

DRAFT

GENERAL REEVALUATION REPORT AND

SUPPLEMENTAL ENVIRONMENTAL

IMPACT STATEMENT II:

RIO GRANDE FLOODWAY,

SAN ACACIA TO BOSQUE DEL APACHE UNIT,

SOCORRO COUNTY, NEW MEXICO

APPENDIX D

**Final Supplemental Environmental Impact
Statement, Rio Grande Floodway, San Acacia
to Bosque del Apache Unit, Socorro County,
NM (July 1992)**

**FINAL
SUPPLEMENTAL ENVIRONMENTAL
IMPACT STATEMENT**

RIO GRANDE FLOODWAY



**San Acacia to Bosque del Apache Unit
Socorro County, NM**



**US Army Corps
of Engineers**
Albuquerque District

JULY 1992

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FINAL
SUPPLEMENTAL ENVIRONMENTAL
IMPACT STATEMENT

RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
SOCORRO COUNTY, NEW MEXICO

U.S. ARMY
CORPS OF ENGINEERS
ALBUQUERQUE DISTRICT

July 1992

**FINAL
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT**

Rio Grande Floodway
San Acacia to Bosque del Apache Unit
Socorro County, New Mexico

The responsible lead agency is the U.S. Army Engineers District, Albuquerque.

Abstract. The Supplemental Environmental Impact Statement addresses the perceived effects of alternative plans developed to provide higher levels of flood protection to floodplain communities, development, and wildlife habitat from flood flows in the Rio Grande, extending from San Acacia, New Mexico, to the headwaters of Elephant Butte Reservoir. Also evaluated is the no action alternative. These alternatives consist of four levels of flood protection (50-, 100-, 200-year and Standard Project Flood) which would be provided by reconstructing an existing earthen embankment that parallels the west bank of the Rio Grande to form a structurally superior levee. The recommended level of flood protection is the 100-year frequency level. The length of the reconstructed levee would be about 54 miles. The construction of a protective levee was authorized by the Flood Control Act of 1948 (Public Law 80-858).

The recommended plan would provide a high degree of flood protection to life and property in the Socorro area, to the low-flow conveyance channel, and to Bosque del Apache National Wildlife Refuge (NWR). The project is designed to minimize the removal of riparian vegetation from the riverward side of the levee. Unavoidable removal of salt cedar, cottonwood, and willow trees would be compensated, as would the filling of a small acreage of wetland. A lower level of flood protection would generally lower the degree of project effects while higher levels of protection, especially the Standard Project Flood, would correspondingly expand project effects. Impacts to endangered wildlife utilizing Bosque del Apache NWR and vicinity would be avoided by scheduling construction of certain levee segments during their absence and close coordination with monitoring personnel. Any cultural resources potentially affected by project construction would be avoided or salvaged.

SEND YOUR COMMENTS TO THE
DISTRICT ENGINEER BY _____

For additional information
PLEASE CONTACT:

Mr. Mark Sifuentes
U.S. Army Corps of Engineers
Albuquerque District
P.O. Box 1580
Albuquerque, NM 87103
(505) 766-3577

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SECTION I - SUMMARY

MAJOR CONCLUSIONS AND FINDINGS

1.01 This document evaluates the effects of alternatives developed to provide increased flood protection to floodplain improvements, human welfare and security, water conveyance facilities, and a major national wildlife refuge from high flood flows in the Rio Grande, extending from San Acacia, New Mexico, to Elephant Butte Reservoir - a distance of about 54 miles. It reflects design refinements made since public review of the draft Supplemental Environmental Impact Statement (SEIS), as well as concerns expressed as a result of this review. Alternatives evaluated in detail consist of four levels of flood protection which would be provided by reconstructing an existing earthen embankment that parallels the west bank of the Rio Grande. These alternatives reflect the flood control plan authorized by the Flood Control Act of 1948. The "no action" alternative is also evaluated. This document is entitled as a "supplement" because of the presence of an existing Environmental Impact Statement that was prepared for a related proposal under the same authorization.

1.02 The recommended plan would provide flood protection up to the 100-year flood frequency level. Associated alternatives consist of the 50- and 200-year flood frequency levels, as well as the greater Standard Project Flood event. The recommended plan has the greatest net flood control benefits, minimizes disturbance to riparian habitat, and has the potential for wetland development and increasing wildlife diversity of riparian habitat. The potential for wetland development in association with borrow removal diminished since distribution of the draft SEIS. This reduction occurred because of a combination of design refinements which further balanced earth requirements, retained more of the riverside slope of the existing embankment, and utilized a higher percentage of earth present in the embankment for its reconstruction. These measures reduced the amount of additional earth required and, consequently, the need for borrow pit development in the riparian zone.

1.03 The provisions and requirements of all applicable Federal statutes, Executive Orders, and State and local policies and land use plans have been included in the recommended plan. Sections 401 and 404 requirements under the Clean Water Act are being met with a State of New Mexico Water Quality Certificate and Corps of Engineers' authorization.

AREAS OF CONTROVERSY OR CONCERN

1.04 Several issues of public concern were identified during the formulation of the recommended plan, public review of the draft SEIS, and subsequent meetings with State and Federal agencies. Those issues of particular public concern, their effects, and any necessary resolutions are identified below. At this point in the progression of the recommended plan, there are no known areas of controversy.

a. Flood Hazards. The recommended plan satisfies this prime objective of increasing the level of flood protection to floodplain development, human welfare and security, and wildlife refuge resources.

b. Sediment Control and Water Salvage. The primary effect the recommended plan would have on these concerns would be to provide a high level of assurance that the water salvage and conveyance function of the low-flow conveyance channel would continue. Other than preventing sedimentation of the low-flow conveyance channel as a consequence of the Rio Grande flooding (up to the 100-year frequency), the recommended plan would not alter the sediment transport/disposition regime in the Rio Grande.

c. Project Effects on Riparian Habitat and Fisheries. A primary project objective is to preserve riparian habitat to the maximum extent possible (especially cottonwood-dominated communities), as well as to improve its value for wildlife. Refined levee design, since distribution of the draft SEIS, has retained a majority of the riverside embankment slope and associated vegetation in the first 44 miles. Riparian vegetation unavoidably removed would be compensated for by the use of high wildlife use cottonwood- and willow-dominated plantings and acquisition of a wildlife conservation easement. Compensation sites would be located within the riparian zone. The potential exists to replace monotypic salt cedar with native riparian vegetation. Successful replacement would increase wildlife species diversity. While wetlands would be constructed to compensate for those displaced by project construction, the potential for expanding wetlands by utilizing borrow pits has, as stated, diminished since distribution of the draft SEIS because of design refinements that reduced the quantity of borrow required. Existing fisheries should not be affected and project construction would be scheduled to avoid any potential to adversely affect endangered species.

d. Alternative Actions Recommended.

(1) Construct dam on the Rio Puerco to retain heavy metals and radionuclides potentially present in sediment carried by the Rio Puerco, as well as to reduce continuing sedimentation of Elephant Butte Reservoir. In response to this request to re-study the feasibility of a dam on the Rio Puerco as an additional feature to the planned action and support from the Texas Congressional Delegation, a reconnaissance-level study addressing these concerns will be initiated when funds are made available.

(2) Reconstruct only weak sections of existing levee embankment for the 25-, 50-, 75-, and 100-year flood frequency events. The Corps is required, by regulation, to examine alternatives which provide various levels of flood protection and select the plan which provides the greatest net benefit. For this project, this level was the 100-year level. The entire existing embankment was examined during the formulation process for areas which may be adequate to provide this level of protection and not require rehabilitation. A determination was made that the entire embankment needs some type of reconstruction and that the reconstruction of intermittent levee sections would be difficult to implement because of increased construction costs, the need to raise some sections, and the need for a drainage system.

e. Compatibility of Recommended Plan with the Rio Grande Bosque Conservation Initiative Currently Being Developed. The recommended plan was formulated utilizing many of the objectives sought by this Initiative to protect, enhance,

and manage the riparian woodland and forest. The design of the levee reflects these objectives as do efforts to increase habitat quality.

f. Mitigation Site and Measures. Following coordination of the draft SEIS, the U.S. Fish and Wildlife Service (Service) and New Mexico Department of Game and Fish (NMDGF) requested that the site mutually selected by the Service and the Corps of Engineers (Corps) - Bosque del Apache National Wildlife Refuge (NWR), be changed to the riparian zone that borders the existing embankment. The Corps concurred with this request. Also requested was an additional measure to be included as part of the overall mitigation plan. This measure consists of acquiring a wildlife conservation easement on some of the adjacent riparian zone. This measure has been included as a mitigation objective and coordination with the State land administering agency to implement this feature is progressing.

g. Inter-relationship of the Recommended Plan to the Functioning of the Low-flow Conveyance Channel and Effects (near, long-term, and cumulative) of Perpetuating This Function. The recommended action is related to the low-flow conveyance channel as it is to all development and life in the 100-year floodplain - it will increase the level of flood protection from high flood flows in the Rio Grande. Its implementation is not connected to resumed use of the low-flow conveyance channel. The fact that the project would provide increased flood protection to the conveyance channel should not appreciably change any effects this facility is having on the riverine and riparian ecosystem, or will continue to have. Cumulative effects of implementing the recommended plan and those transpiring as a consequence of the conveyance channel should not result in an appreciable change from current conditions, since levee reconstruction contains compensation measures to prevent any deterioration of riparian biotic communities and to possibly benefit them.

h. Water Quality. The recommended plan should not affect water quality during construction nor during its operation. A combination of distance from the stream channel, design measures to prevent erosion of the reconstructed levee, and contractual measures to control any contamination of water would insure a maintenance of water quality.

i. Potential of Project to Develop Wetlands and Recreational Ponds. The potential to modify borrow areas to create wetlands has decreased since public review of the draft SEIS. This has resulted because of a refinement in design features which utilizes most of the earth present in the existing embankment, essentially removing the need for any borrow pits in the riparian zone or adjacent floodplain. Nevertheless, the potential for wetland development will still be present. The city of Socorro has expressed a strong interest in these features and coordination will continue as the project progresses in the event an opportunity for wetland development arises.

j. Project Effects on Existing Recreational Resources, Opportunities, and Needs, and Project-Related Opportunities for the Development of Recreational Facilities. The development of project-associated recreational facilities can be accomplished through cost sharing with the local sponsor. Existing recreational uses would be preserved, although there could be some temporary impairment of access during construction. Development of compensational wetlands would expand water-associated recreational opportunities.

k. Project Effects on Significant Historic and Prehistoric Cultural Values. All undisturbed areas affected by project-related activities would be surveyed prior to construction and any properties located, assessed in accordance with 36 CFR, Part 60.4. If avoidance is neither possible nor feasible, a data recovery plan would be developed and coordinated. El Camino Real (Chihuahua Trail) would not be affected, since no project features would be located on the east side of the river.

l. Project Effects on Land Use. The project should not significantly affect land use.

m. Project Potential to Suppress Wildfires, Manage Unauthorized Tenancy in the Bosque, and Reduce Removal of Cottonwood Trees for Firewood. These concerns are not within the Corps of Engineers' authority. However, project features could be designed in coordination with local and State officials to control access and thereby assist in managing these concerns.

UNRESOLVED ISSUES

1.05 There are no known major issues that are unresolved. Most known issues have been resolved by mitigation, modification of project features and construction schedules, or other means.

RELATIONSHIP TO ENVIRONMENTAL STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

1.06 The recommended plan is in full compliance with the following laws, regulations, and Executive Orders as they pertain to Federal water resources activities.

TABLE 1
Relationship of Alternatives to Applicable Environmental Protection Statutes
and Other Environmental Requirements

Compliance 1/ Status

	Recommended Alternative	Alternative Levels of Flood Protection			No-Action Alternative
		50-Year	200-Year	SPF	
<u>Federal Statutes</u>					
Archeological and Historic Preservation Act	Full	Full	Full	Full	Not Applicable
Clean Air Act	Full	Full	Full	Full	Not Applicable
Clean Water Act	Full	Full	Full	Full	Not Applicable
Endangered Species Act	Full	Full	Full	Full	Not Applicable
Farmland Protection Policy Act	Full	Full	Full	Full	Not Applicable
Fish and Wildlife Coordination Act	Full	Full	Full	Full	Not Applicable
National Historic Preservation Act	Full	Full	Full	Full	Not Applicable
National Environmental Policy Act	Full	Full	Full	Full	Not Applicable
Federal Water Project Recreation Act	Full	Full	Full	Full	Not Applicable
National Wildlife Refuge System Administration Act of 1966	Full	Full	Non-Compliance Possible	Non-Compliance Possible	Not Applicable
<u>Executive Orders (E.O.) and Memoranda</u>					
Floodplain Management (E.O. 11988)	Full	Full	Full	Full	Not Applicable
Protection and Enhancement of the Cultural Environment (E.O. 11593)	Full	Full	Full	Full	Not Applicable
Protection of Wetlands (E.O. 11990)	Full	Full	Full	Full	Not Applicable

SEIS-5

Compliance 1/ Status

	Recommended Alternative	Alternative Levels of Flood Protection			No-Action Alternative
		50-Year	200-Year	SPF	
Analysis of Impacts on Prime and Unique Farmlands (CEQ, 11 Aug 80)	Full	Full	Full	Full	Not Applicable
<u>Federal, State, and Local Policies and Land Use Plans</u>					
Master Plan Report for Bosque del Apache NWR	Full	Full	Full	Full	Not Applicable
Resources Management Plan for Elephant Butte and Caballo Reservoirs	Continued Coordination	Continued Coordination	Continued Coordination	Continued Coordination	Not Applicable
Comprehensive Plan for City of Socorro	Full	Full	Full	Full	Not Applicable
<u>Required Federal Entitlements</u>					

SEIS-6

None

1/ KEY

Full Compliance. Having met all requirements of the statute, E.O., or other environmental requirements for the current stage of planning. For alternatives not recommended, full compliance indicates that all statutory requirements could or would be met, or may have been met during the planning or NEPA process.

Partial Compliance. Not having met some of the requirements that normally are met in the current stage of planning. Partial compliance entries are explained in appropriate places in the EIS.

Non-Compliance. Violation of a requirement of the statute, E.O., or other environmental requirement.

Not Applicable. No requirements for the statute, E.O., or other environmental requirement for the current stage of planning.

Continued Coordination. Coordination of the inter-relationship of the alternatives with the developing Resources Management Plan will continue.

SECTION II - NEED FOR AND OBJECTIVES OF THE ACTION

INTRODUCTION

2.01 This section discusses the need for increased flood protection and the planning objectives that were identified as a basis for plan formulation. Included in the discussion is the developmental history and associated Congressional authorizations leading to the proposed action. Also included are the public concerns and resource management needs identified during the planning process and the resulting planning objectives that guided the plan formulation process.

AUTHORITY AND HISTORY

2.02 The Flood Control Act of 1948 (Public Law 80-858) authorized the construction of levees from San Acacia to Bosque del Apache as part of a comprehensive flood control plan. This comprehensive plan, known as the Rio Grande Floodway, provided for the rehabilitation of the levee system and construction of new levees and levee stabilization works in the Española and middle Rio Grande valleys. However, because funds for construction of levees for the San Acacia to Bosque del Apache segment of the floodway were not appropriated, this section of the comprehensive plan was never built. In 1956 the United States Senate directed a review of the authorized plan (in addition to other elements contained in the Rio Grande Floodway) to determine whether any additions or modifications should be made. In response to this review an interim report was prepared, resulting in Cochiti and Galisteo Dams being authorized for construction by the Flood Control Act of 1960.

2.03 In 1961 the United States Senate directed a further review of the 1948 comprehensive flood control plan, with particular reference to the Rio Puerco and Rio Salado. The objective of this review was to consider the flood control measures authorized by the 1948 and 1960 Flood Control Acts, determine the extent and magnitude of the flood and sediment related problems caused by the Rio Puerco and Rio Salado in the middle Rio Grande valley, and determine the feasibility of Federal participation in a plan of improvement which would meet present and long-term needs of the area. As a result of this review, the construction of flood and sediment control dams on the Rio Puerco and Rio Salado was recommended in 1972 in lieu of the originally authorized levee construction. A final environmental impact statement (EIS) was prepared based on this recommendation and filed with the Council on Environmental Quality in 1977. Subsequently, the Water Resources Development Act of 1976 (Public Law 94-587) authorized advanced engineering and design studies. These advanced studies were subsequently terminated when the State of New Mexico withdrew its support for the project due to an objection by the Service and the cost of the two recommended dams. A draft Supplemental EIS was prepared in conjunction with these advanced studies, but it was never filed or circulated. The objection by the Service was due to the periodic inundation of about 300 acres of land on the Sevilleta National Wildlife Refuge that would have occurred by construction of a dam on the Rio Salado. This inundation would have been contrary to management restrictions placed on operation of the refuge by the Campbell Family Foundation, which donated the land to the Service, through The Nature Conservancy, in December 1973. As a consequence of the infeasibility of dam construction, the construction of an engineered, competent levee from and along the alignment of an existing "spoil

bank" emerged as the only other economically feasible alternative. This "spoil bank" was created from the disposal of earth excavated to construct the low-flow conveyance channel during 1951 to 1959 and parallels the west side of the Rio Grande from San Acacia to Elephant Butte Reservoir. This alternative is essentially the same flood control plan that was originally authorized, except that an appreciable amount of earth has been made available since its authorization and the recommended plan will utilize this existing material and alignment.

PUBLIC CONCERNS AND RELATED RESOURCE MANAGEMENT NEEDS

2.04 The levee rehabilitation project has been requested and supported by the New Mexico Interstate Stream Commission. Their concern is for the protection of the low-flow conveyance channel, Bosque del Apache NWR (NWR), communities, irrigated lands and irrigation facilities, and other improvements found within the floodplain. Public concerns and related resource management needs identified during planning, environmental scoping, and public review of the draft SEIS and subsequent meetings included the following:

Increased Flood Protection.

Reduce the threat of flooding and associated economic losses, especially to the low-flow conveyance channel and that portion of the city of Socorro that is within the floodplain.

Preserve and enhance important wildlife areas, particularly Bosque del Apache NWR.

Integrate clearing, sediment removal, and realignment of the Socorro Diversion Channel outfall as an integral part of levee reconstruction.

Address the need for drainage facilities from within the Socorro city limits as provided for in the City of Socorro Drainage Study.

Evaluate project effects on the city of Socorro's participation in the National Flood Insurance Program.

Alternatives.

Evaluate watershed management and associated costs as an alternative.

Include the construction of a dam on the Rio Puerco as a feature of the recommended plan to retain any radionuclides and heavy metals that may pose a hazard to human health below Elephant Butte Reservoir and to retain sediment that is reducing the storage capacity of the Reservoir.

Consider intermittent levee replacement and replacement of weak levee sections for the 25-, 50-, 75-, and 100-year flood frequency events.

Management Concerns.

Integrate project features and construction methods with the purposes for which Bosque del Apache NWR was established.

Evaluate the advantages of the Corps of Engineers taking a more affirmative role in reducing the removal of cottonwood for firewood.

Address the problem of non-authorized tenants in the study area (riparian zone).

Investigate the possibility of constructing fire breaks in the riparian zone in conjunction with the planned levee project.

Preserve existing irrigation works, low-flow conveyance channel improvements and associated structures, river channelization and flood control works, and licensed crossings.

Evaluate the effects of the planned levee project on the operation of Elephant Butte Reservoir, including water salvage, and sedimentation and recovery of lost storage due to sedimentation.

Biological Resources.

Support and contribute to Senator Pete V. Domenici's Initiative to preserve and enhance the Rio Grande riparian corridor.

Modify borrow areas to create wetland and wildlife habitat.

Evaluate effects of project contribution on riparian vegetation and wildlife use.

Evaluate the hydraulic effects of the project on wetlands and marshlands.

Avoid adverse effects to threatened and endangered species and their habitat.

Maximize the preservation of riparian vegetation and wetlands.

Consider a variety of mitigation methods and sites to include planting of cottonwood and willow communities, wetland creation, conservation easements, land purchase, etc., throughout the project area.

Assess project effects on the operation of the low-flow conveyance channel and the effects the operation of the low-flow conveyance channel is having on the ecology of the riparian and riverine corridor downstream from the San Acacia Diversion.

Diversify present flood control and water conveyance purposes to encourage the regeneration of the cottonwood-dominated riparian forest, wetland restoration, vegetation management, and biological diversity; improvement of aquatic habitat; and enhancement of public awareness of the significance and ecological and cultural values of the river corridor.

Incorporate long-term monitoring and maintenance of mitigation measures as an integral part of project operation and maintenance.

Recreation.

Modify the planned project for recreational use, including trails and picnic facilities in the riparian zone.

Address any local cost sharing for recreational fish and wildlife facilities that may be implemented.

Evaluate opportunities to develop ponds for recreational use, such as Escondida Lake near the city of Socorro.

Evaluate the effects of the planned levee on existing recreational resources, opportunities, and needs. Recreational access to the Bosque should be evaluated.

Cultural and Natural Resources.

Preserve significant historic and pre-historic cultural values of our national heritage. Evaluate project effects on El Camino Road, the historic road of New Spain.

Identify any significant national resource identified by the State Natural Heritage Program.

Avoid any impact on any present, proposed or potential unit of the National Park System, National Wild and Scenic River System, or the National Trails System.

Transportation.

Evaluate the effects of construction activities on transportation facilities, including local roads.

Air and Water Quality.

Evaluate the effects of constructing the planned levee on air and water quality and any health hazards.

Miscellaneous.

Evaluate the socio-economic effects of the planned levee project.

Evaluate the effects of the planned levee project on land use and any special land use classifications.

Evaluate the effects of the planned levee project on aesthetics.

Recognize permit requirements.

PLANNING OBJECTIVES AND CONCERNS

2.05 Primary objectives and concerns employed in the development of the recommended plan are those that satisfy the purposes of the authorization and those that were expressed during public coordination, including environmental scoping. These objectives and concerns are as follows:

Provide an increased level of flood protection to human life, health, and well being; social relationships; and economy in the 100-year floodplain.

Reduce flood inundation damages to urban, agricultural, wildlife preserve, and water conveyance improvements in the Rio Grande floodplain from San Acacia, New Mexico, to Elephant Butte Reservoir.

Insure maximum water delivery between San Acacia and Elephant Butte Reservoir to satisfy Rio Grande Compact and 1906 Treaty with Mexico requirements for water delivery.

Preserve, conserve, and enhance important wildlife habitat, particularly Bosque del Apache NWR.

Preserve significant historic and prehistoric cultural values.

Conserve or enhance recreational opportunities within the riparian zone.

SECTION III - ALTERNATIVES INCLUDING THE RECOMMENDED PLAN

INTRODUCTION

3.01 The authorized plan and subsequent alternatives were developed to provide increased flood protection to crops and farmland; urban and suburban development; human life, health, and community functions; Bosque del Apache NWR; and major water conveyance and delivery facilities in the middle Rio Grande floodplain, extending from the mouth of the Rio Puerco downstream to Elephant Butte Reservoir. Reducing the adverse effects of sediment on water conveyance and storage features and facilities was also a major objective.

3.02 The proposed plan reflects concerns that were expressed during interagency coordination, those expressed during environmental scoping, and those expressed during public review of the draft SEIS. Also, the proposed plan described in this final SEIS reflects design refinements made since distribution of the draft SEIS. Major refinements consisted of a reduction in borrow requirements, maximum retention of levee slope vegetation, and a reduction of surplus earth. Mitigation measures have been moved from Bosque del Apache NWR to their placement within the riparian zone throughout the length of the project.

ALTERNATIVES EVALUATED

3.03 Alternatives evaluated during the present study and those developed in previous studies consisted of the following:

- a. Levee Reconstruction (50-, 100-, and 200-year flood frequency levels and the Standard Project Flood*),
- b. Flood and Sediment Control Dams,
- c. Local Levees,
- d. Watershed Land Treatment,
- e. Floodproofing and Zoning,
- f. Intermittent Levee Replacement, and
- g. No Action.

ALTERNATIVES ELIMINATED FROM DETAILED CONSIDERATION

3.04 a. Flood and Sediment Control Dams. As stated, the result of the 1961 Congressional directive to review the levee construction plan authorized in 1948 was a recommendation that flood and sediment control dams be constructed on the Rio Puerco and Rio Salado in lieu of the authorized plan. This recommendation was then followed by advanced engineering and design studies and a subsequent report addressing these dams. Of several damsites evaluated, one was selected

* The Standard Project Flood is defined as that flood that may be expected from the most severe combination of meteorological conditions considered reasonably characteristic of the geographical area in which the basin is located, but excluding extremely rare combinations.

on the Rio Puerco and one on the Rio Salado. These dams would have temporarily detained floodwater and released it at a flow rate which the existing Rio Grande channel could safely convey. Additionally, they would have retained a significant part of the large sediment load currently being deposited in the Rio Grande, associated irrigation and water conveyance systems, and downstream water storage facilities. Briefly, these damsites are as follows: ...

(1) Rio Puerco - The Hidden Mountain Site. This damsite would have been located about 17 river miles from the mouth of the Rio Puerco. This alternative would have required about 18,500 acres of land and cost about \$63,000,000 (1988 price levels).

(2) Rio Salado - The La Jencia (Jinsa) Site. The damsite would have been located about 15 miles upstream of the confluence of the Rio Salado with the Rio Grande. This alternative would have required about 5,400 acres of land and cost about \$52,000,000 (1988 price levels). As stated, this alternative was not pursued because of the cost of the two dams and constraints on the Service to permit inundation of about 300 acres of land on the Sevilleta National Wildlife Refuge.

b. Local Levees. This alternative would have consisted of the removal of only those parts of the existing earthen embankment that are next to the village of San Acacia, the city of Socorro, and Bosque del Apache NWR. These sections of embankment would have been replaced and extended to completely surround these developments. The low-flow conveyance channel would not have been protected. The combined length of these levees would have been 18 miles and would have cost about \$15,000,000 (1988 price levels) for 100-year flood protection. This alternative was not recommended because of its lower net economic benefits, inability to protect the low-flow conveyance channel, need for extensive land acquisition, extensive partitioning of land, and internal drainage problems.

c. Watershed Land Treatment. This measure was the subject of a substantial cooperative study effort among the Corps of Engineers, agencies of the United States Departments of Agriculture and Interior, state and local government agencies, and private interests. A variety of land treatment practices were considered, resulting in the development of three alternative plans. These three alternatives would have cost \$26,000,000, \$72,000,000, and \$94,000,000 (1988 prices). While these alternatives would have contributed to reduced soil erosion, improved water quality, enhanced wildlife use, and improved cover, among other benefits, they would have not effectively served the primary objective of flood control.

d. Floodproofing and Zoning. Nonstructural measures to increase the level of flood protection were considered but were found to be of very limited applicability as well as practicability. Since agricultural and wildlife refuge lands and the low-flow conveyance channel are unsuited to floodproofing and since existing urban development is, in general, not economically feasible to flood proof, floodproofing and zoning are realistically applicable only to areas where urban development is ongoing but not yet in place. This comprised only a very small proportion of the floodplain under study.

e. Intermittent Levee Replacement. The draft SEIS discussed the possibility of not reconstructing those embankment sections that were structurally competent. More refined analysis into construction feasibility demonstrated that this plan would be difficult to implement because of more involved construction efforts required to work around and join many isolated sections, thereby increasing construction costs; the need to raise some sections; and the need to install a

drainage system in the landward toe. Also, the refined levee design of retaining a large reach of the riverside slope of the embankment accomplished a major objective of retaining acceptable embankment sections, which was to preserve as much riverside vegetation as possible.

LEEVE REHABILITATION

3.05 a. Recommended Plan - 100-year Flood Frequency Level.

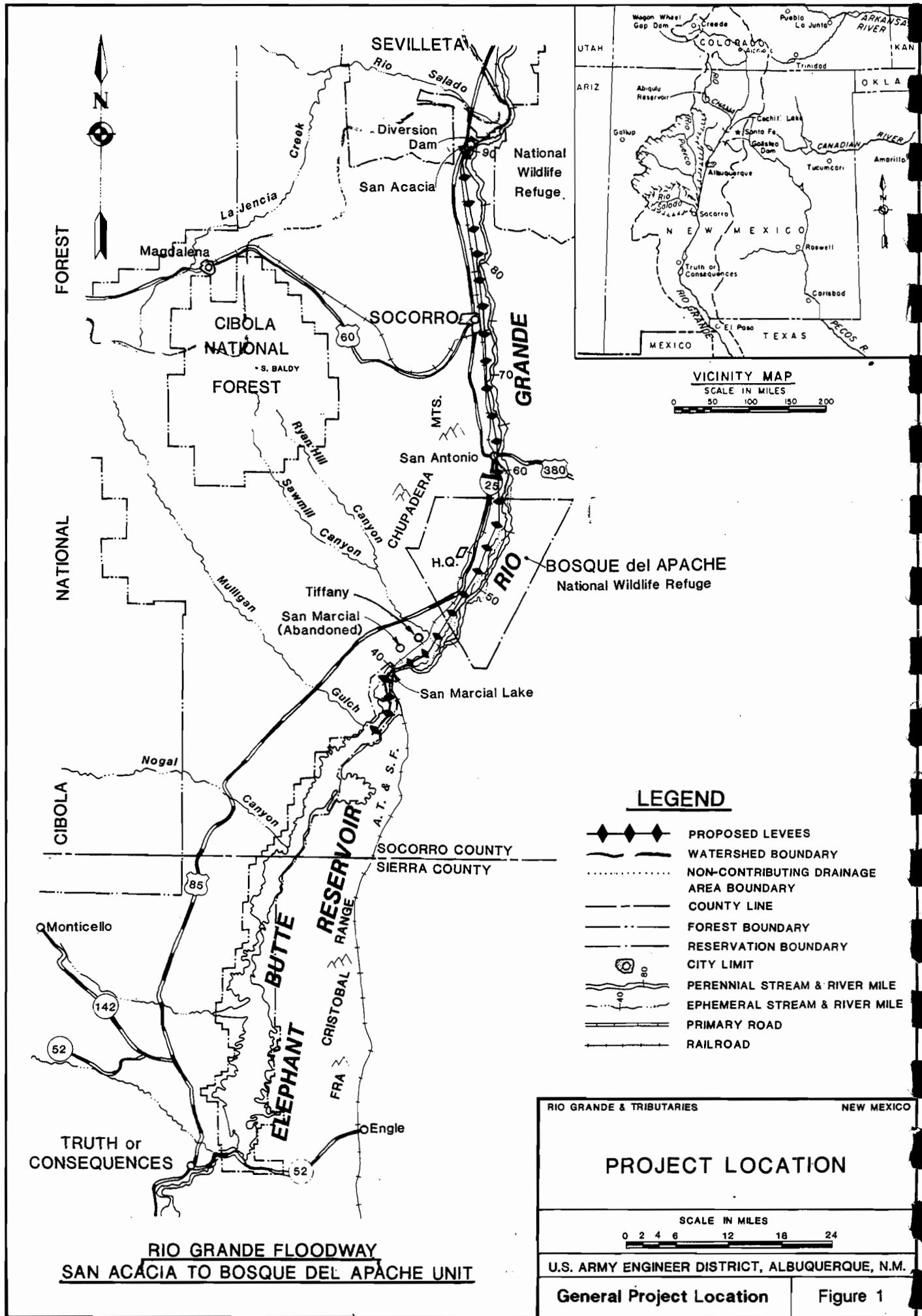
(1) Design Features.

(a) General. The plan recommended for increasing the level of flood protection to floodplain improvements from San Acacia, New Mexico, to Elephant Butte Reservoir consists of rehabilitating the existing earthen embankment that is located on the west bank of the Rio Grande between the river channel and the low-flow conveyance channel. The total length of levee to be rehabilitated would be about 54.3 miles, beginning at the San Acacia Diversion Dam and terminating where the low-flow conveyance channel discharges into Elephant Butte Reservoir. The rehabilitated levee would be an engineered fill, constructed from excavation of the existing embankment and borrow (where needed). These materials are generally silty sands and sand. The design capacity of the levee would be 51,000 cubic feet per second (c.f.s.) at the diversion dam, decreasing to 39,000 c.f.s. at the lower end. A project location map is presented as Figure 1. Table 2 presents design data for the recommended plan as well as alternate levels of protection.

(b) Levee Alignment. The alignment of the rehabilitated levee would be approximately the same as the existing embankment. An exception to this is the first 4,500 feet where the alignment has been altered to accommodate the complex of the irrigation diversion dam, Socorro irrigation canal and flume, low-flow conveyance channel, railroad tracks, and river channel. The project would begin at the base of the mesa that is located at the western abutment of the diversion dam. From here the alignment would proceed between the railroad embankment and the low-flow conveyance channel for a distance of 4,500 feet. It would then cross the railroad embankment and join the existing embankment alignment.

This alignment for the first few thousand feet of the project represents a refinement of that presented in the draft SEIS, where the alignment was located just west of the Socorro irrigation canal and crossed the canal about 3,200 feet from its origin. From this crossing its alignment was the same as the refined design. This refinement removed the need for box culverts in the irrigation canal and conveyance channel to convey flows through the levee. Also, a 0.5-mile-long tie back design feature discussed in the draft SEIS that joined the terminal end of the levee with the adjacent western terrace was removed during design refinement and is not part of the recommended plan.

(c) Levee Design. A majority of the reconstructed levee would be a trapezoidal, earth-fill structure, capable of containing high volume flows in the Rio Grande. Reconstruction would consist of removing part or all of the existing earthen embankment and constructing an engineered flood control facility. As stated, the first 4,500 feet would differ from the remainder of the reconstructed levee because of space constraints. Here, the first 350 feet of the flood control facility would consist of a reinforced concrete floodwall. This floodwall would then transition into a 4,150-foot-long levee section that would



have protective soil cement on its riverward side slope and a vertical panel wall on its landward side. Riprap stone protection would also be placed over the soil cement on the riverward side slope (see Figure 2 for a typical section).

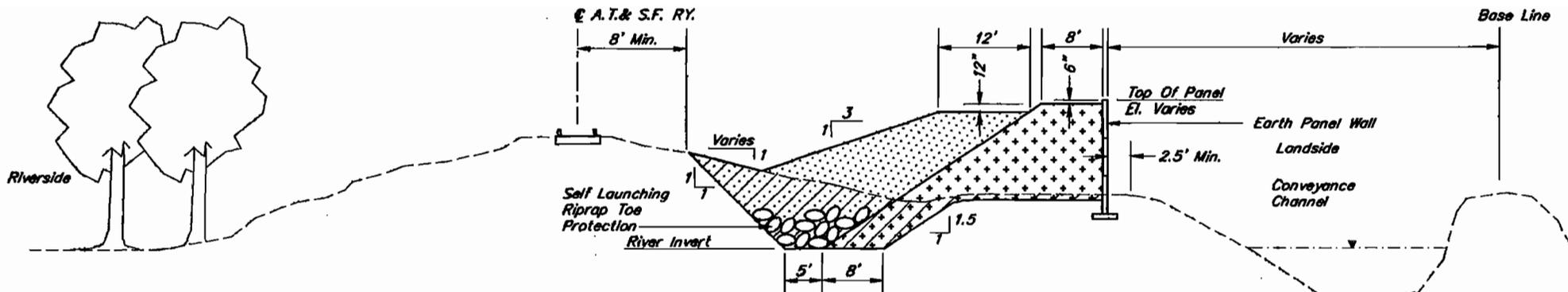
The goal of levee design was to provide a structurally competent facility capable of withstanding high volume flows in the Rio Grande while retaining as much of the "edge" riparian vegetation as possible that is growing on the riverward side and toe of the existing earthen embankment. The center 43.0 miles (to Tiffany) of levee is designed to retain most of the riverward side of the embankment. This retained portion would be incorporated into a new levee design, which would consist of removing the remainder of the embankment and rebuilding to engineering standards (see Figure 2 for a typical section). A total of approximately 6.6 miles of the 43.0 miles would require the removal of the riverside slope and any associated vegetation. The crest of the reconstructed levee would be about 15 feet wide and would accommodate a gravel-surfaced road. Levee side slopes in this reach would be 1 vertical on 2.5 horizontal. The landward toe of the levee would begin about 42 feet from the edge of the low-flow conveyance channel. The height of the rehabilitated levee would average about the same as the present embankment in this reach. Surplus earth would be placed between the retained portion of the embankment and the engineered levee and may also be used to overbuild the levee in areas where it can conveniently be done without loss of riparian vegetation. Access and egress ramps for maintenance equipment would be provided.

A majority of the remaining 10.5 miles of embankment would be removed entirely and replaced with an engineered levee. Flatter side slopes of 1 vertical on 3 horizontal are required in this lower reach because of the sandy character of embankment materials and a higher levee. The maximum increase in levee height above the existing embankment would be about 14 feet with an average of about 10 feet. There would also be an average increase in the basal width of the levee toward the river of about 35 feet. The range in basal widths for the two side slope designs is presented in Table 2. A crest width of 15 feet would continue.

A gated floodwall structure would be used where the levee crosses Brown's Arroyo, which is located about one mile south of the city of Socorro. The floodwall would have 10 rectangular, heavy duty sluice gates. Eight of these gates would be 7 by 10 feet in size and two 10 by 10 feet. When closed, the gate structure would prevent flood flows in the Rio Grande from entering Brown's Arroyo and inundating areas behind the levee.

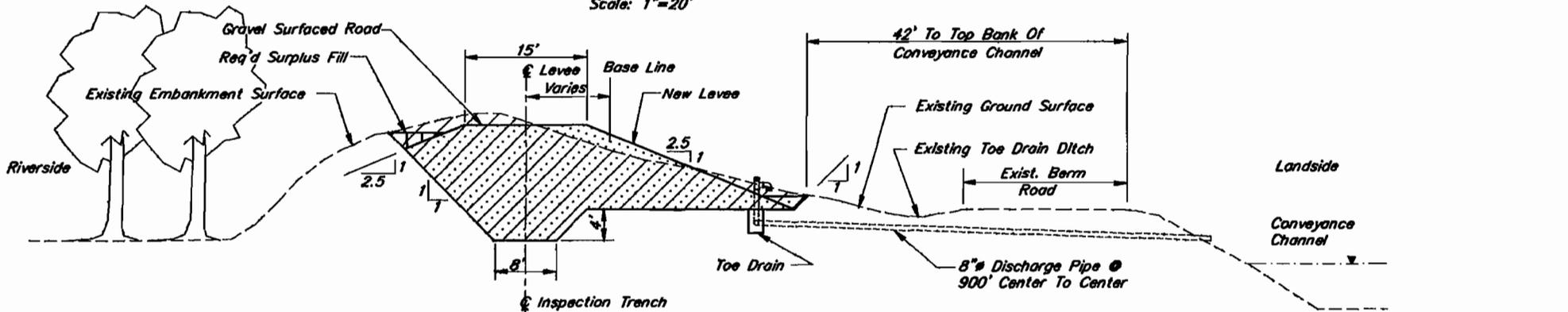
(d) Seepage Control. The levee would have a drain under the landward toe to control seepage. This toe drain would consist of an eight-inch perforated pipe which would collect seepage that moves under the levee during high water periods. Collected seepage would discharge into the conveyance channel at 900-foot intervals. Risers would be provided from the collector pipe at 300-foot intervals to permit cleaning and maintenance (see Figure 2 for details).

(e) Levee Erosion Protection. Sections of levee subject to water erosion from the river would be protected with Kellner Jetties (jacks). Kellner Jetties are used to encourage the growth of vegetation which will reduce water velocities, and consequently, erosion of the levees. This measure would generally be used where protective riparian vegetation is absent or very narrow and will be accomplished in consultation with the Bureau of Reclamation, the Fish



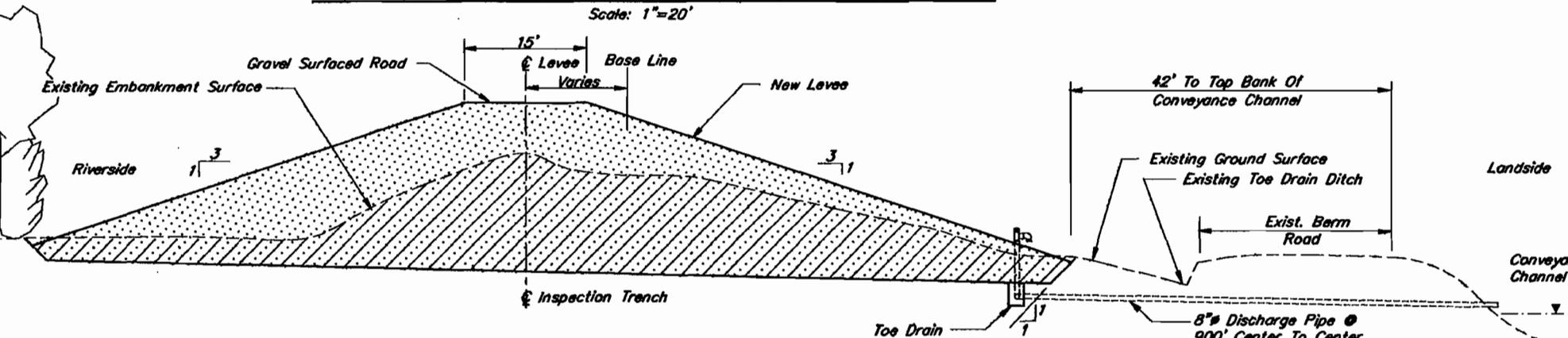
PARTIAL LEVEL REPAIR – UPPER 4000' FEET

Scale: 1"=20'



PARTIAL LEVEL REPAIR – MIDDLE 43.0 MILES

Scale: 1"=20'



LEVEL REPAIR – LOWER 10.5 MILES

Scale: 1"=20'



RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE
TYPICAL LEVEL SECTIONS

U.S. ARMY ENGINEER DISTRICT, ALBUQUERQUE, N.M.

FIGURE 2

and Wildlife Service, and the city of Socorro. Levee sections needing erosion protection would be few.

(f) Railroad Crossings. An increase in levee height would require that the Santa Fe and Pacific Railroad's tracks be raised at two locations where the levee crosses the tracks. The first would be located about 4,600 feet from the beginning of the project and the second located just upstream of the railroad trestle at San Marcial. The upper raise would be about 1.5 feet, affecting about 1,700 feet of track. The lower raise would be about 5.2 feet, affecting about 6,800 feet of track. At each location, both mainline and siding tracks would be raised in place, without stopping rail traffic.

(2) Fill, Borrow, and Disposal Requirements.

(a) Fill. Levee rehabilitation would require an estimated 7,300,000 cubic yards (cu. yds.) of earth (compacted, in place). Almost all of the estimated 7,000,000 cu. yds. present in the existing embankment would be used for levee rehabilitation. An additional 1,800,000 cu. yds. would be required and would be acquired from off-site borrow sources. The combined volume of earth present in the existing embankment and that which would be borrowed exceeds the 7,300,000 cu. yds. required, but would be reduced to that volume by compaction during construction. Approximately 86,500 cu. yds. would be unsuitable material for levee construction and would be used to fill the V-shaped gap between the retained embankment section and the engineered levee (see Figure 2). Potential disposal methods for surplus earth stated in the draft SEIS, e.g., extend river banks, fill borrow pits, and assist Bosque del Apache NWR with development needs, would no longer be necessary because of the ability to incorporate surplus earth into the levee design.

(b) Borrow. No additional earth would be required for construction of the first 43.8 miles of levee. Therefore, no borrow areas would be required. As stated, the remaining 10.5 miles of levee would require an additional 1,800,000 cu. yds. This quantity would be obtained from upland terraces within lands acquired as part of Elephant Butte Reservoir. Approximately 75 to 80 acres of land would be required if the excavation depth were 15 feet; 56 to 60 acres if the excavation depth were 20 feet. While all required borrow can be obtained from outside the reservoir area proper, some borrow will likely be obtained from the reservoir as a result of replacing wetlands lost during project construction. This amount would likely be less than 100,000 cubic yards. Table 2 presents estimated borrow requirements as well as estimated land area requirements for the recommended plan. These requirements are also shown for alternative levels of flood protection.

Approximately 108,000 cu. yds. of gravel would be required for surfacing the levee crest road and about 27,500 cu. yds. of rock for riprap and railroad ballast. This material would likely be obtained from an existing quarry located about five miles south of the city of Socorro. Commercial sand and gravel sources in the general Socorro area may also be utilized.

The use of accumulated sediment from the flood control channel outfall at Socorro will be evaluated and used if needed and suitable.

(c) Disposal. Plant materials, e.g., brush, trees, and grasses, removed as a result of project construction, would be disposed of by burning, burial, chipping, or a combination of these methods. With the exception of chipping and perhaps some limited burning in the immediate project area, the Contractor will be required to dispose of all vegetal waste outside of the riparian zone. The

TABLE 2
DESIGN DATA

Levels of Protection

(Figures in parenthesis represent design data presented in the Draft SEIS)

<u>Design Criteria</u>	<u>50-Year</u>	<u>100-Year Recommended Plan</u>	<u>200-Year</u>	<u>SPF</u>
Levee Length (miles)	54.3 (55)	54.3 (55)	54.3 (55)	54.3 (55)
Levee Height (avg. in ft.)	12.5 (10.2)	14.0 (11.4)	16.0 (13.0)	20.2 (16.5)
1 on 2.5 slope section	10.63	12.0	13.6	17.2
1 on 3 slope section	16.1	18.0	20.6	26.0
Levee Height Range (ft.)				
1 on 2.5 slope section	2.0 to 13.7 (2.3 to 14.0)	5.0 to 16.0 (3.4 to 15.7)	7.0 to 17.0 (5.5 to 16.7)	8.6 to 21.0 (7.0 to 20.7)
1 on 3 slope section	9.8 to 26.6 (8.5 to 19.2)	12.0 to 28.0 (10.4 to 20.2)	14.5 to 30.4 (12.6 to 21.9)	18.7 to 35.0 (16.3 to 25.2)
Crest (top) Width (ft.)	15 (16)	15 (16)	15 (16)	15 (16)
Basal Width (avg. in ft.)	94.6 (66.4)	104.0 (73)	115.0 (80.7)	139.5 (98.0)
1 on 2.5 slope section	84.6	93	102.7	125.0
1 on 3.0 slope section	104.6	115	127.1	154.3
Basal Width Range (ft.)				
1 on 2.5 slope section	52.30 to 105.8 (37.6 to 83.5)	60 to 120 (43.1 to 94.6)	70.38 to 130.0 (50.6 to 102.5)	84.9 to 159.0 (61.0 to 125.3)
1 on 3 slope section	56.7 to 152.7 (73.3 to 131.4)	70.0 to 160.0 (90.5 to 137.7)	80.0 to 162.6 (103.1 to 140)	121.0 to 194.1 (156.3 to 167.1)
Borrow Requirements in Addition to Material in Existing Spoil Bank Levee (cubic yards)	1,570,625 (1,570,625)	1,800,000 (2,848,000)	3,433,598 (5,432,900)	6,923,686 (10,955,200)
Disposal Requirements (cubic yards)	1,368,000 (1,248,000)	86,500 (1,248,500)	1,368,000 (1,248,500)	1,368,000 (1,248,500)

61-SEIS

TABLE 2 (Continued)
DESIGN DATA

<u>Design Criteria</u>	<u>50-Year</u>		<u>100-Year Recommended Plan</u>		<u>200-Year</u>		<u>SPF</u>	
	<u>Riparian</u>	<u>Terrace</u>	<u>Riparian</u>	<u>Terrace</u>	<u>Riparian</u>	<u>Terrace</u>	<u>Riparian</u>	<u>Terrace</u>
Borrow Area Requirements (acres)								
Excavation Depth of 6.5 ft.	- (94)	- (55)	- (171)	- (100)	207 (327)	120 (191)	417 (660)	243 (385)
Excavation Depth of 13 ft.	- (-)	- (-)	- (-)	- (50)	Same as 6.5 (-)	60 (-)	Same as 6.5 (-)	121.5 (-)
Excavation Depth of 15 ft.	- (-)	57-62 (-)	- (-)	75-80 (-)	Same as 6.5 (-)	52 (-)	Same as 6.5 (-)	105.3 (-)
Excavation Depth of 20 ft.	- (-)	42-47 (-)	- (-)	56-60 (-)	Same as 6.5 (-)	68-72 (-)	Same as 6.5 (-)	79 (-)
Additional Levee Area								
1 on 2.5 slope section	0		5		10			
1 on 3.0 slope section	33		38		48		Not	
	(33 Total)		(43 Total)		(58 Total)		Computed	

Contractor will be required to strictly control any burning to prevent any possibility of fire spreading to the riparian woodland. The Contractor will also be required, through contractual agreement, to comply with all applicable Federal, State, and local laws for all disposal measures. Public use of trees for fuel wood may be permitted.

Relatively small quantities of surplus earth resulting from the stripping of earth containing organic material from the embankment sides will become the property of the Contractor. The Contractor will be required to dispose of this earth outside of the riparian zone in full compliance with all applicable Federal, State, and local laws.

(3) Construction Methods, Including Haul Roads, Turn-arounds, and Stockpile Needs. There is likely sufficient area available between the planned riverside toe of the rehabilitated levee and the low-flow conveyance channel to accommodate most, and perhaps all, construction activities without the need to remove or disturb additional riparian vegetation. A linear construction technique would be employed, thereby largely eliminating the need for riparian areas to stockpile fill material.

The present maintenance road for the low-flow conveyance channel can accommodate an appreciable amount of construction vehicular needs, further reducing the need to disturb riparian vegetation. This available area should also minimize use of the riparian zone for turn-arounds. If required, they would be located in sparsely vegetated areas, salt cedar, or both.

Two candidate borrow areas on the terraces have existing access roads. However, one borrow area has no direct route to the end of the levee, and a haul road would be developed along the alignment of an existing dike that leads to the existing embankment. Very little, if any, material is expected to be required from this particular borrow site. Any additional borrow areas would likely require access roads.

Haul roads created for the construction of wetlands would be strategically placed in open, sparsely vegetated areas if possible, or in salt cedar. All abandoned roads and turn-arounds would be disced and revegetated.

(4) Real Estate Requirements and Relocations. The U.S. Bureau of Reclamation (USBR) administers or has easements for a majority of land that would be required for project construction. There are four utilities that cross the levee alignment and would have to be relocated. These are a transcontinental telephone cable (200 feet), a local water line and telephone cable (200 feet), and a Mountain States fiber optics cable (15 miles). The non-Federal sponsor would be responsible for acquiring all lands, easements, rights-of-way, and relocations.

The draft SEIS stated that about three acres of private land (primarily cultivated land), a mobile home, and a barn at and near the village of San Acacia would have to be acquired. Because of a refinement in levee alignment, this acquisition and associated relocations would not be necessary.

(5) Restoration. Borrow areas on the adjacent terraces would be designed to facilitate the planting of native or adapted grasses and shrubs. Any temporary construction areas, such as haul roads, turn-arounds, and any stockpile areas, would also be vegetated, utilizing appropriate plant species. A certain amount of landscaping/beautification is integral to construction projects, such as the recommended plan. This design feature is generally confined to project lands. The possible inclusion of this feature will be coordinated with adjacent communities as plans are further refined.

(6) Recreational Use, Parking, and Access Control. Public vehicular access to the reconstructed levee and associated use would be determined by the managing agency. Measures to widen short sections of the levee crest road to accommodate parallel parking can be constructed and will be coordinated with appropriate Federal, State, and local governments and organizations as project features are refined. The crest road is wide enough to safely accommodate two-way passing. Measures to manage access (if desired) to the riparian zone would also be coordinated. This includes access for cattle grazing.

(7) Recreational and Fish and Wildlife Facilities. Recreational and fish and wildlife facilities can, if adaptable, be developed in conjunction with flood control features through cost-sharing agreements with the non-Federal sponsor. Such facilities can be cost shared on a 50-50 basis. The potential for incorporating these purposes into the flood control plan will be coordinated further as project features are refined. All facilities would be turned over to the local sponsor for operation and maintenance. Any needed authority for participation in construction of such facilities would be the responsibility of the local sponsor, as would funding of all operation and maintenance activities and associated liability.

(8) Permit Requirements and Agreements.

(a) Section 404 of the Clean Water Act. The planned action would involve Elephant Butte Reservoir and three wetlands within the Reservoir. Therefore, a State Water Quality Certification and Corps of Engineers' authorization are required under the provisions of Sections 401 and 404 of the Clean Water Act, respectively. These requirements were accomplished concurrently with the public review of the draft SEIS.

In accordance with 33 CFR 320 to 330 a public notice was issued on 17 August 1990. Public concerns expressed as a result of this public notice were evaluated and incorporated into the project as appropriate. The State Water Quality Certification was received from the state of New Mexico, Environment Department on 16 October 1990. Conditions included in the Certification regarding limiting stream bottom alteration, development of a water quality monitoring plan and implementation strategy, and wetland mitigation methods will be accomplished as an integral part of the project. Design refinements accomplished since issuance of the 401 Certification have removed some potentially affected wetlands that were identified in the public notice, i.e., the river channel and Mulligan Gulch Wetland. The project will comply with the provisions of Section 404 when the Record of Decision is signed for the project.

Included in Appendix H is the application for the State Water Quality Certification, a Section 404 public notice, the State of New Mexico Water Quality 401 Certification, and the Section 404(b)(1) evaluation of the effects of discharging material into wetlands that was included in the draft SEIS.

(b) U.S. Bureau of Reclamation Permits. No permit would be required from the USBR for the proposed project. However, a cooperative agreement among the Bureau, the Middle Rio Grande Conservancy District, and the Corps would be developed to grant to the Corps use of Middle Rio Grande Project interests for construction of the project.

(c) U.S. Fish and Wildlife Service (Service). A construction permit or similar permit would have to be obtained from the Service since about 11.3 miles of levee would be reconstructed on Bosque del Apache NWR. Also, the National Wildlife Refuge System Administration Act of 1966 requires that actions like the proposed project that would cross an element of the National Wildlife Refuge System (Bosque del Apache NWR) be compatible with the purposes for which these areas were established before the Secretary of Interior may authorize its use for such purposes. This "Determination of Compatibility" is included as Appendix B. Provisions included in this determination will be implemented.

(9) Local Sponsorship. Section 103 of the Water Resources Act of 1986 (Public Law 99-662) requires cost sharing of flood control projects by a non-Federal sponsor to pay a minimum of 25 percent of the project cost. The New Mexico Interstate Stream Commission (Commission) is the non-Federal sponsor, and coordination is continuing. The Commission may also solicit financial support from other project beneficiaries. The State has a keen interest in the proposed project, not only in providing increased flood protection to urban and rural facilities, but in protecting the conveyance channel, which is important to the efficient conveyance of water to meet water requirements of the State, Rio Grande Compact, and the 1906 Treaty with the Republic of Mexico.

(10) Operation and Maintenance. Operation and maintenance (O&M) of the completed project would be the responsibility of the local sponsor. Currently, the USBR, through its Albuquerque Projects Office and Socorro, New Mexico, Field Office, is staffed and funded to operate and maintain the existing conveyance channel and associated works. This includes the spoil bank levee and interior drainage facilities, whose failure could adversely affect the channel. Operation and maintenance activities are those actions required to insure the design purpose of the project. These include the repair of the levee due to scour, erosion, or weathering; replacement of rock and other structural protection; replacement of worn or damaged structural components; vegetation removal; and repair of the seepage control system. O&M would also include major levee repair or replacement of levee segments damaged by extraordinary flood flows.

The local sponsor may elect to enter into an agreement with the USBR to operate and maintain the completed project because of USBR's appreciable capability and experience. Funding of specific O&M features, including extraordinary measures required to repair flood damage, would be discussed as a provision in the O&M agreement. Also, maintenance of measures established to compensate for vegetation losses would be part of the O&M agreement.

(11) Costs and Benefit to Cost Ratio. The estimated total cost of the project would be \$55,600,000 (Oct. 1991 price levels inflated to midpoint of construction - Jan. 1995). A total of \$41,700,000 would be Federal and \$13,900,000 would be shared by the local sponsor. Average annual costs (Oct. 1991 data) would be \$4,587,000 (including interest, amortization, and operation and maintenance). Average annual benefits (Oct. 1991) that are expected to accrue are \$11,383,000. The benefit-to-cost ratio for the entire project is 2.4 to 1. Table 4 (page SEIS-29) presents a summary of the benefits, costs, net benefits, and benefit-to-cost ratios of the recommended plan (100-year levee) and levee alternatives offering 50-year, 200-year, and SPF flood protection at the October 1991 price level.

(12) Environmental Protection Measures

(a) Wildlife Habitat Preservation and Conservation. The preservation and conservation of wildlife habitat has been a primary study and design objective as have any opportunities for restoring wetland and native riparian vegetation lost during the development of the middle Rio Grande valley. Foremost is the avoidance of mature, native, cottonwood- and willow-dominated communities and "edge" vegetation (cottonwood, willow, and salt cedar) growing on the riverward toe and side slope of the existing embankment. The refined levee design developed for this project makes a significant contribution toward this objective, as does maximum use of earthen embankment, which reduces the need for creating numerous borrow areas.

Selection of any sites for development of compensation wetlands (particularly in the lower 10.5 miles, where the potential is greater) also stresses the avoidance of the more mature, cottonwood- and willow-dominated plant communities and focuses on open, sparsely vegetated areas; early growth stages; and monotypic salt cedar stands. The objective of selecting these areas, particularly salt cedar, is to replace plant communities of lower wildlife use and benefit with communities of higher wildlife value. This is especially true of wetlands, which have been severely reduced in the middle Rio Grande valley and are quite limited in the arid Southwest. Final wetland site selection will attempt to place these areas at the interface of community/structure types both to avoid fragmentation and to increase diversity and use.

(b) Sensitive Animal and Plant Species. Construction schedules have been adjusted to avoid construction in selected areas where the endangered whooping crane and bald eagle overwinter. The primary area would be Bosque del Apache NWR and vicinity. Aerial and possibly ground surveys would determine if any bald eagle nesting is occurring in the general project area within Elephant Butte Reservoir. If any nests are located, construction would be scheduled to avoid disturbance. Surveys would also be performed to locate any roost trees that bald eagles may be using on a long-term basis that could be affected by the project. If any are located, levee design would be evaluated to avoid these trees. Trees would be removed only if substitute roosting habitat were available which, given numerous groves of cottonwood in the general project area, is likely.

Surveys would also be performed to locate any Notice of Review (see definition in Section IV) animals and plants that may be affected by project construction. If found, project design would be modified to avoid adverse effects if feasible or, in the case of plants, relocated.

State of New Mexico Endangered and Sensitive animals and plants would be treated as discussed for Notice of Review species.

(c) Bosque del Apache NWR. Maximum consideration has been, and is being given, toward protecting the wildlife resources of Bosque del Apache NWR. As stated, construction activities on or in close proximity to the Refuge have been scheduled to avoid the presence of the endangered whooping crane and bald eagle as well as the period of maximum use by waterfowl and cranes. Also, the construction contractor would be instructed to avoid any unnecessary disturbance of vegetation and his actions would be monitored to insure compliance. Close coordination would be maintained with the Refuge during construction to insure maximum compatibility with Refuge goals and objectives.

(d) Contractual Requirements. Specific measures for environmental protection during construction would be written into the contract specifications. The specific protection measures are based on information contained in the Civil Works Construction Guide Specifications for Environmental Protection. This provides for the control of noise, air quality, water pollution, erosion, and aesthetic degradation, as well as protection of vegetation and fish and wildlife resources. In addition, a biologist would periodically monitor construction activities to insure environmental protection measures and commitments are implemented. Coordination will be maintained with the State Environment Department to determine the need for water quality monitoring during construction to assure compliance with State water quality standards. If deemed necessary, monitoring would be accomplished utilizing State recommended methods.

(13) Compensation Measures.

(a) Wildlife Habitat. Measures, amounts, and locations to compensate for any reduction of wildlife habitat and use were developed by both the Service and Corps of Engineers (see Appendices C and D) during the design of the project and reflected in the draft SEIS. Major features of the mitigation plan presented in the draft SEIS consisted of replacing permanent and temporary losses of habitat and wildlife use with cottonwood/willow dominated vegetation communities and replacement of lost wetlands with constructed wetlands. In addition to revegetation of borrow sources and associated disturbance, most compensatory cottonwood/willow planting was to have been accomplished at Bosque del Apache NWR as an element of ongoing replacement of homogeneous salt cedar stands with native cottonwood/willow communities.

This plan has been modified subsequent to issuance of the draft SEIS and ongoing refinements to project design. Refinements to design features presented in the draft SEIS, which largely eliminated the need for borrow removal from the riparian zone and retained a maximum of riparian vegetation on the riverward side slope and toe of the existing embankment in the upper 43.8 miles, appreciably reduced vegetation removal and associated compensation needs. An additional modification to the mitigation plan presented in the draft SEIS was a change in the location of the major mitigation site - from Bosque del Apache NWR to the riparian zone along the length of the project area. This change was requested by the Service and the NMDGF and concurred with by the Corps. Also, a compensation feature discussed for evaluation was that of obtaining a wildlife conservation easement on riparian lands which are administered by the Middle Rio Grande Conservancy District (MRGCD). If feasible, this measure would be implemented as an integral excellent element of the compensation plan. Coordination with MRGCD will continue toward this end.

The draft SEIS reflected a reasonable worst case analysis that was employed in determining mitigation needs. While it recognized that the continuing refinement of design feature could likely lessen effects on riparian vegetation, this approach was appropriate in reflecting design and environmental features as were best known at this planning stage. The current mitigation plan reflects detailed design and environmental features, but where any unknowns or questions still exist, e.g., long-term establishment success of replacement vegetation, a reasonable worst case analysis was still employed.

Mitigation in the form of compensation would be accomplished for any loss of habitat incurred from levee reconstruction. These losses would occur from widening the levee, primarily from the riverward side slope and toe of the existing embankment; wetland replacement; and creation of borrow areas. Measures to compensate for removed riparian vegetation, either permanent or temporary, would be replacement with native trees (cottonwood and willow) and, if possible, acquisition of a wildlife conservation easement. Wetland losses would be replaced with constructed wetlands and upland grasses and shrubs replaced with like vegetation of high wildlife value. The proportion of acreage of replacement vegetation to conservation easement may vary, depending on actual site conditions. If acquisition of a conservation easement proves infeasible, then compensation would consist largely of vegetation replacement. A Supplemental Information Report would reflect final mitigation plans.

Replacement of riparian vegetation would be accomplished utilizing superior strains of native trees and shrubs and use of the pole planting technique. This technique involves the placement of dormant poles, two (2) to three (3) inches in diameter, in a hole dug to the water table. These riparian strains and planting techniques results in rapid growth of well-structured and hardy plants, as well as an advanced stage of tree development. Sites selected for planting would be evaluated for the presence of coarse-textured earth, salinities of less than 3,000 parts per million, and acceptable water table depths. Purposeful flooding of prepared areas to simulate natural regeneration conditions would also be evaluated as an economical alternative to pole planting.

