevated interstate highway extension through the middle of Illinois Unit 4 to connect Interstate 55 with Interstate 80. This project was of sufficient magnitude that it warrants discussion independently (it has been omitted from Exhibit 2-6). Total costs of the extension over the Des Plaines River Valley are \$125 million. Dragonfly specific costs include dragonfly surveying, monitoring, and research, and construction procedures used to minimize adverse impacts to dragonflies and dragonfly habitat. Exhibit 2-7 displays the past costs of the different dragonfly conservation and mitigation activities necessary for the construction of this project.

EXHIBIT 2-7 PAST COSTS OF ILLINOIS I-355 TOLLWAY EXTENSION RELATED TO DRAGONFLY CONSERVATION

ACTIVITY	YEAR	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
Habitat Management	2005-2006	\$20,000	\$21,000	\$22,000
Construction Mitigation	2005-2006	\$933,000	\$976,000	\$1,034,000
Dragonfly Surveys / Monitoring	1995-2006	\$602,000	\$650,000	\$728,000
Administrative Time	1995-2006	\$129,000	\$178,000	\$271,000
Dragonfly Research	2004-2006	\$160,000	\$168,000	\$179,000
<b>TOTAL</b>		<b>\$1,844,000</b>	<b>\$1,993,000</b>	<b>\$2,234,000</b>

Note: Totals may not sum due to rounding

80. The past costs for the I-355 tollway extension are primarily attributable to multi-year programs to survey and monitor the population of dragonflies in proximity to the construction, before and during the initial construction. The largest mitigation cost was the construction of the bridge eight feet higher than the original plans called for in order to ensure that adult dragonflies could fly under the bridge unimpeded.<sup>56</sup> Construction

<sup>56</sup> Written communication from Brian Smith, Senior Project Manager, CTE, January 25, 2007.

mitigation also included use of wetland protective measures for construction machinery such as barrier fences to separate construction activity from the dragonflies and other similar measures. Administrative costs include the costs of legal, professional, and engineering work on preparation and implementation of the conservation efforts within the overall construction program. Research costs involve preparation of the biological opinion and initial costs for a dragonfly working group established to guide the Tollway's efforts.

81. The future costs listed in Exhibit 2-8 include designated funding for additional habitat management measures, such as rivulet restoration, additional construction mitigation (including part of the cost of raising the bridge eight additional feet), additional monitoring and surveying of the dragonfly population in proximity to the construction, additional administrative (legal, administrative, engineering) work, and funds allocated to future research by the dragonfly working group as well as various other future research programs.<sup>57</sup>

**EXHIBIT 2-8 FUTURE COSTS OF ILLINOIS I-355 TOLLWAY EXTENSION RELATED TO DRAGONFLY CONSERVATION**

ACTIVITY	YEAR	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
Habitat Management	2007-2011	\$310,000	\$293,000	\$273,000
Construction Mitigation	2007	\$467,000	\$467,000	\$467,000
Dragonfly Surveys / Monitoring	2007-2008	\$467,000	\$461,000	\$452,000
Administrative Time	2007-2011	\$300,000	\$283,000	\$263,000
Dragonfly Research	2007-2013	\$740,000	\$674,000	\$601,000
<b>TOTAL</b>		<b>\$2,284,000</b>	<b>\$2,178,000</b>	<b>\$2,056,000</b>

Note: Totals may not sum due to rounding

82. At the present, there are no known plans for future road construction in the study area. The Caton Farm Road project may encroach upon Illinois Unit 1, but there are multiple different routes being considered. At present, it is not possible to determine costs of pursuing alternate routes, and the final route has not been selected.<sup>58</sup> As with utility construction, most of the study area units are in relatively remote areas with low population. Also, as is the case with utility construction, there are multiple jurisdictions that are involved with the conservation of wetland areas throughout the states where the study area units are located. These multiple regulations that exist independently of the presence of the dragonfly make future road construction in these areas unlikely.

<sup>57</sup> Some designated funding commitments were open ended. For funding commitments beginning in 2009 with no end date specified, a five year research period was assumed.

<sup>58</sup> Written communication from Charles Crim, Illinois Department of Transportation, October 9, 2006.

**2.4 CHANGES IN OWNERSHIP AND MANAGEMENT PRACTICES**

83. The proposed designation listed land ownership and management changes as threats for several habitat units.<sup>59</sup> These concerns are primarily about scenarios that might occur if new private landowners or land managers decide to pursue land uses or management practices that are not oriented toward dragonfly conservation. The economic impacts of such changes are very difficult to predict. The best estimate possible is to rely on the discussion and estimates presented in Section 2.1, which views the current residential land price of privately held real estate as the expected value for that real estate, given the best predictions of the current landowners and other real estate speculators. As such, the economic impacts associated with unknown land use and management changes are best captured in the full value of the land, as reflected in the current prices.

*Section 7 Consultations*

84. Several section 7 consultations were undertaken concerning the transfer of land ownership between organizations. Exhibit 2-9 provides cost information for these consultations. Exhibit 2-9 indicates which proposed habitat units were concerned, a summary description of the activity evaluated, the year of the consultation, and the undiscounted and present value costs associated with that consultation. Missouri Units 8 through 10 are reported together here, as they are reported together in the proposed rule.

85. These transfers either involved trades of environmentally sensitive land transferred from private to federal ownership or the transfer of federal land to state ownership. As such, these land transfers were reviewed under Section 7. In all cases these exchanges were judged as unlikely to threaten dragonflies or dragonfly habitat.

**EXHIBIT 2-9 PAST CONSULTATION COSTS FOR CHANGES IN OWNERSHIP AND LAND MANAGEMENT**

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
MO 5	Federal land exchange for Doe Run Co. Land	2006	\$5,000	\$5,000	\$5,000
MO 8-10	2 transfers	2006	\$32,000	\$33,000	\$34,000
MO 11	2 transfers	2006	\$11,000	\$11,000	\$11,000
MO 13	2 transfers	2006	\$11,000	\$11,000	\$11,000
MO 14	Federal land exchange for Doe Run Co. Land	2006	\$5,000	\$5,000	\$5,000
MO 15	2 transfers	2006	\$11,000	\$11,000	\$11,000
WI 5	Transfer Lighthouse Ownership to County	2004, 2005	\$29,000	\$31,000	\$34,000
<b>Total</b>			<b>\$102,000</b>	<b>\$106,000</b>	<b>\$112,000</b>

Note: Totals may not sum due to rounding

<sup>59</sup> 71 FR 42442



**2.5 HABITAT CONSERVATION PLAN**

86. A consortium of affected stakeholders have joined together to initiate a Habitat Conservation Plan (HCP), entitled the “Single Species Habitat Conservation Plan for the Hine’s Emerald Dragonfly on Public and Private Lands in Illinois.” The primary HCP planning area spans Illinois Units 1, 2, and 7, and the secondary HCP planning area includes Unit 3 as well. Budgeted costs for developing the HCP are to be divided evenly amongst these four proposed critical habitat units.<sup>60</sup> As of the date of this report, the HCP was still in the initial planning stage.
87. The HCP grew out of meetings of a right of way management team formed in 1996 to address rail line maintenance in areas where the dragonfly was found. The members of the right of way management team now constitute the HCP partnership, which is managed by a steering committee (Materials Services Corporation, Midwest Generation, and ComEd), with technical advisors (the Service, US Army Corps of Engineers, Illinois Department of Natural Resources). Several other active participants are included, and several potential participants are being considered. Most potential participants include stakeholders in the secondary HCP area whose water use could impact dragonfly habitat.
88. Several members of the HCP have incurred costs in addition to their direct investment into the HCP. Exhibit 2-10 displays these costs, which include administrative and professional preparation costs. Additionally, Illinois Unit 7 features the one-time cost of \$375,000. This cost represents the purchase of land (by MSC) east of the Des Plaines river and is associated with the HCP.<sup>61</sup> Exhibit 2-10 also includes that part of the HCP budget spent in 2006.

**EXHIBIT 2-10 PAST UNIT COSTS FOR HABITAT CONSERVATION PLAN**

UNIT	TOTAL COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	\$178,000	\$187,000	\$199,000
IL 2	\$178,000	\$187,000	\$199,000
IL 3	\$178,000	\$187,000	\$199,000
IL 7	\$553,000	\$722,000	\$1,044,000
<b>Total</b>	<b>\$1,088,000</b>	<b>\$1,283,000</b>	<b>\$1,642,000</b>

Note: Totals may not sum due to rounding

89. The total budget for the multi-year HCP project, intended to be available for public review in 2007, is \$1,208,000. Of this, the HCP steering committee will provide

<sup>60</sup> However, as discussed in Section 2.2.1, MSC foresees expenditures up to \$8 million to enable them to mine dolomite deposits in Illinois Unit 2.

<sup>61</sup> Written communication with Michael Melton, Project Manager, Environmental Services Department, MSC. December 20, 2006.

\$838,000 as a 300 percent match to \$370,000 of requested Federal funds.<sup>62</sup> This process is projected to span September 2005 through December 2008. For the purposes of this estimation, the total is divided evenly over the years 2006, 2007, and 2008. Exhibit 2-11 includes these costs as well as additional anticipated expenditures on the part of the HCP partners.

**EXHIBIT 2-11 FUTURE UNIT COSTS FOR HABITAT CONSERVATION PLAN**

UNIT	TOTAL COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	\$265,000	\$256,000	\$246,000
IL 2	\$265,000	\$256,000	\$246,000
IL 3	\$265,000	\$256,000	\$246,000
IL 7	\$265,000	\$256,000	\$246,000
<b>Total</b>	<b>\$1,060,000</b>	<b>\$1,024,000</b>	<b>\$982,000</b>

Note: Totals may not sum due to rounding

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<sup>62</sup> This does not include the estimated \$8 million dollars that MSC expects to pay as part of the HCP if they are allowed to mine their dolomite deposits in Illinois Unit 2 (this cost is discussed in Section 2.2.1).

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90. The primary hydrological threats to dragonfly habitat are localized depletion of water and/or alteration of water patterns, contamination of ground and surface waters, and region wide changes to water levels. Due to the bedrock geology of fractured dolomite underlying dragonfly habitat, surface water may be quickly transmitted to ground water, and groundwater depletion can result in a subsequent rapid depletion of surface water.<sup>63</sup> Given the relative ease of transmission and mingling between surface and groundwater in or close to dragonfly habitat, activities that affect either will cause changes to both types of water sources.
91. Exhibit 3-1 provides per unit low and high cost estimates associated with potential threats to water quality and quantity. Both low and high estimates are included to address uncertainty concerning how to mitigate hydrologic threats. Low estimates represent expected future administrative costs only, assuming no mitigation effort to offset water depletion. The high estimates include costs to mitigate depletion of water in the study area. These costs result from replacement of existing municipal shallow aquifer wells with deep aquifer wells in towns located within one mile of the study area and construction of new deep water wells (in place of shallow wells) to support future projected population growth in those towns.
92. Undiscounted future costs for no mitigation (Low Estimate) are estimated to be \$29,000. In present value terms, impacts range from \$20,000 to \$13,000 assuming discount rates of three and seven percent, respectively. The higher cost estimate for hydrologic mitigation has estimated future costs of \$7.0 million. In present value terms, impacts range from \$5.4 million to \$4.0 million, assuming discount rates of three and seven percent, respectively. These costs are presented as upper bound cost estimates for one method of addressing habitat threats of water depletion and alteration. These upper bound costs are presented as high end cost estimates in the Executive Summary.

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<sup>63</sup> Telephone interview with Mark Walter, Executive Director, Bay Lake Regional Planning Commission, Wisconsin on September 12, 2006. Confirmed in separate discussions with Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, & U.S. Fish and Wildlife Service Chicago Field Office Endangered Species Coordinator on September 26, 2006. The speed at which water is transmitted from surface to groundwater varies based on local geologic conditions.

EXHIBIT 3-1 SUMMARY OF FUTURE WATER USE ACTIVITY COSTS PER UNIT

UNIT	TOTAL COSTS					
	UNDISCOUNTED		PRESENT VALUE (3%)		PRESENT VALUE (7%)	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
IL 1	\$0	\$1,600,000	\$0	\$1,226,000	\$0	\$907,000
IL 2	\$0	\$1,600,000	\$0	\$1,226,000	\$0	\$907,000
IL 3	\$29,000	\$329,000	\$20,000	\$250,000	\$13,000	\$183,000
IL 4	\$0	\$300,000	\$0	\$230,000	\$0	\$170,000
IL 7	\$0	\$3,200,000	\$0	\$2,452,000	\$0	\$1,814,000
<b>Total</b>	<b>\$29,000</b>	<b>\$7,029,000</b>	<b>\$20,000</b>	<b>\$5,383,000</b>	<b>\$13,000</b>	<b>\$3,981,000</b>

Note: Totals may not sum due to rounding

93. Considerable uncertainty surrounds the quantification of these estimates. Foremost, there are currently no data indicating whether existing or future municipal water sources (including groundwater and surface water sources) modify hydrologic conditions to a degree that adversely impact the dragonfly or its habitat. In addition, hydrologic models are unavailable to assess the role of any specific groundwater pumping activity or surface water diversion in determining hydrologic conditions within the study area. As such, this analysis does not quantify the probability or extent to which water use would need to be curtailed or modified to remedy impacts on the dragonfly. It does, however, provide information on the potential scale of economic impacts that could occur if efforts associated with dragonfly conservation result in changes to municipal water supplies.
94. The chapter first discusses economic impacts resulting from efforts to prevent ground and surface water depletion and/or alteration and quantifies impacts to residential water users. Next, it describes potential sources of groundwater contamination. It concludes with a discussion of the implications of potential hydrologic changes in the Great Lakes with regard to the study area.
- 3.1 GROUND AND SURFACE WATER DEPLETION AND/OR ALTERATION**
95. In the study area, ground and surface water alteration and/or depletion is principally caused by residential or commercial/industrial consumption. Increasing population levels and expansions in business activities may exacerbate habitat quality problems.
96. The past administrative costs regarding surface and groundwater depletion and/or alteration are attributed to three technical assistances that occurred in Illinois Units 1, 2, 3, 4, 5, and one informal consultation in Illinois Unit 3. These costs sum to a total of \$24,000 in undiscounted dollars, with a present value of \$26,000 to \$29,000 discounted at three and seven percent, respectively. Exhibit 3-2 presents these costs.

EXHIBIT 3-2 PAST ADMINISTRATIVE CONSULTATION COSTS

UNIT	ACTION	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	Technical Assistance	\$6,000	\$7,000	\$9,000
IL 2	Technical Assistance	\$1,000	\$1,000	\$1,000
IL 3	Technical Assistance, Informal Consultation	\$15,000	\$16,000	\$17,000
IL 4	Technical Assistance	\$1,000	\$1,000	\$1,000
IL 5	Technical Assistance	\$1,000	\$1,000	\$1,000
<b>Totals</b>		<b>\$24,000</b>	<b>\$26,000</b>	<b>\$29,000</b>

Note: Totals may not sum due to rounding

97. Of these past administrative costs, only one consultation is anticipated to recur over the next twenty years. This informal section 7 consultation, construction of barriers to filter storm water run-off and sedimentation in Illinois Unit 3 is anticipated to require maintenance over the next twenty years. The projected cost over the twenty year period is \$29,000 in undiscounted dollars. Further, the present value cost is estimated to be \$20,000 dollars assuming a three percent discount rate and \$13,000 assuming a seven percent discount rate.

3.1.1 RESIDENTIAL CONSUMPTION

98. Residential consumption of groundwater through private and/or municipal wells can draw down the water table in the upper aquifer. When the water table in the upper aquifer is lowered, and when groundwater flow patterns divert toward well intakes, wetland recharge is reduced. This activity can cause dragonfly habitat to become dry and reduce the viability of larval populations.
99. Growing residential use of groundwater is especially important in Illinois Unit 1. In 2000 the adjacent village of Crest Hill drilled a new well and discussed drilling two additional wells.<sup>64</sup> One of the additional wells was completed and has exacerbated local drought conditions, making Illinois Unit 1 less hospitable for the dragonfly.<sup>65</sup>
100. There may be several ways to compensate for increased demands on upper aquifer groundwater. One alternative source of water for municipal systems, suggested in Illinois, is to drill wells into the deep aquifer.<sup>66</sup>

<sup>64</sup> Written communications from Chicago Office Field Supervisor, US Fish and Wildlife Service, to Robert Hamilton, Robert Hamilton Consulting Engineers, PC, October 12, 2000 and from Chicago Office Field Supervisor, US Fish and Wildlife Service to Donald L. Randich, Mayor of the Village of Crest Hill, Illinois, February 2, 2001.

<sup>65</sup> Correspondence from US Fish and Wildlife Service Botanist/Wetland Ecologist, Chicago Field Office, September 13, 2006.

<sup>66</sup> Personal communication with U.S. Fish and Wildlife Service Chicago Field Office Endangered Species Coordinator, September 15, 2006.

101. In Illinois, a cost comparison is possible for drilling a deep aquifer well; the nearby city of Romeoville has both shallow and deep aquifer wells.<sup>67</sup> Engineering estimates for the additional cost to drill a deep aquifer well in Romeoville were \$500,000; drilling a municipal well into the shallow aquifer costs \$200,000.<sup>68</sup> Romeoville has five deep aquifer wells, drilled to a depth of 1,200 feet and seven shallow aquifer wells, and reports no water shortages. Yearly operating costs for deep water wells were unavailable.
102. An added cost estimate for water depletion mitigation is estimated using drilling costs in Romeoville as a proxy value for the cost of drilling for alternate water sources in other areas with potential hydrologic connections to the study area. While this may not be a perfect proxy, it is highly likely that the difference in the magnitude of costs will be constant across similar habitats in different states, even if the underlying geology is not identical. The analysis takes the following steps:
- **Step 1 - Estimate the per capita number of deep aquifer wells necessary to reduce the threats to the dragonfly and its habitat.** The analysis assumes that the number of deep aquifer wells in Romeoville is indicative of the proportion of a town's municipal source that must come from deep water sources to avoid threatening the habitat. The 2000 population of Romeoville (21,142 individuals) is divided by the number of deep aquifer wells (five) for a per capita estimate of 1 well per 4,200 people.
  - **Step 2 - Identify municipal water supplies potentially threatening the study area.** GIS spatial analysis is used to identify towns within one mile of the study area and in the same ground-watershed. The analysis assumes that residential water use from municipal wells currently threatens dragonfly habitat. Towns that have no municipal wells are excluded from the analysis.
  - **Step 3 - Estimate the number of deep aquifer wells needed based on current and future population projections for each town.** The current population in each town is obtained from the Northeast Illinois Planning Commission (NIPC) and divided by the population per well estimated in the first step.<sup>69</sup> The result is an estimate of the total number of deep aquifer wells needed to replace existing water sources. In addition, future population growth is estimated through 2026 using data from NIPC, and this growth is also divided by the per capita well estimate to determine the number of new wells required to support this growing population without threatening the study area.
  - **Step 4 - Estimate the costs of replacing or expanding existing water sources.** The analysis assumes that part of the existing water supply in these towns will be replaced with deep aquifer wells at a cost of \$500,000 per well. In addition, deep aquifer wells needed to support population growth will cost \$300,000 per well

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<sup>67</sup> Romeoville drilled their deep aquifer well to compensate for poor water quality in their local upper aquifer.

<sup>68</sup> Personal communication with Jon Zabrocki, Romeoville Village Engineer, and Chris Drey, Romeoville Water Superintendent, October 25, 2006.

<sup>69</sup> Population projection data available at [www.nipc.org](http://www.nipc.org), as viewed on October 25, 2006.

(i.e., the analysis assumes that in the absence of concerns for dragonfly habitat, additional water demand would have been met by drilling new shallow aquifer wells at a cost of \$200,000 per well).

○ **Step 5 - Estimate future costs of installing deep-aquifer wells.**

The analysis considers the number of wells that will be necessary to install to meet the demands of the each town's projected population growth. Based upon the per capita number of wells for each projected population over twenty years, the number of wells are calculated and assigned a cost of \$300,000. This cost is the extra cost of drilling deep-aquifer wells as opposed to shallow wells, which can potentially alter dragonfly habitat hydrology. These costs are then divided across the habitat units that contain the towns within a one mile radius.

These calculations assume that the ratio of population sizes to wells in Romeoville is transferable, and that underlying geology will generate similar deep well drilling cost differences. Towns that do not use municipal wells are not included in this analysis. The analysis also assumes that residential water use in towns farther than one mile from the study area do not threaten dragonfly habitat, because (1) wells in these areas have a relatively small yield, and (2) better data describing hydrologic conditions in the area are not available.<sup>70</sup>

103. Exhibit 3-3 displays the current and future number of wells for towns within a one mile radius of proposed critical habitat units. Exhibit 3-3 shows the population in 2000 and their expected population growth through 2026.<sup>71</sup> The number of deep aquifer wells required to replace shallow aquifer wells and reduce upper aquifer impacts are also displayed, followed by the undiscounted costs to drill them. For example four deep aquifer wells are necessary in Crest Hill to offset the current demands on surface water. Because each well costs \$500,000, the total economic cost is two million dollars.
104. The exhibit also shows the expected future growth and numbers of deep aquifer wells necessary to compensate for potential water depletion caused by that growth. Crest Hill is projected to require two additional deep water wells by 2026 to compensate for continued population growth. Because new wells would have been drilled to meet this demand for water if the dragonfly were not present, the only relevant cost is the incremental cost of drilling deeper, in this case the difference between the cost of a deep aquifer well (\$500,000) and a shallow aquifer well (\$200,000). As a result, the undiscounted future cost of two new deep wells in Crest Hill is \$600,000. Romeoville has existing deep water wells that mitigate against depletion of the habitat recharge area, hence its costs derive solely from new wells needed to compensate for future population growth.

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<sup>70</sup> This analysis also assumes that the municipalities in question would not drill deep aquifer levels for other reasons, such as lower output of upper aquifer wells due to lower water levels.

<sup>71</sup> [www.nipc.org](http://www.nipc.org) last accessed November 30, 2006

**EXHIBIT 3-3 FUTURE COSTS OF RESIDENTIAL CONSUMPTION**

TOWN <sup>72</sup>	2006 POP.	POP. GROWTH	CURRENTLY NEEDED DEEP WELLS	PROJECTED NUMBER OF WELLS BY 2026	CURRENT COSTS	FUTURE COSTS
Crest Hill, IL	13,329	5,812	4	2	2,000,000	\$600,000
Lockport, IL	15,191	14,022	4	4	2,000,000	\$1,200,000
Romeoville, IL	21,183	15,133	0 <sup>73</sup>	4	N/A	\$1,200,000
<b>Total</b>					<b>\$4,000,000</b>	<b>\$3,000,000</b>

105. Exhibit 3-4 provides per unit costs of residential consumption. Here, the costs reported in Exhibit 3-4 are distributed across the units that are close to them and within the same ground-watershed. If a town is within one mile of more than one unit, the costs of drilling the deep water wells are split among the units. Exhibit 3-4 presents the towns within 1 mile of the units, and undiscounted and present value costs for well drilling.

**EXHIBIT 3-4 PER UNIT FUTURE COSTS OF RESIDENTIAL CONSUMPTION**

UNIT	TOWNS WITHIN 1 MILE	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	Crest Hill, Romeoville	\$1,600,000	\$1,226,000	\$907,000
IL 2	Crest Hill, Romeoville	\$1,600,000	\$1,226,000	\$907,000
IL 3	Romeoville	\$300,000	\$230,000	\$170,000
IL 4	Romeoville	\$300,000	\$230,000	\$170,000
IL 7	Lockport	\$3,200,000	\$2,452,000	\$1,814,000
<b>Total</b>		<b>\$7,000,000</b>	<b>\$5,363,000</b>	<b>\$3,967,000</b>

Note:

- (a) For towns that are proximate to more than one unit, costs are divided between the relevant units.  
 (b) Totals may not sum due to rounding

106. Storm water management practices, oriented toward management of runoff in the presence of urban/suburban impervious surfaces, can assist in groundwater and wetland recharge. Best Management Practices vary widely according to local circumstances, such as the amount of impervious surfaces present, runoff gradients, and proximity of bodies of water. There are also a multitude of different institutional arrangements for

<sup>72</sup> The towns listed are within the recharge area of the dragonfly and affect habitat hydrology. Additionally, these towns rely on municipal wells for water. Lemont is excluded because it is not in the recharge area. Argonne National Laboratories, Bolingbrook, Fairmont, Palos Hills, and Woodbridge are excluded because they do not rely on municipal wells for water. No units in states other than Illinois have municipalities within 1 mile.

<sup>73</sup> Romeoville currently has 7 deep wells. Water costs for Romeoville are for population growth only.



implementing stormwater management including tradeable quotas, stormwater management utilities, or simple regulation. Because stormwater management is dependent on the requirements of specific locations, and because any water savings are likely to be marginal relative to the potential of a deep aquifer well, stormwater management costs are not estimated.

### 3.1.2 COMMERCIAL CONSUMPTION

107. Commercial water users may also threaten dragonfly habitat by depleting ground and surface water reserves. Commercial threats to consumption are associated with Illinois Units 1-7 and Wisconsin Units 3-7. These threats primarily involve concerns about future commercial development in these areas. Agricultural irrigation is not listed as a concern for water depletion, because there is little agriculture in proximity to the Illinois study area and a very small amount (less than one percent) of cropland in Door County (WI Units 3-7) is irrigated.<sup>74</sup>
108. The value of access to water for commercial uses within and in proximity to the study area is difficult to define. It is even more difficult to predict such values in the future. However, as with residential development, the most feasible alternate sources of water may be deep aquifer extraction. Because communities that are likely to access this source of water for residential use would likely also use the source for commercial use, this cost is not separately considered here (to avoid double counting). Current commercial users of water within municipalities that have wells, and rely on those wells for a water source, would be served by the deep aquifer wells discussed in the previous section. As such, costs of commercial use would be captured by the analysis presented in Exhibits 3-3 and 3-4.

### 3.2 GROUND AND SURFACE WATER CONTAMINATION

109. Surface water contamination may lead to groundwater contamination (and vice versa) in locations near proposed habitat. In most cases the activities that result in ground or surface water contamination, such as leakage from underground storage tanks or chemical spills, are legal infractions. Such incidental, un-permitted releases are not considered in this analysis.
110. There are, however, potential legal activities that may result in surface and/or groundwater contamination. The most substantial threat in this category is the use of herbicides and pesticides. Chapter 4 addresses the issue of reliance on herbicides for infrastructure maintenance and estimates costs for practices that do not rely on potentially contaminating chemicals. The next section focuses on the use of pesticides for agricultural production in proximity to the study area. This chapter concludes with a brief discussion of septic system installation, where (although leakages are not permitted) abundant installation may create a threat.

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<sup>74</sup> Agricultural Marketing Service at United States Department of Agriculture, Door County Profile, last updated December 22, 2005.

### 3.2.1 AGRICULTURAL USE OF PESTICIDES

111. In Missouri, pesticide use is considered a threat for Units 8 through 10, and in Wisconsin it is considered a threat for all proposed habitat units. For example, groundwater testing of locations in Door and Ozaukee counties in Wisconsin has identified pesticides and pesticide related substances.<sup>75</sup> These pesticides may be harmful to the dragonfly and its habitat. However, without fate and transport models describing the link between pesticide use proximate to the study area and resulting contaminant levels, information about threshold levels of pesticides threatening the habitat, and detailed land data about the productivity (with and without pesticide use) of each individual parcel, accurate cost estimation is not feasible.
112. Data suggest that pesticide use is decreasing in southeastern Wisconsin. The Wisconsin Apple Growers Association and the University of Wisconsin have worked collaboratively to adopt integrated pest control strategies that are less reliant on pesticides.<sup>76</sup> This trend may be beneficial to dragonfly habitat, and appears to be occurring independently of concern for dragonfly habitat conservation. In addition, the total land in orchards fell by one-third between 1997 and 2002 in Door County, which results in a further decrease in pesticide use.<sup>77</sup>

### 3.2.2 SEPTIC SYSTEM INSTALLATION

113. A potential threat to groundwater resources comes from pre-existing septic systems which may deteriorate.<sup>78</sup> The potential liability of leaking septic systems is one that is present for existing systems in all areas, not only locations near proposed critical habitat. While potential leakages may cause additional harm to dragonfly habitat, all leakages will be considered public health nuisances by local and state public health and environmental officials.
114. As a result, new septic system installations are regulated, thus publicly reviewed and inspected. Costs of existing septic systems that do not operate properly will be internalized in local real estate markets. Loss of waste materials is considered both a public health hazard and a legal infraction in any location; such leakage will be remediated for those reasons.

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<sup>75</sup> Matzen, Amy M. and David A. Saad "Pesticides in Groundwater in the Western Lake Michigan Drainages, Wisconsin and Michigan, 1983-1985," USGS Fact Sheet FS-192-96.

<sup>76</sup> University of Wisconsin at Madison, "Replacing Pesticides with Information," College of Life Sciences Science Report 2006-2007, <http://www.cals.wisc.edu/sciencereport/2006scienceOfSustainableAgriculturePesticides.html>

<sup>77</sup> U.S. Fish and Wildlife Service, 2001. "Hine's Emerald Dragonfly (*Somatochlora hineana*) Recovery Plan." Fort Snelling, Minnesota, 120p.

