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ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE ROSWELL SPRINGSNAIL, KOSTER'S SPRINGSNAIL, PECOS ASSIMINEA, AND NOEL'S AMPHIPOD

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EXECUTIVE SUMMARY

1. This report identifies and analyzes the potential for economic costs associated with the proposed critical habitat designation for four species of invertebrates: the Roswell springsnail (*Pyrgulopsis roswellensis*), Koster's springsnail (*Juturnia kosteri*), Pecos assiminea (*Assiminea pecos*), and Noel's amphipod (*Gammarus desperatus*) (four invertebrates). This report was prepared by Industrial Economics, Incorporated (IEc), under contract to the U.S. Fish and Wildlife Service (Service).

2. On February 12, 2002 (67 FR 6459), the Service published a proposed rule to list the four invertebrates as endangered under the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.) and to designate critical habitat for these species. The proposed rule included two complexes on Bitter Lake National Wildlife Refuge (BLNWR) in Chaves County, New Mexico, totaling 1,127 acres; one complex at Diamond Y Springs in Pecos County, Texas (380 acres); and one complex at East Sandia Spring in Reeves County, Texas (16.5 acres). On August 9, 2005, the Service published its final rule listing the four invertebrates as endangered with critical habitat (70 FR 46304). In that final rule, critical habitat was designated at the Diamond Y Spring and East Sandia Spring complexes, but was not designated on the BLNWR on the grounds that these areas did not meet the definition of "critical habitat" under section 3(5)(A) of the Act (70 FR 46323).[1]

3. On December 19, 2007, Forest Guardians (now WildEarth Guardians) filed a complaint challenging the merits of the critical habitat designation for the four invertebrates, including the exclusion of the BLNWR from the final critical habitat designation. Pursuant to a settlement agreement, the court has partially vacated the August 9, 2005 critical habitat decision (70 FR 46304) with respect to the areas excluded under section 3(5)(A) of the Act. The current action includes proposed critical habitat areas in BLNWR. In addition to the BLNWR units, the current proposal re-proposes the Diamond Y Springs and East Sandia Spring units in Texas.

4. Because of refinements in the GIS technology used to delineate habitat, the boundaries of the units are different from those proposed in 2002. Specifically, the total acreage proposed in the BLNWR units is 68 acres; this contrasts with the 2002 proposal, which included 1,127 acres. Nearly all the proposed habitat is contained within the boundaries of the original proposal. However, as part of the Impoundment Complex, the Service is

[1] U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Roswell springsnail (*Pyrgulopsis roswellensis*), Koster's springsnail (*Juturnia kosteri*), Noel's amphipod (*Gammarus desperatus*), and Pecos assiminea (*Assiminea pecos*)", 50 CFR Part 17, Vol. 74, No. 47, March 12, 2009.

proposing 2.8 acres that are owned by the City of Roswell (New Mexico) which were not included in the previous proposal. This land directly abuts or is adjacent to the BLNWR. The boundaries of the East Sandia Spring unit would also change slightly from the 2005 designation. The unit would be reduced from 16.5 acres to three acres. In total, the Service is proposing 70.6 acres of critical habitat for the Roswell springsnail, Koster's springsnail, and Noel's amphipod. The proposed habitat for the Pecos assiminea includes this acreage plus the Texas units, for a total of 515 acres. Exhibits ES-1 through ES-3 summarizes the proposed units in map form. Note that all the proposed units are currently occupied by one or more of the four invertebrate species.

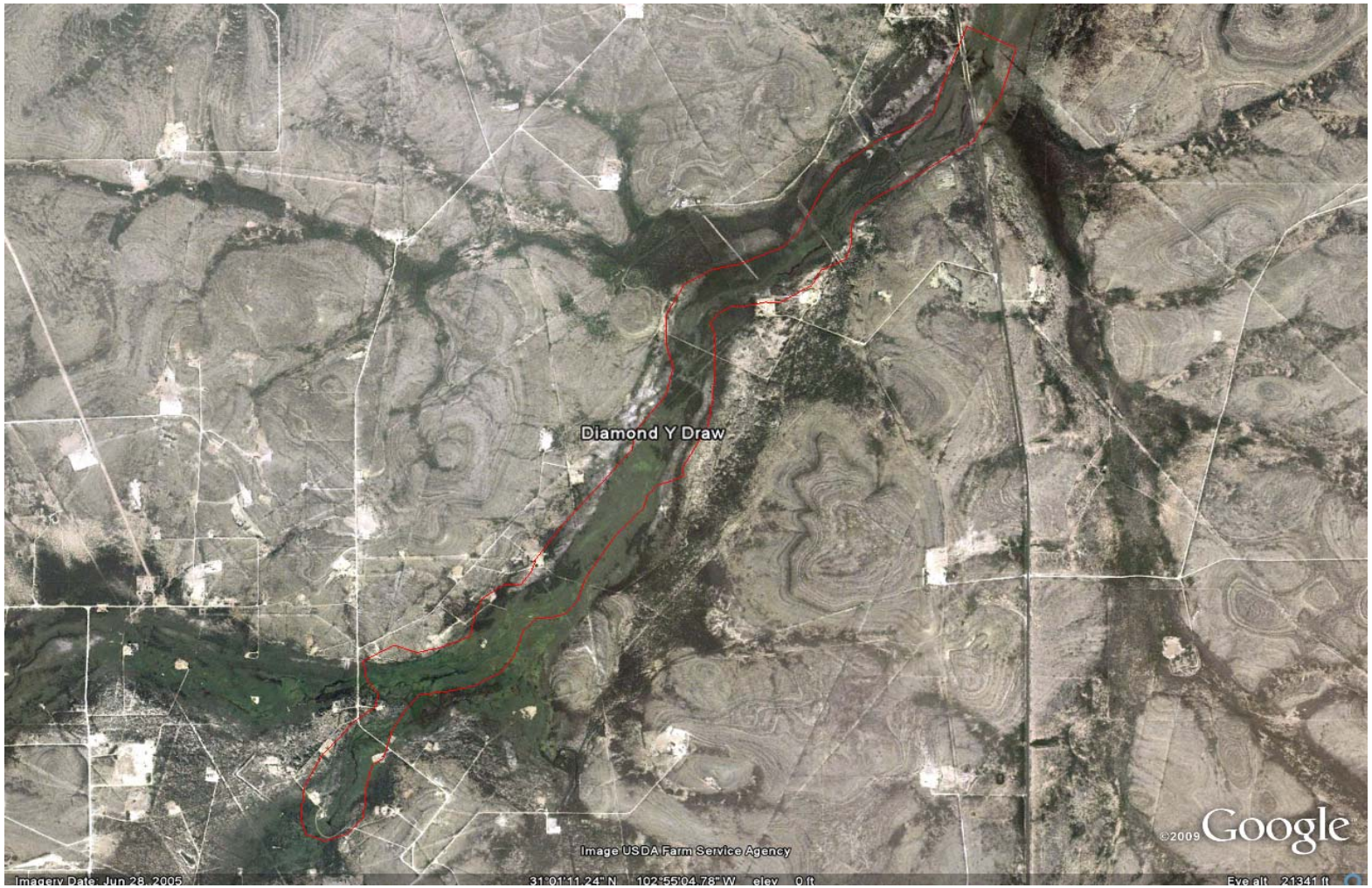
5. This analysis employs a "without critical habitat" and "with critical habitat" framework. The "without critical habitat" scenario represents the baseline for the analysis, considering protections already accorded the four invertebrates; for example, protections provided under the Federal listing and other Federal, State, and local regulations. The "with critical habitat" scenario describes the incremental costs that would not occur but for this designation of critical habitat for the species. In addition, this analysis discusses the potential benefits that could result from four invertebrates conservation efforts.

6. The Service produced a detailed economic analysis in conjunction with the original 2005 critical habitat proposal.[2] The analysis addressed the Texas units ultimately designated, as well as the New Mexico units originally under consideration (and now part of the current proposal). This analysis was made available for, and received, public comment. Therefore, it serves as the foundation for this report. Specifically, this report discusses impacts quantified in the earlier report, and includes updated information where available and appropriate. The original 2005 economic analysis is included as Appendix B to this report.

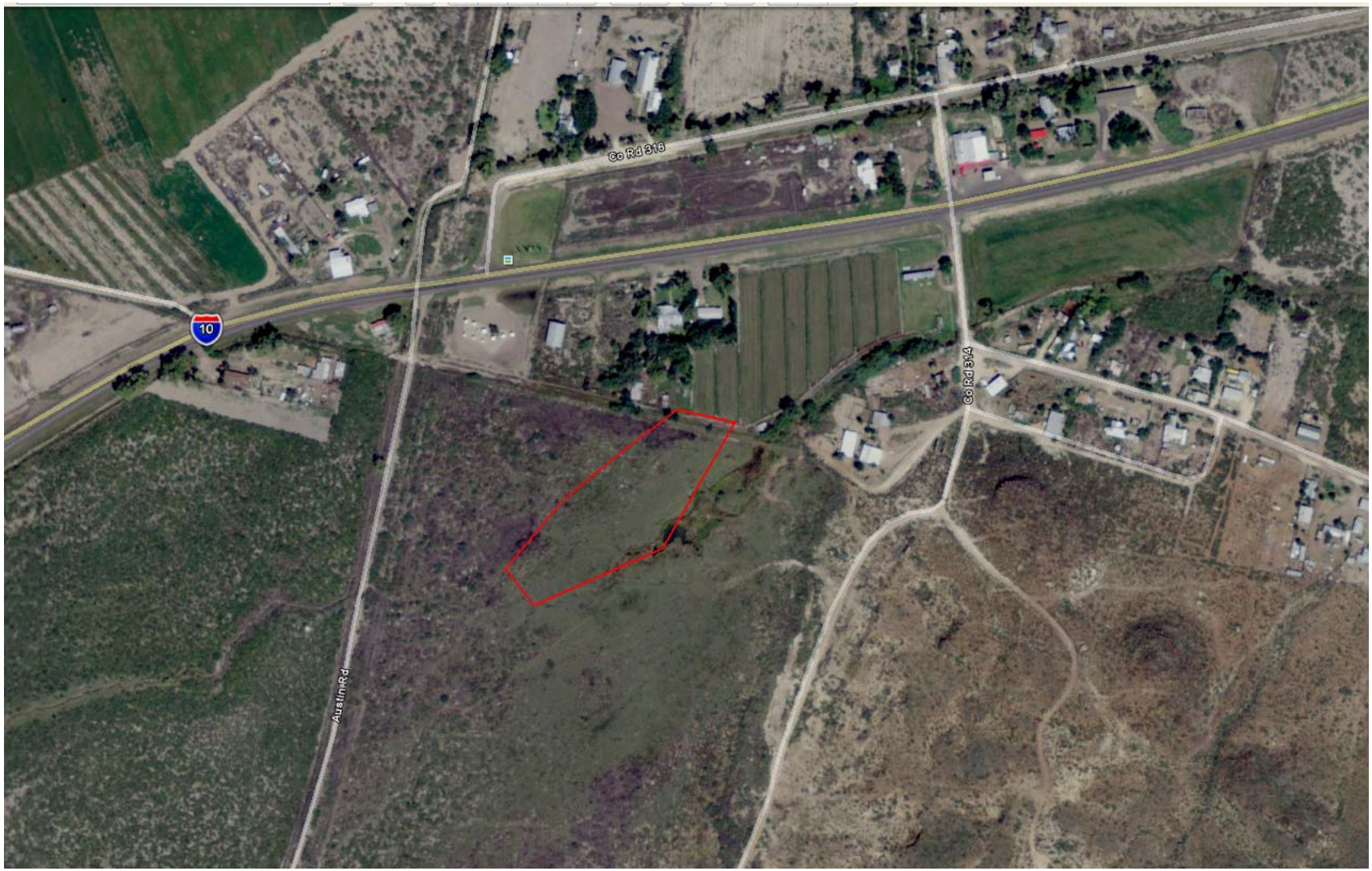
[2] Industrial Economics, Incorporated. 2005. Economic Analysis of Critical Habitat Designation for the Roswell Springsnail, Koster's Springsnail, Pecos Assiminea, and Noel's Amphipod. July 2005.

ES-1. BLNWR UNITS (INCLUDING CITY OF ROSWELL LANDS)

ES-2. DIAMOND Y SPRINGS UNIT



ES-3. EAST SANDIA SPRING UNIT



POTENTIAL INCREMENTAL COSTS

7. This analysis focuses on quantification of the incremental costs of this rulemaking. Incremental costs are those costs expected to be incurred as a result of critical habitat designation for the four invertebrates. Annual incremental costs associated with the designation of critical habitat for the invertebrates are estimated to be very modest: approximately $6,000 (see Exhibit ES-3). All of these costs derive from the added effort associated with considering adverse modification in the context of section 7 consultation.

8. A number of factors limit the extent to which the proposed critical habitat designation results in incremental costs:

   - Conservation measures implemented by New Mexico oil and gas firms are pursued in compliance with BLM's Bitter Lake Habitat Protection Zone requirements. Likewise, modifications pursued by oil and gas developers on private land near the TNC units are already implemented for the benefit of various listed species in the immediate area. None of these costs would be avoided if critical habitat designation for the four invertebrates did not occur on these units.
   - All of the proposed critical habitat is occupied. Therefore, ongoing project modifications and conservation measures are already required to satisfy the jeopardy standard.
   - Most of the proposed critical habitat is already held in conservation status. The small portion of proposed habitat owned by the City of Roswell has already been designated as critical habitat for the Pecos sunflower and is unsuitable for development.
   - Habitat management costs are attributable to existing conservation agreements and are therefore classified as baseline costs (i.e., these costs will be incurred even if critical habitat designation does not occur).
   - Most section 7 consultation would be pursued in the absence of critical habitat. To the extent that incremental costs are incurred in the context of a section 7 consultation regarding the species, they will be borne by public agencies rather than private entities.

9. Consistent with these conditions, the Service states that critical habitat designation for the four invertebrates is unlikely to produce project modifications different from those already required under the jeopardy standard.[3]

[3] U.S. Fish and Wildlife Service, "Incremental effects memorandum for the economic analysis of the proposed rule to revise critical habitat for four southwest invertebrate species," May 21, 2010.

EXHIBIT ES-3. SUMMARY OF COSTS ASSOCIATED WITH DESIGNATION OF CRITICAL HABITAT FOR FOUR INVERTEBRATES, 2010-2039 (7 PERCENT DISCOUNT RATE)

CRITICAL HABITAT UNIT	ACTIVITY/CATEGORY	BASELINE COSTS				INCREMENTAL COSTS	
		ANNUALIZED		PRESENT VALUE		ANNUALIZED	PRESENT VALUE
		Low	High	Low	High		
Sago/Bitter Creek Complex (NM) and Impoundment Complex (NM)	• Oil and gas development (drilling modifications)	$27,200	$62,000	$289,000	$657,000	• None	
	• Habitat management	$59,100		$627,000		• None	
	• Agricultural groundwater withdrawals • Control of residential septic systems • CAFO controls for NPDES permits • Remediation of illegal dumps	Qualitatively assessed; available information suggests that no costs are incurred explicitly for protection of four invertebrates.				• None	
	• BLM Administrative and Consultation Costs	$3,920	$7,920	$42,300	$87,600	$2,050	$21,700
	• Concentrated Animal Feeding Operation Consultation Costs	$2,460		$26,100		$820	$8,690
	• Intra-Service Consultation	$9,080		$96,200		$3,030	$32,100
Diamond Y Springs (TX) and East Sandia Spring (TX)	• Habitat management	Qualitatively assessed; voluntary water protection agreements exist between TNC and oil and gas developers.				• None	
	• Agricultural groundwater withdrawals	Qualitatively assessed; available information suggests that no costs are incurred explicitly for protection of four invertebrates.				• None	
TOTAL OF QUANTIFIED COSTS		$102,000	$141,000	$1,080,000	$1,490,000	$5,900	$62,500
Note: Totals may not sum due to rounding.							

EXHIBIT ES-4. SUMMARY OF COSTS ASSOCIATED WITH DESIGNATION OF CRITICAL HABITAT FOR FOUR INVERTEBRATES, 2010-2039 (3 PERCENT DISCOUNT RATE)

CRITICAL HABITAT UNIT	ACTIVITY/CATEGORY	BASELINE COSTS				INCREMENTAL COSTS	
		ANNUAL		PRESENT VALUE		ANNUAL	PRESENT VALUE
		Low	High	Low	High		
Sago/Bitter Creek Complex (NM) and Impoundment Complex (NM)	• Oil and gas development (drilling modifications)	$27,200	$62,000	$405,000	$923,000	• None	
	• Habitat management	$59,000		$878,000		• None	
	• Agricultural groundwater withdrawals • Control of residential septic systems • CAFO controls for NPDES permits • Remediation of illegal dumps	Qualitatively assessed; available information suggests that no costs are incurred explicitly for protection of four invertebrates.				• None	
	• BLM Administrative and Consultation Costs	$4,110	$8,870	$61,700	$135,000	$2,050	$30,500
	• Concentrated Animal Feeding Operation Consultation Costs	$2,460		$36,600		$820	$12,200
	• Intra-Service Consultation	$9,080		$135,000		$3,030	$45,000
Diamond Y Springs (TX) and East Sandia Spring (TX)	• Habitat management	Qualitatively assessed; voluntary water protection agreements exist between TNC and oil and gas developers.				• None	
	• Agricultural groundwater withdrawals	Qualitatively assessed; available information suggests that no costs are incurred explicitly for protection of four invertebrates.				• None	
TOTAL OF QUANTIFIED COSTS		$102,000	$141,000	$1,520,000	$2,110,000	$5,900	$87,700
Note: Totals may not sum due to rounding.							

POTENTIAL BASELINE COSTS

10. For the reasons noted above, the majority of costs associated with designation of critical habitat for the four invertebrates are baseline costs, i.e., they would be incurred regardless of the proposed designation. Baseline conservation costs have two primary components: (1) project modifications made by oil and gas developers, consistent with requirements under the BLM Habitat Protection Zone; and (2) habitat management costs incurred by the Service, the New Mexico Department of Game and Fish, and The Nature Conservancy.

11. It is possible that additional costs could be incurred by agricultural operations implementing water conservation measures, as well as by concentrated animal feeding operations (CAFOs) implementing wastewater management practices; however, these costs are subject to significant uncertainty and are not readily quantifiable. In Texas, the link between irrigation withdrawals and water depletion requires further hydrological study. In New Mexico, some CAFOs may realize costs associated with the development of emergency action plans, although the extent of these costs and their relationship to four invertebrates protection is unclear.

12. Additional baseline costs are incurred by agencies implementing administrative efforts on behalf of the four invertebrates. All of these costs are associated with the units in and around New Mexico's Bitter Lake NWR. As shown, baseline administrative costs consist primarily of costs associated with intra-Service consultation.

13. As shown in Exhibit ES-3, baseline costs total between $102,000 and $141,000 annually, with a present value of between $1.1 million and $1.5 million based on a seven percent discount rate. Results based on a three percent discount rate are shown in Exhibit ES-4.

POTENTIAL BENEFITS OF FOUR INVERTEBRATES CONSERVATION

14. Conservation of the four invertebrates has potential direct and ancillary benefits, although both are difficult to characterize with analytic certainty:

    - **Direct Benefits**: The four invertebrates may support use values for wildlife enthusiasts visiting habitat areas. Furthermore, the invertebrates may play a role in the overall ecological health of the habitat (e.g., as a food source for other listed species such as the Pecos pupfish).
    - **Ancillary Benefits**: Efforts to conserve the four invertebrates may provide a variety of indirect benefits. For instance, groundwater quality protection by oil and gas developers may avert future drinking water treatment costs and reduce exposure to drinking water contaminants. Furthermore, many of the conservation efforts undertaken for the four invertebrates may also produce improvements to ecosystem health that are shared by other, coexisting species.

15. All of the conservation efforts pursued on behalf of the four invertebrates are done in response to baseline requirements or conservation agreements (i.e., none are expected to be implemented as a result of critical habitat designation). Consistently, any benefits realized are baseline in nature.

CHAPTER 1 | INTRODUCTION

1.1 INTRODUCTION

1. This report estimates the economic costs of proposed critical habitat for four species of invertebrates: the Roswell springsnail (*Pyrgulopsis roswellensis*), Koster's springsnail (*Juturnia kosteri*), Pecos assiminea (*Assiminea pecos*), and Noel's amphipod (*Gammarus desperatus*) (four invertebrates). The report was prepared by Industrial Economics, Incorporated (IEc) for the U.S. Fish and Wildlife Service (Service).

2. This analysis identifies the incremental economic effects of the proposed rule by estimating the costs of actions taken to protect the four invertebrates and their habitat under two scenarios, one "without critical habitat" and the other "with critical habitat." The difference between the two represents the incremental costs of the proposed rule. This information is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation, unless such exclusion would result in the extinction of the species.[1] In addition, this information allows the Service to address the requirements of Executive Orders (E.O.) 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).[2] Detailed discussion of the framework for this analysis is provided in Chapter 2.

3. This chapter provides a brief introduction to the 2010 proposed critical habitat for the four invertebrates. It includes a summary of past legal actions that relate to the current proposal, a map of the proposed units, and a summary of threats to the proposed critical habitat, as determined by the Service.

1.2 PREVIOUS FEDERAL ACTIONS

4. On February 12, 2002 (67 FR 6459), the Service published a proposed rule to list the four invertebrates as endangered under the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.) and to designate critical habitat for these species.[3] The proposed

[1] 16 U.S.C. §1533(b)(2).

[2] Executive Order 12866, Regulatory Planning and Review, September 30, 1993 (as amended by Executive Order 13258 (2002) and Executive Order 13422 (2007)); 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.

[3] Background discussion based on U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Roswell springsnail (*Pyrgulopsis roswellensis*), Koster's springsnail (*Juturnia kosteri*), Noel's amphipod (*Gammarus desperatus*), and Pecos assiminea (*Assiminea pecos*)", 50 CFR Part 17, Vol. 74, No. 47, March 12, 2009.

rule included two complexes on Bitter Lake National Wildlife Refuge (BLNWR) totaling 1,127 acres; one complex at Diamond Y Springs in Pecos County, Texas (380 acres); and one complex at East Sandia Spring in Reeves County, Texas (16.5 acres). On August 9, 2005, the Service published its final rule listing the four invertebrates as endangered with critical habitat (70 FR 46304). In that final rule, critical habitat was designated at the Diamond Y Spring and East Sandia Spring complexes, but was not designated on the BLNWR on the grounds that these areas did not meet the definition of "critical habitat" under section 3(5)(A) of the Act (70 FR 46323).

5. On December 19, 2007, Forest Guardians (now WildEarth Guardians) filed a complaint challenging the merits of the critical habitat designation for the four invertebrates, including the exclusion of the BLNWR from the final critical habitat designation. The plaintiffs alleged that the BLNWR should have been included in the designation because it is the last known occupied habitat for three of the four species (Roswell springsnail, Koster's springsnail, and Noel's amphipod) and that the Refuge's Comprehensive Conservation Plan would not adequately protect the species from threats originating outside of the BLNWR boundaries. Pursuant to a settlement agreement, the court has partially vacated the August 9, 2005 critical habitat decision (70 FR 46304) with respect to the areas excluded under section 3(5)(A) of the Act.

6. The current action includes proposed critical habitat areas in BLNWR. In addition to the BLNWR units, the current proposal re-proposes the Diamond Y Springs and East Sandia Spring units in Texas.

1.3 PROPOSED CRITICAL HABITAT DESIGNATION

7. The four invertebrates occupy springs, seeps, sinkholes, and wetlands near Roswell, New Mexico, and in Reeves and Pecos Counties, Texas. Because of refinements in the GIS technology used to delineate habitat, the boundaries of the units are different from those proposed in 2002. Specifically, the total acreage proposed in the BLNWR units is 68 acres; this contrasts with the 2002 proposal, which included 1,127 acres. Nearly all the proposed habitat is contained within the boundaries of the original proposal. However, as part of the Impoundment Complex, the Service is proposing 2.8 acres that are owned by the City of Roswell (New Mexico) which were not included in the previous proposal. This land directly abuts or is adjacent to the BLNWR. The boundaries of the East Sandia Spring unit would also change slightly from the 2005 designation. The unit would be reduced from 16.5 acres to three acres.

8. Exhibits 1-1 through 1-4 summarize the proposed units in map and tabular form. Note that all the proposed units are currently occupied by one or more of the four invertebrate species.

EXHIBIT 1-1. PROPOSED CRITICAL HABITAT – SAGO/BITTER CREEK COMPLEX AND IMPOUNDMENT COMPLEX

EXHIBIT 1-2. PROPOSED CRITICAL HABITAT – DIAMOND Y SPRINGS

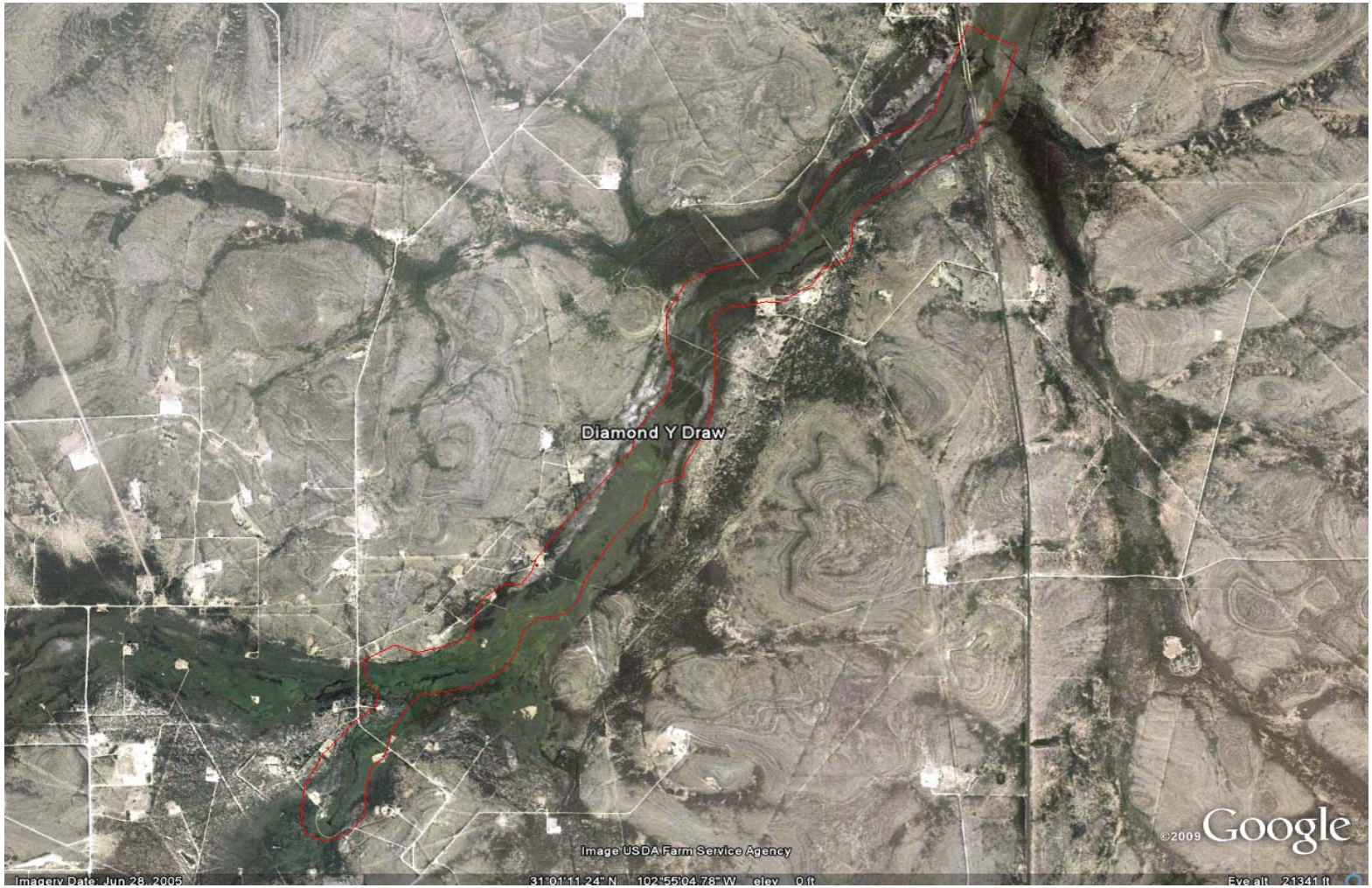


EXHIBIT 1-3. EAST SANDIA SPRING

EXHIBIT 1-4. SUMMARY OF PROPOSED CRITICAL HABITAT, BY UNIT

SPECIES	CRITICAL HABITAT UNIT	LAND OWNERSHIP	UNIT ACREAGE IN CURRENT PROPOSAL
Roswell springsnail; Koster's springsnail; Noel's amphipod	Sago/Bitter Creek Complex (NM)	USFWS	31.9 acres
	Impoundment Complex (NM)	USFWS	35.9 acres
		City of Roswell	2.8 acres
	TOTAL		**70.6 acres**
Pecos assiminea	Sago/Bitter Creek Complex (NM)	USFWS	31.9 acres
	Impoundment Complex (NM)	USFWS	35.9 acres
		City of Roswell	2.8 acres
	Diamond Y Springs (TX)	The Nature Conservancy	441.4
	East Sandia Spring (TX)	The Nature Conservancy	3.0
	TOTAL		**515.0**

1.4 THREATS TO CRITICAL HABITAT AREAS

9. This report describes and quantifies the potential economic costs associated with proposed critical habitat designation for the four invertebrates in relation to the threats identified by the Service. The proposed rule describes specific categories of threats to proposed critical habitat, including:

- Water pollutants associated with oil and gas activities;
- Water pollutants associated with urbanization (e.g., household septic systems);
- Water pollutants associated with agriculture (e.g., concentrated animal feeding operations);
- Reductions in available water as a result of irrigation or other withdrawals; and
- Introduced species.

10. The economic analysis focuses on assessing conservation efforts that may be implemented in order to alleviate these threats.

1.5 PREVIOUS ECONOMIC ANALYSES

11. The Service produced a detailed economic analysis in conjunction with the original 2005 critical habitat proposal.[4] The analysis addressed the Texas units ultimately designated, as well as the New Mexico units originally under consideration (and now part of the

[4] Industrial Economics, Incorporated. 2005. Economic Analysis of Critical Habitat Designation for the Roswell Springsnail, Koster's Springsnail, Pecos Assiminea, and Noel's Amphipod. July 2005.

current proposal). This analysis was made available for, and received, public comment. Therefore, it serves as the foundation for this report. Specifically, this report discusses impacts quantified in the earlier report, and includes updated information where available and appropriate. Chapter 2 discusses the approach to updating the 2005 analysis in greater detail. The original 2005 economic analysis is included as Appendix B to this report.

1.6 STRUCTURE OF THE REPORT

12. The remainder of this report is organized as follows:

- Chapter 2 – Framework used to estimate economic costs and benefits;
- Chapter 3 – Economic costs of conservation efforts;
- Chapter 4 – Administrative costs; and
- Chapter 5 – Economic benefits.

