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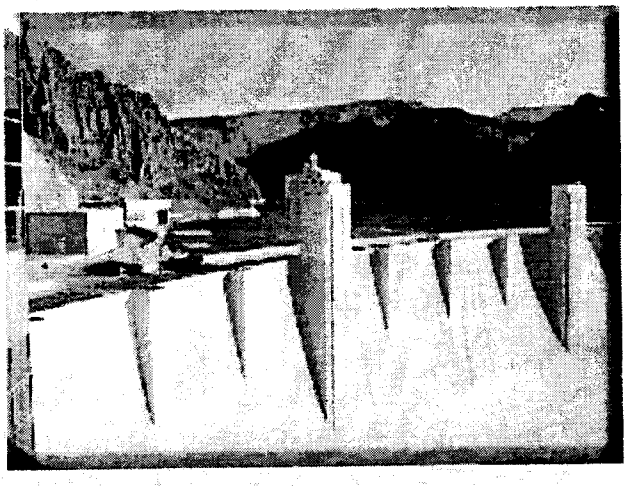
U.S. 93 Hoover Dam Bypass Project

Final Environmental Impact Statement and Section 4(f) Evaluation

Volume I



Federal Highway Administration

Central Federal Lands Highway Division

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U.S. 93 Hoover Dam Bypass
Final
Environmental Impact Statement
and Section 4(f) Evaluation

Submitted Pursuant to 42 U.S.C. 4332 (2) (c), 49 U.S.C. 303, and Section 404(b)(1) of the Clean Water Act, 33 U.S.C. 1344 by the U.S. Department of Transportation Federal Highway Administration and Cooperating Agencies:

- Arizona Department of Transportation
- Nevada Department of Transportation
- U.S. National Park Service
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Coast Guard
- U.S. Fish and Wildlife Service
- Western Area Power Administration

1/5/01
Date of Approval

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Abstract

This final environmental impact statement (FEIS) and Section 4(f) Evaluation documents potential environmental impacts associated with the Hoover Dam Bypass Project on U.S. 93. The proposed project involves construction of a new bridge and highway access across the Colorado River in the vicinity of Hoover Dam. The length of the project is approximately 3.5 miles. The project is in Clark County, Nevada, and Mohave County, Arizona, and lies entirely on Federal Lands—Lake Mead National Recreation Area and the Hoover Dam Reservation. The new bridge and highway would correct alignment and capacity deficiencies on U.S. 93 and would eliminate truck traffic and reduce other through traffic over Hoover Dam. The FEIS addresses the social, environmental, and economic impacts associated with the preferred alternative, two other build alternatives, and a No Build Alternative. All three build alternatives use public recreation land and historic sites protected under Section 4(f) of the U.S. Department of Transportation Act of 1966.

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Preface

This Final Environmental Impact Statement (FEIS) consists of the complete text of the Draft EIS (DEIS) with revisions and additions based on supplemental research and public and agency comments. Substantive revisions to the DEIS are marked in this FEIS by a vertical line in the outside margin next to the revised or added text. The FEIS includes a new Volume II, which describes the DEIS notification and public hearing process, summarizes and reproduces all comments received on the DEIS, and provides responses to comments. This FEIS is also available for review on the U.S. 93 Hoover Dam Bypass Project web site at:

www.hooverdambypass.org

The Federal Highway Administration - Central Federal Lands Highway Division (FHWA) served as the lead agency in the preparation of this document. The following agencies served as cooperating agencies: Arizona Department of Transportation, Nevada Department of Transportation, U.S. National Park Service, U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, U.S. Coast Guard, U.S. Fish and Wildlife Service (USFWS), and the Western Area Power Administration.

On the basis of comments received on the DEIS, FHWA has identified the Sugarloaf Mountain Alternative, with the proposed mitigation measures incorporated herein, as the preferred alternative. The preferred alternative was identified on the basis of minimizing environmental impacts, engineering and operational advantages, and slightly lower construction cost. Sections of the DEIS that have been substantively rewritten or supplemented in response to public and agency comments consist of: Chapter 2 – Alternatives (discussion of preferred alternative identification); Chapter 3 – Biology (incorporation of USFWS Biological Opinion), Cultural Resources, Hazardous Materials, and Construction Impacts; Chapter 5 – Cumulative Impacts; Chapter 6 – Section 4(f) Evaluation; and Appendix B – Laughlin-Bullhead City Alternative.

The U.S. 93 Hoover Dam Bypass FEIS will be used by the FHWA to decide the various discretionary actions required to implement the project. FHWA's decisions will be identified in a Record of Decision. Statements on the FEIS will be accepted by the FHWA and considered in the decision on this proposed action. The FEIS is being distributed for a 30-day notification period that begins on January 19, 2001, and ends on February 20, 2001.

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Acronyms and Abbreviations

AADT	average annual daily traffic
AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
ACOE	United States Department of the Army, Corps of Engineers
A.D.	anno Domini
ADA	Americans with Disabilities Act
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADT	average daily traffic
AGFD	Arizona Game and Fish Department
ANSI	American National Standards Institute
APE	area of potential effects
APP	Aquifer Protection Permit
AQRV	air quality-related value
ARPA	Archaeological Resources Protection Act of 1979
ASC	Arizona Species of Concern
ASTIP	Arizona State Transportation Improvement Plan
ATR	automatic traffic recorder
BA	Biological Assessment
BARA	Bureau of Applied Research in Anthropology
BIA	Bureau of Indian Affairs
BMP	Best Management Practice
B.P.	Before Present (before 1950)
CAA	Clean Air Act
CAP	Central Arizona Project
CCDCP	Clark County Desert Conservation Program
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFLHD	Central Federal Lands Highway Division
CFR	Code of Federal Regulations
CO	carbon monoxide
CPI	Consumer Price Index

CPI-U	Consumer Price Index for All Urban Customers
dBA	decibels on the A-scale
DCS	Design Concept Study
DEIS	Draft Environmental Impact Statement
DOE	Department of Energy
DOI	U.S Department of the Interior
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
e-mail	electronic mail
EO	Executive Order
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FE	Federally-Listed Endangered
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIA	Federal Insurance Administration
FONSI	Finding of No Significant Impact
FSC	Federal Species of Concern
FT	Federally-Listed Threatened
GCVTC	Grand Canyon Visibility Transport Commission
GMP	General Management Plan
g/VMT	grams per vehicle mile traveled
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HCS	Highway Capacity Software
HDNHL	Hoover Dam National Historic Landmark
HDR	Hoover Dam Reservation
HDRA	Hoover Dam Reservation Area
I-10	Interstate 10
I-15	Interstate 15
I-19	Interstate 19
IC	Interchange

ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation Systems
km	kilometer
kV	kilovolt
LBA	Laughlin-Bullhead City Alternative
LCA	Laughlin Crossing Alignment
L_{eq}	equivalent sound pressure levels
LMNRA	Lake Mead National Recreation Area
LOS	level of service
LWCF	Land and Water Conservation Fund Act
M	Monitoring
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MP	mile post
mpg	miles per gallon
mph	miles per hour
MSCP	Multi-Species Conservation Program
NAAQS	National Ambient Air Quality Standards
NAFTA	North American Free Trade Agreement
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NDOT	Nevada Department of Transportation
NDOW	Nevada Division of Wildlife
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966, as amended
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NP	Nevada protected
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRA	National Recreation Area
NRHP	National Register of Historic Places
OHWM	ordinary high water mark

OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
Pb	lead
PCB	polychlorinated biphenyl
PM_{10}	particulate matter with diameter less than 10 microns
$PM_{2.5}$	particulate matter with diameter less than 2.5 microns
PMT	project management team
ppm	parts per million
PSD	prevention of significant determination
R	receptor
RCRA	Resource Conservation and Recovery Act
Reclamation	Bureau of Reclamation
Reservation	Hoover Dam Reservation
ROD	Record of Decision
ROW	right-of-way
RV	recreational vehicle
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulphur dioxide
SO_x	sulphur oxides
SR	State Route
STIP	Statewide Transportation Improvement Program
TCLP	toxicity characteristic leaching procedure
TCP	Traditional Cultural Property
TDS	total dissolved solids
TSCA	Toxic Substances Control Act
TSM	Traffic Systems Management
TVA	Tennessee Valley Authority
U.S.	United States
U.S. 93	United States Highway 93
U.S. 95	United States Highway 95
USDOT	United States Department of Transportation
USFWS	U.S. Fish and Wildlife Service

UST	underground storage tank
V/C	volume to capacity
VMT	vehicle mile traveled
VOC	volatile organic compound
WAPA	Western Area Power Administration
WDM	Wetland Delineation Manual

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Executive Summary

Introduction

United States Highway 93 (U.S. 93) is part of the major transportation network in the western United States and has been designated as a North American Free Trade Agreement (NAFTA) route. The CANAMEX (Canada-Mexico) Corridor was formally designated a high-priority corridor by the National Highway System Designation Act of 1995. However, it cannot accommodate all of the traffic where it crosses over the top of Hoover Dam. To remedy this, the Federal Highway Administration (FHWA), in cooperation with affected state and federal agencies,[1] proposes to bypass Hoover Dam with a new bridge crossing of the Colorado River. This Environmental Impact Statement (EIS) describes the baseline conditions, anticipated impacts, and recommended mitigation. It was prepared in accordance with FHWA guidelines and the provisions of the National Environmental Policy Act (NEPA).

Scoping and Public Involvement

In 1989, the Bureau of Reclamation (Reclamation) created the "Colorado River Bridge Project Management Team" (PMT). The focus of the PMT was to perform engineering and environmental studies, to develop funding agreements, and to manage the design and construction of the new crossing. The PMT is still guiding the project and is made up of Reclamation, the FHWA, Arizona and Nevada Departments of Transportation, Western Area Power Administration (WAPA), and the National Park Service (NPS).

In May 1990, a Notice of Intent was published in the *Federal Register* initiating the EIS by Reclamation as lead agency and beginning the scoping process. Public scoping meetings were held in June 1990 in Kingman, Arizona, and Boulder City and Las Vegas, Nevada. In Boulder City, there was general concurrence that a new crossing was needed to remove traffic from Hoover Dam; however, some preferred to have a bypass around Boulder City in addition to Hoover Dam, while others felt that any road that bypassed Boulder City would severely impact downtown businesses. A newsletter, titled Update, was published in January 1991 and sent to interested individuals. Interviews with numerous community members and several meetings with interested members of the public, the Boulder City Chamber of Commerce, members of the Boulder City Council, and other organizations also occurred.

Prior to completion of the Draft Environmental Impact Statement (DEIS), Reclamation withdrew from the project as the lead agency in 1993. Reclamation's emphasis changed from construction of major public works projects to water resource management. With no lead agency or funding to continue the environmental process for a new crossing, the project was officially put on hold in 1995.

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[1]Arizona Department of Transportation, Nevada Department of Transportation, National Park Service, U.S. Army Corps of Engineers, Bureau of Reclamation, U.S. Coast Guard, U.S. Fish and Wildlife Service, and Western Area Power Administration.

FHWA filed a Notice of Intent in September 1997 to announce FHWA as the new lead agency for environmental review of the project. FHWA conducted three public open houses to allow comment on the alternatives carried forward from the June 1990 scoping meetings. The open houses were held in Kingman, Boulder City, and Las Vegas in late October 1997 to provide information on the alternative alignments under consideration and solicit input for the environmental review process. Approximately 250 people attended. In addition to concerns about various environmental impacts from all three locations, many of the comments from Boulder City focused on considering other alternative crossings in addition to the three build alternatives.

FHWA completed and approved the DEIS on September 14, 1998. The DEIS was circulated to the public on September 25, 1998, with publication of the Notice of Availability in the *Federal Register*. From October 13 to 15, 1998, FHWA held DEIS public hearings on successive evenings in Kingman, Arizona, and Boulder City and Las Vegas, Nevada. Approximately 250 people attended the DEIS public hearings. The court reporter transcripts of oral comments received at the hearings are included in Volume II of the final EIS (FEIS). The entire DEIS was also accessible on the project web site; by November 10, 1998, the close of the DEIS comment period, the web site was accessed over 1,500 times. There were approximately 160 public and agency commenters on the DEIS, including comments received after the close of comment period. See Volume 2 for a full description of the DEIS public input process, the comments received, and the responses to comments.

Description of Proposed Alternatives

Along with the No Build Alternative, three build alternatives are evaluated in detail in this document. From north to south, they are Promontory Point, Sugarloaf Mountain (the preferred alternative), and Gold Strike Canyon. They share common termini, near MP 2.2 in Clark County, Nevada, and MP 1.7 in Mohave County, Arizona. Each alternative would entail construction of a four-lane highway, a new steel or concrete four-lane bridge over the Colorado River near Hoover Dam, four-lane approaches, and the approach bridges and tunnels needed for the approximately 3.5-mile-long project. Current highway design standards for a 60-mile-per-hour (mph) design would be required. Under the build alternatives, commercial trucks would be restricted from Hoover Dam according to vehicle weight or number of axles. The project would be located on lands under the jurisdiction of the U.S. Department of the Interior, Reclamation, and NPS.

Summary of Alternatives Considered

A range of alternatives was considered, and the identification of a preferred alternative was not made until the alternatives' impacts and comments on the DEIS and from the public hearings were fully evaluated. The four most reasonable alternatives fully evaluated (including the No Build Alternative) were developed to a comparable level of detail in the DEIS so that their comparative merits could be analyzed.

Cost Estimate Basis

The cost estimates shown for the alternatives studied in detail are based on the August 1992, Reclamation Phase B Study. The estimates shown in the Phase B Study were actually computed in 1991. Therefore, costs were inflated at 4 percent per year for 11 years, establishing a base year of 2002.

Promontory Point Alternative

The Promontory Point Alternative crosses Lake Mead about 1,000 feet upstream of Hoover Dam. This alternative requires constructing approximately 2.7 miles of highway approach in Nevada; a 2,200-foot-long bridge; and an approximately 0.9-mile highway approach in Arizona. The estimated cost is $204 million for base year 2002.

Sugarloaf Mountain Alternative (Preferred Alternative)

The Sugarloaf Mountain Alternative crosses the Colorado River about 1,500 feet downstream of Hoover Dam. This alternative requires constructing approximately 2.2 miles of highway approach in Nevada, a 1,900-foot-long bridge, and an approximately 1.1-mile highway approach in Arizona. The estimated cost is $198 million for base year 2002.

Sugarloaf Mountain has been identified as the preferred alternative on the basis of minimizing environmental impacts, engineering and operational advantages, and slightly lower construction cost. A detailed discussion of the screening criteria used to identify the preferred alternative is in Section 2.6.2.1.

Gold Strike Canyon Alternative

The Gold Strike Canyon Alternative crosses the Colorado River about 1 mile downstream of Hoover Dam. This alternative requires constructing approximately 2.2 miles of highway approach in Nevada, a 1,700-foot-long bridge, and a 1.1-mile highway approach in Arizona. The estimated cost is $215 million for base year 2002.

No Build Alternative

The No Build Alternative is no action being taken. No Hoover Dam Bypass is developed; no change in the current highway configuration occurs; and no other structural or nonstructural improvements are developed on U.S. 93 near Hoover Dam. Existing hairpin curves, bottleneck conditions, inadequate sight distances, narrow dam crest roadway, and steep grades on U.S. 93 in the Hoover Dam vicinity remain unchanged.

The No Build Alternative does not meet the project purpose and need (see Chapter 1) because it does not decrease travel times or increase travel speeds in the vicinity of the dam. The increased traffic, which will continue to travel at slower speeds, contributes to decreased air quality in the Hoover Dam vicinity and increases accidents and congestion for tourists at Hoover Dam and the Lake Mead National Recreation Area (LMNRA). The potential for a catastrophe involving vehicles containing hazardous materials reasonably may be expected to increase with increasing traffic volume. Risks to innocent bystanders, property damage to the dam and its facilities, contamination of Lake Mead or the Colorado River, and interruption of the power and water supplies to Southwest residents remains or increases.

Summary of Environmental Impacts

Table ES-1 summarizes the impacts identified for the three build alternatives and the No Build Alternative.

Table ES-1
Summary of Environmental Impacts

	Alternative			
Resource	**Promontory Point**	**Sugarloaf Mountain**	**Gold Strike Canyon**	**No Build**
Air Quality	Construction would cause an increase in localized airborne dust and microscopic particulate matter. After mitigation, this impact would be reduced to an acceptable level. A beneficial impact would occur after construction because traffic-caused exhaust fumes would be reduced at Hoover Dam.	Construction would cause an increase in localized airborne dust and microscopic particulate matter. After mitigation, this impact would be reduced to an acceptable level. A beneficial impact would occur after construction because traffic-caused exhaust fumes would be reduced at Hoover Dam.	Construction would cause an increase in localized airborne dust and microscopic particulate matter. After mitigation, this impact would be reduced to an acceptable level. A beneficial impact would occur after construction because traffic-caused exhaust fumes would be reduced at Hoover Dam.	Air quality in the proposed project area would decrease because traffic would continue to move slowly over the Hoover Dam crossing.
Noise	Short-term noise impacts during construction. No noise impact during operation.	Short-term noise impacts during construction. No noise impact during operation.	Short-term noise impacts during construction. Even with mitigation, operation would result in a 20-decibel increase from existing noise levels at the upper end of Gold Strike Canyon.	Noise impacts at Hoover Dam from increased traffic associated with this alternative would exceed any of the build alternatives.
Biological Resources	Disturbance of 0.6 acre of desert wash habitat. Peregrine falcon: breeding territory within 1 mile of bridge site. Desert tortoise[a]: loss of 129 acres of marginal habitat; may affect 8 tortoises in low density population.	Disturbance of 0.3 acre of desert wash habitat. Peregrine falcon: may forage within project area. Desert tortoise[a]: loss of 120 acres of marginal habitat; may affect 8 tortoises in low density population.	Disturbance of 11.0 acres of desert wash habitat. Peregrine falcon: possible breeding territory within 1 mile of bridge site. Desert tortoise[a]: loss of 131 acres of marginal habitat; may affect 9 tortoises in low density population.	No impacts.

Table ES-1
Summary of Environmental Impacts

Resource	Alternative			
	Promontory Point	Sugarloaf Mountain	Gold Strike Canyon	No Build
	Desert bighorn sheep: impact to 25 acres of lambing habitat; access to 1 natural water source disrupted.	Desert bighorn sheep: impact to 20 acres of lambing habitat; impact to 1 human-made water source.	Desert bighorn sheep: impact to 55 acres of lambing habitat; access to 3 natural water sources disrupted.	
Water Resources	Erosion of cut and fill slopes; sediment and containment transport; and increased surface runoff.	Erosion of cut and fill slopes; sediment and containment transport; and increased surface runoff.	Erosion of cut and fill slopes; sediment and containment transport; and increased surface runoff. Gold Strike has the greatest potential for construction impacts.	Continued danger of major hazardous material spill on dam and contamination of lake and river waters.
Cultural Resources [acreage impacted included under Section 4(f)]	Nonmitigable adverse effect to historic views of Hoover Dam (National Historic Landmark).	Mitigable adverse effect to historic setting of Hoover Dam (National Historic Landmark).	No adverse effect to historic setting of Hoover Dam (National Historic Landmark).	No impacts
	Adverse effect on seven historic features eligible for or listed in National Register. A portion of this route is also located in a traditional cultural property.	Adverse effect on eight historic features eligible for or listed in National Register[b]. A portion of this route is also located in a traditional cultural property.	Adverse effect on five historic features eligible for or listed in National Register. A portion of this route is also located in a traditional cultural property.	
Section 4(f)	74 acres of Section 4(f) lands would be impacted. Potential spill in lake could impact additional thousands of acres of recreational waters in LMNRA. Adversely impacts historic "first impression" views of the landmark.	92 acres of Section 4(f) lands would be impacted.	128 acres of Section 4(f) lands would be impacted.	No impacts.

Table ES-1
Summary of Environmental Impacts

Resource	Alternative: Promontory Point	Alternative: Sugarloaf Mountain	Alternative: Gold Strike Canyon	Alternative: No Build
Visual Resources	Would alter view of Lake Mead and upstream landforms from dam and adjacent shores.	Would alter view of downstream landforms from dam and of Hoover Dam from the river and adjacent shores.	Would alter views of Gold Strike Canyon and Black Canyon. Bridge would not be visible from Hoover Dam.	No impacts.
Recreation Resources [acreage impact included under Section 4(f)]	Restrictions on recreation activities within construction safety zone during construction.	Restrictions on recreation activities within construction safety zone during construction. Minor effect on rafting concessions during construction.	Restrictions on recreation activities within construction safety zone during construction. Effect on river rafting, rock climbing, nature study, and hiking. Canyon Trail closed for 5- to 6-year construction period.	Increased traffic at the dam would diminish the quality of recreational experience.
	New bridge would become a tourist attraction.	New bridge would become a tourist attraction.		
Socio-economics	Beneficial impacts from improvements to transportation and circulation.	Beneficial impacts from improvements to transportation and circulation.	Beneficial impacts from improvements to transportation and circulation.	Adverse impact on transportation and circulation. Beneficial impacts associated with a build alternative would not occur.
Hazardous Materials	Impacts Reclamation warehouse storage yard, which has known past and present use and storage of chemicals, and leaking underground fuel storage tanks; impacts two contractor staging and disposal areas where petrochemicals were stored; impacts dump pile, from original dam construction, with rusted metal drums and scrap; also	Impacts Reclamation warehouse storage yard, which has known past and present use and storage of chemicals, and leaking underground fuel storage tanks; impacts two contractor staging and one disposal area where petrochemicals were stored; possibly impacts Arizona-Nevada Switchyard, with noted ground	Impacts the Nevada Spoil Pile, which has numerous metal drums, potential asbestos-containing roofing material, and potential contamination from chemical releases.	See Water Resources.

Table ES-1
Summary of Environmental Impacts

Resource	Alternative: Promontory Point	Sugarloaf Mountain	Gold Strike Canyon	No Build
	impacts abandoned switchyard with potential polychlorinated biphenyl (PCB) contamination in soil.	staining and potential PCB contamination in soil; also impacts Reclamation sewage ponds with potential industrial wastewater contamination.		

[a] These are combined impacts to both Mojave (Nevada) and Sonoran (Arizona) desert tortoises. For the federally listed threatened Mojave desert tortoise, the following impacts would occur: Promontory Point – 95 acres of habitat and 6 tortoises lost; Sugarloaf Mountain – 80 acres of habitat and 5 tortoises lost; and Gold Strike Canyon – 89 acres of habitat and 5 tortoises lost.

[b] An additional, comprehensive historic resources survey was conducted on the Sugarloaf Mountain alignment after it was identified as the preferred alternative, resulting in recordation of seven additional historic features relating to the construction and operation of Hoover Dam. Two of the eight impacted sites would be affected only by a change in historic setting.

Section 4(f) Evaluation

Section 4(f) of the U.S. Department of Transportation Act of 1966, codified in federal law at 49 U.S.C. § 303, declares, "It is the policy of the United States government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation land, wildlife and waterfowl refuges, and historic sites." Section 4(f) specifies, "The Secretary [of Transportation] may approve a transportation program or project...requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site), only if:

1. There is no feasible and prudent alternative to using that land; and

2. The program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use."

Initial alternatives that avoid Section 4(f) land were determined to be unfeasible and imprudent due to: (1) the geographic extent of LMNRA and the location of the proposed project; (2) unfeasible engineering economics; (3) not accomplishing the project purpose and need; and (4) imprudent increases in travel time, user costs, and environmental impacts.

Alternatives using Section 4(f) land were then screened to determine the least-harm alternative based on the amount of area used, the location of the portion used, severity of the portion used, and the function of the portion used. The alternatives south of the Sugarloaf Mountain alignment to Cottonwood Cove and the Temple Bar Alternative were eliminated based on extensive impact to essentially undisturbed Section 4(f) land. The Laughlin-Bullhead City Alternative was eliminated because it does not meet the purpose and need and it would cost an additional $1.4 billion in 20-year total costs. Modifications to

the crest of Hoover Dam would not meet the purpose and need and would result in direct physical alteration of the Hoover Dam National Historic Landmark. The remaining alternatives are therefore Sugarloaf Mountain and Promontory Point.

From these two, the Sugarloaf Mountain Alternative was determined to be the least harm alternative based on the following factors:

- Strong public concern regarding hazardous materials spills in Lake Mead from the Promontory Point Alternative
- Resource and regulatory agency support for Sugarloaf Mountain due to least impact to wildlife, wildlife habitat, and water quality
- No effect on the "first impression" historic views of Hoover Dam
- Ability to more readily blend the Sugarloaf Mountain Alternative into the landscape
- Sugarloaf Mountain Alternative traverses National Register-eligible Traditional Cultural Property (TCP) in an area of extensive disturbance
- Ability to minimize and mitigate impacts through continuing consultation and Native American participation on the Design Advisory Panel (DAP)

Areas of Controversy

One area of controversy has been the elimination of the Willow Beach South Route as a feasible alternative. This alternative would cross the Colorado River about 14 miles downstream of Hoover Dam and would require constructing approximately 22.3 miles of new highway approaches in Nevada and Arizona. This route was eliminated from further consideration because it requires about 19 miles of additional construction, has significantly greater environmental impacts and impacts to Section 4(f) lands, higher costs, and potential adverse economic impacts to Boulder City as a result of bypassing the city and diverting traffic away from downtown businesses.

An alternative Colorado River crossing for rerouted trucks near Laughlin, Nevada, and Bullhead City, Arizona, was initially evaluated and eliminated because the route is 23 miles longer, has 17 more miles of steep grades than the U.S. 93 route via Hoover Dam, and fails to meet the purpose and need for the project. It was re-evaluated in response to public comments made during the preparation of this document. Additional analyses were conducted (Appendix A, Traffic Analysis, and Appendix B, Laughlin-Bullhead City Alternative Study); and it was eliminated from detailed consideration because it would not meet the purpose and need of the project; would not reduce travel time; had much higher operational costs; would have adverse impacts on public safety, sensitive wildlife species, and air quality; would not protect the Hoover Dam Historic Landmark; and would not fully address long-term traffic issues on Hoover Dam.

Other Federal Actions Required for This Project

Federal actions and approvals needed for this project include those listed in Table ES-2.

Table ES-2
Permits and Approvals Anticipated for the Hoover Dam Bypass Project

Agency	Regulated Activity	Required Permit or Approval
Federal		
U.S. Army Corps of Engineers	Discharge of dredge or fill material into U.S. waters	Section 404 Permits
Federal Advisory Council on Historic Preservation (ACHP)	Adverse effects on Historical and Cultural Properties	Programmatic Agreement (PA) between FHWA, Nevada State Historic Preservation Officer (SHPO), the Arizona SHPO, and the ACHP
U.S. Bureau of Reclamation	Use of additional right-of-way for roadway and bridge	Easement
U.S. Bureau of Reclamation	Water use during construction	Water Use Permit
National Park Service	Acquisition of additional right-of-way for roadway and bridge	Easement
U.S. Coast Guard	Impacts on navigable waters (Promontory Point Alt. only)	Section 9 Permit
U.S. EPA	Stormwater discharges	National Pollution Discharge Elimination System (NPDES) Permit
U.S. Fish and Wildlife Service	Impacts on special-status vegetation and wildlife species	Biological Opinion

Summary of Mitigation Measures

Table ES-3 summarizes the measures to minimize harm identified for the three build alternatives.

Table ES-3
Summary of Mitigation Measures[a]

Promontory Point Alternative	Sugarloaf Mountain Alternative	Gold Strike Canyon Alternative
	Air Quality Effects	
Construction	Construction	Construction
Adherence to Clark County dust abatement permit restrictions and requirements in state of Nevada. Comply with ADEQ permit stipulations for portable sources of air pollution in Mohave County, Arizona.	Adherence to Clark County dust abatement permit restrictions and requirements in state of Nevada. Comply with ADEQ permit stipulations for portable sources of air pollution in Mohave County, Arizona.	Adherence to Clark County dust abatement permit restrictions and requirements in state of Nevada. Comply with ADEQ permit stipulations for portable sources of air pollution in Mohave County, Arizona.
Operation	Operation	Operation
No mitigation required.	No mitigation required.	No mitigation required.

Table ES-3
Summary of Mitigation Measures[a]

Promontory Point Alternative	Sugarloaf Mountain Alternative	Gold Strike Canyon Alternative
Noise Effects		
Construction	Construction	Construction
Comply with equipment manufacturer standards and specifications.	Comply with equipment manufacturer standards and specifications.	Comply with equipment manufacturer standards and specifications.
Implement remedial measures in response to specific noise complaints.	Implement remedial measures in response to specific noise complaints.	Implement remedial measures in response to specific noise complaints.
Develop/implement blasting control provisions and limitations.	Develop/implement blasting control provisions and limitations.	Develop/implement blasting control provisions and limitations.
Operation	Operation	Operation
No mitigation required.	No mitigation required.	Consider construction of noise barriers along about 7,000 feet of the roadway facing the canyon trail.
Biological Resource Effects		
Construction	Construction	Construction
Revegetate disturbed land; protect desert washes with barriers; construct offsite watering facilities; build wildlife overpasses and underpasses; place fencing along corridor to guide bighorn sheep and other wildlife to crossing structures; implement monitoring plan to assess effectiveness of bighorn sheep mitigation; contribute project funds to desert tortoise habitat compensation program; conduct preconstruction and preblasting tortoise surveys; relocate tortoises from construction areas; initiate construction worker desert tortoise education program; remove trash to minimize predation on tortoises; minimize destruction of desert tortoise habitat; designate a biologist to oversee tortoise mitigation compliance during construction; construct barriers and underpasses to prevent tortoise road kills, conduct monitoring program of peregrine falcon breeding pairs before/during/after construction; restrict blasting operations during peregrine falcon breeding season; monitor bald eagle use of bridge sites prior to construction; protect bald eagle perch sites; construct a catch net and temporary spill containment	Revegetate disturbed land; protect desert washes with barriers; construct offsite watering facilities; build wildlife overpasses and underpasses; place fencing along corridor to guide bighorn sheep and other wildlife to crossing structures; implement monitoring plan to assess effectiveness of bighorn sheep mitigation; contribute $46,960 in project funds to desert tortoise habitat compensation program; conduct preconstruction and preblasting tortoise surveys; relocate tortoises from construction areas; initiate construction worker desert tortoise education program; remove trash to minimize predation on tortoises; minimize destruction of desert tortoise habitat; designate a biologist to oversee tortoise mitigation compliance during construction; conduct monitoring program of peregrine falcon breeding pairs before/during/after construction; restrict blasting operations during peregrine falcon breeding season; monitor bald eagle use of bridge sites prior to construction; protect bald eagle perch sites; construct a catch net and temporary spill containment system, scale loose rocks prior to/during excavation, and use	Revegetate disturbed land; protect desert washes with barriers; construct offsite watering facilities; build wildlife overpasses and underpasses; place fencing along corridor to guide bighorn sheep and other wildlife to crossing structures; implement monitoring plan to assess effectiveness of bighorn sheep mitigation; contribute project funds to desert tortoise habitat compensation program; conduct preconstruction and preblasting tortoise surveys; relocate tortoises from construction areas; initiate construction worker desert tortoise education program; remove trash to minimize predation on tortoises; minimize destruction of desert tortoise habitat; designate a biologist to oversee tortoise mitigation compliance during construction; conduct monitoring program of peregrine falcon breeding pairs before/during/after construction; restrict blasting operations during peregrine falcon breeding season; monitor bald eagle use of bridge sites prior to construction; protect bald eagle perch sites; construct a catch net and temporary spill containment system, scale loose rocks prior to/during excavation, and use

Table ES-3
Summary of Mitigation Measures[a]

Promontory Point Alternative	Sugarloaf Mountain Alternative	Gold Strike Canyon Alternative
system, scale loose rocks prior to/during excavation, and use netting on canyon slopes to minimize rock-fall impacts on Devil's Hole pupfish, razorback sucker, and bonytail chub; preconstruction surveys and possible salvage of bicolored penstemon.	netting on canyon slopes to minimize rock-fall impacts on Devil's Hole pupfish, razorback sucker, and bonytail chub; preconstruction surveys and possible salvage of bicolored penstemon; replace Reclamation sewage evaporation ponds as a wildlife watering source.	netting on canyon slopes to minimize rock-fall impacts on Devil's Hole pupfish, razorback sucker, and bonytail chub; preconstruction surveys and possible salvage of bicolored penstemon.
Operation	Operation	Operation
Wildlife underpasses, overpasses, and alternate watering sources will be maintained.	Wildlife underpasses, overpasses, and alternate watering sources will be maintained.	Wildlife underpasses, overpasses, and alternate watering sources will be maintained.
Water Resource Effects		
Construction	Construction	Construction
Comply with National Pollutant Discharge Elimination System (NPDES) permit requirements as necessary and appropriate; implement best management practices (BMPs) to reduce potential for degrading offsite water quality; develop extensive BMPs for dewatering during pier construction; construct sediment basins to treat runoff before discharge and for containment of hazardous material spills; inspect construction equipment for leakage; locate refueling and vehicle maintenance facilities away from water pathways; design and construct temporary sanitary waste facilities to protect surface and subsurface water resources; construct bridge under accelerated schedule; utilize catch net for falling debris.	Comply with NPDES permit requirements as necessary and appropriate; implement BMPs to reduce potential for degrading offsite water quality; construct sediment basins to treat runoff before discharge and for containment of hazardous material spills; inspect construction equipment for leakage; locate refueling and vehicle maintenance facilities away from water pathways; design and construct temporary sanitary waste facilities to protect surface and subsurface water resources; relocate sewer evaporation ponds; utilize catch net for falling debris.	Comply with NPDES permit requirements as necessary and appropriate; implement BMPs to reduce potential for degrading offsite water quality; construct sediment basins to treat runoff before discharge and for containment of hazardous material spills; inspect construction equipment for leakage; locate refueling and vehicle maintenance facilities away from water pathways; design and construct temporary sanitary waste facilities to protect surface and subsurface water resources; utilize catch net for falling debris.
Operation	Operation	Operation
Proper design of discharge control features; bridge runoff control/ collection system; protection of roadside conveyance structures; settling basins for roadway runoff capture.	Proper design of discharge control features; bridge runoff control/ collection system; protection of roadside conveyance structures; settling basins for roadway runoff capture.	Proper design of discharge control features; bridge runoff control/ collection system; protection of roadside conveyance structures; settling basins for roadway runoff capture.
Cultural Resource Effects		
Construction	Construction	Construction
Consultation with Nevada and Arizona SHPOs and Native American Tribes for adverse effect	Consultation with Nevada and Arizona SHPOs and Native American Tribes; PA with Advisory	Consultation with Nevada and Arizona SHPOs and Native American Tribes for adverse

Table ES-3
Summary of Mitigation Measures[a]

Promontory Point Alternative	Sugarloaf Mountain Alternative	Gold Strike Canyon Alternative
on National Historic Landmark (NHL), related properties eligible for National Register, and TCP.	Council, SHPOs, NPS, Reclamation, WAPA, NDOT, ADOT, and Native American Tribes for adverse effect on NHL, related properties eligible for National Register, and TCP; apply mitigation measures developed through the PA relating to bridge and corridor design elements and TCP treatment plan.	effects on National Register properties related to Hoover Dam; impacts on TCP would be severe, and it is uncertain if any mitigation would be acceptable to the tribes.
Operation	Operation	Operation
Consultation with SHPOs and tribes for resolution of long-term effects.	Apply measures developed through the PA to minimize long-term effects.	Consultation with SHPOs and tribes for resolution of long-term effects.
	Land Use/Section 4(f) Effects	
Construction	Construction	Construction
PA with SHPOs, Advisory Council, and other parties for adverse effects on NHL and TCP; HAER photo documentation of historic dam views and features; consult with Tribes for TCP mitigation; coordinate access under bridge construction for boat tours and recreationists.	PA with SHPOs, Advisory Council, NPS, Reclamation, WAPA, NDOT, ADOT, and Native American Tribes for measures to minimize harm to NHL, related properties eligible for National Register, and TCP; coordinate construction access with raft tours and recreationists.	PA with SHPOs, Advisory Council, and other parties for adverse effects on National Register properties; impacts on TCP would be severe, and it is uncertain if any mitigation would be acceptable to the tribes; coordinate access under bridge construction for raft tours and recreationists.
Operation	Operation	Operation
Provision for bicycle trail grade separation for access to dam crossing and connections to new U.S. 93 crossing; form and color of bridge structure compatible with NHL and visual environment.	Provision for bicycle trail grade separation for access to dam crossing and connections to new U.S. 93 crossing; form and color of bridge structure compatible with NHL and visual environment.	Provision for bicycle access to dam crossing and connections to new U.S. 93 crossing; form and color of bridge structure compatible with visual environment; consider construction of noise barriers to minimize impact on hikers in upper canyon.
	Visual Resource Effects	
Construction	Construction	Construction
Implement public information program; provide visual simulation and project information.	Implement public information program; provide visual simulation and project information.	Implement public information program; provide visual simulation and project information.
Operation	Operation	Operation
Impacts could be lessened for the bridge by coloring the concrete or steel to blend with the surroundings; use of colored concrete on cable stayed and suspension bridge would reduce effect; use of desert varnish stain on rock slopes.	Use of colored concrete or steel on bridge would reduce effect; use of desert varnish stain on rock slopes; set arch bridge deck height to retain mountain view from dam, if feasible.	Impacts would be reduced by coloring the concrete or steel to blend with the surroundings.

Table ES-3
Summary of Mitigation Measures[a]

Promontory Point Alternative	Sugarloaf Mountain Alternative	Gold Strike Canyon Alternative
Recreation Resource Effects		
Construction Properly post/restrict access to construction areas; coordinate construction activities with Lake Mead Cruises; mark construction zone in Lake Mead with buoys; use netting to prevent debris from falling into river/lake and to protect recreationists.	Construction Properly post/restrict access to construction areas; coordinate construction activities with Colorado River raft and canoe launching sites; use netting to prevent debris from falling into river/lake and to protect recreationists.	Construction Properly post/restrict access to construction areas; coordinate construction activities with Colorado River raft and canoe launching sites; use netting to prevent debris from falling into river/lake and to protect recreationists; closure of hiking trail is unmitigable.
Operation Use unobtrusive, nonglare color for bridge; no additional mitigation required.	Operation Use unobtrusive, nonglare color for bridge; no additional mitigation required.	Operation Use unobtrusive, nonglare color for bridge; consider installation of noise barriers adjacent to hiking trail.
Socioeconomic Effects		
Construction No mitigation required.	Construction No mitigation required.	Construction No mitigation required.
Operation No mitigation required.	Operation No mitigation required.	Operation No mitigation required.
Hazardous Materials Effects		
Construction Investigate hazardous material use and releases, and analyze soil samples at Reclamation warehouse storage yard; assess contractor staging and disposal areas, and conduct soil sampling if needed; conduct sampling at dump pile and remediate any contaminated soils, also control runoff to site; conduct soil sampling at abandoned switchyard and remove/remediate any PCB-contaminated soils, also control runoff to site.	Construction Investigate hazardous material use and releases, and analyze soil samples at Reclamation warehouse storage yard; assess contractor staging and disposal areas, and conduct soil sampling if needed; possibly conduct soil sampling at the Arizona-Nevada Switchyard and remove/remediate any PCB-contaminated soils, also control runoff to site; conduct soil and sludge sampling at the Reclamation sewage evaporation ponds, and properly remove any contaminated soils.	Construction Control roadway runoff from Nevada Spoil Pile through use of barriers or diversion channels.
Operation No mitigation required.	Operation No mitigation required.	Operation No mitigation required.

[a] No mitigation measures were identified for the No Build Alternative.

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CHAPTER 1

Purpose and Need

1.1 Introduction

United States Highway 93 (U.S. 93) is the major commercial corridor for interstate commerce among the states of Arizona, Nevada, and Utah. It is also a direct link between Phoenix and Las Vegas, which are two of the fastest growing areas in the United States. It carries a high volume of traffic from Interstate 40 to Las Vegas and Interstate 15 (I-15). Approximately 30 miles southeast of Las Vegas, U.S. 93 crosses the Colorado River over Hoover Dam. Traffic on Hoover Dam has become highly congested and hazardous vehicle/pedestrian conflicts have increased as a result of large traffic volumes from both private and commercial vehicles that use these routes from the south, southwest, and southeast. The traffic volumes, combined with the mountainous terrain, hairpin curves, inadequate sight distance, narrow dam crest roadway, and steep grades in the Hoover Dam vicinity, create a major bottleneck with high accident potential and substantial delays.

The U.S. 93 corridor, in combination with other highways, creates a continuous north to south corridor between Canada and Mexico, through the United States from Calgary, Alberta, to Nogales, Sonora (Figure 1-1). These highways, consisting generally of four-lane divided facilities with structural sections capable of supporting heavy vehicles, provide north-south linkages from the international border with Mexico via Interstate 19 (I-19) from Nogales to Tucson and Interstate 10 (I-10) from Tucson to Phoenix, in Arizona; and Interstate 15 (I-15) in Nevada, Utah, Idaho, and Montana to the Canadian border. U.S. 93 provides a north-south link between I-10 near Phoenix and I-15 in the Las Vegas metropolitan area. Much of U.S. 93, along with other roadway facilities in the corridor, consists of two-lane undivided highway.

Currently the Nogales, Mexico, border crossing handles more than 250,000 truck crossings annually and is the primary point of entry for produce shipped by truck into the United States from Mexico (*U.S. 93 Development Study*, ADOT, 1993). The U.S. 93 corridor has been recommended by the Arizona Department of Transportation (ADOT) to become Arizona's link in the international trade route proposed by the North American Free Trade Agreement (NAFTA). In addition to connecting Las Vegas and Phoenix, this corridor also links these cities with Tucson and Salt Lake City, Utah.

ADOT plans to improve U.S. 93 to a four-lane divided facility from the Phoenix area to north of Kingman, Arizona. In Nevada, U.S. 93 is a four-lane facility from Las Vegas to Boulder City. The Nevada Department of Transportation (NDOT) is currently evaluating transportation improvements in the Boulder City/U.S. 93 Corridor. After implementing ADOT and NDOT improvements, the only section of U.S. 93 between Phoenix and Las Vegas to remain a two-lane facility will be the 19-mile segment that includes Hoover Dam. While most of the corridor would consist of a high-speed divided facility, the segment in the Hoover Dam vicinity creates a traffic bottleneck between Nevada and Arizona, potentially interfering with interstate and international commerce.

Hoover Dam is the only Colorado River crossing near Las Vegas. The closest alternate crossings are at Davis Dam, 67 miles downstream or at Laughlin, Nevada, 70 miles downstream (Figure 1-2). Because shorter travel times and distances reduce accident exposure and transit costs, the shorter Hoover Dam crossing is preferred by the commercial trucking industry for travel in the Las Vegas-to-Phoenix corridor.

Alternatives to crossing the Colorado River at Hoover Dam are United States Highway 95 (U.S. 95) and State Route 163 (SR 163) in Nevada to Arizona State Route 68 (SR 68) (Figure 1-2), which would add 23 miles to the trip from Las Vegas to Kingman. Another route from Las Vegas to Kingman—U.S. 95 to Interstate 40 to Needles, California, and then east to Kingman—adds 70 miles to the trip.

If the existing bottleneck is eliminated at the dam, U.S. 93 across the Colorado River would be the shortest and fastest route for through traffic between Arizona and Nevada. Traffic flow is generally at speeds near posted limits except at the roadway approaches to Hoover Dam. Average speeds recorded on dam approaches and across the dam crest were as low as 8 miles per hour (mph) (*Traffic Study: Colorado River Bridge*, December 1991).

1.2 History

Hoover Dam, dedicated in 1935, is approximately 9 miles east of Boulder City and 80 miles northwest of Kingman (Figure 1-2). The dam is 1,244 feet long and is situated in the Black Canyon of the Colorado River at the southeastern border of Nevada and the northwestern border of Arizona.

In 1955, the American Society of Civil Engineers named Hoover Dam one of America's seven modern civil engineering wonders. In 1985, it was designated by the U.S. Department of the Interior (DOI) as a National Historic Landmark (NHL) and by the American Society of Civil Engineers as a National Historic Civil Engineering Landmark.

Hoover Dam is key to controlling and regulating the lower Colorado River. It controls floods; stores water for irrigation, municipal, and industrial uses; and provides hydroelectric power generation, recreation opportunities, and wildlife habitat. Except for the tourist facilities, the area surrounding Hoover Dam (known as the Hoover Dam Reservation) is designated as a security-restricted area and is not accessible to the public.

The original road from Boulder City to Hoover Dam was built to provide access for dam construction. From 1934 until the early 1940s, vehicular traffic to the dam came primarily from Las Vegas and Boulder City on U.S. 93. Because few vehicles crossed the dam at that time, there was no interference with dam operations and no traffic safety hazards for dam visitors.

Originally, the highway from Kingman to the dam was a lightly traveled primitive dirt road. Since the early 1940s, ADOT has been improving U.S. 93 between the dam and Kingman, the shortest travel route between Arizona and Nevada. As a result of these highway improvements and the shorter travel distances between Kingman and Las Vegas, through traffic over the dam has steadily increased. This increase, together with population growth in southern Nevada and increasing tourist traffic to Las Vegas, has resulted in serious traffic congestion on U.S. 93 on and near the dam.

As early as 1965, Reclamation recognized the U.S. 93 problems, including sharp turns; narrow roadways; inadequate shoulders; poor sight distances; low travel speeds; and the associated potential for loss of life, contamination of Lake Mead and the Colorado River from hazardous material spills, and effects to Hoover Dam because of these roadway deficiencies.

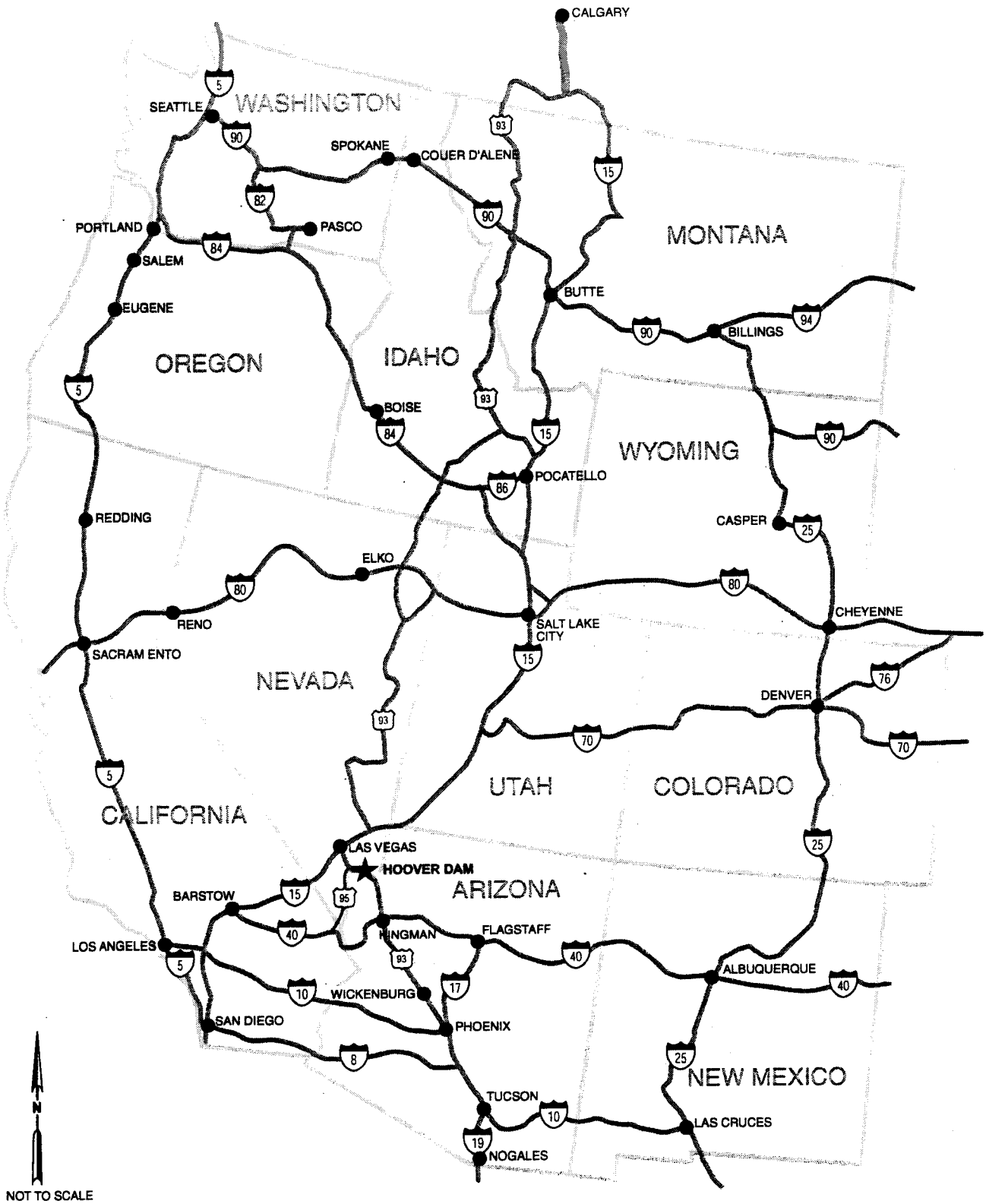

FIGURE 1-1
U.S. 93 TRANSPORTATION CORRIDOR
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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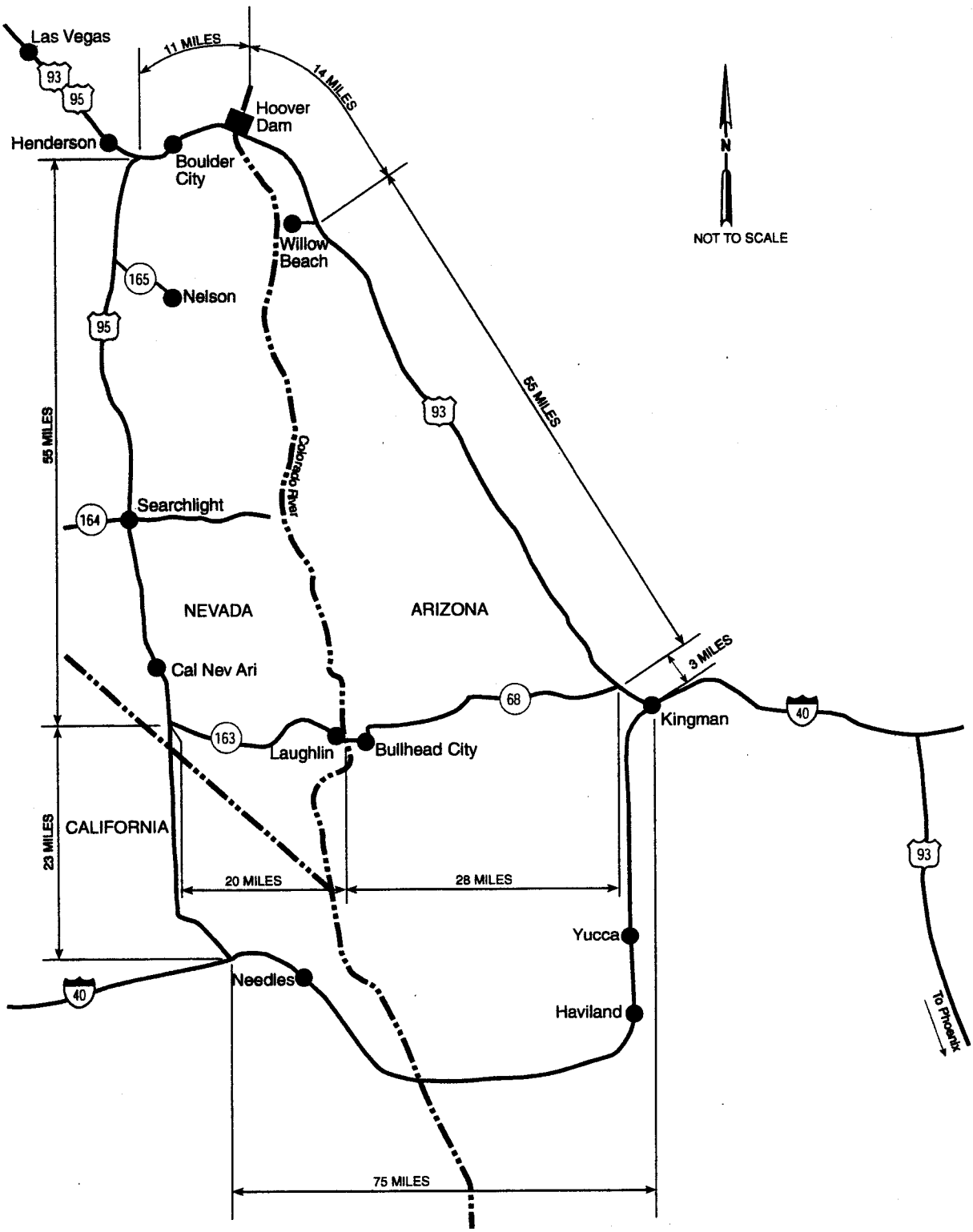

LEGEND

- STATE BOUNDARY
- HIGHWAYS

FIGURE 1-2
EXISTING ALTERNATE ROUTES TO U.S. 93 AND HOOVER DAM CROSSING
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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Reclamation took the lead in seeking a solution to the roadway problems at Hoover Dam. They conducted the following studies: an origin and destination analysis in 1966, a preliminary U.S. 93 relocation corridor study in 1990, and a detailed alignment and bridge type selection study for three bypass alternatives in 1992 (see Chapter 2, Alternatives).

In 1989, Reclamation created the "Colorado River Bridge Project Management Team" (PMT), which directed engineering and environmental studies, developed funding agreements, and managed the preliminary design of a new crossing. The PMT was made up of Reclamation, ADOT, NDOT, Federal Highway Administration (FHWA), and the National Park Service (NPS).

Before releasing the Draft Environmental Impact Statement (DEIS) for public review in 1993, Reclamation withdrew from the project as the lead agency because their mission emphasis changed from constructing major public works projects to water resource management. With no lead agency or funding to continue the environmental process for a new crossing, the project was officially put on hold in 1995.

In the spring of 1997, governors and Congressional representatives from Nevada and Arizona appealed to the U.S. Secretary of Transportation to help fund the completion of the environmental studies. A federal appropriation provided funds to resume studies to evaluate removing truck traffic from Hoover Dam. ADOT and NDOT agreed to contribute funds to complete the studies. In May 1997, the FHWA, Central Federal Lands Highway Division (CFLHD), was named lead agency to resume the Hoover Dam Bypass Project—the project being evaluated in this Environmental Impact Statement (EIS).

1.3 Previous Studies Conducted

As discussed above, U.S. 93 deficiencies in the Hoover Dam vicinity were identified as long ago as 1965. Recognition of these roadway deficiencies resulted in a series of studies that evaluated alternative methods to alleviate deficiencies. Table 1-1 lists the studies conducted to date and provides a brief description of study purposes and findings.

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
U.S. 93 – 466 Hoover Dam Origin and Destination Study, prepared by State of Nevada Department of Highways and U.S. Department of Commerce, Bureau of Public Roads, November 1968.	Study determined the characteristics of traffic congestion at Hoover Dam. Determined that traffic near Hoover Dam can be divided into two categories: through traffic (defined as vehicles using the dam as a bridge to complete their trip), and Hoover Dam dead-end trips (defined as vehicles whose destination is Hoover Dam). Suggested four methods to alleviate traffic problems: (1) develop more parking areas and modify the dam to add two traffic lanes; (2) construct an upstream crossing; (3) construct a downstream crossing; and (4) construct a downstream crossing near Willow Beach (not considered economically justified in 1966 because of Davis Dam crossing downstream).

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
A Study and Recommendations for Handling Traffic and Conducting Visitors at Hoover Dam, prepared by Perkins & Will Corporation for Reclamation, April 1971.	Study determined methods and facilities to handle vehicle traffic and conduct visitors on dam tour. Study assumed that through traffic would bypass the dam by relocating U.S. 93 to a new downstream bridge and that all other traffic would continue to travel across the dam. Recommended a highway bypass, parking structures, and minor highway improvements.
Resume of Studies on Colorado River Crossing Below Hoover Dam, prepared by Reclamation, January 1972.	Study requested Congressional authorization to construct an alternative Colorado River crossing near Hoover Dam.
Facilitating Traffic Flow, Alleviating Safety Hazards, and Expediting Access - Hoover Dam, prepared by Reclamation, September 1977.	Study requested Congressional authorization to increase the cost ceiling of the Boulder Canyon Project Act (authorized in 1928). Additional funds would have provided new facilities to improve traffic flow, alleviated safety hazards, and provided a safe experience for Hoover Dam visitors.
1983 Analysis of Colorado River Crossing Below Hoover Dam, prepared by Reclamation, June 1983.	Study described the project; explored potential hazards to the dam; updated traffic, visitor use, and construction cost data; recommended a portion of construction costs for a bridge be allocated to power revenues; and concluded that a bridge is needed to bypass the dam to provide safe conveyance of traffic on U.S. 93 for safe, efficient operation of Hoover Dam.
Black Canyon Bridge, Colorado River Crossing, Hoover Dam, prepared by Reclamation, January 1986.	Study described the project; provided a basis for seeking funding; explored potential dam hazards; updated traffic, visitor use, and construction cost data; and concluded that a bridge crossing could eliminate some future potential costs to government facilities at Hoover Dam by eliminating commercial vehicles from using the dam crest.
Preliminary Geologic Report for Colorado River Bridge Crossing, Nevada Approach, Clark County, Nevada, prepared by Reclamation, March 1988.	Contains text, photos, and geologic plan maps at a scale of 1 inch equals 200 feet of the Nevada side approach of the Gold Strike Canyon alignment.
Colorado River Bridge – Hoover Dam, Phase A Route Study, prepared by Reclamation, October 1990.	Study determined the preferred general corridor to relocate U.S. 93 crossing the Colorado River. The study considered nine routes. A January 14, 1991, memorandum recommended that six of the routes be eliminated because of increased environmental impacts, disturbance of large amounts of currently undisturbed NPS lands, and increased costs. Routes recommended for further study included Promontory Point, Sugarloaf Mountain, and Gold Strike Canyon.

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
Reconnaissance Geologic Investigation Highway Relocation, prepared by Reclamation, November 5, 1991.	Provided the designers with geologic data including photos and rough geologic mapping for the Phase B Report. Geologic features are approximate as no stationing or surveying had been done along the proposed alignments.
Traffic Study: Colorado River Bridge – Hoover Dam, prepared by CH2M HILL for Reclamation, December 1991.	This traffic study analyzed U.S. 93 from the Gold Strike Casino (now the Hacienda Hotel) to the Arizona lookout south of the dam. Its purposes were to perform a Traffic Systems Management (TSM) study and to provide support to the Reclamation Phase B Corridor Study and EIS for the Colorado River Bridge project. Findings included the existing level of service to be LOS D; through trips represented 70 percent of the total traffic across the dam; average travel time from the Arizona lookout to the Nevada park-n-ride was between 8 minutes (off peak) and 13 minutes (during peak hours); and 30 percent of accidents on the dam involved semitrailer trucks.
Colorado River Bridge Crossing Phase B Corridor Study Developed Bridge Alternatives, prepared by Parsons, Brinkerhoff, Quade & Douglas and HDR Engineering for ADOT and NDOT, January 1992.	Reclamation conducted the Phase B Corridor Studies in conjunction with preparation of the project EIS. The studies identified initial bridge concepts, preliminary design parameters, and costs. This final phase of the bridge type studies began in August 1991 and developed the selected bridge alternatives and their estimated costs.
Movements and Habitat Use of Desert Bighorn in the Black Canyon Area, Arizona Game and Fish Department for Reclamation, March 1992.	The study involved collaring and 2-year monitoring of 49 desert bighorn in the Black Mountains adjacent to Hoover Dam to determine areas of importance, movement corridors, habitat use, and reactions to U.S. 93. Three separate ewe groups/areas were found with significantly different habitat use and home range size. All three of the build alternatives were found to bisect one or more of the ewe groups' home range. The Gold Strike alignment presented the greatest potential difficulties for bighorn.
Colorado River Bridge – Hoover Dam: Public Involvement Plan, prepared by CH2M HILL for Reclamation, May 15, 1992.	The goals of the plan are to: (1) identify issues of concern to the community; (2) provide a plan to address community concerns; and (3) inform the public about the NEPA procedures for selecting a preferred alternative. Formulation of the plan involved in-depth interviews with residents, community and civic leaders, business people, public officials, and members of environmental organizations.
Presence and Movements of Peregrine Falcons in the Area of the Proposed Black Canyon Bridge Project, prepared by Arizona Game and Fish Department for Reclamation and NPS, June 1992.	The purpose of the study was to assess impacts of proposed bridge and associated construction action on the peregrine falcon. Specific objectives of this study were: 1) to locate peregrine falcon breeding areas, 2) to identify important foraging habitats along the river corridor, and 3) to document

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
	presence/ absence of peregrines during the nonbreeding season. The area covered in this study was Lake Mead from Fortification Hill to Hoover Dam, and the Black Canyon of the Colorado River from Hoover Dam downstream to Windy Cove. The report recommendations were: 1) continue to monitor all Black Canyon peregrines discovered during this study from 1992 through a minimum of at least 3 years after completion of the roadway and bridge, and 2) in the event that the preferred bridge corridor is possibly within 2 kilometers (km) of an active peregrine eyrie, monitor impacts of the construction.
Traffic and Revenue Study for Colorado River Crossing, prepared by CH2M HILL and Price Waterhouse for Reclamation, August 1992.	The purpose of the study was to support the new crossing EIS and prepare financial feasibility data to determine the maximum amount of revenue obtainable if the crossing were a toll facility. The study area included U.S. 93 from the U.S. 95 junction to the junction of Arizona Route 68; Arizona 68 west to the Colorado River; Nevada 163 west to U.S. 95; and U.S. 95 north to the junction with U.S. 93. It was concluded that the only feasible alternative route, the Colorado River crossing at Laughlin-Bullhead City, is sufficiently distant to discourage most traffic from diverting around the proposed toll bridge.
Colorado River Bridge – Hoover Dam, Phase B Corridor Studies, prepared by Bureau of Reclamation, August 1992. (Note: This includes the "Developed Bridge Alternatives" report listed above.)	Studies assessed Promontory Point, Sugarloaf Mountain, and Gold Strike Canyon alternatives. Included were a highway approach study and a bridge type study. Identified physical factors that would affect the design, cost estimates, or schedules; developed preliminary mitigation features; included preliminary designs; included a construction cost estimate; and included a final design schedule and construction schedule.

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
Cultural Resource Report: Colorado Bridge Crossing/Hoover Dam Project Bridge Crossing and Highway Alignment Survey, prepared by Reclamation, 1992.	This study reports the results of a 145-acre cultural resource survey of the proposed bridge crossing locations and highway corridors. Forty-four features were identified within the area of potential effect. Eight features had been identified in previous cultural resource activities. The remaining 36 sites were identified during cultural resource surveys for this project. One feature, Hoover Dam, is listed on the National Register of Historic Places (NRHP) and is also a National Historic Landmark (NHL). Two features, the Old Government Railroad and the Old Boulder City Water System, have been determined eligible for listing in the NRHP. Most of the remaining features are associated with the construction, operation, or maintenance of Hoover Dam. These features are not individually eligible but may contribute to the NHL or a historic district focused on the dam. Reclamation determined that a World War II anti-aircraft bunker located on the Arizona side of the river is individually eligible for the NRHP. This study also determined that all alignment options would affect the historic and visual setting of Hoover Dam.
Arizona and Nevada Site Forms for Colorado Bridge Crossing/Hoover Dam Project Bridge Crossing and Highway Alignment Survey, prepared by Reclamation, 1992.	This volume was prepared as a stand-alone supplement to the report prepared by Reclamation. It includes site forms for all the cultural resource features investigated by Reclamation in connection with the survey.
Hoover Dam Bridge Crossing Cultural Resource Site Reassessment: Nevada Sites 26CK4698, 26CK4739, 26CK4750, 26CK4751, 26CK4752, and 26CK4763, prepared by Reclamation, 1993.	Reclamation determined that 23 of the 29 Nevada cultural resource sites originally identified were eligible for NRHP listing as contributing elements to a potential, undefined historic district associated with the construction and/or operation and maintenance of Hoover Dam. The remaining six sites were determined not eligible. The Nevada SHPO questioned Reclamation's determinations and asked for additional information and clarification. This report documents a survey to relocate and reassess the six sites which the SHPO expressed concern about. Reclamation determined that except for portions of the railroad grade (26CK4751), none of the reassessed cultural resource sites would be affected by any of the Hoover Dam bridge crossing alternative alignments.

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
Hoover Dam Bridge Crossing Cultural Resource Site Reassessment: Arizona Sites DD:14:15, DD:14:16, DD:14:17, and DD:14:19, prepared by Reclamation, 1993.	Reclamation determined that four of the eight Arizona cultural resource sites originally identified were NRHP eligible as contributing elements to a potential, undefined historic district associated with the construction and/or operation and maintenance of Hoover Dam. The remaining four were not eligible. The Arizona SHPO questioned Reclamation's determinations and asked for additional information. This report documents a survey to relocate and reassess the four sites which the SHPO expressed concerns about. Reclamation determined that none of the reassessed cultural resource sites would be affected by any of the Hoover Dam bridge crossing alternative alignments.
Desert Bighorn Movements and Habitat Use in Relation to the Proposed Black Canyon Bridge Project: Nevada, Cooperative National Park Resources Studies Unit, University of Nevada for Reclamation, May 1993.	This study characterized bighorn sheep habitat quality and information on movements of radio-collared bighorn to estimate home range size and patterns of movement. Total home range size was determined. It was found that bighorn sheep heavily use the area of the proposed alignments on a year round (ewes) and seasonal basis (rams in fall). The Sugarloaf Mountain Alternative was found to intrude the least on high-use areas and that habitat loss will be greatest for the Gold Strike Canyon Alternative. Big game fencing is recommended along the new highway to reduce bighorn sheep/motor vehicle collisions.
U.S. 93 Colorado River Crossing Corridor Study, prepared by Parsons Brinkerhoff Quade & Douglas for NDOT, December 1994.	A continuation of Reclamation studies, this report analyzed two longer alternatives: Willow Beach South (26 miles) and Hoover Dam/Boulder City Bypass (31 miles). Study purpose was to determine the relative feasibility of these corridors. Feasibility was determined by relative cost, technical engineering difficulty, major impacts, and user benefits.
Biological Assessment for the Hoover Dam Bypass Project, prepared by CH2M HILL for Federal Highway Administration, Central Federal Lands Highway Division, February 1999.	Determined that the preferred alternative may affect the desert tortoise but will not affect any of the other listed species in the project area. Impacts to the desert tortoise would be avoided or minimized with conservation measures.
U.S. 93 Hoover Dam Bypass Project, Sugarloaf Mountain Alternative, Historic Resources Survey, prepared by Kurt P. Schweigert, Associated Cultural Resource Experts for Federal Highway Administration, Central Federal Lands Highway Division, and CH2M HILL, August 1999.	This survey recorded 14 historic features within the area of potential effects (APE) of the preferred alternative, including the Hoover Dam National Historic Landmark. The report evaluated the 13 other historic features for eligibility to the National Register of Historic Places as elements relating/ contributing to the construction and operation of the Hoover Dam. The report also analyzed the affect of the preferred alternative on these historic sites.

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
U.S. 93 Hoover Dam Bypass Project Archaeological Resources Survey Report, prepared by CH2M HILL for Federal Highway Administration, Central Federal Lands Highway Division, April 2000.	This report documents the results of a Class III (intensive) archaeological survey of the three alternative alignments of the proposed bypass. It documents a field survey conducted for all alignments in March 1998 and an intensive archaeological site mapping and recording investigation on two sites in June 1999. The survey and mapping recorded a total of five prehistoric archaeological sites, all located in Arizona, within the APE of the Promontory Point and Sugarloaf Mountain Alternatives. The report concluded that none of the five sites had sufficient research value for prehistoric archaeology, and all were thus found ineligible for the National Register.
Hoover Dam Bypass Bridge Financial Feasibility Study, prepared by Hagler Bailly Services, Inc. for Arizona Department of Transportation and Nevada Department of Transportation, June 2000.	This study outlines options available to meet the financial demands of constructing the Hoover Dam Bypass Project, to aid policymakers in their selection of alternate strategies. The study analyzed the following funding options: federal funding, existing state program funding, new state funding sources (statewide taxes, transportation taxes and fees, tourism-related taxes and fees, and value-capture programs), and tolls or other user charges.
Ha'tata (The Backbone of the River): American Indian Ethnographic Studies Regarding the Hoover Dam Bypass Project, prepared by Richard W. Stoffle et al., University of Arizona for Federal Highway Administration, Central Federal Lands Highway Division, and CH2M HILL, October 2000a.	This study recorded and evaluated the results of field visits conducted by University of Arizona anthropologists with Native American tribal elders. Interviews were conducted in May/June 1998 and May 2000 with representatives from 13 tribes. The report documents feelings of the tribal representatives about the cultural values of the lands in the project area, tribal concerns about the impact of the bypass project, and tribal recommendations for minimizing the impacts.
Hoover Dam Bypass Project: Ethnohistoric Overview and Assessment, prepared by David S. Whitley and Peter Nabokov, W&S Consultants, for Federal Highway Administration, Central Federal Lands Highway Division, and CH2M HILL, October 2000b.	Examined ethnohistoric data from archaeological, historical, and ethnographic sources from the general region of the Hoover Dam Bypass Project study area. Identified traditional Native American land use practices, values, and beliefs. It provided a context for the contemporary ethnographic (FHWA, October 2000) and archaeological (FHWA, April 2000) studies conducted for the project, with the goal of aiding the determination of whether National Register-eligible traditional cultural properties (TCPs) are present in the project area.

Table 1-1
Previous U.S. Highway 93 and Hoover Dam Studies

Study Name, Author, and Date Prepared	Summary of Study
The Land Still Speaks: Traditional Cultural Property Eligibility Statement, prepared by University of Arizona and the American Indian Core Consultation Work Group for Federal Highway Administration, Central Federal Lands Highway Division, October 2000c.	Summarized and evaluated the findings from the ethnographic (FHWA, October 2000a) and ethnohistoric (FHWA, October 2000b) studies conducted for the project. This report identified the Gold Strike Canyon and Sugarloaf Mountain TCP, and determined it to be eligible for the National Register of Historic Places.

1.4 Need for the Project

Several deficiencies on U.S. 93 from the Gold Strike Inn (recently rebuilt as the Hacienda Hotel), Nevada, to Milepost 1 (MP 1) in Arizona have been identified, both from a highway operational standpoint and from a dam operational standpoint. These deficiencies not only create travel delays, but also contribute to accidents and vehicle conflicts.

1.4.1 Highway Deficiencies

The U.S. 93 roadway approaches to Hoover Dam include numerous substandard geometric elements. These elements include horizontal curves with radii too short to provide adequate turning room and that are bounded by rock walls that limit sight distance along the road. The existing roadway cross section does not provide adequate width for disabled vehicles or passage by emergency vehicles; and, at several locations, the roadway width is not adequate for turning.

The highway speed limit is reduced from 55 to 15 mph before the dam from each direction. The primary reasons for the speed reduction are the numerous hairpin curves required for the highway to reach the dam crest roadway and the steep grade. Three curves are of particular concern: one on the Nevada side, referred to as the Nevada Hairpin Curve; and the other two on the Arizona side, referred to as the Arizona Hairpin Curve and the Arizona Horseshoe Curve (see Figure 2-3).

Each of these curves provides less than a 20-mph design speed, and each is located less than 1 mile from the dam. The extreme hairpin curves do not allow adequate width for commercial trucks to pass in opposite directions. Trucks meeting at these locations usually must come to a complete stop, and one truck often must back up to allow the other room to negotiate the curve. The overall impact of these highway deficiencies on the traffic level of service at the dam is discussed in Section 1.4.2 below.

1.4.2 Inadequate Roadway Capacity

The Hoover Dam section of U.S. 93 has reached its capacity during peak periods and cannot provide additional capacity with the current roadway alignment. In 1991, average travel speeds of the 2 miles of roadway on either side of Hoover Dam were 8 to 18 mph. The crest road at Hoover Dam has reached its maximum traffic-carrying capacity and has been at that level since at least 1991. Table 1-2 compares 1997 traffic on the dam with that projected for the years 2017 and 2027.

Table 1-2
Traffic Volumes and Level of Service at Hoover Dam

	1997	2017	2027
Traffic Volumes (Average Annual Daily Traffic)[a]	11,500	21,100	26,000
Level of Service	F	F	F

[a] Actual Reclamation 2000 traffic counts indicate a somewhat greater growth rate than that used for these projections.
Source: Appendix A, Traffic Analysis.

The method used to describe and determine capacity and traffic operating conditions in this study is outlined in the Highway Research Board's *Highway Capacity Manual - Special Report 209* (3rd Edition, 1994), which expresses levels of service (LOS). The LOS concept is a qualitative measure to describe traffic operational conditions and motorist perceptions; it describes speed, convenience, and safety. Six LOSs are used to define operating conditions, designated by the letters A through F. LOS A represents the best operating conditions, while LOS F represents heavily congested flow with traffic demand exceeding highway capacity (Figure 1-3).

Considering the existing highway configuration, speed limit, pedestrians, and vehicle mix (passenger vehicles, semitrucks, and recreational vehicles) of through traffic, highway capacity is 1,200 vehicles per hour. This calculation is based on average operating speeds between 15 and 20 mph and does not consider peak periods such as weekends, holidays, or special events that further exacerbate traffic conditions. The 1991 peak volume of 1,168 vehicles per hour was 97 percent of highway capacity, resulting in traffic congestion (traffic count, August 8, 1991). Traffic counts taken in 1996 indicated peak volumes at or exceeding the total highway capacity. Traffic congestion is increased when vehicles have mechanical difficulties because the shoulders are too narrow to pull off the road.

Primary factors that limit capacity through this section of U.S. 93 are tight curves and steep grades associated with the approach roadways on both sides of the dam; and a single lane in each direction. On the dam crest, conditions are degraded by numerous conflicts with pedestrians crossing the roadway. Neither the improvement of these geometric constraints nor widening of the corridor is feasible with the current alignment over the dam.

1.4.3 Travel Times

Based on current posted speeds along U.S. 93 from the Hacienda Hotel, Nevada, to MP 3 in Arizona (6.3 miles), the estimated average travel time for the existing alignment is 16.5 minutes. A bypass roadway could be estimated to operate at 55 mph. The Sugarloaf Mountain and Gold Strike Alternatives would reduce the distance to 5.5 miles, resulting in a travel time of 6 minutes. This estimate represents a 10.5-minute reduction for each through-vehicle. The Promontory Point Alternative would reduce the distance to 6.1 miles, with a time savings of approximately 10 minutes.

Based on projections that 26,000 vehicles will cross the dam in the year 2027, the peak-hour traffic volume is estimated at 2,340 vehicles. This projection indicates that more than 1,170 hours of travel time delay during the 3 peak hours could be eliminated (see Appendix A, Traffic Analysis).

1.4.4 Interference in Dam Operation

The high volume of vehicles crossing the dam interferes with the vehicle movements needed for operating and maintaining the dam and its facilities.

Vehicular traffic affects most highway and dam maintenance activities. These activities include repairing and replacing turbines and generators, replacing lights along the highway on the dam, maintaining the highway approaches, repairing the spillway, and using the overhead cable that transports heavy equipment and material to the power house. The traffic interference results in additional time and higher costs to complete these activities.

1.4.5 Accident Rate and Potential for Pedestrian-Vehicular Accidents on Hoover Dam

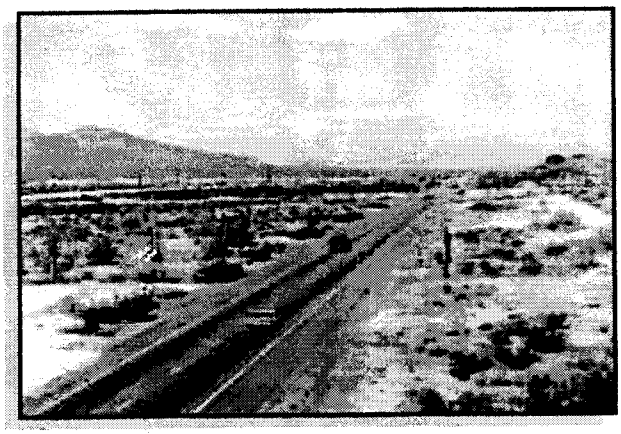
The number of tourists to the Lake Mead National Recreation Area (LMNRA) and Hoover Dam is increasing. Visitors taking the guided tour at the dam have more than tripled (300,000 per year in 1937 to 1.03 million in 1997). This increase is partially due to the opening of the new Hoover Dam Visitor Center in 1996. In addition to pedestrian traffic, about 11,500 vehicles per day cross Hoover Dam; this volume is projected to be about 26,000 vehicles daily in the year 2027.

Since 1964, more than 500 accidents have occurred between Nevada MP 2.2 and Arizona MP 1.2 (a 3.4-mile stretch of highway including the dam). Forty-three accidents between 1985 and 1991 involved one or more personal injuries, including two fatalities. Commercial trucks were involved in 96 of the accidents. In every accident, the cause was partially attributable to existing highway conditions, such as sharp curves, narrow highway width, insufficient shoulder width, poor sight distances, and slow travel speeds. Accident causes that are aggravated by the existing U.S. 93 configuration can be classified as either mechanical failure (engine problems, tire blowouts, or brake failure) or human error resulting from fatigue, intoxication, or judgment errors. As the average annual daily traffic (AADT) across the dam continues to increase, the number of accidents continues to increase accordingly.

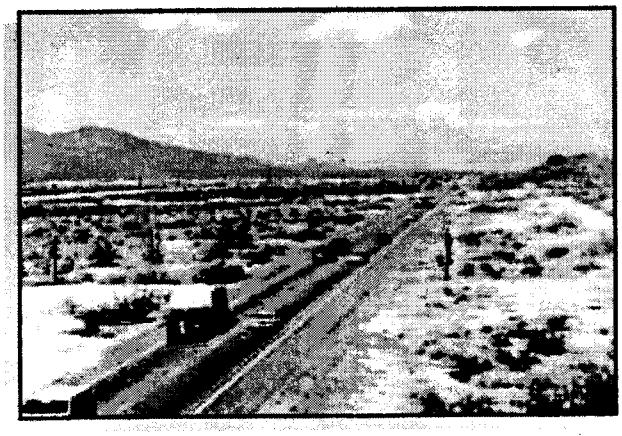
Detailed accident data were obtained from both NDOT and ADOT for the years 1994 through 1997 (Table 1-3). The following data are for the section of U.S. 93 from the Hacienda Hotel in Nevada to MP 3 in Arizona.

Table 1-3
Accident Data for 1994 to 1997

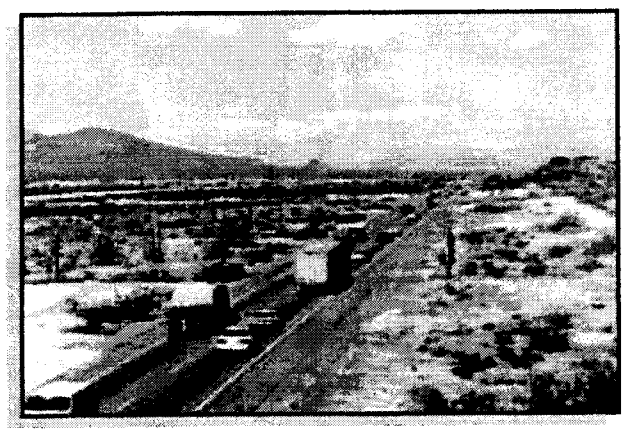
Accident Type	Arizona	Nevada	Total	Percent of Total
Opposing Direction	11	34	45	34
Rear-end	7	21	28	21
Sideswipe	5	9	14	11
Hit Fixed Object	5	3	8	6
Overturned/Off-Road	7	6	13	10
Other	10	13	23	18
Total	**45**	**86**	**131**	**100**



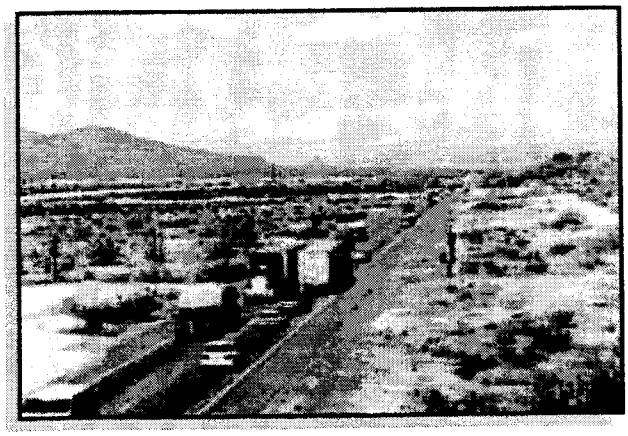
Level of Service A.



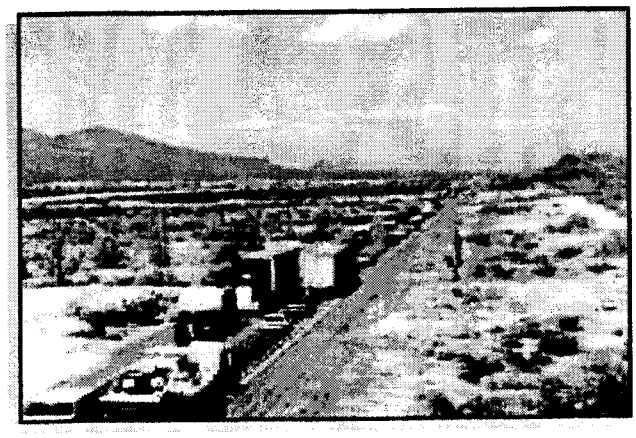
Level of Service B.



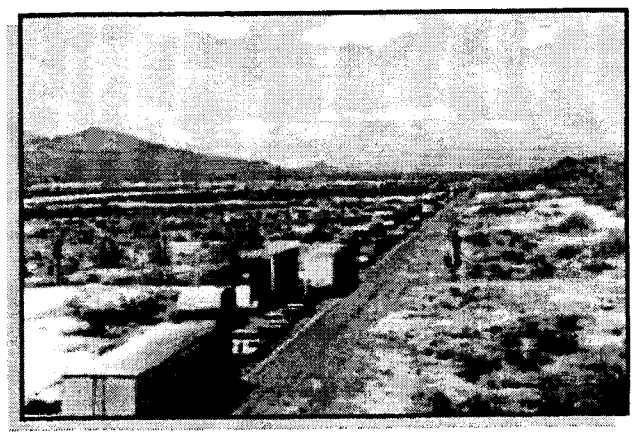
Level of Service C.



Level of Service D.



Level of Service E.



Level of Service F.

FIGURE 1-3
LEVEL OF SERVICE CLASSIFICATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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Table 1-3 shows a high percentage of multiple-vehicle accident types (opposing direction, rear end, and sideswipes) indicating heavy congestion in the study area. The accident rate along this 6.38-mile section of U.S. 93 is 1.35 per million vehicle miles traveled. This rate is slightly higher than the Nevada average of 1.15 accidents per million vehicle miles traveled. Analysis of the same data for the U.S. 93 within 1 mile of Hoover Dam shows a much higher accident rate than the 3-mile approaches. The 0.5-mile segments of U.S. 93 approaching Hoover Dam have an accident rate of 3.97 per million vehicle miles traveled. This rate is over three times the Nevada average of 1.15 per million vehicle miles traveled for rural principal arterials. Similar to the conclusion that can be drawn from the types of accidents, this high rate near Hoover Dam also indicates high levels of congestion.

1.4.6 Safeguarding Hoover Dam Power Plant, Lake Mead, and Colorado River from Hazardous Spills or Explosions

Hoover Dam is a major power supplier for Southern California industry (generating about 4 billion kilowatt-hours of electricity annually); and Lake Mead is an essential storage facility for the water supply for Southwest industries, municipalities, and farmlands.

Many vehicles currently crossing the dam carry volatile fuels, chemicals, or hazardous materials (including explosives, flammable fuels, radioactive materials, acids, and caustic chemicals). Potential hazards resulting from these materials include ignition of combustible materials, contamination of Lake Mead or the Colorado River, and damage to the power house and associated equipment if the materials entered the dam power plant and outlet works. A reasonable worst-case scenario would be the release of gasoline (the flammable liquid most commonly transported across the dam), followed by delayed ignition, resulting in loss of life, severe injuries, and long-term interruption of power generation.

Of particular concern is the highway drainage system in the area near the dam on the Nevada side of the river. Currently, the drainage flows off the edge of the road, down the canyon face, onto the Nevada power house roof, and into the Colorado River. In addition to potential water pollution issues, materials spilled onto the road would drain off the road onto the Nevada power house, possibly resulting in power house damage or destruction. The proposed project may not specifically remedy these conditions, but will remove vehicles transporting large volumes of hazardous materials from the dam crest and provide them a straight, four-lane highway crossing, which will result in a corresponding reduction in potential spill risks.

1.4.7 Quality of Visitors' Experiences at Hoover Dam

There were 9.7 million visitors to the LMNRA in 1997 (personal communication, Bill Burke of the NPS, 1998). Hoover Dam is a popular national and international tourist destination. Tourists enter the visitor center, take the tour, patronize the snack bar, and walk across the dam crest to photograph the facilities from various upstream and downstream vantage points. These activities contribute to traffic congestion and can result in vehicle and pedestrian conflicts. Through-vehicle and truck traffic also emit noise and vehicle exhaust, which diminishes the visitors' experiences at the dam.

1.5 Purpose of Project

The purpose of the project is to reduce or eliminate through traffic over Hoover Dam to accomplish the following objectives:

- Minimize the potential for pedestrian-vehicle accidents on the dam crest and on the Nevada and Arizona approaches to the dam
- Remove a major bottleneck to interstate and international commerce and travel in the west by reducing traffic congestion and accidents in this segment of the major commercial route between Phoenix and Las Vegas
- Replace an inadequate federally owned highway river crossing with a new crossing that meets current roadway design criteria, and improves through-vehicle and truck traffic capacity on U.S. 93 at the dam
- Reduce travel time in the dam vicinity
- Protect Hoover Dam employees, visitors, equipment, power generation capabilities, and Colorado River waters while enhancing the visitors' experience at Hoover Dam by:
  - Safeguarding dam and power plant facilities and the waters of Lake Mead and the Colorado River from hazardous spills or explosions
  - Protecting the dam and power plant facilities from interruptions in electricity and water delivery
  - Providing improved conditions for operating and maintaining Hoover Dam facilities

1.6 Relationship of the Proposed Project to the Statewide Plan or Urban Transportation Plan

This section describes travel demand in relation to the Nevada and Arizona plans and pertinent legislation.