<sup>78</sup> Releases resulting from installation permitting violations would be subject to legal action, and are subject to mandatory remediation. This analysis does not consider incidental, unpermitted releases.

### 3.3 HYDROLOGICAL CHANGES IN THE GREAT LAKES

115. Water levels in Lake Michigan and Lake Huron, which impact dragonfly habitat, have been declining throughout the 1990s. The cumulative decline of these lakes has been an average of 43 centimeters since 1918. While water consumption from cities like Chicago have had an impact, the activity that has had the most substantial impact on water levels was dredging and mining for gravel on the St. Clair and Detroit Rivers.<sup>79</sup> Predictions of changes that could result from global warming include decreased lake and groundwater levels, as well as increased water temperatures.<sup>80</sup>
116. Dredging / gravel mining operations of the type that began in the 1930s and ceased in the 1960s are unlikely to be undertaken due to the magnitude of effects (average 40 centimeter drop in lake levels). However, further gradual decreases in lake levels, and concomitant decreases in groundwater levels may have detrimental effects to habitat. Potential impacts due to global warming could exacerbate human use issues. This cycle of effects is not possible to quantify at this time; significant uncertainty exists in the predictive models and the feedback effects are complex. Thus, climate change induced costs are not estimated in this report.

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<sup>79</sup> International Joint Commission "Protection of the Waters of the Great Lakes: Final Report to the Governments of Canada and the United States," February 22,2000.

<sup>80</sup> Union of Concerned Scientists and the Ecological Society of America, "Confronting Climate Change in the Great Lakes Region: Impacts on Our Communities and Ecosystems," April 2003.

## CHAPTER 4 | POTENTIAL ECONOMIC IMPACTS TO UTILITY AND INFRASTRUCTURE MAINTENANCE

117. Utilities and other infrastructure must be maintained to allow for continued use and to prevent mechanical failure. However, many types of maintenance can cause environmental harm to dragonfly habitat if proper care and precautions are not taken.<sup>81</sup> Utility and infrastructure maintenance can entail direct destruction of habitat, such as wetland destruction by maintenance machinery, or indirect impacts, such as contamination from chemicals or other maintenance materials. The costs of the extra care and caution that must be incorporated into routine maintenance operations are the subject of this chapter.
118. These maintenance costs can be categorized in terms of the type of infrastructure being maintained: utilities (gas lines, electric lines), roads, and railroads. The past and future costs of utility and infrastructure maintenance for each proposed critical habitat unit are presented in Exhibits 4-1 and 4-2. Exhibits 4-1 and 4-2 are summary tables; detailed explanations of impact estimates are presented later in the chapter. Exhibit 4-2 breaks out the total future impacts for the areas proposed for designation and the areas considered for exclusion separately.<sup>82</sup>
119. As Exhibits 4-1 and 4-2 show, the highest impacts are in Illinois Units 1 and 2. These costs are for the past and future maintenance of the railroad owned by Midwest Generation, a power company, that transports the coal it uses for generating electricity in three power plants through those critical habitat units. Other, more modest costs include maintenance of electrical lines (including monitoring of dragonfly populations borne by ComEd) in Illinois Units 1-5 and 7.
120. This chapter begins with the presentation of impacts of dragonfly sensitive utility maintenance, focusing on electrical transmission and distribution lines (primarily in Illinois Units 1-5 and 7), and then discusses pipeline maintenance. The next section concerns road maintenance, and the chapter concludes with a discussion of railroad maintenance.

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<sup>81</sup> Utility and road maintenance are listed as threats in 71 FR 42442 for Illinois units 1-7; Michigan units 1, 3, and 5; Missouri units 5, 8-10, 13, 14, 19-20, and 23-24; and Wisconsin units 3-7, 9, and 10.

<sup>82</sup> While all tables are subject to apparent summation problems due to rounding, this is particularly true for the values of units considered for exclusion in Exhibit 4-2. Most of the reported impacts that round to \$1,000 in this table are actually \$500.

**EXHIBIT 4-1 SUMMARY OF PAST UTILITY AND INFRASTRUCTURE MAINTENANCE COSTS PER UNIT**

UNIT	IMPACTED DEVELOPMENT ACTIVITIES	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	Monitoring, Electrical Line Maintenance	\$486,000	\$557,000	\$668,000
IL 2	Monitoring, Electrical Line Maintenance	\$608,000	\$722,000	\$911,000
IL 3	Monitoring, Electrical Line Maintenance	\$28,000	\$32,000	\$38,000
IL 4	Monitoring, Electrical Line Maintenance	\$9,000	\$10,000	\$13,000
IL 5	Monitoring, Electrical Line Maintenance	\$9,000	\$10,000	\$13,000
II 7	Monitoring, Electrical Line Maintenance, Pipeline Maintenance	\$40,000	\$46,000	\$56,000
MI 1	Road Maintenance	\$1,000	\$1,000	\$1,000
MI 2	Road Maintenance	\$1,000	\$1,000	\$1,000
MO 2	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 3	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 4	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 5	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 8	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 9	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 10	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 11	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 13	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 15	Section 7 Consultations	\$3,000	\$3,000	\$4,000
MO 26	Section 7 Consultations	\$3,000	\$3,000	\$4,000
WI 5	Road Maintenance, Section 7 Consultation	\$2,000	\$2,000	\$2,000
<b>Totals</b>		<b>\$1,222,000</b>	<b>\$1,421,000</b>	<b>\$1,744,000</b>

Note: Totals may not sum due to rounding

EXHIBIT 4-2 SUMMARY OF FUTURE UTILITY AND INFRASTRUCTURE  
MAINTENANCE COSTS PER UNIT

UNIT	IMPACTED DEVELOPMENT ACTIVITIES	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
Proposed Critical Habitat				
IL 1	Monitoring, Maintenance , BMPs	\$501,000	\$433,000	\$365,000
IL 2	Monitoring, Maintenance , BMPs	\$501,000	\$433,000	\$365,000
IL 3	Monitoring, Maintenance , BMPs	\$129,000	\$104,000	\$81,000
IL 4	Monitoring, Maintenance , BMPs	\$129,000	\$104,000	\$81,000
II 5	Monitoring, Maintenance , BMPs	\$129,000	\$104,000	\$81,000
II 7	Monitoring, Maintenance , BMPs	\$129,000	\$104,000	\$81,000
MI 3	BMPs	\$1,000	\$1,000	\$1,000
WI 5	Section 7 Consultations	\$4,000	\$3,000	\$2,000
<b>Totals</b>		<b>\$1,521,000</b>	<b>\$1,285,000</b>	<b>\$1,057,000</b>
Considered for Exclusion				
MI 1	BMPs, Section 7 Consultation	\$3,000	\$2,000	\$2,000
MI 2	Section 7 Consultations	\$2,000	\$2,000	\$1,000
MO 2	BMPs	\$1,000	\$1,000	\$1,000
MO 3	BMPs	\$1,000	\$1,000	\$1,000
MO 4	BMPs	\$1,000	\$1,000	\$1,000
MO 5	BMPs	\$1,000	\$1,000	\$1,000
MO 8	BMPs	\$1,000	\$1,000	\$1,000
MO 9	BMPs	\$1,000	\$1,000	\$1,000
MO 10	BMPs	\$1,000	\$1,000	\$1,000
MO 11	BMPs	\$1,000	\$1,000	\$1,000
MO 13	BMPs	\$1,000	\$1,000	\$1,000
MO 15	BMPs	\$1,000	\$1,000	\$1,000
MO 26	BMPs	\$1,000	\$1,000	\$1,000
<b>Totals</b>		<b>\$11,000</b>	<b>\$10,000</b>	<b>\$9,000</b>

Note: Totals may not sum due to rounding

4.1 UTILITY MAINTENANCE

121. Maintenance of electrical transmission lines (primarily raised) and oil and/or gas pipelines (primarily underground) in a manner that will not harm dragonfly habitat can generate added costs to routine maintenance activities.<sup>83</sup> Some additional costs may be incurred for dragonfly habitat protective maintenance on electric line and pipeline right of

<sup>83</sup> For example, see written correspondence between Randall Root, Burns & McDonnell Engineering Co., Inc., and Ron Abrant, US Army Corps of Engineers, and US Fish and Wildlife Service Biologist, Chicago Field Office, May 24, 2006, May 25, 2006, and June 7, 2006.

way corridors, though most of these costs are likely to result from customary wetlands protective procedures (required independently of the dragonfly presence). Right of way corridors must be maintained (and prepared to minimize dragonfly losses) in order to allow access for emergency repairs should the need arise.<sup>84</sup> Proper preparation and maintenance of right of way corridors can lessen the impact on dragonfly habitat caused during emergency repair work. To capture relevant costs, this analysis uses costs for extra efforts to protect endangered species in general that are borne as part of utility maintenance.

#### ELECTRICAL TRANSMISSION AND DISTRIBUTION LINES

122. Electrical transmission lines are present in several units. In addition, in several situations utility companies have met with Service personnel for section 7 consultations. Exhibits 4-3 and 4-4 display estimates of past and future costs of measures taken to protect the dragonfly or other endangered species. The majority of these costs are associated with maintenance of the electrical lines in Illinois Units 1-5 and 7.
123. Electrical line maintenance in the study area is complicated by the fact that normal maintenance procedures, including treatment of poles with insecticide and use of machinery, are not permitted. In Illinois Units 1-5 and 7, Com Ed has several transmission and distribution lines. These lines are old and require frequent maintenance. Maintenance costs are increased by the dragonfly-specific protective measures that Com Ed employs, such as the use of steel casing to prolong the life of degraded poles and replacement of power pole cross arms by helicopter.<sup>85</sup> Poles not treated with insecticide and located in standing water (habitat) are also expected to fail at a faster rate than treated poles, which necessitates replacement (though steel casing delays replacement by a few years). Other costs come from the necessary monitoring of dragonflies and habitat around maintenance rights of way, to make sure that maintenance impacts are not harming either.
124. Exhibit 4-3 lists past costs for dragonfly-sensitive electrical utility maintenance. These activities included maintenance, dragonfly monitoring, dragonfly sensitive inspections of line quality, and needed pole replacement. There was also a section 7 consultation in 2006 concerning the renewal of electrical line right of way that spanned several units in Missouri.

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<sup>84</sup> Discussion with Brett Richer and Sara Race, ComEd, and Robert Slwinski, Christopher B. Burke Engineering, Ltd., August 16, 2006, Lombard Illinois.

<sup>85</sup> The Service disputes ComEd's claims that C-truss costs are specific to dragonfly protection, since C-trusses are used in other areas that are not dragonfly habitat.

**EXHIBIT 4-3 PAST ELECTRIC UTILITY AND INFRASTRUCTURE MAINTENANCE COSTS  
PER UNIT**

UNIT	IMPACTED DEVELOPMENT ACTIVITIES	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
II 1	Monitoring and Mitigation	\$47,000	\$53,000	\$63,000
II 2	Monitoring and Mitigation	\$108,000	\$136,000	\$185,000
IL 3	Monitoring and Mitigation	\$28,000	\$32,000	\$38,000
IL 4	Monitoring and Mitigation	\$9,000	\$10,000	\$13,000
IL 5	Monitoring and Mitigation	\$9,000	\$10,000	\$13,000
IL 7	Monitoring and Mitigation	\$9,000	\$10,000	\$13,000
MO 2	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 3	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 4	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 5	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 8	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 9	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 10	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 11	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 13	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO 15	Section 7 Consultation	\$3,000	\$3,000	\$4,000
MO26	Section 7 Consultation	\$3,000	\$3,000	\$4,000
<b>Total</b>		<b>\$246,000</b>	<b>\$290,000</b>	<b>\$363,000</b>

Note: Totals may not sum due to rounding

125. Exhibit 4-4 provides estimates of the costs of future maintenance activities for electrical lines. Several of these anticipated costs were provided by ComEd's expected maintenance activities (Illinois Units 1-5 and 7). These include regular application of the maintenance regimen included in Exhibit 4-3, development of emergency management BMPs, and predicted necessary pole replacement. The Missouri Department of Conservation has estimated that the development and circulation of BMPs for endangered



species conserving utility maintenance practices are modest, and are likely to apply to most areas (all Missouri units have a one time \$500 charge as part of their costs).<sup>86</sup>

**EXHIBIT 4-4 FUTURE ELECTRIC UTILITY AND INFRASTRUCTURE MAINTENANCE COSTS PER UNIT**

UNIT	IMPACTED DEVELOPMENT ACTIVITIES	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
II 1	BMPs, Monitoring, Mitigation	\$129,000	\$104,000	\$81,000
II 2	BMPs, Monitoring, Mitigation	\$129,000	\$104,000	\$81,000
IL 3	BMPs, Monitoring, Mitigation	\$129,000	\$104,000	\$81,000
IL 4	BMPs, Monitoring, Mitigation	\$129,000	\$104,000	\$81,000
IL 5	BMPs, Monitoring, Mitigation	\$129,000	\$104,000	\$81,000
IL 7	BMPs, Monitoring, Mitigation	\$129,000	\$104,000	\$81,000
MI 1	BMPs	\$1,000	\$1,000	\$1,000
MI 3	BMPs	\$1,000	\$1,000	\$1,000
MO 2	BMPs	\$1,000	\$1,000	\$1,000
MO 3	BMPs	\$1,000	\$1,000	\$1,000
MO 4	BMPs	\$1,000	\$1,000	\$1,000
MO 5	BMPs	\$1,000	\$1,000	\$1,000
MO 8-10	BMPs	\$2,000	\$2,000	\$2,000
MO 11	BMPs	\$1,000	\$1,000	\$1,000
MO 13	BMPs	\$1,000	\$1,000	\$1,000
MO 14	BMPs	\$1,000	\$1,000	\$1,000
MO 15	BMPs	\$1,000	\$1,000	\$1,000
MO 26	BMPs	\$1,000	\$1,000	\$1,000
<b>Total</b>		<b>\$780,000</b>	<b>\$631,000</b>	<b>\$492,000</b>

Note: Totals may not sum due to rounding

**GAS AND OIL PIPELINES**

126. Maintenance of gas and oil pipelines can be especially threatening to dragonfly habitat, because these pipelines are primarily underground. Maintenance activities that avoid adversely affecting the habitat will generally involve several additional procedures, such as the laying of wooden mats under work areas. However, most proposed units within the study area do not have underground pipelines. Exhibit 4-5 provides information on costs associated with section 7 consultations during pipeline maintenance in Unit 7 in 2000, 2002, and 2006.<sup>87</sup>

<sup>86</sup> Personal communication with Bob Gillespie, Missouri Department of Conservation. October 26, 2006

<sup>87</sup> As of this writing, no gas company, oil company, or engineer has responded to queries regarding extra costs.

EXHIBIT 4-5 PAST COSTS OF GAS/OIL PIPELINE MAINTENANCE

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 7	Technical Assistance Section 7 Consultation	2000	\$2,000	\$3,000	\$4,000
IL 7	Informal Section 7 Consultation	2002	\$14,000	\$17,000	\$20,000
IL 7	Informal Section 7 Consultation	2006	\$14,000	\$17,000	\$20,000
<b>TOTAL</b>			<b>\$31,000</b>	<b>\$36,000</b>	<b>\$44,000</b>

Note: totals may not sum due to rounding

127. Pipeline maintenance is an infrequent occurrence, most often necessary due to aging pipelines. While maintenance of pipelines may be necessary in the future, such projections would have low reliability, and as such, are not presented here.

**4.2 ROAD MAINTENANCE**

128. Road maintenance also requires Best Management Practices for environmental protection, but these BMPs are not specific to dragonfly or endangered species (most BMPs would be necessary in any kind of wetland). As discussed in Section 2.2 and Appendix E, BMPs are likely to be common among many activities and have nominal costs. In several situations specific road maintenance activities have required consultation pursuant to section 7 of the Act. These costs are presented in Exhibit 4-6.

EXHIBIT 4-6 PAST COSTS OF ROAD MAINTENANCE

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
MI 1	Section 7 Consultation	2003	\$1,000	\$1,000	\$1,000
MI 2	Section 7 Consultation	2003	\$1,000	\$1,000	\$1,000
WI 5	Section 7 Consultation	2006	\$2,000	\$2,000	\$2,000
<b>TOTAL</b>			<b>\$4,000</b>	<b>\$5,000</b>	<b>\$5,000</b>

Note: Totals may not sum due to rounding

129. Because these roads will most likely require maintenance over the forthcoming twenty year period, these past section 7 costs are projected into the future based upon their past frequency. Section 7 administrative costs are anticipated to recur in Wisconsin Unit 5 twice more over the next twenty years in 2016 and 2026. Consultation costs are also anticipated for Michigan Units 1 and 2 in 2013 and 2023. The total undiscounted costs for Wisconsin Unit 5 and Michigan Units 1 and 2 is \$8,890. This value translates to \$6,280 discounted at three percent and \$4,098 discounted at seven percent.

#### 4.3 RAILROAD MAINTENANCE

130. Threats to dragonfly habitat from railroad maintenance on frequently used track are not solved by reliance on BMPs. Illinois Unit 1 and Unit 2 have a railroad track which proceeds through the center of the designated unit. This track is owned by Midwest Generation, who ships coal trains through the habitat to their facility on the DesPlaines River, located between Units 2 and 3. The Eastern Joliet and Elgin Short Line operates this section of track for Midwest Generation. The daily train contains 135 cars containing 120 tons of coal per car, a total of over 16,000 tons per day. Midwest Generation is considering increasing the train to 150 cars per day (18,000 tons per day).
131. This volume of freight would be destructive to the railroad tracks under normal circumstances; rails would need to be replaced every 10-15 years. To preserve dragonfly habitat, however, Midwest Generation has had to forego regular maintenance activities in the past, including operating without lubricant until they found a soy-based substitute, which has resulted in the tracks becoming dilapidated (and resulted in a 2-3 year turnover rate). Initially all maintenance activities were prohibited in order to protect the dragonfly. However, the poor current conditions of the tracks (due to lack of maintenance) is now causing damage to the habitat.<sup>88</sup>
132. Exhibit 4-7 details the added costs of allowed dragonfly sensitive maintenance.<sup>89</sup> As discussed above, Midwest Generation switched to a soy-based lubricant, which they identified through research and testing. In addition, research into herbicide prompted manual weed maintenance, which is \$3,100 more expensive per year. Dragonfly monitoring was necessary to locate and track populations while Midwest Generation responded to concerns from the Service. Administrative costs include those costs associated with Midwest Generation's management being involved in dragonfly issues/meetings as part of the Right of Way Management Team (\$40,000 per year for 6 years), as well as for the Environmental Services Division of Midwest Generation to coordinate dragonfly issues (\$30,000 per year for 6 years). Mitigation maintenance, listed in Exhibit 4-7, includes past maintenance actions specific to dragonfly protection, including installation of automatic greasers for the soy lubricant (\$27,000), equipping locomotives with spill containments (\$10,000), and environmental cleaning (\$5,000).

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<sup>88</sup> Written communication from Julia Wozniak, Senior Biologist, Midwest Generation, October 6, 2006.

<sup>89</sup> Historical maintenance costs were supplied by Midwest Generation, and future maintenance costs were estimated for Midwest Generation by Hanson-Wilson, Inc.

EXHIBIT 4-7 PAST COSTS OF RAILROAD MAINTENANCE, ILLINOIS UNITS 1 AND 2

ACTIVITY	YEAR	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
Dragonfly RR Line Research <sup>1</sup>	1996-1997	\$61,000	\$82,000	\$122,000
Research: Soy Lubricant and Effects of Herbicides	2003-2006	\$65,000	\$70,000	\$77,000
Yearly Weed Maintenance	2005-2006	\$6,000	\$7,000	\$7,000
Dragonfly Monitoring	2000-2004	\$345,000	\$421,000	\$544,000
Administrative Costs	2000-2006	\$420,000	\$466,000	\$536,000
Mitigation Maintenance	2006	\$43,000	\$43,000	\$43,000
<b>Total</b>		<b>\$940,000</b>	<b>\$1,089,000</b>	<b>\$1,329,000</b>

<sup>(1)</sup> This research was performed by ComEd before the sale of unit 1 and the easement in unit 2 to Midwest Generation in 1999. These costs were incurred in unit 2 only.

Note: Totals may not sum due to rounding

133. Exhibit 4-8 provides anticipated costs for railroad maintenance in Illinois Units 1 and 2. Short and long-term maintenance are included to capture the effects of railroad track deterioration from lack of maintenance, when it was banned by the Service in order to protect dragonfly habitat. (This claim is disputed by the Service. The Service maintains that the only limitations on maintenance and operation were to not use herbicides or petroleum lubricants.)<sup>90</sup> Cost estimates are provided for required, restorative short-term maintenance needed and long term requirements for rehabilitating the tracks. Actions necessary for reducing non-maintenance related damage arising from railway use are discussed separately in Chapter 5.2.

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<sup>90</sup> During the development of the soy lubricant (up to 2006), the rails were unlubricated. Unlubricated rails degrade in ¼ the time as lubricated rails, which provides some basis for the claim of necessary rail rehabilitation. These cost estimates are included for completeness and may be seen as an upper bound on dragonfly impacts.

EXHIBIT 4-8 FUTURE COSTS OF RAILROAD MAINTENANCE, ILLINOIS UNITS 1 AND 2

ACTIVITY	YEAR	TOTAL COSTS		
		UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
Short Term Track Rehabilitation	2007	\$204,000	\$204,000	\$204,000
Yearly Weed Maintenance <sup>1</sup>	2007-2026	\$62,000	\$48,000	\$35,000
Long-term Track Rehabilitation <sup>2</sup>	2011-2014	\$478,000	\$407,000	\$331,000
<b>Total</b>		<b>\$744,000</b>	<b>\$658,000</b>	<b>\$569,000</b>
<p><sup>(1)</sup> In an October 6, 2006 e-mail Midwest Generation estimated the cost of hand-cutting maintenance for IL units 1 and 2 to be \$6,000. The same work could be done for \$2,900 with herbicide. The difference is \$3,100. The analysis predicts costs 20 years into the future; as such the costs for this activity are assumed to continue through 2026.</p> <p><sup>(2)</sup> Documentation supplied by Midwest Generation states that "Long term maintenance items should be implemented in the four to seven year range..." Four years from the final rule is 2011 and seven years from the proposed rule is 2014. Accordingly, the long-term rehabilitation costs are spread over those years.</p>				

Note: Totals may not sum due to rounding

## CHAPTER 5 | POTENTIAL ECONOMIC IMPACTS TO ROAD AND RAILWAY USE

134. Road and railway use can cause several threats to the dragonfly and its habitat. These threats are distinct from the threats discussed in Chapter 2 (construction) and Chapter 4 (maintenance). The threats identified and discussed in this chapter concern the actual use of roads and railways which are threats that would occur on existing roads and railways even if they were perfectly maintained. The activities discussed in this chapter are unique threats specific to the use of roads and railways: vehicular impacts, hydraulic pumping of sediment, and habitat salinization.
135. Threats result from vehicular impacts by automobiles and trains, the hydraulic pumping of sediment in Illinois Units 1 and 2 during mitigation of train operation threats, and the salinization of habitat due to winter road salt runoff.<sup>91</sup> Both the proposed designation and the recovery plan specify that vehicular impacts are a threat to adult dragonflies.<sup>92</sup> Habitat salinization is identified as a threat in the biological opinion performed as part of the Interstate 355 extension as well as in the species recovery plan.<sup>93</sup> Discussion with Service field offices suggest that salinization is a problem in several habitat areas. Hydraulic pumping of sediment has been identified as a threat by the Service field office in Chicago.<sup>94</sup> Exhibit 5-1 provides past cost estimates by unit due to road and railway use.
136. The costs shown in Exhibit 5-1 are for past studies of these threats. In Illinois Units 1 and 2 there was a study in 2004 looking at the potential mitigation effects of railroad under-cutting, a technique to reduce the effects of the hydraulic pumping of sediment effect. The costs for Illinois Unit 4 were from Illinois Tollway Authority research into the salt spray (salinization) effects, and ways to mitigate it for the I-355 Tollway extension.

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<sup>91</sup> U.S. Fish and Wildlife Service, "Biological Opinion on the Construction, Operation, and Maintenance of the Interstate 355 South Extension for the Federally-Listed Endangered Hine's Emerald Dragonfly (*Somatochlora hineana*)" October 31, 2005.

<sup>92</sup> U.S. Fish and Wildlife Service, "Hine's Emerald Dragonfly (*Somatochlora hineana*) Recovery Plan," Fort Snelling, MN, 2001.

<sup>93</sup> US Fish and Wildlife Service, Chicago Illinois Ecological Services Field Office, "Biological Opinion on the Construction, Operation, and Maintenance of the Interstate 355 South Extension for the Federally-Listed Endangered Hine's Emerald Dragonfly," October 31, 2005; U.S. Fish and Wildlife Service, "Hine's Emerald Dragonfly (*Somatochlora hineana*) Recovery Plan," Fort Snelling, MN, 2001.

<sup>94</sup> Meeting with U.S. Fish and Wildlife Service Chicago Field Office Endangered Species Coordinator, August 16, 2006.

EXHIBIT 5-1 SUMMARY OF IMPACTS TO ROAD AND RAILWAY USE: PAST COSTS

UNIT	FUTURE (UNDISCOUNTED DOLLARS)	FUTURE PRESENT VALUE 3%	FUTURE PRESENT VALUE 7%
IL 1	\$20,000	\$22,000	\$25,000
IL 2	\$20,000	\$22,000	\$25,000
IL 4	\$100,000	\$123,000	\$162,000
<b>Total</b>	<b>\$140,000</b>	<b>\$167,000</b>	<b>\$211,000</b>

Note: Totals may not sum due to rounding

137. Exhibit 5-2 presents costs that will be incurred in the future to protect against vehicular impacts, hydraulic pumping of sediment, salinization, and annual mitigation procedures performed by MSC for track use in Illinois Units 1 and 2. The primary future costs relate to mitigation for hydraulic sediment pumping during use of the railroad in Illinois Units 1 and 2. Exhibit 5-2 presents high and low estimates for Illinois Unit 7, and Wisconsin Units 4 and 5, where costs incurred depend on whether or not a vehicle slowing policy is implemented.

EXHIBIT 5-2 SUMMARY OF IMPACTS TO ROAD AND RAILWAY USE: FUTURE COSTS

UNIT	TOTAL COSTS					
	UNDISCOUNTED		PRESENT VALUE (3%)		PRESENT VALUE (7%)	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
IL 1	\$806,000		\$699,000		\$588,000	
IL 2	\$806,000		\$699,000		\$588,000	
IL 3	\$17,000		\$13,000		\$10,000	
IL 4	\$88,000		\$68,000		\$50,000	
IL 7	\$40,000	\$13,840,000	\$30,000	\$10,604,000	\$22,000	\$7,844,000
WI 4	\$0	\$71,000	\$0	\$54,000	\$0	\$40,000
WI 5	\$0	\$559,000	\$0	\$429,000	\$0	\$317,000
<b>Total</b>	<b>\$1,757,000</b>	<b>\$16,187,000</b>	<b>\$1,508,000</b>	<b>\$12,565,000</b>	<b>\$1,259,000</b>	<b>\$9,438,000</b>

Note: Totals may not sum due to rounding

5.1 VEHICULAR IMPACTS

138. Vehicular impacts have been documented in several cases on many roadways and on a railway in Illinois Unit 7. The speed limit that is sufficiently low as to not harm dragonfly adults has been identified as 15 miles per hour.<sup>95</sup> A policy option that has been considered by the Service to minimize dragonfly take due to vehicular impacts involves slowing traffic on some roads that pass directly through habitat.<sup>96</sup> If such measures were

<sup>95</sup> Written communication from US Fish and Wildlife Service Wisconsin Field Supervisor to Mr. Chris Pagels, Wisconsin Department of Natural Resources, February 2, 2002.

<sup>96</sup> A vehicle slowing policy is being pursued in Wisconsin units four and five. This policy has been discussed for Illinois Unit 7.

adopted, these speed restrictions would only need to be maintained during periods when the adult dragonflies are active, typically mid-June to mid-August. Vehicle slowing may be achieved by the erection of temporary roadway obstructions (removable speed bumps) or enforced speed limits.

139. This analysis assumes that the desired speed reductions would be achieved by the posting of speed limits, and focuses on the impacts of speed reductions to the loss of value of travelers' time. Lost travel time is an important measure of opportunity cost and is likely to be much larger than the cost of posting signs, which will be nominal. This lost value depends upon the value of travel time and the volume of traffic affected.
140. Exhibit 5-3 presents the per unit opportunity costs of time lost for roadways within habitats that could have speed restrictions placed upon them.<sup>97</sup> These estimates are included to capture an upper bound on what costs could be if this mitigation action is taken. If vehicle slowing actions are not taken, then lower bound estimates would be zero. The lower bound values listed in Exhibit 5-2 assume that no policy of vehicle slowing is adopted (the lower bound estimate does not include the cost estimates in Exhibit 5-3).

