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**NAVAL PETROLEUM RESERVE NO. 1
(ELK HILLS)
KERN COUNTY, CALIFORNIA**

**SUPPLEMENT TO
FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR CRUDE OIL TRANSPORT**

**ELK HILLS/COALINGA
CONVEYANCE SYSTEM**

**VOLUME 1
PROJECT DESCRIPTION AND IMPACTS**

MAY 1978

U.S. DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR RESOURCE APPLICATIONS
OFFICE OF NAVAL PETROLEUM AND OIL SHALE RESERVES

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SUMMARY

Statement Type () Draft () Final Environmental Impact Statement

(X) Supplement to Final Environmental Impact Statement

Prepared by: Department of Energy, Assistant Secretary for
Resource Applications, Office of Naval Petroleum
and Oil Shale Reserves

Comments to: Captain John Dick-Peddie
Office in Charge of Construction, Elk Hills
P.O. Box 40
San Bruno, California 94066

Title: Crude Oil Conveyance System From Naval Petroleum
Reserve No. 1 (Elk Hills)
Kern County, California to Coalinga, California

Type of Action: (X) Administrative () Legislative

1. Brief Description of Proposed Action: Pursuant to Public Law 94-258, the Naval Petroleum Reserves Production Act of 1976, Naval Petroleum Reserve No. 1 (NPR-1) was opened up for production for a period of 6 years. The Act also directed the government to acquire pipeline capacity from NPR-1 to marketing terminals for 350,000 barrels per day (B/D) of crude oil. Available pipeline capacity in the vicinity of NPR-1 is less than 150,000 B/D and, therefore, the government is planning to construct a new conveyance system to move 200,000 B/D (expandable to 250,000 B/D) of crude oil from NPR-1, to meet the requirements of Public Law 94-258. This Supplement to the Final Environmental Impact Statement (FEIS) covers the actions necessary to construct and operate an alternate pipeline system from NPR-1 to the vicinity of Coalinga for connection with existing pipelines leading to the San Francisco Bay area. These existing pipelines do not, however, have sufficient available capacity to handle all of the NPR-1 crude oil. In addition, technical and economic problems are associated with the use of these existing pipelines for transporting NPR-1 crude oil. These problems include those associated with heated pipelines, conversion of pipelines from noncommon-carrier status, and the capital costs of expanding pipeline capacities.

The Draft Environmental Impact Statement (DEIS) on crude oil transport which included the alternative conveyance system to Coalinga was published on April 18, 1977. The Final Environmental Impact Statement was filed on September 16, 1977. During the public review of the DEIS, there were a number of strongly worded objections to the proposed intermediate tank farms and connection with existing systems for loading

tankers on the San Luis Obispo County coast. The intermediate tank farms and connections with existing pipelines leading to the San Luis Obispo coast have, therefore, been deleted from the proposed alternative project in this Supplement.

2. Summary of Environmental Impacts and Adverse Effects: Positive impacts of the project would be increased local employment and economic activity. This project and the production of crude oil from NPR-1, would make available additional domestic crude oil for the national supply, though this would represent a true increase in domestic crude oil production only if the west coast surplus situation is resolved. Otherwise, the increase due to Elk Hills production would be offset by a corresponding decrease in other California crude oil production. The adverse effects associated with the project would be generally short term, although some increase in hydrocarbon emissions, loss of vegetation, displacement of some other California crude oil supplies, and visual intrusion would be long-lasting. The loss of vegetation would indirectly affect the endangered San Joaquin kit fox by disturbing small portions of its feeding habitat. The displacement of other California crude oil production would occur since the Elk Hills oil marketed in California would be more competitive economically. More specifically, the provision of adequate pipeline capacity for handling all of the Elk Hills oil north of Coalinga would cause the displaced California crude oil to be unable to reach any existing markets. Possible adverse operational effects would include the risk of large (greater than 1,000 barrels) spills of crude oil along the pipeline. These would largely involve existing disturbed or cultivated areas. Implementation of proper mitigation measures would eliminate or reduce these and other possible effects.

3. Alternatives Considered: Alternatives to the proposed project include:

- o conveyance systems to the SOHIO and/or ARCO Four Corners pipeline
- o conveyance system to Port Hueneme (no longer considered feasible due to environmental problems and incompatibility with other operations)
- o unit trains
- o increased local uses
- o changes within the proposed facilities
- o addition of intermediate tank farms and connection with existing pipelines leading to the San Luis Obispo County coast for tanker loading

- o construction of the proposed project, but postponement of use
- o postponement of construction
- o project cancellation

The postponement and cancellation alternatives would require modification of existing legislation in Public Law 94-258.

4. Comments Requested: The following agencies and organizations have received copies of the Final EIS.

Congressional

Senator Alan Cranston
 Senator S. I. Hayakawa
 Senator John C. Stennis
 Senator Henry M. Jackson
 Congressman B. F. Sisk
 Congressman Leon E. Panetta
 Congressman John H. Krebs
 Congressman William M. Ketchum
 Congressman Robert J. Lagomarsino
 Congressman Barry M. Goldwater, Jr.
 Congressman James F. Lloyd
 Congressman George E. Brown, Jr.
 Congressman Shirley N. Pettis
 Congressman Melvin Price
 Congressman Morris K. Udall

Federal

Department of Agriculture
 Soil Conservation Service (D.C. and Bakersfield)
 Department of Commerce
 Assistant Secretary for Science and Technology
 Deputy Assistant Secretary for Environmental Affairs
 (5 copies)
 National Oceanographic and Atmospheric Agency

 Department of Health, Education and Welfare
 Department of Housing and Urban Development
 Environmental and Land-Use Planning Division
 Regional Administration (Region IX)
 Department of Interior
 Office of Environmental Project Review (20 copies)

 Department of Labor (Occupational Health and Safety)
 Department of Transportation
 Office of Pipeline Safety

Advisory Council on Historic Preservation
Council on Environmental Quality
Environmental Protection Agency (10 copies)
U.S. Water Resources Council

State

State of California
Office of Planning and Research
State Clearing House
Metropolitan Transportation Commission
University of California at Riverside (Archaeological
Research Unit)

Regional

South Coast Air Quality Management District
Metropolitan Zone
District Headquarters
Southern California Association of Governments

Local

Fresno County Planning Department
Kings County Planning Department
Kern County Planning Department
San Luis Obispo County Office of Environmental Coordination
Santa Barbara County Planning Department
Ventura County Planning Department
Los Angeles County Department of Regional Planning
Los Angeles County Board of Supervisors
San Bernardino County Planning Department
Los Angeles Natural History County Museum
Southern California Association of Governments
Fresno County Council of Governments
Kern County Council of Governments
Ventura Regional County Sanitation District
Ventura County Air Pollution Control District
Kern County Air Pollution Control District
Fresno County Air Pollution Control District
San Luis Obispo County Air Pollution Control District
Kings County Air Pollution Control District
Port of Long Beach
South Coast Air Quality Management District
City of Camarillo Department of Environmental Affairs
City of Coalinga
City of Taft
City of Ventura
Los Angeles Department of Airports

City of Oxnard
City of Port Hueneme
City of Palmdale
City of San Bernardino
City of Simi Valley Department of Environmental Affairs
City of Colton
City of Thousand Oaks Department of Environmental Affairs
City of Bakersfield
City of Rialto
Oxnard Harbor District
City of Victorville
Coalinga Unified School District Library
Frenso County Public Library
Avenal Branch Library
Kings County Library
Taft Branch Library
Kern County Library
San Luis Obispo County Library
San Luis Obispo County Library, Avila Beach Branch
Santa Barbara Public Library
Ventura County Library Services Agency
Simi Valley Branch, Ventura County Library
Oxnard Public Library
Port Hueneme Library
Palmdale Library
Los Angeles County Public Library
Lancaster Public Library
Littlerock Public Library
Victorville Public Library
Huntington Beach Public Library
Bakersfield Public Library
San Bernardino County Library
Colton Public Library
Riverside Municipal Museum
San Bernardino County Museum

Other Groups

Antelope Valley College, Department of Archaeology
Bloomington Municipal Advisory Council
California Chamber of Commerce
League of Women Voters, San Luis Obispo and Riverside
League of California Cities
California Institute of Man in Nature
Environmental Information Center
Environmental Policy Committee
California Marine Affairs and Navigation Conference
California Wildlife Federation
Planning and Conservation League

National Resources Defense Council, Inc.
The Wilderness Society
Environmental Defense Fund
Friends of the Earth (California and National)
National Wildlife Federation
Izaak Walton League of America
Audubon Naturalist Society
Sierra Club (San Francisco, Los Angeles, Santa Lucia, and
Gorgonio Chapters)
Western Oil and Gas Association
Pipe Line Technologists
R. M. Parsons Company, Atten: Mr. Thomas Hare
Pace Corporation
Exxon Pipeline Company, Houston, Texas, Attn: Mr. T. Parish
SOHIO Transportation Company, Cleveland, Ohio, Attn: Mr. Fred
Garibaldi
Center for Urban Affairs, Northwestern University, Evanston,
Illinois, Attn: H. Paul Friesema
Tejon Ranch Company, Attn: Mr. Dennis McCarthy
Wrightwood Chamber of Commerce
University of California, Santa Barbara, Department of
Anthropology, Attn: M. Glassow
Phelan Elementary School, P.O. Box 78, Phelan
Phelan Chamber of Commerce
Environmental Center, San Luis Obispo
Clean Air Coalition, San Luis Obispo
Tetra Tech, Inc.
Mission Coast Lung Association
Save Our Coast Coalition
South Bay Conservation Group
Tri-County Conservation League
Atlantic Richfield Company, Transportation Division
Beacon Oil Company
Chevron U.S.A. Inc.
Desert Wide Real Estate, Inc.
Hunt Realty, Inc.
Ben Oman Company
Palmdale Board of Realtors, Inc.

5. Comments Received: Letters from the preceeding agencies, organizations, and individuals and responses to comments made in these letters are included in Volume II.

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I. INTRODUCTION

PART ONE - COALINGA LINE

I. INTRODUCTION

A. Project Description

1. Purpose

The purpose of this document is to provide a supplement to the Final Environmental Impact Statement (FEIS), Crude Oil Transport from Naval Petroleum Reserve No. 1 (NPR-1), Tupman, California, Elk Hills/SOHIO Pipeline Connection Conveyance System, filed on September 16, 1977. The Draft Environmental Impact Statement (DEIS) on Crude Oil Transport from NPR-1 (filed on April 22, 1977) included complete assessment of alternative routes to Coalinga and Port Hueneme as well as the route for connection with the SOHIO Pipeline. Both the Coalinga and Port Hueneme alternatives would deliver the crude oil to California markets where a crude oil surplus situation exists. The SOHIO Pipeline Connection alternative would deliver the crude oil to the central United States where crude oil is in demand and this route, therefore, was favored and carried forward to the FEIS stage. Since questions have been raised concerning the complete reliance placed on the SOHIO Pipeline, this supplement to the FEIS has been prepared to present the Coalinga route alternative.

2. Approach

The approach of this supplement is to present a complete analysis for the Coalinga route in essentially the same format as the FEIS. This supplement is not meant to be a complete environmental impact statement by itself. It is meant to supplement the previously published DEIS and FEIS. Public review of the DEIS covering the Coalinga route resulted in a number of strongly worded objections to the portion of the project including the proposed intermediate tank farms and connection with existing systems for loading tankers on the San Luis Obispo County coast. This portion of the project has, therefore, been deleted from the proposed alternative project in this supplement.

3. Background

The Secretary of the Navy was directed by Congress in Public Law 94-258, the Naval Petroleum Reserve Production Act of 1976, to secure pipeline capacity for not less than 350,000 barrels per day (B/D) of crude oil from Naval Petroleum Reserve No. 1 (NPR-1), Kern County, California, in the Elk Hills area (Fig. 1-1) to a marketing terminal by April 1979. In addition, petroleum production at NPR-1 is to proceed at the maximum efficient rate consistent with sound engineering practices for a period not to exceed 6 years, at the end of which the President with the approval of Congress may extend the production period for additional periods not to exceed 3 years each. Pipeline capacity available for transporting crude oil out of NPR-1 is less than 150,000 B/D (Fig. 1-2) and, therefore, a new conveyance system capable of transporting up to 250,000 B/D of crude from Elk Hills is being proposed to carry out the Congressional mandate.

As of October 1, 1977, the newly created Department of Energy (DOE) has taken over responsibility from the Navy for the production and conveyance of crude petroleum from NPR-1.