13. In addition, the report includes three appendices: Appendix A considers potential impacts on small entities and the energy industry. Appendix B provides the full text of the original 2005 economic analysis for the four invertebrates. Finally, Appendix C provides the text of Region 2 of the Service's memorandum that describes the incremental effects of designating critical habitat for the four invertebrates.

CHAPTER 2 | FRAMEWORK

14. The purpose of this report is to estimate the economic impact of actions taken to protect the four invertebrates and their habitat. This analysis examines the impacts of restricting or modifying specific land uses or activities for the benefit of the species and their habitat within the areas considered for critical habitat designation. This analysis employs "without critical habitat" and "with critical habitat" scenarios. The "without critical habitat" scenario represents the baseline for the analysis, considering protections already afforded the invertebrates; for example, under the Federal listing and other Federal, State, and local regulations. The "with critical habitat" scenario describes the incremental impacts associated specifically with the designation of critical habitat for the species. The incremental conservation efforts and associated impacts are those not expected to occur absent the designation of critical habitat. The analysis forecasts both baseline and incremental impacts likely to occur after the proposed critical habitat is finalized.

15. This information is intended to assist the Secretary of DOI in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.[5] In addition, this information allows the Service to address the requirements of E.O. 12866 and 13211, and the RFA, as amended by SBREFA.[6]

16. This section describes the framework for the analysis. First, it describes the case law that led to the selection of the framework applied in this report. It then describes in economic terms the general categories of economic effects that are the focus of regulatory impact analysis, including a discussion of both efficiency and distributional effects. Next, this section defines the analytic framework used to measure these impacts in the context of critical habitat regulation, including the link between existing and critical habitat-related protection efforts and potential impacts, and the consideration of benefits. It concludes with a presentation of the information sources relied upon in the analysis.

[5] 16 U.S.C. §1533(b)(2).

[6] E.O. 12866, Regulatory Planning and Review, September 30, 1993 (as amended by E.O. 13258 (2002) and E.O. 13422 (2007)); E.O. 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.

2.1 BACKGROUND

17. The U.S. Office of Management and Budget's (OMB) guidelines for conducting economic analysis of regulations direct Federal agencies to measure the costs of a regulatory action against a baseline, which it defines as the "best assessment of the way the world would look absent the proposed action."[7] In other words, the baseline includes the existing regulatory and socio-economic burden imposed on landowners, managers, or other resource users potentially affected by the designation of critical habitat. Impacts that are incremental to that baseline (i.e., occurring over and above existing constraints) are attributable to the proposed regulation. Significant debate has occurred regarding whether assessing the impacts of the Service's proposed regulations using this baseline approach is appropriate in the context of critical habitat designations.

18. In 2001, the U.S. Tenth Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed critical habitat, regardless of whether those impacts are attributable co-extensively to other causes.[8] Specifically, the court stated,

> "The statutory language is plain in requiring some kind of consideration of economic impact in the CHD [critical habitat designation] phase. Although 50 C.F.R. 402.02 is not at issue here, the regulation's definition of the jeopardy standard as fully encompassing the adverse modification standard renders any purported economic analysis done utilizing the baseline approach virtually meaningless. We are compelled by the canons of statutory interpretation to give some effect to the congressional directive that economic impacts be considered at the time of critical habitat designation…. Because economic analysis done using the FWS's [Fish and Wildlife Service's] baseline model is rendered essentially without meaning by 50 C.F.R. § 402.02, we conclude Congress intended that the FWS conduct a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes. Thus, we hold the baseline approach to economic analysis is not in accord with the language or intent of the ESA [Endangered Species Act]."[9]

19. Since that decision, however, courts in other cases have held that an incremental analysis of impacts stemming solely from the critical habitat rulemaking is proper.[10] For example, in the March 2006 ruling that the August 2004 critical habitat rule for the Peirson's milk-vetch was arbitrary and capricious, the United States District Court for the Northern District of California stated,

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[7] OMB, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[8] *New Mexico Cattle Growers Assn v. United States Fish and Wildlife Service*, 248 F.3d 1277 (10th Cir. 2001).

[9] *New Mexico Cattle Growers Assn v. United States Fish and Wildlife Service*, 248 F.3d 1277 (10th Cir. 2001).

[10] *Cape Hatteras Access Preservation Alliance v. Department of Interior*, 344 F. Supp. 2d 108 (D.D.C.); *Center for Biological Diversity v. United States Bureau of Land Management*, 422 F. Supp/. 2d 1115 (N.D. Cal. 2006).

> "The Court is not persuaded by the reasoning of *New Mexico Cattle Growers*, and instead agrees with the reasoning and holding of *Cape Hatteras Access Preservation Alliance v. U.S. Dep't of the Interior,* 344 F. Supp 2d 108 (D.D.C. 2004). That case also involved a challenge to the Service's baseline approach and the court held that the baseline approach was both consistent with the language and purpose of the ESA and that it was a reasonable method for assessing the actual costs of a particular critical habitat designation *Id* at 130. 'To find the true cost of a designation, the world with the designation must be compared to the world without it.'"[11]

20. In order to address the divergent opinions of the courts and provide the most complete information to decision-makers, this economic analysis reports both:

    a. The baseline impacts of protections afforded the four invertebrates absent critical habitat designation; and

    b. The estimated incremental impacts precipitated specifically by the designation of critical habitat for the species.

    Summed, these two types of impacts comprise the fully co-extensive impacts of conservation in areas considered for critical habitat designation.

21. Incremental effects of critical habitat designation are determined using the Service's December 9, 2004 interim guidance on "Application of the 'Destruction or Adverse Modification' Standard Under Section 7(a)(2) of the Endangered Species Act" and information from the Service regarding what potential consultations and project modifications may be imposed as a result of critical habitat designation over and above those associated with the listing.[12] Specifically, in *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, the Ninth Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat, and the Service no longer relies on this regulatory definition when analyzing whether an action is likely to destroy or adversely modify critical habitat.[13] Under the statutory provisions of the Act, the Service determines destruction or adverse modification on the basis of whether, with implementation of the proposed Federal action, the affected critical habitat would remain functional to serve its intended conservation role for the species. A detailed description of the methodology used to define baseline and incremental impacts is provided later in this section.

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[11] *Center for Biological Diversity et al, Plaintiffs, v. United States Bureau of Land Management et al., Defendants and American Sand Association, et al., Defendant Intervenors*, Order re: Cross Motions for Summary Judgment, Case 3:03-cv-02509 Document 174 Filed 03/14/2006, pages 44-45.

[12] Director, U.S. Fish and Wildlife Service, Memorandum to Regional Directors and Manager of the California-Nevada Operations Office, Subject: Application of the "Destruction or Adverse Modification" Standard under Section 7(a)(2) of the Endangered Species Act, dated December 9, 2004.

[13] *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, No. 03-35279 (9th Circuit 2004).

2.2 CATEGORIES OF POTENTIAL ECONOMIC EFFECTS OF SPECIES CONSERVATION

22. This economic analysis considers both the economic efficiency and distributional effects that may result from efforts to protect the four invertebrates and their habitat. Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if the set of activities that may take place on a parcel of land is 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 conservation efforts for the four invertebrates.

23. 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 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 species 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 differences between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

2.2.1 EFFICIENCY EFFECTS

24. At the guidance of OMB and in compliance with E.O. 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 the four invertebrates' 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.[14]

25. 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. Army Corps of Engineers (USACE), 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

[14] 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.

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.

26. 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, protection measures that reduce or preclude 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.

2.2.2 DISTRIBUTIONAL EFFECTS

27. Measurements of changes in economic efficiency focus on the net impact of conservation efforts, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.[15] This analysis considers two types of distributional effects, including impacts on small entities and impacts on energy supply, distribution, and use.[16] It is important to note that these are fundamentally different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

28. This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the RFA, might be affected by future species conservation efforts.[17] In addition, in response to E.O. 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the future impacts of conservation efforts on the energy industry and its customers.[18]

2.3 ANALYTIC FRAMEWORK AND SCOPE OF THE ANALYSIS

29. This analysis identifies those economic activities most likely to threaten the listed species and their habitat and, where possible, quantifies the economic impact to avoid or minimize such threats within the boundaries of the study area (the geographic boundaries of the study area are described later in this chapter). This section provides a description of the methodology used to separately identify baseline impacts and incremental impacts stemming from the proposed designation of critical habitat for the four invertebrates.

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[15] 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.

[16] In addition, critical habitat economic analyses sometimes consider regional economic impacts of conservation efforts as a component of distributional effects. These analyses include estimation of changes in output and employment in affected economic sectors. Actions associated with four invertebrate conservation, however, are not likely to produce economic changes significant enough to warrant regional economic analysis.

[17] 5 U.S.C. §§601 *et seq*.

[18] E.O. 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use, May 18, 2001.

This evaluation of impacts in a "with critical habitat designation" versus a "without critical habitat designation" framework effectively measures the net change in economic activity associated with the proposed rulemaking.

2.3.1 IDENTIFYING BASELINE IMPACTS

30. The baseline for this analysis is the existing state of regulation, prior to the designation of critical habitat, that provides protection to the species under the Act, as well as under other Federal, State and local laws and guidelines. This "without critical habitat designation" scenario also considers a wide range of additional factors beyond the compliance costs of regulations that provide protection to the listed species. As recommended by OMB, the baseline incorporates, as appropriate, trends in market conditions, implementation of other regulations and policies by the Service and other government entities, and trends in other factors that have the potential to affect economic costs and benefits, such as the rate of regional economic growth in potentially affected industries.

31. Baseline impacts include sections 7, 9, and 10 of the Endangered Species Act (Act), and economic impacts resulting from these protections to the extent that they are expected to occur absent the designation of critical habitat for the species.

- Section 7 of the Act, absent critical habitat designation, 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. The portion of the administrative costs of consultations under the jeopardy standard, along with the impacts of project modifications resulting from consideration of this standard, are considered baseline impacts. Baseline administrative costs of section 7 consultation are summarized later in Exhibit 2-2.
- 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, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[19] The economic impacts associated with this section manifest themselves in sections 7 and 10.
- Under section 10(a)(1)(B) of the Act, an entity (e.g., a landowner or local government) may develop an HCP for a listed 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.[20] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately avoided or minimized. The development and implementation of HCPs is considered a baseline protection for the species and habitat unless the HCP is determined to be precipitated by the designation of

[19] 16 U.S.C. 1532.

[20] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at http://endangered.fws.gov/hcp/.

critical habitat, or the designation influences stipulated conservation efforts under HCPs.

Enforcement actions taken in response to violations of the Act are not included in this analysis.

32. 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. If compliance with the Clean Water Act or State environmental quality laws, for example, protects habitat for the species, such protective efforts are considered to be baseline protections and costs associated with these efforts are categorized accordingly. Such efforts, however, may not be considered baseline in the case that they would not have been triggered absent the designation of critical habitat. In these cases, they are considered incremental impacts and are discussed below.

2.3.2 IDENTIFYING INCREMENTAL IMPACTS

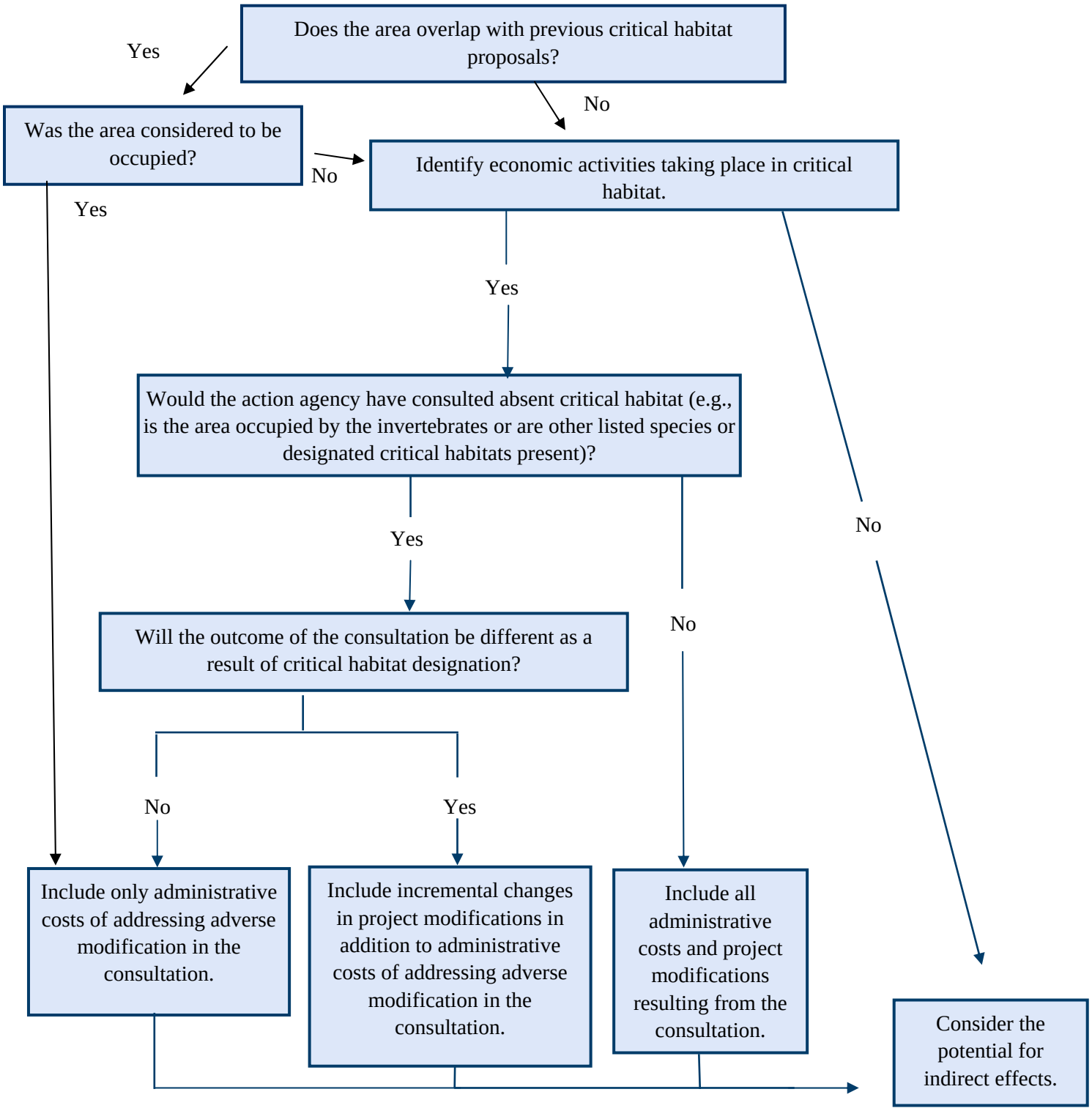
33. This analysis separately quantifies the incremental impacts of this rulemaking. The focus of the incremental analysis is to determine the impacts on land uses and activities from the designation of critical habitat that are above and beyond those impacts due to existing required or voluntary conservation efforts being undertaken due to other Federal, State, and local regulations or guidelines.

34. When critical habitat is designated, section 7 requires Federal agencies to ensure that their actions will not result in the destruction or adverse modification of critical habitat (in addition to considering whether the actions are likely to jeopardize the continued existence of the species). The added administrative costs of including consideration of critical habitat in section 7 consultations, and the additional impacts of implementing project modifications resulting from the protection of critical habitat are the direct compliance costs of designating critical habitat. These costs are not in the baseline and are considered incremental impacts of the rulemaking.

35. Exhibit 2-1 depicts the decision analysis regarding whether an impact should be considered incremental. The following sections describe this decision tree in detail.

36. Incremental impacts may be the direct compliance costs associated with additional effort to forecast consultations, reinitiated consultations, new consultations occurring specifically because of the designation, and additional project modifications that would not have been required under the jeopardy standard. Additionally, incremental impacts may include indirect impacts resulting from reaction to the potential designation of critical habitat (e.g., developing HCPs in an effort to avoid designation of critical habitat), triggering of additional requirements under State or local laws intended to protect sensitive habitat, and uncertainty and perceptional effects on markets.

EXHIBIT 2-1. IDENTIFYING INCREMENTAL IMPACTS OF CRITICAL HABITAT DESIGNATION



Direct Impacts

37. The direct, incremental impacts of critical habitat designation stem from the consideration of the potential for destruction or adverse modification of critical habitat during section 7 consultations. The two categories of direct, incremental impacts of critical habitat designation are: 1) the administrative costs of conducting section 7 consultation; and 2) implementation of any project modifications requested by the Service through section 7 consultation to avoid or minimize potential destruction or adverse modification of critical habitat.

Administrative Section 7 Consultation Costs

38. Parties involved in section 7 consultations include the Service, a Federal "action agency," and in some cases, a private entity involved in the project or land use activity. The action agency (i.e., the Federal nexus necessitating the consultation) serves as the liaison with the Service. While consultations are required for activities that involve a Federal nexus and may jeopardize the continued existence of the species regardless of whether critical habitat is designated, the designation may increase the effort for consultations in the case that the project or activity in question may adversely modify critical habitat. Administrative efforts for consultation may therefore result in both baseline and incremental impacts.

39. In general, three different scenarios associated with the designation of critical habitat may trigger incremental administrative consultation costs:

    1. **Additional effort to address adverse modification in a new consultation -** New consultations taking place after critical habitat designation may require additional effort to address critical habitat issues above and beyond the listing issues. In this case, only the additional administrative effort required to consider critical habitat is considered an incremental impact of the designation.

    2. **Re-initiation of consultation to address adverse modification -** Consultations that have already been completed on a project or activity may require re-initiation to address critical habitat. In this case, the costs of re-initiating the consultation, including all associated administrative and project modification costs are considered incremental impacts of the designation.

    3. **Incremental consultation resulting entirely from critical habitat designation -** Critical habitat designation may trigger additional consultations that may not occur absent the designation (e.g., for an activity for which adverse modification may be an issue, while jeopardy is not, or consultations resulting from the new information about the potential presence of the species provided by the designation). Such consultations may, for example, be triggered in critical habitat areas that are not occupied

by the species. All associated administrative and project modification costs of incremental consultations are considered incremental impacts of the designation.

40. The administrative costs of these consultations vary depending on the specifics of the project. One way to address this variability is to show a range of possible costs of consultation, as it may not be possible to predict the precise outcome of each future consultation in terms of level of effort. Review of consultation records and discussions with Service field offices resulted in a range of estimated administrative costs of consultation. For simplicity, the average of the range of costs in each category is applied in this analysis.

41. Exhibit 2-2 provides estimated administrative consultation costs representing effort required for all types of consultation, including those that considered both adverse modification and jeopardy. To estimate the fractions of the total administrative consultation costs that are baseline and incremental, the following assumptions were applied.

- The greatest effort will be associated with consultations that consider both jeopardy and adverse modification. Depending on whether the consultation is precipitated by the listing or the critical habitat designation, part or all of the costs, respectively, will be attributed to the proposed rule.
- Efficiencies exist when considering both jeopardy and adverse modification at the same time (e.g., in staff time saved for project review and report writing), and therefore incremental administrative costs of considering adverse modification in consultations precipitated by the listing result in the least incremental effort, roughly one-quarter of the cost of the entire consultation. The remaining three-quarters of the costs are attributed to consideration of the jeopardy standard in the baseline scenario. This latter amount also represents the cost of a consultation that only considers adverse modification (e.g., an incremental consultation for activities in unoccupied critical habitat) and is attributed wholly to critical habitat.
- Incremental costs of the re-initiation of a previously completed consultation because of the critical habitat designation are assumed to be approximately half the cost of a consultation considering both jeopardy and adverse modification. This assumes that re-initiations are less time-consuming as the groundwork for the project has already been considered in terms of its effect on the species. However, because the previously completed effort must be re-opened, they are more costly than simply adding consideration of critical habitat to a consultation already underway.

EXHIBIT 2-2. RANGE OF ADMINISTRATIVE CONSULTATION COSTS (2009 DOLLARS)

BASELINE ADMINISTRATIVE COSTS OF CONSULTATION ($2009)					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
CONSULTATION CONSIDERING JEOPARDY (DOES NOT INCLUDE CONSIDERATION OF ADVERSE MODIFICATION)					
Technical Assistance	$420	n/a	$788	n/a	$1,130
Informal	$1,840	$2,330	$1,540	$1,500	$7,130
Formal	$4,090	$4,610	$2,630	$3,600	$15,000
Programmatic	$12,300	$10,200	n/a	$4,200	$26,700
INCREMENTAL ADMINISTRATIVE COSTS OF CONSULTATION ($2009)					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
NEW CONSULTATION RESULTING ENTIRELY FROM CRITICAL HABITAT DESIGNATION (TOTAL COST OF A CONSULTATION CONSIDERING BOTH JEOPARDY AND ADVERSE MODIFICATION)					
Technical Assistance	$560	n/a	$1,050	n/a	$1,500
Informal	$2,450	$3,100	$2,050	$2,000	$9,500
Formal	$5,450	$6,150	$3,500	$4,800	$20,000
Programmatic	$16,400	$13,700	n/a	$5,600	$35,700
NEW CONSULTATION CONSIDERING ONLY ADVERSE MODIFICATION					
Technical Assistance	$420	n/a	$788	n/a	$1,130
Informal	$1,840	$2,330	$1,540	$1,500	$7,130
Formal	$4,090	$4,610	$2,630	$3,600	$15,000
Programmatic	$12,300	$10,200	n/a	$4,200	$26,700
RE-INITIATION OF CONSULTATION TO ADDRESS ADVERSE MODIFICATION					
Technical Assistance	$280	n/a	$525	n/a	$750
Informal	$1,230	$1,550	$1,030	$1,000	$4,750
Formal	$2,730	$3,080	$1,750	$2,400	$10,000
Programmatic	$8,200	$6,830	n/a	$2,800	$17,800
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION| (ADDITIVE WITH BASELINE COSTS ABOVE OF CONSIDERING JEOPARDY)					
Technical Assistance	$140	n/a	$263	n/a	$375
Informal	$613	$775	$513	$500	$2,380
Formal	$1,360	$1,540	$875	$1,200	$5,000
Programmatic	$4,100	$3,410	n/a	$1,400	$8,910

Source: IEc analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2009, and a review of consultation records from several Service field offices across the country conducted in 2002.

Notes:

1. Totals may not sum due to rounding.
2. Estimates reflect average hourly time required by staff.

Section 7 Project Modification Impacts

42. Section 7 consultation considering critical habitat may also result in additional project modification recommendations specifically addressing potential destruction or adverse modification of critical habitat. For forecast consultations considering jeopardy and adverse modification, and for re-initiations of past consultations to consider critical habitat, the economic impacts of project modifications undertaken to avoid or minimize adverse modification are considered incremental impacts of critical habitat designation. For consultations that are forecast to occur specifically because of the designation (incremental consultations), impacts of all associated project modifications are assumed to be incremental impacts of the designation. This is summarized below.

1. **Additional effort to address adverse modification in a new consultation -** Only project modifications above and beyond what would be requested to avoid or minimize jeopardy are considered incremental.
2. **Re-initiation of consultation to address adverse modification -** Only project modifications above and beyond what was requested to avoid or minimize jeopardy are considered incremental.
3. **Incremental consultation resulting entirely from critical habitat designation -** Impacts of all project modifications are considered incremental.

Indirect Impacts

43. The designation of critical habitat may, under certain circumstances, affect actions that do not have a Federal nexus and thus are not subject to the provisions of section 7 under the Act. Indirect impacts are those unintended changes in economic behavior that may occur outside of the Act, through other Federal, State, or local actions, and that are caused by the designation of critical habitat. This section identifies common types of indirect impacts that may be associated with the designation of critical habitat. Importantly, these types of impacts are not always considered incremental. In the case that these types of conservation efforts and economic effects are expected to occur regardless of critical habitat designation, they are appropriately considered baseline impacts in this analysis.

Habitat Conservation Plans

44. Under section 10 of the Act, landowners seeking an incidental take permit must develop an HCP to counterbalance the potential harmful effects that an otherwise lawful activity may have on a species. As such, the purpose of the habitat conservation planning process is to ensure that the effects of incidental take are adequately avoided or minimized. Thus, HCPs are developed to ensure compliance with section 9 of the Act and to meet the requirements of section 10 of the Act.

45. Application for an incidental take permit and completion of an HCP are not required or necessarily recommended by a critical habitat designation. However, in certain situations the new information provided by the proposed critical habitat rule may prompt a landowner to apply for an incidental take permit. For example, a landowner may have

been previously unaware of the potential presence of the species on his or her property, and expeditious completion of an HCP may offer the landowner regulatory relief in the form of exclusion from the final critical habitat designation. In this case, the effort involved in creating the HCP and undertaking associated conservation actions are considered an incremental effect of designation. No specific plans to prepare new HCPs in response to this proposed designation were identified.

Other State and Local Laws

46. Under certain circumstances, critical habitat designation 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 impacts would not have been triggered absent critical habitat designation, they are considered indirect, incremental impacts of the designation.

47. The California Environmental Quality Act (CEQA), for example, requires that lead agencies, public agencies responsible for project approval, consider the environmental effects of proposed projects that are considered discretionary in nature and not categorically or statutorily exempt. In some instances, critical habitat designation may trigger CEQA-related requirements. This is most likely to occur in areas where the critical habitat designation provides clearer information on the importance of particular areas as habitat for a listed species. In addition, applicants who were "categorically exempt" from preparing an Environmental Impact Report (EIR) under CEQA may no longer be exempt once critical habitat is designated. In cases where the designation triggers the CEQA significance test or results in a reduction of categorically exempt activities, associated impacts are considered to be an indirect, incremental effect of the designation.

Additional Indirect Impacts

48. In addition to the indirect effects of compliance with other laws or triggered by the designation, project proponents, land managers and landowners may face additional indirect impacts, including the following:

- **Time Delays -** Both public and private entities may experience incremental time delays for projects and other activities due to requirements associated with the need to reinitiate the section 7 consultation process and/or compliance with other laws triggered by the designation. To the extent that delays result from the designation, they are considered indirect, incremental impacts of the designation.
- **Regulatory Uncertainty -** The Service conducts each section 7 consultation on a case-by-case basis and issues a biological opinion on formal consultations based on species-specific and site-specific information. As a result, government agencies and affiliated private parties who consult with the Service under section 7 may face uncertainty concerning whether project modifications will be recommended by the Service and what the nature of these modifications will be. This uncertainty may diminish as consultations are completed and additional information becomes available on the effects of critical habitat on specific activities. Where information

suggests that this type of regulatory uncertainty stemming from the designation may affect a project or economic behavior, associated impacts are considered indirect, incremental impacts of the designation. In this specific analysis, information is not available to quantify this effect.

- **Stigma -** In some cases, the public may perceive that critical habitat designation may result in limitations on private property uses above and beyond those associated with anticipated project modifications and regulatory uncertainty described above. Public attitudes about the limits or restrictions that critical habitat may impose can cause real economic effects to property owners, regardless of whether such limits are actually imposed. All else equal, a property that is designated as critical habitat may have a lower market value than an identical property that is not within the boundaries of critical habitat due to perceived limitations or restrictions. As the public becomes aware of the true regulatory burden imposed by critical habitat, the impact of the designation on property markets may decrease. To the extent that potential stigma effects on markets are probable and identifiable, these impacts are considered indirect, incremental impacts of the designation.

2.3.3 BENEFITS

49. Under E.O. 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.[21] 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.[22]

50. 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 E.O. 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 conduct new research.[23] *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.*

51. Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements (PCEs) on which the species depends. To this end, critical habitat designation can result

[21] E.O. 12866, Regulatory Planning and Review, September 30, 1993.

[22] 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.

[23] Ibid.

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 increased recreational opportunities 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. The potential ancillary benefits of critical habitat designation are described qualitatively in a separate chapter at the end of this report.

2.3.4 GEOGRAPHIC SCOPE OF THE ANALYSIS

52. The geographic scope of the analysis includes all land proposed as critical habitat. Note the economic impacts may occur outside of the boundaries of the study area (e.g., modifications to nearby oil and gas drilling operations); these impacts are considered relevant to this analysis. To the extent possible, results are presented by proposed critical habitat unit.

2.3.5 ANALYTIC TIME FRAME

53. The analysis estimates economic impacts to activities from 2010 to 2029, 20 years from the expected year of final critical habitat designation. Ideally, the time frame for the analysis would reflect the period over which the invertebrate species recover and critical habitat is no longer needed. Lacking specific information on this recovery period, however, the analysis seeks to forecast impacts over a "reasonably foreseeable" time frame. In this context, reasonably foreseeable is defined as the period during which key economic conditions contributing to costs and benefits can be characterized with relative confidence. These conditions include compliance cost assumptions (e.g., the cost of groundwater protection measures applied at oil and gas wells), fossil fuel demand, agricultural growth, demographic and development patterns, and other factors. Furthermore, the 20-year analytic time frame is consistent with the time frame applied in other critical habitat economic analyses, facilitating comparison of economic impacts across species and rulemakings.

2.4 INFORMATION SOURCES AND PREVIOUS ANALYSES

54. The primary source of information for this report is the detailed economic analysis of the 2005 critical habitat proposal for the four invertebrates.[24] The 2005 analysis addressed economic costs associated with the Bitter Lake NWR units as well as the Diamond Y Springs and East Sandia Spring units. Therefore, the report addressed much the same critical habitat as that proposed in the current action (with modifications discussed in Chapter 1). The report is provided as Appendix B.

[24] Industrial Economics, Incorporated. 2005. Economic Analysis of Critical Habitat Designation for the Roswell Springsnail, Koster's Springsnail, Pecos Assiminea, and Noel's Amphipod. July 2005.

55. To build upon the previous study, the current analysis undertakes several steps:

- First, the analysis identifies key parameters that need to be updated from 2005. Research efforts include returning to original information sources as well as new versions of analogous reports and data. Sources include communications with, and data provided by, Service personnel; representatives of other Federal, State, and local governments; and other stakeholders.
- Second, the analysis integrates this new information wherever possible. For instance, newly available data on the frequency of section 7 consultations provides the foundation for revised estimates of administrative costs.
- All figures, including 2005 and newly gathered data, are updated to 2009 dollars using the gross domestic product implicit price deflator.[25]

[25] GDP deflator accessed on December 8, 2009 at http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=13&Freq=Qtr&FirstYear=2007&LastYear=2009

CHAPTER 3 | ECONOMIC COSTS OF CONSERVATION EFFORTS

56. This chapter reports the estimated costs of conservation efforts benefiting the four invertebrates, including both baseline costs and incremental costs (see Chapter 2). Two major categories of conservation efforts are addressed:

- First, the analysis considers protections implemented by oil and gas development operations.
- Second, the analysis examines investments by Federal, State, and other landowners related to habitat management benefitting the four invertebrates.

57. In addition, the analysis qualitatively considers several other economic activities that may realize costs associated with conservation of the four invertebrates, but which are difficult to characterize with certainty. These include withdrawal of groundwater for agricultural use; residential development and associated groundwater impacts; management of concentrated animal feeding operations; and remediation of illegal refuse dumping.

58. As noted in Chapter 1, an analysis of the economic impact of critical habitat designation was developed by the Service as part of the 2002 proposed critical habitat designation. The previous analysis has been updated and revised to align with the current proposed rulemaking, as described below.