1.6.1 Nevada

The NDOT's Statewide Transportation Improvement Program (STIP) was developed through coordinated efforts of the NDOT; federal, state, local, and tribal governments; and with agencies, planning organizations, transportation providers, and the general public (NDOT, 1997). Evaluating a Hoover Dam bypass is included in the STIP (1998). Constructing a bypass at Hoover Dam is one of six projects listed in NDOT's billion dollar Highway Superproject Program and is shown in NDOT's Work Program—Long Range Element (1998 through 2007).

1.6.2 Boulder City/U.S. 93 Corridor

NDOT, in cooperation with FHWA, began the Boulder City/U.S. 93 Corridor Study and EIS in November 1999. The proposed project involves traffic improvements to U.S. 93 in the Boulder City area, referred to as the U.S. 93 Corridor. The EIS will study the corridor between a western boundary on U.S. 93 in Henderson, Nevada, approximately 1 mile north of the Railroad Pass Hotel Casino, and an eastern boundary on U.S. 93 approximately 4.7 miles east of downtown Boulder City. The eastern boundary is coincident with the planned western end point of the Hoover Dam Bypass project. The project covers a total distance of approximately 10.4 miles on the present route of U.S. 93. The purpose of the project includes reducing traffic congestion and accidents in the corridor, accommodating current and

projected traffic demand, and improving system linkage and route continuity on U.S. 93 for interstate commerce. The planned completion date for the EIS process is June 2002.

NDOT is pursuing development of Boulder City/U.S. 93 Corridor improvements primarily to reduce traffic congestion and accidents in the corridor (see Chapter 2, Alternatives). Previously, NDOT evaluated the feasibility of two alternative Colorado River crossings associated with a bypass (NDOT, 1994). The options were the Willow Beach South Crossing and the Hoover Dam/Boulder City Bypass. To ensure uniformity in the analyses and to provide a more meaningful comparison between the two routes, it was assumed that the two alternatives had the same starting and ending points, and the longer of the two routes (Willow Beach) was used to establish the termini. The western terminus was located at Railroad Pass west of Boulder City near the U.S. 93/U.S. 95 interchange in Nevada. In Arizona, the eastern terminus was approximately 1 mile south of the LMNRA boundary where the existing road narrows from a four-lane divided facility to two lanes before reaching Hoover Dam along U.S. 93.

The Boulder City/U.S. 93 Corridor improvements and the Hoover Dam Bypass are separate projects with independent utilities conceived to meet separate needs; each could be constructed without the other, and each would still fulfill its own objectives. The Boulder City Corridor improvement objective is to reduce traffic congestion and accidents in Boulder City and on U.S. 93; constructing a Hoover Dam Bypass will not reduce or eliminate traffic in Boulder City. The objectives described in the purpose and need for the Hoover Dam Bypass—reducing travel time, eliminating substandard design geometry at the dam and approaches, increasing public safety at the dam, and enhancing visitor experience at the dam—would not be achieved by routing traffic around Boulder City or making other improvements in the Boulder City/U.S. 93 Corridor.

1.6.3 Arizona

The *Arizona State Transportation Improvement Plan* (ASTIP) (ADOT, December 1994) has identified the Phoenix to Nevada (U.S. 93) corridor as one of the top priority corridors within Arizona. The document states:

> *"Existing concerns within the Phoenix to Nevada corridor include the levels of recreation travel and trucking usage with the resulting conflicts and safety concerns. Long-term economic opportunities exist in this corridor, particularly as it relates to completion of a Mexico-Canada link and improvements of access and travel opportunities in Northwest Arizona."*

The U.S. 93 corridor connects Phoenix to I-15 in southern Nevada and has been designated by ADOT to become Arizona's link in the international trade route proposed by NAFTA. ADOT has programmed over $160 million to improve U.S. 93 as a four-lane divided facility from the Phoenix area to north of Kingman, Arizona, within the next several years. ADOT has also programmed $300,000 to begin studies for improving U.S. 93 from MP 0 to MP 15 in the LMNRA.

1.7 Legislation Regarding the Proposed Project

The following sections summarize legislation regarding the proposed project.

1.7.1 Hoover Powerplant Act (Public Law 98-381)

The Hoover Powerplant Act was passed in 1984, and it authorized Reclamation to construct this bridge project. The authorizing legislation specifically prohibits construction of the project through reimbursement from power generation at the dam.

1.7.2 Nevada Senate Joint Resolution 26

This Resolution, dated June 19, 1995, urges Congress to take necessary actions to alleviate problems caused by heavy commercial traffic over Hoover Dam. This remedy includes constructing a highway bypass around Hoover Dam to:

- Divert the heavy flow of trucks transporting highly flammable or hazardous materials, or both, and the heavy flow of regular traffic from traveling over Hoover Dam
- Prevent further air pollution of the area
- Reduce traffic accidents in the area
- Reserve the portion of U.S. 93 over Hoover Dam to accommodate dam tourists
- Prevent Colorado River pollution resulting from potential spills resulting from heavy traffic flow

1.7.3 Nevada Senate Concurrent Resolution 60

This Resolution, dated June 19, 1995, directed the Nevada Department of Motor Vehicles and Public Safety and the Public Service Commission of Nevada to jointly study current regulations governing the transportation of hazardous materials from Arizona to Nevada via U.S. 93 over Hoover Dam; it further directed NDOT to study the feasibility of prohibiting commercial traffic over Hoover Dam, and to study methods of financing road and highway construction projects to divert commercial traffic from traveling over Hoover Dam (see Section 2.5).

1.7.4 Transportation Equity Act for the 21st Century (TEA-21)

This legislation was approved with broad congressional support and was signed into law by President Clinton on June 9, 1998. It reauthorizes the Federal transportation program for years 1998 through 2003.

The legislation authorizes $10 million specifically for the Hoover Dam Bypass project under Arizona High Priority Project 383 and another $31 million under Arizona High Priority Project 1814. In Fiscal Year (FY) 1999, two FHWA discretionary programs allocated additional funds—$4 million from the Public Lands Highway program and $2 million from the National Corridor and Development Program. In FY 2000, the project received $6 million from the Public Lands Highway program and $2 million from the National Corridor and Development Program. An additional $3 million was appropriated in FY 2001 as an add-on to a Defense Bill. In addition, an FY 2001 DOT appropriation included $20 million for the project. The legislation also makes the Hoover Dam Bypass project eligible for additional Federal funding on a year-by-year basis under the Federal Lands Highway Program and the National Corridor Planning and Development Program.

1.8 Relationship of the Proposed Project to Other Modes of Transportation

U.S. 93 does not currently serve airports, rail or port facilities, bike routes, or mass transit services near Hoover Dam. The NPS, in partnership with Reclamation, is planning to establish a bicycle/pedestrian trail that will extend from Boulder City, Nevada, to Hoover Dam. This approved trail will parallel U.S. 93 along the Old Government Railroad grade. As discussed previously, a high-volume mix of passenger, freight, and recreational vehicles in addition to many pedestrian tourists on the dam crest crosses Hoover Dam daily.

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CHAPTER 2

Alternatives

2.1 Introduction

This chapter describes project alternatives being evaluated, previous studies of those alternatives, screening criteria developed to aid in selecting alternatives to be evaluated, the preferred alternative, and alternatives eliminated from detailed impact evaluation.

A range of alternatives was considered, and the identification of a preferred alternative was not made until the alternatives' impacts and comments on the DEIS and from the public hearings were fully evaluated (see Section 2.6.2). The four most reasonable alternatives fully evaluated (including the No Build Alternative) were developed to a comparable level of detail in the DEIS so that their comparative merits could be analyzed.

2.2 Initial Identification of Alternatives

Study summaries in Table 1-1 include descriptions of potential build alternatives that were identified during the public meetings conducted for this EIS. Figure 2-1 shows alignments of these alternatives. In addition, a No Build Alternative is considered. The following sections briefly describe these alternatives.

2.2.1 Promontory Point

This alternative crosses Lake Mead about 1,000 feet upstream from Hoover Dam and requires constructing approximately 2.7 miles of highway approach in Nevada, a 2,200-foot-long bridge, and a 0.9-mile highway approach in Arizona.

2.2.2 Sugarloaf Mountain (Preferred Alternative)

This alternative crosses the Colorado River about 1,500 feet downstream from Hoover Dam and requires constructing approximately 2.2 miles of highway approach in Nevada, a 1,900-foot-long bridge, and a 1.1-mile highway approach in Arizona. Sugarloaf Mountain has been identified as the preferred alternative (see Section 2.6.2.1).

2.2.3 Gold Strike Canyon

This alternative crosses the Colorado River about 1 mile downstream from Hoover Dam and requires constructing approximately 2.2 miles of highway approach in Nevada, a 1,700-foot-long bridge, and a 1.1-mile highway approach in Arizona.

2.2.4 Boulder City North

This alternative crosses the Colorado River about 2.5 miles downstream from Hoover Dam and requires constructing approximately 5.6 miles of highway approach in Nevada, a 2,200-foot-long bridge, and a 2.1-mile highway approach in Arizona.

2.2.5 Boulder City South

This alternative crosses the Colorado River about 2.5 miles downstream from Hoover Dam and requires constructing approximately 9.4 miles of highway approach in Nevada, a 2,200-foot-long bridge, and a 2.1-mile highway approach in Arizona.

2.2.6 Boulder City South Option

This alternative crosses the Colorado River about 2.5 miles downstream from Hoover Dam and requires constructing approximately 8.8 miles of highway approach in Nevada, a 2,200-foot-long bridge, and a 2.1-mile highway approach in Arizona.

2.2.7 Willow Beach North

This alternative crosses the Colorado River about 8 miles downstream from Hoover Dam and requires constructing approximately 13 miles of highway approach in Nevada, a 2,000-foot-long bridge, and a 4-mile highway approach in Arizona.

2.2.8 Willow Beach South

This alternative crosses the Colorado River about 14 miles downstream of Hoover Dam and requires constructing approximately 14.3 miles of highway approach in Nevada, a 2,080-foot-long bridge, and 8 miles of highway approach in Arizona.

2.2.9 Temple Bar

This alternative begins at I-15, approximately 30 miles northeast of Las Vegas. The alignment would proceed in a southeast direction and would require a long bridge to span the "Narrows" in Lake Mead. From the "Narrows," the alignment would generally follow the existing road corridor west of Detrital Wash until it ties with U.S. 93 near the LMNRA boundary. This alternative requires the construction of approximately 28 miles of new road north of Lake Mead and 26 miles of new road along the existing road corridor between Lake Mead and the tie to U.S. 93 in Arizona.

2.2.10 Nelson

This alternative begins at the U.S. 93/U.S. 95 interchange west of Boulder City. It follows the U.S. 95 corridor for 10 miles and then the NV 165 corridor for approximately 20 miles. A new bridge across the Colorado River, 21 miles downstream of Hoover Dam, would be constructed. Approximately 12 miles of new road construction through previously undisturbed lands would be required on the Arizona side to tie back in with U.S. 93 about 40 miles north of Kingman.

2.2.11 Cottonwood

This alternative begins at the U.S. 93/U.S. 95 interchange west of Boulder City and proceeds southerly to Searchlight for approximately 35 miles. The alternative then proceeds easterly for approximately 14 miles, along the existing road corridor to Cottonwood Cove. A new bridge across Lake Mohave and an additional 26 miles of construction would be required on the Arizona side to tie back in with U.S. 93 about 24 miles north of Kingman.

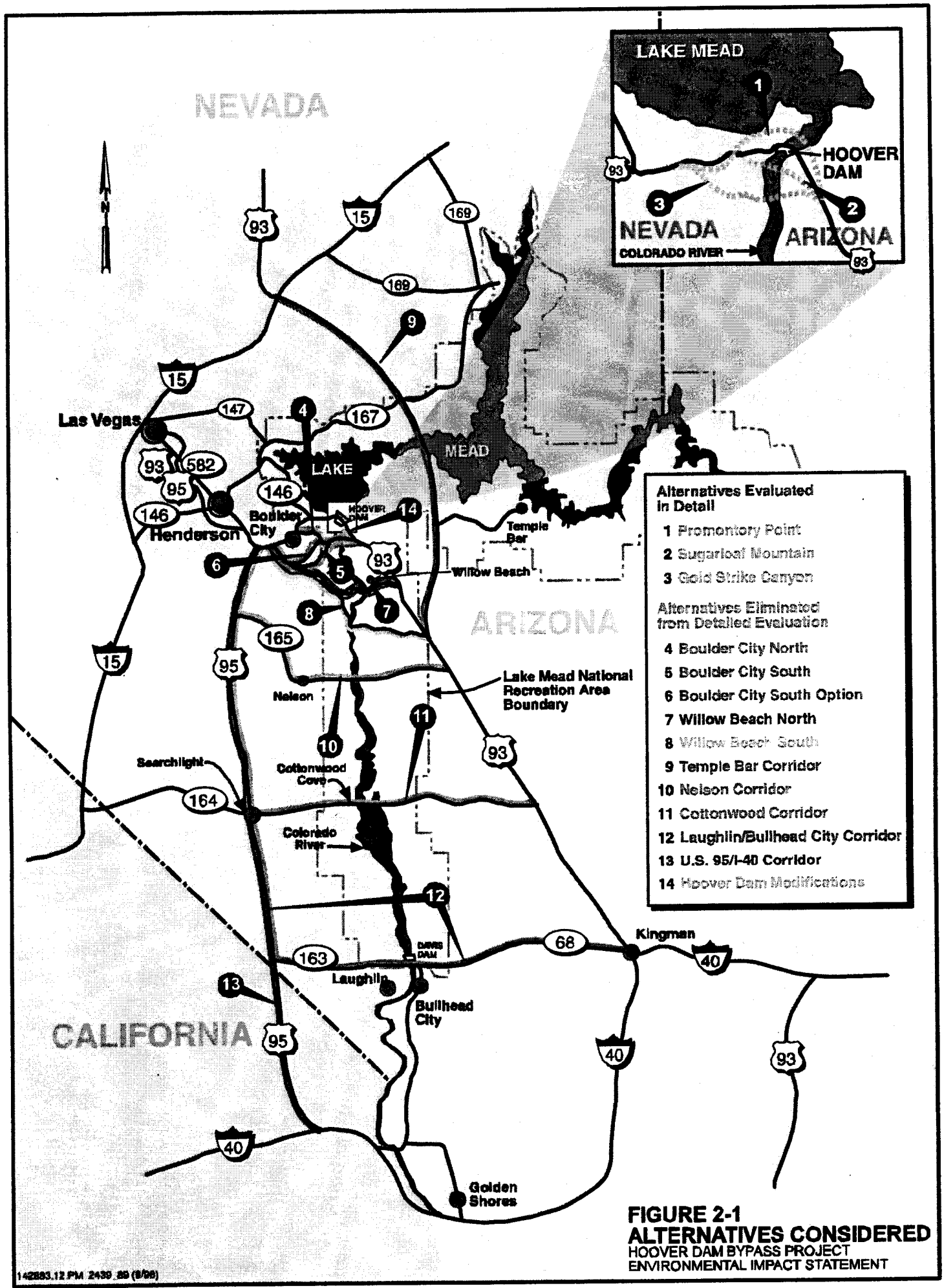

FIGURE 2-1
ALTERNATIVES CONSIDERED
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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2.2.12 Laughlin-Bullhead City

This alternative to U.S. 93 improves the existing route between Boulder City and Kingman via Laughlin and Bullhead City. This alternative uses existing U.S. 95, SR 163, and SR 68. It requires widening approximately 55 miles of U.S. 95 and 14.5 miles of SR 68 to four lanes, adding more pavement to the existing lanes, and constructing a new multi-span bridge crossing the Colorado River between Davis Dam and the existing Laughlin Bridge. This alternative restricts truck traffic from crossing Hoover Dam and reroutes the traffic along the corridor discussed above. Passenger car traffic would not be regulated in any way. This alternative is discussed in detail in Appendix B, Laughlin-Bullhead City Alternative.

2.2.13 U.S. 95/I-40

This alternative to U.S. 93 improves the existing route between Boulder City and Kingman via Needles, California. Approximately 56 miles of U.S. 95 in Nevada and 13 miles of U.S. 95 in California would be widened to four lanes, and existing U.S. 95 would be overlaid with new pavement. No improvements to existing I-40 and its crossing of the Colorado River south of Needles are necessary.

2.2.14 Modifications to Hoover Dam

This alternative includes two options for modifying existing U.S. 93 where it crosses the Colorado River on the crest of Hoover Dam: widening Hoover Dam and constructing an elevated roadway on the dam.

2.2.14.1 Widening Hoover Dam

This option widens the roadway to four lanes on the dam crest and its approaches.

2.3.14.2 Elevated Roadway on Hoover Dam

This option adds an elevated crossing structure to be supported by a portion of Hoover Dam. It also includes new and straighter highway approaches.

2.2.15 Restricting Motorized Traffic from Crossing Hoover Dam

This alternative includes two options: restricting truck traffic and restricting all vehicle traffic from crossing Hoover Dam.

2.2.15.1 Restricting Truck Traffic Only

This option restricts truck traffic from crossing Hoover Dam by restricting specific vehicle classifications. It diverts trucks to alternate routes, but allows automobile traffic to cross Hoover Dam. The most likely diversions are over Davis Dam or the Laughlin Bridge.

2.2.15.2 Restricting All Traffic

This option restricts all motorized vehicle traffic from crossing Hoover Dam by diverting all vehicles to alternate routes; it allows only bicycle and foot traffic on Hoover Dam. The most likely diversions are over Davis Dam or the Laughlin Bridge.

2.2.16 Traffic Systems Management

This alternative includes relatively low-cost, nonstructural improvements designed to reduce traffic congestion, improve traffic flow, and increase existing highway capacity. This alternative could include signs, traffic signals, turn lanes, barriers, traffic controls, and other devices to direct traffic and pedestrians.

2.2.17 No Build

This alternative consists of no action being taken. No Hoover Dam Bypass would be developed, no change in the current highway configuration would occur, no traffic restrictions would be imposed, and no other structural or nonstructural improvements would be developed on U.S. 93 near Hoover Dam.

2.3 Criteria for Screening Alternatives

After the initial identification of alternatives, criteria were developed to screen alternatives. Comparing alternatives to the screening criteria is the process used to reduce the number of alternatives subject to detailed environmental evaluation in this EIS. The following criteria were used to evaluate and eliminate alternatives:

- The purpose and need (discussed in Chapter 1), including engineering and operational standards, safety, and traffic/freight capacity, should be achieved with a reasonable cost.
- Section 4(f) land required for a route alignment should be avoided or minimized pursuant to Section 4(f) of the Department of Transportation Act of 1966.
- Impacts to federally and/or state listed threatened or endangered vegetation and wildlife species and sensitive habitats, such as wetlands, should be avoided or minimized.
- Impacts to cultural resources, including Hoover Dam (a National Historic Landmark) and archaeological (prehistoric and historic) resources, should be avoided or minimized.
- Impacts to aesthetic resources (including visual, noise, dust, and odors) should be avoided or minimized.
- Impacts on recreation resources and to tourists should be avoided or minimized.

2.4 Public Input

Since 1965, the public has had periodic opportunities to comment on this project. Public involvement activities have included scoping meetings held in June 1990 in Kingman, Arizona, and Boulder City and Las Vegas, Nevada. A Notice of Intent was published in May 1990 to advertise the three public scoping meetings; newspaper and press releases were also used to publicize these meetings. The Kingman meeting, held on June 6, 1990, was attended by 12 persons in addition to Reclamation representatives. Attendees expressed interest in selecting the alternative that would solve the traffic problems and be the least damaging environmentally. The Boulder City meeting, on June 7, 1990, was attended by 91 persons in addition to representatives from Reclamation, the State of Nevada, NPS, and the news media. In Boulder City, there was general concurrence that a

new crossing was needed to remove traffic from Hoover Dam; however, the public was divided on the solution. Some preferred to have a bypass around Boulder City in addition to Hoover Dam, while others felt that any road that bypassed Boulder City would severely impact downtown businesses. The Las Vegas meeting, on June 7, 1990, was attended by 17 people in addition to Reclamation representatives.

A newsletter, titled *Update*, was published in January 1991 and sent to interested individuals. Interviews with numerous community members and several meetings with interested members of the public, the Boulder City Chamber of Commerce, members of the Boulder City Council, and other organizations also occurred.

Subsequent to FHWA taking over as lead agency, meetings were held in Kingman, Boulder City, and Las Vegas in late October 1997 to provide information and solicit input for the environmental review process. Approximately 250 people attended and commented at the three meetings. Most comments supported one alternative or another. In Boulder City, many comments focused on considering other alternative crossings in addition to the three build alternatives, specifically those to the south that would bypass Boulder City. Many comments at all three locations raised concerns about various environmental impacts.

FHWA initiated public circulation of the DEIS on September 25, 1998, with publication of the Notice of Availability in the *Federal Register*. From October 13 to 15, 1998, FHWA held DEIS public hearings on successive evenings in Kingman, Arizona, and Boulder City and Las Vegas, Nevada. Approximately 250 people attended the DEIS public hearings. The court reporter transcripts of oral comments received at the hearings are included in Volume II of the final EIS (FEIS). The entire DEIS was also accessible on the project web site; by November 10, 1998, the close of the DEIS comment period, the web site was accessed over 1,500 times. There were a total of approximately 160 public and agency commenters on the DEIS, including comments received after the close of the comment period. See Volume II for a full description of the DEIS public input process.

2.5 Alternatives Considered but Eliminated from Detailed Evaluation

After applying the previous screening criteria to the alternatives, all were eliminated from further consideration except for the three alignments closest to Hoover Dam: Promontory Point, Sugarloaf Mountain, and Gold Strike Canyon. After further analysis and evaluation of comments received on the DEIS, Sugarloaf Mountain was identified as the preferred alternative based on these and other criteria. The other alternatives were eliminated for reasons described below and summarized in Table 2-1.

1. Some alternative routes did not meet the project purpose and need because they would not substantially eliminate roadway deficiencies and reduce traffic congestion on U.S. 93 at Hoover Dam and the dam approaches, eliminate through traffic from the dam, enhance public safety, or protect Hoover Dam and its visitors. Alternatives were also dropped from further consideration if they substantially increased travel time and did not provide system continuity to enhance travel within the U.S. 93 NAFTA corridor. The Laughlin and U.S. 95/I-40 Alternatives were eliminated because motorists would avoid driving the additional 23 and 70 miles, respectively, by continuing to use the Hoover Dam crossing. Therefore, meeting the objectives of enhanced safety and reduced congestion on U.S. 93 at the dam would not be achieved. As described in

Appendix B, Laughlin-Bullhead City Alternative, the Laughlin Alternative would not improve the LOS on U.S. 93 on Hoover Dam.

2. Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 U.S.C. §303) declares that, "it is the policy of the United States government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation land, wildlife and waterfowl refuges, and historic sites." Section 4(f) specifies that the Secretary of Transportation may approve a transportation program or project...requiring the use of 4(f) land only if:

   1. There is no feasible and prudent alternative to using that land; and
   2. The program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use

   Many alternatives would affect these lands; however, some routes have considerably more impact than others (Reclamation, July 1993). The Temple Bar Alternative and all the highway alternatives south of Gold Strike Canyon except the Laughlin and U.S. 95/I-40 Alternatives would affect much more Section 4(f) land than the three northern alternatives near Hoover Dam. Based on the requirement to minimize harm to Section 4(f) property, these southerly alternatives were eliminated from further consideration.

3. Routes nearest Hoover Dam would pass through lands already extensively disturbed by human-made features. Conversely, the Willow Beach, Nelson, Cottonwood, Boulder City, and Temple Bar Alternatives were eliminated because those routes would pass through areas of extensive pristine habitat.

4. Alternatives were eliminated from consideration because their impacts on known peregrine falcon breeding areas, bighorn sheep habitat and movement corridors, desert tortoise habitat, and other wildlife were more severe than the three northern alternatives near the dam.

5. The cost of constructing the routes would increase as the distance away from the dam increases because longer sections of new highway would be required; therefore, longer, more costly alternatives were eliminated. The Laughlin-Bullhead City Alternative, for example, would cost an estimated $130 million to construct and an additional $87 million for improvements that are programmed based on existing needs, versus $198 million to $215 million for alternatives closer to Hoover Dam (see Appendix B, Laughlin-Bullhead City Alternative). Furthermore, considering traffic volumes over a 20-year period, an additional $1.4 billion in total user costs would be incurred due to the increased length of the Laughlin-Bullhead City Alternative (see Appendix B).

6. Alternatives that require keeping the existing highway open to through traffic to provide visitor access to the dam were dropped from further consideration if they also required operating and maintaining extensive lengths of duplicate highway. Alternative routes not close to Hoover Dam (Willow Beach, Nelson, Cottonwood, and Temple Bar) were eliminated for this reason.

7. Restricting truck traffic does not fully meet two critical elements of the project purpose and need; it removes only a portion of the truck traffic contributing to Hoover Dam congestion and results in a substantial increase in travel distance and time for truck traffic. Additionally, closing the dam to commercial truck traffic is subject to FHWA

approval under the provisions of Title 23 of the Code of Federal Regulations (23 CFR). 23 CFR Section 658.11 pertains to additions and deletions of roads on the National Network of Highways, of which U.S. 93 is a part. The NDOT prepared a preliminary evaluation of criteria for network deletion of U.S. 93 as specified by 23 CFR and concluded it would not be feasible to remove the route from the National Network of Highways. Consequently, NDOT concluded it is not feasible to prohibit commercial trucks from crossing Hoover Dam unless a practical alternative crossing is provided.

8. Restricting all traffic from Hoover Dam, with the exception of bicycle and foot traffic, was eliminated because it does not meet the need to remove a major bottleneck to interstate and international commerce. Further, this alternative would not meet other critical elements of the project purpose; specifically, it would not reduce traffic congestion and accidents near the dam on the major commercial route between Phoenix and Las Vegas, and it would not reduce vehicle travel time or improve speed.

9. Alternatives related to Hoover Dam widening were eliminated from further consideration for technical, economic, and cultural reasons. Because tourist traffic would not be separated from through traffic, this option does not solve the public safety problem, and does not protect power and water supplies. No practical way exists to modify Hoover Dam without impacting the historic appearance of the dam or disrupting traffic during construction.

Attaining the required highway design criteria by adding an elevated crossing structure (which would be supported by some portion of Hoover Dam) would require new and straighter highway approaches. Deep and lengthy excavations, or possibly tunnels, are necessary to connect such a structure to the existing highway. Support piers for the elevated structure would cause traffic interference during construction and would permanently affect the space available on the dam crest for tourist movement and dam maintenance operations.

Concerns identified with both dam modification options also include interference with existing transmission lines, towers, and other power facilities; impacts to the historical significance of the site (the integrity and setting of the dam and its status as a NHL); and limited space available for separating traffic, vehicle turning movements, and parking maneuvers.

Table 2-1 summarizes the results of applying screening criteria and rationale for eliminating certain alternatives.

2.6 Alternatives Studied in Detail

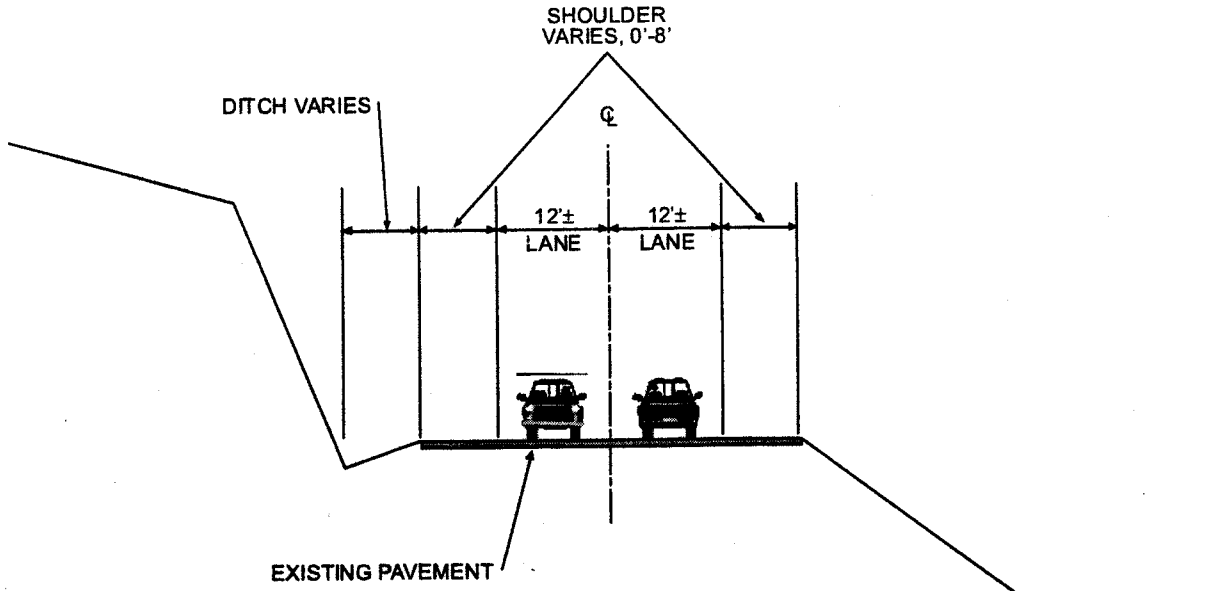
Three build alternatives met the screening criteria and were studied to a feasible level of engineering design and cost analysis, including line-item estimates, as described in the 1992 Phase B Corridor Studies report. For these three alternatives, a new four-lane highway and four-lane bridge would be constructed near Hoover Dam (see Figure 2-2, showing the typical roadway section). Current highway design standards for a 60-mph design are proposed for all three build alternatives. The Nevada and Arizona connections of the old highway/dam crossing to the new U.S. 93 bypass roadway will be designed to provide ingress/egress for bicycles. Detailed traffic analysis will be completed during final design

Table 2-1
Comparison of Alternatives Considered

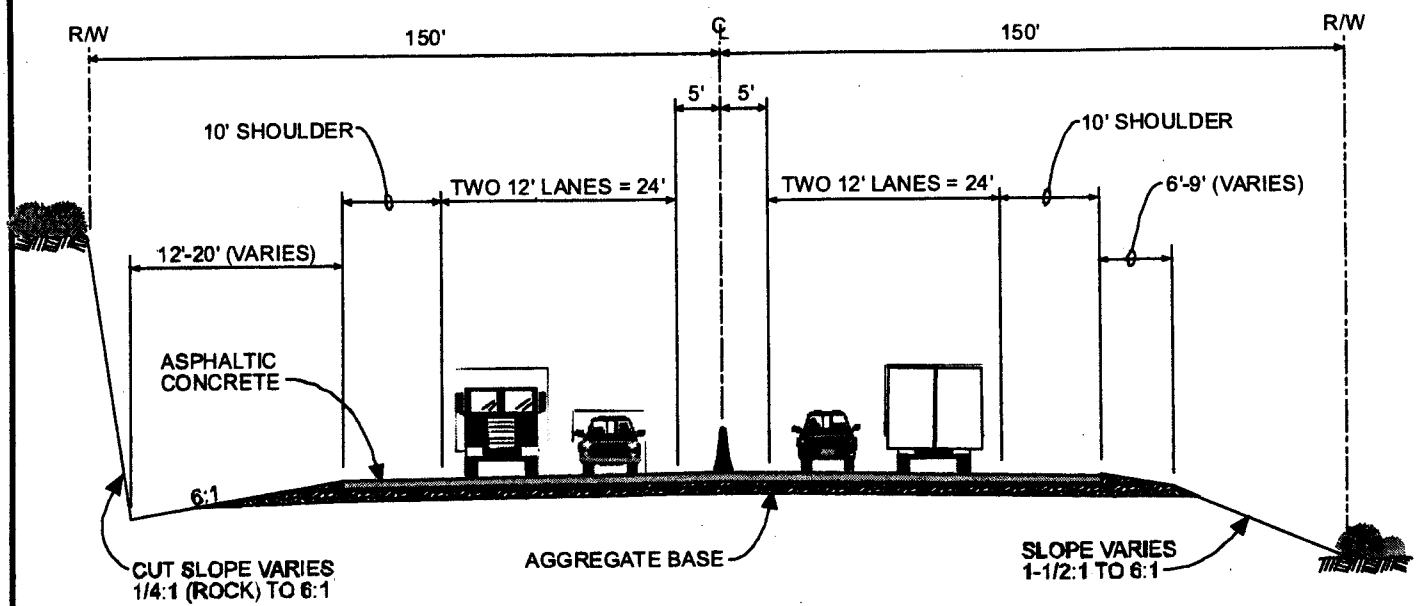
Alternative Name	4(f) Lands Potentially Disturbed (acres)	Distance from the U.S. 93/95 Interchange NV to Kingman, AZ (miles)	Results of Applying Screening Criteria
Promontory Point	74	83	Meets criteria
Sugarloaf Mountain (Preferred)	92	83	Meets criteria
Gold Strike Canyon	128	82	Meets criteria
			Reason for Elimination
Boulder City North	145	82	2, 3, 4
Boulder City South	165	83	2, 3, 4
Boulder City South Option	135	82	2, 3, 4
Willow Beach North	405	81	2, 3, 4, 5, 6
Willow Beach South	575	80	2, 3, 4, 5, 6
Nelson	491	82	2, 3, 4, 5, 6
Cottonwood	436	99	2, 3, 4, 5, 6
Laughlin-Bullhead City	36	106	1, 4, 5
U.S. 95/I-40	0	153	1, 5
Temple Bar	818	149	2, 3, 4, 5, 6
Modifications to Hoover Dam	n/a	n/a	1, 9
Restricting Motorized Traffic to Hoover Dam	n/a	n/a	1, 7, 8
Traffic Systems Management	n/a	n/a	1, 7, 8

Screening Criteria
1. Does not meet purpose and need.
2. Substantial Section 4(f) Impacts.
3. Severe impacts to pristine habitat.
4. Severe impacts to wildlife.
5. Excessive costs.
6. Requires operation and maintenance of duplicate parallel roadways.
7. NDOT determined a commercial truck ban infeasible.
8. No reduction in congestion.
9. Does not solve public safety problem or protect power and water supplies; impacts to historic appearance of dam.

to determine whether at-grade crossings or interchanges are required at or near the project termini. Provision of an interchange connection of existing U.S. 93 with the new Hoover Dam Bypass at or near the western project terminus (east of the Hacienda Hotel) will remove the need for an interchange connection at the Reclamation warehouse, where both the Sugarloaf Mountain and Promontory Point alignments cross existing U.S. 93 (see Figure 2-3). Under the build alternatives, commercial trucks will be restricted from Hoover Dam according to vehicle weight or number of axles; local delivery trucks and



Existing Typical Section



Proposed Typical Section

GENERAL NOTES

1. High quality rock is expected throughout the majority of the study area. Cut slopes vary depending on rock type. Though not shown, widened ditches may be required in areas of very deep cut. In addition, rockfall areas may need special catchment ditches and/or concrete barrier rail installations to protect the highway and its users.
2. More detailed typical sections are depicted in the Phase B Corridor Studies.
3. Two-lane existing typical section shown. Some portions of existing road include a climbing lane.

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FIGURE 2-2
TYPICAL ROADWAY SECTION
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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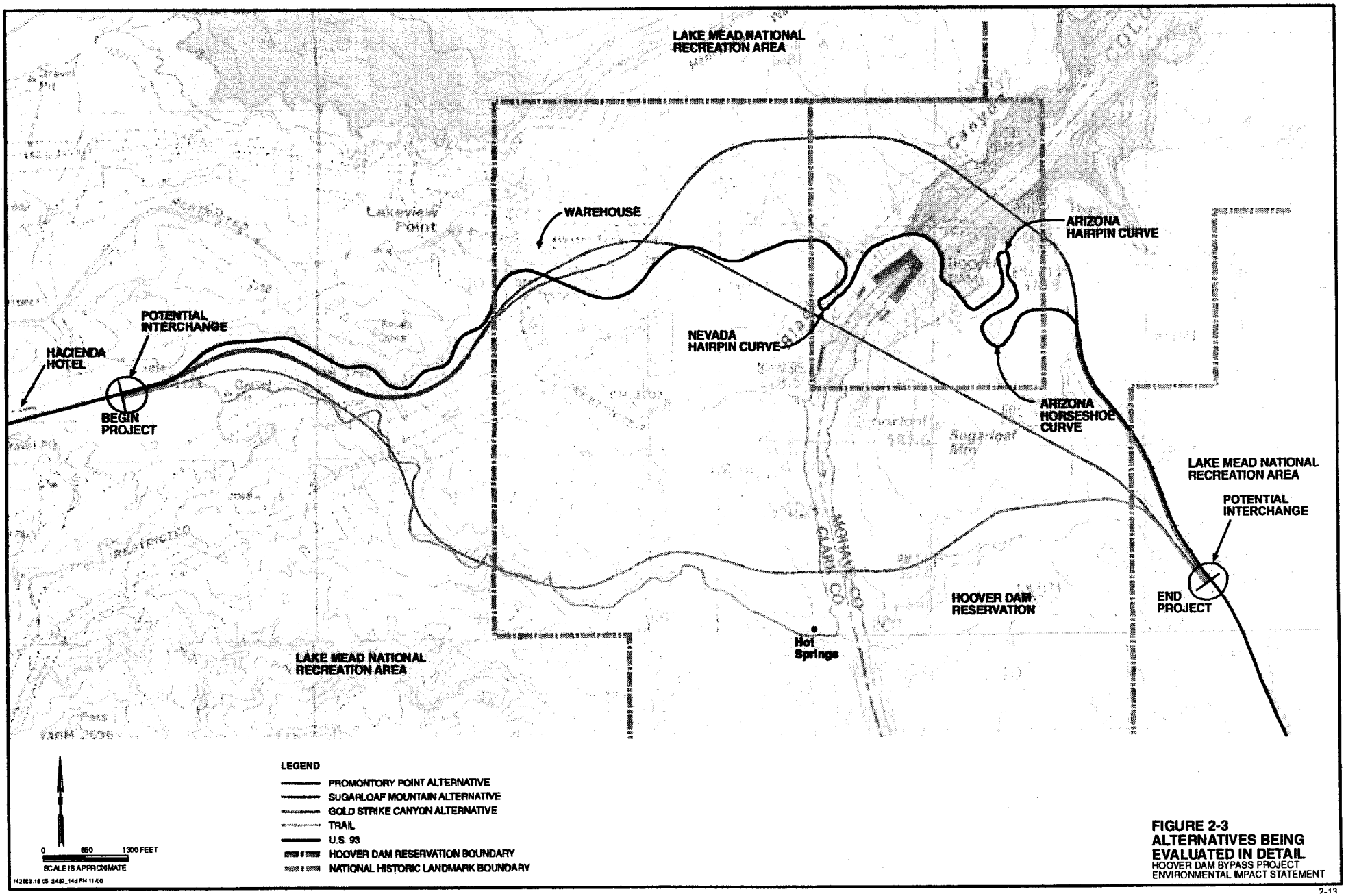

FIGURE 2-3
ALTERNATIVES BEING EVALUATED IN DETAIL
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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administrative/maintenance trucks would be exempted. The No Build Alternative is also described. The following alternatives are shown in Figure 2-3 and are described in the following sections:

- Promontory Point
- Sugarloaf Mountain (Freferred Alternative)
- Gold Strike Canyon
- No Build (Existing U.S. 93)

During the 1992 Colorado River bridge crossing study conducted by Reclamation, generic bridge designs that were determined to be suitable were presented as viable structure alternatives for each river crossing. Presentation of specific bridge designs in this EIS is not intended to preclude other feasible structures. A Design Advisory Panel (DAP), established as part of a Programmatic Agreement (PA) for this project under requirements of the National Historic Preservation Act (NHPA), will provide input on bridge design concepts, structure type, and materials (see Section 3.5). The DAP consists of members from FHWA, NDOT, ADOT, the Nevada and Arizona State Historic Preservation Offices, the Advisory Council on Historic Preservation, the National Historic Landmark Coordinator, NPS, Reclamation, WAPA, and consulting Native American tribes, as well as an independent architectural historian and a registered landscape architect. The FHWA will establish a project development schedule, with design review milestones acceptable to the DAP. The DAP will provide input on bridge design concepts, addressing structure type and materials, in light of the historical visual context of the Hoover Dam National Historic Landmark (HDNHL). The DAP will also provide input on corridorwide design elements, with the goal of developing acceptable aesthetic and material treatments throughout the bypass corridor to mitigate the total project effects on the HDNHL and other proximate historic properties. The DAP, with FHWA as the lead agency, also will be responsible for development of a process for public involvement as design concepts evolve.

The cost estimates shown for the alternatives studied in detail are based on the Reclamation Phase B Study of August 1992. The estimates shown in the Phase B Study were actually computed in 1991. Therefore, costs were inflated at 4 percent per year for 11 years, establishing a base year of 2002.

2.6.1 Promontory Point Alternative

The Promontory Point Alternative crosses Lake Mead about 1,000 feet upstream of Hoover Dam. This alternative requires constructing approximately 2.7 miles of highway approach in Nevada, a 2,200-foot-long bridge, and an approximately 0.9-mile highway approach in Arizona (Figure 2-4).

2.6.1.1 New Highway

The new highway begins about 1,000 feet east of the Hacienda Hotel, following a route just south of existing U.S. 93 to the Reclamation warehouse area. This route traverses the hillside just north of the present Reclamation service road, and follows about the same alignment as the existing service road for approximately 1,300 feet. The highway grade through this segment is about 1 percent as it continues its descent. After crossing the north end of the switchyard, the highway intersects a high narrow ridge, and crosses over a mass of rock fragments below cliffs, descending on a 5 percent grade for a distance of about 2,000 feet to a long-span bridge crossing at Lake Mead.

On the Arizona side of the bridge, the highway traverses an area requiring a deep cut, then follows along the side of a high bluff. The highway then descends at a 6 percent grade to the intersection with existing U.S. 93. A frontage road, approximately 1,700 feet long, must be constructed to provide continued access to the dam for recreation, operation, and maintenance.

2.6.1.2 Bridge Designs

Three bridge designs were initially studied for the Promontory Point Alternative: a concrete cable-stayed bridge, a steel truss rib through-arch bridge, and a suspension bridge (see Figures 2-5, 2-6, and 2-7). The design elevation at the center of the proposed bridge would be 1,463 feet, about 273 feet above the normal water surface elevation of Lake Mead and 231 feet higher than the elevation of the current highway across Hoover Dam.

2.6.1.3 Other Features

This alternative requires several project features in addition to the proposed highway and bridge crossing Lake Mead. These other features include the following:

- A 400-foot-long highway bridge crossing a bend in Gold Strike Canyon
- A 300-foot-long tunnel passing through a high, narrow ridge separating the canyon from the open valley to the northeast
- Wildlife crossings, provided by six underpasses, two overpasses, and the top of one tunnel functioning as an overpass, fencing to guide wildlife to the crossing structures, fencing to continue approximately 2,400 feet beyond the intersection of the new highway with existing U.S. 93 in Arizona, and out-jumps (mounds adjacent to fences) to allow bighorn sheep to exit the fenced highway right-of-way.

2.6.1.4 Project Construction

The Promontory Point Alternative requires 5 years to construct. Assuming that funding becomes available and environmental clearances are obtained, the project would be completed by 2007. The estimated cost of this alternative is $204 million, including preliminary and construction engineering.

No major detours, closures, or traffic delays are expected to occur during construction of the lake bridge and highway approaches. The existing highway could remain open with minimal interference, except during construction at the beginning and ending locations of the project. Construction specifications for the project would provide for maintaining two traffic lanes during construction. In Arizona, the access road must be completed before the existing highway is closed to public traffic.

2.6.2 Sugarloaf Mountain Alternative (Preferred Alternative)

The Sugarloaf Mountain Alternative crosses the Colorado River about 1,500 feet downstream of Hoover Dam. This alternative requires constructing approximately 2.2 miles of highway approach in Nevada, a 1,900-foot bridge, and an approximately 1.1-mile highway approach in Arizona (Figure 2-8).

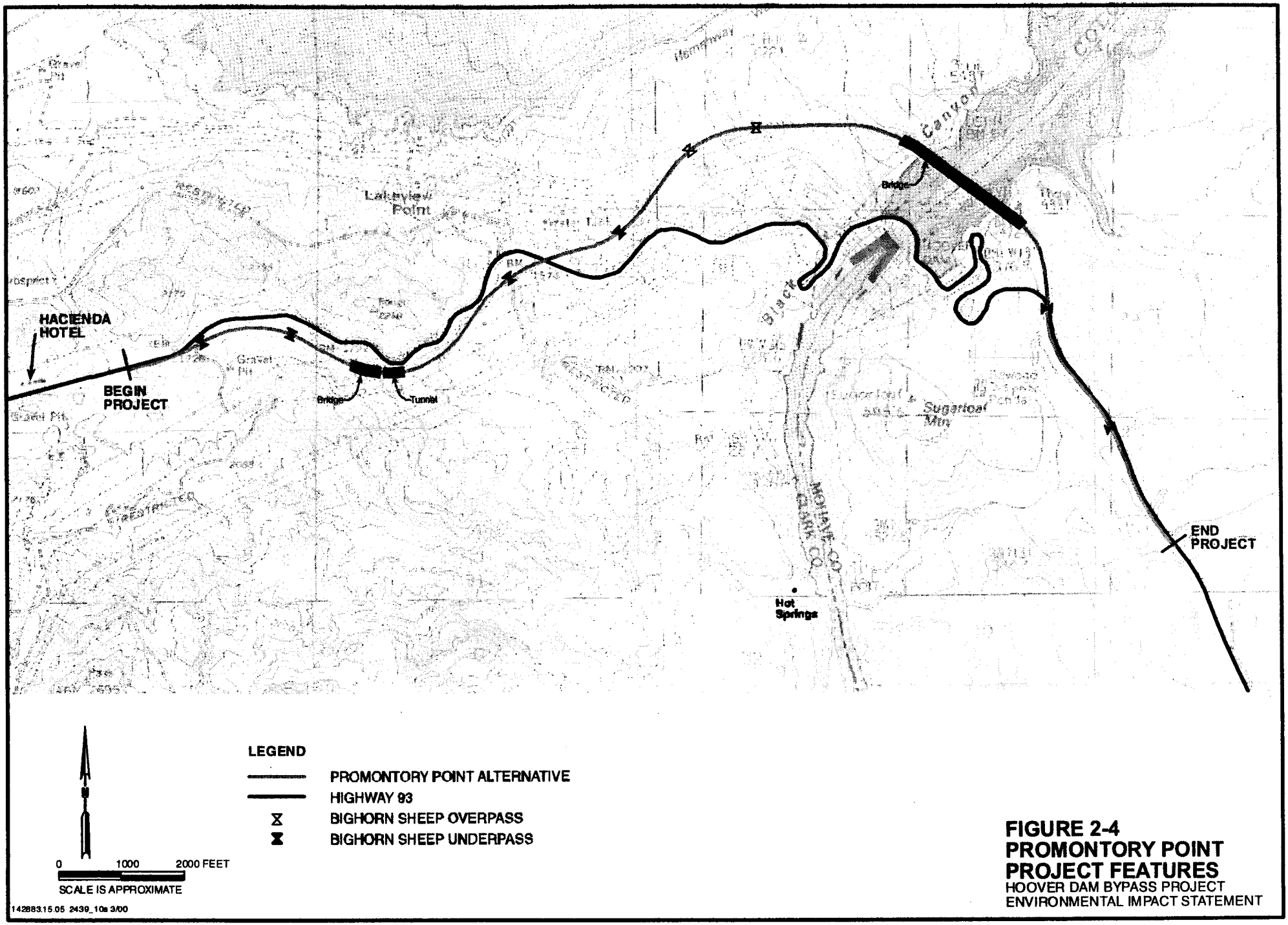

FIGURE 2-4
PROMONTORY POINT PROJECT FEATURES
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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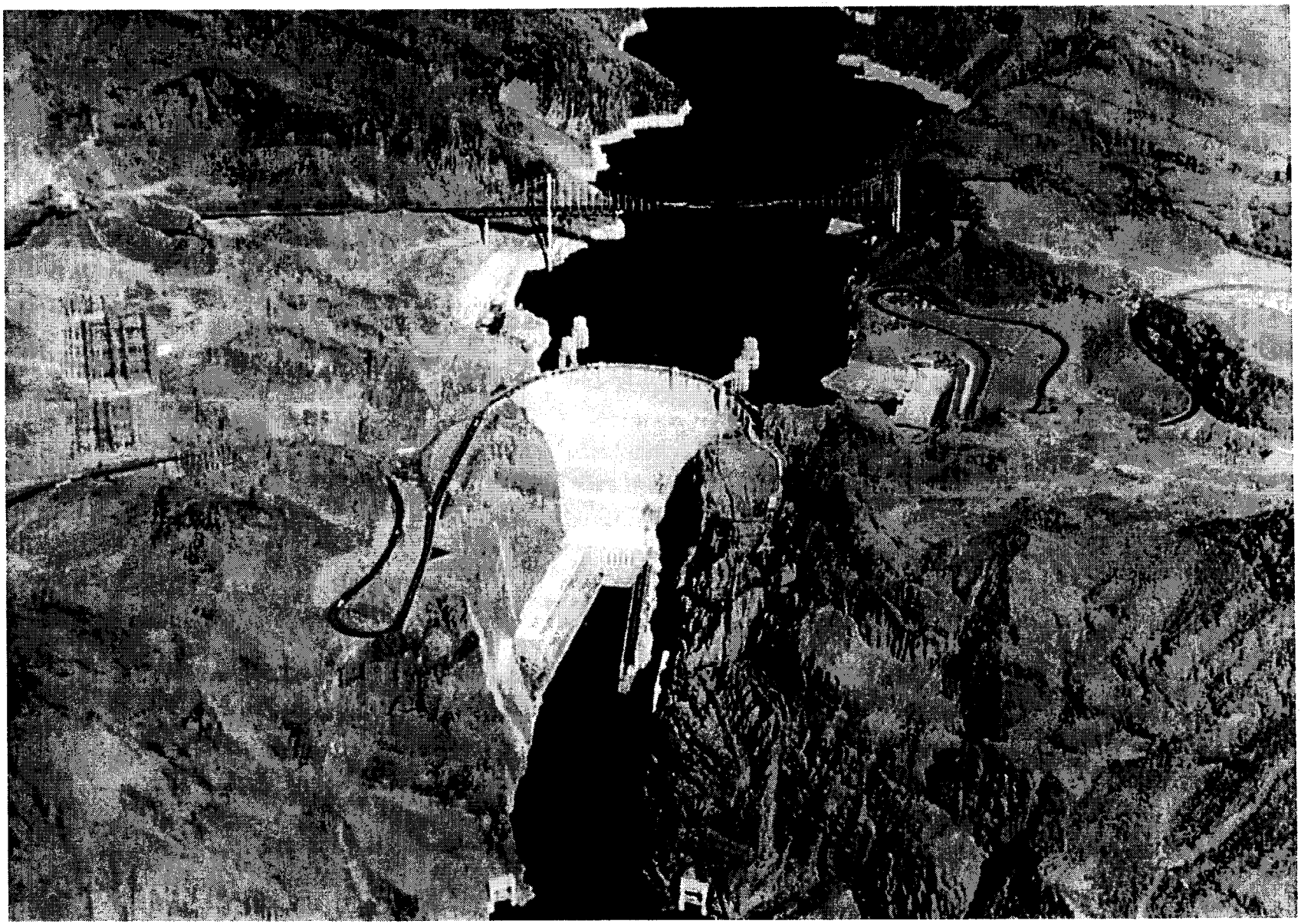

FIGURE 2-5
PROMONTORY POINT
SUSPENSION BRIDGE
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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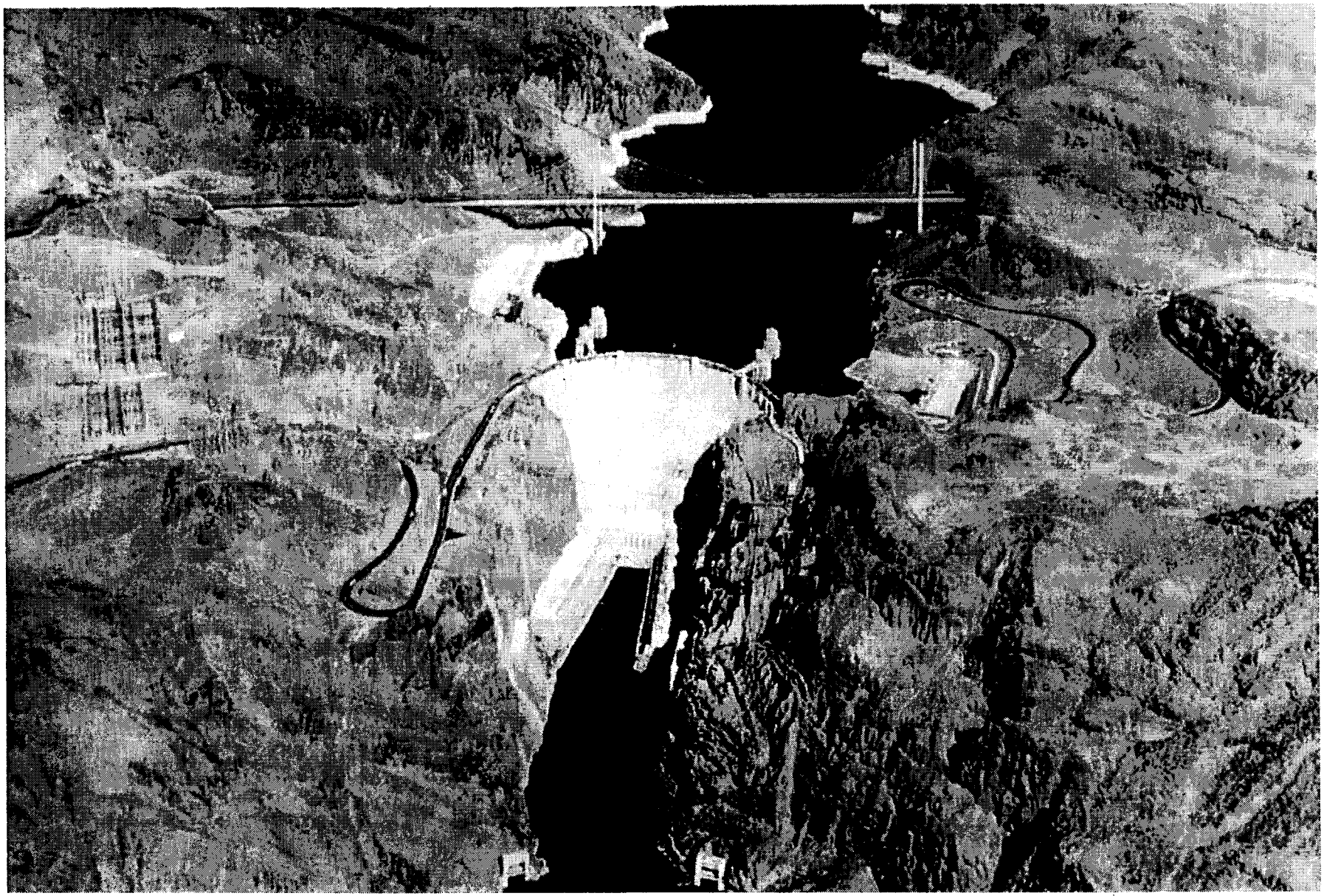

FIGURE 2-6
PROMONTORY POINT
CABLE-STAYED BRIDGE
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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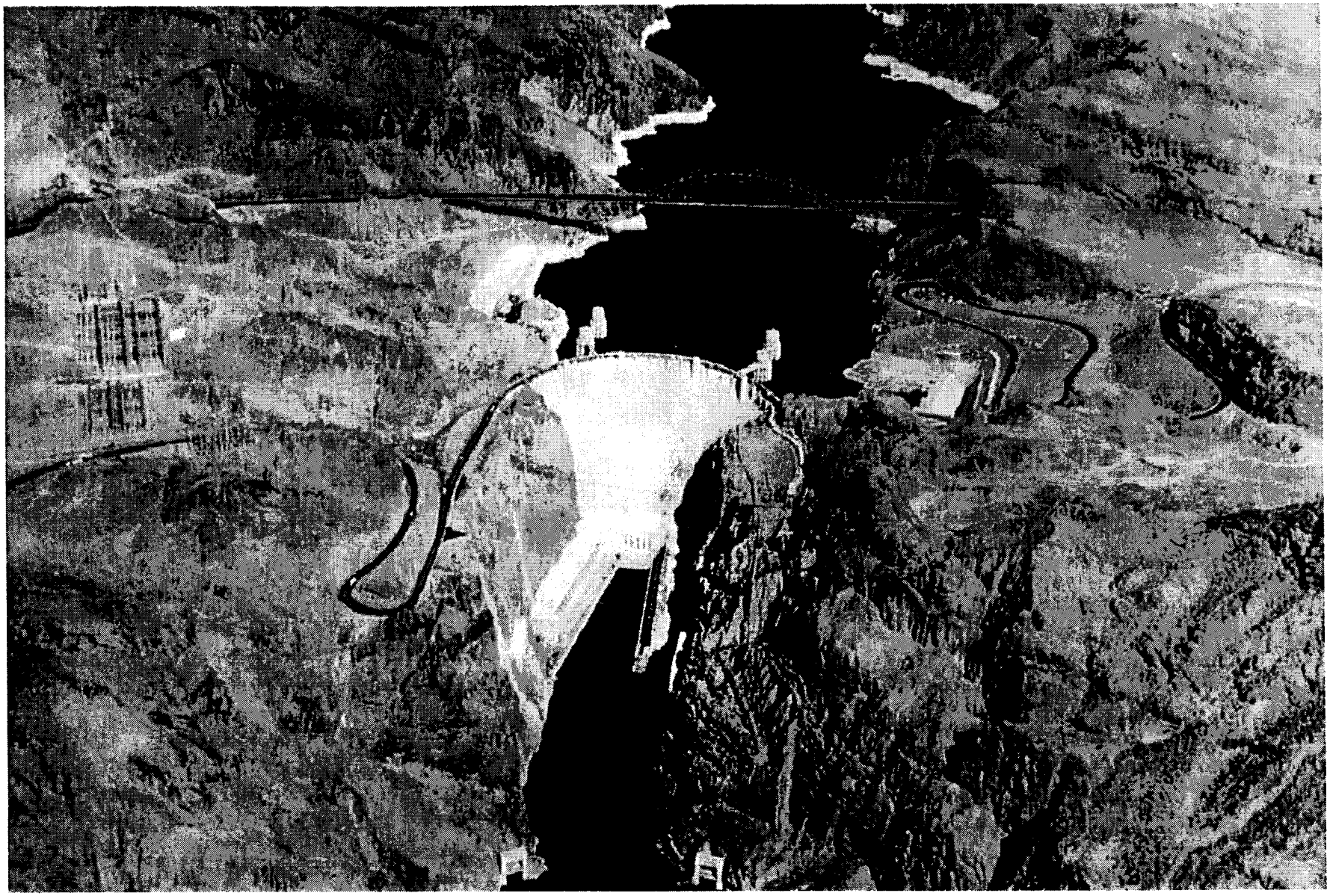

FIGURE 2-7
PROMONTORY POINT
STEEL TRUSS RIB THROUGH
ARCH BRIDGE
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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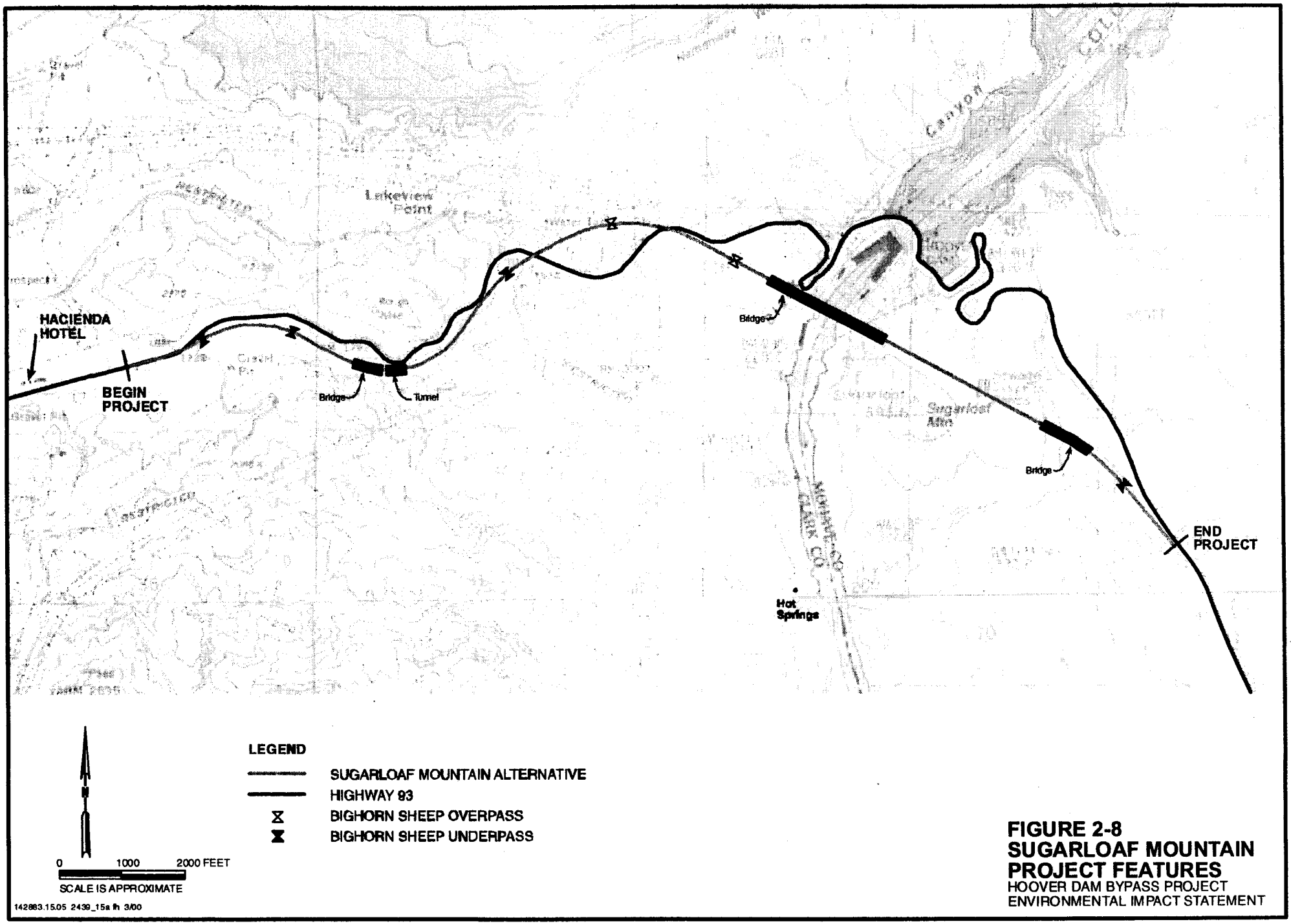

FIGURE 2-8
SUGARLOAF MOUNTAIN PROJECT FEATURES
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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2.6.2.1 Basis for Identification as the Preferred Alternative

The criteria used in screening the alternatives are described in Section 2.3. The following discussion summarizes the suitability of each of the Hoover Dam Bypass alternatives based on these criteria. A seventh criterion has been added to account for the public and agency input received during circulation of the DEIS.

Criterion 1. ***The purpose and need, including engineering and operational standards, safety, and traffic/freight capacity, should be achieved with a reasonable cost.***

The No Build Alternative (No Build) does not meet the purpose and need of the project (as discussed in Section 2.7). All three "build" alternatives meet the purpose and need of the project. The Sugarloaf Mountain and Promontory Point Alternatives have the best roadway geometry; however, the Promontory Point Alternative has a curve at each end of the proposed bridge, whereas the Sugarloaf Mountain Alternative has long, straight approaches to the bridge. This maximizes sight distance and minimizes the possibility of an accident at the Sugarloaf Mountain Alternative bridge. Numerous agencies and citizens opposed the Promontory Point Alternative because of the risk of a hazardous material spill into Lake Mead.

The Gold Strike Canyon Alternative, although 0.1 mile shorter than Sugarloaf Mountain and 0.6 mile shorter than Promontory Point, has the poorest horizontal and vertical alignments. It also has a curve at each end of the proposed bridge. The profile grade is by far the worst of the three build alternatives and includes more than 2.5 miles of grades steeper than 5 percent. The Promontory Point Alternative and the Sugarloaf Mountain Alternative have only 0.5 mile of grades steeper than 5 percent. Gold Strike Canyon requires the construction of 10 bridges in addition to the Colorado River Bridge, whereas Promontory Point has 1 additional bridge and Sugarloaf Mountain has 2 additional bridges. As shown in Figures 2-4, 2-8, and 2-11, each of the three build alternatives would also require one relatively short tunnel.

Construction access and constructability of the Gold Strike Canyon Alternative are the most difficult, although these criteria are difficult to quantify. Gold Strike Canyon is also the most expensive at $215 million, although it is only 9 percent higher than the Sugarloaf Mountain Alternative, which is $198 million. The cost of the Promontory Point Alternative is $204 million.

The preferred alternative under this criterion is the Sugarloaf Mountain Alternative.

Criterion 2. ***Impacts to Section 4(f) land (public parks, recreation areas, wildlife refuges, and historic sites) should be avoided or minimized pursuant to Section 4(f) of the Department of Transportation Act of 1966.***

There are no feasible and prudent alternatives that avoid the use of Section 4(f) land (see Chapter 6). Although the Promontory Point Alternative uses 74 acres of Section 4(f) land and the Sugarloaf Mountain Alternative uses 92 acres, the Sugarloaf Mountain alignment has been determined to be the harm-minimizing alternative based on the following key factors:

- Strong public concern regarding hazardous materials spills in Lake Mead and resulting impact on LMNRA with the Promontory Point bridge

- Resource and regulatory agency support for Sugarloaf Mountain due to least impact to wildlife, wildlife habitat, and water quality
- No adverse impact to the "first impression" historic views of Hoover Dam
- Ability to more readily blend the Sugarloaf Mountain Alternative into the landscape
- Sugarloaf Mountain Alternative traverses the National Register-eligible TCP in an area of extensive disturbance
- Ability to minimize and mitigate impacts through continuing consultation and Native American participation on the DAP

The Gold Strike Canyon Alternative uses 128 acres of Section 4(f) land, impacts existing recreational use, substantially impairs pristine scenic conditions, and has a substantial and potentially unmitigable impact on the Gold Strike Canyon TCP. Therefore, it cannot be considered the harm-minimizing alternative.

Criterion 3. ***Impacts to federally and/or state-listed threatened or endangered vegetation and wildlife species and sensitive habitats, such as wetlands, should be avoided or minimized.***

The Gold Strike Canyon Alternative involves constructing through previously undisturbed areas, whereas the Sugarloaf Mountain and Promontory Point Alternatives are generally located along existing road corridors or through other disturbed areas. Therefore, the Gold Strike Canyon Alternative has substantially more impacts under this criterion. NPS, the U.S. Fish and Wildlife Service (USFWS), the Nevada Division of Wildlife (NDOW), and the Arizona Game and Fish Department (AGFD) are opposed to the Gold Strike Canyon Alternative.

Because of the least impacts to the peregrine falcon, desert bighorn sheep, and desert tortoise, the Sugarloaf Mountain Alternative is preferred under this criterion.

Criterion 4. ***Impacts to cultural resources, including Hoover Dam NHL and archeological (prehistoric and historic) resources, should be avoided or minimized.***

The "build" alternatives adversely affect between 6 and 10 historic properties, including a Traditional Cultural Property (TCP), although the Gold Strike Canyon Alternative is considered to have the least historic impacts because it is located the farthest from Hoover Dam. The Promontory Point and Sugarloaf Mountain Alternatives have an adverse effect on the "historic" setting of Hoover Dam. Consultation with the Native American tribes indicates that the tribes generally do not support any of the "build" alternatives; however, when asked about a preference, they favored the Promontory Point Alternative and strenuously opposed the Gold Strike Canyon Alternative because of significant disturbance to the TCP.

Therefore, the Gold Strike Canyon Alternative has the least historic impacts but has the greatest TCP concerns. The Promontory Point and Sugarloaf Mountain Alternatives have the greatest historic concerns (from a visual standpoint).

Consequently, only the No Build Alternative can be considered to meet this criterion; however, it does not meet the purpose and need of the project.

Criterion 5. ***Impacts to aesthetic resources (including visual, noise, dust, and odors) should be avoided or minimized.***

All of the "build" alternatives will enhance the visitors' experience at Hoover Dam since truck traffic and much of the vehicular traffic will be removed from the dam. The Gold Strike Canyon Alternative is the only alternative that results in a substantial noise increase over existing levels; however, the Gold Strike Canyon Alternative is preferable for the visitors' experience at Hoover Dam since it moves the traffic out of sight and farther away than the other two alternatives. Traffic-generated noise, dust, and odors would be minimized. The number of hikers and recreationists downstream from Hoover Dam is very small compared to the number of visitors at Hoover Dam; therefore, under this criterion, it is reasonable to select an alternative which minimizes impacts and maximizes benefits for the visitors at Hoover Dam.

The Gold Strike Canyon Alternative is considered the preferred alternative under this criterion.

Criterion 6. ***Impacts on recreation resources and to tourists should be avoided or minimized.***

All of the "build" alternatives will have a major beneficial effect on recreation and tourism—primarily for the visitors at Hoover Dam. The visitors' experience at Hoover Dam will be enhanced by removing the truck traffic and much of the vehicular traffic from the crest of the dam. The Gold Strike Canyon Alternative has the greatest negative impact on recreation since the hot springs hiking trail would be closed during construction. The Gold Strike Canyon Alternative would also have a long-term effect on the hiking trail because the highway would be adjacent to or bridged over the trail for most of its length. The Promontory Point Alternative has the most potential impact to the planned bicycle path along the historic railroad grade north of the Reclamation warehouse area. It also has the most impact to water recreation since boating restrictions would be implemented during construction.

The Sugarloaf Mountain Alternative is the preferred alternative under this criterion.

Criterion 7. ***Public and agency input should be taken into consideration.***

The approximately 160 commenters on the DEIS favored the Sugarloaf Mountain Alternative over either of the other two "build" alternatives and the No Build Alternative by a three to one margin (see Section 2.4 and FEIS Volume II). Public comments supported the Sugarloaf Mountain Alternative because of its lowest cost and least environmental impacts. Numerous citizens expressed concerns about the Promontory Point Alternative because of the possibility of a hazardous material spill into Lake Mead. The resource and regulatory agencies, with the exception of the SHPOs, unanimously supported the Sugarloaf Mountain Alternative because of its least impact to wildlife, wildlife habitat, water quality, and jurisdictional waters of the United States (U.S.). The Sugarloaf Mountain Alternative is the preferred alternative under this criterion. Gold Strike Canyon was widely disfavored due to the adverse effects on pristine habitat and recreation area.

Table 2-2 shows which alternative is favored for each of the specific criteria discussed above. The Sugarloaf Mountain Alternative is clearly the preferred alternative using the screening criteria established in the DEIS. Chapter 3 describes the proposed mitigation measures for the preferred alternative.

Table 2-2
U.S. 93 – Hoover Dam Bypass Alternative Preference by Individual Criteria

Alternative	Engineering & Cost	Section 4(f)	Biological	Cultural	Aesthetic/ Visual	Recreation	Public/ Agency Opinion
No Build				X[a]			
Promontory Point							
Sugarloaf Mountain	X	X	X			X	X
Gold Strike Canyon					X		

[a] Does not meet the purpose and need of the project (see Section 2.7).

2.6.2.2 New Highway

Similar to the Promontory Point Alternative, the Sugarloaf Mountain Alternative begins about 1,000 feet east of the Hacienda Hotel, following a route just south of existing U.S. 93 to the Reclamation warehouse area. The highway grade then steepens to 3 percent, passes through a gap in the high rock ridge that parallels the river, and then descends to the southeast to the long-span bridge over the Colorado River. Depending on the final design details, the new bypass roadway would probably cross U.S. 93 at two locations on grade-separated structures and traverse the Reclamation property east of the warehouse. Existing U.S. 93 would continue to provide access to Hoover Dam, Lakeview Point, and the Reclamation warehouse (see Figure 2-4).

From the Arizona end of the proposed river bridge, the highway traverses a deep cut along the north slope of Sugarloaf Mountain. The highway then passes through an area containing two existing sewage evaporation ponds that Reclamation owns and operates. To the east of the sewage ponds, the highway turns south, crosses a wide ravine at a 6 percent downgrade, and intersects existing U.S. 93 approximately 1.1 miles from the dam.

2.6.2.3 Bridge Designs

Bridge design options initially studied for the Sugarloaf Mountain Alternative include: a concrete or steel deck arch bridge and a concrete cable-stayed bridge (see Figures 2-9 and 2-10). Other feasible bridge design types will be considered during final design. The design elevation at the center of the proposed bridge is 1,486 feet, about 836 feet above the water surface of the Colorado River and 254 feet higher than the elevation of the existing highway across Hoover Dam.

2.6.2.4 Other Features

This alternative requires several project features in addition to the proposed highway and bridge crossing the Colorado River. These other features include the following:

- A 400-foot-long highway bridge crossing a bend in Gold Strike Canyon
- A 300-foot-long tunnel passing through a high, narrow ridge separating the canyon from the open valley to the northeast
- An 800-foot-long highway bridge crossing a large ravine on the Arizona highway approach

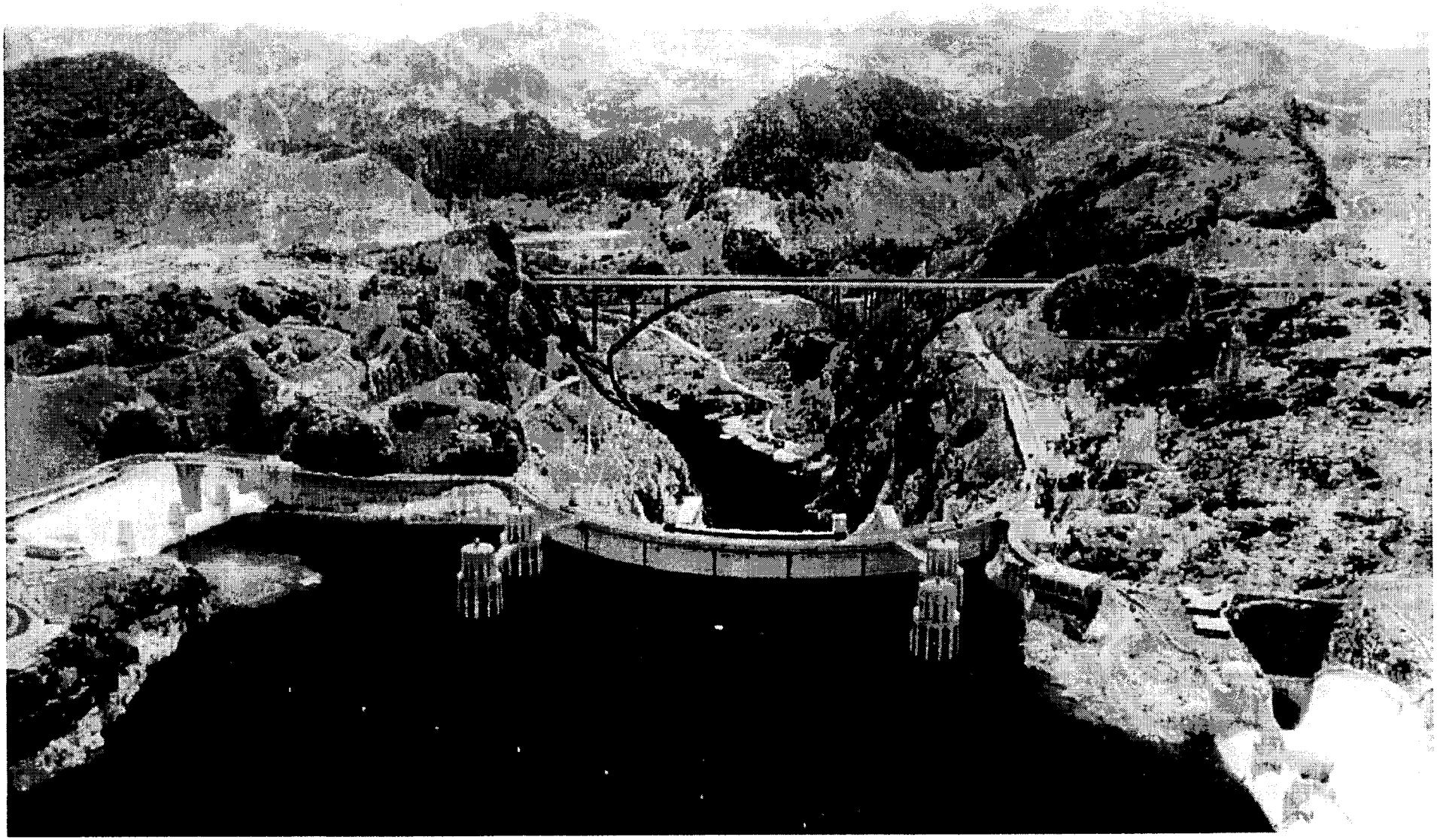

FIGURE 2-9
SUGARLOAF MOUNTAIN
CONCRETE OR STEEL ARCH BRIDGE
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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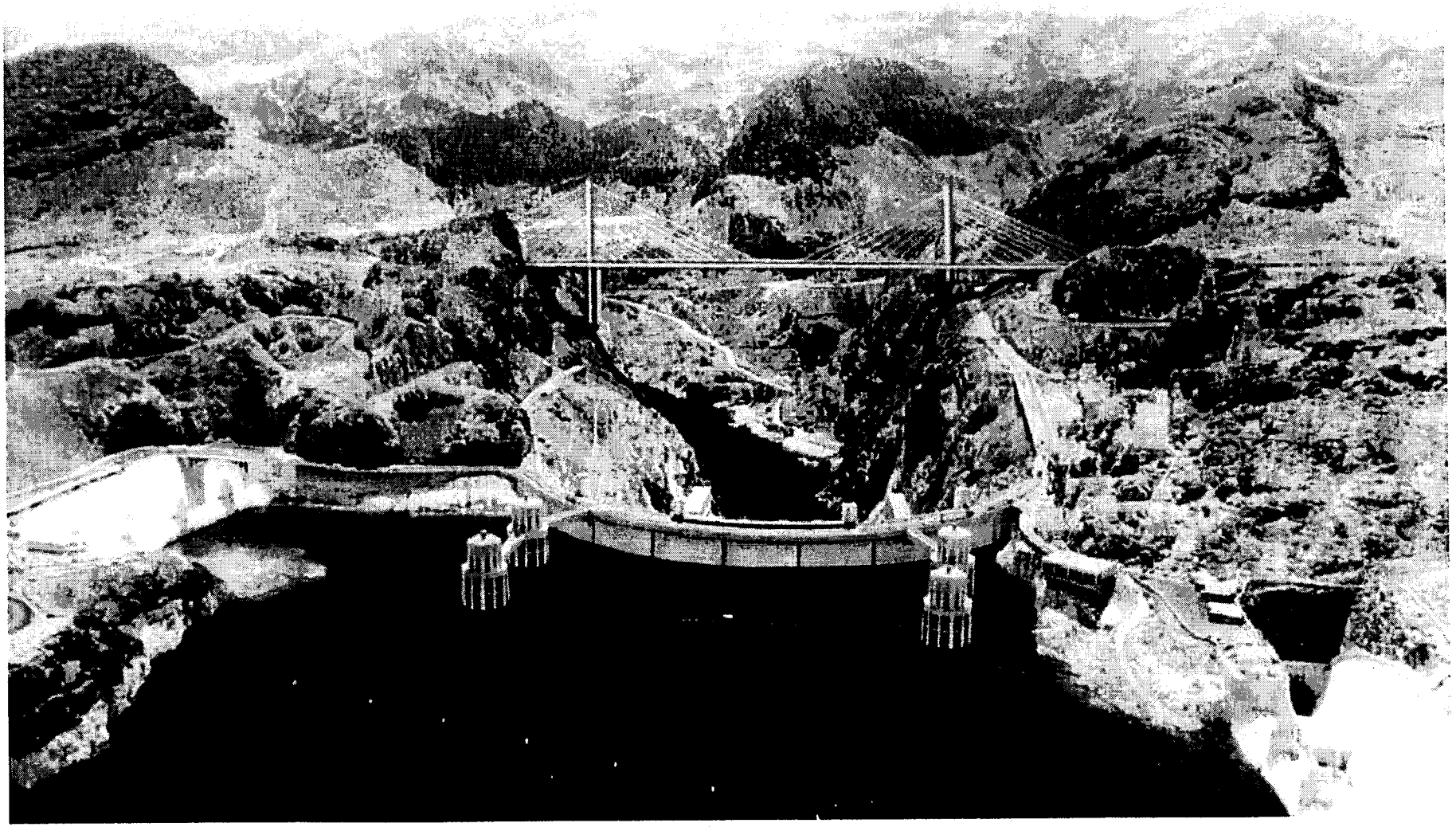

FIGURE 2-10
SUGARLOAF MOUNTAIN CABLE-STAYED BRIDGE
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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- Sewage evaporation pond relocation
- Four wildlife underpasses, three wildlife overpasses, two additional wildlife underpasses provided by the two bridges outlined above, one additional wildlife overpass provided by the tunnel outlined above, fencing to guide wildlife to the crossing structures, fencing to continue approximately 2,400 feet beyond the intersection of the new highway with existing U.S. 93 in Arizona, and out-jumps to allow bighorn sheep to exit the fenced highway right-of-way

2.6.2.5 Project Construction

The Sugarloaf Mountain Alternative requires approximately 5 years to construct. Assuming that funding becomes available and environmental clearances are obtained, the project would be completed by 2007. Estimated construction cost of this alternative is $198 million, including preliminary and construction engineering.

No major detours, closures, or traffic delays are expected to occur during construction of the river bridge and highway approaches. The existing highway could remain open to two-lane traffic with minimal interference, except during construction at the beginning and ending locations of the project and briefly during placement of girders at the two proposed highway overpasses in the vicinity of the Reclamation warehouse.

2.6.3 Gold Strike Canyon Alternative

The Gold Strike Canyon Alternative crosses the Colorado River about 1 mile downstream of Hoover Dam. This alternative requires constructing approximately 2.2 miles of highway approach in Nevada, a 1,700-foot-long bridge, and a 1.1-mile highway approach in Arizona (Figure 2-11).

2.6.3.1 New Highway

From the Nevada side, about 2.2 miles of new highway follow the Gold Strike Canyon to within about 4,000 feet of the Colorado River where it veers northeast from the canyon. The mouth of the canyon is wide, with the sides sloping at 3 feet horizontally for about every 1 foot of elevation change. The highway reaches the 6 percent maximum grade approximately at Station 48+00 and continues that rate of descent for about 1.5 miles.

From the Arizona end of the proposed river bridge, the highway crosses a spoil site created during the original Hoover Dam construction. A highway bridge spans an area between the spoil pile and the hillside, then traverses an area of bench cut with some fills until it bridges a ravine. The highway then turns southeast to intersect with existing U.S. 93. The entire Arizona approach from the abutment of the river bridge on the Arizona side to the intersection with U.S. 93 ascends at a 5.3 percent grade for a distance of about 4,000 feet.

2.6.3.2 Bridge Designs

Two bridge designs were initially studied for the Gold Strike Canyon Alternative: a concrete deck arch and a steel deck arch (see Figures 2-12 and 2-13). The design elevation at the center of the proposed bridge is 1,132 feet, about 482 feet above the water surface of the Colorado River and 100 feet below the elevation of the current highway across Hoover Dam.

2.6.3.3 Other Features

This alternative requires several project features in addition to the proposed highway and bridge crossing the Colorado River. These other features include the following:

- A 300-foot-long tunnel passing through a ridge that separates the canyon from the river
- Bridge structures used in areas where large roadway fills would otherwise encroach on the Gold Strike Canyon hiking trail; retaining walls used to avoid large fills interfering with trails and drainages
- Possible construction of noise barriers along the Gold Strike Canyon trail
- Two wildlife underpasses, 1 wildlife overpass, 10 additional wildlife underpasses provided by the highway bridges outlined above, 1 additional wildlife overpass provided by the tunnel outlined above, fencing to continue approximately 2,400 feet beyond the intersection of the new highway with existing U.S. 93 in Arizona, and out-jumps to allow bighorn sheep to exit the fenced highway right-of-way. NDOT and ADOT will maintain the wildlife underpasses and overpasses within their respective states.

2.6.3.4 Project Construction

The Gold Strike Canyon Alternative requires 5 to 6 years to construct. Assuming that funding becomes available and environmental clearances are obtained, the project would be completed by 2007. Estimated construction cost of this alternative is $215 million, including preliminary and construction engineering.

No major detours, closures, or traffic delays would occur during construction of the bridges and highway approaches. The existing highway remains open with minimal interference, except at the beginning and ending points in Nevada and Arizona. The specifications for the project provide for maintaining two traffic lanes during construction.

2.7 No Build Alternative

Under the No Build Alternative, no Hoover Dam Bypass is developed, no change in the current highway configuration occurs, and no other structural or nonstructural improvements are developed on U.S. 93 near Hoover Dam. Existing hairpin curves, inadequate sight distances, narrow dam crest roadway, and steep grades on U.S. 93 in the Hoover Dam vicinity remain unchanged. No direct construction costs result from this alternative.

However, an increase in operations and maintenance costs is foreseeable because of increased traffic and congestion. The public also incurs added cost because of more frequent traffic delays and accidents.

The No Build Alternative does not meet the project purpose and need because this alternative does not reduce traffic congestion and accidents at the dam or minimize impacts on recreation resources and tourists; and the increased traffic volume, traveling at slower speeds, contributes to decreased air quality in the Hoover Dam vicinity and increases congestion for tourists at Hoover Dam and parts of the LMNRA.