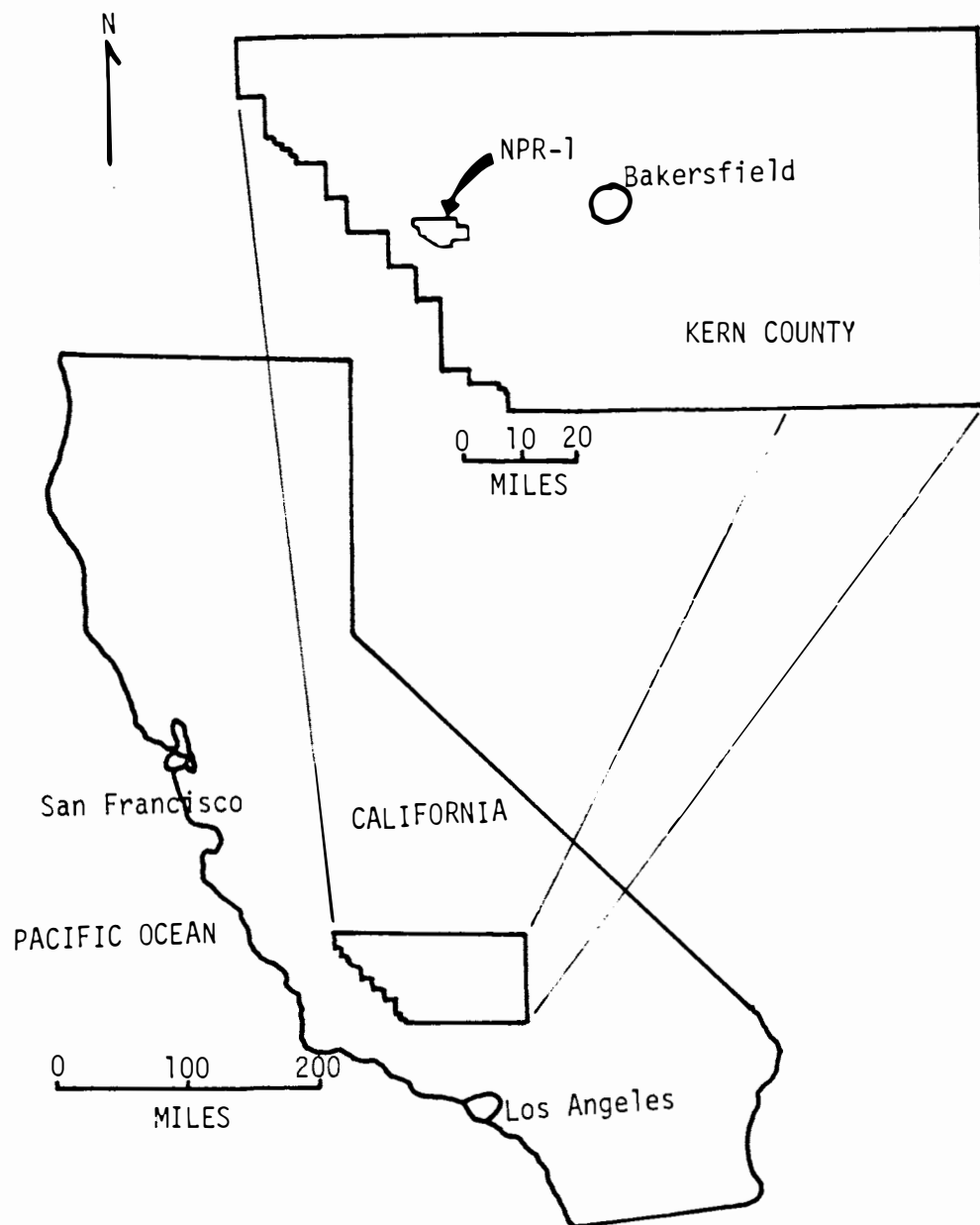


Figure 1-1. Location of the U.S. Naval Petroleum Reserve No. 1 at Elk Hills, Kern County, California.
Source: U.S. Navy

The environmental review process on the conveyance of crude oil from NPR-1 was begun in June 1976 when a preliminary Environmental Assessment (EA) was prepared for four conveyance alternatives. The four alternatives consisted of a system of railroad/truck transport of crude oil and three new buried pipelines: (1) northward to Coalinga, California, (2) westward to a Navy marine terminal at Port Hueneme, California, and (3) southward to a connection with the proposed SOHIO Pipeline in the vicinity of Rialto, California.

The three pipeline alternatives were selected for further environmental study; the rail/truck transport alternative was considered infeasible for the quantity of crude oil to be conveyed. A DEIS of the pipeline alternatives was published in three parts in April 1977. The DEIS contains a full environmental inventory of the study area as well as an environmental impact evaluation of the originally proposed project. Public hearings on each of these three conveyance alternatives were held in the communities of Coalinga, Bakersfield, Taft, San Luis Obispo, Oxnard, San Bernardino, and Palmdale in May and June 1977.

As a result of the review of comments received both in writing and at public hearings it became apparent that the environmental problems associated with the Coalinga and Port Hueneme alternatives were significantly more difficult to deal with than those of the SOHIO connection, particularly with regard to air quality impacts from loading crude oil at marine terminal loading facilities. Taking into consideration the environmental impacts as well as the expected surplus of crude oil in the California area when Alaska oil begins arriving at full projected capacity, the government decided the proposed tie-in to the SOHIO Pipeline would be the preferred method of marketing crude oil from NPR-1. It is believed that implementation of this alternative would maximize distribution of the government's oil to the central and eastern regions at the least possible transportation cost, and with the least environmental impact. Furthermore, this alternative would allow the government's

share of the oil produced at NPR-1 to be placed in storage facilities of the Strategic Petroleum Reserve to be located on the Gulf Coast, should the President so direct, pursuant to Public Law 94-258.

The FEIS on the Pipeline Conveyance System was published in two volumes in September 1977. Volume I contains the project description and environmental impact analysis; Volume II contains written and public hearing comments on the DEIS and responses to these comments. The environmental impact analysis contained in the FEIS reflects the project design changes instituted as a result of the public review.

After the FEIS was published, continuing questions on placing complete reliance on the SOHIO Pipeline made it apparent that a supplement to the FEIS covering the next best conveyance system would have to be prepared. As stated in the opening paragraph, this supplement provides the environmental analysis of the Coalinga conveyance system. This supplement consists of two volumes, similar to the FEIS.

4. Project and Project Modifications

The proposed action would include construction of facilities to store 1,250,000 barrels of crude oil at Elk Hills, pump 200,000 B/D (expandable to 250,000 B/D) of crude in a new underground pipeline to the vicinity of Coalinga (Fig. 1-3), and store 1,000,000 barrels of crude in the Coalinga area. At one time, this action also included intermediate storage facilities at Junction Station and Kettleman City which could feed existing oil pipelines leading to the coast at Avila Beach and Estero Bay. This coastal leg of the project, however, was ultimately dropped as a part of the proposed project due to the environmental problems associated with it (it is considered among project alternatives in Section V). Any purchaser desiring crude oil from the Elk Hills/Coalinga Conveyance System at some intermediate point between Elk Hills and Coalinga would have to arrange for connection, storage, and transportation through a new or existing pipeline system. Any other purchaser

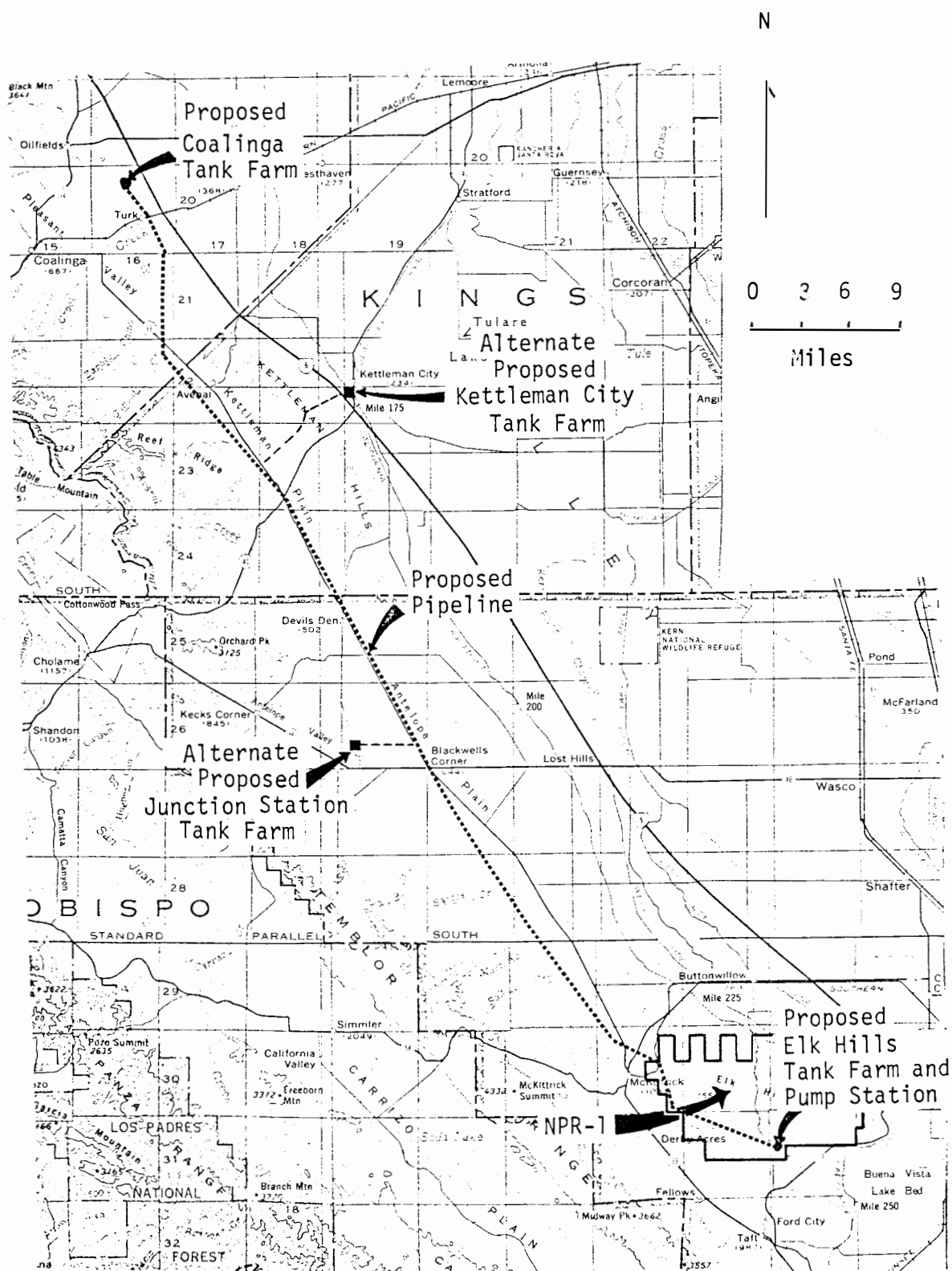


Figure 1-3. Regional Location of Tank Farms, Pump Station, and Pipeline of Elk Hills/Coalinga Conveyance System.

Source: U.S. Geological Survey; State of California, South Half, scale 1:500,000.

of Elk Hills crude oil would have to arrange for storage and transportation from the Coalinga Tank Farm through one of the existing pipeline systems in the Coalinga area or arrange for construction and operation of a new pipeline. While there is more than enough existing pipeline capacity leading northward from Coalinga to handle all of the Elk Hills crude oil, these existing pipeline systems are being used at close to capacity at this time and are projected to be even more fully used in the future. There is some fluctuation in the use of these pipelines and some potential for capacity expansion, but even under the best of conditions, the available pipeline capacity would be insufficient to handle all of the Elk Hills oil. If adequate capacity were made available for all of the Elk Hills crude oil, the result would be displacement of other California crude oil, which would then be unable to reach markets.

This document does not include: (1) production of the crude oil at the Naval Petroleum Reserve No. 1 oil field; and (2) processing and transportation of this crude oil from the oil field and intermediate storage to the Elk Hills Tank Farm serving the Coalinga Pipeline. Environmental assessment of these items is covered in a separate document. Transportation of the crude oil out of the Coalinga area to markets is not included since full details of these markets are not yet defined.

Each of the tank farms would include floating-roof tanks with primary, metallic, shoe-type seals and secondary seals extending from the tank shell to the roof, interconnecting piping, a pump station, metering equipment, control equipment, and accessories. The pipeline to Coalinga would include approximately 85 miles of 30-inch pipe and associated control valves, with no intermediate pump station.

5. Description of Proposed Facilities

a. Elk Hills Tank Farm

The tank farm site would be located in Kern County, California, on government property within the Naval Petroleum Reserve No. 1 (Fig. 1-1). More specifically, the site would be within Section 18, Township 31S and Range 24E, on the southern edge of the NPR-1 (Fig. 1-4). The tank farm would be primarily within the northwest quadrant of Section 18, west of the existing Lease Automatic Custody Transfer (LACT) station and next to the Elk Hills Road (Fig. 1-5).