3.1 SUMMARY

59. Exhibit 3-1 summarizes the anticipated costs of conservation efforts associated with the four invertebrates. As shown, all of the costs evaluated (which excludes administrative costs) are baseline costs and are not directly associated with the designation of critical habitat. A number of factors limit the extent to which the proposed critical habitat designation results in incremental costs, including the fact that all the proposed habit is occupied by the species and virtually all of the proposed habitat is managed for conservation. Consistent with these conditions, the Service's incremental memorandum observes that critical habitat designation for the four invertebrates is unlikely to produce project modifications different from those already required under the jeopardy standard.[26] Some incremental costs are realized through administrative procedures; Chapter 4 addresses these costs.

[26] U.S. Fish and Wildlife Service, "Incremental effects memorandum for the economic analysis of the proposed rule to revise critical habitat for four southwest invertebrate species," May 21, 2010.

60. Baseline conservation costs have two primary components: (1) project modifications made by oil and gas developers, consistent with requirements under the BLM Habitat Protection Zone; and (2) habitat management costs incurred by the Service, the New Mexico Department of Game and Fish, and The Nature Conservancy. It is possible that additional baseline costs could be incurred by agricultural operations implementing water conservation measures, as well as by concentrated animal feeding operations implementing wastewater management practices; however, these costs are subject to uncertainty and are not readily quantifiable.

EXHIBIT 3-1. COSTS OF FOUR INVERTEBRATES CONSERVATION EFFORTS

CRITICAL HABITAT UNIT	ACTIVITY/CATEGORY	BASELINE COSTS				INCREMENTAL COSTS
		ANNUALIZED		PRESENT VALUE		
		Low	High	Low	High	
Sago/Bitter Creek Complex (NM) and Impoundment Complex (NM)	• Oil and gas development (drilling modifications)	$27,200	$62,000	$289,000	$657,000	• Administrative costs only; see Chapter 4
	• Habitat management	$59,100		$627,000		
	• Conservation of agricultural groundwater withdrawals • Control of residential septic systems • CAFO controls for NPDES permits • Remediation of illegal dumps	Qualitatively assessed; available information suggests that no costs are incurred explicitly for protection of four invertebrates.				
Diamond Y Springs (TX) and East Sandia Spring (TX)	• Habitat management	Qualitatively assessed; voluntary water protection agreements exist between TNC and oil and gas developers.				• None
	• Conservation of agricultural groundwater withdrawals	Qualitatively assessed; available information suggests that no costs are incurred explicitly for protection of four invertebrates.				• None
TOTAL OF QUANTIFIED COSTS		$86,300	$121,000	$916,000	$1,280,000	• Administrative costs only; see Chapter 4
Note: Totals may not sum due to rounding.						

3.2 OIL AND GAS DEVELOPMENT

3.2.1 BACKGROUND

61. As a direct result of a 1997 section 7 consultation with the Service regarding the endangered Pecos gambusia, the Bureau of Land Management (BLM) created the Bitter Lake Habitat Protection Zone (HPZ) plan to manage activities on 12,585 acres of Federal mineral estate within the water resource area for the Bitter Lake Refuge. The HPZ rules stipulate that mineral lease owners who apply for permits to drill for natural gas in the

HPZ are required to apply appropriate protective measures and design features to ensure aquifer protection. BLM developed and implemented the HPZ plan for the Pecos gambusia prior to the proposed listing and designation of the four invertebrate species. These groundwater protection measures for oil and gas drilling activities may provide baseline protections to the four invertebrates, so the associated costs are analyzed here.[27]

3.2.2 METHODOLOGY

62. BLM estimates that since the establishment of the HPZ in 1997, it has received approximately one application to drill (APD) every three years.[28] This analysis assumes that this rate of APDs will continue throughout the period of study, for a total of approximately seven APDs anticipated over twenty years.

63. To comply with groundwater protection permit requirements in the HPZ, operators must spend more time drilling, casing, cementing and developing facilities, depending on well-location and depth. HPZ rules require the following drilling modifications:

- **Steel Tanks**: To prevent potential contaminants from leaching to the groundwater, operators drilling in the HPZ are required to use above ground steel tanks in lieu of lined earthen reserve pits to store drilling muds. Steel tanks are required to be located within the perimeter of the well pad and drilling wastes are required to be removed from the Habitat Protection Zone, rather than remaining within the pits indefinitely. Additional expenses related to labor, materials, equipment, transporting costs, and time delays are also incurred. Industry sources place the cost of implementing steel tanks in the range of $55,000 to $137,000 per well (2009 dollars).[29]
- **Well Casing Modifications**: The HPZ stipulates that operators must drill a surface hole to a depth sufficient to protect the freshwater aquifers. Operators must set the surface casing at this depth, cement it in place, and the cement must circle the casing to the surface of the well. Currently, natural gas wells include the cement layer only on the bottom and top portions of the well, with the middle

[27] The analysis focuses on costs incurred by operations in the HPZ. Additional oil and gas operations may be established on land outside the HPZ (but within the BLNWR watershed) where BLM is a landowner or holds mineral rights. BLM representatives indicate that operations in these areas are subject to standard groundwater protection requirements and would not incur increased costs associated with protection of particular species or habitat. Personal communication with Howard Parman, Planning Coordinator, Bureau of Land Management, Roswell Field Office, May 18, 2010.

[28] Personal communication with Dan Baggao, Wildlife Biologist, Bureau of Land Management, Roswell Field Office, December 14, 2009, and Howard Parman, Planning Coordinator, Bureau of Land Management, Roswell Field Office, May 18, 2010. This estimate of the rate of APDs is significantly lower than the estimate (three APDs per year) on which the 2005 analysis was based. BLM representatives note that APDs in the HPZ have slowed in recent years. They also note that APD rates are difficult to predict with confidence given the influence of economic factors such as oil prices.

[29] All unit costs have been adjusted to 2009 dollars using the Gross Domestic Product (GDP) deflator. Accessed on December 8, 2009 at http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=13&Freq=Qtr&FirstYear=2007&LastYear=2009. The 2005 economic analysis (Appendix B) provides a detailed discussion of the information sources consulted for each of the unit cost figures applied in this section.

section below the aquifers cased only in steel. Estimated costs of this modification range from $22,000 to $44,000 per well (2009 dollars).

- **Rights of Way**: As of 2005, there were 11 rights-of-way (ROW) authorizations for pipelines on public lands within the HPZ. According to BLM, ROWs for oil and gas operations on existing leases will continue to be approved but will be subject to standard or special stipulations, or both. Industry sources estimate that operators implementing special requirements for pipeline access may incur costs of up to $4,800 per right-of-way. This analysis assumes that the estimated seven well drilling operations over 20 years will require seven ROWs for pipeline access (2009 dollars).

64. The 2005 report included as Appendix B provides more detail on the sources consulted to develop estimates of drilling modification costs.

3.2.3 ESTIMATED COSTS

65. Applying the unit cost figures and APD assumptions discussed above yields an estimated annual cost of about $27,000 to $62,000 for drilling modifications. Across the 20-year study period, this translates into a present value cost of approximately $289,000 to $657,000 (2009 dollars, applying a discount rate of seven percent).

3.2.4 OTHER POTENTIAL OIL AND GAS DEVELOPMENT COSTS

66. Research suggests the potential for oil and gas interests to incur other costs associated with species conservation, beyond those characterized above. First, oil and gas drilling occurs on private and state lands near the BLNWR units. Currently, 74 active oil and gas wells exist on State lands and 131 active wells exist on private lands within the 12-township source-water capture zone surrounding BLNWR.[30] The New Mexico Oil Conservation Division (part of the New Mexico Energy, Minerals and Natural Resources Department) is the agency responsible for permitting new wells, issuing discharge permits, and monitoring wells. It is possible that the proposed critical habitat designation for the four invertebrates could increase State regulatory scrutiny over proposed drilling operations. In such cases, operators may be required to implement drilling modifications to ensure well integrity and prevent groundwater contamination, in addition to the efforts described above.[31] However, currently no additional State protective measures to ensure protection to aquatic species are anticipated.[32]

67. A second potential source of incremental costs related to oil and gas development is associated with activity around the Diamond Y Spring unit in Texas.[33] Diamond Y Spring Preserve is located within the Gomez Field, an actively producing oil and gas

[30] Go-Tech Data, accessed at http://octane.nmt.edu/gotech/Well/wellactivity.aspx, on April 29, 2010.

[31] Personal communication with Wayne Price, Environmental Bureau, New Mexico Oil Conservation Division, December 8, 2004.

[32] Personal communication with Dan Rubin, Interstate Stream Commission, February 24, 2005.

[33] As of 2005, there were no oil and gas activities occurring adjacent to the East Sandia Spring unit.

field. According to a 1991 report, there were 45 active and plugged oil and gas wells within the Diamond Y Spring Preserve, and 800 to 1,000 wells located within the aquifer throughout the spring basin.[34] Operations could potentially affect surface and groundwater quality within the springs. However, the area supports a variety of threatened and endangered species, including the Leon Springs pupfish, the Pecos gambusia, and the Pecos sunflower, and is already designated as critical habitat for the Leon Springs pupfish. Oil and gas developers currently work in coordination with The Nature Conservancy and have voluntarily implemented a variety of safeguards to protect surface waters within the preserve from contamination. For all these reasons, it is unlikely that designation of critical habitat for the four invertebrates would trigger any additional project modifications. Likewise, it is difficult to characterize baseline costs specifically associated with the four invertebrates given the variety of listed species in the region.

3.2.4 SUMMARY AND CHARACTERIZATION OF BASELINE AND INCREMENTAL COSTS

68. Drilling modification costs associated with complying with BLM's Habitat Protection Zone requirements total $289,000 to $657,000 (present value over 20 years). Texas oil and gas developers incur additional costs in the protection of habitat in Diamond Y Spring Preserve, although these costs are not readily quantifiable. *All of these costs are incurred in the baseline*, as opposed to being attributable to designation of critical habitat for the four invertebrates. In New Mexico, the HPZ was originally established to protect the Pecos gambusia; hence the drilling modifications would be implemented regardless of the designation status of the four invertebrates' habitat. Likewise, modifications pursued by oil and gas developers on private land near the TNC units are already implemented for the benefit of various listed species in the immediate area. Furthermore, in preparation for this analysis, the Service observed that critical habitat designation for the four invertebrates is unlikely to produce project modifications different from those already required under the jeopardy standard.[35]

3.3 HABITAT MANAGEMENT COSTS

69. Several organizations commit funding to maintaining the quality of habitat vital to the four invertebrates. The discussion below considers investments by: (1) the Service through its management of Bitter Lake NWR; (2) the state of New Mexico through its obligations under the State Recovery and Conservation Plan for the four invertebrates; and (3) The Nature Conservancy.

[34] Veni, G., and Associates. 1991. Delineation and preliminary hydrogeologic investigation of the Diamond Y Spring, Pecos County, Texas. Final Report to The Nature Conservancy, San Antonio, TX.

[35] U.S. Fish and Wildlife Service, "Incremental effects memorandum for the economic analysis of the proposed rule to revise critical habitat for four southwest invertebrate species," May 21, 2010.

3.3.1 BITTER LAKE NWR

70. At Bitter Lake NWR, the Service implements a variety of habitat management projects benefitting the four invertebrates:

- On average, the Service spends approximately $15,000 per year on control of invasive species affecting the four invertebrates' habitat.[36] This figure fluctuates from year to year, depending on changes in staffing, funding, weather and other factors. The efforts include (but are not limited to) salt cedar eradication, fire management, and insect suppression.
- In collaboration with the New Mexico Department of Game and Fish, the Service monitors the population and health of the four invertebrates. These efforts cost approximately $3,000 per year.[37]
- Maintenance of water conveyance structures and dikes costs approximately $4,000 per year.[38]
- The Service plans to implement a project to remove native phragmites from several invertebrate sites. While the plans are tentative, the Service anticipates beginning the project in 2012. The total cost of the project over four years would be approximately $17,000.[39]

71. The annual cost of habitat management at Bitter Lake NWR is estimated at $23,000, with a 20-year present value of $246,000, discounted at seven percent.[40] These represent baseline costs associated with four invertebrates conservation. Chapter 4 addresses the potential for incremental section 7 consultation costs associated with management of Bitter Lake NWR.

3.3.2 NEW MEXICO RECOVERY AND CONSERVATION PLAN

72. The New Mexico Wildlife Conservation Act of 1995 requires that New Mexico Department of Game and Fish (DGF) develop recovery plans for species listed as threatened and endangered under the Act. In 2005, DGF published a final version of its recovery plan for the four invertebrates.[41] The plan established a number of long-term habitat and species management initiatives. DGF provided information on expenditures under a key grant program devoted to habitat management for the four invertebrates.[42]

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[36] All costs based on personal communication with Jeff Sanchez, Wildlife Biologist, Bitter Lake NWR, December 14, 2009.

[37] Ibid.

[38] Ibid.

[39] Ibid.

[40] The annual cost estimate incorporates an annualized cost of phragmites removal implemented in the period from 2012 through 2015.

[41] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

[42] The expenditure data reflect funding levels under section 6 grant E-56, which covers all four invertebrates. Data provided by Brian Lang, New Mexico Department of Game and Fish, December 15, 2009.

Actions pursued under this grant include genetic studies, population ecology studies, and monitoring and data entry.

73. In the period from FY 2005 through FY 2009, the average DGF expenditures on four invertebrates management were $36,000 per year. DGF anticipates that future expenditures will be consistent with historical patterns; hence the analysis assumes this figure for future annual costs. Stated as a 20-year present value, costs total about $381,000. Assignment of data to individual activities was not feasible. Note that these costs may overlap slightly with the Service costs described above since some monitoring efforts are pursued collaboratively.

74. DGF also receives funding under a separate grant devoted to habitat management for amphipods, covering Noel's amphipod and other related amphipod species. This grant funds management measures in Bitter Lake NWR, as well as in other locations in New Mexico and west Texas.[43] Because it is not feasible to assign expenditures under this grant specifically to Noel's amphipod or to the proposed critical habitat areas, the cost estimates do not incorporate these expenditures. Hence, the analysis may understate the cost of habitat management measures implemented by DGF.

3.3.3 THE NATURE CONSERVANCY

75. The Nature Conservancy manages Diamond Y Springs Preserve and Sandia Springs for long term habitat conservation and protection of the functional integrity of surface water systems to benefit rare aquatic species and communities within the preserves. TNC pursues conservation to enhance and restore wetland and stream flows benefitting the federally-endangered Leon Springs pupfish, Pecos gambusia, and the threatened Pecos sunflower, as well as the Pecos assiminea. The area includes designated critical habitat for both the Leon Springs pupfish and the Pecos sunflower.

76. Ongoing habitat management actions at Diamond Y and Sandia Springs include efforts to control the reinvasion of salt cedar (*Tamarix ramosissima*) via manual and prescribed fire methods; building of fire breaks; biological inventory and monitoring; and coordination efforts with oil and gas companies to reduce and prevent the likelihood of groundwater contamination within the spring.[44] However, TNC representatives are unable to characterize the cost of these efforts and it is difficult to assign the costs to Pecos assiminea protection given the diverse set of species that benefit.[45] Therefore, this analysis does not include explicit cost estimates for habitat management at the Diamond Y and Sandia Springs units.

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[43] Personal communication with Brian Lang, New Mexico Department of Game and Fish, December 15, 2009.

[44] Personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, May 23 and 29, 2007.

[45] Personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 10, 2009.

3.3.4 SUMMARY AND CHARACTERIZATION OF BASELINE AND INCREMENTAL COSTS

77. The total cost of habitat management measures implemented for the benefit of the four invertebrates is approximately $59,000 per year, with a 20-year present value of $627,000. All of these costs represent baseline costs because they are pursued in accordance with existing Federal, state, and private conservation agreements. As confirmed in the Service's incremental memorandum regarding the four invertebrates, it is unlikely that the introduction of critical habitat will alter the outcome of section 7 consultations and thereby lead to a change in the habitat management practices.[46]

3.4 OTHER POTENTIAL PROJECT MODIFICATION COSTS

78. Several other economic activities may affect the four invertebrates' habitat, and may therefore undertake conservation efforts. Data to assess these activities, however, are limited; therefore, this analysis characterizes them qualitatively.

3.4.1 AGRICULTURAL WATER WITHDRAWALS

New Mexico Units

79. Groundwater pumping associated with irrigation for agricultural activities may impact the groundwater resource areas on which the four invertebrates depend. In New Mexico, agricultural irrigation represents the major source of groundwater withdrawals, accounting for nearly 90 percent of withdrawals in the water capture zone around Bitter Lake NWR.[47] However, existing conservation practices and agreements are likely adequate to ensure protection of the four invertebrates' habitat:

- Due to the Pecos River Compact lawsuit settlement that places limits on the quantity of water that can be pumped from Pecos Valley wells to ensure adequate deliveries to Texas, agricultural operators within the Pecos Valley have modified irrigation practices to conserve water. For example, operators have installed individual use-meters to monitor and conserve water used for crops and have replaced open dirt canals with underground water pipelines.
- Furthermore, the New Mexico Interstate Stream Commission (ISC) has been purchasing water rights of irrigated farmland around the Roswell area to meet Pecos River Compact obligations.
- Federal water rights for the Bitter Lake NWR were secured in 1996. The Service has determined that federally-reserved water rights for Bitter Lake NWR will ensure minimum surface water discharge of Bitter Creek.

[46] U.S. Fish and Wildlife Service, "Incremental effects memorandum for the economic analysis of the proposed rule to revise critical habitat for four southwest invertebrate species," May 21, 2010.

[47] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

As a result of these and other conditions, the New Mexico Department of Game and Fish has determined that spring flows in Bitter Lake NWR would be threatened only under unprecedented drought conditions.[48]

Texas Units

80. In Texas, further hydrological studies would be necessary to determine the impact of groundwater pumping on surface and groundwater levels at Diamond Y and Sandia Springs. Some conditions suggest that irrigation water withdrawals pose minimal risk to the proposed habitat. For example, in Pecos and Reeves Counties, and in areas adjacent to the proposed units, irrigated crop production operations primarily obtain groundwater from aquifers separate from those on which the springs depend. Likewise, according to the Natural Resource Conservation Service, a number of agricultural operators within the two counties currently engage in water conservation practices, including the use of irrigation pipelines.[49] According to projected water demand trends in the 2004 Middle Pecos Water Management Plan, water needs for irrigation purposes are not anticipated to increase over the next fifty years.[50]

81. However, the potential for ground and surface water depletion still exists. TNC has noted that groundwater depletion in other aquifers can potentially impact recharge within the springs. TNC biologists have observed a decline in water levels in the spring during the irrigation season. The hydrology of the area is quite complex, however, and debate continues about the specific aquifer source of water to Diamond Y spring.[51]

82. Despite TNC's concerns, legal leverage for controlling groundwater withdrawals in the area are limited. Under current Texas law, there are no limitations on the amount of groundwater that landowners are allowed to pump. Despite the presence of listed species and critical habitat, little Federal oversight exists on private lands and no clear Federal nexus exists. Therefore, it is unlikely that conservation measures limiting water use will be introduced, and no such measures are quantified in this analysis.

3.4.2 RESIDENTIAL DEVELOPMENT

83. The proposed critical habitat areas for the four invertebrates are primarily located on Federal lands and The Nature Conservancy lands, areas managed for conservation. Similarly, representatives of the City of Roswell suggest that development of city-owned

[48] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

[49] Personal communication with Terry Whigham, Conservationist, Natural Resource Conservation Service, December 12, 2004.

[50] Turnert Collie & Braden Inc, 2004 Middle Pecos Groundwater Conservation District Water Management Plan, prepared for Middle Pecos Groundwater Conservation District, Pecos County, Texas, June 2004.

[51] Industrial Economics, Incorporated. 2008. Economic Analysis of Critical Habitat Designation for the Pecos Sunflower. Prepared for U.S. Fish and Wildlife Service. February 20, 2008.

lands abutting BLNWR is unlikely given the high groundwater table in the area.[52] As such, no development activities are likely within the proposed boundaries of the CHD.

84. Residential development in the region may indirectly affect groundwater quality and quantity, posing a possible risk to the invertebrates' habitat. First, contamination from septic systems may influence groundwater quality in growing areas of Chaves County.[53] The New Mexico Environment Department's Liquid Waste (Septic Tank) Program oversees permitting of septic systems. The Program has identified groundwater "areas of concern" based on water table depth, proximity to known contamination plumes, and other hydrologic factors. Current regulations (adopted in 2005) stipulate that septic systems located on smaller lots (less than three-quarters of an acre) in areas of concern may be required to implement advanced treatment systems rather than conventional septic systems.[54] It is possible that the presence of the four invertebrates could influence permitting decisions, resulting in requirements for more advanced septic treatment systems. However, such impacts are unlikely for several reasons:

- Rural zoning standards in the area west of Bitter Lake NWR call for minimum lot sizes of five acres.[55] Larger lot sizes minimize the potential for groundwater contamination and limit the need for more stringent septic system design standards.
- Officials with NMED indicate that Chaves County currently has no identified areas of concern.[56]
- Finally, NMED officials also indicate that the current Liquid Waste Program regulations do not include species protection as a factor in permitting decisions.[57]

85. Pumping of groundwater for municipal use potentially also could affect regional water availability and subsequently affect habitat for the four invertebrates. In New Mexico, the Roswell aquifer supporting the invertebrates is also a source of municipal water in the region. However, federally-reserved water rights within Bitter Lake NWR will likely ensure minimum surface water discharge in the proposed critical habitat.[58] Furthermore,

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[52] Personal communication with Michael Vickers, Planner, City of Roswell, December 12, 2009.

[53] The overall population of Chaves County grew at a modest rate of 2.7 percent between 2000 and 2008, as compared to New Mexico overall, which grew at 9.1 percent (U.S. Census Bureau, State and County QuickFacts, accessed online at http://quickfacts.census.gov/qfd/states/35/35005.html , accessed on January 11, 2010).

[54] New Mexico Environment Department, Liquid Waste (Septic Tank) Program Guidance, accessed at http://www.nmenv.state.nm.us/fod/LiquidWaste/guidance.html on December 11, 2009.

[55] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

[56] Personal communication with John Wells, NMED Liquid Waste Specialist, District IV, Roswell Field Office, December 14, 2009.

[57] Ibid.

[58] U.S. Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants; Listing Roswell springsnail, Koster's tryonia, Pecos assiminea, and Noel's amphipod as Endangered With Critical Habitat*, Federal Register, Vol. 67, No. 29, February 12, 2002.

New Mexico's recovery plan for the four invertebrates notes that increases in future residential water demand are unlikely.[59] In Texas, the area around the proposed critical habitat is rural and little growth in municipal water demand is expected. Overall, it is unlikely that conservation of the four invertebrates will impose costs associated with residential growth and water demand.

3.4.3 CONCENTRATED ANIMAL FEEDING OPERATIONS

86. Livestock management in concentrated animal feeding operations has grown rapidly in New Mexico, with most of the growth coming in the dairy sector. The number of dairy operations grew from 105 producers and 80,000 cows in 1990, to 175 operations and 300,000 cows in 2003.[60] Approximately 39 dairy CAFOs operate in Chaves County, managing 90,000 cows.[61] Additional dairies in Chaves County have applied for state permits, but are not yet operational.[62]

87. Surface water and groundwater contamination associated with CAFOs on private lands outside of the proposed critical habitat units may occur as a result of wastewater runoff. Wastewater runoff may contribute to nitrate levels in surface and underground water sources on which the four invertebrates depend. Contamination of rivers and groundwater is well documented in New Mexico; the U.S. EPA routinely cites dairies for Clean Water Act violations.[63]

88. Surface water discharges by CAFOs are regulated by the U.S. EPA under the National Pollutant Discharge Elimination System (NPDES).[64] As allowed under EPA's 2008 CAFO regulations, EPA Region 6 and New Mexico have developed a general NPDES permit to regulate discharges from CAFOs in New Mexico. Qualified CAFOs apply for inclusion in the general NPDES permit, as opposed to applying individually for permits. Applicants must submit detailed nutrient management plans along with other permit application materials.

89. The New Mexico general NPDES permit contains several stipulations related to endangered species protection. First, Part III.D.8 specifies that, to ensure species conservation, all CAFOs in several counties (including Chaves) must implement an

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[59] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

[60] Fort, Denise D. and Anthony Edwards, "Dairies in New Mexico: The Environmental Implications of a New Industry, Natural Resources," Energy and Environmental Law Section Newsletter, pp. 13-20, June 2009, obtained online at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1446816.

[61] Cabrera, Victor E., "The New Mexico Dairy Industry," College of Agricultural and Home Economics, Agricultural Science Center at Clovis, New Mexico State University, no date, obtained online at http://aces.nmsu.edu/ces/dairy/documents/nm_dairy.pdf.

[62] Personal communication with Richard Powell, New Mexico Environment Department Surface Water Quality Bureau, December 11, 2009.

[63] Burnett, John, "New Mexico Dairy Pollution Sparks 'Manure War'," National Public Radio, transcript obtained online at http://www.npr.org/templates/story/story.php?storyId=121173780.

[64] New Mexico does not have delegated authority over NPDES permitting.

Emergency Action Plan (EAP). The EAP identifies site-specific management practices that will be implemented to minimize the risk of spills or leaks. In addition, these CAFOs must perform additional soil sampling in areas where manure is land applied.[65]

90. Second, the general permit specifies that a CAFO can only be included in the general permit if its discharges "will not adversely affect any species that are federally-listed as endangered or threatened under the Endangered Species Act (ESA) and will not result in the adverse modification or destruction of habitat that is federally-designated as 'critical habitat' under the ESA."[66] Because the general permit is in its early stages of implementation, it is unknown how many CAFOs may be excluded under this provision.

91. The general permit rules imply two possible categories of conservation costs for CAFO operators:

- First, CAFOs may realize costs associated with development and implementation of EAPs required for listed species conservation.
- Second, CAFOs denied inclusion in the general permit may incur extra costs associated with individual application for a NPDES permit. However, these costs are likely to be administrative in nature (see Chapter 4).

92. Data needed to assess the magnitude of these costs are not readily available. However, the costs are not likely to influence the conclusions of this analysis significantly. First, the EAP requirements are not species-specific, but rather apply to all CAFOs in the specified counties; hence, associating the costs with protection of the four invertebrates (or any species) would be problematic. Second, to the extent that any costs are incurred, they would represent baseline (rather than incremental) conservation costs because: (1) they would be incurred even without the designation of critical habitat (i.e., the permit cites jeopardy as a basis for exclusion from the general permit); and (2) the proposed critical habitat is already designated for other species at the Bitter Lake NWR (Pecos sunflower).

3.4.4 ILLEGAL DUMPING

93. New Mexico's Recovery and Conservation Plan for the four invertebrates identified a problem with illegal dumping of household refuse in sinkholes west of BLNWR. The refuse includes domestic contaminants (e.g., pesticides, waste oil) with the potential to adversely affect groundwater.[67] State biologists verify that the problem is ongoing, and no cleanup has taken place since the publication of the Recovery and Conservation Plan.[68] The affected lands are owned by various parties, including the Service, BLM, and

[65] U.S. EPA Region 6, National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges from Concentrated Animal Feeding Operations (CAFOs) in New Mexico (NMG010000), effective September 3, 2009.

[66] Ibid., Part I.D.4.

[67] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

[68] Personal communication with Brian Lang, New Mexico Department of Game and Fish, May 12, 2010.

the town of Roswell.[69] Officials with the New Mexico Solid Waste Bureau acknowledge that illegal dumps are common in remote areas throughout the state.[70]

94. It is unlikely that the proposed critical habitat designation would influence cleanup of the illegal dumping areas near BLNWR. No direct connection to any Federal permitting programs exists. For instance, while municipal stormwater permits could require remediation, Roswell currently has no stormwater permit in place.[71] Likewise, cleanup would not entail acquisition of a permit analogous to those required for a landfill or other solid waste disposal facility, which are issued under Federal authority.

95. Typically, the Solid Waste Bureau would contact the landowner(s) in question and require them to plan and fund cleanup of the site.[72] While such remedial action would potentially entail costs for the Service, BLM, and other landowners, the costs are not associated with proximity to listed species or critical habitat.

[69] Personal communication with Joel Lusk, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, May 14, 2010.

[70] Personal communication with Darren Padilla, NMED Solid Waste Bureau, May 14, 2010.

[71] Personal communication with Richard Powell, New Mexico Environment Department Surface Water Quality Bureau, May 13, 2010.

[72] Personal communication with Darren Padilla, NMED Solid Waste Bureau, May 14, 2010.

CHAPTER 4 | SECTION 7 CONSULTATION AND OTHER ADMINISTRATIVE COSTS

96. This chapter describes projected future administrative costs of engaging in section 7 consultation activities that consider the four invertebrates and their critical habitat. Similar to the previous chapters of this report, administrative costs are broken into two categories: baseline costs and incremental costs, as detailed below. Forecast consultations are also categorized by the type of consultation (e.g., informal versus formal).

4.1 BACKGROUND

97. This section presents background information about the section 7 consultation process, and information on the development of estimates of administrative cost efforts.

4.1.1 THE CONSULTATION PROCESS

98. 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. In some cases, consultations will involve the Service and another Federal agency only, such as the U.S. Army Corps of Engineers. Often, they will also include a third party, such as the recipient of a Clean Water Act section 404 permit.

99. During a consultation, the Service, the Action agency, and the entity 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 and the potential effects to the species and designated critical habitat associated with the activity; the Federal agency; and whether there is a private applicant involved.

100. Section 7 consultations with the Service may be either informal or formal. *Informal consultation*s consist of discussions between the Service, the Action agency, and the applicant concerning an action that may affect a listed species or its designated critical habitat, and are designed to identify and resolve 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 determination by the Service as to whether the action is likely to jeopardize a species or adversely modify critical habitat, and includes

recommendations to minimize expected impacts. Regardless of the type of consultation or proposed project, section 7 consultations can require substantial administrative effort on the part of all participants.

4.1.2 ADMINISTRATIVE SECTION 7 CONSULTATION COSTS

101. While consultations are required for activities that involve a Federal nexus and which may adversely affect the species regardless of whether critical habitat is designated, critical habitat designation may increase the level of consultation effort in cases where a project or activity may also adversely modify critical habitat. Consultations on the four invertebrates may therefore have both baseline and incremental impacts.

102. As noted earlier, three different scenarios associated with the designation of critical habitat may trigger incremental administrative consultation costs:

1. **Additional effort to address adverse modification in a new consultation:** New consultations taking place after critical habitat designation may require additional effort to address critical habitat issues above and beyond the requirements of listing. In this case, only the additional administrative effort required to consider critical habitat is considered an incremental impact of the designation.

2. **Re-initiation of consultation to address adverse modification:** Consultations that have been completed on a project or activity may require re-initiation to address the requirements of critical habitat. In this case, the costs of re-initiating the consultation, including all associated administrative and project modification costs are considered incremental impacts of the designation.