EXHIBIT 5-3 COSTS OF REDUCING VEHICULAR IMPACTS OVER 20 YEARS

UNIT	ROADWAY(S)	MILEAGE	SPEED REDUCTION (MILES PER HOUR)	TOTAL COSTS		
				UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 7	New Avenue	1.14	40	\$12,351,000	\$9,463,000	\$7,000,000
	Railroad	0.24	64	\$1,449,000	\$1,110,000	\$821,000
WI 4	County Road Q	0.33	30	\$71,000	\$54,000	\$40,000
WI 5	Ridges Road	2.42	20	\$413,000	\$316,000	\$234,000
	Lime Kiln Road	0.64	20	\$147,000	\$112,000	\$83,000
Total				\$14,431,000	\$11,057,000	\$8,179,000

141. To calculate the values in Exhibit 5-3, the length of road where speed limits may be imposed is first calculated, using GIS, for each affected unit. The extra time required for traveling these distances was found by dividing the distances by the speed reduction values (difference between posted limit and 15 miles per hour). The extra time per trip was then multiplied by the daily number of trips on that roadway (obtained from state Departments of Transportation),<sup>98</sup> then multiplied by the number of days the restriction would be in place (61 days from June 15 to August 15). This provides the amount of travel time lost per habitat unit per year.

<sup>97</sup> For a discussion of the economic theory behind the opportunity cost and valuation of travel time, see Small, Kenneth, *Urban Transportation Economics*, Luxembourg: Harwood Academic Publishers, 1992.

<sup>98</sup> Railroad passenger data for Metra commuter rail obtained from Metra website accessed July 9, 2007; Amtrak passenger data obtained from Illinois Department of Transportation document "Monthly Amtrak Corridor Ridership: State Supported Trains, State Fiscal Year 2007"; road usage data from Illinois and Wisconsin Department of Transportation websites, accessed December 4, 2006.



142. Calculation of speed limit impacts on Amtrak and the Metra commuter trains required some additional steps. In addition to the additional time that the passengers may have to spend on the train as it moves at fifteen miles per hour through Illinois unit 7, there would be a loss in the value of time for the train to decelerate before the habitat unit, then to accelerate again after passing through it. Acceleration and deceleration rates for a diesel train with a six car consist were used to calculate the additional time to accelerate and decelerate.<sup>99</sup> The estimated period necessary to slow down would be 36 seconds. The estimated acceleration time is 40 seconds. These additional times are added to the estimated additional 45 seconds that would be necessary to travel the 0.24 miles at 15 miles per hour; the full two minutes and one second are the total lost time per passenger due to rail slowing.
143. To value the opportunity cost of this additional travel time, the analysis relies on guidance issued by the U.S. Department of Transportation (DOT).<sup>100</sup> DOT directs analysts to value time by making adjustments to the hourly wage rate, depending on travel purpose. They recommend valuing personal travel at 50 percent of the pre-tax wage rate. For business travel, 100 percent of total compensation (wages plus benefits) represents the opportunity cost of additional travel time.
144. Because local roads are primarily affected by dragonfly conservation efforts, State wage estimates are used in place of national wages reported by DOT in its guidance. Pre-tax wages for Illinois and Wisconsin are obtained from *Occupational Employment Statistics* published by the Bureau of Labor Statistics (BLS).<sup>101</sup> The 2005 median hourly wage is \$14.78 and \$14.11 in Illinois and Wisconsin, respectively. Applying DOT's guidance, the value of personal time is 50 percent of these wages, or \$7.39 in Illinois and \$7.06 in Wisconsin.
145. To estimate total compensation in these two States, the analysis relies on the *National Compensation Survey*, which reports that in June 2006, on average, benefits accounted for 30 percent of total compensation.<sup>102</sup> Applying this ratio, total compensation on an hourly basis is \$21.11 in Illinois and \$20.16 in Wisconsin.<sup>103</sup> Applying DOT's guidance, the value of travel time for business purposes is equal to 100 percent of hourly total compensation.

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<sup>99</sup> Acceleration and deceleration rates from Caltrain Technology Assessment, available at [www.caltrain.org/pdf/project2025/AppendixD\\_FleetMatrix.pdf](http://www.caltrain.org/pdf/project2025/AppendixD_FleetMatrix.pdf), accessed on July 9, 2007.

<sup>100</sup> Emil Frankel, U.S. Department of Transportation, Memorandum with subject: Revised Departmental Guidance: Valuation of Travel Time in Economic Analysis, February 11, 2003.

<sup>101</sup> Department of Labor, Bureau of Labor Statistics, "Occupational Employment Statistics," as viewed at [http://data.bls.gov/oes/search.jsp?data\\_tool=OES](http://data.bls.gov/oes/search.jsp?data_tool=OES) on December 7, 2006.

<sup>102</sup> U.S. Department of Labor, Bureau of Labor Statistics, "News: Employer Costs for Employee Compensation - June 2006," September 25, 2006, p. 3, as viewed at <http://www.bls.gov/ncs/>.

<sup>103</sup> Note that BLS estimates that benefits account for 30 percent of *average* wages, however this fraction is applied to *median* hourly wages. Median wages are more likely to be a better predictor of typical travelers, because *mean* wages are skewed by a relatively small number of individuals with extremely high wages. Information about *median* total compensation is not readily available.

146. In the context of local travel, DOT assumes that approximately 94.3 percent of trips are for personal purposes and the remainder are for business. Therefore, the weighted average value of travel time is \$8.17 per hour in Illinois ( $[7.39*0.943]+[21.11*0.057]$ ) and \$7.80 in Wisconsin ( $[7.06*0.943]*[20.16*0.057]$ ). These weighted averages are multiplied by the additional hours of travel to estimate the opportunity costs of traveling at reduced speeds through habitat.
147. An additional cost of the limited speed zone would be the additional energy required to return the Amtrak and Metra trains to operating speeds. Acceleration is the action that requires the energy output; deceleration is accomplished by coasting and then braking. The amount of energy necessary for an engine (120 tons) with six cars (360 tons) to reach the maximum permissible 79 miles requires approximately 169,000 BTUs.<sup>104</sup> Assuming that a train accelerates at ten percent efficiency, and converting BTUs to gallons of fuel oil (125,000 BTUs per gallon fuel oil) yields an additional required 14 gallons of fuel oil per passage through the speed limited zone. The costs for this additional fuel are included in Exhibit 5-3.
148. Increased commuting times on the Metra or Amtrak trains could cause some train travelers to switch to using automobiles. However, the economic literature on mode-split indicates that an increase in travel time on a commuter train is unlikely to cause much of a shift to car use. Mode-split studies measure how sensitive travelers are to changes in the cost of traveling. An increase of ten percent of travel time on a commuter train during peak commuting time will cause a one percent increase in demand for commuting by automobile.<sup>105</sup> The additional delay in unit IL 7 may cause a small increase in travel by car. However, the literature indicates that commuters who travel by rail are not very sensitive to small increases in travel times. The estimated change in demand cited above is illustrative of general behavior; there are no publicly available models or data for modeling this specific situation.

## 5.2 HYDRAULIC PUMPING OF SEDIMENT

149. Hydraulic pumping of sediment is a threat specific to Illinois Units 1 and 2, which occurs when the heavily laden coal trains pass over the railroad tracks. These tracks rest on dolomite and other highly destructible materials in the wetlands. When the railroad cars pass over the tracks, they compress the earth beneath the tracks into the wetland. This compression can then forcefully eject dirt, mud, and other debris into the wetlands. This ejected debris then degrades the quality of the habitat.
150. Exhibit 5-4 provides information on costs associated with actions taken in the past to remediate this problem as well as projections of future costs that will be incurred to attempt to solve the problem. The optimal solution to this problem had not been decided

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<sup>104</sup> The estimated energy requirement was obtained from the formula for Kinetic Energy =  $\frac{1}{2} \times \text{Mass} \times (\text{Velocity})^2$ . Kinetic energy is then converted to BTUs (1 BTU = 778 foot-pounds).

<sup>105</sup> Lago, Armando M, Patrick Mayworm, and J Matthew McEnroe (1981) "Transit Service Elasticities," *Journal of Transport Economics and Policy*, pp. 99-119.

at the time of this writing. Midwest Generation commissioned a study of the option of having coal shipped (by barge) to their power generation facility. This alternative would involve reconstruction of several dock facilities and the purchase of new barges. The range of capital costs is between \$77 and \$102 million, with operating costs of between \$36 to \$79 million per year.<sup>106</sup>

151. Midwest Generation has indicated that it would cease operations in their Romeoville and two Chicago facilities if forced to face these costs.<sup>107</sup> This is a worst case scenario. Midwest Generation produces 1,092 megawatts of power and employs 178 workers at their Romeoville facility. Midwest Generation's two plants in the city of Chicago, which are supplied by coal that is delivered to and processed at the Romeoville facility, produces 868 megawatts of power and employs 174 workers at the two Chicago plants. The Service has indicated that this is not their preferred option concerning the problem of hydraulic pumping of sediment.<sup>108</sup>
152. Exhibit 5-4 presents costs associated with the implementation of undercutting, which was tested on a portion of the affected track.<sup>109</sup> While several mitigation options have been discussed, the sole option that has been attempted and for which cost data are available is the practice of undercutting, wherein a portion of track is lifted by a railroad car based mechanism, then new supporting material is forced under the lifted railroad tracks to provide a better surface for the train to operate on. The Service contends that this process is maintenance that the railroad would have to do regardless of the dragonfly, but recognizes that undercutting, combined with the construction of approximately 4 new French drains, and regular culvert maintenance may be potential options for mitigating the hydraulic pumping problem.<sup>110</sup> While regular maintenance may help mitigate the hydraulic pumping problem, maintenance activities may pose a threat to critical habitat.<sup>111</sup> The costs presented in Exhibit 5-4 are for performing the undercutting operation and installing the 4 French drains throughout Illinois Units 1 and 2.

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<sup>106</sup> Energy Ventures Analysis, Inc., "Economics for Alternative Coal Delivery Systems for the Will County, Fisk and Crawford Generating Stations," September 2006.

<sup>107</sup> Meeting with Midwest Generation representatives 8/16/2006.

<sup>108</sup> Written communication from US Fish and Wildlife Service Botanist/Wetland Ecologist, Chicago Field Office, September 12, 2006.

<sup>109</sup> Midwest Generation, "Pilot Undercutting Project at Lockport Prairie," October 7, 2005.

<sup>110</sup> Personal communication with U.S. Fish and Wildlife Service Chicago Field Office Endangered Species Coordinator, November 24, 2006.

<sup>111</sup> There are types and methods of railroad maintenance that the Service has identified which may be employed without threatening the dragonfly or its habitat; Section 4.3 addresses the additional costs of performing such dragonfly sensitive maintenance.

**EXHIBIT 5-4 FUTURE COSTS OF HYDRAULIC PUMPING OF SEDIMENT MITIGATION, ILLINOIS UNITS 1 AND 2**

YEAR	TOTAL COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
2007	\$270,000	\$270,000	\$270,000
2011	\$294,000	\$261,000	\$224,000
2012	\$294,000	\$253,000	\$209,000
2013	\$294,000	\$246,000	\$196,000
2014	\$294,000	\$239,000	\$183,000
<b>Total</b>	<b>\$1,445,000</b>	<b>\$1,269,000</b>	<b>\$1,082,000</b>

Note: Totals may not sum due to rounding

153. In addition, MSC foresees future annual costs of \$5,000 for use of the railroad tracks in Illinois Units 1 and 2. This cost is distinct from mitigation costs associated with use of the tracks for coal shipments. Instead, this cost is uniquely attributable to the increased scrutiny and care necessary to operate trains carrying product from the Romeoville MSC facilities through critical habitat.<sup>112</sup> These costs are calculated to total \$50,000 for each unit in undiscounted dollars over the next twenty years. This cost, per unit, is \$38,000 discounted at three percent and \$28,000 discounted at seven percent. These costs are incorporated into Exhibit 5-2, the summary of future costs.

**5.3 HABITAT SALINIZATION**

154. Habitat salinization was identified as a specific threat in the adverse modification section of the proposed designation. This threat can be isolated in terms of its causes and in terms of costs for remediation. Salinization as a threat was also identified in the Biological Opinion for the Interstate 355 Extension (discussed in Section 2.4).<sup>113</sup> The costs of research into this potential threat are presented in Exhibit 5-5.

**EXHIBIT 5-5 PAST COSTS OF SALINIZATION MITIGATION, ILLINOIS UNIT 4**

ACTIVITY	TOTAL COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
Develop Salt Spray Deposition Model	\$100,000	\$123,000	\$162,000
<b>Total</b>	<b>\$100,000</b>	<b>\$123,000</b>	<b>\$162,000</b>

<sup>112</sup> Written communication with Michael Melton, Project Manager, Environmental Services Department, Material Services Corporation. December 20, 2006.

<sup>113</sup> US Fish and Wildlife Service, Chicago Illinois Ecological Services Field Office, "Biological Opinion on the Construction, Operation, and Maintenance of the Interstate 355 South Extension for the Federally-Listed Endangered Hine's Emerald Dragonfly," October 31, 2005.

155. Several other units in the study area have been identified as potentially in danger of salinization due to salt spray. Salinization can be mitigated by using a different de-icing agent other than sodium chloride. Several substitutes exist, including other salts (calcium chloride, magnesium chloride, and potassium chloride) as well as urea. Costs for these substitutes range in the \$240 to \$300 range. Cost estimates are provided for substituting calcium chloride for sodium chloride on roads within 378 meters of habitat.<sup>114</sup> Calcium chloride is seen as a close substitute for sodium chloride in that it works in similar temperatures, but if handled properly does not harm vegetation.<sup>115</sup> The anticipated costs for mitigation and further research of salinization for the Interstate 355 extension in Illinois are presented in Exhibit 5-6. Illinois Unit 4 has higher listed costs due to ongoing research as part of the Interstate 355 extension.

**EXHIBIT 5-6 FUTURE COSTS OF SALINIZATION MITIGATION, ILLINOIS UNIT 4**

ACTIVITY	TOTAL COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	\$33,000	\$26,000	\$19,000
IL 2	\$32,000	\$25,000	\$18,000
IL 3	\$17,000	\$13,000	\$10,000
IL 4	\$88,000	\$68,000	\$50,000
IL 7	\$40,000	\$30,000	\$22,000
<b>Total</b>	<b>\$211,000</b>	<b>\$161,000</b>	<b>\$119,000</b>

Note: Totals may not sum due to rounding

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<sup>114</sup> Salinization was found to occur up to 378 meters from roadways where road salt was used, US Fish and Wildlife Service, Chicago Illinois Ecological Services Field Office, "Biological Opinion on the Construction, Operation, and Maintenance of the Interstate 355 South Extension for the Federally-Listed Endangered Hine's Emerald Dragonfly," October 31, 2005.

<sup>115</sup> Keating, James (May/June 2001), "Deicing Salt: Still on the Table," *Stormwater: The Journal of Surface Water Professionals*.

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## CHAPTER 6 | POTENTIAL ECONOMIC IMPACTS TO SPECIES MANAGEMENT AND HABITAT PROTECTION

156. This chapter presents past and future costs of conservation efforts undertaken in federal, state, and county forests. Species management and habitat protection practices are performed by government agencies, state and county forest rangers and private groups such as the Nature Conservancy. Historically, funding for species management comes from government agencies, such as the Service, Departments of Natural Resources, or from private land owners working in conjunction with a government agency, such as The Nature Conservancy.<sup>116</sup> These practices include dragonfly population surveys; maintenance of fen habitat; and control of invasive species, feral hogs, and beaver dams.

### PAST COSTS OF SPECIES MANAGEMENT

157. Total past costs for species management including nine section 7 consultations, feral hog monitoring costs in Missouri, installation of perimeter fencing around Missouri Units 5 and 25, and dragonfly population monitoring in Michigan Units 1-6 are \$484,000 in undiscounted dollars and \$526,000 and \$587,000 in discounted dollars at three and seven percent, respectively.
158. A summary of past species management costs is presented in Exhibit 6-1. Past costs include administrative costs, monitoring for feral hogs, installation of fencing around Missouri Units 5 and 25 to protect dragonfly habitat from feral hog incursions, and dragonfly population monitoring in Michigan Units 1-6.<sup>117</sup>

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<sup>116</sup> Written correspondence with Biologist, U.S. Fish and Wildlife Service, Columbia, Missouri Field Office, October 12, 2006.

<sup>117</sup> Appendix D shows how these costs are calculated.

**EXHIBIT 6-1 SUMMARY OF PAST ADMINISTRATIVE AND SPECIES MANAGEMENT COSTS**

UNIT	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
IL 1	\$5,000	\$5,000	\$6,000
IL 2	\$5,000	\$5,000	\$6,000
IL 3	\$5,000	\$5,000	\$6,000
IL 4	\$5,000	\$5,000	\$6,000
IL 5	\$5,000	\$5,000	\$6,000
IL 6	\$5,000	\$5,000	\$6,000
IL 7	\$5,000	\$5,000	\$6,000
MI 1	\$12,000	\$13,000	\$14,000
MI 2	\$16,000	\$18,000	\$20,000
MI 3	\$9,000	\$10,000	\$11,000
MI 4	\$9,000	\$10,000	\$11,000
MI 5	\$9,000	\$10,000	\$11,000
MI 6	\$9,000	\$10,000	\$11,000
MO 1	\$7,000	\$7,000	\$8,000
MO 2	\$7,000	\$7,000	\$8,000
MO 3	\$7,000	\$7,000	\$8,000
MO 4	\$7,000	\$7,000	\$8,000
MO 5	\$63,000	\$68,000	\$77,000
MO 6	\$1,000	\$1,000	\$1,000
MO 7	\$43,000	\$50,000	\$59,000
MO 8	\$7,000	\$7,000	\$8,000
MO 9	\$7,000	\$7,000	\$8,000
MO 10	\$7,000	\$7,000	\$8,000
MO 11	\$7,000	\$7,000	\$8,000
MO 12	\$1,000	\$1,000	\$1,000
MO 13	\$4,000	\$5,000	\$5,000
MO 14	\$1,000	\$1,000	\$1,000
MO 15	\$7,000	\$7,000	\$8,000
MO 16	\$1,000	\$1,000	\$1,000
MO 17	\$1,000	\$1,000	\$1,000
MO 18	\$1,000	\$1,000	\$1,000
MO 19	\$1,000	\$1,000	\$1,000
Mo 20	\$1,000	\$1,000	\$1,000
MO 21	\$7,000	\$7,000	\$8,000
MO 22	\$1,000	\$1,000	\$1,000
MO 23	\$31,000	\$34,000	\$39,000
MO 24	\$31,000	\$34,000	\$39,000
MO 25	\$43,000	\$46,000	\$51,000
MO 26	\$7,000	\$7,000	\$8,000
WI 2	\$19,000	\$20,000	\$22,000
WI 4	\$19,000	\$20,000	\$22,000
WI 5	\$19,000	\$20,000	\$22,000
WI 10	\$29,000	\$32,000	\$36,000
<b>Totals</b>	<b>\$484,000</b>	<b>\$526,000</b>	<b>\$587,000</b>

Note: Totals may not sum due to rounding

#### FUTURE COSTS OF CONSERVATION EFFORTS FOR SPECIES MANAGEMENT

159. Future species management costs estimated in this section are the specific costs of dragonfly conservation efforts that support management of the species. These efforts include: dragonfly population surveys; maintenance of fen habitat; control of invasive species, feral hogs, and beaver dams; and the projected section 7 consultations that these actions are likely to entail. The total future costs presented in this chapter include units proposed for designation as well as exclusion. The total future costs of dragonfly conservation efforts for the entire study area are \$1,672,000 in undiscounted dollars. Present value costs are \$1,270,000 assuming a three percent discount rate and \$935,000 assuming a seven percent discount rate.
160. The total future cost for units proposed for designation is \$474,000 in undiscounted dollars. Present value costs are \$347,000 assuming a three percent discount rate and \$241,000 assuming a seven percent discount rate. These future costs are associated with dragonfly population surveys, control of invasive species, and the projected section 7 consultations that these actions are likely to entail. These efforts are anticipated to occur in units IL 2 and 4; MI 3-6; and WI 2, 4, 5, 10.
161. Of the past section 7 consultations performed since 1995, sixteen are predicted to recur over the next twenty years. These consultations are associated with the cost of species management. These administrative actions range from informal consultations (\$14,313) to programmatic consultations (\$36,554) and occur in Illinois Units 2 and 4; Michigan Units 1-6; Missouri Units 1-5, 7, 8-11, 13, 15, 21, and 23-26; and Wisconsin Units 2-5, and 10. The total cost over twenty years for these section 7 consultations is \$787,000 in undiscounted dollars. These costs translate to \$560,000 and 373,000, discounted at three and seven percent, respectively.

#### 6.1 DRAGONFLY MONITORING

162. Monitoring of the dragonfly requires ongoing scientific evaluations of the size of dragonfly populations and sub-populations and the viability of the species' habitat.<sup>118</sup> Future monitoring is anticipated in all dragonfly units, but future costs are available only for Michigan Units 1-6, based on previous costs for monitoring these specific units. Past costs for monitoring of dragonfly populations across all six Michigan Units were \$27,000 in 2004. At present values, this costs translates to \$30,000 and \$33,000 discounted at three and seven percent, respectively.
163. The specific costs associated with future population monitoring in other units within the study area areas unknown.<sup>119</sup> As such, the future costs of dragonfly monitoring in

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<sup>118</sup> "Hine's Emerald Dragonfly Recovery Plan." Accessed at <http://www.fws.gov/Midwest/Endangered/insects/hed/hed-reclan.html> on October 27, 2006.

<sup>119</sup> Dragonfly monitoring in Michigan is likely to be performed on an ad hoc basis depending on the availability of funding; Personal conversation with Matt Herbert, Michigan Department of Natural Resources, November 28, 2006. The difficulty of calculating an annual future cost for population monitoring (in Wisconsin) was corroborated by the Service; Personal communication with Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, November 29 2006.



Michigan Units 1-6 over the next twenty years is a projection based upon the frequency of population monitoring since 1995: population monitoring of Michigan Units 1-6 is assumed to occur twice over the next twenty years in 2014 and 2024. The future costs for dragonfly monitoring in Michigan Units 1-6 is presented below in Exhibit 6-2.

**EXHIBIT 6-2 FUTURE COSTS OF DRAGONFLY MONITORING**

UNIT	TOTAL COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
MI 1	\$9,000	\$6,000	\$4,000
MI 2	\$9,000	\$6,000	\$4,000
MI 3	\$9,000	\$6,000	\$4,000
MI 4	\$9,000	\$6,000	\$4,000
MI 5	\$9,000	\$6,000	\$4,000
MI 6	\$9,000	\$6,000	\$4,000
<b>Totals</b>	<b>\$55,000</b>	<b>\$39,000</b>	<b>\$26,000</b>

Note: Totals may not sum due to rounding

**6.2 MAINTENANCE OF FEN HABITAT**

164. The natural ecological succession of forests can threaten the fen habitat. Forest management practices to preserve the fen habitat include prescribed burning, brush clearing, mechanical or manual removal of vegetation, and spot application of herbicides.<sup>120</sup> These practices are executed to preserve wetlands in many areas throughout publicly managed forests.<sup>121</sup> As the costs of fen habitat maintenance cannot be uniquely attributed to the dragonfly, no future costs for fen habitat maintenance are presented.

**6.3 INVASIVE SPECIES CONTROL**

165. The larvae and wetland habitat of the dragonfly are threatened by encroachment from invasive species. Future invasive species removal efforts are expected to occur in Wisconsin Units 2 and 4 and to cost \$5,000 annually.<sup>122</sup> The Service recently distributed funds to The Nature Conservancy (Wisconsin Chapter) and the Ridges Sanctuary to perform invasive species control. This distribution of funds is expected to continue<sup>123</sup>.

<sup>120</sup> Personal communication with Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, on October 17, 2006 and Biologist, U.S. Fish and Wildlife Service, Columbia, Missouri Field Office on October 12, 2006.

<sup>121</sup> For discussion of BMPs related to Forest Management, see Appendix E

<sup>122</sup> Personal communication with Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, on October 17, 2006 and U.S. Fish and Wildlife Service Chicago Field Office Endangered Species Coordinator on October 16, 2006.

<sup>123</sup> Personal communication with Biologist, U.S. Fish and Wildlife Service, New Franken, Wisconsin Field Office, on January 22, 2007.

Exhibit 6-3 presents the future costs of invasive species management for Wisconsin Units 2 and 4.

**EXHIBIT 6-3 FUTURE COSTS OF INVASIVE SPECIES MANAGEMENT**

UNIT	FUTURE COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
WI 2	\$100,000	\$77,000	\$57,000
WI 4	\$100,000	\$77,000	\$57,000
<b>Totals</b>	<b>\$200,000</b>	<b>\$153,000</b>	<b>\$114,000</b>

**6.4 FERAL HOG CONTROL**

166. Feral hogs in Missouri threaten dragonfly habitat by wallowing and trampling muddy fens. Fencing and monitoring for feral hogs have proven to be effective forms of habitat protection,<sup>124</sup> as such, fencing and monitoring costs are presented as a potential option for habitat protection. Feral hogs can be deterred from critical habitat by surrounding each of the proposed units in Missouri with three strand barbed-wire fencing, which costs \$0.63 per linear foot.<sup>125</sup> Installation of fences around Missouri Units 5 and 25 was performed in 2006 and cost \$7,500 and \$11,500, respectively.<sup>126</sup>
167. To estimate future fencing costs, first the perimeter distance of each proposed unit is calculated using GIS analysis. The total perimeter distance of the proposed Missouri units is then multiplied by the unit cost of barbed-wire fencing.<sup>127</sup> Fencing costs are calculated in 2007 dollars and are presented as a one time cost, assumed immediately.
168. In addition to fencing the units, the Service expects to pay \$24,000 annually across all Missouri units to control and monitor feral hog populations. The total future cost of fencing and feral hog control is \$619,000 in undiscounted dollars. Present value costs are \$506,000 assuming a three percent discount rate and \$411,000 assuming a seven percent discount rate. The per unit costs are presented in Exhibit 6-4.

<sup>124</sup> Written communication with Biologist, U.S. Fish and Wildlife Service, Columbia, Missouri Field Office, October 12, 2006.

<sup>125</sup> Personal Communication with Bob Gillespie, Missouri Department of Conservation on October 25, 2006.

<sup>126</sup> Written correspondence with Biologist, U.S. Fish and Wildlife Service, Columbia, Missouri Field Office, October 12, 2006.

<sup>127</sup> Missouri units 5 and 25 were surrounded with barbed-wire fencing in 2006. Therefore, the fencing costs for these two units are included in past costs.

EXHIBIT 6-4 FUTURE COSTS OF FERAL HOG MANAGEMENT

UNIT	FUTURE COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
MO 1	\$24,000	\$19,000	\$16,000
MO 2	\$22,000	\$18,000	\$14,000
MO 3	\$21,000	\$16,000	\$13,000
MO 4	\$20,000	\$16,000	\$12,000
MO 5	\$18,000	\$14,000	\$10,000
MO 6	\$22,000	\$18,000	\$14,000
MO 7	\$21,000	\$17,000	\$13,000
MO 8	\$34,000	\$30,000	\$26,000
MO 9	\$34,000	\$30,000	\$26,000
MO 10	\$34,000	\$30,000	\$26,000
MO 11	\$26,000	\$21,000	\$18,000
MO 12	\$22,000	\$17,000	\$14,000
MO 13	\$21,000	\$17,000	\$13,000
MO 14	\$20,000	\$16,000	\$12,000
MO 15	\$20,000	\$16,000	\$12,000
MO 16	\$19,000	\$15,000	\$11,000
MO 17	\$29,000	\$25,000	\$21,000
MO 18	\$29,000	\$25,000	\$21,000
MO 19	\$24,000	\$20,000	\$16,000
MO 20	\$24,000	\$20,000	\$16,000
MO 21	\$20,000	\$15,000	\$12,000
MO 22	\$22,000	\$17,000	\$14,000
MO 23	\$26,000	\$22,000	\$18,000
MO 24	\$26,000	\$22,000	\$18,000
MO 25	\$18,000	\$14,000	\$10,000
MO 26	\$20,000	\$15,000	\$12,000
<b>TOTAL</b>	<b>\$619,000</b>	<b>\$506,000</b>	<b>\$411,000</b>

Note: Totals may not sum due to rounding

**6.5 BEAVER DAMS**

169. Beavers sometimes construct dams in the fens that provide habitat for the dragonfly. These dams can change the hydrology of the fen, thereby harming dragonfly habitat and particularly dragonfly larvae. The effects of beaver dam construction on a fen's hydrology can be mitigated by installing Clemson levelers at a fen's sources of water intake and/or outtake. The Clemson leveler is a porous tube surrounded with a mesh wire cage. The device receives water at the fen's intake and/or outtake and distributes the water over the length of the tube. As the water is gradually released through the tube's many pores, the device prevents a beaver dam from obstructing water flow.