The tank farm would include five 250,000-barrel storage tanks constructed aboveground, interconnecting pipes and valves, and containment berms surrounding the tanks (Fig. 1-6). The tanks would be welded steel, 210 feet in diameter, and 40 feet high. Each tank would have a floating roof, equipped with primary and secondary seals. Piping would connect each tank with the NPR-1 production facility and the outgoing pump station. Each tank would be surrounded by an earthen berm (with erosion protection) 6 feet high with containment volume of 110 percent of tank capacity. Equipment access would be provided by one-lane ramps over the containment berms. Vehicle access would be provided by a road system internal to the tank farm. Oily water and storm water within the bermed areas would be treated with an oil/water separator within the tank farm. Separated water would be discharged to natural drainage channels and the collected oil transferred to storage tanks. Storm water outside of bermed areas would be directed to natural drainage channels.

The tank farm design would permit segregated storage of two basic types of crude oil from two depths within the Elk Hills field (the Shallow Oil Zone and the Stevens Zone). Physical characteristics of the crudes from these zones are different (Appendix B) and project plans

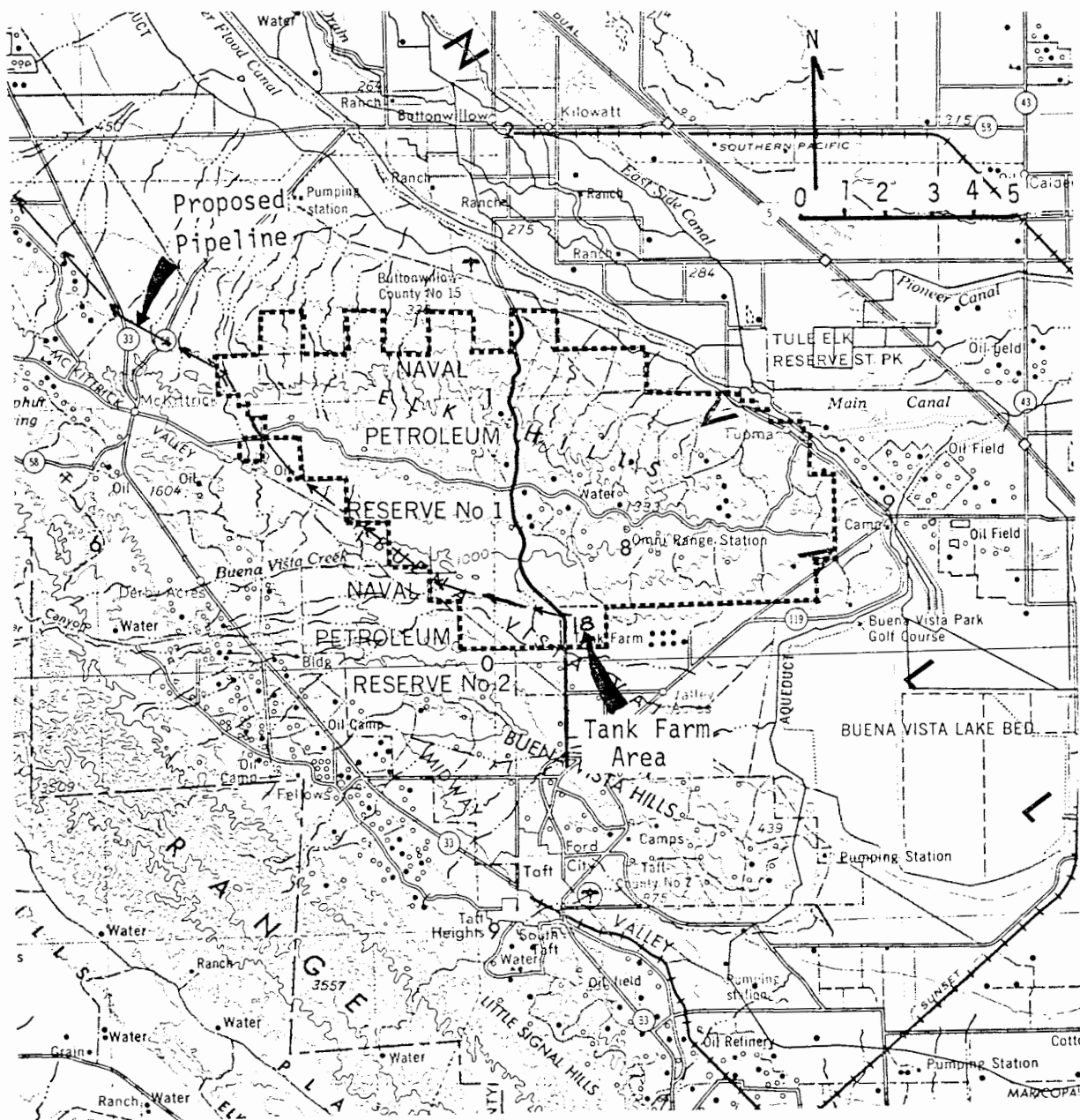


Figure 1-4. General Location and Boundary of Elk Hills Naval Petroleum Reserve No. 1

Source: U.S. Geological Survey, Bakersfield, scale 1:250,000.

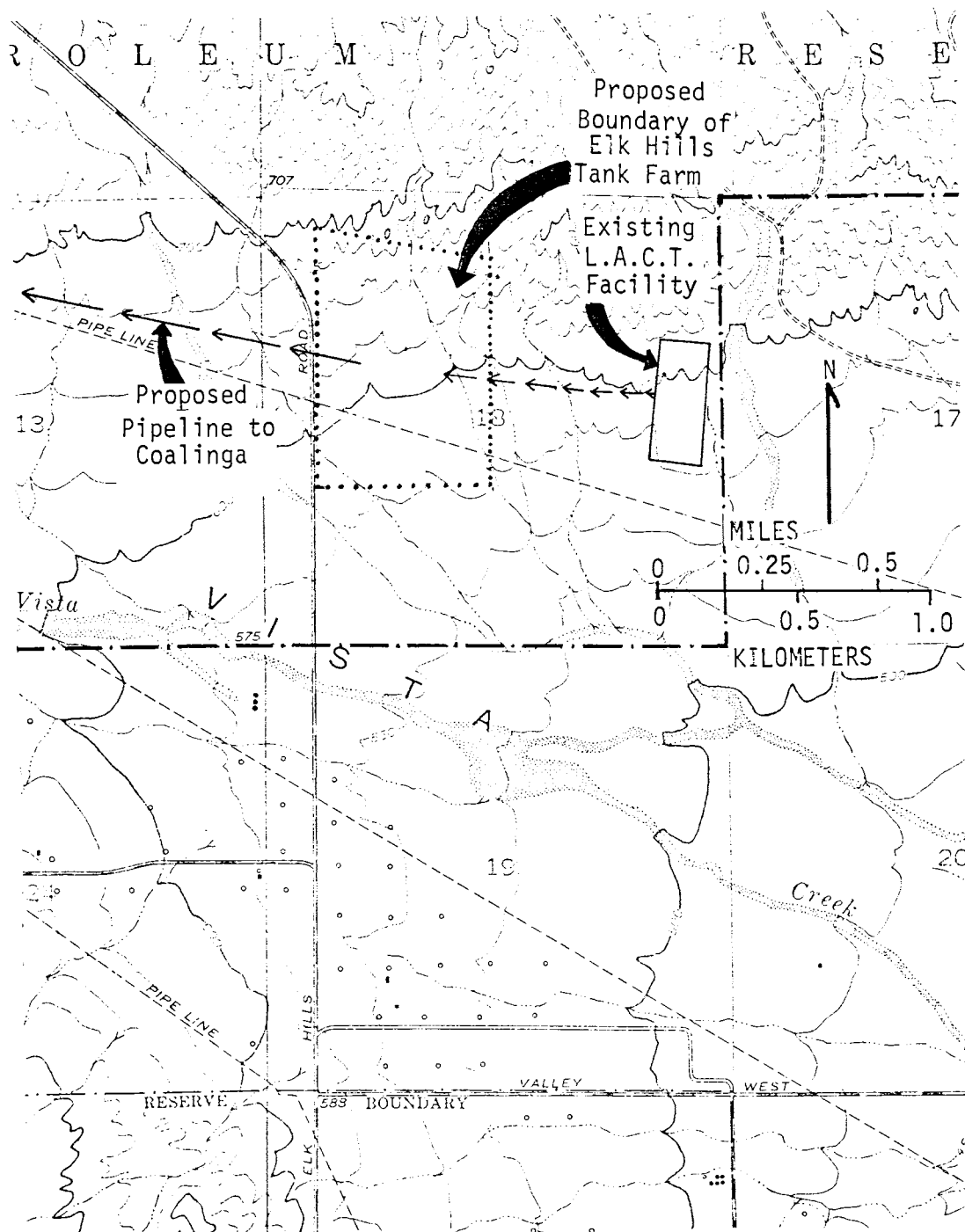


Figure 1-5. Local Area Map of Proposed Elk Hills Tank Farm Site.
Source: U.S. Geological Survey, Taft Quad.

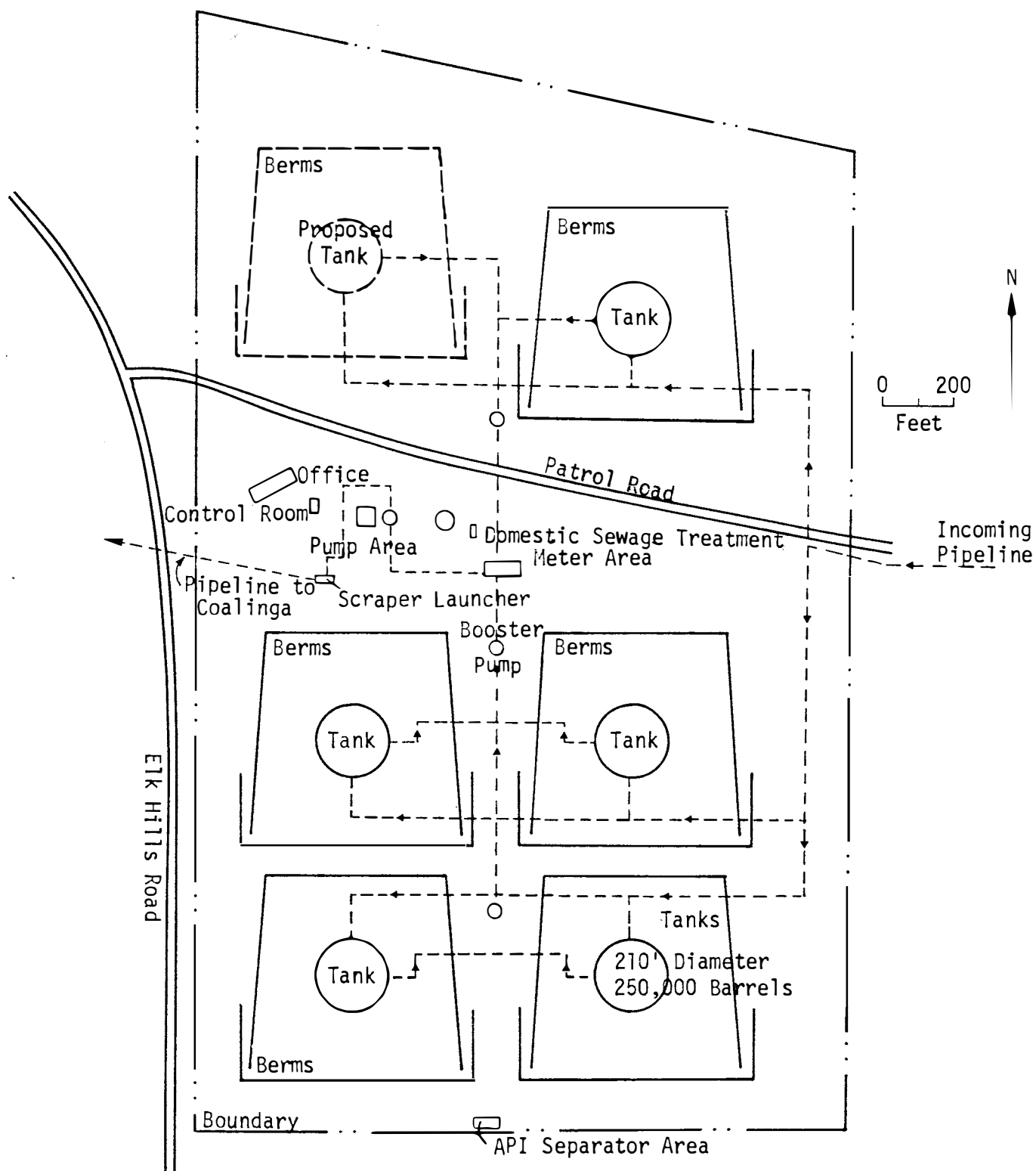


Figure 1-6. Schematic Plan of Facilities at Elk Hills Tank Farm, Naval Reserve No. 1 (Section 18).