3. **Incremental consultation resulting entirely from critical habitat designation:** Critical habitat designation may trigger additional consultations that would not occur absent the designation (e.g., for an activity for which adverse modification may be an issue, while jeopardy is not, or consultations resulting from the new information about the potential presence of the species provided by the designation). Such consultations may, for example, be triggered in critical habitat areas that are not occupied by the species. In this case, all associated administrative and project modification costs are considered incremental impacts of the designation.

103. The administrative cost estimates presented in this chapter take into consideration the level of effort of the Service, the Action agency, and the applicant (where relevant), as well as the varying complexity of the consultation (see Exhibit 5-1).[73]

[73] The costs per consultation described here assume an average level of effort. To the extent that future consultations are not reflective of this average level of effort, this analysis may under or overestimate administrative impacts of section 7 consultation.

EXHIBIT 4-1. PROJECTED ADMINISTRATIVE COSTS PER CONSULTATION EFFORT, BY ACTIVITY ($2009)[1]

BASELINE ADMINISTRATIVE COSTS OF CONSULTATION ($2009)					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
CONSULTATION CONSIDERING JEOPARDY (DOES NOT INCLUDE CONSIDERATION OF ADVERSE MODIFICATION)					
Technical Assistance	$420	n/a	$788	n/a	$1,130
Informal	$1,840	$2,330	$1,540	$1,500	$7,130
Formal	$4,090	$4,610	$2,630	$3,600	$15,000
Programmatic	$12,300	$10,200	n/a	$4,200	$26,700
INCREMENTAL ADMINISTRATIVE COSTS OF CONSULTATION ($2009)					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
NEW CONSULTATION RESULTING ENTIRELY FROM CRITICAL HABITAT DESIGNATION (TOTAL COST OF A CONSULTATION CONSIDERING BOTH JEOPARDY AND ADVERSE MODIFICATION)					
Technical Assistance	$560	n/a	$1,050	n/a	$1,500
Informal	$2,450	$3,100	$2,050	$2,000	$9,500
Formal	$5,450	$6,150	$3,500	$4,800	$20,000
Programmatic	$16,400	$13,700	n/a	$5,600	$35,700
NEW CONSULTATION CONSIDERING ONLY ADVERSE MODIFICATION					
Technical Assistance	$420	n/a	$788	n/a	$1,130
Informal	$1,840	$2,330	$1,540	$1,500	$7,130
Formal	$4,090	$4,610	$2,630	$3,600	$15,000
Programmatic	$12,300	$10,200	n/a	$4,200	$26,700
RE-INITIATION OF CONSULTATION TO ADDRESS ADVERSE MODIFICATION					
Technical Assistance	$280	n/a	$525	n/a	$750
Informal	$1,230	$1,550	$1,030	$1,000	$4,750
Formal	$2,730	$3,080	$1,750	$2,400	$10,000
Programmatic	$8,200	$6,830	n/a	$2,800	$17,800
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION | (ADDITIVE WITH BASELINE COSTS ABOVE OF CONSIDERING JEOPARDY)					
Technical Assistance	$140	n/a	$263	n/a	$375
Informal	$613	$775	$513	$500	$2,380
Formal	$1,360	$1,540	$875	$1,200	$5,000
Programmatic	$4,100	$3,410	n/a	$1,400	$8,910

Source: IEc analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2009, and a review of consultation records from several Service field offices across the country conducted in 2002.

Notes:

1. Totals may not sum due to rounding.
2. Estimates reflect average hourly time required by staff.

4.2 BLM ADMINISTRATIVE COSTS

104. As noted, the Bureau of Land Management (BLM) manages mineral extraction activities within the Bitter Lake Habitat Protection Zone (HPZ), located in the water resource area surrounding Bitter Lake Refuge. In this role, BLM performs periodic section 7 consultations with the Service and incurs other administrative costs associated with habitat protection and species conservation.

105. BLM incurs several categories of baseline administrative costs to ensure compliance with HPZ requirements:

- **Application to Drill (APD) Review**: Reviewing APDs for activities within the Bitter Lake HPZ requires additional BLM staff effort. BLM estimates that staff efforts for reviewing an APD and preparing an Environmental Assessment total about one half of a staff work month.[74] Multiplying by the estimated number of APDs per year (approximately 0.33) yields an annual cost of $1,300 for reviewing APDs. Thus a total of about $13,800 in administrative expenses, in present value terms, may be incurred by BLM to review APDs within the HPZ over the 20-year study period.
- **Monitoring Program**: BLM's HPZ plan specifies that all new wells be accompanied by a monitoring program designed to ensure well integrity. For example, a BLM petroleum engineer technician must monitor the actual circulation of cement around steel casing. Periodic monitoring of operations is also required to detect oil and gas surface and subsurface contamination. BLM estimates efforts by personnel to ensure well integrity at one to five days per well.[75] Relevant monitoring costs are those associated with the cumulative number of new wells, i.e., 0.33 wells in year one, 0.66 wells in year two, etc., up to a total of approximately seven wells in year 20. The present value of monitoring costs is estimated to range from approximately $11,000 to $57,000. In annualized terms, the costs range from $1,000 to $5,000 per year.
- **Section 7 Consultation**: In the baseline, BLM consults periodically with the Service on resource management actions potentially affecting habitat. For instance, in 2007, BLM and the Service consulted on wildfire risk reduction measures to be implemented in the HPZ. Consultation documents provided by U.S. FWS Region 2 suggest that these consultations occur at the rate of approximately two every seven years. At this rate, the baseline costs associated with these consultations is approximately $1,600 per year, or about $17,000 over the 20-year study period (present value).

106. The designation of critical habitat in and around Bitter Lake NWR would imply two categories of incremental administrative costs related to BLM's management of the HPZ:

[74] One BLM work month is valued at $7,800 (personal communication with Dan Baggao, BLM, December 14, 2009).

[75] Estimated workday cost assumes BLM work-month value of $7,000 and 20 work days per month.

- First, incremental costs could be incurred to address adverse modification in the context of existing consultations. At the current rate of consultation between BLM and the Service, annual costs would total about $500, with a present value of $5,700.
- Second, BLM indicates that designation of critical habitat would necessitate an additional consultation once every five years, the focus of which would be potential impacts to the four invertebrates from drilling operations in the HPZ.[76] The annual cost of this additional consultation would be $1,500, with an estimated present value of $16,000 over the 20-year study period.

107. In total, baseline administrative costs associated with BLM's management of the HPZ total $3,900 to $7,900 annually (about $42,000 to $88,000 in present value terms, using a seven percent discount rate). Incremental costs associated with critical habitat designation total about $2,000 annually (about $22,000 in present value terms, using a seven percent discount rate).

4.3 CAFO-RELATED CONSULTATION COSTS

108. As described earlier, CAFOs in Chaves County that discharge to surface waters will likely apply for inclusion under the newly established general NPDES permit in New Mexico. The general permit approach simplifies the administrative demands of NPDES permitting. In particular, CAFOs on the general permit would not be required to conduct individual consultation with EPA and the Service. Instead, consultation occurs between the Service and EPA each time the general permit is renewed.[77] The permit is renewed every five years, implying a total of four consultations over the 20-year study period. Baseline annual costs of this consultation are approximately $2,500 and present value costs are $26,000. As described earlier, incremental costs are assumed to be incurred as a result of additional effort to address adverse modification. These incremental costs total $820 per year, with a present value of $8,700.

109. Rather than apply for inclusion in the general permit, some CAFOs may pursue individual NPDES permits. First, some CAFOs may be denied inclusion in the general permit because of their potential to affect listed species (as stipulated in the general permit Part I.D.4). In addition, some CAFO owners may choose to obtain an individual permit. Because the general permit was recently introduced, it is not clear the extent to which either of these scenarios will occur. To the extent that individual NPDES permits are issued to CAFOs, we may understate consultation costs.

[76] Personal communication with Dan Baggao, BLM, December 14, 2009.

[77] Personal communication with Richard Powell, New Mexico Environment Department Surface Water Quality Bureau, December 11, 2009.

4.4 INTRA-SERVICE CONSULTATION COSTS

110. Intra-Service section 7 consultations occur regularly between Bitter Lake NWR and staff in the New Mexico Ecological Services Field Office.[78] Most of these consultations are informal and focus on habitat management initiatives and their anticipated implications for the four invertebrates and a variety of other resident species. The management measures examined typically include herbicide application, insecticide application, and wildfire risk reduction. Based on consultation records, ten informal intra-Service consultations took place over the period from 2003 through 2009. This implies an average of approximately 1.4 such consultations per year.

111. In addition, one formal intra-Service consultation was held during the period from 2003 through 2009, the focus of which was application of herbicide to areas infested with Russian knapweed. Hence, this analysis assumes an average of one formal consultation every seven years.

112. Baseline costs associated with the current pattern of intra-Service consultation are approximately $9,000 per year, with a present value of $96,000 over the 20-year study period. As described earlier, incremental costs are assumed to be incurred as a result of additional effort to address adverse modification. These incremental costs total approximately $3,000 per year, with a present value of $32,000.

4.5 SUMMARY

113. Exhibit 4-2 summarizes the baseline and incremental administrative costs associated with the protection of the four invertebrates. All of these costs are associated with the units in and around New Mexico's BLNWR. As shown, baseline administrative costs are primarily associated with intra-Service consultation. Incremental costs total approximately $6,000 per year, and consist primarily of the added effort associated with considering adverse modification in the context of section 7 consultation.

[78] Discussion based on consultation history provided by FWS Region 2 on November 10, 2009.

EXHIBIT 4-2. SUMMARY OF ADMINISTRATIVE COSTS

ACTIVITY/CATEGORY	BASELINE COSTS				INCREMENTAL COSTS	
	ANNUALIZED		PRESENT VALUE		ANNUALIZED	PRESENT VALUE
	Low	High	Low	High		
BLM Administrative Costs	$3,920	$7,920	$42,300	$87,600	$2,050	$21,700
CAFO Consultation Costs	$2,460		$26,100		$820	$8,690
Intra-Service Consultation	$9,080		$96,200		$3,030	$32,100
TOTAL COSTS	$15,500	$19,500	$165,000	$210,000	$5,900	$62,500

Note: Totals may not sum due to rounding.

CHAPTER 5 | ECONOMIC BENEFITS

114. This chapter describes potential economic benefits of critical habitat designation for the four invertebrates. It first describes the categories of economic benefit that may derive from the conservation of species and their habitat, and discusses the research methods that economists employ to quantify these benefits. It then describes the available literature that addresses the economic value of invertebrate populations. Next, this chapter summarizes the conservation efforts described in Chapter 3, linking these efforts with potential ancillary economic benefits that may derive from their implementation. Given data limitations, this chapter does not quantify the potential baseline and incremental benefits described.

5.1 CATEGORIES OF BENEFIT RELATING TO SPECIES AND HABITAT CONSERVATION

115. The primary goal of listing a species is to preserve the species from extinction. Various economic benefits, measured in terms of social welfare or regional economic performance, may also result from species and habitat conservation. The benefits of species and habitat conservation can be placed into two broad categories: (1) those associated with the primary goal of species conservation, and (2) those that derive from the habitat conservation efforts to achieve this primary goal.

116. Because a purpose of the Act is to provide for the conservation of endangered and threatened species, the benefits of actions taken under the Act are often measured in terms of the value placed by the public on species preservation (e.g., avoidance of extinction, and/or increase in a species' population). Such social welfare values for a species may reflect both use and non-use values for the species. Use values derive from a direct use for a species, such as commercial harvesting or recreational wildlife-viewing opportunities. Non-use values are not derived from direct use of the species, but instead reflect the utility the public derives from knowledge that a species continues to exist (e.g., existence or bequest values).

117. As a result of actions taken to preserve endangered and threatened species, such as habitat management, various other benefits may accrue to the public. Conservation efforts for species and habitat may result in improved environmental quality, which in turn may have collateral human health or recreational use benefits. In addition, conservation efforts undertaken for the benefit of a threatened or endangered species may enhance shared habitat for other wildlife. Such benefits may be a direct result of modifications to projects, or may be collateral to such actions. For example, ensuring the quality and quantity of ground and surface water available for invertebrate habitat may enhance the habitat of other aquatic species.

118. Economists apply a variety of methodological approaches in estimating both use and non-use values for species and for habitat improvements, including stated preference and revealed preference methods. Stated preference techniques include the contingent valuation method and conjoint analysis or contingent ranking methods. In simplest terms, these methods employ public opinion survey techniques, asking respondents to state what they would be willing to pay for a resource or for programs designed to protect that resource. A substantial literature has developed that describes the application of this technique to the valuation of natural resource assets.

119. More specific to use values for species or habitats, revealed preference techniques examine individuals' behavior in markets in response to changes in environmental or other amenities (i.e., people "reveal" their value by their behavior). For example, travel cost models are frequently applied to value access to recreational opportunities, as well as to value changes in the quality and characteristics of these opportunities. Basic travel cost models are rooted in the idea that the value of a recreation resource can be estimated by analyzing the travel and time costs incurred by individuals visiting the site. Another revealed preference technique is hedonic analysis, which is often employed to determine the effect of specific site characteristics on property values.

5.2 DIRECT VALUE OF INVERTEBRATE POPULATIONS

120. To the extent that the four invertebrates possess or generate economic value, it is difficult to characterize. Research completed for New Mexico's recovery plan for the four invertebrates indicates that "none of the four species is subject to any major consumptive use nor is any likely to be used for any consumptive purpose in the foreseeable future."[79] Literature searches completed for this analysis identified no reports or articles characterizing the direct economic value (use or non-use) of the four invertebrate species or any other related freshwater gastropod or amphipod species in New Mexico or Texas.

121. Nonetheless, it is possible to assign certain features of economic value to the continued existence of the four invertebrates. The New Mexico Department of Game and Fish points out that "members of the public interested in the state's biodiversity are likely to view the species as interesting and important members of the spring systems…"[80] Therefore, the four invertebrates may support use values for wildlife enthusiasts, particularly if the public is provided greater access to the invertebrates' habitat via foot trails or other means.

122. Furthermore, the four invertebrates play a role in the larger ecological diversity of the proposed habitats. While evidence is limited, studies suggest that the four invertebrates may be a food source for other resident species. A study of the Pecos pupfish (classified as threatened by New Mexico) indicated that it feeds on the springsnails and Noel's

[79] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

[80] New Mexico Department of Game and Fish. Recovery and Conservation Plan for Four Invertebrate Species. Prepared by Blue Earth Ecological Consultants, Inc. January 2005.

amphipod. Shorebirds and other fish species likely prey on the invertebrates as well.[81] As such, conservation of the four invertebrates supports the functioning of the larger ecosystem and enhances the values associated with the larger habitat. These values may include use values such as enjoyment by hikers and naturalists, as well as non-use values associated with maintenance of the ecologically unique spring systems on which the four invertebrates and other species depend.

123. Finally, the four invertebrates may provide direct benefits in their role as an ecological indicator species. Biologists have observed that springsnail populations often signal the health of freshwater habitats.[82] Likewise, because reductions in groundwater flow influence their populations, springsnail species provide a reliable indicator of declining water table levels.[83]

124. It is unlikely that designation of critical habitat will influence the nature or magnitude of the direct benefits associated with four invertebrates conservation. Hence, the benefits described above are likely baseline rather than incremental.

5.3 ANCILLARY BENEFITS OF INVERTEBRATE CONSERVATION EFFORTS

125. The public may realize a separate set of indirect benefits as a result of the efforts associated with four invertebrates conservation. Exhibit 5-1 summarizes conservation efforts and the indirect benefits they may provide. Key indirect benefits include the following:

- Improved groundwater quality associated with oil and gas modifications and CAFO permitting requirements may help avert future drinking water treatment costs.
- Improved groundwater and surface water quality could also benefit human health through reduced drinking water exposures and could reduce exposures through contact recreation (e.g., swimming).
- Improved surface water quality could improve the quality and availability of recreational opportunities; for instance, anglers could realize recreational fishing benefits because of improved catch rates.
- Conservation of groundwater resources achieved through reduced irrigation withdrawals may improve the overall aesthetic quality of nearby spring habitats like Bitter Lake NWR. This may yield social welfare gains measureable through

[81] Ibid.

[82] "Western Springsnails on the Brink of Extinction," The Xerces Society for Invertebrate Conservation, July 28, 2004; accessed online at http://www.xerces.org/2004/07/28/western-springsnails-on-the-brink-of-extinction/ on December 18, 2009.

[83] "Endangered Species Act Protection Sought for 42 Great Basin Spring Snail Species," Center for Biological Diversity, February 17, 2009; accessed online at http://www.biologicaldiversity.org/news/press_releases/2009/great-basin-spring-snails-02-17-2009.html on December 18, 2009.

increased willingness-to-pay to visit the affected conservation areas for recreation.

- To the extent that aesthetic improvements or improved water quality lead to an increase in visitation to affected conservation areas, the economy and employment may benefit from increased regional spending.

126. Furthermore, many of the conservation efforts undertaken for the four invertebrates may also produce improvements to ecosystem health that are shared by other, coexisting species. For example, ensuring spring and stream flows for the invertebrates will benefit other aquatic species sharing the habitat, such as the Pecos gambusia and Leon Springs pupfish, as well as other non-listed species. In Bitter Lake NWR alone, wildlife managers have identified 24 fish species.[84] The maintenance or enhancement of use and non-use values for these other species, or for biodiversity in general, may result from invertebrate conservation efforts.

EXHIBIT 5-1. INVERTEBRATE CONSERVATION EFFORTS AND POTENTIAL INDIRECT BENEFITS

CONSERVATION EFFORT	CRITICAL HABITAT UNITS AFFECTED	POTENTIAL ASSOCIATED BENEFITS
Groundwater protection efforts by oil and gas developers	• BLNWR units • Diamond Y and Sandia Springs	• Improved groundwater quality may help reduce costs of treating municipal and private water withdrawals. • Improved groundwater quality may help avoid human health impacts associated with contaminated drinking water. • Improved groundwater quality may improve the habitat of coexistent species and enhance recreational activity associated with those species.
Added surface water protection efforts associated with NPDES permitting of CAFOs in ecologically sensitive counties	• BLNWR units	• Improved surface and groundwater quality may help reduce costs of treating municipal and private water withdrawals. • Improved surface and groundwater quality may help avoid human health impacts associated with contaminated drinking water and other human exposures (e.g., swimming). • Improved surface and groundwater quality may improve the habitat of coexistent species and enhance recreational activity associated with those species.
Limitation on groundwater withdrawals for irrigation	• BLNWR units • Diamond Y and Sandia Springs	• Protection of groundwater quantity may enhance spring environments and thereby improve the habitat of coexistent species and enhance recreational activity associated with those species. • Conservation of groundwater resources may avert long-term water shortages in the region.

[84] U.S. Fish and Wildlife Service, Bitter Lake National Wildlife Refuge, accessed at http://www.fws.gov/southwest/refuges/newmex/bitterlake/wildlife.html , on December 17, 2009.

127. As reviewed in Chapter 3, all of the conservation efforts pursued on behalf of the four invertebrates are done in response to baseline requirements or conservation agreements, i.e., none are implemented as a result of critical habitat designation. Consistently, the benefits characterized here are baseline in nature.

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APPENDIX A | SMALL BUSINESS ANALYSIS AND ENERGY IMPACTS ANALYSIS

1. This appendix considers the extent to which incremental impacts from critical habitat designation may be borne by small entities and the energy industry. The analysis presented in Section A.1 is conducted pursuant to the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996. The energy analysis in Section A.2 is conducted pursuant to Executive Order No. 13211.

2. The analyses of impacts to small entities and the energy industry rely on the estimated incremental impacts resulting from the proposed critical habitat designation. The incremental impacts of the rulemaking are most relevant for the small business and energy impacts analyses because they reflect costs that may be avoided or reduced based on decisions regarding the composition of the final rule. The future baseline impacts associated with the listing of the four invertebrates and other Federal, State, and local regulations and policies, as quantified in this report, are expected to occur regardless of the outcome of this rulemaking.

A.1 SBREFA ANALYSIS

3. In the context of critical habitat economic analyses, the SBREFA analysis focuses on the extent to which the proposal poses incremental costs affecting small private entities. The current proposal to designate critical habitat for the four invertebrates, however, poses no incremental costs to private entities. All of the product modification and conservation costs identified in the economic analysis represent baseline costs that would be realized in the absence of critical habitat. Several factors eliminate the potential for incremental costs among private entities:

- Conservation measures implemented by New Mexico oil and gas firms are pursued in compliance with BLM's Bitter Lake Habitat Protection Zone requirements. Likewise, modifications pursued by oil and gas developers on private land near the TNC units are already implemented for the benefit of various listed species in the immediate area.
- All of the proposed critical habitat is occupied. Therefore, ongoing project modifications and conservation measures are already required to satisfy the jeopardy standard.
- Most of the proposed critical habitat is already held in conservation. The small portion of proposed habitat owned by the City of Roswell has already been

designated as critical habitat for the Pecos sunflower and is unsuitable for development.

- Habitat management costs are attributable to existing conservation agreements and are therefore classified as baseline costs.
- Most section 7 consultation would be pursued in the absence of critical habitat. To the extent that incremental costs are introduced, they are borne by public agencies rather than private entities.

4. Consistent with these conditions, the Service's incremental memorandum observes that critical habitat designation for the four invertebrates is unlikely to produce project modifications different from those already required under the jeopardy standard.[1] Because the proposed habitat designation introduces no incremental costs for private entities, small business impacts are not expected.

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."[2]

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 kilowatts-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

[1] U.S. Fish and Wildlife Service, "Incremental effects memorandum for the economic analysis of the proposed rule to revise critical habitat for four southwest invertebrate species," May 21, 2010.

[2] 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.

- Other similarly adverse outcomes.[3]

7. Two of these criteria are relevant to this analysis: (1) reduction in natural gas production in excess of 25 million Mcf per year; and (2) increases in the cost of energy production in excess of one percent.

8. The proposed CHD is not anticipated to impact natural gas production in excess of 25 million mcf per year:

   - First, affected wells in the Bitter Lake Habitat Protection Zone (HPZ) represent a small share of gas production in New Mexico. The baseline cost of modifications to drilling activities within the HPZ could increase drilling costs by approximately 10 to 20 percent per well. These modifications could potentially increase capital costs or administrative burden up to the point where an operator may decide not to drill a well. An estimated seven wells will require additional project modifications to ensure well integrity. In 2007, there were 42,644 producing gas wells in New Mexico that produced a total of 1,555,618 million cubic feet of natural gas.[4] Thus, the potential yield of the seven impacted wells within the Bitter Lake Habitat Protection Zone represents a small percentage of total State natural gas production. Even if all seven drilling operations were canceled, this represents less annual production than the 25 million mcf per year threshold.

   - Furthermore, drilling modifications costs are part of *baseline* costs associated with four invertebrates conservation. As explained earlier, no *incremental* costs are anticipated for the oil and gas industry as a result of critical habitat designation. Hence, the proposed designation effectively has no impact on natural gas production.

9. Likewise, while drilling modifications increase operating costs to producers within the Bitter Lake Habitat Protection Zone, the proposed rule is not anticipated to result in increases in the cost of energy production in excess of one percent within the state of New Mexico. As noted above, there are approximately 42,644 gas wells in New Mexico that produced a total of 1,555,618 million cubic feet of natural gas in 2007. The seven wells realizing increased drilling costs represent 0.02 percent of all wells in New Mexico. Therefore, it is highly unlikely that the industry would realize a one percent increase in energy production costs statewide. Furthermore, as noted, all modification costs are *baseline* costs rather than incremental costs associated with critical habitat designation. Hence, the proposed designation effectively has no impact on energy production costs.

[3] Ibid.

[4] Energy Information Administration, "Number of Producing Gas Wells," and " Natural Gas Gross Withdrawals and Production," accessed online at http://www.eia.doe.gov/oil_gas/natural_gas/info_glance/natural_gas.html , on January 5, 2010.

APPENDIX B | 2005 ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE ROSWELL SPRINGSNAIL, KOSTER'S SPRINGSNAIL, PECOS ASSIMINEA, AND NOELS AMPHIPOD

ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE ROSWELL SPRINGSNAIL, KOSTER'S SPRINGSNAIL, PECOS ASSIMINEA, AND NOEL'S AMPHIPOD

July 2005

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EXECUTIVE SUMMARY

1. The purpose of this report is to assess the potential economic impacts associated with the designation of critical habitat for the Roswell springsnail, Koster's springsnail, Pecos assiminea, and Noel's amphipod (four invertebrates) and their habitat. This analysis is consistent with the designation as described in the proposed rule. As such, this analysis does not reflect potential changes to the proposed critical habitat designation (CHD) in the final rule. Description of the critical habitat in the final rule may consequently differ from that presented in this analysis. This report was prepared by Industrial Economics, Incorporated for the Service.

2. This report attempts to quantify the economic effects associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries.

3. The four invertebrates are aquatic species native to natural springs, sinkholes, and associated spring runs in dry regions of Chaves County, New Mexico and Pecos and Reeves Counties, Texas. The Service has proposed to designate four units of critical habitat for the four invertebrates. The proposed units encompass 1,524 acres of land within Bitter Lake National Wildlife Refuge in Chaves County, New Mexico and on The Nature Conservancy lands in Pecos and Reeves Counties. All lands proposed as critical habitat are currently occupied by at least one of these invertebrate species.

4. Approximately 74 percent of the proposed CHD occurs on the Bitter Lake National Wildlife Refuge, a refuge managed by the Service to protect and provide habitat for a number of species. The remaining 26 percent of the proposed CHD occurs on lands managed by The Nature Conservancy as preserves.

5. Section 4(b)(2) of the Endangered Species Act (Act) requires the Service to designate critical habitat on the basis of the best scientific data available, after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. The Service may exclude areas from critical habitat designation when the benefits of exclusion outweigh the benefits of including the areas within critical habitat, provided that exclusion will not result in extinction of the species.

Results of the Analysis

6. This analysis considers impacts of conservation measures within Units 1 and 2, both managed by the Bitter Lake National Wildlife Refuge in New Mexico and separated by a few hundred meters, and within Units 3 and 4, which are both managed by The Nature Conservancy in Texas. This analysis focuses on quantifying impacts to activities most likely to be affected by the proposed critical habitat designation. These activities include:

   - Oil and gas development within the Bureau of Land Management's (BLM) Bitter Lake Habitat Protection Zone in Chaves County, New Mexico;

- Livestock operations within Chaves County, NM; and
- Federal, State, and The Nature Conservancy management activities within Chaves County, NM and Pecos and Reeves Counties, TX.

7. This analysis also examines activities that have the potential to be impacted by the proposed designation, but given uncertainties as to the nature of these impacts and future management direction, these impacts are not quantified. These activities include:

- Oil and gas development on private lands in New Mexico and Texas;
- Irrigated agricultural production within New Mexico and Texas; and
- Expanding urban development within Chaves County, NM.

8. This analysis considers the economic impacts of conservation measures taken prior to and subsequent to the final listing and designation of critical habitat for the four invertebrates. Pre-designation impacts are typically defined as all management efforts that have occurred since the time of listing. The four invertebrates have not been listed, but were proposed for listing in February 2002. Since the proposed listing and designation of critical habitat of the four invertebrates, approximately **$336,000 to $494,000** (in present value terms for 2002 through 2004, assuming a seven percent discount rate) in costs have been incurred related to Bitter Lake National Wildlife Refuge conservation measures and the development of a Recovery and Conservation Plan for the four invertebrate species by the State of New Mexico.

9. The present value of total post-designation costs is approximately **$3.8 million to $7.5 million** (assuming a seven percent discount rate), or an annualized cost of $352,000 to $691,000 from 2005 to 2025. Approximately 81 percent of these costs are associated with impacts to oil and gas activities on BLM lands within the Bitter Lake Habitat Protection Zone. Federal, State and The Nature Conservancy management activities are expected to generate 15 percent of total forecast costs.

- **Oil and Gas Development:** Impacts to oil and gas activities are estimated at $2.7 million to $6.1 million in present value terms (assuming a seven percent discount rate) or an annualized cost of up to $561,000 from 2005-2025. This is 81 percent of total forecast costs. These costs are associated with drilling modifications in complying with the BLM Bitter Lake Habitat Protection Zone stipulations to prevent groundwater contamination within the aquifer on which the four invertebrates depend in Units 1 and 2. A maximum of 63 wells within the Bitter Lake Habitat Protection Zone will be required to comply with additional drilling modifications. While these project modifications may increase drilling costs by up to 20 percent per well, the number of impacted wells represents about four percent of all wells on Federal, State, and private land in Chaves County and under 0.2 percent of total producing natural gas wells within the State of New Mexico. The potential annual production of these 63 wells would represent less than four percent of total annual natural gas production in Chaves County (a total of 30,000,000 thousand cubic feet

in 2004).[1] Thus, overall impacts to the regional oil and gas economy are likely to be small. Similar impacts could occur to oil and gas developments on private and State lands in New Mexico and Texas. However, currently no additional State protective measures on drilling operations to ensure protection to aquatic species are anticipated.

- **Livestock Operations:** Impacts to livestock operations are estimated to range from $91,000 to $257,000 from 2005-2025 (assuming a seven percent discount rate) or an annualized cost of up to $24,000. Costs are anticipated to be incurred as a result of section 7 consultation on Concentrated Animal Feeding Operations (CAFOs) within Chaves County, New Mexico. This analysis assumes that every CAFO facility within Chaves County will need to ensure that operational discharges avoid or eliminate impacts to the four invertebrates and their habitat. This will most likely be ensured associated with the facility's securing of a wastewater discharge permit through either through EPA or that State.[2]

- **Federal, State, and The Nature Conservancy management activities.** An estimated $1,053,000 (in present value terms assuming a seven percent discount rate), an annualized cost of $107,000, comprising 15 percent of total costs, is anticipated to be incurred due to conservation management activities that benefit the four invertebrates over from 2005 to 2025. These activities include biological monitoring and habitat enhancement projects.

10. Impacts to irrigated agriculture and urban development activities have the potential to occur as a result of the proposed CHD. However, given uncertainties in the nature of these impacts and future management directions, this analysis is unable to provide a quantitative estimate of impacts to these activities.

- **Irrigated Agricultural Production.** Within New Mexico, conservation management techniques are currently in place that will ensure minimum surface water discharge at Units 1 and 2. In 1996, Bitter Lake National Wildlife Refuge gained legal assurance of sufficient water in its aquatic habitats. Moreover, the state of New Mexico is currently in process of retiring water rights of irrigated farmland adjacent to Units 1 and 2 to ensure water compact deliveries to Texas. Within Texas, further hydrological studies are necessary to determine the impact of groundwater pumping on surface and groundwater levels at Units 3 and 4. Thus, impacts to irrigated agriculture on private lands may occur but are unlikely given present conditions.

- **Expanding urban development**. Development concerns within Bitter Lake National Wildlife Refuge are more directly related to the potential for groundwater contamination from septic tanks constructed in Chaves County than to groundwater

[1] Go-Tech General Production Data, accessed at http://octane.nmt.edu/data/ongard/general.asp.

[2] The State of New Mexico is currently pursuing authorization for primacy for the NPDES permit program from EPA, New Mexico Environmental Department of Surface Water Quality, accessed at http://www.nmenv.state.nm.us/swqb/NPDES.

withdrawals for municipal use. Currently, it is unknown whether modifications to septic tank construction on private lands will be required to provide additional protection for the four invertebrates. Therefore, the potential impact of the proposed designation on residential development cannot be quantified. Within Texas, regional groundwater quantity and quality concerns are more directly related to oil and gas development and irrigated agriculture than to municipal water needs.