Compensation quantities proposed by the Corps for the major community/structure types that would be affected reflect a quantitative evaluation of potential habitat loss and wildlife use of replacement vegetation through time. This quantitative evaluation is based on studies by Hink and Ohmart, 1984; Raitt et al. 1981; and the ongoing cottonwood replacement program at Bosque del Apache NWR. These quantities consist of 46.3 acres of replacement tree plantings and about 185 acres of wildlife conservation easement. The acreage of replacement vegetation is one-half of an estimated 92.6 acres of replacement vegetation that would be required to compensate for lost riparian vegetation (see Table 3). The 185 acres of conservation easement would compensate for the remaining 42.3 acres. As stated, these proportions may be adjusted depending on site conditions. Easement lands would be selected near Bosque del Apache NWR or other favorable locations. If acquisition of a conservation easement is not possible than 92.6 acres would be planted with replacement tree plantings.

Wetland losses would be compensated with an equal number of constructed wetlands - 12 to 14 acres. As stated, the estimated 56 to 60 acres of borrow areas would be planted with grasses and shrubs of high wildlife value. Table 3 presents the kinds and quantities of vegetation communities that would be removed and replacement acreage. A more detailed discussion of the derivation of compensation acreages is presented in Appendix D.

Table 3
Compensation Data

<u>Plant Community</u>	<u>Loss</u>	<u>Replacement Acreage of Cottonwood & Willow (at 100 poles/ac.)</u>
Cottonwood/Willow Edge	560 Cottonwood (ea.) 147 Tree Willows (ea.)	28.3 ac.
Salt Cedar Edge	32 ac.	51.2 ac.
Russian Olive Edge	10 ea.	Included as part of Cottonwood/Willow Edge
Open Areas - Mixture of Salt Cedar, Cottonwood & Tree Willow Saplings	3.6 ac.	4 ac.
Bosque del Apache NWR		
Salt Cedar Edge	4.26 ac.	8.50 ac.
Cottonwood Saplings (Edge)	0.1	0.50 ac.
Mixed Saplings (Edge)	0.1	<u>0.10 ac.</u>
		Total Riparian 92.6 ac.
Upland Grass/Shrub	56-60 ac.	56-60 ac. (in-kind replacement)
Wetlands	12-14 ac.	12-14 ac. (in-kind replacement)

For comparison purposes, the plant community types presented in the draft SEIS that could have been displaced by construction and their associated acreage consisted of the following:

<u>Category</u>	<u>Acreage (acres)</u>
Cottonwood and Willow Edge	6
Salt Cedar Edge	39 (3.5 at Bosque del Apache NWR)
Salt Cedar Non-Edge	122
Open Areas - Grasses, Forbs, and Sapling Trees	38
Open Areas - Bosque del Apache NWR	11
Grass/Shrub	50 (13 feet deep)
Wetlands	12-14

Compensatory acreage consisted of a total of 270 acres to be planted with cottonwood and willow, and 70 acres of constructed wetlands.

(b) Threatened, Endangered, and Sensitive Species. There are three Federally-listed species in the vicinity of Bosque del Apache NWR that could potentially be affected by the proposed action - the whooping crane, bald eagle, and peregrine falcon. As stated, measures that would be taken to preclude any adverse effects due to construction-related activity consist of scheduling construction during the absence of potentially affected species, concentrating construction activities to localize disturbances, and close coordination with Service personnel that monitor the whooping cranes in the Middle Rio Grande Valley. Aerial and possibly ground surveys would determine if any bald eagle nesting is occurring in the general project area within Elephant Butte Reservoir. If any nests are located, construction would be scheduled to avoid disturbance. The peregrine falcon should not be appreciably affected because of anticipated lower use of the conveyance channel by waterfowl prey as the transmission of high flows is resumed and temporary disturbance along the conveyance channel. Most Notice of Review and State Endangered and Sensitive Animal Species would not be affected or significantly affected. There are Notice of Review and State Endangered and Sensitive Plant Species that have the potential for being present in or adjacent to the riparian corridor. Prior to project construction, surveys for the presence of these species and likely habitat (for the meadow jumping mouse, Zapus hudsonius luteus) would be performed on areas of potential disturbance. Any plants located would either be avoided or transplanted to suitable ground. Any habitat located for the meadow jumping mouse would be avoided. Access to the riparian forest/woodland by construction personnel would be limited by contractual restrictions.

(c) Cultural Resources. The recommended plan and project alternatives have limited potential to affect cultural resources in the riparian zone, since most of the areas that would be affected presently consist of levees and other disturbed areas. No evidence of surface or buried cultural remains was found at previously considered riparian borrow sites. However, the potential use of adjoining terraces for borrow sources has a higher potential for encountering cultural remains, and numerous sites are currently known. Existing developed borrow pits on the terraces would be used to the greatest extent possible. Once plans are refined and the locations, or candidate locations, or activities identified, all undisturbed areas would be surveyed by a qualified archeologist prior to construction to identify any cultural properties that may be present. Should any cultural properties be found, they would be assessed in accordance with 36 CFR Part 60.4 to determine their significance. To the extent possible, all cultural resources would be avoided. However, if avoidance is neither possible nor feasible, a data recovery plan, designed to recover significant information that would be lost, would be developed, submitted for review and comment to the New Mexico State Historic Preservation Officer and Advisory Council on Historic Preservation, and implemented prior to initiating any land-disturbing activities. In addition, if any excavation or activity areas are located on or near the floodplain in the vicinity of Tiffany, some monitoring, performed by a qualified professional archeologist, would be accomplished during initial ground disturbance in the event that lost Piro Village of Senecu (see Appendix F) is discovered. If found, an alternate area would be designated in order to avoid adversely affecting the site. Coordination with the State Historic Preservation Officer accomplished during project formulation and design is presented in Appendix G.

(14) Construction Schedule. The schedule for construction of project features and completion of mitigation associated with cultural and fish and wildlife resources is presented as follows. This schedule is dependent on cost-sharing agreements; provision of lands, easements, rights-of-way and relocations; and appropriation of Federal construction funds by the United States Congress. Levee construction would be phased, a section of levee built before another section is built. Four overlapping phases are currently envisioned, each taking 12 to 18 months. Construction of all project features would take an estimated four years.

Construction Schedule

<u>Feature</u>	<u>Date Initiated</u>
Cultural Resources Mitigation	Prior to Project Construction
Feature Design	Fiscal Year 1991
Plans and Specifications (1st. Levee Unit)	Fiscal Year 1992
Contract Award (1st. Levee Unit)	Fiscal Year 1993
Revegetation and Fish and Wildlife Mitigation	During and immediately following construction

TABLE 4
SUMMARY OF BENEFITS AND COSTS¹
SAN ACACIA TO BOSQUE DEL APACHE, NEW MEXICO
(\$1,000 October 1991 Price Level, 8-1/2%)

	<u>SPF Levee</u>	<u>200-Year Levee</u>	<u>100-Year Levee (Recommended Plan)</u>	<u>50-Year Levee</u>
Total Average Annual Benefits	12,119	11,571	11,383	10,589
Total 1st Cost (Uninflated)	82,134	58,493	49,515	45,819
Interest During Construction (4-yr Const. Period)	7,367	5,247	4,441	4,110
Total Investment (Uninflated)	89,501	63,740	53,956	49,929
Interest and Amortization	7,609	5,419	4,587	4,245
Operation & Maint.	200	170	150	130
Tot. Avg. Ann. Cost	7,809	5,589	4,737	4,375
Benefit/Cost Ratio	1.6	2.1	2.4	2.4
Net Benefits	4,310	5,982	6,646	6,214

¹Benefits and costs for all alternatives were estimated in the October 1989 Reevaluation Report. These were revised based on the reanalysis in the 1991 Special Evaluation Report and Feature Design Memorandum, which detailed benefits and costs for the 100-year level of protection.

(15) Discussion of the National Economic Development Plan and Environmental Quality. The National Economic Development (NED) Plan is that alternative that reasonably maximizes net economic benefits. Environmental quality (EQ) criteria emphasizes the protection, preservation, and enhancement of existing environmental values and the minimizing of unavoidable environmental damages. These criteria are used to evaluate the effects of alternative plans on environmental quality and have been established to avoid or mitigate adverse effects of alternative plans and to be consistent with the Nation's environmental values as identified in environmental statutes and Executive Orders. The recommended plan satisfies both the NED and EQ accounts, providing the greatest economic return and social benefits while minimizing environmental, social, and cultural disturbances.

b. Alternate Levels of Flood Protection to the Recommended Plan. Levees providing four levels of flood protection were evaluated in order to identify the level of protection that produced the greatest economic benefits. In addition to the recommended level of protection (100-year flood frequency), these were the 50- and 200-year flood frequency events and the Standard Project Flood. Levee design for the various levels of flood protection would basically vary in dimension - levee size increasing with higher levels of protection and correspondingly decreasing with lower levels. Each of these alternative levee designs would generally follow the alignment of the present embankment. As stated, the exception to this would be the initial 4,700 feet of levee which would be located immediately west of the Socorro Main Canal.

Material to build these alternative levee designs would also be obtained from the existing embankment. Like the recommended plan, the lower level (50-year) of flood protection would not require any additional borrow material for about the first 43.8 miles, with lesser amounts being required from the upland terraces for the remainder. Approximately the same amount of surplus earth would be generated by the 50-year plan as the recommended plan and would be disposed of in the same manner.

Levee designs providing higher levels of flood protection would require substantially greater quantities of fill than available from the existing embankment. This fill would be obtained from borrow sources within the riparian zone for the first 43.8 miles, with commensurately more and larger areas required for SPF protection. Upland borrow sources for the lower reaches would correspondingly be larger. Table 2 presents design data and borrow and disposal requirements for the three alternative flood protection levels as well as the recommended plan for comparison purposes.

Mitigation for adversely affected wildlife habitat and cultural resources would generally be proportional with levee size, less for lower levels of protection and higher for greater levels of protection. The 50-year level, with its smaller basal width, would disturb somewhat less vegetation, and consequently, require slightly less mitigation, whereas the 200-year and SPF levels would result in substantially greater vegetational losses and disturbances and much more mitigation. All borrow areas and disturbance would be revegetated or, in the case of some borrow areas, adapted to wetlands. Potential wildlife and recreational enhancement measures would be comparable for all levels of flood protection, as would Section 404 requirements of the Clean Water Act.

OTHER SUGGESTED SOLUTIONS

3.06 In response to the draft SEIS, the Rio Grande Compact Commission's Commissioner for the State of Texas requested that a component of a previously eliminated alternative, tributary dams, be constructed as a feature of the recommended plan (see Appendix A). This component would be a dam on the Rio Puerco (as described in Paragraph 3.04). The request was made because of concerns that trace heavy metals and radionuclides, resulting from mining in the Grants uranium belt, could be present in the sediment carried by the Rio Puerco and pollute the water supply in Elephant Butte Reservoir. Any pollution of this water supply could threaten public health and agricultural resources downstream, particularly the El Paso/Juarez metropolitan complex. Concern was also expressed regarding the continuing depletion of the storage capacity of Elephant Butte Reservoir by sediment, a significant portion of which is contributed by the Rio Puerco and Rio Salado.

3.07 In response to this request and support of the Texas Congressional delegation, measures are being taken to initiate a reconnaissance level study into these concerns.

NO ACTION (WITHOUT THE PROJECT) ALTERNATIVE

3.08 The no action alternative would be the status quo, with no Federal participation in providing a higher level of flood protection. The U.S. Bureau of Reclamation would continue to maintain the present embankment and, with the exception that it could be breached by high magnitude flows in the Rio Grande, the embankment should remain in its basic state. Non-Federal reconstruction of the embankment to higher standards would not be expected because of the magnitude of the effort and related costs.

COMPARATIVE EFFECTS OF ALTERNATIVES

3.09 The effects of alternatives considered differ largely in degree, since they consist of different sizes of the same basic plan. The base condition with which each alternative level of flood protection is evaluated is the present "spoil bank levee" or embankment and associated resources and land uses. This is considered the no action alternative. The public coordination process associated with the preparation of this SEIS identified alternative solutions, concerns, and resource areas and uses of the potentially affected human environment which were considered significant. Adding to these issues are those identified in laws, regulations, guidelines, or other institutional standards that could be affected. The comparative general effects of the considered alternatives on environmental attributes are shown in Table 5, with indications as to whether a given effect is regarded as beneficial or adverse. The detailed effects and the determination of the degree to which a given alternative serves the overall public interest are discussed in Section V - Perceived Environmental Effects. The major areas of demonstrated public concern and comparative effects of alternatives are as follows:

a. Flood Hazards. All of the alternative levels of flood protection would provide enhanced flood protection to floodplain properties, community safety and well-being, water salvage and conveyance facilities, and Bosque del Apache NWR. The lower levels of flood protection would provide less protection to fewer properties, while the higher levels of protection would correspondingly provide

more protection to greater number of properties or features. The 100-year level of protection provides the greatest economic return for the money invested and, correspondingly, is that level of protection recommended for implementation.

b. Water Salvage, Sedimentation, and Restoration of the Storage Capacity of Elephant Butte Reservoir. A major objective of levee reconstruction is to provide higher degrees of flood and associated sediment protection to the low-flow conveyance channel, thereby providing higher levels of insurance that its critical water salvage and delivery functions are maintained. All alternatives would do this, the degree of insurance being commensurate with the protection level. However, none of the alternatives would affect ongoing sediment transport and depositional patterns in the floodway or in Elephant Butte Reservoir. No alternative would contribute to the restoration of storage capacity at Elephant Butte Reservoir depleted by sediment.

c. Riparian and Riverine Management. All alternatives would have a limited potential to assist in the management of riparian resources. However, certain access and egress features can be incorporated into the project design to help manage access to the riparian zone. The city of Socorro and the Corps are currently coordinating details of such features.

d. Preservation, Conservation, and Enhancement of Riparian Wildlife Habitat. The presence of the existing "spoil bank levee" minimizes the need to remove riparian vegetation from the levee alignment. Further minimizing this need is the refined levee design that seeks to retain as much of the riverward side slope as possible. The amount retained is proportional with the level of protection, the 50- and 100-year levels retaining more than the 200-year and SPF levels. The higher levels would remove substantially more than the lower levels. The amount of vegetation displaced by wider basal levee widths in the lower 10.5 miles would also be proportional with the level of protection.

Only the 200-year and SPF levels would require that borrow pits be developed in the upper 43.8 miles. These alternatives would provide greater opportunities for restoration of native riparian vegetation and wetlands, since a major objective of borrow area location would be to select monotypic stands of the exotic salt cedar and open areas. Table 2 presents estimated borrow area requirements for all levels of flood protection.

The higher levels of flood protection may or may not be compatible with the management objectives of Bosque del Apache NWR. Although there would be opportunities to restore displaced native cottonwood forest and lost wetlands, there would be increasing amounts of vegetation removed from the riverside slope of the existing spoil bank, and the total amount of alternation may not be compatible with management objectives of the Refuge. Construction of all alternatives would be scheduled to avoid the presence of the whooping crane and the bald eagle and major presence of waterfowl and cranes at Bosque del Apache NWR.

The 50-, 100-, and 200-year levels of flood protection would support the goals of the Rio Grande Bosque Conservation Initiative to preserve, conserve, and enhance. However, the amount of riparian vegetation removal associated with the SPF level could be inconsistent with its goals.

d. Water and Sediment Quality. None of the alternative levels of flood protection would affect water or sediment quality. The lack of significant direct contact with water in the river channel and conveyance channel and the presence of contractual measures to control pollution would insure that water and sediment quality is protected.

e. Recreational Activities, Needs, and Plans. All alternatives have the potential for project-associated recreational development on a cost-sharing basis. The 50- and 100-year levels of protection have limited potential for wetland/pond development in the upper 43.8 miles because of the absence of additional earth requirements. However, compensatory wetland development in the lower reach could provide increased opportunities for water-oriented recreation. The 200-year and SPF alternatives have borrow requirements along the entire length of the planned action and, consequently, the potential for creating wetlands/ponds and providing appreciable water-oriented recreational opportunities is correspondingly high.

All alternatives would temporarily impair recreational access to the riparian zone and conveyance channel during construction periods. The duration of restricted access would be commensurate with the level of flood protection - shorter for the 50- and 100-year levels and longer for the 200-year and SPF.

f. Cultural Resources. All alternatives have the potential for encountering cultural remains, the potential being commensurate with the extent of disturbance. The lower levels of protection would have the least potential and the higher levels the greatest. The potential for encountering cultural remains would be greatest on the terraces located west of Elephant Butte Reservoir. El Camino Real would not be affected.

g. Interrelationship to the Functioning of the Low-Flow Conveyance Channel and Associated Environmental Effects. All of the alternatives evaluated provide enhanced flood protection to the conveyance channel, providing a higher level of insurance that its function will continue and saving flood fighting and restoration costs that would be expended were it to flood. Its resumed use after a period of repair and rehabilitation is not related to the alternatives considered. None of these alternatives would appreciably change any effects this facility is having on the riverine and riparian ecosystem, or will continue to have.

TABLE 5
Comparative General Effects of Alternatives Considered
Alternative Levels of Flood Protection

<u>Resource Affected</u>	<u>50-Year</u>	<u>Recommended Plan 100-Year</u>	<u>200-Year</u>	<u>SPF</u>	<u>No Action</u>
Flood Protection	50-year flood protection provided to human resources, floodplain development, water salvage & conveyance facilities, & national wildlife refuge facilities valued at \$193,351,000 (Oct. 1989 prices).	100-year flood protection provided to human resources, flood plain development, water salvage & conveyance facilities, & national wildlife refuge facilities valued at \$231,747,000	200-year flood protection to human resources, flood plain development, water salvage & conveyance facilities, & national wildlife refuge facilities valued at \$248,965,000.	SPF flood protection provided to human resources, flood plain development, water salvage & conveyance facilities, & national wildlife refuge facilities valued at \$266,184,000.	Low level of flood protection maintained. Downstream water deliveries & wildlife refuge vulnerable to high flood flows.
Cost Estimates (1991 prices-uninflated)	\$45,819,000	\$49,515,000	\$58,493,000	\$82,134,000	Average annual flood damages of \$11,900,000 would continue.
Benefit to Cost Ratio	2.4 to 1	2.4 to 1	2.1 to 1	1.6 to 1	N/A
Hydrology & Hydraulics	No effect on flow characteristics, sediment transport, sediment deposition, & groundwater hydrology related to river channel, low-flow conveyance channel, & Elephant Butte Reservoir.	No effect	No effect	No effect	Status quo
Water Management Facilities & Activities	Levee reconstruction not related to resumed use of low-flow conveyance channel or its continued presence.	Same as 50-year level of protection.	Same as 50-year level of protection.	Same as 50-year level of protection.	Status quo

TABLE 5 (Cont'd)
Comparative General Effects of Alternatives Considered
Alternative Levels of Flood Protection

Resource Affected	50-Year	Recommended Plan 100-Year	200-Year	SPF	No Action
Socio-economics	Enhancement of community safety & well-being. Preservation & enhancement of economic development. High degree of insurance for maximum delivery of water for irrigated agriculture & water oriented recreation. Average annual benefits of \$10,227,000.	Enhancement of community safety & well-being. Preservation & enhancement of economic development. Higher degree of insurance for maximum delivery of water for irrigated agriculture & water oriented recreation. Average annual benefits of \$10,993,000.	Enhancement of community safety & well-being. Preservation & enhancement of economic development. Very high degree of insurance for maximum delivery of water for irrigated agriculture & water oriented recreation. Avg. annual benefits of \$11,175,000.	Enhancement of community safety & well-being. Preservation & enhancement of economic development. Extremely high degree of insurance for maximum delivery of water for irrigated agriculture & water oriented recreation. Average annual benefits of \$11,705,000.	Status quo. Potential for economic losses, emotional trauma, & personal injury & loss of life that accompanies large scale flooding.
Transportation Facilities	Minor & temporary disruption of traffic flow.	Minor & temporary disruption of traffic flow.	Similar to recommended plan but somewhat longer in duration.	Minor disruption of traffic flow but duration period much longer.	Status quo
Land Use & Classification	Little change. Negligible effect on Bosque del Apache NWR & associated wilderness areas & research natural areas. Compliance with Farmland Protection Policy Act. Conversion of about 35 acres of land in Elephant Butte Reservoir to flood control purposes.	Effects approximately the same as the 50-yr level of flood protection. Conversion of about 40 acres of land in Elephant Butte Reservoir to flood control purposes.	Increased change. Increased displacement of riparian vegetation along entire length of levee. Increased impact on Bosque del Apache NWR. Compliance with Farmland Protection Policy Act. Conversion of about 50 acres of reservoir land to flood control purposes.	Similar to 200-year protection although land requirements & land use changes would increase appreciable through entire project length. Increased land commitment in Bosque del Apache NWR.	Status quo
Riparian and Riverine Mgmt Concerns	Supports goals of Rio Grande Bosque Conservation Initiative. Possible inclusion of management features.	Supports goals of Rio Grande Bosque Conservation Initiative. Possible inclusion of management features.	Similar to lower levels of protection. High potential for substantial wetland creation.	Similar to lower levels of protection.	Status quo
Resources Mgmt Plan for Elephant Butte & Caballo Reservoirs	Continued Coordination	Continued Coordination.	Continued Coordination.	Continued Coordination.	N/A.

TABLE 5 (Cont'd)
Comparative General Effects of Alternatives Considered
Alternative Levels of Flood Protection

<u>Resource Affected</u>	<u>50-Year</u>	<u>Recommended Plan 100-Year</u>	<u>200-Year</u>	<u>SPF</u>	<u>No Action</u>
Cultural Resources	Survey of undisturbed construction areas. Any located resources to be preserved by avoidance or salvage. El Camino Real not affected.	Survey of undisturbed construction areas. Any located resources to be preserved by avoidance or salvage. El Camino Real not affected.	Survey of undisturbed construction areas. Any located resources to be preserved by avoidance or salvage. Increased borrow requirements increases potential for encountering cultural resources. El Camino Real not affected.	Survey of undisturbed construction areas. Any located resources to be preserved by avoidance or salvage. Significantly greater borrow area requirements correspondingly increases potential for encountering cultural resources. El Camino Real not affected.	Status quo
Plant & Animal Associations	Effects approximately the same as recommended plan. About 10% less removal of vegetation.	Riverine resources not affected. Possible removal 12-14 ac. of wetlands. Removal of riparian "edge" vegetation consisting of about 32 ac. of salt cedar, 700 trees, 3.6 ac. of mixed saplings, & 60 ac. of grassland/shrubland on terraces. Compensation provided. Temporary disturbance of wildlife. Increase in habitat quality for waterfowl, shorebirds & long-term increase in faunal diversity.	Riverine resources not affected. Removal of about 10% more "edge" vegetation & equal wetland acreage. About 70 ac. of grassland, shrubland on terraces removed. Increased compensation required. Approximately 210 ac. of borrow required in riparian zone, resulting in opportunity to create wetlands & replace salt cedar stands with cottonwood/willow community. Temporary but increased disturbance of wildlife near levee & borrow areas. Increase in habitat for waterfowl & shorebirds. Long-term increase in floral & faunal diversity, but could be lessened if cottonwood communities appreciably affected.	Riverine resources not affected. About 20% increase in removal of edge vegetation above the 200-yr level of protection. About 80 ac. of grassland/shrubland on terraces removed. Substantial increase in compensation. Approximately 417 ac. of borrow required in riparian zone, with increased potential to convert salt cedar to cottonwood/willow habitat, but little potential to increase wetland habitat over 200-yr. alternative. Long-term increase in faunal diversity from replacement of salt cedar, but could be reduced if cottonwood forest appreciably affected. Temporary but substantial disturbance to wildlife near levee & borrow areas.	Status quo

TABLE 5 (Cont'd)
 Comparative General Effects of Alternatives Considered
 Alternative Levels of Flood Protection

<u>Resource Affected</u>	<u>50-Year</u>	<u>Recommended Plan 100-Year</u>	<u>200-Year</u>	<u>SPF</u>	<u>No Action</u>
Wildlife Resources of Bosque del Apache NWR.	Effects substantially the same as recommended plan. Compatible with Refuge Master Plan and National Wildlife Refuge System Act.	Substantial flood protection for Refuge resources & associated educational & recreational use. About 4.5 ac. of mostly salt cedar removed & compensated for. Compatible with Refuge Master Plan & National Wildlife Refuge System Act.	Substantial flood protection. Increased removal of riparian edge vegetation-possibly about 8-10 ac. Possible incompatibility with Refuge Master Plan & National Wildlife Refuge System Act.	Substantial flood protection. Appreciable removal of riparian edge vegetation. Possible incompatibility with Refuge Master Plan & National Wildlife Refuge System Act.	Status quo
Endangered Faunal Species	High level of flood protection for whooping crane critical habitat. Construction scheduled to avoid disturbance. Surveys to be accomplished to confirm presence or absence of bald eagle nests. Possible minor disturbance to migrating peregrine falcons. Possible increase in foraging areas.	Same as 50-year plan.	Same as 50-year plan.	Same as 50-year plan.	Low level of flood protection for whooping crane critical habitat.
SEIS-37 Recreation Areas, Needs, & Plans	Potential to provide cost-shared facilities. Temporary restriction of access to riparian zone & conveyance channel in areas of construction. Possible increase in waterfowl oriented opportunities.	Same as 50-year plan.	Approx. the same as 50-yr plan with an increase in the construction period that recreational use would be impaired in construction areas. Substantial potential increase in water-oriented recreational activities due to potential to create appreciable numbers of wetland related to borrow needs.	Same as 200-year plan although the increased construction period would appreciably increase the period of impaired recreational use of particular river segments.	Statu quo

TABLE 5 (Cont'd)
Comparative General Effects of Alternatives Considered
Alternative Levels of Flood Protection

Resource Affected	50-Year	Recommended Plan 100-Year	200-Year	SPF	No Action
Air and Sound Quality	Minor & localized degradation during construction. No violation of standards.	Approximately the same as 50-year plan. No violation of standards	Increase in period of degradation due to longer construction period or increase in construction equipment. No violation of standards.	Significant increase in period of degradation due to longer construction period or increase in construction equipment. No violation of standards.	Status quo
Water & Sediment Quality	No effect	No effect	No effect	No effect	Status quo
Mineral Resources	Use of sand & gravel resources in existing embankment & about 1.6 million cubic yds of earth, 108,000 cubic yds of gravel, & 25,000 cubic yds of rock from adjacent terraces.	Use of sand & gravel resources in existing embankment & about 1.8 million cubic yds of earth, 108,000 cubic yds of gravel, & 28,000 cubic yds of rock from adjacent terraces.	Use of sand & gravel resources in existing embankment & about 3.4 million cubic yds of earth, 10,8000 cubic yds of gravel, & 35,000 cubic yds of rock from riparian zone & adjacent terraces.	Use of sand & gravel resources in existing embankment & about 7 million cubic yds of earth, 108,000 cubic yds of gravel, & 41,000 cubic yds of rock from riparian zone & adjacent terraces.	Status quo
Health & Safety	Enhanced protection to community health & safety from adverse effects of major flooding.	Similar to 50-year plan but at a higher level of protection.	Similar effect as lower levels of protection but at a much higher level of protection.	High level of protection to community health & safety from adverse effects of major flooding.	Continued threat to community health & safety from major flooding.
Visual Quality	Somewhat modified appearance of levee in first 44 miles to a slightly smaller, more formal structure. The first 4500 feet would be characterized by combination of concrete wall & rock & panel surfaced levee. The lower 10.5 miles of levee would be substantially larger.	Approximately the same as 50-year level but slightly larger in lower 10.5 miles.	Same features as recommended plan but somewhat larger. Use of riparian borrow sites for wetland development & establishment of native riparian vegetation should provide visual enhancement.	Same features as recommended plan but substantially larger. Wetland development & replacement of salt cedar with native riparian vegetation should provide visual enhancement. Caution would have to be exercised not to overly disturb/modify riparian vegetation due to high borrow requirements.	Status quo

TABLE 5 (Cont'd)
Comparative General Effects of Alternatives Considered
Alternative Levels of Flood Protection

Resource Affected	Recommended Plan			SPF	No Action
	50-Year	100-Year	200-Year		
Floodplain Management Executive Order 11988	Supports the Executive Order.	Supports the Executive Order.	Supports the Executive Order.	Supports the Executive Order.	Continued low level of flood protection
Protection of Wetlands Executive Order 11990	Supports the Executive Order. Compensatory measures required for disturbance & displacement of small wetlands.	Supports the Executive Order. Similar to 50-year alternative. Compensatory measures included for disturbance & displacement of small wetlands.	Supports the Executive Order. Similar to 50-year alternative. Compensatory measures required for disturbance & displacement of small wetlands.	Supports the Executive Order. Greater amount of disturbance & displacement of wetlands, compensatory measures required.	Possible drying of wetlands.
Environmental Effects of Maintaining the Project	Perpetuate high level of flood protection.	Perpetuate high level of flood protection.	Perpetuate high level of flood protection.	Perpetuate high level of flood protection.	N/A
Irreversible or Irretrievable Commitment of Resources	Labor, fuel, & structural material.	Small increase over 50-yr level largely commensurate with increase in construction period & increase in level of effort.	Greater commitment of resources due to larger facility & construction period.	Substantial increase in commitment of resource due to larger facility & long construction period.	Absence of increased flood protection has potential for substantial commitment of human, economic, & energy resources should flooding occur.
Major Cumulative Effects	Enhanced level of safety & well-being. Relative small (33 ac.) commitment of additional land area, primarily in Elephant Butte Reservoir.	Higher level of flood protection than that provided by 50-yr protection. Small increase (about 10 ac.) in commitment of land area, primarily in Elephant Butte Reservoir.	Substantial increase in level of flood protection than that provided by recommended plan. Increase in land commitment over recommended plan by about 15 acres.	Maximum increase in level of flood protection. Increase in land commitment not computed.	Status quo

SECTION IV - POTENTIALLY AFFECTED ENVIRONMENT

PREFACE

4.01 Resources discussed in this section are those that have been identified as significant in the study area. These include those identified during environmental scoping; those identified as a result of public review of the draft SEIS; those identified in laws, regulations, guidelines or other institutional standards; those that would be affected by the proposed plan that could become the subject of public concern; and those that would aid the reviewer in understanding the ecosystem in which the project would be located. The extent to which these resources are discussed is based on both significance and expressed public concern.

GENERAL ENVIRONMENTAL SETTING

4.02 The study area is the Rio Grande Valley, extending from the San Acacia Diversion Dam located north of the city of Socorro, New Mexico, downstream to the headwaters of Elephant Butte Reservoir. The length of this study area is approximately 58 miles, depending on reservoir storage levels. This 58-mile section is the lower-most part of the 150-mile-long middle Rio Grande valley, which begins at Cochiti Dam. River, riparian (stream bank) forest and woodland, floodplain farmland, bordering terraced plains of grasses and shrubs, basalt-capped mesas, and more distant mountains characterize the valley. The width of the Rio Grande Valley in this reach varies from eight to twelve miles with the nearly flat floodplain of the Rio Grande being one to three miles wide. Elevations along the Rio Grande vary from 4,676 feet at the San Acacia Diversion Dam to about 4,440 feet at the end of the proposed project.

4.03 The floodplain and bordering terraces are primarily rural, with irrigated farming, livestock grazing, and wildlife conservation and enhancement being primary land uses. The major population center is the city of Socorro, which lies partially within the floodplain. Socorro had a 1990 population of 8,159. Smaller communities are San Acacia, Polvadera, San Luis, Lemitar, Escondida, San Pedro, and San Antonio. Elephant Butte Reservoir is the largest reservoir in New Mexico and stores water for irrigation, hydroelectric power, flood control (incidental), and recreation. Bosque del Apache NWR is located near the center of the study area. The refuge provides habitat for a rich diversity of resident and migrant wildlife, wintering waterfowl and cranes, endangered species, and abundant opportunities for wildlife observation and study.

CLIMATE

4.04 The study area has an arid to semi-arid continental climate that is characterized by light precipitation, abundant sunshine, low relative humidity, and a wide diurnal and annual range of temperature. The principal sources of moisture-laden air masses are the Pacific Ocean and the Gulf of Mexico. The average annual precipitation is less than 10 inches throughout the study area. Precipitation at Truth or Consequences averages about 6.27 inches and about 8 inches at Bosque del Apache and Socorro. Approximately 50 percent of the annual precipitation occurs during the three-month period of July through September, usually in the form of brief, intense thundershowers. Winter precipitation, most of which comes from the Pacific Ocean, falls primarily in connection with frontal activity associated with the general movement of storms from west to east.

4.05 The middle Rio Grande valley within the study area has high summer daytime temperatures, cool nights, and wide diurnal and annual temperature variation. Summer daytime temperatures frequently exceed 100 degrees Fahrenheit (°F). The average maximum temperatures in January range from the high 30's to the upper

40's. Temperatures below freezing are common during the winter. Relative humidity is usually low, mitigating considerably the effects of the temperature extremes in both winter and summer. Humidity during the warmer months is below 20 percent much of the time. Wind speeds are usually moderate. However, relatively strong winds often accompany frontal activity in late winter and spring and may exceed 30 miles per hour for several hours.

GEOLOGY

4.06 The study portion of the Rio Grande Valley lies within the Mexican Highlands section of the basin and range physiographic province. This physiographic province is characterized by north to south trending fault-block mountain ranges with wide alluvial valleys. From south central Colorado, the Rio Grande flows through a great rift or depression, which extends through New Mexico and into Mexico, a distance of more than 500 miles. This depression is composed of a series of complex, structural basins separated by canyons or restrictions. These basins are complex grabens (depressions), which have been downfaulted thousands to tens of thousands of feet. Mountainous highlands bordering the east side of the depression have been uplifted thousands of feet. Volcanic fissure eruptions and igneous intrusions mark the west side of the depressions. Both sides of the rift are bounded by major fault zones, which form escarpments in places, but elsewhere they are obscured or deeply buried (USBR, 1977). Comparatively recent basaltic intrusions have left conspicuous mesas, which have restricted more recent Valley cutting.

4.07 The upper portion of the study area is located in the Socorro Basin, which begins at the San Acacia constriction and ends at the San Marcial constriction, a length of about 35 miles (USGS, 1986). As stated, it is eight to 12 miles wide and the floodplain is one to three miles wide. The western boundary is formed by the Lemitar Mountains, Socorro Peak, and the Chupadera Mountains. The eastern boundary includes the Joyita Hills and the Loma de Las Canas Uplift. The lower part of the study area is located in the San Marcial Basin. The San Marcial Basin is about 15 miles long, 10 to 20 miles wide, and includes the upper end of Elephant Butte Reservoir. The Basin is bounded on the east by Black Mesa. The Magdalena and San Mateo Mountains form the western boundary (USGS, 1986).

4.08 The chain of basins has been deeply filled with sediments. Sand, gravel, silt, and clay brought in by rivers and washed down from bordering highlands have been deposited to an estimated depth of 10,000 feet in the deeper basins. Soils along the middle Rio Grande floodplain are recent alluvium of mixed origin. These soils are comprised primarily of sediments deposited by the Rio Grande to which have been added varying amounts of material from the adjacent mesas and mountains by incoming drainage. Below the confluence of the Rio Puerco and the Rio Grande, the soils have been formed from the highly colloidal materials deposited by the Rio Puerco and are generally of a heavy texture (USBR, 1977).

HYDROLOGY AND HYDRAULICS

4.09 a. Channel Characteristics. As stated, the study area is located in the middle valley of the Rio Grande in New Mexico, a 150-mile-long segment extending from Cochiti Dam to Elephant Butte Reservoir. The middle valley is an entrenchment in an alluvium-filled trough from 100 to 300 feet deep and 1 to 3

miles wide. Principal tributary water courses of the Rio Grande below Cochiti Dam are Galisteo Creek, Jemez River, Rio Puerco, and Rio Salado. These water courses are generally ephemeral.

The main channel of the middle Rio Grande is generally 200 to 300 feet wide with a shifting sand substratum. The configuration of the river may be described as one of low sinuosity with some straight reaches. The channel is braided, probably a result of the combination of relatively flat slopes and an overload of sediment. The basic levee system, which was completed in 1936, was laid out to contain the pattern of the river prevailing at that time. Since then, the lateral movement of the channel has been limited by the floodway levees. Formation of sediment bars in the channel during low-flow periods and, in particular, on the recession of flood flows, together with rapid growth of vegetation, materially affects the channel configuration within the levees. The slope of the river drops about three feet per mile from the confluence of the Rio Puerco to Elephant Butte Dam. Within the unstabilized floodway, the braided channel has virtually no banks, and the bed of the river is at or above the level of areas outside the levee due to sediment deposition.

In the 75-mile-long reach of the Rio Grande between the diversion dam at San Acacia to "The Narrows" within Elephant Butte Reservoir, river flows are confined to the low-flow conveyance channel and to a combined floodway channel and cleared floodway in the river channel proper. Flows in the river channel are confined by the "spoil bank" to the west and vegetation and a natural mesa to the east. River flows up to about 2,000 c.f.s. are diverted into the low-flow conveyance channel. That portion of flows exceeding 2,000 c.f.s. continues into the floodway channel, which includes the natural river channel and pilot channels excavated through meanders and deposited sediment during channel maintenance activities. River channel banks subject to water erosion are stabilized by jetty fields. The cleared floodway is kept free of large vegetation by various mechanical means for widths of from 430 to 1,550 feet to permit impediment-free movement of flood flows. A typical section of the existing floodplain showing location of various features is presented in Figure 3.

b. Surface Flows. The surface flows of the middle Rio Grande are of two general types. One type generally occurs from April through June as a result of snowmelt, which may be augmented by general precipitation. Spring flows are characterized by gradual rises to moderate discharge rates; large runoff volumes; and approximately two-month-long flow durations, with shorter duration peak flows included. The other type of flow is summer or flash flows that may occur from May through October. Summer flows are characterized by sharp high peak flows that recede quickly and generally contain smaller runoff volumes. Through the middle Rio Grande valley, flows above 5,000 c.f.s. are considered flood flows. During a large part of the year, there are no surface flows in the main channel of the river in certain areas. The river channel below San Acacia represents the extreme in absence of river flow and can be dry for several months.

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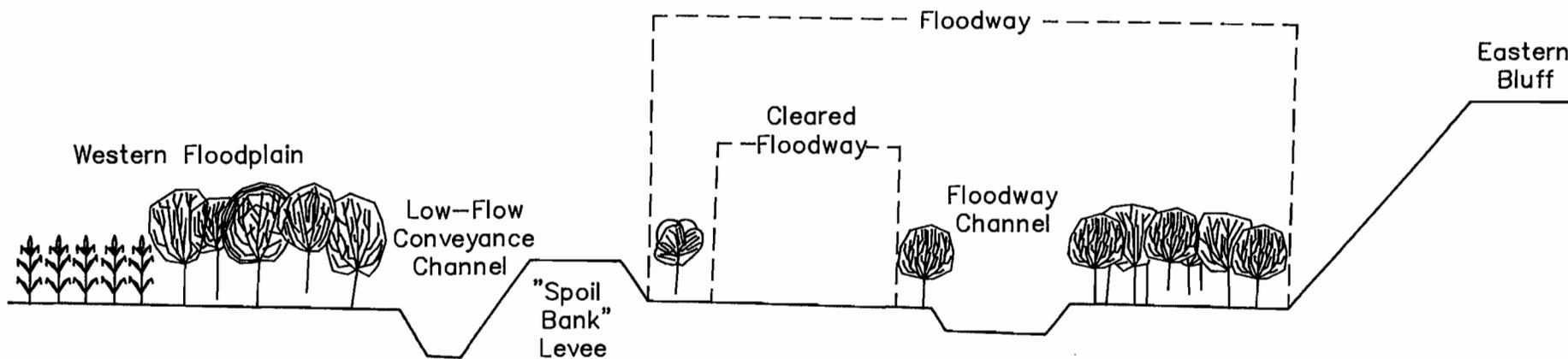


Figure 3. Generalized section of existing floodplain showing location of features. (Not to scale) (After USBR, 1982)

RIO GRANDE FLOODWAY SAN ACACIA TO BOSQUE DEL APACHE UNIT GENERALIZED FLOODPLAIN SECTION	
U.S. ARMY ENGINEER DISTRICT, ALBUQUERQUE, N.M.	
	FIGURE 3

c. Sedimentation. The suspended sediment burden of the Rio Grande is large. Through 1986 maximum daily sediment loads in the floodway at San Acacia and San Marcial have been 1,760,000 tons and 1,200,000 tons, respectively. The problem is severely aggravated by the extremely large sediment contributions from the Rio Puerco and Rio Salado. The Rio Puerco and Rio Salado drainage are two of the principal contributors of sediment to the Rio Grande above Elephant Butte Reservoir. The Rio Puerco Basin represents about 28 percent of the Rio Grande drainage area in New Mexico above Elephant Butte Reservoir, but it contributes only about 4 to 6 percent of the surface water yield. Similarly, the Rio Salado drainage contributes only a small amount of runoff. It is estimated that the two tributaries contribute about 75 percent of the sediment passing San Acacia.

There is more sediment entering the floodway than is being transported away and, as a result, the channel is aggrading, or raising. In recent years the floodway channel has increased some 2 to 10 feet in elevation above the floodplain (USBR, 1982). The river reach immediately south of San Marcial is within Elephant Butte Reservoir and several years of peak water storage has resulted in appreciable sedimentation in this reach. Sedimentation causes numerous significant problems including the impedance and reduction of water deliveries to Elephant Butte Reservoir; increases the potential for flooding by decreasing channel capacity; increases evapo-transpirational losses; decreases the capacity and efficiency of the low-flow conveyance channel and irrigation canals; and depletes the capacity of downstream reservoirs. In addition, the spoil bank separating the conveyance channel from the river channel is being strained because sedimentation is decreasing the channel capacity. This spoil bank was nearly overtopped on several occasions during 1985, 1986, 1987, and 1991.

EXISTING FLOOD HAZARDS

4.10 There are approximately 8,500 square miles of contributing, uncontrolled, drainage area upstream from the proposed project. The two largest tributaries, the Rio Puerco (6,000 sq. mi.) and the Rio Salado (1,395 sq. mi.), enter the Rio Grande immediately upstream from the proposed project and, individually or in combination, are capable of producing flows far in excess of the existing protection provided. These same tributary flows, coinciding with high flows on the main stem of the Rio Grande, would create the most severe flooding condition for the study reach. The average level of protection for the existing 58-mile length of spoil bank levee is about the 10-year flood having a discharge of about 15,000 c.f.s. Discharges for the 50-, 100-, and 200-year flood frequency levels and Standard Project Flood at the San Acacia Diversion are approximately 38,000, 51,000, 72,000, and 122,000 c.f.s., respectively.

4.11 The area subject to major flood damage from inundation, scour, and sediment deposition by the Rio Grande is the floodplain on the west side of the river from San Acacia to the head of Elephant Butte Reservoir. Table 6 shows the value of damageable property from the three flood frequency levels and SPF flood event evaluated based on an economic survey performed in 1981.

4.12 Tangible damages would include physical damages to property, loss of service of public features, reduction of net crop income, emergency costs, and business and financial losses, both in and adjacent to the floodplain. An occurrence of the SPF would result in damages of about \$176 million, including the \$81 million Rio Grande low-flow conveyance channel, plus extended loss of its water salvage and conveyance service. Loss of the channel could also have

international significance, as the 1906 treaty with Mexico requires the delivery of 60,000 acre-feet of water annually. Damages to residential properties and transportation facilities, mostly in the Socorro area, would exceed 85 million dollars. Also, a flood of this magnitude would leave an estimated 3,300 acre-feet of sediment on overbank floodplain areas, requiring removal at a cost in excess of 11 million dollars. Average annual flood damages are about 10 million dollars, with the major sources of damages again being residential and transportation developments in the vicinity of Socorro, sediment deposition in the floodplain, and the U.S. Bureau of Reclamation's low-flow conveyance channel (which alone accounts for about three-fourths of the total).

TABLE 6

VALUE OF DAMAGEABLE PROPERTY (\$1000)
 SAN ACACIA TO BOSQUE DEL APACHE, NEW MEXICO
 (x \$1,000, OCT, 1989 Prices)

<u>Land Use.</u>	<u>Flood Frequency or Event</u>			<u>SPF</u>
	<u>50-Year</u>	<u>100-Year</u>	<u>200-Year(approx)</u>	
Residential Structures	18,055	21,235	24,792	28,348
Residential Contents	9,037	10,626	12,525	14,224
Commercial Structures	10,037	12,586	14,168	15,550
Commercial Contents	5,924	9,312	9,600	9,882
Public Structures	4,796	4,903	5,000	5,098
Public Contents	2,857	2,877	2,908	2,939
Vehicles	6,376	8,487	9,801	11,220
Transportation Facilities	23,859	38,305	43,876	49,447
Utilities	8,009	10,053	11,358	12,662
Crops	4,743	5,543	5,820	6,095
Irrigation Facilities	9,462	15,855	16,580	17,305
Rio Grande Low-Flow Conveyance Channel	80,681	80,681	80,681	80,681
Rural Improvements	8,897	10,639	11,309	11,978
Recreation	<u>645</u>	<u>645</u>	<u>645</u>	<u>645</u>
Total	193,351	231,747	249,063	266,184

4.13 Intangible damages include the possible loss of life, human discomfort, injury and exposure during floods, creation of conditions detrimental to health and security, and interruption of normal community activities directly affecting about 4,300 residents of the Rio Grande floodplain. Bosque del Apache NWR would suffer severe damage in the event of a high magnitude flood. A majority of the fields, impoundments, and extensive water distribution facilities that are used to provide habitat for a myriad of wildlife species, including both State and Federally listed endangered species, would be scoured, covered with sediment, or both. Recreational and educational opportunities at the Refuge would also be severely impaired. Flood damage to the Refuge would also include critical habitat for the endangered whooping crane.

4.14 The city of Socorro is a participant in the National Flood Insurance Program. This program, established by Congress in 1968, allows property owners to purchase Federally backed flood insurance within communities that participate in the program. In return for this insurance protection, participating communities implement floodplain management measures to reduce flood risks to new development.

4.15 Meetings held to discuss the recommended plan subsequent to public review of the draft SEIS surfaced a request to include floodplain maps illustrating the extent of flooding associated with various flood frequency events. Those maps have not been included in this SEIS because of the bulk associated with the number of foldout maps involved and high reproduction costs. A single plate showing the entire reach would result in an appreciable loss of detail and, consequently, was also not included. However, the maps are available upon request from the Albuquerque District.

HISTORIC FLOODING

4.16 Recorded flood history in the study area goes back to the 1920's. Prior to that time, newspaper accounts identified major floods in July 1895 and September 1904. Recorded major floods which would exceed the estimated protection (10-year) afforded by the existing spoil bank levees occurred twice in 1929, in 1936, 1941, and the last time in 1965. A recurrence of any of these floods would have devastating effects; the floods of 1929 would cause an estimated \$136 million in damages.

a. Floods of August and September 1929. The Rio Grande Valley between San Acacia and San Marcial suffered from two floods in 1929, one on August 12 and the other on September 23. The flood of August 12 was caused by a general storm that occurred August 8-11 in southern Colorado and northern and western New Mexico. During this period much of the area received over two inches of precipitation. The heaviest rainfall centered over the Rio Chama, Rio Puerco, and Rio Salado watersheds as well as the side arroyo drainage in the vicinity of Socorro. Floodwaters and sediment damaged crops and homes in San Acacia, San Antonito, Val Verde, La Mesa, and San Marcial. Studies made by the State Engineer indicated peak discharges on the Rio Puerco and Rio Salado of about 30,600 c.f.s. and 27,400 c.f.s., respectively, on August 12. The estimated flow on the Rio Grande at Bernardo, about five miles upstream from the Rio Puerco confluence, was 7,000 c.f.s. The combined flows peaked at an estimated 24,000 c.f.s. about midnight on August 13 at San Marcial, about 60 miles downstream from Bernardo. The storm that caused the flood of September 23 was similar to the August storm. From September 21 to 23, one to four inches of rain fell in the Rio Grande Basin. Peak flows on Rio Puerco and Rio Salado on September 23 were estimated by the State Engineer to be 35,000 c.f.s. and 20,000 c.f.s., respectively. These flows nearly synchronized and joined with a flow of about 9,000 c.f.s. on the Rio Grande to peak at an estimated 60,000 c.f.s. at San Acacia. The resulting flood destroyed crops on 90 percent of the farmed acreage in the Valley, washed out portions of the roadbed of the Atchison Topeka and Santa Fe Railway Co., damaged dikes and ditches, and destroyed the villages of San Acacia, San Antonito, and San Marcial.

b. Flood of July-August 1965. Heavy thunderstorm activity over the Rio Salado and Rio Puerco watersheds produced peak flows of 36,200 c.f.s. on Rio Salado near San Acacia at 11:10 p.m. on July 31, and 3,210 c.f.s. on Rio Puerco near Bernardo at 6:45 p.m. on August 3. The Rio Grande at San Acacia peaked at 17,200 c.f.s. on August 1. This peak on the Rio Grande was the result of the flow from the Rio Salado and illustrates the effect of the main stem on large-peak, small-volume flows from the Rio Salado.

WATER MANAGEMENT FACILITIES AND ACTIVITIES

4.17 a. Irrigation. The Middle Rio Grande Conservancy District (MRGCD) was formed in 1925 primarily because of concerns over the decrease in irrigated areas in the middle Rio Grande valley resulting from water shortages, poor drainage, in-adequate irrigation facilities, and periodic flooding. From 1925 to 1935 the Conservancy District constructed El Vado Dam, a storage reservoir on the Rio Chama; four major irrigation diversion dams on the Rio Grande (of which San Acacia is one); two canal headings; 345 miles of main irrigation canals; and rehabilitated old irrigation ditches. The San Acacia Diversion Dam diverts water from the Rio Grande to provide irrigation water to fields in the Socorro area. MRGCD operates and maintains irrigation and flood control facilities in the middle Rio Grande valley.

Elephant Butte Dam was completed by the USBR in 1916 to provide reservoir storage for the irrigation of farmlands along the Rio Grande between Truth or Consequences, New Mexico and Fort Quitman, Texas. The reservoir also provides storage for supplying the Republic of Mexico with 60,000 acre-feet of water annually under the Treaty of 1906. The reservoir's original capacity was 2,137,200 acre-feet. A hydropower facility at the dam generates electricity. The upstream limit of the reservoir is approximately San Marcial.

In addition to the network of irrigation facilities in the floodplain below San Acacia, Bosque del Apache NWR has an extensive water distribution system of its own with which to irrigate crops, develop and maintain ponds and marshes, and to manage vegetation. Sources of water are the low flow conveyance channel and irrigation and drainage canals.

b. Flood Control. The dominant structure in the study area that provides some flood protection to floodplain developments is the spoil bank located east of the low-flow conveyance channel. This bank was formed from material excavated to create the conveyance channel and from subsequent maintenance and rehabilitation activities. It extends the entire length of the conveyance channel and varies in size.

Additional flood control structures in the immediate study area are local diversion channels at Socorro, which include a discharge channel to the Rio Grande that was constructed by the Corps in 1964 and the USBR's Brown Arroyo Project south of Socorro, which also discharges into the Rio Grande.

The Service, U.S. Bureau of Land Management, U.S. Bureau of Indian Affairs, U.S. Soil Conservation Service, and the Middle Rio Grande Conservancy District have also constructed or presently operate flood control structures in the middle Rio Grande valley. The Service constructed and operates water control structures as well as flood control dikes at Bosque del Apache NWR. The U.S. Bureau of Land

Management has provided improvements in both the Rio Puerco and Rio Salado, including dikes, diversions, small reservoirs, and detention dams. The U.S. Bureau of Indian Affairs has constructed several dams for flood and sediment control on Indian Reservations located within the Rio Puerco and Rio Salado watersheds. The U.S. Soil Conservation Service has constructed two floodwater retarding structures in 1961, one on Big Draw and one on Prop Canyon, tributaries of Bluewater Creek. Land treatment was also instituted on these tributary watersheds by the Soil Conservation Service.

c. Water Conservation and Delivery. During the 1951 to 1959 time period, the USBR constructed a low-flow conveyance channel on the west side of the Rio Grande floodway. This channel extended 75 miles from the "narrows" in Elephant Butte Reservoir to the San Acacia Diversion Dam and has a capacity of approximately 2,000 c.f.s. The purpose of the conveyance channel is to transmit river flows through a critical water-loss area, thus preventing the flows from spreading across the wide floodplain and subsequently dissipating by high evaporation, high seepage, and phreatophytic-vegetation transpiration. The diversion of river flows (up to 2,000 c.f.s.) into the conveyance channel assists in conserving water and making water deliveries required by the Rio Grande Compact and the 1906 Treaty with Mexico.

A period of record analysis by the New Mexico State University Water Resources Research Institute indicates a savings of about 34,000 acre-feet annually. As stated, material excavated from the channel was used to form an embankment that would provide some protection from high flows in the Rio Grande. USBR is currently rehabilitating the conveyance channel by removing accumulated sediment and riprapping its side slopes to prevent sloughing and to increase efficiency. Maintenance roads, bridges and various water-control structures have also been added. The conveyance channel is now much lower than the channel of the Rio Grande as a result of sediment deposition in the main channel.

A record number of high spring runoffs and high reservoir conditions during the 1979 to 1987 period have seriously affected the conveyance system. These conditions diminished the capability to operate the conveyance channel to the point that no water could be diverted into the channel without damaging portions of the channel. A significant reduction in the capacity of the channel and complete sedimentation of the lower 15 miles occurred as a result of recent high water storage at Elephant Butte Reservoir and resultant sediment deposition and backwater effects. The USBR has extensively rehabilitated the Rio Grande floodway and low-flow conveyance channel below Bosque del Apache NWR in response to this extensive sedimentation, and the conveyance channel is currently operational.

d. Operation and Maintenance of Rio Grande Floodway. The USBR is responsible for operation and maintenance activities along the floodway of the Rio Grande from Velarde, New Mexico, to areas within the conservation pool elevations of Elephant Butte and Caballo Reservoirs. The primary purpose of this program is to operate and maintain facilities which have been developed to (1) more effectively meet New Mexico's water obligation under the Rio Grande Compact without curtailment of water use in New Mexico by providing efficient transport of water to Elephant Butte Reservoir, (2) conserve both surface and ground water, (3) reduce the rate of aggradation of the Rio Grande floodway, and (4) provide effective flood control. Operation and maintenance activities consist of

vegetation management, maintaining a cleared floodway, pilot channeling through sediment accumulations, bank protection, and maintenance of the low-flow conveyance channel.

SOCIO-ECONOMIC FEATURES

4.18 a. Population. Within the study area, there is only one urban population center, the city of Socorro. The remainder of the population is rural; however, a number of smaller communities are located in or adjacent to the study area. The 1990 population of Socorro County was 14,764, while the city of Socorro had a stated 1990 population of 8,159. The 1970 and 1980 county populations were 9,763 and 12,566, respectively. The appreciable increase (17 percent) in population from 1980 is due to expanded college and governmental research programs and reactivation of the area's mining industry. The population of Socorro County is predicted to increase to 24,000 by the year 2010, representing a 90.5 percent increase (NMDOL, 1989).

The history of many of the smaller communities in the middle Rio Grande Valley goes back several centuries when they served as outposts along the Camino Real. The pattern of settlement of communities in the fertile land of the Rio Grande Valley demonstrates the historical importance of farming to these communities. As early as the mid-1800's, farmers located north of Socorro were noted for their produce. Since the late 1800's, when mining and agriculture contributed to a growing economy in Socorro County, economic activity has decreased. Many of these smaller communities have been losing population to Socorro, Albuquerque, and other urban areas, so farming opportunities have declined.

The racial and ethnic composition of Socorro County is predominantly Hispanic, comprising 50 to 75 percent of the total population. The population is also predominantly rural and has a low median age.

b. Employment and Economy. Approximately 70 percent of all jobs in Socorro County are in government, wholesale and retail trade, and service jobs. According to statistics provided by the New Mexico Department of Labor, of approximately 6,013 available workers in April 1992, 5,535 of these workers had jobs. As a result, the unemployment rate was 7.9. A county/state comparison of employment in the major economic sectors during 1990 is shown in Table 7.

TABLE 7
EMPLOYMENT
COUNTY/STATE COMPARISON¹

Sector	Socorro County 1991 % of Total Job	New Mexico 1991 % of Total Job
Manufacturing	3	5
Mining	7	8
Construction	2	5
TCU	1	5
Trade	20	4
FIRE	3	5
Services	23	26
Government ²	42	25

¹ Excludes agriculture and mining.

² Most of the government employment reflects faculty, staff, and student employment at the New Mexico Institute of Mining and Technology (NMIMT).

SOURCE: New Mexico Department of Labor

Little future economic expansion is expected in agricultural employment. Expansion of manufacturing activity is not expected either due to the sparse economy and the distance from major population centers. However, Socorro County is expected to grow at a faster rate than the remainder of New Mexico for the next 50 years. This growth is related to the economic health of NMIMT. Employment attracted by NMIMT is expected to help the economy of Socorro County in the future. Employment will grow in Socorro County at slightly faster rates than the State until the end of the century, when the employment rate should be equal to the State average.

c. Income. Per capita, personal income (PCPI) for Socorro County was \$8,637 in 1986 as compared to \$11,428 for the State. This increase in income represents a 36 percent increase from the 1986 PCPI of \$6,353 (BERA, 1989). The increase is higher than most counties in New Mexico and, again, likely reflects the influence of NMIMT. Per capita income should continue to increase.

d. Local Government. County and municipal governments throughout New Mexico are under increasing pressure to meet the need for public services and facilities. Socorro County has managed its resources well in satisfying community needs. They currently have a net budget surplus and a decreasing bonded indebtedness, statistics which have shown Socorro County to be a

financially sound local government. The city of Socorro, while operating with a budget deficit in recent years, has been decreasing its deficit and its bonded indebtedness.

TRANSPORTATION FACILITIES

4.19 There are few transportation facilities that would be affected by the proposed project. The primary highway that would be crossed is U.S. Highway 380. This highway is a major transportation artery, carrying automobile traffic to and from southeastern New Mexico as well as local traffic to military installations. County Road 85-82 crosses the Rio Grande north of the city of Socorro, between the villages of Escondida and Pueblito. Vehicular traffic on this road is very light and local. The Santa Fe and Pacific Railroad has rail facilities within the floodplain. The rail line is adjacent to the Rio Grande near San Acacia and San Marcial and the proposed project would interact with this transportation facility at these locations.

LAND USE, OWNERSHIP, AND CLASSIFICATION

4.20 a. General.

(1) Agriculture. Agriculture dominates land use along the middle Rio Grande valley in the study area. Within the floodplain, there is irrigated farming and livestock pasturage, with livestock grazing on the bordering terraces and mountains. Livestock grazing also occurs within the riparian zone, some unauthorized. Irrigated agriculture is an important component of the economy and way of life for people living along the Rio Grande. As stated, the MRGCD operates and maintains irrigation facilities for floodplain farms and the USBR operates and maintains the low-flow conveyance channel and its related features.

(2) Land Ownership. Ownership of lands within Socorro County and several adjacent counties is shown in Table 8. Federally-owned land within Socorro County accounts for a majority of land ownership. Federal administration of lands particular to this SEIS include the Bureau of Reclamation, the Service, and isolated parcels managed by the Bureau of Land Management. Private land comprises 29.6 percent of total acreage, much of this land being devoted to agriculture. State land equals 14.4 percent and Indian lands total 1.3 per cent. No substantial changes are anticipated in land ownership in the near future.

(3) Important Farmlands. The Farmland Protection Policy Act (Public Law 97-98) establishes criteria for identifying the effects of federal programs or the conversion of farmland to nonagricultural uses. This Act directs federal agencies to "identify and take into account the adverse affects of Federal programs on the preservation of farmland; consider alternative actions, as appropriate, that would lessen such adverse affects; and assure that such Federal programs, to the extent practicable, are compatible with State, unit of local government, and private programs to protect farmland." The term "farmland" includes land defined as prime, unique, or land that is "of statewide or local importance for the production of food, feed, fiber, forage or oilseed crops, as determined by the appropriate State or unit of local government agency or agencies, and that the Secretary determines should be considered as farmland for the purposes of this subtitle." To assist agencies in determining whether proposed sites are subject to the Act and require the exploration of

TABLE 8

LAND OWNERSHIP BY COUNTY

County	Total Acreage	Federal		State		Indian		Private	
		Acres	%	Acres	%	Acres	%	Acres	%
Bernalillo	748,160	154,590	20.7	32,201	4.3	222,527	29.7	338,842	45.3
Catron	4,414,720	2,799,004	63.4	533,037	12.1	0	0	1,082,679	24.5
McKinley	3,495,040	564,580	16.2	183,974	5.3	2,158,410	61.8	588,076	16.8
Sandoval	2,378,880	987,297	41.5	80,192	3.4	650,380	27.3	661,011	27.8
Socorro	4,240,640	2,318,458	54.7	609,547	14.4	56,680	1.3	1,255,955	29.6
Valencia	3,621,120	700,034	19.3	251,746	7.0	849,551	23.5	1,819,789	50.2

Source: New Mexico in Maps, 1986.

alternatives, a Farmland Conversion Impact Rating Form is provided by the Soil Conservation Service. Coordination with the Soil Conservation Service (SCS, Personal Communication, Sept. 1989) indicates that no soils in the general area have been identified as meeting the criteria for prime or unique soils.

b. Specialized.

(1) Sevilleta National Wildlife Refuge. The Sevilleta NWR is located in the upper part of the study area, contiguous to the proposed project area. This refuge was created in 1973 when the Campbell Family Foundation donated 220,200 acres of the Sevilleta Grant, through the Nature Conservancy to the Service. The donation was for the purpose of "creating a vast wildlife refuge to be managed as nearly as possible in its natural state, employing only those management techniques that are consistent with the maintenance of a natural ecological process". Further, "the intent of the Grantor is that the land and the flora and fauna supported by it be managed to permit the natural ecological successions and provinces typical of the area to prevail". The Refuge is managed by the Service and no public use occurs. That part of the refuge boundary located just north of the San Acacia Irrigation Diversion and east of the centerline of the Rio Grande, from the Diversion to the southern boundary of the Refuge (a distance of about 3 miles), interfaces with the proposed project area.