170. The Service expects to install four Clemson levelers in total in Missouri Units 5, 6, 11, and 22,<sup>128</sup> which are threatened by hydrological changes caused by beaver dams. The cost

<sup>128</sup> 71 FR 42442

for each device and its installation is \$3,000. The total cost of the Clemson levelers for the four units \$12,000 in undiscounted dollars. Discounted future costs are the same because the Service is assumed to install the Clemson levelers in 2007. The expected future costs of beaver dam management are presented in Exhibit 6-5.

**EXHIBIT 6-5 FUTURE COSTS OF BEAVER DAM MANAGEMENT**

UNIT	FUTURE COSTS		
	UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
MO 5	\$3,000	\$3,000	\$3,000
MO 6	\$3,000	\$3,000	\$3,000
MO 11	\$3,000	\$3,000	\$3,000
MO 22	\$3,000	\$3,000	\$3,000
<b>TOTAL</b>	<b>\$12,000</b>	<b>\$12,000</b>	<b>\$12,000</b>

171. Recreational off-road vehicles and equestrian activities have the potential to alter dragonfly habitat and extirpate populations.<sup>129</sup> This chapter presents the costs associated with mitigating threats from recreational activities. The largest share of the past costs of mitigation are section 7 consultations for restoration of dragonfly habitat following off-road vehicle use. The future costs of habitat protection are primarily the costs of installing fencing and the projected costs of a formal section 7 consultation for maintenance of off-road vehicle trails. The installation of fencing around dragonfly habitat may obviate the need for additional section 7 consultations related to habitat protection because the habitats will be protected from off-road vehicle and equestrian incursions.

**PAST ADMINISTRATIVE COSTS OF PROTECTION FROM RECREATIONAL ACTIVITIES**

172. Since 1995, there have been five section 7 consultations directly attributable to dragonfly protection from recreational activities. These section 7 consultations occurred in Missouri between 2003 and 2006. The consultations are either programmatic or informal consultations, and the costs of these consultations range from \$36,554 (programmatic consultation) to \$14,313 (informal consultation). The costs of the consultations are divided between the affected units. The total costs of past section 7 consultations are \$138,000 in undiscounted dollars, and \$148,000 and \$162,000 assuming discount rates of three and seven percent, respectively.

**FUTURE COSTS OF PROTECTION FROM RECREATIONAL ACTIVITIES**

173. Future costs of dragonfly protection from recreational activities includes the one-time cost of installing three-strand barbed wire fences around Michigan Units 5 and 6. The details of the cost calculations for fence installation are described in section 7.1. The total cost of installing fencing around Michigan Units 5 and 6 is \$19,000 in undiscounted dollars. The total present values are \$19,000 at both three percent and seven percent since the fencing is assumed to take place in 2007.

**7.1 OFF-ROAD VEHICLE USE**

174. The composition of dragonfly habitat — sheet flows of water, sensitive hydrology, springs, hydric soils, and a general marshy environment — make the habitat susceptible to destruction from off-road vehicle use. Specifically, off-road vehicles can create incidental damage by rutting the fens, thereby destroying dragonfly larvae habitat, and altering the hydrology of the area.<sup>130</sup> The past costs of off-road vehicle use are derived

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<sup>129</sup> 72 FR 42442.

<sup>130</sup> 71 FR 42442.

from Section 7 consultations. These costs include the administrative effort and expense to repair dragonfly habitat, as well as the maintenance of designated off-road vehicle trails to preserve dragonfly habitat.

175. No dragonfly habitat occurs on designated off-road vehicle trails in Federal, State, or county forests. As such, all off-road recreational activity that occurs within dragonfly habitat is illegal. It is also sporadic.<sup>131</sup> Monitoring and policing are performed by Forest Service and county police. Due to the unpredictable nature of this illegal off-road vehicle use, the most accurate costs associated with off-road vehicle habitat destruction are the past costs of repairs and section 7 consultations, described in Exhibit 7-1.

**EXHIBIT 7-1 PAST COSTS OF OFF-ROAD VEHICLE USE**

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
MO 5	Section 7 Consultations	2005, 2006	\$9,000	\$9,000	\$9,000
MO 8	Section 7 Consultations	2003, 2005, 2006	\$18,000	\$19,000	\$21,000
MO 9	Section 7 Consultations	2003, 2005, 2006	\$18,000	\$19,000	\$21,000
MO 10	Section 7 Consultations	2003, 2005, 2006	\$18,000	\$19,000	\$21,000
MO 11	Section 7 Consultations	2003, 2005, 2006	\$18,000	\$19,000	\$21,000
MO 12	Section 7 Consultations	2005	\$3,000	\$4,000	\$4,000
MO 13	Section 7 Consultations	2005, 2006	\$9,000	\$9,000	\$9,000
MO 14	Section 7 Consultations	2005	\$3,000	\$4,000	\$4,000
MO 15	Section 7 Consultations	2005, 2006	\$9,000	\$9,000	\$9,000
MO 21	Section 7 Consultations	2004	\$14,000	\$16,000	\$18,000
MO 23	Section 7 Consultations	2005, 2006	\$8,000	\$8,000	\$9,000
MO 24	Section 7 Consultations	2006	\$5,000	\$5,000	\$5,000
MO 25	Section 7 Consultations	2005, 2006	\$8,000	\$8,000	\$9,000
<b>Total</b>			<b>\$138,000</b>	<b>\$148,000</b>	<b>\$162,000</b>

Note: Totals may not sum due to rounding

<sup>131</sup> Personal communication with Biologist, U.S. Fish and Wildlife Service, Marquette, Michigan Field Office, October 18, 2006. Personal communication with Biologist, U.S. Fish and Wildlife Service, Columbia, Missouri Field Office, October 12, 2006. Personal communication with U.S. Fish and Wildlife Service Chicago Field Office Endangered Species Coordinator, October 16, 2006

176. Protection from off-road vehicle activity includes the placement of boulders and embankments to prevent entrance to sensitive dragonfly habitat and wetland areas.<sup>132</sup> Additionally, an effective form of protection against off-road vehicles in the future is the installation of fencing around units; fencing has proven to be an effective deterrent and is already employed in some Missouri units.<sup>133</sup> Fencing costs are calculated as a one-time activity. The fencing costs for all Missouri units are calculated in Chapter 6, where they are included to capture the cost of feral hog mitigation. They are not included in this chapter to avoid double counting. Because Michigan fencing costs are associated solely with protection from off-road vehicle activity, they are presented in Exhibit 7-2 as one-time costs. Fencing costs are calculated at \$.63 a foot for three-strand barbed wire fences. The cost per foot of fencing was entered into a GIS to obtain the total cost of installing fences along the perimeter of each affected unit.

EXHIBIT 7-2 FUTURE COSTS OF OFF-ROAD VEHICLE PROTECTION<sup>134</sup>

UNIT	ACTIVITY	YEAR	TOTAL COSTS		
			UNDISCOUNTED	PRESENT VALUE (3%)	PRESENT VALUE (7%)
MI 5	Fencing	2007	\$7,000	\$7,000	\$7,000
MI 6	Fencing	2007	\$13,000	\$13,000	\$13,000
<b>Total</b>			<b>\$19,000</b>	<b>\$19,000</b>	<b>\$19,000</b>

Note: totals may not sum due to rounding

## 7.2 EQUESTRIAN ACTIVITY

177. Equestrian activity harmful to dragonfly habitat has been identified in Missouri Unit 21. Although there are designated equestrian trails adjacent to the unit, no designated trails go through the habitat. The installation of fencing outlined in Section 7.1 describes perimeter fencing which is an effective protective measures and their associated costs.<sup>135</sup> Specific fencing costs for Missouri Unit 21 are included in Chapter 6 for mitigation against threats from feral hogs.

<sup>132</sup> Telephone conversation with Kirk Piehler of the US Forest Service on November 21, 2006.

<sup>133</sup> Written communication from Biologist, U.S. Fish and Wildlife Service, Columbia, Missouri Field Office, October 12, 2006

<sup>134</sup> Additionally, units MI 1 and 2 are threatened by illegal recreational vehicle use. Because these units are almost entirely within the Hiawatha National Forest, they are subject to routine protection, surveillance, and maintenance. Pursuant to the 2006 Hiawatha Forest Management Plan and the associated Environmental Impact Statement, no specific costs can be attributed to these units, as protection of the dragonfly habitat is intertwined with ecosystem maintenance and management. Off-road vehicle protection measures are implemented on a case by case basis, as necessary, and are not easily calculated as costs unique to the dragonfly. Personal Communication with Kirk Piehler, US Forest Service, November 21, 2006.

<sup>135</sup> Written communication with Biologist, U.S. Fish and Wildlife Service, Columbia, Missouri Field Office, October 12, 2006.

## APPENDIX A | SMALL ENTITY AND ENERGY IMPACTS ANALYSIS

1. This appendix considers the extent to which the analytic results presented in the previous sections reflect potential future impacts to small entities and the energy industry. The screening analysis presented in this appendix is conducted pursuant to the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) in 1996. Information for this analysis was gathered from the Small Business Administration (SBA), U.S. Census Bureau, and GIS data sources. The energy analysis in Section A.2 is conducted pursuant to Executive Order No. 13211.

### A.1 SBREFA ANALYSIS

2. In accordance with SBREFA, when a Federal agency publishes a notice of rulemaking for any proposed or final rule, it must make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions). No regulatory flexibility analysis is required, however, if the head of an agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. SBREFA amended the RFA to require Federal agencies to provide a statement of the factual basis for certifying that a rule will not have significant economic impact on a substantial number of small entities.
3. To assist in this process, the following represents a screening level analysis of the potential for dragonfly conservation efforts to affect small entities. This screening analysis focuses on small entities that may bear the regulatory costs quantified in this economic analysis. Although indirectly affected businesses are considered, this analysis considers only those entities whose impact would not be measurably diluted. Specifically, this economic analysis quantifies economic impacts of dragonfly conservation associated with the estimated impacts of the proposed rulemaking as described in Chapters 2 to 7 of this analysis. Specifically, six types of activities may be affected:
  - Development (Residential, Commercial, and Road Construction activities);
  - Water use;
  - Utility and infrastructure maintenance;
  - Road and railway use;
  - Species management; and



- Recreation.

4. The screening analysis contained in this appendix focuses on economic impacts to each of these activities in turn:

- *Residential Development (Chapter 2)*. Potential limitations on residential development in Michigan and Wisconsin may impact land values for landowners in the affected units. Affected acreages were computed using a Geographic Information System (GIS). Land values were computed based on tax assessor data in Wisconsin (assessed at market values) and from parcel sale data in Michigan. Land value losses in Wisconsin were not computed for parcels owned by organizations that are unlikely to develop the land (eg. The University of Wisconsin, Wisconsin Department of Natural Resources, The Ridges Sanctuary, The Nature Conservancy (Wisconsin Chapter), as well as local townships and counties. Properties owned by these organizations do not have assessed property values. Information concerning land values and estimated losses due to potential restrictions on residential developments follow:

- ◆ In Wisconsin, GIS tax parcel data denotes seven distinct landowners in Unit 1, nine distinct landowners in Unit 4, and 26 distinct landowners in Unit 5 who own developable land within the proposed critical habitat. The total acreage of developable land within Wisconsin proposed critical habitat is 28.99 acres. The total value of the residential land lost is \$1,460,000. The average value of land lost is \$35,000 per acre. Each landowner is expected to lose an average of approximately 0.69 acres of developable land.
- ◆ In Michigan, GIS tax parcel data are not available, and identifying the number of distinct private land owners within proposed critical habitats in Michigan is not possible.<sup>136</sup> Within Michigan Units 3, 4, 5, and 6, there are 155 acres of developable land which could be restricted. The total value of this land is estimated to be \$245,000. This yields an average approximate value of \$1,580 per acre.

Given the small average size and value of the parcels, the non-institutional landowners in both Wisconsin and Michigan are most likely individuals, who are not considered small entities by the Small Business Administration. However, to the extent that some landowners are businesses or organizations, the loss in value to that owner will depend on the proportion of the total parcel overlapping dragonfly habitat and whether the land can be put to other uses.

- *Commercial Development (Chapter 2)* Material Services Corporation (MSC) owns the rights to dolomite deposits in Illinois Unit 2, and its operations may be

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<sup>136</sup> Public lands, as well as Nature Conservancy land, are not considered small entities and were not included in the GIS analysis for Michigan because they cannot be developed for residential or commercial purposes.

affected by dragonfly conservation efforts. This analysis estimates MSC may undertake \$4 to \$8 million in conservation efforts for the dragonfly. The impact of MSC not being able to mine the dolomite deposit is estimated at \$17.6 million (undiscounted). The Small Business Administration Small Business Standard for the Crushed and Broken Limestone Mining and Quarrying industry sector is 500 employees.<sup>137</sup> The MSC facility in Romeoville, where Illinois Unit 2 is located has 125 employees.<sup>138</sup> MSC has 800 employees in Illinois and Indiana, and was purchased by Hanson, PLC, for \$300 million in 2006.<sup>139</sup> Hanson, PLC, has more than 27,000 employees globally and had revenues over \$6.5 billion in 2005.<sup>140</sup>

- *Road Construction (Chapter 2)* The Illinois Tollway Authority has incurred and will continue to incur costs due to dragonfly conservation efforts in the construction of the Interstate 355 Extension. However, the Illinois Tollway Authority does not meet the definition of a small entity.
- *Water Use (Chapter 3)* Impacts of conservation activities related to water use, are not anticipated to affect small entities. As discussed in Chapter 3, public water systems may incur costs associated with drilling deep water aquifer wells if such a policy is undertaken. The US Environmental Protection Agency has defined small entity public water systems as those that serve 10,000 or fewer persons.<sup>141</sup> Application of this standard to municipalities that could be required to construct deep aquifer wells reveals that none of the municipalities listed in Exhibit 3-3 have populations below 10,000.
- *Utility and Infrastructure Maintenance (Chapter 4)*. Chapter 4 examines the impacts of necessary utility and infrastructure maintenance using dragonfly sensitive procedures (\$1.5 million, undiscounted). Neither ComEd (responsible for electrical line maintenance), county road authorities (responsible for road maintenance), nor Midwest Generation (responsible for railroad track maintenance in Illinois Units 1 and 2) are considered small entities.
- *Road and Railway Use (Chapter 5)*. Chapter 5 discusses necessary railway upgrades for dragonfly protection (\$1.8 million undiscounted) Neither Midwest Generation (responsible for railroad track improvements in Illinois units ), county road agencies (responsible for using non-saline de-icing techniques), nor the individual travelers who would be affected by road slowing (\$13.2 million in lost value of travel time if speed limits are enacted) are considered small entities.

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<sup>137</sup> US Small Business Administration, "Table of Small Business Size Standards Matched to North American Industry Classification System Codes," July 31, 2006.

<sup>138</sup> Written communication from Michael Melton, Environmental Services Department Project Manager, Hanson Material Service, December 20, 2006.

<sup>139</sup> A to Z Build.com, "Hanson Announces the Completed Acquisition of Material Services Corporation" June 21, 2006. <http://www.azobuild.com/news.asp?newsID=2307> accessed January 5, 2007.

<sup>140</sup> Hanson PLC Corporate Overview, December 4, 2006.

<sup>141</sup> U.S. Environmental Protection Agency, "National Primary Drinking Water Regulation: Consumer Confidence Reports; Final Rule," 63 FR 44511, August 19, 1998.

- *Species Management and Habitat Protection (Chapter 6)* Impacts of conservation activities related to species management and habitat protection are not anticipated to affect small entities. As Chapter 6 indicates, species management and habitat protection costs will be borne by The Nature Conservancy (Wisconsin Chapter), The Ridges Sanctuary, the Service, the US Forest Service, the Michigan Department of Natural Resources, and the Missouri Department of Conservation, none of which meet the definition of a small entity.
- *Recreation (Chapter 7)*. Impacts of conservation activities related to recreation are not anticipated to affect small entities. As Chapter 7 discusses, species recreation related costs will be borne by the Michigan Department of Natural Resources, the Missouri Department of Conservation, the Forest Service, and various county police departments, none of which meet the definition of a small entity.

## A.2 POTENTIAL IMPACTS TO THE ENERGY INDUSTRY

5. Pursuant to Executive Order No. 13211, “Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use,” issued May 18, 2001, Federal agencies must prepare and submit a “Statement of Energy Effects” for all “significant energy actions.” The purpose of this requirement is to ensure that all Federal agencies “appropriately weigh and consider the effects of the Federal Government’s regulations on the supply, distribution, and use of energy.”<sup>142</sup>
6. The Office of Management and Budget provides guidance for implementing this Executive Order, outlining nine outcomes that may constitute “a significant adverse effect” when compared with the regulatory action under consideration:
  - Reductions in crude oil supply in excess of 10,000 barrels per day (bbls);
  - Reductions in fuel production in excess of 4,000 barrels per day;
  - Reductions in coal production in excess of 5 million tons per year;
  - Reductions in natural gas production in excess of 25 million Mcf per year;
  - Reductions in electricity production in excess of 1 billion kilowatt-hours per year or in excess of 500 megawatts of installed capacity;
  - Increases in energy use required by the regulatory action that exceed the thresholds above;
  - Increases in the cost of energy production in excess of one percent;
  - Increases in the cost of energy distribution in excess of one percent; or
  - Other similarly adverse outcomes.<sup>143</sup>

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<sup>142</sup> Memorandum For Heads of Executive Department Agencies, and Independent Regulatory Agencies, Guidance For Implementing E.O. 13211, M-01-27, Office of Management and Budget, July 13, 2001, <http://www.whitehouse.gov/omb/memoranda/m01-27.html>.

<sup>143</sup> Ibid.

The Midwest Generation facilities that rely on the transportation of coal through Illinois Units 1 and 2 generate 1,960 megawatts of electricity. The dragonfly conservation measures advocated by the Service, however, are not intended to alter the operation of these facilities. Rather the recommended conservation activities focus on improving maintenance and railway upgrades (see Chapters 4 and 5).

7. The costs included in Chapter 4 (maintenance, \$744,000 undiscounted) and Chapter 5 (railway use, \$1.45 million undiscounted) comprise a total of \$2.19 million, undiscounted. The undiscounted annualized cost is \$110,000. Annualized at 3 percent, this is \$130,000 per year and annualized at 7 percent, this is \$156,000 per year.
8. In 2005, the total gross revenues for the Will County plant were approximately \$215,340,000.<sup>144</sup> The undiscounted annualized cost for railroad improvement is 0.05 percent of gross revenues. The total revenue of the three plants that rely on the coal shipped by rail to the Will County Facility (the Crawford and Fisk generating stations in Chicago) was approximately \$386,613,000. The undiscounted annualized cost for railroad improvement is less than 0.03 percent of gross revenues for the three plants together.

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<sup>144</sup> Written communication from Julia Wozniak, Senior Biologist, Midwest Generation Services, December 13, 2006.

## APPENDIX B | PAST COSTS

EXHIBIT B-1. SUMMARY OF PAST IMPACTS (1995-2006): UNDISCOUNTED

UNIT	DEVELOPMENT	WATER USE	UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE	SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL
<b>Proposed Critical Habitat</b>							
IL 1	\$193,000	\$6,000	\$486,000	\$20,000	\$5,000	\$0	\$711,000
IL 2	\$1,253,000	\$1,000	\$608,000	\$20,000	\$5,000	\$0	\$1,887,000
IL 3	\$179,000	\$15,000	\$28,000	\$0	\$5,000	\$0	\$227,000
IL 4	\$1,845,000	\$1,000	\$9,000	\$100,000	\$5,000	\$0	\$1,960,000
IL 5	\$2,000	\$1,000	\$9,000	\$0	\$5,000	\$0	\$17,000
IL 6	\$1,000	\$0	\$0	\$0	\$5,000	\$0	\$6,000
IL 7	\$554,000	\$0	\$40,000	\$0	\$5,000	\$0	\$599,000
MI 3	\$14,000	\$0	\$0	\$0	\$9,000	\$0	\$23,000
MI 4	\$0	\$0	\$0	\$0	\$9,000	\$0	\$9,000
MI 5	\$0	\$0	\$0	\$0	\$9,000	\$0	\$9,000
MI 6	\$0	\$0	\$0	\$0	\$9,000	\$0	\$9,000
WI 1	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 2	\$0	\$0	\$0	\$0	\$19,000	\$0	\$19,000
WI 3	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 4	\$0	\$0	\$0	\$0	\$19,000	\$0	\$19,000
WI 5	\$50,000	\$0	\$2,000	\$0	\$19,000	\$0	\$71,000
WI 6	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 7	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 8	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 9	\$24,000	\$0	\$0	\$0	\$0	\$0	\$24,000
WI 10	\$0	\$0	\$0	\$0	\$29,000	\$0	\$29,000
WI 11	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$4,114,000</b>	<b>\$24,000</b>	<b>\$1,183,000</b>	<b>\$140,000</b>	<b>\$159,000</b>	<b>\$0</b>	<b>\$5,619,000</b>

UNIT	DEVELOPMENT	WATER USE	UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE	SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL
<b>Considered for Exclusion</b>							
MI1	\$0	\$0	\$1,000	\$0	\$12,000	\$0	\$13,000
MI2	\$0	\$0	\$1,000	\$0	\$16,000	\$0	\$17,000
MO1	\$0	\$0	\$0	\$0	\$7,000	\$0	\$7,000
MO2	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$10,000
MO3	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$10,000
MO4	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$10,000
MO5	\$5,000	\$0	\$3,000	\$0	\$63,000	\$9,000	\$79,000
MO6	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO7	\$0	\$0	\$0	\$0	\$43,000	\$0	\$43,000
MO8	\$11,000	\$0	\$3,000	\$0	\$7,000	\$18,000	\$38,000
MO9	\$11,000	\$0	\$3,000	\$0	\$7,000	\$18,000	\$38,000
MO10	\$11,000	\$0	\$3,000	\$0	\$7,000	\$18,000	\$38,000
MO11	\$11,000	\$0	\$3,000	\$0	\$7,000	\$18,000	\$38,000
MO12	\$0	\$0	\$0	\$0	\$1,000	\$3,000	\$4,000
MO13	\$11,000	\$0	\$3,000	\$0	\$4,000	\$9,000	\$27,000
MO14	\$5,000	\$0	\$0	\$0	\$1,000	\$3,000	\$9,000
MO15	\$11,000	\$0	\$3,000	\$0	\$7,000	\$9,000	\$29,000
MO16	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO17	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO18	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO19	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO20	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO21	\$0	\$0	\$0	\$0	\$7,000	\$14,000	\$21,000
MO22	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO23	\$0	\$0	\$0	\$0	\$31,000	\$8,000	\$39,000
MO24	\$0	\$0	\$0	\$0	\$31,000	\$5,000	\$36,000
MO25	\$0	\$0	\$0	\$0	\$43,000	\$8,000	\$51,000
MO26	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$10,000
<b>Total:</b>	<b>\$73,000</b>	<b>\$0</b>	<b>\$39,000</b>	<b>\$0</b>	<b>\$325,000</b>	<b>\$138,000</b>	<b>\$576,000</b>

EXHIBIT B-2 SUMMARY OF PAST IMPACTS (1995-2006): DISCOUNTED AT 3%

UNIT	DEVELOPMENT	WATER USE	UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE	SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL
<b>Proposed Critical Habitat</b>							
IL 1	\$203,000	\$7,000	\$557,000	\$22,000	\$5,000	\$0	\$795,000
IL 2	\$1,496,000	\$1,000	\$722,000	\$22,000	\$5,000	\$0	\$2,246,000
IL 3	\$188,000	\$16,000	\$32,000	\$0	\$5,000	\$0	\$241,000
IL 4	\$1,994,000	\$1,000	\$10,000	\$123,000	\$5,000	\$0	\$2,134,000
IL 5	\$2,000	\$1,000	\$10,000	\$0	\$5,000	\$0	\$18,000
IL 6	\$1,000	\$0	\$0	\$0	\$5,000	\$0	\$6,000
IL 7	\$722,000	\$0	\$46,000	\$0	\$5,000	\$0	\$774,000
MI 3	\$16,000	\$0	\$0	\$0	\$10,000	\$0	\$26,000
MI 4	\$0	\$0	\$0	\$0	\$10,000	\$0	\$10,000
MI 5	\$0	\$0	\$0	\$0	\$10,000	\$0	\$10,000
MI 6	\$0	\$0	\$0	\$0	\$10,000	\$0	\$10,000
WI 1	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 2	\$0	\$0	\$0	\$0	\$20,000	\$0	\$20,000
WI 3	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 4	\$0	\$0	\$0	\$0	\$20,000	\$0	\$20,000
WI 5	\$55,000	\$0	\$2,000	\$0	\$20,000	\$0	\$78,000
WI 6	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 7	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 8	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 9	\$27,000	\$0	\$0	\$0	\$0	\$0	\$27,000
WI 10	\$0	\$0	\$0	\$0	\$32,000	\$0	\$32,000
WI 11	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$4,703,000</b>	<b>\$26,000</b>	<b>\$1,381,000</b>	<b>\$167,000</b>	<b>\$170,000</b>	<b>\$0</b>	<b>\$6,447,000</b>
<b>Considered for Exclusion</b>							
M11	\$0	\$0	\$1,000	\$0	\$13,000	\$0	\$14,000
M12	\$0	\$0	\$1,000	\$0	\$18,000	\$0	\$19,000
MO1	\$0	\$0	\$0	\$0	\$7,000	\$0	\$7,000
MO2	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$11,000

UNIT	DEVELOPMENT	WATER USE	UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE	SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL
MO3	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$11,000
MO4	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$11,000
MO5	\$5,000	\$0	\$3,000	\$0	\$68,000	\$9,000	\$85,000
MO6	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO7	\$0	\$0	\$0	\$0	\$50,000	\$0	\$50,000
MO8	\$11,000	\$0	\$3,000	\$0	\$7,000	\$19,000	\$41,000
MO9	\$11,000	\$0	\$3,000	\$0	\$7,000	\$19,000	\$41,000
MO10	\$11,000	\$0	\$3,000	\$0	\$7,000	\$19,000	\$41,000
MO11	\$11,000	\$0	\$3,000	\$0	\$7,000	\$19,000	\$41,000
MO12	\$0	\$0	\$0	\$0	\$1,000	\$4,000	\$4,000
MO13	\$11,000	\$0	\$3,000	\$0	\$5,000	\$9,000	\$28,000
MO14	\$5,000	\$0	\$0	\$0	\$1,000	\$4,000	\$9,000
MO15	\$11,000	\$0	\$3,000	\$0	\$7,000	\$9,000	\$31,000
MO16	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO17	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO18	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO19	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO20	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO21	\$0	\$0	\$0	\$0	\$7,000	\$16,000	\$23,000
MO22	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO23	\$0	\$0	\$0	\$0	\$34,000	\$8,000	\$43,000
MO24	\$0	\$0	\$0	\$0	\$34,000	\$5,000	\$39,000
MO25	\$0	\$0	\$0	\$0	\$46,000	\$8,000	\$55,000
MO26	\$0	\$0	\$3,000	\$0	\$7,000	\$0	\$11,000
<b>Total:</b>	<b>\$75,000</b>	<b>\$0</b>	<b>\$40,000</b>	<b>\$0</b>	<b>\$356,000</b>	<b>\$148,000</b>	<b>\$619,000</b>

Note: Totals may not sum due to rounding



EXHIBIT B-3 SUMMARY OF PAST IMPACTS (1995-2006): DISCOUNTED 7%

UNIT	DEVELOPMENT	WATER USE	UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE	SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL
<b>Proposed Critical Habitat</b>							
IL 1	\$216,000	\$9,000	\$668,000	\$25,000	\$6,000	\$0	\$924,000
IL 2	\$1,913,000	\$1,000	\$911,000	\$25,000	\$6,000	\$0	\$2,856,000
IL 3	\$200,000	\$17,000	\$38,000	\$0	\$6,000	\$0	\$261,000
IL 4	\$2,236,000	\$1,000	\$13,000	\$162,000	\$6,000	\$0	\$2,417,000
IL 5	\$2,000	\$1,000	\$13,000	\$0	\$6,000	\$0	\$22,000
IL 6	\$1,000	\$0	\$0	\$0	\$6,000	\$0	\$6,000
IL 7	\$1,044,000	\$0	\$56,000	\$0	\$6,000	\$0	\$1,106,000
MI 3	\$19,000	\$0	\$0	\$0	\$11,000	\$0	\$30,000
MI 4	\$0	\$0	\$0	\$0	\$11,000	\$0	\$11,000
MI 5	\$0	\$0	\$0	\$0	\$11,000	\$0	\$11,000
MI 6	\$0	\$0	\$0	\$0	\$11,000	\$0	\$11,000
WI 1	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 2	\$0	\$0	\$0	\$0	\$22,000	\$0	\$22,000
WI 3	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 4	\$0	\$0	\$0	\$0	\$22,000	\$0	\$22,000
WI 5	\$63,000	\$0	\$2,000	\$0	\$22,000	\$0	\$88,000
WI 6	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 7	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 8	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WI 9	\$30,000	\$0	\$0	\$0	\$0	\$0	\$30,000
WI 10	\$0	\$0	\$0	\$0	\$36,000	\$0	\$36,000
WI 11	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$5,724,000</b>	<b>\$29,000</b>	<b>1,701,000</b>	<b>\$212,000</b>	<b>\$186,000</b>	<b>\$0</b>	<b>\$7,853,000</b>
<b>Considered for Exclusion</b>							
MI1	\$0	\$0	\$1,000	\$0	\$14,000	\$0	\$16,000
MI2	\$0	\$0	\$1,000	\$0	\$20,000	\$0	\$21,000
MO1	\$0	\$0	\$0	\$0	\$8,000	\$0	\$8,000
MO2	\$0	\$0	\$4,000	\$0	\$8,000	\$0	\$12,000
MO3	\$0	\$0	\$4,000	\$0	\$8,000	\$0	\$12,000
MO4	\$0	\$0	\$4,000	\$0	\$8,000	\$0	\$12,000
MO5	\$5,000	\$0	\$4,000	\$0	\$77,000	\$9,000	\$94,000