11. Approximately 91 percent of forecast costs are related to activities occurring within and adjacent to Units 1 and 2 in Chaves County, New Mexico. The remaining 9 percent of estimated costs are related to activities occurring within and adjacent to Units 3 and 4 in Pecos and Reeves Counties, Texas.

12. The economic impacts of conservation efforts for the four invertebrates will be manifested primarily as increased costs for private parties via consultations with Federal Agencies (80 percent). The BLM is anticipated to bear two percent of the total cost of four invertebrates conservation; the Service, five percent; the state of New Mexico, four percent; and The Nature Conservancy, nine percent. Consultations that may involve private entities include those related to oil and gas drilling operations within the BLM's Habitat Protection Zone in Chaves County and livestock operations within Chaves County. Exhibit ES-1 and ES-2 provide a tabular and graphical distribution of estimated present value costs (assuming a seven percent discount rate). Exhibit ES-3 presents estimated costs by proposed critical habitat unit.

Exhibit ES-1

SUMMARY OF ESTIMATED ADMINISTRATIVE AND PROJECT MODIFICATION COSTS ASSOCIATED WITH EACH PARTY

Cost Category	**Administrative**		**Project Modification**		**Total**		**% Total**
	Low	**High**	**Low**	**High**	**Low**	**High**	
Service	$69,000	$232,000	$151,000	$162,000	$219,000	$394,000	5%
Other Federal Agencies	$15,000	$44,000	$52,000	$102,000	$67,000	$147,000	2%
State and Local Governments	$34,000	$101,000	$164,000	$170,000	$197,000	$271,000	4%
The Nature Conservancy	$0	$0	$707,000	$707,000	$707,000	$707,000	9%
Private Entities	$31,000	$75,000	$2,588,000	$5,892,000	$2,619,000	$5,967,000	80%
Total	**$148,000**	**$453,000**	**$3,661,000**	**$7,034,000**	**$3,809,000**	**$7,486,000**	**100%**

*Note totals may not sum due to rounding.

Exhibit ES-2

SUMMARY OF TOTAL ESTIMATED COSTS ASSOCIATED WITH EACH PARTY

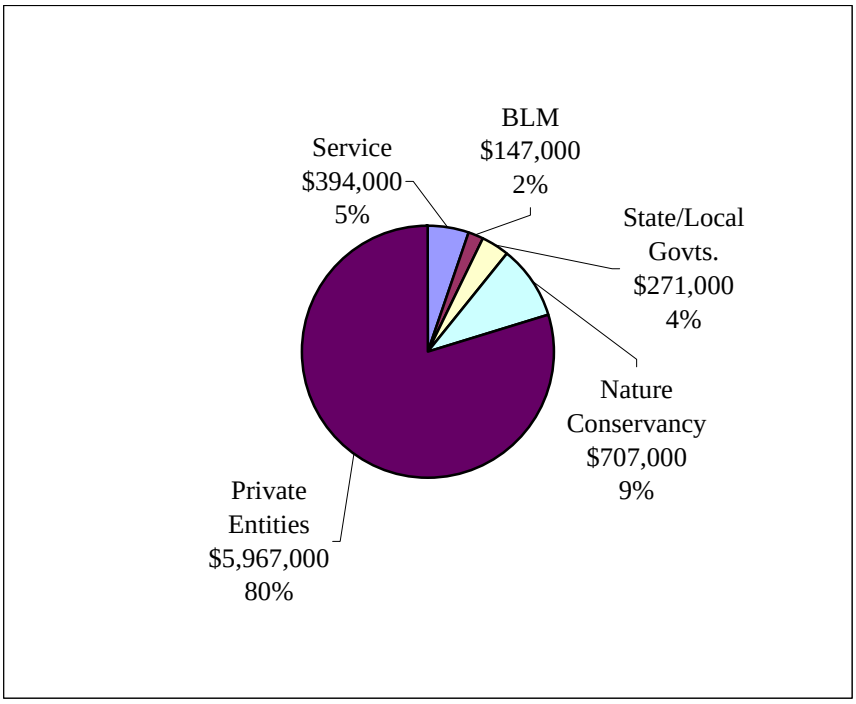
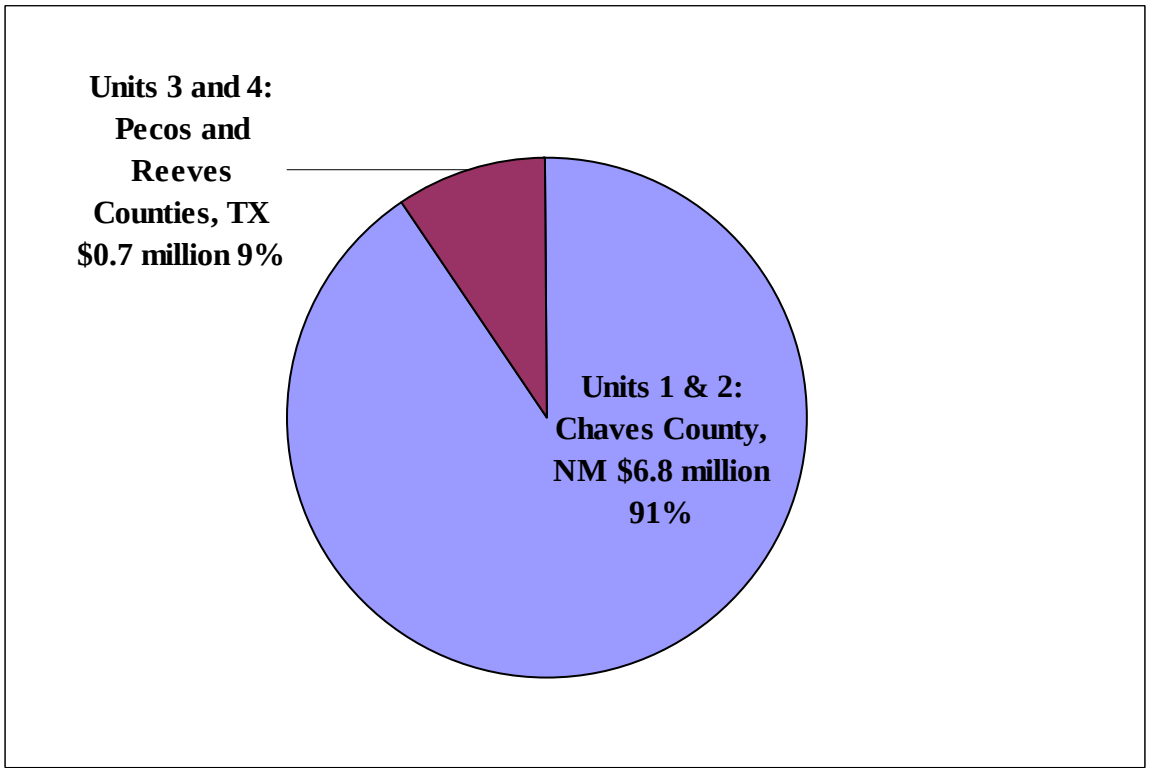


Exhibit ES-3

SUMMARY OF COSTS BY UNIT



13. Economic impacts to the oil and gas industry may translate into impacts to small oil and gas entities operating within the Bitter Lake Habitat Protection Zone and in Chaves County. However, given the large number of oil and gas businesses within New Mexico and that many regional oil and gas businesses operate outside of Chaves County, the number of potentially affected small businesses will be a small percentage of all small oil and gas entities in New Mexico. No impacts to small entities within the irrigated agricultural industry are expected, as groundwater withdrawal activities for agricultural production are unlikely to change as a result of critical habitat for the four invertebrates. In the event that CAFO operators are required to implement additional measures to ensure groundwater protection within the aquifer on which the four invertebrates depend, small entities within the livestock operations industry may be impacted by the proposed designation. Significant impacts to the energy sector are not expected as a result of the proposed critical habitat designation. The yield of the potentially impacted wells within the Bitter Lake Habitat Protection Zone represents a small percentage of total State natural gas production. Moreover, increased drilling costs for wells within the Bitter Lake Habitat Protection Zone are not likely to translate in a one percent increase in energy production costs across the state of New Mexico.

14. Exhibit ES-4 provides an overview of the present value of costs associated with conservation efforts for the four invertebrate species over the next 20 years. To discount and annualize costs, guidance provided by the Office of Management and Budget (OMB) specifies the use of a real rate of three and seven percent.[3]

Exhibit ES-4

PRESENT VALUE OF TOTAL ECONOMIC COSTS (2005 - 2025)

	Total Cost	
	Low	**High**
Total Activity Cost	$6,734,000	$13,389,000
Present Value (7%)	$3,809,000	$7,486,000
Present Value (3%)	$5,143,000	$10,176,000
Annualized (7%)	$352,000	$691,000
Annualized (3%)	$334,000	$660,000

Uncertainties

15. Exhibit ES-5 presents several key assumptions that introduce uncertainty into this economic analysis of four invertebrate species conservation efforts, as well as the potential direction and relative scale of bias introduced by the assumption.

[3] A real discount rate is adjusted to eliminate the effect of expected inflation to discount constant-dollar or real benefits and costs.

Exhibit ES-5 **CAVEATS TO THE ECONOMIC ANALYSIS**	
Key Assumption	**Effect on Cost Estimate**
The presence of other threatened and endangered species (i.e., Pecos gambusia and Leon Springs pupfish) will have no influence on the cost of conservation efforts for the four invertebrates.	+
The BLM Habitat Protection Zone groundwater protection requirements for drilling operations for the Pecos gambusia will adequately address four invertebrates concerns (i.e., no additional modifications will be required for the four invertebrates). Note that costs on drilling operations associated with the Pecos gambusia are included in the analysis.	-
Federally reserved water rights at Bitter Lake National Wildlife Refuge will ensure minimum surface water discharge at Units 1 and 2.	-
Oil and gas activities occurring on private lands surrounding the proposed CHD will not be impacted by the proposed rule.	-
Decisions by operators not to drill on leased lands within the Habitat Protection Zone will result mainly in increased compliance costs, and not in regional economic impacts.	-
Every CAFO facility within Chaves County, New Mexico will need to ensure that operational discharges avoid impacts to the four invertebrates and their habitat. This will most likely be ensured with the facility's securing of a wastewater discharge permit through either the EPA or State as described in Section 4.2.2.	+
No Habitat Conservation Plans will be developed by non-Federal entities for the four invertebrate species.	-
- : This assumption may result in an underestimate of real costs. + : This assumption may result in an overestimate of real costs. +/- : This assumption has an unknown effect on estimates.	

FRAMEWORK FOR THE ANALYSIS SECTION 1

16. The purpose of this analysis is to estimate the economic impact of actions taken to protect the Roswell springsnail, Koster's springsnail, Pecos assiminea, and Noel's amphipod (four invertebrates) and their habitat. This report attempts to quantify the economic effects associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. Costs are examined that (a) have been incurred since the date the species was proposed for listing and through the final designation of critical habitat (pre-designation costs), and (b) are forecast to occur after the listing designation is finalized (post-designation costs).

17. This analysis is consistent with the designation as described in the proposed rule. As such, this analysis does not reflect potential changes to the proposed CHD in the final rule. Description of the habitat designation in the final rule may consequently differ from that presented in this analysis.

18. This information is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.[4] 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).[5] This report also complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[6]

[4] 16 U.S.C. §1533(b)(2).

[5] 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.

[6] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed critical habitat designation, 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)).

19. This section provides the framework for this analysis. First, it describes the general analytic approach to estimating economic effects, including discussion of both efficiency and distributional effects. Next, it discusses the scope of the analysis, including the link between existing and critical habitat-related protection efforts and economic impacts. Finally, it describes the information sources employed to conduct this analysis.

1.1 Approach to Estimating Economic Effects

20. This economic analysis considers both the economic efficiency and distributional effects that may result from species and habitat protection. Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if activities on private lands 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 habitat conservation.

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

22. Where data are available, the analysis attempts to capture the net economic impact imposed on regulated entities and the regional economy of conservation actions for the four invertebrates. That is, the economic impact of species conservation to the land management agencies and regulated community net of any direct off-setting benefit they experience.

1.1.1 Efficiency Effects

23. 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 discern the implications on a societal level of a regulatory action. For regulations specific to the conservation of the four invertebrates, 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 surplus in affected markets.[7]

24. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a landowner or manager 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 his or her land not been designated critical habitat. In the case that 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 provides a reasonable estimate of the change in economic efficiency.

25. 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 real estate market.

26. This analysis begins by measuring costs associated with measures taken to protect species and habitat. As noted above, in some cases, compliance costs can provide a reasonable estimate of changes in economic efficiency. In the case of the four invertebrates, compliance costs are expected to represent a reasonable estimate of efficiency effects, and thus impacts on consumer and producer surpluses in affected markets are considered but not estimated.

1.1.2 Distributional and Regional Economic Effects

27. Measurements of changes in economic efficiency focus on the net impact of conservation activities, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.[8] This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally different measures of economic impact than efficiency effects,

[7] 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. 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

[8] 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.

and thus cannot be added to or compared with estimates of changes in economic efficiency.

Impacts on Small Entities and Energy Supply, Distribution, and Use

28. This analysis considers how small entities, included small businesses, organizations, and governments, as defined by the RFA, may be affected by proposed critical habitat designation.[9] In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the impacts of critical habitat on the energy industry and its customers.[10] While small business impacts are discussed, significant impacts on the energy sector are not expected. See Appendix A for an analysis of impacts to small businesses and the energy industry.

Regional Economic Effects

29. Regional economic impact analysis can provide an assessment of the potential localized effects of conservation measures. Specifically, regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using input/output models. These models rely on multipliers that represent the relationship between a change in one sector of the economy (e.g., expenditures by recreationists) and the effect of that change on economic output, income, or employment in other local industries (e.g., suppliers of goods and services to recreationists). These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.

30. The use of regional input/output models in an analysis of the impacts of species and habitat conservation efforts can overstate the long-term impacts of a regulatory change. Most importantly, these models provide a static view of the economy of a region. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response to this change. For example, these models provide estimates of the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by affected businesses. In addition, the flow of goods and services across the regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.

31. Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of

[9] 5 U.S.C. § 601 *et seq.*

[10] Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001.

distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

1.2 Scope of the Analysis

32. This analysis identified those economic activities believed to be most likely to threaten the listed species and their habitat and, where possible, quantifies the economic impact to avoid, mitigate, or compensate for such threats within the boundaries of the proposed CHD. 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 coextensive with the designation.[11,12]

33. 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. We note that 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 contributes to the efficacy of the CHD efforts, 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.

1.2.1 Sections of the Act Relevant to the Analysis

34. The analysis begins by looking at the costs incurred since the time that the four invertebrate species were proposed for listing in February 2002 and through the time of the listing and final designation of critical habitat. It focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act. It then looks at activities likely to occur post-designation, and quantifies the effects that sections 4, 7, 9, and 10 of the Act may have on those activities.

35. Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as the designation of critical habitat. According to section 4,

[11] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable coextensively to other causes (New Mexico Cattle Growers Association v. USFWS, 248 F.3d 1277 (10th Cir. 2001)).

[12] In 2004, the U.S. 9th Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat (Gifford Pinchot Task Force v. USFWS). 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.

the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."[13]

36. The protections afforded to threatened and endangered species and their habitat are described in sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections are the focus of this analysis:

- 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 the species' designated critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent compliance costs associated with the listing of the species and the designation of critical habitat.

- 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." The economic impacts associated with this section manifest themselves in sections 7 and 10.

- Under section 10(a)(1)(B) of the Act, a non-Federal entity (i.e., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for a threatened or endangered species in order to meet the conditions for issuance of an incidental take permit.[14] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs. All lands proposed for designation for the four invertebrates are Federally-owned or managed by The Nature Conservancy. HCPs are not currently anticipated to be developed by non-Federal entities for the four invertebrate species.

1.2.2 Other Relevant Protection Efforts

37. 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. In addition, under certain circumstances, the designation of 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 may not

[13] 16 U.S.C. 1533.

[14] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning." From: http://endangered.fws.gov/hcp/, as viewed on August 6, 2002.

have been triggered absent the designation of critical habitat, they are included in this economic analysis.

1.2.3 Additional Analytic Considerations

38. Previous economic impact analyses prepared to support critical habitat decisions have considered other types of economic impacts related to the critical habitat designation, including time delay, regulatory uncertainty, and stigma impacts. This analysis considers these types of economic impacts and has determined that the proposed habitat designation for the four invertebrates is unlikely to have economic impacts of this nature.

Time Delay and Regulatory Uncertainty Impacts

39. Time delays are costs due to 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 their responsibilities with regard to critical habitat designation).

Stigma Impacts

40. Changes to private property values associated with public attitudes about the limits and costs of critical habitat designation are known as "stigma" impacts.

1.2.4 Benefits

41. Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.[15] 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. [16]

42. In the context of CHD, 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 conduct new research.[17] *Rather than rely on economic measures, the Service believes*

[15] Executive Order 12866, September 30,1993, "Regulatory Planning and Review."

[16] 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.

[17] 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.

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.

43. 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 increased recreational opportunities 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.

44. It is often difficult to evaluate the ancillary benefits of critical habitat designation. To the extent that the ancillary benefits of the rulemaking may be captured by the market though an identifiable shift in resource allocation, they are factored into the overall economic impact assessment in this report. For example, if decreased off-road vehicle use to improve species habitat leads to an increase in opportunities for wildlife viewing or hiking within the region, the local economy may experience an associated measurable, positive impact. Where data are available, this analysis attempts to capture the *net* economic impact (i.e., the increased regulatory burden less any discernable offsetting market gains), of species conservation efforts imposed on regulated entities and the regional economy.

1.3 Analytic Time Frame

45. The analysis examines activities taking place both within and adjacent to the proposed designation. Estimates of post-designation impacts are 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. The analysis estimates economic impacts to activities from 2005 (anticipated year of species' final listing) to 2025 (twenty years from the year of final designation).

1.4 Information Sources

46. The primary sources of information for this report were communications with and data provided by:

- U.S. Fish and Wildlife Service (Service);
- Bureau of Land Management (BLM);
- The Nature Conservancy (Conservancy);
- Natural Resources Conservation Service (NRCS);
- Environmental Protection Agency (EPA);
- U.S. Army Corps of Engineers (USACE);
- New Mexico Department of Game and Fish (Department);
- New Mexico State Interstate Stream Commission (ISC);

- New Mexico Environmental Department (NMED);
- New Mexico Oil Conservation Division;
- Railroad Commission of Texas;
- Texas Commission on Environmental Quality (TCEQ);
- Chaves County Planning and Zoning Department; and
- Private and Federal Petroleum Engineers.

47. Publicly available data were also used to augment the economic analysis. This report further addresses issues and new information raised during the public comment period for the draft version of this analysis. Please refer to the reference section at the end of this document for a full list of information sources.

BACKGROUND **SECTION 2**

48. The Service has proposed to designate critical habitat for the proposed Federally endangered the Roswell springsnail, Koster's springsnail, Pecos assiminea, and Noel's amphipod, hereafter referred to as the "invertebrate species" or "four invertebrates". This section provides background on the geography, ecology, and human-uses of the proposed critical habitat designation. It details the current state of the proposed lands, including a description of management activities, land ownership, and ecology of the area.

2.1 Species and Designation[18]

2.1.1 Description of Species

49. Roswell springsnail (*Pyrgulopsis roswellensis*), Koster's springsnail (*Juturnia kosteri*), Pecos assiminea (*Assiminea pecos*), and Noel's amphipod (*Gammarus desperatus*) are aquatic species native to natural springs, sinkholes, and associated spring runs in dry regions of Chaves County, New Mexico and Pecos and Reeves Counties, Texas. They are found at two sites in Chaves County, New Mexico, one site in Pecos County, Texas, and one site in Reeves County, Texas. These three snails and one amphipod have an exceedingly limited distribution. The snails are distributed in geographically separate populations and likely evolved from parent species that once enjoyed a wide distribution during wetter, cooler climates.

2.1.2 Description of Designation[19]

50. The Service has proposed to designate four units of critical habitat for these four invertebrates, encompassing a total of 1,524 acres. All of the proposed critical habitat units are currently occupied by at least one of these invertebrate species, and all four are also currently inhabited by at least one other Federally listed endangered species. Descriptions of each critical habitat unit are provided below:

- **Unit 1: Sago/Bitter Creek Complex, Bitter Lake National Wildlife Refuge (Bitter Lake NWR), Chaves County, New Mexico.** Sago Spring, Bitter Creek, and the

[18] U.S. Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants; Listing Roswell springsnail, Koster's springsnail, Pecos assiminea, and Noel's amphipod as Endangered With Critical Habitat*, Federal Register, Vol. 67, No. 29, February 12, 2002.

[19] Ibid.

adjacent gypsum sinkholes comprise the core population center for all four species. The proposed designation includes all springs, seeps, sinkholes, and outflows surrounding Bitter Creek and the Sago Spring Complex. This 521 acre designation is also home to the Federally listed Pecos gambusia, Interior least tern, and Pecos sunflower. It is entirely within the Federally managed Bitter Lake NWR.

- **Unit 2: Impoundment Complex, Bitter Lake NWR, Chaves County, New Mexico.** This complex includes portions of impoundments 3, 5, 6, 7, 15, and Hunter Marsh. This is a another population center for all four invertebrates, with Koster's springsnail being the principal species present. The proposed designation includes all springs, seeps, sinkholes, and outflows surrounding the Bitter Lake NWR impoundments. This 606 acre designation is also home to the Federally listed Pecos gambusia, Interior least tern, and Pecos sunflower. It is entirely within the Bitter Lake NWR.

- **Unit 3: Diamond Y Springs Complex, Pecos County, Texas.** Unit 3 comprises a major population of Pecos assiminea. The proposed designation includes the Diamond Y Spring and approximately 6.8 kilometers (km) or 4.2 miles (mi.) of its outflow ending approximately 0.8 km downstream of the State Highway 18 bridge crossing. Also included is approximately 0.8 km of Leon Creek upstream of the confluence with Diamond Y Draw. All surrounding riparian vegetation and mesic soil environments within the spring, outflow, and portion of Leon Creek are also proposed for designation, as these areas are considered habitat for the Pecos assiminea. This designation incorporates approximately 380 acres of aquatic and neighboring mesic habitat that is also home to the Federally endangered Pecos gambusia, Leon Springs pupfish and Pecos sunflower. The property is owned by The Nature Conservancy.

- **Unit 4: East Sandia Spring, Reeves County, Texas.** This spring contains a population of Pecos assiminea. The proposed designation includes the springhead itself, surrounding seeps, and all submergent vegetation and moist soil habitat found at the margins of these areas. These areas are considered habitat for the Pecos assiminea. This designation is approximately 16.5 acres of aquatic and neighboring upland habitat that is also home to the Federally listed Pecos gambusia, Comanche Springs pupfish, and Pecos sunflower. The property is owned by The Nature Conservancy.

Exhibit 2-1

LAND OWNERSHIP WITHIN PROPOSED CHD FOR THE FOUR INVERTEBRATES

Owner	**Units 1 & 2 New Mexico**	**Units 3 & 4 Texas**	**Total**
Federal Land (National Wildlife Refuge)	1,127 acres	None	1,127 acres
Private Land (The Nature Conservancy)	None	396.5 acres	396.5 acres
Total	**1,127 acres**	**396.5 acres**	**1,523.5 acres**
Percent of Total	**74%**	**26%**	**100%**

2.1.3 Overlap with Other Endangered Species

51. Exhibit 2-2 lists a number of endangered and threatened species that are known to inhabit the proposed critical habitat units. Section 7 consultations regarding a proposed action consider all listed species that may be affected by the action. As a result, section 7 consultations for the four invertebrates may also consider other listed species that occur within the proposed CHD. Many management actions within and adjacent to the proposed CHD have been directed towards Pecos gambusia and Leon Springs pupfish recovery and protection. Costs of habitat restoration projects driven by efforts to preserve these species' habitat that may benefit the four invertebrates are considered in this analysis. To the extent possible, this analysis distinguishes costs related specifically to four invertebrates' conservation where multiple species are subject of a single conservation effort or section 7 consultation. In the case that another species clearly drives a project modification or conservation effort, the associated costs are appropriately not attributed to the four invertebrates. Where it is unclear which species is the causative factor or a particular conservation effort that benefits multiple species, this analysis includes the full costs and acknowledges the multiple considerations that may contribute to the undertaking of that conservation effort.

Exhibit 2-2

OVERLAP WITH OTHER THREATENED AND ENDANGERED SPECIES

Unit	Category	Common Name	Scientific Name	Status
1 & 2	Bird	Interior least tern	*Sterna antillarum*	Federally endangered
1, 2, 3 & 4	Fish	Pecos gambusia	*Gambusia nobilis*	Federally endangered
1, 2, & 4	Plant	Pecos sunflower	*Helianthus paradoxus*	Federally threatened
3	Fish	Leon Springs pupfish	*Cyprinodon bovinus*	Federally endangered with critical habitat
4	Fish	Comanche Springs pupfish	*Cyprinodon elegans*	Federally endangered

2.2 Land Use Activities in the Proposed Critical Habitat Designation

52. The Service has identified the following activities that may occur within or adjacent to the proposed CHD as potentially affecting the conservation status of the species or their habitat: oil and gas development, irrigated agricultural and livestock activities, residential and commercial development, and to a lesser extent, road construction and maintenance. Federal, State, and The Nature Conservancy land management activities also occur within or adjacent to the proposed CHD. These management activities include projects that benefit the four invertebrate species, including nonnative vegetation control, fire suppression, controlled burns, water control structures, and habitat enhancement projects.

53. This analysis focuses on the following activities identified as the most likely to be affected by CHD for the four invertebrates. These activities include oil and gas extraction and development, livestock activities, and Federal, State, and The Nature Conservancy lands management. The analysis also examines activities that have the potential to be impacted by the proposed designation but given uncertainties as to the scale of these impacts and future management directions, these impacts are not quantified. These activities include irrigated agricultural production and expanding urban development. Each of these activities is discussed further in Sections 3 and 4.

SOCIOECONOMIC PROFILE SECTION 3

54. This section summarizes key economic and demographic information for the counties likely to be impacted by the proposed CHD for the four invertebrates. County level data are presented to provide context for the discussion of economic impacts and to illuminate trends that may influence these impacts.

55. To provide context and comparison for the economic analysis, this section first provides demographic information for Chaves County, New Mexico and Pecos and Reeves Counties, Texas, and then details economic activities taking place within and surrounding the proposed CHD.

3.1 Economic Profile of Chaves County, New Mexico and Pecos and Reeves Counties, Texas

56. The proposed CHD for the four invertebrates covers 1,127 acres within Chaves County, New Mexico and 396.5 acres within Pecos and Reeves Counties, Texas. The principal employment sectors in the three counties consist of government, health care and social assistance services, and trade, transportation, and utilities.

3.1.1 Population Patterns

57. In 2000, Chaves County had a population of 61,382, a 6.1 percent increase from a population of 57,849 in 1990. The County is anticipated to grow moderately over the next decade, with population projected to increase by 10 percent by 2020. Roswell, the County's largest city, had a population of 45,293 in 2000, growing 1.8 percent from 1990 levels.

58. From 1990 to 2000, population within Pecos County, Texas grew by 14.5 percent to 16,809. Reeves County's population in 2000 was 13,137, a 17.1 decline from 1990 levels. Both Pecos and Reeves Counties experienced a population decline between 2000 and 2003. Exhibit 3-1 summarizes population data for the areas surrounding the proposed CHD.

Exhibit 3-1

POPULATION ESTIMATES FOR COUNTIES SURROUNDING THE PROPOSED CHD

Region	1990	2000	2010	2020	% Increase 1990-2000	% Increase 2000-2020
United States	248,709,873	281,421,906	--	--	13.2%	--
NEW MEXICO	1,515,069	1,819,046	2,112,986	2,383,116	20.1%	31.0%
Chaves County	57,849	61,382	64,864	67,591	6.1%	10.1%
City of Roswell	44,654	45,451	--	--	1.8%	--
TEXAS	16,986,510	20,851,820	22,802,959	24,330,707	22.8%	16.7%
Pecos County	14,675	16,809	18,229	19,355	14.5%	15.1%
Reeves County	15,852	13,137	14,533	15,731	-17.1%	20.0%

Sources:
(1) U.S. Census Bureau, State & County QuickFacts, accessed at http://quickfacts.census.gov/qfd/
(2) Bureau of Business and Economic Research (BBER), Revised Population Projections for New Mexico and Counties, accessed at http://www.unm.edu/~bber/demo/table1.htm.
(3) Texas State Data Center, Population Estimates and Projections, accessed at http://txsdc.utsa.edu/cgi-bin/prj2004totnum.cgi.

3.1.2 Business Patterns

59. Exhibit 3-2 provides industry and payroll data for Chaves County, New Mexico and Pecos and Reeves Counties, Texas. The "Total Establishments" column displays the total number of physical locations at which business activities are conducted with one or more paid employee in the year 2002. These figures provide a measure of the average density of commercial and industrial entities in the region.

60. In 2002, Chaves County had a total payroll of $342.9 million. The principal industries in Chaves County, in terms of annual payroll, include health care and social assistance services, retail trade, and manufacturing—all industries that are unlikely to be impacted by the proposed designation. Annual payroll within these industries totaled $182.7 million, representing 53 percent of the total County payroll.

61. Pecos County had a total payroll of $57.3 million in 2002, with principal industries including health care and social assistance, retail trade, and mining. Reeves County had a total payroll of $43.6 million with primary industries comprising retail trade, health care and social assistance, and transportation and warehousing.