(2) Bosque del Apache National Wildlife Refuge. Bosque del Apache NWR is located 18 miles south of the city of Socorro and 8 miles south of the village of San Antonio (see Figure 4). It covers 57,191 acres and is bisected by the Rio Grande and its floodplain. Bosque del Apache NWR was established in 1939 to provide "a refuge and breeding ground for migratory birds and other wildlife". The Refuge plays a major role in the Nation's refuge and flyway system. Its artificially created marshes and croplands provide a southern stopping point for large populations of wintering snow geese, ducks, sandhill cranes, and the foster-parent whooping crane flock*. It also serves as a migrational stopover and breeding area for mourning doves, marsh and shorebirds, and many species of song birds. Locally, the Refuge serves other important functions. It provides valuable habitat for a rich diversity of resident wildlife which include deer, pheasants, quail, turkey, rabbits, fish, songbirds, pronghorn antelope, mountain lions, bobcats, raccoons, beaver, muskrat, badgers, and coyotes. In addition to providing wildlife habitat, the refuge hosts various scientific studies, environmental education activities, and public recreational uses. Bosque del Apache NWR receives appreciable visitation from people wishing to participate in the wildlife oriented recreational and environmental educational opportunities that the refuge provides. While most visitors come for sightseeing, photography, and bird watching, the refuge also offers hunting and fishing opportunities for snowgeese, deer, quail, doves, rabbit, and a diversity of warm water fish.

All areas below elevation 4,600 are classified as critical habitat for the endangered whooping crane. This classification is described in further detail later in this section in conjunction with the description of the endangered whooping crane.

*Bosque del Apache NWR is required by law to manage for migratory birds and endangered wildlife species.

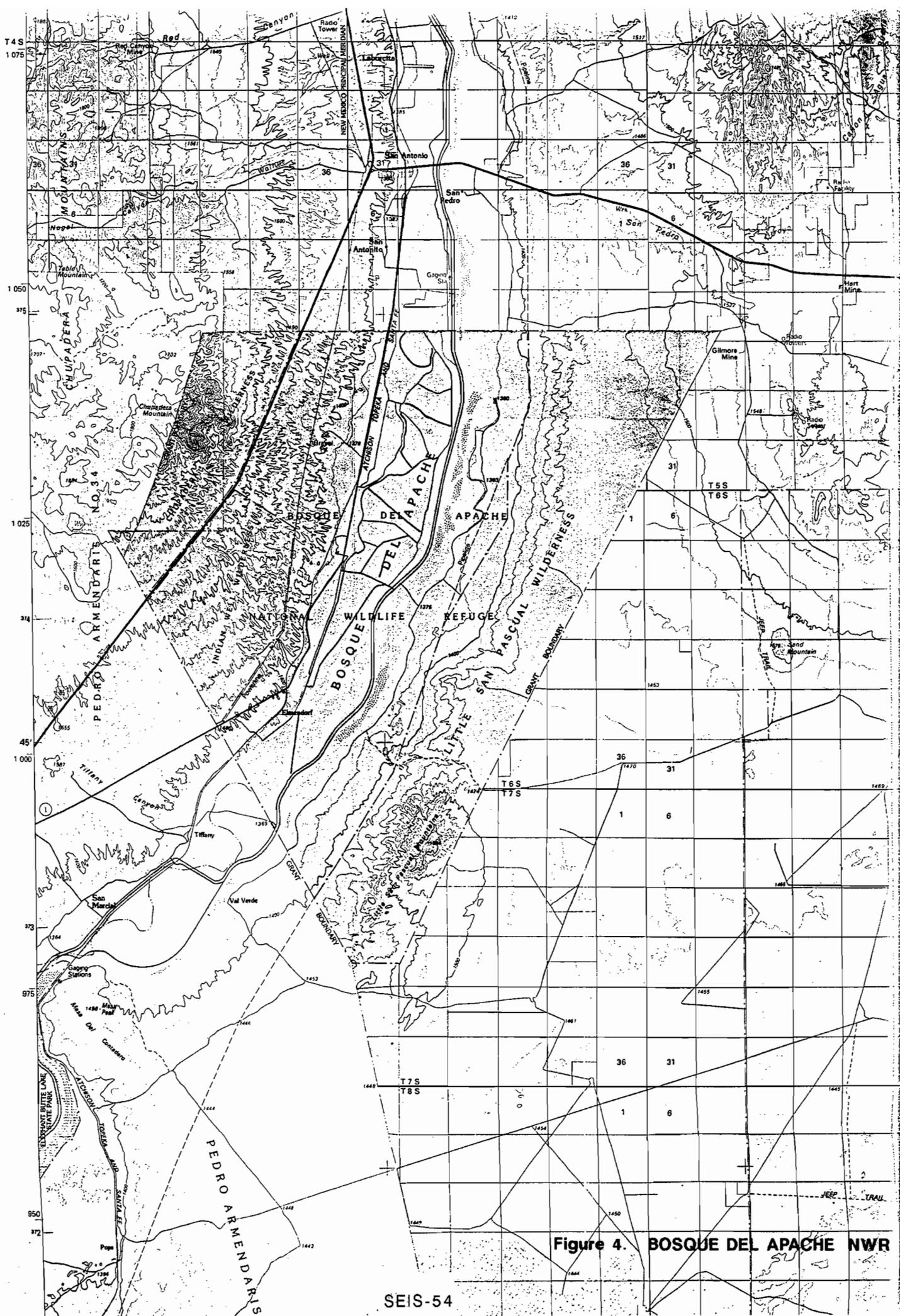


Figure 4. BOSQUE DEL APACHE NWR

The Master Plan Report for Bosque del Apache NWR lists four broad goals for management of the refuge. In order of priority these are as follows:

To provide habitat and protection for endangered species, with special emphasis on the whooping crane.

To provide habitat and protection for migratory birds during the winter, with special emphasis on sandhill cranes, dabbling ducks, and snow and Canada geese.

To provide habitat and protection for resident animals.

To provide the general public an opportunity to see and understand wildlife, and provide visitors with a high-quality wildlife and educationally oriented experience.

Consistent with these goals, the Refuge has recently embarked on an innovative program of enhancing habitat use and diversity by replacing dense, monotypic, salt cedar stands with cottonwood dominated plant communities. The native cottonwood forest provides greater habitat use for larger numbers of wildlife species than the recently established and exotic salt cedar. Current goals are to replace about 150 acres a year, contingent on manpower and funding.

Bosque del Apache NWR is an element of the National Wildlife Refuge System (System) and, as such, is subject to the provisions of the National Wildlife Refuge System Administration Act (Act) of 1966 (Public Law 89-669). This Act provides guidelines for administration of lands and resources within the National Wildlife Refuge System. The Act authorizes the Secretary of Interior to "permit the use of, or grant easements in, over, across, upon, through, or under any areas within the System for purposes such as but not necessarily limited to, power lines, telephone lines, canals, ditches, pipelines, and roads, including the construction, operation, and maintenance thereof, whenever he determines that such uses are compatible with the purposes for which these areas are established". As stated, compatibility determination has been received from the Service reflecting the Service's finding of the project's interrelationship with refuge purposes and goals.

(3) Wilderness Areas. There are three wilderness areas located on Bosque del Apache NWR that were established by legislation in 1974 (see Figure 4). These are the Little San Pasqual Wilderness Area (20,092 acres), Indian Well Wilderness Area (5,362 acres), and Chupadera Wilderness Area (5,576 acres). The former wilderness area is located near the eastern boundary of the Refuge, the latter two near the western boundary. Both are located well outside the floodplain.

(4) Research Natural Areas. Bosque del Apache NWR has designated five Research Natural Areas (RNA's), the uses of which are limited to research, observation, monitoring, and educational activities. RNA's on the west side of the Rio Grande are located west of the conveyance channel. Those to the west of the Rio Grande are above the floodplain.

RIPARIAN AND RIVERINE MANAGEMENT CONCERNS

4.21 a. Rio Grande Bosque Conservation Initiative. On September 6, 1991, New Mexico Senator Pete V. Domenici announced a unique opportunity for New Mexicans to preserve and enhance one of their most valuable natural assets - the Rio Grande riparian corridor (bosque). Entitled the "Rio Grande Bosque Conservation Initiative," this Initiative grew from a recognition of the appreciable biological and social values of the Rio Grande and its bordering cottonwood forest and the need to sustain and enhance these values. The Initiative envisions that by the year 2000, the Rio Grande bosque will be perpetually protected and wisely managed for the use and enjoyment of present and future generations. Its wildlife, recreational, educational, and cultural values will be perpetuated and enhanced through knowledge, planning, and management. These actions will be accomplished in concert with ongoing management activities and will complement existing initiatives such as the Rio Grande Valley State Park. This Initiative will address the needs of the 150-mile-long middle Rio Grande valley. Twelve goals are integral to the Initiative, ranging from habitat management to user management. The first task of this Initiative will be the preparation of a Biological Management Plan. This Plan is tentatively scheduled to begin early in October 1992 and be completed by June 1993.

b. Itinerate Use of Riparian Zone. The riparian forest, especially in urbanized areas, is frequently used by homeless people for either short- or long-term residency. This use frequently leads to conflicts with local governments regarding unauthorized use of public domain, refuse disposal, fires, impairment of public recreational use, drug use, vandalism, and wildlife conservation. The riparian zone in the vicinity of Socorro is also used by the homeless and both City and State governmental officials have concerns regarding this unauthorized use of the riparian forest.

c. Use of Riparian Forest for Fuel Wood. The trees of the riparian forest have historically been cut for fuel wood, fence posts, and building material. Historical accounts tell of substantial tree removal, especially around populated areas. This practice is discouraged today in recognition of the value of the riparian vegetation for protecting flood control structures against stream erosion, wildlife habitat, recreational use, and aesthetic enhancement and appreciation. However, unauthorized cutting and removal of cottonwood trees continues and is an issue of concern to local governments.

d. Fire in the Riparian Zone. Fires in the riparian forest or woodland are frequent occurrences and are mostly man caused. When cottonwood forest is burned, the value of the riparian zone is often degraded for wildlife and recreation since the lower-use salt cedar will frequently establish in place of the cottonwood. Riparian fires are difficult to control because of limited access and resources, especially in rural areas.

RESOURCES MANAGEMENT PLAN FOR ELEPHANT BUTTE AND CABALLO RESERVOIRS

4.22 The USBR has initiated the preparation of a Resources Management Plan for Elephant Butte and Caballo Reservoirs. This resources management plan will be used as a guide by the Bureau of Reclamation and other agency personnel in the allocation of resources and permitting appropriate uses of land and water. Coordination has been initiated with the Corps and will continue to insure that

this resources management plan and the recommended flood control plan are compatible and beneficial uses of reservoir resources are maximized.

CULTURAL RESOURCES

4.23 The following discussion of the cultural history of the Rio Grande corridor in the study area is a synopsis of the historical overview presented in Appendix F. Most of the information presented is derived from the central New Mexico cultural resources overview prepared by Joseph Tainter and Frances Levine (1987).

4.24 The valleys of the Rio Grande and its tributaries have served human habitation and travel from the time of earliest occupation of New Mexico, now believed to date from 25,000 B.C. Early populations were largely nomadic hunters and foragers. Dating from about the time of Christ, the Anasazi, or "ancient people" flourished in the Rio Grande Valley, developed agriculture, and established permanent settlements.

4.25 Until approximately 1,000 years ago, the population of the study area was sparse and dispersed. Known sites predating that time are rare, due partly to a paucity of archaeological research in the area and partly to their having been buried well below the existing ground surface by geological processes. The majority of the discovered sites date to the ceramic period, with two phases particularly well presented: Basketmaker III/Pueblo I and Pueblo II/Pueblo III. At the time of the first Spanish contacts, much of the study area was uninhabited. Former residents of the lower Rio Puerco and Rio Salado may have moved to the Rio Grande and formed the large Piro villages noted by the Spanish explorers. The Navajo eventually established permanent residence in the northern portion of the study area.

4.26 European presence in the area began in 1540 with the Coronado expedition, which ventured north through Arizona, then east into New Mexico. The first European penetration of southern New Mexico took place in August of 1581, when a dozen Spaniards of the Chamuscado-Rodriguez expedition followed the Rio Grande northward and explored much of north-central New Mexico. The first successful effort at colonization began in 1598, when Don Juan de Onate arrived in New Mexico. Spanish settlement of the Rio Grande and its tributaries in New Mexico proceeded slowly and was limited to military outposts and missionary developments; it was disrupted completely by the Pueblo Revolt of 1680, which drove the surviving Europeans southward to El Paso for twelve years. In 1692, Don Diego de Vargas won the allegiance of ten of the 23 occupied pueblos and within two years had subdued the northern pueblos and re-established Spanish rule; however, it was not until the early eighteenth century that the productive Rio Abajo would be settled.

4.27 In 1800, Governor Fernando Chacon was officially instructed to begin resettlement in the vicinity of Socorro, in part, to relieve overcrowding along the Rio Grande to the north and, in part, to populate and protect the lower portion of the Camino Real, the principal artery for information and goods exchange with Mexico.

4.28 In 1846, the United States Army under Brigadier General Stephen Kearney captured the territories of New Mexico and Upper California. Kearney's forces occupied the valley as far south as Socorro. Later that year, Lieutenant Colonel Philip St. George Cooke opened a wagon trail through Socorro to the Pacific.

4.29 As hostilities between the United States and Mexico ceased in 1848, a new wave of immigration established a number of American settlements in the Rio Grande Valley. On February 21, 1862, one of two Civil War battles fought in New Mexico was staged at Valverde, north of the Union-held Fort Craig. In a one-day battle, General H.S. Sibley, commander of the Confederate forces, defeated Colonel E.R.S. Canby's Union detachment.

4.30 In 1912, New Mexico was admitted to the Union as the 47th state. In 1916, the Bureau of Reclamation completed construction of Elephant Butte Dam and Reservoir. Storage operations began in 1915. In 1923, the Middle Rio Grande Conservancy District was created to develop an efficient irrigation system and to insure drainage and flood protection for the towns and communities located along the Rio Grande.

4.31 A check of Museum of New Mexico, Laboratory of Anthropology, Archeological Resources Management (ARM) files indicates approximately 130 known sites in the project vicinity. These range in size from small artifact scatters to large, multi-storied pueblos, and span the time period from Archaic (ca. 7,000 B.C.) through U.S. Territorial (/A.D. 1846-1912). Two, LA 282 and LA 287, are listed on the National Register of Historic Places. Both share a long history of occupation, beginning in the prehistoric Pueblo IV period (between A.D. 1300 - 1600) and continuing into the Spanish Contact Phase (A.D. 1539 - 1680), until abandoned. Many of the other recorded sites in the region merit inclusion on the National Register while others are considered eligible for inclusion. One other significant property to be considered within the area of effect is the Camino Real, or King's Highway, which linked the administrative centers of Mexico to Santa Fe. This property is located on the terraces east of the Rio Grande and generally parallels the river.

PLANT AND ANIMAL ASSOCIATIONS

4.32 a. General. The project area is located within the Chihuahuan Biotic Province (Brown and Lowe, 1980). This province is characterized by warm, temperate, desert scrub plant communities. Within the Middle Rio Grande Valley, plant communities are diverse, ranging from the more aquatic plants of marsh, river, lake, and water conveyance facilities associated with the Rio Grande; the drier, mesic trees and shrubs of the riparian and floodplain corridor; to the zeric grasses and shrubs of bordering terraces and mountain foothills. Commensurate with this plant diversity is a correspondingly high density and diversity of animal life. Indeed, the diversity of animal life that utilizes southwest riparian zones is among the highest of any plant community in the region. The present biological communities reflect extensive alteration (both direct and indirect) by man. The original biological system has been significantly modified by the conversion of large portions of the floodplain to agricultural and residential use; land and water modifications by wildlife refuges; modification of the river's flow regime with upstream dams and irrigation diversions; reservoir flooding; channelization; clearing of riparian vegetation; construction of drains; and, importantly, the introduction and extensive establishment of exotic plant species. As stated, the presence of Bosque del Apache NWR provides critical habitat for wintering waterfowl, as well as providing habitat for endangered species and many indigenous species.

The riparian and riverine corridor is the primary area that would be affected by the planned action. The biotic resources of this corridor and their interrelationships have been described in many studies, primary among which are Hink and Ohmart, 1984; Raitt, et al., 1981; Campbell, 1961; Freeling, 1982; and Hundertmark, 1978. Other important regional riparian studies are Hildebrandt and Ohmart, 1982; Engel-Wilson and Ohmart, 1978; Hansman and Scott, 1977; Zapatka, 1979-81; Cole, 1978; Jojola, 1977; Morrison, 1985, 1987-1988; and Bestgen and Platania, 1987 and 89. Descriptions of plant and animal associations for each major physiographic zone that may be affected by the planned action are as follows.

b. Riverine. The flow regime and channel characteristics of Rio Grande in the San Acacia to Elephant Butte reach have been extensively modified by irrigation diversion, channelization, the low-flow conveyance channel, and reservoir flooding. The withdrawal of appreciable amounts of water for irrigation (including wildlife purposes) in the Socorro area and for conveyance to Elephant Butte Reservoir via the low-flow conveyance channel results in a pronounced reduction in downstream flows and extends the period of time that the channel would normally be dry. This abstraction of water has undoubtedly had a limiting effect on the aquatic community both in diversity and numbers. Aquatic habitat is poor because of the absence or paucity of water as well as extremely heavy turbidity, which is largely contributed by flood flows from upstream tributaries. In addition to these factors that severely limit aquatic habitat, much of the channel substrate is in continual motion, thus precluding the establishment of attached or rooted plant life. A small refugium exists just below the San Acacia Diversion, where a few deep holes and some leakage sustain a limited fish population. Flow volumes and characteristics are not appreciably changed during high discharge periods.

Since 1985, there has been an exception to the norm and no water has been diverted into the low-flow conveyance channel because of high water levels in Elephant Butte Reservoir and associated sedimentation of the conveyance channel. Because of this action, more water has been in the river channel for longer periods, although the channel still experiences dry periods, especially the lower reaches.

A joint, multiple agency study of fishes and microhabitat association from Albuquerque to Elephant Butte Reservoir is currently being conducted jointly by the Bureau of Reclamation, New Mexico Department of Game and Fish, Corps of Engineers, and University of New Mexico. Its purpose is to determine the distribution, abundance, status, and habitat associations of fishes of the Middle Rio Grande. Fish collected during the first year of study in the San Acacia - Elephant Butte reach (Bestgen and Platania, 1989) were the following: Common carp (Cyprinus carpio), Rio Grande silvery minnow (Hybognathus amarus), flathead chub (Hybopsis gracilis), red shiner (Notropis lutrensis), fathead minnow (Pimephales promelas), river carpsucker (Carpionodes carpio), smallmouth buffalofish (Ictiobus bubalus), black bullhead (Ictalurus melas), channel catfish (Ictalurus punctatus), mosquitofish (Gambusia affinis), white crappie (Pomoxis annularis), white sucker (Catostomus commersoni), gizzard shad (Dorosoma cepedianum), and bluegill (Lepomis macrochirus). The Rio Grande silvery minnow and the red shiner were consistently among the most numerous of fishes collected. Very recent collections have demonstrated a pronounced reduction in numbers of the silvery minnow (Platania, 1992, personal communication).

The river channel is used by a variety of wildlife, primarily birds, when streamflow is present. Wintering waterfowl use the river primarily as loafing habitat and herons and egrets forage in shallow pools, especially when fish are stranded. Wintering sandhill crane flocks (Grus canadensis), including whooping cranes (Grus americana), typically use sand bars for night roosting. Sand bars, river, and dry channel are characteristically low in diversity and density (Hink and Ohmart, 1984) for terrestrial animals but such species as raccoons, coyotes, lizards, killdeer, water pipits, spotted sandpipers, juncos, and mountain bluebirds are common users. As with aquatic life, wildlife use of the channel is likely limited by the altered flow regime caused by diversion of appreciable amounts of water from the river channel.

c. Low-Flow Conveyance Channel. As stated, the USBR has recently completed rehabilitating the conveyance channel by removing accumulated sediment and riprapping its side slopes. Generally, fish habitat is quite limited. The channel bottom is fairly uniform with a combination sand and gravel substrate. The side slopes of the channel have little vegetation, but as silt fills the interstitial spaces of the riprap, vegetation is rapidly returning. However, maintenance mowing of the side slope vegetation will limit the extent to which it develops. Resumption of flows in the channel will likely continue to limit fish habitat. Recent collections by Bestgen and Platania, 1989, identified eleven fish species. These are gizzard shad, carp, red shiner, fathead minnow, river carpsucker, white sucker, black bullhead, channel catfish, flathead catfish (Pylodictus olivaris), mosquitofish, and longear sunfish (Lepomis megalotis). A fish survey of the conveyance channel by the Service in 1988 found two additional species, the long-nosed dace (Rhinichthys cataractae) and white bass (Roccus chrysops). The conveyance channel receives fish that swim in from Elephant Butte Reservoir. Mosquitofish, red shiners, and carp were the most abundant fish collected.

Hink and Ohmart, 1984, found that drains and contiguous sandy berms and levee slopes have consistently moderately high to high species diversity and density for reptiles, amphibians, mammals, and birds. Major factors responsible for this high use are a combination of water, dense growth of shrubs, and annual plants along the drains and adjacent open, sandy levee slopes and berm. This high animal use of drains is not likely the case along the conveyance channel and overall wildlife use is likely lower. The conveyance channel lacks some of the features that make the drains more attractive to wildlife, e.g., a slow meandering current with emergent and floating vegetation and a lack of taller, lush, streambank vegetation (a prime determinant). Maintenance mowing of the channel side slopes will perpetuate this condition.

d. Marshes. There are several, small, wetlands at the lower end of the project area, primarily within Elephant Butte Reservoir. Most of these are adjacent to the low-flow conveyance channel and have developed since about 1985 because of high water storage, seepage from high river flows, and an elevated water table. It is likely that some of these wetlands may be transitory due to reservoir drawdown and restoration of the conveyance channel; however, their continued presence is speculative because of changes brought about by high water storage.

Typical vegetation consists of cattail (Typha sp.), sedge (Carex sp.), and bulrush (Scirpus sp.). The present hydrologic regime of these wetlands varies from no standing water, seasonal standing water, to long-term standing water.

Marshes are particularly valuable habitat for a diversity of wildlife because of their relative scarcity in the arid Southwest, their productivity, and because many species are directly dependent on this habitat type. Also, wetland habitat has undergone an appreciable decline in the middle Rio Grande valley during this century, increasing the value of remaining wetlands and encouraging their expansion. Waterfowl, shore and wading birds, amphibians, reptiles, and aquatic and semi-aquatic mammals make extensive use of wetlands. The extent of wildlife use depends on many factors including standing water; size; duration of flooding; development of aquatic vegetation; location; and effects of livestock grazing. There are three wetlands that may be affected by project construction or implementation of compensation measures. These wetlands and a brief description are as follows:

(1) Abandoned Conveyance Channel Below Tiffany. This is an approximately four-mile length of abandoned conveyance channel with a moderate to sparse growth of cattails and sedge. There is no standing water. Cattail growth is generally continuous in the upper one-third of the channel, discontinuous in the middle third, and absent in the lower third. Hydric vegetation is heavily grazed. Use by typical wetland wildlife is low to non-existent.

(2) Levee Toe Wetland. This wetland is located in the Ft. Craig area and forms a narrow strip between the spoil bank levee and the conveyance channel. It is about 1.3 miles long and 40 to 50 feet wide. There is generally some standing water, which is surrounded by a fringe of cattails (emergent, open water). Wildlife use is likely constrained by its location between two maintenance roads, configuration, and cattle grazing.

(3) Mulligan Gulch Wetland. This wetland is located at the terminus of the planned project on the west side of the conveyance channel. Prior to recent inundation by long-term storage in Elephant Butte Reservoir, it covered about 18 to 20 acres. Recent drawdown has likely reduced this area somewhat. This wetland was indirectly created by the USBR as a result of construction activities and maintained by flows from the conveyance channel. From observation, wildlife use of this area, particularly by waterfowl, shore and wading birds, was extensive. Drawdown of the reservoir demonstrates that the general wetland area has been appreciably modified, primarily because of sediment deposition. However, USBR has made provisions to maintain inflow to this area from the conveyance channel. The USBR, the Service, and the Corps are currently exploring measures whereby this area and a nearby ponding area near Ft. Craig (Brushy Lake) could be seasonally flooded for the benefit of migrating and wintering waterfowl. These investigations also include acquisition of water rights.

e. Riparian. The middle Rio Grande valley of New Mexico supports lush riparian vegetation, including extensive acreage of cottonwood forest. This forest is the most extensive remaining gallery cottonwood forest in the Southwest. As such, it is of substantial concern to a variety of agencies at all levels of government and to many wildlife and conservation organizations. As stated, this plant community has been significantly changed with the alteration of the flow regime, clearing of riparian vegetation, diversion of water for irrigation, drainage, and the invasion and establishment of the exotic salt cedar being significant elements causing these changes. Hink and Ohmart characterize most of the riparian plant communities north of Bernardo as dominated by

cottonwood. These cottonwood-dominated plant communities occur in association with a variety of understory shrubs and small trees, chiefly Russian olive (Elaeagnus angustifolia), coyote willow (Salix exigua), salt cedar (Tamarix chinensis), seepwillow (Baccharis salicina), indigo bush (Amorpha fruticosa), New Mexico olive (Forestiera neomexicana), and juniper (Juniperus monosperma). Goodding and peach - leaf willow trees (Salix gooddingii and S. amygdaloides) also occur locally in stands of cottonwoods but in relatively low numbers. These major cottonwood dominated community types were identified based on the types and abundance of understory species. These were cottonwood with coyote willow being the most abundant understory species; cottonwood with Russian olive being the most abundant understory species; and cottonwood with juniper being the most abundant understory species. In addition to the cottonwood communities five other vegetation communities were identified. These were Russian olive, cattail marsh, sandbars, river channel, and salt cedar.

There is a gradual change in species composition of riparian plant communities from Española, south to Elephant Butte Reservoir, and beyond. Salt cedar, common as an understory plant in riparian vegetation generally north of Bernardo, rapidly becomes increasingly abundant south of Bernardo, with extensive, monotypic stands of this species becoming a major riparian community. Also, the frequency of Russian olive decreases, while the frequency of Goodding willow and screwbean mesquite increases. The invasion and extensive establishment of salt cedar has had a wide-spread effect in changing the successional stages and ultimate dominance of many riparian plant communities. Riparian plant communities from the vicinity of San Acacia downstream to, and including Elephant Butte Reservoir, have been described to varying degrees by Campbell, 1961; Raitt et al., 1981; and USBR, 1976 and 1977. However, recent long-term inundation of vegetation in the upper part of Elephant Butte and longer-term flows in the river below San Acacia since 1985 have modified plant communities. A significant consequence of periodic high peaks in the river has been the development of cottonwood seedlings on many sandbars which may serve to regenerate the depleted cottonwood forest. Long-term inundation of mature cottonwood trees in the upper part of Elephant Butte Reservoir has resulted in widespread losses of the trees, although there appears to be some regeneration. Cattle grazing throughout much of the project area has and will continue to have an effect on the development of cottonwood-dominated communities.

As with aquatic life, the abstraction of water from the river for irrigation and conveyance to Elephant Butte Reservoir has likely influenced the riparian plant community. These effects have probably resulted from modification of the long-term "normal" flows rather than high flood flows which remain in the river floodway. Alteration of the hydraulic regime downstream of San Acacia, in concert with man-caused disturbance, has likely favored exotic plants, such as salt cedar, at the expense of the native cottonwood/willow community, which has narrower growth requirements.

As with much of the riparian zone in the middle valley, the composition of plant communities in the project area is quite heterogeneous. Primary dominant plant species are cottonwood, salt cedar, Goodding willow, coyote willow, and seepwillow, which occur in varying proportions, ages, and structure types in most communities. The exception to this are the extensive monotypic stands of salt cedar in which understory vegetation is generally nonexistent. In many community types, salt cedar is dominant or a co-dominant, although some mature cottonwood and tree willow stands have sufficiently closed canopies so as to exclude

understory vegetation. Marsh vegetation of cattail, sedge, and bulrush, is often interdigitated with sapling cottonwoods, salt cedar, willow and baccharis that are establishing on sandbars. This situation is especially true in the upper reservoir area of Elephant Butte where long-term, high water storage has created these conditions. However, with continuing drawdown of the reservoir to more normal storage levels, this hydrophytic vegetation may be transitory.

Studies by Hink and Ohmart and Raitt, et al., have made the greatest contribution toward characterizing wildlife use of the various plant associations that make up the riparian plant community in the general area. Hink and Ohmart's study of 163 miles (Española to San Acacia) of riparian vegetation found that the riparian community, as a whole, supported a rich assemblage of vertebrate species, particularly birds, and population densities were comparable to those observed in other Southwestern riparian systems. The highest densities and diversities of vertebrate wildlife were found in mature cottonwood stands, where Russian olive was the most abundant understory plant, and in dense intermediate-aged cottonwood stands, where coyote willow was the most abundant understory plant. This high use is especially pronounced along the edges of the levees. Cattail marshes support high population densities, but fewer numbers of species, although a relatively large proportion of the species occurring in cattail marsh habitats are unique to them. Open areas, early growth stands, salt cedar habitats, and the river channel support lower densities and numbers of vertebrate species. These habitats are, accordingly, of intense concern to the various ornithological organizations, as well as individual bird specialists.

Birds are the largest and most diverse group among the terrestrial vertebrate fauna with 277 species recorded. This is over 60 percent of the total number of bird species known to occur in New Mexico. The highest densities of birds occur along the levee edges. These high densities observed along levee edges indicate that the type of habitat is among the most heavily used of avian habitats in the study area, and a large proportion of bird species using cottonwood habitats, especially in winter, use levee edges of cottonwood stands more often than the interiors of these stands. Salt cedar edge habitats appear to be in the middle range (about 200 to 450 birds/100 acres) with regard to total density, although this plant association was not sampled as intensely as cottonwood habitats.

Raitt, et al., conducted a study of bird populations in relation to habitat in riparian communities of Elephant Butte and Caballo Reservoirs. This study was contracted by the USBR to assess the effects of proposed and potential operation and maintenance activities on bird life and to provide quantitative data on bird population and communities and their relations to the riparian vegetational types as part of the development of a multiple-use management plan for the ecosystems of the reservoirs. The riparian vegetation types sampled that are relative to the planned action are the following: mature stands of salt cedar; young stands of salt cedar; stands of willow (S. gooddingii); cottonwood groves; and open floodplain with scattered individual and small stands of the above trees. Although salt cedar communities were sampled in the Hink and Ohmart and Raitt studies, a perceived difference in structure types (vertical distribution of foliage) and density would preclude a direct comparison.

This study showed that species diversity of birds was highest in cottonwoods in all seasons, except early fall and the breeding season, generally followed by other native habitats (willow and open floodplain), young salt cedar,

and mature salt cedar. In early fall, mature salt cedar ranked second. During the breeding season, species diversity was highest in native trees (willow, cottonwood, and open floodplain), followed by young salt cedar and mature salt cedar. Salt cedar areas (especially young salt cedar) were more densely populated than other habitats, except during the breeding season. In the breeding season, mature salt cedar was more densely populated and those of willow and open parkland the least. A comparison of the results of this study to those on the lower Colorado River and Rio Grande in Texas showed that overall densities, species diversity, and species richness tend to be relatively low in the bird communities of Elephant Butte Reservoir.

Riparian studies have shown that high values of four vegetation variables - foliage density; patchiness; foliage height diversity; and numbers of cottonwood trees, willow trees, or both; were best predictors of high habitat use by birds. The selective clearing of salt cedar stands followed by revegetation with native trees has shown significant potential for increasing these vegetation variables, with a commensurate increase in bird density and richness. This objective is currently being pursued by Bosque del Apache NWR.

As is apparent, any changes in riparian species composition and density, age structure, and spatial distribution caused by a long-term alteration in flow regime is reflected in a corresponding change in faunal composition, density, and use.

f. Upland. Vegetation on the terraces above the floodplain is characterized by sparse shrub/grassland communities, and typically dominated by creosotebush (Larrea tridentata), mesquite (Prosopis glandulosa), alkali sacaton (Sporobolus aeroides), blue grama (Bouteloua gracilis), and various other dropseeds (Sporobolus sp.). Common wildlife species found in this plant association include desert cottontails (Sylvilagus auduboni), black-tailed jack rabbit (Lepus californicus), coyote (Canis latrans), Ord's kangaroo rat (Dipodomys ordii), silky pocket mouse (Perognathus flavus), Gambels quail (Lophortyx gambelii), scaled quail (Oreortyx pictus), horned lark (Eremophila alpestris), vesper sparrows (Pooecetes gramineus), red-tailed hawk (Buteo jamaicensis), western whiptail lizards (Cnemidophorus tigris), greater earless lizard (Holbrookia texana), leopard lizard (Crotaphytus wislizenii), side-blotched lizard (Uta stansburiana), and the western diamondback rattlesnake (Crotalus atrox).

ENDANGERED, THREATENED, AND SENSITIVE PLANTS AND ANIMALS

4.34 Included in this section are those species that are present, or potentially present, in the project area that are listed at the Federal level, those that are under review for Federal listing, and those that are presently listed at the State level. These lists reflect an update of the species lists presented in the draft SEIS and were developed in consultation with the Service and State of New Mexico on March 3, 1991.

a. Federally Endangered and Threatened. Coordination with the U. S. Fish and Wildlife, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, and additional research into the presence of threatened and endangered species, has shown that the project area is within the overall known ranges of the endangered whooping crane (Grus americana), bald eagle (Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus anatum), least tern (Sterna

antillarum), and piping plover (Charadrius melodus). Pertinent endangered species correspondence is presented in Appendix E. The additional research accomplished subsequent to Section 7 consultation revealed the potential for bald eagle nesting in the upper part of Elephant Butte Reservoir and the possible presence of the piping plover. As such, these features are not reflected in the endangered species correspondence. Consultation with the Service on March 3, 1991, showed that there has been no change in species listing or their status. A concise description of the status of these species and use of project area features is as follows:

(1) Whooping Crane. This species was formerly rather widespread in North America, but through historic times it has declined to the point that at present, it breeds only in Wood Buffalo National Park in the Northwest Territories; from there it migrates through the Great Plains to winter on the Texas coast of Aransas National Wildlife Refuge. Beginning in 1975, an experimental population has been established at Grays Lake National Wildlife Refuge, Idaho, and these birds migrate southward to winter in New Mexico in the autumn and most winter in the Middle Rio Grande Valley (NMDGF, 1985a). Here whooping cranes occupy the same habitats as their foster-parent sandhill cranes. Foraging areas are generally agricultural fields and valley pastures, particularly, where there is waste grain or sprouting crops. Both species of cranes roost together, typically on sand bars in the Rio Grande (NMDGF, 1985a). So far, none of the Idaho whooping cranes have paired and bred. Whooping cranes do not readily tolerate disturbance to themselves or their habitat.

Within Bosque del Apache NWR, all areas at or below 4,600 feet in elevation are critical habitat* for the whooping crane. This area includes most of the floodplain, including the riverine and riparian zone. This classification provides Federal protection to this area under Section 7 of the Endangered Species Act of 1973 and is an official notification to Federal agencies of their responsibilities pursuant to this Act. The existing spoil bank is generally not used by whooping cranes (Taylor, 1988). Like most cranes, whoopers on and off the Refuge are sensitive to disturbances.

During the winters of 1987 to 1988, 1988 to 1989, and 1989 to 1990, whooping cranes used sand bars in the Rio Grande, both within the Refuge and at isolated areas outside the Refuge, e.g., at the San Acacia Diversion, for night roosting. A factor that is thought to be discouraging pair formation among the whooping cranes is the general absence of isolation in the valley, which is a prime requisite by the cranes.

(2) Bald Eagle. The bald eagle migrates and winters (in New Mexico) from the northern border southward regularly to the Gila, Lower Rio Grande, Middle Pecos, and Canadian valleys. This species is found occasionally elsewhere in summer, and is a breeding bird -- with nests reported in "San Juan, Colfax, and Catron Counties". These habitat areas include winter roost and concentration

* Critical habitat means any air, land, or water area (exclusive of those existing man-made structures or settlements which are not necessary to the survival and recovery of a listed species) and constituent elements thereof, the loss of which would appreciably decrease the likelihood of the survival and recovery of a listed species or a distinct segment of its population. The constituent elements of critical habitat include, but are not limited to: physical structures and topography, biota, climate, human activity, and the quality and chemical content of land, water, and air. Critical habitat may represent any portion of the present habitat of a listed species and may include additional areas for reasonable population expansion.

areas such as Navajo Lake, Elephant Butte Lake, Caballo Lake, and the Upper Gila Basin. Winter and migrant populations seem to have increased in New Mexico, apparently as the result of reservoir construction and the expansion of fish and waterfowl populations. In New Mexico and adjacent areas, optimal habitats center on riparian and lacustrine environments -- where food, shelter, and potential nest sites are in the greatest supply for the species. The major food items of bald eagles in New Mexico appear to be waterfowl, fish and carrion. (NMDGF, 1985b)

At Bosque del Apache NWR, the bald eagle is a migrant and winter resident. Eight to ten eagles commonly roost overnight at the Refuge (Taylor, 1988). Twenty bald eagles over-wintered at the Refuge during the winter of 1989 to 1990. There is no nesting. The eagles arrive about mid-November and depart about mid-March. Waterfowl are a major prey item, with emphasis on snow geese. Cottonwood trees in the riparian zone and in the floodplain are used for perches and night roosts. Bald eagles habitually use roosts in Units 18c and 18bw and 18d, which are located outside the riparian zone. Other habitually occupied spots include Unit 12b and borders along Units 9, 5, 6, 14, 13, and 16 as well as Unit 24c, all outside the riparian zone. The extent to which bald eagles use cottonwood trees in the riparian zone is not known, but primary use areas are around the ponds and fields west of the conveyance channel. The number of cottonwood trees in the riparian zone is small relative to the area covered by salt cedar. Also, recent fires have further depleted the number of cottonwood trees.

Significant numbers of bald eagles utilize the head waters of Elephant Butte Reservoir. Presence and use of any given area likely varies, depending on water elevations. Nesting by bald eagles has been reported.

(3) Peregrine Falcon. The peregrine falcon is a spring and fall migrant in the middle Rio Grande valley. Prey consists almost entirely of birds, ranging in size from swallows to ducks and large shore birds. Jays, woodpeckers, swifts, mourning doves, and pigeons are among the commonly taken prey species in the State. Habitat use on Bosque del Apache is similar to that of the bald eagle. Peregrine falcons are reported to prey on waterfowl that are present in the conveyance channel.

(4) Interior Least Tern. The least tern breeds from California, South Dakota, and Maine, southward locally to Chiapas and the Caribbean, with the major inland population in the Mississippi Basin; the species winters from the Pacific Coast of Mexico and the U.S. Gulf Coast southward. In New Mexico, the terns breed in the vicinity of Roswell, including regularly at Bitter Lake National Wildlife Refuge, which is the key habitat area in the State. The species occurs in migration in Eddy County and as a vagrant elsewhere, including Española, Bosque del Apache NWR, near Glenwood, Las Cruces, and Alamogordo (NMDGF, 1985). A single tern was recorded at Bosque del Apache NWR in 1989 (Taylor, 1990). The least tern is a colonially-nesting waterbird, nesting on the ground, typically on sites that are sandy and relatively free of vegetation. In New Mexico and other parts of the southern Great Plains, alkali flats are selected nesting areas. Elimination and degradation of nesting habitat has been the primary reason for its decline and range reduction (NMDGF, 1985c).

(5) Piping Plover. The piping plover breeds (or bred) locally from Alberta and Manitoba, south to Nebraska, in the Great Lakes region, and along the Atlantic Coast from New Brunswick, south to North Carolina (A.O.U. 1983). The

species migrates mainly through the Mississippi Valley and along the Atlantic Coast, and it winters primarily along the Atlantic and Gulf coasts from South Carolina to Texas. In New Mexico, this plover is known only as a rare spring (April) migrant, having been verified at Springer Lake (Colfax County) and reliably reported at Bosque del Apache NWR (Socorro County); there is also an unsubstantiated report from Lake Avalon (Eddy County) in August. The piping plover occurs on sandflats or along bare shorelines of rivers, lakes, or coasts and forages on a variety of invertebrates, including marine worms, fly larvae, beetles, crustaceans, mollusks, and other small animals and their eggs. (NMDGF, 1985d)

b. Federal Notice of Review for Animals* - Categories 1, 2, and 3c.

(1) White - faced ibis (Plegadis chihi) - Cat. 2. Migrant in small numbers in project area (Raitt, 1981). Uncommon but regular spring and fall migrant, seen in flocks up to 70 birds (Hink and Ohmart, 1984). Common at Bosque del Apache NWR from spring through fall, with norm of about 100 birds and peaks of 300 to 400 (personal communication, Bosque del Apache NWR, November 1991).

(2) Ferruginous hawk (Buteo regalis) - Cat. 2. Uncommon migrant and winter visitor in open habitats (Raitt, 1981). Same (Hink and Ohmart, 1984).

(3) Southwestern willow flycatcher (Empidonax traillii extimus) - Cat. 1. Regular and fairly common in migration. Summer resident and breeder.

(4) "Occult" [little brown] bat. (Myotis lucifugus occultus) - Cat. 2. Summer resident tied to permanent watercourses, breeding and roosting in the valley and foraging over open water.

(5) Spotted bat (Euderma maculatum) - Cat. 2. One of the rarest of North American bats. Very rare migrant that may remotely be in the project area.

(6) New Mexico jumping mouse (Zapus hudsonius luteus) - Cat. 1. Key habitat areas include along the Rio Cebolla in the Jemez Mountains, the vicinity of Española, Isleta Marsh (Bernalillo Co.), Bosque del Apache NWR, and the Cloudcroft area. The species may also still persist where previously taken, including near El Rito (Rio Arriba Co.) and Socorro. In both the Jemez Mountains

* Notice of Review for Animals. A notice (Federal Register Vol. 56, No. 225, November 21, 1991) identifying vertebrate and invertebrate animal taxa native to the United States and considered for possible addition to the list of Endangered and Threatened Wildlife. This notice is not a proposal for such addition. The involved taxa do not receive substantive or procedural protection pursuant to the Endangered Species Act of 1973, as amended. Category 1 comprises taxa for which the Service has substantial information on biological vulnerability and threat to support proposals to list them as endangered or threatened species. Proposed rules have not been issued, but their development and publication is anticipated. Category 2 comprises taxa for which information now in possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. The Service emphasizes that these taxa are not being proposed for listing and that there are no specific plans for such proposals, unless additional information becomes available. Further biological research and field study may be needed to ascertain the status of taxa in this category. It is likely that many will be found to not warrant listing. Category 3 comprises taxa that were once being considered for listing as endangered or threatened, but are not currently receiving such consideration. Subcategory 3B comprises taxa that, on the basis of current taxonomic understanding, do not represent distinct entities meeting the Act's definition of species. Subcategory 3C comprises taxa that are now considered to be more abundant and/or widespread than previously thought. Should new information suggest that any such taxon is experiencing a numerical decline, or is under a substantial threat, it may be considered for transfer to categories 1 or 2.

and the Rio Grande Valley, Morrison (1985, 1988) found that preferred habitat for the New Mexico jumping mouse contained permanent streams, moderate to high soil moisture, and dense and diverse streamside vegetation consisting of grasses, sedges, and forbs. Such habitats were characterized by wet meadows in the Jemez Mountains, while they included the edges of permanent ditches and cattail stands in the Rio Grande Valley. These habitats are uncommon along the spoil bank levee.

(7) Rio Grande silvery minnow (Hybognathus amarus) - Cat. 1. Formerly, abundant in Rio Grande (when water is present) and conveyance channel in project area. This species is being considered for emergency listing as Federally endangered because of a precipitous decline in numbers.

c. Federal Notice of Review for Plants* - Categories 1, 2, and 3c.

(1) Sunflower (Helianthus paradoxa) - Cat. 1. Possibly present in riparian zone and floodplain.

(2) Prairie clover (Petalostemon scariosum) - Cat. 3c. Possibly present in riparian zone and floodplain.

(3) Paper-spined cactus (Pediocactus papyracanthus) - Cat. 2. Possibly on terraces adjacent to floodplain.

(4) Alkali grass (Puccinellia parishii) - Cat. 1. Possibly present in floodplain.

d. State of New Mexico Endangered Animals.

(1) Endangered - Group I*

(a) American peregrine falcon. See previous description. The NMDGF may downlist this species to Group II.

(2) Endangered - Group II**

(a) Bald eagle. See previous description.

(b) Whooping crane. See previous description.

* Notice of Review for Plants. A notice (Federal Register Vol. 55, No. 35, February 21, 1990) identifying vascular plant taxa native to the United States that are being reviewed for possible action to the list of Endangered and Threatened Species Act of 1973, as amended. None of the substantive or procedural provisions of the Act apply. Categories 1, 2, and 3c. See previous definitions of categories 1, 2, and 3c for animals.

Group I*. Species whose prospects of survival or recruitment within the State are in jeopardy.

Group II**. Species whose prospects of survival or recruitment within the State are likely to become jeopardized in the foreseeable future.

(c) Olivaceous cormorant (Phalacrocorax olivaceus). In New Mexico, the species breeds and is variably resident in the Rio Grande Valley at Elephant Butte and Caballo Lakes, and it also occurs regularly at Bosque del Apache National Wildlife Refuge -- all of which are key habitat areas. The species also occurs occasionally in the valley, northward to the Bernalillo area, and southward to Las Cruces, plus in the Gila Valley. Cormorants are generally found on larger bodies of water, such as reservoirs, where they prey on fish. Stands of trees and shrubs in or near water appear to be favored nesting sites. The NMDGF has stated that this species may warrant delisting.

(d) Mississippi kite (Ictinia mississippiensis). This kite summers and probably breeds locally in the middle and lower Rio Grande valleys. The NMDGF has proposed that this species be delisted.

(e) Common black hawk (Buteogallus anthracinus). In New Mexico, the black hawk summers primarily at lower elevations in the Gila, San Francisco, and Mimbres drainage, which are key habitat areas for it. This hawk also occurs sparingly in the Rio Grande Valley and has bred as far north as Albuquerque.

(f) Piping plover. See previous description. Proposed Group I.

(g) Least turn. See previous description. Proposed Group I.

(h) Willow flycatcher. See previous description.

(i) Bell's vireo (Vireo bellii). Bell's vireo summers very locally in the Lower Rio Grande and is a vagrant north to Albuquerque.

(j) New Mexico jumping mouse. See previous description.

(k) Rio Grande silvery minnow. See previous description.

e. State of New Mexico Endangered and Sensitive Plants.

(1) Endangered (protected from collection only).

(a) Lady Tressess Orchid (Spiranthes magnicamporum). Possibly in the riparian zone.

(b) Wright's Fishhook cactus (Mammillaria wrightii). Possibly on terraces adjacent to floodplain.

(c) Grama grass cactus (Toumeya papyracanthus). Possibly on terraces adjacent to floodplain.

(d) Giant helleborine orchid (Epipactis gigantea). Possibly in riparian zone.

(e) Catchfly gentian (Eustoma exaltatum). Possibly in riparian zone.

(f) Sunflower (Helianthus paradoxus). See previous description.

(g) Parish's alkali grass (Pucinellia parishii). See previous description.

(2) Sensitive (not protected)

(a) Prairie clover (Dalea scariosum). See previous description.

(b) Plumbago (Limonium limbatum). Possibly present in riparian zone and floodplain.

(c) Fugates' amsonia (Amsonia fugatei). Possibly present in the general project area.

(d) White-flowered visnaquita (Neolloydia intertexta). Abundant in general project area.

RECREATION AREAS, NEEDS, AND PLANS

4.35 Existing Areas and Opportunities. Recreational opportunities within the Rio Grande floodway from San Acacia Diversion Dam to the northern end of Elephant Butte Reservoir are varied. A high demand for outdoor recreational opportunities exists in the middle Rio Grande valley, with much of this demand coming from Bernalillo County, where a high percentage of New Mexico's population is located. The study area satisfies a portion of this demand with resources associated with the riverine corridor and with facilities provided by various governmental agencies. Outdoor recreational activities pursued in the study area include hunting, fishing, picnicking, wildlife observation, and hiking. The city of Socorro provides several urban recreation facilities, which include a golf course, swimming pool, several tennis courts, and a public park. The State of New Mexico manages recreational use of Elephant Butte Reservoir under agreement with USBR.

Waterfowl hunting is a popular seasonal activity in the study area. Perhaps the most popular locations are the La Joya State Game Refuge and Bosque del Apache NWR (goose hunting). The annual snow goose hunt at Bosque del Apache is a popular attraction. The riverside drains, low-flow conveyance channel, interior drains, isolated marshes and ponds, and agricultural fields are also popular waterfowl hunting areas. Waterfowl are hunted in the river channel when water is present. Hunting for sandhill cranes is also becoming popular in the agricultural areas.

The riverine and riparian corridor, including cultivated land in the floodplain, are popular hunting areas for pheasants, mourning doves, quail, turkey, and rabbits. The State and Federal refuges also provide hunting opportunities for these species, as well as for deer on Bosque del Apache NWR.

Fishing opportunities are available in the drains, canals, low-flow conveyance channel, isolated ponds and marshes, and in the river during those infrequent times when extended periods of flow exists. The deeper pools and holes at the San Acacia Diversion Dam are also popular fishing areas. The NMDGF periodically stocks selected drain segments with game fish, such as rainbow trout. Fish caught in the drains, ponds, and the low-flow conveyance channel include small- and largemouth bass, catfish, various sunfish, and white bass. Escondida Lake is an approximately three-acre lake located north of the city of Socorro and is managed by Socorro County under an agreement with the U.S. Bureau of Reclamation. Escondida Lake provides local residents with fishing and picnicking opportunities and is periodically stocked with fish by the NMDGF.

Wildlife observation is a popular recreational pursuit in the riparian corridor throughout the year, but especially popular during the fall migration and winter. Bosque del Apache NWR is a wintering area for thousands of snow and Canada geese, sandhill cranes, ducks, and the endangered whooping crane, and receives appreciable visitation during the winter months.

Hiking opportunities are generally abundant in the study area. Bosque del Apache NWR offers two hiking trails through the refuge and informal opportunities are available throughout most of the riparian zone.

b. Needs and Plans. A shortage of recreational facilities exists in Socorro County at the present time. As the population increases, these shortages will become more noticeable. The 1986 New Mexico Statewide Comprehensive Outdoor Recreation Plan (SCORP) states that the high priority recreational needs for Socorro County are for swimming pools, baseball/softball fields, golf courses, and soccer fields. Medium priority recreational needs are for primitive camping areas, equestrian trails, basketball courts, and hiking trails. The SCORP also states that jogging/walking and swimming are the two top recreational activities in Socorro County.

Within the study area, the only developed trail system is operated and maintained by the Service at Bosque del Apache NWR. The Bosque del Apache trail system consists of two nature/hiking trails, totalling approximately 2.5 miles in length, and a 15-mile auto tour route. The Bosque del Apache NWR master plan states that improvements to the auto and foot tour routes will be made as funds are made available. Improvements to the auto tour system include implementation of conducted tours using a bus or van and the installation of interpretive signs for self-guided auto tours. Interpretive signs were added to the existing 1.75-mile-long foot trail in 1981 and a new marsh foot trail, approximately 1.5 miles in length and containing interpretive signs, was constructed in 1985. An additional one mile of trail is planned for construction in conjunction with the 1.5-mile trail constructed in 1985.

The city of Socorro is currently developing an open space plan that will have the riparian zone as its focal point. Objectives include managing the area to preserve riparian resources and to develop compatible recreational use. The City has requested that recreational facilities and opportunities such as trails, picnic facilities, and water-oriented opportunities such as those provided at Escondida Lake be considered for inclusion in the proposed flood control measures. Recreational facilities can be included as part of the flood control plan on a cost-shared basis with the Local Sponsor. The possible provision of recreation facilities will be coordinated further as the flood control plan is increasingly refined.

AIR AND SOUND QUALITY

4.36 The study area is located in Air Quality Control Region 8 as established by the United States Environmental Protection Agency (EPA). This region does not exceed the National Ambient Air Quality Standards (NAAQS) for sulphur dioxide (SO₂), total suspended particulate matter (TSP), and carbon monoxide (CO). Good air quality in the region is due to the low population, relatively low number of motor vehicles, and no heavy industry discharging particulate matter into the atmosphere. Infrequent high levels of TSP and CO are produced as a result of wind-blown dust and winter atmospheric inversions which trap wood smoke and auto emissions in the lower layers of the atmosphere.

4.37 Regulations of the Prevention of Significant Deterioration (PSD) program of the New Mexico Environmental Improvement Division (NMEID) require that air quality in specific areas may deteriorate only small incremental amounts above any existing levels of pollution in these areas. These regulations apply to all attainment areas throughout the state, which includes the major portion of New Mexico. Under the PSD, program lands are divided into three classes. Class I areas have clean air, and very little increase in air contaminant levels is allowed. Class II areas allow moderate development and moderate increases in air contaminant levels, and Class III areas allow extensive growth and high increases in air contaminant levels. New Mexico does not contain any Class III areas while most of the remainder of the State is classified as Class II. The study area contains one Class I area, the Bosque del Apache NWR wilderness areas. Allowable PSD increments (annual) for Class I areas are $2\mu\text{g}/\text{m}^3$ for SO_2 and $5\mu\text{g}/\text{m}^3$ for TSP.

4.38 Sound levels in the study area are low, which is expected in a primarily rural, agrarian area. Major sources of noise are due to automobile traffic and commercial and industrial activity in the city of Socorro. Other local sound sources are farm operations and periodic USBR maintenance operations.

WATER QUALITY

4.39 Water Quality. Stream use designations and standards designated for surface waters in the study area by the Water Quality Control Commission are as follows:

River Segment: The main stem of the Rio Grande is from the headwaters of Elephant Butte Reservoir, upstream to the Alameda Bridge (Corrales Bridge), including any flow below the perennial reaches of the Rio Puerco and Jemez River, which enters the main stem of the Rio Grande.

a. Designated Uses: Irrigation, limited warmwater fishery, livestock and wildlife watering, and secondary contact recreation.

b. Standards:

(1) In any single sample: dissolved oxygen shall be greater than 4.0 mg/l, pH shall be within the range of 6.0 to 9.0, and temperature shall be less than 32.2°C (90°F).

(2) The monthly logarithmic mean of fecal coliform bacteria shall not exceed 1,000/100 ml; no single sample shall exceed 2,000/100 ml.

(3) At mean monthly flows above 100 cfs, the monthly average concentration for: TDS shall be less than 1,500 mg/l, sulfate shall be less than 500 mg/l, and chloride shall be less than 250 mg/l.

River Segment: Elephant Butte Reservoir.

a. Designated Uses: Irrigation storage, livestock and wildlife watering, primary contact recreation, and warmwater fishery.

b. Standards:

(1) At any sampling site: dissolved oxygen shall be greater than 5.0 mg/l, except for brief periods (6 hours or less) of not less than 4.0 mg/l, pH shall be within the range of 6.6 to 9.0, temperature shall be less than 32.2° C (90°F), and turbidity shall be less than 50 FTU.

(2) The monthly logarithmic mean of fecal coliform bacteria shall not exceed 100/100 ml; no single sample shall exceed 200/100 ml.

(3) The open water shall be free of algae in concentrations which cause nuisance conditions or gastrointestinal or skin disorders.

4.40 An intensive water quality survey of a 40-mile-long segment of the Rio Grande, from Bernardo to San Antonio (Potter, 1987), was conducted by the Surveillance and Standards Section, Surface Water Quality Bureau of the New Mexico Environmental Improvement Division (Environment Department) during June 1987. The objectives of the survey were as follows: (1) to assess the water quality of this reach of the Rio Grande, including the effect of effluent from the Socorro wastewater treatment facility and the presence of pesticides and herbicides; and (2) to determine whether water quality standards are attained in this portion of the Rio Grande.

4.41 Conclusions reached as a result of chemical and physical analyses were as follows:

a. Water quality standards for dissolved oxygen, pH, temperature, fecal coliform bacteria, total dissolved solids, sulfate, and chloride were attained at the stations sampled. General standards were also attained.

b. In general, pesticides and herbicides were not found in detectable concentrations at the three Rio Grande stations where samples were collected. Chlordane and 2,4-D, however, were detected at the San Antonio station. The observed value for chlordane was one percent of the EPA acute aquatic life criterion, but exceeded the recommended chronic criterion for aquatic life and limits for fish consumption. The observed value for 2,4-D meets EPA criteria for water and fish consumption.

c. No concentrations greater than the EPA aquatic life criteria for trace metals and ions were measured; however, arsenic concentrations reported as below the detection limit may exceed recommended criteria for fish consumption.

SEDIMENT QUALITY

4.42 Concern was expressed during public review of the draft SEIS, regarding the possible occurrence of trace heavy metals and radionuclides in sediment carried by the Rio Puerco, a major upstream tributary of the Rio Grande. Possibly originating from uranium mining in the Grants Mineral Belt, a region of past intense uranium mining activity that has since ceased, these toxic materials could be entering the Rio Grande and being deposited in the river channel as well as in Elephant Butte Reservoir. Water stored in Elephant Butte Reservoir could then be contaminated, posing health and environmental concerns to downstream users. Subsequent investigations into this issue demonstrated limited data with Brandvold et al., 1981, being a major contributor to what is known of this

subject in the Rio Puerco Basin. In this study, the physical and chemical characteristics of water and sediments in the San Jose/Rio Puerco River system were investigated. Water samples were analyzed for general chemistries, sediment load, nutrients, heavy metals, and radioactivity. The study showed that dissolved metals in the Rio San Jose were not elevated with respect to the Rio Puerco. The lower Rio Puerco showed elevated levels of molybdenum and vanadium with respect to the Rio Grande. Elevated levels of arsenic, cadmium, cobalt, mercury, molybdenum, uranium, vanadium, and zinc were found in Rio San Jose suspended sediments. Analysis of bed-load sediments indicated elevated levels of arsenic, mercury, and uranium in both the Rio San Jose and Rio Puerco.

4.43 While all of the uranium mines have closed since this study, the tailings piles and other byproducts remain. Additional study is needed to adequately define if any threat to public health exists.

4.44 As stated, in response to a request to restudy the feasibility of a dam on the Rio Puerco in concert with the planned action, and support from the Texas Congressional Delegation, a reconnaissance level study into these concerns will be initiated when funds are made available.

MINERAL RESOURCES

4.45 Primary mineral resources that are present in the vicinity of the planned action and would, or could, potentially be affected consist of sand and gravel. The existing embankment contains an appreciable quantity of excavated sand and gravel that makes up a considerable portion of the valley fill. Also, there are at least a dozen commercial excavation pits along Interstate Highway 25, about one mile east of the project area. There are two developed borrow pits in the Tiffany and Fort Craig areas, one of which would be utilized by the planned action.

4.46 As stated, there is an existing rock quarry near Interstate Highway 25, about five miles south of the city of Socorro. This site is the planned source of riprap and gravel for bank protection and road surfacing.

4.47 Other mineral resource occurrences reported about five miles outside the project area include barite, fluorite, calcite, uranium, silver, iron, perlite, and coal. Geothermal resources also occur in the area.

HEALTH AND SAFETY

4.48 Mosquitos are a general nuisance and potential health hazard to individuals in the middle Rio Grande valley. Irrigated agriculture is a major source of mosquito production, as are numerous drains, canals, and ponds. One species of mosquito, Culex tarsales, is the principal vector of western equine and Saint Louis encephalitis viruses in New Mexico. Another genus that is important as a vector is Aedes. Both western and California encephalitis viruses have been isolated from New Mexico specimens of Aedes dorsalis and Aedes sexans. There is no recent history of encephalitis in the project area. The New Mexico Environmental Improvement Division provides educational, enforcement, and control programs to manage the proliferation of mosquitos. Also, Socorro County has an active mosquito control program.

4.49 The low-flow conveyance channel presents a potential safety hazard to fishermen and maintenance personnel when the channel contains flows at or near its channel capacity. However, maintenance personnel are aware of the dangers associated with the high velocity flow in the channel, and fishermen use of the channel is low when appreciable flows are present.

VISUAL QUALITY

4.50 The evaluation of visual qualities is a value judgement and is subjective, differing according to the perception of each individual. The general visual setting in which the proposed project is located is thought to be of high aesthetic quality. The Rio Grande valley, with its irrigated fields, riparian forest and woodland, and river channel form a verdant corridor in a arid and sparsely vegetated land. Complementing this setting are bordering mountains and basalt mesas. The riparian forest and woodland is thought to possess moderate to high visual qualities, while the spoil bank levee generally has lower visual appeal. The general sparsity of vegetation on the spoil bank levee and disturbed soils largely contribute to this evaluation.

SECTION V - PERCEIVED ENVIRONMENTAL EFFECTS

OVERVIEW OF EFFECTS ASSESSMENT

5.01 The principal effect of the planned action is to provide a higher level of flood security to property, community well-being, water salvage and conveyance facilities, and Bosque del Apache NWR. The project is being designed to take advantage of certain project features to benefit wildlife habitat and recreational uses while minimizing adverse effects. Where there are unavoidable adverse effects on plant and animal communities, these would be compensated for; primarily within the riparian zone. Project construction in certain levee reaches would be scheduled to avoid the presence of the endangered whooping crane and bald eagle. Critical habitat for the whooping crane would not be adversely affected, but would receive an enhanced level of flood protection. Land use and classification should change little. Cultural resource surveys would be accomplished and any significant cultural remains found would be avoided or salvaged. Air and water quality would be preserved. Riverine flow characteristics, hydraulics, and sediment transport and deposition would not be affected. The project does not offer any significant potential to recover lost storage in Elephant Butte due to sedimentation.

FLOOD HAZARDS

5.02 Recommended Plan. Implementation of the recommended plan would provide a significantly higher level of flood protection and security than is currently provided by the existing earthen embankment. Approximately 35,000 acres in the floodplain containing residential, business, and public properties; irrigated lands, improvements, distribution systems, and products; transportation facilities; utilities; the low-flow conveyance channel; drainage facilities; and Bosque del Apache NWR would receive 100-year flood protection as well as protection from scour damage and sediment deposition. Also, future development would be provided with this increased level of flood protection. Correspondingly, the potential for loss of life, injury and exposure; threat to health and security; interruption of community activities and services; cost of flood fighting; appreciable repair costs to Bosque del Apache NWR and the low-flow conveyance channel; and the psychological stresses that accompany flooding would be reduced. Since the value of property in the floodplain subject to damage from the 100-year frequency flood is about \$232,000,000 (Oct. 1989 price level) there would be appreciable benefit to the entire community. Average annual benefits that are expected to accrue from flood control are \$11,383,000 (Oct. 1991 price levels).

5.03 Property owners in the 100-year floodplain would no longer need to purchase flood insurance under the National Flood Insurance Program. Also, there would be appreciable savings in future flood proofing costs, since structures would no longer have to be elevated to the 100-year flood frequency elevation as required by the Federal Emergency Management Authority.