The potential for a pedestrian-vehicle catastrophe or catastrophe involving vehicles containing hazardous materials may reasonably be expected to increase with increasing

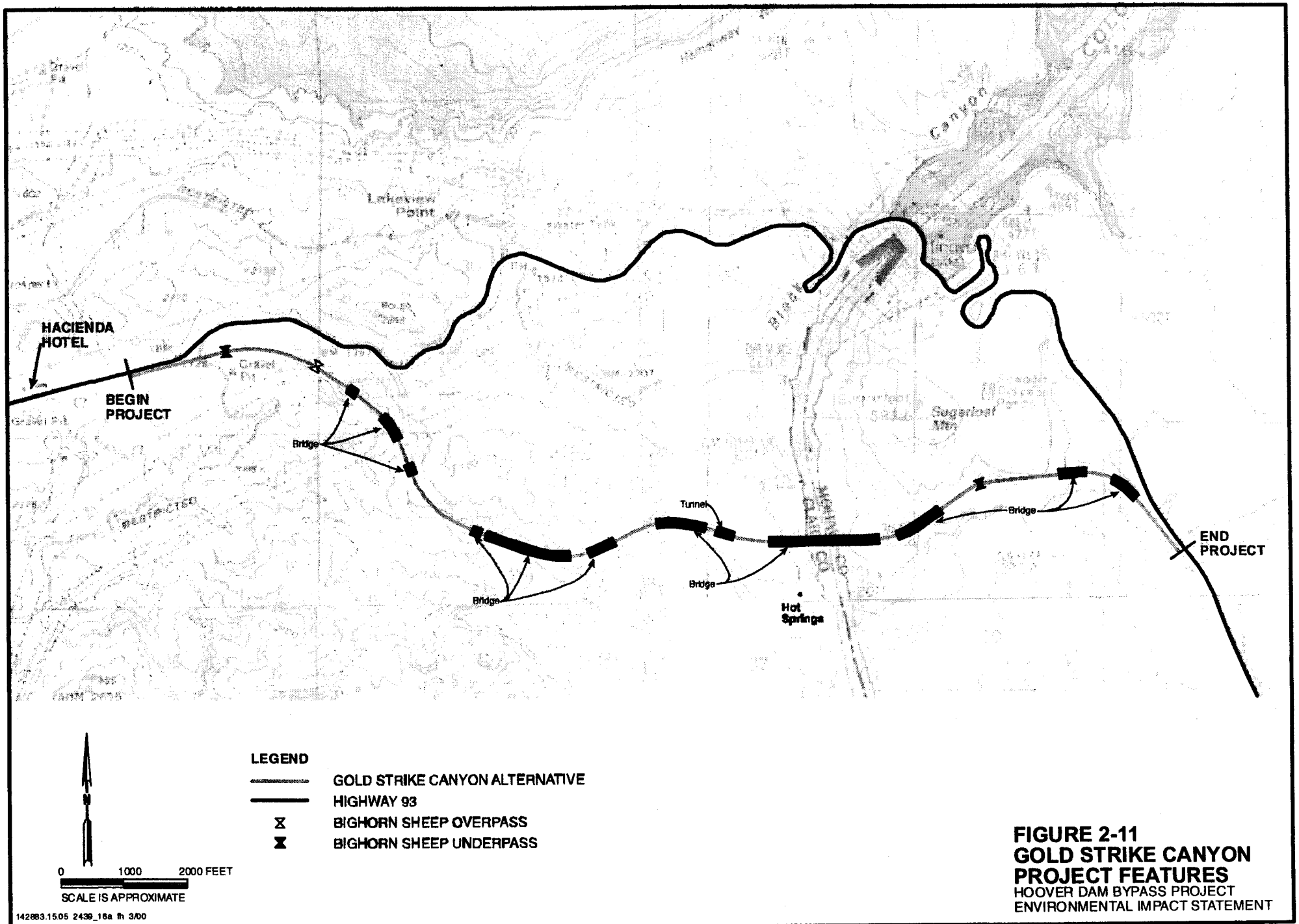

FIGURE 2-11
GOLD STRIKE CANYON PROJECT FEATURES
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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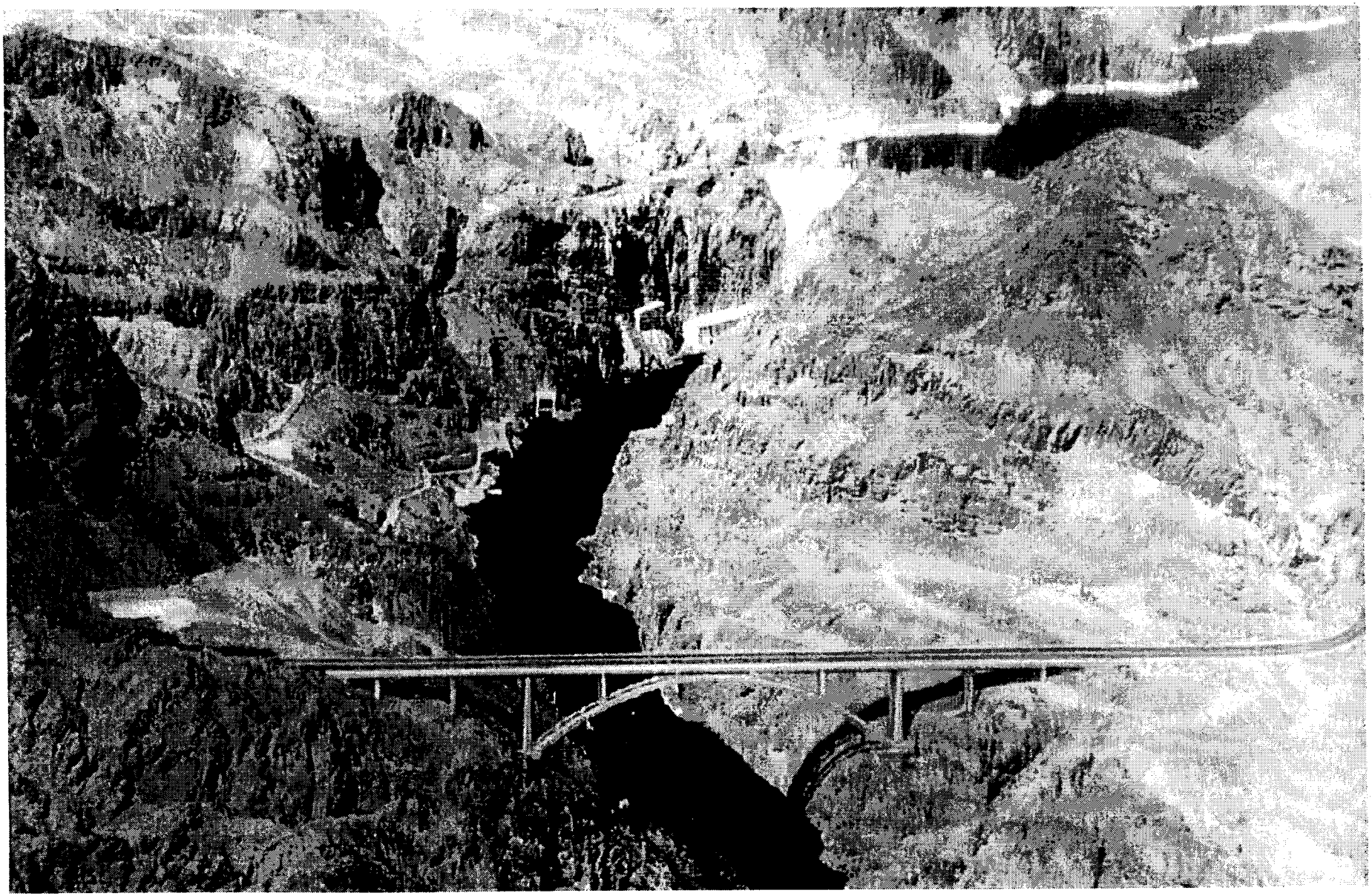

FIGURE 2-12
GOLD STRIKE CANYON
CONCRETE ARCH BRIDGE
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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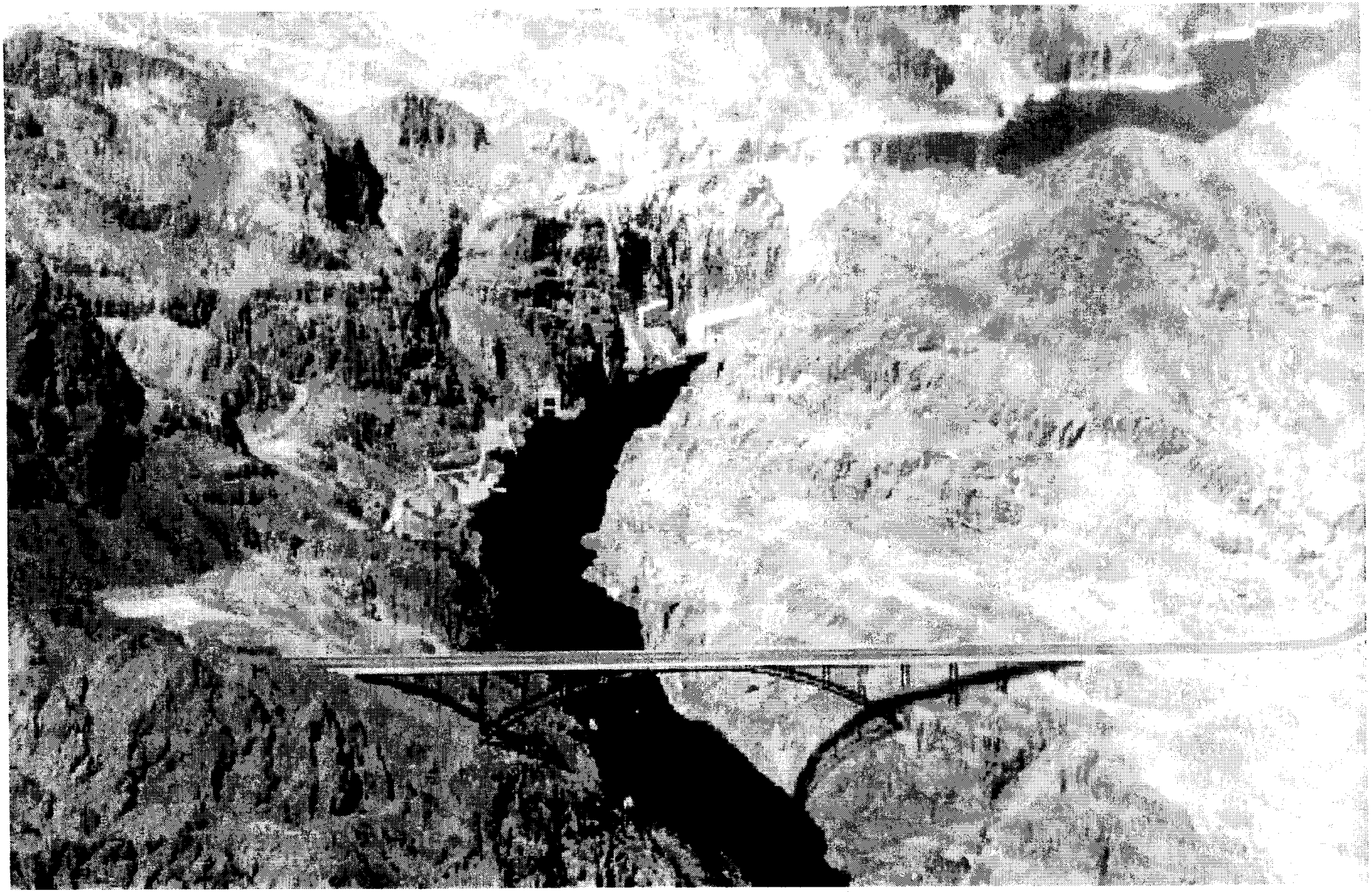

FIGURE 2-13
GOLD STRIKE CANYON
STEEL ARCH BRIDGE
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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traffic volume. The risks to innocent bystanders, property damage to the dam and its facilities, contamination of Lake Mead or the Colorado River, and interruption of the power and water supplies to Southwest residents remain the same or increase.

2.8 Logical Termini

An important aspect of developing highway improvement alternatives is to define the logical termini, or begin and end project points. All three proposed build alternatives begin at the same point on the Nevada side, located about 1,000 feet east of the Hacienda Hotel. All the alignments end at the same point on existing U.S. 93 on the Arizona side, approximately at MP 1.7.

The termini of the Hoover Dam Bypass alternatives were defined to be consistent with the project purpose and need (Chapter 1) and not necessitate other improvements outside the defined project limits (i.e., cumulative or segmental effects). In other words, the project can function independently for its design life, while not requiring or precluding future adjacent highway projects. This action does not change current traffic compositions on regional routes. Thus, it does not generate traffic on the U.S. 93 corridor or other regional routes, nor does it predetermine the alternative selection in adjacent, but unrelated, projects. Two such highway projects are in early planning stages: an NDOT project to address the traffic problems along U.S. 93 in Boulder City that is coincident with the planned western terminus of the Hoover Dam Bypass alignments; and an ADOT project to widen the existing two-lane section of U.S. 93 south of Hoover Dam approximately 15 miles to the existing four-lane divided highway section.

Other alternative routes to U.S. 93 between Kingman and Las Vegas exist. All require substantial out-of-direction travel, as shown in Table 2-1. The Hoover Dam Bypass will provide improved travel time benefits to regional traffic and freight movement among the Phoenix, Kingman, and Las Vegas areas over the design life of the project. Improved overland goods and freight movement is an important NAFTA goal to be achieved by the project to eliminate the traffic bottleneck at Hoover Dam.

2.9 Toll Option

A user fee or toll charge was evaluated as an option for partially funding the new bridge and highway approaches for each of the three build alternatives. A *Traffic and Revenue Study* (Reclamation, August 1992) determined the anticipated toll revenues and the feasibility of financing through a potential bond issue. ADOT and NDOT completed a *Hoover Dam Bypass Bridge Financial Feasibility Study* to determine viable funding sources for the Hoover Dam Bypass (June 2000). The study assessed toll crossings and other financial options. A toll facility would require legislative action and is not supported by ADOT or NDOT, thus it is not considered viable or anticipated. The study recommended that Arizona and Nevada should: 1) continue to pursue full federal funding, and 2) simultaneously pursue "debt backed by federal and by state funds" approaches.

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CHAPTER 3

Affected Environment, Environmental Consequences, and Measures to Minimize Harm

Introduction

This chapter provides a description of the existing social, economic, and environmental settings for the area affected by the three build alternatives and the No Build Alternative. The affected environment is described for each resource of concern in the proposed project area. The discussion contains data, information, issues, and values that have a bearing on possible impacts, mitigation measures, and identification of the Sugarloaf Mountain alignment as the preferred alternative.

Probable beneficial and adverse social, economic, and environmental effects of alternatives under consideration are described. The information provides a basis for evaluating the comparative merits of the alternatives and for identifying the preferred alternative. Some impacts to specific resources were evaluated for each build alternative and the No Build Alternative, while others were evaluated regionally. Where data were available for each alternative and effects differed, individual alternative analyses were performed. This chapter also presents mitigation measures to reduce identified impacts to the preferred alternative and others considered.

This EIS was prepared consistent with FHWA's *Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (FHWA Technical Advisory T 6640.8A, October 30, 1987). This guidance lists potentially significant impacts most commonly encountered by highway projects and directs that these factors should be discussed for each reasonable alternative where a potential for impact exists. Environmental and socioeconomic factors potentially impacted by the proposed project are analyzed in detail in this chapter. Factors which were found to have no potential for project-related impacts and are not discussed in this chapter are as follows:

- Wetlands
- Relocation Impacts
- Joint Development
- Wild and Scenic Rivers
- Coastal Barriers
- Coastal Zone Impacts

The following additional technical reports were prepared for the Hoover Dam Bypass DEIS, and they are available through the Federal Highway Administration, Central Federal Lands Highway Division (contact Dave Zanetell at 303/716-2157 for additional information):

- Air Quality Analysis
- Noise Analysis
- Section 404 Jurisdictional Delineation Report
- Visual Resources Analysis
- Biological Assessment
- Archaeological Resources Survey Report

- Historic Resources Survey Report
- American Indian Ethnographic Study

3.1 Air Quality

3.1.1 Affected Environment

National ambient air quality standards (NAAQS) have been established for several major pollutants referred to as "criteria" pollutants. The NAAQS are two-tiered: primary—to protect public health; and secondary—to prevent degradation to the environment (e.g., impairing visibility, damaging vegetation and property). The six criteria pollutants are:

- Carbon monoxide (CO)
- Particulate matter with diameters less than 10 microns (PM_{10})
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2)
- Ozone
- Lead (Pb)

In addition, the U.S. Environmental Protection Agency (EPA) recently set new standards for particulate matter with diameters less than 2.5 microns ($PM_{2.5}$) and revised the ozone standard. Both Nevada and Arizona have adopted the federal standards.

The Clark County Health District Air Pollution Control Division regulates air quality in Clark County. The Arizona Department of Environmental Quality (ADEQ) regulates air quality in Mohave County.

Because of the larger population density, Clark County has considerably more emissions than Mohave County. Clark County also has several large coal-fired power plants, which account for 93 percent of all SO_2 emissions in Clark County. No large coal-consuming sources exist in Mohave County; therefore, SO_2 emissions are negligible.

Vehicle exhaust creates a significant amount of volatile organic compounds (VOCs), nitrogen oxides (NO_X), and CO emissions. Motor vehicle emissions (particularly CO) are primary contributors to air pollution. CO is a colorless, odorless gas typically formed as a result of incomplete combustion. Elevated concentrations typically occur during the winter because vehicle engines operate less efficiently in cold weather. Concentrations tend to be higher during stable atmospheric conditions when limited mixing and low wind speeds tend to keep pollutants near the ground. They usually occur in the immediate vicinity of congested roads and intersections where vehicles are idling.

Ozone is a pollutant formed through a complex series of temperature-dependent photochemical reactions involving precursor pollutants such as NO_X and VOCs, which are emitted as vehicle exhaust. High ozone concentrations typically occur during multiday periods of hot, sunny days accompanied by stagnant weather patterns. Under these conditions, pollution from outside the region may be transported into the area, compounding the problem. This makes ozone a regional-scale pollutant and can affect rural areas outside the major metropolitan areas.

In addition to ozone formation, exhaust gases (NO_X, hydrocarbons, and SO_2) released into the atmosphere can be converted to fine particulate matter through similar (and related)

chemical and photochemical reactions. Fossil-fuel combustion (resulting from motor vehicles and industry) is the major source of gases in secondary particle formation. These secondary particles are generally very small ($PM_{2.5}$ or less) and are of concern because they stay suspended longer and can go deeper into the lungs. In addition, fine particulate is a major component of regional haze and visibility impairment. The formation of nitrates and sulfates resulting from these reactions creates acid deposition (acid rain) downwind.

Fine particulate matter can also be directly emitted into the atmosphere. Sources of direct particulate emissions include:

- Wind-blown dust from construction activities, unpaved roads, agriculture, and barren lands
- Fine soot generated from residential wood-burning stoves, fireplaces, wildfire, and brush/waste burning
- Fine soot and particulate from motor vehicle emissions and industrial sources
- Sand and gravel operations
- Off-road recreational vehicles

Because of the dry, hot conditions, this region is susceptible to high particulate (PM_{10}) concentrations, especially during construction. The Clark County Air Pollution Control Division estimates that construction activity produces more than 40 percent of the PM_{10} emissions in the Las Vegas Valley.

The Las Vegas and Henderson urban area does not meet air quality standards (nonattainment) for PM_{10} and CO. The southern edge of the nonattainment area is located at Railroad Pass where U.S. 93 and U.S. 95 meet. All other areas in Clark County outside of the Las Vegas Valley (Las Vegas, North Las Vegas, and the Henderson urban area) are in attainment for all pollutants. The proposed project is located outside the nonattainment area. Mohave County (Arizona) does meet air quality standards (attainment) for all pollutants, except in Bullhead City, which is nonattainment for PM_{10} and is located in the southwestern part of the County. Table 3-1 shows the attainment status for Clark and Mohave counties.

Table 3-1
Attainment Status

Location	Status
Clark County	
Las Vegas/Henderson urban area	Nonattainment for PM_{10} and CO
All other areas	Attainment for all pollutants
Mohave County	
Bullhead City	Nonattainment for PM_{10}
All other areas	Attainment for all pollutants
Hoover Dam Area	Attainment for all pollutants

Because the project is located in an area that is meeting air quality standards and no Statewide Improvement Program-related transportation control measures exist, the conformity procedures of 23 CFR 770 do not apply to this project.

Vehicle exhaust is the primary source of project-related air pollution. Pollutants include NO_X, CO, fine particulate, hydrocarbons, and SO_2. Table 3-2 shows existing traffic volumes in the proposed project area.

Table 3-2
Existing Traffic Conditions

Location	AADT	Peak Hour	LOS
West of Hoover Dam	13,200	1,188	E
At Hoover Dam	11,500	1,035	F
East of Hoover Dam	9,300	837	E

Source: Appendix A, Traffic Analysis

Vehicle emissions were estimated using EPA-approved models. Table 3-3 shows estimated emissions per vehicle mile traveled (VMT) as a function of speed for 1997.

Emissions of sulphur oxides (SO_X) and PM are insensitive to vehicle speed. For CO and hydrocarbons, the highest emissions occur at low vehicle speeds, are lowest at about 45 to 55 mph, and then peak again at higher speeds.

Table 3-3
Estimated 1997 Vehicle Emission Rates

Speed	Pollutant Emissions in g/VMT[a]				
(mph)	CO	NO_X	Hydrocarbons	SO_X	PM
10	82.86	3.35	7.84	0.114	5.22
15	60.80	3.11	5.81	0.114	5.22
25	40.13	2.98	3.94	0.114	5.22
35	29.55	3.02	3.02	0.114	5.22
45	23.97	3.15	2.52	0.114	5.22
50	22.87	3.42	2.40	0.114	5.22
55	23.00	3.97	2.39	0.114	5.22
60	37.96	4.58	2.83	0.114	5.22

[a] grams per vehicle mile traveled

Using these emission factors, an estimate of the daily pollution burden around the project site was calculated. A speed of 10 mph was assumed for an average LOS F traffic flow condition, and 25 mph was assumed for a typical free-flow speed near the dam. Using the project-burden relationship (the ratio between vehicle speeds, numbers of vehicles, and emissions), the existing project burden was estimated as shown in Table 3-4.

Table 3-4
Existing Project Burden

	Pollutant Emissions in Pounds per Day				
	CO	NO_X	VOC	SO_2	PM_{10}
Existing Burden	6,890	442	669	17	759
	Burden Emissions in Tons/Year				
Project Burden	1,257	81	122	3	138
Clark and Mohave Counties Emissions	287,614	99,838	52,719	51,302	32,017
Fraction of Inventory	0.0044	0.0008	0.0023	> 0.001	0.004

The existing Hoover Dam crossing, which is a very small segment of the regional roadway system, contributes a small fraction of the total regional pollution inventory and has a minor role in regional pollution impacts such as ozone and regional haze.

CO is considered a microscale pollutant and is usually evaluated for short-term 1-hour and 8-hour hot-spot impacts. For this study, CO impacts in the area immediately around Hoover Dam were evaluated because of worker and visitor density. The dam roadway and the 1,000-foot approaches on either side were included in the analysis. For this analysis, the EPA-approved dispersion model for evaluating CO and particulate impacts from roadway vehicles was used. Worst-case conditions under LOS F were evaluated. The maximum 1-hour CO impact was found to be 6.3 parts per million (ppm) without background. Rural backgrounds ranged from 1 to 2 ppm, well below the standard of 35 ppm.

3.1.2 Environmental Consequences

3.1.2.1 Construction Impacts

Any of the build alternatives, including the preferred alternative, would generate dust emissions during construction. Construction emissions vary from day to day and activity to activity, with each activity having its own potential to release emissions. Construction activities that can produce dust (PM_{10}) emissions include rock blasting and handling, vehicle and truck travel over unpaved roads, blowing wind over disturbed areas, and tail-pipe exhaust being emitted from vehicles and equipment. Because of the variability in timing and intensity of construction, estimating construction-phase pollutant emissions is difficult. Furthermore, activities such as blasting do not have accepted and recognized emission factors. Nevertheless, it is assumed that there will be adverse PM_{10} impacts.

Other pollutants (CO, NO_X, VOC, and SO_X) are primarily emitted from construction equipment exhaust pipes. These pollutants are of less concern because construction activities are generally short-term, spread over a wide area, and do not impede regional air quality standards.

3.1.2.2 Operational Impacts

Daily pollutant emission estimates for the project alternatives are shown below in Table 3-5. Under the No Build Alternative, pollutant emissions increase substantially as the number of vehicles increase and the length of time at LOS F in the proposed project area increases.

The three build alternatives, in contrast, enable lessened CO and VOC emissions as LOS in the proposed project area is improved. In fact, year 2027 CO concentrations for each build alternative are less than existing CO concentrations. With construction of any of the build alternatives, CO emissions at the Hoover Dam roadway would be less: 6,439 pounds per day in year 2027 compared to 6,890 pounds per day currently.

Table 3-5
Daily Emissions by Alternative

	Pollutants in Pounds per Day				
Scenario	**CO**	**NO_x**	**VOC**	**SO_2**	**PM**
Existing	6,890	442	669	17	759
			Year 2017		
No Build	11,182	677	1,177	32	1,712
Build Alternatives[a]	5,120	691	628	32	1,712
			Year 2027		
No Build	14,724	850	1,547	40	2,144
Build Alternatives[a]	6,439	855	785	40	2,144

[a] Build—Differences in air quality impacts between the build alternatives are negligible.

3.1.3 Measures to Minimize Harm

3.1.3.1 Construction Mitigation

The project will obtain and maintain all applicable permits pertaining to dust abatement and blasting. Clark County requires dust control permits for such construction. For Mohave County, the ADEQ stipulates that portable sources of air pollution (i.e., rock, sand, gravel, and asphaltic concrete plants) will require an ADEQ permit. Reasonable steps will be taken to prevent fugitive dust emissions 24 hours a day, seven days a week, during project construction. Specific dust abatement measures (per Clark County Health District dust control permit requirements, revised July 1, 1997) include:

- Keeping all dirt access roads and staging areas watered
- Keeping dirt off paved roads by sweeping, scraping, or flushing with water
- Installing a gravel pad at least 30 feet wide by 50 feet long by 6 inches deep consisting of 1-inch- to 3-inch-thick material at truck exits to minimize dirt tracked out—if necessary, washing down trucks leaving proposed project area
- Stabilizing disturbed areas by watering, revegetating, or applying dust suppressants where no continuing development occurs within 30 days of the disturbance of that area
- Prohibiting open burning onsite without appropriate permits
- Stopping all operations, except watering trucks, during high-wind conditions that result in dust emissions that leave the proposed project area, and applying appropriate mitigation (e.g., soil stabilizers and wind breaks) to areas susceptible to high winds to prevent further occurrences
- Limiting vehicle speeds to reduce dust emissions

3.1.3.2 Operational Mitigation

No mitigation measures exist for the operational phase of the project.

3.2 Noise

3.2.1 Affected Environment

A noise study was performed and a technical report was prepared to meet the requirements of FHWA's *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 CFR 772, April 1992) and the guidelines in FHWA Technical Advisory T6640.8A *(Guidance for Preparing and Processing Environmental and Section 4(f) Documents, 1987).*

All noise levels referred to in this report are stated as hourly equivalent sound pressure levels (L_{eq}), which is the average noise energy level for a stated period of time (e.g., hourly), in terms of decibels on the A-scale (dBA). Noise levels stated in dBA approximate the response of the human ear by filtering out some noise in the low and high frequency ranges that the ear does not detect well. The A-scale is used in most ordinances and standards.

Project traffic noise levels are evaluated against the traffic noise impact criteria established by FHWA, NDOT, and ADOT. The FHWA noise level criterion for noise-sensitive land uses, called Activity Category B sites (e.g., residences, churches, schools, recreational uses, and similar areas), is considered exceeded when the exterior noise level approaches or exceeds 67 dBA. The noise level criterion for extra-sensitive land uses, called Activity Category A sites (i.e., lands where serenity and quiet are of extraordinary significance), is an exterior noise level of 57 dBA. The federal criteria are based on peak-hour traffic noise levels.

Table 3-6 shows the FHWA Design Level/Activity Relationship used to determine the noise abatement criterion for specific land uses (e.g., residential and commercial). FHWA considers a traffic noise impact to occur if predicted peak-hour traffic noise levels approach or exceed the noise abatement criteria or substantially exceed existing levels. NDOT defines "approach" as within 1 dBA of the noise abatement criteria; ADOT defines "approach" as within 2 dBA of the noise abatement criteria. Therefore, in Nevada, the noise abatement threshold is 66 dBA-L_{eq} for Activity Category B, and 56 dBA-L_{eq} for Activity Category A. In Arizona, the noise abatement threshold is 65 dBA-L_{eq} for Activity Category B and 55 dBA-L_{eq} for Activity Category A. NDOT and ADOT both consider 15 dBA to be a substantial increase. Mitigation measures are analyzed based on NDOT and ADOT's policies.

Existing noise levels in the proposed project area were determined by field measurements at five sites identified by the Project Management Team and by modeling existing peak-hour traffic noise levels (see Tables 3-7 and 3-8). These sites were located to best represent the primary sensitive receptors/human activity areas affected by the project. The actual measurements served as verification of the modeling estimates at locations where vehicular traffic was the dominant noise source. Noise levels from traffic for existing and future conditions were calculated using the FHWA traffic noise prediction model (STAMINA 2.0/OPTIMA). Input to the model included traffic volume and vehicle speed data generated for the project.

Table 3-6
Federal Highway Administration Design Noise Level/Activity Relationships

Activity Category	Design Noise Levels (dBA)[a] L_{eq} hourly	Description of Land Use Activity Category
A[a]	57 (Exterior)	Land tracts where serenity and quiet are of extraordinary significance and which serve an important public need and where the preservation of those qualities is essential if they are to continue to serve their intended purpose. Such areas could include amphitheaters, parks or portions of parks, open spaces, or historic districts that are dedicated or recognized by appropriate local officials.
B[a]	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, and parks not included in Category A; and residences, motels, hotels, public meeting rooms, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A and B above.
D	—	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 CFR Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. Federal Highway Administration, April 1992.

[a] Parklands in Categories A and B include all such lands (public or private) used as parks as well as those public lands officially set aside or designated by a governmental agency as parks on the date of public knowledge of the proposed highway project.

Table 3-7
Measured Noise Levels (dBA-L_{eq})

Monitoring Location	Description	Measured Noise Level	Dominant Noise Sources
M1	Lakeview Point	47	Vehicle traffic on U.S. 93, small aircraft overhead, birds
M2	Boat Launch below Hoover Dam	52	Water hitting shore and booms below Hoover Dam
M3	Nevada Intake Tower	72	Vehicle traffic on U.S. 93
M4	Gold Strike Canyon Trail	39	Wind through bushes, birds, small aircraft overhead
M5	Gold Strike Canyon Hot Springs	60	Rushing water

Construction noise levels were also estimated using the methods described in *Highway Construction Noise: Measurement, Prediction, and Mitigation* (1977). However, these estimates should be considered less precise than the traffic noise level calculations because, at this preliminary project stage, assumptions must be made about the construction equipment to be used, location and duration of use, and noise characteristics of each piece of equipment.

Table 3-8
Existing Peak-Hour Noise Levels (dBA-L_{eq})

Receptor Location	Activity Category	Impact Criterion	Modeled Noise Level
R1/M1	B	67	50
R2/M2	B	67	52[a]
R3/M3	B	67	73[b]
R4/M4	B	67	39[a]
R5/M5	B	67	60[a]

[a] Noise levels at this receptor location are dominated by sources other than vehicle traffic. Therefore, existing noise levels are based on measured noise levels rather than modeled.

[b] Noise levels approach or exceed the FHWA noise abatement criterion.

3.2.1.1 Noise Level Measurements

Existing noise levels were measured at 5 monitoring (M) sites. Monitoring location M1 is at Lakeview Point, an overlook to Lake Mead (see Figure 3-1). Monitoring location M2 is at the boat launch below Hoover Dam. This area has restricted access, with groups being allowed access twice daily to launch canoe trips. Monitoring location M3 is on Hoover Dam on the sidewalk by the Nevada Intake Tower. Monitoring location M4 is on the Gold Strike Canyon Trail, and monitoring location M5 is located at the Gold Strike Canyon Hot Springs. Monitoring locations M1 through M5 are all recreational uses (Activity Category B), but are not considered areas where quiet is of significant importance. Table 3-7 shows the measured noise levels at each site.

3.2.1.2 Model Verification

At monitoring locations M1 and M3, which have vehicular traffic as a dominant noise source, noise levels were also estimated by using the FHWA highway noise prediction model. The model uses data on traffic volumes, vehicle mix, speed, vehicle noise emission levels, and roadway geometry to predict traffic-generated noise levels at chosen receptors. To test agreement between calculated and measured noise levels, traffic volumes counted during the monitoring period are used in the model. These levels are then compared with the measured noise levels. For this project, the modeled and measured results agreed within 3 dBA. A traffic noise level variation of 3 dBA or less is considered barely perceptible to imperceptible. Therefore, an agreement between measured and modeled traffic noise levels resulting in 3 dBA or less is acceptable.

3.2.1.3 Existing Noise Levels

Five computer modeling receptor (R) locations, corresponding to the five monitoring (M) locations, were selected for use in predicting noise levels in the proposed project area. To calculate existing peak-hour noise levels, traffic data generated for the project were used in the verified noise model. Existing peak-hour noise levels for the 5 receptors are summarized in Table 3-8. FHWA criteria are shown for comparison.

3.2.2 Environmental Consequences

3.2.2.1 Construction Impacts

Promontory Point Alternative. Construction impacts under the Promontory Point Alternative are the same as those discussed below under the preferred alternative.

Sugarloaf Mountain Alternative (Preferred Alternative). Heavy equipment used during construction would have short-term noise impacts on the recreational areas along the proposed alignment. Receptor locations R1/M1 and R3/M3 are the nearest sensitive sites to construction activity along the Promontory Point Alternative (see Figure 3-1). Each is approximately 1,000 feet from the alternative. Table 3-9 shows estimated noise levels for construction activities at 50 and 1,000 feet.

Blasting would also occur along the alignment during construction. Blasting would be short-term and would occur only when normal excavating methods could not remove solid rock formations. Noise and vibration levels resulting from blasting are dependent on size, timing, and number of blasts; the blast area; transmitting medium; and distance to the receptor.

Gold Strike Canyon Alternative. Heavy equipment used during construction would have short-term noise impacts on the Gold Strike Canyon recreational areas represented by R4/M4 and R5/M5. Receptor locations R4/M4 and R5/M5 are approximately 50 feet and 1,000 feet from the alternative, respectively (see Figure 3-1). Table 3-9 shows estimated noise levels for different construction activities at 50 feet and 1,000 feet.

Table 3-9
Estimated Peak Construction Noise Levels (dBA)

Construction Phase	Loudest Equipment	Noise Level at 50 and 1,000 feet
Clearing and grubbing	Bulldozer, backhoe	89/63
Earthwork	Scraper, bulldozer	91/65
Foundation	Backhoe, loader	88/62
Superstructure	Crane, loader	89/63
Base Preparation	Trucks, bulldozer	91/65
Paving	Paver, trucks	92/66

Source: *Highway Construction Noise: Measurement, Prediction, and Mitigation*. U.S. Department of Transportation, 1977.

Blasting would occur under the Gold Strike Canyon Alternative as discussed under the Promontory Point Alternative.

No Build Alternative. Because no construction would occur under the No Build Alternative, no construction impacts would occur.

3.2.2.2 Operational Impacts

Table 3-10 shows future (year 2017) peak-hour noise levels for the build alternatives and the No Build Alternative. The results show that future predicted traffic noise levels will increase from 1 dBA to 26 dBA above existing ambient levels. However, comparing future noise levels for the three build alternatives with the No Build Alternative indicates that levels will range from a 3 dBA decrease to a 26 dBA increase with the U.S. 93 bypass alternatives. The results also show that traffic-generated noise from the proposed project

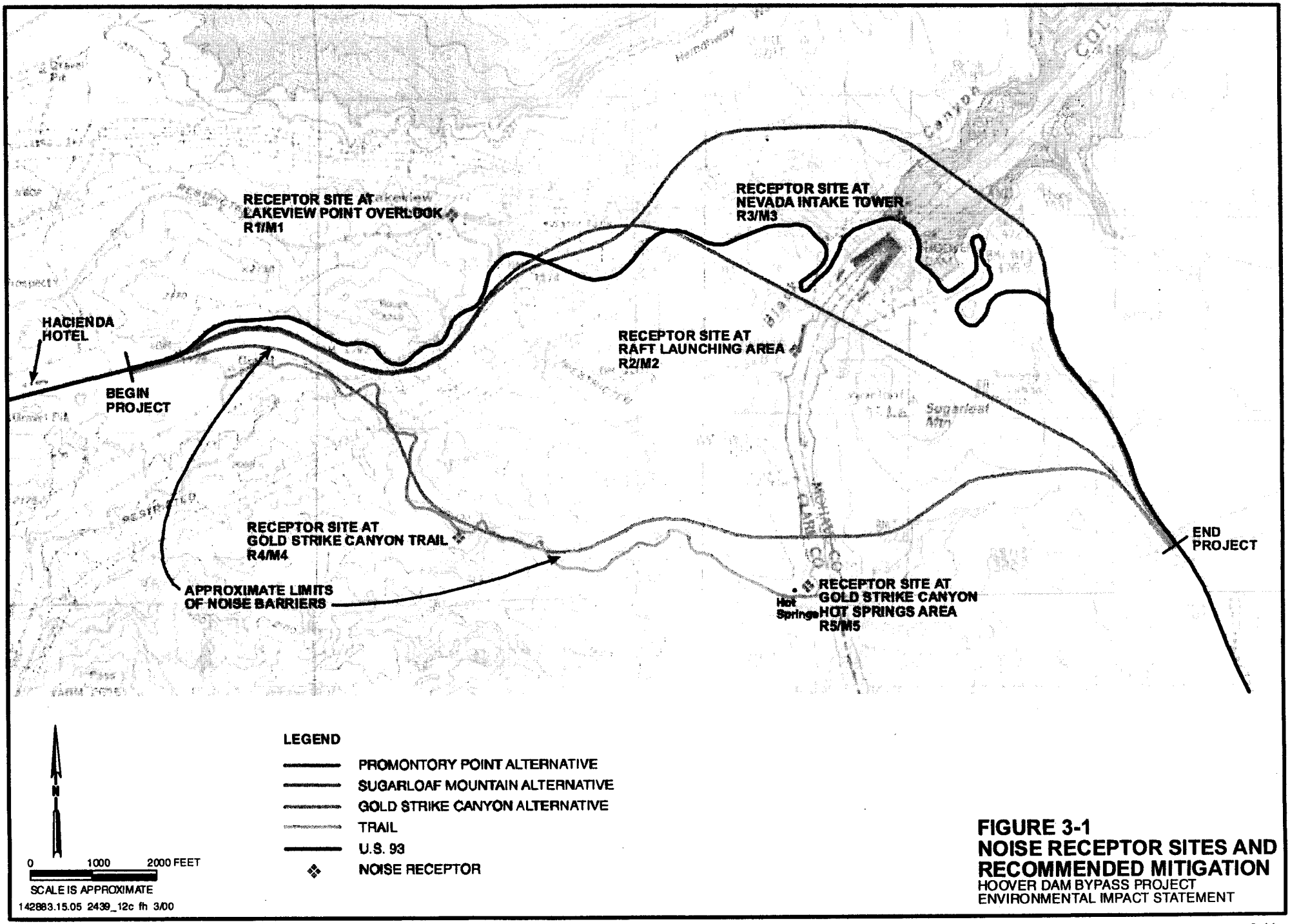

FIGURE 3-1
NOISE RECEPTOR SITES AND RECOMMENDED MITIGATION
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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results in the federal and state noise abatement criteria being exceeded at receptors R3/M3 and R4/M4, the Nevada intake tower and Gold Strike Canyon Trail, respectively. For R3/M3, it should be noted that the project results in only a 1 dBA increase over existing and 3 dBA under the projected no build noise level. Federal and state noise criteria will not be exceeded at R1/M1, representing the Lakeview Point Overlook and planned Historic Railroad Trail, R2/M2 or R5/M5, which represent the raft launching area and the Gold Strike hot springs, respectively.

Based on a study completed by FHWA, the noise produced by a truck traveling at 20 mph is as loud as 85 cars traveling at 20 mph (FHWA, August 2000). Therefore, although modeling shows no perceptible change in future peak-hour average noise levels, high noise emissions from individual trucks crossing the dam will be eliminated, thereby improving the noise environment for HDNHL visitors.

Table 3-10
Future Peak-Hour Noise Levels (dBA-L_{eq})

Receptor Location	Impact Criterion	Existing	Promontory Point	Sugarloaf Mountain	Gold Strike Canyon	No Build
R1/M1	67	50	56	56	51	54
R2/M2	67	52[a]	52[a]	57	52[a]	52[a]
R3/M3	67	73[b]	74[b]	74[b]	74[b]	77[b]
R4/M4	67	39[a]	42	42[a]	65[c]	39[a]
R5/M5	67	60[a]	60[a]	60[a]	60[a]	60[a]

[a] Noise levels at this receptor location are dominated by sources other than vehicular traffic. Therefore, noise levels are based on measured noise levels rather than on modeled.

[b] Noise levels approach or exceed the FHWA noise abatement criterion.

[c] Noise level represents a substantial exceedance of existing levels (i.e., greater than 15 dBA).

Promontory Point Alternative. Noise levels at location R3/M3 would exceed the 67 dBA-L_{eq} criterion because of traffic along U.S. 93. No noticeable noise impacts would occur as a result of U.S. 93 bypass operations.

Sugarloaf Mountain Alternative (Preferred Alternative). Noise levels at location R3/M3 would exceed the 67 dBA-L_{eq} criterion because of traffic along U.S. 93. No noticeable noise impacts would occur as a result of U.S. 93 bypass operations.

Gold Strike Canyon Alternative. Noise levels at location R3/M3 would exceed the 67 dBA-L_{eq} criterion because of traffic along U.S. 93. Noise levels at location R4/M4 would increase to 65 dBA-L_{eq} with the addition of the U.S. 93 bypass. This level would not exceed the 67 dBA-L_{eq} threshold for Category B land uses, but it would constitute a substantial increase (> 15 dBA) under FHWA, NDOT, and ADOT noise abatement policies.[1]

No Build Alternative. Noise levels at location R3/M3 would further exceed the 67 dBA-L_{eq} criterion because of projected increased future traffic volumes on U.S. 93. The projected future noise levels at location R3/M3 would actually be higher because through-trips by

[1]The Nevada Department of Transportation defines the noise abatement criterion as 1 dBA below the FHWA criterion, or 66 dBA.

automobiles and trucks would not be diverted off the dam crossing onto the new bridge alternatives.

3.2.3 Measures to Minimize Harm

3.2.3.1 Construction Mitigation

Promontory Point Alternative. Construction mitigation measures for the Promontory Point Alternative would be the same as those discussed below for the preferred alternative.

Sugarloaf Mountain Alternative (Preferred Alternative). To reduce construction noise levels, the following measures will be implemented:

- Ensure that all engine-powered equipment has mufflers installed according to the manufacturer's specifications
- Require all equipment to comply with applicable equipment noise standards

If specific noise complaints are received during construction, remedial measures will be taken by the resident engineer. These measures could include the following:

- Locate stationary construction equipment as far from nearby noise sensitive properties as possible
- Shut off idling equipment
- Reschedule construction operations to avoid periods of noise annoyance, as determined through consultation with NPS and Reclamation and defined in special provisions
- Notify nearby affected parties whenever extremely noisy work will be occurring
- Install temporary or portable acoustic barriers around stationary construction noise sources

Short-term noise increases from blasting operations may be addressed by the following mitigation measures:

- Publicize the blasting schedule through the local media
- Time blasts so that shock waves created by blasts dissipate or cancel shock waves created by subsequent blasts

Gold Strike Canyon Alternative. Construction mitigation measures for the Gold Strike Canyon Alternative would be the same as those discussed above for the preferred alternative; however, hikers would be excluded along the canyon trail from U.S. 93 to the hot springs for a period of 5 to 6 years (see Chapter 6, Section 4(f) Evaluation).

3.2.3.2 Operational Mitigation

Traffic noise impacts can be mitigated by using several available methods. Available traffic noise abatement measures include traffic management, highway design, and construction of noise barriers.

Traffic management measures include modifying speed limits and restricting or prohibiting truck traffic. Trucks are louder than cars; therefore, restricting their use on project roadways would reduce noise levels at nearby sensitive receptors. However, as U.S. 93 is

projected to be a major NAFTA truck route, predicted year 2017 traffic volumes used for this noise analysis assume a fairly high (18 percent) level of truck traffic. Reduction of traffic speeds would also result in lowered traffic noise levels. However, restricting the types of vehicles or reducing vehicle speeds would conflict with the purpose of this project, which is to decrease congestion and increase safety on Hoover Dam and improve regional traffic flow.

Constructing noise barriers between roadways and affected receptors reduces noise levels by physically blocking the transmission of traffic-generated noise. Barriers can be constructed as walls or earthen berms. As a general guideline, barriers should be high enough to break the line-of-sight between the noise source and the receptor. Barriers must also be long enough to prevent significant flanking of noise around the ends of the barrier. Openings in barriers, such as for driveways, can significantly reduce barrier effectiveness. Earthen berms require more right-of-way than walls and are usually constructed with a 3-to-1 slope. Because the terrain is very steep along the proposed project area roadways, which will have a high percentage of steep cuts, fills, and structures, using earthen berms for noise mitigation may not be reasonable. Walls can be constructed using concrete, wood, or metal.

Promontory Point Alternative. No noise impacts are expected as a result of the Promontory Point Alternative; therefore, no noise mitigation would be required.

Sugarloaf Mountain Alternative (Preferred Alternative). No noise impacts are expected as a result of the Sugarloaf Mountain Alternative; therefore, no noise mitigation would be required.

Gold Strike Canyon Alternative. Noise receptor location R4/M4 would be impacted under the Gold Strike Canyon Alternative due to a substantial exceedance of existing noise levels. Table 3-11 shows the effects of noise barriers constructed along the U.S. 93 bypass in the vicinity of location R4/M4. Figure 3-1 shows the approximate limits of the noise barriers.

Table 3-11 shows that noise barriers, located on the outside shoulder of the roadway on the trail side, could reduce noise levels at R4/M4 to 59 dBA-L_{eq} under the Gold Strike Canyon Alternative. Noise levels would continue to substantially exceed existing levels (by 20 dBA). Although the noise impact would not be completely mitigated, an insertion loss of up to 6 dBA would be possible with the addition of noise barriers.

Table 3-11
Gold Strike Canyon Alternative
Future Peak-Hour Noise Levels (dBA-L_{eq})

Receiver Location	Build, No Mitigation	8-Foot Barrier[a]	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
R4/M4	65	59	59	59	59	59

[a] Minimum barrier height required to break the line-of-sight between an 11.5-foot-truck exhaust stack and the noise receptor.

3.3 Biology

3.3.1 Affected Environment

The proposed project area consists of the Black Canyon of the Colorado River where it crosses the eastern Mojave Desert. The Black Mountains to the east and the El Dorado Mountains to the west dominate the area's topography. These ranges are part of the Basin and Range Geologic Province, with numerous isolated mountain ranges running north to south throughout the Great Basin.

The Black Canyon has winter habitat for bald eagles. Portions of the proposed project area have been previously disturbed by human-made developments, including Hoover Dam, Lake Mead, U.S. 93, electric transmission line towers, construction spoil sites, maintenance facilities, and access roads. Figure 3-2 shows the locations of sensitive biological resources in the proposed project area.

3.3.1.1 Terrestrial Vegetation and Wildlife Communities

Plant communities and associated wildlife in the proposed project area are typical of the Eastern Mojave Desert. Within areas adjacent to the LMNRA, about 463 vertebrate animals are known to occur (Niles et al., 1977). The checklist of vascular plants for the LMNRA is at 800 specific and intraspecific taxa (Holland et al., 1979). This species list is maintained by NPS. Vegetation-type classifications (Brown, 1982) and typical landscapes, plant communities, and wildlife habitats found in the proposed project area are described below.

Creosote-Bursage Plant Community. Creosote-bursage is the dominant vegetation found in the proposed project area, comprising about 70 percent of the LMNRA (NPS, 1986) and most of the Mojave Desert below the 3,000-foot elevation. Dominant plant species include creosote bush, white bursage, sweetbush, white ratany, brittlebush, indigo bush, and Mojave yucca. Associated cacti include single barrel cactus, silver cholla, and beavertail. Common perennial plant species include globemallow and desert trumpet.

Desert Wash Community. Desert washes that support the desert wash community provide relatively higher soil moisture than the creosote-bursage plant community. Within the proposed project area, this community is limited to the bottom of a few narrow drainages found in Gold Strike Canyon. Species composition is similar to the creosote-bursage plant community, with the addition of catclaw acacia, and less occasionally, honey mesquite and desert willow. This plant community has a more complex vegetative structure than the surrounding creosote-bursage plant community, which contributes to more abundant and diverse wildlife. More bird species are found in desert washes than in the surrounding creosote-bursage plant community.

Seep Wetlands and Riparian Areas. A concentration of active springs and seeps occurs on both sides of the Colorado River between Hoover Dam and Willow Beach and in some side canyons including Gold Strike Canyon. Many of these springs and seeps are geothermal, highly mineralized, and support specialized aquatic plants and invertebrates. Riparian and wetland plant species associated with these areas include maidenhair fern, bushy beardgrass, sedges, cattails, salt grass, arrowweed, and salt cedar. The natural riparian vegetation in Gold Strike Canyon has been disturbed by recreational use. The large wash in Arizona immediately south of the Gold Strike Canyon Alternative supports a dense stand of saltcedar and other riparian vegetation. Riverbanks along the Colorado River immediately

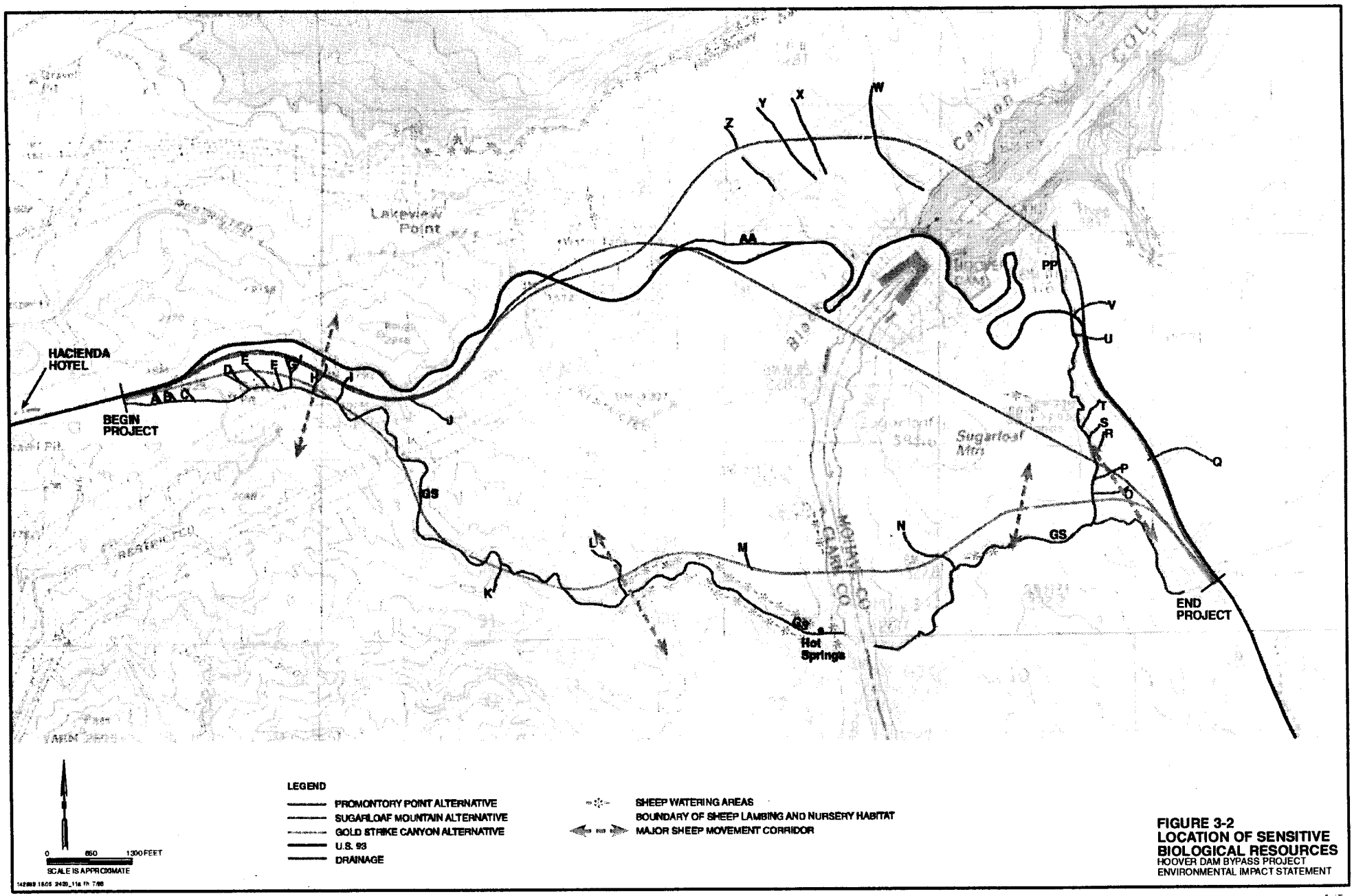

FIGURE 3-2
LOCATION OF SENSITIVE BIOLOGICAL RESOURCES
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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downstream of Hoover Dam support only widely scattered stands of sparse riparian plants, of which saltcedar is the predominant shrub species.

Waters of the United States. Well-defined drainage paths generally exist throughout most of the proposed project area (see Figures 3-2 and 3-3). Approximately 27 small, natural intermittent washes occur along the proposed alignments that drain relatively small watersheds (designated as A through Z, AA, GS, and PP on Figures 3-2 and 3-3). These are narrow washes (1 to 3 feet wide) that drain a local watershed of approximately 2 acres. Two larger, intermittent desert washes also occur in the study area. These washes are broader (from a few feet to over 20 feet wide) and drain watersheds that cover more than 50 acres. One of the larger washes (Gold Strike Canyon Wash) runs along the Gold Strike Canyon Alternative (GS on Figure 3-3). The lower end of the wash has perennial flow. Hot springs occur before the terminus at the Colorado River, producing year-round runoff into the river. A medium-sized, unnamed drainage runs in a north-south direction west of U.S. 93 in Arizona, intersecting each of the build alternatives (PP on Figure 3-3). The major perennial water source in the area is the Colorado River. As shown on Figure 3-3, the river (Lake Mead) is approximately 1,000 feet wide upstream of Hoover Dam and approximately 400 feet wide downstream of Hoover Dam. The width of the river varies both daily and seasonally depending on the amount of rainfall and the amount of water released by Hoover Dam to Lake Mohave.

A field delineation was performed in March 1998 (see Figure 3-3) to determine the extent of waters of the United States under the jurisdiction of the U.S. Army Corps of Engineers. All of the desert washes shown on Figure 3-3 and the Colorado River are considered waters of the United States. No jurisdictional wetlands were identified in the proposed project area.

Cliff Habitat. Extensive cliff habitat exists immediately adjacent to the Colorado River and in Gold Strike Canyon. Many of these areas are composed of basalt and andesite, which have the necessary cracks, ledges, and caverns to provide cover for many wildlife species. These volcanic rocks resist erosion, thus providing relatively stable habitat. Plants adapted for steep cliffs in Black Canyon include cloak fern, pungent brickellia, desert tobacco, pygmy cedar, and desert rock nettle. Cliffs in Black Canyon support reptiles, birds, and mammals. Various raptor species use upward-flowing warm air currents associated with the higher cliffs. Cliff habitat in arid landscapes within 0.25 mile of water has an especially high wildlife value (Maser et al., 1979).

Examples of wildlife species found in the cliff habitat of Black Canyon include collared lizard, chuckwalla, peregrine falcon, bald and golden eagle, great horned owl, white-throated swift, common raven, canyon wren, several bat species, and desert bighorn sheep. A colony of double-crested cormorants has nested recently on the cliffs on the Nevada side of the canyon about 100 yards downstream of Hoover Dam.

3.3.1.2 Aquatic Communities

Colorado River. After Hoover Dam was built, the portion of the Colorado River downstream of the dam changed from a warm, silt-laden river to a cold-water river system. Thus, native warm-water fish, such as the Colorado River squawfish, humpback and bonytail chub, and razorback sucker have been affected by introduced cold-water species. The area downstream of Hoover Dam has subsequently become a popular trout fishery. The Colorado River has been stocked with rainbow trout to maintain the fishery because natural reproduction rates are low or nonexistent.

The Colorado River supports birds during migration and in winter. Yearlong resident waterbird species include the pied-billed grebe, double-crested cormorant, ruddy duck, common gallinule, and American coot (Blake, 1978).

Lake Mead. The LMNRA, although seemingly barren, contains a surprising variety of plants and animals, some of which are found nowhere else in the world. This reservoir, described as a deep, subtropical, moderately productive desert impoundment, supports a valuable sport fishery (Baker et al., 1977). Fish species occurring in Lake Mead are striped and largemouth bass, channel catfish, bluegill, and black crappie (Liston and Grabowski, 1988).

3.3.1.3 Wildlife Resources

The proposed project area supports wildlife characteristic of the eastern Mojave Desert. Biological diversity varies according to topography, plant community, proximity to water, soil type, and season. A literature search and field survey revealed 64 mammal species, 313 bird species, and 46 amphibian and reptile species occurring in the LMNRA (Niles et al., 1997).

The most abundant mammals in the proposed project area are cactus mice and Merriam kangaroo rats. Desert kangaroo rats and desert pocket mice are relatively uncommon and are restricted to areas with sandy soil, such as desert washes. Species associated with rocky habitats include the wood rat, rock pocket mouse, and rock squirrel. Species such as the black-tailed hare, desert cottontail, and southern grasshopper mouse also have widespread distribution in the proposed project area.

The most widespread and numerous predators in the proposed project area are the coyote, gray fox, and several species of raptors (birds of prey). Mountain lion and bobcat are less common and are associated with cliff habitat, dependent on availability of prey.

The proposed project area supports diverse and abundant reptile populations. According to NPS, common species include zebra-tailed, long-tailed brush, desert spiny, and western whiptail lizards, and western diamondback and speckled rattlesnakes.

Birds are the most diverse and abundant class of vertebrate animals found in the proposed project area. The greatest number of birds are associated with major desert washes. Typical breeding birds found in the desert washes include Gambel's quail, mourning dove, ash-throated flycatcher, verdin, and black-tailed gnatcatcher. Breeding birds found in the creosote-bursage plant community include black-throated sparrow and cactus wren. Numerous migratory birds (including Brewer's sparrow, western flycatcher, and species of warblers) move through the proposed project area. Wintering birds include phainopepla, horned lark, and ruby-crowned kinglet.

Special-status species are protected pursuant to federal and state laws. These include those species listed as threatened and endangered and those proposed for listing as threatened and endangered. Although candidate species (federal) and species of concern (federal and state) are not currently protected under federal or state laws, they are also considered special-status species in this analysis, since during the project these species may be upgraded to threatened or endangered status. These special-status species include:

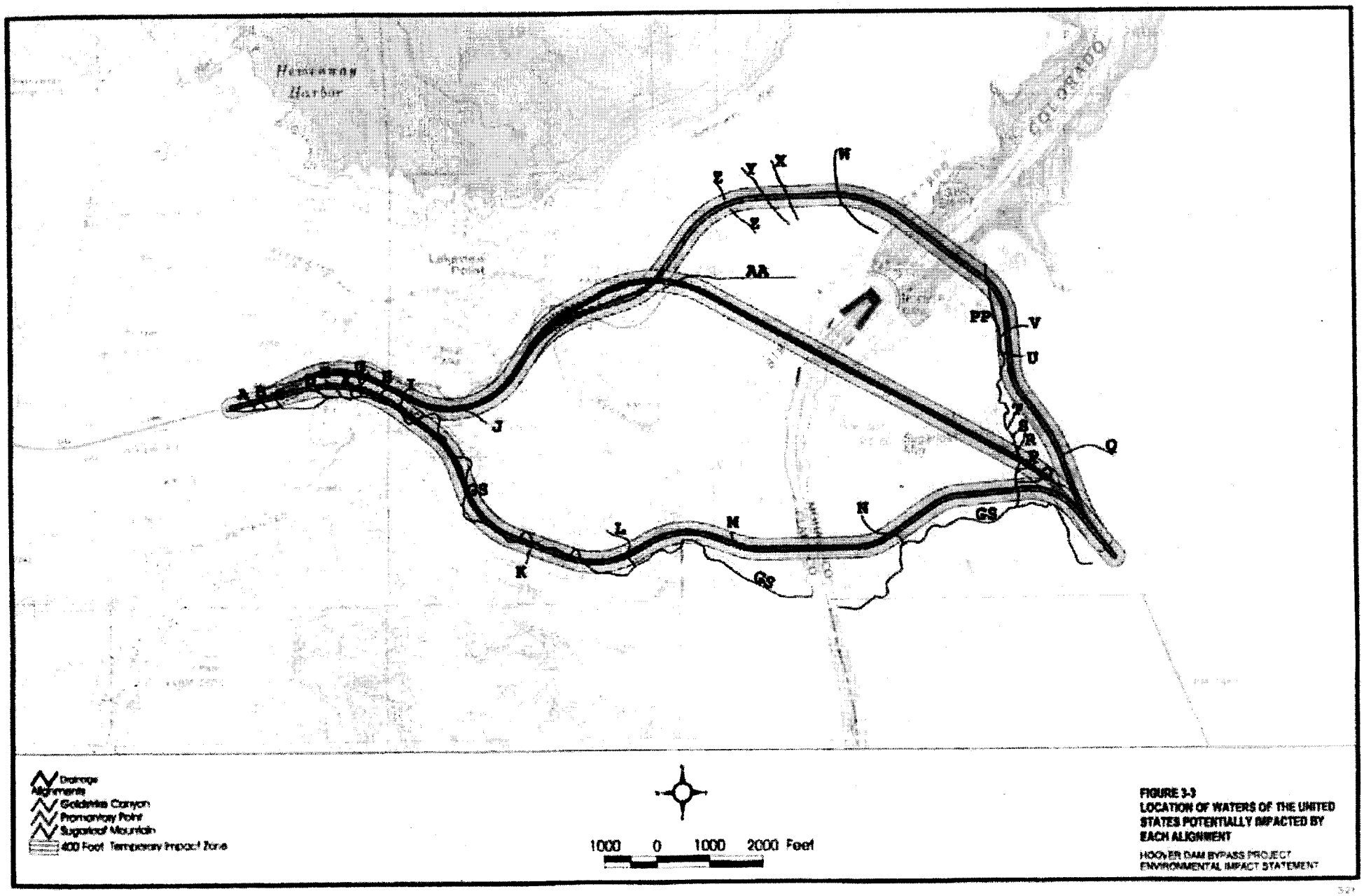

FIGURE 3-3
LOCATION OF WATERS OF THE UNITED STATES POTENTIALLY IMPACTED BY EACH ALIGNMENT

HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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- Wildlife and plant species listed or proposed for listing as threatened or endangered pursuant to the federal *Endangered Species Act* (50 CFR 17.11 for wildlife, 50 CFR 17.12 for plants; and various notices in the *Federal Register* for proposed species)
- Wildlife and plant species that are candidates for listing as threatened or endangered pursuant to the federal *Endangered Species Act* (50 CFR 17, February 28, 1996) (USFWS 1997a, b)
- Species listed by the State of Arizona as threatened or endangered
- Wildlife species identified by AGFD as a species of concern (wildlife species that do not have state or federal status but may still be threatened with extinction)
- Species listed by the State of Nevada as protected (Nevada Administrative Code, Section 503.001-XX); and wildlife species identified by the Nevada Division of Wildlife (NDOW) as a species of concern (wildlife species without state or federal status, but which may be threatened with extinction)

Table 3-12 lists federal special-status species that may occur in the proposed project area, their status, and the likelihood of their presence there. State special-status species (Nevada and Arizona) potentially occurring in the proposed project area are also included in Table 3-12.

Table 3-12
Special-status Vegetation and Wildlife Species Potentially Occurring in the Proposed Project Area and Likelihood of Occurrence

Common Name	Scientific Name	Federal/State Status	Likelihood of Occurrence in Proposed Project Area
Plants			
Las Vegas bear paw poppy	*Arctomecon californica*	FSC/NP& ASC	The Las Vegas bear paw poppy occurs in the LMNRA, but has not been observed within the proposed project area.
Bicolored penstemon	*Penstemon bicolor* ssp. *roseus*	FSC/NP & ASC	Bicolored penstemon occurs in wash gravels or disturbed roadsides at elevations from 1,950 to 5,500 feet. It occurs in the LMNRA, but has not been observed within the proposed project area.
Fish			
Bonytail chub	*Gila elegans*	FE/NP & ASC	The lack of suitable habitat near Hoover Dam and cold water temperatures prevent the area from supporting a viable population.
Razorback sucker	*Xyrauchen texanus*	FE/NP & ASC	Unsuitable habitat and non-native predatory fish prevent reproduction, recruitment, or the occurrence of viable population in the river directly downstream of Hoover Dam (Reclamation, 1992). Some individual adult razorback suckers inhabit the Black Canyon area of the river.
Devil's hole pupfish	*Cyprinodon diabolis*	FE/NP	Devil's hole pupfish are not present at Hoover Dam. A refugium (fish stocking tank) near the raft put-in is being restored to repopulate pupfish in the area.

Table 3-12
Special-status Vegetation and Wildlife Species Potentially Occurring in the Proposed Project Area and Likelihood of Occurrence

Common Name	Scientific Name	Federal/State Status	Likelihood of Occurrence in Proposed Project Area
Amphibians			
Relict leopard frog	*Rana onca*	/NP & ASC	This species has been found in springs downstream of Hoover Dam and in springs on the Overton Arm of Lake Mead (USFWS, 1997b). Surveys conducted by NPS in April and May 1998 at Sugarloaf Spring and Gold Strike Canyon hot spring did not find *Rana onca* at either drainage (Bill Burke, NPS, June 5, 1998 memorandum report).
Reptiles			
Desert tortoise (Mojave population)	*Gopherus agassizii*	FT/NP	Low-density tortoise habitat (supporting fewer than 40 tortoises per square mile) was found throughout the proposed project area. The area was determined to be marginal habitat because of the large amount of rocky terrain and disturbance to the more suitable habitat. The area supports a few desert tortoises of both Mojave and Sonoran populations in Nevada and Arizona, respectively.
Desert tortoise (Sonoran population)	*Gopherus agassizii*	FSC/ASC	
Chuckwalla	*Sauromalus obesus*	FSC/	This species is found in rocky creosote bush habitat along the three build alternatives, especially in talus at the base of cliffs.
Banded gila monster	*Heloderma suspectum cinctum*	FSC/NP & ASC	This species occurs in the project area. Population is at an unknown density.
Birds			
Peregrine falcon	*Falco peregrinus anatum*	FE/NP & ASC	This species is usually found in areas near permanent water with nearby cliffs. Five breeding territories in Black Canyon, 1 mile upstream of Hoover Dam and 14 miles downstream, were identified by the AGFD in 1990. It is likely that the peregrine falcon population in Black Canyon has breeding areas every 3 miles along the river.
Bald eagle	*Haliaeetus leucocephalus*	FE/NP & ASC	A wintering bald eagle population exists, fluctuating between 14 and 24 birds in the LMNRA. The proposed project area contains suitable wintering habitat. No eagles were observed at the three build alternative bridge sites during mid-winter from 1981 through 1991. During 1991 through 1998, 26 bald eagles were observed by the NPS over a 24-mile stretch of Black Canyon, from Hoover Dam to El Dorado Canyon. Most of these sightings occurred during 1996 (12) and 1998 (11). Not more than one or two eagles were observed within 3 miles of the proposed bridge sites.

Table 3-12
Special-status Vegetation and Wildlife Species Potentially Occurring in the Proposed Project Area and Likelihood of Occurrence

Common Name	Scientific Name	Federal/State Status	Likelihood of Occurrence in Proposed Project Area
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE/NP & ASC	In 1997, nesting pairs of southwestern willow flycatchers were documented along the Colorado River at least 40 miles from the proposed project area (Reclamation, 1998). The desert wash/ riparian areas that would be affected by the three build alternatives have no potential to be used by breeding southwestern willow flycatchers.
Mammals			
Spotted bat	*Euderma maculatum*	FSC/NP & ASC	Bat surveys were conducted by NPS in April and May 1998 to inventory the species present within the build alternative corridors. Three locations were surveyed. The surveyed sites, chosen for their proximity to water and vegetation, were Sugarloaf Canyon, Arizona; Gold Strike Canyon, Nevada; and the Hoover Dam sewer lagoons, Arizona. Mist netting proved unsuccessful in all three locations due to a variety of factors, including weather conditions, time of year, and low densities and numbers of bats present. Echolocation calls were recorded using the "Anabat II" system, and species identification was obtained after analysis of the calls. Identification has been confirmed by Biologist Mike O'Farrell, an authority in the analysis of Anabat recordings. High densities of bats were not found at any of the survey locations (Bill Burke, NPS, June 5, 1998 memorandum report).
Yuma myotis bat	*Myotis yumanensis*	FSC/ASC	
Small-footed myotis bat	*Myotis ciliolabrum*	FSC/	
Fringed myotis bat	*Myotis thysanodes*	FSC/ASC	
Long-legged myotis bat	*Myotis volans*	FSC/ASC	
Big free-tailed bat	*Nyctinomops macrotis*	FSC/ASC	
Desert bighorn sheep	*Ovis canidensis nelsoni*	/NP	The combination of the rugged topography of Black Canyon and the water sources along the Colorado River provides exceptional, high-quality desert bighorn sheep habitat.
Yuma puma (mountain lion)	*Felis concolor browni*	/ASC	The historic distribution of the mountain lion includes the mountainous terrain on both sides of the lower Colorado River from Lake Mead to the Gulf of California. Predation on desert bighorn sheep by mountain lions in the proposed project area has been documented (Cunningham and Hanna, 1992; Cooperative National Park Resources Studies Unit, 1990).

Notes

Source: USFWS, 1997a; The Wildlife Society, 1996

Federal Status Codes:
FE—Federally-listed endangered
FT—Federally-listed threatened
FSC—Federal species of concern. These species were formerly known as "Category 2 Candidates." USFWS does not have enough scientific information to support a listing proposal for these species. The USFWS is still concerned about these species and continues to gather information about them.

State Status Codes:
NP—State of Nevada protected (either endangered, threatened, or species of concern)
AT—State of Arizona threatened
ASC—Arizona species of concern

3.3.2 Environmental Consequences

Construction and maintenance activities have disturbed much of the habitat in the proposed project area. Between 20 and 70 percent of the land within the proposed highway right-of-way corridors show signs of past disturbance resulting from dam construction and construction of access roads, electric transmission towers and switchyards, and building sites. In many areas, the land has been scraped down to mineral soil or covered with spoil material. However, wildlife does occur in the altered/disturbed areas, which have minimal human presence and recent disturbance.

Habitats along the three build alternatives were evaluated to determine whether disturbance has occurred. Table 3-13 summarizes those results. Impacts from the No Build Alternative are summarized in Tables 3-13 and 3-14.

3.3.2.1 Construction Impacts

Impacts to biological resources normally occur during construction. Construction impacts identified below were determined based on an average construction right-of-way of 300 feet.

Aside from Lake Mead and the Colorado River, water sources valuable to wildlife are scarce in the proposed project area. As Figure 3-2 shows, each of the build alternatives could affect at least one water source. The Promontory Point Alternative could affect a sump field located near the Reclamation warehouse. The Sugarloaf Mountain Alternative would affect sewage disposal ponds, used as a wildlife watering source, and warehouse water sources. The Gold Strike Canyon Alternative would affect water flow through the lower course of the canyon. According to NDOW, this is a very important perennial water source to wildlife, specifically bighorn sheep. Noise disturbance during construction could affect wildlife using the Colorado River near the hot springs south of the Gold Strike Canyon Alternative. Adverse impacts, as a result of construction, will not occur with the No Build Alternative. This alternative assumes continuation of existing conditions.

Impact of Construction on Common and Special-Status Plant Species. Because no special-status plant species occur along the three build alternatives, no impacts to such species would occur as a result of construction of any of the build alternatives. Construction impacts from equipment storage, parking, and staging areas would, however, result in disturbing several common plant species within the construction zone. Construction of the proposed alternative, including the construction zone itself, would result in the removal of approximately 122 to 143 acres (depending on the alternative) of creosote-bursage habitat (see Table 3-13).

Table 3-13
Comparison of Impacts to General Terrestrial Communities from All Alternatives (Colorado River Bridge – Hoover Dam)

	Alternative			
Impact	**Promontory Point**	**Sugarloaf Mountain**	**Gold Strike Canyon**	**No Build**
Total land disturbance[a]	3.55 miles 134 acres	3.35 miles 122 acres	3.30 miles 143 acres	No change
Impact from soil disposal sites	5 acres	0 acre	23 acres	No change

Table 3-13
Comparison of Impacts to General Terrestrial Communities from All Alternatives (Colorado River Bridge – Hoover Dam)

	Alternative			
Impact	Promontory Point	Sugarloaf Mountain	Gold Strike Canyon	No Build
Habitat previously undisturbed[b]	29 acres 22 percent	26 acres 21 percent	100 acres 70 percent	No change
Desert wash habitat loss	0.6 acre	0.3 acre	11 acres	No change
Seep wetlands and riparian loss	No impact	No impact	No impact	No change
Cliff habitat loss	About 4.2 acres affected by road construction	About 1.4 acres affected by road construction	About 12.7 acres affected by road construction	No change
	Slight disturbances at bridge site	Slight disturbances at bridge site	Slight disturbances at bridge site	
General habitat concerns	Habitat quality is low due to existing disturbances	Habitat quality is low due to existing disturbances	Relatively high quality due to area's isolation	No change
Other miscellaneous impacts	Movement of existing transmission lines and towers would result in minor land disturbance	Movement of existing transmission lines and towers would result in minor land disturbance	No impact	No change

[a] Based on average construction of 300-foot right-of-way. Most vegetation loss is creosote-bursage habitat. About 50 percent of loss could be rehabilitated.

[b] Estimated by aerial photograph interpretation and ground truthing by a Reclamation biologist.

None of the alternatives traverse the seep wetlands or riparian areas, and measures would be taken to protect these areas from indirect impacts during construction. The loss of creosote-bursage habitat (caused by any of the alternatives) is not considered substantial because of the large amounts of similar habitat in the nearby Mojave Desert.

Impact from Construction on Cliff Habitat. Some impact would occur to cliff habitat at the bridge piers and abutments for all build alternatives. Highway construction would remove about 50 vertical feet of cliff habitat on the Arizona side of the Sugarloaf Mountain and Promontory Point bridges (out of about 800 vertical feet). The Gold Strike Canyon Alternative would affect the greatest amount of cliff habitat, or 12.7 acres (Sugarloaf Mountain, 1.4 acres and Promontory Point, 4.2). Loss of cliff habitat is more critical than loss of creosote-bursage habitat because cliff habitat occurs in a limited area and provides unique value to certain plants and wildlife. Cliff habitat near the Colorado River is especially valuable because of its proximity to water.

Impact from Construction on Common and Special-Status Wildlife. During construction, common and special-status wildlife species may be temporarily displaced due to habitat alteration or noise disturbances from construction equipment. Implementing the build alternatives would result in the permanent loss of 26 to 100 acres of potential wildlife habitat (see Table 3-13). These habitats provide roosting, nesting, hiding, and foraging

habitat for wildlife species. Without migration, wide-ranging species such as predators and desert bighorn sheep would permanently lose a portion of their foraging and breeding habitat, resulting in lowered overall carrying capacities from loss of habitat and reduced food sources. Breeding birds such as the black-throated sparrow would permanently lose nesting habitat, cover, and feeding areas.

Construction would have the most pronounced and immediate affects on burrowing rodents and reptiles with small territories. Individuals of those species would either be killed or permanently displaced by excavation and other ground disturbance. It is anticipated that the more mobile wildlife species using the proposed project area would move from the area into surrounding habitats during construction.

Table 3-14 summarizes impacts of the three alternatives to special-status species. A Biological Assessment prepared in 1992 by Reclamation addressed potential impacts to listed species (Reclamation, 1992). This assessment determined that the alternatives may affect the desert tortoise (all three build alternatives), peregrine falcon (Promontory Point and Gold Strike Canyon Alternatives), and chuckwalla (Promontory Point and Gold Strike Canyon Alternatives).

An updated Biological Assessment (BA) was prepared by FHWA and submitted to USFWS with a letter dated February 17, 1999, requesting formal consultation on the Sugarloaf Mountain Alternative (FHWA, 1999). On June 3, 1999, USFWS issued a Biological Opinion for the Hoover Dam Bypass Project (Appendix E). This document represents the opinion of USFWS on the potential effects of the proposed bypass project on federally listed species under the Endangered Species Act of 1973.

The Biological Opinion concludes that the project will not likely affect the following endangered species: bald eagle, American peregrine falcon, razorback sucker, southwestern willow flycatcher, bonytail chub, and Devil's Hole pupfish. For the Mojave desert tortoise, a federally listed threatened species, USFWS found that the project is not likely to jeopardize its continued existence or adversely impact designated critical habitat. USFWS stipulated "reasonable and prudent" measures to minimize project effects on the desert tortoise (see Section 3.3.3.1).

A letter dated November 21, 1997 from the USFWS to the FHWA verified the list of species addressed in the 1992 Biological Assessment (USFWS, 1997). This list was recently updated by USFWS in a letter dated December 5, 2000; this verified the 1997 list for threatened and endangered species (Appendix C).

Table 3-14
Comparison of Impacts of All Alternatives to Special-Status Species

	Alternative			
Species	**Promontory Point**	**Sugarloaf Mountain**	**Gold Strike Canyon**	**No Build**
Devil's hole pupfish	No effect	No effect	No effect	Potential impacts from hazardous material spills
Bonytail chub	No effect	No effect	No effect	Potential impacts from hazardous material spills
Razorback sucker	No effect	No effect	No effect	Potential impacts from hazardous material spills

Table 3-14
Comparison of Impacts of All Alternatives to Special-Status Species

Species	Alternative			
	Promontory Point	Sugarloaf Mountain	Gold Strike Canyon	No Build
Chuckwalla	Impact to rocky habitat in mostly disturbed habitat	Impact to the least amount of rocky habitat in mostly disturbed areas	Impact to the greatest amount of rocky habitat in mostly undisturbed areas	No impacts anticipated
Desert tortoise	Impact to 129 acres of marginal habitat; may affect 8 tortoises in low-density population	Impact to 120 acres of marginal habitat; may affect 8 tortoises in low density population[a]	Impact to 131 acres of marginal habitat; may affect 9 tortoises in low-density population	Future minor loss of habitat from expansion of transmission lines
Peregrine falcon	Impact possible without mitigation; breeding territory is within 1 mile of bridge site (NDOW, 1993)	Impact possible without mitigation; peregrines may forage within project area	Impact possible without mitigation; possible breeding territory within 1 mile of bridge site (NDOW, 1993)	No impacts anticipated; expanding population will stabilize
Bald eagle	Impact unlikely; no known roosting sites near bridge site	Impact unlikely; no known roosting sites near bridge site	Impact unlikely; no known roosting sites near bridge site	No impacts anticipated; possible establishment of breeding population
Desert bighorn	Adverse impact to 25 acres of lambing habitat; access to one natural water source disrupted; need for 9 crossing structures	Adverse impact to 20 acres of lambing habitat; impact to one human-made water source; need for 8 crossing structures	Adverse impact to 55 acres of lambing habitat; access to 3 natural water sources disrupted; need for 13 crossing structures	Gradual increase in highway mortality
Mountain lion[b]	Impact unlikely; loss of 4.2 acres of cliff habitat near developed area	Impact unlikely; loss of 1.4 acres of cliff habitat near developed area	Impact possible; loss of 12.7 acres of cliff habitat in mostly undisturbed, isolated area	No impacts anticipated; population appears to be expanding
Las Vegas bear paw poppy	No impact; gypsum soil not found in this area	No impact; gypsum soil not found in this area	No impact; gypsum soil not found in this area	No impacts anticipated
Bicolored penstemon	Impact possible; disturbance to 0.3 acre of desert wash	Impact possible; disturbance to 0.3 acre of desert wash	Impact possible; disturbance to 10 acres of desert wash	No impacts anticipated

[a] Based on a review of the updated Biological Assessment (FHWA, 1999), USFWS determined in their Biological Opinion that construction of the Sugarloaf Mountain Alternative may result in the direct loss of 5 federally threatened Mojave desert tortoises in Nevada and 80 acres of Mojave desert tortoise habitat in Nevada (see Biological Opinion, Appendix E).

[b] Mountain lions have been sighted several times throughout the proposed project area. Although the area is within the historic range of the Yuma puma, the classification of lions presently residing in the proposed project area is unknown.

Impact from Construction on Desert Tortoise (USFWS Biological Opinion, Appendix E). USFWS determined in their June 3, 1999, Biological Opinion that building the Sugarloaf Mountain Alternative may result in the direct loss of 5 federally threatened Mojave desert tortoises and 80 acres of Mojave desert tortoise habitat in Nevada. In addition, desert

tortoises found in the construction area and on access roads may be harassed by capture and removal, resulting in an estimated 20 tortoises being harassed in association with construction of the preferred alternative. An unknown number of desert tortoise eggs may be destroyed during construction activities. Furthermore, an unknown number of tortoises may be taken in the form of indirect mortality or harm due to increased predation by ravens drawn to trash in the project area and from increased noise and ground vibrations associated with construction.

Impacts will occur from grading and removal of vegetation, digging of tunnels, deposition of spoil material, construction of new roads and bridges, and other activities requiring the use of blasting, heavy equipment, and machinery. Desert tortoises may be killed or injured by vehicles and may be harassed through removal from the construction area. The proposed project could result in the death or injury of desert tortoises that move onto the construction site and roads used by preconstruction and construction crews (Bury, 1978; Luckenbach, 1975; and Nicholson, 1978). Vehicles that stray from the construction area and roads may crush desert tortoises above ground or in their burrows. Habitat used by tortoises for foraging, breeding, and cover will be temporarily disturbed or permanently destroyed. Desert tortoises may be harmed by noise and ground vibrations produced by vehicles and heavy equipment and by blasting operations (Bondello, 1976; and Bondello et al., 1979). Shock waves from blasting may collapse burrows, thereby crushing tortoises.

Tortoises might be unlawfully collected as pets by project personnel, thereby removing them from the wild population. Tortoises that are physically moved out of project areas to prevent mortality or injury could be inadvertently harmed if not handled properly. Urine and large amounts of urates are frequently voided during handling, which may cause a severe water loss, particularly to juveniles (Luckenbach, 1982). Overheating can occur if tortoises are not placed in the shade when ambient temperatures equal or exceed temperature maximums for the species (Desert Tortoise Council, 1996).

However, as discussed in the Biological Opinion (Appendix E), USFWS determined that the level of effect resulting from the project will not reduce appreciably the likelihood of survival and recovery of the Mojave population of the desert tortoise in the wild because:

1. Desert tortoise densities within the proposed project area are very low
2. The proposed project does not occur within conserved habitat or an area designated for recovery of the desert tortoise
3. Impacts to desert tortoises within the project area represent a small impact to the Mojave population of the desert tortoise when total desert tortoise population numbers and geographical extent are considered.

Impact from Construction on Desert Bighorn Sheep. Construction and post-construction activities would render some of the bighorn habitat unusable to a portion of the population in the Black Mountains of Arizona and the El Dorado Mountains of Nevada. Construction activities would occur in habitat where desert bighorn are accustomed to human activities (e.g., traffic, blasting, and maintenance activities around Hoover Dam). However, it is possible that construction could affect ewes during lambing season, causing a temporary lambing decrease in a localized area. Ewes may breed late, prolonging lambing until later in the spring when environmental conditions are less favorable (Cunningham and Hanna, 1992). Table 3-15 compares impacts of the alternatives on desert bighorn.

Table 3-15
Comparison of Impacts of Build Alternatives on Desert Bighorn Sheep

Impact	Alternative		
	Promontory Point	Sugarloaf Mountain[a]	Gold Strike Canyon[a]
Overall quality and quantity of habitat		**Nevada**	
	Moderate amount of bighorn use	Lowest amount of bighorn use	Highest amount of bighorn use
		Arizona	
	Relatively lower amount of bighorn use	Relatively higher amount of bighorn use	Relatively higher amount of bighorn use
Lambing habitat		**Nevada**	
	Loss of about 25 acres of lambing habitat	No loss of lambing habitat	Loss of about 35 acres of lambing habitat
		Arizona	
	No loss of lambing habitat	Loss of about 20 acres of lambing habitat	Loss of about 20 acres of lambing habitat
Movement corridors		**Nevada**	
	Alternative crosses one major movement corridor	Alternative crosses one major movement corridor	Alternative crosses two major movement corridors
		Arizona	
	Alternative does not cross major movement corridor	Alternative crosses one or more major movement corridors	Alternative crosses two major movement corridors
Water sources		**Nevada**	
	Alternative would not affect water source	Alternative would not affect water source	Alternative would affect the Gold Strike Canyon ephemeral wash and tributaries
		Arizona	
	Construction could disrupt movement to water source in Lake Mead	Alternative would affect one human-made water source	Alternative would affect one natural water source

[a] Numerous minor crossings exist in both states.

Impact from Construction on Nesting Raptors and Protected Migratory Birds. Breeding raptors (i.e., birds of prey), including peregrine falcon or other birds protected by the *Migratory Bird Treaty Act* may be nesting in the cliff habitat during construction. Construction impacts, such as noise from equipment and increased traffic, may cause nest abandonment by nesting birds. This would be an adverse impact.

Impact from Construction on Aquatic Communities. Construction of the new bridge and associated highway approaches would minimally affect the aquatic environment in the proposed project area of the three build alternatives. Cable-stayed and suspension bridge types in the Promontory Point Alternative would require placing a pier in Lake Mead, resulting in temporary, minor affects to Lake Mead water quality during construction in that specific area. Implementing the project would increase turbidity and suspended sediment during construction. Without mitigation, excessive sedimentation could

adversely affect the feeding, growth, and survival of downstream fish by reducing feeding success, and by causing avoidance of rearing habitat.

The improved highway conditions with the build alternatives would significantly reduce the potential for hazardous material spills in Lake Mead and the Colorado River by reducing the risk of truck accidents on U.S. 93. Features to lessen the effects of hazardous spills on the new bridge would include a drainage system on the bridge that would collect liquid spills and drain the spills to holding basins at both ends of the bridge.

Impact from Construction on Waters of the United States. Figure 3-2 shows the three proposed alignments and the washes that will be intersected by each alternative alignment. Table 3-16 identifies the potential acreage of fill in waters of the United States for each alignment based on the roadway and bridge designs in the Reclamation Phase B – Corridor Studies (1992). The calculations of fill are separated into permanent and temporary impact categories based on the assumptions listed below. The acreage of fill in waters of the United States should be reassessed as more detailed highway designs become available.