Exhibit 3-2

ECONOMIC ACTIVITY WITHIN CHAVES COUNTY, NM AND PECOS AND REEVES COUNTIES, TX
ANNUAL PAYROLL, EMPLOYMENT, AND TOTAL ESTABLISHMENTS BY INDUSTRY (2002)

	Chaves County, NM			Pecos County, TX			Reeves County, TX		
Industry	**Annual Payroll ($1,000)**	**% Total Annual Payroll**	**Total Establish-ments**	**Annual Payroll ($1,000)**	**% Total Annual Payroll**	**Total Establish-ments**	**Annual**	**% Total Annual Payroll**	**Total Establish-ments**
Forestry, fishing, hunting, and agriculture support	$0	0.0%	7	$0	0.0%	2	$0	0.0%	1
Mining	$8,997	2.6%	52	$9,899	17.3%	26	$3,328	7.6%	7
Utilities	$4,271	1.2%	8	$2,908	5.1%	6	$1,456	3.3%	6
Construction	$22,471	6.6%	119	$2,221	3.9%	21	$985	2.3%	8
Manufacturing	$58,141	17.0%	50	$1,964	3.4%	8	$0	0.0%	4
Wholesale trade	$14,666	4.3%	66	$2,382	4.2%	14	$462	1.1%	7
Retail trade	$50,140	14.6%	262	$10,435	18.2%	75	$11,116	25.5%	33
Transportation & warehousing	$15,243	4.4%	59	$3,418	6.0%	14	$5,151	11.8%	9
Information	$7,435	2.2%	28	$1,326	2.3%	11	$873	2.0%	8
Finance & insurance	$18,684	5.4%	111	$3,372	5.9%	23	$1,928	4.4%	13
Real estate & rental & leasing	$4,140	1.2%	76	$210	0.4%	5	$151	0.3%	8
Professional, scientific & technical services	$18,616	5.4%	100	$0	0.0%	12	$1,999	4.6%	13
Management of companies & enterprises	$4,516	1.3%	10	--	--	--	--	--	--
Admin, support, waste management, remediation services	$0	0.0%	50	$0	0.0%	4	$0	0.0%	5
Educational services	$0	0.0%	6	$0	0.0%	1	--	--	--
Health care and social assistance	$74,469	21.7%	159	$10,564	18.4%	12	$5,697	13.1%	20
Arts, entertainment & recreation	$1,556	0.5%	15	$0	0.0%	2	$237	0.5%	3
Accommodation & food services	$17,125	5.0%	96	$3,544	6.2%	37	$2,798	6.4%	25
Other services (except public administration)	$14,093	4.1%	149	$3,611	6.3%	36	$858	2.0%	25
Auxiliaries (exc corporate, subsidiary & regional mgt)	$143	0.0%	3	--	--	--	--	--	1
Unclassified establishments	$0	0.0%	9	$0	0.0%	2	$0	--	1
Total	**$342,942**	**100.0%**	**1,479**	**$57,278**	**100.0%**	**311**	**$43,653**	**84.8%**	**311**

Source:
U.S. Census Bureau, County Business Patterns, http://www.census.gov/epcd/cbp/view/cbpview.html

3.1.3 Employment by Industry

62. In 2003, a total of 21,109 individuals were employed within all economic sectors in Chaves County. The largest employment sectors within Chaves County include trade, transportation and utilities and the services industries. Employment within the government sector represented 21 percent of the job base while the health care and social assistance services industry employed 13 percent of total jobs. Accommodation and food services and retail trade both accounted for 12 percent of employment.

63. The largest employers within Pecos and Reeves Counties consist of the government and trade, transportation, and utilities sectors. In Pecos County, government jobs accounted for 36 percent of all employment while trade, transportation, and utilities employment constituted 15 percent of total jobs. In Reeves County, government jobs represented 40 percent of total jobs while trade, transportation, and utilities accounted for 19 percent of total employment. Exhibit 3-3 summarizes employment by industry within the three counties containing proposed critical habitat.

Exhibit 3-3

EMPLOYMENT BY INDUSTRY WITHIN COUNTIES CONTAINING PROPOSED FOUR INVERTEBRATES CRITICAL HABITAT

	Chaves County, NM		**Pecos County, TX***		**Reeves County, TX***	
Industry	**Number of Employees**	**% Total Employees**	**Number of Employees**	**% Total Employees**	**Number of Employees**	**% Total Employees**
Natural Resources & Mining	1,940	9%	619	13%	346	9%
Construction	882	4%	186	4%	104	3%
Manufacturing	1,331	6%	70	1%	204	5%
Trade, Transportation & Utilities	4,028	19%	755	15%	730	19%
Information	268	1%	55	1%	31	1%
Financial Activities	807	4%	152	3%	172	4%
Professional & Business Services	1,361	6%	134	3%	55	1%
Education & Health Services	2,828	13%	545	11%	349	9%
Leisure & Hospitality	2,756	13%	463	9%	269	7%
Other Services	553	3%	120	2%	49	1%
Nonclassifiable	7	0%	6	0%	5	0%
Federal Government	354	2%	50	1%	82	2%
State Government	1,538	7%	594	12%	84	2%
Local Government	2,456	12%	1,132	23%	1,369	36%
Total Employment	**21,109**	**100%**	**4,881**	**100%**	**3,849**	**100%**

Sources:
New Mexico Department of Labor, http://www.dol.state.nm.us/wordtext/tabled.xls
Texas Workforce Commission, Labor Market Information,
http://www.tracer2.com/admin/uploadedPublications/1237_coveredemployment2003.xls
Notes:
Texas data reported for 4th quarter of 2003.

3.1.4 Income and Unemployment[20]

64. Chaves County had a per capita personal income of $22,727 in 2002. This was slightly lower than New Mexico's per capita personal income of $24,823. The poverty rate in 1999 for Chaves County was 18.4 percent, a higher rate than New Mexico's average poverty rate of 12.4 percent. The unemployment rate in Chaves County in 2003 was 8.6 percent, higher than the statewide average of 6.4 percent.

65. Pecos County had a per capita personal income of $15,346 in 2002, representing 53 percent of the Texas statewide average of $29,039. The poverty rate in Pecos County was 20.4 percent in 1999, which was higher than Texas' average of 15.4 percent. In 2003, Pecos County's average unemployment rate was 5.5 percent, lower than the statewide average of 6.8 percent.

66. In 2002, Reeves County had a per capita personal income of $17,139. This represented 59 percent of the state average. The County's poverty rate in 1999 was 28.9 percent, or nearly double the statewide poverty level. Reeves County has experienced high unemployment relative to the state. In 2003 the County's average unemployment rate was 11.3 percent.

3.2 <u>Economic Activities Occurring Within and Adjacent to the Proposed CHD</u>

67. The Service and The Nature Conservancy manage all of the proposed critical habitat units. These entities undertake habitat conservation activities to preserve the ecosystem and native species. Economic activities that could generate groundwater contamination or result in the depletion of aquifers may impact the four invertebrates and their habitat. Potentially affected activities within Chaves County, New Mexico and Pecos and Reeves Counties, Texas include oil and natural gas operations, irrigation for agricultural purposes, livestock operations, residential development, and to a lesser extent road construction and maintenance. These activities do not occur immediately within the proposed critical habitat areas but do occur in proximity to the proposed designation and thus could impact the hydrologic conditions and water quality within the proposed designation.

68. The social and economic climate surrounding economic and land management activities within Chaves County, New Mexico and Pecos and Reeves Counties, Texas, is discussed below. The economic impacts of managing these activities in consideration of the needs of the four invertebrates and their habitat are discussed in Section 4.

3.2.1 Federal, State, and The Nature Conservancy Land Management Activities

69. All lands proposed for CHD are located on Federal and The Nature Conservancy lands. The Bureau of Land Management (BLM) manages lands beyond the borders of the Bitter Lake National Wildlife Refuge but within the groundwater source zone of the

[20] Per capita personal income data from Bureau of Economic Analysis; Unemployment data from U.S. Department of Labor, Bureau of Labor Statistics, http://www.bls.gov/data/.

proposed CHD. Furthermore, the New Mexico Department of Game and Fish (Department) is currently developing a state Recovery and Conservation Plan for the four invertebrates. This section describes land management and conservation activities implemented by Federal and State agencies and The Nature Conservancy.

Bitter Lake National Wildlife Refuge Management (Units 1 and 2)

70. Units 1 and 2 of proposed CHD lie completely within the boundaries of the Bitter Lake NWR and are managed by the Service. Bitter Lake NWR was created in 1937 to protect and provide habitat for a number of species, including waterfowl and endangered and threatened fish, such as the Pecos bluntnose shiner, the Pecos gambusia, and the Pecos pupfish. As a result, public recreational activity is not permitted in all of proposed unit 1 and only restricted activity is allowed in proposed unit 2. No recreational activities that could disturb aquatic habitat, such as water sports, fishing, or boating are permitted in either unit under current rules. Visitors use the Refuge primarily for wildlife viewing and bird hunting. Private vehicles are required to remain on established roads, and access to the Refuge is limited to the main entrance.

71. Many activities occurring within the Bitter Lake NWR will be undertaken in the interest of the four invertebrates. Bitter Lake NWR activities include salt cedar control and eradication, controlled burns, fire management, habitat creation and enhancement efforts for the invertebrates and other native species, and water control projects.

- **Oil and Gas Activity.** Both the Federal government and the State of New Mexico own mineral rights at the Bitter Lake NWR. However, Refuge personnel indicate that New Mexico has expressed no recent interest in developing its mineral rights. There are three active oil wells and two natural gas wells on the Refuge. The three oil wells are located down slope on the water gradient from the proposed critical habitat units. The two gas wells are located near the four invertebrates habitat and one of these wells is not in production.[21]

- **Federally Reserved Water Rights.** Units 1 and 2 of proposed critical habitat lie just west of the Pecos River, an important water source in both New Mexico and Texas. Bitter Lake NWR gained legal assurance of sufficient water in its aquatic habitats in 1996. Bitter Lake is currently in negotiations with the New Mexico Interstate Stream Commission, a State agency responsible for administering New Mexico's water resources, to quantify these reserved rights.

BLM Roswell Resource Area Management (Units 1 and 2)

72. While the BLM does not manage any land within the proposed critical habitat units, it does manage almost 1.5 million acres within its Roswell, New Mexico, Resource Area, including significant lands west of units 1 and 2. This situation is exclusive to units 1 and 2, because BLM does not manage any land in Texas, where units 3 and 4 are proposed. A recent study by Balleau et al. (1999) reported that these lands act as a source

[21] Ibid.

area for spring water in the Bitter Lake NWR.[22] Because these species are sensitive to oxygen levels, water temperature, sediments, and contaminants, existing regulations addressing potential water contamination in this source area are relevant to this analysis.[23]

73. The 1999 Balleau study reported that water expected to emerge from Bitter Lake NWR springs over the next 10 to 500 years will come from a broad source area beginning west of Roswell near Eightmile Draw, extending northeast to Salt Creek, and southeast to the Refuge. This broad area sits within a portion of the Roswell Basin and contains a mosaic of Federal, State, and private lands with multiple land uses that include expanding urban development, ranching, commercial farming, and recreation. There have also been extensive oil and gas extraction activities in the area surrounding the Refuge, including at least 190 oil wells. Since this area delineates the groundwater source area of surface water on the Refuge, it likewise could serve as a source for contaminants entering the species' habitat.

74. All of the Federal lands within this area are managed and regulated by the BLM, under the rules and regulations stipulated in the 1997 *Roswell Approved Resource Management Plan*.

- **Bitter Lake Habitat Protection Zone.**[24] Revisions to the *Roswell Approved Resource Management Plan* made by BLM in 1997 prompted a formal section 7 consultation with the Service regarding the endangered Pecos gambusia, which resides on Bitter Lake NWR. As part of this consultation, the Service provided "reasonable and prudent alternatives" to the proposed management plan in order to protect the ground and surface waters that feed the Bitter Lake NWR and Pecos gambusia habitat. In particular, the Service recommended that BLM:

  - "Use the best available hydrologic information to map the movement of water that supplies springs occupied by Pecos gambusia on the Bitter Lake NWR and the Salt Creek Wilderness. Close the lands within the mapped area to oil and gas leasing unless or until the BLM can demonstrate that mandatory protective measures will ensure no aquifer contamination."

  - "For existing leases within the mapped area, apply appropriate measures taken from BLM's 'Practices for Oil and Gas Drilling and Operations in Cave and Karst Areas' and any other appropriate measures to ensure no contamination of water that supplies springs occupied by the Pecos gambusia on the Bitter Lake NWR and the Salt Creek Wilderness. Use monitoring procedures that will detect

[22] Balleau Groundwater, Inc. 1999. Source-water protection zones for Bitter Lake National Wildlife Refuge. A report prepared for the U.S. Fish and Wildlife Service. 42 pp.

[23] Ibid.

[24] Personal communication with Dan Baggao, Wildlife Biologist and Howard Parmenter Bureau of Land Management, Roswell Field Office, November 17, 2004.

any surface or subsurface accidents soon enough that they can be discovered and corrected before significant harm to the aquifer occurs."[25]

75. In accordance with this recommendation and in the interest of general water quality, the BLM has developed a Habitat Protection Zone (HPZ) plan for 12,585 acres of the Federal mineral estate and 9,945 acres of the Federal surface estate that are within the water source area for the Bitter Lake NWR, as specified in the Balleau study. The Bitter Lake HPZ was established in October of 2002 and is managed to protect the ground and surface water resources of Bitter Lake NWR for the next ten to fifteen years.[26] The HPZ includes less than one percent of the 1.49 million surface acres and less than 0.2 percent of the 8.4 million subsurface mineral estate managed by BLM in the Roswell Resource Area.

State of New Mexico Recovery and Conservation Plan for Four Invertebrate Species[27] (Units 1 and 2)

76. The Department, under direction of the New Mexico Wildlife Conservation Act amendments of 1995, is currently in the process of developing a State Recovery and Conservation Plan for the Four Invertebrates Species. The four-fold purpose of the recovery plan is to:

- Restore and maintain viable populations of the species and their habitat;
- Mitigate adverse social or economic impacts resulting from recovery actions;
- Identify social or economic benefits and opportunities; and
- Use existing resources and funding sources, to the extent possible, to implement the plan.

77. The Department has noted that it has minimal jurisdiction over the lands that the four species occupy and that recovery efforts will occur in collaboration with other State, Federal, and local government entities as well as with private landowners. The Department has developed the plan concurrently with the Interstate Stream Commission. The State Recovery Plan also proposes specific conservation, restoration, and protection actions under its strategy, including restoring viable populations of the four invertebrates in suitable habitat at two or more sites within their known historic range. To implement the recovery effort the Department has stated that it must establish cooperative working relationships with other state, Federal, and local government entities and private

[25] Bureau of Land Management, Roswell Approved Resource Management Plan and Record of Decision, October, 1997.

[26] Ibid.

[27] New Mexico Department of Game and Fish, Draft Recovery and Conservation Plan for Four Invertebrate Species, November 4, 2004; Personal communication with Brian Lang, Endangered Invertebrates Biologist, New Mexico Department of Game and Fish, November 11, 2004 and November 22, 2004; Personal communication with Dan Rubin, Representative, Interstate Stream Commission, December 1, 2004.

landowners.[28] Costs related to developing the State Recovery and Conservation Plan are examined in Section 4.[29]

The Nature Conservancy Management (Units 3 and 4)[30]

78. Units 3 and 4 are within Diamond Y Springs Preserve and Sandia Springs Preserve, which are both owned and managed by The Nature Conservancy. These preserves are managed for long term habitat conservation and protection of the functional integrity of surface water systems to benefit rare aquatic species and communities within the preserves. Projects occurring on Diamond Y Springs and Sandia Springs include on-going salt cedar and mesquite eradication, habitat enhancement projects, the building of fire breaks, biological inventory and monitoring, and coordination efforts with oil and gas companies to reduce and prevent the likelihood of groundwater contamination within the springs.

79. The Nature Conservancy does not own the mineral rights at units 3 and 4. The companies that own or lease these rights have generally worked with The Nature Conservancy to protect these lands, but their rights to drill for minerals remain dominant over surface ownership rights.

3.2.2 Water Use Overview in Proposed CHD Regions

80. Within southeastern New Mexico the shallow aquifer of the Roswell Artesian Basin, a source of water to the Pecos River, is the principal source of water for irrigation and municipal water supply. The basin is fully appropriated and has been closed to new appropriations since 1937.[31] In Chaves County, groundwater is the primary water source for irrigated agriculture and municipal use. Exhibit 3-4 presents water use data by category of use within Chaves County.

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[28] New Mexico Department of Game and Fish, Draft Recovery and Conservation Plan for Four Invertebrate Species, November 4, 2004.

[29] Future costs associated with implementing the State Recovery and Conservation Plan will be incurred pending completion and approval by the state of New Mexico.

[30] Karges, J. 2003. Aquatic conservation and The Nature Conservancy in West Texas. Pp. 145-150 In Garrett, G. P. and N. L. Allan (eds.) Aquatic fauna of the Northern Chihuahuan Desert. Special Publication 46. The Museum of Texas Tech University; Personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 3, 2004.

[31] Personal communication with Dan Rubin, Representative, Interstate Stream Commission, December 1, 2004.

Exhibit 3-4

SUMMARY OF WATER USE IN CHAVES COUNTY (ACRE-FEET, 2000)

Category	Surface Water Withdrawal	Groundwater Withdrawal	Total Withdrawals	% of Total Withdrawals
Public Water Supply	-	18,205	18,205	4.9%
Domestic (self-supplied)	-	1,040	1,040	0.3%
Irrigated Agriculture	24,162	313,305	337,467	91.3%
Livestock (self-supplied)	238	10,196	10,433	2.8%
Commercial (self-supplied)	-	1,596	1,596	0.4%
Industrial (self-supplied)	-	546	546	0.1%
Mining (self-supplied)	-	169	169	0.0%
Power (self-supplied)	-	-	-	0.0%
Reservoir Evaporation	-	-	-	0.0%
TOTAL:	24,400	345,056	369,456	100.0%

Source:
New Mexico Water Use Data 2000 by County, accessed at http://www.seo.state.nm.us/water-info/water-use/county00/chaves.html

81. Groundwater pumping has historically reduced inflows from the Roswell Artesian Basin. Due to a court ruling that requires New Mexico to ensure that more water reaches downstream riparian zones and other users in Texas to meet Pecos River Compact obligations, the New Mexico Interstate Stream Commission (ISC) is purchasing 18,000 acres and associated water rights of irrigated farmland around Roswell and Carlsbad. The ISC is retiring water rights in the Pecos Valley and plans to transfer water downstream to ensure water deliveries to Texas.[32] No hydrologic models currently exist to determine the impact of these plans on the springs at the Bitter Lake NWR.[33]

82. Bitter Lake NWR is located at the juncture between the Roswell Artesian Basin and the Pecos River. Groundwater levels and the nature and timing of flows within the Pecos River are important components for maintaining aquatic habitat within the Refuge. In 1996, Bitter Lake NWR gained legal assurance of sufficient water in its aquatic

[32] Personal communication with Dan Rubin, Representative, Interstate Stream Commission, December 1, 2004.

[33] A comment on the draft version of this analysis provided by the New Mexico Interstate Stream Commission states that a recent report prepared by the New Mexico Office of the State Engineer provides the most recent information regarding the hydrology of the Roswell Artesian Basin. The report concludes that, "an extended, extreme drought, and not groundwater depletion through human activity, would potentially threaten the future supply of water for the proposed critical habitat located within the BLNWR." (New Mexico Office of the State Engineer, Roswell Basin Guidelines for Review of Water Right Applications, Adopted February 9, 2005.) This information does not change the quantitative results presented in this analysis.

habitats. The Service has stated that this acquisition should ensure minimum surface water discharge of Bitter Creek.[34]

83. Within the Texas portion of the proposed CHD, groundwater is pumped predominantly to meet the needs for irrigated agriculture. Irrigated agriculture accounts for 92 percent of water use in Pecos County, and 96 percent of water use in Reeves County. Groundwater withdrawals for irrigated agriculture could potentially impact the hydrological conditions within Units 3 and 4. However, further hydrological studies are necessary to determine the impact of groundwater pumping on surface and groundwater levels at Diamond Y Spring and Sandia Springs Preserves. Exhibit 3-5 summarizes water use data within Pecos and Reeves Counties, Texas.

Exhibit 3-5

SUMMARY OF WATER USE IN PECOS AND REEVES COUNTIES, TEXAS (ACRE-FEET, SURFACE AND GROUNDWATER, 2002)

Category	Pecos County	% of Total	Reeves County	% of Total
Municipal	4,662	6.8%	1,034	1.6%
Manufacturing	2	0.0%	640	1.0%
Mining	163	0.2%	88	0.1%
Irrigation	62,505	91.6%	63,640	96.2%
Livestock	913	1.3%	751	1.1%
Total	68,245	100.0%	66,153	100.0%

Source:
Texas Water Development Board, 2002 Water Use Survey Summary Estimates, accessed at http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/HistoricalWaterUse/2002WaterUse/HTML/2002County.htm

3.2.3 Oil and Gas Development Activities

84. New Mexico ranks second in the U.S. for natural gas production and third in proven gas reserves of all producing U.S. states. The State also ranks fifth in crude oil production and fourth in proven oil reserves. In 2002, Chaves County ranked fifth in the state of New Mexico for both natural gas and oil production. That year Chaves County produced 748 thousand barrels of oil and 31.1 million cubic feet of natural gas.[35] There are currently over 2,600 oil and gas wells within Chaves County.[36]

85. Texas ranks first in the nation for both crude oil and natural gas production. In 2003 operations within Pecos County produced 9.3 million barrels of oil and 160 million cubic feet of natural gas. Reeves County produced over 740,000 barrels of oil and 31.8 million cubic feet of natural gas. A total of 6,728 oil and 1,425 natural gas wells

[34] U.S. Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants; Listing Roswell springsnail, Koster's tryonia, Pecos assiminea, and Noel's amphipod as Endangered With Critical Habitat*, Federal Register, Vol. 67, No. 29, February 12, 2002.

[35] New Mexico Energy, Minerals and Natural Resources Department, New Mexico's Natural Resources 2002, accessed at http://www.emnrd.state.nm.us/Mining/resrpt/3Extract.pdf on November 15, 2004.

[36] Go-Tech Data, accessed at http://octane.nmt.edu/data/ongard/county.asp on December 10, 2004.

currently exist within Pecos and Reeves Counties.[37] Exhibit 3-6 presents oil and natural gas statistics for the three counties.

Exhibit 3-6

SUMMARY OF OIL AND NATURAL GAS PRODUCTION IN COUNTIES CONTAINING PROPOSED CRITICAL HABITAT, 2004

	Chaves County, NM	Pecos County, TX	Reeves County, TX
Oil Production (barrels)	748,000	9,557,075	707,206
% State	1%	2.7%	0.2%
Number of Wells	783	5,594	1,124
Natural Gas Production (thousand cubic feet)	31,882,632	143,363,299	27,833,789
% State	2.0%	3.0%	0.6%
Number of Wells	1,507	1,139	304

Source: New Mexico Energy, Minerals and Natural Resource Department, New Mexico's Natural Resources 2003, accessed at http://www.emnrd.state.nm.us/Mining/resrpt/3Extract.pdf; Go-Tech Production Data, http://octane.nmt.edu/data/ongard; Railroad Commission of Texas, Oil & Gas Production Data Query, accessed at http://webapps.rrc.state.tx.us/PDQ/home.do, http://www.rrc.state.tx.us/divisions/og/information-data/stats/oggwlct.pdf, http://www.rrc.state.tx.us/divisions/og/information-data/stats/ogowlct.pdf.

3.2.4 Agriculture Activities

86. Livestock operations remain an important economic activity within Chaves County, New Mexico. Within Pecos and Reeves Counties, irrigated crop production is a large component of the regional economy. Exhibit 3-7 summarizes agricultural production and market value data for the three counties.

87. Chaves County ranks first in New Mexico for agricultural production, with over $280 million in agricultural output generated in 2002. Livestock sales accounted for nearly 90 percent of the total value of agricultural output. The dairy industry, which proliferated during the 1990s, ranks as the top livestock commodity. Other top livestock commodities include beef cattle, sheep and angora goats.

88. Pecos County generated $38.2 million in agricultural output in 2002, with crop production accounting for over 60 percent of sales. Reeves County produced $18.6 million in agricultural output, with livestock sales accounting for 60 percent of total production.

89. Agricultural landowners within New Mexico and Texas typically own water rights along with their land. Irrigated agriculture within Chaves County accounted for 91 percent of groundwater withdrawals and 80 percent of all groundwater depletion in 2000.[38] In 2002, irrigated agriculture accounted for 92 percent of total water use in Pecos

[37] Railroad Commission of Texas, Oil & Gas Production Data Query, accessed at http://webapps.rrc.state.tx.us/PDQ/home.do on December 10, 2004.

[38] New Mexico Water Use Data 2000 by County, accessed at http://www.seo.state.nm.us/water-info/water-use/county00/chaves.html.

County and 96 percent in Reeves County.[39] Irrigated agricultural operators within all three counties engage in water conservation strategies, such installing underground pipelines as opposed to relying upon open canals.[40]

Exhibit 3-7

AGRICULTURAL PROFILE OF COUNTIES SURROUNDING THE PROPOSED CHD

Item	**Chaves County, NM**	**Pecos County, TX**	**Reeves County, TX**
Number of farms	604	270	160
% 1997-2002	-12%	-16%	-20%
Land in farms (acres)	2,515,660	2,916,070	1,009,877
Average Size of farm (acres)	4,165	10,800	4,974
Market Value of Production	$283,949,000	$38,218,000	$18,563,000
Crops	$29,989,000	$23,633,000	$7,330,000
Livestock sales	$253,960,000	$14,585,000	$11,233,000
Average per farm	$470,115	$141,547	$111,824
State Rank	1	102	161
Top five livestock inventory items (number)	Cattle and calves 179,494	Sheep and lambs 64,672	Cattle and calves 16,120
	Sheep and lambs 36,930	Cattle and calves 34,685	Horses and ponies 400
	Horses and ponies 1,947	All goats 19,144	Layers 20 weeks and older 205
	Layers 20 weeks old and older 1,181	Horses and ponies 1,121	Deer (D)
	All Goats 1,090	Deer (D)	Goats 29
Top five crop items (acres)	Forage 37,237	Forage 7,320	Forage 4,805
	Corn for silage 16,754	All Cotton 5,740	All Cotton 2,111
	Pecans 3,903	Pecans (D)	Sorghum for silage 1457
	Sorghum for silage 2,560	All vegetables harvested 1,873	All wheat for grain 940
	All wheat for grain 2,169	All wheat for grain (D)	All vegetables harvested 719

Notes: (D) Cannot be disclosed.
Source: USDA, NASS, 2002 Census of Agriculture County Profile, accessed at http://www.nass.usda.gov/census/census02/profiles/ on December 1, 2004.

[39] Texas Water Development Board, 2002 Water Use Survey Summary Estimates, accessed at http://www.twdb.state.tx.us/data/popwaterdemand/2003Projections/HistoricalWaterUse/2002WaterUse/HTML/2002County.htm.

[40] Personal communication with Terry Whigman, Conservationist, Natural Resource Conservation Service, December 12, 2004.

3.2.5 Residential Development

90. Chaves County is projected to experience moderate growth over the next twenty years. The County is currently developing a comprehensive plan to guide development activities. According to the Planning and Zoning Department, the County has assessed groundwater capabilities and has determined that there is enough water within the shallow Artesian aquifer to support an additional 100,000 residents.[41] New subdivision and housing developments within the Chaves County area rely upon domestic wells for water supply. Domestic wells are typically required in areas where community water systems are not available, and are generally relied upon in suburban and semi-rural areas. Exhibit 3-8 and 3-9 provide population projections and housing construction data for Chaves County.

Exhibit 3-8

CHAVES COUNTY POPULATION PROJECTIONS: 2000-2025

	Population	% Increase
2000	61,453	-
2005	63,295	3.0%
2010	64,864	2.5%
2015	66,311	2.2%
2020	67,591	1.9%
2025	68,560	1.4%

Source: Bureau of Business and Economic Research (BBER), University of New Mexico, http://www.unm.edu/~bber/demo/table1.htm

Exhibit 3-9

CHAVES COUNTY HOUSING CONSTRUCTION: 1990-2002

	Housing Units	% Change	Housing units authorized
1990	23,386	-	n/a
2000	25,647	10%	30
2002	25,948	1%	29

Source: U.S. Census Bureau

91. Pecos County is projected to experience growth over the next twenty years. Municipal water demand for the city of Fort Stockton, located approximately eight to 12 miles south of Unit 3 (Diamond Y Springs), is projected to increase by 6.7 percent

[41] Personal communication with Grant Pinkerton, Director, Chaves County Planning and Zoning Department, December 9, 2004.

between 2000 and 2020 (from 2,892 acre-feet to 3,086 acre-feet).[42] Water demand after 2020 is anticipated to experience minimal growth, with total demand between 2000 and 2050 projected to increase by 7.5 percent. Currently municipal water is obtained from the Edwards-Trinity Aquifer, an aquifer separate from the aquifer supporting Unit 3. Reeves County experienced a 17 percent population decrease between 1990 and 2000 and expanding urban development is not anticipated in areas adjacent to Unit 4. Groundwater quality and depletion concerns within Units 3 and 4 are more directly related to oil and gas exploration activities and irrigated agricultural production than to municipal development.[43]

[42] Turnert Collie & Braden Inc, 2004 Middle Pecos Groundwater Conservation District Water Management Plan, prepared for Middle Pecos Groundwater Conservation District, Pecos County, Texas, June 2004.

[43] Personal communication with John Karges, Conservation Biologist, West Texas Program Office, December 3, 2004.

ECONOMIC IMPACTS SECTION 4

92. This section considers the economic impacts of actions taken to protect the four invertebrates and their habitat. It quantifies the economic effects of the proposed critical habitat designation, as well as protective measures taken as a result of the species' proposed listing or other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. First, it provides a discussion of *pre-designation impacts*, as the impacts associated with species and habitat conservation efforts in place from the time of the proposed listing and designation of critical habitat to listing and final designation of critical habitat. Impacts associated with these management efforts may be on-going until the time of final designation. Second, this section provides estimates of *post-designation impacts*; potential future impacts associated with the critical habitat designation as proposed and other species and habitat conservation management efforts related to the four invertebrates.

93. This analysis focuses on quantifying impacts to activities most likely to be affected by the proposed critical habitat designation for the four invertebrates. These activities include:

- Oil and gas development within BLM's Bitter Lake Habitat Protection Zone in Chaves County, New Mexico;
- Livestock operations within Chaves County, NM; and
- Federal, State, and The Nature Conservancy management activities within Chaves County, NM and Pecos and Reeves Counties, TX.

94. This analysis also examines activities that have the potential to be impacted by the proposed designation. However, given uncertainties as to the scale of these impacts and future management directions, this analysis does not provide a quantitative estimate of these impacts. These activities include:

- Oil and gas development on private lands in New Mexico and Texas;
- Irrigated agricultural production within New Mexico and Texas; and
- Expanding urban development within Chaves County, NM.

95. The total pre-designation costs associated with four invertebrates conservation are estimated at approximately **$336,000 to $494,000** in present value terms (2002 through 2004, assuming a seven percent discount rate). Total post designation costs are approximately **$3.8 million to $7.5 million** in present value terms from 2005-2025 (assuming a discount rate of seven percent), or an annualized cost of $352,000 to $691,000. Note, all costs are presented in present value terms unless otherwise stated.

96. Approximately 91 percent of forecast costs are related to activities occurring within and adjacent to Units 1 and 2 in Chaves County. The remaining nine percent of estimated costs are related to activities occurring within and adjacent to Units 3 and 4 in Pecos and Reeves Counties.

97. Of all the activities that may be affected by the proposed designation, oil and gas drilling operations occurring within BLM's Bitter Lake Habitat Protection Zone are anticipated to generate 81 percent of total costs. Federal, State and The Nature Conservancy management activities are expected to generate 15 percent of total forecast costs. Private entities are anticipated to bear the majority of forecast costs (80 percent). BLM is anticipated to bear two percent of the total costs of four invertebrates conservation, the Service five percent, the State of New Mexico State four percent, and The Nature Conservancy, nine percent.

98. The impacts associated with potential future species and habitat management efforts are manifested in economic efficiency effects (i.e., social welfare) as outlined below.