5.04 Increased protection to the low-flow conveyance channel and its water conveyance and salvage functions is a major benefit of the recommended action. The USBR estimates that following a flood severe enough to breach the existing earthen embankment, the low-flow conveyance channel would be filled with sediment

flow, with a total loss at the 25-year event). During this time, flows which would ordinarily be diverted into the conveyance channel would continue down the river channel where evaporational and infiltrational losses would be higher. Although the historical average annual water losses are 70,000 acre-feet, as much as 455,000 acre-feet could be lost over a five-year period during an extremely wet cycle. This water would have an economic value of almost 67 million dollars at \$150 an acre-foot. Also, loss of the channel could jeopardize the annual delivery of 60,000 acre-feet of water to Mexico as mandated by the 1906 treaty. This possibility could have international ramifications.

5.05 Retention of floodwaters within the floodway would correspondingly contain the heavy load of water-borne silt and prevent its deposition on cultivated lands, wetlands, and water delivery systems. Heavy sediment deposition could require its removal, regrading of fields, cleaning of water delivery systems and drains, or all three. Heavy sedimentation could also have serious adverse effects on Bosque del Apache NWR and habitat provided for wintering and migratory waterfowl and cranes as well as critical habitat for the endangered whooping crane. Grain production and roosting and loafing habitat could be seriously curtailed and limited until sediment was removed and fields and marshes regraded. A reduction of critical wintering habitat from this regional refuge on which waterfowl and cranes are highly dependent could have appreciable adverse effects on populations. Depleted habitat would initially cause waterfowl and cranes to move to state refuges north of Bosque del Apache, where available feed would be rapidly depleted. The birds would then likely move south to the lower Rio Grande valley and perhaps into Mexico. An inadequate food supply would likely cause these birds to migrate early into the San Luis Valley, where dense waterfowl concentrations and harsh weather would result in disease and resultant mortality. The endangered whooping crane would almost certainly be adversely affected by depleted food supplies. Overall, waterfowl and crane populations in the central flyway could be adversely affected by flooding of Bosque del Apache NWR, and especially so if food production is impaired for two or more years.

5.06 Alternative Levels of Flood Protection. Flood protection to the 50- and 200-year frequency levels and SPF would correspondingly result in lesser and greater area and improvements protected. However, these alternatives did not provide the highest net economic benefits compared to their costs and, consequently, did not meet criteria for plan selection.

5.07 Local Levees. During a meeting with the NMDGF subsequent to public review of the draft SEIS, a request was made to address effects on the low-flow conveyance channel if only portions of the levee were reconstructed (see discussions on alternatives eliminated from detailed evaluation - local levees). The primary impact would be that the conveyance channel would still not receive a higher degree of flood protection and its water salvage and conveyance function jeopardized. This lack of enhanced flood protection for the conveyance channel was a primary reason this fragmented plan was eliminated early in plan formulation. Other reasons consisted of very high costs associated with tie back levees at each levee segment to prevent upstream flooding from entering the protected area, extensive land acquisition, partitioning of land, and likely local resistance because of land taking and visual alteration.

5.08 No Action. A no action alternative is one in which there would be no project construction. Without a plan to provide increased protection from floodwaters, people and the Federal and non-Federal features and facilities in the floodplain would continue to be susceptible to inundation from high flood flows. The Federal and non-Federal features of the floodplain that would be most at risk under the no action alternative are Bosque del Apache NWR, the low-flow conveyance channel, and portions of the city of Socorro. A substantial portion of the city of Socorro lies within the 100-year floodplain and is subject to damage from flooding. As stated, Bosque del Apache NWR provides critical winter habitat for waterfowl, cranes, and the endangered whooping crane that could be seriously impaired as a result of a major flood; and the low-flow conveyance channel helps to convey water in accordance with the Rio Grande Compact and the Treaty with Mexico, obligations that would be difficult to satisfy if the channel were damaged or destroyed by floodwaters.

5.09 The city of Socorro's participation in the National Flood Insurance Program, and its strict enforcement of floodplain development regulations, would serve to reduce flood damages up to 100-year storm flooding event in newer developments. It would correspondingly reduce the financial risk to individual property owners participating in the flood insurance program. Also, Socorro could possibly expand existing, locally implemented flood control features for their City. While those measures would assist in alleviating flooding in some areas, they would not provide a comprehensive plan for the combined communities, nor would they protect against large-magnitude floods. Furthermore, there could be large areas, especially of existing development, left with little, if any, flood protection.

HYDROLOGY AND HYDRAULICS

5.10 Recommended Plan. The recommended plan should not significantly affect flow characteristics and sediment transport in the Rio Grande nor should it affect the rate of sediment deposition in Elephant Butte Reservoir. While there would be localized changes in sediment transport characteristics in the Rio Grande relative to preproject conditions, there would not be any significant increase in sedimentation within Elephant Butte Reservoir. The short duration of major flood events transports insignificant amounts of sediment relative to normal floods of long duration, which are the prime conveyors of sediment. No effects are anticipated to groundwater flow patterns.

5.11 Alternative Levels of Flood Protection. The effects of alternative levels of flood protection should be equivalent to the recommended plan.

5.12 No Action. The status quo would exist in the absence of the project.

WATER MANAGEMENT FACILITIES AND ACTIVITIES

5.13 Recommended Plan. The effects that the proposed action would have on irrigation, flood control, and water conservation facilities have been generally covered under the heading of "FLOOD HAZARDS" in this section. Field level review of the draft SEIS raised the issue of the interrelationship of the "proposed project and the potential to once again dewater the Rio Grande downstream from the San Acacia Diversion Dam (via the low-flow conveyance channel) as inextricably linked." The interrelationship of the planned action to the conveyance channel is one of protection afforded the conveyance channel from high

magnitude flows in the Rio Grande. This protection would correspondingly protect the water salvage and conveyance function of the conveyance channel from flooding effects up to the 100-year frequency event. As stated, these functions are important to the agricultural economy below Elephant Butte Dam and water deliveries to the Republic of Mexico. Also, the planned action would save the high costs that would be associated with restoring the flood-damaged conveyance channel to a functional state. However, the proposed action would not affect the diversion function of the conveyance channel as evidenced by the fact that the channel is presently operational once more after extensive repairs. Any decision to cease or modify the diversion of Rio Grande flows into the conveyance channel would be institutional and not related to the proposed action.

5.14 Alternative Levels of Flood Protection. Other than lesser or greater degrees of protection to the conveyance channel, the effects of alternative levels of flood protection would be equivalent to the recommended plan.

5.15 No Action. No action would maintain the status quo.

SOCIO-ECONOMIC FEATURES

5.16 Recommended Plan. The principal effect that the recommended flood control levee would have on socioeconomic features would be the enhancement of community safety and well-being. The potential for economic losses, emotional trauma, and personal injury or loss of life that accompany flooding would be greatly reduced. Future development and residents would also be recipients of the enhanced safety and well being. Community cohesion would be preserved.

5.17 Since the recommended levee would follow the alignment of an existing spoil bank levee, no private residential structures would have to be relocated to allow construction. The recommended plan would not preclude any future development in the study area. Construction activities should not appreciably alter urban and rural traffic patterns in the immediate vicinity of the planned levee project. However, there could be some temporary and minor inconveniences for Bureau of Reclamation maintenance crews.

5.18 For the anticipated four-year construction period, there would be an increase in income to the local economy related to wages, material, and equipment - associated purchases. A temporary increase in income is expected to be appreciable for the construction period. There would also be an increase in employment during this period, especially in the construction services and retail trade. Following construction, there would be some small inflow of monies related to operation and maintenance of the project. Floodplain communities, as well as Bosque del Apache NWR, would correspondingly benefit economically from the monetary and manpower savings in flood-fighting measures, cleanups, and restoration of damaged property and facilities. The uninterrupted productivity of the community and provision of services would benefit individual citizens as well as the communities as a whole.

5.19 Alternative Levels of Flood Protection. Alternate levels of flood protection, 50- and 200-year and SPF, would also significantly enhance community safety and well-being, as well as resulting in significant economic savings. However, these alternatives have fewer net benefits than the recommended plan (see Table 4). The higher levels of flood protection would correspondingly

result in more monies entering local economies because of longer construction and employment periods. The 50-year level of protection would result in slightly less money being introduced into local economies.

5.20 No Action. In the absence of the recommended plan, residents, business owners and farmers along the west side of the Middle Rio Grande floodplain would not enjoy enhanced safety and well-being from the absence of flooding or the threat of flooding. Correspondingly, area residents would not be beneficiaries of the short- and long-term economic and social benefits that an engineered flood control levee would provide.

TRANSPORTATION FACILITIES

5.21 Recommended Plan. Project construction would not involve any direct modifications to U.S. Highway 380 or County Road 85-82. However, construction equipment would cross these vehicular routes and there would likely be some minor delays when construction was occurring in these particular levee reaches.

5.22 Since the method to be used to raise the height of the railroad line by the Santa Fe and Pacific Railroad allows rail traffic to continue during levee reconstruction, any delays should be minimal.

5.23 Alternative Levels of Flood Protection. The effects of these alternative levels of protection would be similar to the recommended plan. Since the construction period would be slightly shorter with the 50-year level of protection and somewhat longer with the higher levels of flood protection, anticipated traffic delays would be commensurate with the level of protection. No significant adverse effects are foreseen with any alternative.

5.24 No Action. Without the proposed action, there would not be any effect on vehicular traffic.

LAND USE AND CLASSIFICATION

5.25 Recommended Plan. Existing and future land use would change little with the recommended action. A majority of land that would be directly affected by project construction is currently dedicated to the same purpose. However, approximately 40 acres of riparian land in the lower 10.5 miles would be displaced by an enlarged levee. An appreciable amount of this length is within Elephant Butte Reservoir. The recommended plan would not affect lands used or planned for commercial, industrial, residential, and public development in the study area.

5.26 The alignment presented in the draft EIS for the first 4,700 feet of levee would have affected approximately three acres of farmland that is classified as "farmland of statewide importance" for the production of food, feed, fiber, forage, or oilseed crops. In compliance with the Farmland Protection Policy Act (Act), alternatives were explored to avoid the "conversion of farmland to non-agricultural uses." No structurally feasible or cost effective measures were identified at this stage in project design. Subsequent design refinements resulting in the present design removed the need to acquire the three acres of farmland and satisfied the goal of the Act. The flood control objective of the project fully supports the Act by protecting a significant acreage of farmland

from the adverse effects of flooding, sedimentation, and scour, as well as protecting the irrigation water conveyance system which makes irrigated agriculture possible.

5.27 The recommended plan is being closely coordinated with the Service to insure design features are compatible with the land-use purposes, plans, and goals of Bosque del Apache NWR. This coordination has maximized the protection and conservation of refuge resources. As stated, the Service has issued a "Compatibility Determination" reflecting its finding of the project's interrelationship with refuge purposes and goals and is included in this document.

5.28 The reconstructed levee should not be affected by cattle grazing, which occurs intermittently along the present embankment (with increased use below Bosque del Apache NWR). Any damage (trails) would be minor, which could be repaired easily and inexpensively. Levee reconstruction would temporarily exclude cattle from the construction zone, as well as removing approximately 40 acres of marginal grazing land that would be displaced by increasing the basal width of the levee.

5.29 Project construction would not affect the three wilderness areas at Bosque del Apache NWR, nor the five Research Natural Areas. Also, the nearby Sevilleta NWR would not be affected.

5.30 Alternative Levels of Flood Protection. Land use effects from the 50-year flood frequency level of flood protection would be similar to the 100-year level. However, the 200- and SPF levels, with their larger basal widths, would convert substantially more of the riparian zone for flood control purposes. The two higher levels would require appreciable amounts of borrow throughout the length of the project. However, these sites would be restored with native vegetation and converted to wetlands, thereby maintaining existing land use.

5.31 No Action. Existing and planned land use should remain basically unaltered without implementation of the recommended plan.

RIPARIAN AND RIVERINE MANAGEMENT CONCERNS

5.32 Recommended Plan. The project could assist local governments in controlling use and abuse of the riparian forest by judiciously locating levee access and egress points. Coordination of these possible actions with local, County, and State officials could assist in controlling itinerate use, fires, garbage dumping, and unauthorized wood cutting. This increased management of the riparian forest would increase its wildlife and recreational values. Any clearing of vegetation to create fire lines would have to be accomplished in connection with project associated features. However, any possibility of their creation would be very closely coordinated with Federal and State wildlife management agencies and local governmental bodies because of potential adverse effects on wildlife habitat & creation of access roads into the riparian forest.

5.33 The recommended plan is consistent with the goals of Senator Pete Domenici's Rio Grande Bosque Conservation Initiative. An important contribution that levee rehabilitation would make to Initiative objectives would be the safe containment of flood flows or high discharges that are necessary to meet native flora regenerative and maintenance needs not fully obtainable with the current

embankment. Although there would be riparian vegetation removed as a result of project construction and some wetlands filled, measures taken to compensate for these losses would provide habitat of higher wildlife use and increase the wildlife use and diversity of existing habitat. Salt cedar would be replaced with native cottonwood and willow, and wetlands filled as a result of project construction would be replaced with constructed wetlands of greater complexity, thereby fostering greater wildlife use and diversity. The possible acquisition of a wildlife conservation easement would also contribute to Initiative management objectives. Also, the opportunity to work with local governmental entities to design project features to facilitate public management of the riparian zone and potentially provide recreational facilities would appreciably support Initiative goals. Bosque del Apache NWR and the wildlife resources it supports would benefit by receiving increased flood protection as would cultivated fields that parallel the river on which wildlife are also highly dependent.

5.34 The fact that the project would provide increased flood protection to the low-flow conveyance channel should not appreciably change any effects this facility is having on the riverine and riparian ecosystem, or will continue to have. Comparing the effects of "with the project" versus "without the project" in the event of an infrequent high magnitude flood that could damage the conveyance channel, a reconstructed levee would indeed prevent damage to the channel and maintain its function to convey flows diverted from the Rio Grande up to 2,000 c.f.s. Employing the "without the project" scenario, damage would occur to the conveyance channel and prevent diversion of river flow (up to 2,000 c.f.s.) into the conveyance channel. This damage would allow all flows to continue down the river channel until the conveyance channel was repaired. With the project this temporary period of increased flow in the river would not occur. Therefore, the temporary benefits of increased flow to the riparian ecosystem would not occur. However, this scenario would be highly infrequent and of relatively short duration and may not be of significance to the overall, long-term functioning of the riparian and riverine ecosystem.

5.35 Alternative Levels of Flood Control. The potential to assist local governments with management of the riparian forest would be approximately the same as the recommended plan. The effects of alternate levels of flood protection on the goals of the Rio Grande Bosque Conservation Initiative would be approximately the same, although, varying in degree - the 50-year having smaller impacts and the higher levels correspondingly greater effects. The higher levels of protection would have a high potential for wetland creation. The degree of vegetation removal and alteration associated with the SPF level of protection could be significant enough as to be inconsistent with the goals of the Initiative.

5.36 No Action. This course of action would result in a continuation of existing conditions.

RESOURCES MANAGEMENT PLAN FOR ELEPHANT BUTTE AND CABALLO RESERVOIRS

5.37 Recommended Plan. The development of the resources management plan for Elephant Butte and Caballo Reservoirs is in its early stages. Coordination will be maintained between the Corps and Bureau of Reclamation to insure compatibility of plans and maximum benefit to project resources and use.

5.38 Alternative Levels of Flood Protection. See Recommended Plan.

5.39 No Action. Under this scenario, the management plan would not likely consider implementation of the plan flood control in the immediate future.

CULTURAL RESOURCES

5.40 Recommended Plan. As stated, the recommended plan has limited potential to affect cultural resources that may be present in the riparian zone and adjacent areas, since most of the areas that would be affected consist of levees and other disturbed areas. However, the planned use of adjoining terraces for borrow material has a higher potential for encountering cultural remains. Once plans are refined and the locations, or candidate locations, of borrow areas and ancillary activity locations are established, all undisturbed areas potentially affected by project related activities would be surveyed for the possible presence of cultural properties. If found, they would be assessed in accordance with 36 CFR Part 60.4 to determine their significance. To the extent possible, all cultural resources would be avoided, with particular emphasis on Fort Craig. El Camino Real would not be affected. If avoidance is neither possible nor feasible, a data recovery plan would be developed and submitted for review and comment to the New Mexico State Historic Preservation Officer and Advisory Council on Historic Preservation. The approved recovery plan would be implemented prior to initiating any land modifying activity. These measures would protect any cultural resources that may be present, as well as contribute to our knowledge of our cultural heritage.

5.41 Alternative Levels of Flood Protection. The 50-year level of flood protection, with decreased borrow requirements, would have a lower probability of encountering cultural remains on the bordering terraces. Conversely, higher levels of flood protection would appreciably increase the probability of encountering cultural remains with their significantly greater earth disturbing requirements.

5.42 No Action. The absence of land disturbing activities would preclude any effect on cultural remains. Correspondingly, the opportunity to discover unknown remains, especially covered remains, and add to our knowledge of past cultures would not be present.

PLANT AND ANIMAL ASSOCIATIONS

5.43 a. Aquatic Habitat, Including Wetlands

Recommended Plan. Aquatic habitat in the Rio Grande and low-flow conveyance channel should not be affected. Small construction features in the low-flow conveyance channel, e.g., discharge pipes from toe drains, would have a negligible effect on aquatic habitat. Also, sandbars and adjacent shallow water in the river that are important night roost sites for wintering sandhill and whooping cranes would not be affected.

The possibility of improving the low wildlife value of the wetlands that have developed in the abandoned section of conveyance channel would be investigated and implemented if feasible. These wetlands could be dredged deeper and excavated material used for project construction if soil composition is suitable. Any necessary water rights to offset evaporational losses would be provided for.

If the Levee Toe Wetlands near Fort Craig are still present when construction commences, they will likely be covered by the expanded base of the reconstructed levee. The loss of this six to seven acres of wetland habitat would be restored at a nearby site through the use of borrow depressions. With proper siting, design, and acquisition of water rights, wetland use should be enhanced.

The recommended plan presented in the draft SEIS offered significant potential for additional expansion of both permanent and temporary aquatic habitat by the creation of borrow pits in the riparian zone. Designed and sited for maximum wildlife use, borrow pits can provide permanent aquatic habitat and development of wetland vegetation, appreciably benefiting fish, waterfowl, shore- and wading birds, as well as other wildlife species. However, refinements to the recommended plan that resulted in a majority of the existing earthen embankment being utilized eliminated the need for additional borrow in the upper 43.8 miles. Also, the presence of more favorable borrow sources from the terraces bordering the west side of Elephant Butte Reservoir has reduced the need to create borrow areas within the Reservoir area and, consequently, the potential for wetland creation (outside of wetland mitigation needs). However, the option will remain open.

Within Elephant Butte Reservoir, permanent wetland creation (either for compensation or enhancement) west of the conveyance channel likely has the highest potential for maximizing habitat development, wildlife use, and longevity, primarily because of the significantly lower probability of sedimentation. Any wetland development riverward (east) of the conveyance channel has the potential for sedimentation from high river flows, high reservoir storage levels, or both. Even with strategic placement and the low frequency of high water storage, the longevity of created wetlands is questionable. Therefore, emphasis for locating wetlands would be west of the conveyance channel.

An existing 0.5-mile-long dike at the lower end of Mulligan Gulch Wetland would likely be modified for use as a haul road to access a borrow source on the adjacent terrace. This dike was formed to manage water diverted into the wetland and its use as a haul road should not affect the wetland. Coordination would be maintained with USBR to possibly include measures in this dike that would benefit management of the wetland, e.g., gates. Use of the dike alignment for joining (tie-back levee) the reconstructed levee to the western terrace was considered in the draft SEIS, but, as stated, was deleted in the refined plan.

Alternative Levels of Flood Protection. The 50-year level of flood protection would have approximately the same effects and level of effects as the recommended plan. The higher levels of flood protection would also have about the same effects, but, in addition, would have appreciable potential for wetland development. This potential is made possible by the need for borrow from the riparian zone and the ability to design borrow pits for wetland development.

No Action. The status quo would continue.

b. Riparian Habitat.

Recommended Plan. As stated, a major objective of project planning was to conserve riparian vegetation, with an emphasis on mature cottonwood and willow communities. The draft SEIS reflected a reasonable worst-case analysis of project effects on vegetation and associated loss or modification of wildlife use. This approach was consistent with the level of project planning where design and construction details are yet general, and recognized that with subsequent refinement of details, the extent of project-caused effects would be correspondingly refined, with a possible decrease. This final SEIS reflects this refined design. Specific areas where refined design changed the extent of project effects are the elimination of riparian borrow areas and associated haul roads, maximum retention of existing riverward embankment side slopes, and use of construction methods that largely removed the need for turn-around and stockpile areas.

A total of about 6.6 miles of the first 43.8 miles of embankment (to Tiffany) would require the partial or total removal of the riverside side slope and any associated vegetation. This removal would generally be in relatively short, discontinuous sections. As stated, species composition and area or number removed would consist of approximately 14.5 acres of various aged salt cedar, 200 cottonwood trees with a 6-inch dbh (diameter at breast height) or greater, 38 tree willows, 10 Russian olive trees, and about 0.1 acre of a combination of salt cedar, cottonwood, and tree willow saplings. Vegetation removed from the lower 10.5 miles of embankment, much of which is in Elephant Butte Reservoir, would be from a combination of the levee side slope, as well as from the area adjacent to the levee that would be covered by an expanded levee base. This removal would consist of approximately 17.5 acres of various aged salt cedar, 360 cottonwood trees, 109 tree willows, and 3.5 acres of a combination of salt cedar, cottonwood, and willow saplings.

Removal of vegetation would correspondingly reduce animal habitat and use. Of these losses, the permanent removal of cottonwood dominated plant communities would be of greater significance. As stated, these losses would be compensated to prevent any reduction in wildlife use due to project construction. Construction associated activity and noise would temporarily disturb wildlife in the general area of construction. Wildlife use would likely decrease temporarily in affected areas along the levee edge and if construction occurred during the nesting season, there would also be a temporary decrease in nesting. Construction of the levee in segments rather than extremely long reaches should help minimize disturbance to wildlife.

Alternative Levels of Flood Protection.

(1) 50-Year Frequency Level. The 50-year level of flood protection would affect riparian vegetation and associated wildlife use less than the recommended plan. This level of flood protection has a narrower basal width, thereby decreasing the removal of edge vegetation and associated wildlife use. There would still be wildlife disturbance associated with construction activity and sounds, but it would be of shorter duration. Like the recommended plan, this alternative would have little potential for converting salt cedar to native riparian vegetation and for creation of wetlands. This low potential is related to the low borrow requirements.

(2) 200-Year Frequency and SPF Levels. These higher levels of protection would result in substantially greater loss of "edge" vegetation (both salt cedar and cottonwood) than the recommended plan, primarily resulting from an increase in structure size. Correspondingly, there would be a decrease in wildlife use and compensation would have to be made for these losses. There would be substantial borrow requirements from the riparian zone throughout the upper 43.8 miles of levee reconstruction. These borrow needs would offer the opportunity to select areas and plant communities of lower wildlife use, e.g., open areas and homogeneous salt cedar stands, and replace these areas and plant communities with higher wildlife use communities, such as cottonwood/willow and wetlands. Since the SPF plan would require substantial amounts of borrow, there is the potential that the higher use cottonwood and willow communities could be affected to a greater degree and, therefore, the positive effects of replacing lower wildlife use areas with higher value communities could be lessened.

No Action. A continuation of existing plant communities and associated wildlife use would likely occur in the absence of the planned project. However, increased emphasis on preserving, conserving, and enhancing riparian riverine biotic communities could result in an enhanced ecosystem.

c. Upland Habitat.

Recommended Plan. Loss of upland habitat would consist primarily of grassland and shrub. These losses should be relatively small (approx. 56 to 60 acres at a 20 ft. excavation depth) and temporary, as would associated wildlife use. Borrow areas would be revegetated with grasses and shrubs to restore vegetational cover and wildlife use. Any removal of creosotebush due to borrow activities and subsequent revegetation with grasses and higher wildlife use shrubs would likely enhance wildlife use. Given the abundance of upland habitat and revegetation of disturbed areas, the effects of these alteration activities should be small.

Alternative Levels of Flood Protection. Upland borrow sources for the 50-year level of flood protection would, like the recommended plan, be from below the Tiffany area. As such, some 42 to 47 acres (excavation depth of 20 feet) could be required. Wildlife effects would be similar to the recommended plan for this reach. The higher levels of flood protection would remove larger areas of scrub/grassland habitat with estimated acreage requirements of about 70 acres (excavation depth of 20 feet) for the 200-year alternative and 80 acres for the SPF alternative. Acreage figures for the higher levels of protection could increase commensurate with a reduction in riparian borrow quantities. Increasingly greater habitat removal would correspondingly result in a temporary depression of wildlife use. Revegetation with grasses and shrubs would restore wildlife use and perhaps enhance habitat value if creosotebush were removed.

No Action. In the absence of the recommended plan, the present plant community and associated wildlife would likely continue for a considerable period.

WILDLIFE RESOURCES OF BOSQUE DEL APACHE NWR

5.44 Recommended Plan. As stated, the recommended plan would provide a high degree of security to Bosque del Apache NWR and attendant wildlife and educational objectives from the damaging effects of flooding. Designated

critical habitat for the endangered whooping crane would correspondingly receive this high degree of security as would overwintering habitat for the bald eagle. The scheduling of levee construction to avoid the presence of the whooping crane and bald eagle would correspondingly largely avoid the presence of the large wintering population of waterfowl and cranes. Because of this scheduling, project construction would have little, if any, effect on wintering waterfowl and cranes, and would be compatible with the Refuge's role in the Nation's refuge and flyway system.

5.45 As stated, an assessment of levee design in relation to riparian vegetation indicates that about 4.47 acres of vegetation, primarily salt cedar, would be displaced. These losses would be from the embankment's riverward side slopes and toe area, primarily at the lower half of the Refuge. Specifically these losses would consist of about 0.46 acre of medium to large salt cedar, 0.1 acre of cottonwood, 3.8 acres of young salt cedar, and about 0.1 acre of a combination of salt cedar, cottonwood, and tree willow saplings. An additional acre was added to compensate for any unforeseen losses or over-clearing by the Contractor.

5.46 Removal of vegetation would result in a corresponding loss of wildlife habitat. These small losses would be compensated for on the Refuge with native riparian vegetation and the overall effect on wildlife use should be negligible. There would likely be some temporary disturbance to wildlife utilizing the riparian forest/woodland "edge" due to construction noise and activity and wildlife would likely avoid using the immediate area during construction.

5.47 Alternative Levels of Flood Protection. Alternative levels of flood protection would provide lesser and greater degrees of flood protection to the Refuge. The 50-year level of protection would remove slightly less vegetation and disturb wildlife less, but the overall effects on wildlife would be about the same. The 200-year level of flood protection would remove slightly more edge vegetation (primarily salt cedar) than the recommended plan and appreciably more would be removed with the SPF alternative. Borrow needs would be appreciably greater with the higher levels of flood protection, requiring borrow sites throughout the entire length of the project. Since the Service has requested that no borrow sites be located on the Refuge, material would be obtained from outside sources.

5.48 No Action. The status quo would be maintained with this alternative.

ENDANGERED, THREATENED, AND SENSITIVE PLANTS AND ANIMALS

5.49 a. Federally Endangered.

Recommended Plan. The primary effect of project construction on endangered species would be to provide a higher level of protection to critical habitat. The scheduling of project construction to avoid disturbance to migrating or wintering birds and their prey, surveys to locate any nesting and important roosts, plus any associated design modification to prevent or reduce adverse impacts, would cumulatively protect and enhance the continued presence of these species.

The peregrine falcon should not be appreciably affected, although, it may avoid hunting on those sections of conveyance channel where construction is occurring.

Wetlands constructed to mitigate for displaced wetlands could increase foraging areas for the bald eagle and peregrine falcon because of the attractiveness of their larger, more complex wetland attributes.

Levee reconstruction would not modify critical habitat features that are necessary for the survival and recovery of the endangered whooping crane. The existing embankment would be reconstructed to higher structural standards and its general features would remain.

Alternative Levels of Flood Protection. The 50-year level of flood protection would have similar effects on the bald eagle and whooping crane as the recommended plan. Impacts of higher levels of protection would also be similar, although the potential to create an appreciable number of wetlands with these alternatives would benefit the bald eagle by expanding its foraging opportunities.

No Action. The status quo would be maintained with this alternative.

b. Federal Notice of Review for Animals.

Recommended Plan. Construction activity could result in some temporary disturbance to the ferruginous hawk and willow flycatcher, but no significant adverse effects are foreseen. There could be some temporary displacement of any nesting species along the levee if construction occurred in the breeding season. Use of construction areas by the ferruginous hawk would likely be discouraged until construction activity ceased. Wetland compensation measures would benefit the white-faced ibis and the ferruginous hawk may benefit somewhat from the opening up of dense salt cedar stands. The Rio Grande silvery minnow would be unaffected. As stated, surveys would be performed to determine if the New Mexico jumping mouse were present in immediate project areas, although most of the anticipated construction areas do not contain suitable habitat. If found, project design would be modified to avoid adverse effects if possible.

Alternative Levels of Flood Protection. The 50-year level of flood protection would have effects similar to those of the recommended plan, although somewhat reduced. The higher levels of flood protection, and especially the SPF, would have longer disturbance periods and appreciably more salt cedar habitat removed than the recommended plan. Borrow removal would result in a loss of salt cedar habitat for flycatchers (*Epidonax sp.*) until regrowth occurred. Wetland development would benefit wading birds in this category and the ferruginous hawk may benefit from the opening up of dense salt cedar stands, increasing foraging opportunities.

No Action. The status quo would be maintained with this alternative.

c. Federal Notice of Review for Plants.

Recommended Plan. Construction areas would be surveyed for the presence of these plants. If found, the area would be avoided if possible or plants relocated. Experience has shown that pioneer plants such as prairie clover and sunflower will rapidly colonize disturbed areas.

Alternative Levels of Flood Protection. The increased area that would be disturbed by the higher levels of flood protection increases the potential for disturbance. Correspondingly, the 50-year level decreases the potential for disturbance.

No Action. The status quo would be maintained with this alternative.

d. State of New Mexico Endangered Animals.

Recommended Plan. See previously described effects for the peregrine falcon, bald eagle, and whooping crane, meadow jumping mouse, and silvery minnow. The olivaceous cormorant could be benefitted by wetland compensation measures at the head of Elephant Butte Reservoir. The Mississippi kite, black hawk, willow flycatcher, and Bell's vireo could be temporarily disturbed if any of these species happen to be present during actual construction.

Alternative Levels of Flood Protection. The increased area of wildlife habitat that would be removed or disturbed by the higher levels of flood protection increases the potential for animal disturbance. Conversely, the potential for increasing habitat value and diversity by replacing salt cedar with native cottonwood and willow and the creation of wetlands correspondingly increases. The 50-year level of protection decreases the potential for disturbance as well as wetland creation and conversion of homogeneous salt cedar stands to native cottonwood and willow.

No Action. The status quo would be maintained with this alternative.

e. State of New Mexico Endangered and Sensitive Plants.

Recommended Plan. Construction areas would be surveyed to determine the possible presence of endangered and sensitive plants. If found, the area would be avoided if possible or the plant relocated. As stated, some plant species, e.g., prairie clover and sunflowers, rapidly establish on disturbed soil and, thus, would benefit from project construction.

Alternative Levels of Flood Protection. The increased area that would be disturbed by the higher levels of flood protection increases the potential for disturbance. Correspondingly, the 50-year level decreases the potential for disturbance.

No Action. The status quo would be maintained with this alternative.

RECREATION AREAS, NEEDS, AND PLANS

5.50 Recommended Plan. Construction related activities would temporarily restrict access to the riparian zone and conveyance channel as the various levee segments were constructed. Also, fish and wildlife resources in the immediate vicinity of construction activities would likely be disturbed. This temporary restriction of access and wildlife disturbance would affect such recreational pursuits as seasonal hunting, nature observation, fishing, and picnicking. However, these effects should be minor and of short duration, and alternate access points are available.

5.51 The construction of compensatory wetlands would enhance waterfowl hunting opportunities and help satisfy a portion of the heavy regional demand for this activity.

5.52 The possible construction of pullouts along the levee and judicious placement of access and egress points should act to enhance the quality of all recreational activities along the river.

5.53 Enhanced flood protection for Bosque del Apache NWR would correspondingly insure that the significant recreational opportunities and uses at the refuge are perpetuated. Existing opportunities would not be affected.

5.54 The recommended plan has the potential for contributing to the recreational needs of the communities within the study area, particularly the city of Socorro and its open-space plan. As stated, the Corps of Engineers can participate with the city of Socorro under a 50-50 cost-sharing agreement to construct certain kinds of recreational facilities on project lands. Since trails, picnic facilities, and water-oriented opportunities have been identified as recreational needs in Socorro County, their incorporation into the design of project features could assist in fulfilling this need. A refined analysis of the quantity and quality of earth in the existing embankment for use in levee rehabilitation since circulation of the draft SEIS shows that no additional earth would be required in the Socorro area. Therefore, the potential for pond/marsh creation in association with borrow excavation and associated recreational and wildlife benefits has diminished considerably. Should an unexpected need arise, coordination will be initiated with the city of Socorro, state of New Mexico, and Department of Interior to take advantage of the recreation and wildlife benefits that could occur with constructed wetlands.

5.55 Alternate Levels of Flood Protection. Recreational effects of alternative levels of flood protection should be similar to the recommended plan. However, with the 200-year and SPF level of flood protection, the period of impaired access and wildlife disturbance would be longer. Also, any significant removal of cottonwood dominated "edge" vegetation associated with the two higher levels of flood protection could depress recreational pursuits such as hunting and nature observation because of a change in plant community/structure type.

5.56 While the 50-year level of flood protection would also not lend itself to wetland construction in the upper reaches of the project, the 200-year and SPF levels would require additional fill, making constructed wetlands and associated recreational opportunities a real possibility.

The potential for project-associated recreational development on a cost-sharing basis would be similar to the recommended plan for all alternatives.

5.57 No Action. Without the proposed flood control levee, no existing recreational facilities or opportunities would be adversely affected by construction activities. However, the recreational facilities located in the floodplain, between San Acacia Diversion Dam and Elephant Butte Reservoir, would not receive any additional flood protection than that offered by the existing spoil bank. Without the proposed project, the opportunity for cost-sharing of project-related recreational features would be unavailable, as would the opportunity for assisting in meeting the current and future recreational demand.

AIR AND SOUND QUALITY

5.58 Recommended Plan. No significant short- or long-term deterioration of air and sound quality is anticipated. Protection provisions would be included in all contracts and would be consistent with Federal, State, and City regulations.

5.59 Construction equipment would slightly increase the concentrations of carbon monoxide, nitrogen oxide, sulfur dioxide, hydrocarbons, and particulates. The primary exhaust products from diesel engines are sulphur dioxide, nitrogen oxide, and particulates. This small increase in exhaust products would not exceed air quality standards either singly or cumulatively.

5.60 Dust generation would be strictly controlled through contractual requirements and little dust production is anticipated. What dust that is unavoidably generated should be small and should not significantly add to the total amount of air contaminants. No irritation or health hazards are anticipated as a result of any dust generation. After levee construction is complete, the planting of native or adapted vegetation to prevent or reduce future dust generation would be evaluated and implemented as necessary.

5.61 There would be an increase in sound levels in the immediate project vicinity due to operation of heavy machinery. Because of the low wavelength frequency of diesel engines, the sound level should not be excessive. This increase in sound levels would be likely be unobtrusive along much of the project corridor because of the general sparsity of habitation.

5.62 Alternate Levels of Flood Protection. The effects of these alternative levels of flood protection would be similar to the recommended plan. The 50-year level would contribute slightly lower quantities of pollutants because of the reduced construction effort and periods. The SPF level would contribute higher quantities because of an increased construction effort and period. As with the recommended plan no significant short- or long-term deterioration of air and sound quality is anticipated.

5.63 No Action. Without the recommended action, there would not be any effect on air quality in the San Acacia to Elephant Butte reach.

WATER AND SEDIMENT QUALITY

5.64 Recommended Plan. The recommended plan should not affect water quality in the Rio Grande or in Elephant Butte Reservoir. Refinements in project design since public review of the draft SEIS would largely remove situations whereby any direct or indirect contact would be made with water in the Rio Grande, the low-flow conveyance channel, Elephant Butte Reservoir, or in irrigation canals (see Appendix H). Also, project features are designed to avoid conditions that would degrade water quality during the life of the project. Contract specifications would contain measures to protect surface water quality from erosional products, chemical and fuel spills, oil disposal, and any other potentially toxic wastes. Therefore, no project-associated activity is anticipated that would adversely affect surface water quality to an extent that would impair the fishery and primary contact recreation designated uses.

5.65 Since sediment transport and deposition characteristics of the Rio Grande within Elephant Butte Reservoir would not be appreciably affected by the recommended plan, there would not be any modifications to existing water chemistry should pollutants be associated with sediment that is being contributed by the Rio Puerco.

5.66 Alternative Levels of Flood Protection. As with the recommended plan alternative levels of flood protection would not affect water quality. Although higher levels of protection would likely require borrow pits within the riparian zone, excavation activities would not be in direct contact with surface flows and subsequent inundation of created depressions by high flood flows should not degrade water quality.

5.67 No Action. Under the "no action" alternative, surface water quality in the study area would continue to be affected by existing conditions.

MINERAL RESOURCES

5.68 Recommended Plan. Almost all of the earthen resources in the existing embankment would be reused in accomplishing the proposed action. In addition, sand, gravel, and clay located on the western terraces adjoining Elephant Butte Reservoir would also be utilized. Other than the use of earth and rock from the general project area, plus a relatively small amount of water and cement, no other mineral resources would be affected. Because of the abundance of these minerals in the general area, no effects on their continued availability would occur.

5.69 Alternate Levels of Flood Protection. The effects of alternative levels of flood protection would be similar to the recommended plan, differing in quantity relative to the level of flood protection - lesser quantities for the 50-year level and greater quantities for the two higher levels.

5.70 No Action. Without the action, relatively small quantities of sand and rock would continue to be removed from adjacent developed sources for embankment maintenance and repair of flood damage.

HEALTH AND SAFETY

5.71 Recommended Plan. One of the primary reasons for developing the recommended flood control levee is to protect life, health, and property from the adverse consequences of major flooding. With the implementation of recommended plan, the threat of disease, injury, and possible loss of life that accompanies major flooding would be greatly reduced.

5.72 Construction work would be occurring when the low-flow conveyance channel periodically conveys appreciable volumes of water. Construction workers would be warned of the danger of the fast moving water to prevent accidental drownings.

5.73 The propagation of mosquitos from compensatory wetlands that would be created in association with the project can be easily controlled by use of biological measures such as the use of mosquitofish. This measure is an effective means of controlling mosquito propagation and the creation of larger and more complex wetlands could reduce conditions that encourage mosquito production.

5.74 Construction personnel are required to wear hearing protection when sound levels from equipment exceed 85 decibels ambient regardless of duration. Also, no toxic or hazardous substance problems are foreseen.

5.75 Alternative Levels of Flood Protection. The 50-year flood frequency level of design would provide a lower level of protection to health and safety, with higher flood frequency design levels providing correspondingly higher level of protection. The 50-year level would, like the recommended plan, have a relatively small area of compensatory wetlands created, lowering the potential for mosquito production. Substantially greater wetland development would be associated with the 200-year and SPF levels, and, consequently, the potential for increased mosquito production. However, biological control of mosquitos, using mosquito fish, should prevent any problem from arising.

5.76 Any depressions created as a result of borrow operations and not converted to wetlands, could fill with water during those infrequent periods when there is appreciable flow in the river. If water remained in these depressions long enough to permit the development of mosquito larvae, then the creation of borrow depressions could locally increase the number of mosquitos. Any increase in the number of mosquitos should not increase the potential for encephalitis, since there is no recent history of this disease. Maintenance personnel should not experience any added aggravation, nor should floodplain residents. Any need for some form of chemical control by State or County health officials during these possible infrequent events is low.

5.77 No Action. Without the recommended plan, the health and safety of residents in flood prone areas would still be threatened by high magnitude floods.

VISUAL QUALITY

5.78 Recommended Plan. The presence of the low-flow conveyance channel, adjacent embankment, associated maintenance roads, and ongoing rehabilitation measures on the conveyance channel have altered the visual setting of the riverine and riparian corridor for many years. Implementation of the recommended plan would have little additional effect on the existing visual setting and in some reaches, could improve it. A significant increase in the size of portions of the levee, primarily within Elephant Butte Reservoir, would modify the existing visual setting. Here the reconstructed levee would become a major visual feature.

5.79 Alternative Levels of Flood Protection. The 50-year level of protection would have similar effects on the visual setting of the immediate levee area. The 200-year level, with its somewhat larger levee and need for borrow throughout its entire reach, would affect the visual setting to a greater degree. The increased change would be largely due to the creation of borrow areas. However, revegetation with native cottonwood and willow trees and conversion to wetlands would restore and perhaps enhance preproject visual characteristics. The SPF alternative has a high potential for appreciably modifying existing visual characteristics, since it would remove more "edge" vegetation and has substantial borrow requirements.

5.80 No Action. In the absence of the recommended plan or alternate levels of flood protection, visual characteristics should basically remain as is. Failure of the existing embankment as a consequence of high flood flows would undoubtedly reduce visual characteristics in the recommended project area, as well as in the floodplain.

EXECUTIVE ORDER 11988, FLOODPLAIN MANAGEMENT

5.81 Recommended Plan. The recommended action supports the directives of this Executive Order. The provision of a higher degree of flood protection would correspondingly reduce the rate of flood losses; minimize the effect of flooding on human safety, health, and welfare; and preserve the natural and beneficial values of the floodplain. Contributing to the beneficial use and safety of the floodplain is the city of Socorro's participation in the National Flood Insurance Program. Through this program, the City has instituted an overall community program of corrective and preventative measures for reducing flood damage. These measures take a variety of forms and generally include zoning, subdivision or building requirements, or special purpose floodplain ordinances.

5.82 Alternative Levels of Flood Protection. The effects of levees providing alternative levels of flood protection with regard to this Executive Order would be similar to the recommended plan.

5.83 No Action. Without the recommended or alternative plans, less protection would be provided for residences located within or adjacent to the middle Rio Grande floodplain in the study area.

EXECUTIVE ORDER 11990 - PROTECTION OF WETLANDS

5.84 Recommended Plan. The recommended plan supports the directives of this Executive order by protecting wetlands, minimizing effects on wetlands, and restoring any affected wetlands. As stated in Section IV, wetlands (albeit of very low wildlife value) have recently developed in portions of the approximately 4.0 mile-long section of conveyance channel at Tiffany that was relocated and abandoned many years ago. The wider base of the reconstructed levee would cover sections of the edge of the abandoned channel, resulting in some loss of cattails. Associated construction activity would likely result in some additional losses. Compensation for adverse effects on this wetland, as well as possible enhancement, could be achieved easily by excavating certain channel sections and thereby raising habitat values or constructing wetlands in favorable areas west of the active conveyance channel. If the Levee Toe Wetlands are still present when construction commences, they would likely be filled. Additional wetlands would be created to compensate for their loss if this were the case. The project has the potential to assist in restoring the Mulligan Gulch Wetlands and this potential will be coordinated as the project progresses.

5.85 Alternative Levels of Flood Protection. The 50-year level of flood protection would have about the same effect on wetlands as would the recommended plan. In addition to these effects, the 200-year level would disturb more wetland vegetation in the abandoned conveyance channel, but, importantly, would have the potential for extensive wetland development through the adapting of borrow pits. This potential for constructed wetlands would be even greater with the SPF plan.

5.86 No Action. In the absence of increased flood protection, wetlands on Bosque del Apache NWR would continue to have a low level of flood protection. The wetlands located in the abandoned section of conveyance channel would remain undisturbed, with low habitat value.

ENVIRONMENTAL EFFECTS OF MAINTAINING THE PROJECT

5.87 Recommended Plan. The objective of project maintenance would be to insure the design life and effectiveness of project features. Maintenance activities would generally consist of maintaining the levee road, repair of any floodwater damage to the levee and protective jetty jacks and riprap, and maintenance of the levee toe drain. Also, additional bank protection in the form of jetty jacks and riprap could be required after any extraordinary flood event. The limited amount of required rock and soil would likely come from existing upland sources. Application of standard environmental protection and mitigative measures would prevent significant adverse effects.

5.88 The recommended levee design accommodates the continuing aggradation of the riverbed. No future increase in levee height is anticipated in order to maintain adequate flood protection because of a decrease in channel capacity.

5.89 Alternative Levels of Flood Protection. The environmental effects of operating and maintaining levees providing alternative levels of flood protection would be similar to the recommended plan.

5.90 No Action. Without the operation and maintenance of the recommended or alternative flood control levees, the levees would be unable to provide effective flood control and their useful life would be reduced.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

5.91 Recommended Plan. Irreversible or irretrievable commitment of resources that would be associated with the recommended action consists principally of labor, fuel, and structural material, e.g., concrete, steel, pipe, and ancillary equipment. The earth and rock used in reconstructing the embankment is reusable and is not considered an irreversible or irretrievable commitment of resources.

5.92 Vegetation and associated wildlife use displaced by project construction would be re-established or compensated for and, consequently, would not be an irreversible or irretrievable commitment of resources.

5.93 The presence and continued functioning of the low-flow conveyance channel and associated resource commitments and effects are governed institutionally, and will continue until regulations and objectives are changed. The planned action will not, and cannot, change these conditions. However, it would save a significant irreversible and irretrievable commitment of human, physical, and monetary resources that would result from high magnitude flooding and associated repair. The continued existence of the low-flow conveyance channel is irrelevant to the degree of flood protection to be provided, although the frequency of inoperability due to flood damage is relevant.

5.94 Alternative Levels of Flood Protection. Irreversible or irretrievable effects on various attributes would be similar to that of the recommended plan, varying in degree in direct proportion to the level of flood protection.

5.95 No Action. The status quo would be maintained in the absence of the planned action.

MAJOR CUMULATIVE EFFECTS

5.96 Recommended Plan. The major effect of the recommended plan would be the enhanced level of safety and well-being provided to communities located on the floodplain to the west of the Rio Grande and the enhanced level of flood protection provided for the low-flow conveyance channel and Bosque del Apache NWR. The potential for loss of life, injury, emotional trauma, and economic losses that accompany major flooding would be greatly reduced.

5.97 Compensation for lost riparian vegetation (predominantly salt cedar) and wetlands with native cottonwood and willow and more complex wetlands should maintain or improve habitat value.

5.98 An important added effect made possible by an improved levee is the enhanced opportunity to implement important elements of biological management for the preservation of the riverine and riparian ecosystem throughout the middle Rio Grande valley. The improved levee would make a significant contribution toward permitting the safe conveyance of river flows of sufficient quantity to flood the riparian zone and enable regeneration of the riparian forest.

5.99 The added effects of levee rehabilitation to past, continuing, and future effects of operating the low-flow conveyance channel on the aquatic and riparian ecosystem of the Rio Grande should be minimal, if any at all. The only foreseeable change in conditions would be that which would have occurred should the added degree of flood protection not been present during major flood events. If such events should have breached an unrehabilitated embankment, then water that would have normally been diverted from the Rio Grande into the conveyance channel would have continued down the Rio Grande until the damage to the conveyance channel was repaired. This period is estimated to range from two to six years, depending on the extent of damage incurred. During this period, additional water would have been available to the aquatic and riparian ecosystem below the San Acacia Diversion Dam. The frequency of these events occurring is low.

5.100 Alternative Levels of Flood Protection. The 50-year alternative would also provide enhanced flood protection to a 54.3-mile-long reach of floodplain, but at a lower level than the recommended plan. Cumulative environmental effects would be slightly lower than those associated with the recommended plan. The frequency of potential exceedance of the 50-year level of protection would increase, correspondingly increasing the potential for flood damage to the conveyance channel and resulting increased periods of increased flows in the Rio Grande below the San Acacia Diversion Dam due to the temporary cessation of conveyance channel functioning.

5.101 The 200-year and SPF alternatives would provide very high levels of security from high magnitude floods to floodplain development and human welfare. Unlike the lower levels of flood protection, these higher levels have borrow requirements that encompass the entire project length. These requirements make possible opportunities for expanded wetland development and replacement of homogeneous salt cedar with the higher value cottonwood/willow communities, thereby improving the value of the entire riverine ecosystem. These goals can

be achieved; however, because of the larger levee sizes and appreciable borrow requirements, especially with the SPF plan, the potential to affect more of the higher wildlife use habitat would rise accordingly, requiring more extensive restoration and compensation measures.

5.102 The higher levels of flood protection would add somewhat to the potential cumulative effects of the project and low-flow conveyance channel on the riverine and riparian biological communities. These flood control levels would provide a higher probability that a breach would not occur in the event of a high magnitude flood, temporarily impairing the function of the low-flow conveyance channel and causing increased flows in the river channel.

5.103 No Action. The cumulative effect of no action would be the continued vulnerability of floodplain development, regionally valuable wildlife habitat, and human life and welfare to high magnitude flooding and associated potential for appreciable economic, social, and wildlife losses. No action would maintain the probability that high river flows would breach the existing spoil bank levee, temporarily impairing the function of the low-flow conveyance channel and allowing increased flows in the river channel. These potential events could have a short-term benefit for biological ecosystems, but long-term effects may be negligible.

SECTION VI - LIST OF PREPARERS

<u>Name</u>	<u>Expertise and Experience</u>	<u>Role</u>
Mark S. Sifuentes	Biology - Master of Science 20 Years in NEPA Compliance, Biology, Environmental Planning - Albuquerque District COE	Prepare and Coordinate Draft and Final SEIS
Sandra L. Rayl	Archeology - Master of Science 6 Years Cultural Resources Management - Albuquerque District COE 3 Years Cultural Resources Management - Bureau of Indian Affairs 5 Years Cultural Resources Management - National Park Service 3 Years Salvage Archeology and Cultural Resources Management - Educational Institutions	Description of Cultural Resources & Associated Project Effects

SECTION VII - PUBLIC INVOLVEMENT

PUBLIC INVOLVEMENT PROGRAM

7.01 The process for identifying significant issues related to the proposed action, related alternatives, and for determining the scope of these issues has been initiated through a general public involvement program. When the decision was made to prepare a SEIS for the authorized flood protection project, a Notice of Intent was published in the December 31, 1987, Federal Register. The scoping process was formally initiated by letter dated May 12, 1988. This letter transmitted a public invitation to contribute issues of concern, study authorization and history, the proposed alternative and prior plans and alternatives, a map depicting the location of the proposed feature reconstruction, anticipated time schedules for construction, and response form. The response form included an invitation from the Corps to meet with individuals, groups, and agencies to further discuss issues of concern. Several requests to meet with the Corps were received and meetings were subsequently held. This method of both notifying and informing the public was chosen as being the most effective means by which to determine additional significant issues to be addressed in the SEIS. Notices announcing the scoping process and inviting participation were sent to local radio stations, newspapers, libraries, and post offices, and about 80 Federal, State, and local agencies, private organizations, and individuals. Fifteen agencies, organizations, and individuals provided scoping comments. One of these responses directly resulted in a meeting to discuss concerns in detail. In addition to this formal coordination, coordination with the more involved agencies such as the Bureau of Reclamation, New Mexico Interstate Stream Commission, city of Socorro, and the Service was accomplished as an ongoing process of project development.

7.02 The draft SEIS was distributed to approximately 120 Federal, State, local, and private government agencies and individuals. This distribution included the Public Notice for obtaining a Corps' authorization and State Water Quality Certificate as required under the provisions of Section 404 and 401 of the Clean Water Act. The Public Notice solicited comments and information to evaluate the probable effect of the proposed action on the public interest.

7.03 As part of the distribution of the draft SEIS, a notice of availability of the document was published in regional newspapers and made available to radio stations. The draft SEIS and accompanying Public Notice were also sent to local libraries and post offices. Five multiple agency meetings were held in Albuquerque, Socorro, and Las Cruces in response to the draft SEIS. Concerns expressed as a consequence of scoping and circulation of the draft SEIS were summarized in Section II, Paragraph 2.04 (Public Concerns and Related Resource Management Needs). A list of scoping participants, respondents to the draft SEIS, and participants in subsequent meetings is included in Subsection 7.03.

7.04 There has been continuous coordination with the Service (particularly Bosque del Apache NWR) and the USBR. These two governmental agencies have administration responsibilities that would be directly affected by the proposed action and the integration and compatibility of proposed project features with these responsibilities has been a major objective of the planning process.

REQUIRED COORDINATION

7.05 This study is being coordinated with the Service pursuant to the requirements of the Fish and Wildlife Coordination Act of 1958 (72 Stat. 563) (PL 85-624), the Endangered Species Act of 1973, as amended (87 Stat. 884) (PL 93-205), and the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668) (PL 89-669). The final Coordination Act Report is included in Appendix C and endangered species correspondence in Appendix E. Consultation with the New Mexico State Historic Preservation Office and National Park Service has been initiated and is continuing pursuant to the National Historic Preservation Act of 1966 (80 Stat. 915), as amended (94 Stat. 2987). Coordination with the Advisory Council on Historic Preservation will be accomplished in accordance with the Archeological and Historic Preservation Act of 1974 (PL 93-291), contingent on the results of cultural resources surveys and determination of eligibility. The draft SEIS was forwarded to and comments requested from Federal agencies having jurisdiction by law or special expertise with respect to any environmental effect involved and any appropriate Federal, State, or local agency which is authorized to develop and enforce environmental standards. Comments were also requested from State and local clearing houses in accordance with OMB Circular A-95 (Revised).

LIST OF AGENCIES AND INDIVIDUALS

7.06 The following is a list of agencies, organizations, and individuals to whom copies of the draft SEIS were sent, those who were invited to participate in the scoping process, and those who commented on the draft SEIS or accompanying Public Notice. An asterisk indicates agencies or individuals who participated in the scoping.

FEDERAL AGENCIES

Received Draft SEIS and Invitation to Participate in Scoping

Commented on Draft SEIS

U.S. Department of Interior
Office of Environmental Project
Review

International Boundary and Water
Water Commission

U.S. Public Health Service
Department of Health and Human
Services

U.S. Department of Agriculture,
Soil Conservation Service

*U.S. Bureau of Reclamation
Upper Rio Grande Projects
Office

U.S. Department of Interior,
Bureau of Land Management

*U.S. Bureau of Reclamation
Rio Grande Project Office

U.S. Department of Interior,
Fish and Wildlife Service

*U.S. Bureau of Reclamation
Elephant Butte Project Office

U.S. Department of Interior
Office of the Secretary

U.S. Environmental Protection Agency

FEDERAL AGENCIES (Cont.)

Received Draft SEIS and Invitation
to Participate in Scoping

Commented on Draft SEIS

Advisory Council on Historic
Preservation

*U.S. Forest Service, Region 3

U.S. Fish and Wildlife Service,
Region 2

U.S. Fish and Wildlife Service,
Ecological Services

U.S. Fish and Wildlife Service,
Bosque del Apache NWR

U.S. Geological Survey

Bureau of Land Management

National Oceanic and Atmospheric
Administration

U.S. Environmental Protection
Agency, Region VI

International Boundary and Water
Commission

U.S. Department of Energy

Office of Environmental Affairs,
Department of State

U.S. Department of Agriculture,
Agricultural Stabilization and
Conservation Service

U.S. Department of Agriculture
Soil Conservation Service

U.S. Department of Agriculture
Farmers Home Administration

U.S. Department of Agriculture
Agricultural Marketing Service

Chairman and Federal Representative
Rio Grande Compact Commission

FEDERAL AGENCIES (Cont.)

Received Draft SEIS and Invitation
to Participate in Scoping

Commented on Draft SEIS

*U.S. National Park Service
Federal Highway Administration
Federal Energy Administration
U.S. Postal Service
Socorro, NM
San Antonio, NM
Truth or Consequences, NM
U.S. Department of Commerce
Department of Housing and Urban
Development
Honorable Pete V. Domenici
Honorable Jeff Bingaman
Honorable Joseph R. Skeen
Honorable Bill Richardson
Honorable Steven H. Schiff
N.M. Congressional Projects Office

STATE AGENCIES

Received Draft SEIS and Invitation
to Participate in Scoping

Commented on Draft SEIS

*Environmental Improvement Division N.M. Department of Game and Fish
N.M. Interstate Stream Commission N.M. Health & Environment Department
Surface Water Quality Bureau
*N.M. State Highway & Transportation N.M. State Clearinghouse
Department
State Parks and Recreation N.M. State University, Department of
Fishery & Wildlife Sciences

STATE AGENCIES (Cont.)

Received Draft SEIS and Invitation
to Participate in Scoping

Commented on Draft SEIS

*State Historic Preservation Bureau

State of Texas, Rio Grande Compact
Commission

Rio Grande Compact Commission,
Commissioner for Texas

*Rio Grande Compact Commission,
Commissioner for Colorado

Honorable I.M. Smalley,
N.M. State Senate

Honorable Maurice Hobson,
N.M. State House of Representatives

N.M. Energy, Minerals, and Natural
Resources Department

N.M. State Engineer's Office

Governor of New Mexico

N.M. State Clearing House for
Intergovernmental Review

Commerce & Industry Department

Economic Department & Tourism

S.E. Reynolds, N.M. State Engineer

Middle Rio Grande Conservancy
District

Water Resources Research Institute

N.M. State University, Department
of Fishery & Wildlife Services

N.M. Department of Game & Fish

*Elephant Butte Irrigation District

N.M. Communications & Rural
Development Bureau

CITY AND LOCAL GOVERNMENT

Received Draft SEIS and Invitation
to Participate in Scoping

Commented on Draft SEIS

Mayor of Socorro

City of Socorro

*Socorro City Clerk

Socorro County Manager

Socorro County Commissioners

Socorro Director of Economic
Development

Socorro County Agent

Middle Rio Grande Council of
Government

Public Library of Truth or
Consequences, NM

INDIVIDUALS AND PRIVATE ORGANIZATIONS

Received Draft SEIS and Invitation
to Participate in Scoping

Commented on Draft SEIS

*Ms. Gabriella G. Palmer

Hubert & Hernandez, P.A. Law Offices

Ms. Charlene Temple

Mr. Don Lovato

Mr. Paul R. Krehbiel

Socorro Defensor - Chieften

KSRC

KCHS

Socorro Herald

Sierra County Sentinel

The Nature Conservancy

Albuquerque Wildlife Federation

*N.M. Wildlife Federation

INDIVIDUALS AND PRIVATE ORGANIZATIONS (Cont.)

Received Draft SEIS and Invitation
to Participate in Scoping

Commented on Draft SEIS

Ducks Unlimited

New Mexico Trout

Central N.M. Audubon Society

Randell Davey Audubon Center

Sierra Club, Rio Grande Chapter

The Wilderness Society

Openhiemer Industries

Santa Fe Pacific Railroad Co.

Southwest Research & Information
Center

The Conservation Fund

*Mr. Ken Stinnet

*Mr. Mark Hitchcock

Ms. Roxanne Gunter

Dr. S.D. Schemnitz

Ms. Cathy Butcher

Mr. Roger Peterson

Mr. Paul R. Krehbiel

MEETINGS HELD IN RESPONSE TO DRAFT SEIS

1. September 26, 1990, meeting with:

U.S. Fish and Wildlife Service, Bosque del Apache NWR
City of Socorro
N.M. Interstate Stream Commission
U.S. Bureau of Reclamation
Middle Rio Grande Conservancy District
Bureau of Land Management
Corps of Engineers

2. October 23, 1990, meeting with:

N.M. Environment Department
N.M. Department of Game and Fish
Corps of Engineers

3. November 5, 1990, meeting with:

N.M. Department of Game and Fish
U.S. Fish and Wildlife Service
Corps of Engineers

4. December 11, 1990, meeting with:

State of Texas, Rio Grande Compact Commission
U.S. Bureau of Reclamation
N.M. Interstate Stream Commission
International Boundary and Water Commission
Middle Rio Grande Conservancy District
Elephant Butte Irrigation District
El Paso County Water Irrigation District No. 1
El Paso, Texas City/County Health District
N.M. Department of Agriculture
Elephant Butte Lease Lot Association
U.S. Fish and Wildlife Service
Corps of Engineers

5. January 5, 1991, meeting with:

N.M. Department of Game and Fish
U.S. Fish and Wildlife Service
Corps of Engineers

PUBLIC VIEWS AND RESPONSES

7.07 Several issues of public and private concern were raised during preparation of the draft SEIS. Primary among these were the following issues:

a. Flood hazards, water salvage, sedimentation, and decreasing reservoir storage volume.

b. Preservation, conservation, and enhancement of riparian habitat. Project effects on wildlife, particularly waterfowl, cranes, upland birds, and fisheries.

c. Project effects on existing recreational resources, opportunities, and needs, and project-related opportunities for the development of recreational facilities.

d. Potential of project to develop wetlands and recreational ponds.

e. Project potential to assist in the management of riparian resources.

f. Project effects on cultural resources, particularly the Camino Real.

7.08 A majority of concerns such as preservation and enhancement of wildlife habitat, cost-shared recreational development, and preservation of cultural resources are basic project considerations. Other concerns such as management of riparian features and uses are not within the responsibility of the Corps. However, structural design features can be incorporated into the project to assist local governments in their management of riparian resources, provided they are consistent with overall design of the project and do not raise construction costs.

7.09 Coordination of the draft SEIS surfaced additional concerns or recommendations. Primary among these were the consideration of other alternatives, particularly the addition of a dam on the Rio Puerco; a change in location of mitigation sites and incorporation of additional compensation measures; an assessment of the inter-relationship of the recommended plan to the functioning of the low-flow conveyance channel and long-term cumulative effects of perpetuating its function; an assessment of the inter-relationship of the recommended plan to Senator Pete V. Domenici's Rio Grande Bosque Conservation Initiative; and the consideration of irreversible and irretrievable commitment of resources involved with the recommended plan. These and other concerns and recommendations have been evaluated and are reflected in this final SEIS.