Source: Pipe Line Technologists, 1977.

provide for separate storage and ultimate sale of each of the two crude oils. Segregated storage for 20 percent of the total storage as Shallow Oil Zone crude and 80 percent as Stevens Zone crude would be accommodated. Adjacent to the tankage would be located the following equipment and support facilities: (1) transfer/charge pumps; (2) metering station; (3) main line pumps and scraper launcher; (4) Central Control Building with control instrumentation, monitoring equipment, and communications; (5) maintenance and warehouse building; and (6) auxiliary equipment. All pumps would be electrically powered.

Transfer/charge pumps would receive crude oil from storage through a manifold suction system with appropriate valve system to select draw-off from the storage tank or tanks. Normal operation would require one or two pumps on with one off (standby). These pumps would pump through the metering station to the main line pump station. The capability would be to transport 200,000 B/D of crude, expandable to 250,000 B/D with added pumps. Detailed pump and driver characteristics are described in Appendix B. The main line pump station would have three pumps, two to normally operate in series with one standby.

Control, monitoring and telemeter communications of tank farm and pipeline activities would be integrated into a total system control panel located in the Central Control Building at the Elk Hills site. System operating information from the Coalinga tank farm site would also be monitored at this location.

Electrical service would be provided from a new substation located at or near the site. A 4,160-volt system, with appropriate accessories, would power the main line pumps and a 480 volt step-down transformer would provide power for the transfer/charge pumps and all other electrically driven equipment.

b. Elk Hills to Coalinga Pipeline

The Elk Hills to Coalinga Pipeline would leave the Elk Hills Tank Farm at its west perimeter and continue northwesterly for approximately 84 miles to the Coalinga area. The actual route is shown on Figure 1-3 and is given in the Project and Environmental Atlas, Appendix C. Major features along the route are included below with distance expressed as Mile Post (M.P.) or the miles along the pipeline from Elk Hills:

<u>M.P.</u>	<u>Features</u>
0	Manual block valve and check valve
8.7	Underboring Skyline Road
12	Underboring State Highway 58
12.2	Remotely operated block valve
13.3	Underboring State Highway 33
16.7	Underboring Cymric Road
17.9	Manual block valve and check valve
18.7	Underboring Lokern Road
19.6	Salt Creek
22.5	Underboring Seventh Standard Road
22.9	Chico Martinez Creek
26.6	Santos Creek
26.8	Check Valve
35	Remotely operated block valve
36.8	Blackwells Corner. Underboring State Highway 46

<u>M. P.</u>	<u>Features</u>
41.1	Manual block valve
46	Underboring Twisselman Road. Check Valve
48.9	Remotely operated block valve Devils Den Canal overcrossing
58.4	Check Valve. Underboring State Highway 41
63.2	Big Tar Creek. Check Valve
67	Underboring Big Tar Canyon Road
70.7	Garza Creek
71.7	Canoas Creek
77.2	Remotely operated block valve Zapato Chino Creek
79	Underboring Jayne Avenue
81-82	Los Gatos Creek. Underboring Phelps Avenue
84	Back pressure control valve system. Coalinga Tank Farm

Accessory facilities for the main pipeline would include three manual block valves (completely stops flow in both directions when closed), four remotely operated block valves, six check valves (completely stops flow in direction opposite to pumping direction), one pressure reducing valve system, metering equipment, scraping equipment for line cleaning, and a telecommunications system for pump and valve control.

c. Coalinga Tank Farm

The Coalinga tank farm site would be located in Fresno County, 8 miles northeast of Coalinga and within the northwest quadrant of Section 9, Township 20S and Range 16E, west of Highway 5, and directly south of Palmer Avenue and the Caliola Pumping Station tank farm (Fig. 1-7).

The Coalinga Tank Farm (Fig. 1-8) would receive crude oil from the pipeline and provide 1,250,000 barrel storage in tankage similar to the tank farm at Elk Hills, five tanks of 250,000 barrel capacity each (one for Shallow Oil Zone crude and four for Stevens Zone crude) with each tank 210 feet in diameter and 40 feet high. The receiving system would include a controlled metering station into storage with all necessary manifolding and valving to place the incoming crude in appropriate tanks. The receiving meter station would be similar to the one at Elk Hills with the same monitoring and control capability, including leak detection telemeter transmission. The delivery system would include an output metering station and interconnecting piping with pumps capable of delivering 250,000 B/D of crude to existing crude oil lines near Coalinga leading to the San Francisco Bay Area (e.g., Chevron USA, Inc., Union Oil Company of California, and Getty Oil Company).

d. Connection with Existing Pipelines in Coalinga Area

Several existing pipeline systems in the vicinity of the proposed Coalinga Tank Farm transport crude oil to the San Francisco Bay Area. Before use of these pipelines can be made by Elk Hills oil, however, a number of difficulties would have to be overcome. The most immediate difficulty is the fact that whereas the existing pipeline capacity would be more than enough to handle the Elk Hills oil, the available (unused) capacity would be insufficient for all of it. If sufficient capacity were made available to transport all of the Elk Hills crude oil, other California

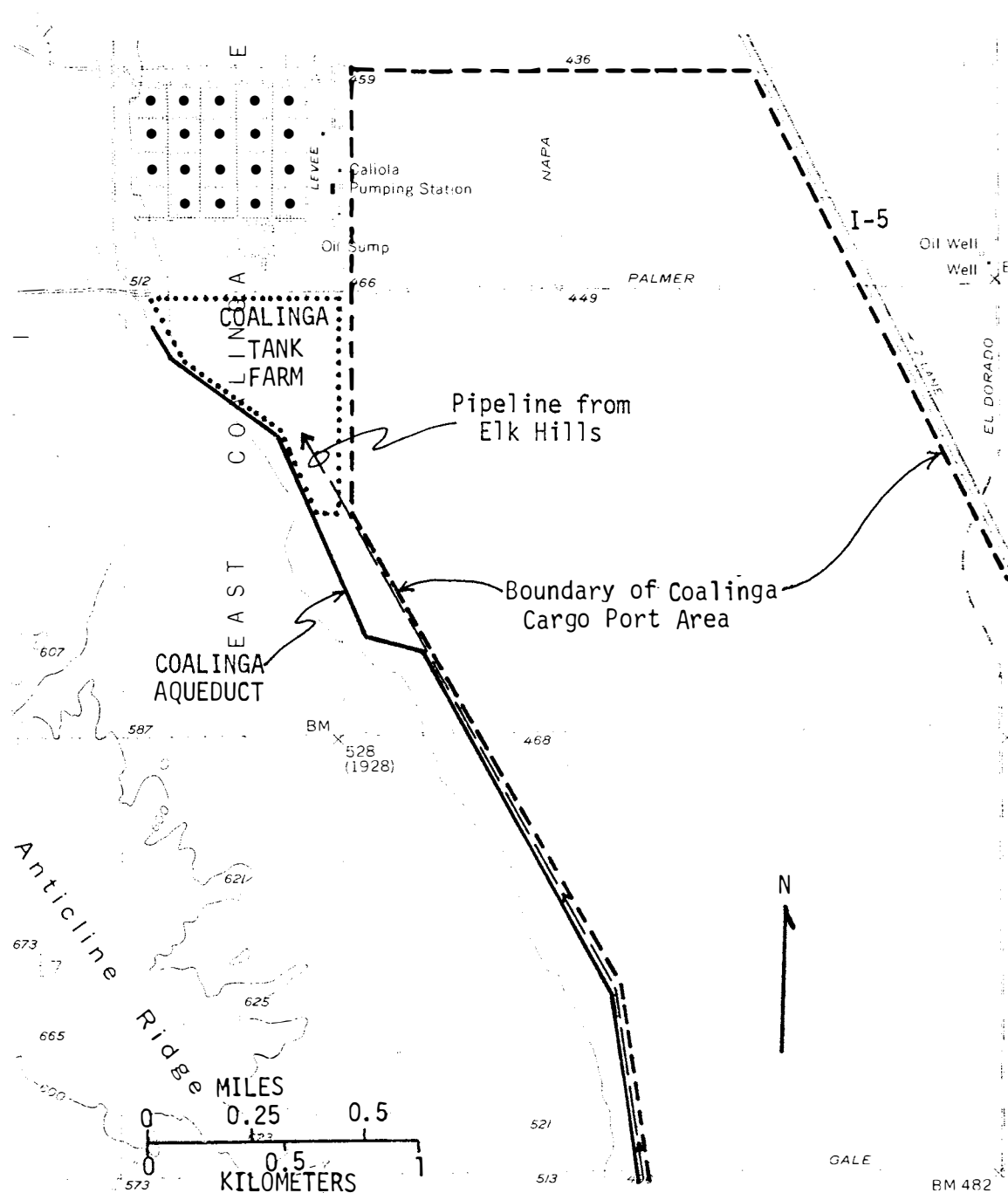


Figure 1-7. Local Area Map of Coalinga Tank Farm Site.
Source: U.S. Geological Survey, Gujarral Hills Quadrant.

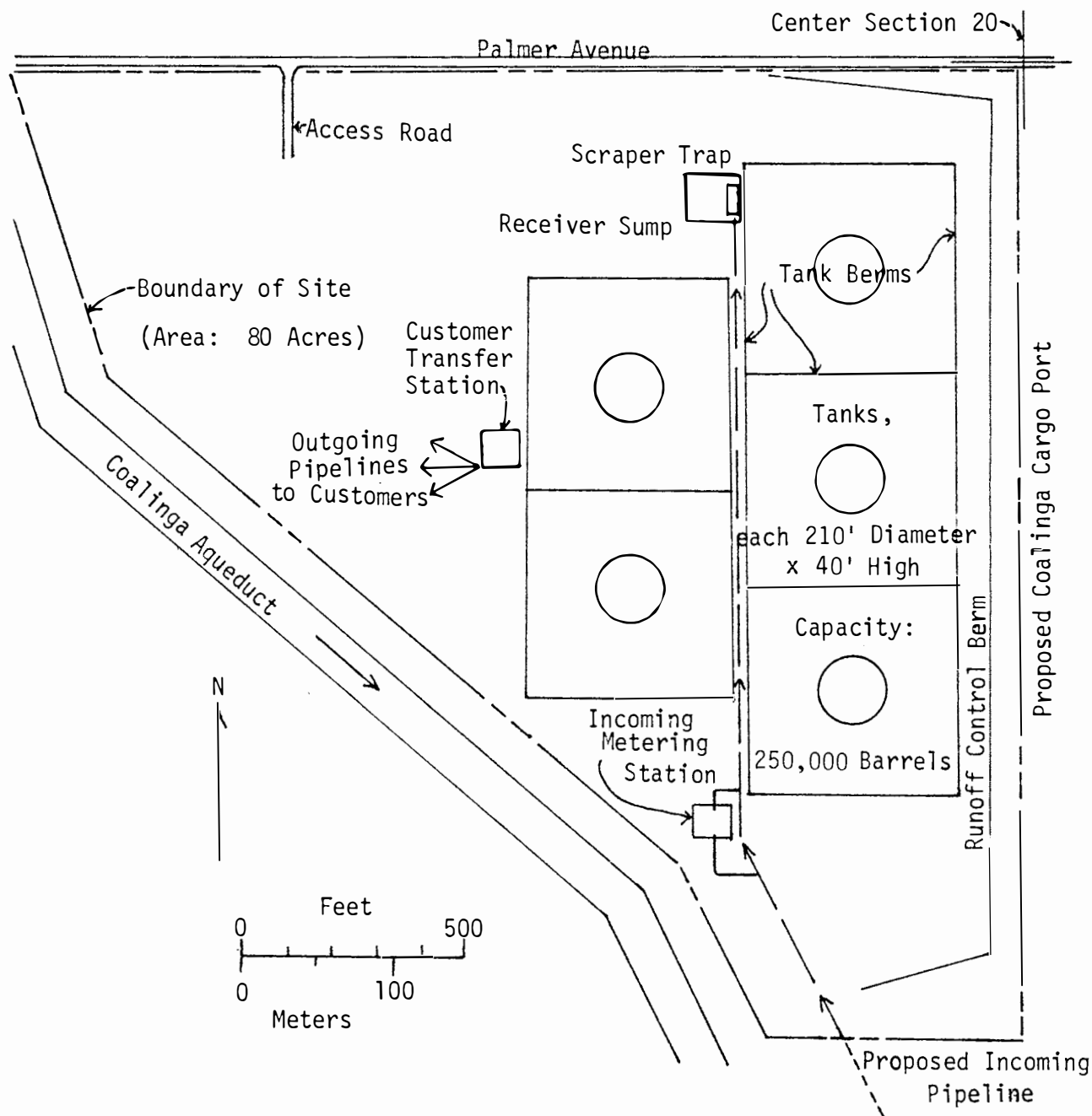


Figure 1-8. Layout of Facilities at Proposed Coalinga Tank Farm.
Source: URS Company, 1977.

oil would be displaced and unable to reach markets. Other difficulties are related to the present mode of operation of the existing pipeline systems. One of the systems operates a heated crude oil line. Presumably, the Shallow Oil Zone crude could be shipped heated, but technical difficulties may prevent the Stevens Zone oil from being transported hot. In any event, heated transport would add significantly to the cost of Elk Hills oil and is not technically required. In addition, two of the systems presently do not operate their pipelines on a common carrier basis. Use of such systems would require resolution of this noncommon-carrier basis as well as an appropriate throughput agreement. Another of the systems (Chevron) has its pipeline in the vicinity of Coalinga, but the pump station is near Kettleman City. Use of this system would require a lateral pipeline leading to this pump station for connection. Finally, three of the existing systems could physically expand pipeline capacity in the future. Such expansion would involve significant capital investments which the government would have to provide (totally or partially) if it wished to use such capacity. Even with these expansions, however, the Elk Hills oil would not be accommodated without displacing other California crude oils.