UNIT	DEVELOPMENT	WATER USE	UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE	SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL
MO6	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO7	\$0	\$0	\$0	\$0	\$59,000	\$0	\$59,000
MO8	\$11,000	\$0	\$4,000	\$0	\$8,000	\$21,000	\$44,000
MO9	\$11,000	\$0	\$4,000	\$0	\$8,000	\$21,000	\$44,000
MO10	\$11,000	\$0	\$4,000	\$0	\$8,000	\$21,000	\$44,000
MO11	\$11,000	\$0	\$4,000	\$0	\$8,000	\$21,000	\$44,000
MO12	\$0	\$0	\$0	\$0	\$1,000	\$4,000	\$5,000
MO13	\$11,000	\$0	\$4,000	\$0	\$5,000	\$9,000	\$29,000
MO14	\$5,000	\$0	\$0	\$0	\$1,000	\$4,000	\$10,000
MO15	\$11,000	\$0	\$4,000	\$0	\$8,000	\$9,000	\$32,000
MO16	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO17	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO18	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO19	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO20	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO21	\$0	\$0	\$0	\$0	\$8,000	\$18,000	\$26,000
MO22	\$0	\$0	\$0	\$0	\$1,000	\$0	\$1,000
MO23	\$0	\$0	\$0	\$0	\$39,000	\$9,000	\$48,000
MO24	\$0	\$0	\$0	\$0	\$39,000	\$5,000	\$44,000
MO25	\$0	\$0	\$0	\$0	\$51,000	\$9,000	\$60,000
MO26	\$0	\$0	\$4,000	\$0	\$8,000	\$0	\$12,000
<b>Total:</b>	<b>\$78,000</b>	<b>\$0</b>	<b>\$42,000</b>	<b>\$0</b>	<b>\$401,000</b>	<b>\$162,000</b>	<b>\$683,000</b>

Note: Totals may not sum due to rounding

## APPENDIX C | FUTURE COSTS

EXHIBIT C-1 SUMMARY OF FUTURE IMPACTS (2007-2026): UNDISCOUNTED

UNIT	DEVELOPMENT		WATER USE		UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE		SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL	
			LOW	HIGH		LOW	HIGH			LOW	HIGH
<b>Proposed Critical Habitat</b>											
IL 1	\$265,000		\$0	\$1,600,000	\$501,000	\$806,000		\$0	\$0	\$1,571,000	\$3,171,000
IL 2	\$8,265,000	\$17,882,000	\$0	\$1,600,000	\$501,000	\$805,000		\$14,000	\$0	\$9,585,000	\$20,802,000
IL 3	\$265,000		\$29,000	\$329,000	\$129,000	\$17,000		\$0	\$0	\$439,000	\$739,000
IL 4	\$2,284,000		\$0	\$300,000	\$129,000	\$88,000		\$14,000	\$0	\$2,515,000	\$2,815,000
IL 5	\$0		\$0		\$129,000	\$0		\$0	\$0	\$129,000	
IL 6	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
IL 7	\$265,000		\$0	\$3,200,000	\$129,000	\$40,000	\$13,840,000	\$0	\$0	\$434,000	\$17,433,000
MI 3	\$32,000		\$0		\$1,000	\$0		\$18,000	\$0	\$51,000	
MI 4	\$32,000		\$0		\$0	\$0		\$18,000	\$0	\$50,000	
MI 5	\$42,000		\$0		\$0	\$0		\$18,000	\$7,000	\$67,000	
MI 6	\$139,000		\$0		\$0	\$0		\$18,000	\$13,000	\$170,000	
WI 1	\$94,000		\$0		\$0	\$0		\$0	\$0	\$94,000	
WI 2	\$0		\$0		\$0	\$0		\$138,000	\$0	\$138,000	
WI 3	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 4	\$386,000		\$0		\$0	\$0	\$71,000	\$138,000	\$0	\$524,000	\$595,000
WI 5	\$983,000		\$0		\$4,000	\$0	\$559,000	\$38,000	\$0	\$1,023,000	\$1,582,000
WI 6	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 7	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 8	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 9	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 10	\$0		\$0		\$0	\$0		\$57,000	\$0	\$57,000	
WI 11	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
<b>Total</b>	<b>\$13,048,000</b>	<b>\$22,665,000</b>	<b>\$29,000</b>	<b>\$7,029,000</b>	<b>\$1,521,000</b>	<b>\$1,756,000</b>	<b>\$16,186,000</b>	<b>\$474,000</b>	<b>\$19,000</b>	<b>\$16,846,000</b>	<b>\$47,894,000</b>
<b>Considered for Exclusion</b>											
MI1	\$0		\$0		\$3,000	\$0		\$23,000	\$0	\$26,000	
MI2	\$0		\$0		\$2,000	\$0		\$33,000	\$0	\$35,000	
MO1	\$0		\$0		\$0	\$0		\$51,000	\$0	\$51,000	
MO2	\$0		\$0		\$1,000	\$0		\$50,000	\$0	\$50,000	

UNIT	DEVELOPMENT	WATER USE		UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE		SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL	
		LOW	HIGH		LOW	HIGH			LOW	HIGH
MO3	\$0	\$0	\$0	\$1,000	\$0	\$0	\$48,000	\$0	\$49,000	\$49,000
MO4	\$0	\$0	\$0	\$1,000	\$0	\$0	\$48,000	\$0	\$48,000	\$48,000
MO5	\$0	\$0	\$0	\$1,000	\$0	\$0	\$99,000	\$0	\$99,000	\$99,000
MO6	\$0	\$0	\$0	\$0	\$0	\$0	\$25,000	\$0	\$25,000	\$25,000
MO7	\$0	\$0	\$0	\$0	\$0	\$0	\$104,000	\$0	\$104,000	\$104,000
MO8	\$0	\$0	\$0	\$1,000	\$0	\$0	\$43,000	\$0	\$44,000	\$44,000
MO9	\$0	\$0	\$0	\$1,000	\$0	\$0	\$43,000	\$0	\$44,000	\$44,000
MO10	\$0	\$0	\$0	\$1,000	\$0	\$0	\$43,000	\$0	\$44,000	\$44,000
MO11	\$0	\$0	\$0	\$1,000	\$0	\$0	\$38,000	\$0	\$38,000	\$38,000
MO12	\$0	\$0	\$0	\$0	\$0	\$0	\$22,000	\$0	\$22,000	\$22,000
MO13	\$0	\$0	\$0	\$1,000	\$0	\$0	\$26,000	\$0	\$26,000	\$26,000
MO14	\$0	\$0	\$0	\$1,000	\$0	\$0	\$20,000	\$0	\$21,000	\$21,000
MO15	\$0	\$0	\$0	\$1,000	\$0	\$0	\$29,000	\$0	\$30,000	\$30,000
MO16	\$0	\$0	\$0	\$0	\$0	\$0	\$19,000	\$0	\$19,000	\$19,000
MO17	\$0	\$0	\$0	\$0	\$0	\$0	\$29,000	\$0	\$29,000	\$29,000
MO18	\$0	\$0	\$0	\$0	\$0	\$0	\$29,000	\$0	\$29,000	\$29,000
MO19	\$0	\$0	\$0	\$0	\$0	\$0	\$24,000	\$0	\$24,000	\$24,000
MO20	\$0	\$0	\$0	\$0	\$0	\$0	\$24,000	\$0	\$24,000	\$24,000
MO21	\$0	\$0	\$0	\$0	\$0	\$0	\$29,000	\$0	\$29,000	\$29,000
MO22	\$0	\$0	\$0	\$0	\$0	\$0	\$25,000	\$0	\$25,000	\$25,000
MO23	\$0	\$0	\$0	\$0	\$0	\$0	\$84,000	\$0	\$84,000	\$84,000
MO24	\$0	\$0	\$0	\$0	\$0	\$0	\$84,000	\$0	\$84,000	\$84,000
MO25	\$0	\$0	\$0	\$0	\$0	\$0	\$76,000	\$0	\$76,000	\$76,000
MO26	\$0	\$0	\$0	\$1,000	\$0	\$0	\$29,000	\$0	\$29,000	\$29,000
Total	\$0	\$0	\$0	\$11,000	\$0	\$0	\$1,198,000	\$0	\$1,209,000	\$1,209,000

Note: Totals may not sum due to rounding

EXHIBIT C-2 SUMMARY OF FUTURE IMPACTS (2007-2026): DISCOUNTED AT 3%

UNIT	DEVELOPMENT		WATER USE		UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE		SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL	
			LOW	HIGH		LOW	HIGH			LOW	HIGH
<b>Proposed Critical Habitat</b>											
IL 1	\$256,000		\$0	\$1,226,000	\$433,000	\$699,000		\$0	\$0	\$1,387,000	\$2,613,000
IL 2	\$5,528,000	\$11,305,000	\$0	\$1,226,000	\$433,000	\$698,000		\$11,000	\$0	\$6,669,000	\$13,672,000
IL 3	\$256,000		\$20,000	\$250,000	\$104,000	\$13,000		\$0	\$0	\$393,000	\$622,000
IL 4	\$2,178,000		\$0	\$230,000	\$104,000	\$68,000		\$11,000	\$0	\$2,360,000	\$2,590,000
IL 5	\$0		\$0		\$104,000	\$0		\$0	\$0	\$104,000	
IL 6	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
IL 7	\$256,000		\$0	\$2,452,000	\$104,000	\$30,000	\$10,604,000	\$0	\$0	\$390,000	\$13,416,000
MI 3	\$32,000		\$0		\$1,000	\$0		\$13,000	\$0	\$45,000	
MI 4	\$32,000		\$0		\$0	\$0		\$13,000	\$0	\$45,000	
MI 5	\$42,000		\$0		\$0	\$0		\$13,000	\$7,000	\$61,000	
MI 6	\$139,000		\$0		\$0	\$0		\$13,000	\$13,000	\$164,000	
WI 1	\$94,000		\$0		\$0	\$0		\$0	\$0	\$94,000	
WI 2	\$0		\$0		\$0	\$0		\$103,000	\$0	\$103,000	
WI 3	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 4	\$386,000		\$0		\$0	\$0	\$54,000	\$103,000	\$0	\$489,000	\$544,000
WI 5	\$980,000		\$0		\$3,000	\$0	\$429,000	\$27,000	\$0	\$1,009,000	\$1,438,000
WI 6	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 7	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 8	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 9	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 10	\$0		\$0		\$0	\$0		\$41,000	\$0	\$41,000	
WI 11	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
<b>Total</b>	<b>\$10,178,000</b>	<b>\$15,955,000</b>	<b>\$20,000</b>	<b>\$5,383,000</b>	<b>\$1,285,000</b>	<b>\$1,507,000</b>	<b>\$12,564,000</b>	<b>\$347,000</b>	<b>\$19,000</b>	<b>\$13,355,000</b>	<b>\$35,552,000</b>
<b>Considered for Exclusion</b>											
MI1	\$0		\$0		\$2,000	\$0		\$17,000	\$0	\$19,000	
MI2	\$0		\$0		\$2,000	\$0		\$23,000	\$0	\$25,000	
MO1	\$0		\$0		\$0	\$0		\$39,000	\$0	\$39,000	
MO2	\$0		\$0		\$1,000	\$0		\$38,000	\$0	\$38,000	
MO3	\$0		\$0		\$1,000	\$0		\$36,000	\$0	\$36,000	

UNIT	DEVELOPMENT	WATER USE		UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE		SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL	
		LOW	HIGH		LOW	HIGH			LOW	HIGH
MO4	\$0		\$0	\$1,000		\$0	\$36,000	\$0		\$36,000
MO5	\$0		\$0	\$1,000		\$0	\$71,000	\$0		\$72,000
MO6	\$0		\$0	\$0		\$0	\$21,000	\$0		\$21,000
MO7	\$0		\$0	\$0		\$0	\$77,000	\$0		\$77,000
MO8	\$0		\$0	\$1,000		\$0	\$36,000	\$0		\$37,000
MO9	\$0		\$0	\$1,000		\$0	\$36,000	\$0		\$37,000
MO10	\$0		\$0	\$1,000		\$0	\$36,000	\$0		\$37,000
MO11	\$0		\$0	\$1,000		\$0	\$31,000	\$0		\$31,000
MO12	\$0		\$0	\$0		\$0	\$17,000	\$0		\$17,000
MO13	\$0		\$0	\$1,000		\$0	\$20,000	\$0		\$21,000
MO14	\$0		\$0	\$1,000		\$0	\$16,000	\$0		\$17,000
MO15	\$0		\$0	\$1,000		\$0	\$22,000	\$0		\$23,000
MO16	\$0		\$0	\$0		\$0	\$15,000	\$0		\$15,000
MO17	\$0		\$0	\$0		\$0	\$25,000	\$0		\$25,000
MO18	\$0		\$0	\$0		\$0	\$25,000	\$0		\$25,000
MO19	\$0		\$0	\$0		\$0	\$20,000	\$0		\$20,000
MO20	\$0		\$0	\$0		\$0	\$20,000	\$0		\$20,000
MO21	\$0		\$0	\$0		\$0	\$22,000	\$0		\$22,000
MO22	\$0		\$0	\$0		\$0	\$20,000	\$0		\$20,000
MO23	\$0		\$0	\$0		\$0	\$63,000	\$0		\$63,000
MO24	\$0		\$0	\$0		\$0	\$63,000	\$0		\$63,000
MO25	\$0		\$0	\$0		\$0	\$56,000	\$0		\$56,000
MO26	\$0		\$0	\$1,000		\$0	\$22,000	\$0		\$22,000
<b>Total</b>	<b>\$0</b>		<b>\$0</b>	<b>\$10,000</b>		<b>\$0</b>	<b>\$923,000</b>	<b>\$0</b>		<b>\$933,000</b>

Note: Totals may not sum due to rounding

EXHIBIT C-3 SUMMARY OF FUTURE IMPACTS (2007-2026): DISCOUNTED AT 7%

UNIT	DEVELOPMENT		WATER USE		UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE		SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL	
			LOW	HIGH		LOW	HIGH			LOW	HIGH
<b>Proposed Critical Habitat</b>											
IL 1	\$246,000		\$0	\$907,000	\$365,000	\$588,000		\$0	\$0	\$1,199,000	\$2,106,000
IL 2	\$3,566,000	\$6,793,000	\$0	\$907,000	\$365,000	\$588,000		\$8,000	\$0	\$4,526,000	\$8,661,000
IL 3	\$246,000		\$13,000	\$183,000	\$81,000	\$10,000		\$0	\$0	\$349,000	\$519,000
IL 4	\$2,056,000		\$0	\$170,000	\$81,000	\$50,000		\$8,000	\$0	\$2,195,000	\$2,365,000
IL 5	\$0		\$0		\$81,000	\$0		\$0	\$0	\$81,000	
IL 6	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
IL 7	\$246,000		\$0	\$1,814,000	\$81,000	\$22,000	\$7,844,000	\$0	\$0	\$348,000	\$9,984,000
MI 3	\$32,000		\$0		\$1,000	\$0		\$8,000	\$0	\$41,000	
MI 4	\$32,000		\$0		\$0	\$0		\$8,000	\$0	\$40,000	
MI 5	\$42,000		\$0		\$0	\$0		\$8,000	\$7,000	\$57,000	
MI 6	\$139,000		\$0		\$0	\$0		\$8,000	\$13,000	\$160,000	
WI 1	\$94,000		\$0		\$0	\$0		\$0	\$0	\$94,000	
WI 2	\$0		\$0		\$0	\$0		\$74,000	\$0	\$74,000	
WI 3	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 4	\$386,000		\$0		\$0	\$0	\$40,000	\$74,000	\$0	\$460,000	\$500,000
WI 5	\$980,000		\$0		\$2,000	\$0	\$317,000	\$17,000	\$0	\$999,000	\$1,316,000
WI 6	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 7	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 8	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 9	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
WI 10	\$0		\$0		\$0	\$0		\$28,000	\$0	\$28,000	
WI 11	\$0		\$0		\$0	\$0		\$0	\$0	\$0	
<b>Total</b>	<b>\$8,061,000</b>	<b>\$11,290,000</b>	<b>\$13,000</b>	<b>\$3,980,000</b>	<b>\$1,057,000</b>	<b>\$1,258,000</b>	<b>\$9,437,000</b>	<b>\$241,000</b>	<b>\$19,000</b>	<b>\$10,650,000</b>	<b>\$26,025,000</b>
<b>Considered for Exclusion</b>											
MI1	\$0		\$0		\$2,000	\$0		\$11,000	\$0	\$13,000	
MI2	\$0		\$0		\$1,000	\$0		\$15,000	\$0	\$16,000	
MO1	\$0		\$0		\$0	\$0		\$28,000	\$0	\$28,000	
MO2	\$0		\$0		\$1,000	\$0		\$27,000	\$0	\$28,000	

UNIT	DEVELOPMENT	WATER USE		UTILITY AND INFRASTRUCTURE MAINTENANCE	ROAD AND RAILWAY USE		SPECIES MANAGEMENT AND HABITAT PROTECTION	RECREATION	TOTAL	
		LOW	HIGH		LOW	HIGH			LOW	HIGH
MO3	\$0		\$0	\$1,000		\$0	\$26,000	\$0		\$26,000
MO4	\$0		\$0	\$1,000		\$0	\$25,000	\$0		\$26,000
MO5	\$0		\$0	\$1,000		\$0	\$49,000	\$0		\$49,000
MO6	\$0		\$0	\$0		\$0	\$17,000	\$0		\$17,000
MO7	\$0		\$0	\$0		\$0	\$55,000	\$0		\$55,000
MO8	\$0		\$0	\$1,000		\$0	\$30,000	\$0		\$31,000
MO9	\$0		\$0	\$1,000		\$0	\$30,000	\$0		\$31,000
MO10	\$0		\$0	\$1,000		\$0	\$30,000	\$0		\$31,000
MO11	\$0		\$0	\$1,000		\$0	\$25,000	\$0		\$25,000
MO12	\$0		\$0	\$0		\$0	\$14,000	\$0		\$14,000
MO13	\$0		\$0	\$1,000		\$0	\$15,000	\$0		\$16,000
MO14	\$0		\$0	\$1,000		\$0	\$12,000	\$0		\$13,000
MO15	\$0		\$0	\$1,000		\$0	\$16,000	\$0		\$17,000
MO16	\$0		\$0	\$0		\$0	\$11,000	\$0		\$11,000
MO17	\$0		\$0	\$0		\$0	\$21,000	\$0		\$21,000
MO18	\$0		\$0	\$0		\$0	\$21,000	\$0		\$21,000
MO19	\$0		\$0	\$0		\$0	\$16,000	\$0		\$16,000
MO20	\$0		\$0	\$0		\$0	\$16,000	\$0		\$16,000
MO21	\$0		\$0	\$0		\$0	\$16,000	\$0		\$16,000
MO22	\$0		\$0	\$0		\$0	\$17,000	\$0		\$17,000
MO23	\$0		\$0	\$0		\$0	\$46,000	\$0		\$46,000
MO24	\$0		\$0	\$0		\$0	\$46,000	\$0		\$46,000
MO25	\$0		\$0	\$0		\$0	\$38,000	\$0		\$38,000
MO26	\$0		\$0	\$1,000		\$0	\$16,000	\$0		\$16,000
<b>Total</b>	<b>\$0</b>		<b>\$0</b>	<b>\$9,000</b>		<b>\$0</b>	<b>\$693,000</b>	<b>\$0</b>		<b>\$702,000</b>

Note: Totals may not sum due to rounding



## APPENDIX D | ADMINISTRATIVE COSTS

1. This appendix presents the categories of section 7 consultations and their associated costs. This appendix defines the four types of section 7 administrative costs presented in this report: technical assistance, informal consultations, formal consultations, and programmatic consultations.

### D.1 CATEGORIES OF ADMINISTRATIVE COSTS

#### TECHNICAL ASSISTANCE

2. Frequently, the Service responds to requests for technical assistance from State agencies, local municipalities, and private landowners and developers who may have questions regarding whether specific activities may affect critical habitat. Technical assistance costs represent the estimated economic costs of informational conversations between these entities and the Service regarding the designation of critical habitat for the HED. Most likely, such conversations will occur between municipal or private property owners and the Service regarding lands designated as critical habitat or lands adjacent to critical habitat. The Service's technical assistance activities are voluntary and generally occur in instances where a Federal nexus does not exist. When a technical assistance consultation entails the geographic area of more than one critical habitat unit, the cost is distributed across the affected units.

#### SECTION 7 CONSULTATIONS

3. Section 7(a)(2) of the Act requires Federal agencies (Action agencies) to consult with the Service whenever activities that they undertake, authorize, permit, or fund may affect a listed species or designated critical habitat. There are two scenarios under which the designation of critical habitat can result in section 7 consultations with the Service beyond those required by the listing. These include:
  - New consultations, which can occur when activities involving a Federal nexus are proposed in critical habitat not thought to be currently occupied by the species; and
  - Re-initiations of consultations, which result when consultations that previously occurred under the listing are re-initiated due to new information or circumstances generated by the designation.

In some cases, consultations will involve the Service and another Federal agency only, such as the U.S. Forest Service. More often, they will also include a third party involved

in projects on non-Federal lands with a Federal nexus, such as state agencies and private landowners.

4. During a consultation, the Service, the Action agency, and the landowner manager applying for Federal funding or permitting (if applicable) communicate in an effort to minimize potential adverse effects to the species and/or to the proposed critical habitat. Communication between these parties may occur via written letters, phone calls, in-person meetings, or any combination of these. The duration and complexity of these interactions depends on a number of variables, including the type of consultation, the species, the activity of concern, the potential effects to the species and designated critical habitat associated with the activity that has been proposed, the Federal agency, and whether there is a private applicant involved.
5. Section 7 consultations with the Service may be either informal or formal. *Informal consultations* consist of discussion between the Service, the Action agency, and the applicant concerning an action that may affect a listed species or its designated critical habitat. The process is designed to identify and resolve potential concerns at an early stage in the planning process. By contrast, a *formal consultation* is required if the Action agency determines that its proposed action may or will adversely affect the listed species or designated critical habitat in ways that cannot be resolved through informal consultation. The formal consultation process results in the Service's determination in its Biological Opinion of whether the action is likely to jeopardize a species or adversely modify critical habitat, and recommendations to minimize those impacts. Regardless of the type of consultation or proposed project, section 7 consultations can require substantial administrative effort on the part of all participants.
6. Occasionally, the Service will issue a *programmatic consultation*. Programmatic consultations involve multiple government agencies and address overarching objectives for large geographic areas. Specifically, a programmatic consultation outlines and defines the course of action for multiple government bodies that perform tasks and activities in the same area. For example, in The Mark Twain National Forest a programmatic consultation was issued for all work related to the Land and Resource Management Plan. The programmatic consultation addresses specific practices such as forest management, road maintenance, and prescribed burning that may occur within the national forest. In this way, the consultation delineates appropriate actions that county and local ranger districts may undertake in the national park and within endangered species habitats.

#### **D.2 ESTIMATED COSTS OF CONSULTATIONS AND TECHNICAL ASSISTANCE**

7. Estimates of the cost of an individual consultation and technical assistance request were developed from a review and analysis of historical section 7 files from a number of Service field offices around the country conducted in 2002. These files addressed consultations conducted for both listings and critical habitat designations. Cost figures were based on an average level of effort of low, medium, or high complexity, multiplied by the appropriate labor rates for staff from the Service and other Federal agencies.

8. The administrative cost estimates presented in this section take into consideration the level of effect of the Service, the Action agency, and the applicant, as well as the varying complexity of the consultation or the technical assistance request. Costs associated with these consultations include the administrative costs associated with conducting the consultations, such as the costs of time spent in meetings, preparing letters, and the development of a biological opinion. Exhibit D-1 provides a summary of the estimated administrative costs of consultations and technical assistance requests.

**EXHIBIT D-1 ESTIMATED ADMINISTRATIVE COSTS OF CONSULTATION AND TECHNICAL ASSISTANCE EFFORTS (PER EFFORT)**

CONSULTATION TYPE	SERVICE	ACTION AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT
Technical Assistance	\$260-\$680	N/A	\$600-\$1,500	N/A
Informal Consultation	\$1,000-\$3,100	\$1,300-\$3,900	\$1,200-\$2,900	\$0-\$4,000
Formal Consultation	\$3,100-\$6,100	\$3,900-\$6,500	\$2,900-\$41,00	\$4,000-\$5,600
Programmatic Consultation	\$11,500-\$16,100	\$9,200-\$13,800	N/A	\$5,600

Source: IEC analysis based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2002, a review of consultation records from several Service field offices across the country. Confirmed by local Action agencies.  
 Note: Low and high estimates primarily reflect variations in staff wages and time involvement by staff.

**D.3 SUMMARY OF PAST ADMINISTRATIVE COSTS**

9. Since the listing of the dragonfly in 1995, there have been 51 section 7 consultations in the study area. Exhibit D-2 presents a summary of the type of dragonfly related section 7 consultations by state.

**EXHIBIT D-2 SUMMARY OF CONSULTATIONS BY STATE**

STATE	TYPES OF CONSULTATIONS			
	TECHNICAL ASSISTANCE	INFORMAL	FORMAL	PROGRAMMATIC
Illinois	8	4	3	1
Michigan	1	2	1	0
Missouri	0	2	1	18
Wisconsin	1	10	0	0
<b>Totals</b>	<b>9</b>	<b>17</b>	<b>5</b>	<b>20</b>

10. As shown in Exhibit D-2, section 7 consultations involving Missouri units often entailed programmatic consultations, as almost all Missouri units are in the Mark Twain National Forest, and are therefore subject to the Land and Resource Management Plan.

11. The specific costs per unit of section 7 consultations are presented according to threat. These costs are detailed in chapters 2 through 7 of this report.