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Rio Grande Floodway
San Acacia to Bosque del Apache Unit
Socorro County, New Mexico

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 Rio Grande Floodway
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 Socorro County, New Mexico

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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT ...
Rio Grande Floodway
San Acacia to Bosque del Apache Unit
Socorro County, New Mexico

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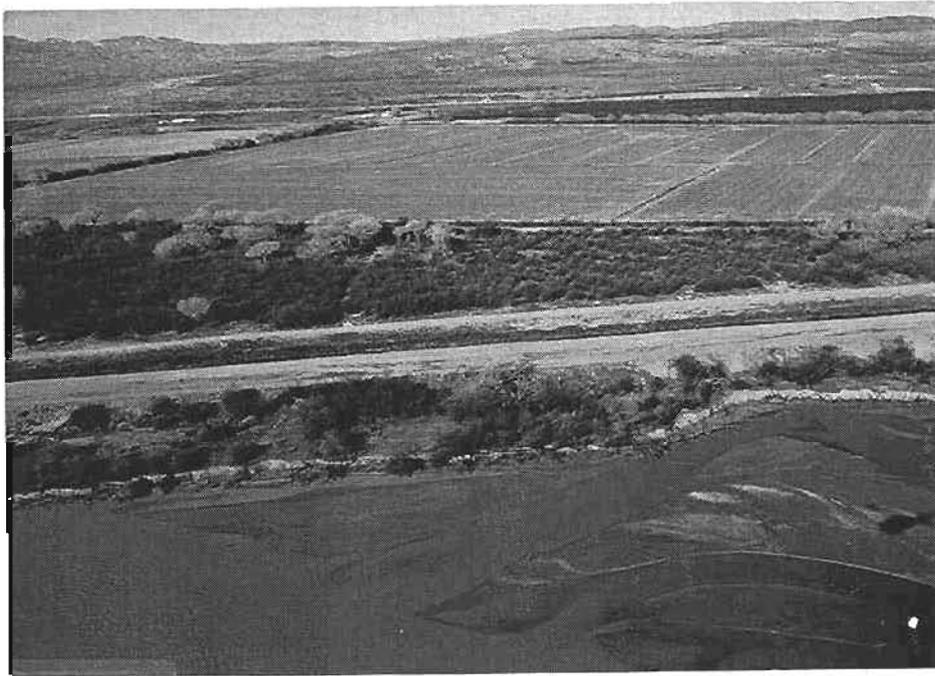


Photo 1 Characteristic features of project area. From bottom to top - river channel, riparian zone, spoil bank levee, conveyance channel, and floodplain vegetation and cultivated land.



Photo 2 Conveyance Channel and floodway. Note spoil bank levee between the two.

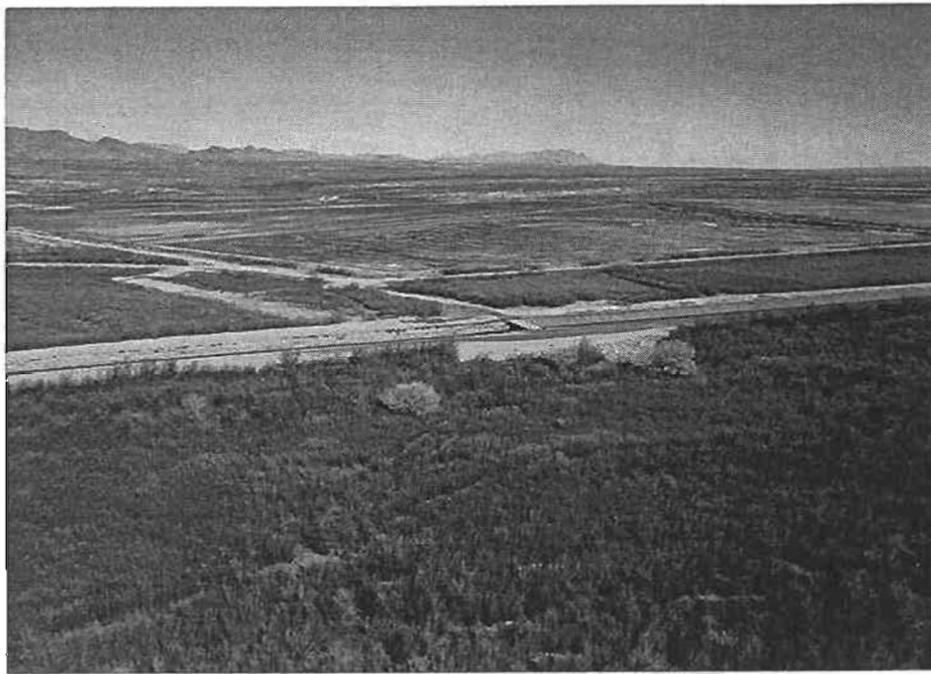


Photo 5 Waterfowl resting ponds at Bosque del Apache NWR. Conveyance Channel at center. Note extensive salt cedar stands that characterize much of lower project area.



Photo 6 Food plots at Bosque del Apache NWR.

APPENDICES

APPENDIX A
PUBLIC VIEWS AND RESPONSES

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and Wildlife Service, and Corps of
Engineers

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INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO

SEP 20 1990

OFFICE OF THE COMMISSIONER
UNITED STATES SECTION

Mr. Mark S. Sifuentes
Albuquerque District
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, New Mexico 87103

Dear Mr. Sifuentes:

Thank you for the opportunity to review and comment on the draft supplemental environmental impact statement (SEIS) for increased flood protection on the Rio Grande from San Acacia, New Mexico to the upper reaches of Elephant Butte Reservoir (even though the draft SEIS is entitled "Rio Grande Floodway, San Acacia to Bosque del Apache Unit, Socorro County, NM," apparently the Bosque del Apache Unit includes the reach to the upper portion of Elephant Butte Reservoir which is 15 miles downstream of the National Wildlife Refuge). The improvements would be achieved by replacing the existing spoil embankment paralleling the west side of the Rio Grande with a structurally sound levee capable of containing the 100-year flood event (the recommended alternative).

1. Jurisdictionally, the U.S. Section of the International Boundary and Water Commission is required by the convention of May 21, 1906 (TS 455; 34 Stat. 2953), to insure the annual delivery of 60,000 acre-feet of Rio Grande waters in accordance with a monthly schedule (Paragraph 4.17, page SEIS-39). We favor any action that protects the conveyance channel and that will not jeopardize the annual delivery of water to Mexico mandated by the 1906 treaty.
2. The relationship of alternatives table (Table 1, pages SEIS-3 and SEIS-4) contains much information that is not referenced or used in Section I -- Summary. It may not be understood how the Recommended Alternative is only "Processing in Progress" for both the Clean Water Act and the National Wildlife Refuge System Administration Act of 1966 when the other three alternatives are in fact indicated as at "Full" compliance. Also, Table 1 has an entree, "Continued Coordination," not defined in the table key.
3. As a matter of historical accuracy (Paragraph 4.52, page SEIS-52 and Appendix D, page 7), Elephant Butte Dam construction began in 1908, was delayed because of difficulty obtaining reservoir land, was restarted in 1912, and was completed in 1916. Storage operation began in 1915.

Thank you for the opportunity to review and comment on the draft SEIS.

Sincerely,

Conrad G. Keyes, Jr.
Principal Engineer, Planning

1. No response required.
2. The table on compliance is an integral part of SECTION I - SUMMARY. Concur with second sentence that the reader may not have fully understood how the recommended alternative is only "processing in progress" for both the Clean Water Act and the Wildlife Refuge System Administration Act when the associated alternatives indicate "full" compliance. The intent was that conditions for compliance would be met by the non-selected alternatives, but the actual procedure that the selected alternative must comply with to obtain a required product was underway. The definition of full compliance has been amended to improve understanding. Also, the "continued coordination" entree is defined in this final document.
3. The sentences in question have been modified to improve their accuracy.

United States
Department of
Agriculture

Soil
Conservation
Service

517 Gold Ave., SW
Room 3301
Albuquerque, NM 87102

September 27, 1990

Mr. Mark S. Sifuentes
Albuquerque District
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, New Mexico 87103

Dear Mr. Sifuentes:

4. We have reviewed the draft Supplemental Environmental Impact Statement (SEIS) planned to increase security for flood flows in the Rio Grande, extending from San Acacia, New Mexico, to the upper reaches of Elephant Butte reservoir. If planned measures are implemented as written, we have no concerns for this project.

4. No response required.

Thank you for the opportunity to review this SEIS.

Sincerely,



Ray T. Margo, Jr.
State Conservationist



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
SOCORRO RESOURCE AREA
198 Neel Ave., N.W.
Socorro, New Mexico 87801

September 25, 1990

IN REPLY REFER TO:
2000
6500 (038)

Mr. Mark S. Sifuentes
Albuquerque District
U. S. Corp of Engineers
P. O. Box 1580
Albuquerque, NM 87103

Dear Mr. Sifuentes:

After reviewing the Draft Supplemental Environmental Impact Statement, Rio Grande Floodway, we offer the following comments:

5. 1. Reference to page SEIS-46; first paragraph, Federally owned lands should also include isolated parcels under the administration of the Bureau of Land Management.
6. 2. Why does the existing earthen embankment levee need to be removed to be rebuilt? Could it not be modified or added to?
7. 3. If the toe of the 88-foot wide levee extends into the riparian area, how will you mitigate the loss of riparian habitat?
8. 4. Where will the new wetland area be located to mitigate the loss of the 900 foot by 40 foot area in the Milligan Gulch Wetland?
9. 5. Has the N. M. Department of Game and Fish been notified and/or consulted on this project?
10. 6. How are the Bald Eagle cottonwood roosting trees to be protected going to be identified along the river areas outside of Bosque del Apache National Wildlife Refuge?

Sincerely,

Harlen Smith
Area Manager

5. The Bureau of Land Management has been included as one of the land managing agencies.
6. All or part of the existing embankment does not meet design standards for an engineeringly competent levee that would withstand high floodflows. However, the refined design presented in this SEIS does retain a portion of the existing embankment.
7. Any loss of riparian vegetation, including salt cedar, will be mitigated by their replacement with native vegetation and, possibly, a wildlife conservation easement on existing plant communities with demonstrated high wildlife use. Wetlands will also be constructed because of their importance to riparian ecosystems and scarcity in the region.
8. The condition of the Mulligan Gulch Wetland is not known at this point because of continued inundation. However, it would not be affected by project construction. The levee rehabilitation project has the potential to assist in restoring its values either through the acquisition of needed water rights or to physically restore its values if degraded by sedimentation because of high water storage in Elephant Butte Reservoir.
9. The New Mexico Department of Game and Fish has been involved with this project both through its involvement with the Fish and Wildlife Coordination Act, meetings, and personal communication.
10. Bald eagle use of cottonwood trees along the levee alignment as roost trees is doubtful. However, aerial and pedestrian surveys would be accomplished to provide insurance. If a roost tree did exist that was determined to be of significant importance to the wintering eagles and no substitute roosting habitat were available, then design modifications would be made to retain this tree.



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

November 9, 1990

District Engineer
U.S. Army
Corps of Engineers
P.O. Box 1580
Albuquerque, New Mexico 87103

Re: Public Notice No. NM-OYT-0631, Construction and Rehabilitation of Levees
Adjacent to the Rio Grande and in Elephant Butte Reservoir from San
Acacia to Elephant Butte Reservoir

Dear Sir:

This is the report of the U.S. Fish and Wildlife Service (Service) on Public Notice NM-OYT-0631 dated August 17, 1990, concerning an authorization application for the Albuquerque District Corps of Engineers to discharge material into the river channel, old conveyance channel, adjacent wetlands, and Elephant Butte Reservoir during the construction and rehabilitation of levees adjacent to the Rio Grande and in Elephant Butte Reservoir from San Acacia to Elephant Butte in Socorro County, New Mexico.

This report has been prepared in accordance with the requirements of the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) and may be used in your public interest review (33 CFR 320.4) as it relates to protection of fish and wildlife resources. The following views and recommendations constitute the report of the Department of the Interior under 503 DM 1 on the subject permit application. This report has been coordinated with the New Mexico Department of Game and Fish.

The proposed project is located on the west bank of the Rio Grande extending 55 miles from the U.S. Bureau of Reclamation low-flow conveyance channel heading at the San Acacia Diversion Works to the end of the conveyance channel Elephant Butte Reservoir near San Antonio, Socorro County, New Mexico. Levee rehabilitation will be performed in Townships 1, 2, 3, 5 and 6 South, Range 1 East; Townships 5 and 6 South, Range 1 West; and Townships 7 and 8 South, Range 2 West.

The project involves construction and rehabilitation of approximately 55 miles of existing levee along the Rio Grande. Disposal of clean waster fill material and construction of portions of the levee will involve discharges into waters of the United States. Fills are to be placed in the river channel, old conveyance channel, adjacent wetlands, and Elephant Butte Reservoir.

The existing earthen embankment will be removed and rebuilt to produce a facility capable of withstanding high volume flows in the Rio Grande. The levee will be approximately 73 feet wide at the base and 16 feet high having a trapezoidal cross section with 1V:2.5H side slopes. The southern 20 miles of levee will have 1V:3H side slopes. Sections of the reconstructed levee will contain a drainage system to provide positive seepage control, and will be protected by Kellner jetty jacks at locations vulnerable to erosion from high stream velocities.

Five areas within waters of the United States may be filled during construction of the project.

1. River channel, Rio Grande: Surplus earth may be used to widen the existing stream bank and refill any borrow excavations located below the ordinary high water mark. Any fill material in the channel will be stabilized by mechanical means (Kellner jacks) and by establishing of native riparian vegetation.
 2. Abandoned section of the low-flow conveyance channel near Tiffany and San Marcial which contains wetlands: Temporary fills will be used to create work roads and platforms to support levee reconstruction in an area approximately 1.5 miles long by 40 feet wide. The toe of an 88-foot side levee may partially extend into the wetland. All temporary fills will be removed upon levee completion.
 3. Levee toe wetland¹ located in Elephant Butte Reservoir between spoil bank and conveyance channel: The widened levee base and/or construction roads will extend across this strip of wetland about 1.3 miles long and 40 feet wide.
 4. Elephant Butte Reservoir below elevation 4450.30 m.s.l. (USGS datum): Levee reconstruction along existing spoil bank (approximately 4.4 miles). The levee in this location will be 12 feet high with an 88-foot wide base (trapezoidal section), using approximately 600,000 cubic yards of random fill (silty sands).
 5. Mulligan Gulch wetland¹, an 18-acre area within Elephant Butte Reservoir west of the conveyance channel: Tie-back levee will follow the existing dike alignment, but will be wider which may cause the loss of a 900-foot by 40-foot area of wetland. Any loss of wetland at the terminal end of the project will be compensated by wetland expansion in conjunction with borrow activities.
- ¹ Wetlands in Elephant Butte Reservoir may have developed only recently due to long-term water storage in the reservoir. Low water levels could dry these areas.

The stated purpose of the project is to provide protection against the 100-year frequency flood to the city of Socorro, rural transportation and irrigation facilities, Bosque del Apache National Wildlife Refuge, and Bureau of Reclamation low-flow conveyance channel. A project objective is to avoid or minimize the removal and disturbance of edge vegetation along the riverward toe of the existing embankment, particularly native, cottonwood-dominated communities. The planned levee base width will be smaller than presently existing throughout a majority of the project area. Proposed dates of construction are from February 1992 to March 1995.

The project was authorized for construction by the Corps of Engineers as a unit of the Rio Grande Floodway by the Flood Control Act of 1948 (Public Law 80-858, Section 203). Funds for construction were never appropriated. In 1961, the U.S. Senate directed a further review of the 1948 comprehensive flood control plan, with particular reference to the Rio Puerco and Rio Salado. As a result of this review, construction of flood and sediment control dams on the Rio Puerco and Rio Salado was recommended in 1972 in lieu of the originally authorized levee rehabilitation. Subsequent advanced engineering and design studies were terminated when the State of New Mexico withdrew its support for the project because of costs and potential inundation of 300 acres of Sevilleta National Wildlife Refuge. As a consequence of the unfeasibility of dam construction, rehabilitation of existing levees was again evaluated.

Under provisions of the Fish and Wildlife Coordination Act, the Albuquerque Ecological Services Field Office has analyzed the project impacts on fish and wildlife habitat. In a Fish and Wildlife Coordination Act Report dated November 7, 1989, the following recommendations were made.

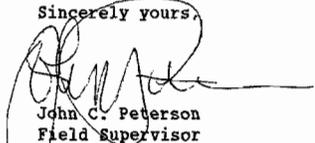
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| <p>11. 1. The basal width of the new levee shall be oriented as close as possible to the low-flow channel to reduce the loss of riparian/wetland habitat.</p> <p>12. 2. Existing roads shall be used to move equipment or haul fill. In areas where it is necessary to construct new roads, they shall be located on barren ground, areas where vegetation is sparse, or in monotypic saltcedar habitat. Palustrine forest and scrub-shrub habitats where cottonwood trees are a major component, as well as any palustrine emergent habitats shall be avoided.</p> <p>13. 3. Stockpile and equipment turnaround areas should be placed in barren areas. If barren areas are not available, monotypic stands of saltcedar shall be used.</p> <p>14. 4. If needed, borrow excavation sites shall be located in open areas or in monotypic stands of salt cedar. These borrow areas shall be modified to benefit wildlife.</p> <p>15. 5. All areas designated as temporary impact areas (haul roads, stockpile areas, turnarounds) shall be revegetated with cottonwood, willow, New Mexico olive and native</p> | <p>11. Concur.</p> <p>12. Although few new construction roads are envisioned, any constructed roads would be placed in plant communities or areas with low wildlife use to the maximum extent possible. Compensation measures would be implemented for any removal of wildlife habitat.</p> <p>13. As with the previous comment, few, if any, stockpile and equipment turnaround areas are anticipated outside the existing levee alignment and maintenance road. If necessary, they would be located in plant communities or areas with low wildlife use to the maximum extent possible. Compensation measures would be implemented for any removal of wildlife habitat.</p> <p>14. This recommendation would be implemented to the maximum extent possible.</p> <p>15. Concur. The Corps believes that sufficient knowledge is present on these revegetation methods so that additional study is not necessary.</p> |
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shrubs. Because these disturbed areas are often invaded rapidly by saltcedar, it may be necessary to suppress saltcedar until planted vegetation is established. A study should be conducted on the vegetative techniques, using pole plantings, rainfall harvesting and erosion blankets.

16. 6. Large cottonwoods that might die as a result of root damage from the placement of the levee toe shall be left in place, creating snags that provide a valuable habitat component for a variety of wildlife.
17. 7. Any cottonwood/willow/New Mexico olive habitat that is impacted will be mitigated at a 5:1 ratio. Additionally, any combination of these habitat, cottonwood, willow and Russian olive shall be mitigated at a 4:1 ratio. Barren and monotypic salt cedar areas will be mitigated at a 2:1 ratio.
18. 8. A detailed wildlife analysis, similar to the Hink/Ohmart study, shall be conducted for the entire project reach.
19. 9. Financial participation in modifying Bosque del Apache National Wildlife Refuge and local state refuges for the benefit of waterfowl and Federally endangered species, shall be accomplished. Plans for converting low value habitat at Bosque del Apache to high value riparian wetland habitat will cost 1.5 million 1989 dollars. Additionally, conversion of similar land at Bernardo or La Joya State Refuge will cost \$200,000 1989 dollars.

Provided the above measures are incorporated into the permit, the Service will not object to the issuance of permit NM-OYT-0631. If you have any questions, please call Chuck Mullins at 883-7877.

Sincerely yours,


John C. Peterson
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Refuge Manager, Bosque del Apache National Wildlife Refuge, Socorro,
New Mexico
Project Superintendent, Bureau of Reclamation, Albuquerque, New Mexico
Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife
Enhancement, Albuquerque, New Mexico

16. Concur.

17. The mitigation ratios developed by the Corps are based on wildlife use of the community structure type removed, the wildlife use of replacement vegetation and developmental stages through time, establishment success of replacement vegetation based on measures being accomplished at Bosque del Apache NWR, and absence of data related to long-term establishment success of compensatory planting measures. These ratios are similar to those recommended by the Service.

18. Because of the immediate proximity of the project area to that studied by Hink and Ohmart and studies by Raitt, et al. at the head of Elephant Butte Reservoir, no detailed wildlife studies were accomplished or are envisioned to be undertaken. Information obtained from these studies was applied to planning and design objectives, as well as mitigation measures and quantities.

19. Subsequent to this letter, the Service re-evaluated the use of Bosque del Apache NWR for use in project-related mitigation and enhancement purposes. The Service's request was to emphasize improvement and management of riparian habitat and de-emphasize use of Bosque del Apache NWR.



United States Department of the Interior



OFFICE OF THE SECRETARY
OFFICE OF ENVIRONMENTAL AFFAIRS
POST OFFICE BOX 649
ALBUQUERQUE, NEW MEXICO 87103

November 19, 1990

ER 90/790

Lt. Colonel Steven M. Dougan
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, New Mexico 87103-1580

Dear Colonel Dougan:

This responds to your letter to the Director, Office of Environmental Affairs, requesting our evaluation and comments on the draft supplemental environmental impact statement (SEIS) for the Rio Grande Floodway, San Acacia to Bosque del Apache Unit, Socorro County, New Mexico. The following comments are provided for your consideration.

GENERAL COMMENTS

20. Based on discussions between members of your staff and the Fish and Wildlife Service (Service), and comments received from other Interior Bureaus, we do not believe the statement, as written, adequately reflects impacts which can be anticipated under the proposed alternative. Also, the statement does not reflect modifications to the proposed project now under consideration. Although the presentation of "worst case scenario" impacts for the preferred alternative would appear to encompass similar impacts of any proposal scaled down from the preferred alternative, the recently discussed information that only segments of the existing levee may require reconstruction essentially presents a new action alternative that should be analyzed. The comments and questions we have listed below reflect our finding that the document is inadequate with respect to specific discussions of primary and secondary impacts of construction and operation
22. of the proposed levee. The data provided are confusing in their presentation and should be reviewed for technical accuracy before the document is finalized or rereleased for public review.
23. The local sponsor for operation and maintenance (O&M) should be identified in the SEIS. The local sponsor and the Bureau of Reclamation (Reclamation) should commit to signing a cost-sharing agreement which specifies the respective O&M roles before finalizing the SEIS. In light of our experience in maintaining the existing spoil bank levee in times of periodic high flows, we believe the cost-sharing agreement should address the occasional need for additional funds to perform extraordinary O&M activities resulting from damaging flows.

20. The draft SEIS reflects issues and effects raised during the plan formulation process, scoping for preparation of the draft EIS, and extensive coordination with the Fish and Wildlife Service as required by the Fish and Wildlife Coordination Act. The purpose of circulating the draft SEIS is to further the coordination effort so that the final EIS will reflect concerns to the maximum extent possible - in full compliance with the intent and spirit of NEPA.

21. An EIS is prepared when general design features are known. More refined design is recognized and the EIS strives to address all anticipated effects. The subject draft EIS recognized more refined design and this refinement has been occurring since public review of the draft EIS. This final EIS reflects very detailed design, although this level of analysis is unusual for a final EIS. This level of detail was done to assist the Fish and Wildlife Service in the preparation of a compatibility determination for levee construction to occur on Bosque del Apache National Wildlife Refuge.

Areas where the draft EIS did recognize the possibility of more refined design are: "...some sections (upper reaches) may meet structural standards and would only receive earth to achieve the desired dimensions" (SEIS-12, first paragraph, fifth sentence) and "...some embankment sections may not be appreciably modified" (SEIS-19, first complete paragraph, sixth sentence).

22. Inadvertant typographical errors will be corrected and clarity of data presentation insured.

23. Operation and maintenance of the completed project will be the responsibility of the local sponsor - the New Mexico Interstate Stream Commission. This responsibility will be part of the Local Cooperation Agreement with the sponsor. Any agreements made by the sponsor with another entity for operation and maintenance will be between these two entities.

24. The SEIS should also address fully the need to perform both routine and extraordinary O&M on the levee so that additional National Environmental Policy Act compliance will not be required before those activities can be performed. Extraordinary maintenance may include, for example, the need to raise the height of the levee in response to continuing aggradation of the riverbed of the adjacent Rio Grande, or the need to armor certain riverside segments of the levee to retard excessive scouring.
25. A related document, the draft General Design Memorandum, Appendix D (Local Cooperation Agreement), Article VIII, states that the local sponsor (as opposed to Reclamation) shall O&M the completed levee. Reclamation would O&M the completed levee, but cannot be considered the local sponsor. This discrepancy between the two documents must be correctly resolved in each document.
26. The document refers to Escondida Lake (page SEIS-66) which is north of the City of Socorro and provides recreational opportunities to local residents. It does not indicate if this recreation area will be impacted by the proposal. If impacts to the area are anticipated, compliance with Section 6(f) of the Land and Water Conservation Fund (L&WCF) Act should be initiated, since this area was improved with a matching grant from the L&WCF.
- The L&WCF Act of 1965, as amended, established a grant program which provides states with funds to acquire and develop public outdoor recreation lands and waters. The L&WCF is administered in each state by the State Liaison Officer (SLO), appointed by the Governor. In New Mexico, the SLO is Mr. Robert M. Evetts, Field Services Bureau Chief, Energy, Minerals and Natural Resources Department, P.O. Box 1147, Santa Fe, New Mexico 87504-1147. The SLO and park administrator should be contacted concerning potential impacts to these recreation resources.
- The L&WCF Act, Section 6(f), states that no property acquired or developed with assistance from the L&WCF shall be converted to other than public outdoor recreation uses without the approval of the Secretary of the Interior. If a conversion of use cannot be avoided, the SLO should be contacted to initiate the process for obtaining the Secretary's approval. Coordination efforts related to conversion should be documented.
27. The SEIS does not mention mineral resources. Our records, however, show that sand and gravel occur in the vicinity of the project and there are at least a dozen pits along Interstate Highway 25 about 1 mile east of the project area. Other mineral resource occurrences reported about 5 miles outside the project area, include barite, fluorite, calcite, uranium, silver, iron, perlite, and coal. Geothermal resources also occur in the area. We suggest that subsequent versions of the document describe mineral resources in the area and project impacts on them. If no adverse impacts are identified, a statement to that effect should be included.

24. The environmental effects of maintaining the project were discussed on page SEIS-88 of the draft EIS. This discussion has been expanded to include "extraordinary maintenance."

25. This final EIS reflects a corrected discussion.

26. The project would not affect Escondida Lake. The only way that Escondida Lake could be affected would be the possibility of expanding the existing pond to obtain additional earth for levee reconstruction. This action would be accomplished only with the consent and approval of the Secretary of the Interior, State of New Mexico, and the city of Socorro. However, the potential for pond/marsh expansion or creation is low, since no borrow needs are anticipated for the levee segment adjacent to Escondida Lake. The text of this final SEIS has been modified to reflect this fact.

27. A discussion of mineral resources in the vicinity of the planned project, their anticipated use, and foreseeable effects has been included in this final SEIS.

28. The discussion of mitigation alternatives and criteria should be expanded to specifically identify and quantify the areas delineated for mitigation.
29. These areas should be comprised of suitable locations throughout the proposed project area, not confined to the Bosque del Apache Refuge. Those advantages listed on pages 19 and 20 are not found only within the boundaries of the Refuge: compensation would still remain in the immediate project area; public land (as stated in paragraph (5) on page 16) is present throughout the majority of the area that would be required for project construction; the program of re-vegetation on the Refuge could be expanded to other lands with the expertise provided by Refuge personnel funded by the Corps of Engineers; the fire suppression program developed by the Refuge and other County, State, Federal, and local agencies is now, and will in the future be, just as responsive to fires off-Refuge as those occurring on-Refuge; and protection from grazing could also be provided on sites exterior to the boundaries of the Refuge. Some proposals for habitat creation would appear to require a water right in order to implement them. We suggest that the Army Corps of Engineers coordinate closely with the New Mexico State Engineer's Office to assure the feasibility of these proposals.
30. Specific sites for disposal of surplus earth (spoil) should be discussed in far greater detail than that provided on page 16. Placement, configuration, and re-vegetation potential (or lack thereof) render spoil sites a very difficult project-induced impact to mitigate. The document should be amended to state where these sites will occur. Additionally, the impact statement should be modified to state that there is very low to no potential for the placement of 252,000-cubic yards of spoil on the Bosque del Apache Refuge due to lack of access and lack of suitability as a substrate if the spoil consists of very sandy materials. We recommend that, wherever possible, the spoil be incorporated into levee construction throughout the proposed project area. Specific sites of spoil deposition exterior to the levee must be identified with concomitant mitigation measures identified to assure avoidance of wildlife habitat. If spoil is to be deposited on the riverward side of the levee, it would appear that all benefits expected to be derived from narrowing the levee and moving it closer to the low-flow channel would be negated by large quantities of surplus earth placed adjacent to the new levee in the riparian or flood-plain zone. This also raises questions which should be addressed in the document concerning the stability of these spoil areas during periods of flows within the flood plain and any subsequent impacts on water quality and downstream areas.
36. The lack of specific impact locations and perhaps inaccurate vegetative characteristics and values of the locations preclude adequate assessment of the extent and degree of impacts. Therefore, we do not believe that this document provides sufficient data with which to analyze or mitigate those impacts.

28. Mitigation quantities were stated in the draft SEIS and refined quantities presented in this final SEIS. Specific mitigation sites will be developed in conjunction with plans and specifications with the involvement of the Fish and Wildlife Service. Wetland mitigation would likely be accomplished in the Mulligan Gulch and Brushy Lake areas. However, specific sites are being held in abeyance until discussions among the Bureau of Reclamation, Corps of Engineers, and Fish and Wildlife Service to seasonally flood the stated areas to enhance wildlife use lead to more definitive measures.

29. This recommendation by the Service not to confine mitigation to Bosque del Apache NWR differs from compensation measures developed through extensive prior coordination with the Service. The selection of (and associated rationale) Bosque del Apache for implementing most mitigation (and associated rationale) was accomplished jointly by the Service and the Corps in full compliance with the Fish and Wildlife Coordination Act. The primary objective was to maximize wildlife benefits through existing management, thereby achieving a maximum return for the dollars invested. The Corps is agreeable to locating compensation measures within the riparian zone throughout the project area and will involve the Service in selecting areas that will maximize benefits to the riparian ecosystem. There are ample riparian areas where wildlife habitat can be improved. In reality, the degree of protection and management that can be provided on the Refuge may not be possible elsewhere.

30. Concur. Costs for the acquisition of water rights are a part of the total project cost and coordination of this issue will be maintained with the State Engineer's Office.

31. The refined design has reduced and incorporated surplus earth into levee reconstruction.

32. The potential for successful planting of riparian vegetation on surplus material used to fill borrow areas was based on several years of research by the Soil Conservation Service (funded by several agencies, including the Corps) on the selection and development of high quality riparian plantings (particularly cottonwood and willow trees) and planting techniques. Also, research associated with large-scale planting of riparian vegetation at Bosque del Apache NWR demonstrates that the sandy earth that would be disposed of would be a highly adequate substrate. Refined design has essentially removed the potential for surplus earth and, accordingly, the need for revegetation.

33. The final SEIS will so reflect. This offer was made in a spirit of cooperation to assist with potential Refuge needs - and only if the material were suitable with Refuge requirements.

34. The refined design incorporates almost all of the anticipated surplus into the new levee.

35. The possibility of using some (not large quantities) surplus earth in places where the river channel is immediately adjacent to the levee was based on the desirability of providing a buffer between the river and levee to protect the levee from the scouring affects of high velocity flows. As stated in the draft SEIS, this material would have been stabilized by using jetty jacks and vegetation. While this measure would have created additional cottonwood and willow forest (without degrading water quality), disposal areas are no longer required, rendering this issue moot.

36. Comment 36 continued.

36. The precise location detail that is requested is not normally provided in an Environmental Impact Statement. An Environmental Impact Statement has never been intended as the forum for presentation of detailed technical data, but rather as a concise document used to plan actions, make decisions, and inform the public of the rationale used in formulation of alternatives and the analysis of associated effects. The plant communities and associated wildlife that were described in the draft SEIS were based on vegetation surveys and studies done in the middle Rio Grande valley (both field survey and literature review). In addition, areas that would be affected or possibly affected were defined in the field, together with the Fish and Wildlife Service. This level of analysis was considered highly sufficient to analyze the major effects of the recommended plan and associated alternatives. The draft SEIS recognized that as design features were refined, the level of impact analysis would also be refined. This document reflects this refined analysis. Effects of levee rehabilitation on riparian vegetation were analyzed at 264-foot intervals along the planned levee alignment, except on Bosque del Apache, where one-tenth mile increments were used.

37. The impact statement should provide an acceptable standard to determine the adequacy of mitigation over time. Specifically, we recommend that all mitigation dealing with reestablishment of mature riparian communities be directed toward ensuring 80 percent survival of vegetation 5 years hence.

As stated on page 70 (paragraph 5.04) of the document, a major benefit of the recommended action is increased protection to the low-flow conveyance channel and its water conveyance and salvage functions. Indeed, the benefits of that protection alone account for approximately 75 percent of the total benefits accrued to the proposed project. The primary function of the low-flow conveyance channel is the removal of all low flows from the natural river bed for transport downstream. For these reasons, we view the proposed project and the potential to once again dewater the Rio Grande downstream from the San Acacia diversion dam as inextricably linked. The discussion of those secondary, or indirect, impacts of the project must be included in the impact statement.

38. We believe that, in order to be a complete analysis of impacts, the document should be expanded to address these secondary impacts of operation of the low-flow channel in relationship to the increased commitment of state, local, and Federal agencies to conserve the high natural resource values of the Rio Grande corridor. The specific and very real threats to the river's ecosystem of developmental pressures, habitat fragmentation, and lack of regeneration to replace senescent trees, do not appear to have been addressed in the consideration of impacts for this proposed project. Incorporation of such goals as diversification of present flood control and water conveyance purposes to encourage regeneration of the cottonwood-dominated riparian forest, wetland restoration, vegetation management, and biological diversity; improvement of aquatic habitat, and the increase of public awareness of the significance and ecological and cultural values of the river corridor would greatly enhance the impact statement.
39. During a September 26, 1990, meeting with the Army Corps of Engineers and other interested agencies, the Town of Socorro expressed an interest in identifying areas along the riverine corridor (including the Rio Grande floodway and levee) to serve as "greenways." We are supportive of this concept. However, before a commitment in the SEIS to a "greenway" can be made, the issue and identification of who, or what authority will provide the funding for O&M, administration, and management of these areas for public use must be determined. Additionally, since public access would be permitted and encouraged, the issue of Government liability must be fully addressed and resolved prior to finalizing the SEIS. Finally, the proposed greenways themselves and public accessibility must be compatible with requirements to maintain the levee and floodway.
40. We are concerned about the criteria utilized in determining relative values of existing vegetative habitats for selection of borrow areas. On page 14, the greatest value is attributed to mature native habitats while early growth stages of the same native habitat is considered a suitable borrow selection site. These young stands are very important as they will one day replace mature senescent stands. The major objective of avoidance of the more mature cottonwood- and willow-dominated plant communities to focus

37. Current research and experience with re-establishment of native riparian vegetation is not sufficient to develop standards for establishment. Ongoing re-establishment programs by the Service, Bureau of Reclamation, and the Corps are being monitored and this information will be used to provide the highest establishment rate possible. Density of plantings will assist in achieving an establishment goal.

38. This statement reflects a misunderstanding of the purpose of the recommended plan, the purpose of the low-flow conveyance channel, and the current condition of the conveyance channel. As stated, the purpose of the proposed project is to provide a higher level of flood protection to floodplain developments than the current spoil bank levee (or embankment). Protected development does include the conveyance channel and its function to minimize water transmission losses by diverting flows up to 2,000 c.f.s. from the Rio Grande. Protection of this facility is a major project benefit. However, the proposed action has no "potential to once again dewater the Rio Grande downstream from the San Acacia diversion dam..." The reason the conveyance channel has not been in operation for several years is because of ongoing repair, both of the conveyance channel proper and the spoil bank levee. This repair is needed to remove extensive sedimentation caused by high water storage in Elephant Butte Reservoir and to reconstruct breaks in the spoil bank levee caused by flood flows in the Rio Grande. Operation of the conveyance channel will resume once repairs are made - independent of the planned action. A reconstructed, engineered levee would appreciably reduce the potential for levee failure and associated damage to the conveyance channel from the Rio Grande. Relevant discussions in the draft SEIS have been refined in this document to reflect these facts.

39. This final SEIS has been expanded to include a discussion of an Initiative began by Senator Pete Domenici since public review of the draft SEIS to develop measures to "perpetually protect and wisely manage" the resources of the Middle Rio Grande corridor. Many of the goals of the planned action are shared by the Initiative - a reasonable parallel, since the Corps assisted in the development of the Initiative. Consistent with the added discussion of the Initiative, this document addresses the inter-relationship of the proposed action and alternatives with the Initiative. However, this EIS will not be the forum for an exhaustive discussion of the environmental effects of the low-flow conveyance channel. The effects of this facility are reflected only to the extent that they are related to the planned action - directly, indirectly, and cumulatively.

40. The Corps' participation in the development of a "greenway" in the Socorro area would consist of assisting in the identification of potential areas for greenway establishment, incorporating features (access ramps, gates, parking, etc.) into levee design that would contribute to the greenway plan, possible wetland creation, and construction of cost-shared (50/50) recreation facilities (e.g., trails). The O&M administration and management of these areas and facilities, including associated funding, would be the responsibility of the local sponsor (who may work with another governmental agency). This extent of Corps' participation is reflected in this document. Concur that the greenway development must be compatible with requirements to maintain the levee and floodway.

41. As reflected in the draft SEIS, wildlife use of the various community/structure types was based on many riparian studies, primary among which was Hink and Ohmart and Rait, et al.. These two studies are most pertinent to this reach of the Rio Grande. Some areas with young cottonwood were selected as candidate

Comment 41 continued.

borrow areas above Tiffany not only because of their low wildlife use, but because of the ability to rapidly restore or enhance their growth stages by revegetation with cottonwood and willow poles...Also, the potential for natural revegetation would still exist. Since the need for borrow areas above Tiffany has largely disappeared, no disturbance in previously proposed borrow areas would occur.

impacts on open, sparsely vegetated areas and early growth stages would save old stands, but would accomplish nothing for early seral stages or natural regeneration processes. By including no action that would increase opportunities for seed bed creation and seed germination, the proposal would limit future riparian communities to merely survivors of the construction and "one-shot" mitigation operations. "Open" areas should be described in more detail. These could consist of saltgrass meadow openings which constitute some of the rarer habitat types in the entire riparian system. However, the impact statement provides insufficient information to judge.

42. Although the document repeatedly states that impacts to the river itself would not occur (see our comment No. 5 regarding secondary impacts), it does refer to construction in the river bed. All necessary steps should be taken to ensure the survival of diminishing populations of aquatic life native to the river. Of primary consideration should be the Rio Grande silvery minnow (*Hypognathus amarus*).
43. We believe that, as they are phrased, the references to the required compatibility determination on the Bosque del Apache Refuge are somewhat misleading (page 23, (12)(c); page 30, Table 5; page 50, 1st incomplete paragraph). As indicated in coordination meetings with your staff, the Service has not yet completed an assessment of compatibility; they were awaiting project details to be provided in this document. As indicated in the comments provided, they will require further and more detailed information on vegetative impacts of levee construction, borrow site development, and spoil disposal prior to assessing compatibility of your proposal with the purpose for which the Refuge was established.
44. It is somewhat disturbing to note that, although this project would entail continuing annual funding and staff for operation and maintenance of the levee, mitigation is only considered on a one-time basis. Commitment to continued maintenance of riparian communities required to mitigate habitats destroyed or degraded through project construction and operation is considered essential.

SPECIFIC COMMENTS

45. Summary page, 2nd Paragraph: Is the figure 171 acres inclusive of the 46 acres discussed in the succeeding sentence?
46. Page 12, Item (e): The figures 3.0 to 3.5 acres of disturbance on the Bosque del Apache National Wildlife Refuge (Refuge) do not reflect the 22 acres discussed on page 14. The discussion of 3.0 to 3.5 acres of disturbance should be clarified to indicate disturbance caused by specific construction actions as opposed to borrow or spoil areas.
47. Service reconnaissance of the current levee right-of-way on the Refuge indicates that the 3.0 to 3.5 acres of impacted vegetation estimated in this document is unrealistic and should be expanded. Based on that reconnaissance, we question the accuracy of the quantification throughout

42. Since more refined design has largely eliminated the need for borrow on disposal sites near the river, no direct or indirect impact on the silvery minnow should occur.

43. Since a Compatibility Determination has been provided by the U.S. Fish and Wildlife Service, this wording is no longer necessary and has been removed.

44. Part of the rationale developed by the U.S. Fish and Wildlife Service and the Corps for putting much of the mitigating on Bosque del Apache NWR was to include mitigation as part of an ongoing maintenance program. Its incorporation into an ongoing program would have reduced maintenance costs while maximizing benefits (for the Refuge also). However, maintenance of established mitigation areas outside of Bosque del Apache NWR would be made an O&M requirement.

45. (This comment addresses the Abstract rather than the Summary). Yes. This final SEIS reflects revised acreage figures as well as improved sentence clarity.

46. Correct. The 3.0 to 3.5 acreage figure was specific to edge disturbance as well as salt cedar. Correspondingly, the 22 acres discussed on page 14 (and elsewhere) of the draft SEIS was discussed under the heading of "Fill and Borrow Requirements." The material was in the format suggested.

47. A detailed assessment (one-tenth mile intervals) of the amount and composition of vegetation that would be lost on Bosque del Apache NWR as a result of the project, showed that 3.47 acres of vegetation, primarily salt cedar, would be lost due to project construction. An additional acre was added as a buffer to compensate for any unforeseen losses. This assessment was jointly accomplished by Refuge and Corps' personnel. The refined figure demonstrates that the original assessment and estimate were accurate.

the proposed project area. Additionally, the impact statement categorizes this acreage as salt cedar vegetation. It is our observation that much of the levee toe vegetation on the Refuge that would be impacted consists of desirable cottonwood, black willow, and associated understory species in varying stages of maturity.

48. Page 14, Item 2(a): The discussion within the first three sentences is unclear. If the project total is 7,300,000 cubic yards, 90 percent of this figure is 6,570,000 cubic yards. The remaining 10 percent of this total would be 730,000 cubic yards - the 3,848,000 figure of the next sentence far exceeds this 10 percent figure.

The addition of the specific cubic yardage figures in this paragraph sums to 2,835,000. This figure coincides with neither the 3,848,000 figure listed in this paragraph nor the figure of 2,848,000 in Table 2, page 15.

Addition of the acres needed for borrow areas discussed in this paragraph yield a total of 219 - this conflicts with the figure of 272 acres in Table 2, page 15.

49. Page 15, 1st paragraph: The total of 221 acres for borrow areas (171 from riparian zones and 50 from upland terraces) does not agree with either the 219 acres on page 14 or the 272 acres in Table 2.
50. Page 22, 1st paragraph: The discussion provided in this paragraph confuses riparian restoration techniques with moist soil management. The latter is a very different management action aimed at producing natural wetland foods for wildlife.
- We recommend that this paragraph be deleted.
51. Page 46, (2) Land Ownership: The Bureau of Land Management administers considerable acreage in Socorro County and should be included in this discussion.
52. Page 48, Footnote: This should be corrected to state that the Refuge is managed for migratory birds rather than waterfowl.
53. Page 62, Items (b) (1) and (2): Refuge data indicated that white-faced ibis and ferruginous hawk occurrences are more common and populations larger than indicated here.
54. Page 63, Item (9): The Bosque del Apache Refuge is currently considering an investigation of the distribution, abundance, and habitat needs of the meadow jumping mouse. It may be possible to expand the research with Corps of Engineers funding to address the project area.

48. Confusion resulted from the fact that 9,124,000 cu. yds. should have been used rather than 7,300,000 cu. yds. The former figure is the uncompacted volume, the latter figure is the compacted, in place, volume. Also, the amount of required borrow should have been 2,848,000 cu. yds, not 3,848,000 cu. yds. - a regrettable typographical error. Refined quantities are presented in this document.

49. The acreages stated in the draft SEIS are correct. When adding separate acreage figures, the excavation depth (in parenthesis to the right of the given acreage) must be taken into consideration - especially the 50-acre figure used for borrow from the terraces. Fifty acres are required for an excavation depth of 13.5 feet. Twice this area, 100 acres, are necessary for an excavation depth of 6.5 feet. This document reflects refinements to these figures.

50. Concur.

51. This paragraph has been modified to include the Bureau of Land Management, as well as other Federal land administrators.

52. The wording has been changed.

53. Additional data supplied by Bosque del Apache NWR has been included.

54. The possibility of a joint investigation of the distribution, abundance, and habitat needs will be coordinated with Bosque del Apache NWR. Multiple agency participation in studies maximizes data collection while lowering individual agency costs.

SUMMARY COMMENTS

In summary, we recommend that the Draft Supplemental Environmental Impact Statement be revised to:

55. a. specify impact areas and quantify all analyses of impacts and effects.
56. b. correct identified discrepancies of acreage figures for all impacts.
57. c. commit mitigation efforts to all areas throughout the proposed project area, not just the Bosque del Apache Refuge.
58. d. discuss the relationship and possible conflicts of the proposed action with increased commitment of resource agencies to conserve and enhance the resources of the Middle Rio Grande corridor.
59. e. provide adequate information of sufficient detail to the Fish and Wildlife Service for use in determining the compatibility of the proposed project with the purposes for which the Bosque del Apache Refuge was established.

If the above concerns are adequately addressed, we believe the final statement will satisfactorily describe the existing resources of the project area and the expected impacts that would be realized by the proposed activities.

Sincerely,



Raymond P. Churan
Regional Environmental Officer

55. The refined design features reflected in this document will correspondingly define affected areas and quantify effects.

56. The final SEIS reflects refined project design and data.

57. This change in the position of the Fish and Wildlife Service from what was expressed to the Corps during plan formulation is agreeable.

58. Concur.

59. This recommendation has been accomplished with the Service's issuance of a Compatibility Determination to the Corps.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202-2733

OCT 15 1990

Mr. Mark S. Sifuentes
Albuquerque District
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, New Mexico 87103

Dear Mr. Sifuentes:

In accordance with our responsibilities under Section 309 of the Clean Air Act, the National Environmental Policy Act (NEPA), the Council on Environmental Quality Regulations for Implementing NEPA, and Section 404 of the Clean Water Act, the Region 6 Office of the U.S. Environmental Protection Agency (EPA) has completed its review of the Draft Supplemental Environmental Impact Statement (SEIS) for the proposed levee rehabilitation project planned to increase security for communities and human welfare, water conveyance facilities, and the Bosque del Apache National Wildlife Refuge from flood flows within the Rio Grande, extending from San Acadia, New Mexico, to the upper reaches of Elephant Butte Reservoir.

This enhanced flood protection would be achieved by rehabilitation of the existing levee embankment that parallels the west side of the Rio Grande with a designed, competent levee, capable of containing the 100-year flood event. The existing earthen levee will be removed and rebuilt. The levee will be approximately 73 feet wide at the base and 16 feet high having a trapezoidal cross-section with 1V:2.5H side slopes.

The majority of the levee rehabilitation work will be outside waters of the United States and not subject to regulation under the Clean Water Act. For those areas of unavoidable impact, mitigation is provided which includes revegetation of disturbed areas and expansion of old and creation of new wetland habitats. Coordination has been performed with the U.S. Fish and Wildlife Service under both the Fish and Wildlife Coordination Act and Section 7 of the Federal Endangered Species Act. The Service has concluded that the project with the proposed mitigation measures should adequately minimize and compensate unavoidable environmental impacts.

60. We classify your Draft SEIS as Lack of Objections (LO). Specifically, we have no objection to the levee rehabilitation project as proposed. Sufficient screening has occurred to insure environmental impacts will be avoided, minimized, and properly mitigated where unavoidable.

60. No response required.

Our classification will be published in the Federal Register according to our responsibility to inform the public of our views on the proposed Federal

actions, under Section 309 of the Clean Air Act.

We appreciate the opportunity to review the Draft SEIS. Please send our office one copy of the Final SEIS at the same time it is sent to the Office of Federal Activities, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460.

Sincerely yours,



Robert E. Layton Jr., P.E.
Regional Administrator



GOVERNOR
GARREY CARRUTHERS

DIRECTOR AND SECRETARY
TO THE COMMISSION
BILL MONTOYA

State of New Mexico



DEPARTMENT OF GAME AND FISH

VILLAGRA BUILDING
SANTA FE
87503

STATE GAME COMMISSION

GERALD MAESTAS, CHAIRMAN
ESPAÑOLA

RICHARD A. ALLGOOD
SILVER CITY

CHRISTINE DIGREGORIO
GALLUP

BOB JONES
DELL CITY, TX

J.W. JONES
ALBUQUERQUE

October 16, 1990

Lt. Colonel Steven M. Dougan
Albuquerque District Engineer
U. S. Army Corps of Engineers
P. O. Box 1580
Albuquerque, New Mexico 87103-1580

Dear Colonel Dougan:

61. The Department of Game and Fish (Department) has reviewed the Section 404 permit application (NM-OYT-0631) by the Army Corps of Engineers (ACOE) for authorization to construct and rehabilitate 55 miles of levees between the Rio Grande and the Low Flow Conveyance Channel (LFCC) from San Acacia to Elephant Butte Reservoir in Socorro County. Fills associated with the project are proposed to be placed in the Rio Grande channel, the old LFCC, adjacent wetlands and in Elephant Butte Reservoir. The stated purpose of the project is to provide protection against the 100-year frequency flood to the city of Socorro, rural transportation, irrigation facilities, the Bosque del Apache National Wildlife Refuge (NWR) and the LFCC operated by the Bureau of Reclamation. The Department has also reviewed the ACOE's draft Supplemental Environmental Impact Statement (SEIS) for the Rio Grande Floodway, and our comments are based on the information provided in that document.
62. The Department has had little input in the development of the levee project. Attached are our February 17, 1989 comments on the draft Fish and Wildlife Coordination Act Report for this project. In neither the final Coordination Act Report by the U.S. Fish and Wildlife Service (USFWS) or in the draft SEIS are
63. the Department's concerns fully addressed. The issue of mitigation has been apparently settled between the ACOE and the USFWS with most mitigation measures accruing to Bosque del Apache NWR's "ongoing program of replacing monotypic stands of salt cedar with native riparian species" (p. SEIS 19). Successful re-establishment of the native vegetation is beneficial to wildlife; however, funding by the ACOE of operation and maintenance costs on the refuge does not mitigate habitat loss from the levee project, it only accelerates an existing program.

61. Although the Department of Game and Fish (Department) cites the Corps' Section 404 Permit Application under the Clean Water Act, a majority of comments made are in response to the draft SEIS; therefore, these comments are included as part of the final EIS.

62. The Corps of Engineers has relied heavily on the joint coordination of the Department and the U.S. Fish and Wildlife Service through the Fish and Wildlife Coordination Act. However, this dependence on a combined response does not relieve the Corps of its responsibility to insure that the Department has direct input into project formulation. Subsequent to field-level review of the draft SEIS, meetings were held with Department representatives on October 23 and November 5, 1990, and January 5, 1991. Concerns expressed at these meetings have been considered in project plans and are reflected in this document.

63. The location of sites for mitigation is flexible, consistent with good management of public funds. A recent change in the position of the Fish and Wildlife Service not to necessarily put a majority of mitigation features on Bosque del Apache NWR has resulted in their relocation in the riparian zone.

October 16, 1990

64. The Department requests that areas outside of the refuge be purchased, protected and/or enhanced as habitat for fish and wildlife. The success of the proposal to create higher value in existing wildlife habitat on the refuge is speculative and at best, may only meet the habitat requirements of those wildlife species targeted by the refuge. The justification for mitigating on the refuge (pp. SEIS 19-20) highlights the need for additional protection of wildlife habitat outside of the
65. refuge boundaries. The entire Rio Grande corridor should be emphasized for protection and management, not just the convenient areas already managed.

Flood protection for the Bosque del Apache NWR is stated as a justification for the levee project throughout the SEIS. In fact, flooding at the refuge is described as a potential

66. biological disaster (p. SEIS 71). The Department does not agree with this scenario, especially since waterfowl, cranes and other wildlife derive benefit from flood events. An active floodplain and its vegetative expression are the reasons why the high concentration of wildlife is found along the Rio Grande and on the refuge.
67. The greatest biological impacts will occur upon completion of the levee project, when the LFCC is in full operation. The SEIS on page 26 states, "A major objective of levee reconstruction is to provide higher degrees of flood and associated sediment production to the low-flow conveyance channel, thereby providing higher levels of insurance that its critical water salvage and delivery functions are maintained."
68. Although these are associated projects, no discussion of the long-term or cumulative impacts derived from these projects are discussed. The National Environmental Policy Act and the Council for Environmental Quality regulations require the incorporation of related actions into one impact statement [40 CFR 1502.4(a), 1508.7, 1508.25(a)]. Issues associated with the combined projects are the periodic drying up of the Rio Grande, elimination of aquatic habitat diversity, the loss of recently developed wetlands and the establishment of a 55-mile barrier to terrestrial wildlife movement across the floodplain.

The above issues, and those found in the attachment, need to be addressed by the ACOE. Until these issues can be resolved, the Department cannot support the Rio Grande Floodway Levee Project as it has been presented in this permit application.

Sincerely,



Bill Montoya
Director

BM/CSP/mlm
Att.

64. This request is consistent with refined mitigation objectives and plans. Elements of this request will likely be implemented.

65. Concur. The Corps supports this goal and is a partner in promoting its protection, conservation, and enhancement. The recently recommended project can make some small contribution toward this goal, but it is of such magnitude that only a coalition of parties can begin to handle its implementation.

66. Concur that waterfowl, cranes, and other wildlife can benefit from flooding. However, Bosque del Apache NWR is a highly developed facility, having an extensive irrigation and water delivery system, appreciable cropland, and numerous ponding areas. The time and monetary expenditures in constructing and maintaining these systems is appreciable and a significant part of the wildlife value of the Refuge is dependent on water delivery and management. As stated in the draft SEIS, the sedimentation that accompanies major flooding events could seriously impair Refuge operations and wildlife benefits, requiring significant expenditure of funds to restore the function of this facility.

67. Reconstruction of the spoil bank levee and resumed use of the low-flow conveyance channel are not related. The conveyance channel has not been used for several years due to its filling with sediment at its terminal end, which was caused by high water storage at Elephant Butte Reservoir. Resumed operation will occur with or without levee reconstruction.

68. The projects are associated to the same degree that every other development (and person) in the 100-year floodplain is, i.e., the reconstructed levee will provide a higher level of protection from large magnitude flood flows in the Rio Grande. This protection will preserve development, life, and normal functions, and conserve the tremendous cost of repairing flood damage. The continued presence and function of the conveyance channel is not dependent on the project. The project would serve to save the tremendous costs of restoring the function of the conveyance channel should flood waters enter the channel, as well as maintaining water deliveries required by the Rio Grande Compact and the 1906 treaty with the Republic of Mexico.

The association of levee rehabilitation with the low-flow conveyance channel and the cumulative and long-term effects of this association are reflected in this final SEIS.

GOVERNOR
GARREY CARRUTHERS

DIRECTOR AND SECRETARY
TO THE COMMISSION
BILL MONTOYA

State of New Mexico



DEPARTMENT OF GAME AND FISH

VILLAGRA BUILDING
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DELL CITY, TX

J.W. JONES
ALBUQUERQUE

November 26, 1990

Lt. Colonel Steven M. Dougan
Albuquerque District Engineer
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, New Mexico 87103-1580

Dear Colonel Dougan:

This letter serves to summarize the comments of the Department of Game and Fish as discussed in the two meetings conducted by your staff regarding the Draft Supplemental Environmental Impact Statement for the Rio Grande Floodway. These meetings, held on October 23 and November 5, 1990, were also attended by the New Mexico Environment Improvement Division and U.S. Fish and Wildlife Service, respectively. These comments are provided to support and further clarify those issues presented in our October 16, 1990 correspondence.

69. **Additional alternatives should be evaluated.** Recommended are measures that address just the "weak points" in the levee, not total levee reconstruction. Weak point analyses should include 25, 50, 75 and 100-year flood protection increments. Also, these actions could be incorporated with zoning measures to provide added long-term protection in development areas. The benefits of weak point and non-structural flood control measures include less physical and biological disturbance, and are more cost effective.

70. **Minimize width of levee wherever rehabilitated and realigned.** This was proposed in the DEIS; however, the ACOE has since proposed spoiling excess levee material adjacent to the levee in those locations previously occupied by the wider structure. The placement of the spoil material adjacent to the levee is opposed by the Department. The unconsolidated spoil material will have the potential to erode into the Rio Grande floodplain during flood events if placed east of the levee. Also, the potential of a narrower levee to provide additional

69. The Corps is required, by regulation, to examine alternatives which provide various levels of flood protection and select the plan which provides the greatest net benefit. For this project, the 100-year level of protection provides the greatest net benefit. The entire existing embankment was examined for areas which may be adequate to provide this level of protection and not require rehabilitation. It was determined the entire length needed some type of reconstruction; however, most of the reconstruction is only a partial removal and replacement of the existing landside embankment. This was done in an effort to minimize impacts to the riverside slopes of the existing levee.

70. The refined design retains a significant amount of vegetation that is on the riverside slope for approximately 44 of the levee's 54.3 miles. The disposal of surplus earth on the riverward sideslope of the reconstructed levee and adjacent to the riverward levee toe to form a riverbank were two of several possible disposal sites discerned in the draft SEIS (page SEIS-16, third paragraph). These sites would have been limited in extent and located only where no vegetation existed. Also, protection against scouring would have been provided by planting native riparian vegetation. Since more refined design accommodates surplus material as an integral part of the levee, the reason for this concern no longer exists.

November 26, 1990

- area for bosque development (a benefit given in the DEIS) will not be realized. It is incumbent upon the ACOE to minimize the detrimental biological impacts whenever the opportunity exists. This is particularly relevant to
71. this project, the goal of which is to protect and perpetuate the operation of the Low Flow Conveyance Channel which has significantly impaired the biological integrity of the Rio Grande and its floodplain.
 72. **All staging and temporary spoil storage areas need to be identified.** Inherent in the method of reconstructing the levee in one mile increments is the development of temporary areas of storage and equipment access. These areas can be significant depending upon the habitat, acreage and duration of impact.
 73. **Long-term monitoring and maintenance of mitigation measures need to be incorporated into the project.** This is especially important for revegetation and artificial wetland creation. The uncertainties of climate, flow regimes and anthropogenic influences mandate establishing a contingency for mitigation failure during the life-time of the levee. Contingency planning and costs should be incorporated within the operation and maintenance program for the levee.
 74. **Mitigation actions should be employed along the length of the levee and as close to site impacts as feasible.** Situations may exist whereby this will not be possible and off-site mitigation will be required. The Department will continue to work with the ACOE and USFWS to locate suitable mitigation sites. Also, non-structural mitigation measures such as conservation easements need to be explored. Measures that protect and enhance the Rio Grande corridor will provide greater long-term benefits.
 76. **Include an evaluation of the Low Flow Conveyance Channel (the primary beneficiary) as it relates to this project.** Again, this is required under NEPA for related or synergistic projects. The cumulative impacts of the two projects, both for the near and long-term, need to be presented.

Please contact Chris Pease (827-9907) of this office should you have any questions or require further coordination.

Sincerely,



Bill Montoya
Director

BM/csp

A-22

71. The objective of the project is to provide a higher level of flood protection to development and life in the 100-year floodplain. The low-flow conveyance channel is a major feature that would be protected, as is Bosque del Apache NWR. However, the continued functioning of the conveyance channel is not dependent on the project. The project would save the expenditure of large sums of money to restore the channel in the event a large flood event breached the existing spoil bank, as well as preventing the interrupted delivery of water to downstream owners as required by law. Continued operation of the conveyance channel is an institutional concern. These facts are reflected in this document.

72. Temporary storage areas for earth (fill or excess) should be accommodated within the construction area between the conveyance channel and the edge of the riparian zone. No areas within the riparian zone are envisioned. Staging areas may be located within the construction zone or the contractor may, at his discretion, select areas west of the conveyance channel that are privately owned. Since the contractor may elect to find his own staging area, identification of these areas is not possible.

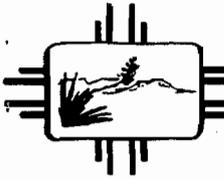
73. Concur that monitoring and maintenance of mitigation measures should be an integral part of the project. Therefore, the maintenance of established mitigation measures will be made an operation and maintenance requirement.

74. A change in the position of the Fish and Wildlife Service regarding the use of Bosque del Apache NWR for a majority of mitigation measures and subsequent meetings has resulted in a combined decision to locate most mitigation measures within the riparian zone and as close to the area affected as feasible.

75. The purchase of land south of Bosque del Apache NWR, or purchase of conservation easements, or both, and incorporation into the Refuge would enhance the wildlife value of the Refuge, as well as increasing its management flexibility. However, under the current administration, the purchase of land for mitigation is not encouraged if other options are available that avoid the taking of land. Further discouraging land purchase is the complex land ownership below the Refuge. Conservation easements above the Refuge holds promise and this measure has been included as an objective of the mitigation plan.

76. Please refer to response number 71.

A-22



New Mexico Health and Environment Department

GARREY CARRUTHERS
Governor
DENNIS BOYO
Secretary
MICHAEL J. BURKHART
Deputy Secretary
RICHARD MITZELFELT
Director

CERTIFIED MAIL # P 612 425 408
RETURN RECEIPT REQUESTED

16 October 1990

Mr. Mark R. Andrews
Albuquerque District Corps of Engineers
P.O. Box 1580
Albuquerque, NM 87013

SUBJECT: Water Quality Certification for Activity Proposed Under Permit
Application No. NM-OYT-0631, Dated August 17, 1990

Dear Mr. Andrews:

Pursuant to section 401(a)(1) of the federal Clean Water Act, the Surface Water Quality Bureau has examined an application from the Army Corps of Engineers for State certification of a section 404 permit to place dredged material into the mainstem of the Rio Grande and Elephant Butte Reservoir. The proposed project is located in Socorro County, on the Rio Grande mainstem the project extends for 55 miles from the San Acacia Diversion works to the head of Elephant Butte reservoir and within the reservoir at the mouth of Milligan Gulch. The proposed project involves rehabilitation of existing spoilbank levees and reconstruction of 4.8 miles of levees below the maximum water surface of Elephant Butte Lake. The stated purpose of the project is to provide protection against the 100-year frequency flood event.

The Bureau has determined that the proposed project is located in segments 2-105 and 2-104 of the Rio Grande Basin as described in the "Water Quality Standards for Interstate and Intrastate Streams in New Mexico as Amended Through March 8, 1988". Designated uses for which the mainstem is protected include irrigation, limited warmwater fishery, livestock and wildlife watering and secondary contact recreation. Elephant Butte reservoir is protected for irrigation storage, livestock and wildlife watering, primary contact recreation and warmwater fishery.

- ENVIRONMENTAL IMPROVEMENT DIVISION -
Harold Runnels Building
1190 St. Francis Dr.
Santa Fe, New Mexico 87503

A-23

A-23

Mr. Mark R. Andrews
16 October 1990
Page Two

The Bureau has reviewed the description of the proposed activity and is concerned that, as proposed, this activity may adversely affect surface water quality to an extent which will impair the fishery and primary contact recreation designated uses. This concern is due to potential and likely exceedances of State water quality standards at section 2-102.A., 2-102.J. and 2-104.B. Information was not presented on methods or techniques which will be used to limit sedimentation and turbidity during construction. Under authority delegated to the Environmental Improvement Division by the New Mexico Water Quality Control Commission, the State of New Mexico finds that this discharge, as proposed, will not comply with any or all of the applicable provisions of the federal Clean Water Act (i.e., sections 301, 302, 303, 306, or 307) and with appropriate requirements of State law. The State of New Mexico therefore issues section 401 certification for application NM-OYT-0631 on a conditional basis subject to our later review and approval of the following items which are specifically included in this certification: 1) The Corps shall develop a plan to limit stream bottom alteration due to sedimentation resulting from the filling operations, 2) The Corps shall develop a water quality monitoring plan and implementation strategy which will assure attainment of State water quality standards for turbidity, and 3) The Corps shall provide detailed information on the methods to be used in the proposed mitigation of wetland losses or alteration. The Bureau will be happy to work with Corps staff in these efforts.