6. Summary of Land Requirements

Total land requirements include both those lands acquired and dedicated for continuing use of the tank farms and those acquired as easements for the pipelines. The Elk Hills Tank Farm would be on land presently controlled by the government and the other tank farms would be on private land. The pipeline corridor generally would cross private lands except for the portions within government property at Elk Hills, at public streets, roads, and highways, within special public districts (flood control and water), and within three small parcels of land administered by the Bureau of Land Management. The private lands which would be acquired would either be purchased or acquired by condemnation.

The tank farms would require the following land: Elk Hills - 110 acres; Coalinga - 80 acres. The pipeline right-of-way for construction and operation would be 50 feet wide, or about 6.1 acres per mile of pipeline, for a total of about 510 acres for the main pipeline. Access right-of-way requirements for these facilities would be defined when design is finalized. Total land requirements for the project would be about 700 acres plus access road requirements.

7. Construction and Restoration Procedures

Total construction costs for the project are estimated to be between 65 and 66 million. During construction, four separate crews would be working, and for a portion of the construction period, several of these crews would be working simultaneously. The four crews are: the site preparation crew, the electrical crew, the pipeline crew, and the tank farm crew. The pipeline crew would be divided into five to ten independent teams operating simultaneously. The tank farm, electrical, and site preparation crews would each be divided into two independent teams operating simultaneously.

a. Schedule

The facilities of this project must be constructed and fully operable by 5 April 1979, according to federal legislation (Public Law 94-258). The schedule for construction of the project from a go-ahead time is 12 to 16 months, including delivery time for long lead-time equipment items. The site preparation crew would need 16 weeks to complete their work at the tank farm sites. The electrical crew would need 35 weeks, beginning at about the same time as the site preparation crew. The pipeline crew would need 30 to 40 weeks and would also begin with the site preparation crew. The tank farm crew would need 30 to 35 weeks and would not begin work at Elk Hills until after the site preparation crew had finished there (about 8 weeks). These times

(Fig. 1-9) are based on a primary 40-hour work week for crew members. Construction times can be compressed by utilization of more than 40 hours per week, but at added cost (premium pay, etc.).

b. Organization and Methods

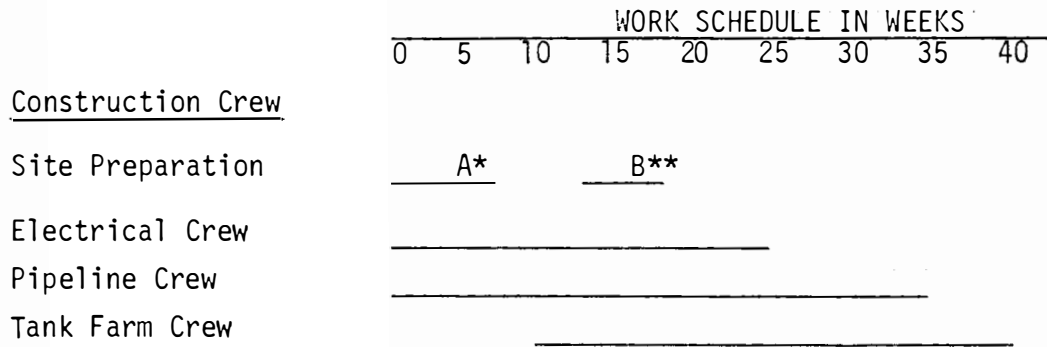
The construction activities would be under the direct control of the Officer in Charge of Construction (OICC), Naval Facilities Engineering Command, Elk Hills, and project monitoring would be directed from the Elk Hills Office by the resident OICC. Actual construction would be accomplished by contract with private firms.

In addition to the set of contractor quality control procedures which any contractor would operate under during construction, the OICC would conduct independent inspections in accordance with government inspection procedures. This would include government inspection and witnessing of tests for long lead-time equipment items and observance of pipeline construction techniques.

c. Tank Farm Construction

Construction of the tank farms would include approximately 10 to 15 pieces of heavy equipment for the site preparation, assembly and erection of facilities, and restoration and finishing. Site preparation would involve testing of substrates, minor grading, and clearing. For the Elk Hills Tank Farm, delivery of equipment, personnel, and materials would be made from Elk Hills Road (using State Highway 119 and Interstate Highway 5). In the event that the Elk Hills production program involves construction of a new railroad line into NPR-1, it could be used for delivery of construction materials for this project. For the Coalinga Tank Farm, Palmer Avenue would be used for delivery (using State Highway 33 and Interstate Highway 5). All construction storage and shelter would be provided on each site. Grading of the site would

Figure 1-9
CONSTRUCTION SCHEDULE FOR COALINGA



*A is preparation of the Elk Hills site.

**B is preparation of the Coalinga site.

provide sediment and runoff control during construction and would provide a buffer against possible equipment-induced fires (e.g., fire started by welding sparks or spilled construction vehicle fuels). Assembly and erection of tanks, metering and control facilities, and the pump station would be conducted as standard industrial practices require. As material arrives on the site, the tank farm crew would construct the various elements. For the storage tanks, steel plates would be assembled by welding, using both automatic and manual techniques common to the industry. Large flat bed trucks would be used to deliver the plates to the site. The plates would be moved into position for welding by conventional cranes and sideboom tractors as needed. All exposed steel surfaces of the tanks would have received shop cleaning and priming prior to delivery to the site, thereby minimizing the need for field sandblasting. The tanks would receive a final protective coating of paint following erection. Upon completion of erection, the tank would be given a hydrostatic test by completely filling it with water. This testing would be at a controlled rate conforming with the foundation design and to accomplish a preloading and test of the foundation as well as the tank shell. Hydrotest water would be obtained from the NPR-1 wastewater system and the total amount required would be equal to the volume of the largest tank and would be reused for each of the other tanks of the tank farm. The volume would be obtained over several days, if necessary, to minimize effects on the system. Ultimately, the used water would be discharged back to the wastewater system over several days, if necessary, to minimize effects of discharge. All exterior surfaces of storage tank bottoms would be cathodically protected to control corrosion. Final grades for tank berms, roads, and general grounds, along with reseeding of grounds, and finish painting of tanks would be in accordance with the overall finishing requirement for the area concerned. Tank and other structure finish paint would be chosen to conform with the prominent area coloration and tone to minimize the scale and contrast of the project to the surrounding area and its visual effects upon passengers on Elk Hills Road and Palmer Avenue.

d. Pipeline Construction

The pipeline would be built by the pipeline crews that move along the right-of-way in a defined portion of route termed a "spread." All spreads would be worked on simultaneously.

Each main line pipeline spread would be made up of several units, each having a separate function. The units would be organized to proceed with the work in the following general order: clearing and grading the right-of-way; hauling and stringing the line pipe; ditching; pipe bending; laying and welding; X-ray inspection; applying protective coating; lowering and tying-in; backfilling; testing; and right-of-way cleanup and restoration.

Special construction would consist of fence building, road and railroad boring for casing pipe, water crossings and block valve installation. In open country, this type of construction may be a few miles ahead of the pipe laying crews.

The construction spread through hilly and populated areas would be somewhat smaller than a cross-country spread. This spread would progress at a much slower rate and contain its activities within a shorter area.

The various construction units may be generally described as follows:

Clearing and grading right-of-way. Usually one of the first jobs encountered by this unit would be to install gates in all the fences that cross the right-of-way. Some fences serve only to show property lines, while others may contain animals. Permanent fence repairs would be completed during final cleanup operations.

Clearing would include removal of aboveground obstacles to the work such as trees, brush, crops and boulders. It would include removal of tree stumps and roots in the ditch line that would interfere with operation of the ditching machine. Any large trees would be sawed into manageable or marketable lengths and stacked or removed from the right-of-way. Removal of only the trees, brush, and crops necessary for construction and maintenance would be permitted.

Grading would include leveling the ground surfaces as needed to permit transit and operation of vehicles and equipment and to permit placement of the pipeline at the desired elevation. This would involve cutting away the earth in some places and building it up in others. Construction of roads and bridges, stabilizing soil to support heavy equipment, and various other kinds of work may also be needed.

Hauling and stringing line pipe. The pipeline ditch would be open for as short a time period as possible, with stringing usually preceding ditching.

Pipe-stringing trucks would be used to transport the pipe in 40- to 80-foot sections from shipment point or storage yards to the pipeline right-of-way. As the trucks deliver the line pipe along the right-of-way, sideboom tractors would pick off a section at a time and lay them end-to-end beside the ditch line for future line-up and welding.

Ditching. Ditching would include all excavation work required to provide a ditch of the specified dimensions and depth of pipe cover. Typical ditch dimensions are 6 to 7 feet in depth and 4 to 5 feet in width. Where possible, a conventional ditching machine would be used. A backhoe or other equipment would be used for ditching where conditions are unusual. Ditching may also be accomplished by power shovels, drag-lines, hand tools, plows, rippers, and other methods or combinations of them.

Ditching in the vicinity of other underground structures would require special care. This is especially true of other pipelines, cables, and conduits that cross or are buried along the ditch line. Extra care would be exercised in searching out such structures and all parties of these facilities would be invited to observe excavation and other operations that may affect their structures.

Pipe bending, alignment, and welding. The pipeline would be bent as necessary to conform to the terrain and fit the contour of the ditch both vertically and horizontally. As much as practical, the ditch bottom would be leveled and straight enough for the pipe to fit by natural flexure induced by its own weight.

The pipe would be bent by placing individual lengths of it in bending machines. Complete bends would consist of a series of small bends each of which would be made by a pull of the machine at one position on the pipe. Right-of-way conditions sometimes require pipe bends of such short radius that field bending is not practical. In these cases manufactured or shop-made bends would be used.

Welding the pipe would include elevating the pipe on skids to provide clearance lineup for welding, and holding it in alignment during the first welding pass. Internal lineup clamps would be used to align the pipe joints whenever possible with external clamps being used as required. The welding crew would apply the remaining weld passes to bring the thickness of the weld to the thickness of the pipe and would finish by applying a cap weld of about 1/16-inch thickness. The suitability of the completed weld would then be determined by nondestructive inspection (X-ray inspection of welds would be used).

Protective coating. The pipe would be coated with a protective layer to inhibit corrosion. The pipe coating would be either mill- or field-applied after thoroughly removing all dirt, rust, and loose mill

scale from the surface. Approved methods of transportation and handling of coated pipe would be rigidly followed to protect the coating. All weld joint areas and damaged areas would be coated or repaired prior to lowering or backfilling.

Coating discontinuities that would permit moisture to reach the pipe would be located by means of an electrical "holiday" detector. This is a device that develops an electrical potential between the pipe and an electrode in contact with the outside of the coating or ground. The electrical potential is high enough to produce an arc in air longer than the coating thickness, but not high enough to produce an arc through a satisfactory thickness of coating. Pinholes of microscopic size can be detected. All coated pipe would be tested prior to backfilling. A cathodic protection system would be installed on the pipeline following placement in the ditch to provide additional corrosion protection.

Lowering and tying-in. The pipe would be lifted and lowered into the ditch by two or more side-boom tractors acting in unison and spaced so that the weight of unsupported pipe would not cause buckling or other damage. Rubber rollers or padded slings would be used so the tractors can lower the pipe as they travel along the ditch line without damage.

Tie-ins would be required whenever there is a break in the continuous operation of the mainline pipe gangs. This would occur at road crossings, water crossings, block valves, and other special locations. Tie-in welds are usually made in the ditch at the final elevation. Each tie-in weld requires pipe handling for lineup, cutting to exact length, pipe cleaning and coating, and backfilling, in addition to normal welding and weld inspection.