- Administrative Costs: Costs associated with engaging in section 7 consultation, including time spent attending meetings, preparing letters and biological assessments, and in the case of formal consultations, the development of a Biological Opinion by the Service are quantified as administrative costs. Section 7 consultation can require substantial administrative effort on the part of all participants. These impacts are measured as the cost of labor required to fulfill these managerial duties. Estimates of per-effort costs associated with informal and formal consultations are presented in Exhibit 4-1. Costs of the biological assessment are typically borne by the Action agency. Unless otherwise stated, this table is used to develop total administrative costs for consultations associated with activities within the proposed CHD for the four invertebrates.

- Project Modification Costs: Species and habitat management efforts that involve project consultation activity are likely to result in project modifications to comply with the goals of the management efforts. Costs of implementing these modifications are associated with changes in labor or material requirements that may occur at one point in time and/or be on-going.

Exhibit 4-1

ESTIMATED ADMINISTRATIVE COSTS OF CONSULTATION AND TECHNICAL ASSISTANCE EFFORTS FOR THE FOUR INVERVERTBRATES (PER EFFORT)[a]

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 - $4,100	$4,000 - $5,600
Programmatic Consultation	$11,500 - $16,100	$9,200 - $13,800	N/A	$5,600

[a] Low and high estimates primarily reflect variations in staff wages and time involvement by staff.

Sources: IEc analysis based on data from the Federal Government General Schedule Rates, Office of Personnel Management, 2002, a review of consultation records from several Service field offices across the country.

99. This analysis measures impacts of conservation measures associated with the four invertebrates pre-listing and designation of critical habitat. Section 4.1 discusses pre-designation impacts associated with species and habitat management efforts, including all management efforts that have occurred since the time of the proposed listing of the four invertebrates in February 2002, and are expected to continue to occur through the time period when critical habitat designation is anticipated to be finalized in August 2005. Section 4.2 discusses post-designation impacts forecast from 2005 through 2025.

100. Appendix A presents a screening level analysis of the potential effects of proposed critical habitat designation on small entities (i.e., small businesses, small organizations, and small government jurisdictions) to satisfy the requirements of the Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996.[44] Finally, pursuant to Executive Order No. 13211, Appendix A reports the potential impacts the proposed critical habitat designation is likely to have on the energy industry.

4.1 Pre-Designation Impacts (2002-2005)

101. Pre-designation impacts include all management efforts that have occurred since the time of listing. The four invertebrates have not been listed but were proposed for listing in February 2002. Since the proposed listing of the four invertebrates species, there have been specific conservation actions implemented that have taken into account the protection of the species.

102. Federal projects occurring on Bitter Lake NWR have factored in the location and proposed listing of the four invertebrates. Moreover, the Department and other State agencies have collaborated to create a draft Recovery and Conservation Plan for the invertebrate species. Past costs (subsequent to the proposed listing in 2002) have included the following activities:

[44] Regulatory Flexibility Act, 5 U.S.C. 601 et. seq.

- **Federal and State Lands Management.** As of 2002, Bitter Lake NWR has engaged in approximately six low effort informal IntraService Section 7 consultations on Refuge projects potentially impacting or benefiting the species.[45] These projects have included salt cedar control and eradication measures, controlled burns, water control structures, and habitat creation projects.[46] Many of these projects were implemented as a result of an emergency Section 7 consultation related to a Burned Area Rehabilitation Plan for the Sandhill Fire in 2000. For example, between 2000 and 2002, the Department conducted an extensive macroinvertebrate and aquatic habitat monitoring program within the Bitter Lake NWR.[47] At the time, the four invertebrates were candidate species for listing. Data and research collected during monitoring program will likely minimize the need for future species and habitat studies. This analysis therefore considers costs associated with these pre-listing monitoring efforts. The present value of administrative costs related past section 7 consultation and project costs associated monitoring invertebrate habitat are estimated at $206,000 to $238,000 (assuming a seven percent discount rate).[48]

- **State Recovery and Conservation Plan.** The Department initiated working on a State *Recovery and Conservation Plan for Four Invertebrates* in 2002. Currently, the State is reviewing the draft plan. Past costs related to developing the recovery plan have included monitoring the four invertebrates habitat, consultant fees, and staff time devoted to developing the plan. Past efforts are estimated to range from $161,000 to $255,000, in present value terms (assuming a discount rate of seven percent), and have been incurred by the Department and the New Mexico Interstate Stream Commission.[49]

103. Pre-designation costs incurred by Federal and State agencies related to conservation measures and recovery plan development for the four invertebrates are estimated to range from $366,000 to $494,000 in present value terms (assuming a discount rate of seven percent).

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[45] Personal communication with Gordon Warrick, Wildlife Biologist, Bitter Lake National Wildlife Refuge, November 11, 2004.

[46] Many management actions within and adjacent to the proposed CHD (e.g., salt cedar control and eradication) will been directed towards multi-species recovery and protection. In each instance, this analysis attempts to identify costs specifically related to conservation of the four invertebrates. Where data are not available to accurately capture costs specific to four invertebrates conservation efforts, this analysis includes the full costs and notes the multiple considerations that may contribute to the undertaking of the particular management action.

[47] U.S. Fish and Wildlife Service, Bitter Lake National Wildlife Refuge, Sandhill Fire Burned Area Emergency Rehabilitation (BAER) Plan, March 24, 2000.

[48] Monitoring program cost data were obtained from the Sandhill Fire Burned Area Emergency Rehabilitation Plan, March 24, 2000.

[49] Personal communication with Jim Stuart, Endangered Species Recovery Plan Biologist, New Mexico Department of Game and Fish, November 11, 2004; Brian Lang, Endangered Invertebrates Biologist, New Mexico Department of Game and Fish, November 11, 2004; Dan Rubin, Representative, Interstate Stream Commission, December 1, 2004.

4.2 Post-Designation Impacts (2005-2025)

104. This section forecasts costs that may occur after the designation is finalized in August 2005 through 2025. It discusses future management actions involving species and habitat protection, including a discussion of the types of economic impacts associated with each component of these management actions.

4.2.1 Oil and Gas Development

105. The following sections examine potential economic impacts to oil and gas activities in both the New Mexico and Texas portions of the proposed CHD. First, this analysis quantifies the economic impact of conservation activities for the four invertebrates associated with oil and gas development located within the Bitter Lake groundwater resource area. Second, this analysis considers but does not quantify potential impacts to oil and gas development occurring on private lands within New Mexico and Texas.

106. Economic impacts to oil and gas development activities are estimated at 81 percent of the total post-designation impacts, or $2.7 million to $6.1 million from 2005-2025 (an annualized cost of $246,000 to $561,000). These costs are associated with drilling modifications in complying with BLM Bitter Lake Habitat Protection Zone stipulations to prevent groundwater contamination within the aquifer on which the four invertebrates depend in Units 1 and 2. A maximum of 63 wells within the Bitter Lake Habitat Protection Zone will be required to comply with additional drilling modifications. While these project modifications may increase drilling costs by up to 20 percent per well, the total number of impacted wells represents under about percent of the total Federal, state, and private natural gas wells in Chaves County and under 0.2 percent of total producing natural gas wells within the State of New Mexico. Thus, overall impacts to the regional oil and gas economy are likely to be small.

Units 1 and 2

107. As a direct result of a 1997 section 7 consultation with the Service regarding the endangered Pecos gambusia, BLM created the Bitter Lake Habitat Protection Zone (HPZ) plan to manage activities on 12,585 acres of Federal mineral estate within the water resource area for the Bitter Lake Refuge. As a result, mineral lease owners who apply for permits to drill for natural gas in the HPZ are required to apply appropriate protective measures and design features to ensure aquifer protection. BLM developed and implemented the HPZ plan for the Pecos gambusia prior to the proposed listing and designation of the invertebrate species. However, as similar groundwater protection measures for oil and gas drilling activities would be required for the four invertebrates, this analysis considers the costs to operators in complying with HPZ stipulations.[50]

[50] Personal communication with Dan Baggao, Wildlife Biologist, Bureau of Land Management, Roswell Field Office, December 14, 2004.

108. There are currently 17 oil and gas leases within the HPZ that are operated by seven companies. A total of 20 natural gas wells currently exist on these leases. BLM has estimated a maximum potential development of 66 additional wells within the HPZ according to well spacing requirements established by the New Mexico Oil Conservation Division.[51] BLM anticipates that it could receive a maximum of three applications to drill (APDs) for natural gas wells in the HPZ each year over the next ten to fifteen years.[52] This analysis assumes that this rate of three APDs per year will apply throughout the period of study, for a total of 63 APDs anticipated over twenty years.

Impacts to Oil and Gas Operators on Federal Lands

109. To comply with groundwater protection permit requirements in the HPZ, operators will have to spend more time drilling, casing, cementing and developing facilities, depending on well-location and depth. Significant drilling modifications to ensure groundwater protection are stipulated in the Habitat Protection Zone (HPZ) plan as follows:[53]

- **Steel tanks for drilling in lieu of reserve pits.** To prevent potential contaminants from leaching into the groundwater, operators drilling in the HPZ are required to use above ground steel tanks in lieu of lined earthen reserve pits to store drilling muds. Steel tanks are required to be located within the perimeter of the well pad and drilling wastes are required to be removed from the Habitat Protection Zone, rather than remaining within the pits indefinitely.[54]

Additional expenses incurred by drilling operators in implementing this project modification are related to labor, materials, equipment, transporting costs, and time delays. For example, the process may delay drilling completion by half a day and transporting and disposing wastes can be costly, depending on the distance to travel. Transporting costs may not be high within the HPZ as a landfill exists within the Roswell area.[55]

According to an industry estimate (Yates Petroleum Corporation), this project modification, including labor, equipment, materials, transporting costs, and time delay will cost $75,000 to $125,000 per well for a 5,000-foot well, the anticipated depth of a natural gas well in the HPZ.[56] A National Parks Service petroleum

[51] U.S. Bureau of Land Management, Roswell Field Office, Habitat Protection Zone Environmental Assessment, EA-NM-060-00-030, October 2002.

[52] Personal communication with Dan Baggao, Wildlife Biologist, Bureau of Land Management, Roswell Field Office, December 14, 2004.

[53] U.S. Bureau of Land Management, Roswell Field Office, Habitat Protection Zone Environmental Assessment, EA-NM-060-00-030, October 2002.

[54] According to industry sources, closed-loop systems with offsite disposal of wastes to protect wetlands are becoming a typical environmental precaution mandated by southwestern State and Federal landowners.

[55] Personal communication with Bruce Stubbs, Pecos Petroleum Engineer, December 10, 2004.

[56] Letter from Drilling Engineering Manager, Yates Petroleum Corporation, to Field Manager, Bureau of Land Management, Roswell Field Office, July 18, 2001.

engineer confirmed this as a reasonable high-end estimate for this project modification, but indicated that closed-loop systems may cost less than this and can potentially result in cost savings.[57] Another regional petroleum engineer indicates that these modifications can add additional expenses of $50,000 per well.[58] This analysis estimates the cost of this project modification to range from $50,000 to $125,000 per well.

Assuming that a maximum of three wells are drilled in, or require access through, the Habitat Protection Zone every year, this drilling project modification may result in an economic cost ranging from $1.7 to $4.3 million, in present value terms, for the drilling of 63 natural gas wells over 21 years.[59]

- **Well Casing modifications.** The HPZ stipulates that operators must drill a surface hole to a depth sufficient to protect the fresh water aquifers. Operators must set surface casing at this depth, cement in place, and cement must circulate the casing to the surface of the well. Currently, natural gas wells include the cement layer only on the bottom and top portions of the well, with the middle section below the aquifers cased only in steel. BLM has stated that there is a potential in this instance for steel to corrode and cause the well to fail, which would create a risk of groundwater contamination.[60]

  Casing modifications may result in additional expenses related to labor, materials, and equipment. Costs are estimated to range from $20,000 to $40,000 per well to comply with casing requirements.[61] At a maximum drilling of 63 natural gas wells over 21 years, $696,000 to $1.4 million in costs, in present value terms, may be incurred in compliance with this HPZ stipulation.

- **Protection measures and design features for proposed rights-of-ways actions.** There are currently 11 rights-of-way (ROW) authorizations for pipelines on public lands within the HPZ. According to BLM, ROWs for oil and gas operations on existing leases will continue to be approved but will be subject to standard or special stipulations, or both. Based on one industry estimate (Yates Petroleum), special requirements for pipeline access may incur costs of up to $4,400 per right-of-way.[62] This analysis assumes that the estimated 63 well drilling operations over 21 years

[57] Personal communication with Pat O'Dell, Petroleum Engineer, National Parks Service, December 9, 2004.

[58] Personal communication with Bruce Stubbs, Pecos Petroleum Engineer, December 10, 2004.

[59] BLM and petroleum engineers note that operators often develop more than one well at time and that cost savings can be achieved via economies of scale. Moreover, closed-loop systems are associated with potential cost savings to the operator. For example, closed-loop systems can: (1) reduce the footprint of a drilling operation; (2) eliminate the expense of creating an earthen pit; and (3) reduce drilling mud costs. Given uncertainties about potential cost savings and specific operating structures for leaseholders, this analysis assumes that operators will incur the upper-bound estimated cost of this project modification.

[60] Personal communication with Dan Baggao, Wildlife Biologist, Bureau of Land Management, Roswell Field Office, December 14, 2004.

[61] Personal communication with Bruce Stubbs, Pecos Petroleum Engineer, December 15, 2004.

[62] Information provided by BLM regarding pipeline access for Karen Federal #2, #3, & #4.

will require 63 ROWs for pipeline access. An estimated $153,000 in costs, in present value terms, related to pipeline ROWs may be incurred over 21 years.

110. Petroleum engineers note that testing and monitoring may require operators to shut down well production periodically but that this is not likely to result in a large impact to operations. The main concern, in terms of economic impacts, is the additional drilling modifications that can increase drilling costs by 10 to 20 percent per well.[63] These modifications can potentially increase capital costs or administrative burden up to the point where an operator may decide not to drill a well. A total of three APDs within the HPZ have been appealed or are undergoing the appeal process due to the additional drilling requirements. In one case, an operator has decided not to pursue drilling.[64] The decision not to drill is a function of the potential yield of each well, the financial condition of the operator, availability of other leases, and other operating decisions. Detailed data required to estimate such impacts for wells potentially impacted by four invertebrate conservation measures are not available.

111. The present value of total impacts to oil and gas operators in complying with Habitat Protection Zone plan groundwater protection stipulations are forecast to range from $2.6 to $5.9 million over 21 years (assuming a seven percent discount rate).

Impacts to BLM

112. BLM is likely to face increased administrative costs in reviewing APDs and monitoring drilling operations within the HPZ to ensure compliance with HPZ plan stipulations. Moreover, as a result of the 1997 consultation on the Pecos gambusia, the BLM removed 11 unleased parcels of Federal minerals from the HPZ. The following costs are anticipated to be incurred by BLM related to implementing the HPZ plan:

- **Application to Drill (APD) Review.** Reviewing APDs for activities within the Bitter Lake HPZ is likely to require additional BLM staff effort. BLM estimates cumulative staff efforts for reviewing APDs and preparing an Environmental Assessment at approximately $1,250 to $1,750 per APD, or $3,750 to $5,250 per year for reviewing three APDs.[65] Thus a total of $43,000 to $61,000 in administrative expenses, in present value terms, may be incurred by BLM to review APDs within the HPZ from 2005-2025.

  There are three APDs that are currently undergoing an appeal process by operators due to additional drilling requirements under the HPZ. BLM has noted that regulatory burden dramatically increases when APD environmental assessments are appealed by operators and that the appeal process can stretch over several months. Considering three APDs within the HPZ represent only five percent of total APDs

[63] Personal communication with Bruce Stubbs, Pecos Petroleum Engineer, December 15, 2004 and Jim Krogman, Yates Petroleum, December 21, 1004.

[64] Personal communication with Dan Baggao, Wildlife Biologist, Bureau of Land Management, Roswell Field Office, December 14, 2004.

[65] One BLM work month is estimated at $5,000 to $7,000.

reviewed by BLM on an annual basis, the appealing process can create significant administrative burden.[66] BLM also anticipates that the appeal process will likely delay proposed drilling operations. Thus the anticipated 63 APDs and assumed 63 natural gas wells sunk within the HPZ represents an upper-bound estimate of potential well drilling activity. Additional staff time required to review appealed Environmental Assessments for APDs is unknown but will likely be a strain on BLM's resources.[67]

- **Section 7 Consultation.** BLM has indicated that section 7 consultation with the Service has been conducted programmatically in recent years, thereby reducing the actual number of consultations. However, given the proposed CHD for the four invertebrates, BLM may consult with the Service on potential impacts to the species of drilling operations within the HPZ.[68] This analysis assumes that BLM will consult informally with the Service once per year to ensure that drilling operations and pipelines access within the HPZ ensure adequate groundwater protection to address four invertebrates concerns. Thus a total of 21 informal consultations are anticipated over from 2005-2025, with potential administrative costs to BLM and the Service of $27,000 to $81,000 in present value terms.

- **Monitoring Program**. BLM's HPZ plan specifies that all new wells be accompanied by a monitoring program designed to ensure well integrity. For example, a BLM petroleum engineer technician must monitor the actual circulation of cement around steel casing. Periodic monitoring of operations is also required to detect oil and gas surface and subsurface contamination. BLM estimates efforts by personnel to ensure well integrity at one to five days per well.[69] Thus monitoring efforts for three wells per year could incur costs ranging from $700 to $3,500 per year. The total cost, in present value terms, is estimated to range from $8,000 to $41,000 to monitor a maximum of 63 wells over 21 years.

- **Removal of Unleased Federal Parcels.** As a direct result of the 1997 section 7 consultation on the Pecos gambusia, BLM has closed 11 unleased parcels, totaling 1,520 acres of Federal mineral estate within the HPZ in order to reduce the threat of

[66] A comment submitted on the draft version of this analysis stated that it is inappropriate to include the costs of delays in proposed drilling operations associated with industry appeals because the industry is appealing compliance with environmental protections and therefore burdening themselves (letter from Forest Guardians to U.S. Fish and Wildlife Service, June 3, 2005). Industry appeals regarding drilling applications, however, are a result of the implementation of environmental regulations, including the Act, that recommend additional species and habitat conservation efforts be undertaken with the drilling activity. The economic impacts of delays triggered by appeals concerning these protections are therefore considered relevant in understanding the impact of conservation efforts for the four invertebrate species.

[67] Personal communication with Dan Baggao, Wildlife Biologist, Bureau of Land Management, Roswell Field Office, December 14, 2004.

[68] Ibid.

[69] Estimated workday is derived from an assumed BLM work-month of $7,000.

groundwater contamination. The unleased Federal minerals amount to 12 percent (1,520 acres) of the total Federal minerals (12,618 acres) within the HPZ.[70]

Removing these parcels from potential development prevents a maximum of nine wells, based on New Mexico regulations requiring at least 160 acres per gas well. The closure of these unleased parcels is likely to result in lost production opportunities, royalties, and job opportunities. However, given the small acreage proposed, impacts would likely be small relative to the total production in the county.

Wells on Federal leases in Chaves County have historically produced millions of dollars of oil and natural gas revenues. In 1999, approximately $3.7 million in Federal royalties were generated from oil and gas production within the County.[71] Currently, there are approximately 1,230 wells on Federal lands produced oil or gas in Chaves County.[72] BLM has also stated that the 11 parcels removed from the lease market represent under one percent of the total 5,381,274 acres available for lease in the BLM Roswell Resource Area that are believed to have a high hydrocarbon potential.[73] Thus, reducing the total development opportunity in the region by nine wells will likely have a small economic effect over twenty years.

113. Total administrative impacts, in present value terms, to BLM and the Service on oil and gas activities within Bitter Lake HPZ are estimated to range from $78,000 to $183,000 over 21 years.

Impacts to State and Private Oil and Gas Development[74]

114. Oil and gas drilling activities occur on private and State lands within the Roswell area. There are currently 832 oil and gas wells on State lands and 603 wells on private lands within Chaves County.[75] In the areas surrounding Bitter Lake NWR, there are at least 190 oil wells that are potential sources of contamination. The New Mexico Oil Conservation Division (Division), as part of the New Mexico Energy, Minerals and Natural Resources Department, is the agency responsible for permitting new wells, issuing discharge permits, and monitoring wells. The Division develops and enforces regulations in the oil and gas industry for the protection of fresh waters, public health and the environment. It is possible that the proposed designation for the four invertebrates could increase state regulatory scrutiny over proposed drilling operations. In such a case, operators may be required to implement drilling operations in a manner to ensure well

[70] U.S. Bureau of Land Management, Roswell Field Office, Habitat Protection Zone Environmental Assessment, EA-NM-060-00-030, October 2002.

[71] Minerals Management Service, Federal Mineral Revenue Disbursements to States, Identified by County of Origin, accessed at http://www.mrm.mms.gov/Stats/pdfdocs/cty99.pdf.

[72] Go-Tech Data, accessed at http://octane.nmt.edu/data/ongard/county.asp on December 10, 2004.

[73] BLM, Roswell Approved Resource Management Plan and Record of Decision, October 1997.

[74] Personal communication with New Mexico Oil Conservation District, December 8, 2004.

[75] Go-Tech Data, accessed at http://octane.nmt.edu/data/ongard/county.asp on December 10, 2004.

integrity and prevent groundwater contamination.[76] However, currently no additional State protective measures to ensure protection to aquatic species are anticipated.[77]

115. Oil and gas development activities in areas near Units 1 and 2 of the proposed CHD may result in take of the four species after it is listed. In those cases, developers of oil and gas wells may choose to apply for an incidental take permit and Habitat Conservation Plan (HCP) under section 10 of the Endangered Species Act and appropriately mitigate impacts to surface and groundwater resources. For authorized take, an HCP would need to be completed and an incidental take permit issued prior to the impact occurring. The potential for this occurrence is unknown.

Units 3 & 4[78]

116. Units 3 and 4 are located entirely on lands owned and managed by The Nature Conservancy as preserves. However, oil and gas extraction-related activities occurring on private lands outside of Diamond Y Spring may impact surface and groundwater resources. Currently there are no oil and gas activities occurring adjacent to Unit 4 at East Sandia Spring.

117. Diamond Y Spring Preserve is located within the Gomez Field, an actively producing oil and gas field. According to a 1991 report, there were 45 active and plugged oil and gas wells within the Diamond Y Spring Preserve, and 800 to 1,000 wells located within the aquifer throughout the spring basin.[79] While the oil and gas industry does not pose a threat to groundwater levels at Diamond Y, operations may potentially impact surface and groundwater quality within the springs.[80]

118. In addition to hosting Pecos assiminea, Diamond Y Preserve is home to a variety of threatened and endangered species, including the Leon Springs pupfish, the Pecos gambusia, and the Pecos sunflower and rare plants. Diamond Y has also been designated as critical habitat for the Leon Springs pupfish.[81] Oil and gas developers have voluntarily implemented safeguards to protect surface waters within the preserve from the potential of contamination. Measures in the past have included:

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[76] Personal communication with Wayne Price, Environmental Bureau, New Mexico Oil Conservation Division, December 8, 2004.

[77] Personal communication with Dan Rubin, Interstate Stream Commission, February 24, 2005.

[78] Information for this section was obtained from personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 3, 2004.

[79] Veni, G., and Associates. 1991. Delineation and preliminary hydrogeologic investigation of the Diamond Y Spring, Pecos County, Texas. Final Report to The Nature Conservancy, San Antonio, TX.

[80] Karges, J. 2003. Aquatic conservation and The Nature Conservancy in West Texas. Pp. 145-150 In Garrett, G. P. and N. L. Allan (eds.) Aquatic fauna of the Northern Chihuahuan Desert. Special Publication 46. The Museum of Texas Tech University.

[81] 45 FR 54678, August 15, 1980.

- Constructing a protective dike around the head pool of Diamond Y Spring to reduce the likelihood of potential spills from upslope facilities reaching the area;
- Decommissioning buried corrosible metal pipelines in areas adjacent to vulnerable aquatic habitats and replacing pipelines with synthetic surface lines that are more easily monitored and repaired if necessary;
- Installing emergency shut-off valves at both sides of any creek crossings; and
- Berming oil well pads at production sites to sufficiently contain any potential contaminant spill volume prior to detection.

119. A matching grant in the mid-1990s from an oil and gas company and the National Fish and Wildlife Foundation provided funds to remove abandoned well pad sites and raised access roads within Diamond Y which had previously impeded surface flow.

120. In 1992 there was a crude oil spill from a breached pipeline into Leon Creek upstream from Diamond Y Spring. To curb the flow of contaminants into Leon Creek, the responsible parties dug a trench network down slope of the spill to produce a barrier to migration of contaminants. According to the Railroad Commission of Texas, the agency responsible for permitting oil and gas activities within Texas, trench network maintenance efforts continue to occur at the site.[82]

121. In addition, a natural gas plant occurs within 1 kilometer of the Diamond Y Spring head pool. A plume of natural gas that exists at this plant has been fully delineated and operators have installed approximately 44 sentinel monitoring wells down gradient to prevent the migration of contaminants towards the preserve. According to the Railroad Commission of Texas Operator Cleanup Program, the migration has been controlled by the wells and the plume is currently stable and does not pose a threat to Diamond Y Springs.[83]

122. Past conservation costs have been tied to voluntary projects from energy companies and remediation measures tied to the Leon Creek oil spill. Information related to costs in implementing partnership projects is not available, although The Nature Conservancy and Railroad Commission personnel have indicated that spill remediation measures and the replacement of metal pipelines with synthetic lines have likely incurred significant expenses.[84]

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[82] Personal communication with Bill Renfro, Senior Technical Coordinator, Operator Cleanup Program, Railroad Commission of Texas, December 13, 2004.

[83] Personal communication with Bill Renfro, Senior Technical Coordinator, Operator Cleanup Program, Railroad Commission of Texas, February 18, 2005.

[84] Personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 3, 2004 and December 17, 2004; Bill Renfro, Senior Technical Coordinator, Operator Cleanup Program, Railroad Commission of Texas, December 13, 2004.

123. Future costs to oil and gas activities within Unit 3 are anticipated to be related to continued partnership projects between The Nature Conservancy and regional oil and gas companies. Moreover, in the case of another spill, remediation efforts will likely factor in habitat concerns for invertebrates and other aquatic species inhabiting the springs.

124. Subsurface drilling, or similar oil and gas development activities in areas near the Unit 3 element of the proposed CHD may result in take of the Pecos assiminea after it is listed. In those cases, developers of oil and gas wells may choose to apply for an incidental take permit and Habitat Conservation Plan (HCP) under section 10 of the Endangered Species Act and appropriately mitigate impacts to surface and groundwater resources within the springs. For authorized take, an HCP would need to be completed and an incidental take permit issued prior to the impact occurring. The potential for this occurrence is unknown.

4.2.2 Agricultural Activities

125. This analysis examines the potential economic impact of the proposed CHD for the four invertebrates on irrigated agriculture and livestock operations. In present value terms an estimated $91,000 to $257,000 in total potential costs to agricultural activities are anticipated to be related to four invertebrates protective measures over twenty years. Costs are anticipated to be incurred as a result of section 7 consultation on Concentrated Animal Feeding Operations (CAFOs) within Chaves County, New Mexico. Currently, impacts to groundwater withdrawals for irrigated agriculture within the regions surrounding the proposed designation are not anticipated. Within New Mexico, conservation management techniques are currently in place that will ensure minimum surface water discharge at Units 1 and 2. Within Texas, further hydrological studies are necessary to determine the impact of groundwater pumping on surface and groundwater levels at Units 3 and 4. Thus, impacts to irrigated agriculture on private lands may occur but are unlikely given present conditions.

Groundwater Quality Impacts

126. Groundwater contamination associated with agricultural activities occurring on private lands outside of the proposed critical habitat units may occur as a result of wastewater runoff from concentrated animal areas (i.e. dairies, feed lots, and chicken farms). Wastewater runoff may contribute to nitrate levels in surface and underground water sources on which the four invertebrates depend. The Service has noted that nitrate levels in the underground aquifer near Roswell are high.[85]

127. National Pollutant Discharge Elimination System (NPDES) permits are required by EPA in New Mexico and Texas for the discharge of wastewater from eligible CAFOs. EPA is currently proposing to reissue General NPDES permits for discharges from CAFOs in New Mexico. The NPDES permit proposal adds additional requirements to all

[85] U.S. Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants; Listing Roswell springsnail, Koster's tryonia, Pecos assiminea, and Noel's amphipod as Endangered With Critical Habitat*, Federal Register, Vol. 67, No. 29, February 12, 2002.

existing facilities meeting the definition of CAFO within New Mexico. Permitted facilities will be allowed to discharge to waters of the U.S. in the event of a chronic or catastrophic storm if facilities are properly designed, constructed, and operated to contain all process-generated wastewater and runoff from a 25-year/24-hour storm event. Facilities will be required to submit a notice of intent for coverage and determine whether their operations satisfy requirements as described in EPA's "Proposed National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges from CAFOs in New Mexico, Oklahoma, and on Indian lands in New Mexico and Oklahoma".[86]

128. EPA Region 6 is currently consulting with the Service on the general permit to geographically designate areas of concern for endangered and threatened species and critical habitat. If a CAFO, or the point where authorized discharges reach waters of the U.S., is located within a designated area of concern, operations would be required to "meet conditions and measures to avoid or eliminate adverse effects to listed species or critical habitat that were caused by authorized discharges".[87]

129. According to the New Mexico Environmental Department of Surface Water Quality, there are currently 47 CAFOs within Chaves County related primarily to dairy and to a lesser extent beef cow operations.[88] The Surface Water Quality Bureau does not anticipate additional CAFO facilities within the region.[89] Under the proposed general permit, EPA may consult on the effect of CAFOs on the four invertebrate species and their habitat. Limited data exists on whether all regional CAFOs are operating within designated areas of concern. The analysis of impacts to CAFO facilities include:

- **Section 7 Consultation.** This analysis assumes that every CAFO facility within Chaves County will need to ensure that operational discharges avoid or eliminate impacts to the four invertebrates and their habitat. This will most likely be ensured associated with the facility's securing of a wastewater discharge permit through either through EPA or that State.[90] A total of $91,000 to $257,000 in administrative costs, in present value terms, is anticipated over 21 years.

- **Project Modifications.** Operators may implement additional protective measures to avoid or eliminate impacts to listed species or critical habitat. Currently, limited data are available to accurately capture potential costs to CAFO operators.

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[86] U.S. Environmental Protection Agency, Proposed NPDES General Permit for Discharges from Concentrated Animal Feeding Operations (CAFOs) in New Mexico, Oklahoma, and on Indian Lands in New Mexico and Oklahoma (NMG010000 and OKG010000), accessed at http://www.epa.gov/region6/6wq/npdes/genpermt/cafoguidance.pdf on December 1, 2004.

[87] Ibid.

[88] Personal communication with Richard Powell, Environmental Scientist/Specialist, New Mexico Environmental Department Surface Water Quality Bureau, December 14, 2004.

[89] Ibid.

[90] The State of New Mexico is currently pursuing authorization for primacy for the NPDES permit program from EPA, New Mexico Environmental Department of Surface Water Quality, accessed at http://www.nmenv.state.nm.us/swqb/NPDES.