Table 3-16
Acreage of Permanent and Temporary Fill in Waters of the United States for Each Alignment

Alignment	Temporary Fill 200-Foot Construction Area Each Side of the Centerline	Permanent Fill 50-Foot Impact Area Each Side of the Centerline
Promontory Point[a]	0.76	0.14
Sugarloaf Mountain	0.66	0.11
Gold Strike Canyon	2.77	0.67

[a] Impact areas of suspension bridge west tower: temporary 0.07 ac, permanent 0.06 ac

The following assumptions were used in calculating acreage of fill in waters of the United States:

- An area 200 feet on each side of the centerline of the alignments would temporarily be used for access, construction staging and material stockpiling, or would be filled by adjacent excavated materials. All stockpiled material would be removed following construction.
- For the Gold Strike alignment, all of Gold Strike Canyon Wash from U.S. 93 to Station 117+00, within and outside of the area 200 feet on each side of the centerline, would be used for heavy equipment access resulting in permanent alteration of the wash and temporary fill in waters of the United States.
- An area 50 feet on each side of the centerline of each alignment would be permanently filled by either construction of the road base or side slopes.
- With the exception of the Promontory Point cable-stayed and suspension bridge types, the area below the plane of the ordinary high water mark (OHWM) of the Colorado River (Lake Mead and Lake Mohave) will not be filled by bridge construction on any alignment. Span or arch bridges will be constructed. The Promontory Point bridge west tower would be in the lake, and the impacted acreages are included in Table 3-16.[2]

[2]If the Promontory Point Alternative were selected, a U.S. Coast Guard permit under Section 9 of the Rivers and Harbors Act would be required for construction of the bridge over Lake Mead. The fill for bridge pier construction would also be subject to U.S. Army Corps of Engineers Nationwide Permit #15 under Section 404 of the Clean Water Act.

- Bridge construction for all other drainages will result in permanent fill in waters of the United States. Structural piers, retaining walls, and abutment excavation associated with the bridge construction will result in fill in waters of the United States.

3.3.2.2 Operational Impacts

Impact of Operation on Common and Special-Status Wildlife. Without planned fencing, increased road kill of wildlife is expected. Wildlife regularly using the area in the vicinity of the new alternative would be expected to cross the roadway at some location. Nocturnal birds and mammals are especially at risk of collision due to temporary blindness from vehicle lights (Schultz, 1986).

Impact of Operation on Desert Tortoise. According to the USFWS Biological Opinion (Appendix E), postconstruction indirect effects will result from operation of the proposed project. These effects are later in time and are reasonably certain to occur. Obviously, road kills of tortoises on the new highway are a direct, adverse impact on this wildlife population. However, indirect effects during operation and maintenance are subtle and may affect tortoise populations and habitat quality over an extended period of time. Indirect effects are of particular concern for long-lived species such as the tortoise because project-related effects may not become evident in individuals or populations until years later.

Operation and maintenance (as well as construction) activities associated with the project may create trash and litter or standing water adjacent to the highway facility that could attract tortoise predators such as the common raven, kit fox, and coyote (Berry, 1985; and BLM, 1990). Natural predation in undisturbed, healthy ecosystems is generally not an issue of concern. However, predation rates may be altered when natural habitats are disturbed or modified. Common raven populations in some areas of the Mojave Desert have increased 1,500 percent from 1968 to 1988 in response to expanding human use of the desert (Boarman, 1992). Since ravens were scarce in this area prior to 1940, the current level of raven predation on juvenile desert tortoises is considered to be an unnatural occurrence (BLM, 1990).

Impact of Operation on Desert Bighorn Sheep. Results of studies by Cunningham and Hanna (1992) and Ebert and Douglas (1993) show that the main threat of project implementation to desert bighorn is an increase in vehicle and bighorn collisions. The main concern of NDOW and AGFD has been the existence of a new four-lane, high-speed highway in bighorn habitat that would increase the number of animals killed along the highway.

No Build Alternative. Existing conditions will continue under the No Build Alternative. An increase in truck accidents, as a result of traffic congestion and current highway conditions, could increase in the potential for hazardous material spills in Lake Mead and the Colorado River. In addition, the added congestion and increase in road traffic may result in an increase of vehicle-wildlife collisions on U.S. 93.

3.3.3 Measures to Minimize Harm

3.3.3.1 Construction Mitigation

Approximately 50 percent of the total land disturbed within the highway right-of-way will be revegetated. Topsoil will be stockpiled as much as possible during construction and replaced on disturbed areas directly outside the highway shoulders after construction to

re-establish desert vegetation. Salvaged cacti, yucca, and candidate plant species will be removed, stockpiled, and replanted.

Desert washes will be protected by placing barriers below excavation areas to prevent construction spoil from falling in the washes. In addition, several sections of washes will be bridged. Culverts placed in fill areas will be installed to allow runoff to flow unrestricted, and erosion protection devices will be placed at the ends of each culvert. For construction of bridge abutments, loose rocks will be scaled prior to and during excavation work, and netting on the canyon slopes will be used during blasting to minimize rock fall and contamination of Colorado River waters.

Wildlife drinking sources currently used by desert bighorn sheep, which could be directly affected by construction, will be relocated to nearby areas. They will be placed so that they are easily found by resident sheep but are far enough from the construction site so that sheep could use the new water source without being disturbed by construction. Specific types and locations of these offsite watering facilities will be determined through consultation with the AGFD, NPS, and NDOW.

Several underpasses and overpasses will be strategically located near traditional bighorn sheep movement corridors to provide safe crossings for them and other wildlife and to prevent small populations from being isolated. Additionally, highway bridges (included in the highway because of topographic demands) will also provide safe crossings. The location, design, and number of crossing structures were determined during consultations among wildlife biologists from AGFD, NDOW, NPS, and Reclamation. These criteria were based on studies conducted by AGFD and NPS from 1989 through 1992 in conjunction with this project. The numbers of crossing structures are summarized in Table 3-17 and are shown on Figures 2-4, 2-8, and 2-11.

Table 3-17
Estimated Number of Wildlife Crossing Structures for Each Alternative[a]

	Alternative		
Crossing Structure Type	**Promontory Point**	**Sugarloaf Mountain**	**Gold Strike Canyon**
Wildlife underpass	6	4	2
Wildlife overpass	2	3	1
Highway bridge	1	2	10
Tunnel	1	1	1

[a] Source: Reclamation, 1992

Fencing will be placed along both sides of the highway corridor to guide wildlife to crossing structures, thereby reducing the potential for animals being killed. Fencing will be continued approximately 0.5 mile beyond the intersections of the new highway with existing U.S. 93 in Arizona. Monitoring to determine the effectiveness of the above-mentioned physical mitigation features will be conducted following construction activities. Specific monitoring procedures and duration of effort will be determined through consultation with NPS, AGFD, USFWS, and NDOW.

Desert Tortoise. In the Biological Opinion regarding construction of the Sugarloaf Mountain Alternative, USFWS determined the reasonable and prudent measures necessary and appropriate to minimize take of Mohave desert tortoises in Nevada. The Biological Opinion also stipulates terms and conditions for implementation of the reasonable and prudent measures, as follows (see Biological Opinion, Appendix E, for full details):

1. Measures shall be taken to minimize mortality or injury of desert tortoises due to construction activities, blasting operations, and use of heavy equipment.

   a. Prior to the initiation of construction, a desert tortoise education program will be presented to all personnel who will be onsite, including surveyors, construction engineers, employees, contractors, contractors' employees, supervisors, inspectors, subcontractors, delivery personnel, and all visitors operating a vehicle in the project area. This program will contain information concerning the biology and distribution of the desert tortoise, its legal status and occurrence in the project area, the definition of "take" and associated penalties, the measures designed to minimize and mitigate the effects of construction activities, the means by which employees can help facilitate this process, and reporting procedures to be implemented in case of desert tortoise encounters.

   b. At least 7 days, and no more than 30 days, prior to the initiation of construction within right-of-ways without tortoise-proof fencing, a qualified biologist(s) will survey the site for desert tortoises using techniques providing 100 percent coverage. Transects will be no greater than 10 meters apart. The site boundaries will be flagged prior to the biological survey.

      All burrows found in the construction zone, whether occupied or vacant, will be excavated by a qualified biologist and collapsed or blocked to prevent desert tortoise re-entry. All burrows will be excavated by hand with hand tools to allow removal of desert tortoises or desert tortoise eggs. All desert tortoise handling and burrow excavations will be conducted by a qualified desert tortoise biologist in accordance with USFWS-approved protocol (Desert Tortoise Council, 1994 [revised 1996]).

   c. All desert tortoises and desert tortoise eggs located in the linear right-of-way will be relocated 300 to 1,000 feet into adjacent undisturbed habitat. Tortoises found above ground will be placed under a marked bush in the shade. A tortoise located in a burrow will be placed in an existing unoccupied burrow of the same size and orientation as the one from which the tortoise was taken. If a suitable natural burrow is unavailable, a qualified biologist will construct one of the same size and orientation as the one from which the tortoise was removed utilizing the protocol for burrow construction in section B.5.f (Desert Tortoise Council, 1994 [revised 1996]). Any tortoise found within 1 hour before nightfall will be placed in a separate clean cardboard box and held overnight in a cool location. The box will be covered and kept upright at all times to minimize stress to the tortoise. Each box will be used once and then disposed of properly. The tortoise will be released the following day in the same area from which it was collected, using the procedures described above. Each tortoise will be handled with a different pair of disposable latex gloves. After each use, the gloves will be properly discarded and a fresh set used for each subsequent tortoise handling.

   d. Desert tortoises will be moved only by a qualified desert tortoise biologist and solely for the purpose of moving them out of harm's way. Appropriate State permits will be acquired from NDOW prior to handling any live desert tortoise, desert tortoise carcass, or desert tortoise egg.

   e. All desert tortoises observed by project workers will be reported immediately to the qualified biologist, who will move the tortoise offsite into adjacent undisturbed

habitat. Tortoises will be handled only when necessary and in accordance with guidelines provided in the Biological Opinion.

f. If blasting is required in desert tortoise habitat, a desert tortoise biologist will be assigned to each blasting crew or to each area in which blasting will occur. Prior to any blast, a 200-foot radius around the blast site will be surveyed for desert tortoises using techniques providing 100 percent coverage; transects will be no greater than 10 meters apart. Aboveground tortoises will be relocated at least 500 feet from the blast site. Desert tortoises located in burrows that are within 50 feet of the blast site will be relocated at least 75 feet away from the blast site to an unoccupied existing burrow of the same size and orientation. If a suitable existing burrow is unavailable, an artificial burrow of the same size and orientation will be constructed by an approved biologist utilizing USFWS-approved protocol (Desert Tortoise Council, 1994 [revised 1996]). Burrows either occupied by desert tortoise or with undetermined occupancy status and located 50 feet or further away from the blast site will be flagged and stuffed with newspaper prior to the blast. The newspaper will be removed immediately after the blast and the burrows assessed for damage.

g. Any time a vehicle is parked in desert tortoise habitat, the ground around and underneath the vehicle will be inspected for desert tortoises prior to moving the vehicle. If a desert tortoise is observed, an authorized biologist will be contacted. If possible, the tortoise will be left to move on its own. If the tortoise does not move within 15 minutes, the tortoise will be removed and relocated by the authorized biologist in accordance with the tortoise handling provisions of the Biological Opinion.

h. Herbicides shall not be used in the project area unless approved in writing by USFWS.

i. Vehicles shall not exceed the legal speed limit (posted or unposted) of the roads used during construction activities. The Clark County speed limit for unposted roads is 25 mph.

2. Measures shall be taken to minimize predation on tortoises by ravens drawn to the project area.

   Trash and food items will be disposed of promptly in predator-proof containers with resealable lids. Trash includes, but is not limited to, cigarettes, cigars, gum wrappers, tissue, cans, paper, and bags. Trash containers will be removed regularly (at least once per week). This effort will reduce the attractiveness of the area to opportunistic predators such as desert kit fox, coyotes, and common ravens. Any construction refuse, including, but not limited to, broken parts, wrapping material, cords, cables, wire, rope, strapping, twine, buckets, metal or plastic containers, boxes, and welding rods will be removed from the site each day and disposed of properly.

3. Measures shall be taken to minimize destruction of desert tortoise habitat, such as soil compaction, erosion, or crushed vegetation, due to construction and maintenance activities.

   a. Project vehicles will remain within designated areas or on existing roads. Off-road travel is prohibited except to complete a specific task within designated areas or in emergency situations.

b. All areas to be disturbed will have boundaries flagged prior to construction, and all disturbance will be confined to the flagged areas. All employees will be instructed that their activities must be confined to locations within the flagged areas. Disturbance beyond the actual construction zone is prohibited.

c. Stockpile areas, vehicle turn-arounds, and vehicle service locations will be approved by Reclamation or NPS prior to the initiation of construction activities. These areas will be surveyed for desert tortoise and desert tortoise eggs. Any desert tortoises or desert tortoise eggs found within these areas will be removed in accordance with the tortoise handling provisions of the Biological Opinion. Whenever possible, stockpile areas, vehicle turn-arounds, and vehicle service locations will be restricted to previously disturbed areas. If not in previously disturbed sites, stockpile areas, vehicle turn-arounds, and vehicle service locations will be considered habitat disturbance for payment of remuneration fees.

d. Topsoil will be removed to a depth of 6 to 12 inches in all areas of potential seed-bearing soil where ground breaking will take place. The determination of which soils are potentially seed-bearing will be the responsibility of the tortoise biologist.

e. Removed topsoil will be stockpiled in a separate area and designated as "topsoil" to prevent contamination by or combination with other excavated soils. Reasonable measures will be taken to ensure the protection and preservation of the stockpiled topsoil to prevent loss of the seed bed from wind and rain or contamination by other soils or manmade contaminants. Stockpile areas for topsoil will be located in areas that are secure from construction traffic or flash floods.

f. Excavated tunnel material will be disposed of in designated areas previously approved by the individual Federal agency that has administration authority over the affected land.

g. Equipment and materials storage will be located in previously disturbed areas whenever possible. If not in previously disturbed sites, equipment and storage areas will be considered habitat disturbance for payment of remuneration fees.

h. Any fuel or hazardous waste leaks or spills will be stopped or repaired immediately and cleaned up at the time of occurrence. USFWS/maintenance vehicles will carry a bucket and pads to absorb leaks or spills.

i. Contaminated soil will be removed and disposed of at an appropriate facility. If spills occur in a maintenance yard, they will be cleaned up after construction is complete.

j. All waste and leftover materials remaining after construction of this project will be removed from the site after project completion.

k. Prior to initiation of construction, FHWA shall ensure that $587 per acre of disturbance is paid into the account administered by Clark County for the Clark County Desert Conservation Plan (CCDCP) as offsite mitigation for destruction of desert tortoise habitat resulting from the project. This rate will be indexed for inflation based on the Bureau of Labor Statistics Consumer Price Index for All Urban Consumers (CPI-U) on January 31 of each year. Fees assessed or collected for projects covered under the Hoover Dam Bypass Biological Opinion after January 31st of each year will be adjusted based on the CPI-U.

This fee will be paid directly to the Desert Tortoise Public Lands Conservation Fund Number 730-9999-2315 administered by Clark County. The administrator serves as the banker of these funds and receives no benefit from administering these funds. These funds are independent of any other fees collected by Clark County for desert tortoise conservation planning.

The payment shall be accompanied by the *Section 7 Fee Payment Form* (Biological Opinion, Appendix E) and completed by the payee. The project proponent or applicant may receive credit for payment of such fees and deduct such costs from desert tortoise impact fees charged by local government entities.

FHWA anticipates that 80 acres of desert tortoise habitat will be disturbed as a result of the proposed project, requiring $46,960 in remuneration fees.

4. Measures shall be taken to ensure compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion.
   a. FHWA will designate a field contact representative responsible for overseeing mitigation compliance and for coordination with the agencies.
   b. A qualified biologist(s) will be available during all phases of construction. In accordance with *Procedures for Endangered Species Act Compliance for the Mojave Desert Tortoise* (USFWS, 1992), a biologist should: (1) possess a bachelor's or graduate degree in biology, ecology, wildlife biology, herpetology, or related fields; (2) demonstrate a minimum of 60 days of prior field experience using accepted resource agency techniques to survey for desert tortoises; and (3) have the ability to recognize and to accurately identify and record all types of desert tortoise sign.
   c. The qualified biologist(s) will be responsible for determining compliance with mitigation measures as defined by the Biological Opinion. Qualified biologist(s) will have the authority to briefly halt construction and maintenance activities that are not in compliance with the terms and conditions of the Biological Opinion. Construction and maintenance activities will be halted only long enough to remedy the immediate situation and will apply only for the equipment and parties involved in the situation. All actions of noncompliance or conditions of threat to federally proposed or listed species will be recorded immediately by the qualified biologist(s) and reported to FHWA. FHWA will immediately report all such actions and conditions to USFWS.
   d. All fuel or hazardous waste leaks, spills, or releases will be reported immediately to FHWA and the Federal agency that administers the land where the incident occurs.
   e. Upon locating dead or injured desert tortoises, the field contact representative will notify FHWA immediately by phone and within 5 days by writing. Initial notification also must be made immediately to the Division of Law Enforcement of the USFWS in Las Vegas, Nevada. Written notification to USFWS will be made within 15 days of the date of the finding or incident and will include the following information: (1) date and time of finding or incident; (2) location of carcass or injured tortoise; (3) a photograph; (4) cause of death or injury; and (5) other pertinent information. Care will be taken in the handling of sick or injured specimens to ensure effective treatment and care, and in the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of a sick or injured desert tortoise or

preservation of the biological materials from a dead desert tortoise, the finder has the responsibility to carry out instructions provided by the Division of Law Enforcement of the USFWS to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

f. The qualified biologist(s) will maintain a record of each observation of desert tortoise during the project. The information gathered will include the following: (1) location; (2) date and time of observation; (3) whether tortoise was handled; (4) general health and whether it voided its bladder; (5) location tortoise moved from and location moved to; and (6) any observed unique physical characteristics of each individual.

g. FHWA and a qualified biologist will prepare a report to be distributed to NPS, Reclamation, USFWS, and NDOW no later than 90 days following the completion of construction activity. The report will document the number and location of desert tortoises encountered, their disposition, effectiveness of mitigation measures, practicality of mitigation measures, recommendations for future mitigation measures that allow for better protection or more workable implementation, and an estimate of acreage disturbed.

Desert Bighorn Sheep. Fencing will be constructed and maintained to prevent desert bighorn sheep from entering the highway. Out-jumps will be constructed at strategic locations to provide an escape for any sheep accidentally trapped inside the fenced highway right-of-way. Roadside signing will be installed warning motorists of the possibility of encountering wildlife in the area. In addition, crossing structures will be incorporated into the highway design to allow bighorn movement through established movement corridors. With the mitigation features currently planned, the project could probably result in a net overall reduction of animals killed along or on the highway. Movements to water sources during summer could be disrupted during and immediately after construction by the presence of the highway. Alternate water sources will also be provided for mitigation.

A mitigation monitoring plan will be implemented in consultation with AGFD, NDOW, and NPS. The plan will assess effectiveness of the crossing structures, fencing, and alternate water sources. Adjustments will be made, if needed.

Peregrine Falcon. Biologists from AGFD and NPS will monitor peregrine falcons in the proposed project area 3 to 4 times per year at least 2 years before, during, and after 1 year of public use of the new Colorado River bridge. NDOW will coordinate their ongoing peregrine falcon surveys in the area with AGFD and NPS.

If breeding territories are found within 0.5 mile of construction activities, consultation will be reinitiated with USFWS to determine appropriate mitigation measures.

Bald Eagle. Biologists from AGFD, NPS, and Reclamation will monitor bald eagle use of the bridge crossing sites during two consecutive winters before construction, and any preferred hunting perch sites or night roosting sites will be identified. Measures will be taken to not affect any preferred hunting perch sites or night roosting sites for bald eagles. If bald eagles were to nest in the project vicinity, consultation with USFWS will be reinitiated.

Devil's Hole Pupfish. No construction below the waterline will occur in the Colorado River in Black Canyon. For construction of the Sugarloaf Mountain alignment, a catch net and temporary spill containment system will be constructed at the Colorado River crossing to catch falling debris and collect contaminants if spilled. For construction of bridge

abutments, loose rocks will be scaled prior to and during excavation work, and netting on the canyon slopes will be used during blasting to minimize rock fall.

An assessment of the potential effects of the blasting activities of the project will be completed prior to implementation. If the assessment identifies unavoidable impacts to the Devil's Hole pupfish, formal consultation with USFWS will be initiated, and appropriate conservation and mitigation measures will be included in the Biological Opinion.

Razorback Sucker. No construction below the waterline will occur in the Colorado River in Black Canyon. As for the Devil's Hole pupfish, measures will be taken to ensure that any falling debris from the cliffs will not affect water quality that could affect razorback suckers further downstream of the Hoover Dam or in Lake Mohave.

If the assessment identifies unavoidable impacts to the razorback sucker, formal consultation with USFWS will be initiated, and appropriate conservation and mitigation measures will be included in the Biological Opinion.

Bonytail Chub. There will be no construction below the waterline in the Colorado River in Black Canyon. Measures will be taken to ensure that any falling debris from the cliffs will not affect water quality that could affect the bonytail chub further downstream in Lake Mohave.

Mountain Lion. Mitigation measures for desert bighorn sheep will also mitigate effects to the mountain lion population.

Bicolored Penstemon. Preconstruction surveys of bicolored penstemon will be performed. Plants found within the construction right-of-way will be salvaged, as will topsoil possibly containing penstemon seeds. Any salvaged plants will be stockpiled and replanted within the constructed highway right-of-way.

Migratory Birds. No land clearing will occur during the avian breeding season. Actions will be taken to ensure that no migratory birds, their nests, or nest contents, will be harmed during construction.

Waters of the United States. Temporary impacts will be avoided or minimized by designating construction access, stockpile, and staging areas outside of waters of the United States and by designing effective rock debris restraints on steep slopes. In many locations, especially on the Gold Strike Canyon alignment, the proposed road is located on steep rocky slopes. Excavation of a road base will result in the need to move considerable amounts of rock debris. In the absence of effective barriers, this material will fall into the adjacent washes. This potential fill is included in the temporary impacts to waters of the United States.

Permanent impacts can be minimized on the Gold Strike Canyon alignment. This could be accomplished by placement of span bridges in place of road fill at many locations. Impacts may be further reduced by bridge design and bridge construction methods that minimize or avoid all fill in waters of the United States. Avoiding impacts to waters of the United States at bridge crossings will reduce permanent impacts on the Sugarloaf Mountain alignment from 0.11 to 0.07 acre and on the Gold Strike Canyon alignment from 0.67 to 0.38 acre. Placement of the Promontory Point west bridge pier (for the cable-stayed and suspension designs) in the waters of Lake Mead would require Section 10 and Section 404 U.S. Army Corps of Engineers and Section 9 U.S. Coast Guard permits for navigable water crossings and placement of bridge and fill in waters of the United States.

Permanent impacts can be further reduced by highway design and highway construction methods that will reduce the fill to less than 50 feet on either side of the centerline in the vicinity of waters of the United States.

3.3.3.2 Operational Mitigation

NDOT and ADOT will maintain wildlife underpasses and overpasses in their respective states. Alternate water sources provided for mitigation will be maintained by either NPS or Reclamation. Reclamation sewage evaporation ponds will be replaced as a wildlife watering source, or a new source will be provided if relocated ponds are fenced (with Sugarloaf Mountain Alternative).

3.4 Water Resources

3.4.1 Affected Environment

Annual precipitation in Las Vegas Valley averages 4.1 inches per year (National Oceanic and Atmospheric Administration, 1991). Precipitation rates in the proposed project area are similar.

Several natural drainages occur along the three build alternative alignments (Figure 3-3). Most are narrow (1- to 3-feet wide) washes that drain a local watershed of approximately 2 acres. However, two broader intermittent desert washes (from a few feet to more than 20 feet wide) drain watersheds of more than 50 acres in the proposed project area. One is a medium-sized, unnamed drainage that runs in a north-south direction west of U.S. 93 in Arizona, intersecting each of the build alternatives.

The other of the larger drainages (Gold Strike Canyon Wash) runs along the Gold Strike Canyon Alternative. At the lower end of the wash, before terminating at the Colorado River, are hot springs that produce year-round runoff into the river. The only water courses with perennial flows existing in the proposed project area are the Colorado River, Lake Mead, and the lower Gold Strike Canyon Wash (supplied by hot springs). The remainder of the washes are intermittent.

The River Mountains to the northwest, Lake Mead to the north, and Lake Mohave to the south flank the proposed project area. Lake Mead can store nearly 2 years of average Colorado River flow. When full, Lake Mead is 110 miles long with an 822-mile shoreline and a capacity of 26 million acre-feet. The figure that NPS uses most often is based on the average lake elevation of 1,200 feet, resulting in a shoreline 714 miles long. If the shoreline for Lake Mohave is also included, the length is approximately 953 miles long.

No known groundwater resources are located within the River Mountains or along the mountain flanks. Alluvial aquifers within Las Vegas Valley supply about 15 to 20 percent of the water to Las Vegas Valley. The River Mountains are not known to be a source of any significant recharge to these alluvial aquifers (Malmberg, 1965). In addition, the volcanic rocks composing the mountains are not considered suitable for the formation of useful aquifer systems (Plum, 1989). However, there may be fracture porosity within the rocks that could contain groundwater at elevations below the level of Lake Mead. No known water wells are located in the vicinity of the proposed project area.

Floodplains. The Federal Government created the National Flood Insurance Program (NFIP) in 1968. This program is an effort to reduce the financial losses incurred by private citizens and public entities from the devastating effects of flooding. The program is

administered by the Federal Insurance Administration (FIA), a division of the Federal Emergency Management Agency (FEMA).

Flood zones designated as "X" zones are minimal to moderate risk flood zones. Flood zones designated as "A" zones are one of two Special Flood Hazard Area (SFHA) zones that are subject to damage from rising water. FEMA maps obtained from Clark County, Nevada and Mohave County, Arizona for the project area indicate that, while the Colorado River itself is considered to be a Zone A flood potential, the surrounding land areas, by virtue of their elevations, are designated as Zone X.

3.4.2 Environmental Consequences

3.4.2.1 Construction Impacts

Runoff draining to and from the project during construction will impact water quality. New cut and fill slopes will erode by a combination of sheet, rill and concentrated flow. The eroded material will travel downslope and eventually enter the channel network characteristic of each alternative. Once in the channel, the sediment can travel downstream provided the channel characteristics and runoff volume are adequate to sustain material movement. At natural channel crossings, disturbed channel sections will erode creating point sources of sediment and potentially long-term disruption to channel stability.

Channel bypass systems will be constructed in areas where runoff is diverted around the work site. These systems will be temporary features, small in geometric cross section (i.e., 2-foot-deep v-channel with 2:1 slopes, at a minimum) and generally not constructed adequately to sustain long-term use. Their use will result in large volumes of soil being eroded from the channel and transported through the site. The volume removed and deposited will be proportional to the bypass channel length and slope.

Temporary access roads will be constructed, and occasionally sections will be washed away from storm runoff. Material from these roads will potentially make it to live water. In addition to washed out road sections, other segments might be weakened and fail during a lesser runoff event. In general, with sediment movement, the closer the eroded material is deposited to live water, the higher the probability that with time the sediment will actually enter it.

Equipment working along the construction site will also contribute to water quality impacts. Construction equipment will leak various petroleum compounds contaminating isolated areas of the work site. When these areas come in contact with runoff, the compound(s) will be mobilized and could potentially enter live water. Areas utilized for fueling equipment will also be prone to contamination from spills and can be transported when runoff is present. Other sources of construction-related contamination will result from materials such as concrete, concrete and asphalt coatings, and emulsions being delivered to the construction site. The equipment used for delivery of these products would be cleaned after the delivery. The waste material will be discharged within the construction corridor and will become mobilized during storm events.

The roadway profiles vary from less than 0.5 percent to slightly greater than 6 percent. For the Promontory Point and Sugarloaf Mountain Alternatives, approximately 80 to 90 percent of the alignment is less than 3 percent. For the Gold Strike Canyon Alternative, only about 29 percent of the alignment is less than 3 percent. Typically for disturbed areas, steeper ditch grades result in increased erosion.

Of the three alternatives, the Gold Strike Canyon alignment should have the greatest potential for impacting water quality from erosion during construction. Cut and fill slopes in the lower canyon sections will have the greatest impact on the Colorado River water quality due to the relatively short travel distance to the river. The alternative having the second greatest potential for impacting water quality is the Sugarloaf Mountain alignment followed closely by the Promontory Point alignment. These latter two alternatives are constructed on similar terrain. However, since the Sugarloaf Mountain Alternative has a slightly steeper overall slope, the erosion potential is greater.

Equipment impacts to water quality for each alternative will also differ. Due to the steeper slopes associated with the Gold Strike Canyon Alternative, spills and discharges from equipment will quickly travel downslope and have the potential for reaching live water sooner than the other two alternatives. However, during bridge construction, the potential for contamination directly to live water is greater for the Promontory Point alignment due to the increased time necessary to construct the longer bridge over live water. In addition, pier construction would require extensive dewatering operations and erosion control BMPs. This type of construction significantly increases the potential for accidents during construction and the unanticipated release of concrete or sediment into waters of the U.S.

3.4.2.2 Operational Impacts

Once the construction is completed and the roadways are functional, the various alignments will still impact water quality. Exposed cut and fill slopes will continue to erode until stabilized by vegetative or mechanical means. Discharge from culverts and roadway channels will cause erosion due to steep slopes and elevated velocities unless properly designed. Additional runoff generated from the road surface, if uncontained, will carry pollutants and trash offsite or deposit them directly in live water if originating from bridge surfaces. Chemical spills resulting from vehicle accidents are a possibility and, if uncontained, will impact water quality. Therefore, long-term impacts to water quality from operation of the bypass could exceed the actual construction impacts if not properly mitigated.

Since the roadway surface is impermeable, essentially all precipitation falling on it will travel from the surface as runoff to catch basins and then to nearby natural channels. This additional runoff is not expected to increase downstream flood flows in nearby channels since the roadway runoff will enter the channel system prior to the generation of the local or regional peak flow. The roadway runoff will increase the localized volume in the nearby channels, but this is not expected to pose any problems. The volume in most cases will be small when compared to that generated on a local or a regional basis. As a result, no impacts to flood flow or floodplains are anticipated from the alternatives.

Runoff generated from bridges that directly discharge to receiving waters or channels could alter localized water quality. Unlike roads, bridges typically do not accommodate vehicle parking except under emergency conditions such as vehicle breakdown. As such, the level of contamination resulting from pollutants is probably low to warrant treatment of the runoff. Normally the bulk of pollutants originating from roadway surfaces are removed from the road surface by the "first flush" or initial runoff generated during a storm.

The Gold Strike Canyon Alternative is anticipated to have the greatest impact to water quality during roadway operations. Due to the steep slopes associated with the road profile, sediment generation from the slopes, channels, and culvert outfalls will be higher than the other two alternatives, unless mitigation measures are implemented. The alternative having the next greatest impact would be the Sugarloaf Mountain Alternative,

due to its steeper overall slopes when compared to those of the Promontory Point Alternative.

When considering water quality impacts resulting from bridge-generated runoff, the Gold Strike Canyon Alternative poses the greatest impact due to the combined length of all the bridges along the alignment. The Sugarloaf Mountain Alternative would have the second greatest impact followed by the Promontory Point Alternative. However, when just considering the longest single Colorado River/Lake Mead crossing, Promontory Point is ranked first, then Sugarloaf Mountain followed by Gold Strike Canyon Alternative. This is based strictly on bridge length without implementing mitigation measures. In addition, an uncontained spill on the Promontory Point bridge over Lake Mead has the potential to contaminate or make unusable the water stored for future use.

Floodplains. Each of the three build alternatives will transversely encroach into an area designated as Zone A flood potential, as they cross the Colorado River. The degree of encroachment is somewhat higher for the Promontory Point Alternative since it crosses Lake Mead with a longer bridge upstream of Hoover Dam. The degree of encroachment of the build alternatives will be limited to bridge piers and abutments supporting the structures. These structural encroachments will not be of sufficient extent/volume to cause the existing water surface elevation to increase substantially. If these structural encroachments result in a cumulative rise in water surface elevation of less than 1 foot, the established standard of the NFIP, the level of flooding risk associated with the three build alignments would be considered low.

No Build Alternative. Although the No Build Alternative would avoid the potential short-term impacts to local water quality resulting from erosion and spills during construction activities, runoff from U.S. 93 across Hoover Dam presently impacts local water quality. This impact is primarily from road surface runoff which carries pollutants from the current heavy traffic usage of the highway. In addition, transportation of hazardous materials across the dam results in an increased potential for accidental spills that could significantly impact waters of Lake Mead and the Colorado River. Reclamation currently maintains a facility-specific emergency preparedness plan for Hoover Dam to deal with potential hazardous material transport accidents that might occur on the dam crest and approaches. The Hoover Dam Police standard operating procedures also contain provisions for responding to accidental hazardous material spills (personal communication, Jeff Weaver July 15, 1998). However, there is no on-site containment facility to handle hazardous material or waste spilled in a trucking accident on or near the dam crossing.

Under the No Build Alternative, the environmental benefits to local water resources from removing conventional traffic and hazardous material transporters from the dam to a new bridge, which incorporates an engineered runoff conveyance system, will not be realized.

3.4.3 Measures to Minimize Harm

Implementation of Best Management Practices (BMPs) along the project corridor will dramatically reduce water quality impacts to the Colorado River below Hoover Dam. Both construction and operational impacts are to be mitigated through the use of BMPs. During construction, it will be imperative to manage stormwater runoff above and below the project so that the net impact to receiving water is negligible. This will be achieved by routing upslope runoff around the construction site, minimizing exposure to disturbed slopes, and collecting and treating onsite runoff and discharging it so that the water quality entering the receiving waters is not impaired.

During system operation, channels conveying roadway-derived runoff will be designed to resist erosion. Cut-and-fill slopes will be stabilized using vegetative and/or mechanical means, and roadway-derived runoff will be captured and treated to remove suspended solids prior to discharging from the project area.

For both the construction and operation phase, the main concern will be to isolate runoff-rich suspended sediment in treatment basins. By ignoring this issue, the volume of runoff derived from this project, although small, could potentially impact receiving water quality to varying degrees. Immediately downstream of the project area, sediment-rich roadway runoff could mix with unimpaired runoff and degrade localized water quality. Further downstream, as additional runoff water is added, the impacts from the project area are reduced due to dilution. By the time the roadway runoff enters the Colorado River, water quality from the roadway would most likely be negligible. Based on the anticipated impacts to water quality immediately downstream of the roadway, water quality parameters, such as suspended solids, turbidity, color and total dissolved solids (TDS), will be elevated if not collected and treated. It is possible this runoff could exceed the threshold limits for suspended solids and turbidity. Collecting and treating this runoff prior to discharging to natural drainage channels will prevent impacts to localized water quality.

The standards of water quality below Hoover Dam that will be pertinent to this project are as follows:

Parameter	Water Quality Standards for Beneficial Uses
Temperature °C – maximum $\Delta T°$	Nov.-Apr.: $\leq$ 13°C May-June: $\leq$ 17°C July-Oct.: $\leq$ 23°C $\Delta T° \leq 2°C$
pH Units	S.V.: 7.0 – 8.3 ΔpH: $\pm$ 0.5 Max.
Total Phosphates (as P) – mg/L	A-Avg.: $\leq$ 0.05 ---
Nitrogen Species (N) – mg/L	Nitrate S.V.: $\leq$ 10 Nitrate S.V.: $\leq$ .06 Ammonia S.V.: $\leq$ .02 (un-ionized)
Dissolved Oxygen – mg/L	S.V. Nov.-May: $\geq$ 6.0 June-Oct.: $\geq$ 5.0
Suspended Solids – mg/L	S.V.: $\leq$ 25
Turbidity – NTU	S.V.: $\leq$ 10
Color – PCU	Increase must not be more than 10 PCU above natural conditions
Total Dissolved Solids – mg/L	S.V.: $\leq$ 723
Alkalinity (as $CaCO_3$) – mg/L	Less than 25 percent change from natural conditions

Parameter	Water Quality Standards for Beneficial Uses
Fecal Coliform – No./100 mL	≤ 200/400°

3.4.3.1 Construction Mitigation

Depending on how each alternative is phased for construction will determine some of the mitigation measures. Assuming each phase of construction actively disturbs more than 5 acres, a National Pollutant Discharge Elimination System (NPDES) permit will be required. Through the terms and conditions written into the permit, both discharge limitations and water quality standards are primarily implemented and enforced. The NPDES permit must be consistent with discharge limitations and water quality standards established for the receiving waters.

The construction sites for all alternatives will have to be retrofitted with BMP improvements. These improvements reduce the potential of degrading offsite water quality or watercourses during the short construction period. Examples of some of the BMPs that will likely be common to all the alternatives are construction of silt barriers (silt fences or straw bale check dams) to trap sediment, not allowing it to flow to offsite channels. The contractor will be required to remove the trapped silt and debris to an offsite location before removing the barriers. Offsite flows will be routed around cut and fill slopes to prevent contamination of runoff. Bypass channels must be properly designed to convey anticipated flow volumes and velocities. Construction equipment must be cleaned on a regular basis to minimize potential runoff contamination from petroleum products. Sediment basins will be constructed to treat sediment-rich runoff before discharging it offsite to drainage channels. Construction equipment will be inspected frequently for leaks and repaired immediately when discovered. All equipment will be fueled and serviced at designated locations in order to minimize work site contamination. These fueling locations will be located away from nearby channels, swales, or other features that would quickly facilitate movement in the event of a spill. Upon completing the construction, all contaminated material (e.g., concrete wash water) will be removed and disposed of in accordance with local, regional, and federal regulations. Temporary sanitary waste facilities will be designed and developed in a manner that protects both surface and subsurface water resources.

For all the build alternatives, a catch net and temporary spill containment system will be constructed at the Colorado River or Lake Mead crossing to catch falling debris and collect contaminants if spilled. For construction of bridge abutments, loose rocks will be scaled prior to and during excavation work, and netting on the canyon slopes will be used during blasting to minimize rock fall.

As an additional mitigation measure for the preferred Sugarloaf Mountain Alternative, the sewer evaporation ponds will have to be relocated and allow for possible wildlife or fencing improvements.

For the Promontory Point Alternative, to further reduce the chance for water quality contamination, bridge construction across the lake should be on an accelerated schedule. Because this is the longest of the three alternative bridges actually crossing live water, it will require a greater length of time to construct and thereby increase the chance for contaminating the lake.

3.4.3.2 Operational Mitigation

Mitigation measures for all alternatives will include properly designed roadway channels that will resist erosion, construction of energy dissipating structures at all culverts whose discharge velocity will cause downstream erosion, and building sediment trapping basins strategically located to maximize sediment removal and still function as a chemical spill containment structure.

Cut and fill slopes will continue to erode unless stabilized using vegetative or mechanical means. Vegetation will slow surface runoff, help bind soils, reduce raindrop impact and break up flow patterns. Mechanical means include geotextiles such as matting, retaining walls, and rock slope protection. Matting and similar products prevent extensive contact between surface runoff and soil, keeping the soil intact. Retaining walls decrease cut and fill slopes which in turn reduce runoff velocities and erosion potential. Rock slope protection armors the slope, preventing soil movement.

Discharge in roadside channels and from culverts will erode, transporting sediments downstream. Slopes along roadside channels and at discharge points from culverts may be steep, promoting erosion. Therefore, both conveyance features will require some sort of protection in the form of channel lining, reduced slopes, or energy dissipating structures. Channel lining may be in the form of rock riprap, and energy dissipating structures will be designed elements that will break up and reduce discharge velocities.

Over time, the roadway surface will collect contaminants such as oil, grease, soil, and trash. When it rains, these contaminants will be mobilized and washed from the road surface to nearby natural and roadside channels. To lessen the impact these contaminants have on water quality, the runoff will be drained to settling basins, allowing the larger suspended material to settle. Dissolved contaminants would remain mobile and travel through the basins to the nearby drainage network. Besides capturing road pollutants, these basins will also serve to contain chemical spills resulting from vehicle accidents. Each basin will be designed to contain a certain rainfall runoff volume before allowing discharge. If an accident occurred, and provided the basins were dry at the time of the accident, the spill volume in most cases will be accommodated. These settling basins will require periodic cleaning. Any fences that may be incorporated into the basin design must be compatible with basin maintenance and function.

In addition, all bridges over live water will have the potential to collect the "first-flush" runoff volume from the bridge as well as the spill volume that might be generated from a semi-truck tanker spill. The bridge runoff unit volume is small and could potentially be captured and transferred to a basin located near the bridge abutment for treatment. Once the first-flush volume is captured, additional runoff volume will be discharged. In the event an accident on the bridge resulted in a chemical spill, this first flush system will normally have the capacity to collect the volume from a typical truck tanker. The roadway and bridge settling basins will be maintained by NDOT or ADOT, depending on their location.

At this preliminary stage of design, the location and extent of potential settling basins is uncertain. If the eventual design causes impacts beyond those cleared in this EIS, additional studies and National Environmental Policy Act (NEPA) documentation will be prepared for those areas.

3.5 Cultural Resources

3.5.1 Affected Environment

Cultural resources are defined as buildings, sites, districts, structures, and objects significant to history, architecture, archaeology, culture, or science. Significant cultural resources are those that are listed in or are eligible for listing in the National Register of Historic Places (NRHP). Listed resources or those resources determined eligible for NRHP listing are often referred to as "historic properties." The NRHP is the nation's inventory of historic properties, and NRHP documentation includes a recommendation about whether a property is significant at the local, State, or national level. The 1992 changes to the National Historic Preservation Act of 1966 as amended (NHPA) acknowledge that traditional cultural properties (TCPs) can be eligible for listing in the NRHP. TCPs are those historic properties important to American Indian tribes. Hoover Dam itself is a National Historic Landmark (NHL)—a property designated by the Secretary of the Interior as possessing national significance in one or more categories: American history, architecture, archaeology, engineering, and culture. NHLs are also listed on the NRHP.

The NHPA and the Archaeological Resources Protection Act of 1979 (ARPA) are two of the more important legislative mandates that require Federal agencies to identify cultural resources within their jurisdictions and consider the effects on those resources as a consequence of federal "undertakings." Undertakings are those projects planned and constructed by federal agencies and also include those projects assisted by federal agencies through funding, technical support, or administrative authorizations (licenses, permits, and rights-of-way).

The NHPA requires federal agencies to take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the NRHP. Further, the federal agency is required to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking. The ACHP has promulgated 36 CFR 800 as a set of regulations for federal agencies to follow in fulfilling the cultural resource consultation and compliance process. The regulations provide a step-by-step procedure for the entire compliance process, from initial identification of a resource, through its evaluation, and to final treatment measures (avoidance, data recovery, etc.) if required for historic properties.

While it is federal policy to avoid or minimize adverse effects to cultural resources when planning, constructing, and/or assisting federal projects, in some cases it is impossible to avoid disturbing or destroying some cultural resources if an authorized development is to be implemented. In such instances, it is federal policy to recover the information embodied in those resources through historical, archaeological, and ethnographical study before the project begins. Other federal policies that may be applicable to the consideration of cultural resources potentially affected by the project include EO 13007 and the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA).

Because the project is a federal undertaking, consultation with Indian Tribes is mandated by several policies, laws, and regulations including EO 13007, ARPA, NAGPRA, NHPA, and NEPA. Consultation is recognized as the most effective means of determining if TCPs are present within a project area.

All of the historic properties in the area of potential effects have been assessed in terms of their eligibility (or lack thereof) for listing in the NRHP. With the exception of the recently

discovered prehistoric archaeological sites documented during 1998 and 1999, additional historic sites relating to Hoover Dam, and the eligible TCP site, the NRHP eligibility status of all of the historic sites and features in the project area was determined through earlier consultations (1991 to 1993) between the former lead agency (Reclamation) and the Arizona and Nevada SHPOs.

Preliminary consultations between Reclamation and the ACHP were conducted in 1991 with the result that the ACHP found the Gold Strike Alternative to be the least likely to produce adverse effects on the Hoover Dam NHL. ACHP urged Reclamation to refine its analyses and provide the DEIS for their review. FHWA provided ACHP with the DEIS and has consulted with ACHP on the preferred alternative. The majority of the effect determinations discussed in this DEIS were made by the SHPOs during the 1991 to 1993 consultations with Reclamation.

After a 4-year hiatus and transfer of lead agency responsibility from Reclamation to FHWA, formal consultations with the two SHPOs were reinitiated in October 1997. These consultations continued through both the NEPA process and the Section 106 process. Prior to cessation of the project study in 1993, Reclamation had not yet initiated consultations with affected Indian tribes. FHWA started tribal consultations through implementation of an intensive program of field trips and elder interviews that were conducted in late May/early June 1998. Beginning in December 1999, FHWA formally requested the participation of interested Native American tribal representatives in a series of government-to-government consultation meetings to facilitate identification and treatment of traditional cultural properties for the Hoover Dam Bypass. NPS and Reclamation cultural resource staff assisted FHWA in identifying the appropriate tribal representatives to involve in the consultation process. Consultation meetings involving 12 Native American tribes, FHWA, NPS and Reclamation occurred during completion of the NEPA and Section 106 process in 2000, specifically on January 11, March 30, May 8, August 15 and 16, and November 15. These meetings will continue after approval of the Record of Decision, through design and construction of the Hoover Dam Bypass.

3.5.1.1 Surveys, Tribal Interviews, and Literature Reviews

Prior to mid-1993, Reclamation conducted cultural resources inventories as part of the preparation of the Hoover Dam Bypass DEIS (Queen 1992 and White 1993a,b). These surveys resulted in the identification and recordation of numerous historic features, several of which are associated with the construction of Hoover Dam. Except for a single rock feature, no prehistoric Native American sites were identified by Reclamation. Literature sources revealed 44 cultural features within the area, and 42 of the 44 features are associated with constructing, operating, and maintaining Hoover Dam. Thirty-three of the features are not considered individually eligible for listing in the NRHP; however, they may contribute to a potential historic district that focuses on constructing, operating, and maintaining Hoover Dam.

A large prehistoric archaeological site was discovered in November 1997. An archaeological survey of the three build alternatives was conducted in March 1998. Following FHWA standards, an Area of Potential Effects (APE) was established for the three build alternatives. The APE, defined as all ground surface 200 feet to each side of the staked centerline, was intensively surveyed by a team of archaeologists walking transects parallel to the centerline, spaced a maximum of 20 meters. When cultural materials were found, the location was flagged, and the archaeological sites were formally recorded. The survey resulted in the discovery and recordation of five prehistoric archaeological sites on the Arizona side (including the site found in 1997). FHWA, in consultation with the

Arizona SHPO, determined that these five sites are not eligible for the National Register (see further discussion of sites 14:21 and 14:22 below). The Arizona State Museum assigns site registration numbers for Mohave County, Arizona, and includes the partial descriptor "NV" in its registration numbers.

AZ:NV:DD:14:21 Sugarloaf Mountain (in the APE)	Gypsum Period (5000-2000 B.P.) or Late Prehistoric (750 B.P-Contact)
AZ:NV:DD:14:22 Sugarloaf Mountain (in the APE)	Unknown prehistoric time period
AZ:NV:DD:14:23 Promontory Point (in the APE)	Unknown prehistoric time period
AZ:NV:DD:14:24 Promontory Point (outside APE)	Unknown prehistoric time period
AZ:NV:DD:14:25 Promontory Point (in the APE)	Unknown prehistoric time period

The May-June 1998 site visits and field interviews with tribal elders, conducted for FHWA by the University of Arizona, resulted in completion of an ethnographic study report for the Hoover Dam Bypass Project in December 1998 (FHWA, October 2000a). That report included preliminary findings, summarized in the DEIS, indicating the presence of potentially significant traditional cultural properties in the vicinity of the bypass project.

After identification of Sugarloaf Mountain Alternative as the preferred alternative, following circulation of the DEIS in November 1998, NPS and Reclamation directed FHWA to conduct a detailed historic resources survey to update and expand the sites previously recorded by Reclamation, as well as additional intensive surface mapping and documentation of archaeological sites 14:21 and 14:22 located in Arizona. Both the historic and archaeological surveys were scoped to provide additional documentation to address National Register eligibility of sites in the APE of the preferred alternative. Those additional investigations, conducted during March and June 1999, resulted in completion of a supplemental archaeological resources survey report (FHWA, April 2000) and a historic resources survey report (FHWA, August 1999) for the Sugarloaf Mountain Alternative.

The 1999 archaeological resources survey report concluded that sites 14:21 and 14:22 were not eligible for the National Register, because after detailed surface inspection and mapping, it was determined the sites lacked information important in the prehistory of the areas. The historic resources survey report resulted in identification of seven additional National Register eligible historic properties relating to construction and operation of Hoover Dam. Those reports and the December 1998 ethnographic study (FHWA, October 2000a) were submitted by FHWA to the Arizona and Nevada SHPOs in August 1999 with a request for concurrence in determinations of National Register eligibility for the affected historic properties.

The Nevada and Arizona SHPOs commented back to FHWA, in September and October respectively, concurring in the determinations of National Register eligibility for most of the historic properties documented by FHWA. However, the Nevada SHPO requested that FHWA conduct an ethnohistoric study to provide documentary context for assessing the potential traditional cultural properties identified by the tribal elders during the 1998 field interviews, and that FHWA commence formal government-to-government consultation

with affected Native American tribes concerning the significance and National Register eligibility of the potential traditional cultural properties in the project area. The Arizona SHPO also requested further consideration of potential TCPs in the area, as well as additional information on archaeological sites 14:21 and 14:22, within a broader historic and ethnographic context, to more fully evaluate the potential National Register eligibility of these sites. (See Appendix C and Volume II for copies of all pertinent FHWA, SHPO, and Native American tribal correspondence relating to cultural resources.)

At the first meeting between the Native American tribal representatives and the federal agencies, held on January 11, 2000, the tribes requested that the 1998 ethnographic studies be expanded to other locations and include additional tribes and elders. As a result, the University of Arizona conducted additional site visits and interviews during May 2000. The resulting report (FHWA, October 2000a), coupled with the ethnohistoric assessment report (FHWA, October 2000b), provided documentation supporting a determination by FHWA and the SHPOs that the Gold Strike Canyon and Sugarloaf Mountain TCP is eligible for the National Register of Historic Places (FHWA, October 2000c). The National Register eligible TCP boundaries include archaeological site 14:21 (FHWA, April 2000), which Reclamation noted in an October 6, 2000, letter to FHWA supporting the TCP eligibility, "should be considered to contribute to the eligibility of the larger Gold Strike Canyon and Sugarloaf Mountain TCP" (see Appendix C, October 6, 2000, Reclamation letter).

3.5.1.2 Archaeological Context

The prehistory of the proposed project area covers the time period from about 12,000 years before present (B.P.) (B.P. being before 1950) to the time of initial European contact in A.D. 1600, and is divided into five periods: Lake Mohave (12,000 to 7000 B.P.), Pinto (7000 to 5000 B.P.), Gypsum (5000-2000 B.P.), Saratoga Springs (2000 to 800 B.P.), and Late Prehistoric (750 B.P.-Contact) (Ezzo et al., 1995).

Lake Mohave Period (12000 to 7000 B.P.). Evidence of Paleo-Indian occupation in the vicinity of the proposed project is lacking. Either the material remains were quickly covered over, or they were rapidly scattered about or washed away from their original location, effectively destroying the site. The Paleo-Indian culture gave rise to a series of more localized cultural manifestations known as the Archaic, represented in the proposed project area by the Pinto and Gypsum periods.

In general, the Archaic represents a period of hunting and gathering characterized by reduced mobility, more localized adaptations, and greater diversity of tool kits. Most recorded sites from this time period are surface finds.

Pinto Period (7000 to 5000 B.P.). The Pinto period is defined by the presence of the Pinto complex—an assemblage characterized by leaf-shaped knives, scrapers, and projectile points. Pinto settlement in the proposed project vicinity was centered around water sources, particularly drainages and remnant pluvial lakes. Settlement focused on valley floors, favoring lowland, well-watered habitats. Hunting continued to be an important dietary component, but milling implements appeared for the first time, indicating a greater reliance on, and orientation toward, plant food resources than during the preceding Lake Mohave period (Ezzo et al., 1995).

Gypsum Period (5000 to 2000 B.P.). The Gypsum period represents a continuation of the pre-agricultural Pinto foraging lifestyle. Gypsum sites evidence greater use of milling implements, resource diversification, and greater emphasis on plant and seed processing. Gypsum period assemblages are characterized by a variety of projectile points. Other tools

include leaf-shaped points, flake scrapers, choppers, hammerstones, rectangular-based knives, manos, mortars, and pestles.

The Gypsum period appears to have been a time of increased human activity in the proposed project area. Groups moved through a range of diverse ecological zones that included mountains, riverine habitats, and other lowland areas, to hunt, collect, and process seeds and wild plants (Ezzo et al., 1995). Compared to previous periods, there are a greater variety of site types: rockshelters and caves were utilized, and open-air sites included camps and specialized activity areas. Bighorn sheep became a significant food source, and small game, which was abundant in the riparian communities or well-watered areas, was also hunted (Ezzo et al., 1995).

Saratoga Springs Period (2000 to 800 B.P.). The Saratoga Springs period exemplifies the influence of the Anasazi in the proposed project area. It can be divided into four phases: Moapa phase (1650 to 1450 B.P.), Muddy River phase (1450 to 1250 B.P.), Lost City phase (1250 to 850 B.P.), and Mesa House phase (850 to 800 B.P.). The Moapa phase corresponds to the Basketmaker II period of the Colorado Plateau, a time when pithouse villages made their first appearance. The Moapa phase represents the beginning of the transition from a foraging to a sedentary, agricultural way of life in the northern Southwest (Ezzo et al., 1995).

The Muddy River phase corresponds to the Basketmaker III period on the Colorado Plateau and is characterized by the introduction of ceramics and the bow and arrow. Settlements consisted of small numbers of randomly arranged pithouses and food storage cists. The introduction of ceramics and the bow and arrow had significant effects on hunting and storage capabilities. This introduction reduced the use of food storage cists in caves for storing seeds and plant materials for extended periods of time; it also reduced the need for woven baskets for use in cooking, storage, and water transport (Ezzo, et al., 1995).

The Lost City phase corresponds to the Pueblo I and the early and middle stages of the Pueblo II period on the Colorado Plateau. There was a shift from subterranean or semi-subterranean structures to surface structures, generally with associated storage facilities.

The Mesa House phase corresponds to the late Pueblo II period on the Colorado Plateau and represents the final period of Anasazi settlement in the Las Vegas Valley and neighboring areas. The primary distinguishing characteristic of the Mesa House phase is the new types of decorated ceramics. Agriculture continued to be an important component of subsistence, but wild foods continued to be significant (Ezzo et al., 1995).

Ezzo et al. (1995) discuss the two recent models that attempt to explain Virgin Anasazi expansion and demise. Rafferty's model (Rafferty 1984, 1990a,b) relies on the concept of world-systems theory to buttress his argument that Anasazi expansion into the Las Vegas Valley was driven by population increase and the need to secure valuable resources for exchange into Chaco Canyon (the leaders of which were sending such goods to the heart of the Toltec empire in central Mexico). Lyneis's (1990, 1992a,b) model adheres closely to available data and recognizes the complexity of human systems and behavior to address the issue of Anasazi expansion and retreat.

Late Prehistoric Period (750 B.P.-Contact). Late prehistoric occupation in the project area is characterized by artifact assemblages that include Owens Valley Brownware ceramics, a variety of projectile points, large triangular knives, incised stones, steatite beads, slate pendants, shell beads, unshaped manos and metates, and mortars and pestles. These artifacts describe the basic lifestyle of a foraging people who may have practiced horticulture on a small scale and lived in small, mobile groups that exploited well-watered

and upland environments. These assemblages provide good evidence for the abandonment of the region by the Anasazi and the arrival of the Southern Paiute (Ezzo et al., 1995). Ezzo et al. (1995) also reviewed the complex issues surrounding the nature and timing of the entry of the Paiutes (or their direct ancestors) into the region—either as early as several thousand years ago or as recently as a thousand or fewer years ago.

Southern Paiute sites tend to consist of surface artifact scatters often associated with hearths or arrangements of fire-cracked rock. Caves and rock shelters were preferred locations for occupation, and petroglyphs occasionally occur on rock shelter walls or on standing boulders—an attribute of the Patayan tradition (Ezzo et al., 1995). According to Ezzo et al. (1995) the Patayan influence in the region at this time is more significant than in any previous period; the pattern of interaction between Patayan and Anasazi and Patayan and Paiute becomes a common occurrence after A.D. 1000 in the Arizona Strip and adjacent areas to the west. The Patayan subsistence and settlement is similar to that of the Southern Paiute – mobility and a mixed subsistence base in a wide range of ecological zones including floodplains, valleys, and uplands. Fragile-pattern sites, primarily an aspect of the Patayan cultural tradition, occur in the region as well. These sites are created by the deliberate or incidental removal of desert pavement from the surfaces of benches, piedmonts, or relict river terraces to create intaglios, earth figures, or geoglyphs in linear, abstract, zoomorphic, and anthropomorphic shapes. Another feature common to Patayan sites along the lower Colorado River are rocks deliberately shaped into a number of patterns (circles and lines). Rock rings (circles) may have functioned as hearths, sleeping areas, or windbreaks, while linear alignments probably functioned as directional markers that pointed travelers toward a particular locality.

Late prehistoric activity in the area represents a time of rather dispersed, small mobile groups occupying habitats and landforms that were previously utilized by the Virgin Anasazi. Subsistence was maintained through a combination of farming the floodplains of the Virgin and Muddy Rivers and probably the larger washes, and exploiting a wide range of ecological zones for wild plant and animal resources (Ezzo et al., 1995).

Historic Period (Contact-Hoover Dam Construction). The earliest Euro-American exploration of the Colorado River dates from the mid-1500s. The Colorado River was discovered and explored in 1540 by the Alarcon, Diaz, and Cardenas expeditions. In 1604-05, Ornate led another Spanish expedition to the mouth of the Little Colorado River, then followed the river to the Gulf of California. Throughout the 1700s, the Spanish conducted several expeditions into the area including explorations by Father Sedelmeyer (1744), Father Garces (1771 and 1775-76), Father Anza (1774), and Father Escalante (1776).

Trappers began to explore the area in the mid-1800s. In 1826, James Puttie became the first white to ascend the Colorado River from its mouth to the Rocky Mountains and in the same year, Jedediah Smith also explored the Colorado River, beginning at its confluence with the Virgin River to the area around Needles, California. From 1846 to 1860, War Department survey parties explored and mapped the Lower Colorado River. In 1857-58, Lt. J.C. Ives completed the first detailed exploration of the Colorado River as he traveled by steamboat from the mouth of the river to a point in the vicinity of Las Vegas Wash. When the Civil War ended, survey and exploration resumed in the Colorado River basin.

Regulation of the Colorado River demanded federal involvement because the river had navigable status (the government had jurisdiction over its control and use) and the river was international (actions affecting water supply required agreement with Mexico). In addition, the Colorado flowed through several states with different and sometimes

contradictory water needs and interests. To reach agreement on the disposition of water rights to the Colorado River, the states of Colorado, California, Nevada, Arizona, Utah, Wyoming, and New Mexico formed the League of the Southwest in 1919. The league urged the federal government to help develop the water resources of the Colorado River basin. In 1921, Congress authorized the states to form a compact to achieve agreement on equitable water distribution. Not all states agreed to the terms, however, and the compact was never ratified.

The states did not reconcile their differences until Congress enacted the Boulder Canyon Project Act in 1928. Six of the seven states had to ratify the compact in order for the Act to take effect; it was ratified in 1929 with only Arizona abstaining. The compact provided for equitable water distribution and ensured Mexico's rights to use the waters of the Colorado River system. It also acknowledged that domestic, agricultural, and hydropower uses should take precedence over navigation.

The Boulder Canyon Project Act authorized construction of a 20,000,000 acre-foot capacity reservoir and dam in Boulder Canyon and a high-line canal from Laguna Dam to the Imperial Valley. By 1920, all alternative potential dam sites had been eliminated except for those in Boulder Canyon and Black Canyon, near Las Vegas. Site D in lower Black Canyon was eventually selected as the dam site. Designs for a dam had been developed during the 1920s, and final designs for a massive arch-gravity dam were approved by the Colorado River Board on November 19, 1932.

The design called for the dam to have a base thickness of 660 feet, a crest width of 45 feet, and a crest length of 1,282 feet. The dam would create the largest reservoir in the world at that time, approximately 115 miles long, with a maximum depth of 590 feet, covering 227 square miles, with a capacity of 32,000,000 acre-feet. In 1931, a railroad was constructed from Boulder City to the Hoover Dam construction site for moving materials and equipment. Construction began in November 1932, and the first concrete was poured in June 1933. By February 1935, enough of the dam was completed to begin controlling the flow of the Colorado River and creating the reservoir. Secretary of the Interior Harold Ickes officially accepted the dam and power plant as complete in March 1936, almost 2 years ahead of schedule. President Franklin Roosevelt dedicated the dam on September 30, 1935, and the reservoir was named Lake Mead in February 1936 in honor of Dr. Elwood Mead, former Commissioner of Reclamation.

3.5.1.3 Traditional Cultural Properties

The University of Arizona (U of A) conducted ethnographic investigations in 1998 and 2000 to support the preparation of the EIS. Since TCPs may be eligible for NRHP listing in accordance with recent amendments to the NHPA, U of A was scoped to conduct a program of detailed field interviews with tribal representatives ("elders") to assist FHWA determine the presence/absence of TCPs and to facilitate future project consultations between FHWA and the various Indian tribal governments (see Sections 3.5.1 and 3.5.1.1).

The major finding of the ethnographic investigation is that the overall project area lies within a National Register-eligible TCP. FHWA recommended the site as an eligible TCP, and the SHPOs, Reclamation, and NPS concurred. This property encompasses a geographic area that includes Gold Strike Canyon on the Nevada side and Sugarloaf Mountain on the Arizona side. Among many statements by the elders, the participating tribal representatives believe:

- Sugarloaf Mountain and the Gold Strike Hot Springs are on "The Salt Song Pathway."

- Amongst the Mohaves, Sugarloaf Mountain is linked to the Origin Mountain, Avikwa'ame.
- Gold Strike Canyon Hot Springs and Sugarloaf Mountain are connected to Gypsum Cave and the Creator.
- Sugarloaf Mountain is marked by healing stones used for doctoring.
- Ceremonial clearings on Sugarloaf Mountain were used for vision quests and dancing.
- Gold Strike Canyon and Sugarloaf Mountain are near a traditional turquoise mine.
- A petroglyph on top of Sugarloaf Mountain is a universal symbol and a trail marker.
- The Gold Strike Canyon Hot Springs are sacred, used for healing and purification.

3.5.2 Environmental Consequences

3.5.2.1 Historical

Eighteen historic sites or features previously identified by Reclamation (Queen, 1992, and White, 1993a, b) would be affected or potentially affected by the three alternatives: Hoover Dam – 26-CK-3916, the Kingman Switchyard – AZ:DD:14:1, Waste Tailings (AZ) – AZ:NV:DD:14:15, Old Construction Road and Test Borings (AZ) - AZ:NV:DD:14:16, World War II Bunker (AZ) - AZ:NV:DD:14:18, the Wooden Ladders (NV) – 26-CK-4734, the Cantilevered Walkway – 26-CK-4742, the Tunnel – 26-CK-4748, Tailings (NV) – 26-CK-4750, the Old Government Railroad grade (Reclamation lands) – 26-CK-4751, Building Foundations (NV) – 26-CK-4752, the Diversion Channel – 26-CK-4753, a Retaining Wall – 26-CK-4754, a Trash Scatter – 26-CK-4763, some elements of the Electrical Power Transmission Switchyard (the Nevada State Switchyard, the M.W.D. Switchyard, and the Southern California Edison Switchyard) – 26-CK-4765, the Scenic Overlook (NV) – 26-CK-4766, Transmission Towers and Lines (NV) – 26-CK-5180, and an Old Construction Road (AZ) – AZF:2:87.

Seven additional historic and cultural properties identified by FHWA after circulation of the DEIS would be affected or potentially affected by the proposed project: the Hoover Dam Transmission Towers in Arizona - AZ:NV:DD:14:29, Old Arizona U.S. Highway 93 Segment in APE - AZ:NV:DD:14:30, Sugarloaf Mountain Survey Station - AZ:NV:DD:14:31, Stone Gates and Lower Portal Access Road (NV) - 26-CK-5789, U.S. 93 Switchback Segment in Nevada - 26-CK-5790, the Arizona-Nevada Switchyard (NV) - 26-CK-5792, and the Gold Strike Canyon and Sugarloaf Mountain TCP. (See FHWA, August 1999, for historic properties, and Section 3.5.1.3 along with FHWA, 2000a, and FHWA, October 2000b, for detailed documentation on the TCP; also see Appendix C, August 27, 1999, and October 12, 2000, FHWA Determination of Eligibility letters to SHPOs.)

Promontory Point Alternative. In June 2000, FHWA applied the criteria of adverse effect and determined in consultation with the Nevada and Arizona SHPOs that the Promontory Point Alternative would have an adverse effect on the Hoover Dam National Historic Landmark because the bypass project would introduce visual elements that diminish the integrity of the property's significant historic features and setting, although it would not cause any physical damage to the dam complex. An adverse effect is found when a project may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Section 110(f) of the NHPA requires that the Agency Official, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to any NHL

that may be directly and adversely affected by an undertaking (36 CFR 800.10); however, FHWA and NPS have determined that the historic views of the dam would be adversely affected and cannot be mitigated. The Promontory Point Alternative would enhance protection of the physical features of the dam by removing trucks from the dam and thereby eliminating the potential for hazardous material spills and large vehicle collisions with dam facilities.

It was also determined, based on previous findings by Reclamation (Queen, 1992, and White, 1993) and recent investigations by FHWA (FHWA, August 1999), that the Promontory Point Alternative would have an adverse effect on the following additional historic properties eligible for the National Register for their association with the construction and operation of Hoover Dam or as contributing elements to the NHL (see above): Old Arizona U.S. Highway 93 Segment in APE, Old Government Railroad Grade (NV), Building Foundations (near Nevada bridge abutment), the Diversion Channel and Retaining Wall (NV), the Nevada State Transmission Switchyard (NV), and the historic Transmission Towers and Lines in Nevada (see Appendix C, June 6, 2000, FHWA Determination of Eligibility and Effect letters to SHPOs). The Promontory Point Alternative would also have an adverse effect on the Gold Strike Canyon and Sugarloaf Mountain TCP (FHWA, October 2000a).

The Old Government Railroad grade (Reclamation lands) would be partially affected by the Promontory Point Alternative. The diversion channel and retaining wall are not individually eligible for listing in the NRHP, but are eligible as contributing elements to a potential Hoover Dam historic district under NRHP, criterion "C." Both may suffer possible direct impact as a result of Promontory Point construction.

The Nevada State electric power transmission switchyard is not individually eligible, but is eligible as a contributing element to a potential district under NRHP criterion "C." The Promontory Point construction could produce both direct and indirect impacts, and partial demolition may be required.

Sugarloaf Mountain Alternative (Preferred Alternative). In June 2000, FHWA applied the criteria of adverse effect and determined, in consultation with the Nevada and Arizona SHPOs, that the Sugarloaf Mountain Alternative would have an adverse effect on the Hoover Dam NHL because the bypass project would introduce visual elements that diminish the integrity of the property's significant historic features and setting, although it would not cause any physical damage to the dam complex. However, FHWA and NPS determined that the preferred alternative would not detract from the historic views of the dam as would the Promontory Point Alternative. The Sugarloaf Mountain Alternative would enhance protection of the physical features of the dam by removing trucks from the dam and thereby eliminating the potential for hazardous material spills and large vehicle collisions with dam facilities.

It was also determined, based on previous findings by Reclamation (Queen, 1992, and White, 1993) and recent investigations by FHWA (August 1999), that the Sugarloaf Mountain Alternative would have an adverse effect on the following additional historic properties eligible for the National Register for their association with the construction and operation of Hoover Dam or as contributing elements to the NHL (see above): Kingman Switchyard (AZ), Transmission Towers and Lines in Arizona, Old Arizona U.S. Highway 93 Segment in APE, Old Government Railroad Grade (NV), Transmission Towers and Lines in Nevada, Stone Gates and Lower Portal Access Road (NV), U.S. 93 Switchback Segment (NV), and the Arizona-Nevada Switchyard (NV) (see Appendix C, June 6, 2000, FHWA Determination of Eligibility and Effect letters to SHPOs); however, the Kingman Switchyard

and the U.S. 93 Switchback Segment would not be physically damaged, but only indirectly affected by a change in the setting. The Sugarloaf Mountain Alternative would also have an adverse effect on the Gold Strike Canyon and Sugarloaf Mountain TCP (FHWA, October 2000a).

The Kingman Switchyard is not individually eligible, but it is eligible as a contributing element to a potential district. Construction could produce indirect effects on its visual and historic setting. The Old Government Railroad grade (Reclamation lands) would be partially affected by construction. Construction could produce both direct and indirect impacts on the Arizona-Nevada Switchyard, and modification or demolition may be required.

Gold Strike Canyon Alternative. In 1991, during early consultation on the bypass project, Reclamation along with NPS and the Nevada and Arizona SHPOs reviewed the effects of the Gold Strike Canyon Alternative and concluded that it would have "no adverse effect" on the Hoover Dam National Historic Landmark because a bridge at this location "competes the least with the Landmark" (see Appendix C, October 2, 1991, Reclamation meeting notes). The Gold Strike Canyon Alternative would not cause any physical damage to the dam complex and would enhance protection of the physical features of the dam by removing trucks from the dam, thereby eliminating the potential for hazardous material spills and large vehicle collisions with dam facilities.

It was also determined, based on previous findings by Reclamation (Queen, 1992, and White, 1993) and recent investigations by FHWA (FHWA, August 1999), that the Gold Strike Canyon Alternative would have an adverse effect on the following historic properties eligible for the National Register for their association with the construction and operation of Hoover Dam or as contributing elements to the NHL (see above): Arizona Waste Tailings, Old Construction Road and Test Borings (AZ), Old Arizona U.S. Highway 93 segment in APE, Wooden Ladders (NV), and the Waste Tailings in Nevada (see Appendix C, June 6, 2000, FHWA Determination of Eligibility and Effect letters to SHPOs). The effects on the Tunnel (NV) and Cantilevered Walkway (NV) properties were undetermined by Reclamation. The Gold Strike Canyon Alternative would also have an adverse effect on the Gold Strike Canyon and Sugarloaf Mountain TCP (FHWA, October 2000a).

The waste tailings, cantilevered walkway, tunnel, and the Nevada tailings are not individually eligible, but are eligible as contributing elements to a potential district. The Nevada tailings would suffer direct impact from Gold Strike Canyon construction, while the walkway could suffer partial or direct impact. The tunnel could provide construction access to the Gold Strike Canyon worksite if it were enlarged to accommodate heavy equipment. The Arizona tailings could also suffer partial impact from Gold Strike Canyon construction.

3.5.2.2 Archaeological

Five prehistoric archaeological sites were recorded during investigation of the proposed project alternatives. None of these sites were found to be eligible for the National Register. Four of the five sites are within the APE (ASM NV:DD:14:21, -22, -23, and -25) while one appears to be outside the APE (ASM NV:DD:14:24). All four sites within the APE would likely be impacted, while the site outside the APE might be impacted without fencing.

Promontory Point Alternative. Two prehistoric archaeological sites were recorded within the APE of the Promontory Point Alternative (ASM NV:DD:14:23 and -25), and one site was recorded just outside the APE (ASM NV:DD:14:24). These three sites were found to be ineligible for NRHP listing.

Sugarloaf Mountain Alternative (Preferred Alternative). Two prehistoric archaeological sites lie within the APE of the Sugarloaf Mountain Alternative. Although not individually eligible, one site is a contributor to the eligible TCP (ASM NV:DD:14:21); the other is not (ASM NV:DD:14:22).

Gold Strike Canyon Alternative. No archaeological sites were detected in those portions of the Gold Strike Canyon Alternative APE that were surveyed in March 1998.

3.5.2.3 Traditional Cultural Properties

As a result of government-to-government consultation and as indicated above, the ethnographic study (FHWA, October 2000a) indicates that an NRHP-eligible TCP is present in the project area, and construction of any of the three build alternatives would adversely affect this property.

3.5.2.4 Construction Impacts

Promontory Point Alternative. Construction of the Promontory Point Alternative would have an adverse effect on the historic visual setting of Hoover Dam. FHWA and NPS determined that the adverse effect on the historic views of the dam could not be mitigated. Segments of the Old Government Railroad grade within Reclamation jurisdiction would be adversely affected; however, NPS is in the process of developing an agreement with NDOT to convert this historic railroad grade to a bicycle/pedestrian trail (see Section 3.8, Recreation Resources). A part of the diversion channel and a small segment of the retaining wall would be destroyed by construction. The northernmost electrical power transmission switchyard would be partially or totally destroyed, and transmission towers in Nevada would be relocated. The Old Arizona U.S. Highway 93 segment would be directly impacted.

The two ineligible prehistoric archaeological sites within the APE would likely be destroyed during construction.

The Promontory Point Alternative would also directly impact approximately 14 acres from the northeastern portion of the Gold Strike Canyon and Sugarloaf Mountain TCP on the Arizona side.

Sugarloaf Mountain Alternative (Preferred Alternative). Construction of the Sugarloaf Mountain Alternative would have an adverse effect on the historic visual setting of Hoover Dam; however, this effect can be mitigated. Several of the historic transmission towers and lines in Arizona and Nevada will require relocation for construction of the bypass roadway and bridge. A portion of the abandoned Arizona U.S. 93 segment in the APE will be covered by construction of a bridge over Kingman Wash. The bypass may directly impact the stone gates, but would not affect the lower portal access road near the Reclamation warehouse on the Nevada side. A segment of the Old Government Railroad grade within Reclamation jurisdiction will be directly affected (see Section 3.8, Recreation Resources). The Arizona-Nevada Switchyard may be modified or fully demolished.

Two individually ineligible prehistoric archaeological sites are located in the APE. One site would be partially destroyed during construction, and the other site would be completely destroyed during construction (see Section 3.5.2.2).

The Sugarloaf Mountain Alternative would also directly impact approximately 22 acres from the northern portion of the Gold Strike Canyon and Sugarloaf Mountain TCP on the Arizona side. The preferred alternative alignment traverses along the base of Sugarloaf Mountain, approximately 700 feet north and 200 feet below the mountain top. The area

where the bypass crosses the TCP is already disturbed by transmission lines and towers, a switchyard and other power facilities, maintenance roads, and sewer evaporation ponds.

Gold Strike Canyon Alternative. Construction of the Gold Strike Canyon Alternative would have no adverse effect on the historic visual setting of Hoover Dam. The historic waste tailings on the Arizona side would be partially destroyed by project construction. The Old Arizona U.S. 93 highway segment would be directly impacted. The cantilevered walkway and tailings on the Nevada side would be partially destroyed. The tunnel could be substantially altered if it is enlarged to accommodate access by large, heavy equipment needed for construction.

The Gold Strike Canyon Alternative would also directly impact approximately 51 acres from the entire length of the Gold Strike Canyon and Sugarloaf Mountain TCP. Of the three build alternatives, the Gold Strike Canyon alignment would have the most substantial impact on the TCP, physically damaging large, presently undisturbed portions of most of Gold Strike Canyon on the Nevada side and the southern flank of Sugarloaf Mountain on the Arizona side.

All Alternatives. The ethnographic study indicates that the project area lies within a TCP. Thus, all three build alternatives impact the TCP. According to the tribal representatives (FHWA, October 2000a), specific impacts might include:

- Tremendous amounts of ground disturbance (especially at Gold Strike Canyon).
- Intrusion and interference with ceremonies, songs, or trail systems.
- Scaring away rams and damaging artifacts and archaeological sites during construction and project operation.
- Construction and project operation would destroy the whole site, the scenery, and the culture related to it. The bridge could destroy artifacts and aesthetic setting.
- Any kind of construction would damage Indian sacred land/country.
- Dynamiting rock and bulldozing may injure workers and tourists (construction killed a Pahrump Paiute Hoover Dam project worker in 1935).
- Construction would trample ruins and deplete the herds of mountain sheep.
- Construction would damage mountain sheep trails to water. Undiscovered rock writings might be destroyed.
- There will be more pollution and public access, more vandalism and destruction.
- Known and unknown cultural resources would be destroyed.
- There would be a lot of damage, especially on Sugarloaf Mountain.
- Construction would hurt the rocks.

3.5.2.5 Operational Impacts

Promontory Point Alternative. Construction of the Promontory Point Alternative would have an adverse effect on the historic visual setting of Hoover Dam, which would continue if the Promontory Point Alternative were constructed. Because segments of the Old Government Railroad grade within Reclamation jurisdiction would be destroyed, there would be no operational impacts to this feature. Similarly, those portions of the diversion tunnel and retaining wall that would be destroyed by construction would likely not experience further

impact resulting from project operation. The northernmost electric power transmission switchyard, which would be partially or totally destroyed, would not likely experience further impact from project operations. Operation of the Promontory Point Alternative would affect the historic setting of the World War II Bunker in Arizona and the old building foundations (near the bridge abutment) and remaining transmission towers in Nevada.

Since construction would probably destroy one prehistoric archaeological site and may likely destroy another, the potential effects of project operation would be moot. If one of the sites escapes destruction or damage from road construction, it could still be subject to operational impacts from the new roadway. Without fencing, destructive impacts during operation could take the form of off-road-vehicle use adjacent to the roadway, or illegal collection of artifacts facilitated by easy road access. None of these archaeological sites are eligible for the NRHP.

Sugarloaf Mountain Alternative (Preferred Alternative). Construction of the Sugarloaf Mountain Alternative would have an adverse effect on the historic visual setting of Hoover Dam; however, this impact can be reduced by implementation of mitigation measures in the PA. The anticipated visual impacts expected to affect the Kingman Switchyard and the Sugarloaf Mountain Survey Station can be mitigated. The Arizona-Nevada Switchyard, if not demolished, would be visually impacted from project operations. The U.S. 93 switchback segment in Nevada and the remaining historic transmission towers also would be visually impacted from project operations.

Operation of this alternative could produce impacts to a prehistoric archaeological site in addition to its partial destruction resulting from construction. Without planned fencing, destructive impacts during operation could take the form of off-road-vehicle use adjacent to the roadway or illegal collection of artifacts facilitated by easy road access to the site if there is no access control fencing. This site is a contributing element of the TCP.

Gold Strike Canyon Alternative. Construction of the Gold Strike Canyon Alternative would have no adverse effect on the historic visual setting of Hoover Dam. Project operation would also have no adverse effect on the historic visual setting of Hoover Dam. The waste tailings on the Arizona site that would be partially destroyed by project construction, and the cantilevered walkway and tailings on the Nevada side that would also be partially destroyed, would not likely experience any further impact resulting from project operation. The tunnel, which might be substantially altered if it is enlarged to accommodate access by large, heavy equipment needed for construction, would not likely experience further impact from project operations. Because no archaeological sites were identified in or adjacent to this alternative, no operational impacts are expected.

All Alternatives. Operational impacts to the TCP would include traffic noise, exhaust emissions, and a change in the visual setting.

No Build Alternative. If the Hoover Dam Bypass Project is not built, there will be no effect on known/recorded historic properties. The known/recorded prehistoric archaeological sites and historic archaeological features associated with the construction of the Old Boulder City Water System and Hoover Dam are located well away from pedestrian or vehicle tourist traffic. Hence, continued operation of the existing highway bridge (over the dam) and existing highway approaches should have no effect on these resources. However, under No Build, the traffic congestion on the historic two-lane crest roadway and approaches will worsen, further degrade the historic setting, and increase the potential for traffic collisions with dam appurtenances.

The presence of Hoover Dam and operation of the existing highway bridge and approaches have diminished several traditional cultural values that the Indian Tribes ascribe to the overall project vicinity. If the project is not built, there would be no further effects to the TCP than those that presently exist. However, failure to build the project may result in great harm to Native American cultural values if an accidental spill (off the dam) of hazardous materials pollutes the Colorado River.

3.5.3 Measures to Minimize Harm

For the NRHP eligible historic and cultural features affected by the project, formal consultations with Nevada and Arizona SHPOs and the federal land-managing agencies (NPS and Reclamation) were completed for the preferred alternative for determination of specific measures to minimize harm to these cultural resource sites.

A PA that commits FHWA to implement specific activities and mitigation measures to resolve the adverse effects on historic properties from the preferred alternative was developed in consultation among the ACHP, FHWA, Nevada and Arizona SHPOs, NPS, Reclamation, WAPA, NDOT, ADOT, and interested Native American tribal governments. The PA stipulates, in part, that FHWA will establish a Design Advisory Panel (DAP) to review bridge design concepts and corridorwide design elements, develop Corridor Design Criteria for aesthetic consistency of major structural, roadway and earthwork elements, mitigate adverse effects on historic resources according to the Secretary of Interior Standards, and mitigate adverse effects on the TCP based on specific measures identified in consultation with the Native American tribes who are invited signatories to the PA. The DAP consists of members from FHWA, NDOT, ADOT, the Nevada and Arizona SHPOs, the ACHP, the NHL Coordinator, NPS, Reclamation, WAPA, and consulting Native American tribes, as well as an independent architectural historian and a registered landscape architect. The PA includes a clause listing highway and power facilities maintenance and operations exemptions for activities by Reclamation, WAPA, NPS, ADOT, and NDOT within the TCP boundaries.

The PA incorporates a Treatment Plan for avoidance, minimization, and mitigation of adverse effects to historic and cultural properties. The specific mitigation measures in the Treatment Plan for historic resources include documenting the Hoover Dam National Historic Landmark viewshed and related historic features in accordance with the Historic American Engineering Record (HAER) standards, determined in consultation with the NPS/HAER. Mitigation measures currently identified for the TCP have resulted from the ongoing government-to-government consultation meetings between FHWA, NPS, Reclamation, and the Native American tribes. The mitigation measures recommended by the tribes to date and incorporated in the PA include providing funding to the tribes for continuing consultation through design and construction, providing access for the tribes to the TCP, developing a statement of work for conducting future studies of cultural landscapes in the surrounding area, and providing Native American cultural interpretive exhibits in the vicinity of Hoover Dam.

3.5.3.1 Construction Mitigation

Promontory Point Alternative. In June 2000, FHWA applied the criteria of adverse effect and determined in consultation with the Nevada and Arizona SHPOs that the Promontory Point Alternative would have an adverse effect on the Hoover Dam NHL because the bypass project would introduce visual elements that diminish the integrity of the property's significant historic features and setting. Furthermore, FHWA and the NPS have determined

that construction of a bridge at the Promontory Point crossing would adversely affect visitors' "first impression" historic views of the dam. These views occur as motorists approach the dam on existing U.S. 93 from both Nevada and Arizona. The dominance of the Promontory Point bridge would significantly detract from the historic views of the dam and could not be mitigated. Measures to minimize harm would be required for segments of the Old Government Railroad grade within Reclamation jurisdiction. Furthermore, because the railroad is under conversion to a bicycle/pedestrian trail by NPS, it must be protected as a recreation resource (see Section 3.8). Measures may be required for a portion of the diversion tunnel and a small segment of the retaining wall because these features are eligible as contributing elements to a potential historic district. Because the electric power transmission switchyard is eligible as a contributing element to a potential historic district, measures to minimize harm would likely be required. Mitigation would also be required for the transmission towers in Nevada, the Old Arizona U.S. 93 highway segment, and the TCP. Consultation with the Nevada and Arizona SHPOs would be required to determine the nature and magnitude of the measures.

Mitigation for construction impacts to prehistoric archaeological sites NV:DD:14:23, NV:DD:14:24, and NV:DD:14:25 would not be required because these sites were found ineligible for the National Register. However, construction in these areas may require an archaeological and Native American monitor, and in any cases of unanticipated discovery, the finds would have to be secured and protected until appropriate actions could be implemented.

Sugarloaf Mountain Alternative (Preferred Alternative). In June 2000, FHWA applied the criteria of adverse effect and determined in consultation with the Nevada and Arizona SHPOs that the Sugarloaf Mountain Alternative would have an adverse effect on the Hoover Dam NHL because the bypass project would introduce visual elements that diminish the integrity of the property's significant historic features and setting. However, in contrast to the Promontory Point Alternative, FHWA and NPS determined the preferred alternative bridge would not detract from the "first impression" historic views as visitors approach the dam from the Arizona and Nevada approaches. The Design Advisory Panel established in the PA will provide input on bridge design concepts, addressing structure type, materials, and colors to minimize the visual impact.

The PA/Treatment Plan for the Sugarloaf Mountain Alternative includes other specific measures to minimize harm to historic and cultural properties that will be directly impacted during construction. For all adversely affected historic and cultural properties, the PA identifies and requires an appropriate level of documentation for each site prior to construction. The specific level of documentation for all properties, including HAER recordation, will be determined in consultation with NPS/HAER authorities. HAER recordation may include large format photography of affected features; measured drawings where appropriate; reproduction of original design drawings, construction specifications, and historic photographs; photography of the property setting; and a historical context.

In Arizona, the properties to be mitigated before they are impacted by construction consist of historic transmission towers and lines to be removed and the Old Arizona U.S. 93 highway segment. In Nevada, the properties to be mitigated consist of the Old Government Railroad grade, historic transmission lines and towers, and the stone gate structure. Since NPS is converting the railroad grade to a bicycle/pedestrian trial, those critical segments will be protected as a recreation resource through close coordination between FHWA and

NPS (see Section 3.8). If the Arizona-Nevada Switchyard cannot be avoided by engineering design, it too will be documented prior to any modification or demolition.

Mitigation for construction impacts to prehistoric archaeological sites NV:DD:14:21 and NV:DD:14:22 will not be required because these sites were found ineligible for the National Register; although, site NV:DD:14:21 was found to be a contributing element of the TCP. However, construction in these areas may require an archaeological and Native American monitor, and in any cases of unanticipated discovery, the finds would have to be secured and protected until appropriate actions could be implemented.