Backfilling. A variety of backfilling procedures would be used to perform the work effectively and economically to comply with

specifications regarding protection of pipe and coatings. Motor graders, angle dozers, and crawler-mounted side-pull backfillers would be used to move dirt from the spoil bank to the ditch. Where necessary, the back-filled earth would be compacted to avoid later settling that would leave a surface depression. In certain areas, where damage may occur to the pipe coating, additional protection would be provided by padding the ditch with clean sand backfill. Throughout most of the pipeline route, the top of the pipe would be buried 36 to 48 inches below the grade of the surrounding land. In rocky areas, coverage would be a minimum of 12 to 18 inches, depending on conditions.

Special construction. Some items of construction would require the use of specialized equipment and procedures. The following are some typical jobs requiring special construction.

Highway and railroad crossings. In most cases, roadbeds supporting roadways or railroads would be crossed by boring a hole horizontally from one side to the other ("jacking"). The cutting head of the boring auger would be slightly larger than the casing pipe or line pipe. The pipe would be installed immediately behind the cutting head as it advances. Various means would be used to keep the boring head on course. This control would be used because the pipe needs to be almost perfectly straight and at the prescribed elevation. Steel or concrete casing would be used to encase road crossings where required by federal, state, local, or railroad authorities. Figures 1-10 and 1-11 show typical cased and uncased crossings.

Water crossings. For submerged crossings, the pipe would be buried in the streambed at a depth below the probable future scour level. This would require specialized equipment to prepare the ditch. Various types of mechanical equipment would be used, as well as a combination of excavating and materials-handling units that can serve as backhoe, dragline, clamshell, or crane. Construction at streams would typically require a few weeks time.

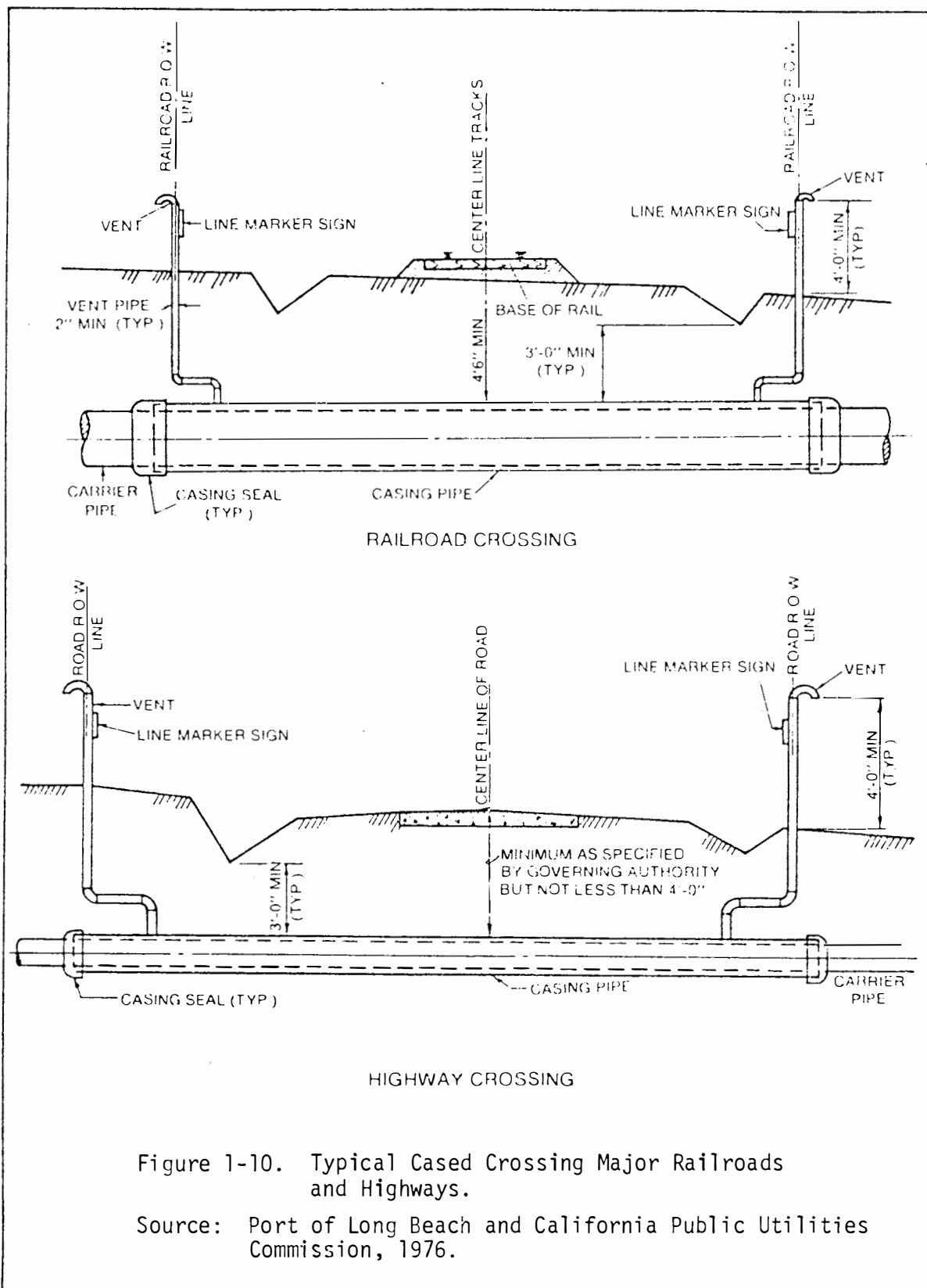


Figure 1-10. Typical Cased Crossing Major Railroads and Highways.

Source: Port of Long Beach and California Public Utilities Commission, 1976.

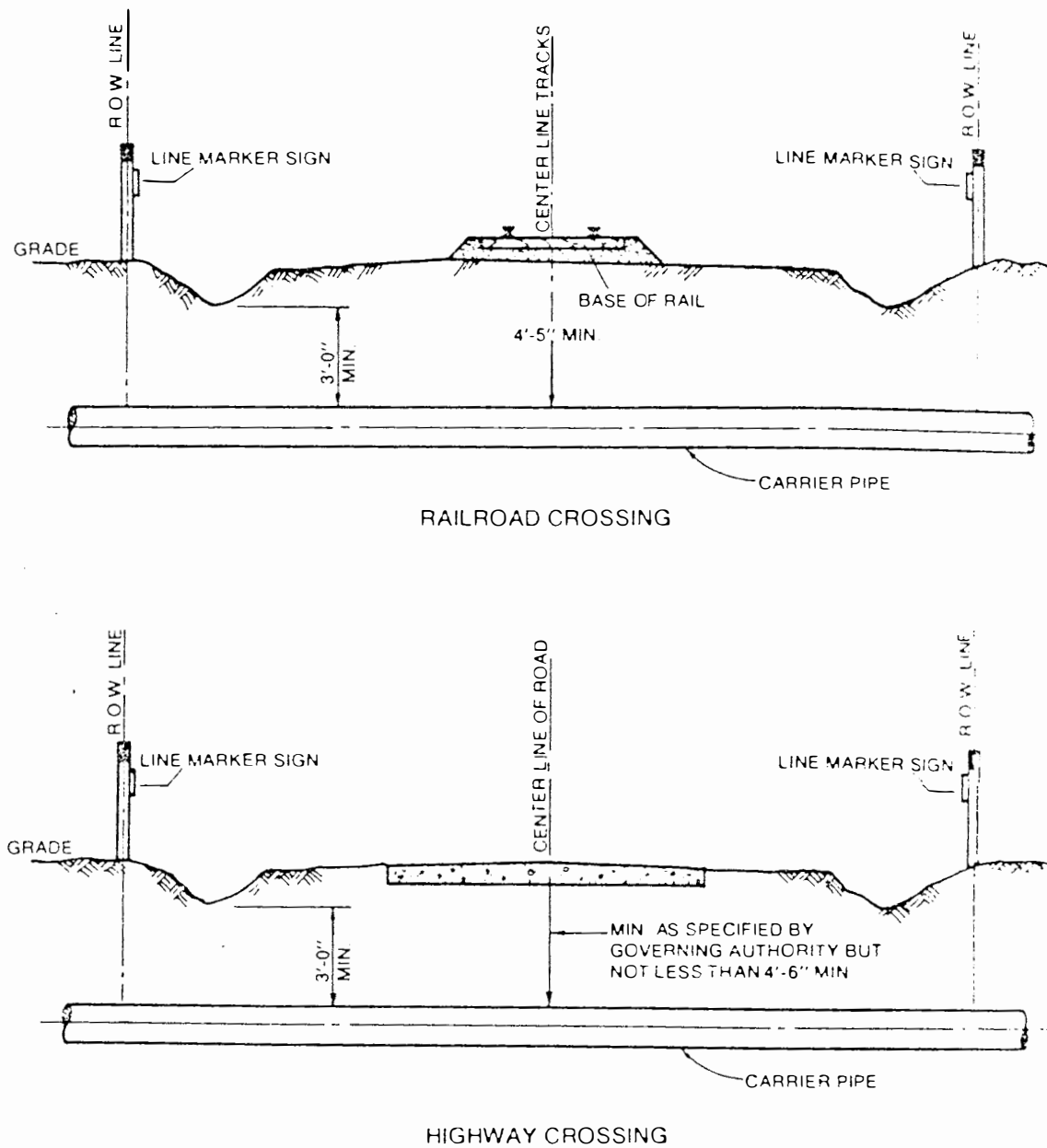


Figure 1-11. Typical Pipeline Uncased Crossing Railroads and Highways.

Source: Port of Long Beach and California Public Utilities Commission, 1976.

. The crossing of the Coalinga Aqueduct at Los Gatos Creek would be done by a pipe bridge (Fig. 1-12) over the open channel of Los Gatos Creek at a point where the aqueduct passes beneath Los Gatos Creek as a siphon. The pipe would come above ground adjacent to the channel wall and within a fenced lot and pass across the open channel inside steel casing of 48-inch diameter. The outer casing would be pitched so as to cause any leaks and spills of the pipe to flow to the outside of the channel walls and into the pipeline lots on either side of the aqueduct. In this manner, gravity flow of any leakage would be passed away from any possible contamination of the open channel of the aqueduct, and without possible flow back into the aqueduct from the pipeline lots.

Piping construction procedure would include making up strings of pipe, examining the welds, applying protective coatings, and hydrostatically testing the pipe strings. All work to be done on the pipeline would be completed before installation in the stream or over the aqueduct and care would be taken to keep any construction debris from falling into the water. Retesting after installation would also be done. All stream crossings would be scheduled and planned for installation during the normal period of no stream flow.

Flows in all streams traversed by the pipeline are intermittent. Because of the low or intermittent flows, the pipeline would be buried across the channels of involved streams. This generally involves excavation into the rocky channel of the stream with possible additional coating of the pipe, and burial with cobble-size riprap in order to hold the line in place during flow periods.

Testing. In addition to standard mill testing of all pipe and fittings, all welds would be examined by nondestructive techniques and hydrostatic testing would be performed after construction and before the line is placed in crude oil service. Mill testing includes nondestructive testing by one or more of the following methods: radiographic, ultra-sonic, electromagnetic, and hydrostatic.