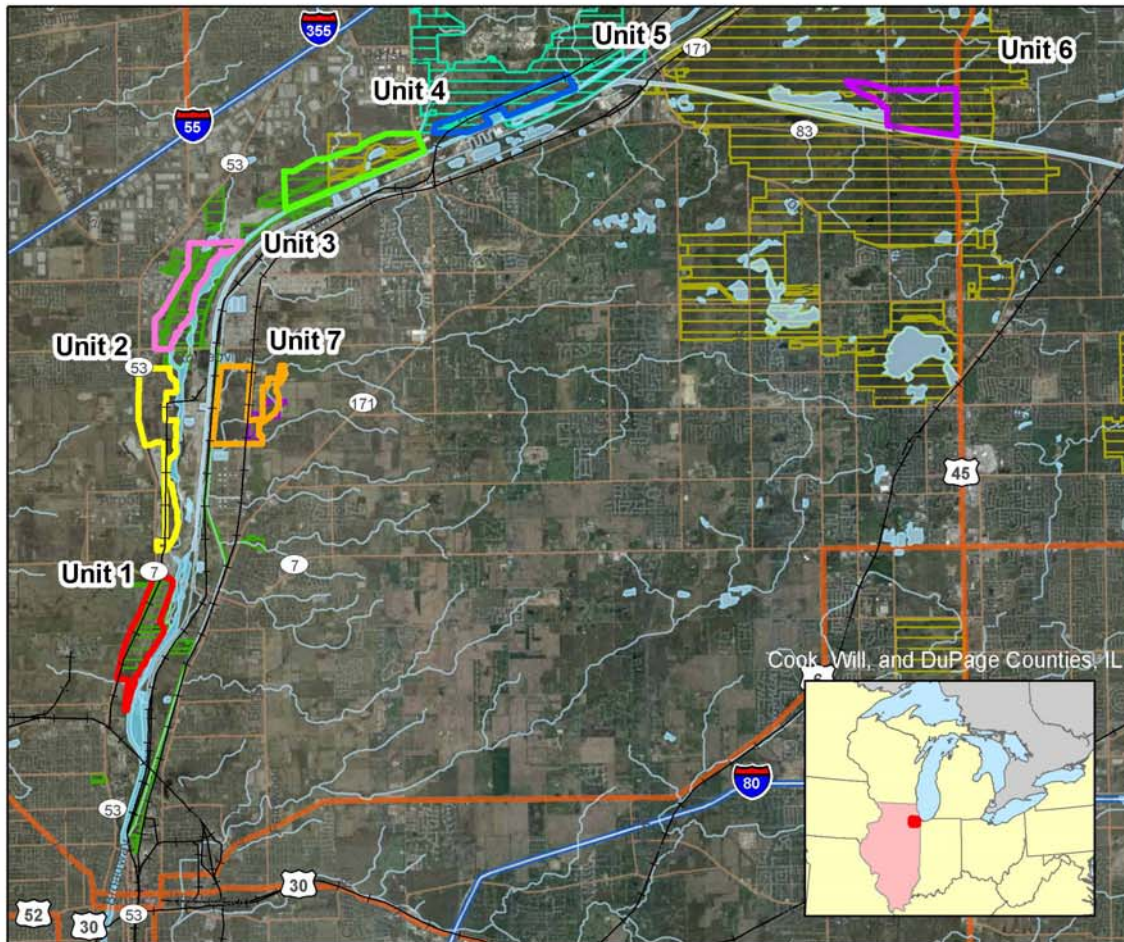
## APPENDIX E | BEST MANAGEMENT PRACTICES

1. Best Management Practices (BMPs) implemented in dragonfly habitat are compiled and outlined on a case by case basis. In general, the BMPs implemented coincide with general BMPs for work in wetlands and riparian zones. These BMPs include:
  - establish a 100 foot buffer around wetlands. This buffer increases if work is to be performed on steep embankments
  - operate heavy machinery only on dry, well-drained, or frozen ground, this helps to minimize rutting and changes to habitat hydrology
  - avoid creating roads or temporary roads through wetlands or upland areas
  - use only pesticides and herbicides labeled for use in wetlands or riparian areas. Use spot-applications of chemicals
  - avoid equipment maintenance and fueling within sensitive areas; establish staging areas on dry ground away from wetlands and riparian areas commensurate with an established buffer, described above.
  - ensure run-off and erosion from vehicle operation on roads does not interfere with the wetland; construction of culverts, and erosion barriers and countermeasures such as silt fences serve this purpose.
  - maintain skid trails on slopes less than fifteen percent
  - selectively remove vegetation such that removal does not negatively impact habitat. Additionally, proper clean up of vehicle residues, re-vegetating damaged areas, and filling-in wheel ruts mitigates detrimental change to wetland and riparian areas.
2. Costs for these BMPs are not likely to be significant and may be incurred as typical operating practices in wetlands. Cases where BMPs specific to the dragonfly have been developed and are recommended have been included in this report.

APPENDIX F  
STUDY AREA MAPS



EXHIBIT 1 ILLINOIS ALL UNITS



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Units 1-7**  
1:142,000

- Habitat and Land Ownership
- Unit 1
  - Unit 2
  - Unit 3
  - Unit 4
  - Unit 5
  - Unit 6
  - Unit 7
  - IL Department of Natural Resources
  - Will County Forest Preserve
  - DuPage County Forest Preserve
  - Cook County Forest Preserve
  - Railroad

**Threats to Habitat**

All Units: Utility and Road Maintenance, Ground and Surface Water Depletion and/or Alteration, Septic System Installation, Commercial Development, Utility and Road Construction, Habitat Fragmentation, Management and Land Use, Ecological Succession, Encroachment of Invasive Species

Unit 1: Railroad Maintenance, Culvert Maintenance, Vehicle Impacts, Hydraulic Pumping of Sediments into Habitat, Off-road vehicle use

Unit 2: Railroad Maintenance, Culvert Maintenance, Quarrying, Vehicle Impacts, Hydraulic Pumping of Sediments into Habitat

Unit 4: Culvert Maintenance, Salinization of Habitat

Unit 5: Culvert Maintenance

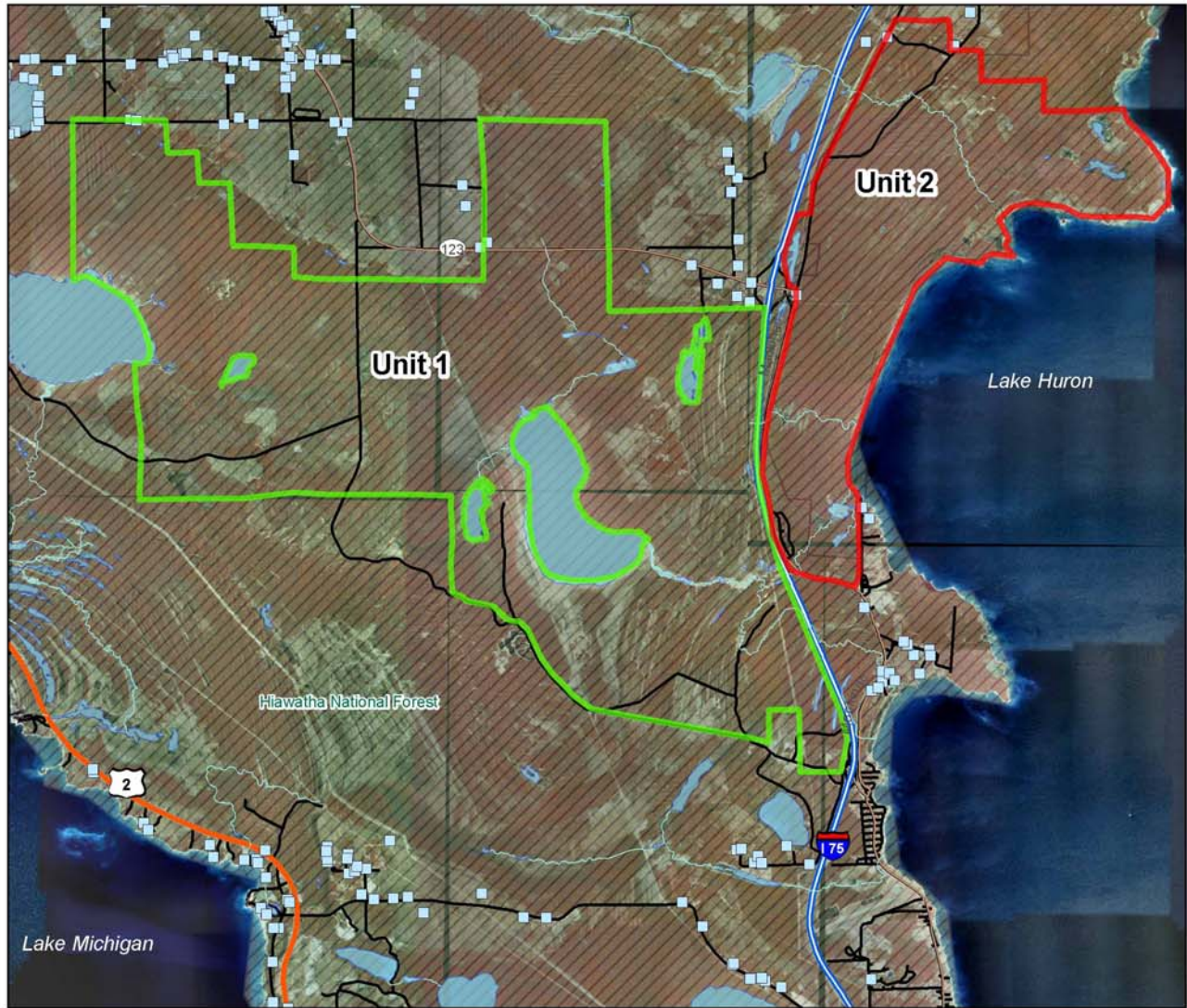
Unit 7: Vehicle Impacts



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Illinois 1	Will County Forest Preserve District; Private			249	170	419
Illinois 2	Private				439	439
Illinois 3	Will County Forest Preserve District; Private			323	14	337
Illinois 4	Will County Forest Preserve District; Cook County Forest Preserve District			607		607
Illinois 5	DuPage County Forest Preserve District; Private			222	104	326
Illinois 6	Cook County Forest Preserve District			387		387
Illinois 7	Illinois Department of Natural Resources; Private		130		350	480



EXHIBIT 2 MICHIGAN UNITS: 1, 2



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Units 1 and 2**

1:74,000

**Habitat and Landownership**

- Unit 1
- Unit 2
- Hiawatha National Forest
- Wells

**Threats to Habitat**

Unit 1: Utility and Road Maintenance, Logging, Vehicle Impacts, Off-road vehicle use, Dragonfly Monitoring, Ecological Succession, Encroachment of Invasive Species

Unit 2: Logging, Vehicle Impacts, Off-road vehicle use, Dragonfly Monitoring, Ecological Succession, Encroachment of Invasive Species

**Mackinac County, MI**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Michigan 1	Hiawatha National Forest, State Forest, Lafarge Corporation	9,296	65		91	9,452
Michigan 2	Hiawatha National Forest	3,508			3	3,511



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EXHIBIT 3 MICHIGAN UNIT: 3



**Proposed Habitat for Hine's Emerald Dragonfly: Unit 3**

1:14,000

**Habitat and Landownership**

-  Unit 3
-  Department of Natural Resources
-  The Nature Conservancy
-  Wells

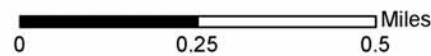
**Threats to Habitat**

Unit 3: Utility and Road Maintenance, Culvert Maintenance, Ground and Surface Water Depletion and/or Alteration, Residential Development, Septic System Installation

Mackinac County, MI

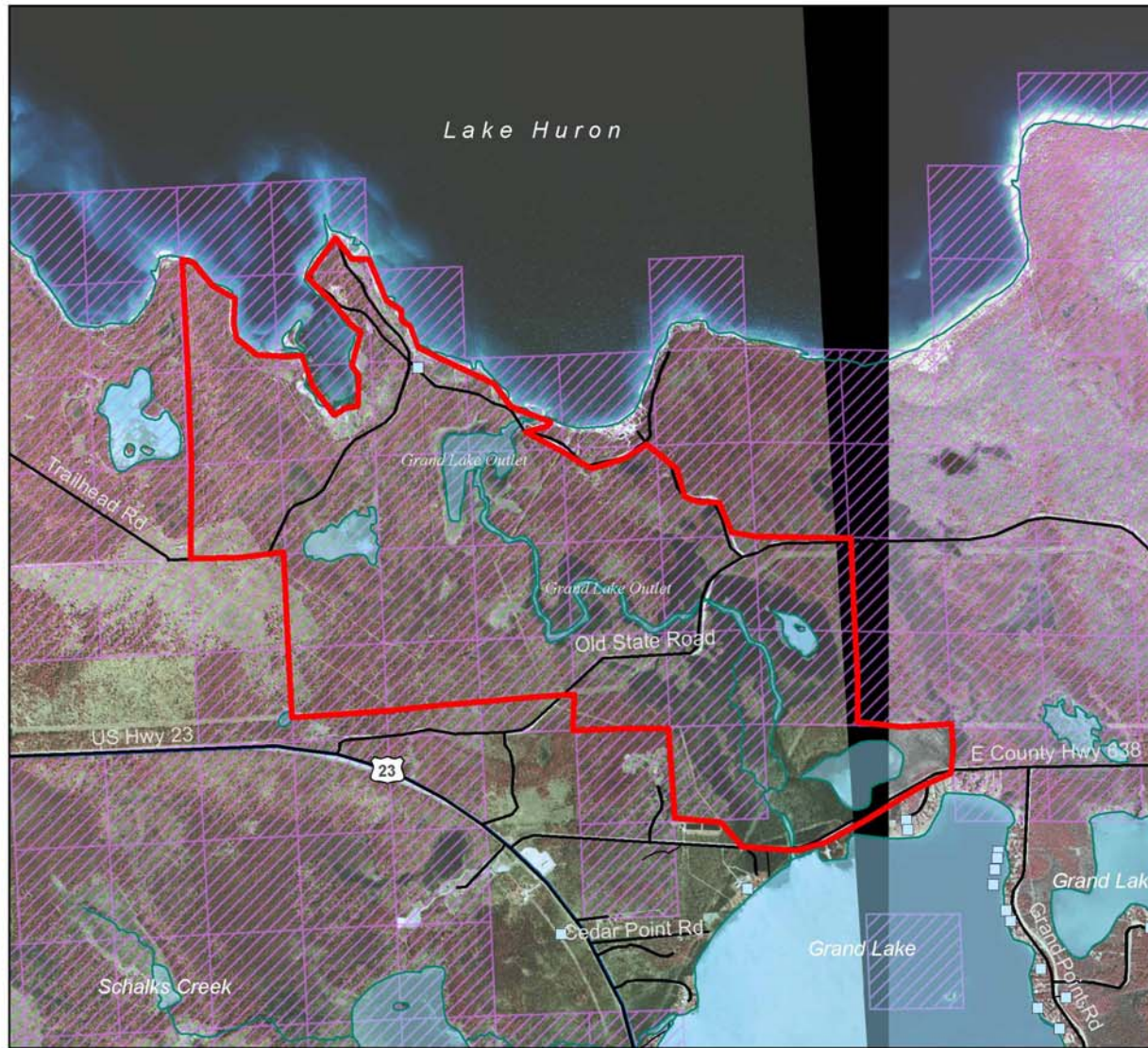


UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Michigan 3	Michigan Department of Natural Resources; Nature Conservancy; Private		23		27	50



Portions of Unit 3 are being considered for exclusion

EXHIBIT 4 MICHIGAN UNIT: 4



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 4**

1:25,000

**Habitat and Landownership**

- Unit 4
- Department of Natural Resources
- Wells

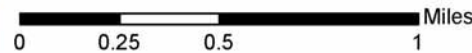
**Threats to Habitat**

Unit 4: Residential Development, HED Monitoring

Presque Isle County, MI

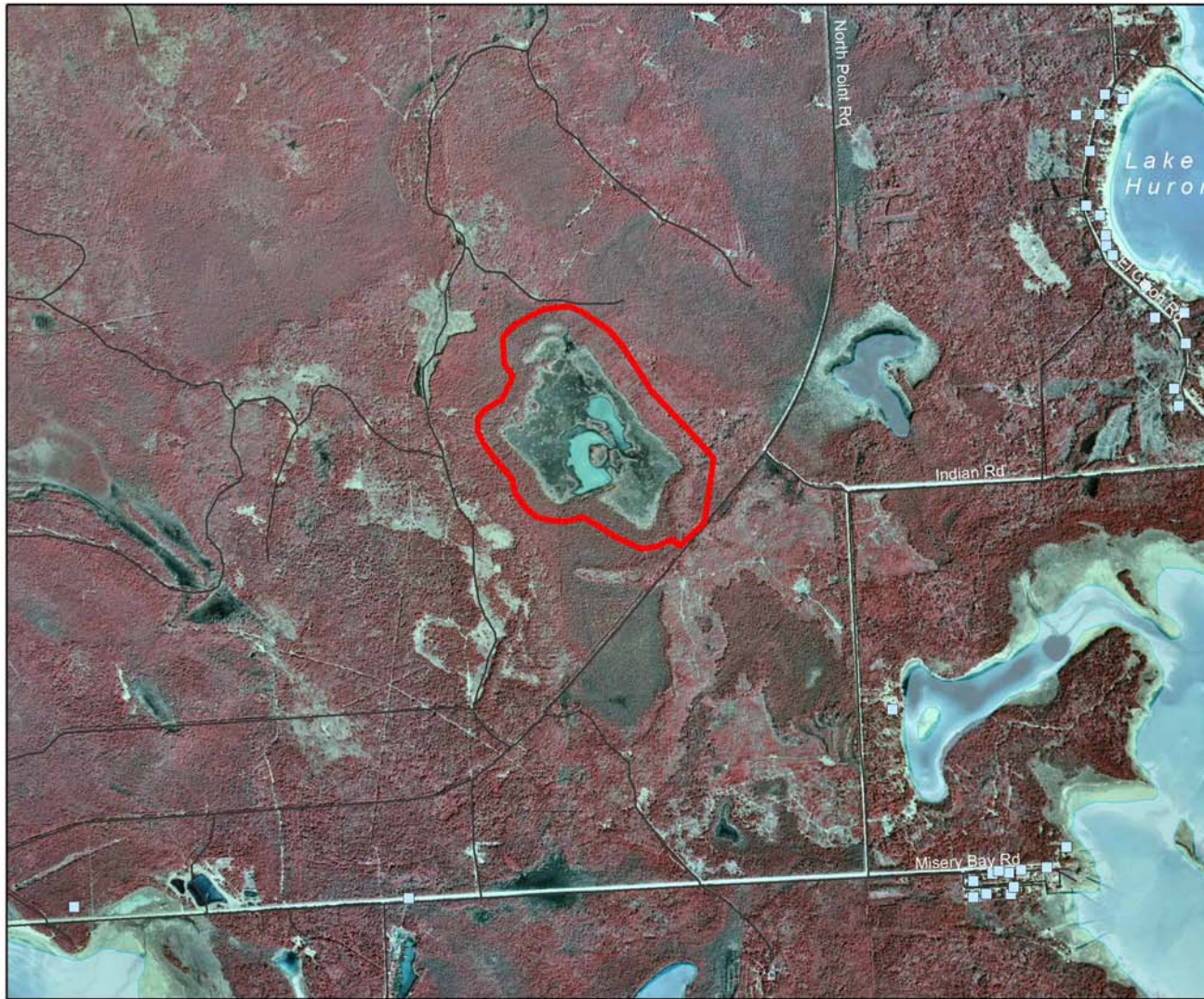


UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Michigan 4	Michigan Department of Natural Resources		875		84	959



Portions of Unit 4 are being considered for exclusion

EXHIBIT 5 MICHIGAN UNIT: 5



**Proposed Habitat for  
Hine's Emerald Dragonfly:  
Unit 5**

1:24,000

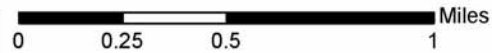
**Habitat and Hydrology**

- Unit 5
- Wells

**Threats to Habitat**

Unit 5: Utility and Road Maintenance, Ground and Surface Water Depletion and/or Alteration, Off-road vehicle use

Alpena County, MI



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Michigan Unit 5	Private and State of Michigan		65		91	156

Portions of Michigan Unit 5 are being considered for exclusion



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EXHIBIT 6 MICHIGAN UNIT: 6



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 6**

1:21,000

**Proposed Critical Habitat Units**

- Unit 6
- Wells

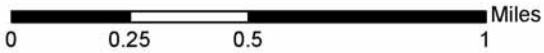
**Threats to Habitat**

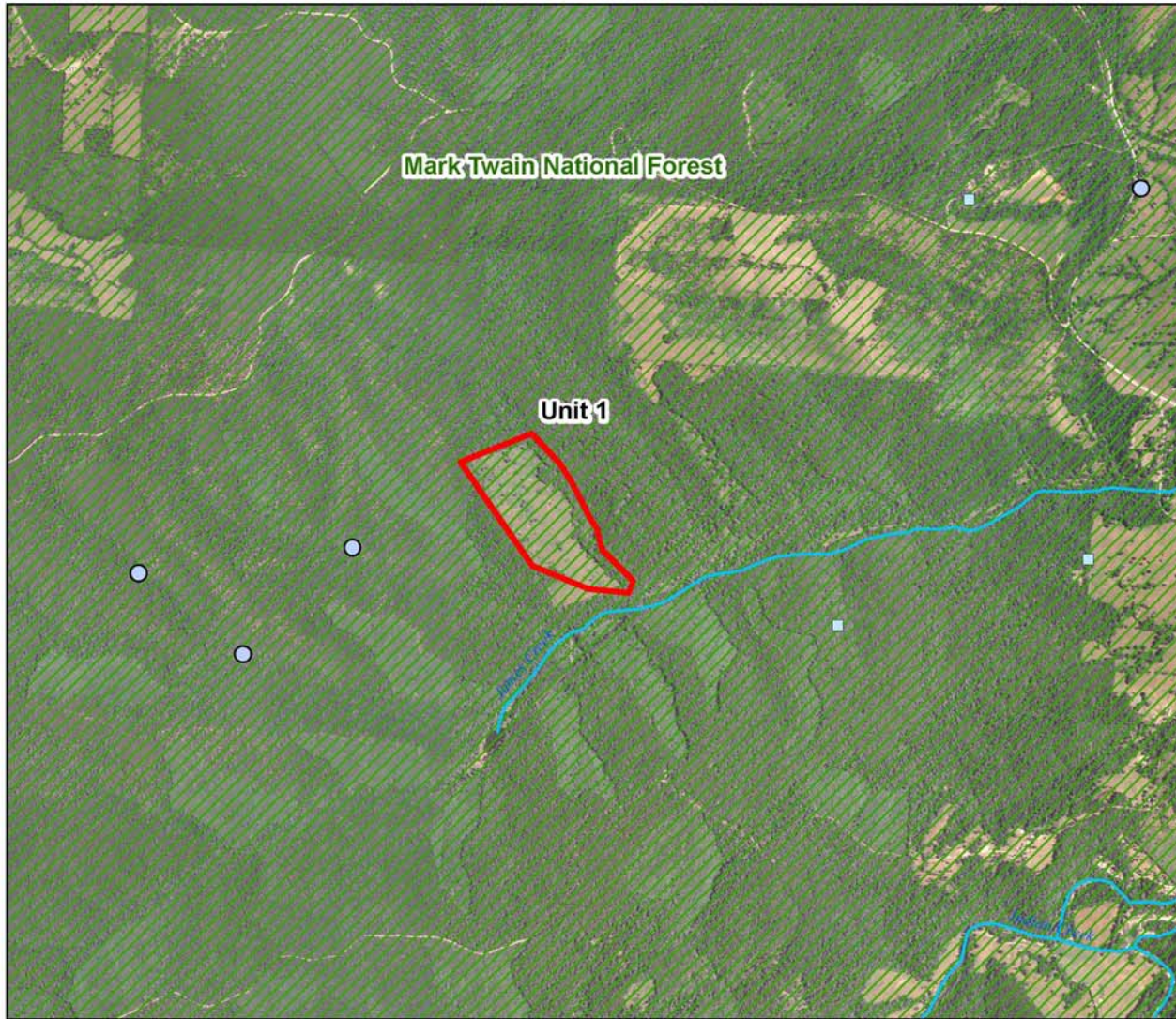
Unit 6: Residential Development, Illegal Trash Dumping, Off-road Vehicle use

**Alpena County, MI**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Michigan 6	Private				220	220





**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 1**  
1:29,000

**Habitat and Landownership**

- Unit 1
- Mark Twain National Forest
- Springs
- Wells

**Threats to Habitat**

Unit 1: Habitat Fragmentation, Forest Management Practices, Feral Hogs

Crawford County, MO



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 1	US Forest Service	90				90

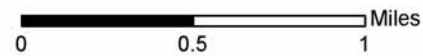
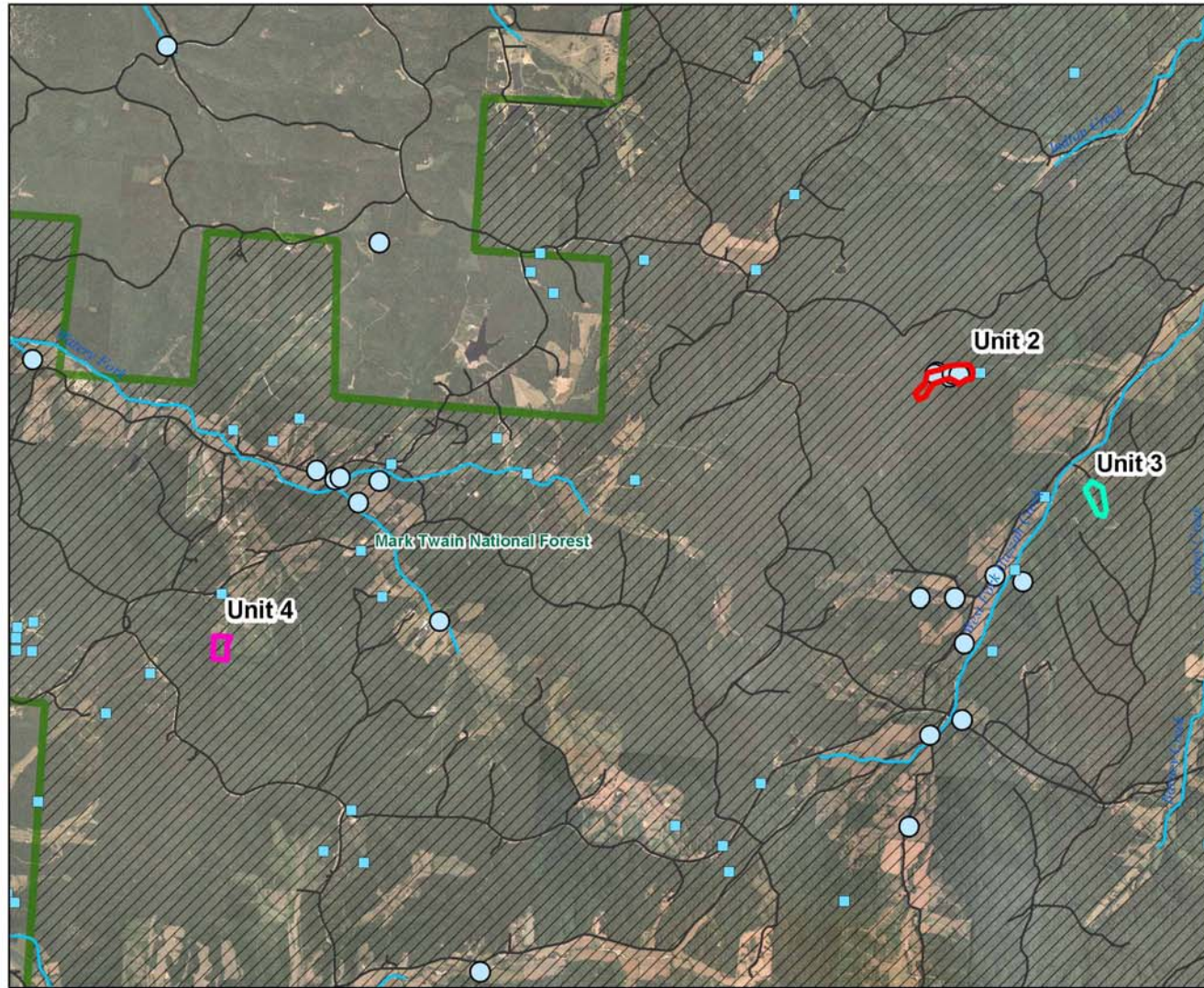


EXHIBIT 8 MISSOURI UNITS: 2, 3, 4



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 2, 3, and 4**

1:70,000

**Habitats and Landownership**

- Unit 2
- Unit 3
- Unit 4
- Mark Twain National Forest
- Springs
- Wells
- Roads

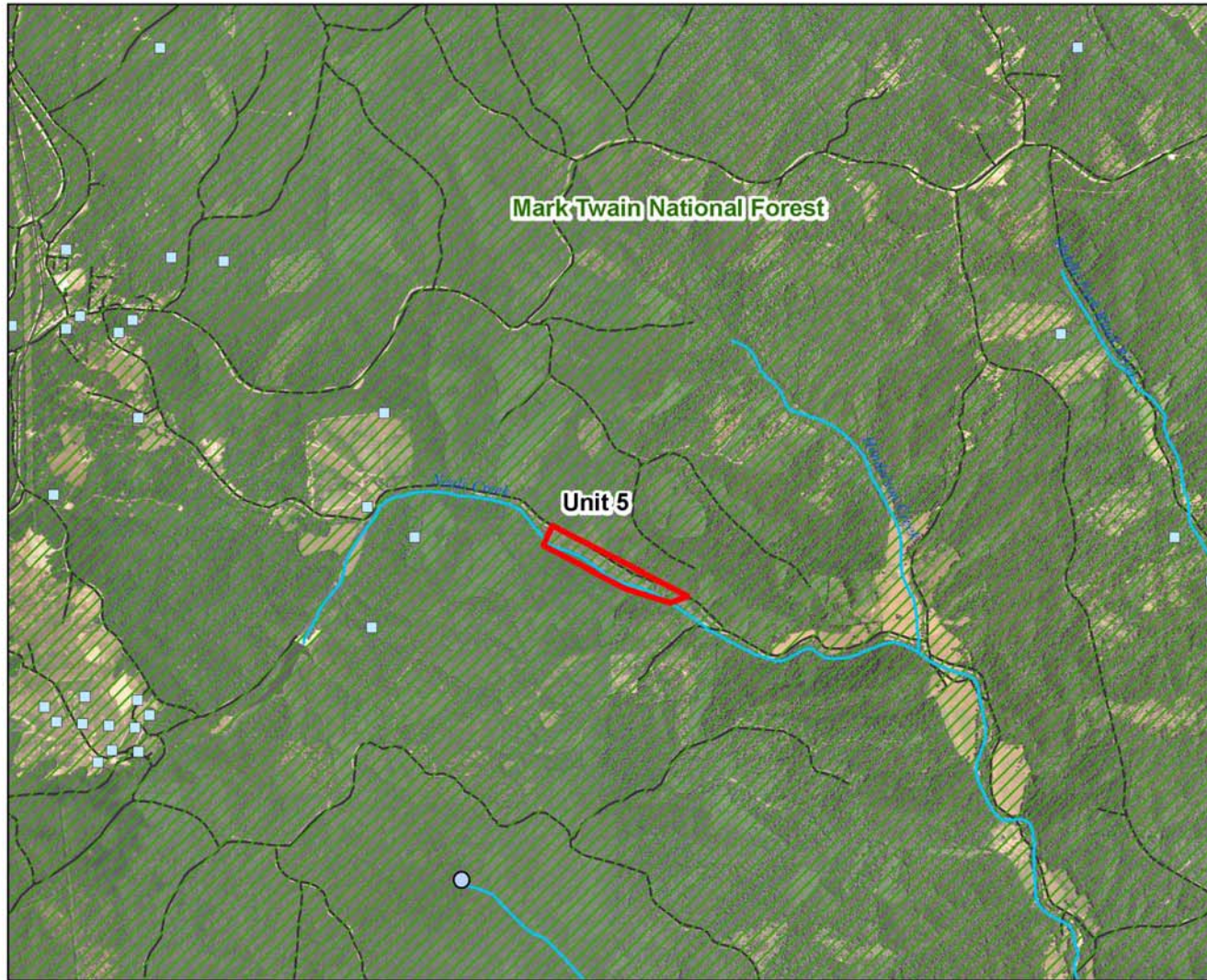
**Threats to Habitat**

- Unit 2: Habitat Fragmentation, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs
- Unit 3: Habitat Fragmentation, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs
- Unit 4: Habitat Fragmentation, Forest Management Practices, Feral Hogs