The State of New Mexico specifically reserves the right to amend or revoke this certification if such activity is necessary to insure attainment of the designated uses for this surface water. Please address any questions concerning this permit to Mr. David Coss of my staff at (505) 827-2829.

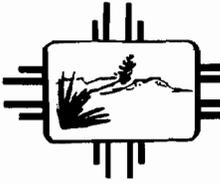
Sincerely,



Jim Piatt
Chief
Surface Water Quality Bureau

xc: Members of the New Mexico Water Quality Control Commission
District Manager, Environmental Improvement Division
District Engineer, U.S. Army Corps of Engineers
Susan Alexander, NPS Coordinator, Region VI, EPA

77. Refinements in project design since public review of the draft SEIS will largely remove situations whereby any direct or indirect contact would be made with water in the Rio Grande or conditions created that would degrade water quality during the life of the project. Therefore, no project-associated activity is anticipated that would adversely effect surface water quality to an extent that would impair the fishery and primary contact recreation designated uses. Coordination will be maintained with the Surface Water Quality Bureau to insure these concerns are adequately satisfied.



New Mexico Health and Environment Department

See following letter.

GARREY CARRUTHERS
Governor
DENNIS BOYD
Secretary
MICHAEL J. BURKHART
Deputy Secretary
RICHARD MITZELFELT
Director

December 10, 1990

Mr. James White
Albuquerque District
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, NM 87103

Dear Mr. White:

My staff reviewed your Draft Supplemental Environmental Impact Statement, Rio Grande Floodway: San Acacia to Bosque del Apache Unit (Corps of Engineers, Albuquerque District: August 1990), and expressed a number of concerns, as stated in the attached memorandum from the Surface Water Quality Bureau.

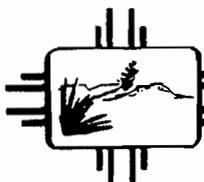
I concur in full with the views expressed by my staff. Please let me know if you have any questions.

Sincerely,

Richard Mitzelfelt
Director

RM:GC/mdg
Attachment

cc: Jim Piatt
David Coss
Gedi Cibas



New Mexico Health and Environment Department

GARREY CARRUTHERS
Governor

DENNIS BOYD
Secretary

MICHAEL J. BURKHART
Deputy Secretary

RICHARD MITZELFELT
Director

MEMORANDUM

TO: Gedi Cibas, Program Support Bureau

THROUGH: Jim Piatt, Acting Chief, Surface Water Quality Bureau

FROM: *DC* David Coss, WRS II, Surface Water Quality Bureau

RE: Draft Supplemental Environmental Impact Statement, Rio Grande
Floodway: San Acacia to Bosque del Apache Unit. EID File # 567
ER

DATE: November 21, 1990

Staff of the Surface Water Quality Bureau have reviewed the above referenced draft environmental impact statement (EIS) prepared by the US Army Corps of Engineers, Albuquerque District. The project discussed in the EIS involves construction and rehabilitation of approximately 55 miles of existing levee along the Rio Grande. The existing earthen embankment will be removed and rebuilt to produce a facility capable of withstanding high volume flows in the Rio Grande.

78. As described in the draft document, the proposed project would not meet State water quality requirements. Although the Corps states on page 85 that there will be no water quality impacts, staff believes that in a project of this magnitude, operating near and, in some cases, within the Rio Grande channel, there is significant potential for water quality impairment. The Corps of Engineers has received conditional Section 401 certification from EID for a Section 404 permit needed to undertake this project. Conditions imposed by EID included the following:
79. 1. The Corps shall develop a plan to limit stream bottom alteration due to sedimentation resulting from the filling operations.
80. 2. The Corps shall develop a water quality monitoring plan and implementation strategy which will assure attainment of State water quality standards for turbidity.
81. 3. The Corps shall provide detailed information on the methods to be used in the proposed mitigation of wetland losses or alteration.

Staff has met with Corps representations to discuss these conditions. The Corps is in the process of revising the EIS supplement to better address water quality concerns raised by the Division. Until these concerns are fully satisfied, the Division should continue to oppose the project.

78. The Corps of Engineers has reassured the potential of the planned project (as refined) to affect water quality and has concluded that water quality in the Rio Grande, the low-flow conveyance channel, and irrigation canals would not be affected. This conclusion is based on minimal contact with surface water, minimal (if any) borrow needs in the riparian and floodplain zones, design measures to prevent scouring of levee sideslopes, and stringent contractual requirements to prevent contamination of surface water. In essence, the fact that construction efforts would be away from the main channel and construction activities have to be accomplished in relatively dry conditions, essentially removes the opportunity for construction activities to have any effect on water quality.

79. Refined project design does not include disposal of surplus earth in or near the stream channel. The current plan will be coordinated with the Environment Department prior to construction to insure all concerns are resolved.

80. As stated, the construction plans will be coordinated with the Environment Department prior to construction to access the need for water quality monitoring and to insure State concerns are addressed.

81. Concur.

82. As stated, the potential to degrade water quality is low and the Corps will continue to coordinate with the Environment Department to insure all concerns are resolved. All water quality concerns raised by the State are addressed in this document.

NEW MEXICO

SCR-2

STATE CLEARINGHOUSE FINAL REVIEW CERTIFICATION

DATE: September 14, 1990

TITLE: Rio Grand Floodway-US Army Corps of Engineers Albq.

APPLICANT: San Asacia to Bosque del Apache Unit Socorro Cnty NM
Socorro County, New Mexico

STATE APPLICANT IDENTIFIER (SAI) NUMBER: NM 90-08-22-368

FEDERAL CATALOG NO: _____

FEDERAL AGENCY: _____

FINAL REVIEW

83. PROPOSED ACTION IS SUPPORTED.

PROPOSED ACTION IS NOT IN CONFLICT WITH STATE, AREAWIDE OR LOCAL PLANS.

COMMENTS ARE ATTACHED FOR SUBMISSION WITH THIS PROPOSED ACTION.

TO THE APPLICANT:

YOU MAY NOW SUBMIT YOUR APPLICATION PACKAGE, THIS FORM, AND ALL REVIEW COMMENTS TO THE FEDERAL OR STATE AGENCY (IES) FROM WHOM ACTION IS REQUESTED.

PLEASE NOTIFY THE STATE CLEARINGHOUSE (SINGLE POINT OF CONTACT) OF ANY CHANGES IN THIS PROJECT. REFER TO THE SAI NUMBER ON ALL CORRESPONDENCE PERTAINING TO THIS PROJECT.

Aurilia Hernandez
 STATE-POINT-OF-CONTACT

9/14/90
 DATE

83. No response required.

COLLEGE OF AGRICULTURE AND HOME ECONOMICS

DEPARTMENT OF FISHERY AND WILDLIFE SCIENCES
P.O. Box 30003, Campus Box 4901
Las Cruces, New Mexico 88003-0003
Telephone (505) 646-1544



October 12, 1990

Mr. Mark S. Sifuentes
Albuquerque District
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, NM 87103

Dear Mark:

I have reviewed your draft Supplement Environment Impact Statement (SEIS) with interest.

84. I am concerned about disturbance of high value to wildlife young and old stages of cottonwoods and meadows and would hope that vegetation disturbance would be almost entirely be restricted to salt cedar sites (low quality wildlife habitat).
85. Sandbars and adjacent shallow water in the river are important night roost sites for wintering sandhill and whooping cranes. I would hope that some of this habitat would be perpetuated particularly in the vicinity of the Bosque del Apache National Wildlife Refuge.
86. The projected area to be impacted seems to be too low and therefore mitigation acreage would be inadequate.
87. Overall I commend you for your obvious concern to avoid wildlife habitat losses.

Sincerely yours,

Handwritten signature of S.D. Schemnitz in cursive.

S.D. Schemnitz
Professor
Wildlife Science

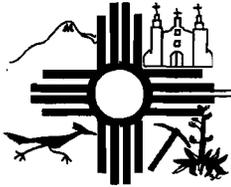
SDS:taj

84. A primary planning objective is to avoid or minimize disturbance to vegetation communities/structures that have high wildlife use. Lower value salt cedar stands would be selected over native plant communities with the objective of restoring these areas with the higher value cottonwood and willow communities. The decreased need for borrow reduced the potential for disturbing cottonwoods and meadows, but correspondingly reduced the opportunity to replace salt cedar with higher value cottonwood and willow.

85. Project construction would not likely affect river channel characteristics and associated night roosting of wintering sandhill and whooping cranes. The scheduling of project construction in the immediate vicinity of Bosque del Apache NWR to avoid the cranes' overwintering stay should further reduce any project-associated disturbance.

86. The area of habitat that could be affected that was presented in the draft SEIS was carefully calculated based on project requirements. Where refined data was not available, then a worst reasonable analysis was employed. Area figures presented in this document are based on refined design features and detailed analysis of affected vegetation, e.g., effects of levee reconstruction were assessed at 200- and 264-foot intervals.

87. No comment necessary.



CITY OF SOCORRO

RAVI BHASKER
MAYOR

111 SCHOOL OF MINES ROAD
P.O. DRAWER K
SOCORRO, NEW MEXICO 87801
(505) 835-0240

GEORGE PATRICK SALOME, JR.
CITY CLERK

October 15, 1990

Mr. Mark S. Sifuentes
Albuquerque District
U.S. Army Corps of Engineer
P.O. Box 1580
Albuquerque, New Mexico 87103

Re: Middle Rio Grande Floodway, San Acacia to Bosque del Apache
Unit Levee Project

Dear Mr. Sifuentes:

Pursuant to your correspondence of August 15, 1990 regarding the distribution of the Corps' Draft Supplemental Environmental Impact Statement on subject Levee project, and subsequent to our meeting at the Bosque Del Apache Wildlife Game Refuge on September 26, 1990, submitted herewith are the City's views on the EIS and comments regarding the meeting.

In order to be consistent with the activity by The City of Socorro regarding the project, I need to refer to City Clerk Pat Salome's and my meeting with you in Albuquerque on August 2, 1988 for input to the EIS. As I stated at the September 26th meeting, the City's concerns were very well addressed in the draft EIS.

On August 23, 1990, Mayor Ravi Bhasker, City Clerk Pat Salome, Felix Torres and I met with Mr. Phil Norton and John Taylor of the Bosque Del Apache Wildlife Game Refuge at City Hall in Socorro. Several issues concerning the EIS were discussed including the suggestion by The City that another meeting with representatives from the Army Corps of Engineers, The City of Socorro, Bosque Del Apache Wildlife Game Refuge, County of Socorro, Bureau of Land Management, Bureau of Reclamation, Middle Rio Grande Conservancy District and others was needed prior to responding to the EIS.

Mayor Bhasker agreed that Mr. Norton of the Bosque Del Apache take the lead and call the meeting for the Bosque Del Apache facility.

The following comments as addressed in August 1988 by City Clerk Salome and myself, and again on September 26, 1990 and as addressed in the draft EIS reflect the City's views and needs.

1. FLOOD HAZARDS, August 2, 1988

88. Cleaning and/or removal of all obstructions from the existing flood control channel. Materials removed will be utilized for the rehabilitating of the present earthen embankment on the west side of the river.

September 26, 1990

89. a. In addition to cleaning and/or removing all obstructions, I recommended that a borrow-pit be located within the flood control channel to effect removal of all re-usable materials for construction of the new levee.
90. b. Re-align the eastern-most part of the channel in a south-easterly direction so as to effect a self-cleaning process from all run-off.

2. COMMENTS ON THE 50/100 YEAR RAINFALL, FLOOD PLAIN

a. August 2, 1988

91. The need to provide for proper drainage facilities upon implementation of the work plan as provided for in the City's City-Wide Drainage Study that was prepared in September 1982 at a cost to the City of \$45,165.45 - Subject work plan having been estimated at (1982 prices) \$2,320,000.00

b. September 26, 1990

Mr. Mark Sifuentes' remarks alluded to the need to include in the EIS, the recommendation the City-Wide Drainage Study provide for future implementation of the project by the City of Socorro.

c. September 26, 1990

I again addressed, and complemented Mr. Sifuentes for the inclusion of all of the issues as presented by the City in the EIS, and added that the recently established Flood Plain by the Federal Emergency Management Agency (FEMA) were causing some concerns and problems to City Government and some citizens of Socorro, such as in the construction of homes as an example, and that hopefully, with the construction of the levee, that the Flood Plain would change.

88. There will be some removal of accumulated sediment and obstructions from the mouth of the flood control channel as part of the construction of tie-back levees at this location. However, removal of any remaining sediment and obstructions is an operation and maintenance feature to be accomplished by the city of Socorro.

89. As stated, some material would be removed from the mouth of the channel. However, the need for additional material to reconstruct this segment of levee is negligible, largely eliminating the need to develop any borrow sources.

90. The channel was intentionally designed to decrease flow velocities entering the Rio Grande. Accompanying a reduction in velocity is sediment deposition. Periodic removal of accumulated sediment as an operation and maintenance feature was a component of the flood control channel.

91. The Corps of Engineers does not have the authority to address local storm drainage problems and, consequently, is outside the scope of the planned action.

Corps of Engineers, San Acacia to Bosque Del Apache Leeve. Page 3

Some discussion was held regarding the level of our streets versus the level of the Rio Grande. The level of Manzanares Street in front of the Val Verde Hotel was discussed as well as El Camino Real and other areas in the Flood Plain.

3. LAND USE AND RECREATIONAL RESOURCES, OPPORTUNITIES AND NEEDS.

August 2, 1988

92. a. Implementation by the City of Socorro in it's Comprehensive Plan's Land Use Policy, the provision for recreational facilities such as walk-ways, bike, horse trails, picnic grounds, etc;, in the Bosque, and;

The provision of additional ponds for recreational use, such as the Escondida (4-mile) lake could be developed during the construction of the Rio Grande Leeve.

September 25, 1990

93. As reported at the meeting at the Bosque Del Apache, the City of Socorro has contacted the State Highway and Transportation Department, The State Forestry Division and State Park and Recreation Division of the Energy, Minerals and Natural Resources Department on the possibility of implementating the "Adopt A Highway" Program, "Beautification Program", and "Open Space Program" which have to do with the planting of trees, shrubbery and plants along our Highway and by-ways.

Additionally, it's concievable that such programs could be integrated with the Army Corps of Engineers' construction project of the Rio Grande Leeve, within the City's jurisdictional areas..

92. As reflected in the EIS, cost-shared recreational features such as those mentioned can be an integral part of the flood control project. Because refined project design largely eliminates the need for additional material for levee construction, the potential to develop ponds in this reach has appreciably decreased. If a need does arise, the Escondida area will receive high priority.

93. A certain amount of landscaping/beautification can be included as a part of the planned action. However, this feature would have to be within the general project area.

Corps of Engineers, San Acacia to Bosque Del Apache Leeve. Page 4

4. COST SHARING PER SECTION 103, WATER RESOURCES ACT OF 1986

Subsequent to a correspondence to Ravi Bhasker, Mayor, City of Socorro dated September 17, 1990 from Mr. Carl L. Slingerland, Secretary, New Mexico Interstate Streams Commission, and same subject issue of cost sharing as addressed on September 26, 1990 by Mr. Mark Andrews of the Corps of Engineers at the Bosque Del Apache meeting:

Bennie Barreras, speaking for the City of Socorro suggested that the City could participate by joining the Interstate Stream Commission and/or U.S. Army Corps of Engineers in a lobbying effort to either the New Mexico Legislature and/or our Congressional Delegation in Washington for the cost-sharing funds needed by the New Mexico Interstate Stream Commission

On May 26, 1987 The City of Socorro contacted the Honorable Jeff Bingaman, Pete Domenici, Bill Richardson, Joseph Skeen, and Manuel Lujan asking for their assistance in the construction of subject levee. The same could take place now.

Thank you again for offering the City the opportunity to comment. If we can be of further assistance, please do not hesitate to call.

Sincerely,


Ravi Bhasker,
Mayor, City of Socorro

ATTEST:

Pat Salome, City Clerk

cc: Carl L. Slingerland, Secretary
New Mexico Interstate Stream Commission
Felix Torres, City of Socorro

RB/PS:bb

LAW OFFICES
HUBERT & HERNANDEZ, P.A.

STEPHEN A. HUBERT
STEVEN L. HERNANDEZ
BEVERLY J. SINGLEMAN
LEE E. PETERS

2100 NORTH MAIN STREET
SUITE 1
R.O. DRAWER 6220
LAS CRUCES, NEW MEXICO 88006-6220
TELEPHONE (505) 526-2101

No response necessary

August 28, 1990

District Engineer
U.S. Army Corps of Engineers
ATTN: CESWA-ED-PE
P.O. Box 1580
Albuquerque, New Mexico 87103

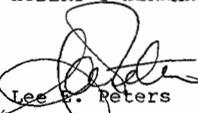
RE: Draft Supplemental Environmental Impact Statement Regarding
Enhanced Flood Protection in Rio Grande From San Acacia to
Elephant Butte Reservoir

To Whom It May Concern:

Pursuant to the notice published in the Las Cruces Sun News on
August 24, 1990, please send to this office a copy of the Draft
Supplemental Environmental Impact Statement for the planned
measures to provide enhanced flood protection to flood plain
communities, water conveyance facilities and Bosque del Apache
National Wildlife Refuge from large magnitude flows in the Rio
Grande extending from San Acacia to the upper reaches of Elephant
Butte Reservoir. Thank you for your assistance.

Sincerely,

HUBERT & HERNANDEZ, P. A.



Lee E. Peters

LEP/srd

MEETINGS HELD IN RESPONSE

TO

REVIEW OF DRAFT SEIS

Issues and Responses

September 26, 1990, Multiple Agency Meeting at Bosque del Apache NWR.

Agencies with representatives are as follows:

U.S. Fish and Wildlife Service (Bosque del Apache NWR)
City of Socorro
New Mexico Interstate Stream Commission
Bureau of Reclamation
Middle Rio Grande Conservancy District
Bureau of Land Management
Corps of Engineers

Concerns and recommendations expressed at this meeting are as follows and are reflected in this document.

Comment: Include floodplain maps and various flood frequencies in the SEIS.

Response: The large number of maps precludes their inclusion, but can be obtained on request.

Comment: Discuss project effects on FEMA (Federal Emergency Management Authority) building restrictions.

Response: These effects are discussed in this document.

Comment: Discuss the alternative of a dam on the Rio Puerco.

Response: This issue is discussed in this document.

Comment: Consider leaving structurally competent sections of the existing embankment and using surplus to overbuild levees.

Response: This alternative is evaluated in this document.

Comment: Expand the discussion of operations and maintenance features and associated funding.

Response: This discussion has been expanded.

Comment: Discuss the open space plan being developed by the city of Socorro.

Response: This plan and the inter-relationship of the planned action are included.

Comment: Consider incorporating access and egress features for livestock use into levee design.

Response: This issue is currently being coordinated with the Bureau of Reclamation and the Middle Rio Grande Conservancy District.

Comment: Address public use of the reconstructed levee and associated public safety.

Response: These issues have been addressed in this document.

Comment: Provide more detailed discussion on the funding of operation and maintenance activities for the completed project.

Response: This discussion has been expanded.

October 23 and November 5, 1990, Meetings with New Mexico Health and Environment Department, New Mexico Department of Game and Fish, and Corps of Engineers.

Concerns and recommendations expressed at these meetings are as follows and are reflected in this document.

Comment: Include approximate number of processing sites and acreage.

Response: Any need for processing sites could largely be accommodated in the area between the riparian woodland and conveyance channel. Therefore, the riparian area should not be affected.

Comment: Include wording regarding the inclusion of construction methods to meet water quality standards.

Response: While project construction should have little, if any, water contact and project features are designed to resist erosion, appropriate wording has been included in this document.

Comment: Avoid placing surplus soil on the riverward side of the levee.

Response: The refined levee design does not include this disposal measure.

Comment: Avoid any disturbance to the river channel that could potentially have an adverse effect on the silvery minnow.

Response: Concur. No project features should affect the silvery minnow.

Comment: Increase coordination of state endangered and threatened species.

Response: Updating of State endangered and threatened species for the final SEIS was accomplished with the N.M. Department of Game and Fish.

Comment: Prior to the filling of any wetland, a survey for the New Mexico jumping mouse should be performed.

Response: This commitment was made in the draft SEIS and would be accomplished prior to construction.

Comment: Include wording in EIS that measures will be taken to insure State water quality standards are maintained.

Response: Appropriate wording has been included in this document.

Comment: Consider moving mitigation (compensation) from Bosque del Apache NWR to the riparian zone, preferably close to Bosque del Apache NWR. Consider acquiring a conservation easement within the riparian zone and land purchase south of Bosque del Apache NWR, with management by the Refuge. Consider combining conservation easement with Socorro Valley Park, Bosque del Apache NWR, or both.

Response: These recommendations have been considered, made part of the compensation plan where possible, and are reflected in this document.

Comment: Evaluate effects of providing structural (levee) protection to only selected areas of floodplain development.

Response: This subject is discussed in this document.

Comment: Mitigation for wetland losses should be at a two-for-one ratio.

Response: Because of the low quality of wetlands that would be filled and the anticipated higher value of replacement wetlands, a one-for-one replacement ratio was selected. Wildlife use of replacement wetlands should more than double.



STATE OF TEXAS
RIO GRANDE COMPACT COMMISSION
EL PASO

JACK HAMMOND
COMMISSIONER

October 10, 1990

Lt. Col. Steven M. Dougan
District Engineer
U S Army Corps of Engineers
Albuquerque District
P.O. Box 1580
Albuquerque, New Mexico 87103-1580

Dear Colonel:

In response to the public notice regarding the proposed construction and rehabilitation of the levees adjacent to the Rio Grande from San Acacia to Elephant Butte Reservoir I request that a public hearing be held regarding this proposed project. The site of this meeting should be in the Las Cruces/ El Paso area.

Sincerely,

A handwritten signature in black ink, appearing to read "Jack", written over the word "Sincerely,".

Jack Hammond

JH/tlb

A meeting was held in Las Cruces, New Mexico, on December 11, 1990, in response to this request by Mr. Jack Hammond for a public hearing to discuss the proposed project and draft Supplemental Environmental Impact Statement. Major concerns expressed at this meeting and accompanying responses are summarized and presented in the following pages. Federal, State, and local governmental agencies represented are as follows:

- Corps of Engineers
- Fish and Wildlife Service
- Bureau of Reclamation
- International Boundary and Water Commission
- New Mexico Interstate Stream Commission
- State of Texas Rio Grande Compact Commission
- New Mexico Department of Agriculture
- Middle Rio Grande Conservancy District
- El Paso, Texas, City/County Health District
- Elephant Butte Irrigation District
- El Paso County Water Irrigation District No. 1
- Elephant Butte Lease Lot Association

Mr. Jack Hammond, Commissioner for State of Texas Rio Grande Compact Commission

Comment: The 100-year level of flood protection is not adequate and should be greater.

Response: The Corps is required, by regulation, to examine alternatives which provide various levels of flood protection and select the plan which provides the greatest net benefit. For this project, the 100-year level of protection provides the greatest net benefit.

Comment: Trace heavy metals and radionuclides resulting from mining in the Grants' uranium belt could be present in the sediment carried by the Rio Puerco and pollute the water supply in Elephant Butte Reservoir. In addition to flood hazard problems and quantity of sediment, the quality of sediment being deposited into Elephant Butte Reservoir should be of major concern.

Response: Concur with this concern. Coordination among the New Mexico Environment Department and U.S. Geological Survey demonstrates a similar concern and need for related testing to determine if any threat to human health exists. Coordination among concerned parties is ongoing to investigate this concern.

Comment: The proposed project would accelerate the rate of sediment deposition in Elephant Butte Reservoir by increasing stream velocities and scouring of the streambed. This scouring will move potentially contaminated sediments at the mouth of the Rio Puerco into Elephant Butte Reservoir, potentially endangering the water supply for almost two million people and contaminating extensive farmland below the Reservoir.

Response: The planned project would not have any significant effect on sediment transport in the Rio Grande nor the rate of sediment deposition in Elephant Butte Reservoir. While there would be localized changes in sediment transport characteristics in the Rio Grande relative to pre-project conditions, there would not be any significant increase in sedimentation within Elephant Butte Reservoir. The short duration of major flood events transports insignificant amounts of sediment relative to normal flows of long duration, which are the prime conveyors of sediment.

Comment: A dam on the Rio Puerco (and on the Rio Salado, if possible) in concert with the proposed levee project, would appreciably reduce continuing sediment transport into Elephant Butte Reservoir, as well as reduce potential health hazards.

Response: In response to this request and the support of the Texas Congressional Delegation, steps are being taken to initiate a reconnaissance-level study into these concerns. These concerns and resultant measures to address these concerns are reflected in this document.

Comment: Evaluate the potential of borrow material to release any contaminants present.

Response: Little potential exists for any contaminants to be released since relatively little borrow would be obtained from the riparian zone or contiguous floodplain.

Comment: Evaluate the effect of acid rain on radionuclides and heavy metal concentrations in runoff and subsequent effects on crops downstream of Elephant Butte.

Response: This concern will be evaluated as part of a reconnaissance-level study for the Rio Puerco. As stated, the planned action would not appreciably affect sediment transport and water quality.

Mr. Ed Fifer, El Paso County Irrigation District No. 1

Comment: A lot of money has been spent getting water to El Paso and the City is currently developing the Rio Grande as a source of municipal water supply. If water delivery and quality could be affected, then the City may have to change its direction.

Response: As stated, the planned action would not affect water delivery or quality. A planned reconnaissance study of the feasibility of a dam on the Rio Puerco would address potential threats to human health and welfare from any heavy metals and radionuclides contributed by the Rio Puerco.

Comment: How does the project benefit water users below Elephant Butte Dam?

Response: The planned action, through its increased protection of the conveyance channel and its water delivery and salvage function, would appreciably assist in perpetuating the agricultural economy of southern New Mexico and the El Paso and Juarez areas that are critically dependent on water storage at Elephant Butte Reservoir for irrigation. The conveyance channel salvages, on the average, 71,000 acre-feet of water annually that also helps fulfill water delivery commitments to Texas and Mexico.

Mr. W.O. Gary, Elephant Butte Irrigation District

Comment: The District has to comply with the Clean Water Act and if there is a potential to degrade water quality, then the District has to address this issue.

Response: Please see first response to Mr. Ed Fifer.

Mr. Conrad Keys, Jr., International Boundary and Water Commission

Comment: All concerned downstream water users need to make a financial commitment to support any additional study proposals that are suggested.

Response: Concur. Cost sharing would not be required for a reconnaissance-level study, but 50-50 (Federal/Non-Federal) cost sharing for any subsequent feasibility study would be necessary.

Mr. Gary Esslinger, Elephant Butte Irrigation District

Comment: A dam on the Rio Puerco would reduce sedimentation of Elephant Butte Reservoir and resultant depletion of storage capacity for irrigation water and eventual need to raise Elephant Butte Dam.

Response: As stated, a reconnaissance-level study into the feasibility of a dam on the Rio Puerco is being addressed. This study will address continuing storage depletion at Elephant Butte Reservoir.

January 5, 1991, Meeting with Fish and Wildlife Service, New Mexico Department of Game and Fish, and Corps of Engineers

Concerns and recommendations expressed at this meeting are as follows and are reflected in this document.

Comment: Locate mitigation measures near areas where losses occurred.

Response: This will be done to the extent practicable. As stated, the mitigation area that was mutually decided upon during project formulation by the Service and the Corps was to use Bosque del Apache NWR. The mitigation plan subsequently developed by the Department of Game and Fish, Fish and Wildlife Services, and Corps of Engineers is to utilize the riparian zone throughout most of the project area for mitigation purposes.

Comment: Include maintenance of mitigation measures as a part of operation and maintenance responsibilities, including a replacement level that should be attained.

Response: Concur. The operation and maintenance responsibilities will include the mitigation measures.

Comment: Evaluate alternate plans for disposal of surplus earth.

Response: Refined project plans incorporate surplus earth into levee design.

Comment: Include a section in the EIS discussing irreversible or irretrievable commitment of resources which will be involved in the development of the project.

Response: This topic has been included in this final SEIS.

Comment: Consider design alternatives of reconstructing only critical sections of levee and a combination of structural and non-structural alternatives.

Response: These alternatives were included in the draft EIS and have been revisited for clarity and accuracy.

Comment: Refrain from disposing of surplus earth on the riverward levee sideslope and in the channel.

Response: Refined levee design incorporates the relatively small amount of surplus earth into the reconstructed levee.

Comment: Put details of pole planting technique into EIS.

Response: While detailed technical descriptions are not normally a part of an EIS, a concise description of this technique has been included in this final SEIS.

Comment: Include conservation easements as a component of mitigation.

Response: An easement for wildlife conservation has been made an objective compensation plan, primarily upstream of Bosque del Apache NWR. This objective would be implemented if possible. Complex land ownership below the Refuge seriously discourages any opportunity to pursue this option.

Comment: Emphasis should be placed on finding the best place to locate mitigation measures.

Response: The objective of mitigation measures and sites has been to maximize riparian ecological attributes on both a short- and long-term basis. This objective continues, consistent with economic, social, and institutional constraints.

Comment: Address the effects of confined flows on the regeneration of cottonwoods.

Response: These effects have been addressed in this final SEIS.

Comment: Address effects of stockpiling earth.

Response: The general absence of need for stockpile areas outside the levee footprint and intervening area toward the conveyance channel was described in the draft SEIS. Refined design has substantiated this and further describes an even lower probability. This final SEIS reiterates this fact.

Comment: Include a statement in the EIS that a biologist would monitor construction.

Response: Concur. This statement has been included in the final SEIS.

Comment: Operation and maintenance requirements should include provisions to insure mitigation measures are successful, including joint agency reviews.

Response: Mitigation measures are based on the best available technology and experience to insure the desired results will be achieved. Experience gained with large-scale establishment of cottonwood and other native riparian plants at Bosque del Apache NWR will greatly assist in designing planting plans for this project. This issue will be discussed with the operations and maintenance entity as a feature of O&M needs.

APPENDIX B
DETERMINATION OF COMPATIBILITY



United States Department of the Interior

FISH AND WILDLIFE SERVICE
POST OFFICE BOX 1306
ALBUQUERQUE, N.M. 87103



In Reply Refer To:
Region 2/RF

OCT 21 1991

Lieutenant Colonel Michael J. Debow
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1580
Albuquerque, New Mexico 87103-1580

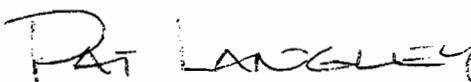
Dear Colonel Debow:

Enclosed for your information and use is the *Determination of Capability* for the portion of the proposed Rio Grande Floodway, San Acacia to Bosque del Apache Unit, that traverses the Bosque del Apache National Wildlife Refuge (Refuge). Based on additional project data provided on May 31, 1991, by your office, and on the conditions and constraints imposed for on-Refuge activities, the segment of levee reconstruction within the boundaries of the Refuge has been found to be compatible with the purposes for which the Refuge was established. However, it should be noted that this determination in no way alleviates the concerns of this agency expressed during planning meetings and set forth in the Department of Interior's letter dated November 19, 1990, for the extremely limited analysis of impacts that could be caused by the proposed project exterior to Refuge boundaries and for the lack of adequate mitigation of those impacts. A copy of that letter has been enclosed for your information. We require that those concerns be adequately addressed before concurrence by this office is provided for the project in its entirety.

Based on the recognized value of the middle Rio Grande corridor and the increased commitment of State, local, and Federal entities to conserve the resources of the river, we look forward to working with you in the planning of the San Acacia to Bosque del Apache Unit. This project not only accomplishes the purposes of flood control and protection of lives and property, but will also aid in the conservation of the river, its flows, and the living corridor.

Should you have any questions concerning the issues raised in this letter or in previous comments on the proposed project, please do not hesitate to contact Jennifer Fowler-Propst, Field Supervisor, New Mexico Ecological Services Office at (505) 883-7877 or FTS 474-7877.

Sincerely,


Acting Regional Director

Enclosures

memorandum

DATE: August 15, 1991

REPLY TO
ATTN OF: Refuge Manager, Bosque del Apache NWR

SUBJECT: Determination of Compatibility with Refuge Purposes and Objectives for the San Acacia to Bosque del Apache, New Mexico Continuous Levee Project, Socorro County, New Mexico

TO: Regional Director, Region 2, Albuquerque, New Mexico
THRU: Associate Manager AZ/NM

By authority of the National Wildlife Administration Act of 1966, the Endangered Species Act of 1973 and Executive Order 8289 dated November 22, 1939, establishing Bosque del Apache National Wildlife Refuge as "a refuge and breeding ground for migratory birds and other wildlife", I am directed to determine the compatibility of the San Acacia to Bosque del Apache, New Mexico Continuous Levee Project proposed by the U.S. Army Corps of Engineers with refuge purposes for establishment. U.S. Fish and Wildlife Service policy also requires that this project be consistent with refuge objectives. These objectives are listed below in priority order.

1. To provide habitat and protection for endangered species, with special emphasis on the whooping crane.
2. To provide habitat and protection for migratory birds during the winter, with special emphasis on sandhill cranes, dabbling ducks, snow geese and Canada geese.
3. To provide habitat and protection for resident animals.
4. To provide the general public an opportunity to see and understand wildlife, and provide visitors with a high-quality wildlife and educationally oriented experience.

In formulating our compatibility statement we have reviewed several documents pertaining to the proposed project including:

- Project Reevaluation Report: San Acacia to Bosque del Apache, New Mexico, October, 1989.
- Draft Environmental Impact Statement: Rio Grande Floodway San Acacia to Bosque del Apache Unit - Socorro County, New Mexico, October 1989.

- Draft Supplemental Environmental Impact Statement: Rio Grande Floodway San Acacia to Bosque del Apache Unit - Socorro County, New Mexico, August, 1990.
- Final Fish and Wildlife Coordination Act Report for San Acacia to Bosque del Apache, New Mexico Continuous Levee Project, Socorro County, New Mexico, November 1989.
- Review of Draft Supplemental Environmental Statement for the Rio Grande Floodway, Socorro County, New Mexico (ER 90/790).
- Letter dated May 31, 1991 from the ACE Engineering and Planning Division Planning Branch to FWS Regional Director, Region 2 providing final construction design.

Project Description

The proposed levee will be located just east of the low flow conveyance channel at the site of the present spoil bank levee. Overall project information indicates the dike top would be 16' wide with side slopes of 1:3. The overall height of the dike will be 11-12'. Toe drains will be constructed along the dike's western toe draining into the low flow conveyance channel to provide seepage control. The existing spoil bank levee would be scraped to the base elevation and stockpiled at one-half to one-mile intervals. This material would then be mixed with heavier soil obtained from borrow areas and used to construct the new levee. On Bosque del Apache NWR (Refuge), there will not be any excavation or deposition of surplus earth without the request or permission of the U.S. Fish and Wildlife Service (Service). Also, no need is foreseen for turn-around or stockpile areas. Jetty jacks or other protective structures may be placed at potential erosion sites at the discretion of the Service.

Local Impacts to Refuge Purposes Resulting from Construction of the Continuous Levee

Riparian vegetation adjacent to the existing low flow conveyance channel spoil bank provides significant habitat for migrating and breeding birds and other wildlife. Construction of the levee will require removal of a portion of this habitat resulting in a permanent negative impact. Disturbance during the construction phase of the project will temporarily displace wildlife species unique to the area.

-General Species Impacts

Typical species include those listed in Tables 1 and 2. In addition to these species commonly associated with cottonwood/willow/saltcedar communities are several species of

special concern on the refuge. Raptor species including the red-tailed hawk (Buteo jamaicensis), northern harrier (Circus cyaneus), Swainson's hawk (Buteo swainsoni), rough-legged hawk (Buteo lagopus), sharp-shinned hawk (Accipiter striatus), ferruginous hawk (Buteo regalis) and golden eagle (Aquila chrysaetos) roost and forage within riparian habitats and along productive edge habitat which would be most affected through construction. High small mammal concentrations on which many of these raptor species depend would also be affected. Resident wildlife species including the Rio Grande turkey (Meleagris gallopavo) and mule deer (Odocoileus virginianus) are also commonly seen species. Sandbars along the river are important loafing and roosting sites for sandhill cranes, waterfowl and waterbirds. The adjacent low flow conveyance channel also supports numerous waterfowl and waterbirds seasonally. There would be temporary disturbance to these species due to actual construction work. A delay in the construction time period to avoid peak wildlife winter use periods will aid in lessening impacts to raptors and waterfowl and waterbirds when population concentrations are highest. Overall, mentioned species should have adjacent areas of similar habitat available temporarily during construction phases.

-Endangered and Threatened Species Impacts

Federally endangered species which are common in the impact area include the whooping crane (Grus americana) and bald eagle (Haliaeetus leucocephalus). Less common species include the peregrine falcon (Falco peregrinus) and the interior least tern (Sterna antillarum). Again, a delay in the construction time period to avoid peak wildlife winter use periods will reduce or eliminate temporary impacts to whooping cranes and bald eagles as these species are winter visitors. Use by peregrine falcons is seasonal generally occurring during migration periods and consists of use by two or three individuals. Sightings of the interior least tern are rare with no prolonged stay yet recorded on the refuge. Adjacent similar habitat is available which can be used temporarily by these species during construction phases. A category 2 candidate species, the meadow jumping mouse (Zapus hudsonius luteus) may also occur in the impacted area although wet meadow and ditch bank habitats used by the species are uncommon along the existing levee.

-Permanent Impacts

The scope of permanent impacts occurring as a result of construction reflect separate and joint reconnaissance of existing vegetation and value classifications by Army Corps of Engineers and Refuge staff. Additional project data presented to the Director, FWS Region 2, dated May 31, 1991, show revisions to original designs based on this reconnaissance. The project now indicates that about 4.47 acres of vegetation will be removed as a result of cuts from the top of the river side of the current spoil bank levee and the extension of the base width of the dike

Table 1. Common Wildlife Species found in the Cottonwood or Deciduous Tree Habitat Type (Hink and Ohmart 1984)

Common Name	Scientific Name
Mourning dove	<u>Zeniada macroura</u>
Black-chinned hummingbird	<u>Archilochus alexandri</u>
Gambel quail	<u>Callipepla gambelii</u>
Northern flicker	<u>Colaptes auratus</u>
Ash-throated flycatcher	<u>Myiarchus cinerascens</u>
European starling	<u>Sturnus vulgaris</u>
American robin	<u>Turdus migratorius</u>
Black-headed grosbeak	<u>Pheucticus melanocephalus</u>
Dark-eyed junco	<u>Junco hyemalis</u>
White-crowned sparrow	<u>Zonotrichia leucophrys</u>
Cooper hawk	<u>Accipiter striatus</u>
American kestrel	<u>Falco sparverius</u>
Eastern fence lizard	<u>Sceloporus magister</u>
New Mexico whiptail lizard	<u>Sceloporus magister</u>
White-footed mouse	<u>Peromyscus leucopus</u>
Western harvest mouse	<u>Reithrodontomys montanus</u>
House mouse	<u>Mus musculus</u>
Botta pocket gopher	<u>Thomomys bottae</u>
Rock squirrel	<u>Spermophilus variegatus</u>
Beaver	<u>Castor canadensis</u>
Muskrat	<u>Ondatra zibethicus</u>
Raccoon	<u>Procyon lotor</u>
Porcupine	<u>Erethizon dorsatum</u>
Striped skunk	<u>Mephitis</u>
Desert cottontail	<u>Sylvilagus auduboni</u>
Coyote	<u>Canis latrans</u>

Table 2. Common Wildlife Species found in the Wetland Habitat Type. (Hink and Ohmart 1984).

Common Name	Scientific Name
Pied-billed grebe	<u>Podilymbus podiceps</u>
Virginia rail	<u>Rallus limicola</u>
Sora	<u>Porzana carolina</u>
American coot	<u>Fulica americana</u>
Yellow-headed blackbird	<u>Xanthocephalus xanthocephala</u>
Red-winged blackbird	<u>Agelaius phoeniceus</u>
Killdeer	<u>Charadrius vociferus</u>
Spotted sandpiper	<u>Actitis macularia</u>
Black phoebe	<u>Sayornis nigricans</u>
Marsh wren	<u>Cistothorus palustris</u>
Song sparrow	<u>Melospiza melodia</u>
Swamp sparrow	<u>Melospiza georgiana</u>
Woodhouse toad	<u>Bufo woodhousei</u>
Chorus frog	<u>Pseudacris triseriata</u>
Bullfrog	<u>Rana catesbeiana</u>
Tiger salamander	<u>Ambystoma tigrinum</u>
Common gartersnake	<u>Tlhamnophis sirtalis</u>

in excess of the current spoil bank levee base. Of the 300 survey stations taken at 200' intervals through the refuge, 81 or 27% will have some vegetation removed. Of the 81 stations affected, 33 or 41% will involve vegetative impacts through cuts made at the top of the current spoil bank levee at or between stations 1614-1620, 1678-1686, 1690-1692, 1712, 1724-1728, 1732-1734, 1752, 1766-1768, 1820-1829, 1847-1853, 1887-1891 and 2105. Larger amounts of vegetation will be removed through extension of the base width of the current spoil bank where essentially the entire existing levee will be reconstructed. This will occur at 48 or 59% of all affected stations. Specifically, this will occur at or between stations 1640, 1776-1778, 1792, 1905, 1937, 1941-1949, 1953-1959, 1963, 1969, 1977-1991, 1995, 1991-2005, 2009-2013, 2019-2021 and 2027-2035. Vegetation removal may or may not extend to the existing spoil bank toe at stations 1939, 1961, 1965, 1993, 1997, 2023 and 2041-2043 depending on construction constraints. Although many jetty jacks are included in the construction proposal which would substantially alter impact acreage figures, ACE personnel indicate these will be installed subject to FWS discretion. Additional project data outlining this agreement will be forwarded to the FWS Regional Director. To compensate for unknown losses or over-clearing by the contractor one acre has been added to the stated acreage compensation figure. Construction of turn around, haul roads and stockpile areas will not occur on the refuge. Excess spoil will not be deposited on the refuge. Vegetation impacted through the project would result in the loss of habitat to migratory birds,

breeding birds and other wildlife including federally listed endangered and threatened species. Presumably mitigation measures for habitat loss would compensate any impact to existing riparian habitat.

Overall Impacts to Refuge Purposes Resulting from Construction of the Continuous Levee

A broader view of the impacts the proposed construction would have on refuge purposes reveals generally positive factors. The natural flooding regimes of the Rio Grande which sustained and perpetuated associated riparian flora and subsequently the rich fauna of the cottonwood/willow bosque have been altered or eliminated with the construction of dams above and below the Middle Rio Grande Valley. In addition, a generally continuous levee is already in place within the Middle Rio Grande reach which has eliminated periodic flooding of the valley floor. Further damage to the natural flooding events of the Rio Grande is unlikely as a result of this project, an indication that most of the damage has already been done. Strictly speaking, construction of the continuous levee is actually a revamping and upgrading of an existing spoil bank levee already in place to protect urban and agricultural developments including Bosque del Apache NWR from flooding.

Historically, Bosque del Apache NWR was constructed in the late 1930's and early 1940's within the Middle Rio Grande floodplain. Although some diking was constructed early to protect impoundments and agricultural areas from possible flooding, many of the accomplishments of this period were completely destroyed during severe flooding in 1941. Construction and maintenance efforts were again initiated after World War II and continue today. The investment in the creation and maintenance of riparian and wetland areas served by the Bosque del Apache NWR irrigation system west of existing spoil bank levees is staggering with habitats supported by this system irreplaceable. Although the existing Riverside Canal spoil bank dike and the low flow conveyance channel spoil bank dike provide some flood protection, losses due to a flood comparable with that which occurred in 1941 would be devastating to developments and populations of waterfowl and cranes utilizing the refuge. From this standpoint the continuous levee project has a positive impact to current refuge resources.

East of the current low flow conveyance channel spoil bank levee, native flora conditions along the current river channel are alarming. Decadent older stands now dominate with an increasing degree of invasion by exotic species. Regeneration through natural means although still possible is limited due to generally regulated stream flows on the Rio Grande by the Bureau of Reclamation and the U.S. Army Corps of Engineers. To reverse these conditions, properly timed periodic river flooding which provides regenerative capabilities and maintenance of native riparian flora must resume. Construction of the continuous levee

project would provide the containment of flood flows to meet native flora regenerative and maintenance needs currently not possible with existing spoil bank levee conditions.

Determination

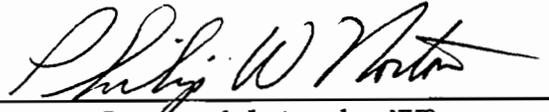
Reviewing both local and overall impacts detailed above, the continuous levee project through Bosque del Apache NWR is deemed compatible with the purposes for which the refuge was established and consistent with refuge objectives providing the following stipulations are met:

1. Construction will occur during lower wildlife use seasons.
2. The basal width of the new levee shall be oriented as close as possible to the low flow channel to reduce the loss of riparian/wetland habitat.
3. Existing roads shall be used to move equipment or haul fill.
4. Stockpile and equipment turn around areas will not be located on the refuge.
5. Borrow excavation sites or fill deposition sites will not be located on the refuge.
6. All impacted areas should be thoroughly evaluated for suitability as revegetation sites prior to revegetation. Evaluation must include water table fluctuation monitoring and ground water salinity monitoring for at least one year prior to revegetation and complete soils analysis stressing soil texture profiles and salinity determination.
7. Large cottonwoods that might die as a result of root damage from the placement of the levee toe shall be left in place, creating snags that provide a valuable habitat component for a variety of wildlife.
8. In agreement with the coordination act report, any cottonwood/willow/Russian olive habitat that is impacted will be mitigated at a 5:1 ratio. Monotypic salt cedar areas will be mitigated at a 2:1 ratio. Saltgrass habitats are recognized as some of the rarer habitat types in the Middle Rio Grande riparian zone. This habitat should be mitigated at a higher than 2:1 ratio.
9. The Bosque del Apache NWR refuge manager shall reserve the right to halt construction activities if the U.S.

Army Corps of Engineers or their contractor do not abide by the agreed upon construction design and compatibility statement conditions.

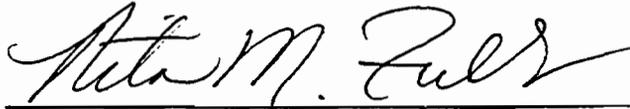
10. The Bosque del Apache NWR refuge manager will be present at the preconstruction conference which will include Army Corps of Engineers personnel and the contractor to assure compliance with construction designs and compatibility statement conditions.

Prepared by:



Philip W. Norton, Refuge Manager, Bosque del Apache NWR

Reviewed by:



10/7/91

Nita M. Fuller, Associate Manager, AZ/NM

Concurrence:

Active



10/10/91

for Joseph P. Mazzoni, Assistant Regional Director - ARW, Region 2

APPENDIX C
FISH AND WILDLIFE COORDINATION ACT REPORT
AND
CORPS OF ENGINEERS RESPONSE



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

November 7, 1989

District Engineer
Corps of Engineers, U.S. Army
P. O. Box 1580
Albuquerque, New Mexico 87103-1580

Re: Final Fish and Wildlife Coordination Act Report for San Acacia to
Bosque del Apache, New Mexico Continuous Levee Project, Socorro
County, New Mexico (CE)

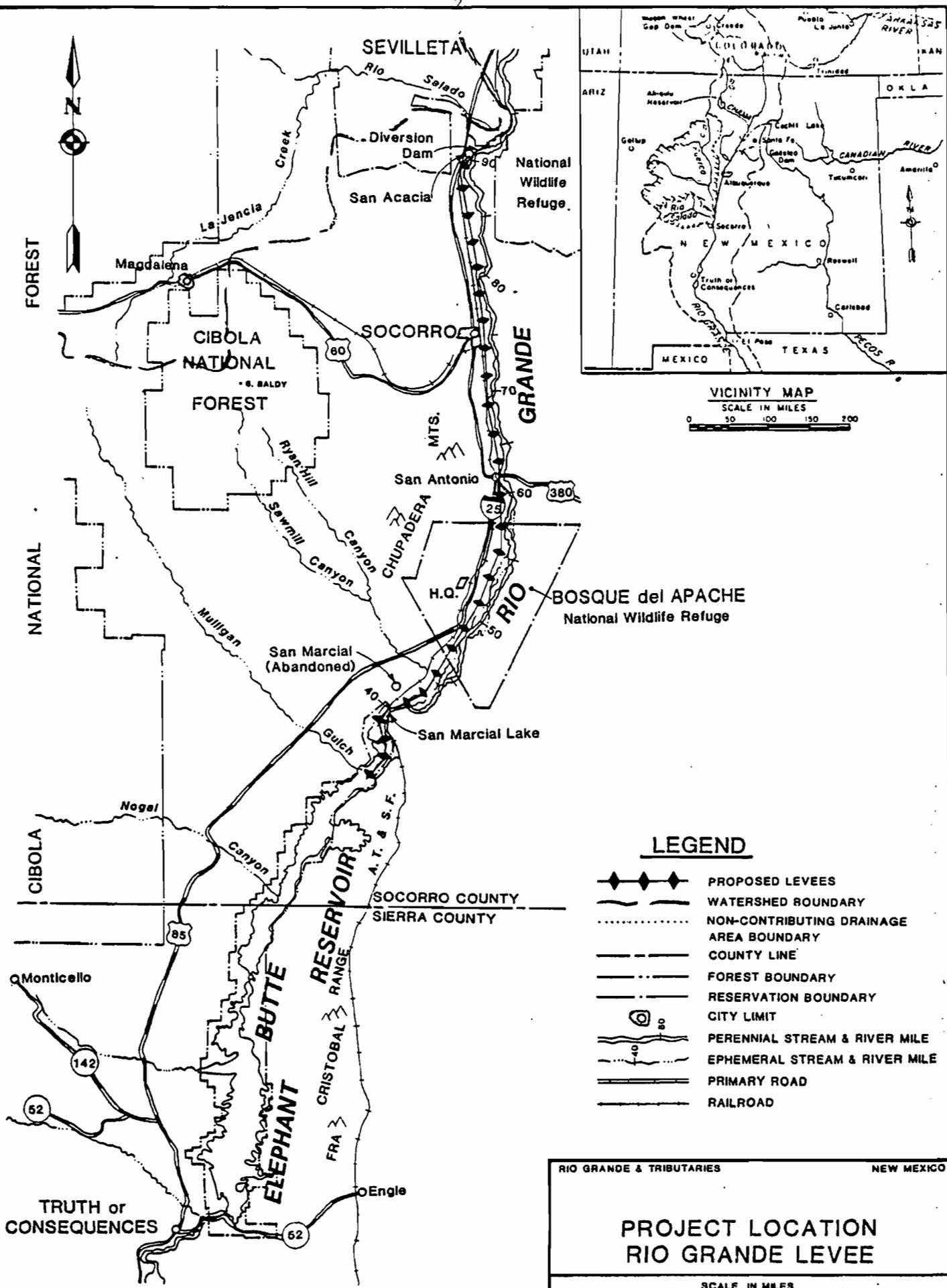
Dear Colonel Dougan:

This completes the U.S. Fish and Wildlife Service's (Service) Final Fish and Wildlife Coordination Act Report on the U.S. Army Corps of Engineers (Corps) project, San Acacia to Bosque del Apache, New Mexico Continuous Levee Project, Socorro County, New Mexico. The report was prepared by the Service' Albuquerque Ecological Services Field Office, under the authority of and in accordance with the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e). It has been coordinated with the New Mexico Department of Game and Fish and Bosque del Apache National Wildlife Refuge. Subsequent to the September 18, 1989 completion date of this report, new information was made available by the Corps. Changes have been incorporated in response to the latest engineering data.

The project was authorized for construction as a unit of the Rio Grande Floodway by the Flood Control Act of 1948 (Public Law 80-858, Section 203). Funds for construction were never appropriated. In 1961, the U. S. Senate directed a further review of the 1948 comprehensive flood control plan, with particular reference to the Rio Puerco and Rio Salado. As a result of this review, the construction of flood and sediment control dams on the Rio Puerco and Rio Salado was recommended in 1972 in lieu of the originally authorized levee rehabilitation. Subsequent advanced engineering and design studies were terminated when the State of New Mexico withdrew its support for the project because of costs and potential inundation of 300 acres of the Sevilleta National Wildlife Refuge. As a consequence of the unfeasibility of dam construction, the rehabilitation of existing levees was again evaluated.

STUDY AREA DESCRIPTION

The Rio Grande within the project flows through a broad floodplain bordered on the west by the Magdalena Mountains and on the east by the Chupadera Mesa and encompasses approximately 34,840 acres within Socorro County, New Mexico. The proposed levee would stretch 58 miles from San Acacia to the upper end of Elephant Butte Reservoir (Figure 1).



LEGEND

- ◆◆◆ PROPOSED LEVEES
- WATERSHED BOUNDARY
- NON-CONTRIBUTING DRAINAGE
- AREA BOUNDARY
- COUNTY LINE
- FOREST BOUNDARY
- RESERVATION BOUNDARY
- CITY LIMIT
- PERENNIAL STREAM & RIVER MILE
- EPHEMERAL STREAM & RIVER MILE
- PRIMARY ROAD
- RAILROAD

RIO GRANDE & TRIBUTARIES NEW MEXICO

**PROJECT LOCATION
RIO GRANDE LEVEE**

SCALE IN MILES

0 2 4 8 12 18 24

U.S. ARMY ENGINEER DISTRICT, ALBUQUERQUE, N.M.

Figure 1. General project location map.

In the project area, the channel of the Rio Grande is paralleled on the west side by the Bureau of Reclamation's low flow conveyance channel from San Acacia to the upper end of Elephant Butte Reservoir. The existing levee is the spoil bank resulting from the construction of the low flow conveyance channel and lies between the channel and the Rio Grande. It is this levee that would be rebuilt to provide greater flood protection for the low flow conveyance channel or water conveyance ditch. During normal water years, the low flow conveyance channel can handle the entire river flow, allowing water managers the option of dewatering the historic Rio Grande channel (Figure 2).

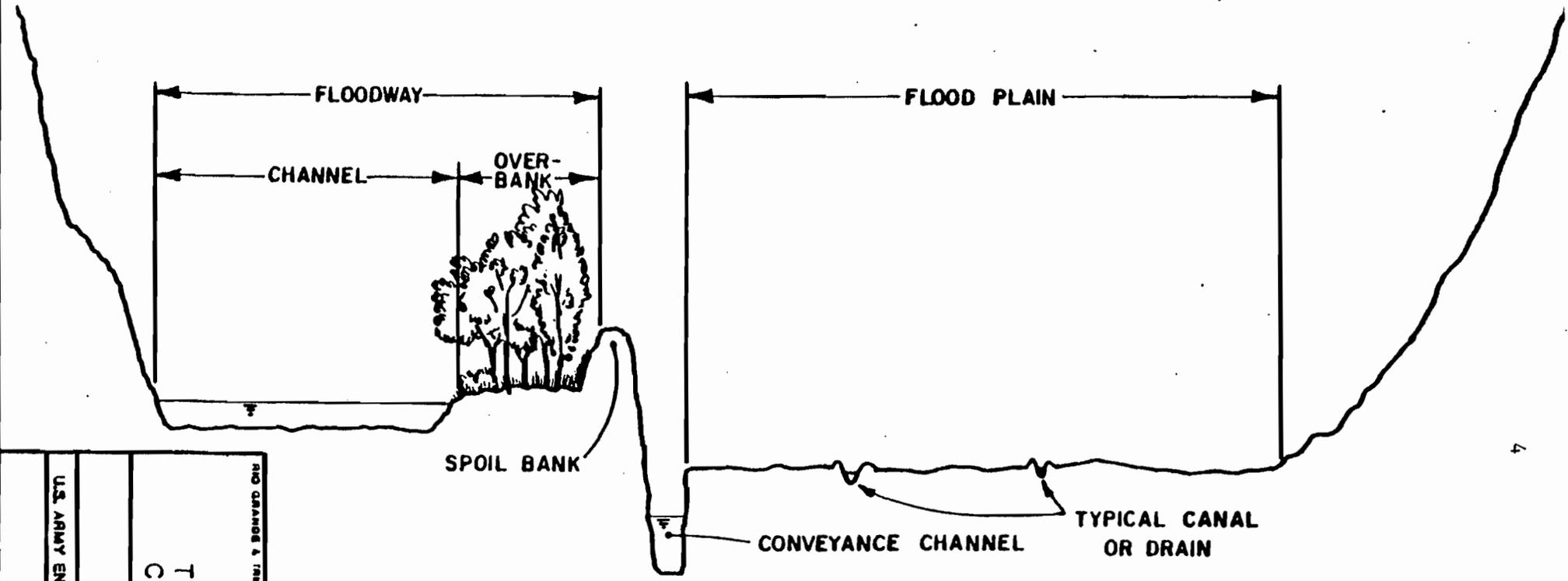
PROJECT DESCRIPTION

The proposed levee would closely follow the alignment of the existing spoil bank levee. Preliminary design information for the 100-year protection levee is provided in the Decision Document (U.S. Army Corps of Engineers, November 1988). This document specifies that the top of the levee would be 12 feet wide, the side slopes of approximately 2.5:1 and an average height of 11.6 feet. Toe drains that discharge into the low flow conveyance channel would provide seepage control. Subsequent to the Decision Document, refined project engineering data was provided by the Corps.

As shown in Figure 2, the existing spoil bank levee parallels the low flow conveyance channel and is immediately adjacent to the overbank or riparian/wetland habitat area. This existing spoil bank levee would be scraped down to the base elevation and stockpiled at one-half to one-mile intervals. The preliminary design assumes that 90 percent of the original spoil material could be combined with finer materials (i.e., silts, clays), obtained from suitable borrow areas and then be utilized to construct the new levee. In addition, jetty jacks or other protective structures may be placed at certain locations to prevent erosion to the new levee from possible high river flows.

Fish and Wildlife Resources Without the Project

Historically the Rio Grande was a meandering multi-channeled river with oxbows, emergent wetlands and gallery-type cottonwood forests (U.S. Fish and Wildlife Service 1978, Campbell and Dick-Peddie 1964). Agricultural developments, particularly the draining and ditching activities of Federal and local project entities, have changed the character of the river. Today, water in the Rio Grande channel is intermittent and confined within a developed pilot channel with only a small portion of the original riparian woodlands and wetlands remaining. Continuous regulation of the river has facilitated the invasion of saltcedar, which has displaced native vegetation in many areas. Despite these impacts, the existing riparian habitat of the Rio Grande floodway provides significant habitat for wildlife, especially birds.



TYPICAL VALLEY CROSS-SECTION
 NOT TO SCALE

NO DAMAGE & IMPAIRMENT NEW MEXICO

TYPICAL VALLEY
 CROSS-SECTION

NOT TO SCALE

U.S. ARMY ENGINEER DISTRICT, ALBUQUERQUE, N.M.

FIGURE 2

Terrestrial Resources

Table 1 shows areas and vegetative descriptions of riparian woodlands and wetlands on both sides of the Rio Grande from San Acacia to San Marcial. The most extensive habitat on the west side of the river, where impacts are likely to occur, is palustrine scrub-shrub wetland. A large portion of this scrub-shrub habitat is composed of nearly pure stands of saltcedar. Large areas of palustrine scrub-shrub/palustrine emergent wetland are found on Bosque del Apache National Wildlife Refuge. The habitats on the refuge are composed largely of saltcedar in association with cattails, bulrushes and salt grass.

In some of the project area, the palustrine forest/scrub-shrub wetland habitat is dominated by mature Rio Grande cottonwoods with saltcedar as a dominant understory. In a few locations, Russian olive is found as the dominant understory shrub. Another common association of this habitat is the combination of Rio Grande cottonwood with saltcedar as the dominant overstory and understory.

The wildlife use most likely to occur along the Rio Grande from Española to San Acacia, New Mexico, within the cottonwood-Russian olive habitat, is a high density of birds, averaging over 900 birds per 100 acres. Some densities were as high as 2,159 birds per 100 acres. The number of different bird species or species richness (defined as the number of species present with a density greater than .5 per 100 acres) was also very high for cottonwood areas, with as many as 55 species found in one community structural type. The highest species richness values were found along drains. The most abundant species in cottonwood habitats were the mourning dove and black-chinned hummingbird. Other common species include Gambel quail, northern flicker, ash-throated flycatcher, European starling, American robin, black-headed grosbeak, dark-eyed junco, white-crowned sparrow, Coopers hawk and American kestrel (Table 2). Hink (1984) observed 277 species of birds in the study area, which represent over 60 percent of the bird species known to occur in New Mexico.

The wetland type habitat supports high bird densities but fewer bird species than the deciduous tree type. Bird densities were as high as 1,327 birds per 100 acres, but the highest species richness values were 20. Species found in cattail marshes are usually restricted to that specific habitat. Common wetland wildlife species from the Rio Grande corridor are listed in Table 3.

Endangered Species

The value of riparian habitat to Federally listed threatened and endangered species is important. Four Federally endangered species, the whooping crane, bald eagle, peregrine falcon and interior least tern, utilize the Rio Grande floodplain in the project area. Approximately 10 of the experimental Rocky Mountain whooping crane population presently winter in the area. They are most frequently found at Bosque del Apache National

Table 1. Areas and vegetative description of the categories of riparian woodlands and wetlands along the Rio Grande from San Acacia to San Marcial, New Mexico.