The PA/Treatment Plan for the preferred alternative incorporates measures to minimize harm to the Gold Strike Canyon and Sugarloaf Mountain TCP. The Native American tribal representatives, through a representative on the Design Advisory Panel, will have input to the Corridor Design Criteria for the bypass roadway and bridge. Native American tribal representatives may monitor construction of the roadway facility through the TCP area and the related lithic scatter (NV:DD:14:21) located on the eastern flank of Sugarloaf Mountain. Other mitigation measures that have been requested by the tribal representatives during the government-to-government project consultation meetings will be elaborated and refined by FHWA, the federal land managing agencies, and consulting tribes under the PA. The specific measures that have been recommended by the tribes and included in the PA for consideration by FHWA and the federal land managing agencies are to:

- Consummate a Memorandum of Understanding regarding the continued government-to-government consultation between FHWA and the tribes
- Provide funds as available for ongoing tribal consultation
- Involve the tribes in the design aspects of the new bridge and roadway
- Continue the consultation with the tribes throughout the design and construction process
- Protect the confidentiality of sensitive cultural information provided to the federal agencies by tribal representatives
- Provide access for the tribes to traditional cultural places in the project area
- Develop a statement of work for conducting future cultural landscape studies for the larger area encompassing the Gold Strike Canyon and Sugarloaf Mountain TCP
- Provide Native American cultural interpretive exhibits, developed in consultation with tribal representatives
- Develop a separate treatment plan for any inadvertent discoveries of human remains during any project-related activity

Gold Strike Canyon Alternative. In 1991, Reclamation, NPS, and the SHPOs concluded that construction of the Gold Strike Alternative would have no adverse effect on the historic visual setting of Hoover Dam, suggesting that measures to minimize harm would not be required. Because the waste tailings on the Arizona site (NV:DD:14:15) are eligible for NRHP listing as contributing elements to a potential historic district, measures to minimize harm could be required. The same situation would apply to the cantilevered walkway (26-CK-4742) and tailings on the Nevada side (26-CK-4750). The tunnel (26-CK-4748), if substantially altered to accommodate passage of large construction equipment, might also be subject to measures because it is also eligible for NRHP listing as a contributing element to a potential historic district. The TCP would be substantially impacted, and it is uncertain if any mitigation would be acceptable to the tribes.

No prehistoric archaeological sites were detected in those portions of the Gold Strike Canyon Alternative surveyed in March 1998 or examined by Reclamation's archaeological staff in 1991 to 1992. Because no archeological sites were identified along this alternative, no specific mitigation measures would be required; however, construction may require an archaeological and Native American monitor, and in any cases of unanticipated discovery, the finds would have to be secured and protected until appropriate actions could be implemented.

3.5.3.2 Operational Mitigation

Promontory Point Alternative. As noted above, construction of the Promontory Point Alternative would result in adverse effects on the historic visual setting of Hoover Dam. These visual impacts are considered by FHWA and NPS to be unmitigable. Therefore, no available measures exist to minimize harm during project operation.

The portion of the Old Government Railroad grade directly impacted by the Promontory Point Alternative would be mitigated according to the measures defined in the PA for the preferred alternative. Given the substantial impact to the railroad grade by the Promontory Point alignment, conversion of the grade as a bicycle/pedestrian trail by NPS may not be practicable under this alternative (see Section 3.8).

Measures to minimize harm may be required during construction for the portion of the diversion tunnel and small segment of the retaining wall because these features are eligible as contributing elements to a potential historic district. Once constructed, it is unlikely that harm minimization measures would be required for these two features during project operation.

Operation of the Promontory Point Alternative would affect the historic setting of the old building foundations (near the bridge abutment) and the remaining transmission towers in Nevada. Mitigation measures likely would be required. Because the electric power transmission switchyard is also eligible as a contributing element to a potential historic district, measures to minimize harm would likely be required during construction; but once constructed, such measures are not likely to be required during project operation. Consultation with the Nevada SHPO would be required to determine the nature and magnitude of the measures.

The historic setting of the World War II Bunker on the Arizona side would be affected by the operation of the bypass passing below it on this alignment. Consultation with the Arizona SHPO would be required to determine the nature of any mitigation measures needed to resolve this impact.

Site AZ:NV:DD:14:23, found ineligible for the NRHP, would probably be destroyed by construction; therefore, operational impacts would be irrelevant. Sites AZ:NV:DD:14:24 and -25 are also not eligible for NRHP listing, and mitigation would not be required.

Sugarloaf Mountain Alternative (Preferred Alternative). As noted above, construction of the Sugarloaf Mountain Alternative would produce adverse effects to the historic visual setting of Hoover Dam. Operation of the Sugarloaf Mountain Alternative will change the long-term visual setting of the historic landmark, as well as the Kingman Switchyard and the Sugarloaf Mountain Survey Station in Nevada, the U.S. 93 Switchback in Arizona, and the remaining historic transmission towers and lines in both states.

Input by the Design Advisory Panel on bridge design concepts, structure type and materials, and in developing corridorwide design criteria will mitigate the total project effects on the NHL and other proximate historic properties, as stipulated in the PA. The panel will consist of representatives from FHWA, ACHP, the National Historic Landmark Coordinator, NPS, Reclamation, WAPA, the signatory Native American tribes, the Nevada and Arizona SHPOs, NDOT, ADOT, an independent architectural historian, and an independent registered landscape architect. Design enhancements from this panel will minimize both the short-term construction impact as well as the long-term operation impact of the new highway bypass on the historic landscape.

Construction impacts may require mitigation of AZ:NV:DD:14:21 as a contributing element of the TCP. Site AZ:NV:DD:14:22 is not eligible, and mitigation would not be required. Operational impacts on the TCP will be minimized through measures applied from the PA.

Gold Strike Canyon Alternative. As noted above, construction of the Gold Strike Canyon Alternative would have no adverse effect to the historic visual setting of Hoover Dam, suggesting that measures to minimize harm would not be required, either during construction or operation. Because the waste tailings on the Arizona site are eligible for NRHP listing as a contributing element to a potential historic district, measures to minimize harm during construction could be required. Once implemented, however, it is unlikely that further measures to minimize harm would be required during operation. The same situation would apply to the cantilevered walkway and tailings on the Nevada side. The tunnel, if substantially altered to accommodate passage of large construction equipment, might also be subject to measures because it too is eligible for NRHP listing as a contributing element to a potential historic district. Once implemented, however, it is unlikely that further measures to minimize harm to the tunnel would be required.

No archaeological sites were identified in this alternative; therefore, no impacts are expected and no mitigation required.

All Alternatives. Operation of any of the build alternatives would diminish the integrity of the visual and audible setting of the Gold Strike Canyon and Sugarloaf Mountain TCP on a long-term basis. The mitigation measures and treatment approach incorporated in the PA and described in Section 3.5.3.1 for the preferred alternative will be further refined and possibly expanded during continued consultations between FHWA, the land managing agencies, and the tribal representatives, with the goal of minimizing the intrusion of the highway bypass on future Native American uses of the TCP.

No Build Alternative. No mitigation measures would be required to reduce harm to prehistoric and historic archaeological sites and features if the project is not built.

Indian tribes that participated in this investigation suggested several measures that would reduce adverse effects to their TCP and its associated cultural values if the project is built. Some of these measures could be implemented in a no build scenario to mitigate the existing harmful effects of the existing conditions on these cultural values (e.g., a monument to Indian peoples, educate Indians and non-Indians that Hoover Dam is where Indian ancestors lived, close the hot springs and open them only to the Indians, set aside an area(s) for Indian use, and include Indian tribes in comanagement of lands in the project area).

3.6 Land Use

3.6.1 Affected Environment

This section discusses existing land uses in the vicinity of the three build alternatives. Three types of federal land are in the proposed project area: LMNRA, administered by the NPS; Hoover Dam Reservation (HDR), administered by Reclamation; and the Hoover Dam National Historic Landmark (HDNHL), also administered by Reclamation (see Figure 2-3). Current land uses are described below. A Section 4(f) evaluation pertaining to federally protected parklands and historic sites was prepared and is included as Chapter 6. The proposed project area is entirely on federal lands located within Clark County and Mohave County. For comparative purposes, brief descriptions of applicable land use policies are given below.

The Promontory Point and Sugarloaf Mountain Alternatives would traverse LMNRA, HDR, and HDNHL lands; the Gold Strike Canyon Alternative would traverse only LMNRA and HDR lands. The portions of the three alternatives on the Nevada side of the Colorado River are in Clark County, and the portions on the Arizona side of the Colorado River are in Mohave County.

3.6.1.1 Existing Land Uses in the Project Area and Vicinity

To characterize existing land uses along the three build alternative alignments and in the vicinity, on-the-ground and drive-by area surveys were performed March 9 and 10, 1998. Outside the proposed project area, immediately west of the western terminus of the three build alternatives is the Hacienda Hotel (formerly called the Gold Strike Inn at the time of the survey). Outside the proposed project area, immediately east of the eastern terminus of the three build alternatives is undeveloped open space. Immediately north and south are lands dedicated to open space and recreational uses. To the north is Lake Mead; to the south is the Colorado River. Hoover Dam separates the two water features. Most of the proposed project area is undeveloped open space, portions of which are used for recreational purposes.

Existing land uses along the Promontory Point Alternative and in its vicinity include undeveloped recreational land (36 acres minimum, Mohave County General Plan) and electric transmission and distribution facilities and other facilities associated with Hoover Dam.

Existing land uses along the Sugarloaf Mountain Alternative and in its vicinity include undeveloped recreational land, a water tank, sewage evaporation ponds, and electric transmission facilities associated with Hoover Dam. About 400 feet downstream of this alternative is a rafting concessionaire's put-in on the Colorado River. Access to this put-in is provided by Reclamation's restricted access Lower Portal Road. Reclamation operates a warehouse associated with the dam operations approximately midway between the western terminus and Hoover Dam.

Existing land uses along the Gold Strike Canyon Alternative and in its vicinity include undeveloped recreational land and an undesignated trail used to hike through Gold Strike Canyon down to the river. Near the mouth of the canyon are the drainages of geothermal seeps and hot springs, some of which have human-made blockages to form ponds of warm water. These ponds are used for recreational purposes.

Farmlands. As previously noted, most land within the vicinity of the proposed project is undeveloped, with a large portion dedicated to recreational uses. Agricultural land uses typically are not excluded from these areas.

As a result of a substantial decrease in the amount of open farmland, Congress passed the Farmland Protection Policy Act (PL 97-98; 7 U.S.C. 4201 et seq.). The purpose of the Act is to minimize the unnecessary and irreversible conversion of farmland to nonagricultural uses by federal programs/actions. The Act further requires that federal programs/actions be administered in a manner that will be compatible with state and local government and private programs and policies to protect farmland. The Act specifies three categories of farmlands:

- Prime farmland—land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion (7 U.S.C. 4201[c][1][A]).
- Unique farmland—land other than prime farmland that is used for the production of specific high-value food and fiber crops such as citrus, tree nuts, olives, cranberries, fruits, and vegetables (7 U.S.C. 4201[c][1][B]).
- Additional farmland of statewide or local importance—land identified by state or local agencies for agricultural use, but not of national significance (7 U.S.C. 4201[c][1][C]).

No present agricultural land uses that fall within these farmland categories have been identified within the project vicinity.

3.6.1.2 Land Use Planning

The Clark County General Plan, Mohave County General Plan, the LMNRA General Management Plan (GMP), Reclamation's Hoover Dam Reservation, and the National Historic Landmark are the development guides in the proposed project area. Although the land use plans for Clark and Mohave Counties have no legal authority over management of federal lands, federal agencies strive to achieve conformance with adjoining land use plans.

Clark County General Plan. The proposed project area within Nevada is located within Clark County. The Clark County General Plan lists several general planning goals applicable to the proposed project. These goals are provided below.

- Goal 1: To promote public health, safety, and welfare
- Goal 2: To promote efficient use of public services
- Goal 3: To promote development compatible with the natural environment

Mohave County General Plan. The proposed project area within Arizona is located within Mohave County. The Mohave County General Plan lists several major planning concepts that define its vision for year 2010. Among these are three concepts applicable to the project: promote beneficial economic growth, development, and renewal; protect the environment; and preserve and enhance historic, cultural, open space, and recreational lands and structures.

Transportation is addressed as part of the General Plan's Public Infrastructure Element. The County recognizes the relationship between land uses and transportation facilities. In addition, the County acknowledges the importance of compatibility of the County's roadway system with city, state, and federal roads. General Plan transportation policies

apply to streets within the County's jurisdiction, namely arterial roads and collectors within the County's street system. No specific General Plan transportation policies apply to the proposed project area; however, the following three goals generally apply to the proposed project area:

- Goal 51: To plan, construct, and maintain an efficient transportation system that is adequate to meet the mobility needs of County residents and businesses
- Goal 52: To promote compatibility between roadway improvements, land use patterns, and natural features
- Goal 53: To minimize the impacts of automobile travel on the County's air quality, natural environment, and developed communities (Freilich, Leitner & Carlisle, 1995)

Lake Mead National Recreation Area General Management Plan. The LMNRA GMP, prepared by the NPS, provides a management strategy for the two reservoirs (Lake Mead and Lake Mohave) and surrounding lands within the National Recreation Area (NRA). The NRA contains 1,482,476 acres of federal land and 28,212 acres of nonfederal land (see Figure 6-1).

The NPS management strategy focuses on accommodating increasing visitor use at the NRA while protecting the area's most outstanding natural and cultural values. The NPS seeks to provide a quality visitor experience in a manner that will ensure visitor safety and will protect the area's significant resources. Due to increasing demands on the park's waters, shoreline resources, and facilities, a Lake Management Plan is in preparation. This plan will supplement the GMP in the areas of recreational carrying capacity and shoreline recreation facilities.

Hoover Dam Reservation. The Hoover Dam Reservation (Reservation) delineates lands managed by Reclamation for security purposes and for operating and maintaining Hoover Dam, its buildings and structures, electric transmission lines, towers, switchyards, and spoil disposal sites. No specific management plan has been prepared for guiding development within the Reservation; however, public access to certain areas within the Reservation is restricted, and portions of the area are fenced. As such, Reservation lands do not fall under federal parkland protective provisions (see Chapter 6). Controlled access to the Colorado River about 1 mile west of Hoover Dam is provided by a locked gate at the Lower Portal Road and U.S. 93 intersection. Access is allowed to a rafting concessionaire, a tour group operator, and individuals having permits issued by Reclamation.

Hoover Dam National Historic Landmark. Hoover Dam is a designated National Historic Landmark and is listed in the National Register of Historic Places. It is under the jurisdiction of Reclamation. National Historic Landmarks identify, designate, recognize, and protect buildings, structures, sites, and objects of national significance. The NPS, in cooperation with other government agencies, professionals, and independent organizations, administers the landmark program. Once a site is designated a National Historic Landmark, the owner maintains all rights and privileges of ownership. However, the designation requires that federal transportation projects affecting a landmark take steps to minimize harm to the affected property, under Section 4(f) of the Department of Transportation Act. The dam also falls under the protective provisions of Section 106 of the National Historic Preservation Act.

3.6.2 Environmental Consequences

3.6.2.1 Construction Impacts

Consequences associated with development of the project alternatives, including the preferred alternative, are based on the compatibility of the alternatives with both existing land uses and applicable planning documents governing the use of project lands. Changes in land use and patterns resulting from the three build alternatives evaluated are generally consistent with federal and local land use plans. Impacts from the three build alternatives are separated into those associated with construction, and those resulting from operation of the alternatives.

Potential effects on land use are associated with project construction rather than operation because once the right-of-way easement has been granted and construction begins, no further changes to land use patterns are expected. Existing land uses surrounding the proposed project area would not be precluded during the construction period. Access to most existing land uses would be maintained; the exception is the trail in Gold Strike Canyon, which would be closed to public access during construction of the Gold Strike Canyon Alternative.

The primary land use change associated with the build alternatives is the development of currently undeveloped recreational land for a four-lane highway in the proposed project area. Table 3-18 shows the total acreage that would be developed in each jurisdiction.

Table 3-18
Acreage to be Developed for Each Build Alternative[a]

Jurisdiction	Promontory Point	Sugarloaf Mountain	Gold Strike Canyon
Lake Mead National Recreation Area	94.5	95.9	97.1
National Historic Landmark Boundary	40.6	25.7	0.0
Hoover Dam Reservation	73.9	70.7	81.2
Total Acreage	209.0	192.3	178.3

[a]Includes areas of all potential project components.

3.6.2.2 Operational Impacts

Existing land uses surrounding the proposed project area would not be affected following project completion. The change from recreational land to highway would constitute a small change when compared to the expansive amount of open space area in the surrounding region. Access to existing land uses would be maintained during project operation. No operational impacts on air quality were identified with the build alternatives; however, the Gold Strike Canyon Alternative would have an unmitigable noise impact on recreational land uses.

3.6.2.3 No Build Alternative

Because the No Build Alternative would result in no construction, no land use changes would occur. However, there would be negative effects on visitor usage as congestion increases on the dam.

3.6.3 Measures to Minimize Harm

Noise, visual, and access impacts on recreational land use with construction and operation of the Gold Strike Canyon Alternative could not be mitigated (see Section 3.8.3.2). No other adverse impacts on land use from construction or operation were identified; therefore, no mitigation is warranted.

3.7 Visual Resources

3.7.1 Affected Environment

3.7.1.1 Visual Environment

Landscape Description. The proposed project area is within the LMNRA, which retains an undisturbed character throughout much of its area, but also includes some developed facilities. The desert in the proposed project area is at elevations ranging from about 650 feet to about 2,000 feet. Soils in the proposed project area are pink, red, and brownish-gray. Landforms are mountains, valleys, and beaches, and include the deeply incised Black Canyon, Gold Strike Canyon, and Sugarloaf Mountain. Landcover in the proposed project area includes Lake Mead, the Colorado River, low-lying and sparse desert vegetation, rock formations, and human-made development such as Hoover Dam facilities, electric transmission towers and lines, access roads, and U.S. 93.

Visual Character. Primary forms in the proposed project area are Lake Mead, Hoover Dam, Colorado River, and Black Canyon. Hoover Dam, viewed either from U.S. 93 or from the air, is a large mass. Views from the dam, lake, river, or canyon also show the area's variety of forms. Aerial views and views from the river and dam all exhibit strong lines. For example, Hoover Dam provides both horizontal and vertical lines in the landscape. Electric transmission towers and lines provide angled, vertical, and horizontal lines. U.S. 93 introduces a horizontal line across the landscape. The walls of Black Canyon exhibit vertical lines, and viewed from the air, the river exhibits a meandering line.

Color variety in the proposed project area is evidenced by the Canyon's pinkish-brown rock formations and soils; lightness is introduced by the concrete of the dam structure; and brightness is provided by the sun's reflection off the dam, lake, and river. Additional color is added by the blues and greens of the lake and river. Area texture includes rock formations, topography, water surfaces, and low-lying vegetation.

Outside of Lake Mead, Hoover Dam is the most dominant human-made feature within the proposed project area. Its position in the canyon relative to overlooks, viewpoints, and the visitor center clearly make it the visual focus. Its size makes it an impressive structure, and its placement within the deep canyon makes it compatible with the area. Visual diversity is provided by the mixture of natural and human-made environment such as the variety of forms; straight and curved lines; lightness, darkness, and color variety; and textural variety offered by ground surface relief and vegetation. The area's landscape forms, lines, color combinations, and textures all contribute to visual continuity.

Visual Quality. Three criteria were used to evaluate the proposed project area's visual quality: vividness, intactness, and unity. Determining vividness of the proposed project area includes assessing the area's landforms, landcover, and human-made development. The proposed project area's vividness rating is high. The area's landforms (steep canyon walls and mountains) contribute to the memorable view. Water bodies (both lake and

river) provide a vivid landscape because of their color, reflection of sunlight, motion, and shoreline. Human-made development in the area contributes to the view's vividness by its contrast with the natural landscape (the dam and its facilities, angled design of electric transmission line towers, parking lots, and roads).

Intactness of the proposed project area is demonstrated by the integrity of the features. Human-made features add to the area's complexity and visual variety. The area appears very ordered; a view of the dam from downstream exhibits symmetry and strong lines.

Landscape unity is achieved by the mixture of natural elements and human-made alterations. Compatibility exists between the natural landscape (canyon, lake, and river) and the human-made facilities (dam, electric transmission lines, visitor center, parking lots, concessions, and road).

The NPS considers many natural features within the LMNRA to be outstanding. Uniqueness, critical habitat protection, and aesthetic and recreational value are criteria used by the NPS to consider natural features outstanding. Features include warm springs, unique geologic formations and plant communities, scenic vistas, desert bighorn lambing grounds, and coves popular for their sandy beaches or scenic beauty.

Black Canyon is the only site near the proposed project area afforded special protection by the NPS because of its geologic and scenic values, numerous hot and warm springs, and winter habitat for bald eagles. The NPS-protected area begins about 1 mile south of the Gold Strike Canyon Alternative and extends south for about 9 miles. In addition to protecting the integrity of the natural feature, the NPS indicates that the views provided by this feature must also be considered. Therefore, the NPS indicates that if development around Black Canyon is made visible from U.S. 93 on the Arizona side of Hoover Dam, the canyon's scenic integrity would be compromised. In addition, the NPS recognizes that the view corridor from the Colorado River through Black Canyon is an outstanding view that should be protected (NPS, 1986).

National Scenic Byways possess outstanding qualities that exemplify a region's characteristics. No National Scenic Byways are in Nevada or Arizona near the proposed project area. U.S. 93 is a Nevada Scenic Byway; however, it is not designated as such in or near the proposed project area. No Arizona Scenic Byways are in or near the proposed project area.

No rivers in Nevada or Arizona near the proposed project area are designated pursuant to the *Wild and Scenic Rivers Act*.

3.7.1.2 Viewer Characteristics

Viewer Groups, Exposure, and Sensitivity. For all three build alternatives, viewer groups can be classified as one of two types:

- Recreationists visiting the Hoover Dam area (including Hoover Dam itself, Lake Mead, Colorado River, and Black Canyon)
- Drivers and passengers traveling in vehicles through the Hoover Dam area

Recreationists are considered a sensitive viewer group because their viewing of the dam, the lake, the river, and the canyon is expected to last up to several hours. Recreationists generally value, and are more aware of, the aesthetic quality of their surroundings than commuters or people at work, because their focus is usually on their surroundings while

they are relaxing; or the recreational activity they are engaging in, which is usually enhanced by their surroundings. Because Hoover Dam, a National Historic Landmark visited by more than 1 million tourists annually, is so well known both nationally and internationally, and provides spectacular photograph opportunities, recreationists visiting the Hoover Dam area are considered particularly sensitive to the surrounding views.

Drivers and passengers traveling over Hoover Dam (through traffic) are considered a less sensitive viewer group than recreationists because of their relatively short view time while traveling across the dam, the obstructed views offered from within vehicles, and because their focus is to negotiate a vehicle in traffic congestion and reach a final destination. Scenic driving for pleasure is a valid recreational activity, and the sensitivity of such viewers should not be ignored. However, because of the short view time, the driver distraction occurring from traveling in heavy traffic, and the obstructed views within vehicles while crossing the dam, these travelers are considered less sensitive viewers than recreationists.

Recreationists' Existing Views. Recreational boaters on Lake Mead experience unobstructed views of Black Canyon and Hoover Dam from up to 1.2 miles upstream. Recreationists on Lake Mead or its shores do not have views of the downstream side of the dam, Black Canyon downstream of the dam, or the Colorado River.

Recreationists visiting Lakeview Point Overlook in Nevada have a view of Lake Mead. Viewer groups at the Arizona Lookout and parking areas have a view of the dam and lake. Recreationists on the dam crest looking upstream have an unobstructed view of Lake Mead and Black Canyon for 1.2 miles. Looking downstream from the dam crest, recreationists have an unobstructed view of the Colorado River and Black Canyon for 0.5 mile.

Recreationists on the Colorado River at the rafting and canoeing put-ins about 0.5 mile downstream of Hoover Dam have an unobstructed view of the dam and Black Canyon when looking upstream. From the put-ins looking downstream, recreationists have unobstructed views of the Colorado River and Black Canyon for about 0.6 mile.

Recreationists hiking the Gold Strike Canyon trail have limited views. Because Gold Strike Canyon is narrow, winding, and steeply sloped, views of Hoover Dam from the trail are precluded. From the trail, views of the Colorado River and Black Canyon are completely obstructed until the last 0.1 mile of the trail.

Recreationists at the hot springs in Gold Strike Canyon have views of the Colorado River and Black Canyon from the pool closest to the river; views of the river and the canyon from the other pools are obstructed. Views of Hoover Dam (upstream) from the hot springs are completely obstructed.

Drivers' and Passengers' Existing Views. Drivers and passengers traveling over existing U.S. 93 and Hoover Dam have limited views. At a speed of 10 mph, a vehicle crosses the dam in 1.5 minutes, which is considered a short view time. In addition, from passenger vehicles traveling east, Lake Mead and the Colorado River cannot be seen at all, and views of Black Canyon are limited. Views from passenger vehicles traveling west are obstructed in a similar manner. The viewshed from within higher vehicles, such as commercial trucks, is greater than from passenger vehicles, but is still of short duration and is partially obstructed by the vehicle itself.

3.7.2 Environmental Consequences

3.7.2.1 Construction Impacts

Impacts on visual resources during construction that are common to all three build alternatives include the following:

- Dust would be emitted from earthmoving activities, construction vehicles and equipment, construction worker vehicles, materials delivery vehicles, and from areas within the construction zone that have been disturbed or where excavated material is stockpiled. Fugitive dust, if emitted in sufficient quantities, and if adverse weather conditions persist, could impair or degrade existing views (either from the ground or from the air).

- Depending on their values, interests, and preconceived expectations, for some recreationists viewing the area (either from the ground or from the air) the presence of construction equipment and its associated activities would detract from the views currently experienced. For other recreationists, the presence of equipment and highway/bridge construction would be interesting and would add visual variety to the landscape, creating additional photographic opportunities.

- Hoover Dam is currently lit at night and provides interesting nighttime views. For some recreationists, the additional light that would be emitted during nighttime construction (if it occurs) would detract from the nighttime views experienced during the dam visit. Depending on their values and expectations, for other recreationists, the additional light and associated construction activities would add visual interest to the setting. This issue would be of less concern to recreationists if the Gold Strike Canyon Alternative were constructed, because that alternative is not visible from Hoover Dam. However, the canyon downstream might appear brighter during nighttime construction if that alternative were selected.

Promontory Point Alternative. Construction of the Promontory Point Alternative would last approximately 5 years. During construction of this alternative, the view of Lake Mead from Hoover Dam (regardless of bridge design) would be altered from its existing, primarily undisturbed, state to one exhibiting a highly disturbed character. Construction vehicles, equipment, and personnel would alter the slopes on both sides of the lake. The waste disposal area would not be visible from the dam, river, or lake, but would be seen from U.S. 93 in Arizona.

Changes to the visual environment in the area of this alternative would be noticeable to visitors to the dam, the lake (when near the dam), and from the air. As discussed previously, changes to the landscape are expected to be offensive to some viewers and interesting to others. The impact on visual resources from construction activities would not be permanent, but because of the length of the construction period, they are not short-term. Other existing views, such as from the rafting put-ins on the Colorado River and the hiking trail and hot springs, would not be affected.

Sugarloaf Mountain Alternative (Preferred Alternative). Construction of the preferred Sugarloaf Mountain Alternative is expected to last approximately 5 years. During construction of this alternative, the view of Black Canyon from Hoover Dam and Lake Mead would be affected. Although the view area is already largely disturbed, construction vehicles, equipment, and personnel would alter the slopes on both sides of the canyon.

Changes to the visual environment in the area of this alternative would also be noticeable from the dam, the river (when near the dam), and from the air. Construction vehicles, equipment, and personnel would alter the canyon slopes on both sides of the river, and the emerging bridge structure would become a dominant visual element. As discussed previously, changes to the landscape are expected to be offensive to some viewers and interesting to others. The impact on visual resources from construction activities would not be considered permanent, but because of the length of the construction period, they are not considered short-term. Other existing views, such as from the hiking trail and hot springs, would not be affected.

Gold Strike Canyon Alternative. Construction of the Gold Strike Canyon Alternative would last approximately 5 to 6 years. During construction of this alternative, views from the lake or dam toward the Gold Strike Canyon Alternative (regardless of bridge design) would not be affected because that alternative cannot be seen from the lake or dam.

Changes to the visual environment in the area of this alternative would be noticeable from the river and the air. Construction vehicles, equipment, and personnel would alter the canyon slopes on both sides of the river. One waste disposal area would be visible from the trail, and another disposal area would be visible from U.S. 93 in Arizona. No waste disposal areas would be visible from the dam, lake, or river. In addition, areas for cut and fill and materials laydown would be visible from the put-in area on the Colorado River. As discussed previously, changes to the landscape are expected to be offensive to some viewers, and interesting to others. The impact on visual resources from construction activities would not be considered permanent, but because of the length of the construction period, they are not considered short-term.

Much of the Gold Strike Canyon Alternative would either parallel or cross the canyon hiking trail. Use of the trail would be precluded during construction of this alternative; therefore, existing views from the hiking trail would be eliminated. Because the trail would be closed to the public, access to the hot springs would only be available from the river. The view from the hot springs looking directly north toward the Gold Strike Canyon Alternative would be obstructed by topography and, therefore, would not be affected. The view from the hot springs looking to the northwest would be affected by construction equipment and activities.

No Build Alternative. Because the No Build Alternative would result in no construction, no construction-related impacts on existing visual resources are expected at Hoover Dam, Lake Mead, the Colorado River, Black Canyon, or the Gold Strike Canyon hiking trail and hot springs. In addition, no construction-related impacts on aerial views would occur.

3.7.2.2 Operational Impacts

Visible structural features of the three build alternatives have been assessed and compared with the area's pattern elements and character, and its vividness, intactness, and unity to determine the compatibility of the proposed features with the existing landscape.

Figure 3-4 shows the four viewpoints selected for visual simulations. To show what is currently visible from four viewpoints in the proposed project area, photographs were taken at each location. These photographs serve as existing condition views and provide the basis for comparing various bridge designs and alternatives being considered. Alternative bridge designs have been superimposed onto the photographs in visual simulations. The following viewpoints were selected:

- From aboard the Desert Princess on Lake Mead looking toward Hoover Dam (Figures 3-5, 3-6, and 3-10)
- From the Arizona Overlook toward Lake Mead (Figures 3-7 and 3-8)
- From atop Hoover Dam on the Arizona side looking downstream (Figures 3-9 and 3-10)
- From the rafting put-in on the Colorado River about 0.5 mile downstream of Hoover Dam looking south (Figures 3-11 and 3-12)

Figure 3-4 shows the locations of each of the four viewpoints and the alignments of the three build alternatives. As shown in Figure 3-4, the direction of each view is toward one of the three alternatives. The viewpoints chosen are popular photograph opportunity locations. Viewpoints 1 through 3 were selected because they represent views that recreationists would experience while visiting the Hoover Dam area. Many locations exist at the dam, lake, and scenic lookouts where photographs could be taken, and many views from each location could be generated. The location and direction of each photograph taken are considered representative of the views provided while at the Hoover Dam area.

Viewpoint 4 was chosen to show the view seen by the 18,500 recreationists who put-in annually to raft or canoe the Colorado River. Because the Gold Strike Canyon Alternative is not visible from Hoover Dam but is visible from the put-in location, the river put-in provides the best view of that alternative by recreationists. Although a view looking upstream toward Hoover Dam could also have been provided from Viewpoint 4 (which would have shown the Sugarloaf Mountain Alternative), it was determined that the Sugarloaf Mountain Alternative could be adequately assessed from Viewpoint 3, a location visited by more tourists than Viewpoint 4.

Impacts Common to All Build Alternatives. Adding a bridge and its associated facilities to the landscape in the Hoover Dam area would alter the landscape. Regardless of the alternative implemented, these facilities would be visible from at least one viewpoint. For some viewers, these features would add visual variety and interest to the landscape. For other viewers, the addition of such features would detract and possibly even degrade the landscape. If the proposed project is implemented, regardless of the alternative selected, a new view of the surrounding landscape from the bridge and its roadway approaches would be created. The view on the bridge would be limited to features seen from moving vehicles traveling about 60 mph; bicyclists, pedestrians, and stopped vehicles would not be allowed on the new bridge.

However, as discussed in Volume II, in anticipation of great public desire for views of Hoover Dam from the new bridge on the Sugarloaf Mountain alignment, FHWA will study the technical feasibility of a separate viewing facility associated with the bridge. Further details of such a facility cannot be determined until design of the bridge and approaches is advanced beyond the current level. Details of how people would be conveyed to the viewing facility and evaluation of environmental impacts would be addressed in a separate NEPA document, written for the specific purpose and need of providing views of Hoover Dam from or in the vicinity of the new bridge, if the construction scope of the viewing facility exceeds the anticipated impacts addressed in this EIS.

Promontory Point Alternative. Views of the Promontory Point Alternative would be unobstructed from locations on Lake Mead up to 1.2 miles upstream of the dam. The new bridge would be visible from Hoover Dam and by aerial sightseers, thus changing the landscape setting of Lake Mead from the dam and the air. For some viewers, this change

would detract from the lake's view. This viewer group expects the views to be unchanged from existing conditions, or expects the changes to be unnoticeable or unobtrusive. For others, the bridge design would add variety to the lake view. This viewer group would notice the visual change, but would not be offended by the change to the view.

A bridge at the Promontory Point crossing would adversely affect visitors' "first impression" historic views of the dam. These views occur as motorists approach the dam on existing U.S. 93 from both Nevada and Arizona. The dominance of the Promontory Point bridge would significantly detract from the historic views of the dam and could not be mitigated. In contrast, the Sugarloaf Mountain bridge would not detract from the historic views as visitors approach the dam from the Arizona and Nevada approaches. (See Figures 3-7 and 3-8 for views from the Arizona Overlook.)

Steel Truss Rib Through Arch Bridge from Viewpoint 1. Figures 3-5 and 3-6 show Hoover Dam from aboard the Desert Princess on Lake Mead (Viewpoint 1). The top photograph in Figure 3-5 shows the existing view from the boat toward Hoover Dam. The top photograph in Figure 3-6 simulates what a steel truss rib through arch bridge crossing Lake Mead would look like from aboard the Desert Princess. This bridge design would add a large form, contrasting lines, unobtrusive color, and texture changes (from the appearance of lattice steelwork on the arch) to the view.

From this viewpoint, the Hoover Dam facilities and electric transmission line towers are subordinate features and do not detract from the existing view. The position, size, and shape of the steel truss rib through arch bridge make it a feature that would dominate the view from the boat. This bridge design would add to visual diversity by intermixing horizontal, vertical, and curved lines to a predominantly undisturbed view of the landscape. Although adding diversity, the bridge would not add visual interest to the landscape. In addition, it would interrupt the visual continuity of the mountains in the background because of the presence of the arch and vertical bridge lines near the center of the photograph.

The visual quality shown in Figure 3-5 would be affected by this bridge design. Vividness would be compromised by the introduction of the bridge structure. In addition, the landscape intactness and unity would be affected by the size and prominence of the form, contrasting lines, and textural differences between the proposed bridge and the existing landscape.

Hoover Dam and Lake Mead would be visible to motorists traveling over the new bridge; however, the view would be partially obstructed by the safety barrier that would be installed on both sides of the bridge. Because stopped vehicles, bicyclists, and pedestrians would be precluded from the new bridge, and vehicle speeds across the bridge would be 60 mph, the new bridge would not provide the benefits of extended viewing opportunities of Lake Mead and Hoover Dam.

Concrete Cable-Stayed Bridge from Viewpoint 1. Also shown in Figure 3-6 from aboard the Desert Princess on Lake Mead (Viewpoint 1) is a simulation (lower photograph) of how a concrete cable-stayed bridge crossing Lake Mead would look from this viewpoint. This bridge design would add a large form that exhibits little texture; contrasting diagonal, vertical, and horizontal lines; and a color contrast from the concrete towers.

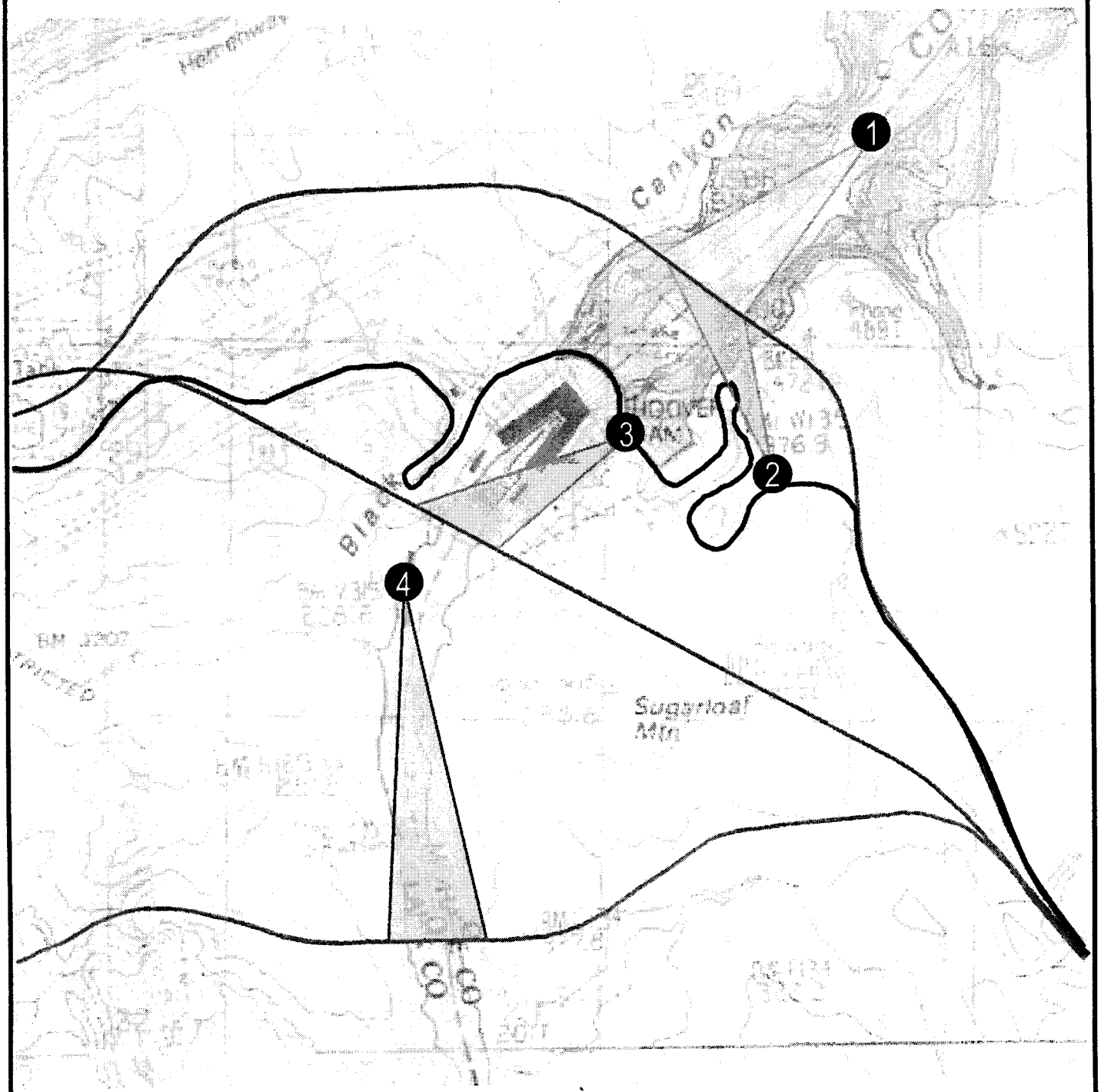

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FIGURE 3-4
VIEWPOINTS FOR VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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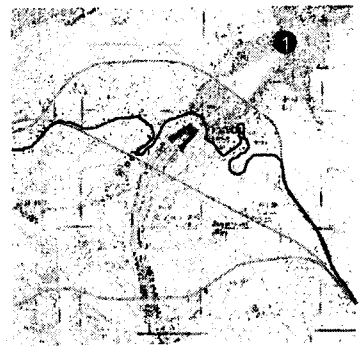
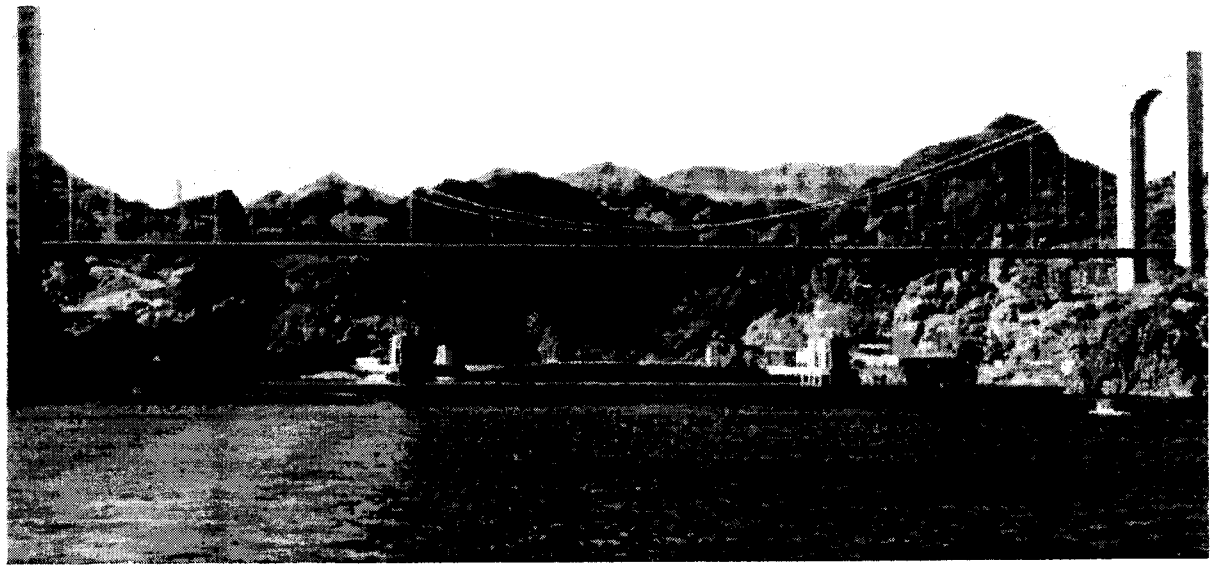


Existing conditions view from the Desert Princess on Lake Mead (Viewpoint 1)



View of suspension bridge from the Desert Princess on Lake Mead
(Viewpoint 1)

FIGURE 3-5
PROMONTORY POINT ALTERNATIVE
VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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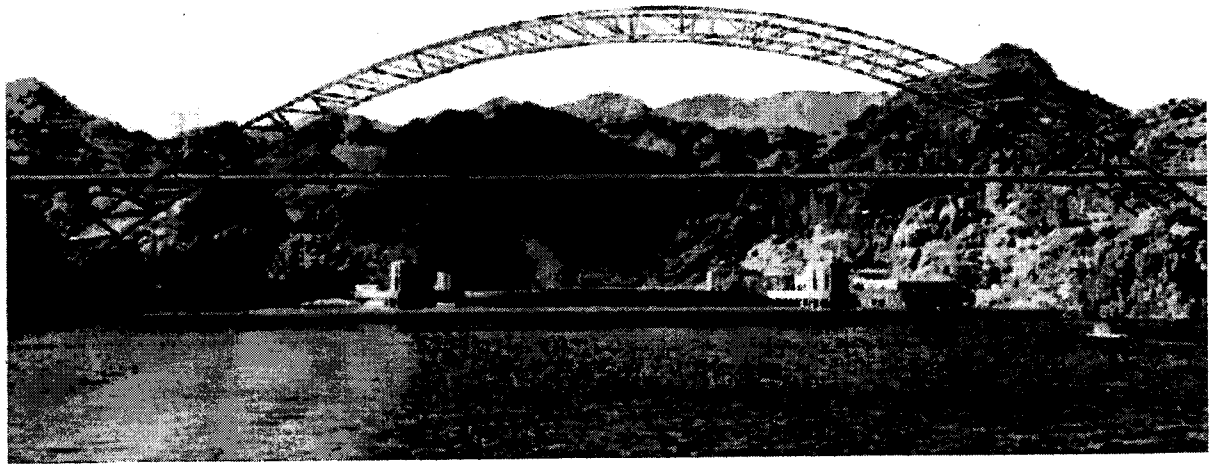
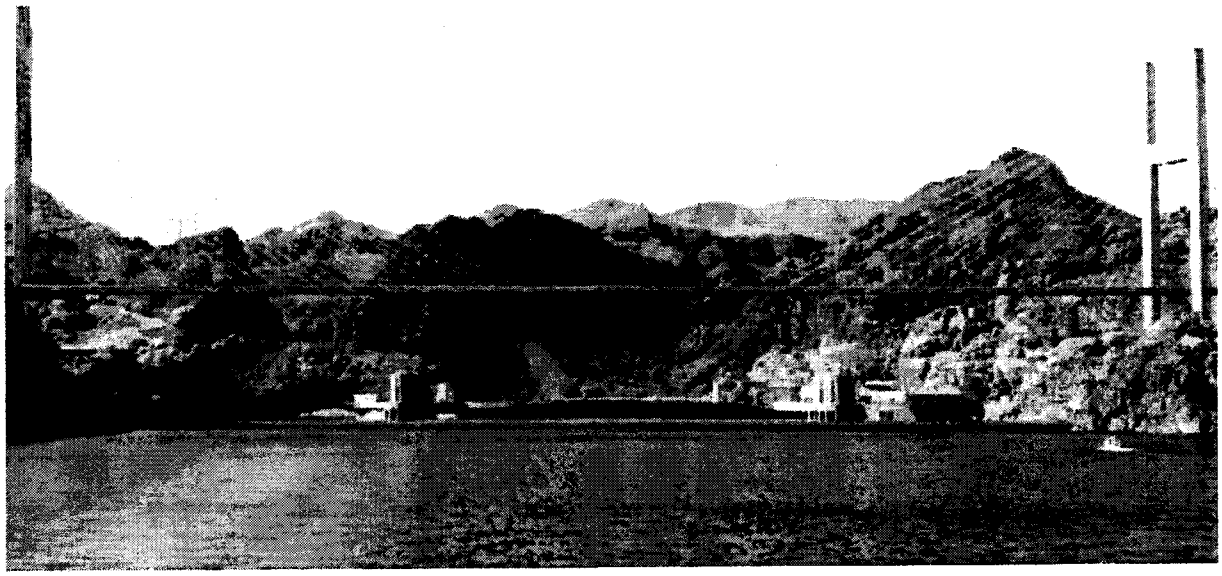


View of steel truss rib through arch bridge from the Desert Princess on Lake Mead
(Viewpoint 1)



View of concrete cable-stayed bridge from the Desert Princess on Lake Mead
(Viewpoint 1)

FIGURE 3-6
PROMONTORY POINT ALTERNATIVE
VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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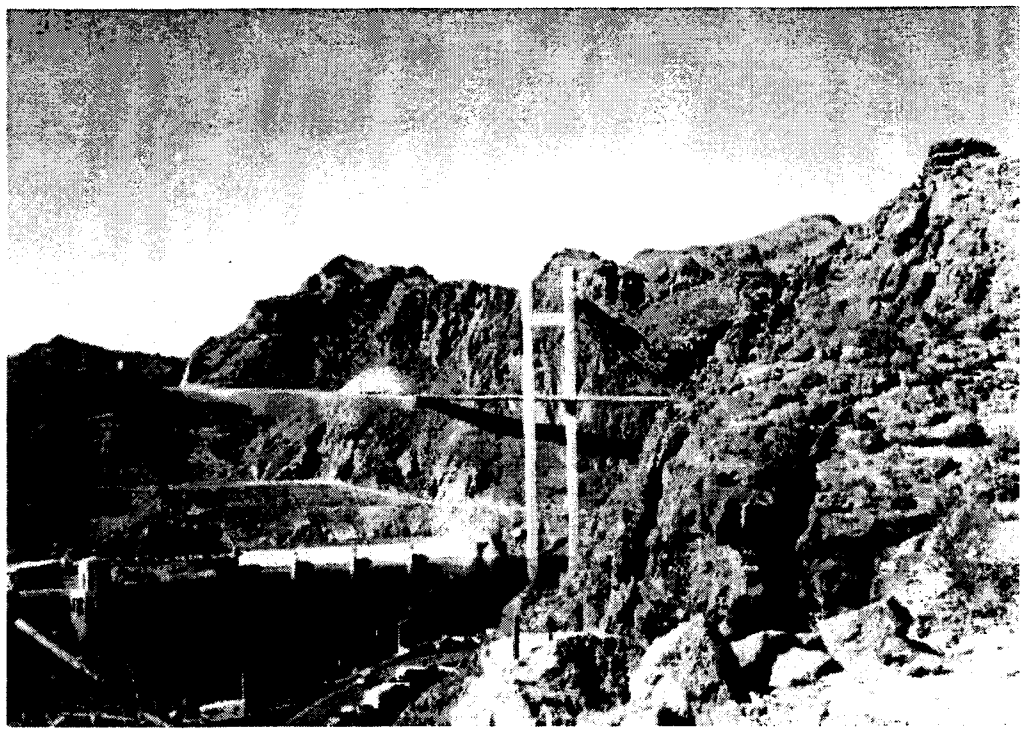
Existing conditions view from the Arizona Overlook (Viewpoint 2)



View of cable-stayed bridge from the Arizona Overlook (Viewpoint 2)

FIGURE 3-7
PROMONTORY POINT ALTERNATIVE VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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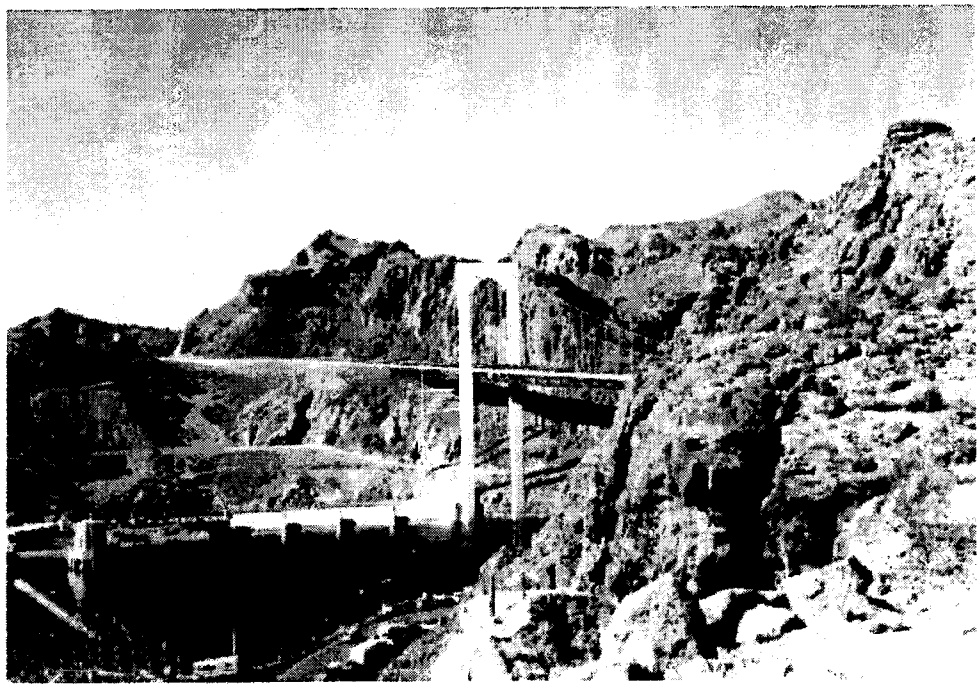
View of steel truss rib through arch bridge from the Arizona Overlook (Viewpoint 2)



View of suspension bridge from the Arizona Overlook (Viewpoint 2)

FIGURE 3-8
PROMONTORY POINT ALTERNATIVE VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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Existing conditions view looking south from Hoover Dam (Viewpoint 3)

View looking south of concrete cable-stayed bridge from Hoover Dam (Viewpoint 3)

FIGURE 3-9
SUGARLOAF MOUNTAIN ALTERNATIVE
VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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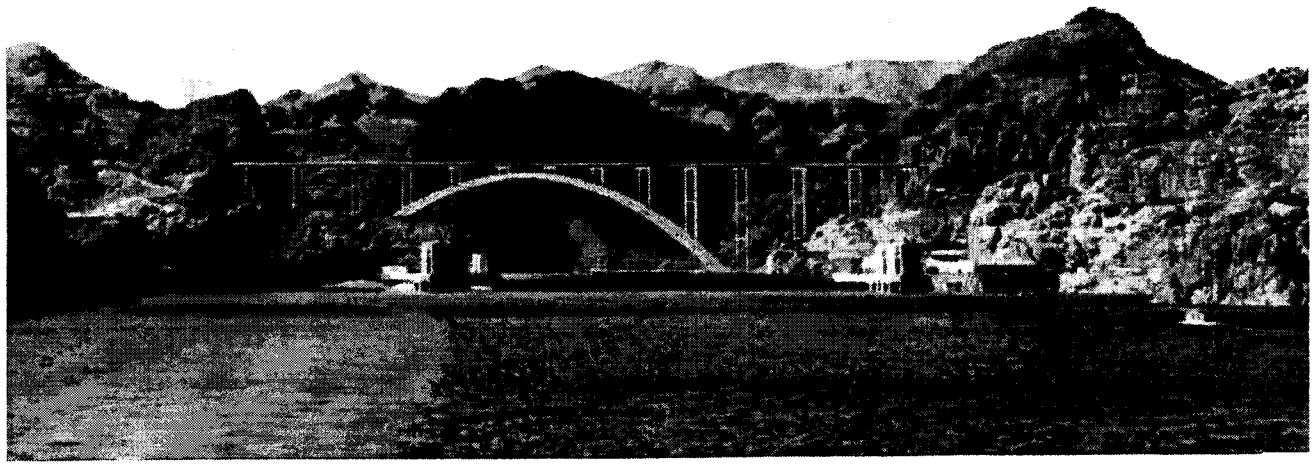
View looking south of concrete or steel deck arch bridge from Hoover Dam (Viewpoint 3)



View looking south of concrete or steel deck arch bridge from Lake Mead (Viewpoint 1)

FIGURE 3-10
SUGARLOAF MOUNTAIN ALTERNATIVE
VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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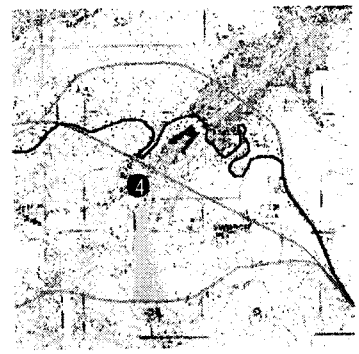
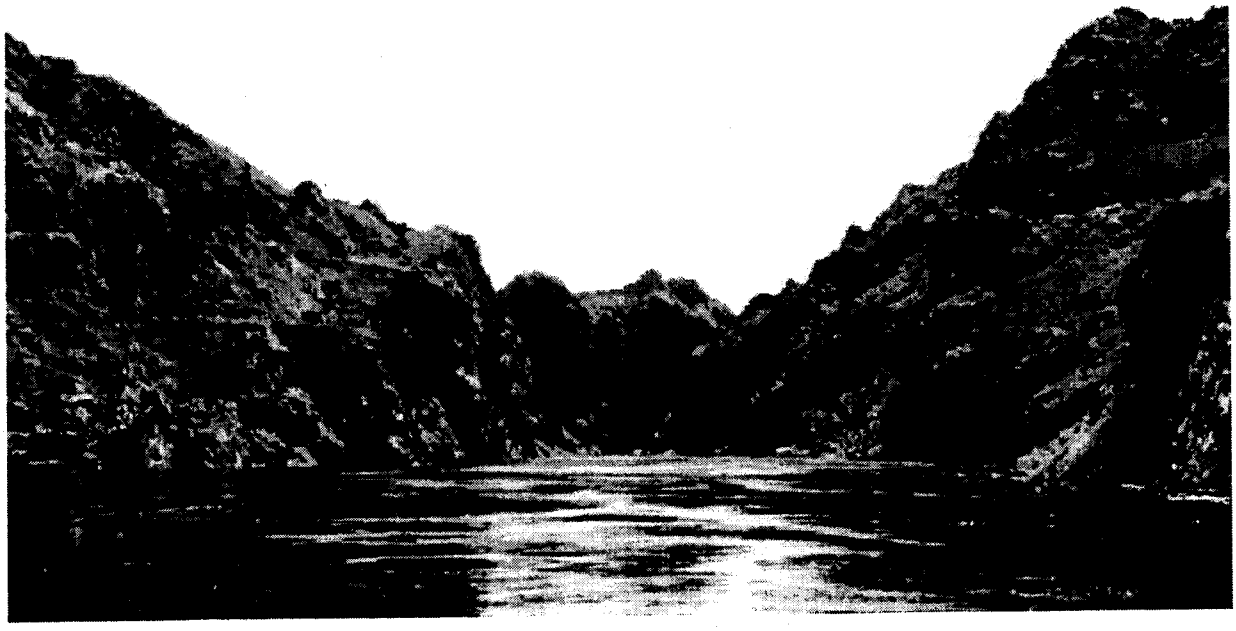
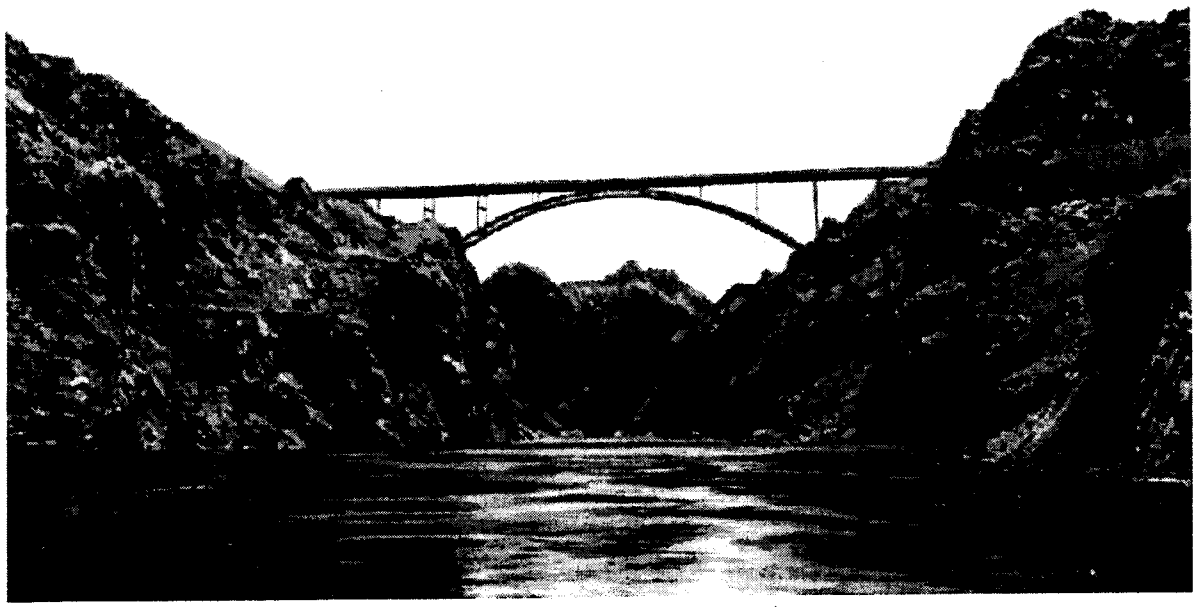




Existing conditions view from the rafting put-in south of Hoover Dam (Viewpoint 4)



View of steel deck arch bridge from the rafting put-in south of Hoover Dam (Viewpoint 4)

FIGURE 3-11
GOLD STRIKE CANYON ALTERNATIVE VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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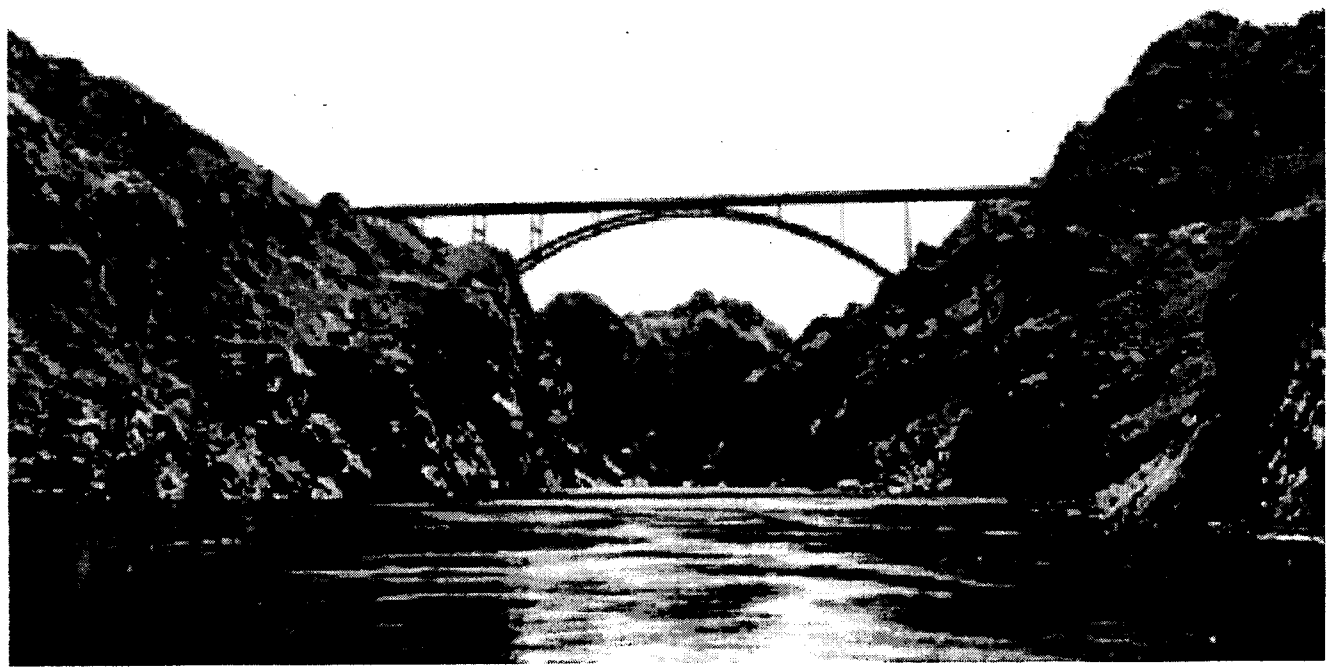

View of concrete deck arch bridge from the rafting put-in south of Hoover Dam
(Viewpoint 4)

FIGURE 3-12
GOLD STRIKE CANYON ALTERNATIVE
VISUAL SIMULATIONS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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From this viewpoint, the position, size, and presence of the concrete towers make the bridge a dominant feature within the photograph. Their presence is the most obvious structural feature that would affect the view of the landscape. This bridge design is less dominant than the steel truss rib through arch design discussed above. This bridge design would add little diversity to the view because the diagonal cables, although visible, are not prominent. The cables, therefore, would not detract from the view, but would maintain the view's continuity by minimizing obstructions to the existing view of the mountains in the background. Impacts on the visual quality of the view shown in Figure 3-5 would not be adverse because of this bridge design. As shown in the simulation, the vividness (memorability of the existing landscape components) would remain, and the landscape view would remain intact. The unity (visual harmony between landscape elements) would be affected by the structure's size and prominence, its contrasting lines, and textural differences; however, this impact is not considered adverse.

Hoover Dam and Lake Mead would be visible to motorists traveling over the new bridge; however, the view would be partially obstructed by the safety barrier on both sides of the bridge. Because stopped vehicles, bicyclists, and pedestrians would be precluded from the new bridge, the bridge would not provide the benefits of extended viewing opportunities of Hoover Dam and Lake Mead.

Suspension Bridge from Viewpoint 1. Figure 3-5 also shows the simulated view of a suspension bridge crossing Lake Mead from aboard the Desert Princess on Lake Mead (Viewpoint 1, bottom photograph). This bridge design would add a large form that exhibits little texture, contrasting vertical and horizontal lines, and a color contrast from the concrete towers.

From this viewpoint, the position, size, and presence of the concrete towers result in the bridge being a dominant feature. Their presence is the most obvious structural feature that would affect the view of the landscape. Similar to the concrete cable-stayed bridge, this design is less dominant than the steel truss rib through arch design. This design would add little diversity to the view. The cables would not detract from the view, but maintain the view's continuity by minimizing obstructions to the existing mountain view.

The visual quality of the view shown in Figure 3-5 would not be greatly affected by this bridge design. As shown in the simulation, the vividness (memorability of the existing landscape components) would remain, and the landscape view would remain intact. The unity (visual harmony between landscape elements) would be marginally affected by the size and prominence, contrasting lines, and textural differences of the structure.

Hoover Dam and Lake Mead would be visible to motorists traveling over the new bridge; however, the view would be partially obstructed by the safety barrier on both sides of the bridge. Because stopped vehicles, bicyclists, and pedestrians would be precluded from the new bridge, the bridge would not provide the benefits of extended viewing opportunities of Hoover Dam and Lake Mead.

Steel Truss Rib Through Arch Bridge from Viewpoint 2. Figure 3-7 shows a view from the Arizona Overlook (Viewpoint 2) looking across Lake Mead. The top photograph in that figure shows the existing view from the overlook. The top photograph in Figure 3-8 is a simulation showing what a steel truss rib through arch bridge would look like from this viewpoint. This bridge design would add a large form that exhibits texture (from the steel latticework on the arch), and contrasting lines.

From this viewpoint, the bridge is not a dominant feature that detracts from the existing view. Although the arch is a prominent feature, the presence of the hillside in the right foreground of the photo eliminates part of the arch. This bridge design would add to the visual diversity of the view by intermixing horizontal, vertical, and curved lines to a view that mixes natural and human-made elements. Because this view of the steel truss rib through arch design would not significantly affect the backdrop of the mountains in the background, it would not interrupt the visual continuity of the view.

Therefore, the visual quality of the view shown in Figure 3-7 would not be adversely affected by this bridge design.

Concrete Cable-Stayed Bridge from Viewpoint 2. Also shown in Figure 3-7, from the Arizona Overlook (Viewpoint 2) is a simulation (bottom photograph) showing what a concrete cable-stayed bridge would look like from this viewpoint. This bridge design would add a large form that exhibits little texture; strong diagonal, horizontal, and vertical lines; and a color contrast from the concrete towers.

From this viewpoint, this bridge design is not a dominant feature that detracts from the existing view. Although the bridge concrete towers are prominent features because of the hillside in the right foreground, the other tower and remainder of the span are not visible from this viewpoint. In addition, the cables are essentially "lost" against the background. Similar to the suspension bridge design, this bridge design would add little diversity to the view because the diagonal cables are not prominent. They would not detract from the view, but would maintain the view's continuity.

Therefore, the visual quality of the view shown in Viewpoint 2 (Figure 3-7) would not be greatly affected by this bridge design.

Suspension Bridge from Viewpoint 2. Figures 3-7 and 3-8 are the view from the Arizona Overlook (Viewpoint 2) looking across Lake Mead. The top photograph in Figure 3-7 shows the existing view from the overlook. The lower photograph in Figure 3-8 shows how a suspension bridge across Lake Mead would look from this viewpoint. This bridge design would add a large form that exhibits little texture, strong horizontal and vertical lines, and a color contrast from the concrete towers.

From this viewpoint, the bridge is not a dominant feature that detracts from the existing view. Although the bridge's concrete towers are prominent features, because of the hillside in the right foreground the other tower and remainder of the span are not visible from this viewpoint. This bridge design would add little diversity to the view because the vertical cables, although noticeable, would not detract from the view at the overlook, thus maintaining the view's continuity. The height of the tower (below the mountain slope in the background) would also aid in maintaining the view's continuity. Therefore, this bridge design would not adversely affect Viewpoint 2 visual resources.

Sugarloaf Mountain Alternative (Preferred Alternative). Views of the Sugarloaf Mountain Alternative would be unobstructed from Hoover Dam and from the rafting put-in 0.5 mile downstream of the dam. In addition, the new bridge would be visible by aerial sightseers, thus changing the aerial view of the dam and canyon. For some aerial viewers, this change would detract from the lake view. This viewer group expects views to be unchanged from existing conditions, or expects changes to be unnoticeable or unobtrusive. For others, the bridge design would add variety to the lake view. This viewer group would notice the visual change, but would not be offended by the change to the view.

As mentioned above, in anticipation of public demand for views of Hoover Dam from the new bridge on this alignment, FHWA will study the technical feasibility of a separate viewing facility associated with the bridge. Further details of such a facility cannot be determined until design of the bridge and approaches is advanced beyond the current level.

Consideration of the following specific bridge designs for Sugarloaf Mountain and the other build alternatives in this EIS is not intended to preclude other feasible structures. A Design Advisory Panel, established as part of a Programmatic Agreement for this project under requirements of the National Historic Preservation Act, will provide input on bridge design concepts, structure type, and materials (see Section 3.5).

Concrete Cable-Stayed Bridge. Figures 3-9 and 3-10 are a view of Black Canyon looking downstream from the eastern side of Hoover Dam (Viewpoint 3). As shown in the top photograph in Figure 3-9, the view is dominated by human-made development such as the electric transmission line towers in the foreground, and to a lesser degree, U.S. 93 and the vehicles on the right side of the photograph. The bottom photograph simulates how a concrete cable-stayed bridge crossing Black Canyon would look when standing atop the dam. This bridge design would drastically alter the view by adding a large form, a variety of lines, contrasting color, and little texture.

From this viewpoint, the bridge towers, bridge deck, and diagonal lines dominate the view. The bridge design would add to the visual diversity of the landscape because of the contrasting lines and colors; however, it would not add to the visual interest of the view. The presence of the bridge would interrupt the visual continuity of the view of the one mountain in the middleground (center of photograph) and the mountains in the background.

The visual quality of the view shown in Figure 3-9 would be only slightly affected by this bridge design, due to the presence of the transmission towers in the foreground. The vividness of the view would be slightly degraded by the presence and closeness of the bridge structure. In addition, the intactness and unity of the view would be affected by the size and prominence of the bridge form; the vertical, horizontal, and diagonal lines; and the textural differences between the proposed bridge and the existing landscape.

Hoover Dam and Lake Mead would not be visible to passenger cars traveling over the new bridge. Stopped vehicles, bicyclists, and pedestrians would be precluded on the new bridge roadway; however, FHWA will study the feasibility of a separate viewing facility associated with the bridge.

Concrete or Steel Deck Arch Bridge. Figure 3-10 simulates how a concrete or steel deck arch bridge crossing Black Canyon would look. This bridge design would add a large form that exhibits little texture; vertical, horizontal, and curve lines; and color difference (with a concrete arch).

From this viewpoint, the position, size, and strong horizontal line created by the bridge deck makes the bridge a dominant feature within the photograph and detracts from the view. Visual diversity of the view would not be notably improved or degraded, except with the contrasting color of the concrete arch. The visual continuity of the mountain in the middleground (center of photograph) and the mountains in the background would be decreased. The height of the bridge deck (along the top of the mountain in the middleground) also affects the view adversely.

The visual quality shown in Figure 3-9 would be only slightly affected by this bridge design, due to the presence of the transmission towers in the foreground. The visual impact is considered less than that discussed for the concrete cable-stayed bridge design, and the concrete arch would have greater visual impact than steel due to the greater mass. Similar to the concrete cable-stayed bridge, the vividness of the view would be slightly degraded by the presence and closeness of the bridge structure. In addition, the view's intactness and unity would be affected by the size and prominence of the bridge form; the vertical and horizontal lines; and the textural differences between the proposed bridge and the existing landscape.

Hoover Dam and Lake Mead would not be visible to passenger cars traveling over the new bridge. Stopped vehicles, bicyclists, and pedestrians would be precluded on the new bridge roadway; however, FHWA will study the feasibility of a separate viewing facility associated with the bridge.

The Sugarloaf Mountain Alternative would impact the views of Black Canyon from the dam crest and Lake Mead. However, the Sugarloaf Mountain Alternative could be blended into the landscape more readily than the Promontory Point Alternative. This is because (1) the Sugarloaf Mountain alternative deck structure would form a fairly contiguous horizontal line with the canyon rim, (2) the structure would not significantly protrude above the horizon line when viewed from the dam crest, and (3) the structure would not protrude above the horizon line when viewed from Lake Mead. Conversely, the Promontory Point Alternative would be obtrusive and protrude above the strong horizontal component of Lake Mead regardless of bridge type.

Gold Strike Canyon Alternative. Views of the Gold Strike Canyon Alternative would be completely obstructed from Hoover Dam, the Arizona Overlook, and Lake Mead. The new bridge would be visible from the rafting put-in 0.5 mile downstream of Hoover Dam and by aerial sightseers. The bridge at this location would also change the landscape setting of Gold Strike Canyon as seen from the hiking trail and hot springs. For some viewers at the river launch and those seeing the area by air, this change would detract from the view. For other viewers, the bridge design would add variety to the view. It should be noted that the view of the bridge from rafts floating down river from the rafting launch would increase as the rafters float toward the bridge. Once downstream of the bridge, views of the bridge would again decrease. Views by recreationists using the hiking trail or hot springs would be adversely affected by this alternative, regardless of the bridge design selected.

Steel Deck Arch Bridge. Figures 3-11 and 3-12 show a view of Black Canyon looking downstream from the rafting put-in located 0.5 mile south of Hoover Dam. The top photograph in Figure 3-11 is the existing view from the put-in. The bottom photograph simulates how a steel deck arch bridge would look from the put-in. This bridge design would add a large form; contrasting horizontal, vertical, and curved lines; unobtrusive color; and texture changes to the view.

From this viewpoint, the existing landscape appears largely undisturbed. The only noticeable human-made feature is the retaining wall in the upper right corner of the photograph. The position, size, and shape of the bridge structure make it a feature that would dominate the view from a raft. The structure would add to the visual diversity of the view. The bridge structure would not interrupt the visual continuity of the mountains in the background, and it would not affect the view of the slopes in the middleground.

The visual quality shown in Figure 3-11 would be affected by this bridge design; although, of the two bridge designs being considered for this alternative, it is the less obtrusive design. The vividness of the landscape components would not be adversely affected by the bridge structure; however, the view's intactness and unity would be slightly compromised by the size and prominence of the form and contrasting lines.

Concrete Deck Arch Bridge. Figure 3-12 simulates how a concrete deck arch bridge would look. Similar to that discussed for the steel deck arch bridge, this bridge design would add a large form; contrasting horizontal, vertical, and curved lines; unobtrusive color, and texture changes to the view. As the simulation shows, these effects would be more pronounced with this bridge design than that for the steel deck arch bridge.

This design would have the same effect on the visual dominance, diversity, and continuity of the view as was described for the steel deck arch bridge. In addition, this bridge design would affect the view's vividness, intactness, and unity in the same manner; however, these effects would be more pronounced with this bridge design.

This bridge design would affect the quality of the view shown in Figure 3-11 in the same manner as that described for the steel deck arch bridge. Because the concrete forms on this bridge are larger than the steel shown in the steel deck arch bridge, the visual impact from this bridge design is greater than that for the steel deck arch bridge.

No Build Alternative. Implementing the No Build Alternative would result in no additional roadway or bridge being constructed, and would therefore result in no physical changes to the existing roadway and Hoover Dam crossing. No change to the views currently experienced by recreationists visiting the Hoover Dam area (including the dam, Lake Mead, Colorado River, Black Canyon, and Gold Strike Canyon hiking trail and hot springs) is expected. Aerial views would also be unaffected by this alternative.

As traffic levels continue to increase, vehicle speeds on the dam are expected to decrease, resulting in longer views for through-traffic drivers and passengers. Although the view duration would be increased for this viewer group, the quality of the view would remain obstructed (either by vehicle height or by the vehicle itself). In addition, as noted previously, the focus of this viewer group is not its surroundings but primarily its concentration on negotiating through traffic, avoiding pedestrians, and reaching its final destination. Therefore, this is not considered a benefit to this viewer group.

3.7.3 Measures to Minimize Harm

Visual simulations were created to illustrate the impacts to visual resources from each of the three build alternatives. Figure 3-4 shows the viewpoints for the visual simulations. Figures 3-5 through 3-12 are visual simulations for each alternative.

3.7.3.1 Construction Mitigation

Regardless of the alternative selected, certain views during the construction period would be altered by the presence of construction vehicles, equipment, personnel, and emerging new highway facilities. This impact is expected to be considered adverse by some viewers and is an unavoidable consequence of project construction.

The following mitigation measure will be implemented to reduce impacts on visual resources: implement a public information program that could include an Internet web site, and provide data sheets to Hoover Dam visitors. Information to be provided includes a

description of the proposed project, the purpose and need, a construction schedule, and an explanation of what viewers are seeing and what can be expected to be seen in the future. A visual simulation will be included so that the viewer can see what the constructed project will look like when complete. Providing project information may alleviate viewers' concerns about construction-related view obstruction by explaining that the project is intended to improve traffic continuity and visitor safety.

3.7.3.2 Operational Mitigation

Regardless of the alternative selected, the proposed bridge would alter the view, either from Hoover Dam, Lake Mead, the river rafting put-ins, or the Gold Strike Canyon hiking trail and hot springs. For all the alternatives, the rock cuts adjacent to the proposed bridge will be engineered to minimize impacts on visual resources. This could include special blasting techniques to avoid pre-split shear rock faces. Resulting ledges will be topsoiled and revegetated to the extent possible. Rock slopes and slope protection in the vicinity of the bridge will be stained with a desert varnish to reduce the visual impact from the proposed construction adjacent to the bridge.

Promontory Point Alternative. Impacts on visual resources from the steel truss rib through arch bridge could be lessened by coloring the steel to blend with the surrounding environment.

To reduce impacts on visual resources from the concrete cable-stayed bridge and the suspension bridge, the concrete should be tinted to blend with the surrounding environment, which would reduce the visibility of the towers.

Sugarloaf Mountain Alternative (Preferred Alternative). Impacts on visual resources from the concrete cable-stayed bridge, if selected, will be reduced by tinting the concrete with a nonglare color that blends with the surrounding environment. However, the closeness of the bridge to the dam would still result in the bridge dominating the downstream view from the dam.

Although the computer simulation is conceptual in Figure 3-10, impacts on visual resources from the concrete or steel deck arch bridge could be lessened by setting the bridge deck elevation so that the mountain in the center of the photograph would be more prominent. However, this may not be feasible from an engineering design, earthwork, or economic standpoint. If not, the view will remain affected, but is not considered adverse because of the visual intrusion of the transmission line towers in the foreground. If either a concrete or steel arch bridge design is selected, the impact may be lessened by coloring the structure to blend with the surrounding environment.

Gold Strike Canyon Alternative. Impacts on visual resources from either the concrete deck arch bridge or the steel deck arch bridge would be reduced by coloring the concrete or steel so that the bridge blends more effectively with the surrounding environment. This measure would reduce the visual impact perceived by the hikers, hot spring users, rafters, and other river users near the proposed alignment.

3.8 Recreation Resources

3.8.1 Affected Environment

Hoover Dam, about 1,244 feet long and 726 feet tall, is situated in Black Canyon and is one of the most spectacular structures in the world. It is an NHL and a popular tourist

attraction in southern Nevada and northern Arizona. Reclamation operates a visitor center at the dam, offers daily guided tours, provides parking for 851 personal vehicles and 22 buses (a multistory parking garage and an outdoor parking lot are adjacent to and on the dam), and has several scenic overlooks providing photograph opportunities (personal communication with Dan Jensen/Reclamation, 1998). Photography is a very popular activity at the dam because of the dam's historic significance and its massive size. In addition, souvenir shops and restrooms are available.

Three food and beverage concessionaires were located at the dam until a fire destroyed the one located at the Arizona Lookout. Plans to relocate the two remaining concessions (one in Nevada and the other in Arizona) to the lower level of the multistory parking garage are nearly complete. The third concession at the Arizona Lookout has been rebuilt. The existing concession building on the Nevada side of the dam may be converted into a museum and is currently under study. The existing Arizona-side concession trailer will be removed from the site early in 2001 (personal communication with Dan Jensen/Reclamation, 2000).

About 33.2 million visitors have toured Hoover Dam since 1937. There were about 1.03 million visitors in 1997 and an average of 2,823 persons daily in 1997 (personal communication with Kris Mills/Reclamation, 1998). Public access to the downstream side of the dam and Colorado River for 0.5 mile is precluded for safety reasons. The area is fenced in certain locations, and warning signs are posted. This area is accessible only to dam personnel and those having Reclamation permits.

The LMNRA had 9.7 million visitors in 1997 (personal communication with Bill Burke/NPS, 1998). Six developed recreation areas are on Lake Mead, with day-use areas, boating facilities, campgrounds, and lodging. In addition, Lake Mead Cruises operates a boat tour aboard the Desert Princess, a paddlewheel boat with a capacity of several hundred people. Sightseeing is the most popular activity; other activities include fishing, boating, houseboating, parasailing, scuba diving, jet skiing, swimming, canoeing, kayaking, hiking, and nature study.

The developed recreation area on Lake Mead nearest to the proposed project is Boulder Beach, located on the western arm of Lake Mead. Boulder Beach can be accessed from U.S. 93/95 in Henderson via Lake Mead Drive and from Nevada SR 166 (Lakeshore Drive). Facilities at Boulder Beach include a marina, camping areas, picnic areas, a swimming beach, lodging, two launch ramps, store and restaurant, boat gasoline station, restrooms, and parking areas (personal communication with Bill Burke/NPS, 1998).

The Hacienda Hotel, located on U.S. 93 about 3 miles west of Hoover Dam, provides gaming, lodging, and eating facilities. About 0.5 mile downstream from Hoover Dam, a rafting concessionaire (Black Canyon Raft Tours) operates a dock with a fleet of 11 rafts that accommodate from 18 to 42 people each and are used to float customers down the Colorado River. About 18,500 customers floated the river in 1997. The rafting concession operates from February 1 to November 30, and by special arrangement in December and January (personal communication with Ron Opfer/Black Canyon Raft Tours, 1998). It has a permit to use Reclamation's restricted access road (the Lower Portal Road) from U.S. 93 down to the river (personal communication with Dan Jensen/Reclamation, 1998).

Reclamation also issues permits to individuals to launch canoes at a put-in about 20 yards downstream of the rafting put-in. Groups of up to 15 people are escorted twice daily from Reclamation's warehouse to the river put-in via Lower Portal Road. Demand for this

service exceeds capacity; the service usually requires advance reservations. In 1997, 7,212 individual permits were issued for this service (personal communication with Dan Jensen/Reclamation, 1998).

In addition, in February 1998 a tour group was issued an annual permit by Reclamation to escort groups from Las Vegas to tour Hoover Dam and provide access to Lower Portal Road to photograph the dam from the helicopter pad and canoe put-in. To date, the average number of users has been 10 per week (personal communication with Dan Jensen/Reclamation, 1998).

A 2.5-mile-long trail is used by visitors to hike through Gold Strike Canyon to the Colorado River and hot springs. The Gold Strike Canyon trail is not an official NPS-designated trail. The trail is used for nature study, photography, technical rock climbing, and accessing the hot springs. An estimated 1,000 hikers use the trail and hot springs annually, mostly in the cooler months (personal communication with Jim Holland/NPS, 1998). To accommodate the needs of hot springs users, the NPS provides a portable toilet at the canyon mouth.

Historic railroad grades and tunnels near Hoover Dam are currently used for hiking and mountain biking. The NPS, in partnership with Reclamation, the City of Boulder City, and the Southwest Gas Trailhikers, have developed a proposal to convert these existing railroad grades to a hiking/bicycle trail under the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The historic railroad grades were constructed in 1931 for moving materials and equipment to the Hoover Dam construction site. The planned trail will extend from Boulder City to Hoover Dam, a distance of 8 miles, and will serve as an extension of the Hemenway Wash Trail that was constructed by Boulder City. The development of this trail is being supported financially with matching funds from the City of Boulder City and the Southwest Gas Trailhikers.

Commercial airplane and helicopter sightseeing flights originating in Las Vegas and nearby small airports and helipads also are available to recreationists wanting aerial views of Hoover Dam, Lake Mead, and the Colorado River.

3.8.2 Environmental Consequences

3.8.2.1 Construction Impacts

Impacts during construction of the proposed project common to all three build alternatives include the following:

- Dust would be emitted from earthmoving activities, construction vehicles and equipment, construction worker vehicles, material delivery vehicles, and from areas within the construction zone that have been disturbed or where excavated material is stockpiled. The magnitude of the impact on recreationists visiting Hoover Dam, Lake Mead, the Colorado River, and Gold Strike Canyon hot springs and hiking trail would vary by alternative.

- Noise would be emitted during all construction phases. Noise sources include construction vehicles and equipment, construction worker vehicles, and materials delivery vehicles. Noise levels associated with construction activities are typically 88 dBA to 92 dBA at a distance of 50 feet, which would be a noticeable change from ambient noise levels. The magnitude of the impact on recreationists visiting Hoover Dam, Lake Mead, Colorado River, hot springs, and the hiking trail would vary by alternative.

- Effects on water-dependent recreation activities would occur from construction work at Lake Mead near Hoover Dam and at the Colorado River rafting and canoeing put-ins because of the temporary impacts on access and water quality (this would apply only to the Promontory Point and Sugarloaf Mountain Alternatives).

- Effects on access to Hoover Dam, Lake Mead, the Colorado River, and the hiking trail in Gold Strike Canyon would occur because of proposed project construction activities. Roadway access and the access to Hoover Dam from Lake Mead may be restricted at times during construction to ensure the public's safety. The canyon trail would be closed during construction if the Gold Strike Canyon Alternative were selected.

- Effects of the presence of construction equipment would occur. For some recreationists, the presence of construction equipment and its associated activities would detract from the recreational experience. For others, the presence of equipment and construction activities would be interesting, creating additional photographic opportunities.

- Increased light emitted from the construction area would occur if nighttime construction is conducted. Hoover Dam is currently lit at night and provides interesting nighttime views for tourists. For some recreationists, the additional light that would be emitted during nighttime construction, if it occurs, would detract from the nighttime views experienced during the dam visit. Again, depending on their values and expectations, for other recreationists the additional light and associated construction activities would add interest to the setting. This issue would be less of a concern to recreationists if the Gold Strike Canyon Alternative were constructed because that alternative is not visible from Hoover Dam. However, the canyon downstream might appear brighter during nighttime construction, if that alternative were selected.

Impacts specific to the three build alternatives and the No Build Alternative are described below.

Promontory Point Alternative. Construction of the Promontory Point Alternative would last approximately 5 years. During construction of this alternative, an area of Lake Mead upstream of Hoover Dam would be designated as a construction safety zone. This designation would limit public use of that area of the lake for recreational activities by eliminating access to Hoover Dam on its upstream side (from Lake Mead). Access restrictions and periods of closure would be coordinated with NPS and the lake tour operators (e.g., the Desert Princess tour concessionaire). No other effects on activities at Lake Mead would be expected.