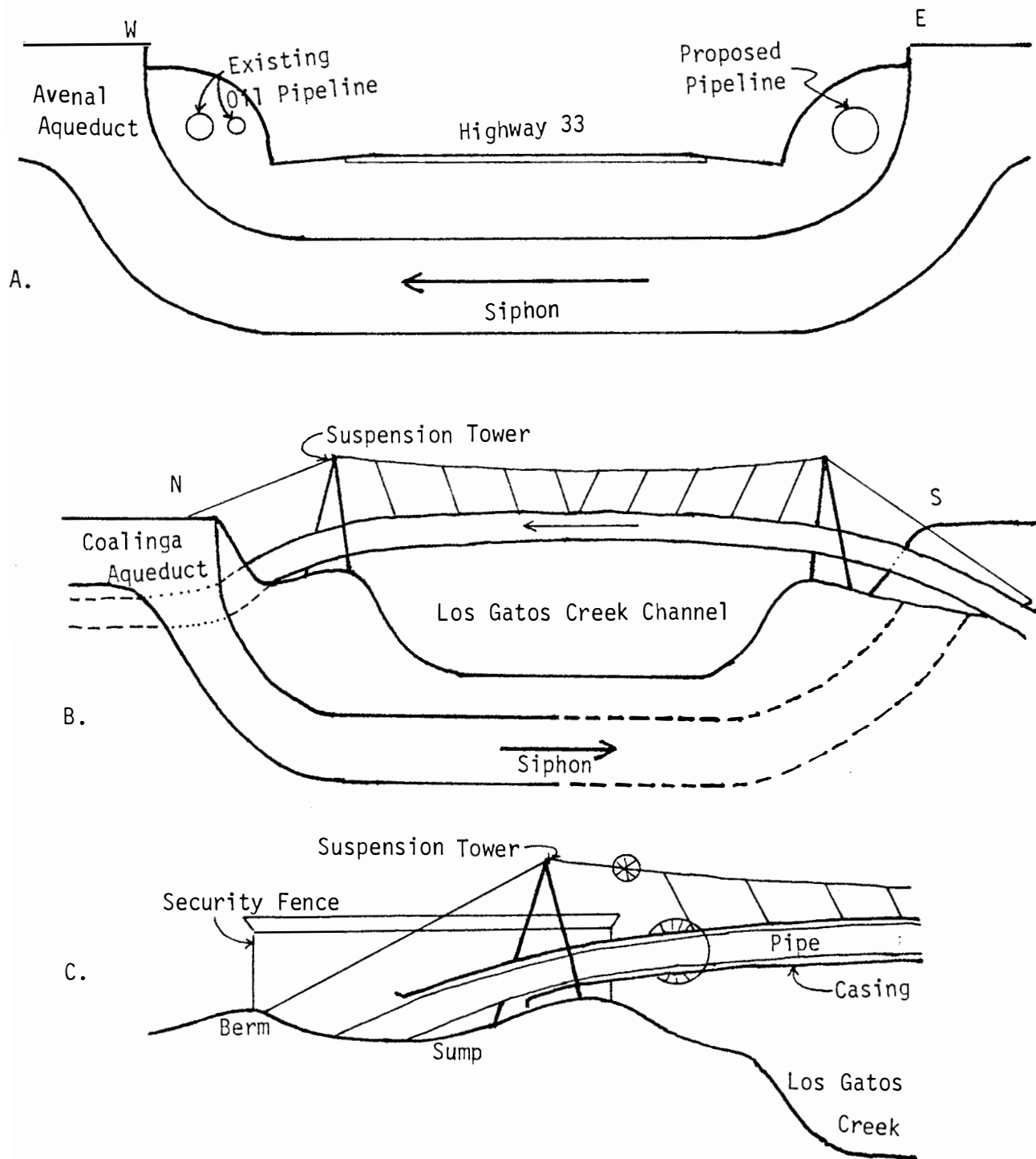


Figure 1-12. Schematic Diagrams of Aqueduct Crossings Along Coalinga Pipeline. A. Avenal Aqueduct at MP 49.5. B. Coalinga Aqueduct and Los Gatos Creek at MP 81.4. C. Detail of Pipeline Suspension.

Source: URS Company

The field hydrostatic test would be conducted in accordance with requirements of Part 195, Title 49, Code of Federal Regulations, ANSI B31.4 (Liquid Petroleum Transportation Piping Systems), along with applicable state and local regulations. Nondestructive testing of pipeline welds would be accomplished by X-ray or other approved techniques. Tests would be certified and an accurate record of tests maintained.

Basically, the hydrostatic test involves filling the line with a suitable liquid test medium, usually fresh water, until a predetermined internal pressure is achieved. This pressure would be 1.25 times the normal pipeline operating pressure. Such tests are designed to prove that the pipe, fittings, and weld sections would maintain their mechanical integrity without failure or leakage under pressure conditions at least 25 percent more severe than those encountered during normal operations.

The entire pipeline would be tested in relatively short sections. The length of these sections would be dictated primarily by changes in elevation. Longer test segments would be utilized in areas where little change in elevation is encountered.

e. Restoration

Specific right-of-way cleanup and restoration plans have not been developed to date, but would conform to all laws, rules, and guidelines and requirements of government agencies having jurisdiction.

Rights-of-way would be cleaned up by removal and disposal of construction debris and surplus materials. Considerable restoration of the right-of-way surface would be accomplished during backfilling operations. Where further breaking up of clods and smoothing of the earth surface is required, disc harrows or other equipment would be used.

Tillable land would be restored so that normal cultivation could be resumed. The entire soil produced (approximately 0.5 yds.³/yd. of ditch) when spread over a 50-foot right-of-way results in a little more than 1 inch of additional soil. This is subject to settling and should not be a serious impediment to cultivation.

Temporary openings in fences would be replaced and fences restored to their original condition insofar as practical. Markers showing exact locations of pipelines would be installed at road and fence crossings. Markers also would identify owners of the pipeline and would contain other information such as kind of material transported, and location and telephone number of owner in case of emergency.

From this point in the cleanup and restoration operation, each treatment may be specific to given points along the right-of-way. Further restoration procedures may be determined by a combination of five factors:

- o Preconstruction conditions.
- o Existing land-use plans.
- o The requirements of the owner and/or controller of the land.
- o The techniques used in the clearing and installation phases of construction.
- o The program for maintenance of the operating right-of-way and ancillary facilities.

The relative importance of each factor at each location would depend on the local circumstances. The following considerations may be applied determining the restoration procedures:

- o Restoration would attempt to return the disturbed areas to conditions as close as practical to those existing before construction, where this does not interfere with

the primary functions of the right-of-way. Such interferences include new construction over the right-of-way and impediments to pipeline inspection and maintenance.

- o Land-use plans may allow for or require that the restored areas exhibit characteristics different from the preconstruction conditions.
- o In cases of public land, all appropriate regulations and guidelines would be followed. Restoration of privately-owned lands may be based, at least in part, on needs of the landowner.
- o The technique used in clearing and installation often would determine the techniques and extent of restoration required.
- o The program of maintenance often would determine the techniques and extent of restoration.
- o Several approaches to restoration are available. These may be used separately or in various combinations. The choice would depend on the five factors listed above. The most common available approaches include the following:

Surface Contouring	Chemical Treatments, Adhesives
Removal of Debris	Chemical Treatments, Neutralizers
Surface Cultivation	Chemical Treatments, Fertilizers
Mulches	Replanting
Structures	

These approaches generally may be considered under various land-use types, as listed below, and would be subject to modification based on further studies.

- o All Land-Use Types

In all land-use types, restoration would follow pipeline construction specifications, usually beginning with the disposal of debris and the restoration of normal contour and surface soils. Surface contouring and terracing, and certain structures, may be used as diversions to concentrate and/or channel surface water flow. Where appropriate, topsoil may be returned to cover the trench backfill material.

o Barren Lands

Mulching may be practiced, where appropriate, to prepare seedbeds and control erosion. Fertilizers may be applied where appropriate. For the stabilization of critical areas, spray-on adhesives may be used. Revegetation programs would be based on well-accepted guidelines, as noted earlier.

o Forest and Woodland

Mulching may be practiced, where appropriate, to prepare seedbeds and control erosion. Fertilizers and spray-on adhesives may be used on local sites. Revegetation programs would be based on well-accepted guidelines as noted earlier.

o Improved Pasture and Cultivable Lands

These lands typically are privately owned. Therefore, their restorations may be based on preconstruction agreements with the landowner. Restoration beyond normal cleanup procedures often is accomplished by the landowner during his normal agricultural operations.

o Rights-of-Way

Restoration of the pipeline right-of way may be modified when coincident with or crossing other rights-of-way.

Where electric transmission line rights-of-way are encountered, restoration programs may conform to those for the land-use type on which the encounter occurs, to those of the preexisting right-of-way, or to a program devised with the operator of the preexisting right-of-way, as appropriate.

The crossing of certain minor roads may be accomplished by trenching. In such cases, restoration of the road margins would follow the above guidelines, and restoration of the roadway itself would conform to the laws, regulations, and guidelines of the government agency having jurisdiction, or to the needs of the owner, as appropriate.

o Streams

Restoration of the right-of-way where it crosses a stream would emphasize stream-bank stabilization. This stabilization may involve mulches, spray-on adhesives, and/or revetment structures, where appropriate.

o Ancillary Facilities

Permanent access roads and valve stations would be restored to ensure soil stabilization and minimize impact on the landscape. Each case would be treated based on the characteristics of the site and the operational needs of the site.

f. Abnormal Effects

The magnitude of the project construction would present hazards such as fires, spills of fuels, and damages and accidents involving construction personnel and the general public. These hazards or abnormal effects would vary with the terrain and land uses. Usual construction safety programs and injury and damage liability insurance would be required of all contractors.

8. Normal Operations and Maintenance Program

The operation and maintenance of the tank farms, pipelines, and pumping and communications stations would be accomplished by the Officer in Charge, Naval Petroleum Reserves in California. Storage and transfers would be controlled through the storage facilities, back pressure control valve system, and pump stations. Security of the tank farms, pipelines, and pump stations would involve patrols of facilities.

a. Elk Hills Tank Farm

Operation of the Elk Hills Tank Farm would involve an operator on duty at the facility around the clock. Depending upon its characteristics or origin, oil from the reserve production would be stored in appropriate tanks. A maximum of 200,000 B/D (expandable to 250,000 B/D) would be distributed to the tank farm for conveyance to the Coalinga system. Staff would monitor the volumes and types of incoming oil and

determine the time and the flow rates for transferring oil to the pumping station and outgoing pipeline. Periodic maintenance of tank farm equipment would be undertaken on a defined schedule.

A major task of operation would involve 24-hours-per-day monitoring of the flow from the Elk Hills Tank Farm, passage through the pump station, flow through the Coalinga Pipeline, and delivery to the Coalinga Tank Farm. Volume and flow rate data would be transmitted to central control at the Elk Hills Tank Farm, and inputs would be continuously assessed for possible indication of leakage and equipment malfunction.

The overall surveillance system (monitoring of the input and output metering equipment data from both ends of the pipeline) as well as the local Elk Hills Tank Farm control and instrumentation systems would be utilized to: (1) prevent operating conditions from causing crude oil leaks or spills by regulating pipeline flow rates and pressures; (2) isolate pipeline sections by closing remotely controlled block valves and, therefore, minimize any spills that might occur; (3) provide orderly control and shutdown of operating equipment through automatic control sequences; (4) provide for pipeline shutdown by the operator at central control, in the event of seismic activity or other emergency situations; (5) provide a sophisticated system for automatic leak detection; and (6) provide a means for continuously monitoring all pipeline system operations from a single location.

Once operational, the pipeline route would be flown at least once a week and checked for leaks and any unusual construction activity along the route. The pipeline would be well marked along this route with appropriate signs. In addition, the pipeline would be checked annually from the ground for any surface indications of leaks of the type not noted by aerial surveillance, or for any other potential problems. Since pipelines normally have a "break in" period of up to 3 years

during which small leaks may develop, more frequent walkovers may be initially required.

b. Coalinga Pipeline

The operation of the pipeline would generally involve control from the Elk Hills Tank Farm. The pump station, remotely-controlled block valves, and pressure reducing valve system would be controlled from the Elk Hills Control Center. One roving station operator would be on duty around the clock to handle any pipeline activities in the field. Batching of the Shallow Oil Zone and Stevens Zone crudes would also be controlled by the Control Center. The pipeline would be cleaned at regular intervals by scrapers in order to reduce accumulations within the pipe. Material collected by scraping would either be blended back into subsequent Stevens Zone crude oil batches or sent to waste disposal sites which accept such material.

Precautionary measures that would be part of normal operations include surface and aerial patrols. The pipeline would be patrolled by air at least once a week and annually by ground parties. The patrols would observe leaks and any activities that may endanger the pipeline or valves. Activities that might interfere with pipeline operations would be monitored and the involved personnel would be notified of the presence of the pipeline.

The proposed pipeline would include flow monitoring with inlet measurement at Elk Hills and outlet measurements at Coalinga (input/output monitoring). Data would be transmitted every 10 seconds to the Control Center at Elk Hills on flow and pressure. The system would have minimum leak detection capability of 1 percent of throughput (which is 200,000 B/D) or 1.4 barrels per minute. The data transmission system design details are not yet finalized, but transmission could use both microwave radio and/or commercial telephone lines.

c. Coalinga Tank Farm

The Coalinga Tank Farm would be operated in a manner similar to that at Elk Hills. Although no major pump station would be located at this facility, field pumps would be provided for subsequent oil distribution. Incoming oil would be metered and rates and volumes would be communicated to the Elk Hills Tank Farm Control Center. Passage of oil from tanks to customers for sale would be under meter and pump control. Communication facilities would be integrated with those of customer pipelines in order to determine the times for optimal injection of the oil into such pipelines. Monitoring of flows from the tank farm and those going into other pipelines would be communicated to Elk Hills for the assessment of possible oil spill within the system and for the determination of transferred volumes and charges.

d. Abnormal Operations

Possible abnormal operations would include firefighting and oil spill cleanup at the tank farms and along the pipeline. Such operations and further considerations of oil spills are given later in this section, under item 9, Risk Assessment and Spill Prevention.