TYPE ^{1/} (Map symbol keyed to Figure)	DESCRIPTION ^{1/}	AREA (in acres) ^{2/}	
		East Side of Channel	West Side of Channel
<u>Palustrine System</u>	Includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens. The Palustrine System was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog and fen. It also includes the small, shallow, permanent or intermittent water bodies often called ponds.		
Palustrine Scrub/Shrub (PSS)	Areas dominated by woody vegetation less than 6 m (20 ft.) tall. The species include trees, shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Salt cedar (<u>Tamarix pentandra</u>) predominates over most of this area with young coyote willow (<u>Salix exigua</u>) and Rio Grande cottonwood (<u>Populus fremontii wislizenii</u>) occurring. Four-wing saltbush (<u>Atriplex canescens</u>), various berry bushes (<u>Ribes</u> spp.), and New Mexico olive (<u>Forestiera neomexicana</u>) are shrubs found.	2,560	11,172
Palustrine Open Forest (PFO)	Area characterized by woody vegetation that is 6 m (20 ft.) tall or taller. Principally Rio Grande cottonwood with occasional patches of coyote willow.	126	437
Palustrine Emergent (PEI)	The emergent wetland areas are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. Vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. Characteristic plant species in this area are rushes (<u>Juncus</u> spp.) and cattails (<u>Typhus</u> spp.).	0	0
Palustrine Open Water (POW)	Ponded water with no emergent plant growth. Located outside of river channel.	0	27
Palustrine Open Forest// Palustrine Scrub/Shrub (PFO/PSS)	Combination with canopy of trees and understorey of scrub/shrubs.	2,360	3,058
Palustrine Scrub/Shrub/ Palustrine Emergent (PSS/PEI)	Combination of scrub/shrub and emergent vegetation.	47	8,065
Palustrine Scrub/Shrub// Palustrine Flats (PSS/PFL)	Combination of scrub/shrub and mud flats.	0	250
Palustrine Open Forest// Palustrine Emergent (PFO/PEI)	Combination of forested canopy over emergent vegetation.	0	52
<u>Riverine System</u>	Includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 o/oo.		
Riverine Open Water (R2OW and R4OW)	Areas of open water within the riverine system.	0	916

1. Source: USFWS 1980.

2. Source: Cowardin et al. 1979.

Table 2. Common Wildlife Species found in the Cottonwood or Deciduous Tree Habitat Type (Hink and Ohmart 1984)

Common Name	Scientific Name
Mourning dove	<u>Zeniada macroura</u>
Black-chinned hummingbird	<u>Archilochus alexandri</u>
Gambel quail	<u>Callipepla gambelii</u>
Northern flicker	<u>Colaptes auratus</u>
Ash-throated flycatcher	<u>Myiarchus cinerascens</u>
European starling	<u>Sturnus vulgaris</u>
American robin	<u>Turdus migratorius</u>
Black-headed grosbeak	<u>Pheucticus melanocephalus</u>
Dark-eyed junco	<u>Junco hyemalis</u>
White-crowned sparrow	<u>Zonotrichia leucophrys</u>
Cooper hawk	<u>Accipiter striatus</u>
American kestrel	<u>Falco sparverius</u>
Eastern fence lizard	<u>Sceloporus magister</u>
New Mexico whiptail lizard	<u>Sceloporus magister</u>
White-footed mouse	<u>Peromyscus leucopus</u>
Western harvest mouse	<u>Reithrodontomys montanus</u>
House mouse	<u>Mus musculus</u>
Botta pocket gopher	<u>Thomomys bottae</u>
Rock squirrel	<u>Spermophilus variegatus</u>
Beaver	<u>Castor canadensis</u>
Muskrat	<u>Ondatra zibethicus</u>
Raccoon	<u>Procyon lotor</u>
Porcupine	<u>Erethizon dorsatum</u>
Striped skunk	<u>Mephitis mephitis</u>
Desert cottontail	<u>Sylvilagus auduboni</u>
Coyote	<u>Canis latrans</u>

Table 3. Common Wildlife Species found in the Wetland Habitat Type.
(Hink and Ohmart 1984).

Common Name	Scientific Name
Pied-billed grebe	<u>Podilymbus podiceps</u>
Virginia rail	<u>Rallus limicola</u>
Sora	<u>Porzana carolina</u>
American coot	<u>Fulica americana</u>
Yellow-headed blackbird	<u>Xanthocephalus xanthocephala</u>
Red-winged blackbird	<u>Agelaius phoeniceus</u>
Killdeer	<u>Charadrius vociferus</u>
Spotted sandpiper	<u>Actitis macularia</u>
Black phoebe	<u>Sayornis nigricans</u>
Marsh wren	<u>Cistothorus palustris</u>
Song sparrow	<u>Melospiza melodia</u>
Swamp sparrow	<u>Melospiza georgiana</u>
Woodhouse toad	<u>Bufo woodhousei</u>
Chorus frog	<u>Pseudacris triseriata</u>
Bullfrog	<u>Rana catesbeiana</u>
Tiger salamander	<u>Ambystoma tigrinum</u>
Common gartersnake	<u>Thamnophis sirtalis</u>

Wildlife Refuge. Eight bald eagles, which were also winter residents, utilized the riparian habitat on and near the refuge during the past winter. Two sightings of the interior least tern have been confirmed at Bosque del Apache National Wildlife Refuge. The terns are spring/fall migrants and were possibly vagrants. A determination has been made that the project will not adversely impact the whooping crane, bald eagle or interior least tern. The construction time period will be delayed during the winter months when the animals are present and resume during the spring-fall months of each year when the animals are absent.

The project may have an impact on the Federally endangered peregrine falcon. The peregrine falcon, a spring/fall migrant along the Rio Grande, is a predator on waterfowl inhabiting the low flow conveyance channel. Presently, the low flow conveyance channel has low to moderate flows. This is a result of flows being diverted at San Acacia into the historic Rio Grande channel (the reason for this diversion is the "wet" cycle experienced during the last five years and the deterioration of the low flow conveyance channel at its juncture with Elephant Butte Reservoir). The reduced flows in the low flow conveyance channel enable emergent vegetation to become established, attracting waterfowl which in turn attract the peregrine falcon. Depending on future flows in the conveyance channel and their relation to construction activity from the project, there may be an impact on the peregrine falcon's hunting activity. Importantly, there exists an opportunity for this project to provide additional critical

habitat for these Federally endangered animals by providing habitat improvement on adjacent Bosque del Apache National Wildlife Refuge as well as adjacent state refuges.

Aquatic Resources

On July 26-27, 1988, Service personnel conducted a project-wide electrofishing survey on the low flow conveyance channel and collected one water quality sample at the Elmendorf Drain outfall (approximately eight miles south of the Bosque bridge) (Table 4). The water quality test was conducted to assess the quality of irrigation return water. Fish surveys were conducted at five mile increments for the entire project area, using the Bosque Bridge as a reference point (Table 5). These data are included in the report to address the fishery in the waters of the low flow conveyance channel and not because of perceived or anticipated impacts on the conveyance ditch from the levee project. Fish surveys were also conducted on ponds at Bosque del Apache National Wildlife Refuge. The species, in order of abundance collected on the refuge were carp, mosquito fish, sunfish and bullheads. No fish surveys were conducted in the historic Rio Grande channel.

Data collected at the Elmendorf Drain are presented in Table 4. One water quality sample and fish survey were conducted at this site.

Table 4. Water quality test at the Elmendorf Drain (approximately eight miles south of Bosque bridge).

Water Quality		Fish Species	Amount
Turbidity	80 NTU	Carp	9
Total chlorine	0.10 mg/l	Sunfish	3
Free chlorine	0.05 mg/l	Gambusia	50+
Ammonia	ND	Channel catfish	2
Hardness	(Ca CO ₃) 420 mg/l	Bullhead	1
Temperature	60°F		
Ph	7.8 at temperative of 6.5°C		
Conductivity	700 micromhs		

Future Fish and Wildlife Without the Project

No significant change in fish and wildlife habitat is expected in the future without the project. Residential development should not impact this area because of its distance from major metropolitan areas. Additionally, agricultural practices presently being managed adjacent to this area should remain stable.

Table 5. Fish Species in Low Flow Conveyance Channel.

Site	Habitat Type	Conductivity (Micromhos)	Water Temp (°F)	Time Sur- veyed (Sec.)	Distance covered (Ft.)	Carp	Sunfish	Mosquito- fish	Channel catfish	Bullhead	Long-nosed dace	Bluegill	Shiner	Shad	White Bass	Sucker
Bosque Bridge	Rock bottom pool/riffle swift current	90	78	386	225	25			6		15					
1.5 miles south of Bosque Bridge	Sand bottom pool/riffle swift current	90	78	209	150	6						1				
3.0 miles south of Bosque Bridge	Sand bottom pool/riffle swift current	90	78	188	150	1	2	2								
5 miles south of Bosque Bridge	Sand bottom pool/riffle moderate current	Not taken	Not taken	261	150	1	10						1			
9 miles south of Bosque Bridge further travel possible because of lake level).	Sand bottom almost no current	710	70	324	200	1	8						6	12	1	
1.5 miles north of Bosque Bridge (unit 6 outlet)	Rocky bottom swift current	100	62	486	150	13			3	4			3		3	1
0 miles north of Bosque Bridge	Rocky bottom swift current	Not taken	Not taken	217	150	9						2			1	
5 miles north of Bosque Bridge	Rocky bottom swift current	100	72	229		1	1									23
1 miles north of Bosque Bridge	Rocky bottom swift current	70	72	205	150			1	14	2			2			
5 miles north of Bosque Bridge	Rocky bottom emergent vegetation swift current	130	80	234	150	10	3	20								
1 miles north of Bosque Bridge	Rocky bottom emergent vegetation swift current	100	74	262	150	24										21

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Impacts to Fish and Wildlife With the Project

The plan being evaluated for increasing the level of flood protection to floodplain improvements from San Acacia to Elephant Butte Reservoir, consists of rehabilitating the existing spoil bank that is located on the west bank of the Rio Grande. Four flood frequency levels of protection have been evaluated, the 50-, 100-, and 200-year, as well as the Standard Project Flood frequency. Of these flood frequencies, the 100-year level of protection has been selected as the recommended plan.

Terrestrial Resources

Major aspects of project construction were focused upon during the analyses of impacts on wildlife habitat. These features include the new levee alignment, spoil areas, borrow areas, haul roads, Kellner Jack placements and armoring of the riverside toe of the levee. Each of these construction activities will impact riparian habitat. Depending upon the location of these activities, impacts will range from adverse affects on high value cottonwood forests to simple disturbance of unvegetated soil. However, without knowing the exact location of construction activities, site specific mitigative measures cannot be provided.

Based upon discussions with Corps personnel and analysis of the Decision Document and subsequent refined data, we assume the levee will be constructed with the following specifications. In reconstructing the levee, the Corps will use the material that presently exists in the levee, mixing it with some additional soil when necessary. The Corps assumes that 10-15 percent of the existing levee soil might be unsuitable, thus necessitating the construction of borrow areas. Haul roads and turn-around sites would also be necessary. The Corps estimates that 117 acres will be necessary for these features.

The proposed alignment of the levee will be closely positioned to its present location or slightly aligned to the west. Based upon reconnaissance of the project area, we believe it is possible to reconstruct the levee so there will be no impact to the adjacent riparian habitat. Every effort should be made to avoid wetland areas. However, as stated by the Corps in their refined data, impact to 42 acres could occur from the new levee alignment.

Final engineering data has highlighted a feature of this project that has just recently been developed. Based upon the latest engineering design, the existing levees are much larger than necessary. Therefore, the disposal of excess material will be required. The spoil will be used to build up banks, in locations where the river channel is close to the levee. Some construction activity would take place in the river, which could cause an increase in sediment loading. Acreage figures from the deposition of this spoil have not been converted to mitigation acreage figures. Depending upon the size of this activity mitigation acreage may be substantially increased.

Aquatic Resources

Originally, the project data indicate that there would be no construction impact to the waters in the Rio Grande or in the low flow conveyance channel. Groundwater and surface watered wetlands that presently exist, because of the elevation of Elephant Butte Reservoir, would also be avoided. With the latest engineering feature, spoil deposition, these will probably be an impact to the Rio Grande channel. This feature has not been discussed in the mitigation plan.

Endangered Species

The construction of the proposed levee could impact the Federally endangered peregrine falcon. Agreement has been reached that construction would be halted during the winter (November-February) months, insuring no disturbance to the bald eagle and whooping crane. The likelihood of disturbing the interior least tern is remote, based on frequency of sightings in the Rio Grande.

As discussed previously in this report, the peregrine falcon is a spring/fall migrant in the Rio Grande valley and because of existing conditions in the low flow conveyance channel, there is a possibility of project impacts to the bird.

DISCUSSION

During the review of the project, a determination was made that significant riparian/wetland habitat impacts will occur. However, we believe that project impacts to these resources could be mitigated, by management activities in the Rio Grande riparian area and on adjacent wildlife refuges.

Project features, borrow and spoil areas, haul roads and turn-around sites will impact 117 acres of Rio Grande riparian area. Additionally, using a worst case scenario, another 42 acres of riparian area will be impacted by the new levee alignment. As presently planned, a total of 159 acres of riparian habitat will be modified by the levee construction. Depending upon the kind of riparian habitat type impacted, mitigation can offset this figure. Because of the scarcity and high wildlife value of cottonwood, willow and Russian olive habitat in the Rio Grande, a high mitigative ratio of 5:1 has been used. A variation of this type of habitat, i.e., cottonwood/willow, cottonwood, willow, Russian olive, if impacted, it should be mitigated at no less than 4:1 ratio. Salt cedar and open riparian areas should be mitigated on a 2:1 ration.

The mitigation for riparian impacts can be accomplished using cottonwood/willow pole plantings, and the planting of understory riparian species. Understory riparian species should include wolfberry, skunkbush sumac, screwbean mesquite, silver buffaloberry and fourwing saltbush.

Grasses such as blue grama, galleta, western wheatgrass, little bluestem, spike muhly, sheep fescue, Indian ricegrass, side oats grama and alkali sacaton should also be included in the plantings. We suggest that at least one study be initiated using the above grass species in conjunction with an erosion blanket on the face of the existing spoil levee.

Modification of borrow areas should be accomplished for wildlife. Considerable data and expertise on construction and management of borrow areas for wildlife is available from previous Corps studies. Borrow areas, if properly constructed, add habitat variety and structure to riparian areas. We believe a small site within the influence of the low flow channel should be constructed for study purposes.

Severe impacts to wildlife and fisheries presently result from the management of the low flow conveyance channel during normal and "wet" cycle years. A detailed study, similar to the Hink and Ohmart study conducted in the middle Rio Grande is needed for this area. The study should be performed during different management regimes of the low flow conveyance channel (normal versus wet cycles) to provide data on the Rio Grande during watered and dewatered conditions. This study should focus on riparian wildlife species with special emphasis on Federally endangered species.

A recent survey conducted by the New Mexico Department of Game and Fish found approximately 40 bald eagles in and around Elephant Butte Reservoir (immediate vicinity of Bosque del Apache National Wildlife Refuge). These birds were taking advantage of the fish and waterfowl prey base that is available at the reservoir. The reservoir, at its present elevation, is ideal for these birds since they prefer to roost and perch in trees located in the vicinity of their food source.

Proposed management practices on adjacent Bosque del Apache National Wildlife Refuge as well as State refuges in the immediate vicinity would result in a benefit to the eagles. Presently these refuges are converting their unproductive lands to moist soil management. This practice will expand the eagle's prey base. Moist soil management also involves some acreage conversion to cottonwood/willow habitat to provide roosting and perching trees for eagles.

Bosque del Apache National Wildlife Refuge personnel have developed a plan for converting the monotypic salt cedar habitat on the refuge to moist soil habitat. This plan involves clearing the salt cedar habitat within certain leveed areas and applying controlled water management. This should convert lands vegetated with salt cedar to habitat that will attract large numbers of waterfowl. Management of the moist soil lands will also enlarge fishery habitat, thus, providing an additional prey base for the eagle. This water management plan, in conjunction with tree plantings, will create a situation similar to the one presently available at Elephant Butte Reservoir. Moist soil management on the refuges will also enlarge habitat

potential for feeding, loafing and nesting for benefit of the other Federally endangered species i.e., the interior least tern, whooping crane and American peregrine falcon.

This project provides an excellent opportunity to enhance lands for fish and wildlife purposes. Public Law 99-662, dated Nov. 17, 1986, cited as the Water Resources Development Act of 1986, provides an avenue to enhance lands for species of national concern as well as Federally endangered plants and animals. As previously discussed, the Bosque del Apache National Wildlife Refuge is situated in the project area and offers the chance for project funds to enhance refuge lands. This authority is cited as follows in Sec 906 (e) (1) (2) (3) of the Act:

In those cases when the Secretary, as part of any report to Congress, recommends activities to enhance fish and wildlife resources, the first costs of such enhancement shall be a Federal cost when:

- 1) such enhancement provides benefits that are determined to be national, including benefits to species that are identified by the National Marine Fisheries Service as of national economic importance, species that are subject to treaties or international convention to which the United States is a party, and anadromous fish;
- 2) such enhancement is designed to benefit species that have been listed as threatened or endangered by the Secretary of the Interior under the terms of the Endangered Species Act, as amended (16 U.S.C. 1531, et seq.), or
- 3) such activities are located on lands managed as a national wildlife refuge.

With species of national concern, waterfowl, the presence of numerous Federally endangered species and the location of a national refuge in the project area, the provisions of the Act are fully met for enhancement.

New Mexico Department of Game and Fish personnel are also studying the conversion of unproductive refuge lands to wetland or moist soil habitat. Due to inadequate water control structures, the refuges at La Joya and Bernardo (immediately north of the project area) are presently underutilized. With an upgrade in these water structures, moist soil management areas can be developed to enhance State lands for wildlife.

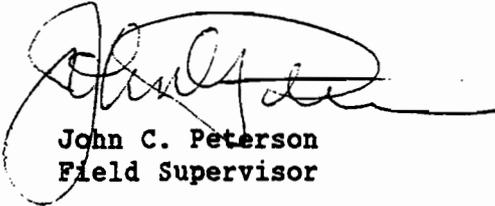
Additional wetlands at Bosque del Apache National Wildlife Refuge and State refuges should be created to compensate for any possible disturbances to the peregrine falcon, the bald eagle and whooping crane. This would create an additional food base, loafing and hunting areas for the peregrine falcon, bald eagle, whooping crane and waterfowl species.

Recommendations

1. The basal width of the new levee shall be oriented as close as possible to the low-flow channel to reduce the loss of riparian/wetland habitat.
2. Existing roads shall be used to move equipment or haul fill. In areas where it is necessary to construct new roads, they shall be located on barren ground, areas where vegetation is sparse, or in monotypic saltcedar habitat. Palustrine forest and scrub-shrub habitats where cottonwood trees are a major component as well as any palustrine emergent habitats shall be avoided.
3. Stockpile and equipment turnaround areas should be placed in barren areas. If barren areas are not available, monotypic stands of saltcedar shall be used.
4. If needed, borrow excavation sites shall be located in open areas or in monotypic stands of salt cedar. These borrow areas shall be modified for benefit of wildlife.
5. All areas designated as temporary impact areas (haul roads, stockpile areas, turnarounds, etc.) shall be revegetated with cottonwood, willow, Russian olive and native shrubs. Because these disturbed areas are often invaded rapidly by saltcedar, it may be necessary to suppress saltcedar until the planted vegetation is established. A study should be conducted on the vegetative techniques, using pole plantings, rainfall harvesting and erosion blankets.
6. Large cottonwoods that might die as a result of root damage from the placement of the levee toe shall be left in place, creating snags that provide a valuable habitat component for a variety of wildlife.
7. Any cottonwood/willow/Russian olive habitat that is impacted will be mitigated at a 5:1 ratio. Additionally, any combination of these habitat, cottonwood, willow and Russian olive shall be mitigated at a 4:1 ratio. Barren and monotypic salt cedar areas will be mitigated at a 2:1 ratio.
8. A detailed wildlife analysis, similar to the Hink/Ohmart study, shall be conducted for the entire project reach.
9. Financial participation in modifying Bosque del Apache National Wildlife Refuge and local State refuges for the benefit of waterfowl and Federally endangered species,

shall be accomplished. Plans for converting low value habitat at Bosque del Apache to high value riparian wetland habitat will cost 1.5 million 1989 dollars. Additionally, conversion of similar land at Bernardo or La Joya State Refuge will cost \$200,000 1989 dollars.

Sincerely yours,



John C. Peterson
Field Supervisor

cc:

Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Refuge, Manager, Bosque del Apache National Wildlife Refuge, Socorro,
New Mexico

Project Superintendent, Bureau of Reclamation, Albuquerque, New Mexico
Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife
Enhancement, Albuquerque, New Mexico

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CORPS OF ENGINEERS' RESPONSE
TO
FINAL FISH AND WILDLIFE COORDINATION ACT REPORT

1. Recommendation No. 1. The basal width of the new levee shall be oriented as close as possible to the low-flow channel to reduce the loss of riparian/wetland habitat.

Response: Concur

2. Recommendation No. 2. Existing roads shall be used to move equipment or haul fill. In areas where it is necessary to construct new roads, they shall be located on barren ground, areas where vegetation is sparse, or in monotypic saltcedar habitat. Palustrine forest and scrub-shrub habitats where cottonwood trees are a major component as well as any palustrine emergent habitats shall be avoided.

Response: Concur to the extent possible.

3. Recommendation No. 3. Stockpile and equipment turnaround areas should be placed in barren areas. If barren areas are not available, monotypic stands of saltcedar shall be used.

Response: Concur. However, few, if any, stockpile areas are anticipated.

4. Recommendation No. 4. If needed, borrow excavation sites shall be located in open areas or in monotypic stands of salt cedar. These borrow areas shall be modified for benefit of wildlife.

Concur. Planned measures to benefit wildlife are conversion to wetlands and revegetation with native riparian plants.

5. Recommendation No. 5. All areas designated as temporary impact areas (haul roads, stockpile areas, turnarounds, etc.) shall be revegetated with cottonwood, willow, Russian olive and native shrubs. Because these disturbed areas are often invaded rapidly by saltcedar, it may be necessary to suppress saltcedar until the planted vegetation is established. A study should be conducted on the vegetative techniques, using pole plantings, rainfall harvesting and erosion blankets.

Response: Generally concur. There is probably no need to study vegetation techniques such as rainfall harvesting and use of erosion control blankets since the techniques are well known.

6. Recommendation No. 6. Large cottonwoods that might die as a result of root damage from the placement of the levee toe shall be left in place, creating snags that provide a valuable habitat component for a variety of wildlife.

Response: Concur. This recommendation would be made a requirement upon the agency that assumes the operation and maintenance responsibility of the project.

7. Recommendation No. 7. Any cottonwood/willow/Russian olive habitat that is impacted will be mitigated at a 5:1 ratio. Additionally, any combination of these habitats, cottonwood, willow and Russian olive shall be mitigated at a 4:1 ratio. Barren and monotypic salt cedar areas will be mitigated at a 2:1 ratio.

Response: The Corps can agree to a replacement ratio no greater than 2 to 1, utilizing native trees for unavoidable saltcedar removal. The basis for this replacement ratio is the long-term removal of "edge" which generally has the higher wildlife use, the uncertainty of the extent of replacement success at this time (pole planting at Bosque del Apache should help clarify this uncertainty), and the appreciably lower cost of compensation at Bosque del Apache National Wildlife Refuge. No compensation will be made for vegetation removal in association with wetland creation.

The replacement ratio for cottonwood and willow dominated plant associations is excessive based on the two definitive wildlife studies conducted in the area and the appreciable higher wildlife use of replacement vegetation anticipated (even by the Service itself) on Bosque del Apache National Wildlife refuge due to intense management and protection from fire and grazing. However, since the acreage of these plant associations will likely be small, an equitable agreement is anticipated. We have coordinated this issue informally with our higher authority reviewers.

8. Recommendation No. 8. A detailed wildlife analysis, similar to the Hink/Ohmart study, shall be conducted for the entire project reach.

Response: Do not concur. The effects of the various water management practices on riverine and riparian fish and wildlife resources are largely outside the scope of the project and its influence of the present ecosystem. Present studies, i.e., Hink and Ohmart and Raitt et al. are providing necessary planning guidance to preserve, conserve, and enhance riparian resources.

9. Recommendation No. 9. Financial participation in modifying Bosque del Apache National Wildlife Refuge and local State refuges for the benefit of waterfowl and Federally endangered species, shall be accomplished. Plans for converting low value habitat at Bosque del Apache to high value riparian wetland habitat will cost 1.5 million 1989 dollars. Additionally, conversion of similar land at Bernardo or La Joya State Refuge will cost \$200,000 1989 dollars.

Response: The Corps of Engineers involvement with State and Federal refuges can only be in association with compensation and enhancement as specified in the Water Resources Development Act of 1986. Compensation measures accomplished on refuges would largely have to be "in kind" for resources or ecosystems adversely affected. As currently envisioned, the replacement cost for resources adversely affected would be transferred to the U. S. Fish and Wildlife Service for compensation work at Bosque del Apache. This federal refuge is the likely compensation location since any adverse project effects would be in this general area and restoration should generally be in the area affected. The Corps will recommend riparian habitat enhancement

at Bosque del Apache NWR in accordance with the Water Resources Development Act of 1986. The amount of enhancement and cost will be developed in coordination with the Service.

Additional responses to issues presented in the main text of the Coordination Act Report are as follows:

1. Page 3, Project Description, General. The project description should recognize the planned creation of about 40 acres of wetlands from borrow areas.
2. Page 3, second paragraph, third sentence. The current design is for a 16-foot-wide crest width; 2.5:1 side slopes for the first 42 miles and 3:1 for the lower 13 miles; and a average levee height of 9.8-feet.
3. Page 8, second paragraph. Section 7 consultation under the Endangered Species Act has determined that there would not be any significant interaction between the planned action and the peregrine falcon.
4. Page 11, 4th paragraph, last sentence. Forty-two acres is used as a reasonable worst case figure, recognizing that no vegetation is present along some reaches of the "spoil bank levee".
5. Page 11, last paragraph. The disposal of surplus earth has not been finalized. Likely disposal measures at this planning stage consist of adding more earth to the riverward side of the reconstructed levee if sufficient room is available and the extension of river banks in areas where the river channel is next to the levee. Earth placed in the river channel is next to the levee. Earth placed in the river channel to extend the river banks would be stabilized with Kellner jacks and riparian vegetation to preclude or minimize its erosion by streamflow. An indirect consequence of bank extension could be to expand riparian vegetation.
6. Page 12, third paragraph. Please refer to comment 3.
7. Page 12, penultimate paragraph, first and second sentences. The use of the subjunctive mood might be more appropriate since figures given to the Service represent a reasonable worst case analysis.
8. Page 12, last paragraph. The recommended mitigation ratios are discussed later in association with the Service's recommendation.
9. Page 13, fist paragraph. Revegetation techniques are known sufficiently that this recommendation is not necessary.
10. Page 13, second paragraph. The Corps concurs that prior to the creation of a large number of wetlands the underground hydraulic regime should be evaluated in relation to the development of "healthy" marshes.
11. Page 13, third paragraph. These effects of a modified flow regime are largely independent of the planned effort. Existing wildlife studies by Hink and Ohmart and Raitt et al. are providing appreciable guidance for project planning.

12. Page 14, first complete paragraph. The Corps concurs with this potential opportunity to enhance resources at Bosque del Apache National Wildlife Refuge in association with the proposed action. This potential will be pursued as part of the project.

13. Page 14, first paragraph. Measures to avoid adverse effects to potentially endangered species were established in Section 7 coordination under the Endangered Species Act. The Corps concurs that Bosque del Apache National Wildlife Refuge would serve as an excellent location for compensation measures for unavoidable loss of wildlife habitat associated with project construction. However, these measures relate to enhancement rather than compensation for endangered species. The creation of wetlands as now planned would very likely enhance the bald eagle and peregrine falcon but a majority of these would not be on the refuge.

APPENDIX D
FISH AND WILDLIFE MITIGATION
INCREMENTAL COST ANALYSIS

APPENDIX D

FISH AND WILDLIFE MITIGATION INCREMENTAL COST ANALYSIS

INTRODUCTION

Incremental analysis is a Corps of Engineers' policy mandated procedure that describes the process followed and factors considered in selecting fish and wildlife mitigation features. This procedure identifies cost differences for mitigation features that address a mitigation objective and help select the most cost effective mitigation features. The opportunity to incorporate management options or various levels of management within a given plan or alternative for this particular project is limited because of the type of mitigation measures considered, by existing land use, or both.

RESOURCE INVENTORY AND CATEGORIZATION

The plant and animal communities which characterize the study area have been described in Section III of the final SEIS to which this Incremental Analysis is appended. Plant communities that could or would be affected by the planned action consist of the following dominant vegetation or areas: cottonwood/willow edge; salt cedar edge; salt cedar non-edge; wetland; open-area mixture of grasses, forbs, shrubs; sapling trees of cottonwood, salt cedar, and willow; and open-area sparse grasses and salt cedar. Upland grass and shrub habitat would also be affected by borrow activities. However, this plant community is not included in the mitigation analysis since borrow area revegetation with similar or higher wildlife value grasses and shrubs is an integral part of project construction. Of these plant communities, the native plant associations of cottonwood and willow and cattail marsh have the highest priority in terms of wildlife values and regional importance. Ranking of habitat is based on quantitative wildlife use referenced and discussed in the main body of the final SEIS, as well as resilience and time to reestablish a community of comparable composition and structure.

AMOUNT OF HABITAT TYPES REMOVED

The draft SEIS employed a reasonable, worst case estimate of acreage affected because design features were still general at that stage of planning. Subsequent refinement of design features has enabled a corresponding refinement of project effects and acreage affected. An assumption is made that recently developed wetlands, caused by high water storage in Elephant Butte Reservoir, would persist, following reservoir drawdown and rehabilitation of sediment-filled water conveyance facilities. Mitigation in the form of compensation would be accomplished for vegetation and wetland losses incurred primarily as a result of levee enlargement and reconstruction. A reasonable, worst case analysis is still employed where the extent of disturbance is unknown, e.g., abandoned conveyance channel.

Survey results showed that about 14.5 acres of various aged salt cedar, 200 cottonwood trees with a 6-inch dbh (diameter at breast height) or greater, 38 tree willows (Salix goodingii or S. amygdaloides), 10 Russian olive trees, and

about 0.1 acre of a combination of salt cedar, cottonwood, and tree willow saplings could be removed from the first 43.8 miles of embankment. The remaining 10.5 miles, most of which is within Elephant Butte Reservoir or affected by high water storage, could lose about 17.5 acres of various aged salt cedar, 360 cottonwood trees, 109 tree willows, and 3.5 acres of a combination of salt cedar, cottonwood, and willow saplings. Many cottonwood trees are located in relatively dense, discontinuous stands at the toe of the embankment. Total combined acreage or number that could be removed are about 32 acres of salt cedar (mostly edge), 560 cottonwood trees, 147 tree willows, 10 Russian olive trees, and 3.6 acres of a combination of salt cedar, cottonwood and tree willow saplings (see Table 1).

Table 1

<u>Plant Community</u>	<u>Acreage or Number</u>
Salt Cedar	
Edge	32 (ac.)
Non-Edge	Small acreage possibly used for wetland mitigation
Cottonwood Edge	560 (ea.)
Tree Willow Edge	147 (ea.)
Mixture of Salt Cedar, Cottonwood, and Willow Saplings	3.6 (ac.)
Russian Olive Edge	10 (ea.)
Upland Grassland and Shrub	60 (ac.)
Wetlands	
Abandoned Conveyance Channel	6 to 7 ac. max.
Levee Toe Marsh	6 to 7 ac.

Cottonwood and willow forest and woodland rank high in wildlife species diversity and require several decades to establish. Also, the high wildlife use of this community is more pronounced along the levee edges where contributions from adjacent and different habitat types compliment wildlife use of this zone. Because of these characteristics any temporary, and especially permanent, removal of mature cottonwood- and willow-dominated communities is a major mitigation objective.

Salt cedar communities rank relatively low in species diversity although density of those species utilizing salt cedar is relatively high. Salt cedar is very resilient and is capable of rapidly re-establishing. The selective clearing of salt cedar stands, followed by revegetation with native trees, has shown significant potential for increasing bird density and richness. Also, the relatively low wildlife use of salt cedar makes stands of this plant species prime candidates for constructing high value wetlands or planting compensatory cottonwood/willow vegetation.

Open, early age communities have moderate to high wildlife density and diversity. They are commonly located in or near the active river channel, side channels, or areas where riparian vegetation has been eliminated by long-term inundation. They frequently follow a pattern of removal by high flows followed by re-establishment. Although these community types are resilient, those with a dominance of cottonwood and willow have the potential to develop into higher wildlife use acres and, consequently, would be avoided to the extent possible. This community type would be considered as a candidate area for wetland creation.

Sparsely vegetated, dry openings have both low wildlife diversity and density. This community type would be used for any needed construction-related activity. These areas would be prime compensation sites for establishment of cottonwood/willow trees or wetland compensation.

Wetlands are particularly valuable habitat for a diversity of wildlife because of their relative scarcity in the arid Southwest, their productivity, and because many wildlife species are directly dependent on aquatic habitat. Wildlife use of wetlands that could be affected by project construction is limited by a lack of standing water, disturbance, size and configuration, and grazing. Wetland compensation may include rehabilitation of the Mulligan Gulch Wetland.

Upland grassland, and especially creosotebush-dominated shrubland, are candidate borrow locations because of the potential to re-establish vegetation rapidly, as well as the potential to improve ground cover and associated uses in the case of creosotebush.

COMPENSATION MEASURES AND QUANTITIES

Measures to compensate for the reduction of wildlife habitat have been recommended by the U.S. Fish and Wildlife Service (Service) during the development of the recommended plan and were reflected in the draft SEIS (see Appendix C). The Service's recommended replacement ratios are: two acres of cottonwood tree plantings (poles) for each acre of salt cedar removed and five acres of cottonwood tree plantings for each acre of cottonwood, willow, or Russian olive removed. While Bosque del Apache NWR was initially selected by the Service and the Corps as the site where a majority of compensation measures (replacement of removed vegetation with cottonwood and willow trees) would be accomplished, the Service and the New Mexico Department of Game and Fish asked that a different compensation strategy be utilized following the distribution of the draft SEIS. This strategy involves relocating the compensation site from Bosque del Apache NWR to within the riparian zone at selected sites throughout the project area (generally above Elephant Butte Reservoir). The rationale for this change is to compensate for losses closer to affected areas, thereby maintaining the overall wildlife use of the riparian zone and using an existing program of salt cedar replacement on Bosque del Apache NWR to enhance wildlife habitat on the Refuge proper.

An additional element of this modified strategy is to reserve a portion of the riparian zone for wildlife conservation via a conservation easement. The primary goal of a conservation easement would be to improve habitat with management - primarily by excluding grazing. Used in tandem, the amount of planted acreage could be reduced commensurate with the extent of the conservation easement. As stated in the main text, coordination will continue with the Middle Rio Grande Conservancy District, the land-managing agency. If not feasible, then

compensation by the use of replacement vegetation and associated management would be the prime method of compensation. These compensation strategies are discussed in the following paragraphs.

The Corps has conducted a quantitative assessment of potential loss of habitat use by wildlife compared to wildlife use of replacement vegetation through time to develop compensation ratios. Replacement vegetation would be cottonwood and willow utilizing the pole planting technique, which consists of planting a dormant pole in a small diameter hole that is excavated to the water table. This quantitative evaluation compared avian use of the various community/structure types, since birds are the largest animal group utilizing riparian vegetation and are good indicators of habitat quality. Where specific quantitative data were not available, use figures that were thought to insure conservation of use were selected. Compensation ratios developed by the Corps for the major community/structure types that could be affected utilizing cottonwood/willow replacement vegetation are presented in Table 2. Compensation for lost wetlands will be at a one-for-one replacement ratio. This compensation ratio for affected wetlands is considered highly adequate because of the anticipated higher quality that can be achieved through constructed wetlands. Replacement of affected wetlands would be accomplished by their improvement, expansion, replacement, or all three.

Table 2

<u>Community Affected</u>	<u>Replacement Ratio</u>
Cottonwood/Willow Edge	1:2 Ratio (Removal considered permanent)
Salt Cedar Edge	1:1.6 Ratio (Removal considered permanent)
Salt Cedar Non-Edge	Possible use for wetland compensation. No replacement.
Open Areas - mixture of salt cedar, cottonwood, & tree willow saplings	1:1.1 (Removal considered permanent)
Wetlands	
Abandoned Conveyance Channel	Improvement of affected areas or 1:1 replacement.
Levee Toe Wetlands	1:1
Upland Grass & Shrubland	1:1 (Temporary removal, mechanical revegetation)

Although the developed replacement ratio for the removal of cottonwood and willow edge is 1:2, a ratio of 1:4 is conditionally adopted. This increase has been accomplished because of the lack of long-term data for the establishment and developmental success of plantings. While short-term data at Bosque del Apache NWR demonstrates good to excellent results, the success of the program will be monitored and, if necessary, the stated ratio modified. Presented in Table 3 is the estimated compensation acreage by revegetation category. A planting density of approximately 100 cottonwood/tree willow pole plantings per acre is utilized.

Acquisition of a wildlife conservation easement within the riparian zone and subsequent fencing and management would enhance plant diversity and structure and, correspondingly, enhance fauna diversity and density. This enhancement would be maximized in those plant communities with demonstrated high wildlife use, e.g., cottonwood/willow. Therefore, a strategy of selecting existing cottonwood stands and managing for wildlife can be an effective compensation measure. A conservative estimate of the increase in wildlife value that would occur utilizing a conservation easement is 25 percent, realizing that the exclusion of grazing in some southwestern riparian zones has far exceeded this figure. Therefore, a ratio of 4 acres of easement lands can be substituted for every acre of planned planted acreage. Arbitrarily using one-half (46.3) of the 92.6 acres that would be planted, about 185 acres could be acquired for a wildlife conservation easement. As stated, the acreage figures for planting and conservation easements may be adjusted, depending on actual site conditions, increasing easement lands while decreasing planted acreage or visa versa.

Table 3

Estimated Number of Compensation Acres by Vegetation Category

<u>Category</u>	<u>Compensation Ratio</u>	<u>Acres or Numbers Affected</u>	<u>Compensation Acreage*</u>
Cottonwood/Willow Edge (includes Russian olive)	1:2 (ultimately 1:4)	707 ea.	28.3 ($\frac{4 \times 707}{100}$)
Salt Cedar Edge	1:1.6	32 ac.	51.2 (1.6 x 32)
Salt Cedar	Possible use of small acreage for wetland compensation - no compensation		
Open Area (early growth stage consisting of sparse grasses, shrubs, & saplings of cottonwood, willow & salt cedar)	1:1.1	3.6 ac.	4 (1.1 x 3.6)
Wetlands			
Abandoned Conveyance Channel	Improvement of Affected Areas	6-7	6-7 (1 x 6-7)
Levee Toe Wetlands	1:1	6-7	6-7 (1 x 6-7)

Estimated Compensation Requirements Specific to Bosque del Apache NWR

<u>Category</u>	<u>Compensation Ratio</u>	<u>Acres or Numbers Affected</u>	<u>Compensation Acreage</u>
Cottonwood Edge	1:5	0.1	0.5 (0.1 x 5)
Salt Cedar Edge	1:2	4.26	8.5 (2 x 4.26)
Open Areas (mixed saplings)	1:1	0.1	0.1 (1 x 0.1)

*100 cottonwood/tree willow plantings per acre

COMPENSATION ALTERNATIVES (STRATEGIES)

Several alternative measures were formulated and evaluated to select a compensation plan that was both cost effective and accomplished the objectives established for the project. As stated, the alternative that was recommended in the draft SEIS, use of Bosque del Apache NWR, was removed from consideration following public review of the draft SEIS and subsequent meetings with the Fish and Wildlife Service and the New Mexico Department of Game and Fish. The Service requested that their previously recommended use of Bosque del Apache NWR for accomplishing project compensation be changed to accomplishing compensation within the riparian zone of the Rio Grande throughout the length of the project. Consequently, this alternative is no longer a viable option and is not included in the following discussion of alternatives. Also, a major compensation feature of alternatives presented in the draft SEIS was that of borrow area creation. Since more refined design has largely eliminated the need for the creation of borrow areas within the riparian zone, this feature is not reflected in the following discussion of alternatives. In-kind compensation for the removal of salt cedar as an option was not consistent with the stated mitigation objective of improving wildlife habitat and, consequently, was not considered as an option.

Alternative 1 (The Recommended Plan)

- a. Use of public land within the riparian zone.
- b. Combination of planting of native riparian vegetation and wildlife conservation easement.
- c. Wetland replacement on public land.
- d. Management of compensation lands.

Alternative 2

- a. Use of public land within the riparian zone.
- b. Use of open areas and monotypic salt cedar stands and replacement with native riparian vegetation.
- c. Wetland replacement on public lands.
- d. Management of compensation lands.

Alternative 3

- a. Combination of using public and private land within the riparian zone.
- b. Use of open areas and monotypic salt cedar stands and replacement with native riparian vegetation.
- c. Wetland replacement on public lands.
- d. Management of compensation lands.

Alternative 4

- a. Purchase of private, cultivated floodplain land located near the riparian zone.
- b. Site preparation and planting of compensatory native riparian vegetation.
- c. Wetland replacement on private land.
- d. Management of compensation lands.

COSTS ASSOCIATED WITH COMPENSATION ALTERNATIVES

Costs associated with converting monotypic salt cedar stands to native vegetation are largely based on costs obtained from Bosque del Apache NWR, which is conducting large-scale replacement of salt cedar. Refuge costs have been adjusted to reflect probable contract costs for any mitigation work accomplished on purchased land or public land. Costs associated with obtaining a wildlife conservation easement are based on grazing rates used by the Bureau of Land Management and associated fees.

Alternative 1 (Recommended Plan)

<u>Feature</u>	<u>Quantity (acs.)</u>	<u>Cost</u>	
		<u>Unit Cost (per ac.)</u>	<u>Total Cost</u>
Planting of native riparian vegetation on public land (includes 10 ac. on Bosque del Apache NWR) (purchase & planting)	46.3*	\$5,000	\$242,500
Conservation Easements - Public Land	185 (approx.)	28	5,180
Fencing	85 ac.	\$2/ft.	105,600
Wetland Replacement on Public Land (includes water rights of 6.5 ac. ft./ac. @ \$3,000/ac. ft.)	14 (max.)	5,000	70,000
Management	111 (Job-10 yrs.)	100	<u>11,100</u>
TOTAL			\$434,380

*Assumes about one-half of calculated 92.6 acres of replacement vegetation necessary to compensate for vegetational loss, i.e., 46.3 acres.

Alternative 2

<u>Feature</u>	<u>Quantity (acs.)</u>	<u>Cost</u>	
		<u>Unit Cost (per ac.)</u>	<u>Total Cost</u>
Use of Public Land Within Riparian Zone (including 10 ac. on Bosque del Apache NWR)	92.6	-0-	-0-
Site Preparation, Plant Purchase & Planting	92.6	\$5,000	\$485,000
Wetland Development (includes water rights of 6.5 ac. ft. per ac. @ \$3,000/ac. ft.)	14 (max.)	5,000	70,000
Management	111 (Job-10 yrs.)	100	11,100
Fencing	15,000 ft.	\$2/ft.	<u>30,000</u>
TOTAL			\$574,100

Alternative 3

<u>Feature</u>	<u>Quantity (acs.)</u>	<u>Cost</u>	
		<u>Unit Cost (per ac.)</u>	<u>Total Cost</u>
Use of Public & Private Land Within the Riparian Zone	47 Public/47 Private	(-0-) (\$500)	\$ 23,500
Site Preparation, Plant Purchase & Planting	92.6	\$5,000	\$463,000
Wetland Replacement on Public Land	14 (max.)	5,000	70,000
Management	111 (Job-10 yrs.)		11,100
Fencing	15,000 ft.	\$2/ft.	<u>30,000</u>
TOTAL			\$597,600

Alternative 4

<u>Feature</u>	<u>Quantity (acs.)</u>	<u>Cost</u>	
		<u>Unit Cost (per ac.)</u>	<u>Total Cost</u>
Purchase Private, Cultivated Land in Floodplain	92.6	\$3,500	\$324,100
Site Preparation, Plant Purchase & Planting	92.6	3,000	277,800
Wetland Replacement on Public Land	14	5,000	70,000
Management	111 (Job-10 yrs.)	100	11,100
Fencing	15,000 ft.	\$2/ft.	<u>30,000</u>
TOTAL			\$713,000

ANALYSIS AND SUMMARY OF COMPENSATION ALTERNATIVES

Alternative number one, consisting of 46.3 acres of compensatory planting of cottonwood and willows and acquisition of a conservation easement on about 185 acres of high wildlife use riparian vegetation, satisfies the objective resulting from multiple agency coordination. In addition, it also is the lowest cost alternative. Alternative number two is also a viable alternative and would be utilized in the event acquisition of a wildlife conservation easement is not feasible.

APPENDIX E

ENDANGERED SPECIES CORRESPONDENCE



DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1580
ALBUQUERQUE, NEW MEXICO 87103-1580

REPLY TO
ATTENTION OF:

January 26, 1988

Engineering and Planning Division
Planning Branch

Mr. John Peterson
Field Supervisor
Ecological Services, USEWS
P.O. Box 4487
Albuquerque, New Mexico 87196

Dear Mr. Peterson:

The Albuquerque District is currently studying a plan to reduce the effects of flooding and sediment deposition on farmlands, urban areas, the Bosque del Apache National Wildlife Refuge, and major water conveyance and storage facilities in the Middle Rio Grande Valley from runoff contributed by the Rio Puerco and Salado drainages. This plan consists of the rehabilitation of the existing levee system which extends from the San Acacia Diversion Dam to the head of Elephant Butte Reservoir.

In accordance with Section 7(a) of the Federal Endangered Species Act, as amended, we request a list of any listed endangered or threatened species, critical habitat, or those proposed for listing that could be affected by the planned action.

Your continued coordination in this endeavor is appreciated.

Sincerely,

Samuel N. Aiken, P.E.
Chief, Engineering and Planning Division



**UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**

Ecological Services
Suite D, 3530 Pan American Highway NE
Albuquerque, New Mexico 87107

Cons. #2-22-88-I-035

February 12, 1988

District Engineer
Corps of Engineers, U.S. Army
Attn: Chief, Engineering and Planning Division
P. O. Box 1580
Albuquerque, New Mexico 87103

Re: Río Grande Floodway - San Acacia to Bosque del Apache

Dear Mr. Aiken:

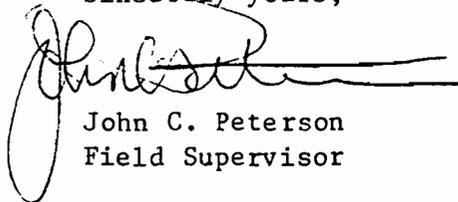
This responds to your letter dated January 27, 1988 requesting a list of species Federally listed or proposed to be listed as threatened or endangered. The proposed action involves rehabilitating the existing levee system which extends from the San Acacia Diversion Dam to the head of Elephant Butte Reservoir. Your geographic area of interest is Socorro County, New Mexico.

We have used the information in your request to narrow the enclosed list of species occurring in the project area to those which may be affected by your proposed action. We find that the bald eagle, whooping crane and the interior least tern may be found in the project area.

Information relating to the Section 7 consultation process has been enclosed for your use in project planning. We suggest you contact the New Mexico Department of Game and Fish and the New Mexico Energy, Minerals and Natural Resources Department for information concerning fish, wildlife and plants of State concern.

If we can be of further assistance, please call Chuck Mullins at (505) 883-7877 or FTS 474-7877.

Sincerely yours,



John C. Peterson
Field Supervisor

Enclosures

cc: (w/cy encl)
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, Energy, Minerals and Natural Resources Department, Forestry
Division, Santa Fe, New Mexico
Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife
Enhancement, Albuquerque, New Mexico

Species List

Proposed Rio Grande Floodway San Acacia to Bosque del Apache,
Socorro County, New Mexico

February 12, 1988

Listed Species

Whooping Crane (Grus americana) - Occupies the project area October through February. Roosts on gravel bars and islands in the Rio Grande. Feeds in cultivated fields and wetlands within several miles of the Rio Grande.

Authorities: James Lewis, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM 87103, (505) 766-3974 and Roderick Drewien, c/o Bosque del Apache National Wildlife Refuge, P.O. Box 1246, Socorro, NM 87801, (505) 835-1828.

Interior Least Tern (Sterna antillarum athalassos) - This species nests on sandy beaches on shorelines of streams, rivers and lakes and is found on Bitter Lake National Wildlife Refuge.

Authority: John P. Hubbard, New Mexico Department of Game and Fish, State Capitol, Santa Fe, New Mexico 87503, (505) 827-2438.

Bald Eagle (Haliaeetus leucocephalus) - Winters in the project area and is also a migrant. Roosts in large trees which may or may not be close to their feeding areas. These include rivers, reservoirs, and ponds.

Authorities: John P. Hubbard, New Mexico Department of Game and Fish, Villagra Bldg., Santa Fe, New Mexico 87503, (505) 827-7438.



DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1580
ALBUQUERQUE, NEW MEXICO 87103-1580

REPLY TO
ATTENTION OF:

April 19, 1988

Engineering and Planning Division
Planning Branch

Mr. John Peterson
Field Supervisor
United States Fish and
Wildlife Service
Ecological Service
Suite D, 3530 Pan American
Highway Northeast
Albuquerque, New Mexico 87107

Dear Mr. Peterson:

I have reviewed your letter of February 12, 1988 which states that the endangered whooping crane (Grus americana), interior least tern (Sterna antillarum athalassos), and the bald eagle (Haliaeetus leucocephalus) may be found in the vicinity of the spoil bank levee that extends from the San Acacia irrigation diversion to the headwaters of Elephant Butte Lake. We have taken the liberty of adding the peregrine falcon (Falco peregrinus anatum) since it is present in the subject area during migration. For the consultation procedures of the Endangered Species Act of 1973 and Section 7(c) of the 1978 amendments, the U.S. Army Corps of Engineers, Albuquerque District, has compiled information on these species in order to assess possible effects that rehabilitation of the spoil bank may have on them. This information was derived from an on-site inspection of the areas affected, consultation with knowledgeable persons, in-house data and expertise, current literature, and a review of related studies and reports. The results of these studies and assessment of potential effects are presented in the enclosed Biological Assessment.

Based on this assessment the Corps of Engineers has determined that rehabilitation of the existing spoil bank could have an effect on the whooping crane and the bald eagle and associated critical habitat. The flood protection function of the project would provide a high degree of protection to habitat, including critical habitat, from the damaging effects of flooding, accompanying sedimentation, and habitat modification or loss. The potential for flooding to adversely affect the continued recovery of the whooping crane would be significantly reduced. Measures that would be taken

to prevent adverse effects due to construction related activity consist of scheduling construction during the absence of affected species, concentrating construction activities to localize disturbances, and close coordination with U.S. Fish and Wildlife Service personnel that monitor the whooping cranes in the middle Rio Grande Valley. Implementation of the project, combined with measures to avoid potential adverse effects, should result in a net benefit to endangered species. Therefore, I feel no further coordination is required.

Should you have any questions or require additional information, please contact Mr. Mark Sifuentes of my staff at 766-3577.

Sincerely,

Samuel N. Aiken, P.E.
Chief, Engineering and Planning Division

Enclosure

BIOLOGICAL ASSESSMENT OF THE PROBABLE EFFECTS
OF LEVEE REHABILITATION MEASURES ON ENDANGERED
BIRDS IN THE SAN ACACIA TO ELEPHANT BUTTE
RESERVOIR REACH OF THE RIO GRANDE

INTRODUCTION

The Albuquerque District is currently reevaluating a flood and sediment control plan authorized by the Flood Control Act of 1948 (Public Law 80-858, 203). This reevaluation is being accomplished because of institutional problems with the recommended detention reservoirs on the Rio Puerco and Rio Salado drainages. Its objective is to reduce the effects of flooding and sediment deposition on farmlands, urban areas, a national wildlife refuge, and major water conveyance and storage facilities in the middle Rio Grande Valley resulting from drainage from the Rio Puerco and Rio Salado.

MEASURES BEING EVALUATED

The authorized plan currently being evaluated consists of rehabilitating the existing spoil bank that is located on the west bank of the Rio Grande from San Acacia to the headwaters of Elephant Butte Lake. The rehabilitated levee would follow the alignment of the spoil bank. The levee embankment would average about 11.6 feet high, have 2 1/2 horizontal to 1 vertical side slopes, and have a 12-foot-wide crown. As currently envisioned material from the present spoil bank would be used to construct the engineered levee. About 10 percent of the spoil bank material would be unsuitable and would be disposed of at presently unknown sites. If soils analysis finds a greater percentage of spoil bank material unsuitable, then suitable material would have to be obtained elsewhere. Alternative borrow sources have not been identified at this planning stage but potentially could be located in the riparian zone, in the flood plain, or on the bordering terraces. Seepage under the levee would be controlled with drains in the landward toe of the levee. These toe drains would consist of 12-inch diameter, perforated pipe that would discharge into the conveyance channel. Sections of levee subject to water erosion would be protected with Kellner jetties, riprap, or vegetation. Restorative or mitigative measures would consist of revegetation with high quality riparian vegetation, enhancement of riparian vegetation, and conversion of borrow areas into wetlands.

PERCEIVED INTERRELATIONSHIP WITH ENDANGERED SPECIES

General There are four species currently classified as Federally endangered that could be present in the general vicinity of the proposed action and could possibly be affected. These are the interior least tern (*Sterna antillarum athalassos*), bald eagle (*Haliaeetus leucocephalus*), whooping crane (*Grus americana*), and peregrine falcon (*Falco peregrinus*),

Species Account

a. Interior Least Tern. The least tern breeds from California, South Dakota, and Maine southward locally to Chiapas and the Caribbean, with the major inland population in the Mississippi Basin; the species winters from the Pacific Coast of Mexico and the U.S. Gulf Coast southward. In New Mexico the terns breed in the vicinity of Roswell, including regularly at Bitter

Lake National Wildlife Refuge which is the key habitat area in the state. The species occurs in migration in Eddy County and as a vagrant elsewhere, including Espanola, Bosque del Apache National Wildlife Refuge, near Glenwood, Las Cruces, and Alamogordo (NMDCF, 1985). The tern has not been recorded at Bosque del Apache National Wildlife Refuge in recent years (Taylor, 1988). The least tern is a colonially-nesting waterbird, nesting on the ground, typically on sites that are sandy and relatively free of vegetation. In New Mexico and other parts of the southern Great Plains, alkali flats are selected nesting areas. Elimination and degradation of nesting habitat has been the primary reason for its decline and range reduction (NMDGF, 1985a).

b. Bald Eagle. The bald eagle migrates and winters [in New Mexico] from the northern border southward regularly to the Gila, lower Rio Grande, Middle Pecos, and Canadian valleys. This species is found occasionally elsewhere in summer, and is a breeding bird -- with nests report in "San Juan, Colfax, and Catron Counties". These habitat areas include winter roost and concentration areas such as Navajo Lake, Elephant Butte Lake, Caballo Lake, and the Upper Gila Basin. Winter and migrant populations seem to have increased in New Mexico apparently as the result of reservoir construction and the expansion of fish and waterfowl populations. In New Mexico and adjacent areas, optimal habitats center on riparian and lacustrine environments -- where food, shelter, and potential nest sites are in the greatest supply for the species. The major food items of bald eagles in New Mexico appear to be waterfowl, fish and carrion. (NMDGF, 1985b)

At Bosque del Apache National Wildlife Refuge the bald eagle is a migrant and winter resident. Eight to ten eagles commonly roost overnight at the refuge (Taylor, 1988). There is no nesting. The eagles arrive about mid-November and depart about mid-March. Waterfowl are a major prey item with emphasis on snow geese. Cottonwood trees in the riparian zone and in the flood plain are used for perches and night roosts. Bald eagles habitually use roosts in Units 18c and 18bw and 18d, which are located outside the riparian zone. Other habitually occupied spots include Unit 12b and borders along Units 9, 5, 6, 14, 13 and 16 as well as Unit 24c, all outside the riparian zone. The extent to which bald eagles use cottonwood trees in the riparian zone is not known, but primary use areas are around the ponds and fields west of the conveyance channel. The number of cottonwood trees in the riparian zone is very small relative to the area covered by salt cedar. Also, recent fires have further depleted the number of cottonwood trees.

Bald eagles also utilize the head waters of Elephant Butte Lake. Presence and use of any given area likely varies, depending on water elevations.

c. Whooping Crane. This species was formerly rather widespread in North America, but through historic times it has declined to the point that at present, it breeds only in Wood Buffalo National Park in the Northwest Territories; from there it migrates through the Great Plains to winter on the Texas coast at Aransas National Wildlife Refuge. Beginning in 1975, an experimental population has been produced at Grays Lake National Wildlife Refuge, Idaho, and these birds migrate southward to winter in New Mexico in the autumn, and most winter in the middle Rio Grande Valley (NMDGF, 1985c). Here whooping cranes occupy the same habitats as their foster-parent

sandhill cranes. Foraging areas are generally agricultural fields and valley pastures, particularly where there is waste grain or sprouting crops. Both species of cranes roost together, typically on sand bars in the Rio Grande (NMDGF, 1985c). So far, none of the Idaho whooping cranes have paired and bred. Whooping cranes do not readily tolerate disturbance to themselves or their habitat.

Within Bosque del Apache National Wildlife Refuge, all areas at or below 4,600 feet in elevation are critical habitat* for the whooping crane. This area includes most of the flood plain, including the riverine and riparian zone. This classification provides Federal protection to this area under Section 7 of the Endangered Species Act of 1973 and is an official notification to federal agencies of their responsibilities pursuant to this act. The existing spoil bank is generally not used by the whooping cranes (Taylor, 1988). Like most cranes, whoopers on and off the refuge are sensitive to disturbances.

During the winter of 1987 to 1988, whooping cranes used sand bars in the Rio Grande both within the refuge and at isolated areas outside the refuge, e.g., at the San Acacia Diversion, for night roosting. A factor that is thought to be discouraging pair formation among the whooping cranes is the general absence of isolation in the valley, which is a prime requisite by the cranes.

d. Peregrine Falcon. The peregrine falcon is a spring and fall migrant in the middle Rio Grande Valley. Prey consists almost entirely of birds ranging in size from swallows to ducks and large shore birds. Jays, woodpeckers, swifts, mourning doves, and pigeons are among the commonly taken prey species in the state. Up to three falcons have been recorded annually at Bosque del Apache. Habitat use on Bosque del Apache is similar to that of the bald eagle.

PERCEIVED EFFECTS OF PROJECT IMPLEMENTATION ON ENDANGERED SPECIES

Interior Least Tern. The presence of this species in the proposed project area is doubtful. Consequently, project implementation should not affect this bird.

Bald Eagle. The proposed project could have an effect on the small number of bald eagles that overwinter at Bosque del Apache National Wildlife Refuge. The enhanced level of flood protection provided the refuge and its

*Critical habitat means any air, land, or water area (exclusive of those existing man-made structures or settlements which are not necessary to the survival and recovery of a listed species) and constituent elements thereof, the loss of which would appreciably decrease the likelihood of the survival and recovery of a listed species or a distinct segment of its population. The constituent elements of critical habitat include, but are not limited to: physical structures and topography, biota, climate, human activity, and the quality and chemical content of land, water, and air. Critical habitat may represent any portion of the present habitat of a listed species and may include additional areas for reasonable population expansion.

wildlife resources would benefit this species by protecting and perpetuating habitat, including habitat for prey species. Conversely, construction activities during the winter months could disturb the eagles and their prey, perhaps requiring them to modify their use of the refuge. Since the primary use areas appear to be away from the riparian zone, any use change would likely be small and temporary. Depending on water levels at Elephant Butte Lake which would determine where the head of the lake was, and construction during the period of eagle presence, eagles could possibly be disturbed. If eagles were present, disturbances would likely be localized and overall eagle presence and use of the lake should not be affected.

The scheduling of construction to avoid that period of the year when whooping cranes are present (discussed later in this section) would simultaneously avoid any possible adverse effects of construction on bald eagles. The basal width of the rehabilitated levee should be within that of the existing spoil bank and few, if any, of the bordering trees should be affected. However, at this stage in project planning, precise design, distances, and construction requirements are not known precisely enough to definitely state the extent to which cottonwood trees near the riverward toe of the rehabilitated levee would be affected. While the avoidance of cottonwood trees would be a major objective in the alignment of the levee, the possibility exists that some trees could be affected. If a tree, or trees, were removed from the toe of the levee that received bald eagle use, other trees in the vicinity would likely be substituted by the eagle. Although there could be a local redistribution of eagle use within the immediate area, no decline in bald eagle use is anticipated. Any needed borrow areas would be strategically located to avoid cottonwood trees that could potentially be used by eagles for roosting.

Whooping Cranes. The proposed project would have an effect on the experimental flock of whooping cranes and their designated critical habitat. The enhanced level of flood protection afforded the refuge by the project would correspondingly provide a high level of insurance that critical habitat for the whooping cranes would be perpetuated as well as substantially improving future chances of whooping crane survival and expansion. The physical rehabilitation of the spoil bank should not affect the whooping cranes. However, if construction were to occur during the October 15 to March 1 period that the cranes are present, the activity and sounds associated with construction could disturb the whoopers especially on the refuge and contiguous areas. Isolated roosting areas could also be disturbed by construction activities and sounds. An effective precautionary measure that could be employed to prevent any possible adverse effects to whooping cranes in this general area of the refuge would be to schedule construction activities from March 1 to October 15 (Brown, 1988). Since crane use of areas outside the general refuge area changes frequently, consultation with the whooping crane monitoring team prior to contract award would determine avoidance measures. These measures could range from constructing only short sections of the levee at a time to minimize widespread disturbance to scheduling construction during the absence of the whoopers.

Peregrine Falcon. The peregrine falcon should not be affected by the proposed project. The migratory status of the peregrine falcon, combined with the confined construction area, should preclude any significant interaction.

CONCLUSIONS

The proposed project would affect two endangered species, the bald eagle and the whooping crane. Primary area of effect is the Bosque del Apache National Wildlife Refuge. The flood protection function of the project would provide a high degree of protection to habitat, including critical habitat from the damaging effects of flooding, accompanying sedimentation, and habitat modification or loss. The potential for flooding to adversely affect the continued recovery of the whooping crane would be significantly reduced. Measures that would be taken to prevent adverse effects due to construction-related activity and sound consist of scheduling construction during the absence of affected species, concentrating construction activities to localize disturbances, and close coordination with U.S. Fish and Wildlife Service personnel that monitor the whooping cranes in the middle Rio Grande Valley. Modifications of levee alignment would be accomplished, if necessary, to avoid critical roost areas. Maximum avoidance of cottonwood trees in the riparian zone, especially along the riverward side of the levee, would assist in perpetuating continued bald eagle use of the Refuge. The use of these measures to avoid adverse effects would result in a net benefit to endangered species.

REFERENCES

- Brown, Wendy. 1988. U.S. Fish and Wildlife Service Personal Communication, March 1988.
- New Mexico Department of Game and Fish. 1985a. Handbook of Species Endangered in New Mexico, BIRD/LA/ST/AN:1-2. Account by John P. Hubbard.
- _____. 1985b. Handbook of Species Endangered in New Mexico, BIRD/AC/HA/LE:1-2. Account by John P. Hubbard.
- _____. 1985c. Handbook of Species Endangered in New Mexico, BIRD/GR/GR/AM:1-2. Account by John P. Hubbard.
- Taylor, John. 1988. U.S. Fish and Wildlife Service-Bosque del Apache National Wildlife Refuge. Personal Communication, March 1988.