Existing recreational activities at Hoover Dam, the Colorado River, Gold Strike Canyon hiking trail and hot springs, and the Hacienda Hotel would not be affected by construction of this alternative. In addition, the ground and aerial tour groups would not be affected.

In areas where blasting, earthmoving, other construction activities, and spoil disposal areas are located, construction safety zones would also be established. These zones would preclude using the area for hiking or other dispersed recreational activities currently occurring along the alignment.

Sugarloaf Mountain Alternative (Preferred Alternative). Construction of the preferred Sugarloaf Mountain Alternative is expected to last approximately 5 years. Certain areas along the Colorado River and along U.S. 93 would be designated as construction safety zones. These designations would preclude public use of those areas for recreational activities. The rafting concession and the canoeing put-in should be able to continue to

operate with minor interruptions in service by coordinating launching to avoid conflicts with construction activities. Access to the river put-in and helipad by ground tours may be interrupted by construction activities; coordination should occur to avoid conflicts with such activities.

Existing recreational activities at Lake Mead, Hoover Dam, Gold Strike Canyon hiking trail and hot springs, and the Hacienda Hotel would not be affected by construction of the proposed project. In addition, ground and aerial tour groups would not be affected by construction of this alternative.

In areas where blasting, earthmoving, other construction activities, and spoil disposal areas are located, construction safety zones would be established. These zones would preclude using the area for hiking or other dispersed recreational activities currently occurring along the proposed alternative.

Gold Strike Canyon Alternative. Construction of the Gold Strike Canyon Alternative would last approximately 5 to 6 years. Certain areas along the Colorado River and U.S. 93 would be designated as construction safety zones. These designations would preclude public use of those areas for recreational activities. The Gold Strike Canyon hiking trail would be closed during construction. The rafting concession and the canoeing put-in should be able to continue to operate with minor interruptions in service by coordinating launching and passage through the construction zone to avoid conflicts with construction activities.

Existing recreational activities at Lake Mead, Hoover Dam, and the Hacienda Hotel would not be affected by construction of this alternative. In addition, aerial tour groups would not be affected.

In areas where blasting, earthmoving, other construction activities, and spoil disposal areas are located, construction safety zones would be established. These zones would preclude using the area for hiking or other dispersed recreational activities currently occurring along the proposed alternative.

No Build Alternative. Because the No Build Alternative would result in the proposed project not being constructed, no construction-related impacts on existing recreational activities are expected at Hoover Dam, Lake Mead, Colorado River put-ins, Gold Strike Canyon hiking trail and hot springs, Hacienda Hotel, and ground or aerial tours.

3.8.2.2 Operational Impacts

Impacts during the operational phase of the proposed project common to all three build alternatives include the following:

- The new bridge, regardless of the alternative chosen, would likely become a tourist attraction because of its association with and proximity to Hoover Dam, its design, and the setting in which it would be located. This would result in recreationists in the area making it a travel destination. This is considered a benefit to recreationists desiring the experience.

- For some recreationists, the presence of the new bridge would detract from the recreational experience offered at Hoover Dam by changing the view from the dam. For other recreationists, the presence of the new bridge would add to the variety of the view from the dam, which they would consider to be interesting, thus creating additional photographic opportunities. (The view from the dam would change with either the Promontory Point Alternative or Sugarloaf Mountain Alternative.)

- Because traffic congestion would be alleviated at Hoover Dam, CO and VOC daily emissions are expected to be reduced by approximately 50 percent and 80 percent, respectively. Pedestrian safety would also be improved. This is considered a benefit to recreationists atop the dam.

Impacts specific to the three build alternatives and the No Build Alternative are described below.

Promontory Point Alternative. The new bridge would be visible from Hoover Dam and from aerial sightseeing recreationists, thus changing the recreational setting of Lake Mead from the dam and the air. For some recreationists, this change would detract from the lake view. For other recreationists, the bridge design would add variety to the lake view. The presence of the new bridge would not preclude recreational opportunities currently offered at Hoover Dam and by aerial sightseeing.

The bridge would also be visible to recreationists on Lake Mead (those in motorized and nonmotorized water craft, anglers, and swimmers) and along adjacent shores (e.g., hikers and picnickers) in the dam vicinity. Similar to that discussed for views from Hoover Dam and the air, the quality of the recreational experience of some recreationists on and around Lake Mead would be degraded, and the experience of other recreationists would be enhanced by the presence of the new bridge. The new bridge would not preclude recreational opportunities currently offered by Lake Mead and its shores. No significant changes to existing noise levels are expected.

Because traffic would be diverted from atop Hoover Dam to the new bridge, traffic congestion would be reduced, thereby reducing the potential for vehicle collisions with pedestrian tourists on the dam. The reduction in traffic would also reduce the amount of truck traffic noise and volume of air pollutants emitted from vehicles on the dam. These three improvements are considered benefits to recreationists visiting Hoover Dam.

Hoover Dam may also be visible to motorists traveling over the new bridge and approaches; however, the safety barrier and the high elevation of the proposed bridge (relative to the dam) will minimize viewing opportunities. Because stopped vehicles, bicyclists, and pedestrians would be precluded from the new bridge, additional opportunities to photograph Hoover Dam would not be provided.

Implementation of the Promontory Point Alternative, on its current alignment, would impact the planned railroad grade hiking/bicycle trail. Because the alignments for both the Promontory Point Alternative and the railroad grade trail are preliminary and have not been finalized, there would be an opportunity for NPS and FHWA to work collaboratively to develop a compatible design for the two facilities. This collaboration in the design of these two transportation facilities would ensure the railroad grade trail would not be adversely affected by subsequent development of the U.S. 93/Hoover Dam Bypass.

Implementation of the Promontory Point Alternative would not affect other recreational activities at the Colorado River, the Gold Strike Canyon hiking trail and hot springs, or the Hacienda Hotel.

Sugarloaf Mountain Alternative (Preferred Alternative). The new bridge would be visible from Hoover Dam and from aerial sightseeing tours, thus changing the recreational setting of the Colorado River immediately downstream of the dam from both the dam and the air. For some recreationists, this change would degrade the river view. For other recreationists, the bridge design would add variety to the river view. The presence of the new bridge would

not preclude the recreational opportunities currently offered by Hoover Dam and aerial sightseeing.

The bridge would be visible to recreationists on the Colorado River at the rafting and canoeing put-in locations, located about 0.5 mile downstream of Hoover Dam. The quality of the recreational experience of some recreationists on the Colorado River would be degraded, and the experience of other recreationists would be enhanced by the presence of the new bridge. The new bridge would not preclude recreational opportunities currently offered at the rafting and canoeing put-ins or at the hot springs and hiking trail. As rafters and canoeists float downstream away from the proposed bridge, the view of the bridge would diminish, until approximately 0.4 mile downstream from the put-in, at which point the bridge would not be visible. No significant changes from existing noise levels are expected.

Because traffic would be diverted from atop Hoover Dam to the new bridge, traffic congestion would be reduced, thereby reducing the potential for vehicle collisions with pedestrian tourists on the dam. The reduction in traffic would also reduce the amount of truck traffic noise and volume of air pollutants emitted from vehicles on the dam. These three improvements (pedestrian safety, noise, and air quality) are considered benefits to recreationists visiting Hoover Dam.

Hoover Dam may also be visible to motorists traveling over the new bridge and approaches; however, the safety barrier and the high elevation of the proposed bridge (relative to the dam) will minimize viewing opportunities. Stopped vehicles, bicyclists, and pedestrians would be precluded on the new bridge roadway; however, FHWA will study the feasibility of a separate viewing facility associated with the bridge.

Implementation of the Sugarloaf Mountain Alternative, on its current alignment, would impact the planned railroad grade hiking/bicycle trail. Because the alignments for both the Sugarloaf Mountain Alternative and the railroad grade trail are preliminary and have not been finalized, there is an opportunity for NPS and FHWA to work collaboratively to develop a compatible design for the two facilities. Since Sugarloaf Mountain is the preferred alternative, this design collaboration would ensure the railroad grade trail would not be adversely affected by the U.S. 93/Hoover Dam Bypass.

Implementation of the Sugarloaf Mountain Alternative would not affect other recreational activities at Lake Mead, the Gold Strike Canyon hiking trail and hot springs, and the Hacienda Hotel.

Gold Strike Canyon Alternative. The new bridge would not be visible from Hoover Dam or by the ground tours; therefore, those activities would not be affected. It would be visible to aerial sightseeing recreationists, thus changing the recreational setting of Black Canyon and the Colorado River in the vicinity of the construction zone from the air. For some recreationists, this change would degrade the river view. For other recreationists, the bridge design would add variety to the river view. The presence of the new bridge would not preclude aerial sightseeing opportunities.

The location where the bridge would cross the river would be visible to recreationists at the rafting and canoeing put-in locations, located about 0.5 mile downstream of Hoover Dam. It would be visible to recreationists using the hot springs and hiking trail. For some recreationists, the quality of the recreational experience in Black Canyon, on the Colorado River, and at the hiking trail and hot springs would be degraded. The presence of the new bridge would not preclude recreational opportunities currently offered at the rafting and

canoeing put-ins or at the hot springs and hiking trail. After put-in, rafters and canoeists would float downstream toward the proposed bridge, resulting in the bridge becoming increasingly large. Once downstream of the bridge, it would remain visible for approximately 0.8 mile.

The addition of vehicle traffic to the currently undeveloped Gold Strike Canyon would increase existing ambient noise levels by 26 dBA. With construction of noise barriers on the roadway, noise levels along the canyon trail would still represent a substantial increase over existing levels, which would be an adverse impact. This increase in noise levels and the bridges and highway in the canyon would affect the quality of the recreational experience of users of the hiking trail in that area (see Chapter 6, Section 4(f) Evaluation).

Because traffic would be diverted from atop Hoover Dam to the new bridge, traffic congestion on the dam would be reduced, thereby reducing the potential for vehicle collisions with pedestrian tourists on the dam. The reduction in traffic would also reduce the amount of truck traffic noise and volume of air pollutants emitted from vehicles on the dam. These three improvements are considered benefits to recreationists visiting Hoover Dam.

Implementation of the Gold Strike Canyon Alternative would not affect recreational activities at Lake Mead and the Hacienda Hotel.

No Build Alternative. Implementation of the No Build Alternative would result in no additional roadway or bridge being constructed, and would result in no physical changes to the existing roadway and Hoover Dam crossing. Traffic levels on U.S. 93 are projected to continue to increase, and the number of recreationists visiting Hoover Dam, Lake Mead, and the Colorado River and its environs is also expected to continue to increase. The continued increase in vehicles along U.S. 93 near Hoover Dam and atop the dam is expected to further increase traffic congestion.

Increased traffic would result in increased travel times for both through-vehicles and vehicles whose final destination is the dam, and would also result in additional noise and vehicle fumes on the roadway and atop the dam. Increased travel times may affect the enjoyment of the travelers' recreational experience, and the visit to Hoover Dam would likely be degraded by associated additional noise and vehicle fumes.

Additional traffic would increase the potential for vehicle and pedestrian collisions on the dam, resulting in an increased public safety hazard. Continuing to allow commercial trucks to cross the dam, in combination with the expected increased traffic levels, would also increase the public safety hazard. The increase in recreationists visiting the dam would compound this public safety hazard. This increased hazard potential would adversely affect the recreational experience at the dam.

Implementation of the No Build Alternative would not adversely affect Lake Mead recreational activities. However, if traffic congestion increases to intolerable levels to motorists, they may elect to drive to their destination using an alternate route, even if it is longer. Motorists who chose an alternate route would forego the recreational opportunities offered at Hoover Dam, the Colorado River, the Gold Strike Canyon hiking trail and hot springs, and the Hacienda Hotel.

3.8.3 Measures to Minimize Harm

3.8.3.1 Construction Mitigation

Regardless of the alternative selected, certain areas would be designated for construction activities, which would preclude using those areas for dispersed recreational activities. In most cases, this impact on recreational activities is not considered adverse. Designated construction safety zones and construction areas would have signs posted, and public access to those areas would be precluded, thus reducing the potential for recreationists to be injured in the construction zone or by construction activities. The hiking trail in Gold Strike Canyon would be closed during construction of the Gold Strike Canyon Alternative, which would be an adverse impact on the recreationists using this area.

Promontory Point Alternative. The following mitigation measures should be implemented:

- Construction activities should be coordinated with Lake Mead Cruises to avoid conflicts.
- The construction zone within Lake Mead should be marked with buoys, or other devices, to preclude access by private and commercial boats.

Sugarloaf Mountain Alternative (Preferred Alternative). Raft and canoe launchings at the put-ins on the Colorado River will be scheduled to avoid conflicts between construction activities and put-ins.

Gold Strike Canyon Alternative. The following mitigation measures should be implemented:

- Raft and canoe launchings at the put-ins on the Colorado River, and floating through the construction zone, should be scheduled to avoid conflicts between construction activities and river floating.
- A net or other device should be used to prevent construction materials or equipment from falling from the bridge into the river.
- The loss of trail access from U.S. 93 to the hot springs during the construction period is considered unmitigable.

3.8.3.2 Operational Mitigation

Recreational activities at Hoover Dam, Lake Mead, and the Colorado River would not be precluded by implementation of any of the three build alternatives. Selection of the Sugarloaf Mountain Alternative would alter the view from Hoover Dam and the river put-ins.

Promontory Point Alternative. No additional mitigation for this alternative is required or recommended.

Sugarloaf Mountain Alternative (Preferred Alternative). Based on recommendations of the DAP to reduce visibility of the bridge from recreational viewpoints, the bridge could be painted or tinted with nonglare colors that blend with the surrounding environment. No additional mitigation for this alternative is required or recommended.

In anticipation of public demand for views of Hoover Dam from the new bridge on this alignment, FHWA will study the technical feasibility of a separate viewing platform associated with the bridge. Further details of such a facility cannot be determined until design of the bridge and approaches is advanced beyond the current level.

Gold Strike Canyon Alternative. Noise levels resulting from operation of this alternative were calculated to be 65 dBA-L_{eq} at the top of the hiking trail, compared against an existing noise level of 39 dBA in the canyon. The federal/state noise criterion or standard to be achieved is 67 dBA-L_{eq}. It would be possible to reduce the noise levels by constructing noise barriers located at the outside edge of the roadway adjacent to the trail (shown on Figure 3-1). A 6 dBA-L_{eq} reduction could be achieved, resulting in a noise level of 59 dBA. Although the barriers would reduce the noise level below the federal/state criterion, the resulting noise level still represents a substantial increase over existing conditions. Reduced access for hikers and aesthetic impacts from the elevated roadway in the canyon also cannot be mitigated.

3.9 Socioeconomics

3.9.1 Affected Environment

This section describes the population, employment, and income levels in Clark County and Boulder City, Nevada and Mohave County, Arizona. Boulder City is the nearest town to the proposed project area and is, therefore, the focus of the discussion. This section also discusses social conditions, environmental justice, and transportation and circulation.

3.9.1.1 Population

The Hoover Dam area is located within Clark County, Nevada, and Mohave County, Arizona. Clark County, in southern Nevada, covers 7,911 square miles and has a countywide population density of 125 people per square mile. The 1996 population was 992,593, an increase of 34 percent over 1990. The Las Vegas and Henderson population of 560,359 represents approximately 48 percent of Clark County's total population.

Mohave County, in western Arizona, covers 13,312 square miles with a countywide population density of 9 people per square mile. Between 1990 and 1996, population increased by 30 percent, to 121,602.

Boulder City is situated along the eastern border of Clark County, about 24 miles southeast of Las Vegas and 6 miles southwest of Hoover Dam. Boulder City's population has grown more slowly than the rest of the county because of its controlled growth ordinance. Current population is approximately 14,500.

3.9.1.2 Employment

Tourism is a primary economic force in Clark County. Boulder City offers a full range of services to the increasing numbers of tourists, with motels, restaurants, and an airport. Although gambling is not permitted within the city, Hacienda Hotel (located on U.S. 93 between Boulder City and Hoover Dam), a major employer in the area, offers gaming and other entertainment. Federal and local government agencies are the most significant employers in the local labor force. In addition to tourism and government, a light industrial area in the city provides commercial and manufacturing jobs to the local economy.

Construction, trade, finance, real estate, and services provide the majority of employment in Mohave County. Employment opportunities at Hoover Dam consist of federal jobs and privately operated food and gift concessionaires.

In 1989, average personal per capita income in Boulder City was $17,231; Clark County was $15,109; and the State of Nevada was $15,214. The national personal per capita income was $14,420.

3.9.1.3 Social Conditions

The proposed project is located entirely on federal land about 6 miles northeast of the nearest residential area in Boulder City. Boulder City is the only city in Nevada where gambling is prohibited. The city has also instituted a controlled growth policy to prevent rapid development and to preserve the utility systems and social infrastructure. Boulder City offers a quiet, small town atmosphere.

3.9.1.4 Environmental Justice

Environmental justice refers to social inequity in bearing the burdens of adverse environmental impacts. Certain U.S. socioeconomic groups, including ethnic minorities, the elderly, rural residents, and others, have historically experienced a disproportionate share of adverse effects from locally undesirable land uses such as toxic waste dumps, landfills, and freeway projects.

Consistent with Title VI of the 1964 *Civil Rights Act* and Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, dated February 11, 1994, all proposed projects and decisions must ensure that minority and low-income populations are not disproportionately adversely affected by transportation programs or projects.

The FHWA policy toward environmental justice is to address whether any social group is disproportionately impacted by a proposed project, and to identify possible mitigation measures to avoid or minimize adverse social impacts. Specifically, the FHWA intends that no person in the U.S. shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

Table 3-19 presents 1990 census data for Las Vegas, Henderson, and Boulder City, Nevada; and for Kingman, Arizona.

Table 3-19
1990 Census Data by Locality Near the Proposed Project Area

Las Vegas	Henderson	Boulder City	Kingman
Total Population			
258,295	64,942	12,567	12,722
Race (Percent)			
White: 78.4	White: 91.5	White: 97	White: 94.5
Black: 11.5	Black: 2.7	Black: 0.4	Black: 0.1
AI[a]: 0.9	AI: 1.0	AI: 1.0	AI: 1.3
A[b]: 3.6	A: 2.1	A: 1.2	A: 1.5
Other[c]: 5.6	Other: 2.7	Other: 0.4	Other: 2.6

Table 3-19
1990 Census Data by Locality Near the Proposed Project Area

Las Vegas	Henderson	Boulder City	Kingman
Total Households			
99,954	23,353	5,116	4,961
Race (Percent)			
White: 82	White: 92.7	White: 98	White: 95
Black: 10.1	Black: 2.7	Black: 0	Black: 0.2
AI: 0.9	AI: 1.0	AI: 1.0	AI: 1.1
A: 2.8	A: 1.4	A: 0.7	A: 1.2
Other: 4.2	Other: 2.2	Other: 0.3	Other: 2.5
Households by Age Group			
<25: 5,904	<25: 1,288	<25: 104	<25: 210
25-34: 24,401	25-34: 6,019	25-34: 616	25-34: 849
35-44: 22,469	35-44: 6,059	35-44: 874	35-44: 967
45-54: 16,431	45-54: 3,846	45-54: 880	45-54: 800
55-64: 13,510	55-64: 2,876	55-64: 888	55-64: 772
65-74: 11,903	65-74: 2,422	65-74: 1,092	65-74: 807
Households (all races) Age 55 and Over and Percentage Below the Poverty Level			
30,749	6,141	2,642	2,135
(52 Percent)	(46 Percent)	(45 Percent)	(65 Percent)
Households Age 55 and Over Below the Poverty Level[d] by Race[e] (Percent)			
White: 50.5	White: 45.7	White: 23.5	White: 64.3
Black: 63.8	Black: 48.4	Black: 0	Black: 100
AI: 65.1	AI: 24.5	AI: 12.8	AI: 41.1
A: 60.1	A: 32.4	A: 21.4	A: 100
Other: 51.4	Other: 71.7	Other: 0	Other: 100
Families Above the Poverty Level in 1989 by Race (Percent)			
White: 76.3	White: 88.2	White: 93.5	White: 89.2
Black: 7.9	Black: 2.1	Black: 0	Black: 0.2
AI: 0.9	AI: 0.8	AI: 1.3	AI: 1.4
A: 2.8	A: 1.3	A: 0.4	A: 1.2
Other: 4.0	Other: 2.5	Other: 0.3	Other: 2.5
Families Below the Poverty Level in 1989 by Race (Percent)			
White: 4.6	White: 4.4	White: 4.5	White: 5.2
Black: 2.4	Black: 0.4	Black: 0	Black: 0
AI: 0.1	AI: 0.1	AI: 0	AI: 0
A: 0.2	A: 0.1	A: 0	A: 0.2
Other: 0.8	Other: 0.1	Other: 0	Other: 0.1
Per Capita Income by Race in 1989 ($)			
White: 16,121	White: 16,951	White: 17,254	White: 12,370
Black: 9,252	Black: 11,691	Black: 1,096	Black: 10,400
AI: 12,140	AI: 11,008	AI: 13,788	AI: 10,480
A: 12,465	A: 10,846	A: 26,219	A: 37,571
Other: 8,436	Other: 9,773	Other: 9,712	Other: 12,523

Table 3-19
1990 Census Data by Locality Near the Proposed Project Area

	Las Vegas	Henderson	Boulder City	Kingman

[a] AI—American Indian, Eskimo, or Aleut

[b] A—Asian or Pacific Islander

[c] Other—Other Race

[d] FHWA defines low income as a median household income of less than $15,150 for a family of four. Numbers presented in this table are conservative because they include the household income category of $15,000 to $24,999 to ensure including those households with household income between $15,000 and $15,150.

[e] These numbers show, for example, that 50.5 percent of all white households age 55 and over are below the poverty level in Las Vegas, Nevada.

Source: 1990 U.S. Census Data

3.9.1.5 Transportation and Circulation

U.S. 93 is a north-to-south trending highway with the southern terminus at Wickenburg, Arizona (northwest of Phoenix). U.S. 93 intersects I-15 in Las Vegas and heads north near the eastern boundary of Nevada, bisects Idaho, and continues north through western Montana to the Canadian border. This route is used by traffic from Tucson and Phoenix, Arizona; to Las Vegas and Reno, Nevada; and Salt Lake City, Utah. Usage has increased since NAFTA implementation. The U.S. 93 corridor, in combination with other highways, creates a continuous north-to-south corridor between Canada and Mexico, through the United States from Calgary, Canada, to Nogales, Mexico (Figure 1-1). These highways, consisting mostly of four-lane divided facilities with structural sections capable of supporting heavy vehicles, provide north-to-south linkages from the international border with Mexico via I-19 from Nogales to Tucson, and I-10 from Tucson to Phoenix, in Arizona; and I-15 in Nevada, Utah, Idaho, and Montana to the Canadian border. U.S. 93 provides a north-to-south link between I-10 near Phoenix to I-15 in the Las Vegas metropolitan area. Much of U.S. 93 is a two-lane undivided highway.

Currently, the Nogales border crossing handles more than 250,000 truck crossings annually and is the primary point of entry for produce shipped by truck into the U.S. from Mexico (ADOT, 1993). The U.S. 93 corridor has been recommended by ADOT to become Arizona's link in the international trade route proposed by NAFTA.

ADOT plans to improve U.S. 93 to a four-lane divided facility from Wickenburg to north of Kingman, Arizona in the next several years. In Nevada, U.S. 93 is four lanes from Las Vegas to Boulder City. After implementing ADOT improvements, the only section of U.S. 93 that will remain two lanes (between Phoenix and Las Vegas) will be the 19-mile segment that includes Hoover Dam. Although most of the corridor would generally consist of a high-speed divided facility, the Hoover Dam segment creates a traffic bottleneck between Nevada and Arizona, potentially interfering with interstate and international commerce.

Hoover Dam is the only Colorado River crossing near Las Vegas. The next closest crossings are at Davis Dam, 67 miles downstream, or at Laughlin, 70 miles downstream. Because shorter travel times and distances reduce accident exposure and transit costs, the shorter Hoover Dam crossing is preferred by the commercial trucking industry for travel in the Las Vegas to Phoenix corridor.

Other routes that cross the Colorado River are U.S. 95 and SR 163 in Nevada to Arizona SR 68 (see Figure 2-1), which would add 23 miles to the trip from Kingman to Las Vegas.

Another route from Kingman to Las Vegas, I-40 to Needles, California, and then north on U.S. 95 to Las Vegas, adds 70 miles to the trip (see Table 2-1).

As the shortest route, U.S. 93 across Hoover Dam would offer a time savings for through traffic between Arizona and Nevada if the existing bottleneck is eliminated at the dam. Traffic flow is generally at speeds near posted limits except at roadway approaches to Hoover Dam. Average speeds recorded on the approaches to the dam and across the dam crest were as low as 8 mph (*Traffic Study: Colorado River Bridge*, Reclamation, December 1991).

The Hoover Dam section of U.S. 93 has reached capacity during peak periods and cannot provide additional capacity with the current roadway alignment. In 1991, average travel speeds for the 2 miles of roadway on either side of Hoover Dam were 8 to 18 mph. Table 3-20 presents 1997 AADT and LOS at Hoover Dam (see Traffic Analysis - Appendix A).

Table 3-20
Average Annual Daily Traffic and Level of Service at Hoover Dam

Measurement	1997
AADT	11,500
LOS	F

The LOS compares projected traffic with the theoretical capacity of a roadway segment. LOS is designated A to F, with A representing unconstrained and free-flowing traffic, and F representing unstable flow with near gridlock conditions. As shown in Table 3-20, traffic congestion at Hoover Dam is nearing gridlock.

Bicyclists and Pedestrians. Bicycles currently have access to and across Hoover Dam on U.S. 93. There are no bicycle lanes on U.S. 93, nor is the highway a designated bicycle route. The NPS and NDOT are in the process of developing a bicycle/pedestrian trail from Boulder City to Hoover Dam on the Railroad Grade just north of U.S. 93 (see Section 3.8, Recreation Resources).

3.9.2 Environmental Consequences

3.9.2.1 Build Alternatives

Population. No change in regional (Clark and Mohave counties) population is expected from implementation of any of the build alternatives. Recent trends in population growth are not expected to be altered. Because Boulder City has a growth ordinance, population increases within the city are expected to continue at the same rate as in the past 10 years.

Employment. Construction of any of the build alternatives would create both direct and indirect employment opportunities in the region. Direct employment would be provided for project construction workers. Indirect employment would be provided for those in construction material manufacturing and delivery, project goods and services, and project operation and maintenance.

The number of direct and indirect jobs that would be created during the construction period is based on the relationship between construction costs and the multipliers for construction employment. It is expected that Las Vegas, Henderson, Boulder City, and Kingman would provide the labor pool. During the construction period, between 2,900 to 3,440 new jobs would be created in the region.

The Hacienda Hotel, located about 3 miles west of Hoover Dam, employs about 450 people, many of whom live in Boulder City. Implementation of the build alternatives is not expected to affect the number of employees at this establishment.

Income. Few permanent jobs would be created by construction of any of the build alternatives; therefore, the personal per capita income is not expected to change in Clark or Mohave counties.

In both Arizona and Nevada, minor adverse impacts may occur to the dam concessionaires as a result of through-traffic reduction over the dam. However, these impacts would be offset by the expected continued increase in dam visitors. Reduced traffic congestion on the dam would make it a more desirable attraction to visit. The rafting concession would continue operation with only minor interruptions by coordinating its scheduled raft launching to avoid conflicts with construction activities; therefore, it is not expected to be adversely affected. Access restrictions to Hoover Dam from Lake Mead would be coordinated with lake tour operators.

Impacts to the local economy would be most notable during the construction period. Based on the cost range for the alternatives, for every dollar spent in bridge construction and highway approaches, $1.75 would be generated in the regional economy. An estimated range of economic activity from construction expenditures would be from $233 to $257 million.

During operation of the proposed project, traffic would continue to pass through Boulder City as it currently does. Therefore, changes in spending within the city (and resultant economic impacts) are expected to be negligible when compared to existing levels.

Social Conditions. Because the proposed project's western terminus is located about 4 miles east of the Boulder City limits, the city's existing social infrastructure (including schools, recreational areas, churches, businesses, and emergency services) is not expected to be adversely affected. In fact, the reduction in traffic congestion and potential safety hazards at and near the dam are likely to reduce the demand upon Boulder City emergency response personnel. In addition, no businesses or households would need to be relocated, and Boulder City's community cohesion and property values would not be affected.

If the proposed project is implemented, perceived social impacts, such as noise, pollution, and associated decreases in quality of life, would occur in Boulder City at the current same rate. Therefore, no impact on the city's social conditions is expected from any of the build alternatives.

Environmental Justice. E.O. 12898 requires identification and avoidance of disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Because the area where the build alternatives would be constructed and operated is currently unpopulated, no minority or low-income groups live in that area. Therefore, disproportionately high and adverse human health or environmental effects on minority and low-income groups are not anticipated.

Transportation and Circulation. U.S. 93 traffic forecasts were completed using historic traffic data obtained from ADOT and NDOT and applying expected annual traffic growth rates of between 4 and 5 percent for 1997. The AADT volumes and associated LOS at Hoover Dam for years 2017 and 2027 under the No Build Alternative are presented in Table 3-21.

Table 3-21
Forecasted Average Annual Daily Traffic and Level of Service at Hoover Dam Under No Build Alternative

	Year	
Measurement	**2017**	**2027**
AADT	21,100	26,000
LOS	F	F

Source: Appendix A, Traffic Analysis

The LOS at Hoover Dam is expected to improve from F to E with implementation of any of the build alternatives. The primary reason the LOS would not improve more than level E is the mountainous terrain, steep grades, and sharp curves. Speeds are expected to be low; however, the roadway capacity would be well above the anticipated demand, and traffic delays on the dam are not expected.

If any of the build alternatives are implemented, the AADT and associated LOS in year 2017 for the new bridge crossing are 16,400 and A, respectively. In year 2027, the AADT and LOS would be 19,900 and B, respectively.

Bicyclists and Pedestrians. Bicycles and pedestrians would be restricted from crossing the new Hoover Dam bypass bridge if any of the proposed build alternatives are constructed. The bicycle through route and dam access would be via existing U.S. 93, but some portions would be impacted by the new highway and would need to be reconstructed. The dam crossing would stay open to automobile traffic and bicyclists visiting the historic landmark. The Nevada and Arizona connections of the old highway/dam crossing to the new U.S. 93 bypass roadway would be designed to provide ingress/egress for bicycles. Detailed traffic analysis would be completed during final design to determine whether at-grade crossings or interchanges are required to accommodate the expected volumes of vehicles exiting to or returning from the dam crossing.

3.9.2.2 No Build Alternative

Implementation of the No Build Alternative would result in no change to existing population trends and growth in Clark and Mohave counties. In addition, this alternative would result in the creation of no direct or indirect jobs (and, therefore, no change to the local economy), and no change to the existing personal per capita income level in the region.

Similar to that for the build alternatives, no impacts to the existing social infrastructure of Boulder City (including schools, recreational areas, churches, and businesses) are expected. However, the expected increase in traffic congestion and associated potential safety hazards at and near the dam may affect the demand upon Boulder City emergency response personnel during emergencies. No businesses or households would need to be relocated, and Boulder City's community cohesion and property values would not be affected by this alternative.

If the No Build Alternative is implemented, perceived social impacts (such as noise, pollution, and associated decreases in quality of life) would occur in Boulder City at the current rate. Because the No Build Alternative would result in no project being constructed, no adverse effects on minority or low-income populations are expected.

With implementation of the No Build Alternative, LOS is expected to remain F at Hoover Dam. The AADT and associated LOS in year 2017 at the dam if the No Build Alternative is implemented are 21,100 and F, respectively. In year 2027, the AADT and LOS would be 26,000 and F, respectively. Although LOS at the dam would continue to be F when compared to existing conditions, the increase in AADT (83.5 and 126 percent in years 2017 and 2027, respectively) would result in significant transportation and circulation impacts on U.S. 93 at and near the dam (see Table 3-21).

3.9.3 Measures to Minimize Harm

Because no adverse impacts on population, employment, income, social conditions, minority or low-income populations, or transportation and circulation are expected as a result of implementing any of the build alternatives, no mitigation is required.

3.10 Hazardous Materials

3.10.1 Affected Environment

Sites with known or suspected hazardous waste that may be affected by the proposed project were evaluated to assess environmental concerns at each site. These sites are known or suspected to be contaminated with hazardous wastes because of historical use, storage, or release of hazardous materials at the site. This evaluation is based on Level I Contaminant Surveys that were conducted for the Promontory Point, Sugarloaf Mountain, and Gold Strike Canyon Alternatives in May 1992 (Reclamation, May 1992a, b, c), a Resource Conservation and Recovery Act of 1976 (RCRA) Compliance Evaluation Inspection report from March 1996, and a subsequent survey in May 1998. General locations of these sites are shown in Figure 3-13.

3.10.1.1 Promontory Point Alternative

Seven potential hazardous waste sites exist on or adjacent to the Promontory Point Alternative corridor: the Reclamation warehouse storage yard; two staging areas used by contractors during construction of the new visitor center; two disposal areas used during construction of the new visitor center and during rehabilitation of U.S. 93 in the vicinity of the dam; a dump pile; and an abandoned switchyard. Because the Promontory Point and Sugarloaf Mountain Alternatives both impact the Reclamation warehouse storage yard, environmental concerns for this site would be the same as those discussed below, under the preferred alternative.

Contractor Staging and Disposal Areas. At the time of the survey, Reclamation was building the new visitors' facility at Hoover Dam. The prime contractor constructed two staging areas for this work at Stations 120+00 and 125+00. The two disposal areas consisted primarily of excavated rock, soil, and milled pavement; however, some old pipe, rebar, scrap metal, and other construction debris were evident. One of the disposal areas had been flattened and used for equipment storage. A large storage tank and several 55-gallon containers of motor oil and antifreeze were also stored at one staging area on or near the alignment centerline at Station 125+00.

These areas are of concern because chemicals, including motor oil, antifreeze, and diesel fuel, were used and stored at these sites. Several noticeable oil stains were observed on the ground (Reclamation, 1992a). If it is determined that chemicals were released to the soil,

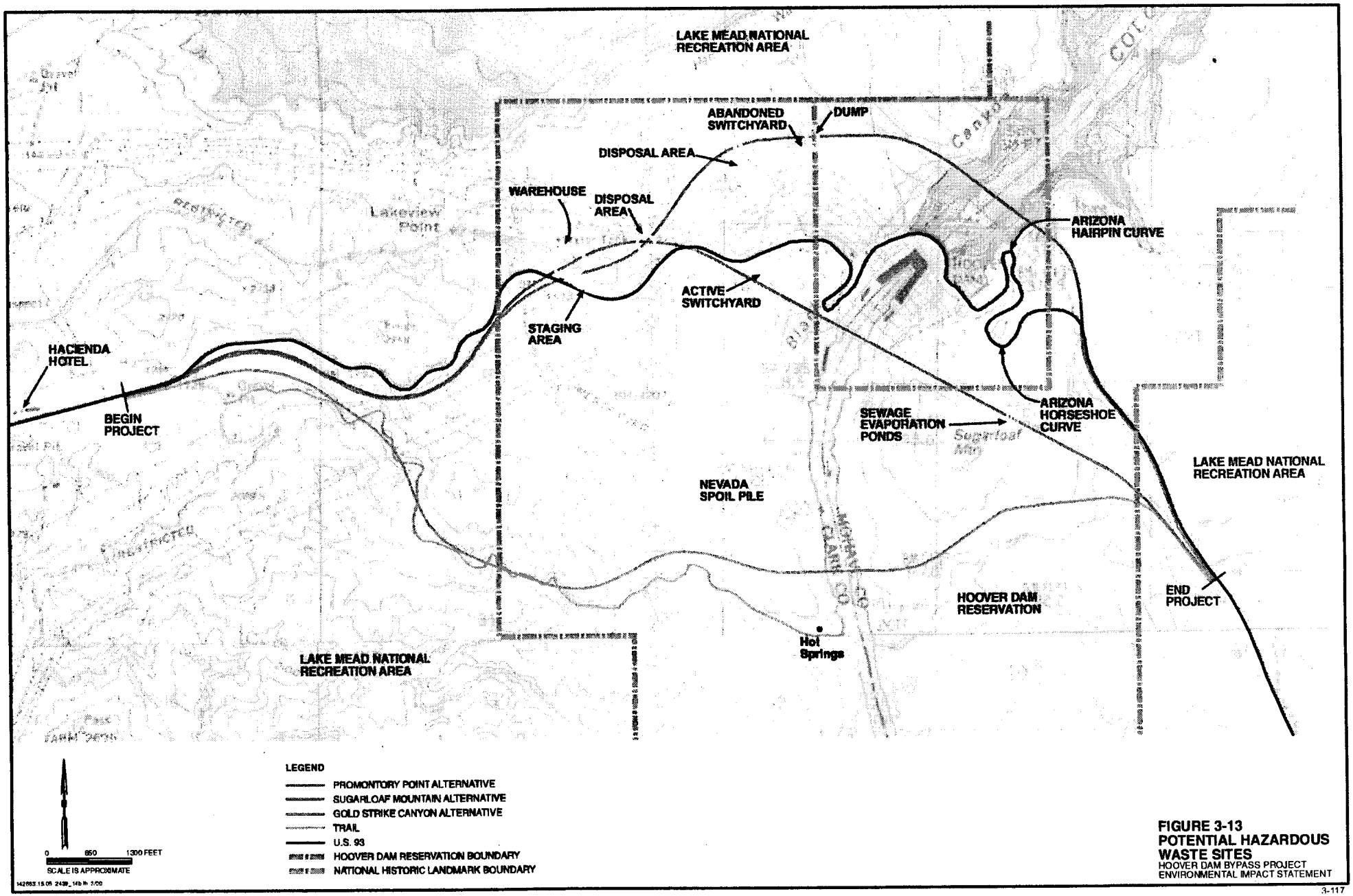

FIGURE 3-13
POTENTIAL HAZARDOUS WASTE SITES
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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contaminated soil may be encountered during construction activities. Site cleanup was the responsibility of the contractor after completion of the project.

Dump Pile. An original dump pile used during construction of Hoover Dam is located along the Promontory Point Alternative alignment (Reclamation, May 1992a), approximately 400 feet left of centerline at Station 151+00. The area has the appearance of an industrial waste site due to the scattered metal shavings, numerous rusted 5-gallon and 55-gallon containers, concrete blocks, scrap metal, and sheet metal. Some ground discoloration was observed. Because the dump pile is located upgradient from the proposed alignment, a potential pathway for contamination exists from the dump to the subject alignment through surface runoff or a subsurface plume of contamination.

Abandoned Switchyard. There were several substantial oil stains noticed at each of the switchyards north of U.S. 93 in the immediate vicinity of the Promontory Point alignment. The switchyard near the centerline at Station 151+50 is currently out of service. A transformer had a yellow tag on it to indicate it contained PCBs. Additional environmental concerns at this site include oil stains on the ground. If the oil is the result of a transformer leak, the oil could potentially contain PCBs.

PCBs are a subset of the synthetic organic chemicals known as chlorinated hydrocarbons. Between 1926 and 1977, PCB-containing products were manufactured for use in applications such as electrical transformers, where stable, fire-resistant, heat-transfer properties were demanded. The most extensive use of PCBs occurred in dielectric fluids. Such fluids typically have the following characteristics: a heavy oil appearance, high boiling point, high chemical stability, high flash point, low electrical conductivity, and low water solubility. PCBs are known to cause chronic reproductive effects, gastric disorders, and skin lesions in laboratory animals. In addition, the U.S. EPA suspects that PCBs are probable human carcinogens.

During the 1970s, in an effort to minimize the potential for adverse health effects caused by PCBs and other substances, Congress passed the Toxic Substances Control Act (TSCA), which strictly regulates all aspects of PCB use. TSCA prohibits the manufacture, processing, and distributing in commerce of PCBs, except as exempted by the EPA. TSCA also prescribes that the use, marking, and disposal of PCBs be strictly regulated by EPA. Regulations issued pursuant to TSCA require generator identification numbers and the manifesting of PCB wastes. Also, some state RCRA programs, particularly in the area of disposal, place additional restrictions on the handling of PCBs.

In July 1992, the Tennessee Valley Authority (TVA), under a Western Area Power Administration (WAPA) contract (Contract No. DE-A165-91 WA 09429), conducted a preliminary environmental assessment of the potential for PCB contamination of this and other Nevada Power Company switchyards at this location. The report of this assessment, which included sampling and analysis of transformer oils, noted that approximately 6,600 gallons of oil containing PCBs were present onsite in seven circuit breakers, ranging in capacity from 600 to 2,200 gallons. Blue PCB labels on these circuit breakers indicated that PCBs were present in the oil at concentrations under 50 ppm. An exception was one circuit breaker bushing that had a yellow label, indicating PCB concentrations greater than 50 ppm. The Hazardous Material Coordinator for Hoover Dam has indicated that these units have not been drained, and that jurisdiction and responsibility for proper closure of the transformers/circuit breakers would lie with WAPA (personal communication, Jeff Weaver, 1998).

The TVA preliminary assessment also noted that one minor spill involving PCB-containing oil occurred in 1990 at this location. The spill was remediated under the supervision of the Phoenix office of WAPA. The assessment further evaluated the potential for PCBs at this location to migrate into the environment. It was determined that the greatest threat to the environment would come from storm-induced drainage through the site's lower switchyards and culverts to the river. The potential hazards to the public and worker exposures via the soil and air pathways was judged to be minimal (personal communication, Jeff Weaver, 1998).

3.10.1.2 Sugarloaf Mountain Alternative (Preferred Alternative)

Six potential hazardous waste sites exist on or adjacent to the Sugarloaf Mountain Alternative corridor: the Reclamation warehouse storage yard; two staging areas used by contractors during construction of the new visitor center; one disposal area used during construction of the new visitor center and during rehabilitation of U.S. 93 in the vicinity of the dam; an active switchyard; and sewage evaporation ponds. Because the Sugarloaf Mountain and Promontory Point Alternatives both impact the two contractor staging areas, and one of the contractor disposal areas, environmental concerns are the same as those discussed previously. The following sections address environmental concerns regarding the Reclamation warehouse storage yard, the active switchyard, and the sewage evaporation ponds.

Reclamation Warehouse Storage Yard. The Sugarloaf Mountain Alternative would pass through the Reclamation warehouse storage yard at Station 107+00. Environmental concerns at this site include past and present chemical use and storage, stained soils, and drains and other pathways for potential contamination. A partial list of known chemical and hazardous waste include paint, PCBs, solvents, used oil, asbestos, and solvent rags. A small oil stain was noticed in the outside parking area of the warehouse.

Another concern at this site is potential residual petroleum hydrocarbons in soil resulting from two leaking underground fuel storage tanks that were removed in 1991. The underground storage tanks (USTs) were used for refueling maintenance vehicles and consisted of a 500-gallon diesel fuel tank and a 3,000-gallon gasoline tank. An estimated 500 gallons of unleaded fuel were released to the soil. The site was subsequently remediated in accordance with Nevada Division of Environmental Protection regulations and to the satisfaction of the Clark County Health District.

A 1996 inspection report states that the majority of hazardous waste currently generated onsite is paint waste. Samples taken of sandblast residue were analyzed, and results show that one sample contained 6 ppm lead, and all others passed toxicity characteristic leaching procedure (TCLP) tests. The drum of material from which the "hot" sample was collected was disposed of as hazardous waste. At the time that the samples were taken, staff recommended that sandblast residues generated in the future be collected as they are generated. The inspection concluded with no violations being observed at the warehouse and storage yard facilities.

Arizona and Nevada Switchyard. This active switchyard is located downgradient of the Sugarloaf Mountain Alternative near Station 139+00. The 1992 Level I Survey and Contaminant Survey Checklist stated that there were several substantial oil stains noticed on the ground at this site; however, WAPA staff have stated that the circuit breakers no longer use oil containing PCBs.

Sewage Evaporation Ponds. Two sewage evaporation ponds are located along the alignment near the centerline at Station 183+00. These ponds receive sewage from the visitor center. No evidence exists to suggest that industrial wastewater has been discharged to the ponds. During 1992 and on other occasions, bighorn sheep have been observed grazing alongside and drinking from the ponds, which removes most concern of contamination other than the normal sewage that would be found at this type of facility. The two sewage evaporation ponds will need to be excavated, closed, and relocated if the Sugarloaf Mountain Alternative is implemented.

3.10.1.3 Gold Strike Canyon Alternative

One hazardous waste site, a spoil pile located in Nevada near the Colorado River, would be impacted by the Gold Strike Canyon Alternative. The spoil pile is littered with metal shavings, numerous 5-gallon and 55-gallon containers, concrete pillars, scrap metal, wood timbers, and roofing material (that may contain asbestos). The spoil site is used as a practice range for the police personnel working at the dam. Surface soils at this waste site could potentially be contaminated from historical chemical releases. Because the spoil site is located downgradient of this proposed alignment, roadway runoff could potentially carry and spread surface soil contamination further downgradient of the waste site.

3.10.2 Environmental Consequences

Discussion of potential impacts from hazardous material haul-vehicle accidents is provided in the Water Resources section (Section 3.4).

3.10.2.1 Promontory Point Alternative

Because the Promontory Point and Sugarloaf Mountain Alternatives both impact the Reclamation warehouse storage yard, measures to address environmental concerns at this site would be the same as those discussed below under the Preferred alternative.

Contractor Staging and Disposal Areas. According to the Level I Contaminant Survey (Reclamation, May 1992a), contractors were responsible for cleaning staging areas. However, there is still the potential for encountering hazardous materials at the contractor staging and disposal areas. If this material is discovered during construction, the contractor would comply with the provisions of the Hazardous Materials Management Plan. During construction operations, some of the material in the two disposal areas may be excavated and either recompacted or moved to another location. Prior to excavation, additional sampling and testing would be required to confirm that no hazardous materials were disposed of at these sites.

If hazardous materials are discovered during surveys or construction, FHWA or its contractor would become a hazardous waste generator. A generator identification number would need to be obtained in order to transport hazardous materials, identify the hazardous material, and disclose the haul route to a specific treatment and/or disposal facility. The contractor must also comply with all requirements of the RCRA, associated state hazardous waste disposal requirements, and all of the provisions of the OSHA regulations regarding health and safety of workers and the handling of hazardous waste.

Dump Pile. To determine whether contamination from the dump pile has affected the alternative alignment, soil sampling should be conducted. Subsurface soil samples will determine whether a plume of subsurface contamination has migrated from the dump pile

to the alternative alignment. In addition, surface soil samples should be conducted to determine whether surface runoff has carried contaminants to the alternative roadway site.

As described above for the Contractor Staging and Disposal Areas, the contractor would comply with the provisions of the Hazardous Materials Management Plan if hazardous materials were discovered during construction. Additionally, the contractor would be required to comply with all requirements of the RCRA and associated state hazardous waste disposal requirements, and all of the provisions of the OSHA regulations regarding health and safety of workers and the handling of hazardous waste.

A generator identification number would also need to be obtained for the removal of any hazardous materials from the dump pile, if any should be found. And, as described above, FHWA or its contractor would need to disclose the haul route to a specific treatment and/or disposal facility.

Abandoned Switchyard. To address environmental concerns at this site, surface soil samples should be conducted before construction begins to determine whether oil or PCBs are present. Construction workers could be exposed to hazardous materials if any PCB-contaminated soil were present during construction or excavation in the project area.

If PCB-contaminated soils are unearthed or removed from the site, FHWA or its contractor may become a hazardous waste generator. A generator identification number would need to be obtained, as discussed above. The contractor would also be required to comply with RCRA, associated state hazardous waste disposal requirements, and OSHA regulations.

3.10.2.2 Sugarloaf Mountain Alternative (Preferred Alternative)

Because the Sugarloaf Mountain and Promontory Point Alternatives both impact the two contractor staging areas and one of the contractor disposal areas, measures to address environmental concerns at these sites are the same as those discussed above. The following sections describe measures to address environmental concerns at the Reclamation warehouse storage yard, the active switchyard, and the sewage evaporation ponds.

Reclamation Warehouse Storage Yard. Contaminated soil may be encountered during excavation and construction activities, and contaminated soils may pose health and safety risks to construction workers. If encountered, this soil would require special handling, storage, and disposal procedures according to the type and extent of contamination. If this material is discovered during construction, rather than prior to, the contractor would comply with the provisions of the Hazardous Materials Management Plan. In either case, the contractor would be required to comply with all requirements of the RCRA and associated state hazardous waste disposal requirements, and all of the provisions of the OSHA regulations regarding health and safety of workers and the handling of hazardous waste.

Further studies and soil sampling would be required to determine the type and extent of contamination because there is no existing information regarding the potential hazardous waste sites. After these studies are complete, FHWA, in consultation with the appropriate regulatory agencies, would determine which soils can be handled as hazardous waste and which soils would be handled as nonhazardous. When this information is available, methods for treating the contamination onsite would be determined, and procedures for handling and disposing of the waste would be resolved.

If it is determined that chemicals used and stored at the warehouse were released to the environment, or that residual petroleum hydrocarbons are present, FHWA or its contractor would become a hazardous waste generator upon extraction of the contaminated soil. The

contractor would then need to obtain a generator identification number in order to transport hazardous materials, identify the hazardous material, and disclose the haul route to a specific treatment and/or disposal facility.

Arizona and Nevada Switchyard. The presence of soil staining at the switchyard indicates the possibility of PCB-contaminated soil. Because PCB-contaminated soil requires special cleanup and disposal procedures and may pose health and safety risks to construction workers, soil samples would be taken in areas where oil stains are observed or leaks suspected. If PCB-contaminated soils are unearthed or removed from the site, FHWA or its contractor would become a hazardous waste generator. A generator identification number would need to be obtained, as discussed above. The contractor would also be required to comply with RCRA, associated state hazardous waste disposal requirements, and OSHA regulations.

Sewage Evaporation Ponds. The proposed Sugarloaf Mountain Alternative centerline would bisect the sewage evaporation ponds. While it is expected that no industrial wastewater has been discharged to the ponds, this would be verified through sludge and soil sampling. In either case, the two sewage evaporation ponds would need to be excavated, closed, and relocated if the Sugarloaf Mountain Alternative is implemented.

If industrial wastewater were discovered in the pond, contaminated sludge or soils could impact worker health and safety, as well as soil and sludge storage and disposal procedures. The removal of these contaminated sludge or soils would result in FHWA or its contractor becoming a hazardous waste generator. A generator identification number would need to be obtained, as discussed above. The contractor would also be required to comply with RCRA, associated state hazardous waste disposal requirements, and OSHA regulations.

3.10.2.3 Gold Strike Canyon Alternative

Because the Nevada Spoil Pile is located downgradient of the proposed alternative, roadway runoff could potentially affect this waste site. Roadway runoff should be controlled through barriers or diverted to prevent future runoff from spreading potential surface soil contamination downgradient of the waste site.

3.10.2.4 No Build Alternative

Should the No Build Alternative be selected, hazardous materials sites described above would not be affected. No further testing or remediation would occur.

3.10.3 Measures to Minimize Harm

3.10.3.1 Promontory Point Alternative

Because the Promontory Point and Sugarloaf Mountain Alternatives both impact the Reclamation warehouse storage yard, measures to address environmental concerns at this site would be the same as those discussed below under the Preferred alternative.

Potential Contractor Staging and Disposal Areas. Documentation reviews and personnel interviews would be conducted to determine whether releases have occurred, the extent of contamination, and how the contamination was addressed. An assessment would be conducted at the site to ensure that cleanup was conducted properly. Soil sampling would be conducted if evidence (e.g., discolored soil, odors, stressed vegetation) suggests that contamination may still be present.

Dump Pile. If recommended sampling shows that contamination has migrated to the proposed project location, excavation or remediation of affected soils may be required, depending on contaminant types and concentrations. At a minimum, soil should be monitored during excavation activities to segregate suspected contaminated soils. Roadway runoff should be controlled by barrier use or by being diverted to prevent future runoff from impacting the roadway site.

Abandoned Switchyard. If soil samples indicate that hazardous materials are present in the area, affected soil should be removed and disposed of in accordance with applicable environmental regulations. PCB-contaminated soil requires special cleanup and disposal procedures and may pose health and safety risks to construction workers.

Any PCBs remaining in the transformers at the abandoned switchyard would require proper disposal prior to demolition or dismantling. In addition, per EPA Region IX PCB Spill Cleanup Policy, any PCB-contaminated soil would need to be remediated to background levels (i.e., detection limits), where practicably attainable, for any PCB spill from a source greater than 50 ppm PCBs. In certain cases, EPA Region IX would consider alternative cleanup levels. Cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 allows deviation from the Regional Policy when the reason for deviation is included in the Record of Decision (ROD).

3.10.3.2 Sugarloaf Mountain Alternative (Preferred Alternative)

Because the Sugarloaf Mountain and Promontory Point Alternatives both impact the two contractor staging areas and one of the contractor disposal areas, measures to address environmental concerns at these sites are the same as those discussed above. The following sections describe measures to address environmental concerns at the Reclamation warehouse storage yard, the active switchyard, and the sewage evaporation ponds.

Reclamation Warehouse Storage Yard. To address environmental concerns at this site, chemical usage, storage, and releases would be investigated and documented. Interviews of onsite personnel and internal record reviews would be performed to determine locations and quantities of hazardous materials used and released in the storage yard. This information would then be used to implement an investigation of soils that would be affected by roadway construction. Soil samples would be taken in areas where discoloration, odors, or known releases have occurred or are suspected. Soil would be monitored during excavation activities to segregate contaminated soils.

Records documenting underground fuel tank removal would be reviewed to determine the vertical and horizontal extent of contamination, location and quantity of contaminated soil excavated, whether in situ remediation was implemented, and the cleanup standard attained. This review would help determine whether residual petroleum hydrocarbons are likely to be encountered during excavation and construction, and at what concentrations. Soil in the tank area would be monitored during excavation to segregate contaminated soils.

Since contaminants could become airborne during removal, additional control measures would be taken to ensure that airborne toxics concentration levels do not exceed any state or federal standards.

Arizona and Nevada Switchyard. Surface soil sampling would be conducted in areas where oil stains are located in order to confirm the presence of PCB-contaminated soil. If PCB-contaminated soil is discovered in the switchyard and the site is affected by construction of the bypass, affected soil would be removed and disposed of in accordance

with applicable environmental regulations. Alternately, if contaminated soils remain in place, roadway runoff will be controlled by barrier use or by being diverted to prevent future runoff from spreading the contamination downgradient of the yard. Per EPA Region IX, PCB Spill Cleanup Policy, any PCB-contaminated soil would need to be remediated to background levels (i.e., detection limits), where practicably attainable, for any PCB spill from a source greater than 50 ppm PCBs. In certain cases, the EPA, Region IX, would consider alternative cleanup levels. Cleanup under the CERCLA of 1980 allows deviation from the Regional Policy when the reason for deviation is included in the ROD.

Sewage Evaporation Ponds. Soil and sludge sampling would be conducted to confirm that industrial wastewater has not been discharged to the ponds. If it were discovered that industrial wastewater had been discharged there, contaminated sludge or soils would need to be removed in order to protect workers' safety during construction of the proposed project. Removal would require special safety and handling procedures and would require compliance with all applicable state and federal regulations.

The ADEQ will be contacted before pond excavation during construction of the proposed project to determine whether specific closure or material handling and disposal requirements apply.

3.10.3.3 Gold Strike Canyon Alternative

Roadway runoff from the Nevada Spoil Pile should be controlled through barriers or diverted to prevent future runoff from spreading potential surface soil contamination downgradient of the waste site.

3.10.3.4 No Build Alternative

Should the No Build Alternative be selected, no mitigation is warranted because there would be no effect.

3.11 Construction Activities and Impacts

This section presents activities and associated impacts that would occur during construction of the build alternatives.

3.11.1 Construction Activities

Project construction activities would include the following:

- Earthwork (including clearing, grading, grubbing, embankment construction, batch plant accommodation, fill, and erosion control activities)
- Removal or relocation of existing facilities
- Roadway approach construction (both Nevada and Arizona)
- Structure construction (bridges, tunnels, ramps, and walls)
- Roadway surfacing and barriers
- Existing traffic maintenance during construction
- Dust abatement
- Wildlife fencing, security fencing, and gates

- Cross-drainage culverts
- Signing and lighting
- Pavement marking and paint striping
- Landscaping and seeding
- Abandoned roadway obliteration

3.11.2 Construction Impacts

Construction impacts are short-term and temporary, and cease when a project is operational. Project construction impacts include effects on local air quality and ambient noise levels; increased erosion; potential fuels or chemical spills; potential transportation and circulation impacts; effects on vegetation, wildlife habitat, recreation, and cultural resources; disturbance of special-status species; and effects on the area's visual resources. These impacts are discussed in more detail in this chapter.

Four separate construction contracts are expected for the proposed project: the Nevada approach, the Arizona approach, the bridge, and completion activities. Table 3-22 shows estimated construction times for the Promontory Point, Sugarloaf Mountain, and Gold Strike Canyon Alternatives. It is anticipated that Nevada and Arizona highway approach construction would occur concurrently.

Bridge construction would not begin until significant portions of the approach highways are completed. Paving would not begin until the bridge and both highway approaches are completed.

Completion activities include paving the roadway and bridge, installing barriers and signs, and finishing the tie-ins to the existing highway. Table 3-22 shows that these activities are anticipated to require about 4 months, regardless of the alternative selected.

Table 3-22
Estimated Construction Period for Build Alternatives

Contract	Promontory Point	Sugarloaf Mountain	Gold Strike Canyon
Nevada Approach	28 months	34 months	42 months
Arizona Approach	15 months	23 months	30 months
Bridge	38 months	36 months	33 months
Completion Activities	4 months	4 months	4 months
Total Construction Time	4 years, 9 months	4 years, 7 months	5 years, 3 months

Source: Reclamation. *Colorado River Bridge—Hoover Dam, Arizona-Nevada. Phase B—Corridor Studies.* August 1992.

3.11.2.1 Promontory Point Alternative

This alternative would be located just south of existing U.S. 93 until it reaches the Reclamation warehouse. Depending on the final design details, the new bypass roadway will probably cross U.S. 93 at one location on a grade-separated structure and traverse the Reclamation property east of the warehouse. Existing U.S. 93 would continue to provide access to Hoover Dam, Lakeview Point, and the Reclamation warehouse (see Figure 2-4).

Project construction would not affect traffic operations on the existing highway, except at the beginning of the alternative where the two roads cross near the warehouse.

On the Nevada approach, it appears that a balance between cut and fill quantities can be attained, and a waste disposal area would not be required. On the Arizona approach, one waste disposal area would be required.

An electric transmission tower on the Nevada approach would need to be relocated. Relocation of any one transmission tower may require additional work on adjoining towers of that particular line. An abandoned WAPA switchyard would need to be removed.

No major detours, closures, or traffic delays are expected during construction of the highway approaches. The existing highway could remain open with little interference except during the tie-in activity at the beginning and end of the project. Completion of the access road in Arizona is required before the existing highway could be closed to the public. Hauling across the existing Arizona highway would be necessary. Some delays could occur during blasting operations associated with excavation above the existing highway.

3.11.2.2 Sugarloaf Mountain Alternative (Preferred Alternative)

The preferred Sugarloaf Mountain Alternative follows the same corridor as the Promontory Point Alternative except at the Reclamation warehouse area, where the alternative turns to the southeast. Depending on the final design details, the new bypass roadway will probably cross U.S. 93 at two locations on grade-separated structures and traverse the Reclamation property east of the warehouse. Existing U.S. 93 would continue to provide access to Hoover Dam, Lakeview Point, and the Reclamation warehouse (see Figure 2-4).

On the Nevada approach, it appears that a balance between cut and fill quantities can be attained, and a waste disposal area will not be required. Hauling material for embankments would be required. On the Arizona approach, all material excavated from Sugarloaf Mountain would be expected to be used to build roadway embankments and no disposal would be required.

The sewage evaporation ponds on the Arizona side would be removed, and new ponds would be constructed downhill to the east of the existing ponds. The highway may affect the Reclamation warehouse storage yards.

No major detours, closures, or traffic delays are expected to occur during highway approach construction. The existing highway would remain open with little interference except during the tie-in activity at the beginning and end of the project. Hauling across the existing highway in two locations would be necessary. Construction of the Nevada access road would accommodate existing highway traffic during construction.

Transmission Towers and Lines. Construction of the preferred alternative would require removal and modification of existing electrical transmission components and construction of new electrical transmission components. The final configuration of electrical towers, transmission lines, and facilities would be determined during final design. FHWA would work with WAPA during final design to select the most beneficial solution considering all project elements and factors (e.g., operation and maintenance characteristics for both electrical transmission and transportation, historic and visual impacts, and construction considerations and costs). Any necessary modifications to the existing system would be performed under the direct oversight of WAPA.

Seven preliminary Colorado River crossing electrical transmission reconfiguration options have been developed by WAPA in coordination with FHWA (see Figures 3-14A through 3-14G).

All options require removal of existing spans (up to 10) and towers (up to 4) and construction of new spans (up to 7). Most options would require construction of new towers (up to 4) and modification of existing towers (up to 2) and spans (1). All options require removal of one or two existing Colorado River spans before bridge construction. One option requires construction of a new Colorado River span. Three of the options would require removal of the existing Arizona-Nevada Switchyard and replacing a single-phase circuit with a double-phase circuit to the Mead Substation.

Regardless of the final electrical transmission configuration chosen at the Colorado River crossing, the preferred alternative would require removal and construction of one tower, modification of two existing towers, and removal and construction of two spans in the vicinity of the bridge/tunnel on the Nevada side (see Figure 2-8).

Meetings with WAPA engineers confirmed that minimal additional right-of-way would be needed to implement any of the options. Therefore, indirect impacts outside of the project limits covered in this EIS would be minimal or nonexistent. FHWA would work with the two SHPOs to mitigate any adverse effects related to removal of historic transmission towers and facilities.

Construction Staging Areas. The preferred alternative is located generally south of the existing road corridor so that construction can be accomplished without interfering with traffic. Because the majority of the construction work would be done with no traffic to maintain, most of the necessary contractor staging could be done within the proposed right-of-way. For additional contractor staging, Reclamation has identified five areas that are available (Figure 3-15). These areas have been previously disturbed and are presently used for maintenance and contractor staging. No new staging areas would be required to construct the preferred alternative.

Material Sources. The design of the preferred alternative would be advanced during final engineering so that the earthwork quantities (cuts and fills) would be balanced. Borrow material would not be required. A waste area for excess rock would not be required.

FHWA would not identify material sources for the production of aggregates. It is anticipated that the native rock within the right-of-way may be adequate to produce some or all of the aggregate needed for the project. Other aggregates may come from readily available commercial sources in the Boulder City and Las Vegas vicinity.

3.11.2.3 Gold Strike Canyon Alternative

This alternative would begin about 1,000 feet east of the Hacienda Hotel. The alternative would turn to follow Gold Strike Canyon toward the Colorado River.

Three waste disposal areas would be required on the Nevada approach to accommodate excess waste material. One waste disposal area on the Arizona approach would be required.

No significant relocation of existing features has been identified for this alternative. The alternative would cross under several existing transmission lines; no existing transmission towers would be affected. Two existing wood pole electric lines (one in Nevada and one in Arizona) cross the alternative, and some minor pole relocation may be necessary.

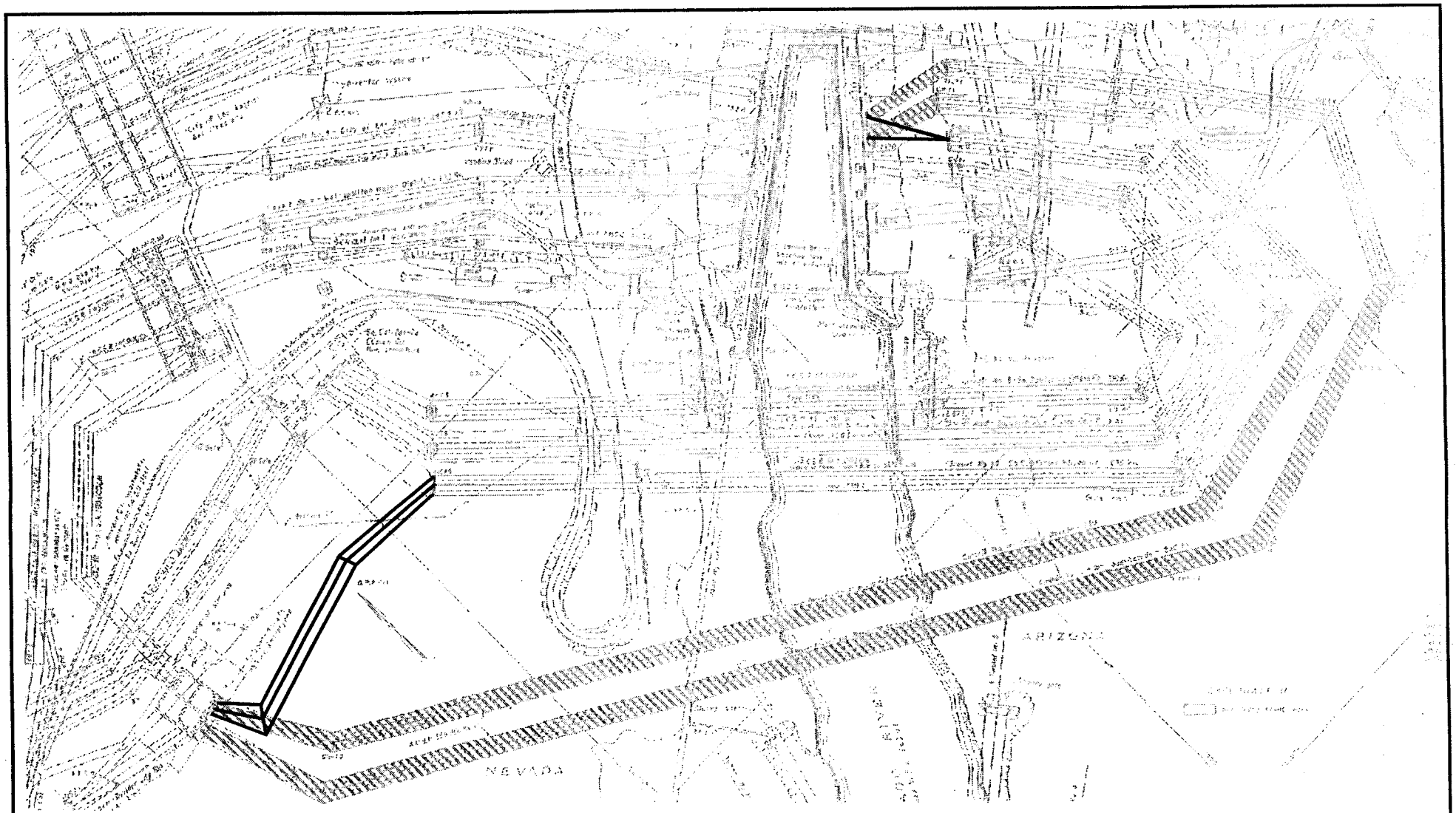

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FIGURE 3-14A
TRANSMISSION LINE REMOVAL AND RELOCATION OPTION #1
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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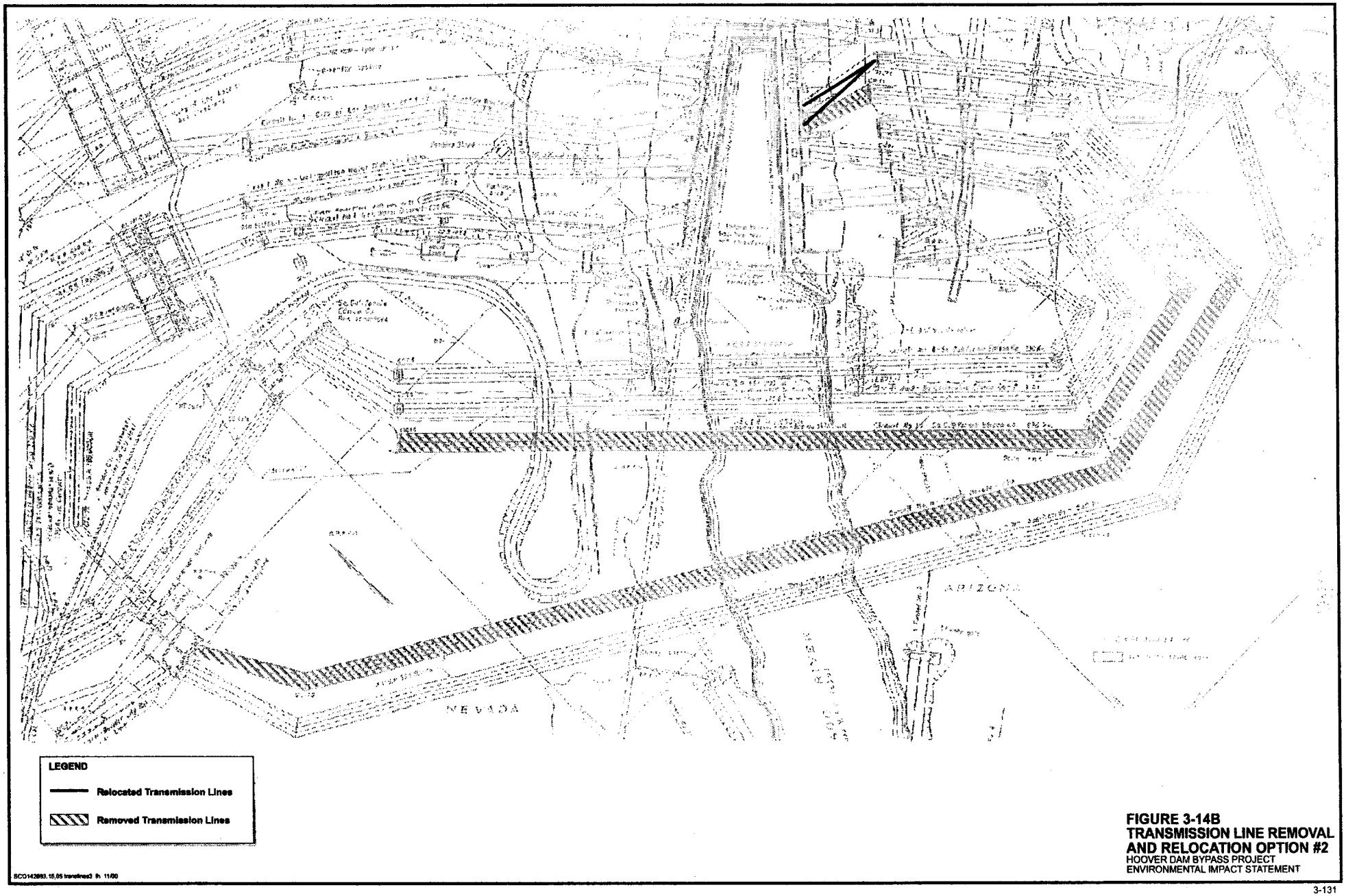

FIGURE 3-14B
TRANSMISSION LINE REMOVAL AND RELOCATION OPTION #2
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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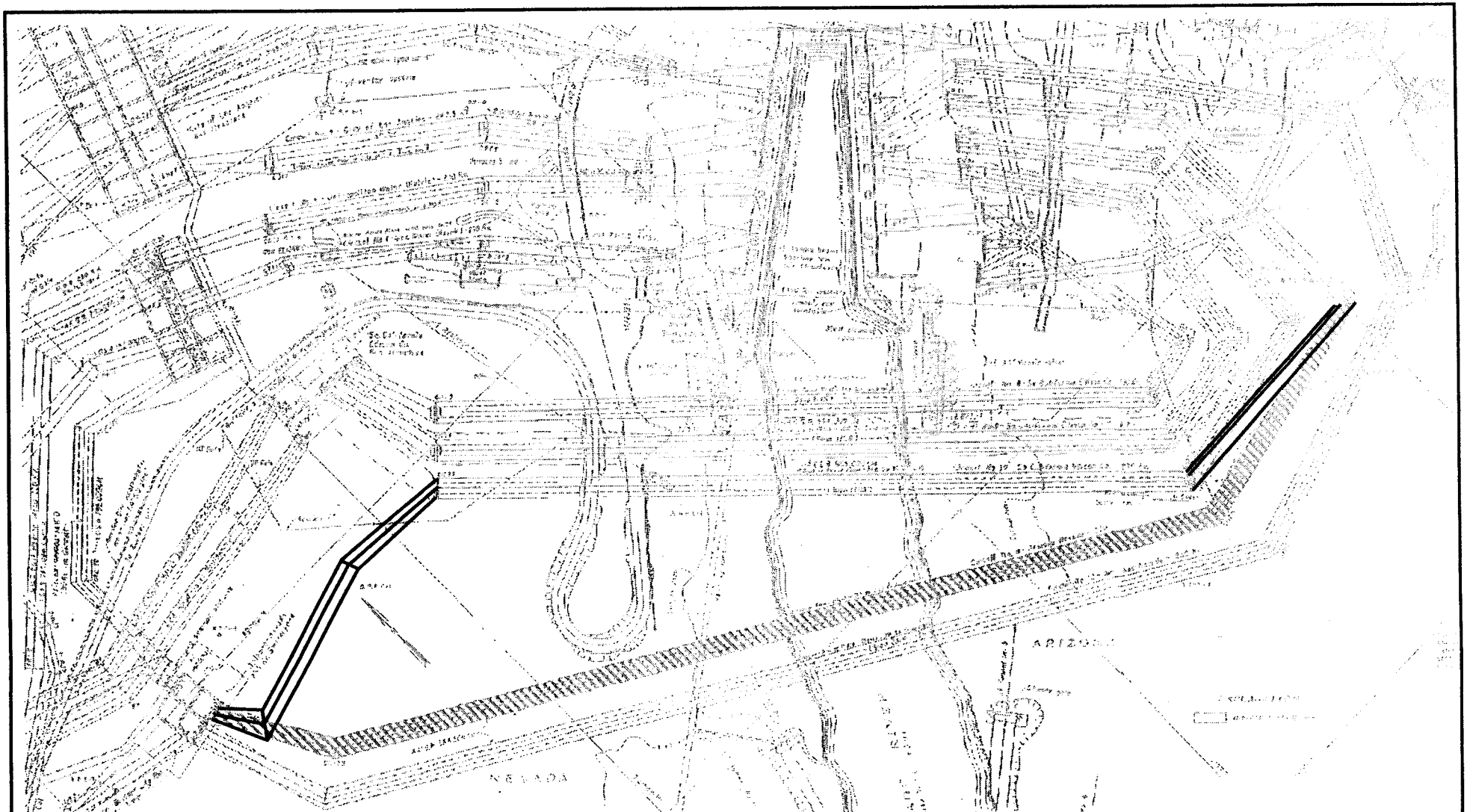

FIGURE 3-14C
TRANSMISSION LINE REMOVAL AND RELOCATION OPTION #3
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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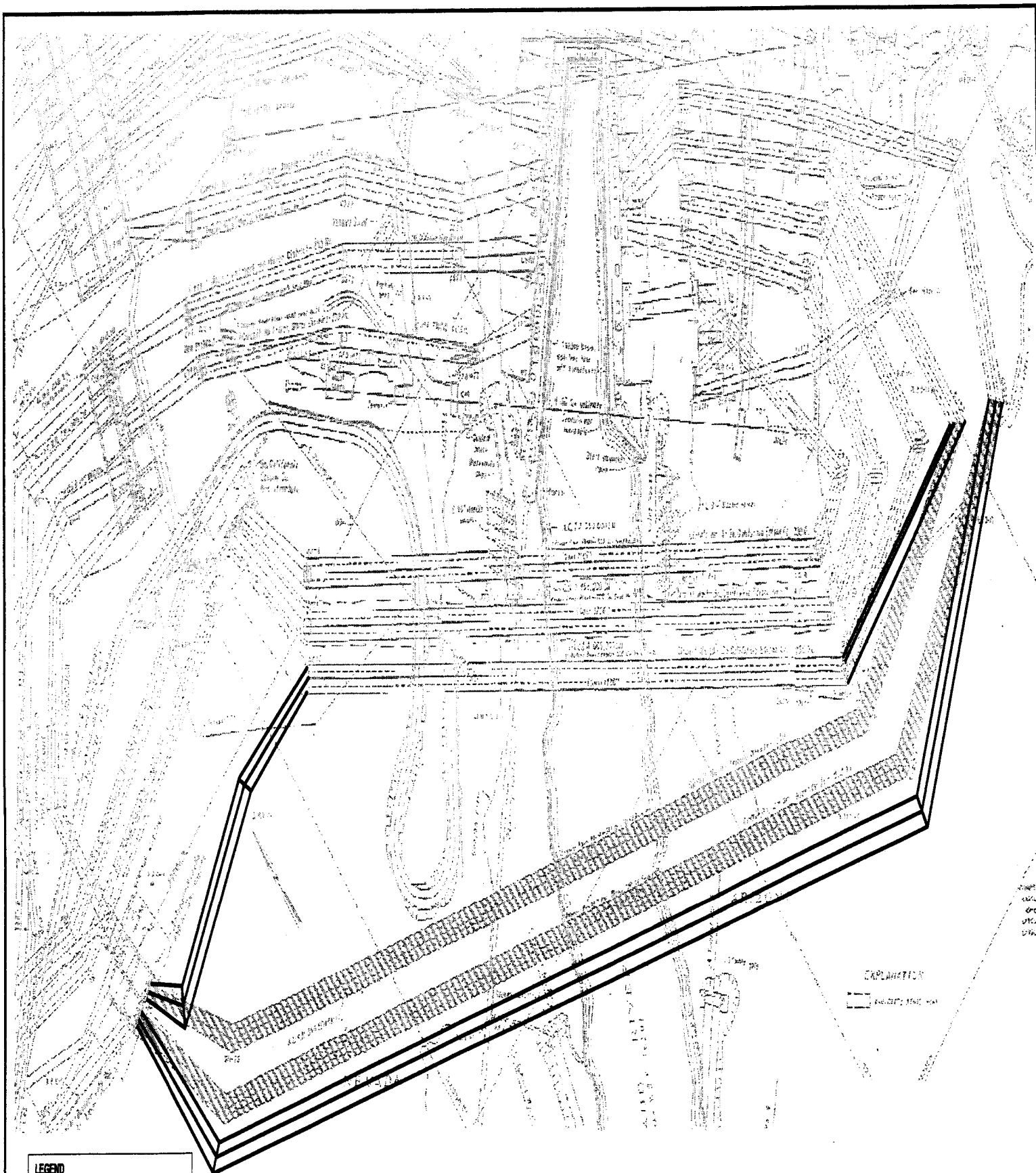

FIGURE 3-14D
TRANSMISSION LINE REMOVAL AND RELOCATION OPTION #4
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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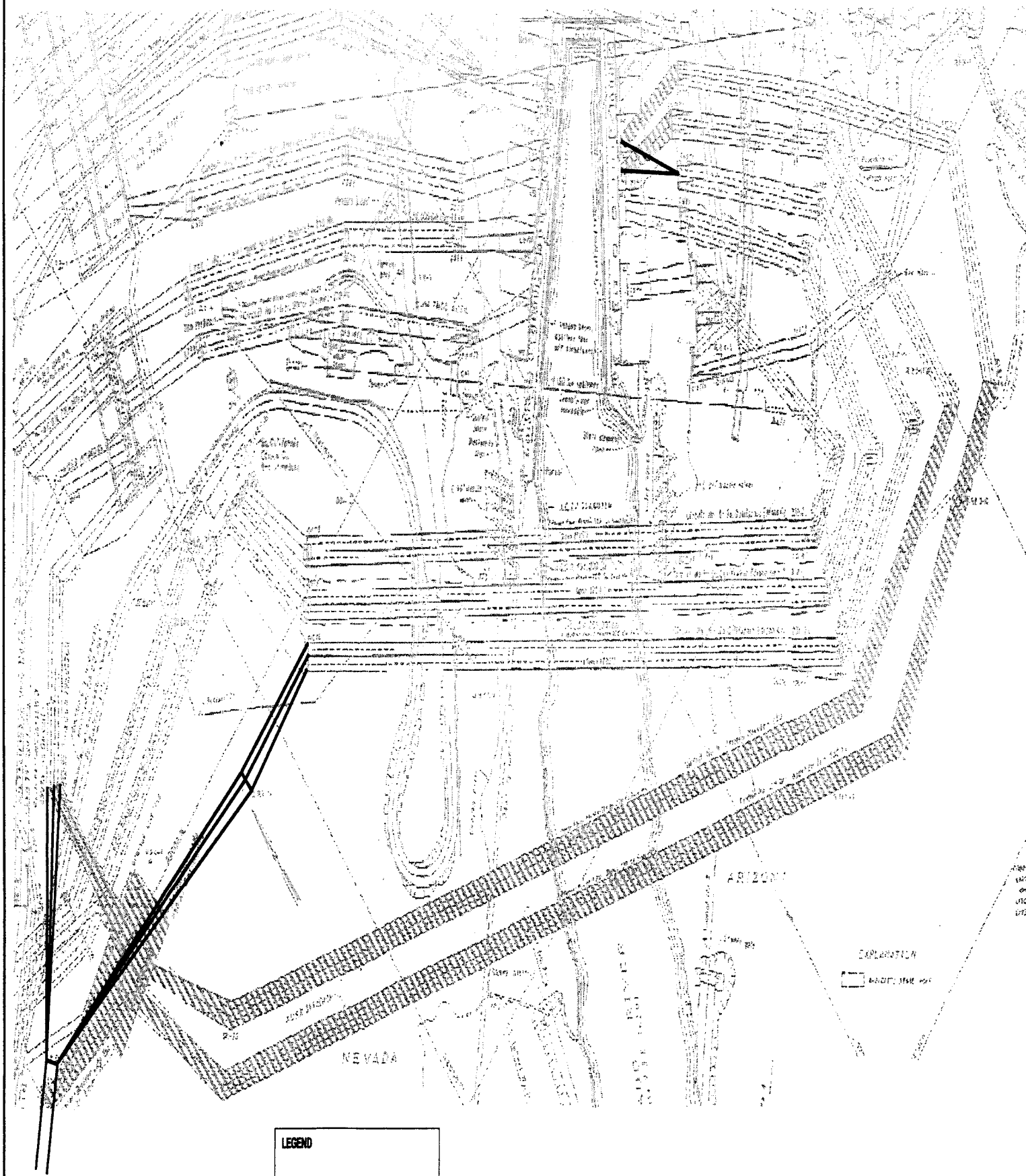

FIGURE 3-14E
TRANSMISSION LINE REMOVAL AND RELOCATION OPTION #5
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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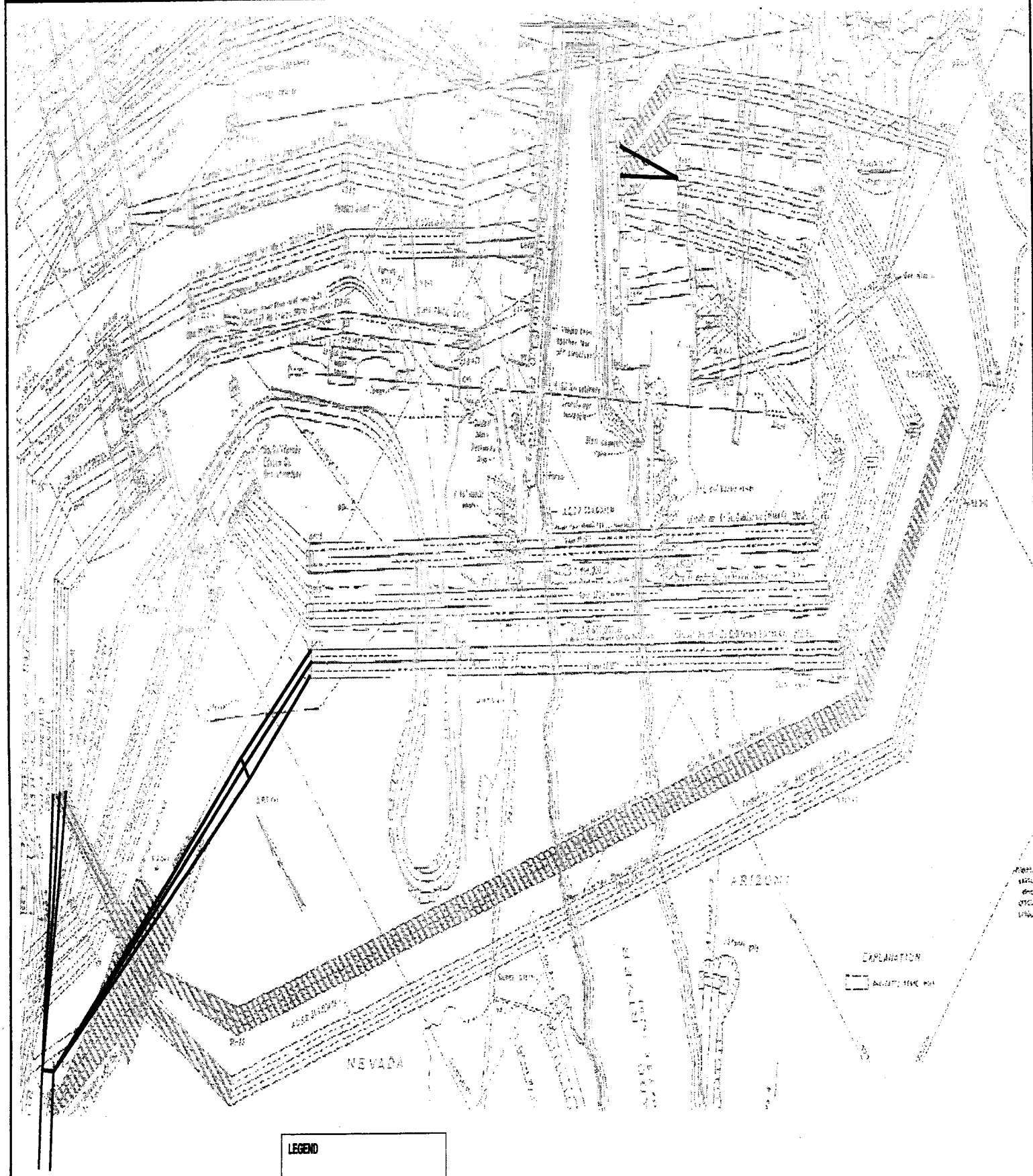

FIGURE 3-14F
TRANSMISSION LINE REMOVAL AND RELOCATION OPTION #5A
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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FIGURE 3-14G
TRANSMISSION LINE REMOVAL AND RELOCATION OPTION #6
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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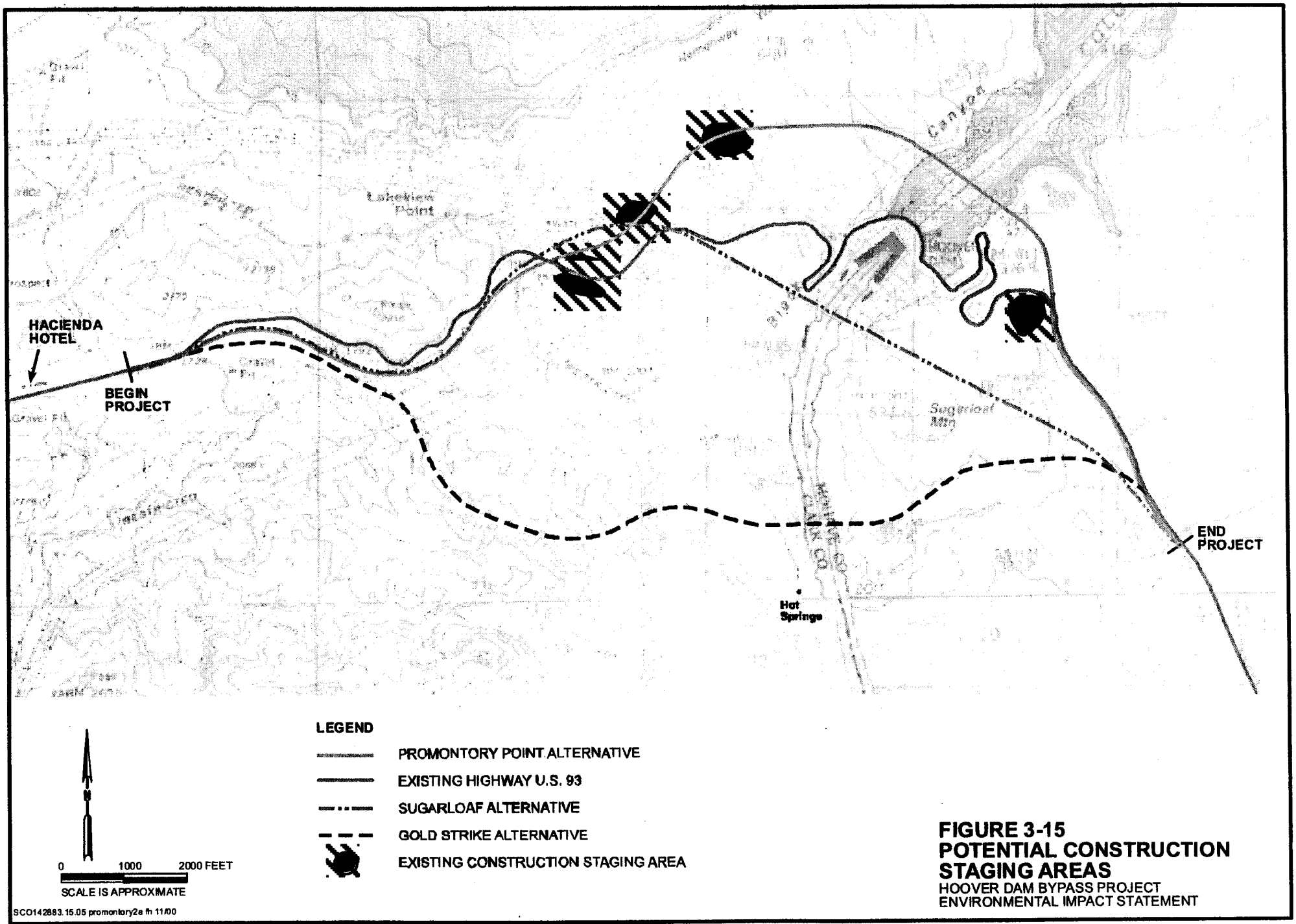

FIGURE 3-15
POTENTIAL CONSTRUCTION STAGING AREAS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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No major detours, closures, or traffic delays are expected during construction of the highway approaches. The existing highway could remain open with little interference except during the tie-in activity at the beginning and end of the project. Some improvements to the existing Reclamation access road, including enlarging the old haul road tunnel, would be required. All other Nevada construction access would be along the alternative from the beginning of U.S. 93. The Gold Strike Canyon hiking trail would be closed during construction, as the canyon bottom would be graded and used as an access road. On the Arizona approach, construction access would be primarily along the alternative from U.S. 93 back toward the river.