Dent County, MO



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 2	US Forest Service	34				34
Missouri 3	Private (inholdings)				18	18
Missouri 4	US Forest Service	14				14



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 5**

1:43,500

**Habitat and Landownership**

- Unit 5
- Mark Twain National Forest
- Springs
- Wells
- Roads

**Threats to Habitat**

Unit 5: Utility and Road Maintenance, Utility and Road Construction, Habitat Construction, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs, Beaver Dams

**Iron County, MO**



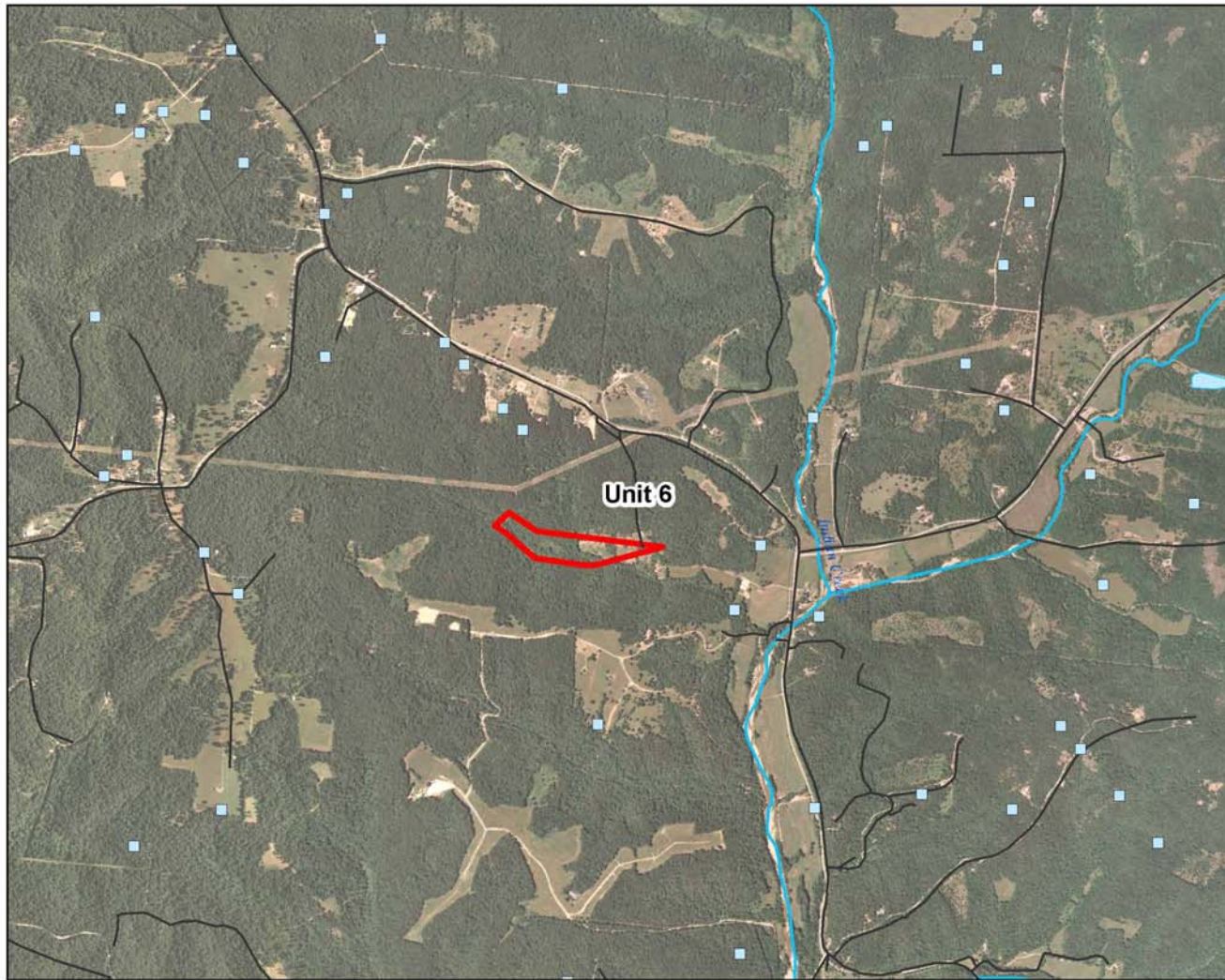
UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 5	US Forest Service	50				50



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**Proposed Critical Habitat for  
Hine's Emerald Dragonfly:  
Unit 6**  
1:27,700

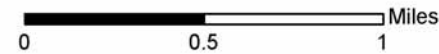
**Habitat and Hydrology**

- Unit 6
- Springs
- Wells
- Roads

**Threats to Habitat**

Unit 6: Habitat Fragmentation, Ecological Succession, Forest Management Practices, Feral Hogs, Beaver Dams

**Morgan County, MO**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 6	Private				22	22

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**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 7**

1:33,000

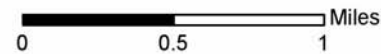
**Habitat and Landownership**

- Unit 7
- Mark Twain National Forest
- Springs
- Wells
- Roads

**Threats to Habitat**

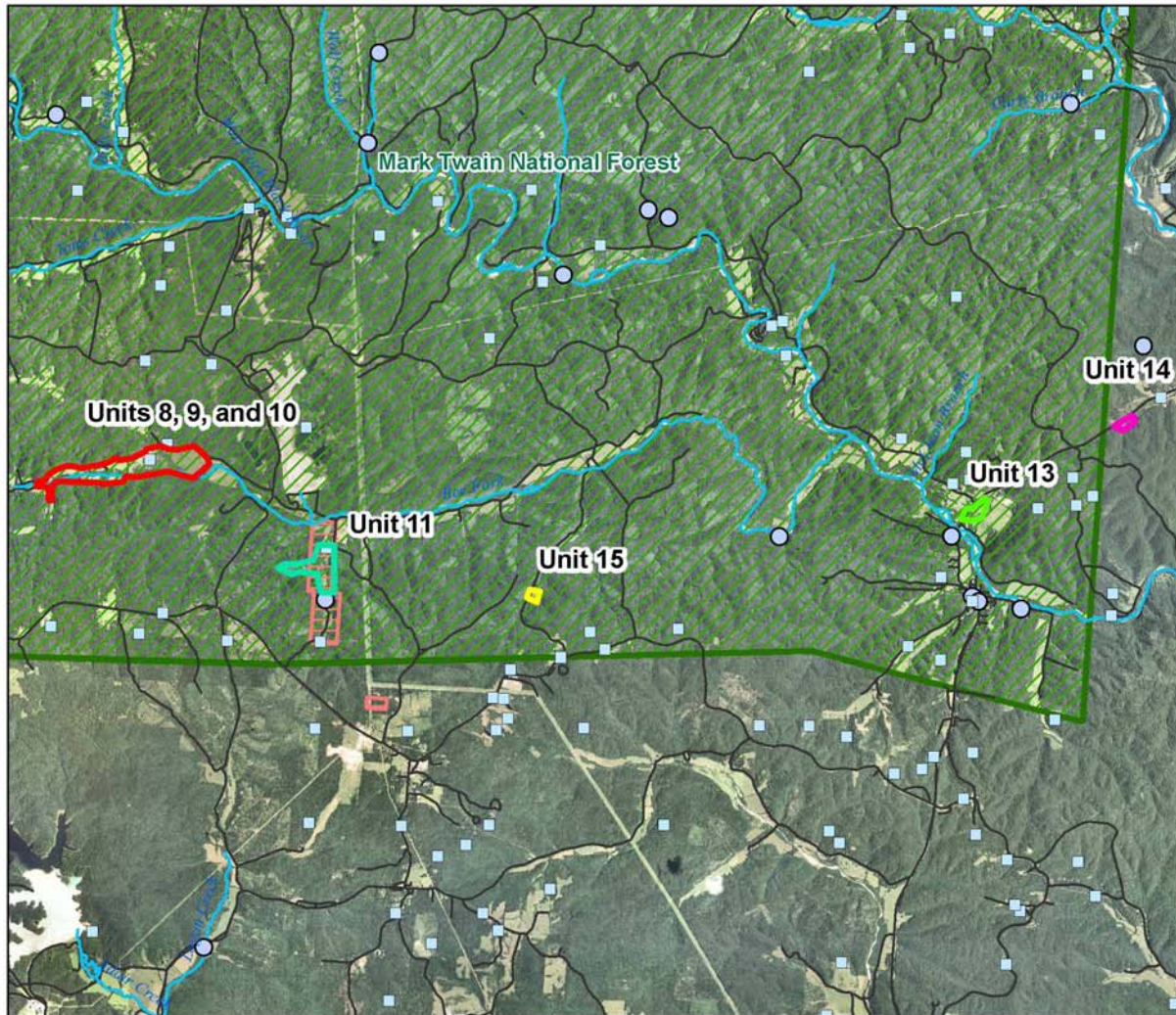
Unit 7: Habitat Fragmentation, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs

**Phelps County, MO**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 7	US Forest Service	33				33

EXHIBIT 12 MISSOURI UNITS: 8, 9, 10, 11, 13, 14, 15



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Units 8-11 and 13-15**  
1:111,500

**Habitats and Landownership**

- 8, 9, 10
- 11
- 13
- 14
- 15
- Mark Twain National Forest
- The Nature Conservancy
- Roads
- Wells
- Springs

**Threats to Habitat**

All Units: Habitat Fragmentation, Forest Management Practices, Feral Hogs

Units 8, 9, 10: Utility and Road Maintenance, Herbicide/Pesticide Use, Ecological Succession

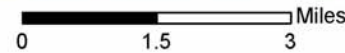
Unit 11: Beaver Dams

Unit 13: Utility and Road Maintenance, Utility and Road Construction

Unit 14: Utility and Road Maintenance, Utility and Road Construction, Beaver Dams

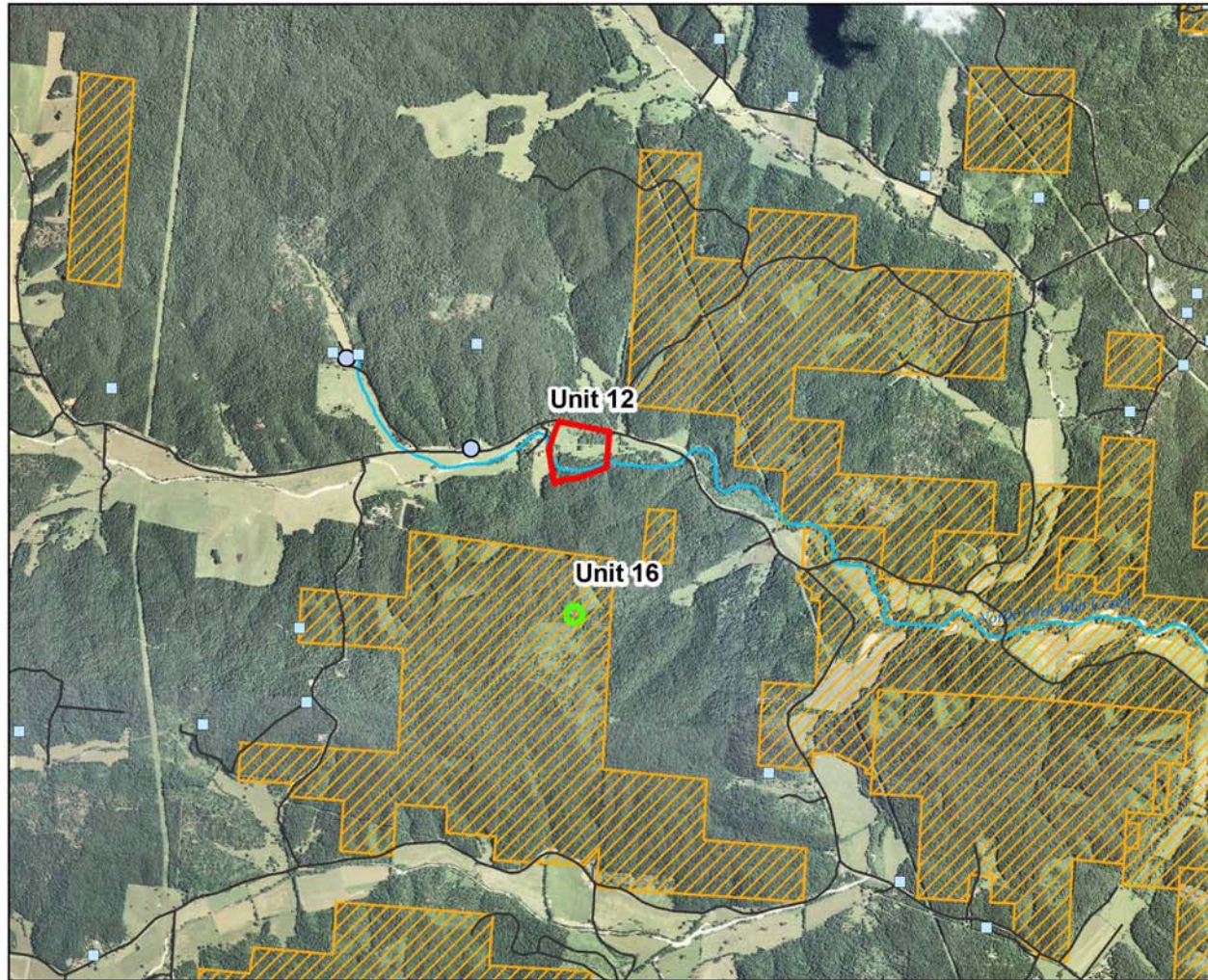
Unit 15: Habitat Fragmentation, Off-Road Vehicle Use, Ecological Succession, Beaver Dams

**Reynolds County, MO**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 8, 9, 10	US Forest Service	333				333
Missouri 11	US Forest Service; Nature Conservancy; Private	45			68	113
Missouri 13	Private (inholdings)				30	30
Missouri 14	Private				14	14
Missouri 15	Private (inholdings)				11	11
Missouri 16	Missouri Department of Conservation		4			4

EXHIBIT 13 MISSOURI UNITS: 12, 16



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Units 12 and 16**

1:47,000

**Habitats and Landownership**

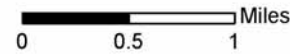
- Unit 12
- Unit 16
- Department of Conservation
- Springs
- Wells
- Roads

**Threats to Habitats**

Unit 12: Habitat Fragmentation, Change in Ownership, Ecological Succession, Forest Management Practices, Feral Hogs

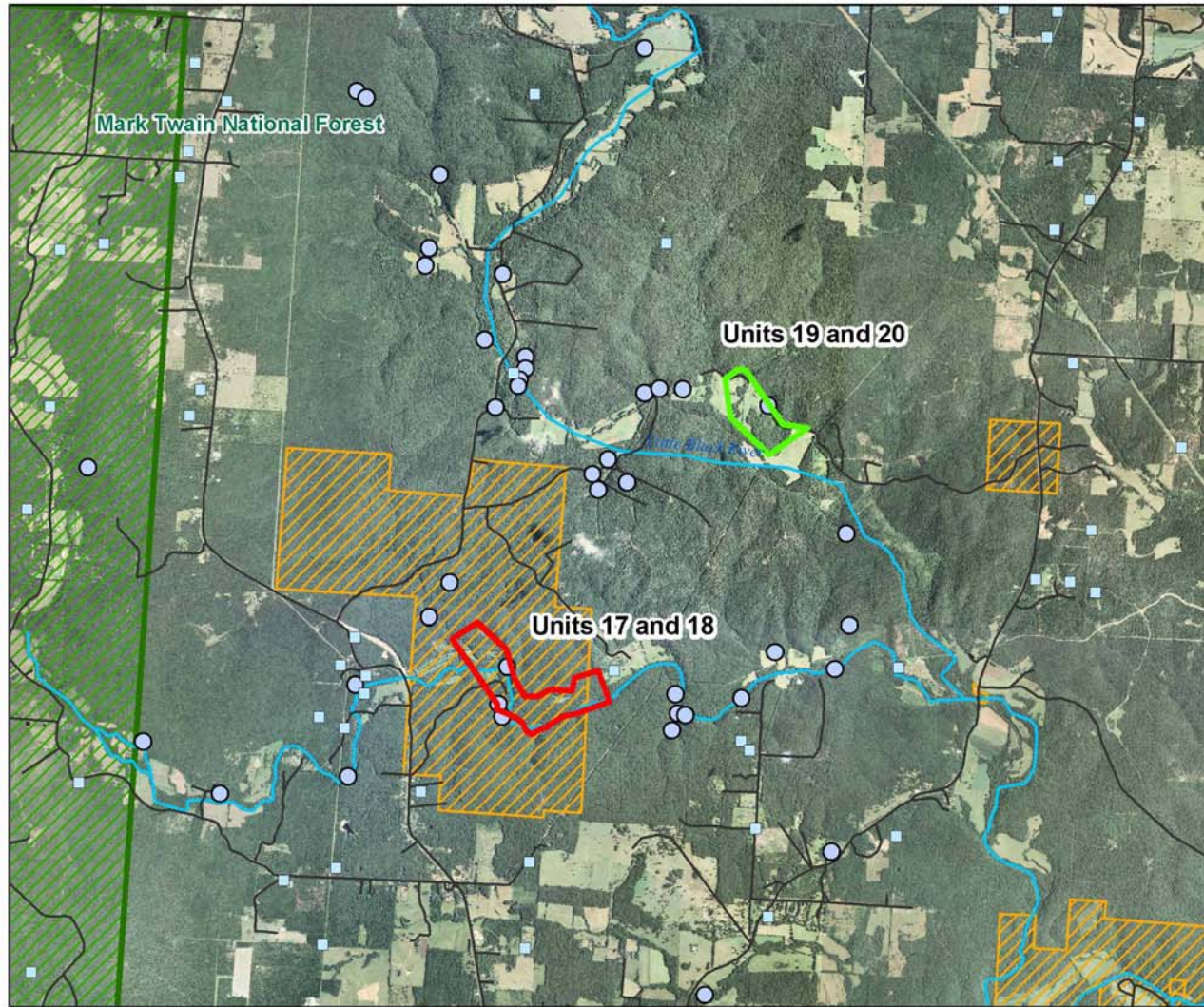
Unit 16: Habitat Fragmentation, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs

**Reynolds County, MO**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 12	Private				50	50
Missouri 16	Missouri Department of Conservation		4			4

EXHIBIT 14 MISSOURI UNITS: 17, 18, 19, 20



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Units 17, 18, 19, and 20**

1:68,000

**Habitats and Land Ownership**

- Units 17 and 18
- Units 19 and 20
- Mark Twain National Forest
- Department of Conservation
- Springs
- Wells
- Roads

**Threats to Habitats**

Units 17, 18: Habitat Fragmentation, Management and Land Use, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs

Units 19, 20: Utility and Road Maintenance and Construction, Habitat Fragmentation, Off-Road Vehicle Use, Ecological Succession, Forest Management Practices, Feral Hogs

Ripley County, MO



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 17, 18	Missouri Department of Conservation		224			224
Missouri 19, 20	Private				115	115



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**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 21**

1:21,000

**Habitat and Landownership**

- Unit 21
- Mark Twain National Forest
- Roads
- Springs
- Wells

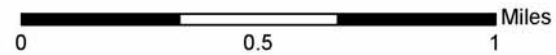
**Threats to Habitat**

Unit 21: Habitat Fragmentation, Equestrian Use, Forest Management Practices, Feral Hogs

Ripley County, MO

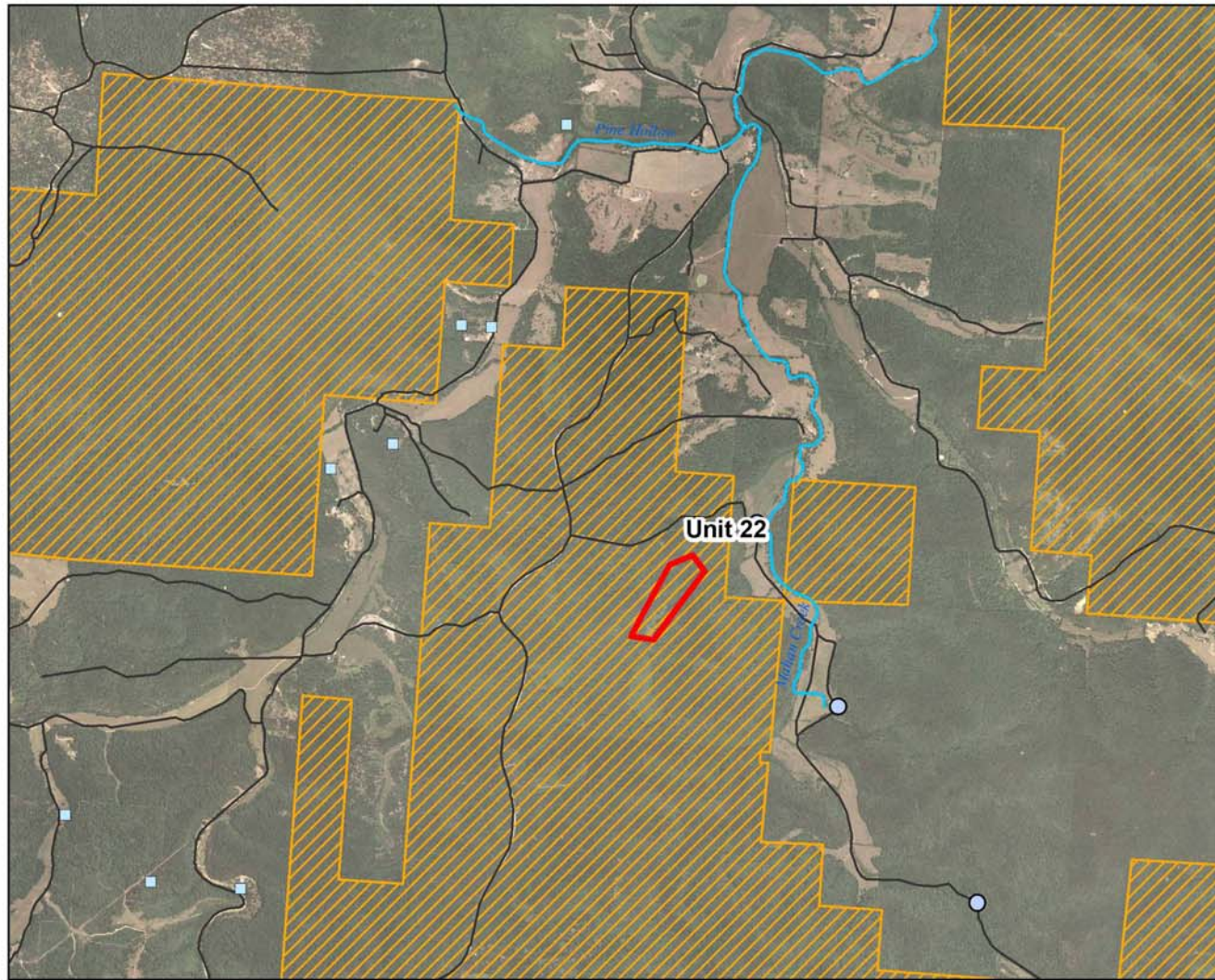


UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 21	US Forest Service	6				6



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**Proposed Critical Habitat for  
Hine's Emerald Dragonfly:  
Unit 22**  
1:38,500

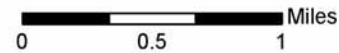
**Habitats and Landownership**

- Unit 22
- Department of Conservation
- Springs
- Wells
- Roads

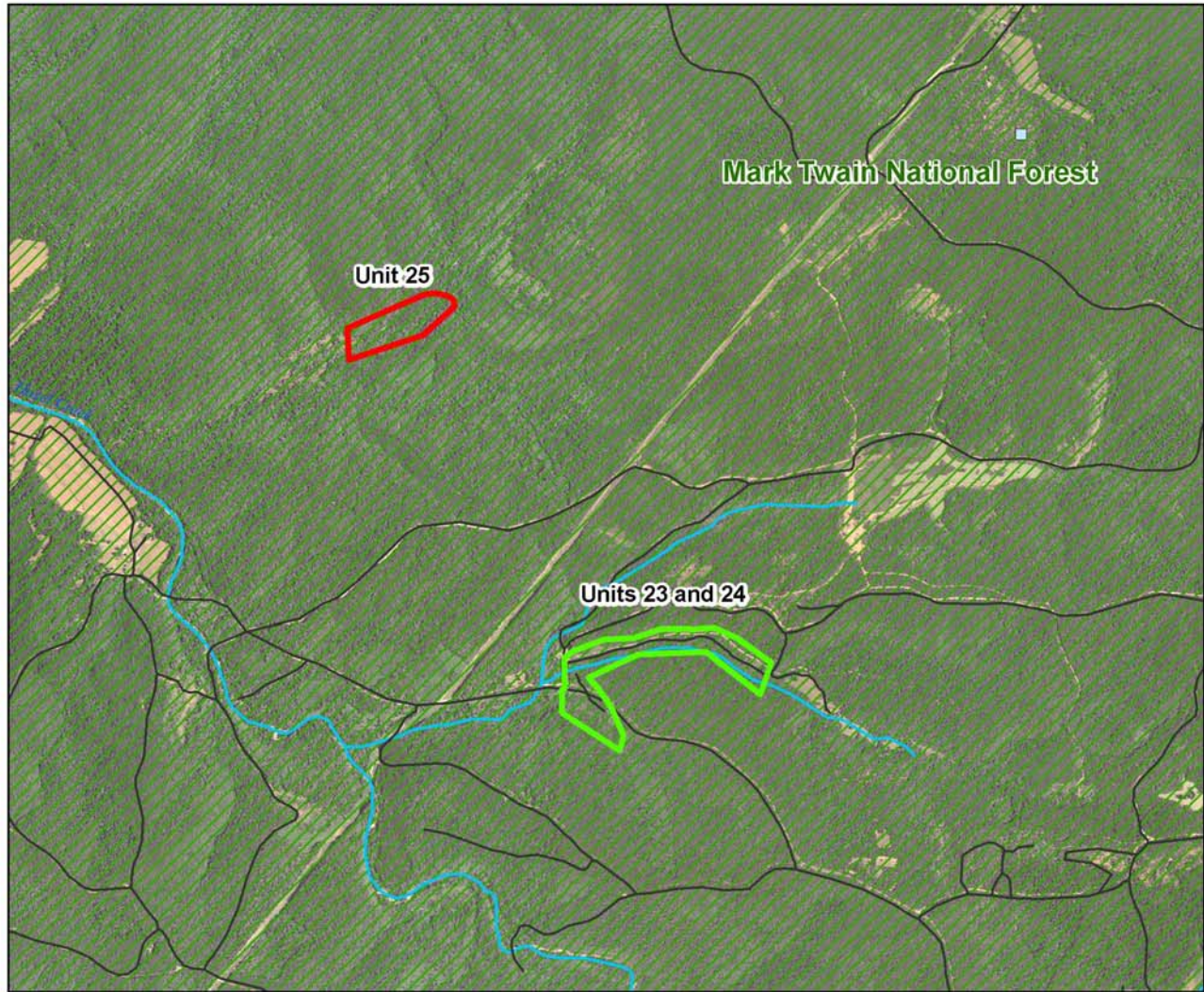
**Threats to Habitat**

Unit 22: Habitat Fragmentation, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs

Shannon County, MO



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 22	Missouri Department of Conservation		32			32



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Units 23, 24, and 25**

1:33,000

**Habitats and Landownership**

- Units 23 and 24
- Unit 25
- Mark Twain National Forest
- Springs
- Wells
- Roads