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services

Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

March 9, 1990

District Engineer
Corps of Engineers, U.S. Army
P. O. Box 1580
Albuquerque, New Mexico 87103

Dear Colonel Dougan:

This responds to your Biological Assessment Of The Probable Effects Of Levee Rehabilitation Measures On Endangered Birds In The San Acacia To Elephant Butte Reservoir Reach Of The Rio Grand. The Albuquerque District is currently reevaluating a flood and sediment control plan authorized by the Flood Control Act of 1948 (Public Law 80-858, 203). The objective of the plan is to reduce the effects of flooding and sediment deposition from the Rio Puerco and Rio Salado on farmlands, urban areas, a national wildlife refuge, and major water conveyance and storage facilities in the middle Rio Grande Valley. The plan currently being evaluated proposes to rehabilitate the existing spoil bank that is on the west side of the Rio Grande from San Acacia to the head of Elephant Butte Reservoir. The rehabilitated levee would generally follow the alignment of the existing spoil bank.

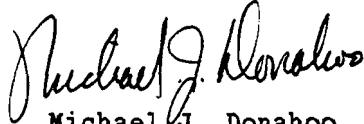
There are four species currently classified as Federally endangered that could be present in the vicinity of the proposed action and could possibly be impacted. These species are the interior least tern (*Sterna antillarum athalassos*), bald eagle (*Haliaeetus leucocephalus*), whooping crane (*Grus americana*), and peregrine falcon (*Falco peregrinus*). However, as stated in the biological assessment, measures that would be taken to prevent adverse impacts due to construction related activity include but are not limited to the following:

1. Schedule construction during the absence of the species;
2. Concentrate construction activities to localize disturbance;
3. Coordinate closely with U.S. Fish and Wildlife Service personnel, especially when construction is taking place on Bosque del Apache National Wildlife Refuge and;
4. Avoid impacts to cottonwood trees that would be used by roosting bald eagles even to the extent of shifting alignment of the levee.

It is our opinion that this biological assessment addresses the issues associated with the stated Federally listed species. With the above-mentioned provisions, there should be no adverse impact to any Federally endangered species from the proposed Corps project.

If you need additional information please call Chuck Mullins at (505) 883-7877 or FTS 474-7877.

Sincerely yours,



Michael J. Donahoo
Acting Field Supervisor

cc:

Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife
Enhancement, Albuquerque, New Mexico

APPENDIX F
CULTURAL HISTORY OVERVIEW

CULTURAL HISTORY OVERVIEW

The following cultural history overview focuses on the immediate study area within the Rio Grande riverine corridor. Most of the information presented derives from the central New Mexico cultural resources overview prepared by Joseph Tainter and Frances Levine (1987).

The valleys of the Rio Grande and its tributaries have served human habitation and travel from the time of the earliest occupation of New Mexico, dating from at least 12,000 years ago. Early populations were largely nomadic hunters and foragers. Until approximately 1,000 years ago, the population of the study area was sparse and dispersed. Known sites predating that time are rare, due partly to a paucity of archeological research in the area, and partly to their having been buried well below the existing ground surface by geological processes.

Dating from about the time of Christ, the Anasazi or "ancient ones" flourished in the Rio Grande valley, developed agriculture, and established permanent settlements. The majority of the discovered sites date to the ceramic period, with two phases particularly well represented: Basketmaker III/Pueblo I and Pueblo II/Pueblo III. Throughout prehistory in the riverine corridor, there tends to be a preference for settlement along the east river margin versus the west.

Within the study area, the earliest substantial evidence for riverine occupation occurs during the San Marcial Phase (A.D. 300 -800). A recent survey by Marshall and Walt (1984) identified a concentration of Basketmaker III (San Marcial Phase) sites in the Fra Cristóbal area where a concentration of Archaic sites had been found (Tainter and Levine 1987:35). The settlements of this period tend to be small and are characterized by pit structures west of the river and masonry-based jacals east of the river.

The subsequent Pueblo I period (Tajo Phase A.D. 800 - 950 or 1000) marks the first substantial occupation of the riverine zone. Most of the sites of this period tend to cluster on the eastern gravel benches of the Rio Grande in the La Joya and San Acacia areas, near the confluence of the Rio Salado and Rio Grande. Tajo Phase sites are small villages of one to ten surface rooms, with occasional pit structures (Tainter and Levine 1987:37).

The local Pueblo II period (Early Elmendorf Phase A.D. 950 or 1000 - 1100) sites are distributed from the lower Rio Puerco south to Bosque del Apache. During this time, settlement expanded into areas that were essentially unoccupied during the preceding Tajo Phase. Structural sites tend to be located on riverine gravel benches; nonstructural sites are situated on sandy benches or riverbanks (Tainter and Levine 1987: 38). Village aggregation is noted during this phase, perhaps indicating increased social, economic, and ritual organization.

During the subsequent Pueblo III period (Late Elmendorf Phase A.D. 1100 -1300), the aggregated villages coalesced into large fortified sites situated on elevated, defensible buttes, knolls, and benches along the river. Marshall and Walt (1984) attribute the defensive settlement pattern and apparent increased social integration of the Late Elmendorf Phase to the regional unrest of the time. Temporally this period corresponds to the Chacoan collapse and the

general migration and regional depopulation occurring in much of the Anasazi homeland to the west and northwest (Tainter and Levine 1987:39).

The Late Puebloan Period (Ancestral Piro Phase A.D. 1300 - 1540) in the riverine corridor is characterized by a dramatic population increase, with the population aggregating into large, plaza-oriented villages constructed of puddled adobe (Tainter and Levine 1987:43). The increase in village size is clearly seen when comparing fourteenth and fifteenth century sites. Fourteenth century sites average around 100 ground floor rooms, contrasted with 200 to 600 for fifteenth century sites. This period marks the first major settlement of the southern riverine area and the first major expansion to the west bank of the Rio Grande, with villages paired on the east and west riverbanks (Tainter and Levine 1987).

The Early Historic Period (Colonial Piro Phase A.D. 1541 to 1680) spans the time from the Spanish entrada and period of Spanish cultural domination, particularly along the Rio Grande, until the Pueblo Revolt. At the time of the first Spanish contacts, much of the study area was uninhabited. Former residents of the lower Rio Puerco and Rio Salado may have moved to the Rio Grande and formed the large Piro villages noted by the Spanish explorers. During this period, ten Ancestral Piro villages were occupied; nine had been abandoned; and nine new villages were established. Sites generally conformed to one of two settlement patterns: large plaza communities of Ancestral Piro form, with large square rooms laid out in grid-like fashion on masonry footings, and with a chapel; and smaller pueblos of variable form more typical of the earlier time periods (Tainter and Levine 1987:43).

The period from 1540 to 1598 marks the epoch of Spanish colonial exploration, beginning with Coronado's entrada into the southwest and ending with the founding of the first Spanish colony near the confluence of the Rio Chama and the Rio Grande in the area designated, Rio Arriba. European presence in the area began in 1540 with the Coronado expedition, which ventured north through Arizona, then east into New Mexico. The first European penetration of southern New Mexico took place in August of 1581, when a dozen Spaniards of the Chamuscado-Rodriguez missionary expedition followed the Rio Grande northward. The first village reached on the Rio Grande was probably the abandoned Piro village of San Felipe, located ca. three miles south of Socorro (Tainter and Levine 1987:78). The Chamuscado-Rodriguez party passed through at least 16 Piro pueblos, five situated on the west bank and 11 on the east bank of the Rio Grande. The west bank villages were Taxumulco, Piquinaguatento (Chiquinagua), Pina, Piasla, and Santiago; the east bank villages included Tomatlan, Mexicalcingo, Caxole, Pueblo Nuevo, Ponsitlan, La Pedrosa, El Hosso (El Osso), Elota, San Juan, San Miguel, and San Felipe (San Phelipe) (Tainter and Levine 1987:80). Paired east and west bank villages include Taxumulco and Tomatlan; Piquinaguatento and Caxole; Pina and San Juan; and Piastla and San Miguel.

In early 1583, the Franciscan Order of Mexico sent a rescue party to return to Mexico the friars, whom the Chamuscado-Rodriguez party had left behind to missionize the Tiwa village of Puaray, located near present day Bernalillo. While enroute to Puaray, the expedition leader, Don Antonio de Espejo, learned of the friars murder. Rather than quit the expedition and return immediately to Mexico, Espejo trekked east to explore the Manzano Mountains, where he visited and documented eleven Margrias (Xumana) pueblos along the east flank of the mountains.

In 1598, the first Spanish settlement and colonial capitol was established near the northern Rio Grande Tewa villages, near present day Santa Cruz. Enroute to the Rio Arriba, the Don Juan de Oñate party apparently camped for more than a month among the Piro. The chronicles document eight Piro settlements: San Juan Baptista, Sevilleta, Alamillo, Pilabó, Teypama or Teypana, Qualacú, San Pascual, and Senecú (Tainter and Levine 1987:82).

Spanish settlement of the Rio Grande and its tributaries proceeded slowly and was limited to military outposts and missionary developments. The Spanish missionization program pitted church against state for the control of limited resources, including labor. Between 1626 and 1629, several missions had been established in the Piro pueblos (Socorro, San Antonio de Padua at Senecú, Nuestra Señora del Socorro de Pilabó, San Luis Obispo de Sevilleta at Seelocú, and Alamillo. The decade of the 1630's and early 1640's were stressful years, witnessed by increased raiding of Hispanic villages and Indian pueblos by nomadic Apaches. Contributing to the stress were European demands for native labor and native goods, drought which led to crop failures and famine, and smallpox epidemics which took their toll on the young adult (reproductive) segment of the population. In her study of Piro subsistence, Earls (1985) suggests that raiding was facilitated by more accessible (e.g., concentrated) goods and the mobility of livestock. The growing conflict between encomenderos and clergy over the disposition of agricultural products and livestock created shortages within the Pueblos, and flagrant violations of Spanish law regarding tribute and land use eventually led to the Pueblo Revolt. In 1680, the Pueblos successfully united to drive the clergy and Hispanic colonists and soldiers from New Mexico, thereby ending the first phase of Spanish colonization (Tainter and Levine 1987:87).

It appears that the Piro pueblos were abandoned during the revolt, with some Piro and Isleta occupants joining the Hispanos in their retreat from New Mexico south to the El Paso District. Along the way the refugees filed past the burned and abandoned villages of Sevilleta, Alamillo, Socorro, and Senecú (Marshall 1984:237). Those Piro who remained behind took refuge at Isleta, Acoma, and settlements in the Fra Cristóbal Mountains. Those who fled with the Hispanos to El Paso established two villages, Senecú del Sur and Socorro del Sur, on the east bank of the Rio Grande and were quickly assimilated into Mexican village life (Tainter and Levine 1987:91).

In 1681, Governor Otermín attempted to reconquer the New Mexico pueblos and reestablish Spanish rule. Although the attempt was thwarted, he did succeed in attacking Isleta Pueblo, and taking 385 Isletans to El Paso. The Pueblo of Isleta del Sur was established near the two El Paso Piro villages.

Weakened by inter- and intra-factionalism, the scarcity of food, and continual Apache raids, the Rio Grande pueblos were no longer unified. In 1692, Don Diego de Vargas won the allegiance of 10 of the 23 occupied pueblos and within two years had subdued the northern pueblos and reestablished Spanish rule; however, it was not until the early eighteenth century that the productive Rio Abajo would be resettled.

Throughout the Colonial period unsuccessful efforts were made to induce the nomadic populations to establish permanent settlements, for it was the easiest way for the Spanish to impose their authority over native populations. Because

of the constant raiding on Hispanic villages by nomads, christianized Indians (genízaros) were often sent to settle frontier communities to buffer the Hispanic colonies against attacks. Cerro de Tomé and Valencia were genízaro communities for Albuquerque. Other efforts to curb raiding were attempted, such as the reinstatement of the Taos and Pecos pueblo trade fairs in Comanche territory, and stationing troops at the ruins of Quarai and Tajique in the abandoned Salinas Province to thwart the Apache (Tainter and Levine 1987:94-95).

In 1800 Governor Fernando Chacón was officially instructed to begin resettlement in the vicinity of Socorro, in part to relieve overcrowding along the Rio Grande to the north and in part to populate and protect the lower portion of the Camino Real, the principal artery for information and goods exchange with Mexico. Through the issuance of a series of land grants, the communities of Alamillo, Socorro, Sevilleta, and Senecú were resettled. The Lo de Padilla land grant located near Isleta pueblo had already been issued in 1718, when Diego de Padilla reclaimed land owned by his family prior to the Pueblo Revolt. The Town of Socorro grant was issued in 1818, followed by the Nuestra Señora de los Dolores de Sevilleta grant in 1819. In 1819, Pedro Ascue de Armendaris petitioned for and was granted a tract of land at Valverde, situated along the Camino Real. The following year, he petitioned for additional lands to the south in the Jornada del Muerto. In 1820 the lands were granted to him as the Fray Cristóbal grant, along with additional lands northwest of the Valverde grant (Tainter and Levine 1987:99-100). The Armendaris grant was abandoned in 1824 due to Navajo raids.

In 1821 the era of Spanish rule ended when New Mexico became part of the Independent Republic of Mexico under the Treaty of Cordova. In the brief 27 years of Mexican occupation, settlement in New Mexico expanded well beyond the Rio Grande corridor, and trade and commerce with the outside world was encouraged.

During the entire Spanish occupation, encompassing approximately 300 years, most trade and information exchange took place between New Mexico and the Spanish headquarters in Mexico City via the Camino Real (Royal Road). Established in the 1500's, the 1200-mile long El Camino Real de Tierra Adentro connected the colonial centers of Chihuahua, El Paso, and Santa Fe to Mexico City (Figure 1), and was the primary thoroughfare used by missionaries, colonists, soldiers, and commercial caravans. The route entered the Provincia de Nuevo Mexico below El Paso del Norte at a place called La Toma del Rio. At El Paso, the trail crossed the Rio Grande, following the river north to Las Cruces. From Las Cruces the trail left the meandering river, crossing the 125-mile long barren, waterless stretch of desert known as the Jornada del Muerto, and rejoined the river near present day San Marcial. The trail then continued along the east bank of the Rio Grande northward to Santo Domingo, where it headed overland to Santa Fe (U.S. Fish and Wildlife Service 1987).

Among the first to blaze the trail was the missionary party led by Francisco Sanchez Chamuscado. After the founding of Santa Fe in 1610, the trail terminus was established. Within the study area, ruins of Piro pueblos and pre-revolt haciendas were among some of the stopping places (parajes) along the route. After the founding of Albuquerque in 1706 and Chihuahua City in 1709, merchants in Chihuahua operated the ox-drawn carreta (wooden cart) caravans for commercial

gains. By the end of the eighteenth century, the annual Chihuahua fair had changed the pattern of trade and the northern Camino Real became known as the Camino de Chihuahua (U.S. Fish and Wildlife Service 1987).

With Mexican independence from Spain in 1821, New Mexico became part of Mexico. Under Spanish rule, the New Mexico Province had been isolated from foreign trade and peoples, and solely dependent on the Camino for its outside contacts. During the Mexican period, this was to change when a second trail, the Santa Fe Trail, which linked Missouri to Santa Fe was opened. For the first time, Santa Fe was no longer a terminus, but rather a midpoint for two important commercial trails, the Santa Fe and Chihuahua. A stage coach line to El Paso followed the Camino until 1880, when the Atchison Topeka and the Santa Fe (AT&SF) railroad constructed its transcontinental line on the trail (U.S. Fish and Wildlife 1987).

Today, traces of the Camino Real are visible from the air in the northern Rio Grande, on the east bank of the Rio Grande within the Bosque del Apache wildlife refuge, in the Jornada del Muerto, in the El Paso area, and in Mexico. However, most trail segments await ground verification.

Between 1823 and 1845, 11 land grants were made in the general study area, most in the former province of the Salinas (Xumanas) pueblos, east of the Manzano Mountains. Two, the Bosque del Apache and Jornada del Muerto grants, are within the study area. In 1845, Antonio Sandoval, a wealthy citizen of Albuquerque, petitioned for and was granted three tracts of land, two grazing tracts and a farming tract. The farming tract requested was the Bosque del Apache grant located along the Rio Grande south of Socorro. The two grazing tracts, the Estancia Springs grant and the Agua Negra grant, were issued as repayment for loans he had made to the government (Tainter and Levine 1987:105).

The Jornada del Muerto grant issued in 1846 overlapped with the Armendaris Fray Cristóbal grant. Armendaris who held claim to his lands even after they had been abandoned due to Navajo raids in 1824 protested the Jornada del Muerto grant boundaries. The petitioners, Juan Bautista Vigil-Alarid and Antonio Jose Rivera were prohibited from making any improvements of the land until the suit had been settled. The matter was not resolved until some years later when the Court of Private Land Claims rejected the Jornada del Muerto land grant (Tainter and Levine 1987:105).

On August 15, 1846, General Stephen Watts Kearny and the Army of the West marched into Las Vegas, New Mexico and claimed the territory of New Mexico for the United States. However, the New Mexico takeover appears to have been negotiated long before Kearny marched into New Mexico. Most scholars believe that James Magoffin, an influential American trader and liaison to Mexico, arranged the terms of the "conquest" with Governor Armijo, for Armijo offered no resistance. Mexican rule of the New Mexico province came to an end in 1848 with the annexation of New Mexico and California to the United States under the terms of the Treaty of Guadalupe Hidalgo. Texas had been annexed earlier (Tainter and Levine 1987:112-113). With the acquisition of new territories, the United States began its westward expansion in fulfillment of the "manifest destiny"; however, the conquest of New Mexico would not be completed until the nomadic Indians had been subdued.

Even as late as the mid 1850's, incessant raids by Apaches and Navajos impeded extensive settlement in the Rio Abajo. In February, 1852, 143 citizens of Socorro County petitioned the Territorial Governor for protection. In response, garrisons were sent to Doña Ana, Socorro, Tomé, and Albuquerque. Fort Conrad, built in 1851 just east of the ruins of Valverde offered some protection, but was abandoned in 1854 when Fort Craig was built.

On February 21, 1862 one of two Civil War battles fought in New Mexico was staged at Valverde, north of the Union-held Fort Craig. In a one-day battle, General H.H. Sibley, commander of the Confederate forces, defeated Colonel E.R.S. Canby's Union detachment. The Union troops under the command of Colonel Nicholas Pino surrendered Socorro to Sibley. However, after waging an indecisive battle at Glorieta, Sibley's forces retreated to Texas, bypassing the still Union-held Fort Craig (Tainter and Levine 1987:115,118).

After the Civil War battles in New Mexico had ended, military action against the Navajos and Apaches intensified. Lemitar was attacked in 1863 and 1864 by Navajos encamped in nearby Ojo de Cibola, 15 miles to the west. In 1862, Colonel Christopher (Kit) Carson was ordered by Commander James H. Carleton to round up Mescalero Apaches and Navajos and confine them to an internment camp at Bosque Redondo near Fort Sumner. The Mescaleros fled Bosque Redondo in 1865, and in 1873 were resettled on a reservation south of Fort Stanton in southeastern New Mexico. In 1868 the Navajos were returned to their homeland in northeastern Arizona and northwestern New Mexico on a newly established reservation. By the mid 1860's the Indian wars in central New Mexico had ended, and the area began to exhibit some economic and social stability (Tainter and Levine 1987:118-119).

In order to resolve the conflict between Hispanic and American land values and to clear land titles, the Office of the Surveyor General was established in New Mexico in 1854. One of the major goals was to survey the public domain and establish the township grid by which tracts of land could be legally described. The 1855 New Mexico cadastral survey fixed the central meridian control point, which established the principal meridian and baseline from which the townships and ranges within the state have been surveyed, within a roomblock of the Cerro Indio Pueblo archeological site (Marshall 1984:147). Between 1854 and 1860, the Rio Grande from Santa Fe to El Paso was surveyed (Tainter and Levine 1987:119).

In 1880, the AT&SF transcontinental railroad reached San Marcial, New Mexico. In 1908, the Belen cutoff was constructed to shorten the route. The cutoff crossed the Texas panhandle entering New Mexico at Clovis, then continued westward to Vaughn, joining the main trunk of the Santa Fe at Belen. With the coming of the railroad, the mining industry boomed. Socorro County experienced a minor boom between 1870 and 1893 when silver was discovered in the Socorro Peak mining district. The boom ended in 1893 with the demonetization of silver. A smelter was opened in Socorro in 1881 to refine lead carbonate ore extracted from the Magdalena mining district. In 1883, a railroad spur was constructed from Socorro to Magdalena, and then south to Kelly to the lead mines. By the 1880's decreasing lead prices forced a closure of the mining and smelting industry in the Socorro area. The only profitable mine in the immediate area was the Carthage coal field, which was probably mined as early as the 1850's to supply Fort Conrad and Fort Craig. The coal field, located ca. 10 miles south

of San Antonio, supplied the Socorro smelter with coke. In 1882 the AT&SF constructed a spur line from San Antonio to Carthage to haul the coke. The spur was in use until 1894 or 1895, at which time the mine was temporarily shut down. In the early 1900's the mine was reopened for large scale commercial production and a new railroad, the New Mexico Midland Railroad, was constructed on the old AT&SF route. It was in use from 1906-1936. When the Carthage field was closed down, the railroad continued to haul coal from the Tokay mine, located two miles south of Carthage. The Tokay field was in operation from 1915 to about 1950; during the last 15 years of operation, coal was trucked to San Antonio (Tainter and Levine 1987:130).

On January 6, 1912, New Mexico was admitted to the Union as the 47th state. In 1916 the Bureau of Reclamation began construction of Elephant Butte Dam and reservoir. In 1923 the Middle Rio Grande Conservancy District was created to develop an efficient irrigation system and to ensure drainage and flood protection for the towns and communities located along the Rio. The Conservancy conveyance channel parallels the Rio Grande levee in the study area. A major flood along the Rio Grande in 1929 caused extensive damage to the towns and facilities of Old and New San Marcial, Valverde, and La Mesa, located upstream of the dam. After the flood, the AT&SF railroad relocated all its facilities from San Marcial to Belen. This action sent the local economy into a downward spiral, forcing many residents to move from the area in search of work. Today the Middle Rio Grande valley continues to be an important agricultural area. Within the study area, the larger towns of Socorro and San Antonio supply goods and services to the neighboring communities and travelers. And Socorro, the seat of Socorro County, hosts the New Mexico Institute of Mining and Technology, formerly the New Mexico School of Mines, established in 1889 during the mining boom.

APPENDIX G
CULTURAL RESOURCES CORRESPONDENCE



STATE OF NEW MEXICO
OFFICE OF CULTURAL AFFAIRS
HISTORIC PRESERVATION DIVISION

ARREY CARRUTHERS
GOVERNOR

VILLA RIVERA, ROOM 101
228 EAST PALACE AVENUE
SANTA FE, NEW MEXICO 87503
(505) 827-8320

HELMUTH J. NAUMER
CULTURAL AFFAIRS OFFICER

THOMAS W. MERLAN
DIRECTOR

June 20, 1988

Lt. Colonel Kent R. Gonser, CE
District Engineer
Albuquerque District
US Army Corps of Engineers
Post Office Box 1580
Albuquerque, New Mexico 87103-1580

Rc: Rio Grande Floodway, San Acacia to Bosque del Apache Unit

Attn: Mr. William E. Huntley, Study Manager

Dear Colonel Gonser:

Thank you for informing this office of the study of flood protection for flood plain development and wildlife on the Rio Grande between San Acacia and the Head of Elephant Butte reservoir being initiated by the Albuquerque District.

From the preliminary description of the proposed plan, it appears that the rehabilitation of the existing levee on the west bank of the Rio Grande between the low flow conveyance and the river has little potential to affect significant cultural resources within this heavily disturbed area. However, many of the associated activities, such as material source, disposal, and stockpile areas, access and haul roads, equipment parks, and other land disturbing undertakings, do have the potential to affect properties entered in or eligible for inclusion in the National Register of Historic Places adversely.

Since plans for the proposed levee rehabilitation project are not yet sufficiently developed to determine the locations of such activities, it is impossible to comment at this time on the potential effects. Therefore, I will look forward to consulting with the Albuquerque District in accordance with the provisions of 36 CFR Part 800 as your study progresses. In the meantime, please contact this office if you require any information regarding register, or recorded archaeological and historical resources within the study area.

Sincerely,

Thomas W. Merlan
State Historic Preservation Officer

TWM:DER:bc/Log 14709

cc: John Schelberg
Mike Pitel

APPENDIX H
COMPLIANCE WITH
THE
CLEAN WATER ACT

PREFACE

Refinements to project design since preparation of the Section 404 (b) (1) evaluation have eliminated some project features presented in this evaluation. These consist of the need for borrow areas within the riparian zone, the disposal of surplus material in the river channel, and any construction activities in Mulligan Gulch Wetland. An exception to the latter site is the possible deposition (temporary) of dredged or fill material due to construction activities if measures are taken to restore and improve this wetland as compensation for the filling of other wetlands. The net effect of these design refinements is to reduce the number of discharge sites and, correspondingly, the extent of wetland disturbance.

August 2, 1990

Deputy District Engineer for
Project Management

Mr. Jim Piatt
Surface Water Quality Bureau
Environmental Improvement Division
Harold Runnels Building
1190 St. Francis Dr.
Santa Fe, New Mexico 87503

Dear Mr. Piatt:

Enclosed is an application for State Water Quality Certification for a project now under design by the U. S. Army Corps of Engineers. The project is the Rio Grande Floodway, San Acacia to Bosque del Apache Unit, New Mexico and involves rehabilitating approximately 55 miles of existing spoilbank levee along the west bank of the Rio Grande and parallels the Bureau of Reclamation's Rio Grande Conveyance Channel.

We have just completed the general design stage and a Draft Environmental Impact Statement (DEIS) for the project. Very shortly, a copy of the DEIS will also be provide for your review and comment.

If we can provide further information, please contact Mr. Mark Andrews, Project Manager at (505) 766-1239.

Sincerely,

John J. Cunico, P.E.
Deputy District Engineer for
Project Management

Enclosures

Describe any adverse water quality impacts that would result from the proposed activity (immediate and long range): _____

~~The project plan would not affect water quality in the Rio Grande or Elephant Butte Lake. The fill material is described below. (See Appendix F of the Draft Environmental Impact Statement).~~

7. Describe the methods to be used to prevent water quality impacts which could interfere with the attainment of the state's water quality standards. If those actions include constructing ponds, dams, or other structures please attach plans, schedules, and other information as appropriate: _____

~~During construction, contract specifications would contain measures to protect surface water quality from erosional products, chemical and fuel spills, oil disposal, and other potentially toxic wastes. (See Page SEIS-85 of the Draft Environmental Impact Statement).~~

8. Describe the physical and chemical characteristics of the dredged or fill material (such as rock size, mineral content or man-made materials). Be as specific as possible: _____

See attached table.

9. Project Schedule:

Beginning Date February 1992

Completion Date March 1995

10. I certify that the information contained in this application, to the best of my knowledge, is true, complete and accurate.

Authorized Agent or
Applicant

Mark L. Andrews

Date: 2 August 1990



Public Notice

US Army Corps
of Engineers

Albuquerque District

P.O. Box 1580
Albuquerque, NM 87103-1580

FAX No. 505-766-2770

Permit Application No:
NM-OYT-0631

Date: August 17, 1990

Phone: (505) 766-2776

Suspense Date: October 16, 1990

In Reply Refer to District Engineer, ATTN: CESWA-CO-R

Interested parties are notified that the District Engineer has received an authorization application under Section 404 of the Clean Water Act (33 USC 1344). The application is for an authorization to **construct and rehabilitate levees** adjacent to the **Rio Grande** and in **Elephant Butte Reservoir** from San Acacia to Elephant Butte in Socorro County, New Mexico; Application No. NM-OYT-0631.

Name of Applicant: Albuquerque District Corps of Engineers, P.O. Box 1580, Albuquerque, New Mexico 87103-1580.

Location: The proposed project is located on the west bank of the Rio Grande with fills to be placed in the river channel, the old conveyance channel, adjacent wetlands, and Elephant Butte Reservoir.

The project will extend 55 miles from the U.S. Bureau of Reclamation's low-flow conveyance channel (at the San Acacia Diversion Works) to the end of the conveyance channel at the head of Elephant Butte Reservoir near San Antonio, Socorro County, New Mexico.

Levee rehabilitation will be performed in Townships 1, 2, and 3 South, Ranges 1 East and 1 West; Townships 4 and 5 South, Range 1 East; Townships 5 and 6 South, Range 1 West; and Townships 7 and 8 South, Range 2 West.

Description of Work: The project involves construction and rehabilitation of approximately 55 miles of existing levee along the Rio Grande. Disposal of clean waste fill material and construction of portions of the levee will involve discharges into waters of the United States.

The existing earthen embankment will be removed and rebuilt to produce a facility capable of withstanding high volume flows in the Rio Grande. The levee will be approximately 73 feet wide at the base and 16 feet high having a trapezoidal cross-section with 1V:2.5H side slopes. The southern 20 miles of levee will have 1V:3H side slopes. Sections of the reconstructed levee will contain a drainage system to provide positive seepage control, and will be protected by Kellner jetty jacks at locations vulnerable to erosion from high stream velocities.

Five areas within waters of the U.S. may be filled during construction of the project:

- **River channel, Rio Grande:** Surplus earth may be used to widen the existing streambank and refill any borrow excavations located below the ordinary high water mark. Any

NEWS RELEASE

August 17, 1990

fill material in the channel will be stabilized by mechanical means (Kellner jacks) and establishment of native riparian vegetation.

- **Abandoned section of the low-flow conveyance channel** near Tiffany and San Marcial which contains wetlands: Temporary fills will be used to create work roads and platforms to support levee reconstruction in an area approximately 1.5 miles long by 40 feet wide. The toe of 88-foot wide levee may partially extend into the wetland. All temporary fills will be removed upon levee completion.

- **Levee toe wetland¹**, located in Elephant Butte Reservoir between spoil bank and conveyance channel: The widened levee base and/or construction roads will extend across this strip of wetland about 1.3 miles long and 40 feet wide.

- **Elephant Butte Reservoir below elevation 4450.30** m.s.l. (USGS datum): Levee reconstruction along existing spoil bank (approximately 4.4 miles). The levee in this location will be 12 feet high with an 88 foot wide base (trapezoidal section), using approximately 600,000 cubic yards of random fill (silty sands).

- **Mulligan Gulch wetland¹**, an 18 acre area within Elephant Butte Reservoir west of the conveyance channel: Tie-back levee will follow the existing dike alignment, but will be wider which may cause the loss of a 900 foot by 40 foot area of wetland. Any loss of wetland at the terminal end of the project will be compensated by wetland expansion in conjunction with borrow activities.

Note¹: Wetlands in Elephant Butte Reservoir may have developed only recently due to long-term water storage in the reservoir. Low water levels could dry these areas.

The stated purpose of the project is to provide protection against the 100-year frequency flood to the city of Socorro, rural transportation and irrigation facilities, the Bosque del Apache National Wildlife Refuge, and the Bureau of Reclamation's low-flow conveyance channel. A project objective is to avoid or minimize the removal and disturbance of edge vegetation along the riverward toe of the existing embankment, particularly native, cottonwood-dominated communities. The planned levee base width will be smaller than present existing levee throughout a majority of the project area.

Proposed mitigation of unavoidable impacts to waters of the United States includes revegetation of areas disturbed by construction, and expansion-of-old/creation-of-new wetland habitat in borrow areas.

Proposed dates of construction are from February 1992 to March 1995.

August 17, 1990

Related Work: The majority of the levee rehabilitation work will be outside waters of the United States and is not subject to regulation under the Clean Water Act.

Plans and Data: Drawings showing the location of the work site and other data are enclosed with this notice. If additional information is desired, it may be obtained from the applicant or from:

Ms. Jean Manger
Albuquerque District Corps of Engineers
P.O. Box 1580
Albuquerque, NM 87103-1580
telephone (505) 766-2776

Statement of Findings: Depending on the placement of borrow pits, there is a potential to impact known and previously undiscovered archeological sites and portions of the Camino Real. Once candidate borrow areas have been identified, cultural resources surveys would be conducted. Should it be determined that significant cultural resources would be impacted, consultation with the New Mexico State Historic Preservation Office (NMSHPO) and Advisory Council on Historic Preservation would be conducted pursuant to 36 CFR 800 to determine appropriate mitigation measures. This constitutes the extent of cultural resource investigations by the District Engineer.

There are four species currently classified as Federally endangered that could be present in the vicinity of the proposed project and could possibly be impacted. These species are the interior least tern (Sterna antillarum), bald eagle (Haliaeetus leucocephalus), whooping crane (Grus americana), and peregrine falcon (Falco peregrinus). Section 7 consultation has been completed with the U.S. Fish and Wildlife Service. Measures that would be taken to prevent adverse impacts due to construction related activity include, but are not limited to, the following:

- Schedule construction during the absence of the species;
- Concentrate construction activities to localize disturbance;
- Coordinate closely with U.S. Fish and Wildlife Service personnel especially when construction is taking place on Bosque del Apache National Wildlife Refuge; and
- Avoid impacts to cottonwood trees that would be used by roosting bald eagles even to the extent of shifting alignment of the levee.

The Service states that with the above provisions, there should be no adverse impact to any Federally endangered species from the proposed project.

August 17, 1990

The applicant has applied to the New Mexico Environmental Improvement Division for certification that this work is in compliance with applicable State water quality standards.

The applicant is responsible for obtaining all other required Federal, State and local authorizations for this work.

In accordance with environmental procedures and documentation required by the National Environmental Policy Act of 1969, an environmental impact statement (EIS) will be prepared for this project. The draft Supplementary EIS is available for review and comment concurrent with the present public notice comment period. The EIS may be seen at the office of the Albuquerque District, U.S. Army Corps of Engineers, Room 8419, 517 Gold Avenue SW, Albuquerque, NM.

Comments: Any comments concerning this project should be received by the District Engineer no later than October 16, 1990. Comments received after the end of the Public Notice comment period will not be considered. However, more time may be given if a request, with a valid reason, is received prior to the suspense date.

The decision whether to issue an authorization will be based on an evaluation of the probable impact, including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments.

The evaluation of the impact of this activity will include application of the guidelines promulgated by the Administrator, EPA, under authority of Section 404(b) of the Clean Water Act.

All factors relevant to the proposal and the cumulative effects will be considered; including:

- | | |
|-----------------|---------------------------------------|
| - conservation | - general environmental concerns |
| - economics | - historic properties |
| - aesthetics | - fish and wildlife values |
| - wetlands | - flood plain values |
| - flood hazards | - shoreline erosion and accretion |
| - land use | - water supply and conservation |
| - navigation | - energy needs |
| - recreation | - food and fiber production |
| - water quality | - consideration of property ownership |
| - safety | - and, in general, the needs and |
| - mineral needs | welfare of the people. |

An authorization will be granted for this activity unless it is found to be contrary to the public interest.

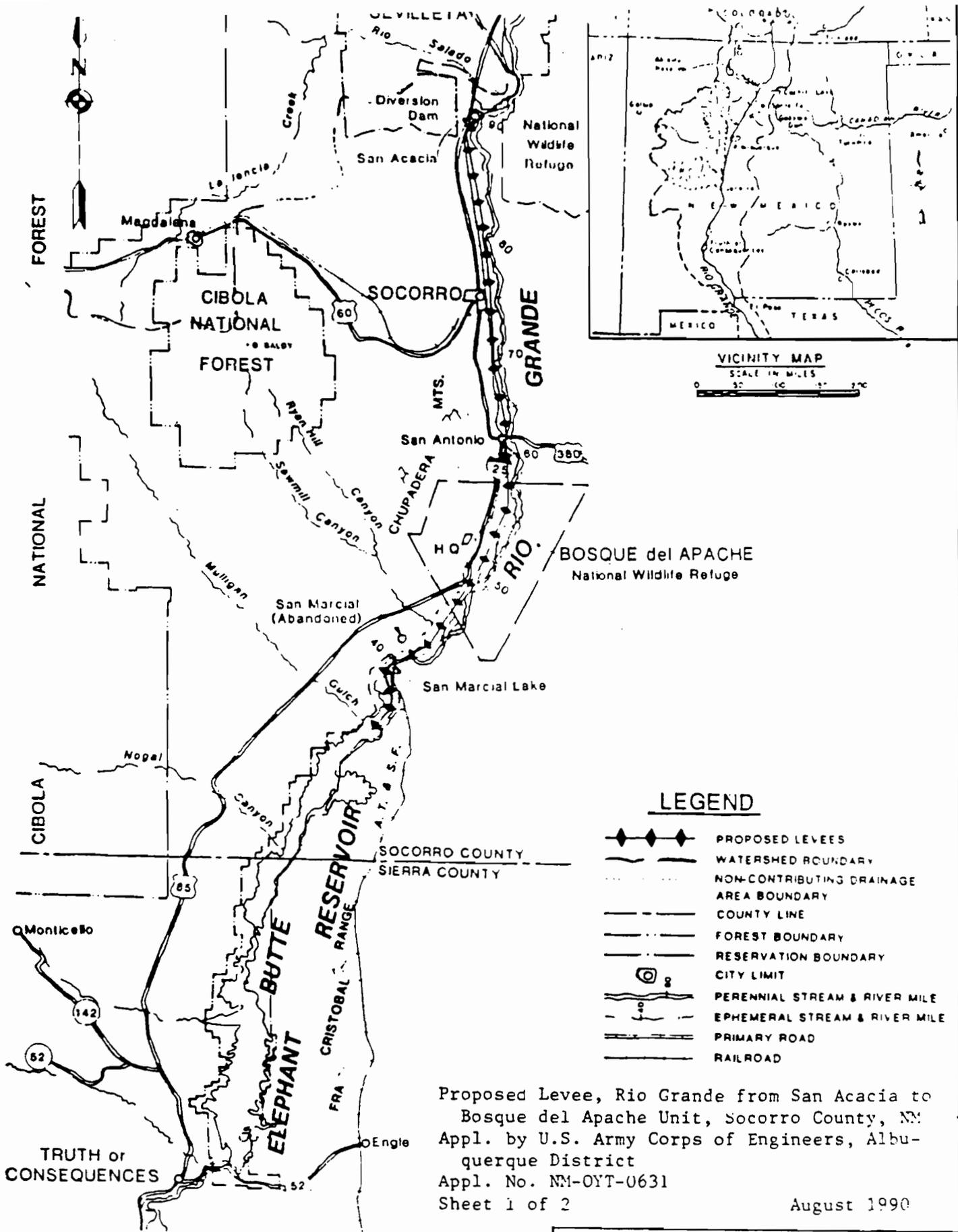
August 17, 1990

The Corps of Engineers is soliciting comments from the public; Federal, state, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition, or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

Any person may request a public hearing. The request must be submitted, in writing, to the District Engineer within 60 days of the date of this notice and must clearly set forth the reasons for holding a public hearing.

Steven M. Dougan
Lieutenant Colonel, EN
District Engineer

Enclosure



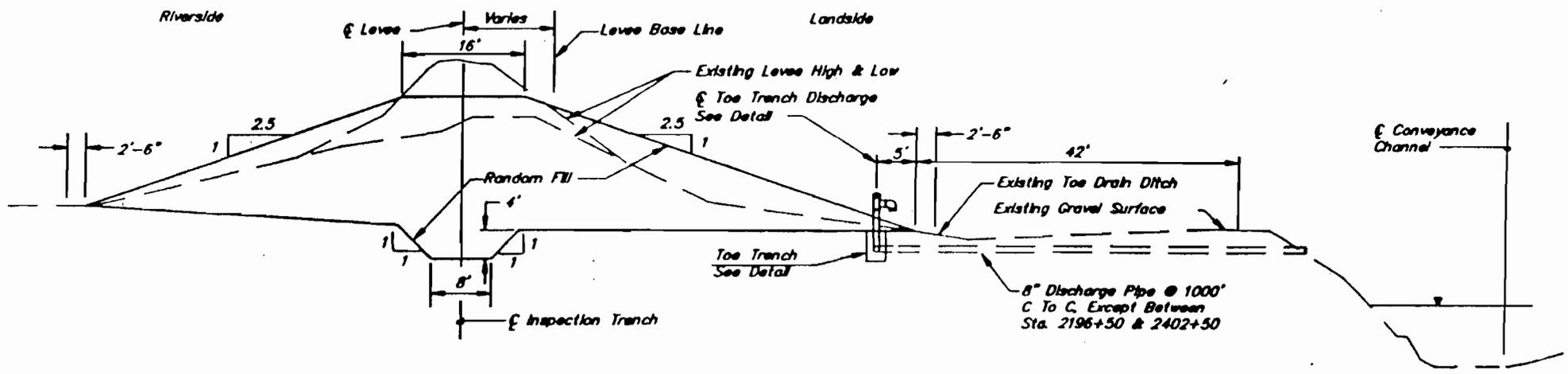
**RIO GRANDE FLOODWAY
 SAN ACACIA TO BOSQUE DEL APACHE UNIT**

SCALE IN MILES
 0 2 4 6 8 12 16 24

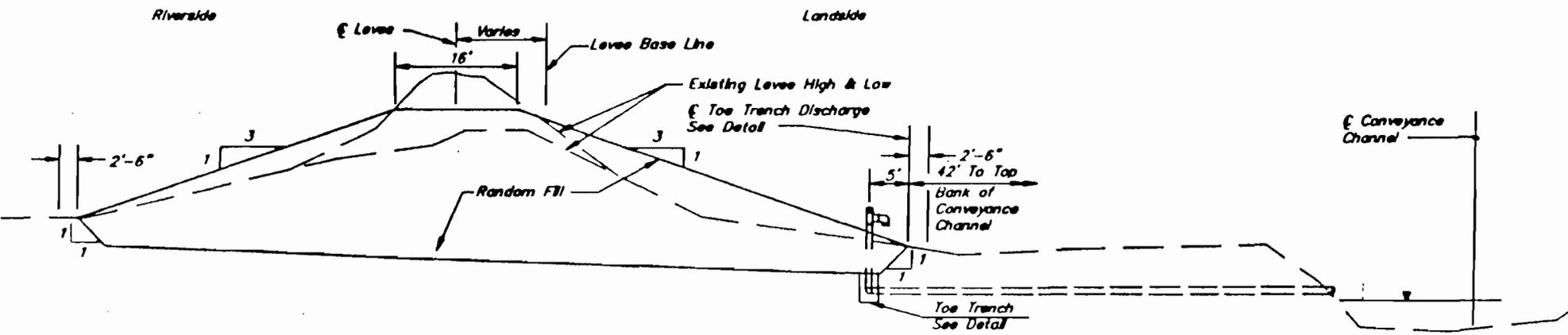
U.S. ARMY ENGINEER DISTRICT, ALBUQUERQUE, N.M.

General Project Location	Figure 1
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H-10



UPPER 35 MILES
Not To Scale



LOWER 20 MILES
Not To Scale

TYPICAL LEVEE SECTIONS

Proposed Levee, Rio Grande from San Acacia to
 Bosque del Apache Unit, Socorro County, NM
 Appl. by U.S. Army Corps of Engineers,
 Albuquerque District
 Appl. No. NM-OYT-0631
 Sheet 2 of 2
 August 1990

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1580
ALBUQUERQUE, NEW MEXICO 87103-1580
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PUBLIC NOTICE



New Mexico Health and Environment Department

GARREY CARRUTHERS
Governor

DENNIS BOYO
Secretary

MICHAEL J. BURKHART
Deputy Secretary

RICHARD MITZELFELT
Director

**CERTIFIED MAIL # P 612 425 408
RETURN RECEIPT REQUESTED**

16 October 1990

Mr. Mark R. Andrews
Albuquerque District Corps of Engineers
P.O. Box 1580
Albuquerque, NM 87013

SUBJECT: Water Quality Certification for Activity Proposed Under Permit
Application No. NM-OYT-0631, Dated August 17, 1990

Dear Mr. Andrews:

Pursuant to section 401(a)(1) of the federal Clean Water Act, the Surface Water Quality Bureau has examined an application from the Army Corps of Engineers for State certification of a section 404 permit to place dredged material into the mainstem of the Rio Grande and Elephant Butte Reservoir. The proposed project is located in Socorro County, on the Rio Grande mainstem the project extends for 55 miles from the San Acacia Diversion works to the head of Elephant Butte reservoir and within the reservoir at the mouth of Milligan Gulch. The proposed project involves rehabilitation of existing spoilbank levees and reconstruction of 4.8 miles of levees below the maximum water surface of Elephant Butte Lake. The stated purpose of the project is to provide protection against the 100-year frequency flood event.

The Bureau has determined that the proposed project is located in segments 2-105 and 2-104 of the Rio Grande Basin as described in the "Water Quality Standards for Interstate and Intrastate Streams in New Mexico as Amended Through March 8, 1988". Designated uses for which the mainstem is protected include irrigation, limited warmwater fishery, livestock and wildlife watering and secondary contact recreation. Elephant Butte reservoir is protected for irrigation storage, livestock and wildlife watering, primary contact recreation and warmwater fishery.

Mr. Mark R. Andrews
16 October 1990
Page Two

The Bureau has reviewed the description of the proposed activity and is concerned that, as proposed, this activity may adversely affect surface water quality to an extent which will impair the fishery and primary contact recreation designated uses. This concern is due to potential and likely exceedances of State water quality standards at section 2-102.A., 2-102.J. and 2-104.B. Information was not presented on methods or techniques which will be used to limit sedimentation and turbidity during construction. Under authority delegated to the Environmental Improvement Division by the New Mexico Water Quality Control Commission, the State of New Mexico finds that this discharge, as proposed, will not comply with any or all of the applicable provisions of the federal Clean Water Act (i.e., sections 301, 302, 303, 306, or 307) and with appropriate requirements of State law. The State of New Mexico therefore issues section 401 certification for application NM-OYT-0631 on a conditional basis subject to our later review and approval of the following items which are specifically included in this certification: 1) The Corps shall develop a plan to limit stream bottom alteration due to sedimentation resulting from the filling operations, 2) The Corps shall develop a water quality monitoring plan and implementation strategy which will assure attainment of State water quality standards for turbidity, and 3) The Corps shall provide detailed information on the methods to be used in the proposed mitigation of wetland losses or alteration. The Bureau will be happy to work with Corps staff in these efforts.

The State of New Mexico specifically reserves the right to amend or revoke this certification if such activity is necessary to insure attainment of the designated uses for this surface water. Please address any questions concerning this permit to Mr. David Coss of my staff at (505) 827-2829.

Sincerely,



Jim Piatt
Chief
Surface Water Quality Bureau

xc: Members of the New Mexico Water Quality Control Commission
District Manager, Environmental Improvement Division
District Engineer, U.S. Army Corps of Engineers
Susan Alexander, NPS Coordinator, Region VI, EPA

APPENDIX H

SECTION 404(b)(1) EVALUATION AND COMPLIANCE
DETERMINATION

I. Project Description

a. Location. The recommended action would be located in Socorro County, New Mexico and would parallel the west bank of the Rio Grande from the San Acacia Diversion Dam to the head of Elephant Butte Reservoir.

b. General Description. The existing "spoil bank" levee that currently borders the west bank of the Rio Grande would be reconstructed to provide 100-year-level flood protection to urban development, water conveyance facilities, Bosque del Apache National Wildlife Refuge (NWR), and irrigated farmland. The length of spoil bank that would be reconstructed is approximately 55 miles. Its alignment would be about the same as that of the existing spoil bank. Approximately 90 percent of earth required would be obtained from the existing embankment with the remainder obtained from the riparian zone, adjacent flood plain, bordering terraces, or a combination of these sources. An estimated 1.2 million cubic yards of earth would be unusable and would be disposed of by layering on the rehabilitated levee, widening riverbanks in areas where the river is adjacent to the levee and associated stabilizing with Kellner jetties (jacks) and riparian vegetation, upland disposal, or a combination of these measures. Riparian habitat removed or disturbed would be replaced with high value native riparian vegetation and wetlands. A major portion of mitigation measures would be accomplished on Bosque del Apache NWR by expanding an existing program of replacing monotypic salt cedar with native riparian vegetation.

c. Authority and Purpose. The planned project is authorized by the Flood Control Act of 1948 (Public Law 80-858). Its purpose is to provide 100-year flood protection to flood plain improvements, human welfare and security, water conveyance facilities, and Bosque del Apache NWR from San Acacia to the head of Elephant Butte Reservoir.

d. General Description of Dredged or Fill Material.

(1) General Characteristics of Material - Alluvial materials of sands, sandy silts, silty sands, sandy clay, and clayey sands.

(2) Quantity of Materials - variable from a few thousand cubic yards to a hundred thousand cubic yards depending on which of the five areas is involved.

e. Description of the Proposed Discharge Sites. There are five areas where material would or could be placed, either permanently or temporarily, into a water of the United States, including wetlands. These are described as follows and shown on the accompanying map.

(1) River Channel. Locations within the ordinary high water mark where banks are very narrow and their widening and stabilization would help protect levee from water scour.

(a) Size. Likely less than 50 acres.

(b) Type of Site. Confined river channel.

(c) Type of Habitat. Sandy, sparsely vegetated or barren river channel.

(d) Timing and Duration of Discharge. Variable, any time of year and duration of several days to several weeks.

(2) Abandoned Conveyance Channel. Short section of channel below Tiffany, portions of which are now wetlands. Some earth could be placed in channel during construction of this levee segment.

(a) Size. About 40 to 50 feet wide and one and one-half miles long.

(b) Type of Site. Abandoned water conveyance channel.

(c) Type of Habitat. Narrow band of continuous to discontinuous growth of cattails with some bulrush. No standing water. Heavily grazed.

(d) Timing and Duration of Discharge. Variable, any time of year and duration of several days to several weeks.

(3) Levee Toe Wetland. Located in Elephant Butte Reservoir between spoil bank levee and conveyance channel.

(a) Size. Narrow strip approximately 1.3 miles long and 40 to 50 feet wide. Approximately six to seven acres.

(b) Type of Site. Confined wetland.

(c) Type of Habitat. Marsh.

(d) Timing and Duration of Discharge. Variable, any time of year and duration of several weeks to several months. Placement permanent.

(4) Elephant Butte Reservoir. That part of the reservoir below elevation 4450.30 (USGS datum) is classified as a water of the United States. The existing spoil bank extends into the reservoir below this elevation and will be reconstructed and enlarged.

(a) Size. Approximately 4.4 miles of levee would require varying degrees of additional fill below this elevation.

(b) Type of Site. Zone of reservoir fluctuation.

(c) Type of Habitat. Existing "spoil bank" and adjacent woodland.

(d) Timing and Duration of Discharge. Variable, any time of year and duration of several weeks to several months. Permanent placement.

(5) Mulligan Gulch Wetland. The Mulligan Gulch Wetland is an approximately 18-acre wetland that is located within Elephant Butte Reservoir. It is at the terminus of the project and west of the conveyance channel. This wetland was indirectly created by the USBR as a result of construction activities and is maintained by flows from the conveyance channel. Lengthy inundation of this area from recent, abnormally high water storage has significantly modified the general area, primarily because of sedimentation. The extent to which the wetland has been modified is unknown because of continued inundation of the general area from river flows and from the conveyance channel. Its continued presence or existence is currently unknown, because of a variety of factors including possible physical alteration, effects caused by planned rehabilitation of the now sediment-filled conveyance channel, and needed water rights to sustain the wetland. For purposes of this evaluation, the assumption is made that this wetland would be present in the future.

The alignment of the terminal, tie back section of levee would be about the same as the existing dike that detains water to help form this wetland. As such, there is some potential that a small part of the wetland could be affected. Also, the possible expansion of this wetland as a part of borrow excavation could involve some temporary fill being placed in the wetland.

(a) Size. About 18 acres.

(b) Type of Site. Confined wetland with water largely derived from conveyance channel.

(c) Type of Habitat. Marsh, open water, and flooded salt cedar.

(d) Timing and Duration of Discharge. Variable, any time of year and duration of several weeks to several months.

f. Description of Disposal Method. Placement by track or rubber tire machinery.

II. Factual Determination.

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope.

(a) River Channel. Increase in elevation and no change in slope.

(b) Abandoned Conveyance Channel. Increase in invert elevation if filled or a decrease in elevation if further excavated for wetland development, or both. Little change in slope.

(c) Levee Toe Wetland. Increase due to fill placement.

(d) Elephant Butte Reservoir. No changes.

(e) Mulligan Gulch Wetland. No significant change anticipated.

(2) Sediment Type. Little change.

(3) Fill Material Movement. Measures would be taken to stabilize.

(4) Physical Effects on Benthos.

(a) River Channel. None.

(b) Levee Toe Wetland. Loss due to permanent fill placement.

(c) Abandoned Conveyance Channel. None.

(d) Elephant Butte Reservoir. No effect.

(e) Mulligan Gulch Wetland. Possible removal of a narrow strip of land at base of dike for a distance of about 900 feet.

(5) Other Effects. None foreseen.

(6) Action taken to Minimize Impacts. Minimizing construction zone along terminal tie-back levee (if in contact with wetland fringe). Any compensation required would be accomplished by proportionately expanding size of wetland.

b. Water Circulation, Fluctuation, and Salinity Determinations. The following water features would not apply to the Levee Toe Wetland since it would be completely filled.

(1) Water

(a) Salinity. No change.

(b) Water Chemistry. No change.

(c) Clarity

[1] River Channel. No change.

[2] Abandoned Conveyance Channel. Not applicable.

[3] Elephant Butte Reservoir. Levee would exclude water storage from a small part of reservoir area. Possible increase in clarity of impounded water.

[4] Mulligan Gulch Wetland. Possible minor and temporary increase in turbidity along base of levee.

(d) Color. No effect.

(e) Odor. No effect.

(f) Taste. No effect.

(g) Dissolved Gas Levels. No effect.

(h) Nutrients. No effect.

(i) Eutrophication. No effect.

(2) Current Patterns and Circulation.

(a) Current Patterns and Flow.

[1] River Channel. Reduce meander in immediate disposal areas.

[2] Abandoned Conveyance Channel. No effect.

[3] Elephant Butte Reservoir. Storage excluded from a small part of reservoir area.

[4] Mulligan Gulch Wetland. Inundation prevented from highly infrequent high water storage in reservoir. However, water would still be impounded during reservoir storage due to detention of flows in conveyance channel.

(b) Velocity. No effect.

(c) Stratification. No effect.

(d) Hydrologic Regime.

[1] River Channel. No effect.

[2] Abandoned Conveyance Channel. No effect.

[3] Elephant Butte Reservoir. No effect.

[4] Mulligan Gulch Wetland. No significant effect although water from the reservoir would not directly enter reservoir during high storage periods.

(3) Normal Water Level Fluctuation. No effects. Exclusion of reservoir water storage into Mulligan Gulch Wetland compensated by impoundment of flows in conveyance channel.

(4) Salinity Gradients. No effect.

(5) Actions That Will Be Taken to Minimize Effects. No foreseeable actions required.

c. Suspended Particulate/Turbidity Determination.

(1) Expected Changes in Suspended Particulates and Turbidity levels. No significant changes foreseen.

(2) Effects (degree and duration) on Chemical and Physical Properties of the Water Column.

(a) Light Penetration. No significant effect.

(b) Dissolved Oxygen. No effect.

(c) Toxic Metals and Organisms. No effect.

(d) Pathogens. No effect.

(e) Aesthetics. No significant effect.

(3) Effects on Biota.

(a) Primary Production, Photosynthesis. No significant effects foreseen.

(b) Suspension/Filter Feeders. No significant effects foreseen.

(c) Sight Feeders. No significant effects foreseen.

(4) Action Taken to Minimize Impacts. Contractual requirements to minimize activities near or in water that would increase turbidity.

d. Contaminant Determinations. The material proposed for discharge should not introduce, relocate, or increase contaminants. Also, contract specifications contain provisions for the protection of water quality from such pollutants as petrochemicals used for fuel, lubrication, etc.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on Plankton. No significant effect except at Levee Toe Wetland which would be filled with a resultant loss of plankton.

(2) Effects on Benthos. No significant effects foreseen except at Levee Toe Wetland which would be filled with a resultant loss of benthos.

(3) Effects on Nekton. No significant effects foreseen except at Levee Toe Wetland which would be filled with a resultant loss of nekton.

(4) Effects on Aquatic Food Web. No effects foreseen except at Levee Toe Wetland which would be filled with a resultant loss of interacting biota.

(5) Effects on Special Aquatic Sites. The abandoned conveyance channel, Levee Toe Wetland, and Mulligan Gulch Wetland are wetlands and, therefore, fall under the classification of Special Aquatic Sites within the context of waters of the United States.

(a) Abandoned Conveyance Channel. A narrow, continuous to discontinuous band of wetland vegetation (primarily cattails) is located in the channel bottom and provides little wetland habitat. The possible temporary placement of fill would likely depress what wetland habitat is provided but would not have a significant adverse effect on associated wildlife use. Conversely, the possibility of excavating accumulated sediment from the channel to provide levee fill would greatly improve wetland features and use.

(b) Levee Toe Wetland. Compensation for the displacement of this wetland with fill would be accomplished by the creation of additional wetlands in association with borrow activities. Judicious siting, design, and permanent water would enhance wildlife use.

(c) Mulligan Gulch Wetland. If the alignment of the terminal tie-back levee section is near the southern fringe of this wetland, a narrow strip of marsh vegetation could be displaced with associated loss of wildlife use. Conversely, the levee would reduce sedimentation of the wetland during high water storage. Combined with possible expansion of the wetland in association with borrow excavation, wetland values would be appreciably enhanced.

(6) Threatened and Endangered Species. Wetland expansion, creation, or both would benefit the threatened and endangered species.

(7) Other Wildlife. All project features affecting waters of the United States have features incorporated into them to preserve and, where possible, enhance wildlife habitat. These features include planting of native riparian vegetation and creation of wetlands.

(8) Actions to Minimize Impacts. Actions taken to minimize impacts include design accommodations, contractual restrictions, revegetation, and wetland expansion and creation features.

f. Proposed Disposal Site Determinations.

(1) Mixing Zone Determination. No effects.

(2) Determination of Compliance with Applicable Water Quality Standards. See EIS for water quality standards. Based on an evaluation of planned project activities associated with waters of the United States there is no indication that State water quality standards would be violated. Most of the planned action consists of rehabilitating an existing structure using much of the same material. Combined with contractual environmental protection specifications, state water quality should be preserved.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water Supply. No effect.

(b) Recreational and Commercial Fisheries. Potential to enhance recreational fishing by creating wetlands.

(c) Water Related Recreation. In addition to having the potential to provide additional fishing opportunities the potential to provide increased waterfowl hunting opportunities as well as educational opportunities.

(d) Aesthetic. Possible long-term improvement in visual quality.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. The upper part of Elephant Butte Reservoir (among other parts of the reservoir) is administered for recreation by the State of New Mexico. However, there is no active management in this reach. The possible provision of wetlands would make recreational opportunities available to the State if they and USBR elected to manage these areas for public recreation.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The direct cumulative effects of placing fill in several wetlands should be relatively small. Accompanied by planned improvement or compensatory measures, as well as more extensive wetland development, the aquatic ecosystem should be enhanced. However, indirect cumulative effects of the project as a whole would be to reinforce the continued containment of overbank flows which, in a natural riverine ecosystem, would create meanders, oxbows, and depressions which would give rise to a diversity of wetlands and associated wildlife use. A higher level of flood protection to Bosque del Apache NWR would continue the regional high wildlife, educational, and recreational use that aquatic resources on this refuge provide.

h. Determination of Secondary Effects on the Aquatic Ecosystem. No significant secondary effects either positive or negative, are foreseen.

FINDING OF COMPLIANCE
FOR
RIO GRANDE FLOODWAY
SAN ACACIA TO BOSQUE DEL APACHE UNIT
SOCORRO COUNTY, NEW MEXICO

1. No significant adaptation of the Section 404(b)(1) guidelines were made relative to this evaluation.
2. Practical alternatives exist for two of the five discharge (placement) sites associated with the planned action. These sites are the river channel and Mulligan Gulch Wetland. As stated in the EIS, placement of clean fill in the river channel to increase bank width, and associated stabilization with native riparian vegetation is one of several disposal sites that would likely be used. Other disposal sites would not affect aquatic sites. The judicious use of the river channel would substitute very poor and abundant sandbar habitat with high wildlife use riparian forest, resulting in an overall gain in wildlife density and diversity.

There is some flexibility in determining the alignment for the terminal tie-back levee and maximum emphasis is being placed on avoiding the Mulligan Gulch Wetland during advanced design. If avoidance is neither practicable or feasible the extent of impact will be minimized and any adverse effects compensated by expanding this wetland. Given the anticipated minor impact on this wetland, the ease of compensating for any infringement, and the opportunity to enhance wildlife habitat, this alternative is considered to be in the interest of the aquatic ecosystem.

Alternatives to avoid discharge (or potential to) into the abandoned conveyance channel are limited by high costs and physical constraints. The alternative of utilizing the alignment of the spoil bank that parallels the relocated section of the conveyance channel has both higher costs and severe space limitations. Also, this alternative would leave the wetland vulnerable to heavy sedimentation from high river flows. To move the alignment riverward decreases channel capacity, requires an increase in levee height, removes more habitat, requires more habitat compensation, and substantially increases costs. Moving the alignment just west of the conveyance channel would require land acquisition and would leave the wetland vulnerable to sedimentation from the river. The chosen alternative accommodates levee design, minimizes riparian removal, has lower costs, and maximizes the potential to improve this wetland.

There is no reasonable alternative for rehabilitating that section of the spoil bank levee that extends into Elephant Butte Reservoir other than no construction. Use of the present alignment would result in the least disturbance of aquatic as well as terrestrial habitat, and compensation measures would expand aquatic habitat.

The alignment of the levee could be moved into the riparian zone to bypass the Levee Toe Wetland. However, this would result in a considerable increase in riparian vegetation removed, both from the new alignment and from increased

borrow requirements. Also, this change in alignment would change the hydraulic characteristics of the channel and could require an increase in upstream levee height. A change in levee alignment to avoid the wetland is not being pursued because of increased habitat disturbance, increased construction costs, and the ability to compensate for these wetlands by constructing higher use wetlands in association with borrow activities.

3. State Water Quality Standards would not be violated by planned (or potential) placement actions. Also, placement will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

4. Use of planned placement sites will not adversely affect any endangered species or their critical habitat.

5. The proposed placement of earth will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values will not occur.

6. Appropriate measures to avoid or minimize adverse effects of placed material on aquatic ecosystems include compatible feature designs, avoidance of high flow periods in the Rio Grande, contractual guidance or restrictions, avoidance of riparian aquatic sites to the extent practicable, and implementation of mitigation and compensation measures presented in Section 3.05a(11) of the SEIS.

7. Application of Section 404(b)(1) guidelines demonstrates that the proposed sites for the placement of earth comply with the provisions of the Clean Water Act. Integral to this determination is the inclusion of appropriate measures to avoid, minimize, or compensate for any unavoidable adverse effects.