3.12 Energy

3.12.1 Construction Energy Usage

This section discusses the energy used to construct and operate the proposed project. Construction and operation of the three build alternatives would require similar fuel commitments. The No Build Alternative would not require fuel for construction.

The energy consumed to construct the proposed project can be estimated by making assumptions about the following variables:

- Construction cost of the alternative
- Construction duration of the alternative
- Number of construction workers traveling to and from the construction site
- Number of trucks and pieces of equipment used
- Efficiency of trucks and equipment (e.g., mpg)
- Length of time trucks and equipment would be used

For this analysis, the energy consumed would be the fuel used for project trucks, construction equipment, and workers' personal vehicles. Based on construction cost and duration, the estimated number is 70 full-time-equivalent workers throughout the construction duration of each of the build alternatives.

For the Promontory Point Alternative, fuel usage over the 4-year, 9-month construction period is estimated at 500,000 to 800,000 gallons, or 400 to 640 gallons per day.

For the Sugarloaf Mountain Alternative, fuel usage over the 4-year, 7-month construction period is estimated at 520,000 to 835,000 gallons, or 430 to 690 gallons per day.

For the Gold Strike Canyon Alternative, fuel usage over the 5-year, 3-month construction period is estimated at 560,000 to 900,000 gallons, or 400 to 650 gallons per day.

3.12.2 Operation Energy Usage

Primary energy usage during operation of the proposed highway and bridge would be fuel for vehicles traveling over the roadway and structure. Because roadway and bridge inspection and maintenance would require regular, but infrequent, trips to the area, energy usage for this phase would be lower than for the construction phase, and is not considered significant.

Post-construction operational energy requirements are expected to be less per vehicle for the three build alternatives than for the No Build Alternative because the existing traffic congestion on U.S. 93 near Hoover Dam and atop the dam is expected to worsen as traffic

volumes increase. This condition would result in increasingly lower fuel efficiency of vehicles traveling across Hoover Dam.

3.13 Local Short-Term Uses Versus Long-Term Productivity

This section discusses the proposed project's short-term impacts on resource use, and maintenance and enhancement of long-term productivity. Construction and operation of any of the three build alternatives would result in similar short- and long-term impacts and benefits. The following sections discuss these impacts and benefits.

3.13.1 Short-Term Uses of Man's Environment

Short-term project costs include the commitment of substantial financial and material resources. Short-term uses of man's environment include project impacts considered significant and temporary, including construction effects on local air quality; ambient noise levels; increased erosion; potential fuel or chemical spills; potential transportation and circulation impacts; effects on vegetation, wildlife habitat, recreation, and cultural resources; disturbance of special-status species; and effects on the area's visual resources. These impacts are mitigated to less than significant levels with the preferred alternative.

Project construction impacts are discussed in more detail earlier in this chapter. A benefit during the construction phase would be the creation of construction-related employment.

3.13.2 Long-Term Effects of the Proposed Project

Dedication for the proposed project would preclude opportunities for alternate land uses. Long-term effects of the proposed project include changes in landforms, visual quality, recreational opportunities, and localized hydrology; an increase in localized ambient noise levels; reduction of open space; and a loss of vegetation and wildlife habitat.

Long-term benefits would include increased public safety at Hoover Dam resulting from traffic reduction and commercial truck elimination, and improved travel speeds on U.S. 93 resulting in time savings for personal vehicles and commercial trucking. An additional benefit is U.S. 93 would become part of the international trade route proposed by NAFTA.

U.S. 93 on the Arizona and Nevada approaches to Hoover Dam currently operates at LOS E. The LOS at the dam is currently F. If the No Build Alternative is implemented, both approaches and Hoover Dam will be at LOS F by year 2017. Constructing and operating the proposed project would result in LOS E at Hoover Dam, LOS B at the Nevada approach in year 2017 and C for year 2027, and LOS A at the Arizona approach in year 2017 and B for year 2027.

3.13.3 Conclusion

The proposed transportation improvements would meet long-term needs identified in the Nevada and Arizona state transportation plans. These plans consider present and future traffic requirements based on existing and future intended land use patterns. The local short-term project construction impacts, after mitigation is implemented, are acceptable in view of the maintenance and enhancement of long-term productivity that would be provided for the local area; for Nevada, Arizona, and Utah; and for international trade pursuant to NAFTA. In addition, long-term benefits provided by the proposed bridge and roadway alternative are anticipated to outweigh the long-term impacts of operating the facility.

3.14 Irreversible and Irretrievable Commitment of Resources

This section discusses the proposed project's irreversible and irretrievable commitment of resources. Implementation of any of the build alternatives would require a commitment of natural, physical, human, and fiscal resources. Construction and operation of any of the three build alternatives would require a similar commitment of these resources. This discussion focuses on the following issues:

- The project's use of nonrenewable resources during the construction and operation. Included in this discussion are fossil fuels, highway construction materials, electricity, water, and labor.
- The changes expected to occur as a result of the proposed project. These changes include the commitment of land for the proposed project, physical changes in the environment, effects on human populations, and fiscal changes.

3.14.1 Use of Nonrenewable Resources

As discussed in Section 3.12, construction of the proposed project would require the use of fossil fuels for construction vehicles and equipment and construction worker vehicles. Relatively minor amounts of electricity may also be used at construction trailers or by portable generators during project construction. In addition, operation of the proposed project would require the use of fossil fuels by vehicles traveling along the constructed alternative.

Both labor and highway construction materials, such as concrete, sand, aggregate, and steel, would be expended during construction. Labor and natural resources would also be used in the fabrication of construction materials. These materials generally are not retrievable. The use of these materials and labor during project construction would not have an adverse effect on the continued availability of these resources. Operation of the proposed project would result in greater fuel efficiency of vehicles traveling on the newly constructed alternative when compared to those vehicles traveling at slower speeds on the existing highway across Hoover Dam.

3.14.2 Expected Changes as a Result of the Proposed Project

Nevada and Arizona have committed land for use as a transportation corridor along U.S. 93. The new Nevada and Arizona approaches would require the commitment of additional land to construct and implement the proposed project. This additional commitment of land would result in the loss of public parkland and recreation areas, vegetation and wildlife habitat and foraging areas, and it would affect special-status species and wildlife dispersion opportunities.

Land used for the proposed project is considered an irreversible commitment during the period land is used for the highway facility. If, in the future, a greater need arises for use of the land, or if the highway facility is no longer needed, the land could be converted to another use. However, it is not likely that once the proposed project is constructed such a conversion would ever be necessary or desirable.

As discussed in Section 3.7, Visual Resources, alteration of the landscape where the proposed project is constructed would be considered an irreversible environmental change. Although the proposed bridge and new highway could be removed and the land converted

to another use in the future, it is neither likely that such conversion would occur, nor is it likely that the landscape would return to its pre-project condition.

Construction of the proposed project would generate jobs for the approximately 4- to 5-year construction period. During construction, labor would be needed to build the proposed bridge and roadway and to fabricate construction materials. Long-term maintenance of the proposed project would also generate jobs.

Construction of the proposed project would require a substantial one-time expenditure of federal and possibly state funds, which are not considered retrievable. Long-term facility maintenance costs are also not retrievable. A slight decrease in the amount of expenditures at the two concession stands on the dam may result from fewer vehicles traveling across the dam after the new roadway and bridge are constructed. No change in expenditures in Phoenix or Kingman, Arizona, or Las Vegas, Boulder City, or Henderson, Nevada, are expected from implementation of the proposed project. No change in highway taxes are expected from the proposed project.

3.14.3 Conclusion

Tourists, residents, and the commercial trucking industry of Clark County, Mohave County, and throughout Nevada, Arizona, and Utah would benefit by the proposed improvements to the transportation system. These benefits consist of increased public safety at Hoover Dam by reducing the amount of traffic on the dam and eliminating commercial trucks from it; and improved travel speeds on U.S. 93, resulting in a time savings and reduction in transit costs for commercial trucks and a time savings for personal vehicles traveling between Phoenix and Las Vegas. In addition, roadway improvements would allow the U.S. 93 corridor to be part of the international trade route proposed by NAFTA. These benefits are anticipated to outweigh the commitment of the above-listed natural and fiscal resources.

CHAPTER 4

Unavoidable Adverse Impacts

4.1 Introduction

Some impacts to specific resources were evaluated for each build alternative and the No Build Alternative, while others were evaluated regionally. Where data were available for each alternative and effects differed, individual alternative analyses were performed.

Constructing and operating any build alternative would irreversibly and irretrievably commit environmental resources to the project. An irreversible commitment is the permanent loss of the resource.

4.2 Air

After implementing construction mitigation measures, no further adverse impacts were identified. As a result of implementing one of the build alternatives, a beneficial impact would occur because air quality is expected to improve in the proposed project area during operations. Because of increased traffic, air quality in the Hoover Dam vicinity would worsen if the No Build Alternative were selected (see Section 3.1).

4.3 Noise

Even with mitigation measures, the Gold Strike Canyon Alternative would still exceed standards at the upper end of the canyon on the hiking trail. Noise is higher for the No Build Alternative than for any of the build alternatives at the dam crossing (see Section 3.2).

4.4 Biological Resources

Implementing any build alternative could result in the loss of 122 to 143 acres of wildlife habitat (see Table 3-13), including associated vegetation and either the displacement of, or direct loss of, associated wildlife. Partial recovery of some of these losses may be attained through the mitigation measures described in Chapter 3, Measures to Minimize Harm. Implementation of the build alternatives will result in 0.66 to 2.77 acres of temporary fill and 0.11 to 0.67 acres of permanent fill in waters of the United States (see Table 3-16, Section 3.3).

4.5 Water Resources

For the build alternatives, constructing the roadway will increase both short-term and long-term sediment yield over existing conditions. Removing existing vegetative and rock cover will disturb existing conditions, increasing the short-term sediment yield and impacting local and, to a lesser extent, regional water quality. Using BMPs and other measures discussed in Chapter 3 will reduce this impact.

For the three build alternatives, no adverse unavoidable long-term impacts would occur following implementation of BMPs and design/construction of hazardous material spill containment elements (see Section 3.4).

4.6 Cultural Resources

4.6.1 Promontory Point Impacts

Adverse effects on the Hoover Dam National Historic Landmark (NHL) would occur from visual elements of the project that would diminish the integrity of the historic features and setting. Furthermore, FHWA and the NPS determined that construction of the new bridge would adversely affect visitors' historic views of the dam from U.S. 93 in both Nevada and Arizona, and this could not be mitigated. Based on the preliminary design, the Promontory Point Alternative also would have an adverse effect on the following additional historic properties eligible for the National Register for their association with the construction and operation of Hoover Dam or as contributing elements to the NHL: NV:DD:14:30, 26-CK-4751, 26-CK-4752, 26-CK-4753, 26-CK-4754, 26-CK-4765, and 26-CK-5180 (see Section 3.5).

Unavoidable adverse impacts would occur to prehistoric archaeological site NV:DD:14:23 and probably to site NV:DD:14:25. These impacts would occur during construction for the former and operations for the latter. These sites were found to be ineligible for the National Register.

The Promontory Point Alternative also would have an adverse effect on the Gold Strike Canyon and Sugarloaf Mountain TCP.

4.6.2 Sugarloaf Mountain Impacts (Preferred Alternative)

Adverse effects on the NHL would occur from visual elements of the project that would diminish the integrity of the historic features and setting. However, FHWA and the Nevada and Arizona SHPOs determined these effects can be mitigated. Based on the preliminary design, the Sugarloaf Mountain Alternative also would have an adverse effect on the following additional historic properties eligible for the National Register for their association with the construction and operation of Hoover Dam or as contributing elements to the NHL: NV:DD:14:1, NV:DD:14:29, NV:DD:14:30, 26-CK-4751, 26-CK-5180, 26-CK-5789, 26-CK-5790, and 26-CK-5792. Of these, sites NV:DD:14:1 and 26-CK-5790 would not be physically damaged but only indirectly affected by a change in the setting.

Unavoidable adverse impacts would occur to prehistoric archaeological sites NV:DD:14:21 and NV:DD:14:22 from construction of this alternative. These sites were found to be ineligible for the National Register; however, 14:21 is a contributing element of the TCP.

The Sugarloaf Mountain Alternative would also have an adverse effect on the Gold Strike Canyon and Sugarloaf Mountain TCP; however, the alignment traverses the TCP in an area of extensive disturbance. The Nevada and Arizona SHPOs, the Advisory Council on Historic Preservation, and participating Native American tribes have signed a Programmatic Agreement including measures and processes for minimizing harm to the TCP from the preferred alternative.

4.6.3 Gold Strike Canyon Impacts

Based on the preliminary design, the Gold Strike Canyon Alternative would have an adverse effect on the following historic properties eligible for the National Register for their association with the construction and operation of Hoover Dam or as contributing elements to the NHL: NV:DD:14:15, NV:DD:14:16, NV:DD:14:30, 26-CK-4743, and 26-CK-4750.

Since no archaeological sites were identified along this alternative, no unavoidable adverse impacts are expected.

The Gold Strike Canyon Alternative also would have an adverse effect on the Gold Strike Canyon and Sugarloaf Mountain TCP. Based on the severity of this impact, it may be unmitigable.

4.7 Land Use

No unavoidable adverse impacts are identified for any of the three build alternatives. If the No Build Alternative is selected, changes in land use would not occur (see Section 3.6).

4.8 Visual Resources

The proposed bridge (regardless of the alternative implemented) would alter the view, both during construction and operation, from Hoover Dam, Lake Mead, the river put-ins, or the hiking trail and hot springs. For the Promontory Point Alternative, the impact on visual resources is considered unmitigable. Some viewers may consider the bridge to add variety to the view.

FHWA and the NPS determined that construction of a bridge at the Promontory Point crossing would adversely affect visitors' "first impression" historic views of the dam. These views occur as motorists approach the dam on existing U.S. 93 from both Nevada and Arizona. The dominance of the Promontory Point bridge would significantly detract from the historic views of the dam and could not be mitigated. In contrast, the Sugarloaf Mountain bridge would not detract from the historic views as visitors approach the dam from the Arizona and Nevada approaches because it is not visible due to the existing roadway alignment, which presents a direct view of the dam and Lake Mead (see Section 3.7).

4.9 Recreation

Regardless of the alternative selected, construction activities would affect recreation activities that occur in designated construction safety zones or construction areas. In addition, the hiking trail in Gold Strike Canyon would be closed to public access during construction of the Gold Strike Canyon Alternative. This effect is considered an unavoidable adverse impact but is necessary to protect the public's safety.

The proposed bridge (if either the Promontory Point or Sugarloaf Mountain Alternative is implemented) would alter the view, either from Hoover Dam, Lake Mead, or the river put-ins. Implementation of the Gold Strike Canyon Alternative would alter the view from the hiking trail and the hot springs. This impact is considered unavoidable but is not necessarily adverse. Some recreationists are expected to consider the bridge as adding variety to the views.

Unavoidable adverse noise impacts to recreation on the hiking trail are anticipated if the Gold Strike Canyon Alternative is implemented (see Section 3.8).

4.10 Socioeconomics

No unavoidable adverse impacts on population, employment, income, social conditions, minority or low-income populations are expected from any of the build alternatives or from the No Build Alternative.

Implementation of any of the build alternatives would have a beneficial impact on transportation and circulation that would not occur if the No Build Alternative were selected (see Section 3.9).

4.11 Hazardous Materials

No unavoidable adverse impacts would occur from implementing any of the build alternatives or from the No Build Alternative (see Section 3.10).

CHAPTER 5

Cumulative Impacts

Note: The following chapter has been substantially revised based on comments received on the DEIS from EPA (see Volume II).

5.1 Introduction

This section addresses potential cumulative impacts to the environment that could be associated with the implementation of the proposed U.S. 93 Hoover Dam Bypass Project in concert with one or more other past, present, or reasonably foreseeable future actions or projects. Specifically, this section is prepared in accordance with the requirements of NEPA and guidance from the Council on Environmental Quality (CEQ), Considering Cumulative Effects Under the National Environmental Policy Act. The CEQ regulations define a "cumulative impact" for purposes of NEPA as follows:

> Cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR §1508.7).

This cumulative impacts section gives emphasis to the actions or projects that are likely to cause the most significant cumulative impacts (i.e., projects that would occur relatively close to the project site). For other transportation projects in the region, this cumulative impacts section focuses primarily on the potential impacts of reasonably foreseeable future actions. The impacts of past and present actions are also discussed, but in less detail and in a more qualitative manner.

5.2 Cumulative Impacts Analysis

5.2.1 Other Actions/Projects Included in the Cumulative Impacts Analysis

The following criteria were considered in identifying those past, present, or reasonably foreseeable projects that could result in cumulative impacts:

- Projects that have an application for construction and/or operation pending before an agency with permit authority
- Projects that are listed on the Arizona Transportation Improvement Program (STIP) or the Nevada STIP
- Projects that have the potential to generate environmental impacts that, when addressed collectively with the proposed project, could result in cumulative impacts to the environment
- Projects that are of a similar character, could affect similar environmental resources, or are located in geographic proximity to the proposed project

5.2.2 Scope of the Cumulative Impacts Analysis

The geographic area addressed in this analysis varies according to the nature and characteristics of each environmental resource. Two geographic areas are defined to categorize this analysis. A description of each follows:

1. The first area is the vicinity of the proposed project and includes the area within the NHL boundary, portions of the HDR boundary, and portions of the LMNRA (see Figure 2-3).

2. A second area encompasses a substantial portion of the surrounding desert region, a geographic area generally corresponding to the Las Vegas and Henderson urban area in Clark County, Nevada, and Mohave County, Arizona. This geographic area is used to include a broader range of other projects and environmental resources well beyond the immediate vicinity of the proposed project.

5.2.3 Timing and Duration of Other Actions/Projects

For each of the projects addressed in this analysis, the time period in which it would be implemented, including construction and operational phasing, is defined. Information on the timing and duration for the other projects was obtained from applicant proposals, when available. When this information was not available and could not otherwise be obtained through reasonable efforts (e.g., direct contact with applicants), professional judgement was used to estimate a reasonable time frame to complete the regulatory review and permit issuance processes needed for implementation of the other projects.

5.2.4 Future Time Horizon of the Proposed Project

A horizon has been selected to discuss potential cumulative impacts of the Hoover Dam Bypass and other past, present, and reasonably foreseeable projects. The time horizon for the Sugarloaf Mountain Alternative, the preferred alternative, is 7 years, the approximate time to complete design and construction.

5.2.5 Cumulative Projects Data and Information

Each of the projects addressed in this cumulative effects analysis is supported by different levels of information, depending upon the current status of the particular project. For future projects, this information ranges from a simple project description, identifying its goals and objectives, to a comprehensive environmental review performed in accordance with NEPA or other state or local environmental regulations. For past projects, relevant agencies or departments were interviewed about documents that might discuss the history of the project, including past project impacts.

This analysis uses the level of information available at the time this EIS document was prepared to describe these other projects and their respective potential impacts on the environment. If sufficient data or information on specific aspects of the proposed project were not available to complete an analysis comparable to the evaluation of other projects, and reasonable efforts to obtain that information were unsuccessful (as in the case of the U.S. 95 widening in Nevada), professional judgement was used to estimate the potential impacts.

5.2.6 Reasonable Forecast Analysis

In accordance with the CEQ guidance, this analysis assesses future cumulative effects for projects that can be reasonably forecast. This includes those projects that are currently funded or for which other NEPA analysis is being prepared, and those that are being considered but have not reached a funding or environmental document stage.

5.3 Methods Used for Identifying Other Past, Present, and Reasonably Foreseeable Actions/Projects

Several methods were used to identify other past, present, and reasonably foreseeable projects that could, in concert with the proposed Hoover Dam Bypass, contribute to cumulative impacts on the environment. For projects occurring on lands administered by federal agencies, the agency with primary land management authority identified projects that could potentially contribute to cumulative environmental effects. These agencies include the following:

- ADEQ
- ADOT
- AGFD
- FHWA
- Los Angeles Department of Water and Power
- NPS
- Nevada Department of Conservation and Natural Resources
- NDOT
- WAPA
- Reclamation
- USFWS

Surveying other land management authorities within the southeast Nevada/western Arizona region identified other projects. These surveys consisted of informal inquiries designed to acquire existing available environmental documentation and project descriptions. Concerning other projects located on private properties in the vicinity of the proposed bypass, the Clark and Mohave County Planning Departments determined that there are no applications or proposals for specific plans.

5.4 List of Past, Present, and Reasonably Foreseeable Actions/Projects and Respective Environmental Impacts

The actions or projects that could result in changes to the local environment (and result in cumulative impacts when combined with the proposed project) would include any actions proposed by NPS and Reclamation, and highway projects proposed by NDOT, ADOT, or local jurisdictions such as Clark and Mohave counties.

NPS and Reclamation administer the land in the immediate vicinity of Hoover Dam. No new actions or projects are proposed within the project area by these two agencies; therefore, no environmental impacts (such as biological, cultural, air quality, noise, recreation, visual, or aesthetic) would result and, consequently, the proposed project would not contribute to significant cumulative impacts. Similarly, no projects are proposed by

Clark and Mohave counties in the immediate project vicinity that would contribute to cumulative environmental impacts with the proposed project.

ADOT and NDOT each have two reasonably foreseeable future projects. NDOT plans to begin improvements (widening the two-lane segments to four-lane, median divided) to U.S. 95 from the California/Nevada state line to the U.S. 93 intersection west of Boulder City. Further, NDOT is currently preparing an environmental document for U.S. 93 improvements from the western terminus of the Hoover Dam Bypass project to U.S. 93 about 1 mile north of Railroad Pass Casino, west of Boulder City. ADOT is currently constructing improvements on Arizona SR 68 from MP 1.2 to MP 14.5. Further, ADOT plans to begin a preliminary study for improvements to U.S. 93 from the LMNRA eastern boundary to the eastern terminus of the Hoover Dam Bypass project.

5.4.1 Past Actions/Projects Near and Within the Project Vicinity

In its natural state, the Colorado River flowed unimpeded some 1,700 miles with a vertical elevation drop of more than 14,000 feet from its beginnings in the southern Rocky Mountains and eastern Great Basin to its terminus at the Gulf of California. The lower portion of the river from the Grand Canyon downstream was typically low gradient and flowed through a rather broad alluvial valley with relatively few confined reaches. At its mouth was an alluvial delta containing vast marshes, riparian forests, and backwaters. Such habitats were present along the entire reach of the lower river. The riparian belt extended away from the river for up to several miles, where the water table was relatively shallow.

Seasonal flooding resulted in the creation of several distinct communities of plants and animals. High water occurred around June, with low flows occurring during the winter months. Riparian communities were in a constant state of succession as the river, on a seasonal basis, was constantly depositing new sediment, shifting its channel, and creating and destroying habitat. Floodplain communities developed in areas prone to extended periods of inundation, and the aquatic community evolved consisting of a main channel with separate or connected oxbows and backwaters.

The overall ecosystem of the lower Colorado River today is quite different from that which existed prior to modern day use and development. During historic times, the area surrounding the Hoover Dam was used for a wide variety of purposes. Past activities in the project area and vicinity included cattle grazing, hunting, and mining for turquoise, gold, and silver. Mining occurred in the late 1800s and early 1900s in several areas within about 5 miles of Hoover Dam. Turquoise mining occurred near the location of the Hacienda Hotel; gold and silver mining occurred in locations on the Arizona side of the dam. Cattle grazing and hunting historically occurred in the project vicinity, but were not allowed near Hoover Dam (personal communication, Bill Burke, NPS, 1998).

The project area and vicinity currently consist of a mixture of land uses and facilities. Current uses and facilities include the dam and related hydroelectric facilities, a utility corridor (transmission towers and lines), a transportation corridor (U.S. 93 and access roads to the dam, lake, and river), and developed recreation facilities (visitors' center and parking garage at the dam, boating facilities, rafting and canoeing facilities, hiking trails, hot springs, and scenic lookouts).

These past and present activities, in addition to future planned projects, have and will continue to have a variety of impacts on the environment in the vicinity of Hoover Dam. These projects are described below in chronological order from past to future.

5.4.1.1 Construction of Hoover Dam

In 1928, Congress passed the Boulder Canyon Project Act authorizing construction of Hoover Dam. (Hoover Dam has also been called Boulder Dam; Congress made the name Hoover Dam permanent in 1947 after Herbert Hoover, the 31st President of the United States, who strongly supported construction of a high concrete dam on the Colorado River.) Construction of Hoover Dam began in 1931, and the last concrete was poured in 1935 – exactly 2 years, 1 month, and 28 days ahead of schedule. Hoover Dam's reservoir, Lake Mead, is America's largest man-made reservoir and can store 28.5 million acre-feet (9.2 trillion gallons) of water, or nearly 2 years of the river's average annual flow. (An acre-foot of water could cover a football field to a depth of 1 foot.)

Direct Impacts of Dam Construction

In order to construct Hoover Dam, engineers first drove a diversion tunnel through the wall of the river canyon from a point upstream of the dam site to a point downstream. They then lined the tunnel with concrete and built inlet and outlet sections to minimize flow turbulence. Cofferdams (watertight structures that allow exposure of the riverbed) were placed across the river above and below the dam site to divert the water into the tunnel and prevent it from backing up into the dam site. During construction of Hoover Dam, the Colorado River was diverted into four 56-foot-diameter tunnels averaging more than 4,000 feet in length. These tunnels were drilled and blasted out of the rock walls on either side of the river. Tunneling activity reached its peak in January 1932, with as much as 16,000 cubic yards of rock being hauled away every day by the truck fleet. The construction of the cofferdams required the removal of nearly 213,000 cubic yards of river silt from the bed of the Colorado River, which was replaced by sand and gravel and covered with concrete.

These activities completely altered streamside communities in the construction zone. The river could no longer supply water to flora and fauna along the natural stream course, and organisms that move with the stream flow had no natural bank habitat to supply them with nutrition and cover. After they diverted the river, work crews cleared the vegetation from the dam construction and reservoir areas. Thus, riparian habitat was directly destroyed. Dam construction required excavation of foundation and abutment areas for the dam. First workers dredged the area and removed all earth, sand, gravel, and loose rock, directly destroying riparian vegetation. Digging in the river bottom may have lowered the water table and made water inaccessible to established vegetation root systems. Additional rock was drilled, blasted, excavated, loaded, and removed so that the dam could be constructed on solid bedrock.

Facilities, such as roads, buildings, minor utility pipelines, surfaced areas for parking, and storage areas, were developed to facilitate construction. For the Hoover Dam construction, power lines were also strung across the Mojave Desert from San Bernardino and Victorville, California, to a substation on a rocky promontory near the canyon rim to provide power for all machines and illuminate the entire dam site, including tunnels.

As part of the necessary infrastructure for the construction of the dam, the Boulder Canyon Project Federal Reservation was created. This 144-square-mile area in the Eldorado Valley included the dam site, the lower portion of the future reservoir, the site of Boulder City, and

vast stretches of open territory around the town. This area was under federal control and, unlike the surrounding jurisdictions, gambling, the sale of liquor, and other practices deemed injurious to the workers and the orderly progress of work were strictly prohibited. The town, named Boulder City, included eight 172-man dormitories, one 53-man office dormitory, more than 600 family cottages, a mess hall and recreation hall, an office building, company store, laundry, and a 20-bed hospital. Sewer and water lines were laid out and hooked up, and nearly 20 miles of streets were paved. Reclamation spent well over a million dollars constructing the administration building, government residences, and landscaping for streets and parks. Privately financed structures housing various independent businesses sprung up along Nevada Highway, the main street in town. The key to this transformation of the Eldorado Valley was a network of elaborate, expensive pumps and pipes that carried water from the Colorado River out of Black Canyon to the town (Stevens, 1988).

After the construction of Hoover Dam was completed, a large portion of Boulder City was razed, as required by the government contract. This included hundreds of cottages, half a dozen dormitories, the mess hall, the recreation hall, and many other structures. The southern half of the city was returned to a state closely resembling its predam condition. Two dormitories were set aside to house Civilian Conservation Corps workers working on the Boulder Dam National Recreation Area, and a number of cottages were resold and hauled offsite for other uses. However, the landscaping remained and some of the original buildings are still standing, including the hospital, Grace Community Church, the Boulder Dam Hotel, and a number of enlarged and renovated cottages (Stevens, 1988).

On February 29, 1936, Hoover Dam and its powerhouse were accepted as complete. In addition to the direct, adverse, environmental effects of the dam's construction, there were immediate beneficial effects, which included water and power for the Los Angeles metropolitan area and water and flood protection for the fertile agricultural lands of Southern California and Arizona.

In general, the development of Hoover Dam and its associated facilities involved construction activities that likely resulted in temporary localized impacts on air quality, ambient noise levels, water quality, recreation resources, and aesthetic and visual resources. Impacts on local air quality would have likely occurred from construction equipment and vehicles traveling on dirt roads and during earth-moving activities. The impacts from increases in ambient noise levels would have resulted from the construction equipment, vehicles, and personnel constructing the various projects. Impacts to local water quality and riparian ecosystems could be expected to have occurred where construction activities, including scaling of the cliffs in Black Canyon, were conducted near Lake Mead, the Colorado River, or any of the washes or other water bodies in the project vicinity. The impacts to aesthetic resources would have occurred from the presence of the construction vehicles, equipment, and personnel, the dust and noise generated, and the change to the landscape that resulted. All of these impacts are construction related, specific to the projects' locations, and once the projects were completed, the impacts ceased and natural systems (air, water, vegetation, and wildlife) adapted and stabilized. Furthermore, prior to development of the dam, there were no permanent human receptors or habitations sensitive to noise, air, and aesthetic impacts – only construction workers and visitors to the construction site.

Long-term impacts to cultural resources occurred during project construction because of both the disturbance to the cultural resource sites and the imposition of new facilities

changing the setting and accessibility of cultural resource sites. Consultations with Native Americans for the DEIS provided numerous comments from tribal informants that construction of the dam and impounding of the waters of Lake Mead had a serious adverse effect on the traditional cultural landscape.

Substantial long-term visual effects on the environment occurred. After project construction was completed and the construction vehicles and equipment were removed, the change to the landscape from the dam and Lake Mead was dramatic and profound, and it was unlikely to revert to its preproject conditions.

The development of Hoover Dam and its associated facilities also contributed in a beneficial manner to the local and regional economy, local recreation resources, transportation and circulation in the area, and public utilities across the southwestern United States. This project, constructed during the Great Depression, employed a large number of previously unemployed workers. This work and the paycheck it provided enabled employees and their families to move from the tents and shacks north of Las Vegas to Boulder City, and to forego the soup kitchens in Las Vegas. Beneficial economic effects were realized regionally during construction from the purchase of materials, goods, and services in the local area and region. Construction personnel working on these projects contributed to secondary spending by their individual purchases of goods and services. Additionally, some workers made a large impact to the economy of Las Vegas by gambling away the majority of their paychecks during their days off.

Benefits to recreationists occurred by the development of additional recreation facilities and opportunities in the area. Benefits to commuters, tourists, commercial truck traffic, and local and regional consumers accrued by the development of the local roadway and interstate highway system in the area and the creation of HDNHL, a major tourist attraction. The development of U.S. 93 provides a more direct route between Las Vegas and Kingman, improving interstate commerce and numerous recreation facilities and other types of establishments.

Loss of Riparian Vegetation. Filling the reservoir and operation of the dam severely impacts vegetation, both in the immediate area around the dam and downstream. When the reservoir fills, riparian habitat becomes inundated, directly destroying the submerged vegetation. Many of the plant species that are not submerged in the initial filling area are unable to tolerate the subsequent water-level fluctuations typical in reservoirs and die off, reducing habitat for wildlife. Terrestrial habitat shrinks in acreage as a direct result of inundation. The land-water interface in the project area increases, resulting in shifts in flora and fauna as the ecology changes from that of a river to that of a lake-like impoundment.

Because sediment is entrapped in the reservoir upstream of a dam, the downstream system receives essentially clear, "sediment-hungry" water. The clear water derives its equilibrium load by entraining bed sediments and eroding riverbanks. These actions decrease the floodplain width and, therefore, decrease the area available for establishment of riparian habitat.

If the normal pattern of seasonal flooding is altered as a result of dam operation, long-established patterns of soil fertility relationships will change as well. For example, riparian vegetation that depends on spring deposition of silt for seedling establishment will not be generated. Floodplain lakes, marshes, swamps, and ponds may not receive annual or seasonal replenishment of water and nutrients. Use of a dam for hydroelectric

generation can produce fluctuations downstream that shift conditions from those of a large stream to those of a small headwater in a short period of time.

Effect of Dams on Terrestrial Life. Many birds use the shores and banks of streams and rivers for nesting. Although reservoirs can increase the area of land suitable for nests, dam operation often causes unexpected fluctuations in water levels that wash away eggs or inundate nest sites.

Other birds use riparian trees for nesting, roosting, and hunting. Reservoirs often make open-water habitat out of streamside forests, killing the trees. The effect is beneficial for snag-loving birds, so long as the dead trees are left standing, but it is detrimental for birds that use living trees during their various life stages.

Reptiles and amphibians commonly lay their eggs on stream banks or in river shallows. Reservoir fluctuations prematurely end their development, as the eggs are either inundated or desiccated beyond their tolerance.

The development of Hoover Dam facilities resulted in long-term changes to biological resources. Impacts to biological resources typically occurred during the construction phase of a project, but they are considered long-term because of their effects on local habitats and species. Although the dam was constructed prior to the Endangered Species Act, substantial impacts likely occurred to both common and sensitive native plant and animal species.

Effects of Dams on Aquatic Life. Faunal remains in archaeological sites show that Colorado River fishes were caught and eaten by Indians, as well as early canyon explorers. Studies completed during the late 1930s, during and after the construction of Hoover Dam, noted faunal declines when compared to earlier studies. A 1944 survey of the lower Colorado River was the first to provide insight on both native and introduced fishes downstream from the new Hoover and Parker dams. Reductions in native species were attributed to environmental changes associated with damming (Hunt and Huser, 1988).

Impacts have resulted from changes to wetland vegetation along the river. Streamside vegetation is essential in maintaining the aquatic ecosystems that support fisheries. Roots of riparian plants stabilize banks, prevent erosion, and occasionally create overhanging banks that serve as cover for fish. Streamside trees and herbs decrease the amount of sediment passing into the water and keep water temperatures cool enough to support cold-water fisheries. Sedimentation blocks fish gill filaments and results in fish death by anoxemia and carbon dioxide retention. Sedimentation also decreases the oxygen supply to fish eggs, resulting in their death, and alters the habitat of the aquatic invertebrates that form the prey base for many fish.

Riparian vegetation also serves as a source of large organic debris, which distributes sediments in a stream and creates pool and riffle habitat for aquatic organisms. Organic debris is an important source of nutrition for aquatic ecosystems.

Alien fish also attracted early attention in research studies and surveys. Lake Mead changed the Colorado River in ways that enhanced lentic-adapted (i.e., adapted to living in still waters such as lakes, ponds, or swamps), non-native species, and reservoir sport fisheries became important regional resources. A remarkable array of both native and non-native species were used as bait, and bait and forage fishes escaped or were intentionally stocked to join and feed expanding game fish populations. Many alien fish

could not adapt to the environment or competition for resources and disappeared, but others became well established. The original fauna of 30 or so native species in the Colorado basin has increased to 80 or more, including species from as far away as Europe, Asia, and Africa. Few things seem to help native fish survive the presence of alien species, aside from strong evidence that flooding in canyons displaces non-native fish, while native species are unaffected. In fact, native fish are often enhanced by flood removal of predators and competitors. However, the effect is temporary, since alien fish from populations protected in reservoirs and ponds upstream soon reinvade the canyons (Hunt and Huser, 1988).

Establishment of Salt Cedar. Historically, the lower Colorado River ecosystem was a mosaic of different native vegetation communities comprised mainly of Fremont cottonwood, Goodding willow, honey mesquite, screwbean mesquite, quailbush, and arrowweed, as well as many other plant species. This ecosystem was extremely important to many wildlife species, especially neotropical migratory bird species. However, native plant communities began to change soon after the completion of Hoover Dam. The elimination of annual spring floods produced an environment more suitable for the establishment of salt cedar, an exotic plant introduced during the mid-1800s, than for the regeneration of many native species.

While many native species are very susceptible to elimination by fire, salt cedar thrives on it. Salt cedar drops its needles each year during the winter, producing a thick carpet of highly flammable duff within a short amount of time. Once a fire begins, it spreads rapidly through the salt cedar. After burning, salt cedar sprouts new shoots from roots, while many native species do not. Salt cedar also produces seed throughout almost the entire year, so it is ready to take advantage of any disturbance that occurs, including fire. Through these two mechanisms, salt cedar is able to outcompete native plants and has become the dominant plant species along many riparian areas in the Southwest, including the lower Colorado River. Many areas have become pure stands of salt cedar after wildfires have swept through. Unfortunately, salt cedar has limited value as wildlife habitat. Additionally, as the predominance of salt cedar increases along the Colorado River, so does the frequency of wildfires, thereby spreading salt cedar even more.

Potential Cumulative Impacts

The construction of Hoover Dam has resulted in long-term impacts to the immediate vicinity and surrounding region. The U.S. 93 Hoover Dam Bypass Project will have localized, long-term impacts to terrestrial wildlife, desert washes, and aesthetics of Black Canyon; therefore, the bypass will contribute to cumulative impacts in the project area. These impacts are discussed in more detail in Section 5.5.2.

May and June 1998 site visits and field interviews with Native American tribal elders, conducted for FHWA by the University of Arizona, resulted in completion of an ethnographic study report for the Hoover Dam Bypass project in December 1998. That report included preliminary findings, summarized in the DEIS, indicating the presence of potentially significant traditional cultural properties in the vicinity of the bypass project. Additional site visits and interviews were conducted during May 2000. The resulting report (FHWA, October 2000a), provided documentation supporting a determination by FHWA and the SHPOs that the Gold Strike Canyon and Sugarloaf Mountain TCP is eligible for the National Register of Historic Places. In the interviews with the tribal elders, there was a clear feeling expressed that the construction of Hoover Dam had a substantial adverse impact on traditional cultural values, including: inundating the Colorado River from which

traditional songs and power were derived; flooding Native American village sites, a salt trail, and salt mines; destroying ancient fishing places; bringing pollution, public access, and vandalism to traditional lands; impacting the land with numerous power transmission towers; and overdeveloping the area for recreation. The Hoover Dam Bypass will have an adverse effect on the TCP and is discussed in Section 5.5.1.

5.4.1.2 Hoover Dam Visitor Center and Parking Facilities

The new visitor center and parking garage was opened at Hoover Dam in 1997. The Finding of No Significant Impact (FONSI) for the Visitor Center and Parking Facilities (September 20, 1979) concluded that there would be slight social and economic impacts. Reclamation, in consultation with the Nevada and Arizona SHPOs, determined that the project would have an adverse effect on the HDNHL. That effect was addressed through design review stipulations in an MOA signed by the federal ACHP on April 9, 1991.

Impacts on wildlife and vegetation were determined to be extremely small, almost nonexistent, and only temporary in nature because they would cease at the end of construction. Impacts to natural vegetation and archaeological sites that may have been present in the project area were minimized or avoided because they were destroyed or covered with concrete when the dam was initially constructed. The remaining natural vegetation is located on the canyon walls, and very little of the project occurred in that area.

The project was found to have beneficial effects by improving safety, relieving congestion, and providing a more efficient means of operation, particularly of the visitor services. Visitors would no longer have to wait for long periods in extreme heat and would be able to take the tour in a much more enjoyable and efficient manner. The project was determined to be in harmony with the designs, aesthetics, and the operation of the dam, and would provide for a continuity of design and purpose. The project features were designed so that they would blend with the existing dam and facilities.

Potential Cumulative Impacts

According to the FONSI, construction did not result in impacts that were more than minimal. As a result, this project, in combination with the proposed Hoover Dam Bypass, would not result in any cumulative impacts.

5.4.2 Present Actions/Projects Near and Within the Project Vicinity

This section focuses on federal, state, and local agency management plans and programs affecting the environmental resources in the project area. Detailed references for these plans and programs can be found in EIS Chapter 9.

5.4.2.1 Lake Mead General Management Plan

NPS's Lake Mead General Management Plan, approved in 1986 for a 25-year or longer period, follows a strategy that centers on accommodating increasing visitor use while protecting the area's most outstanding natural and cultural resources. It also addresses visitor use and flash flood safety problems that face most developed areas.

Solving existing crowding/congestion problems and accommodating projected increases in visitation would require expansion and improvement of existing developed areas, circulation improvements, improvement of existing shoreline access points, and establishment of new developed areas. The Management Plan establishes maximum levels

of development that could accommodate increasing use in the future, while not exceeding reasonable capacity limits. These are maximum levels, not goals; development within the maximum levels would occur only when demand and economic feasibility justify the expansion (NPS, 1986).

The Management Plan has resulted in and will continue to result in the following primary impacts during the 25-year projected life of the plan:

- Improvements in water quality in beach areas
- Destruction of or severe damage to soils, causing minor disruptions in drainage patterns that would temporarily increase erosion potential
- Seismic exploration for oil and gas leases would have the potential to cause adverse impacts to bighorn sheep herds, although proposed mitigation measures and the assumption that activity would remain sporadic, as in the past, reduces these impacts to a less than significant level

Potential Cumulative Impacts

Management Plan impacts, when considered in conjunction with those from the Hoover Dam Bypass Project, may result in cumulative impacts to the bighorn sheep population. The plan will result in beneficial impacts to water quality, so the bypass would not contribute to cumulative water quality impacts. Similarly, the Hoover Dam Bypass Project is not expected to impact soils, so cumulative soil impacts are not expected. Cumulative impacts to the bighorn sheep population are discussed in more detail in Section 5.5.2.

5.4.2.2 Reclamation Endangered Species Conservation

As part of Reclamation's ongoing operations and maintenance activities, the agency has an ongoing program of endangered species conservation. These programs are defined in the Description and Assessment of Operations, Maintenance, and Sensitive Species of the Lower Colorado River (Reclamation, 1996). The activities range from very specific to broad multispecies conservation programs, and they occur within the immediate Hoover Dam Bypass Project area as well as in the surrounding region. Reclamation's endangered species conservation activities include the following programs.

Endangered Razorback Sucker and Bonytail Conservation. Reclamation has an active program for the conservation and recovery of endangered razorback suckers and bonytail. These activities are part of the current routine operation of the Lower Colorado River system. As part of the Lower Colorado River Multi-Species Conservation Program (MSCP) interim conservation effort, federal and state biologists met in July 1995 to prioritize and quantify recovery and conservation program needs for endangered fish and other species during the 1995 to 2005 period. The following programs represent some of the ways this is currently being achieved.

- **Native Fish Work Group.** The purpose of this program is to replace the aging population of adult razorback suckers resident to Lake Mohave with immature fish spawned by wild populations to maintain the population's genetic diversity and viability.
- **Willow Beach National Fish Hatchery.** Reclamation has been working with the USFWS at the Willow Beach National Fish Hatchery to retrofit portions of a cold water fish hatchery facility to rear native warm-water fishes. Heating systems have been designed and installed for the hatch house for initial rearing of eggs and larvae. Since the

initiation of this program, approximately 8,000 young razorback suckers have been reared for stocking into rearing ponds at Lake Havasu (Reclamation, 1996).

- **HAVFISH Project.** Reclamation is an active partner of the multi-agency, Lake Havasu Fishery Improvement Project, HAVFISH. One of the objectives of this program is to release 25,000 razorback suckers and 25,000 bonytail into Lake Havasu over the next 10 years.

- **Boulder City Golf Course Native Fish Rearing Project.** Reclamation and NDOW signed an interagency agreement with the City of Boulder City to use the ponds at the Boulder City Golf Course for rearing native fish. During 1994, the first lake on the course was drained, and a new liner and aeration system were installed. Approximately 1,400 juvenile razorback suckers were stocked in the ponds, and over 400 of these were stocked into Lake Havasu in 1995. This program has since expanded with the development of three more ponds on the golf course.

- **Hualapai Native Fish Rearing Facility.** Reclamation is providing technical and financial support to the Hualapai Tribe in northern Arizona for the development of a native fish rearing facility. This facility may raise razorback suckers, bonytail, humpback chubs, and other native fishes for reintroduction into the Colorado River and its tributaries within the Grand Canyon and on tribal lands.

Native Riparian Plant Restoration. Reclamation is maintaining and expanding the cooperative native riparian plant restoration programs initiated along the Lower Colorado River. These partnership activities include the establishment of native plant nurseries, demonstration plantings, enhancement projects, and research. Reclamation has committed at least $100,000 per year for 5 years, beginning in 1996, for native riparian plant restoration.

Three-Finger Lake Project. In 1993, Reclamation and USFWS began a cooperative project to restore Three-Finger Lake, which is located on the California side of the lower Colorado River within the Cibola Division, south of Blythe. Approximately 120 acres of channels and shallow backwater areas, plus one 20-acre native fish rearing pond, were dredged. This project included the construction of the water intake system, protective levees and bankline structures, and the planting of native riparian vegetation.

Boulder City Wetland Project. The primary objective of the Boulder City Wetland Project is to demonstrate using reclaimed municipal wastewater to restore habitat for threatened and endangered species, and species of concern. Secondary objectives include public education and research on improving water quality and restoring habitat for sensitive species. The wetland receives Colorado River water blended with treated wastewater from Boulder City's wastewater treatment plant. The blended wastewater flows through a wetland system consisting of a stream containing shallow marshes and pools, then through four deep-water ponds. The stream and ponds contain a variety of native wetland plants and are bordered by native riparian plantings. Water from this wetland is used to irrigate turf at an adjacent Veterans Cemetery.

Lower Imperial Division Wetland Enhancement. This proposed cost-share project will restore and maintain streamflow of sufficient quality and quantity to enhance and assist in recovering and protecting riparian/wetland and aquatic fish and wildlife habitat. The proposed project extends from Imperial Dam upstream to Martinez Lake and encompasses a 9.5-mile reach of the lower Colorado River, including about 3,000 acres of riparian habitat

and wetlands and 22 backwater lakes. The area is used extensively by waterfowl, neotropical birds, sport fish, amphibians, mammals, songbirds, and other wildlife. Project objectives for the California and Arizona sides of the river include: restore the historical California channel, creating habitat for the endangered Yuma clapper rail and razorback sucker and for other species of concern; restore inflow and outflow to approximately 20 isolated backwater lakes adjacent to the river that have been partially or totally plugged by silt and vegetation; protect existing riparian stands of native cottonwood, willow, and mesquite; and restore and enhance wetlands.

Las Vegas Wash Wetland Restoration. Reclamation and NPS have entered into an agreement to construct two new wetlands totaling approximately 20 acres on the lower end of the Las Vegas Wash near its discharge to Lake Mead. These two multipurpose wetlands are designed to enhance marsh and riparian habitat within the eroded channel of the wash and also to provide for the polishing of perennial effluent flows. The purpose of this effort is to enhance habitat for the benefit of aquatic and riparian-dependent species.

MSCP Development. The Lower Colorado River MSCP is a cooperative federal/lower basin states/tribal/ private effort to conserve Endangered Species Act-listed and sensitive species dependent on the river. This program has the goal of benefitting more than 100 federal-, or state-listed, candidate and sensitive species and their habitats, ranging from aquatic, wetland and riparian, to upland.

As part of the development of this MSCP, Reclamation is generating a BA and requested formal Section 7 consultation on its present discretional routine operations and maintenance. Reclamation has discretion in the following areas:

- Managing target elevations of Lake Mohave, Lake Havasu, and Senator Wash Reservoir
- Making determinations of surplus, normal, and shortage conditions
- Implementing Endangered Species Act Section 7 endangered species conservation measures, such as cooperative efforts to preserve the endangered razorback sucker and bonytail populations in Lake Mohave and elsewhere on the Lower Colorado River
- Making management decisions on actions that affect recreation, the natural environment, and private development (along with the activities), limited by the fact that such decisions do not result in a new or additional consumptive use of Colorado River water or violate other mandates as specified in the "Law of the River"

Potential Cumulative Impacts

The Endangered Species Conversation Program has been designed to result in a beneficial impact to the region's biological resources. These plans are resulting in the recovery of native fish populations in the Lower Colorado River, enhancement and restoration of wetlands, restoration of native riparian plant habitat, and the conservation of federal- and state-listed threatened endangered species and species of concern. As a result, the beneficial project impacts of the Species Conservation Program, when considered in conjunction with the project impacts of the Hoover Dam Bypass Project, do not contribute to cumulative impacts.

5.4.2.3 Clark County Desert Conservation Program

The desert tortoise was emergency listed as endangered in 1989 and was later changed to threatened status in 1990. Historically, when development occurred that required the taking of a special-status species, a Habitat Conservation Plan was necessary in order to obtain an incidental take permit. Because of the length of time between species listings and completion of Habitat Conservation Plans, and because of the rapid growth and development occurring in the Las Vegas Valley CCDCP, the program was to provide a mechanism to allow development to occur on tortoise habitat within Clark County in exchange for the conservation of publicly owned desert tortoise habitat outside the urban area. The intent was to achieve a balance between economic stability and long-term environmental preservation.

The program called for the preparation of a Short-Term Habitat Conservation Plan in 1990 and a Long-Term Desert Conservation Plan, which became effective in 1995. In 1995, USFWS approved the Long-Term Plan and granted a 30-year incidental take permit to Clark County. The plan is based on the funding of certain measures identified in the USFWS Recovery Plan for the Desert Tortoise. The source of funding is a $550-per-acre mitigation fee on development. The permit area includes all private land within Clark County and all land that becomes private through any means.

Potential Cumulative Impacts

The proposed project would be constructed on federal lands and is not directly affected by the CCDCP. However, implementation of the preferred alternative would result in a loss of 120 acres of marginal habitat and, as indicated in Section 3.3.3 of the EIS, mitigation would be implemented to minimize impacts on the desert tortoise. Mitigation will include contributing project funds to the desert tortoise habitat conservation program, conducting preconstruction surveys, relocation of affected tortoises, and construction worker education regarding tortoises. With implementation of this mitigation, development of the proposed project would not contribute to cumulative impacts on the desert tortoise, nor would it conflict with the goals and objectives of the CCDCP.

5.4.3 Reasonably Foreseeable Future Projects

This section focuses on the reasonably foreseeable actions that are proposed or are in the planning stage that would occur near the project area. The actions evaluated are roadway improvement programs proposed for Nevada and Arizona. Provided below is a brief description of each of these highway projects and their anticipated short-term and long-term adverse impacts on the environment.

5.4.3.1 Boulder City/U.S. 93 Corridor Study

NDOT is conducting a Boulder City/U.S. 93 Corridor Study, the primary objectives of which are:

- Resolving traffic problems in the vicinity of Boulder City
- Extending freeway status to the U.S. 93/U.S. 95 interchange
- Improving operations at the junction of U.S. 93/U.S. 95
- Creating a safer transportation corridor
- Accommodating future transportation demand
- Improving system linkage on U.S. 93 and maintaining route continuity

In November 1999, NDOT began an environmental study of the segment of U.S. 93 between the Wagonwheel Interchange and the Hacienda Hotel. This project is in the environmental study stage, and no project alternatives or alignments have been selected; however, if there is a project as an outcome of the study, construction could begin as early as 2005. The eastern terminus of the project is coincident with the western terminus of the U.S. 93 Hoover Dam Bypass alignment. However, the Boulder City Corridor and the Hoover Dam Bypass are separate projects with independent utility, conceived to meet separate needs; each could be constructed without the other, and each would still fulfill its own objectives.

Traffic analysis conducted for the Hoover Dam Bypass indicates that, if constructed on the proposed timeline, the new bridge crossing does not generate additional traffic west of the dam. This is because there is not currently a noteworthy volume of traffic utilizing an alternate route.

If, however, the Hoover Dam Bypass were not constructed until 2027, the project would result in a 24 percent increase in traffic west of the dam and in Boulder City. This is because the gridlock at the dam would be so severe that a substantial percentage of traffic would seek an alternate route simply due to the extensive delays at the dam. Thus, if construction of the bypass occurs in 2027, vehicles using an alternate route would return to the bypass, resulting an increase in traffic of approximately 24 percent (see Appendix B).

Potential Cumulative Impacts

Depending on the timing of project development, construction activities associated with the Boulder City/U.S. 93 Corridor project could overlap with those of the Hoover Dam Bypass Project, resulting in temporary localized air quality, traffic, noise, visual, or water quality impacts.

Depending on site-specific conditions, a southerly bypass alternative around Boulder City would likely have long-term adverse impacts on desert tortoise and bighorn sheep, which are species also impacted by the dam bypass. The Boulder City/U.S. 93 Corridor bypass alternative would also have potential cultural resource and visual impacts on the undeveloped desert landscape to the north, south, and east of the city. However, the extent or location of potential environmental impacts and required mitigation measures are unknown at this time. Identification of impacts and potential mitigation measures will not be possible until project alternatives have been fully analyzed for the Boulder City/U.S. 93 Corridor. Despite this lack of early engineering information, the potential for cumulative impacts does exist for biological, cultural, Section 4(f), and visual resources. These are discussed in more detail in Section 5.5.2.

5.4.3.2 U.S. 93 Widening in Arizona

The ASTIP (December 1994) has identified the Phoenix to Nevada U.S. 93 corridor as one of the top priority corridors within Arizona. ADOT is programming and constructing various improvements along U.S. 93 in Arizona, from south of Wickenburg to Hoover Dam. Improvements will be phased consistent with funding levels and highway safety and capacity priorities. Ultimately, U.S. 93 will be widened to a continuous four-lane divided highway from Wickenburg to Hoover Dam.

ADOT will widen U.S. 93 to 4 lanes south from the new Hoover Dam Bypass interchange to the improved four-lane divided section 13 miles to the south at the LMNRA boundary. This segment of roadway is the final link between I-40 near Kingman and the Arizona terminus of the Hoover Dam Bypass Project. This widening could be done either

concurrently with construction of the Hoover Dam Bypass or soon after its completion. However, if the dam bypass is not constructed, the U.S. 93 widening will still proceed when ADOT determines traffic congestion in this restricted capacity two-lane section reaches unacceptable levels. If this widening is not completed, the 13-mile segment will create a regional traffic bottleneck between the proposed four-lane Hoover Dam Bypass and I-40, as well as south of I-40 to Phoenix (once the widening of U.S. 93 between Wickenburg and Kingman occurs).

Potential Cumulative Impacts

This work may occur either concurrently with or soon after construction of the Hoover Dam Bypass Project, potentially resulting in cumulative short-term impacts on air quality, traffic, noise, visual, and water quality. In addition, long-term impacts to biological, cultural, and parkland resources may occur, depending on site-specific conditions. However, the impacts could be reduced by reuse of some of the old highway alignment, which is already disturbed (see Section 5.5.2.2); there are several sections where this is a possibility. Nonetheless, the ADOT U.S. 93 widening project has the potential for cumulative impacts to biological, cultural, and Section 4(f) resources. These impacts are discussed in more detail in Section 5.5.2.

5.4.3.3 U.S. 95 Widening in Nevada

NDOT has a project listed in the long-range element of the Transportation System Projects list to widen the two-lane segment of U.S. 95 from the California/Nevada state line west of Laughlin to U.S. 93 west of Boulder City. This segment of U.S. 95 will be widened to a four-lane divided highway based on funding availability and traffic demand. Improvements to U.S. 95 will be a three-stage project. The first third to be designed and bid will be from Searchlight to a point approximately 18 miles north; $18 million is funded and construction is targeted for fall 2001. The second third of the highway to be improved would be the southern 20-mile section; the anticipated cost is about $19 million, and it would be constructed about 1 year later if funding is available. The final stage is the northern third of U.S. 95; it is approximately 18 miles long, would cost about $18 million, and would be constructed as soon as funding became available.

Potential Cumulative Impacts

This program of improvements to U.S. 95 is in the very early planning stages, and few details about the project or potential environmental impacts are currently available from NDOT. Since the project is being funded and designed in three stages starting far south of Hoover Dam, there is no potential for cumulative short-term impacts from construction because the final stage will not likely be built until after completion of the Hoover Dam Bypass. Furthermore, no cumulative traffic operational impacts are foreseen because the highway users are different; most of the traffic on U.S. 95 is traveling to and from Las Vegas with no intention or need to go through Boulder City and/or Hoover Dam. Long-term impacts to biological and cultural resources may occur, depending on site-specific conditions; however, impacts will be very small because all of the work will be within previously disturbed right-of-way. Therefore, the NDOT U.S. 95 widening project has the potential for cumulative impacts to biological and cultural resources, but no engineering or environmental details are available at this time. NDOT is currently preparing an Environmental Assessment (EA) for the entire route (about 60 miles).

5.4.3.4 SR 68, Bullhead City - East, Widening in Arizona

From its junction with SR 95 in Bullhead City, Arizona, 14.6 miles of SR 68 is being widened (from MP 1.2 to MP 14.5) so that the roadway will have four travel lanes all the way to its terminus at U.S. 93. SR 68 is currently a four-lane roadway from MP 14.5 to U.S. 93, and it provides the only east-west roadway linking U.S. 93 near Kingman with Laughlin, Nevada, across the Colorado River from Bullhead City. ADOT traffic studies determined that a minimum of two eastbound and two westbound travel lanes were required to provide adequate operational characteristics and driver safety. This project is currently under construction. An environmental assessment (EA) was completed for this project in June 1999 (ADOT, 1999).

Potential Cumulative Impacts

Construction on this project was started in September 2000 and is scheduled to be completed in the fall 2001. Approximately 127 acres will be disturbed by project construction. The Draft and Final EAs for this project evaluate the potential for cumulative impacts to biological, Section 4(f), and visual resources. These impacts are discussed in more detail in Section 5.5.2.

5.5 Cumulative Environmental Impacts

Certain impacts associated with the proposed U.S. 93 Hoover Dam Bypass Project could arise which, in conjunction with impacts attributable to other projects (either in the immediate vicinity or with similar characteristics), could have the potential to result in collectively adverse effects to the environment that are of greater significance than those generated individually by the proposed project. Cumulative impacts could include those effects considered to be less than significant individually, but which could become significant when evaluated in relation to impacts from other projects.

5.5.1 Potential Cumulative Impacts

This section describes the cumulative impacts to environmental resources that could potentially arise with implementation of the proposed Hoover Dam Bypass Project in association with the other projects and programs described in this chapter. This discussion is presented by environmental resource areas. Because NPS, Reclamation, or Clark or Mohave counties do not propose development in or near the project area, no impacts on the environment would be expected, and the proposed project would not contribute to cumulative impacts. Therefore, the cumulative effect analysis focuses on the major roadway improvements that are planned to occur in the immediate vicinity of the proposed project and could result in environmental impacts that, when combined with those of the proposed project, have the potential to result in cumulative impacts.

5.5.1.1 Biological Resources

On June 3, 1999, USFWS issued its Biological Opinion for the Hoover Dam Bypass Project. This document represents the opinion of USFWS on the potential effects of the proposed bypass project on federally listed species under the Endangered Species Act of 1973. The Biological Opinion concluded that the project will not likely affect the following endangered species: bald eagle, American peregrine falcon, razorback sucker, southwestern willow flycatcher, bonytail chub, and Devil's Hole pupfish. For the Mojave desert tortoise, a federally listed threatened species, USFWS found that the project is not likely to

jeopardize its continued existence or adversely impact designated critical habitat. USFWS stipulated "reasonable and prudent" measures to minimize project effects on the desert tortoise, including payment of $46,960 to Clark County for offsite mitigation for the loss of 80 acres of desert tortoise habitat. This EIS also concluded that the Hoover Dam Bypass preferred alternative will impact 20 acres of known habitat of desert bighorn sheep, which is a USFWS species of concern, as well as a State of Nevada protected and State of Arizona threatened species.

There is insufficient environmental and engineering information available for the future U.S. 93 and U.S. 95 highway improvement projects to identify potential cumulative impacts on endangered, threatened, or protected species also affected by the Hoover Dam Bypass. However, since these two future projects will primarily involve widening of existing highways, it is assumed that additional adverse impacts can usually be avoided with environmentally sensitive design, including continued use of protected game crossing structures, right-of-way fencing to minimize animal mortality, and other measures, including roadside signing for wildlife areas. Lands immediately adjacent to major highways are generally low-value biological habitats because of their highly disturbed nature. Hence, no cumulative biological impacts are anticipated from these future projects.

In contrast, the Boulder City/U.S. 93 Corridor alternatives have the potential for cumulative impacts on biological resources also impacted by the Hoover Dam Bypass. A new highway around Boulder City would fragment the existing habitat and essentially isolate most biota now occupying the area between the existing U.S. 93 corridor and any bypass route. As a result of any new highway, human development of the affected area may be accelerated, eventually causing its entire loss as wildlife habitat. The worst-case alternative for biological resources would be a southern bypass similar to that defined in NDOT's 1994 U.S. 93 Colorado River Crossing Corridor Study. The primary difference between the potential project alternatives is the greater habitat loss associated with the approximately 14-mile southern corridor. Considerably more impact to the desert tortoise can be anticipated with a southern alternative, because this corridor cuts through almost continuous tortoise habitat from the point it departs the U.S. 93/U.S. 95 interchange to the point at which it exits the Eldorado Valley and enters the Eldorado Mountains east of Boulder City. The new alignment alternatives for the Boulder City/U.S. 93 Corridor project also have the potential to impact local populations of desert bighorn sheep, which range throughout the River Mountains, often entering the lower slopes and even occasionally crossing U.S. 93. Therefore, although NDOT has not completed environmental and engineering studies for the Boulder City/U.S. 93 Corridor, it is likely that a bypass alternative on new (undisturbed) alignment will impact two special-status wildlife species also impacted by the Hoover Dam Bypass – the desert tortoise and desert bighorn sheep – and thus collectively cause a cumulative impact on these resources. The cumulative acreage of impacted habitats will not be known until NDOT completes preliminary design for the Boulder City/U.S. 93 Corridor.

The SR 68 project has the potential for cumulative impacts to desert bighorn sheep. This project traverses important desert bighorn sheep habitat in the Black Mountains of northwestern Arizona. This habitat was already fragmented by the existing highway, which has effectively split the population for 40 or more years. The construction of two wildlife crossings designed and situated primarily for use by bighorn sheep is part of the proposed mitigation for the project. If successful (i.e., desert bighorn sheep use the crossings), this project could result in a net beneficial impact to desert bighorn sheep.

However, this roadway improvement would result in a disturbance of approximately 90 acres of desert bighorn sheep habitat. Therefore, the Hoover Dam Bypass and the SR 68 widening projects would cumulatively impact 110 acres of bighorn sheep habitat; however, both projects include game crossings to minimize the effect on sheep movement.

USFWS considered cumulative effects in their June 1999 Biological Opinion for the Hoover Dam Bypass and concluded that future federal actions unrelated to the proposed project will require separate consultation pursuant to Section 7 of the Endangered Species Act. Since the majority of the land surrounding the proposed project is administered by Reclamation, NPS, or BLM, any action on those lands will be subject to consultation under Section 7. USFWS further concluded that actions on private lands within Clark County are expected to increase as the human population increases. The rapid growth of the human population, as well as tourism, has resulted in loss and degradation of desert tortoise habitat and loss of individual tortoises. These impacts are expected to continue according to USFWS. However, the CCDCP and associated incidental take permit addresses take of desert tortoises and destruction of their habitat from future development projects on nonfederal lands within Clark County. USFWS anticipates that measures in the CCDCP will continue to mitigate and minimize such effects.

5.5.1.2 Archaeological/Historical (Section 106) Resources

The U.S. 93 Hoover Dam Bypass will not impact significant prehistoric archaeological resources. However, it will have an adverse effect on the HDNHL, some contributing features, and the Gold Strike Canyon and Sugarloaf Mountain Traditional Cultural Property (TCP) within the area of potential effects of the preferred alternative.

Considering the nearby foreseeable future highway projects described in Section 5.4.3, on the Nevada side there are no recorded prehistoric sites of known significance within the potential alignments for development of the U.S. 93 Boulder City Corridor. The only reported prehistoric sites are isolated lithic flake scatters, ceramics, and milling stone stations located on the broad alluvial fan east of the Boulder City Airport. However, larger prehistoric archaeological sites, such as rockshelters, campsites, and rock alignments are situated in the River Mountains north of Boulder City, and the Eldorado Mountains to the east contain similar prehistoric resources including prehistoric turquoise mines. Historic sites in the Boulder City area include the Sullivan Turquoise Mines near Hacienda Hotel and in Hemenway Valley; potential remains from the Alunite Mining District and Boulder Annex Townsite near Railroad Pass; historic power transmission lines emanating from the Hoover Dam generating stations to locations in California, Arizona, and Nevada; a Union Pacific Railroad Line from Boulder City to the dam for which berms, bridges, and other features can still be found; and the Boulder City National Register Historic District, which could be affected by improvements to existing U.S. 93 through town. Considering the adverse effect of the preferred alternative on HDNHL and related features, there is a potential for consequential cumulative impacts on this resource due to the possibility of impacts from a Boulder City Corridor alternative on the power transmission lines emanating from the dam, which were found eligible for the National Register as contributing elements to the HDNHL. Furthermore, a Boulder City/ U.S. 93 Corridor Alternative could have a cumulative impact on the Goldstrike Canyon and Sugarloaf Mountain TCP, which is adversely affected by the Hoover Dam Bypass and is located approximately 0.75 mile east of the Hacienda Hotel and south of existing U.S. 93. However, the exact nature and limits of any significant cultural resources potentially affected by the Boulder City Corridor will not be known until detailed studies are completed by NDOT.

On the Arizona side, the abandoned former roadway of U.S. 93 was evaluated within the area of potential effects of the Hoover Dam Bypass. It was found eligible for the National Register for its association with the construction of Hoover Dam. The roadway recorded here is a fill or grade extending from the current highway on the north and running southward roughly parallel to the current highway route. The surface retains some gravel and small pieces of asphalt. This fill-and-cut segment is a portion of the original route of U.S. 93, as it was built in the late 1930s. The contract for construction of Hoover Dam included provisions for completing approaches to the dam for the highway to Las Vegas, Nevada, and a road to Kingman, Arizona. The approaches to Hoover Dam on both sides of the canyon were widened in 1957, and it is possible the recorded segment was abandoned at that time. However, there is certainly the potential for other historic resources, as well as prehistoric archaeological sites along the U.S. 93 corridor in Arizona that might be impacted by widening the highway, especially if it were done on a new alignment. More specific information on potential cultural resources that could be affected by the widening of U.S. 93 in Arizona will not be available until environmental studies are completed for this project, but no National Register resources are presently known that may be affected and that would result in a cumulative impact when considered collectively with the dam bypass effects.

5.5.1.3 Section 4(f) Resources

The preferred alternative for the Hoover Dam Bypass permanently uses approximately 92 acres of Section 4(f) lands from the LMNRA, the HDNHL, and the National Register eligible TCP. It was determined that there are no feasible and prudent alternatives to the use of Section 4(f) land and that the proposed action includes all possible planning to minimize harm to the Section 4(f) lands resulting from their use.

NDOT's Boulder City/U.S. 93 Corridor Study alternatives may impact land within the LMNRA located northeast of Boulder City, between the eastern limit of the project and the recreation area boundary. Using an assumed general highway right-of-way section of 300 feet, as was done for the U.S. 93 Hoover Dam Bypass, the Boulder City Corridor could result in permanent use of over 50 acres of Section 4(f) land from the LMNRA if a southern bypass alternative were selected. Other potential alternative corridors have not been studied fully by NDOT, and the extent of their potential Section 4(f) impact cannot be estimated at this time.

Widening of the 13-mile two-lane segment of U.S. 93 in Arizona, from the future Hoover Dam Bypass interchange to the boundary of the LMNRA, would use Section 4(f) recreation land administered by NPS. In some areas, ADOT has 400 feet of existing highway right-of-way; however, at this predesign stage it is unknown what portions of the widening would be on LMNRA or ADOT land. If ADOT did the widening on the existing alignment of U.S. 93, it is estimated that an additional 50 feet of right-of-way would be required. Assuming all the new highway right-of-way would be on LMNRA land, this ADOT project could result in the permanent use of approximately 80 acres of Section 4(f) land.

Based on the location of existing U.S. 93 through the LMNRA, there is no feasible and prudent alternative to the use of Section 4(f)-protected land for either the proposed Boulder City/U.S. 93 Corridor or the U.S. 93 widening in Arizona. Thus, these two reasonably foreseeable future projects in the immediate vicinity of the Hoover Dam Bypass would have the potential to generate Section 4(f) impacts that, when addressed collectively with the proposed project, could result in a considerable cumulative impact to public recreation and

historic lands. Impacts to Section 4(f) resources from improvements to SR 68 through the LMNRA were evaluated for the project and appended to the Final EA (ADOT, 1999). The evaluation concluded that expanding the roadway through the LMNRA will not substantially impair the activities, features, or attributes of the Section 4(f) resource, either by direct impacts (land takings for easements) from MP 1.6 to MP 2.0 or by constructive use/proximity impacts from MP 1.23 to MP 1.6. The total area of LMNRA required is 1.92 acres.

The four highway projects together could permanently use approximately 224 acres of land from the LMNRA, the HDNHL, and TCP. However, this potential cumulative impact to Section 4(f) land from the four highway projects would still be substantially less than five of the alternative alignments considered for the Hoover Dam Bypass: Willow Beach North, Willow Beach South, Nelson, Cottonwood, and Temple Bar (see Table 2-1).

5.5.1.4 Visual Resources

The preferred Sugarloaf Mountain alignment for the Hoover Dam Bypass will be located approximately 1,500 feet downstream from Hoover Dam and about 254 feet higher than the crest of the dam (see Figure 2-9). This new bridge crossing over Black Canyon will be in full view from the dam (see Figure 3-10). Consequently, it was found to have an adverse effect on the historic landmark owing to the introduction of visual elements that diminish the integrity of the property's significant historic features (36 CFR 800.5). This EIS determined that other visual effects of the Hoover Dam Bypass on the surrounding environment could be mitigated (see Section 3.7).

NDOT's planned Boulder City and U.S. 95 highway improvements and ADOT's planned U.S. 93 widening will likely have both short-term and long-term visual impacts on the surrounding desert environment. However, the planned U.S. 93 and U.S. 95 improvements will be all within existing highway corridors, which have been a part of the desert landscape for many decades and, therefore, may not have adverse visual impacts. Of these three foreseeable future projects, only the Boulder City Corridor alternatives have the potential for substantial visual impacts on presently undeveloped desert landscape, which is located in the Eldorado Valley to the south and the Colorado River and Eldorado Mountains to the north and east. As discussed under Archaeological and Historic Resources (Section 5.5.2.2), the Boulder City Corridor southern bypass alternative could contribute to a cumulative impact on historic features related to Hoover Dam (i.e., the power transmission lines). However, even if a southern bypass were the selected alternative, these transmission lines are not part of the historic viewshed of Hoover Dam; therefore, it does not appear that development of the Boulder City Corridor would contribute to a cumulative visual impact on the HDNHL.

Improvements underway on SR 68 will result in some long-term impacts to visual resources. These impacts result from the loss of some rock spires and other visual features, increased rock cuts, and a change in the overall character in some areas of the project. However, due to its location, SR 68 will have no cumulative impacts to HDNHL visual resources.

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CHAPTER 6

Section 4(f) Evaluation

Introduction

6.1 Purpose of Section 4(f) Evaluation

Section 4(f) of the U.S. Department of Transportation Act of 1966, codified in Federal law at 49 U.S.C. § 303, declares that, "it is the policy of the United States government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation land, wildlife and waterfowl refuges, and historic sites." Section 4(f) specifies that, "the Secretary [of Transportation] may approve a transportation program or project... requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site), only if—

1. There is no feasible and prudent alternative to using that land; and
2. The program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use."

The use of Section 4(f) resources occurs when: (1) land from a Section 4(f) site is permanently acquired for a transportation project, (2) when there is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose, or (3) when the proximity impacts of the transportation project on the Section 4(f) site, without acquisition of land, are so great that the purposes for which the Section 4(f) site exists are substantially impaired. The latter type of use is also known as a "constructive use." Constructive use occurs when the transportation project does not incorporate land from a Section 4(f) resource, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired. Constructive use has been determined to occur under the following cases (23 CFR 771.135[p]):

- The projected noise level increase attributable to the project substantially interferes with the use and enjoyment of a noise-sensitive facility of a resource protected by Section 4(f).
- The proximity of the proposed project substantially impairs aesthetic features or attributes of a resource protected by Section 4(f), where such features or attributes are considered important contributing elements to the value of the resource.
- The project results in a restriction on access which substantially diminishes the utility of a significant publicly owned park, recreation area, or historic site.
- The ecological intrusion of the project substantially diminishes the value of wildlife habitat in a wildlife or waterfowl refuge adjacent to the project or substantially interferes with the access to a wildlife or waterfowl refuge, when such access is necessary for established wildlife migration or critical life cycle processes.

Section 4(f) is applicable to historic sites and archaeological resources when the resource is included on, or eligible for, the NRHP (23 CFR 771.135[e]). Section 4(f) does not apply to

archaeological sites where it is determined after consultation with the SHPO and the ACHP that the resource is important chiefly because of what can be learned by data recovery and has minimal value for preservation in place. Constructive use is defined as not occurring when compliance with the requirements of Section 106 of the NHPA (16 U.S.C. § 470) and related regulations for proximity impacts of a proposed project on an NRHP site results in a finding of "no effect" or "no adverse effect" (36 CFR 800.5).

Section 4(f) further requires consultation with the Department of the Interior (DOI), and as appropriate, the involved offices of the Departments of Agriculture and Housing and Urban Development in developing transportation projects and programs which use lands protected by Section 4(f).

Because the Hoover Dam Bypass Project would use Section 4(f) lands, this evaluation identifies significant Section 4(f) resources in the project area, describes the nature and extent of the use of these significant properties, evaluates alternatives that would avoid the use of Section 4(f) resources, and describes measures to minimize harm to the affected resources.

6.2 Proposed Project

6.2.1 Introduction

U.S. 93 is a primary highway that traverses the western part of the nation from Montana to Arizona. U.S. 93 functions as a principal arterial highway providing a north-south transportation corridor and is an integral part of the State and national highway systems. In addition to the interstate commerce that uses this route, vacationers from throughout the country use U.S. 93 in their travels between Phoenix, Arizona, and Las Vegas, Nevada, and points beyond.

The present route of U.S. 93 uses the crest of Hoover Dam as a bridge to cross the Colorado River. The proposed project would remove trucks and through-vehicular traffic from the crest of Hoover Dam by rerouting U.S. 93 to a new bridge crossing and associated approach highways. This new route would reduce or eliminate the steep grades, sharp curves, narrow highway width, substandard shoulders, poor sight distances, and low travel speeds of the existing route.

6.2.2 Purpose and Need

A complete discussion of the purpose and need for the project is provided in Chapter 1 of this EIS and is incorporated herein by reference.

The purpose of the project is to reduce or eliminate through traffic over Hoover Dam to:

- Minimize the potential for pedestrian-vehicle accidents on the dam crest and on the Nevada and Arizona approaches to the dam
- Remove a major bottleneck to interstate and international commerce and travel in the west by reducing traffic congestion and accidents in this segment on the major commercial route between Phoenix and Las Vegas
- Replace an inadequate federally owned highway river crossing with a new crossing that meets current roadway design criteria, and improves through-vehicle and truck traffic capacity on U.S. 93 at the dam

- Reduce travel time in the dam vicinity
- Protect Hoover Dam employees, visitors, equipment, power generation capabilities, and Colorado River waters while enhancing visitors' experiences at Hoover Dam by:
  - Safeguarding dam and power plant facilities and the waters of Lake Mead and the Colorado River from hazardous spills or explosions
  - Protecting the dam and power plant facilities from interruptions in electricity and water delivery
  - Providing improved conditions for operating and maintaining Hoover Dam facilities

6.2.3 Project Alternatives Using Section 4(f) Lands

A complete discussion of the project alternatives is provided in Chapter 2 and is incorporated herein by reference. A listing of these alternatives and the Section 4(f) acreage used is provided below (see Section 2.2 for details).

Alternatives Using Section 4(f) Lands

- Promontory Point (74 acres)
- Sugarloaf Mountain (92 acres)
- Gold Strike Canyon (128 acres)

Alternatives Using Section 4(f) Lands, Considered but Eliminated (see Figure 2-1)

- Boulder City North (145 acres)
- Boulder City South (165 acres)
- Boulder City South Option (135 acres)
- Willow Beach North (405 acres)
- Willow Beach South (575 acres)
- Nelson (491 acres)
- Cottonwood (436 acres)
- Temple Bar (818 acres)
- Laughlin-Bullhead City (36 acres)
- Modifications to Hoover Dam
  - Option for widening Hoover Dam
  - Option for elevated highway on Hoover Dam

6.2.3.1 Promontory Point Alternative

The Promontory Point Alternative would cross Lake Mead about 1,000 feet upstream of Hoover Dam and would require construction of approximately 2.7 miles of approach road in Nevada, a 2,200-foot bridge over Lake Mead, and 0.8 mile of approach road in Arizona. The three bridge types that are considered in the EIS for this alternative are a steel truss rib through-arch bridge, a concrete cable-stayed bridge, and a steel suspension bridge. However, presentation of specific bridge designs in this EIS is not intended to preclude other feasible structures. The Promontory Alternative would include six wildlife underpasses, one highway bridge, and one tunnel. Fencing would be placed along both sides of the highway corridor to guide wildlife to the crossing structures.

6.2.3.2 Sugarloaf Mountain Alternative (Preferred Alternative)

The Sugarloaf Mountain Alternative would cross the Colorado River about 1,500 feet downstream of Hoover Dam and would require constructing approximately 2.2 miles of highway approach in Nevada, a 1,900-foot bridge, and approximately 1.1 miles of highway approach in Arizona. Bridge types considered in the EIS for this alternative are a concrete or steel deck arch bridge and a concrete cable-stayed bridge; however, presentation of specific bridge designs in this EIS is not intended to preclude other feasible structures. A Design Advisory Panel will provide input on bridge design concepts, structure type, and materials (see Section 3.5). The Sugarloaf Mountain Alternative would include four wildlife underpasses, three wildlife overpasses, two highway bridges (which also serve as wildlife crossings), and a tunnel. Fencing would be placed along both sides of the highway corridor to guide wildlife to the crossing structures.

6.2.3.3 Gold Strike Canyon Alternative

The Gold Strike Canyon Alternative would cross the Colorado River about 1 mile downstream of Hoover Dam and would require construction of approximately 2.2 miles of approach road in Nevada, a 1,700-foot bridge, and 1.1 miles of approach road in Arizona. The bridge types considered in the EIS for this alternative are a concrete deck arch bridge and a steel deck arch bridge; however, presentation of specific bridge designs in this EIS is not intended to preclude other feasible structures. The Gold Strike Canyon Alternative would include two wildlife underpasses, one wildlife overpass, ten highway bridges, and one tunnel. Noise barriers could be constructed on the outside shoulder along the roadway facing the trail through Gold Strike Canyon to reduce noise impacts on the hiking trail. Fencing would be placed along both sides of the highway corridor to guide wildlife to the crossing structures.

6.2.4 Other Alternatives Considered, But Eliminated

Following completion of the Phase A Study (Reclamation, October 1991; see Chapter 1 for more details), the PMT[1] agreed (Memorandum, January 1991) that all alternatives except for Promontory Point, Sugarloaf Mountain, and Gold Strike Canyon be eliminated from further consideration. After analyzing the alternatives under specific screening criteria (Section 2.3), all were eliminated from further consideration except for the three alignments closest to Hoover Dam: Promontory Point, Sugarloaf Mountain, and Gold Strike Canyon. The other alternatives were eliminated for reasons described below:

1. Some alternative routes did not meet the project purpose and need because they would not substantially eliminate roadway deficiencies and reduce traffic congestion on U.S. 93 at Hoover Dam and dam approaches, eliminate through traffic from the dam, enhance public safety, or protect Hoover Dam and its visitors. Alternatives were also dropped from further consideration if they substantially increased travel time and did not provide system continuity to enhance travel within the U.S. 93 corridor. The

[1]The PMT is currently an interagency team composed of the Federal Highway Administration – Central Federal Lands Highway Division, National Park Service, the Arizona and Nevada Divisions of the Federal Highway Administration, the Arizona and Nevada Departments of Transportation, and the Bureau of Reclamation. The PMT was established in 1989 to oversee project planning, environmental studies, design development, and project funding. The PMT representatives from these agencies have participated in reviews of the proposed project area, environmental studies, preliminary engineering, and the DEIS throughout the planning process.

Laughlin-Bullhead City Alternative was eliminated because motorists would avoid driving 23 additional miles by continuing to use the Hoover Dam crossing. Therefore, meeting the objectives of enhanced safety, improved level of service, and reduced congestion on U.S. 93 at the dam would not be achieved.

2. Except for U.S. 95/I-40, all of the build alternatives would affect Section 4(f) lands; however, some routes have considerably more impact than others. The Temple Bar Alternative and all the highway alternatives south of Gold Strike Canyon except the Laughlin-Bullhead City and U.S. 95/I-40 Alternatives would affect much more Section 4(f) land than the three alternatives near Hoover Dam. Based on the requirement to minimize harm to Section 4(f) property, these southerly alternatives were eliminated from further consideration.

3. Routes nearest Hoover Dam would pass through lands already extensively disturbed by human-made features. Conversely, the Willow Beach, Nelson, Cottonwood, Boulder City, and Temple Bar Alternatives were eliminated because those routes would pass through areas of extensive pristine habitat.

4. Alternatives were eliminated from consideration because their impacts on known peregrine falcon breeding areas, bighorn sheep habitat and movement corridors, desert tortoise habitat, and other wildlife were more severe than the three alternatives near the dam.

5. The cost of constructing the alternative routes generally increases as the length of the route and the distance from the dam increases. The higher costs of the Hoover Dam/Boulder City Bypass ($317 million) and Willow Beach South ($409 million) routes were added justification for their elimination from further consideration (NDOT, 1994).

6. The Laughlin-Bullhead City Alternative would result in additional total 20-year costs of approximately $1.4 billion over the alternatives studied in detail, due to the increased length of the alternative (see Appendix B).

7. Alternatives that require keeping the existing highway open to through traffic to provide visitor access to the dam were dropped from further consideration if they also required operating and maintaining extensive lengths of duplicate highway. Alternative routes not close to Hoover Dam (Willow Beach, Nelson, Cottonwood, and Temple Bar) were eliminated for this reason.

(See Chapters 1 and 2 for additional information about these routes.)