**Threats to Habitats**

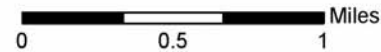
Units 23, 24: Utility and Road Maintenance and Construction, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs

Unit 25: Habitat Fragmentation, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs

**Washington County, MO**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 23, 24	US Forest Service	75				75
Missouri 25	US Forest Service	33				33







**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 26**

1:16,000

**Habitat and Landownership**

- unit 26
- Mark Twain National Forest
- Springs
- Wells
- Roads

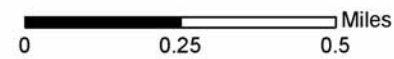
**Threats to Habitat**

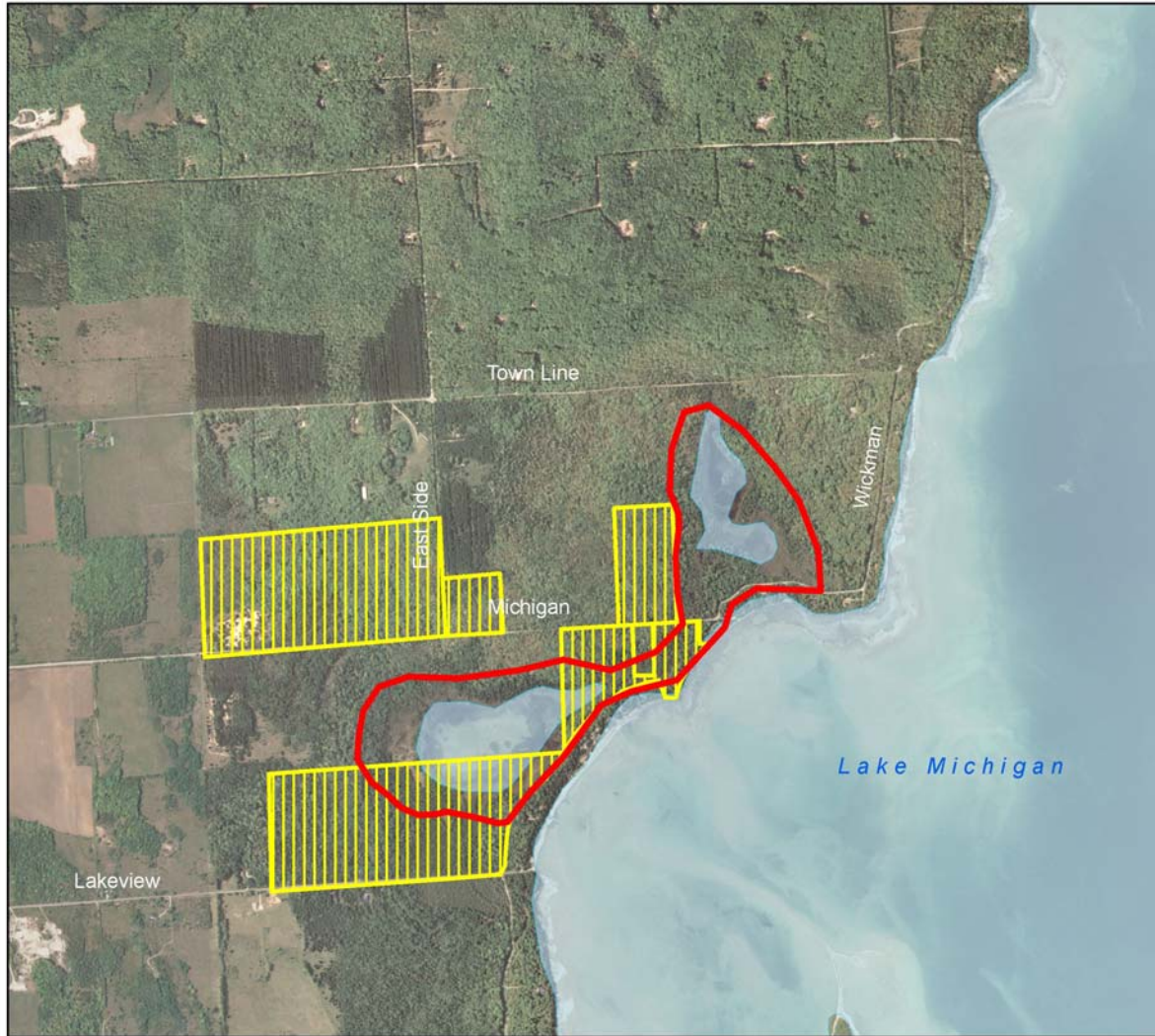
Unit 26: Habitat Fragmentation, Off-Road Vehicle Use, Forest Management Practices, Feral Hogs,

**Wayne County, MO**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Missouri 26	US Forest Service	5				5





**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 1**

1:20,000

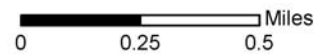
**Habitat and Landownership**

- Unit 1
- WI State Natural Area
- wells
- spring

**Threats to Habitat**

Unit 1: Ground Water Depletion and/or Alteration, Low Great Lakes Water Levels, Herbicide/Pesticide Use, Septic System Installation, Habitat Fragmentation, Logging, Vehicle Impacts, Encroachment of Invasive Species

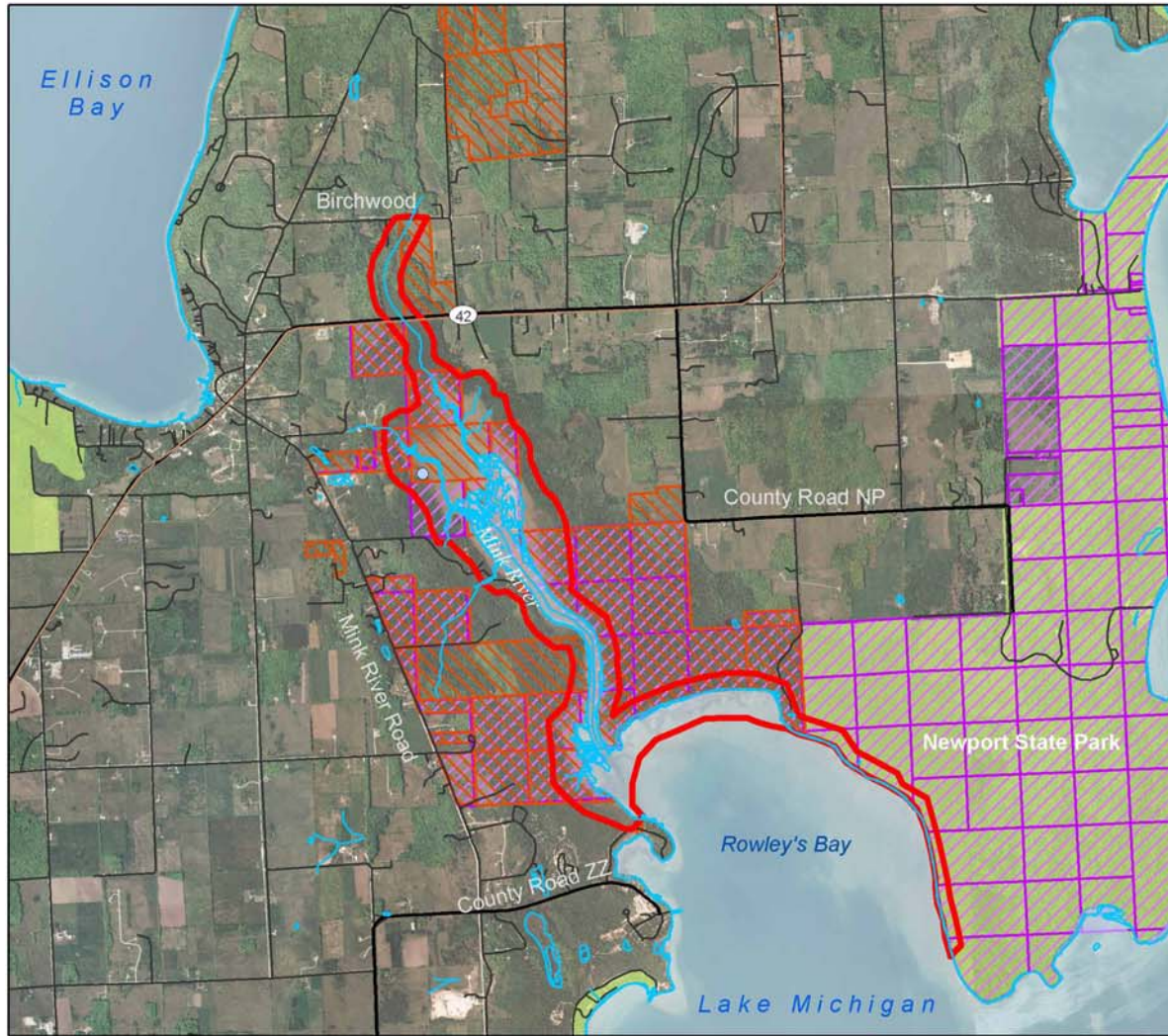
Door County, WI



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Wisconsin 1	Wisconsin Department of Natural Resources			41	116	157

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**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 2**

1:46,000

**Habitat and Landownership**

-  Unit 2
-  WI Department of Natural Resource
-  The Nature Conservancy
-  wells
-  spring

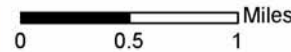
**Threats to Habitat**

Unit 2: Ground and Surface Water Depletion and/or Alteration, Low Great Lakes Levels, Herbicide/Pesticide Use, Septic System Installation, Habitat Fragmentation, Logging, Vehicle Impacts, Encroachment of Invasive Species

**Door County, WI**

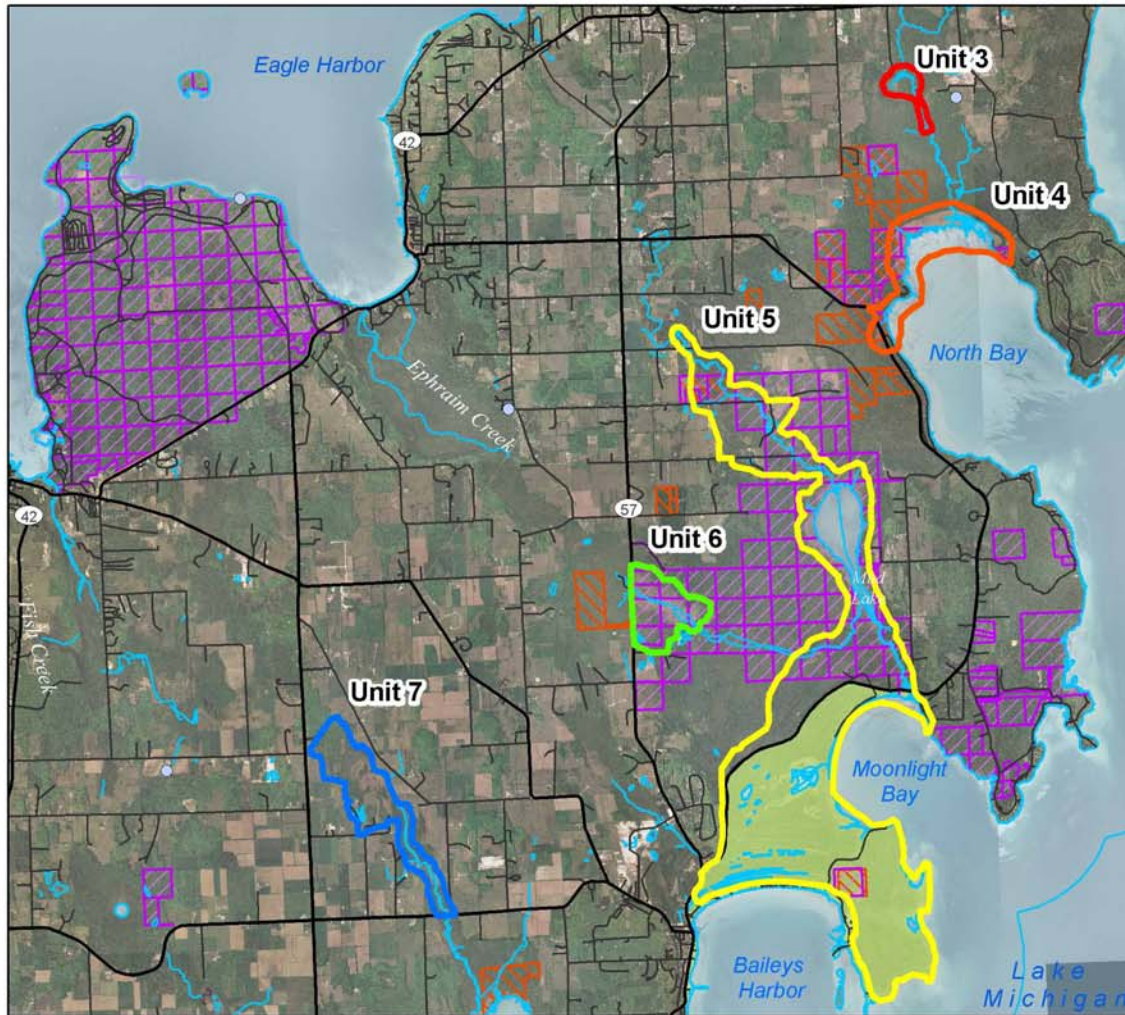


UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Wisconsin 2	Nature Conservancy; Wisconsin Department of Natural Resources; Private		32	51	731	814



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EXHIBIT 21 WISCONSIN UNITS: 3, 4, 5, 6, 7



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Units 3 - 7**  
1:90,000

**Habitats and Landownership**

- Unit 3
- Unit 4
- Unit 5
- Unit 6
- Unit 7
- Bailey's Harbor Park and Ridges Sanctuary
- WI Department of Natural Resources
- The Nature Conservancy
- wells
- spring

**Threats to Habitats**

Units 3-7: Utility and Road Maintenance, Ground and Surface Water Depletion and/or Alteration, Low Great Lakes Water Levels, Herbicide/ Pesticide Use, Residential Development, Septic System Installation, Utility and Road Construction, Habitat Fragmentation, Logging, Quarrying, Vehicle Impacts, Ecological Succession, Encroachment of Invasive Species, Beaver Dams

Door County, WI



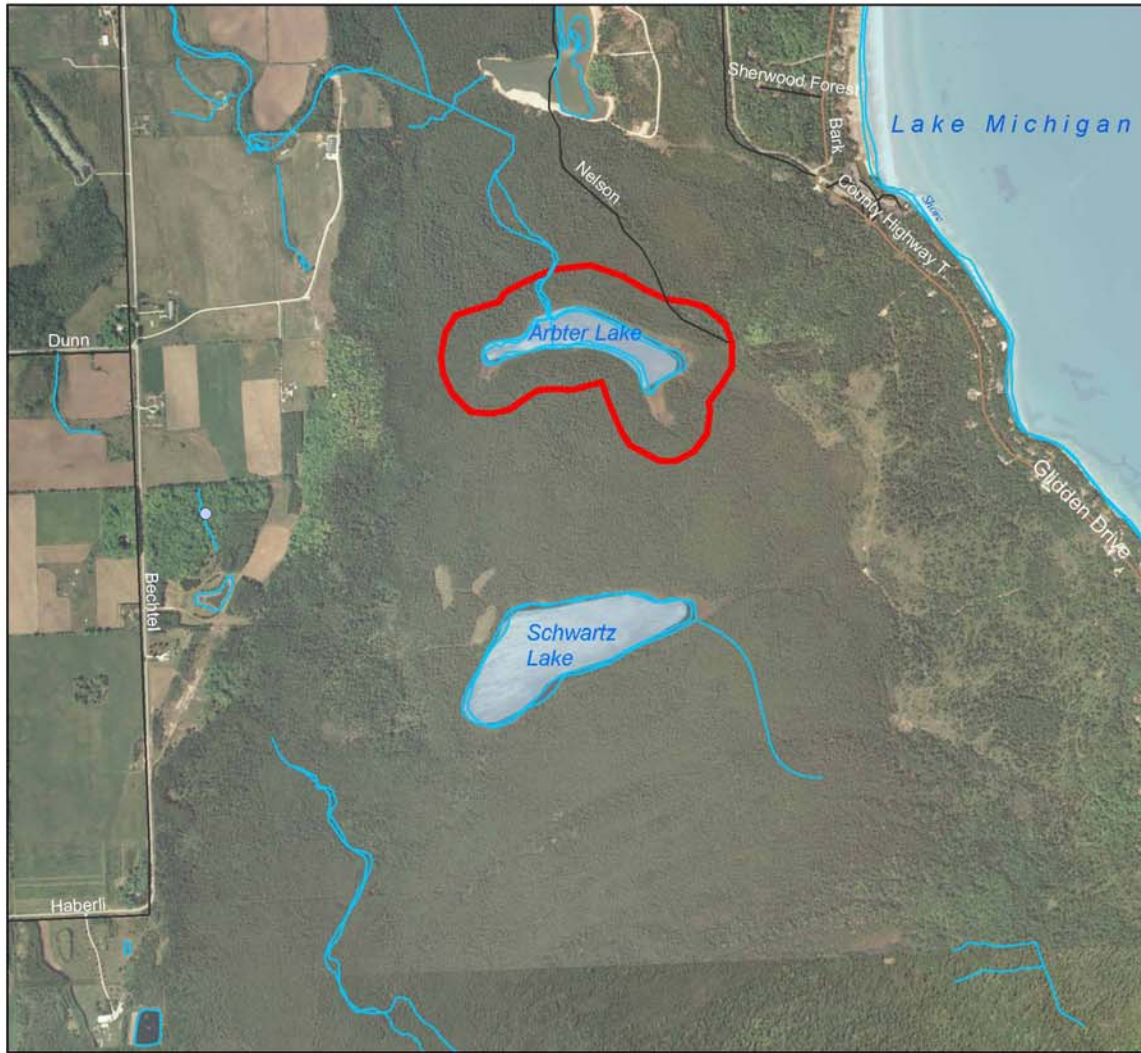
UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Wisconsin 3	Private				66	66
Wisconsin 4	Nature Conservancy; Wisconsin Department of Natural Resources; Private				407**	407
Wisconsin 5	Nature Conservancy; Wisconsin Department of Natural Resources; Private		816	1,527	750**	3,093
Wisconsin 6	Wisconsin Department of Natural Resources; Private		200		30	230
Wisconsin 7	Private				352	352

\*\* Portions of this land are held by The Nature Conservancy



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EXHIBIT 22 WISCONSIN UNIT: 8



**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 8**

1:17,500

**Habitat and Hydrology**

- Unit 8
- wells
- spring

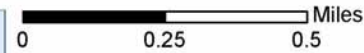
**Threats to Habitat**

Unit 8: Ground and Surface Water Depletion and/or Alteration, Herbicide/Pesticide Use, Logging, Quarrying, Encroachment of Invasive Species

Door County, WI

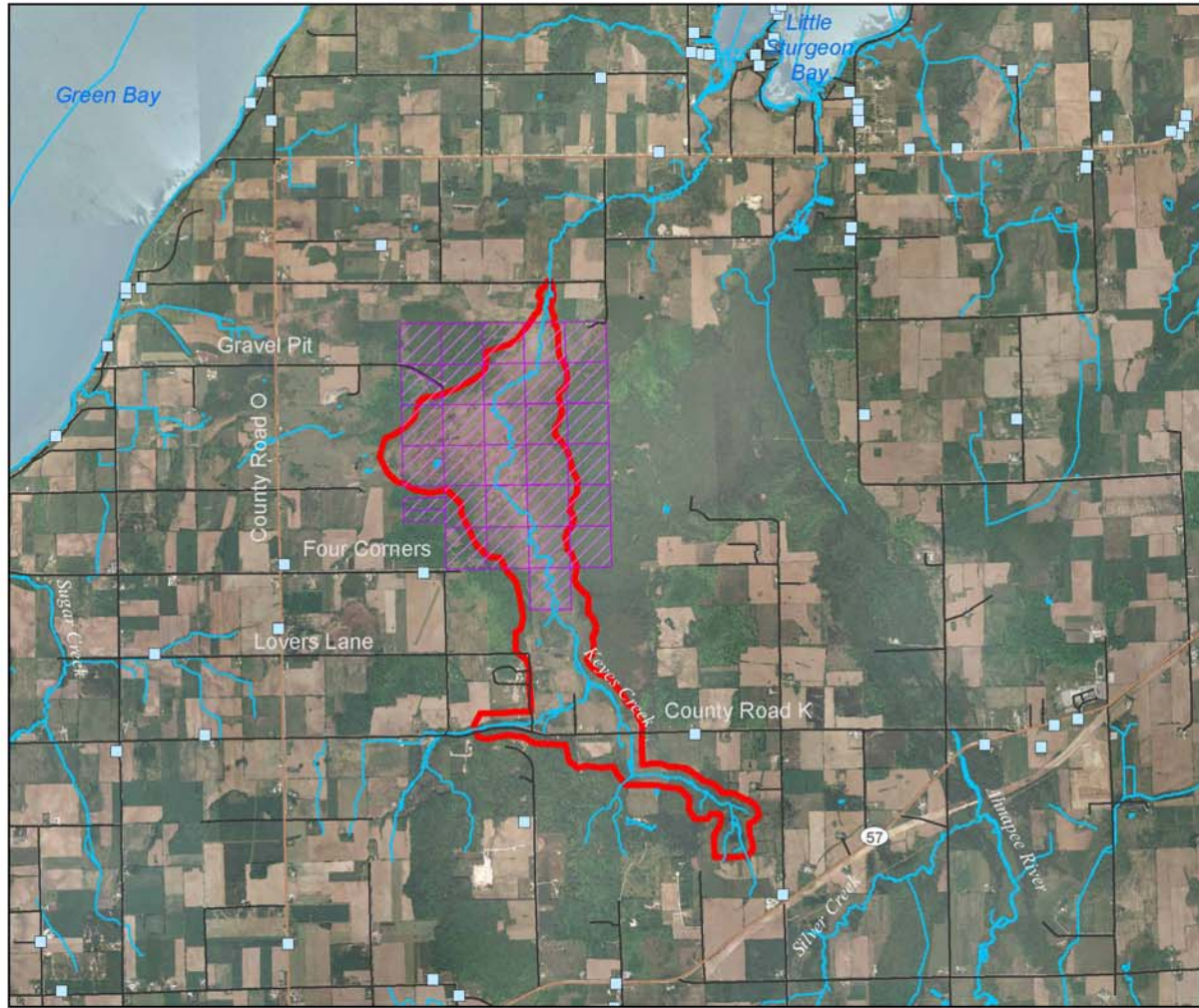


UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Wisconsin 8	Nature Conservancy; Private				70	70



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**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 9**

1:60,000

**Habitat and Landownership**

- Unit 9
- Department of Natural Resources
- wells

**Threats to Habitat**

Unit 9: Utility and Road Maintenance, Ground and Surface Water Depletion and/or Alteration, Herbicide/Pesticide Use, Residential Development, Septic System Installation, Utility and Road Construction, Habitat Fragmentation, Vehicle Impacts

**Door County, WI**

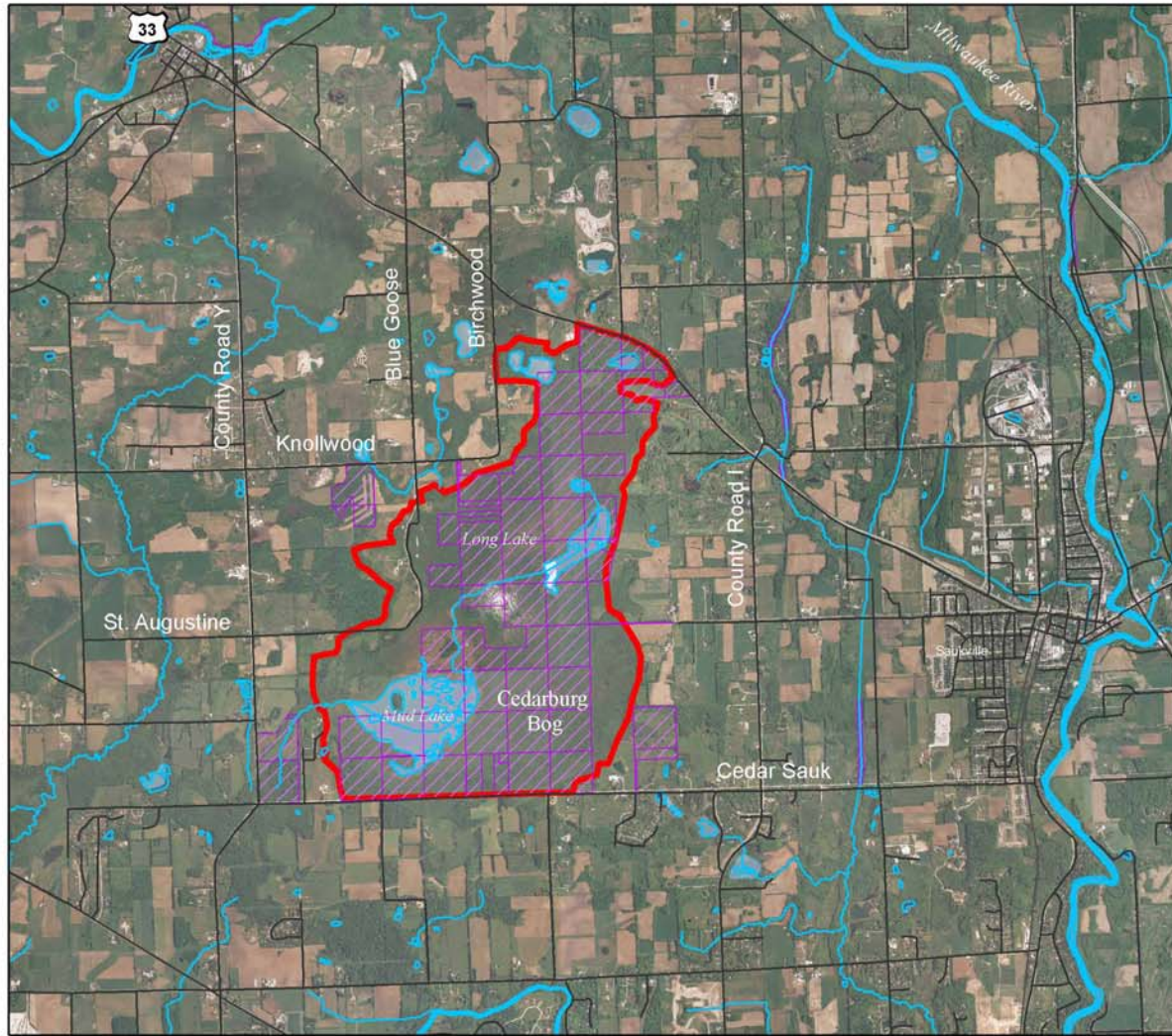


UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Wisconsin 9	Wisconsin Department of Natural Resources State Wildlife Area		684		509	1,193



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**Proposed Critical Habitat for  
Hine's Emerald Dragonfly:  
Unit 10**

1:59,000

**Habitat and Landownership**

- Unit 10
- WI Department of Natural Resources
- wells

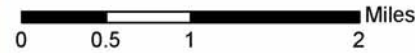
**Threats to Habitat**

Unit 10: Utility and Road Maintenance, Ground and Surface Water Depletion and/or Alteration, Herbicide/Pesticide Use, Residential Development, Septic System Installation, Utility and Road Construction, Habitat Fragmentation, Logging, Vehicle Impacts, Encroachment of Invasive Species

**Ozaukee County, WI**



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Wisconsin 10	Wisconsin Department of Natural Resources; Private		1,512		800	2,312



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**Proposed Critical Habitat for Hine's Emerald Dragonfly: Unit 11**

1:24,500

**Habitat and Hydrology**

- wells
- spring
- Unit 11

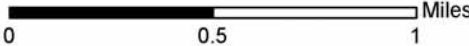
**Threats to Habitat**

Unit 11: Residential and Commercial Developer alteration of wetland hydrology, contamination of surface and groundwater, logging, and invasive species

Door County, WI



UNIT	LANDOWNER(S)/ LAND MANAGER(S)	LANDOWNERS (ACRES)				
		FEDERAL	STATE	LOCAL	PRIVATE	TOTAL
Wisconsin 11	Private				147	147





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- Written communication from Brian Smith, Senior Project Manager, CTE, January 25, 2007.
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### GIS data Sources

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Cline, Denise. GIS Coordinator. Northeast Michigan Council of Governments. Provided GIS data for Presque Isle and Alpena County

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Environmental Systems Research Institute

Haight, Tom. Door County, WI GIS/LIO Coordinator. Provided GIS data of Door County

Illinois Geologic Survey

Michigan Geographic Data Library, last accessed 9/22/06

Michigan State Government

Missouri Department of Conservation

Missouri Department of Natural Resources

Missouri Nature Conservancy

Paul Riess. GIS Operator. Land Information Access Agency. Provided data for Mackinac County, MI

TerraServer Satellite Imagery

U.S. Census Bureau

United States Department of Agriculture 2005 aerial imagery

U.S. Fish and Wildlife Service

University of Missouri

Will County Forest District, IL

Wisconsin Department of Natural Resources

The Nature Conservancy (Wisconsin Chapter)