130. According to the Texas Commission on Environmental Quality (TCEQ), CAFO facilities do not occur in Pecos County or in Reeves County within 60 miles of the proposed critical habitat units 3 and 4. Moreover, according to the TCEQ, there are no facilities in Pecos or Reeves Counties that require wastewater discharge permits.[91] As such, this analysis does not anticipate impacts to CAFOs within Pecos and Reeves Counties.[92]

Groundwater Withdrawal Impacts

131. Extensive groundwater pumping associated with irrigation for agricultural activities may impact the groundwater resource areas on which the four invertebrates depend within New Mexico and Texas. Currently, the state of New Mexico is in the process of retiring water rights of irrigated farmland adjacent to Units 1 and 2 to ensure water compact deliveries to Texas. Moreover, Federally reserved water rights within Bitter Lake NWR will likely ensure minimum surface water discharge at Units 1 and 2. Within Texas, further hydrological studies are necessary to determine the impact of groundwater pumping on surface and groundwater levels at Units 3 and 4. Thus, this analysis does not forecast impacts of the proposed CHD on irrigated agriculture activities.

Units 1 & 2 (Chaves County, New Mexico)

132. Currently, irrigated agriculture accounts over 90 percent of total groundwater withdrawals within Chaves County. Chaves County farmers generally own water rights along with their land. Due to the Pecos River Compact lawsuit settlement that places limits on the quantity of water that can be pumped from Pecos Valley wells to ensure adequate deliveries to Texas, agricultural operators within the Pecos Valley have modified irrigation practices to conserve water. For example, operators have installed individual use-meters to monitor and conserve water used for crops and have replaced open dirt canals with underground water pipelines.

133. As discussed in Section 3.2.2, the New Mexico Interstate Stream Commission (ISC) is currently purchasing water rights of irrigated farmland around the Roswell area to meet Pecos River Compact obligations. The ISC plans to retire water rights in the Pecos Valley and transfer water to well fields downstream to increase water deliveries to Texas. Federal water rights for the Bitter Lake NWR were secured in 1996. The Service has determined that Federally reserved water rights for Bitter Lake NWR will ensure minimum surface water discharge of Bitter Creek. The Service is currently in negotiations with the State of New Mexico to quantify these rights.[93]

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[91] Texas Natural Resource Conservation Commission, "Wastewater Facilities" and "Wastewater Flow Databases," 2002, accessed at http://www.texasep.org/html/cnty/county_main.html.

[92] Personal communication with Greg Larson, Texas Commission on Environmental Quality, Region 7, Midland office, December 8, 2004.

[93] Personal communication with Paul Tashjian, Hydrologist, U.S. Fish and Wildlife Service, November 9, 2004; Dan Rubin, Representative, Interstate Stream Commission, November 9, 2004.

134. Current conditions within Bitter Lake NWR are considered suitable for the spring habitats.[94] However, any reduction in current groundwater levels will likely impact the four invertebrates and their habitat. Thus, groundwater pumping to the extent that it causes a significant reduction in the quantity of water in areas occupied by the species could potentially result in taking of the species. Private landowners may choose to apply for an incidental take permit and may develop and implement Habitat Conservation Plans. Given the likelihood of adequate groundwater levels from Federally reserved water rights, potential impacts of the proposed CHD on groundwater withdrawals for irrigated agricultural purposes are not anticipated.

Units 3 & 4 (Pecos and Reeves Counties, Texas)

135. Within Diamond Y Springs and Sandia Springs, groundwater availability and spring discharge remain issues of concern. In Pecos and Reeves Counties, and in areas adjacent to the proposed units, irrigated crop production operations primarily obtain groundwater from aquifers separate from those on which the springs depend.[95] The Nature Conservancy has noted that groundwater depletion within other aquifers can potentially impact recharge within the springs, although currently the interactions between aquifers and zones are imperfectly defined for the region. Potential future measures to maintain spring discharge within the springs will require further hydrological studies to determine subterranean impacts of withdrawals from other aquifers. The Nature Conservancy has stated that additional research on the delineation of watersheds is crucial to the sustainable, long-term conservation of the springs.[96] If hydrological studies determine a link between the various aquifers, the Service may work with private landowners on a volunteer basis to assure that irrigation practices minimize groundwater impacts to the Pecos assiminea.

136. According to the Natural Resource Conservation Service, a number of agricultural operators within the two counties currently engage in water conservation practices, including the use of irrigation pipelines.[97] According to projected water demand trends in the 2004 Middle Pecos Water Management Plan, water needs for irrigation purposes are not anticipated to increase over the next fifty years.[98]

137. Current conditions within Diamond Y Spring and East Sandia Spring are considered suitable for the spring habitats to support Pecos assiminea. However,

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[94] Personal communication with Paul Tashjian, Hydrologist, U.S. Fish and Wildlife Service, November 9, 2004.

[95] Personal communication with Terry Whigman, Conservationist, Natural Resource Conservation Service, December 12, 2004.

[96] Karges, J. 2003. Aquatic conservation and The Nature Conservancy in West Texas. Pp. 145-150 In Garrett, G. P. and N. L. Allan (eds.) Aquatic fauna of the Northern Chihuahuan Desert. Special Publication 46. The Museum of Texas Tech University; Personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 3, 2004.

[97] Personal communication with Terry Whigham, Conservationist, Natural Resource Conservation Service, December 12, 2004.

[98] Turnert Collie & Braden Inc, 2004 Middle Pecos Groundwater Conservation District Water Management Plan, prepared for Middle Pecos Groundwater Conservation District, Pecos County, Texas, June 2004.

reduction in current groundwater levels could impact the species and its habitat. Thus, groundwater pumping to the extent that a significant reduction in the quantity of water in areas occupied by the species could potentially result in taking Pecos assiminea. Private landowners may choose to apply for an incidental take permit and may develop and implement Habitat Conservation Plans. Given uncertainties as to the potential impacts of irrigation-related groundwater withdrawals on surface and groundwater levels and recharge zones within Units 3 and 4, this analysis does not forecast future economic impacts to agricultural production activities.

4.2.3 Residential Development

138. All proposed critical habitat areas for the four invertebrates are located on Federal lands and The Nature Conservancy lands managed as preserves. As such, no development activities may take place within the proposed boundaries of the CHD. However, groundwater contamination associated with expanding urban development within Chaves County may impact groundwater quality within the Roswell Basin source area. Moreover, within New Mexico, the aquifer supporting the invertebrates is also a source for municipal water in the region.

Groundwater Quality Impacts

139. Expanding urban development includes the installation of subsurface septic tanks, which can be a source of groundwater contamination in Chaves County. Most subdivision developments in Chaves County require the installation of septic tanks, as developed areas are not connected to sewage systems.

140. Subdivision developers must apply for liquid waste permits from the New Mexico Department of Environment (NMED). NMED is currently revising its Liquid Waste (Septic Tank) Program to address aquifer and surface water segments that are vulnerable to contamination from septic tanks and other on-site systems. NMED is currently in the process of mapping areas of concern at the county level. These "Areas of Concern" include:

> "water-table aquifers with a vadose zone thickness of 100 foot or less containing no soil or rock formation that would act as a barrier to saturated or unsaturated wastewater flow; sites within one mile of a known ground-water plume of anthropogenic anoxic or nitrate contamination within an aquifer, provided that the site overlies the same aquifer; an aquifer overlain by fractured bedrock; an aquifer in karst terrain; or an alluvial aquifer that discharges to a gaining stream located within 200 feet of the proposed disposal-field or seepage-pit location."[99]

141. Liquid waste permit applications for conventional septic systems on lots smaller than three-quarters of an acre within Area of Concerns will receive greater scrutiny in order to protect public health and prevent degradation of a body of water. Chaves County

[99] New Mexico Environment Department, Liquid Waste (Septic Tank) Program Guidance, accessed at http://www.nmenv.state.nm.us/fod/LiquidWaste/guidance.html on December 9, 2004.

Planning and Zoning ordinances, however, currently require that lands within the western side of Roswell be subdivided into no less than 5-acre parcels in order to minimize the number of septic tanks constructed and thereby minimize potential groundwater contamination related to public health concerns.[100]

142. While the potential for groundwater contamination from septic tanks remains a concern, it is unknown whether the state of New Mexico will require additional construction modifications to provide protection for the four invertebrates.[101] Therefore, potential impacts of the proposed designation on residential development activity are currently unknown.

Groundwater Withdrawal Impacts

143. Within New Mexico, the Roswell aquifer supporting the invertebrates is also a source for municipal water in the region. Chaves County has assessed groundwater capabilities and has determined that there is enough water in the aquifer to support additional 100,000 residents.[102] As the Service has determined that Federally reserved water rights for Bitter Lake NWR will ensure minimum surface water discharge at Bitter Lake NWR, this analysis does not anticipate future impacts to municipal groundwater demands. Four invertebrate concerns within Bitter Lake NWR, as examined above, are more directly related to groundwater contamination from septic tanks.

144. Land use activities surrounding the proposed critical habitat areas in Pecos and Reeves Counties, Texas are predominantly related to oil and gas development and irrigated crop production. Regional groundwater pumping concerns are therefore more directly related to irrigated agriculture than to municipal water needs. Fort Stockton, the nearest town to Diamond Y Draw Complex (Unit 1) obtains municipal water from the Edward-Trinity aquifer, which is likely located in a separate aquifer from those that feed the springs.[103] As noted in Section 4.2.2, the interactions between numerous aquifers and recharge zones in the region are currently undefined in the region. There is a potential, however, that municipal water withdrawals may impact the hydrology at the springs. However, given that growth in municipal water demand within the region is projected to be minimal (See Section 3.2.4), this analysis does not anticipate impacts to urban development within Pecos and Reeves Counties.[104]

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[100] Personal communication with Grant Pinkerton, Directory, Chaves County Planning and Zoning Department, December 9, 2004.

[101] Ibid.

[102] Ibid.

[103] Personal communication with Terry Whigman, Conservationist, Natural Resource Conservation Service, NRCS Conservationist, December 14, 2005.

[104] Personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 3, 2004 and December 17, 2004; Terry Whigman, Conservationist, Natural Resource Conservation Service, NRCS Conservationist, December 14, 2005.

4.2.4 Federal Lands Management

145. Many activities occurring within the vicinity of the proposed CHD within Bitter Lake NWR will be undertaken in the interest of the four invertebrates. Bitter Lake NWR activities include salt cedar control and eradication, controlled burns, fire management, habitat creation efforts for invertebrates, and water control projects. Costs are anticipated to be incurred related to the following activities:[105]

- **Dike rehabilitation.** Dike rehabilitation will create additional habitat for the invertebrates. Costs are budgeted at $60,000 to implement this specific project.[106]

- **Salt cedar control and eradication.** Bitter Lake NWR efforts to control the re-invasion of salt cedar to increase water flows are likely to occur on an annual basis. Based on estimates provided within the Sandhill Fire Burned Area Emergency Rehabilitation Plan, salt cedar control and eradication measures within the two units are likely to incur costs of up to $6,000 per year. The present value of these costs is estimated to be $70,000.[107]

- **Monitoring efforts.** Future monitoring efforts are estimated to range from $23,000 to $32,000 in present value terms from 2005-2025.[108]

- **IntraService Consultation.** Bitter Lake NWR personnel will likely engage in low effort informal IntraService section 7 consultations on an annual basis to address impacts of activities on the four invertebrates. Potential project modifications are likely to be minimal, given the beneficial nature of Bitter Lake NWR projects and activities. The present value of costs associated with future consultations are anticipated to range from $31,000 to $116,000 over 21 years.

146. The present value of total costs anticipated to be incurred by Bitter Lake NWR in engaging in Section 7 consultation and implementing projects that will benefit the four invertebrates are forecast to range from $182,000 to $278,000 over 21 years.

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[105] Many management actions within and adjacent to the proposed CHD (e.g., salt cedar control and eradication) will been directed towards multi-species recovery and protection. In each instance, this analysis attempts to identify costs specifically related to conservation of the four invertebrates. Where data are not available to accurately capture costs specific to four invertebrates conservation efforts, this analysis includes the full costs and notes the multiple considerations that may contribute to the undertaking of the particular management action.

[106] Personal communication with Gordon Warrick, Wildlife Biologist, Bitter Lake National Wildlife Refuge, November 11, 2004; Brian Lang, Endangered Invertebrates Biologist, New Mexico Department of Game and Fish, November 11, 2004.

[107] U.S. Fish and Wildlife Service, Bitter Lake National Wildlife Refuge, Sandhill Fire Burned Area Emergency Rehabilitation (BAER) Plan, March 24, 2000.

[108] Personal communication with Gordon Warrick, Wildlife Biologist, Bitter Lake National Wildlife Refuge, November 11, 2004 and Brian Lang, New Mexico Department of Game and Fish, December 20, 2004.

4.2.5 The Nature Conservancy Lands Management[109]

147. The Nature Conservancy manages Diamond Y Springs Preserve and Sandia Springs for long term habitat conservation and protection of the functional integrity of surface water systems to benefit rare aquatic species and communities within the preserves. Projects occurring on Diamond Y Springs and Sandia Springs that benefit Pecos assiminea and its habitat include ongoing salt cedar and mesquite eradication to control the re-invasion of salt cedar via manual or prescribed fire methods, building of fire breaks, biological inventory and monitoring, habitat enhancement projects and coordination efforts with oil and gas companies to reduce and prevent the likelihood of groundwater contamination within the springs. These efforts have been undertaken to enhance and restore wetland and stream flows to benefit the Federally endangered Leon Springs pupfish, Pecos gambusia, and the threatened Pecos sunflower.[110] Future activities will likely also address the invertebrates and their habitat. For instance, The Nature Conservancy is proposing to manipulate bank sides of pools to create additional habitat for the Leon Springs pupfish. This project will likely be planned to minimize potential disturbance to Pecos assiminea.

148. The Nature Conservancy has also indicated the potential for creating a conservation plan to formally assess conservation elements and future management actions within Units 3 and 4. The proposed plan will likely include targeted management actions for the Pecos assiminea.

149. Limited data are available to estimate the costs of future management activities within Units 3 and 4. Based on estimated costs of past habitat enhancement projects, this analysis assumes that approximately $61,000 could be incurred on an annual basis to benefit aquatic habitat at the springs for various threatened and endangered species, including the Pecos assiminea. The present value of the total costs are anticipated to be $707,000.[111] The Nature Conservancy notes that funds for projects are derived from a variety of sources, including state grants and private donations.[112]

150. These costs are related to conservation efforts implemented by The Nature Conservancy to benefit the ecosystem of the springs and are consistent with the mission of the organization. Data are not available to accurately capture costs specific to Pecos assiminea conservation efforts as the relative level of consideration for this species among the multiple species considered is unclear. This analysis therefore captures the full costs and caveats that because these conservation efforts are undertaken for multiple

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[109] Information obtained from personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 3, 2004 and December 17, 2004.

[110] Ibid.

[111] In the past, mechanical, chemical, and prescribed burn salt cedar and invasive species control efforts have incurred costs of up to $61,000 for a year of efforts within both Diamond Y Draw and Sandia Springs, Supplemental Environment Project Agreement between The Nature Conservancy and the Texas Commission on Environmental Quality, accessed at http://www.tceq.state.tx.us/assets/public/legal/sep/natureconservancy.PDF.

[112] Personal communication with John Karges, Conservation Biologist, The Nature Conservancy, West Texas Office, December 3, 2004 and December 17, 2004.

reasons, including the full costs likely overstates the costs related to Pecos assiminea conservation.

4.2.5 State Recovery and Conservation Plan[113]

151. The Department of Game and Fish State Recovery and Conservation Plan for the Four Invertebrates is currently in the draft planning stage. As such, information on the complete costs of implementing potential conservation measures is not yet available. Potential costs of the strategy are expected to be undertaken by the Department and include, but are not limited to, the following:

- **Genetic Studies.** Conducting genetic studies for the invertebrates is estimated at $27,000 annually over four years. The present value of total costs is estimated to be $98,000.

- **Population Ecology Studies.** Costs associated with implementing these studies are budgeted at $14,000 annually over four years. The present value of total costs is estimated to be $51,000.

- **Monitoring and data entry.** The Department anticipates three months full time of data entry, estimated at $15,000 to $21,000.

152. Thus, a total of $164,000 to $170,000 in costs, in present value terms, are anticipated be incurred in developing and implementing the State Recovery and Conservation Plan. As noted, this estimate does not include all future potential projects but incorporates the best available information to date.

[113] Recovery and Conservation Plan cost information obtained from New Mexico Department of Game and Fish, November 10, 2004 and December 14, 2004.

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APPENDIX A:

ANALYSIS OF IMPACTS TO SMALL ENTITIES AND ENERGY MARKETS

1. This appendix considers the extent to which the analytic results presented in this analysis reflect impacts to small businesses or energy markets. The analysis of the effect of four invertebrates conservation efforts on small entities is conducted pursuant to the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory

2. Enforcement Fairness Act (SBREFA) in 1996. The energy analysis is required by Executive Order No. 13211.

A.1 SBREFA Analysis

3. This section considers the extent to which the analytic results presented above reflect impacts to small businesses. The small business analysis presented in this section is based on information gathered from the Small Business Administration (SBA), U.S. Census Bureau, and U.S. Department of Agriculture and comparisons with the results of the economic analysis. The following summarizes the sources of potential future impacts on small businesses as a result of future conservation efforts for the four invertebrates.

4. Lands proposed for critical habitat designation include only Federal and The Nature Conservancy lands. The majority, 81 percent, of total forecast economic impacts is anticipated to be associated with oil and gas production. Specifically, these impacts are the result of modifications to oil and gas companies operating within the BLM Bitter Lake Habitat Protection Zone in Chaves County, New Mexico. These economic costs may translate into impacts to small oil and gas entities. While oil and gas production also occurs in Unit 3 of the proposed critical habitat in Pecos County, Texas, this analysis does not quantify any modification to those operations as a result of conservation efforts for the invertebrate species.

5. Of the remaining impacts forecast in this analysis costs, 15 percent will be borne by Federal agencies and The Nature Conservancy for implementing conservation efforts in their land management activities that benefit the four invertebrates. The remaining approximately four percent of forecast costs are associated with potential consultation on CAFOs within Chaves County, New Mexico.

6. Activities anticipated to occur within the next 20 years within or adjacent to the proposed critical habitat for the four invertebrates that potentially effect small businesses include:

- Oil and gas production;
- Irrigated agricultural production; and
- Livestock operations.

7. The Small Business Administration size standards for various types of businesses likely to be affected, and the geographic region used in this small business analysis, for each of these industries, are provided in Exhibit A-1. As highlighted, all businesses related to oil and gas production, irrigated agricultural production, and livestock operations within Chaves County, New Mexico and Pecos and Reeves Counties, Texas are considered small. As a result, this analysis assumes that the all revenue and expenditures associated with these activities are related to or are incurred by small entities. Exhibit A-1 reports the total number of businesses in Chaves County, New Mexico and Pecos and Reeves Counties, Texas that may be associated with these expenditures, by NAICS (North American Industry Classification System) code. Information on small entities within the agriculture industry is gathered from the 2002 Census of Agriculture. Information on small entities within the oil and gas extractive industry is gathered from 2002 U.S. Census Bureau County Business Patterns.

Exhibit A-1

SMALL BUSINESS SIZE STANDARDS AND APPLICABLE GEOGRAPHIC REGION FOR SMALL BUSINESS IMPACTS ANALYSIS

	Number of Business		
NAICS Code/Industry and Small Business Size Standards	**Chaves County, NM**	**Pecos County, TX**	**Reeves County, TX**
Subsector 211 - Oil and Gas Extraction (500 Employees)	35	11	2
Subsector 111 - Crop Production ($750,000)	374	105	118
Subsector 112 - Animal Production (including dairy cattle and milk production, sheep and goat farming) ($750,000)	301	N/A	N/A

Source:
Size standards based on SBA's Table of Small Business Size Standards based on NAICS 2002, http://www.sba.gov/size/sizetable2002.html.
2002 Census of Agriculture and 2002 County Business Patterns.

The following discussion of small business impacts considers impacts that may result from restrictions on these activities for the benefit of the four invertebrates.

A.1.1 Oil and Gas Development

8. Impacts to oil and gas companies resulting from conservation efforts for the four invertebrates have the potential to affect some small business operating adjacent to the proposed CHD in Units 1 and 2 in Chaves County, New Mexico. As discussed in Section 4.2.1, expected future impacts on the oil and gas industry include administrative costs, project modification costs, and delay impacts associated with complying with BLM stipulations in the Bitter Lake Habitat Protection Zone plan. BLM developed and implemented the plan for the Pecos gambusia prior to the proposed listing and designation of the four invertebrate species. However, as similar groundwater protection measures for oil and gas drilling activities would be required for the four invertebrates,

this analysis considers the costs to operators in complying with Habitat Protection Zone stipulations.

9. Estimated impacts to natural gas extraction related to project modifications and administrative efforts are likely to increase drilling costs by approximately 10 to 20 percent, or by as much as $150,000 per natural gas well. An estimated 63 wells will require additional project modifications to ensure well integrity and prevent the opportunity for groundwater contamination. These modifications can potentially increase capital costs or administrative burden up to the point where an operator may decide not to drill a well. A total of three APDs within the HPZ have been appealed or are undergoing the appeal process due to the additional drilling requirements. In one case, an operator has decided not to pursue drilling.[114] Given the size of the companies operating within the Habitat Protection Zone and the large amount of available minerals within the Roswell area, it is likely that producers will be able to shift production to other locations. However, if oil and gas producers are unable to shift production elsewhere, up to seven companies could be impacted, based on the number of companies operating on leases within the Bitter Lake Habitat Protection Zone with the potential for additional well development.[115] The decision not to drill is a function of the potential yield of each well, the financial condition of the operator, availability of other leases, and other operating decisions. Detailed data required to estimate the potential for such impacts are not available.

10. Several of these companies with leases in the Bitter Lake Habitat Protection Zone are considered the top-producing operators of natural gas within New Mexico, according to New Mexico Oil and Gas Association.[116] Moreover, most of the oil and gas companies that operate within Chaves County are headquartered outside of the proposed critical habitat region and have operations in multiple locations. Therefore the relevant area for purposes of this small business analysis is at the state level. There are approximately 211 small businesses in the oil and gas extraction sector within the state of New Mexico that generated $189.2 million in revenue in 2002.[117] Given the large number of oil and gas businesses within the New Mexico and that many regional oil and gas businesses also operate outside Chaves County, the number of potentially affected small businesses is a small percentage of all small oil and gas entities in New Mexico.

11. As described in Section 4.2.1 of this analysis, oil and gas drilling also occurs on private lands outside of Diamond Y Spring in Unit 3 of the proposed critical habitat. Unit 3 is comprised of lands managed as a preserve by The Nature Conservancy. While oil and gas activities in this area may present water quality issues, they are not considered

[114] Personal communication with Dan Baggao, Wildlife Biologist, Bureau of Land Management, Roswell Field Office, December 14, 2004.

[115] U.S. Bureau of Land Management, Roswell Field Office, Habitat Protection Zone Environmental Assessment, EA-NM-060-00-030, October 2002.

[116] New Mexico Oil and Gas Association accessed at http://www.nmoga.org/index2.html.

[117] US Census Bureau, 2002 County Business Patterns.

a threat to groundwater levels in the region.[118] This analysis does not forecast modifications to oil and gas production in Texas and therefore no impacts to small businesses are quantified.

A.1.2. Irrigated Agricultural Production

12. Agricultural production dependent on groundwater irrigation occurs within Chaves County, New Mexico and Pecos and Reeves Counties, Texas. This analysis assumes that all farms operating within the regions in the three counties are small entities.

13. Extensive groundwater pumping associated with irrigated agricultural production may impact the groundwater resource areas on which the four invertebrates depend within New Mexico and Texas. The state of New Mexico is currently in process of retiring water rights of irrigated farmland adjacent to Units 1 and 2 to ensure water deliveries to Texas under the Pecos River Compact. Moreover, Federally reserved water rights within Bitter Lake NWR will likely ensure minimum surface water discharge at Units 1 and 2.[119] Within Texas, further hydrological studies are necessary to determine the impact of groundwater pumping on surface and groundwater levels at Units 3 and 4. As a result, groundwater withdrawal activities for agricultural production are unlikely to change as a result of the presence of the four invertebrates in the region. Thus, no impacts to small entities within the irrigated agricultural industry are expected.

A.1.3 Livestock Operators

14. According to information provided by the NMED, Surface Water Quality Bureau, approximately 47 CAFO facilities exist within Chaves County. This analysis assumes that all CAFOs within Chaves County are small entities. This analysis assumes that every CAFO facility within Chaves County will need to ensure that operational discharges avoid or eliminate impacts to the four invertebrates and their habitat. This will most likely be ensured associated with the facility's securing of a wastewater discharge permit through either through EPA or the State as described in Section 4.2.2. In the event that CAFO operators are required to implement additional measures to ensure groundwater protection within the Roswell aquifer on which the four invertebrates depend, small entities within the livestock operations industry could potentially be impacted the proposed critical habitat rule.

15. According to the Texas Commission on Environmental Quality, CAFO facilities do not occur in Pecos County or in Reeves County within 60 miles of the proposed

[118] Karges, J. 2003. Aquatic conservation and The Nature Conservance in West Texas. Pp. 145-150 In Garrett, G. P. and N.L. Allan (eds.) Aquatic fauna of the Northern Chihuahuan Desert. Special Publication 46. The Museum of Texas Tech University.

[119] U.S. Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants; Listing Roswell springsnail, Koster's tryonia, Pecos assiminea, and Noel's amphipod as Endangered With Critical Habitat*, Federal Register, Vol. 67, No. 29, February 12, 2002.

critical habitat units 3 and 4. As such, this analysis does not anticipate impacts to small entities within the livestock industry in Pecos and Reeves Counties, Texas.[120]

A.2 Potential Impacts to the Energy Industry

16. 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."[121] The Office of Management and Budget has provided guidance for implementing this Executive Order that outlines nine outcomes that may constitute "a significant adverse effect" when compared without 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 kilowatts-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.[122]

17. Two of these criteria are relevant to this analysis: (1) reductions in natural gas production in excess of in excess of 25 million mcf per year and (2) increases in the cost of energy production in excess of one percent. This analysis determines that the oil and

[120] Personal communication with Greg Larson, Texas Commission on Environmental Quality, Region 7, Midland office, December 8, 2004.

[121] 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.

[122] 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.

gas industry is not likely to experience "a significant adverse effect" as a result of conservation efforts for the four invertebrates.

18. The proposed CHD is not anticipated to impact natural gas production in excess of 25 million mcf per year. Additional modifications to drilling activities within the Bitter Lake Habitat Protection Zone are forecast to increase drilling costs by approximately 10 to 20 percent per well. An estimated 63 wells will require additional project modifications to ensure well integrity. As examined above, these modifications can potentially increase capital costs or administrative burden up to the point where an operator may decide not to drill a well. In 2002, there were 35,873 producing gas wells within New Mexico that produced a total of 1,655,906 million cubic feet of natural gas.[123] Thus, the potential yield of the 63 impacted wells within the Bitter Lake Habitat Protection Zone represents a small percentage of total State natural gas production.

19. While drilling modifications increase operating costs to producers within the Bitter Lake Habitat Protection Zone, the proposed rule is not anticipated to result in increases in the cost of energy production in excess of one percent within the state of New Mexico. As noted above, there are approximately 35,873 gas wells within New Mexico that produced a total of 1,655,906 million cubic feet of natural gas in 2002. Increased drilling costs for a maximum of 63 wells is therefore not likely to translate in a one percent increase in energy production costs across the state.

20. Impacts to ongoing oil and gas production in Pecos County, Texas are not forecast as it is unclear whether these activities will require conservation efforts for the invertebrate species. As described in Section 4.2.1, while oil and gas activities in this region may affect groundwater quality, they are not anticipated to affect groundwater levels.

[123] Energy Information Administration, New Mexico Natural Gas Summary accessed at http://tonto.eia.doe.gov/dnav/ng/ng_sum_lsum_dcu_SNM_a.htm.

APPENDIX C | REGION 2 INCREMENTAL EFFECTS MEMORANDUM

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
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Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

May 21, 2010

Memorandum

To: Leslie Katz Genova, Senior Associate, Industrial Economics, Inc.

From: Field Supervisor, New Mexico Ecological Services Field Office, Albuquerque, New Mexico

Subject: Incremental effects memorandum for the economic analysis of the proposed rule to revise critical habitat for four southwest invertebrate species

When consulting under section 7 under the Endangered Species Act in designated critical habitat, independent analyses are conducted for jeopardy and adverse modification. Jeopardy and adverse modification are not equivalent standards; however, in practice for the four invertebrates—Roswell springsnail, Koster's tryonia, Pecos assiminea, and Noel's amphipod—there are not likely to be any differences in project modifications made under the jeopardy standard and the adverse modification standard. According to the Director's Memorandum of December 9, 2004, the analysis of "destruction or adverse modification of designated critical habitat" relies on whether critical habitat would remain functional to serve the intended conservation role for the species. Jeopardy occurs when an action is reasonably expected, directly or indirectly, to diminish a species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced (50 CFR 402.02). Due to the biology and life characteristics of these species, when consulting under either standard, in order to reach a conclusion of jeopardy or adverse modification, the proposed action would have to make the habitat unsuitable to support the invertebrates. The ability of these species to persist is very closely tied to the quality of their habitats. Alterations of habitat that diminish the value of the habitat (e.g. flow, water quality, suitability of substrate) and the amount of habitat for the species would be likely to affect population size, reproduction, and recruitment of the invertebrates, and would therefore appreciably reduce their likelihood of survival in the wild and constitute jeopardy. All four species have short life spans (approximately one year) and a long breeding season (spring through fall); therefore, population numbers are able to rebound in a relatively short time period. Because of this ability to rebound, if the habitat is not compromised, activities that harm or kill existing individuals are unlikely to result in jeopardy to the species. In most cases, the results of consultation under the adverse modification and jeopardy standards are likely to be similar because 1) the primary constituent elements that define critical habitat are also essential for survival of all four species, 2) all four species are severely curtailed in range, 3) numbers of individuals in surviving populations are very small, and 4) critical habitat is only being proposed in areas currently occupied by the species.

For example, an action that killed a number of individuals at a site but did not affect the habitat (i.e., over-sampling or trampling) is unlikely to jeopardize the species unless a large percentage of the population were lost. The high reproductive rate of each of the four species should allow the populations to rebound rather quickly. Only actions that render the habitat unsuitable by adversely modifying critical habitat via the primary constituent elements would be likely to jeopardize the species. Consequently, the outcome of section 7 consultations in such cases would likely not be substantially different with designation of critical habitat compared to existing consultations conducted under the jeopardy standard. Additionally, the outcome of formal consultation that does not determine jeopardy or adverse modification results only in discretionary conservation recommendations. Critical habitat designation may interject additional considerations for protection of habitat function, suitability, or capability over the long term into section 7 consultations. This could result in additional discretionary conservation recommendations.

If you have any questions, please contact Susan Oetker at 505-761-4761.

Wally Murphy