6.2.4.1 Modifications to Hoover Dam

This alternative was examined with two options for modifications to existing U.S. 93 on the crest of Hoover Dam:

- **Option for Widening Hoover Dam.** This option would widen the dam crest and connect it to the existing highway near each abutment, which would result in more traffic lanes through the dam area with no significant improvement in traffic flow. Tourist traffic would not be separated from the through traffic, and traffic interference with dam maintenance operations would still occur. Constructing new highway approaches to fit a widened dam crest would require large amounts of earthwork and complex approach structures.

- **Option for Elevated Highway on Hoover Dam.** This option was examined to attempt to attain the desired highway design criteria by adding an elevated crossing structure (which would be supported by some portion of Hoover Dam). It would require entirely new and straighter highway approaches. Extremely deep and lengthy excavations, or possibly tunnels, would be necessary to connect such a structure to the existing highway.

Both options of this alternative were eliminated because:

1. The approach roads to the dam have sharp switchback curves with radii less than 100 feet and grades as steep as 7 percent. Because of these existing restrictive conditions, the design criteria for a four-lane highway with a maximum 6 percent grade and a minimum curve radius of 1,500 feet could not be met by making reasonable improvements to the existing highway.
2. It would result in significant adverse impacts to the historical significance of the site—the integrity and setting of the dam and its status as an NHL.
3. It would cause interference with the Hoover Dam Visitor Center and further complicate conditions for separation of traffic, vehicle-turning movements, and parking maneuvers.
4. It does not solve the problems of safety to the public, does not protect the power and water supplies, and does not improve the situation of interference with operations and maintenance of the dam facilities.
5. No practical way exists to make these modifications without major impacts to the historic appearance of the dam and disruption to traffic during construction.

6.3 Section 4(f) Properties

Because of the unique situation of Section 4(f) lands within the LMNRA being continuous from 40 miles north, where the LMNRA meets the Grand Canyon National Recreation Area, to 60 miles south of the existing corridor, it is not possible to avoid these lands and still maintain the service that existing U.S. 93 provides for this area of the West (Figure 6-1).

There are three primary Section 4(f) properties involved with the proposed action—the LMNRA, the HDNHL, and a traditional cultural property (TCP) determined eligible for the National Register of Historic Places. LMNRA encompasses approximately 1,482,476 acres of federal land and 28,212 acres of nonfederal land and is managed by the NPS. The HDNHL encompasses approximately 330 acres of federal land that is managed by Reclamation as a part of the Hoover Dam Reservation Area (HDRA). The HDRA was reserved specifically for reclamation and power generation purposes and for the protection and security of the dam power plant and associated facilities. Areas within the HDRA, and not within the HDNHL or TCP, are not considered 4(f) property.

The LMNRA was established October 8, 1964, by Public Law 88-639, for "the general purpose of public recreation, benefit, and use, and in a manner that will preserve, develop, and enhance...the recreation potential and in a manner that will preserve the scenic, historic, scientific, and other important features of the area."

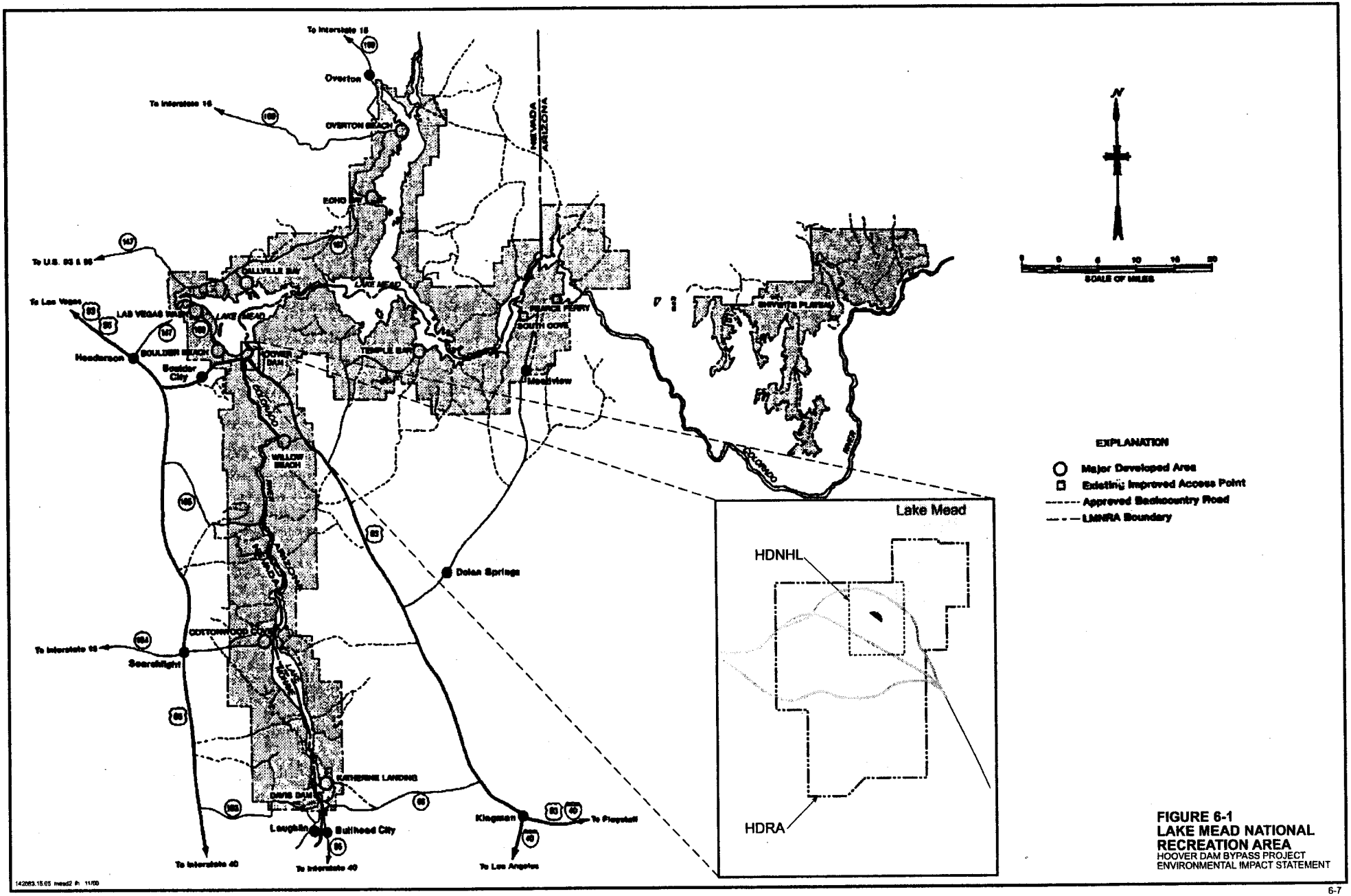

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FIGURE 6-1
LAKE MEAD NATIONAL RECREATION AREA
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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The LMNRA and the HDNHL include a wide variety of scenic and recreational resources. Most of the LMNRA is arid desert. Rugged mountains, expansive alluvial fans, and dry washes dominate the landscape. The LMNRA encompasses two reservoirs formed by the Colorado River: (1) Lake Mead, 110 miles long and formed by Hoover Dam, has 162,677 acres of water surface and more than 822 miles of shoreline; and (2) Lake Mohave, 67 miles long and formed by Davis Dam, has 28,800 acres of water surface and more than 254 miles of shoreline (Figure 6-1).

This ruggedly scenic area is famous for Hoover Dam, Lake Mead, the Colorado River, recreational activities, and wildlife. Attributes identified by the NPS that contribute to the overall quality and management of the LMNRA include aesthetics, cultural, historic, recreational, noise, air, and existing natural or biological resources. Potential impacts to these attributes by the proposed project are summarized in Chapter 3.

The recreational activities available in the LMNRA include sightseeing, hiking, camping, picnicking, backpacking, fishing, hunting, boating, river rafting, and bicycling. In 1997, there were 9.7 million visitors to the LMNRA. More than 1 million visitors toured Hoover Dam in 1997. The LMNRA and Hoover Dam are popular tourist destination areas, both nationally and internationally.

6.4 Impacts on the Section 4(f) Properties

As defined in the introduction, the use of a Section 4(f) resource occurs either when land from a Section 4(f) site is permanently acquired for a transportation project, when temporary occupancy has adverse effects, or when the proximity impacts of the project on the Section 4(f) site are so great that the purposes for which the Section 4(f) site exists are substantially impaired. Table 6-1 presents a simplified summary of Section 4(f) impacts that each alternative would have if implemented. The Hoover Dam Bypass project alternatives would impact three primary Section 4(f) properties: the LMNRA, which is a federal public park and recreation land, the HDNHL, which is listed in the National Register, and a National Register-eligible TCP. No wildlife or waterfowl refuges are located in the vicinity of the proposed project. No National Register-eligible archaeological sites have been identified within the project's area of potential effects (APE); however, one archaeological site within the APE was found to be a contributing element of the TCP. Acreage impacts on Section 4(f) lands are shown graphically in Figure 6-2.

As discussed in the introduction, constructive use is defined as not occurring when compliance with the requirements of Section 106 of the NHPA (16 U.S.C. § 470) and related regulations for proximity impacts of a proposed project on an NRHP site results in a finding of "no effect" or "no adverse effect" (36 CFR 800.5). However, pursuant to the ACHP regulations implementing Section 106, an undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to: (1) physical destruction of or damage to all or part of the property; (2) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; and (3) introduction of visual, audible, or atmospheric elements that diminish the integrity of the property's significant historic features (36 CFR800.5 [a]).

6.4.1 Promontory Point Alternative

The Section 4(f) properties and/or resource values were identified and assessed for potential impact by the Promontory Point Alternative. The following summarizes the results of that effort. (A more detailed description of these analyses and conclusions can be found in Chapter 3.)

6.4.1.1 Park Land and Recreation

The Promontory Point Alternative would permanently use a total of 74 acres of Section 4(f) land (39.2 acres within the LMNRA, 20.3 acres within the NHL, and 14.3 acres within the TCP; see Figure 6-2). A major regulatory agency concern and potential worst-case impact on recreational lands is the threat of a major hazardous materials spill on the new bridge, which could impact thousands of acres of lake waters and shoreline within the LMNRA. This alternative would not directly impact any recreational facility or resource located within Section 4(f) land. During construction, the noise of construction and presence of heavy equipment would temporarily lower the aesthetic experience for some visitors at the dam and in the area; however, others would find the construction operation interesting. Following construction and the subsequent diversion of traffic off the dam to the new bridge, truck-derived noise and exhaust fumes would be removed from the dam, thereby improving conditions for dam visitors. The long-term effect of this alternative will be to improve the recreationists' access to Hoover Dam by reducing traffic congestion and to make U.S. 93 a safer transportation facility. The new bridge could also become a recreational attraction in itself because of its proximity to Hoover Dam.

6.4.1.2 Cultural and Historic Resources

Implementation of the Promontory Point Alternative would affect a total of nine historic and cultural resource sites subject to protection under Section 4(f). These consist of Hoover Dam (listed as an NHL and in the NRHP), a concrete diversion channel (a contributing element to the NHL), a concrete retaining wall (a contributing element to the NHL), a power transmission switchyard (a contributing element to the NHL), transmission towers in Nevada, the Old Government Railroad grade, building foundations (near Nevada bridge abutment), U.S. 93 segment in Arizona (a contributing element to the NHL), and the TCP. The alternative crosses Lake Mead approximately 1,000 feet upstream from the dam and takes 20.3 acres of right-of-way from the northern portion of the 330-acre NHL property. This constitutes a permanent use of a portion of the historic property under Section 4(f). The alternative also uses 14.3 acres of land from the TCP.

FHWA and the NPS have determined that construction of a bridge at the Promontory Point crossing would adversely affect visitors' "first impression" historic views of the dam. These views occur as motorists approach the dam on existing U.S. 93 from both Nevada and Arizona. The dominance of the Promontory Point bridge would significantly detract from the historic views of the dam, because the bridge would conflict with Hoover Dam at the visitors' first opportunity to view it, a condition that could not be mitigated. In addition, preliminary Reclamation consultation with the SHPOs in the early 1990s indicated that the Promontory Point bridge alternative would be too close and would compete with the dam.

Table 6-1
Section 4(f) Impacts of the Hoover Dam Bypass Project

Resource	Promontory Point	Sugarloaf Mountain	Gold Strike Canyon	No Build[a]
Cultural Resources				
Hoover Dam (NHL)	Adverse effect to historic visual setting (nonmitigable)[b]	Adverse effect to historic visual setting (mitigable)[b]	No adverse effect to historic visual setting	(See footnote[c])
Dam-related historic features eligible for National Register[d]	Adverse effect on seven features	Adverse effect on eight features[e]	Adverse effect on five features	No change
TCP eligible for National Register	Adverse effect	Adverse effect	Adverse effect (nonmitigable)	
Noise[f]	No impact	No impact	Substantial increase in noise (>15 dBA) in upper canyon	Impacts to Hoover Dam location due to increased traffic
Recreation	Slight impact to boaters on Lake Mead. Positive impact to visitors at Hoover Dam	Positive impact to visitors at Hoover Dam	Impacts on Gold Strike Canyon Trail hikers due to loss of access. Positive impact to visitors at Hoover Dam	No change
Aesthetics	Impact to historic view of Hoover Dam and Black Canyon	Impact to existing view of Black Canyon	Impact to existing views of Black Canyon and Gold Strike Canyon	No change
Section 4(f) Land	Would take 20.3 acres of NHL land, 39.2 acres of LMNRA land, and 14.3 acres of TCP for 74 total acres	Would take 12.4 acres of NHL land, 57.1 acres of LMNRA land, and 22.3 acres of TCP for 92 total acres	Would take 0 acre of NHL land, 76.6 acres of LMNRA land, and 51 acres of TCP for 128 total acres	No change

[a] No action is defined by the Council of Environmental Quality as either, "no change from current management practices" or "the proposed activity would not take place." The No Build Alternative provides data for comparison purposes.

[b] FHWA and NPS determined the Promontory Point bridge would adversely affect the historic views of Hoover Dam while the Sugarloaf Mountain bridge would not, and that this impact cannot be mitigated.

[c] The No Build Alternative could result in potential structural damage from accidents and hazardous spills and in continued modification of the dam and its setting to improve traffic safety and access. Without long-range cultural resources planning, this alternative eventually may result in effects to the historic values from which the dam derives its significance.

[d] See Section 3.5 for specific details on impacts to cultural resources in the project area.

[e] FHWA conducted a supplemental historic resources survey of the preferred alternative and located six additional historic features associated with the NHL; two of the eight adversely affected features only have the setting impacted.

[f] See Table 3-6 for specific details.

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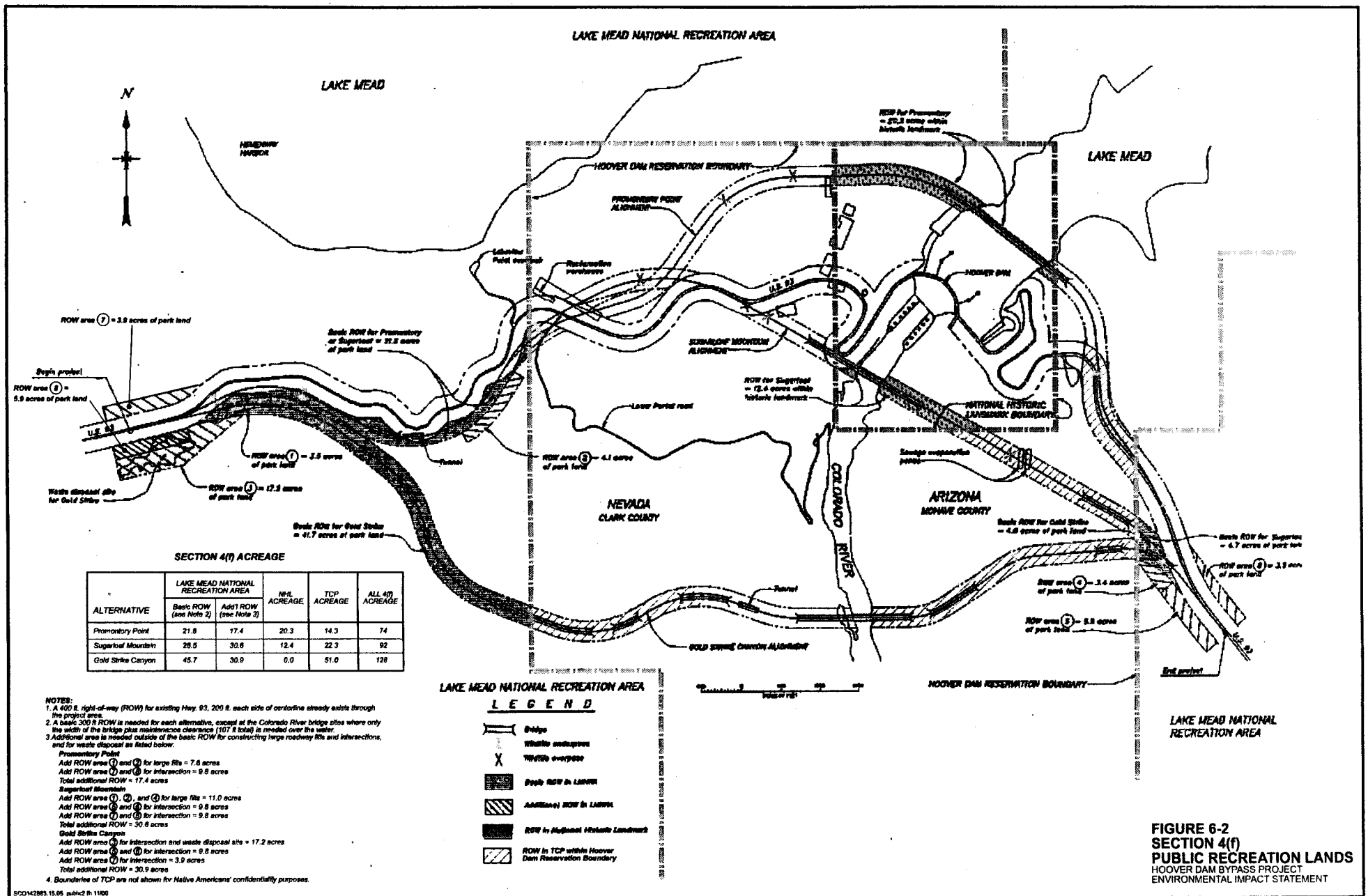

SECTION 4(f) ACREAGE

ALTERNATIVE	LAKE MEAD NATIONAL RECREATION AREA		NHL ACREAGE	TCP ACREAGE	ALL 4(f) ACREAGE
	Basic ROW (see Note 2)	Add'l ROW (see Note 3)			
Promontory Point	21.8	17.4	20.3	14.3	74
Sugarloaf Mountain	26.5	30.6	12.4	22.3	92
Gold Strike Canyon	45.7	30.9	0.0	51.0	128

NOTES:

1. A 400 ft. right-of-way (ROW) for existing Hwy. 93, 200 ft. each side of centerline already exists through the project area.
2. A basic 300 ft ROW is needed for each alternative, except at the Colorado River bridge sites where only the width of the bridge plus maintenance clearance (107 ft total) is needed over the water.
3. Additional area is needed outside of the basic ROW for constructing large roadway fills and intersections, and for waste disposal as listed below:

   Promontory Point
   Add ROW area ① and ② for large fills = 7.6 acres
   Add ROW area ⑦ and ⑧ for intersection = 9.8 acres
   Total additional ROW = 17.4 acres

   Sugarloaf Mountain
   Add ROW area ①, ②, and ④ for large fills = 11.0 acres
   Add ROW area ⑥ and ⑧ for intersection = 9.8 acres
   Add ROW area ⑦ and ⑨ for intersection = 9.8 acres
   Total additional ROW = 30.6 acres

   Gold Strike Canyon
   Add ROW area ⑤ for intersection and waste disposal site = 17.2 acres
   Add ROW area ⑥ and ⑪ for intersection = 9.8 acres
   Add ROW area ⑦ for intersection = 3.9 acres
   Total additional ROW = 30.9 acres

4. Boundaries of TCP are not shown for Native Americans' confidentiality purposes.

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FIGURE 6-2
SECTION 4(f)
PUBLIC RECREATION LANDS
HOOVER DAM BYPASS PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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As with the other two build alternatives, this alternative would enhance protection of the physical features of Hoover Dam by removing trucks from the dam, thereby eliminating the potential for hazardous material spills and large-vehicle collisions with dam facilities.

6.4.1.3 Noise

Five receptor sites were selected in human-use areas to determine current and predicted noise impacts for this project: the Lakeview Point Overlook, the Nevada Intake Tower at the dam, a raft launch concession below the dam, the hot springs located at the mouth of Gold Strike Canyon, and a point along the Gold Strike Canyon Trail (Figure 3-1).

The closest receptor sites for Promontory Point Alternative are the Lakeview Point Overlook (receptor R1/M1) and the Nevada Intake Tower (receptor R3/M3). Lakeview Point Overlook would experience a future predicted noise level of 56 dBA; noise sources consist primarily of U.S. 93. The Nevada Intake Tower is predicted to have a future noise level of 74 dBA from traffic on U.S. 93 and the new bridge. The existing noise level at R1/M1 is 50 dBA (from U.S. 93), and at R3/M3 it is 73 dBA (also from U.S. 93). The new bridge would be located approximately 1,000 feet upstream of the dam. Most recreational activity in this area is associated with Hoover Dam visitation. As with Sugarloaf Mountain Alternative, most of the proposed alignment for Promontory Point falls within 2,000 feet of existing U.S. 93. Hence, constructing the Promontory Point Alternative would not result in significant increases in noise.

6.4.1.4 Aesthetics

Views of the Promontory Point Alternative would be unobstructed from locations on Lake Mead up to 1.2 miles upstream of the dam. The new bridge would be visible from Hoover Dam (which receives over 1 million visitors per year) and by aerial sightseers, thus changing the landscape setting of Lake Mead from the dam and the air. As discussed in Chapter 3, the visual quality of the view looking toward the dam from a boat on the lake would be most affected by the steel truss rib through arch bridge design on this alignment. The vividness (memorability of the existing landscape components) would be compromised by the introduction of the bridge structure. In addition, the intactness of the landscape and the unity (visual harmony between landscape elements) would be affected by the size and prominence of the form, contrasting lines, and textural differences between the proposed bridge and the existing landscape.

Views of Lake Mead from the dam crest, of the dam crest itself, and of Black Canyon from Lake Mead would be dominated by the Promontory Point bridge. The adverse visual effect could not be mitigated due to the obtrusive nature of the bridge and the protrusion of the structure, regardless of type, above the horizon.

6.4.1.5 Access

The Promontory Point Alternative would improve access to the HDNHL interpretive facilities by diverting all but visitor traffic off the existing, highly congested, two-lane dam crossing and approaches and onto a new four-lane U.S. 93 bridge located approximately 1,000 feet upstream from the dam.

6.4.2 Sugarloaf Mountain Alternative (Preferred Alternative)

The Section 4(f) properties and/or resource values were identified and assessed for potential impact by the Sugarloaf Mountain Alternative. The following summarizes the results of that effort. (A more detailed description of these analyses and conclusions can be found in Chapter 3.)

6.4.2.1 Park Land and Recreation

As stated previously, the Sugarloaf Mountain Alternative would permanently use 92 acres of Section 4(f) land (57.1 acres within the LMNRA, 12.4 acres within the HDNHL, and 22.3 acres within the TCP) (Figure 6-2). Much of this alternative traverses or is adjacent to areas of existing disturbance (e.g., power lines and related facilities). The Sugarloaf Mountain Alternative would not directly impact any recreational facility or resource located within Section 4(f) land. During construction, the noise of construction and presence of heavy equipment would temporarily lower the aesthetic experience for some visitors at the dam and in the area; however, others would find the construction operation interesting. Undesignated trail-use regulations within the LMNRA might need to be adjusted to accommodate construction activities, but these inconveniences would be minor and relatively short term. Following construction and the subsequent diversion of traffic off the dam to the new bridge, truck-derived noise and exhaust fumes would be removed from the dam, thereby improving conditions for dam visitors. The long-term effects of this alternative would be to improve the recreationists' access to Hoover Dam by reducing traffic congestion and to make U.S. 93 a safer transportation facility. The new bridge could also become a recreational attraction in itself because of its proximity to Hoover Dam.

In summary, the Sugarloaf Mountain Alternative would not significantly change the remaining portions of Section 4(f) lands in relation to noise or recreation qualities (see Chapter 3 for details). Construction activities would disrupt traffic flow and have some adverse effects on noise, visual, and aesthetics qualities, but these effects would be relatively short term. These activities would be closely monitored by and coordinated with Reclamation and NPS to minimize adverse impacts and activities.

6.4.2.2 Cultural and Historic Resources

Implementation of the Sugarloaf Mountain Alternative would affect 10 historic and cultural sites. These resources are the HDNHL, a power transmission switchyard (a contributing element to the NHL), the Old Government Railroad grade, transmission towers in Nevada, stone gates, U.S. 93 switchback (a contributing element to the NHL), Kingman Switchyard in Arizona, transmission towers in Arizona, the Old U.S. 93 segment in Arizona (a contributing element to the NHL), and the TCP. The alternative crosses the Colorado River gorge 1,500 feet downstream from the dam and takes approximately 12.4 acres of right-of-way from the 330-acre NHL property in its southwest corner. This constitutes a permanent use of a portion of the historic property under Section 4(f). The alternative also uses 22.3 acres of land from the TCP.

The Sugarloaf Mountain bridge would not detract from the "first impression" historic views as visitors see the dam from the Arizona and Nevada approaches because it is not visible due to the existing roadway alignment that presents a direct view of the dam and Lake Mead. The Sugarloaf Mountain Alternative would enhance protection of the physical features of Hoover Dam by eliminating the potential for hazardous material spills and large-vehicle collisions with dam facilities.

Archaeological site NV:DD:14:21 contains a cobble deposit with associated lithic reduction debris located on the lower slope of Sugarloaf Mountain. It is located within and contributes to the National Register eligibility of the larger TCP, and would be impacted by the bypass construction. Specifically, the site contains "doctor rocks" identified by tribal elders as used for healing and other ceremonial purposes.

Impacts to the Gold Strike Canyon and Sugarloaf Mountain TCP include land disturbance and changes in viewshed and noise. However, the land traversed by this alternative and viewsheds from prominent TCP locations have been significantly altered by construction of the dam and associated facilities. Furthermore, the Native American tribal elders interviewed in the ethnographic study stated that the integrity of the Sugarloaf TCP has not been diminished by the superficial impacts of traffic, construction of the treatment pond, or the presence of power lines.

6.4.2.3 Noise

The closest noise receptor site to the Sugarloaf Mountain Alternative is the raft launch site (receptor R2/M2), where the noise generated by traffic on the new bridge would be 57 decibels. The Nevada Intake Tower (R3/M3), which is about 2,030 feet from the proposed Sugarloaf bridge, would experience a predicted future noise level of about 74 decibels; noise sources consist of the new bridge, the existing dam crossing, and the Visitor's Center. Although this exceeds the federal noise abatement criterion, it represents a noise level decrease of approximately 3 dBA from the future no build predicted level of 77 dBA and an increase above the existing noise level of only 1 dBA. The existing noise level at R2/M2 is 52 dBA (from sound of river), and at R3/M3 it is 73 dBA (from existing traffic on U.S. 93). The future reduction is due to traffic being diverted to the new crossing (approximately 1,500 feet downstream from the dam).

The predicted 56 dBA noise level at the Lakeview Point Overlook (R1/M1) would be the same as the Promontory Point Alternative, given that these bypass alternatives are on essentially the same alignment near the overlook. Most of the proposed Sugarloaf Mountain Alternative falls within 2,000 feet of the existing U.S. 93 alignment; therefore, no significant increases in noise pollution would result along the entire length of the proposed highway.

6.4.2.4 Aesthetics

Views of the Sugarloaf Mountain Alternative would be unobstructed from Hoover Dam, except for the transmission towers and rock outcroppings in the foreground, and from the raft launch site 0.5 mile downstream of the dam. In addition, the new bridge would be visible by aerial sightseers, thus changing the aerial view of the dam and canyon. As discussed in Chapter 3, the visual quality of the view looking downstream from the eastern side of Hoover Dam would be most affected by the concrete cable-stayed bridge design. The vividness (memorability of the existing landscape components) of the view would be degraded by the presence and closeness of the bridge structure. In addition, the intactness and unity (visual harmony between landscape elements) of the view would be affected by the size and prominence of the bridge form; the vertical, horizontal, and diagonal lines; and the textural differences between the proposed bridge and the existing landscape.

The Sugarloaf Mountain bridge would be visible looking toward Black Canyon from Lake Mead and from the dam crest. However, certain bridge types would tend to blend into the surroundings due to continuity between the horizontal deck and canyon rim elements and the fact that elements of the bridge would not significantly protrude above the horizon line.

(See Figure 3-10.) Other bridge types whose towers and cable supports rise above the horizon line include elements that are similar in appearance to the existing power lines and transmission structures. Final bridge type will be based on input from a Design Advisory Panel, formed by the Programmatic Agreement, to mitigate adverse historic and visual impacts in concert with other major project factors.

6.4.2.5 Access

The Sugarloaf Mountain Alternative would improve access to the HDNHL interpretive facilities by diverting all but visitor traffic off the existing, highly congested, two-lane dam crossing and approaches and onto a new four-lane U.S. 93 bridge located 1,500 feet downstream from the dam.

6.4.3 Gold Strike Canyon Alternative

The Section 4(f) properties and/or resource values were identified and assessed for potential impact by the Gold Strike Canyon Alternative. The following summarizes the results of this effort. (A more detailed description of these analyses and conclusions can be found in Chapter 3.)

6.4.3.1 Park Land and Recreation

The Gold Strike Canyon Alternative would permanently use a total of 128 acres of Section 4(f) recreation land (76.6 acres within the LMNRA and 51 acres within the TCP) (Figure 6-2). This alternative would result in negative impacts to Gold Strike Canyon hikers. Although the Gold Strike Canyon trail is not an official NPS-designated trail, numerous hikers use it as a trail leading to the hot springs located at the lower end of Gold Strike Canyon. The trail would be closed during the 5- to 6-year construction period. The proposed highway for this alternative would pass over the trail at several locations, and traffic from the new highway would create new noise pollution along nearly the whole length of the trail. (See the following discussion of noise, aesthetics, and access impacts on the Gold Strike Canyon Trail.)

Within Gold Strike Canyon , the roadway would be constructed primarily on elevated structures where it would overlay and cross the popular Gold Strike Canyon Trail from near the trailhead located just south of U.S. 93 (approximately 0.5 mile south of the Lakeview Point turnoff) to within about 0.5 mile of the river, a total distance of approximately 1 mile. The length of the trail from the trailhead to the HDRA Boundary, approximately 0.75 mile along the proposed highway, is within the LMNRA and is under Section 4(f) protection. The HDRA is excluded from the LMNRA for the protection and security of the dam powerplant and associated facilities.

Following construction and the subsequent diversion of traffic off the dam to the new bridge, truck-derived noise and exhaust fumes would be removed from the dam, thereby improving conditions for dam visitors. The long-term effect of this alternative will be to improve the recreationists' access to Hoover Dam by reducing traffic congestion and to make U.S. 93 a safer transportation facility.

6.4.3.2 Cultural and Historic Resources

Implementation of the Gold Strike Canyon Alternative would only indirectly affect Hoover Dam through a slight change to the visual historic setting. Opinions of the Nevada and Arizona SHPOs and the NPS were that construction of a bridge at the Gold Strike crossing

location would have no adverse effect on the historic visual setting of the landmark.[2] The Gold Strike Canyon Alternative would also affect six other historic and cultural sites. These resources are the wooden ladders site (a contributing element to the NHL), Nevada waste tailings (a contributing element to the NHL), Arizona waste tailings (a contributing element to the NHL), construction road and test borings (contributing elements to the NHL), the Old U.S. 93 segment in Arizona (a contributing element to the NHL), and the TCP. As with the other two alternatives, the Gold Strike Canyon Alternative would enhance protection of the physical features of Hoover Dam by removing trucks from the dam, thereby eliminating the potential for hazardous material spills and large vehicle collisions with dam facilities.

6.4.3.3 Noise

The Gold Strike Canyon Alternative is the farthest from existing traffic-generated noise pollution associated with U.S. 93. Implementing this alternative would result in a permanent increase of approximately 26 dBA at the Gold Strike Canyon Trail site from traffic on the new U.S. 93 alignment, for a total of 65 dBA (the present ambient noise level is approximately 39 dBA). This would be below the 67-dBA federal noise abatement criterion; however, it would constitute a substantial increase (more than 15 dBA) under NDOT and ADOT noise abatement policies. Therefore, the projected noise level increase attributable to the project would substantially impair the use and enjoyment of the Gold Strike Canyon Trail by hikers. With mitigation (see below), the projected noise level increase can be reduced to 20 dBA above existing conditions, for a total of 59 dBA.

There is no predicted increase in the existing ambient noise level of 60 dBA at the Gold Strike Canyon Hot Springs from this alternative realignment of U.S. 93. Existing noise levels at the hot springs are caused from the sound of rushing water around the hot springs. The hot springs site would be shielded from future traffic-associated noise from the Gold Strike Canyon Alternative by intervening cliffs. Due to the serene and quiet nature of the previously undisturbed area, mitigation must be considered in those areas that would be affected by excessive noise levels (increases greater than 15 dBA above the existing ambient levels). Noise level decreases of approximately 3 dBA are predicted at both the Nevada Intake Tower and at Lakeview Point (from predicted future no-build levels of 77 dBA and 54 dBA, respectively) due to traffic being diverted to the new crossing location approximately 1 mile downstream.

6.4.3.4 Aesthetics

Views of the Gold Strike Canyon Alternative would be completely obstructed from Hoover Dam, the Arizona Overlook, and Lake Mead. The new bridge would be visible from the raft put-in 0.5 mile downstream of Hoover Dam and by aerial sightseers. As discussed in Chapter 3, the new Colorado River bridge would substantially change the landscape setting of Gold Strike Canyon as seen from the hiking trail and hot springs. From the view of Black Canyon looking downstream from the raft launch location, the concrete deck arch bridge design would have the most pronounced visual affect. Because the concrete forms on this bridge are larger than in the steel deck arch bridge, the visual impact from this bridge design is greater than for the steel deck arch bridge. With either bridge design, the vividness of the landscape components would not be adversely affected by the bridge

[2]The Advisory Council on Historic Preservation concurred with these preliminary opinions in a December 11, 1991 letter stating, "We agree that the construction of the bridge at Gold Strike Canyon appears to be the alternative which is least likely to have an adverse effect on the Hoover Dam National Historic Landmark."

structure; however, the intactness and unity of the view would be compromised by the size and prominence of the form and contrasting lines.

The Gold Strike Canyon Trail is used by visitors to hike down through the canyon to the river and the hot springs. Because of the heavy use of the hot springs area, the NPS has provided a portable toilet and trash receptacles at the mouth of the canyon.

At several locations in the canyon the highway alignment would cross over or lay directly above the canyon bottom and hiking trail. Construction of primarily highway bridges and retaining walls is required in lieu of fills through Gold Strike Canyon because fill slopes would interfere with drainage flows and drastically alter the canyon bottom for hiking. Views by recreationists using the hiking trail or hot springs would be adversely affected by this alternative, regardless of the bridge design that is selected.

6.4.3.5 Access

The Gold Strike Canyon Alternative would improve access to the HDNHL interpretive facilities by diverting all but visitor traffic off the existing, highly congested, two-lane dam crossing and approaches and onto a new four-lane U.S. 93 bridge located about 1 mile downstream from Hoover Dam.

During the construction period for this alternative (5 to 6 years), the Gold Strike Canyon trail would be closed from U.S. 93. Recreation activities within this area would be prohibited. Consequently, hiking access along this popular public parkland trail through Gold Strike Canyon to the river and hot spring pools would be blocked for years during construction of this highway alternative. Furthermore, the natural views and rugged appeal of this pristine canyon setting would be permanently replaced with concrete columns and overhead bridges crisscrossing the canyon trail for most of its length. This condition would substantially diminish the utility of this natural trail access to the river.

6.5 Avoidance Alternatives

Because of the unique situation of Section 4(f) lands being continuous from 40 miles north to 60 miles south of the existing corridor, it is not possible to avoid these lands and still maintain the service that existing U.S. 93 provides for this area of the Southwest (Figure 6-1). Consequently, there are no reasonable alternative routes that meet the project purpose and need, and avoid the use of Section 4(f) lands. The following avoidance alternatives are fully described and compared in Chapter 2.

A total of four alternatives would avoid the use of Section 4(f) lands:

- No Build Alternative
- Restricting motorized traffic from crossing Hoover Dam
  - Option for restricting truck traffic only
  - Option for restricting all traffic
- Traffic Systems Management
- U.S. Highway 95/I-40

6.5.1 No Build Alternative

The No Build Alternative would consist of no action being taken. No bypass of Hoover Dam would be developed, no change in the current highway configuration would occur, and no other structural or nonstructural improvements would be developed on U.S. 93 near Hoover Dam. Existing hairpin curves, inadequate sight distance, narrow dam crest roadway, and steep grades on U.S. 93 in the vicinity of Hoover Dam would remain unchanged. No direct construction costs would result from this alternative.

However, an increase in operations and maintenance costs is foreseeable because of the increased traffic and congestion on and near the dam. The public would also incur added costs because of more frequent traffic delays and accidents.

The No Build Alternative would not meet the purpose and need of the project as it would not remove a major bottleneck to regional commerce by increasing the capacity of U.S. 93 near the dam to improve through-vehicle and truck traffic, nor would it substantially reduce traffic congestion and accidents at the dam and approaches. It would not minimize out-of- direction travel during periods of significant delays at the dam crossing or reduce vehicle hours of travel and improve travel speeds. It may increase the potential for a catastrophic spill of hazardous materials with increasing automobile and truck traffic volumes on the dam and approaches. The risks to innocent bystanders, property damage to the dam and its facilities, contamination of the waters of Lake Mead or the Colorado River, and interruption of the power and water supply for people in the Southwest would remain or increase.

This alternative would not minimize impacts on recreation resources and tourists. It would not reduce the potential for pedestrian-vehicular accidents on the crest of the dam and on the Nevada and Arizona approaches to the dam. The increased traffic volumes, ranging from a forecasted 21,100 AADT in 2017 to 26,000 AADT in 2027 on Hoover Dam under no build versus 4,700 AADT in 2017 to 6,100 AADT in 2027 under the bypass alternatives, traveling at slower speeds would contribute to decreased air quality in the vicinity of Hoover Dam (see Traffic Analysis, Appendix A). There would also be increased congestion for tourists at Hoover Dam and parts of the LMNRA.

6.5.2 Restricting Motorized Traffic from Crossing Hoover Dam

The possibility of restricting traffic from using Hoover Dam to cross the Colorado River was examined with two options:

- Restricting truck traffic (through restriction on specific classifications of vehicles), which results in diversion to alternate routes, but leaves Hoover Dam open to automobile traffic; and
- Restricting all traffic, which results in diversion of all traffic to alternate routes and thus closes Hoover Dam to all motorized vehicles.

At the present time, Hoover Dam is the only Colorado River crossing in the general vicinity of Las Vegas, Nevada. The closest alternate crossings are at Lee's Ferry, 250 miles upstream of Hoover Dam; and at Davis Dam or Laughlin Bridge, 67 and 70 miles downstream, respectively. As a result, the river crossing on Hoover Dam is very important to both the commercial trucking industry and other travelers on U.S. 93.

In 1997, the AADT on Hoover Dam was 11,500 vehicles (13,200 vehicles on the Nevada side). Excluding commercial busses, approximately 18 percent of these daily vehicles were commercial trucks. Closure of the dam to traffic would likely result in a diversion of these vehicles to State Route (SR) 163 and U.S. 95 in Nevada and SR 68 in Arizona (the Laughlin-Bullhead City Alternative). These routes would add 23 miles to the trip from Kingman, Arizona, to Las Vegas, Nevada. Another possible route from Kingman to Las Vegas would be Interstate 40 (I-40) to Needles, California, and then north on U.S. 95 to Las Vegas. However, vehicles using these routes would travel 50 more miles than if they used SR 163 in Nevada as the alternate route. In either instance, U.S. 95 south of Las Vegas would experience a dramatic increase in traffic.

This alternative (with two options) for traffic restriction was eliminated because:

1. It does not fulfill the designated functional requirements of U.S. 93 as a principal arterial highway.
2. It would eliminate a major segment of a primary north-south U.S. highway.
3. The traffic congestion and safety considerations would merely be shifted from Hoover Dam to other locations.
4. Major sections of the alternate routes were not designed and built to sustain the heavy loads and volume of vehicles that would be diverted from Hoover Dam, resulting in a shortened life for those highways.
5. In addition to the extra travel distance, alternative transportation routes have greater elevation changes, resulting in both increased travel time and operating cost for commercial carriers and the general traveling public (see Appendix B).

6.5.3 Traffic Systems Management

A Traffic Systems Management (TSM) Study was completed in January 1992 to determine whether or not a low cost solution exists for the current and projected traffic congestion, pedestrians, and vehicle safety problems at the present crossing. Typically, TSM addresses signing and signalization, turn lanes and traffic channelization, vehicle turn-outs, vehicular access and parking controls, and pedestrian channelization and barriers.

The TSM Study concluded that some minor improvements in traffic flow could result from low cost changes in operational conditions; specifically: (1) existing crosswalks should be widened and supplemental signing added to better concentrate pedestrian crossings, which would minimize accident potential and improve overall traffic flow on the dam crest; and (2) the immediate approaches to Hoover Dam should be signed to indicate the location of visitor parking lots, which was done with construction of the Visitor's Center. The study concluded this would alleviate some of the traffic congestion that results from visitor confusion regarding parking lot locations.

However, because of the existing horizontal curves, roadway width on the dam, and pedestrian volumes, no significant improvements could be realized without provision of an alternate route. The existing traffic conditions will only deteriorate with future growth of the traffic volumes. The existing geometry of the highway approaching and over Hoover Dam is a source of difficulty for semitrailer trucks in making the necessary maneuvers around the hairpin curves and the 90-degree curve. This condition will continue to result in

accidents and extensive delays to through traffic. The study recommended that a new four-lane route should be provided.

Therefore, this alternative was eliminated from further consideration because it could not meet the purpose and need of the project. Since this alternative would only involve modifications to the existing route, it would not use additional Section 4(f) resources; however, the TSM Study concluded that only minor improvements in traffic flow could result from changes in operational conditions. This alternative was eliminated because:

1. No significant improvements to traffic flow would be realized due to the existing geometry of the highway approaching and crossing Hoover Dam, including the inadequate horizontal curves and highway width on the dam, and due to the high traffic and pedestrian volumes.
2. It does not fulfill the designated functional requirements of U.S. 93 as a principal arterial highway.
3. The vehicle-pedestrian, vehicle-vehicle, and vehicle-sheep conflicts would not be changed.

6.5.4 U.S. 95/I-40

This alternative to U.S. 93 improves the existing route between Boulder City and Kingman via Needles, California. Approximately 56 miles of U.S. 95 in Nevada and 13 miles of U.S. 95 in California would be widened to four lanes. No improvements to existing I-40 and its crossing of the Colorado River south of Needles are necessary.

The U.S. 95/I-40 Alternative does not meet the project purpose and need because it would not substantially eliminate roadway deficiencies and reduce traffic congestion on U.S. 93 at Hoover Dam and dam approaches, eliminate through traffic from the dam, enhance public safety, or protect Hoover Dam and its visitors. The U.S. 95/I-40 Alternative was eliminated because motorists would avoid driving the additional 70 miles by continuing to use the Hoover Dam crossing. Therefore, meeting the objectives of enhanced safety and reduced congestion on U.S. 93 at the dam would not be achieved.

6.6 Justification for Use of Section 4(f) Land

6.6.1 Evaluation of Potential Avoidance Alternatives

The basis for concluding that there are no feasible and prudent alternatives to the use of Section 4(f) land must demonstrate that:

- There are unique problems or unusual factors associated with the alternatives that avoid Section 4(f) lands, or
- The cost, social, economic, and environmental impacts, or community disruption from such alternatives reach extraordinary magnitudes.

The geographic shape of LMNRA and the location of existing U.S. 93 (i.e., a narrow strip of area extending approximately 60 miles south of the existing road corridor and a variable width strip of area extending approximately 40 miles east of the existing corridor, see Figure 6-1) creates a unique problem regarding total avoidance of Section 4(f) land.

6.6.1.1 U.S. 95/I-40

Any alternative that would route through traffic around the southern end of the LMNRA would add, at a minimum, approximately 25 miles of out-of-direction travel to the mileage currently traveled by existing U.S. 93 motorists. Based on analysis of the Laughlin-Bullhead City Alternative (LBA), which traverses the extreme southern end of LMNRA, this represents an additional $1.4 billion dollars in total 20-year costs (see Appendix B). These additional total user costs are an increase of approximately 10 percent over the build alternatives studied in detail and result in a negative benefit to cost ratio. Thus, the U.S. 95/I-40 alternative that passes far to the south of LMNRA and adds approximately 70-miles to the trip length is considered to be unfeasible with respect to engineering economics and imprudent regarding the increased travel time, user costs, and environmental impacts.

6.6.1.2 Restricting Traffic from Hoover Dam

This alternative was determined to be unfeasible and imprudent primarily because:

- It does not fulfill the designated functional requirements of U.S. 93 as a principle arterial highway
- It would eliminate a major segment of a primary north-south U.S. highway

Additional reasons are explained in section 6.5.2.

6.6.2 Purpose and Need

The U.S. 95/I-40 Alternative, passing to the south of LMNRA, and the No Build Alternative do not meet the project purpose and need because a substantial portion of the through traffic (all for the no build) would continue to use existing U.S. 93 due to the 70-mile trip length increase from Kingman, Arizona to Las Vegas, Nevada. Therefore, pedestrian-vehicle accident rates, congested bottleneck conditions, substandard approaches, and travel time would not be improved.

The Traffic Systems Management alternative would not significantly improve traffic flow across Hoover Dam, minimize the potential for pedestrian-vehicle accidents, improve protection of the dam facility, or improve operation and maintenance conditions, and therefore it does not meet the project purpose and need.

6.6.3 Least Harm Alternative

When there are no feasible and prudent alternatives that avoid the use of Section 4(f) land, the final Section 4(f) evaluation must demonstrate that the preferred alternative is a feasible and prudent alternative with the least-harm on the Section 4(f) resources after considering mitigation. To make a least harm determination, the net impact on Section 4(f) land may consider not only size of land used , but also the:

- Location of the portion used
- Severity of the portion used
- Function of the portion used

The remainder of this section describes the logic used to determine the least harm alternative. Two build alternatives with relatively lower Section 4(f) use are the Laughlin-Bullhead City and Modifications to Hoover Dam alternatives.

6.6.3.1 Modifications to Hoover Dam.

The two modification alternatives, widening the crest and elevating the highway structure, would not:

- Minimize the potential for pedestrian-vehicle accidents
- Improve protection of the dam facility
- Improve operation and maintenance conditions

Therefore, these alternatives do not meet the project purpose and need. In addition, the two modification alternatives would result in direct adverse physical alteration to the HDNHL in terms of its original design, setting, materials, and workmanship.

6.6.3.2 Laughlin-Bullhead City

The LBA does not meet the project purpose and need; would not reduce travel time; would have adverse impacts on public safety, sensitive wildlife species, and air quality; would not protect the HDNHL; and would not fully address long-term traffic issues on Hoover Dam.

Further, based on the LBA study in Appendix B an additional $1.4 billion dollars in total 20-year costs would be accrued. These additional total user costs are an increase of approximately 10 percent over the build alternatives studied in detail and result in a negative benefit to cost ratio. Thus, this alternative is considered to be unfeasible with respect to engineering economics and imprudent regarding the increased travel time, user costs, and environmental impacts.

6.6.3.3 Alternatives Eliminated Based on Acreage and Quality Impacts

Based on Section 4(f) acreage impact considerations the following initial alternatives can be readily eliminated.

- Gold Strike Canyon (128 acres)
- Boulder City North (145 acres)
- Boulder City South (165 acres)
- Boulder City South Option (135 acres)
- Willow Beach North (405 acres)
- Willow Beach South (575 acres)
- Nelson (491 acres)
- Cottonwood (436 acres)
- Temple Bar (818 acres)

In addition, the LMNRA Section 4(f) acreage traversed by these alternatives is essentially undisturbed.

6.6.3.4 Determination of Least-Harm Alternative

Based on the above discussion the remaining two alternatives are Sugarloaf Mountain and Promontory Point. Promontory Point Alternative uses approximately 74 acres of Section 4(f) land. Sugarloaf Mountain Alternative uses approximately 92 acres. However, much of Sugarloaf Mountain Alternative traverses or is adjacent to areas of existing disturbance (e.g., power lines and related facilities) that detract from recreational and scenic qualities.

The Sugarloaf Mountain Alternative uses approximately 58 acres of LMNRA, 12 acres of the HDNHL and 22 acres of the TCP. The Promontory Point Alternative uses approximately 40 acres of LMNRA, 20 acres of the HDNHL and 14 acres of the TCP.

As discussed earlier in this section, least-harm considerations are not always a function of minimizing acreage take. Other important factors such as location, severity and function of the portion taken also may play a role in the decision-making process.

Three primary Section 4(f) activities or features are affected by the Sugarloaf Mountain and Promontory Point Alternatives:

- Recreational opportunities associated with LMNRA
- Recreational opportunities associated with HDNHL
- The historic and cultural values of HDNHL and TCP

Both alternatives improve recreational opportunities at the dam and in the LMNRA by reducing congestion, vehicle-pedestrian conflicts, and environmental impacts associated with truck traffic. Neither alternative permanently restricts access to recreational sites currently in use or planned for use. Neither alternative results in perceptible changes in noise pollution.

Both alternatives cross waters of the Colorado River. However, during the comment period on the DEIS, there was strong public concern regarding the potential for a hazardous material spill in Lake Mead from the Promontory Point bridge. Furthermore, the resource and regulatory agencies, with the exception of the SHPOs who preferred Gold Strike Canyon during early reviews for its lack of visibility from the HDNHL, unanimously supported the Sugarloaf Mountain Alternative due to least impact to wildlife, wildlife habitat, water quality, and jurisdictional waters of the U.S.

The Sugarloaf Mountain Alternative would not impact views of the dam as motorists approach from Arizona or Nevada. Conversely, the Promontory Point Alternative would be directly visible and would detract from the "first impression" historic views of the dam.

Both alternatives would adversely impact the scenic views from the dam crest and Lake Mead. However, the Sugarloaf Mountain Alternative could be blended into the landscape more readily than the Promontory Point Alternative. This is because (1) the Sugarloaf Mountain Alternative deck structure would form a fairly contiguous horizontal line with the canyon rim, (2) the structure would not significantly protrude above the horizon line when viewed from the dam crest, and (3) the structure would not protrude above the horizon line when viewed from Lake Mead. Conversely, the Promontory Point Alternative would be obtrusive and protrude above the strong horizontal component of Lake Mead regardless of bridge type.

Both alternatives would affect the TCP. Both alternatives would be located in previously disturbed portions of the TCP. The Promontory Point Alternative would follow the northern boundary of the TCP along existing U.S. 93, whereas the Sugarloaf Mountain Alternative would traverse a portion of the TCP. Therefore, the Promontory Point Alternative would create less disturbance from a location standpoint. However, the Sugarloaf Mountain Alternative would traverse the southern boundary of the existing disturbed area, and the tribal elders interviewed stated that the integrity of the Sugarloaf TCP has not been diminished by existing disturbance. In addition, impacts due to land disturbance, visual changes, and noise would be mitigated through continuing consultation with Native American tribes and by Native American involvement in the Design Advisory Panel, formed by the Programmatic Agreement.

Therefore, the Sugarloaf Mountain Alternative has been determined to be the harm-minimizing alternative based on the following factors:

- Strong public concern regarding hazardous materials spills in Lake Mead from the Promontory Point Alternative
- Resource and regulatory agency support for Sugarloaf Mountain due to least impact to wildlife, wildlife habitat, and water quality
- No effect on the "first impression" historic views of Hoover Dam
- Ability to more readily blend Sugarloaf Mountain Alternative into the landscape
- Sugarloaf Mountain Alternative traverses the National Register-eligible TCP in an area of extensive disturbance
- Ability to minimize and mitigate impacts through continuing consultation and Native American participation on the Design Advisory Panel

6.7 Measures to Minimize Harm

Following is a description of the measures that will be implemented in an effort to minimize harm to Section 4(f) resources.

6.7.1 Recreation Resources

During the 5- to 6-year construction period for this project, certain recreation activity areas would be designated as construction safety zones and recreation would be limited, or in other places it would be eliminated entirely. Specifically during blasting operations, short periods would occur when recreation access to affected areas must be prohibited for protection of the public. Trail-use regulations within the LMNRA may need to be adjusted to accommodate construction activities and to assure the safety of trail users. Scheduling of these activities would be closely coordinated with the NPS and Reclamation, and there would be ongoing public information provided.

Bicyclists and pedestrians would be prohibited from using the new bridge on any of the bypass alignments. However, the existing crossing would be maintained on the roadway across Hoover Dam.

Construction safety practices would require that nets be used under the work area during construction to protect areas below the bridges from falling debris, tools, equipment, or building materials.

6.7.2 Aesthetics

Cuts, fills, and other construction activities would be performed so as to minimize impact to scenic values, especially in undeveloped areas like Gold Strike Canyon. Mitigation techniques would include rough cuts, feathering cut/natural environmental interfaces, use of artificial desert varnish on rock cuts to match adjacent natural colors, colored concrete, and other state-of-the-art methods (see Chapter 3). Care would be taken to remove all construction debris and other trash from the site as construction is completed.

Excavated topsoil would be stored during construction and replaced on appropriate disturbed areas outside the highway shoulders after construction to aid in re-establishing desert vegetation. Cactus, yucca, and candidate plant species would be removed and replanted, or reseeded in consultation with the NPS. The Programmatic Agreement for historic and cultural properties also specifies that Corridor Design Criteria must be developed for aesthetic consistency of major structural, roadway, and earthwork elements of the bypass.

Specific mitigation measures for the three bypass alternatives, as developed in the EIS Visual Resources Analysis, are as follows:

6.7.2.1 Promontory Point Alternative

In June 2000, FHWA applied the criteria of adverse effect (under 36 CFR 800.5) and determined in consultation with the Nevada and Arizona SHPOs that the Promontory Point Alternative would have an adverse effect on the Hoover Dam NHL because the bypass project would introduce visual elements that diminish the integrity of the significant historic features and setting of the property. Furthermore, FHWA and NPS concluded that the new Promontory Point bridge would adversely affect visitors' historic views of the dam from U.S. 93 in both Nevada and Arizona, and this could not be mitigated. Preliminary opinions of the Nevada and Arizona SHPOs were that the adverse visual effect of the Promontory Point Alternative could not be mitigated.

However, as documented in Chapter 3, impacts on visual resources from the steel truss rib through arch bridge could be lessened by coloring the steel to blend with the surrounding environment.

For a concrete cable-stayed bridge, to reduce the visibility of the pillars on the bridge, the concrete should be tinted with nonglare colors that blend with the surrounding environment. In addition, the cuts for the roadway approaches should be engineered to minimize impacts on visual resources. Any slope protection should be tinted to blend with the surrounding landscape.

For a suspension bridge, to reduce the impacts on visual resources from the bridge, the concrete pillars should be tinted with nonglare colors that blend with the surrounding environment. In addition, the roadway cuts for the roadway approaches should be engineered to minimize impacts on visual resources. Any slope protection should be tinted to blend with the surrounding landscape.

6.7.2.2 Sugarloaf Mountain Alternative (Preferred Alternative)

FHWA also determined in consultation with the Nevada and Arizona SHPOs that the Sugarloaf Mountain Alternative would have an adverse effect on the NHL because the bypass project would introduce visual elements that diminish the integrity of the significant historic features and setting. However, FHWA and NPS concluded that the preferred alternative would not detract from the historic views of the dam as would the Promontory Point Alternative. Measures to minimize the aesthetic/visual impact on the historic setting were developed in consultation with the SHPOs (see Section 6.7.3). Preliminary opinions of the Nevada and Arizona SHPOs were that the adverse effect of the Sugarloaf Mountain Alternative could be mitigated through design features.

Impacts on visual resources from a concrete cable-stayed bridge for the Sugarloaf Mountain Alternative could be reduced by using colored concrete or painting the bridge using a nonglare color that blends with the surrounding environment. However, the closeness of the bridge to the dam would still result in the bridge dominating the downstream view from the dam.

6.7.2.3 Gold Strike Canyon Alternative

Impacts on visual resources from either the concrete deck arch bridge or the steel deck arch bridge would be reduced by coloring the concrete or steel so that the bridge blends more effectively with the surrounding environment. This measure would reduce the visual impact perceived by the hikers, hot spring users, rafters, and other river users near the proposed alignment. No impact on views from either Lake Mead or Hoover Dam would be expected from this alternative.

6.7.3 Cultural and Historic Resources

A PA that commits FHWA to implement specific activities and mitigation measures to resolve the adverse effects on historic properties from the preferred alternative was developed in consultation among ACHP, FHWA, Nevada and Arizona SHPOs, NPS, Reclamation, WAPA, NDOT, ADOT, and interested Native American tribal governments. The PA stipulates, in part, that FHWA will establish a Design Advisory Panel to review bridge design concepts and corridorwide design elements, develop Corridor Design Criteria for aesthetic consistency of major structural, roadway and earthwork elements, mitigate adverse effects on historic resources according to the Secretary of Interior Standards, and minimize adverse effects on the TCP based on specific measures identified in consultation with the Native American tribes, who are invited signatories of the PA.

The PA incorporates a Treatment Plan for avoidance, minimization, and mitigation of adverse effects to historic and cultural properties. The specific mitigation measures in the Treatment Plan for historic resources include documenting the Hoover Dam National Historic Landmark viewshed and related historic features in accordance with the Historic American Engineering Record (HAER) standards, determined in consultation with the NPS/HAER authorities. HAER recordation may include large format photography of affected features, measured drawings where appropriate, reproduction of original design drawings and construction specifications and historic photographs, photography of the property setting, and preparation of an historical context.

Mitigation measures currently identified for the TCP have resulted from the ongoing government-to-government consultation meetings among FHWA, NPS, Reclamation and the Native American tribes. The mitigation measures recommended by the tribes to date

and incorporated in the PA include providing funding to the tribes for continuing consultation through design and construction, providing access for the tribes to the TCP, developing a statement of work for conducting additional studies of cultural landscapes in the surrounding area, and providing Native American cultural interpretive exhibits. (See Section 3.5.3.1 for further details.)

6.7.4 Noise

The Gold Strike Canyon Alternative would require consideration of mitigation measures in the upper reaches of the Gold Strike Canyon Trail along the alignment where the predicted noise levels would be increased by 26 decibels above the ambient noise levels (39 dBA). A modeling/monitoring receptor site (R4/M4) located on the Gold Strike Canyon Trail was used in the analysis of projected noise from the Gold Strike Canyon Alternative. Table 6-2 shows the effects of noise barriers constructed along the trail side of the U.S. 93 Bypass in the vicinity of receptor R4/M4.

Table 6-2
Gold Strike Canyon Alternative
Mitigated Future Peak-Hour Noise Levels (dBA-L_{eq})

Receptor Location	Build, No Mitigation	8-Foot Barrier[a]	10-Foot Barrier	12-Foot Barrier	14-Foot Barrier	16-Foot Barrier
R4/M4	65	59	59	59	59	59

[a]Minimum barrier height required to break the line-of-sight from an 11.5-foot truck exhaust stack and the noise receptor.

Table 6-2 shows that noise barriers located on the outside shoulder of the elevated roadway could reduce noise levels in the affected portion of the hiking trail to 59 dBA-L_{eq} (hourly equivalent sound pressure levels). However, the mitigated noise levels would still result in a substantial increase over existing ambient levels (more than 15 dBA) under NDOT and ADOT noise abatement policies.

Although the noise impact would not be mitigated below this federal and state criterion, an insertion loss of up to 6 dBA would be feasible with the addition of noise barriers. Under noise abatement policies of the FHWA, noise barriers would be constructed only if they are determined to be reasonable and feasible (FHWA, Highway Traffic Noise Analysis and Abatement - Policy and Guidance, June 1995). A 5-dBA noise reduction must be achieved for the noise barriers to be considered feasible, which can be accomplished for the Gold Strike Canyon Trail (as shown in Table 3-11). One reasonableness factor that can be analyzed for recommended barriers is benefit-cost. To achieve the minimum noise reduction of 5 dBA and break the line-of-sight along the portion of the hiking trail impacted by the Gold Strike Canyon Alternative would require construction of approximately 5,170 feet of noise barriers located along about 7,000 feet (1.3 miles) of the roadway. The barriers would begin near the trailhead off U.S. 93 (engineering station 45+50) and end at a major side-canyon/sheep crossing bridge (station 115+50), where the roadway diverges from the main canyon/trail and heads northeasterly (Figure 3-1).

To construct 5,170 feet of noise barriers at a height of 10 feet would cost approximately $1,048,000 (subject to adjustment during final design). The barriers would be placed only on the outside shoulder of the roadways and bridges facing the trail, but not in locations where the trail lies under the elevated roadway. This mitigation cost would benefit the hikers and rock-climbers using this hiking trail to the hot springs. The NPS estimates that

approximately 1,000 hikers currently use the Gold Strike Canyon Trail on an annual basis (Jim Holland, personal communication, July 2, 1998). Thus, the cost of the noise barriers would equate to approximately $1,000 per hiker annually, or about $50 per hiker over a 20-year period.

Although the FHWA noise abatement policy does not have a specific guideline for the number of people to be protected, as compared against the total cost of noise abatement, this is a critical factor in making a determination on the reasonableness of the cost of noise mitigation, and it needs to be considered during selection and design of the preferred project alternative. This cost may not be reasonable considering that the total number of hikers using the Gold Strike Canyon Trail is very small compared to the total number of visitors to the LMNRA (9.7 million in 1997) and since the barriers will not eliminate the substantial increase over existing ambient levels (i.e., more than 15 dBA). Even with mitigation, the projected traffic noise level from U.S. 93 through the canyon would be 20 dBA greater than existing ambient conditions. The final decision on installing noise abatement barriers would be made during completion of project design if the Gold Strike Canyon Alternative were selected in the Record of Decision.

6.7.5 Recreation Resources

Construction safety practices will require that nets be used under the work area during bridge construction to protect areas below from falling debris, tools, equipment, or building materials. Some seasonal and daily blasting restrictions may be imposed throughout the construction period. Restrictions and schedules for blasting will be determined before construction. Construction of the Promontory Point bridge may require access restrictions to Hoover Dam from Lake Mead; however, periodic closures would be coordinated with lake tour operators. Construction of the Sugarloaf Mountain bridge may cause minor interruptions in access for the rafting concession and canoeing put-ins; however, conflicts can be avoided by coordinating launching activities with construction access. Access to the Gold Strike Canyon Trail would be prohibited during all phases of construction and the rafting concession will continue to operate with minor interruptions.

6.8 Coordination

Two agencies have jurisdiction over Section 4(f) lands crossed by the U.S. 93 proposal. The LMNRA is administered by the NPS and the HDNHL is administered by Reclamation as a part of the HDRA.

Reclamation originally proposed the bridge project in 1965, and they issued the Notice of Intent and initiated scoping meetings as the lead agency in 1990. The NPS, as custodian over the park land involved in this proposal, has taken an active role in all planning phases of the proposed project. NPS is a member of the PMT, which was established by Reclamation in 1989 to oversee project planning, environmental studies, design development, and project funding. The PMT is an interagency project management team composed of the NPS, the Arizona and Nevada Divisions of the FHWA, NDOT, ADOT, and Reclamation. Representatives from these agencies attended monthly meetings beginning in November 1989 until Reclamation stopped work in 1993. The PMT meetings were reinitiated in 1997 under the FHWA, Central Federal Lands Highway Division as lead agency. This team has participated in reviews of the project area, environmental studies, preliminary engineering, and the EIS throughout the planning process. The Western Area Power Administration (WAPA), U.S. Army Corps of Engineers, EPA, USFWS, NDOW, and

AGFD have also met with the PMT and have provided input on project alternatives and purpose and need.

Site visits and field interviews with Native American tribal elders were conducted by the University of Arizona during May and June of 1998. This resulted in a draft report concluding that a potentially significant traditional cultural property (TCP) may exist in the vicinity of the bypass project. Following circulation of the draft report, the Nevada SHPO requested that FHWA conduct an ethnohistoric study to provide documentary context for assessing the potential TCP identified during the 1998 field interviews. Further, the Nevada SHPO requested that FHWA commence formal government-to-government consultation with the affected Native American tribes concerning the significance and National Register eligibility of the potential TCP in the project area. The Arizona SHPO also requested further consideration of potential TCPs in the area.

During the first government-to-government consultation meeting, the tribes requested that the 1998 studies be expanded to other locations and include additional tribes and elders. Subsequent studies by the University of Arizona and W & S Consultants and additional government-to-government consultations were conducted in 2000. These efforts resulted in an FHWA determination, and Nevada and Arizona SHPO concurrence, that the Gold Strike Canyon and Sugarloaf Mountain TCP is eligible for listing on the National Register of Historic Places. Continuing government-to-government consultations between FHWA and Native Americans, and Native American participation in the DAP, will be utilized to minimize and mitigate impacts to the TCP.

Consultations between FHWA and the Nevada and Arizona SHPOs resulted in concurrence on the adverse effects of the undertaking on historic properties and signing of a Programmatic Agreement in December 2000. FHWA will continue to consult with the Advisory Council on Historic Preservation, the SHPOs, and other signatories to implement the terms of the PA during the design and construction phases of the Hoover Dam Bypass.

Consultations will also continue with the NPS and Reclamation, as the officials having jurisdiction over the affected Section 4(f) lands, throughout the design and construction phases. As mandated under Section 6(f) of the Land and Water Conservation Fund (LWCF) Act, the NPS must also assure that any conversion of LWCF purchased or improved lands is compensated with replacement lands of equal value, location, and usefulness. In a letter dated April 30, 1998, the FHWA requested information from the following agencies to determine whether any LWCF monies were used to purchase or improve any of the recreational lands potentially impacted by the Hoover Dam Bypass Project: Arizona State Parks, Nevada Division of State Parks, NPS Midwest Support Office (for lands in Arizona), and NPS Great Basin Support Office (for lands in Nevada). The NPS has responded by letter dated May 18, 1998, indicating no LWCF monies were used to purchase or improve any LMNRA lands affected by the project.

6.9 Determination

Based upon the above considerations, there is no feasible and prudent alternative to the use of Section 4(f) land and the proposed action includes all possible planning to minimize harm to the Lake Mead National Recreation Area, the Hoover Dam National Historic Landmark, and the Gold Strike Canyon and Sugarloaf Mountain TCP resulting from such use.

CHAPTER 7

Coordination and Consultation

7.1 Introduction

A Public Involvement Strategy was developed for this project. The strategy was prepared following interviews with 17 key stakeholders to assess information needs and appropriate tools for communicating information about the project and receiving input from the public. Those stakeholders are listed below.

Bill Smith, Boulder City Councilman

Lou Sorenson, Kingman City Manager

Larry Castillo, Mohave County Commissioner

Kevin Hill, Henderson City Councilman

Bruce Woodbury, Clark County Commissioner

Kurt Weinrich, Director
Regional Transportation Commission

Randy Harness, Conservation Chair
Sierra Club

Jim Moore
Nature Conservancy

Joyce Larkin
Hoover Dam Visitor Center

Brad Benson, Chairman
CAUTION

Cheryl Ferrance
Boulder City Chamber of Commerce

Trish Williamson
Public Relations Coordinator
Las Vegas Chamber of Commerce

Ray Chamberlain or Ted Scott
American Trucking Association

Dave Berry
Swift Transportation Company

Terry Smalley
Executive Vice President

Daryl E. Capurro, Managing Director
Nevada Motor Transport Association

David Creer, Executive Director
Utah Motor Transport Association

Stan Randolph, Consultant
California Trucking Association

A total of six project newsletters were distributed for public information. Public participation and comment on potential environmental concerns were encouraged through two of these newsletters, three public open houses, and by providing project-dedicated voice mail and a project web site. Three public hearings were held for public comment on the DEIS in October 1998. Appendix C contains agency correspondence. Volume II contains a detailed description of the DEIS public hearings and the comments received.

7.2 Public Scoping

Following a May 1990 Notice of Intent published in the *Federal Register*, Reclamation initiated the EIS and began the scoping process. Public scoping meetings were held in June 1990 in Kingman, Arizona, and Boulder City and Las Vegas, Nevada. In Boulder City, there was general concurrence that a new crossing was needed to remove traffic from Hoover Dam; however, the public was divided on the solution. Some preferred to have a bypass around Boulder City in addition to Hoover Dam, while others felt that any road that bypassed Boulder City would severely impact downtown businesses. A newsletter, titled *Update*, was published in January 1991 and sent to interested individuals. Interviews with numerous community members and several meetings with interested members of the public, the Boulder City Chamber of Commerce, members of the Boulder City Council, and other organizations also occurred.

7.3 Public Comment Meetings

The FHWA filed a Notice of Intent in September 1997 to announce FHWA as the new lead agency for environmental review of the project. FHWA conducted three public open houses to allow comment on the alternatives carried forward from the June 1990 scoping meetings. The public open houses were noticed in the first newsletter mailed in early October 1997 and in the following newspapers: *Las Vegas Review Journal, Las Vegas Sun, Kingman Miner, Arizona Republic,* and *Boulder City News*. A press release announcing the public open houses was distributed to local media outlets through NDOT and ADOT public affairs offices.

7.3.1 Kingman, Arizona, Public Open House Held October 27, 1997

The first public open house was held in Kingman. The meeting was informal, consisting of six stations with a display board at each station. The display boards included the three proposed alternatives, the project schedule, the environmental review process, and an aerial photograph of the proposed project area. Comments were noted on flip chart pads at each station, and comment sheets were provided as handouts. Comments were varied and included concern for project funding, habitat impacts, existing hazardous roadway conditions, and consideration of a north-south alternative.

7.3.2 Boulder City, Nevada, Public Open House Held October 28, 1997

The second public open house was held in Boulder City. The meeting format was the same as for the Kingman meeting. Public comments were extensive and focused primarily on considering other alternative crossings, specifically those to the south, bypassing Boulder City. Other comments related to mitigation of traffic congestion, pedestrian safety, wildlife impacts, and funding and schedule.

7.3.3 Las Vegas, Nevada, Public Open House Held October 29, 1997

The third and final public open house was held in Las Vegas. The meeting format was the same as for the Kingman and Boulder City meetings. Comments focused on pedestrian safety, truck traffic considerations, visual impacts of a new crossing, project funding, and general support for one of the three alternatives.

7.4 Public Agency Partnering Session Held October 29, 1997

A partnering session with federal, state, and local agencies was conducted early in the project. The session was to inform these agencies of the Project Management Team's direction to complete the environmental review process, discuss individual agency issues and concerns about the project, and develop a partnership and promote communications among the agencies. The session resulted in a Team Charter signed by all participants acknowledging a willingness to work together to achieve the best possible project.

7.5 Project Management Team Meetings

The Project Management Team, described in Chapter 1, met regularly to discuss the project, review interim work products, and provide guidance and direction for preparing the EIS and other permit applications. In 1998 meetings were held on January 20, March 17, and May 12. In 1999, meetings were held on February 9, April 20, June 29, and November 15. In 2000, meetings were held on April 12, June 13, July 11, October 4, and November 30.

7.6 Public Outreach

A project presentation was developed to inform and educate stakeholders and the general public. Presentations to local agencies were given, and letters were sent to local governments and entities offering to give presentations to their staffs and constituents. Copies of these letters are found in Appendix C, Correspondence.

The presentation was made to the Laughlin Town Advisory Board in a public meeting on April 14, 1998. The FHWA Project Manager also presented the project and was available for questions on a live call-in televised program, NDOT Update, broadcast on channels 42 and 63 from Las Vegas on May 15, 1998.

In addition to DEIS public hearings held on October 13, 14, and 15, 1998, presentations about the project and the EIS process were made at annual Transportation Conferences jointly sponsored by the University of Nevada, Las Vegas; the American Society of Civil Engineers; and the Institute of Transportation Engineers in October 1998 and in September 1999. Similar presentations were made at the 1998 and 1999 Annual Statewide Conferences of the Arizona Public Works Association and at the 1999 and 2000 Annual Arizona Conferences on Roads and Streets.

A project web page was developed (http://www.hooverdambypass.org/) to provide project information including details on alternatives, an explanation of the environmental review process, a project schedule, and information material that is developed. An e-mail address was also established (haussler@road.cflhd.gov) for users to provide feedback to the Project Management Team.

7.7 DEIS Public Review and Comment

FHWA initiated public circulation of the DEIS on September 25, 1998, with publication of the Notice of Availability in the *Federal Register*. From October 13 to 15, 1998, FHWA held DEIS public hearings on successive evenings in Kingman, Arizona, and Boulder City and Las Vegas, Nevada. Approximately 250 people attended the DEIS public hearings. The court reporter transcripts of oral comments received at the hearings are included in Volume II of the final EIS (FEIS). The entire DEIS was also made accessible on the project

web site, with an online commenting feature. By November 10, 1998, the close of the DEIS comment period, the web site was accessed over 1,500 times. There were a total of approximately 160 public and agency commenters on the DEIS, including comments received after the close of comment period. See Volume II for a full description of the DEIS public input process, the comments received, and the responses to comments.

7.8 Consultation with Native American Tribes

Amendments to the regulations implementing the NHPA were published on July 1, 1999. These new regulations required initiation of formal government-to-government consultations between FHWA, Reclamation, and NPS with Native American tribes affected by the proposed project. The new regulation requires, in part:

> *...the Agency Official to consult with any Indian tribe...that attaches religious and cultural significance to historic properties that may be affected by an undertaking. Such Indian tribe...shall be a consulting party. The Agency Official shall ensure that consultation in the Section 106 process provides the Indian tribe...a reasonable opportunity to identify its concerns about historic properties, advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, articulate its views on the undertaking's effects on such properties, and participate in the resolution of adverse effects. It is the responsibility of the Agency Official to make a reasonable and good faith effort to identify Indian tribes...that shall be consulted in the Section 106 process. Consultation with an Indian tribe must recognize the government-to-government relationship between the Federal government and Indian tribes. The Agency Official shall consult with representatives designated or identified by the tribal government...(36 CFR 800.2).*

FHWA, in partnership with NPS and Reclamation, began identifying additional Native American tribes with an interest in the Hoover Dam Bypass in late summer through fall 1999. These activities occurred concurrently with consultation meetings held between FHWA, NPS, and Reclamation with the Arizona and Nevada SHPOs and the ACHP; these meetings addressed both the historic preservation issues associated with project impacts on the HDNHL and the Native American tribes' cultural values. FHWA sent out invitations to representatives of 17 tribes on December 9, 1999, requesting their participation in formal consultation meetings on the project. To date, five meetings have been held with the tribal representatives: on January 11, 2000, in Laughlin, Nevada; on March 30, 2000, at the Hoover Dam Visitor Center; on May 8, 2000, in Henderson, Nevada; and on August 15 and 16, 2000, and November 15, 2000, in Boulder City, Nevada. The May 8 meeting was held with a Core Consultation Group, consisting of six tribal representatives, that was delegated by the full assembly of tribes to lead the consultation process with FHWA on their behalf. Attendance by Native American tribal representatives at the government-to-government consultation meetings has ranged from about 25 to 30 participants.

The Agency/Native American government-to-government consultation meetings resulted in a Memorandum of Understanding (MOU) between the tribes and FHWA, and in the tribes being included as invited signatories on the Programmatic Agreement (PA) for treatment of historic properties affected by the Hoover Dam Bypass. The MOU and PA stipulate that the Native American tribes will continue in a formal consultation role with the agency officials involved in the project through its design and implementation.

7.9 Permits

Permits and approvals are required to construct and operate the Hoover Dam Bypass project. Table 7-1 summarizes the agency-regulated activities and required federal, State of Nevada, State of Arizona, Clark County, and Mohave County permits and approvals anticipated to construct and operate the alternatives at Promontory Point, Sugarloaf Mountain, or Gold Strike Canyon.

Table 7-1
Permits and Approvals Anticipated for the Hoover Dam Bypass Project

Agency	Regulated Activity	Required Permit or Approval
Federal		
U.S. Army Corps of Engineers	Discharge of dredge or fill material into U.S. waters	Section 404 Permits
Federal ACHP	Coordination of project design and construction to minimize impacts on historic properties	Programmatic Agreement between FHWA, NSHPO, ASHPO, and ACHP (Section 106 consultation)
U.S. Bureau of Reclamation	Use of additional right-of-way for roadway and bridge	Easement
U.S. Bureau of Reclamation	Water use during construction	Water Use Permit
National Park Service	Acquisition of additional right-of-way for roadway and bridge	Easement
U.S. Coast Guard	Impacts on navigable waters	Section 9 Permit
U.S. EPA	Stormwater discharges	National Pollution Discharge Elimination System (NPDES) Permit
U.S. Fish and Wildlife Service	Impacts on special-status vegetation and wildlife species	Biological Opinion
Nevada State		
Nevada State Historic Preservation Officer (NSHPO)	Impacts on cultural resources	Section 106 Review
Nevada Division of Environmental Protection	Impacts on water quality	Section 401 Water Quality Certification
Nevada Division of Environmental Protection	Construction activities disturbing more than 5 acres of land	General Stormwater Permit for Construction Activities
Nevada Division of Environmental Protection	Discharge to surface waters	National Pollutant Discharge Elimination System Permit
Nevada Division of Environmental Protection	Approval of plans and specifications necessary prior to construction start	Design Review of Plans and Specifications
Nevada Division of Environmental Protection	Discharge to surface waters	Temporary or Permanent Discharge Permit
Nevada Division of Water Resources	Water use during construction	Water Right Permit
Nevada Department of Transportation	Coordination of project design, construction, operation, maintenance, and financing	Memorandum of Agreement between FHWA, NDOT, and ADOT
Nevada Division of Wildlife	Potential disturbance of desert tortoise	Handling Permit

Table 7-1
Permits and Approvals Anticipated for the Hoover Dam Bypass Project

Agency	Regulated Activity	Required Permit or Approval
Nevada Division of Wildlife	Potential impacts on common and special-status wildlife species	Permit
Nevada State Division of State Lands	Acquisition of right-of-way in vicinity of Colorado River (Gold Strike Alternative only)	Easement
Arizona State		
Arizona State Historic Preservation Officer (ASHPO)	Impacts on cultural resources	Section 106 Review
Arizona Department of Environmental Quality or Arizona Department of Water Resources	Impacts on water quality	Section 401 Water Quality Certification
Arizona Department of Environmental Quality or Arizona Department of Water Resources	Construction activities disturbing more than 5 acres of land	General Stormwater Permit for Construction Activities
Arizona Department of Environmental Quality or Arizona Department of Water Resources	Discharge to surface waters	National Pollutant Discharge Elimination System
Arizona Department of Environmental Quality or Arizona Department of Water Resources	Approval of plans and specifications necessary prior to construction start	Design Review of Plans and Specifications
Arizona Department of Environmental Quality or Arizona Department of Water Resources	Discharge to surface waters	Temporary or Permanent Discharge Permit
Arizona Department of Environmental Quality or Arizona Department of Water Resources	Portable air pollution sources	Permit
Arizona Department of Environmental Quality	Classification of construction waste material and transport of solid wastes generated to an ADEQ-approved facility, at the contractor's option	May require facility approval (waste stored onsite more than 90 days)
Arizona Department of Water Resources	Water use during construction	Water Right Permit
Arizona Department of Transportation	Coordination of project design, construction, operation, maintenance, and financing	Memorandum of Agreement between FHWA, NDOT, and ADOT
Arizona Game and Fish Department	Potential impacts on common and special-status wildlife species	Permit
Clark County[a]		
Clark County Health District, Air Pollution Control District	Dust emissions from construction activities	Dust Control Permit
Clark County Health District, Air Pollution Control District	Emissions from portable emissions units used at project construction site; examples include but are not limited to rock crushers, generators, and cement plants	Various Location Permit
Clark County Planning Department	Construction of aboveground structures in Clark County	Use Permit

Table 7-1
Permits and Approvals Anticipated for the Hoover Dam Bypass Project

Agency	Regulated Activity	Required Permit or Approval
Clark County Building Department	Construction of aboveground structures in Clark County	Building Permit
Clark County Department of Public Works and Community Development	Grading at project site	Grading Permit
Clark County Department of Public Works and Community Development	Drainage associated with grading and construction activity	Drainage Study
Mohave County[a]		
Mohave County	Emissions from portable emissions units used at project construction site; examples include but are not limited to rock crushers, generators, and cement plants	Various Location Permit
Mohave County	Construction of aboveground structures in Mohave County	Use Permit
Mohave County	Construction of aboveground structures in Mohave County	Building Permit
Mohave County	Grading at project site	Grading Permit
Mohave County	Drainage associated with grading and construction activity	Drainage Study

[a]The federal government complies with county permitting requirements (personal communication, Kris Mills, Reclamation, July 2, 1998)

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CHAPTER 8

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CHAPTER 9

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CHAPTER 10

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Department of Energy, Las Vegas, NV

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Benson, Ms. Louise, Hualapai Tribe, Peach Springs, AZ

Bowekaty, Mr. Malcomb, Pueblo of Zuni, Zuni, NM

Bradly, Ms. Carmen, Kaibab Paiute Tribe, Fredonia, AZ

Butler, Ms. Elda, Ahamakav Cultural Society, Mohave Valley, AZ

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Chaco, Mr. Paulson, Navajo Nation, Window Rock, AZ

Chavez, Mr. David, Chemehuevi Tribal Council, Havasu Lake, CA

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Drye, Ms. Brenda, Kaibab Paiute Tribe, Fredonia, AZ

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Hayden, Ms. Nancy, Yavapai-Prescott Tribe, Prescott, AZ

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James, Ms. Lynette, Yavapai-Prescott Tribe, Prescott, AZ

Kinlichinia, Ms. Juanita, Moapa Paiute Indian Tribe, Moapa, NV

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Kuyvaya, Ms. Sue, The Hopi Tribe, Kykotsmovi, AZ

Lehi, Mr. Johnny, San Juan Southern Paiute Tribe, Tuba City, AZ

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Miller, Ms. Kami, Moapa Paiute Indian Tribe, Moapa, NV

Miller, Ms. Lalovi, Moapa Paiute Indian Tribe, Moapa, NV

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Mogart, Mr. Terry, The Hopi Tribe, Kykotsmovi, AZ

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Ohte, Mr. Darryl, Moapa Paiute Indian Tribe, Moapa, NV

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Owl, Ms. Pauline, Fort Yuma Quechan Tribal Council, Winterhaven, CA

Panteah, Mr. Loren, Pueblo of Zuni, Zuni, NM

Petach, Ms. Lynn, Chemehuevi, Reseda, CA

Pikyavit, Mr. Benn S., Kaibab Paiute Tribe, Fredonia, AZ

Putesoy, Mr. Matthew, Havasupai Tribe, Supai, AZ

Rice, Mr. Stan Jr., Yavapai-Prescott Tribe, Prescott, AZ

Savala, Ms. Gevene, Kaibab Paiute Tribe, Fredonia, AZ

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Stoffle, Dr. Richard, University of Arizona, Tucson, AZ

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Taylor, Mr. Wayne, The Hopi Tribe, Kykotsmovi, AZ

Tom, Mr. Eugene, Moapa Paiute Indian Tribe, Moapa, NV

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Wilder, Mr. Lonnie, Hualapai Tribe, Peach Springs, AZ

Corporations

Dames & Moore, Phoenix, AZ

Hagler Bailly Services, Inc., Arlington, VA

Haley & Aldrich, Brea, CA

Haley & Aldrich, Denver, CO

Las Vegas Review-Journal, Las Vegas, NV

Vollmer Associates LLP, New York, NY

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Private Individuals

Best, Dr. Wallace H.

Cooper, Bill

Leporati, Arnold

Murray, Sam A.

Plummer, Bill

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Bureau of Reclamation, Phoenix, AZ

NPS, San Francisco, CA

Hoover Dam Bypass
Summary DEIS Distribution
(Prior to November 10, 1998 Close of Comment Period)

Arizona Elected Officials

Governor Jane Dee Hull

Senator Jon Kyl

Senator John McCain

Congressman Bob Stump

Nevada Elected Officials

Governor Bob Miller

Senator Richard Bryan

Senator Harry Reid

Congressman John Ensign

Congressman Jim Gibbons

Organizations

Boulder City Chamber of Commerce, Boulder City, NV

Bullhead City Chamber of Commerce, Bullhead City, AZ

Henderson Chamber of Commerce, Henderson, NV

Kingman Chamber of Commerce, Kingman, AZ

Las Vegas Chamber of Commerce, Las Vegas, NV

Laughlin Chamber of Commerce, Laughlin, NV

Federal, State, and Local Government Agencies

AZ Department of Public Safety, Phoenix, AZ

AZ Department of Water Resources, Phoenix, AZ

AZ State Dept. of Commerce, Phoenix, AZ

AZ State Parks, Phoenix, AZ

Boulder City Council, Boulder City, NV

Bullhead City Manager, Bullhead City, AZ
Bureau of Indian Affairs, Phoenix, AZ

Bureau of Land Management, Las Vegas, NV

Bureau of Land Management, Kingman, AZ

Clark County Public Works Dept, Las Vegas, NV

Henderson City Manager, Henderson, NV

Kingman City Council, Kingman, AZ

Kingman City Manager, Kingman, AZ

Las Vegas City Manager, Las Vegas, NV

Laughlin Town Manager, Laughlin, NV

Mohave County Public Works Dept, Kingman, AZ

NV Commission on Tourism, Las Vegas, NV

NV Planning Commission, Carson City, NV

Regional Transportation Commission, Las Vegas, NV

Southern Nevada Water System, Boulder City, NV

Town Office of Searchlight, Searchlight, NV

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Chemehuevi Tribe, Lake Havasu, CA

Colorado River Indian Tribes, (Chemehuevi) AZ

Hualapai Tribe, Peach Springs, AZ

Kaibab Paiute Tribe, Pipe Springs, AZ

Las Vegas Indian Center, Las Vegas, NV

Las Vegas Indian Tribe, Las Vegas, NV

Moapa Paiute Tribe, Moapa, NV

Paiute Indian Tribes of Utah, Cedar City, UT

Pahrump Paiute Tribe, Pahrump, NV

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Geddie, John

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EcoPlan Associates, Inc., Mesa, AZ

Toll Roads Newsletter, Frederick, MD

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