9. Personnel Requirements

Personnel requirements for the project would include those related to construction activities and those related to operation of the tank farms and pipeline.

a. Construction Activities

Construction personnel requirements (and construction cost) would largely depend upon the schedule for construction. The following estimated requirements depend upon the assumption of a 40-hour work week. Crew requirements are as follows:

<u>Crew Type</u>	<u>Estimated Crew Size</u>	<u>Estimated Peak Crew Size</u>
Site Preparation	25	25
Electrical	10	10
Pipeline	310	390
Tank Farm	25 to 30	40

An average wage for a composite construction crew is \$13.20 per hour plus \$16.00 per day for subsistence while in the field.

b. Operation

Operating personnel requirements would center at the Elk Hills Tank Farm where a total staff of 15 on a rotating shift basis for 24-hour coverage would be employed. The Coalinga operations would similarly have 24-hour coverage, but with only 9 workers on rotating shifts. Total operating staff would, therefore, be 24.

Maintenance and pipeline patrolling would either be done by operating personnel or would be handled by an outside contractor.

10. Mothballing Procedures

The project facilities could become temporarily unnecessary at any time before expiration of the useful life of the facilities or depletion of the oil fields and it would then become desirable to secure the facilities for later reactivation. The securing of facilities under these circumstances is called "mothballing."

Typical procedures to be followed would include:

- o Empty the storage tanks, the pipeline, and pump station manifolds and equipment of all crude oil.

- o Refill the pipeline with water containing a corrosion inhibitor.
- o Refloat the internal (or external) tank roofs at low level with water and back off the roof seals.
- o Drain and remove pump seals and refill with vapor inhibitor to prevent corrosion.

11. Abandonment Procedures

The project facilities could become unnecessary at some indefinite time in the future (at the end of the useful life of the facilities or upon depletion of the oil fields). Abandonment and surplus designation of the tank farms and pipeline system would involve the sale and removal of facilities or transfer of deed and easements for the facilities. The tank farms, pump and monitoring stations, and valves may have real salvage value over the cost of removal. The pipeline salvage value may not be sufficient to compensate for removal costs and land restoration. A reasonable alternative may involve the declaring of excess and surplus of the entire complex or the pipeline facilities and easement/right-of-way. Private parties may consider acquisition of the facilities for continued use in this pipeline corridor.

12. Risk Assessment and Spill Prevention

The purpose of the risk assessment is to identify potential problem areas in the Elk Hills/Coalinga Conveyance System that may lead to accidents and/or spills in the course of operation. The conveyance system has been examined with respect to its major components, namely, the pipeline and tank farms.

Historical data were used to develop frequency, cause, and magnitude of spills and accidents to the extent possible; the various components of the conveyance system were then evaluated in terms of identified risks. These findings, discussed under accident spill prevention,

are concerned with the safety of operations (including safety features encompassed in design and construction) of the proposed project.

a. Pipeline

General. Because they are buried and fixed in place, pipelines are not subject to collision or loss of control, the major causes of spills by other modes of petroleum transport. Consequently, pipelines have long been recognized as the safest way to transport large volumes of petroleum products. Even though the pipeline accident rate is low, industry and government continue to seek a better safety record through improved design and operation.

The Office of Pipeline Safety (OPS) of the Department of Transportation annually compiles statistics for all liquid pipeline spills. These statistics for the period 1968 through 1975 serve as the basis for identifying the risks associated with the operation of crude oil pipelines. These data indicate that the average crude oil trunk line experiences 0.0027 spills per mile of line per year. In more recent years (1973-1975) this rate has dropped to .0020 spills per mile per year. However, even this rate is considered high because it includes statistics on older pipelines (constructed prior to 1950) that have a demonstrated higher accident rate. A more realistic accident rate has been derived from a study of European pipelines (which are generally of recent vintage). This rate is 0.0011 accidents per mile per year.

These data for the recent U.S. and European experiences have been used to estimate the frequency of spill by size for the proposed trunk line from Elk Hills to Coalinga (Table D-1, Appendix D). These results suggest that a major spill (<25,000 barrels) during the anticipated life of this 84-mile pipeline is most unlikely. This does not imply, however, that a spill of this magnitude could not occur nor that contingency plans responsive to such an event should not be devised. A

moderate spill of 5,000 barrels might occur during the 25- to 50-year life of the pipeline. Small spills (500 barrels) are likely to occur periodically.

The causes of pipeline spills are varied. Heavy equipment rupturing of buried lines presently accounts for almost 28 percent of all accidents; external corrosion accounts for about 23 percent. Other important causes of accidents include equipment failure and human error (18%) and pipe weld or wall failure (12.6%). Minor causes include internal corrosion, natural disaster, and vandalism.

Although specific accident data on California pipelines are not available, special causative factors unique to the state were discussed with several pipeline operators. In the San Joaquin Valley, equipment rupturing lines (the so-called "third-party" accident) is of greatest concern. The valley is one of the most intensively cultivated areas in the country and sub-soiling techniques are widely used to improve the permeability of the soil and to increase productivity. Even with the best notification systems and marking, pipelines in this area have become increasingly subject to the third-party accidents. Consequently, new or replacement pipelines in the area are now buried at a depth of 5 feet or more. The OPS data indicate that such action would be most beneficial since for all accidents caused by equipment rupturing lines, more than 90 percent occur in lines that are buried at or above 40 inches.

Pipelines in California may also be subjected to the direct effects of earthquakes and to the indirect effects of landslides. In general, earthquake damage to pipelines has been minimal and primarily limited to pipelines that used acetylene welds. In the 1971 San Fernando earthquake, no failures were reported on a modern 18-inch liquid line that passed close to the epicenter of the earthquake. Because of new and more stringent codes on the placement of pipe through known fault

zones, the possibility of earthquake damage to newly constructed pipelines is remote. Nonetheless, proper design, operation, and preventative actions must be taken to insure that extensive damage does not occur.

Fire and explosion resulting in injury or death to personnel does periodically occur as a result of pipeline accidents. Fire is a primary concern at tank farms -- spills the primary concern along pipelines.

The magnitude and frequency of spills and accidents can be minimized by proper attention to design, construction, operation, and contingency planning. Contingency plans are particularly concerned with spill detection, identification, containment, and cleanup and restoration.

Elk Hills/Coalinga Line. The proposed Elk Hills/Coalinga Pipeline would meet or, in most cases, exceed basic industry design codes. A major consideration of pipeline safety is the maximum spill that might occur under the "worst case" conditions. This "design spill" is kept as low as possible, particularly in environmentally-sensitive areas. For the proposed line, the spill potential (Fig. 1-13) is:

<u>POTENTIAL SPILL</u> <u>(Thousands of barrels)</u>	<u>PERCENT OF</u> <u>LINE LENGTH</u>
>40	2
30-40	9
20-30	17
10-20	43
< 10	29
	<u>100</u>

Eighty-nine percent of the line has a design spill of 30,000 barrels or less, while less than 2 percent of the line has a spill potential of 40,000 barrels or more. The actual amount of the spill is likely to be

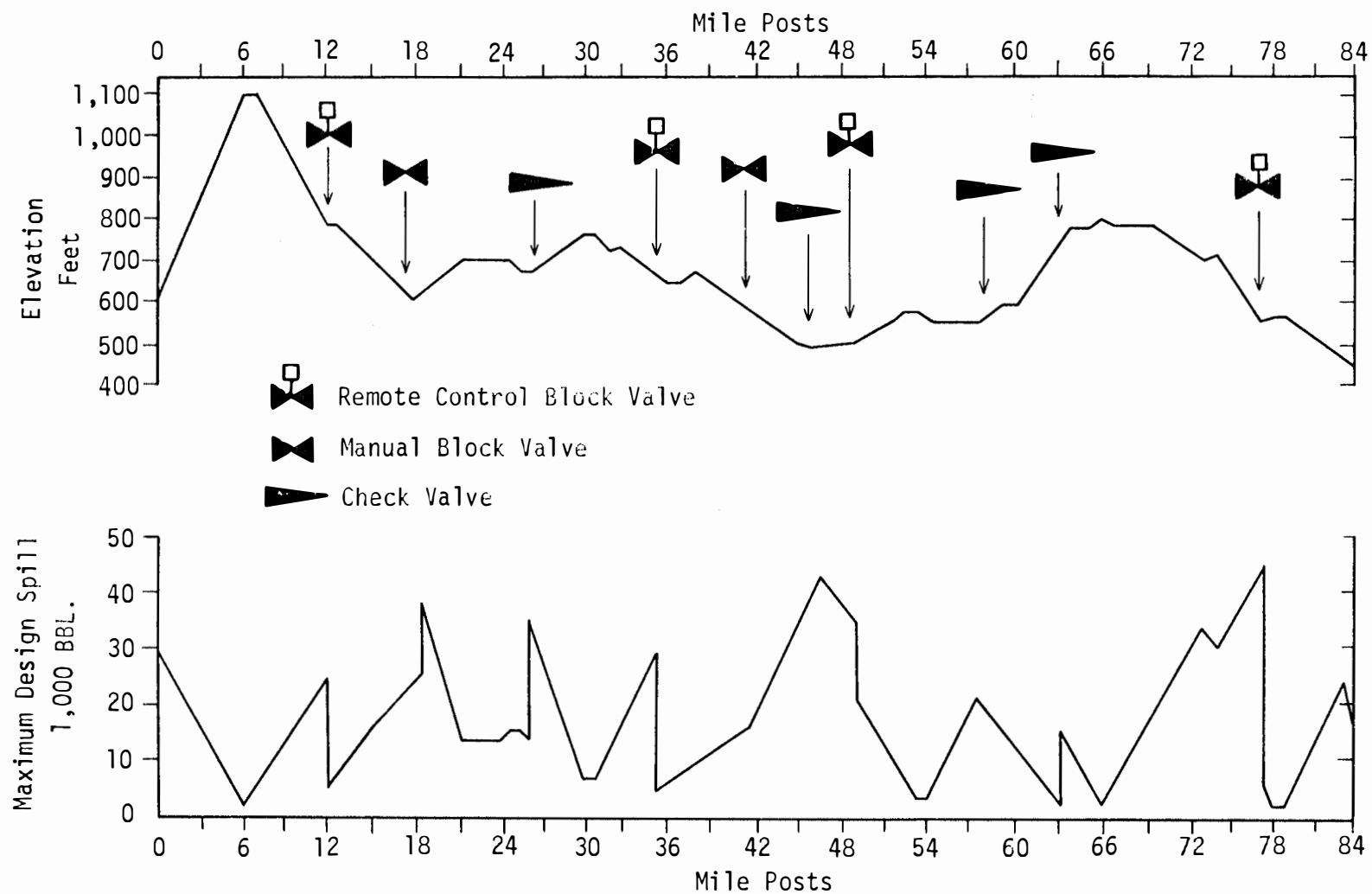


Figure 1-13. Route Profile and Maximum Design Spill
for Coalinga Main Pipeline

Source: URS Company

lower because of the quick shutdown features designed into the lines, pooling of oil in low points in the line, and the expected prompt response of repair crews.

The pipeline would incorporate one or more detection devices, which rely on differential changes in pressure and flow, and automatic shut-down of the pump stations and key block valves. A most essential feature of this instrumentation is to be an inlet-outlet detector that measures flow in at Elk Hills and flow out at Coalinga. The maximum loss prior to shutdown (including verification time of 8 minutes) would be about 17.5 barrels. Smaller leak rates that are detected by inventory control, may result in losses of up to 1,200 barrels. In general, extremely small leaks are likely to be detected only when the escaping oil has saturated the ground and surfaced. If not detected promptly through aerial surveillance or third-party reports, small leaks could accumulate, perhaps to as much as 700 barrels.

The pipeline itself would be provided with a protective coating and sufficient test points so that a cathodic protection system could be installed within the first year of operation. Typically, a pipeline has about a 3-year break in period during which "holidays" (minor flaws in the coating) would be detected and corrective action taken.

In the construction phase, welds would be X-rayed to insure their integrity. After completion, the pipeline would be hydrostatically tested at 1.25 times the maximum operating pressure of the pipe. The pipeline would normally be buried and held in place by riprap at dry washes. Where the pipeline crosses the two aqueducts, it would be encased in an exterior pipe designed to direct any spills away from the waterways. The pipeline does not cross any known major active faults nor does it encounter any potential landslide areas.

Throughout most of the pipeline route, the top of the pipe would be buried at a minimum of 36 inches. Where it passes through or near irrigated lands, the pipeline would be covered by at least 48 inches of earth. Once operational, the pipeline route would be checked at least weekly from the air for minor leaks and for any construction or agricultural activity. The pipeline would be well-marked and each land owner would be notified of the presence of the line on his property. The pipeline would be walked annually and checked for any surface manifestations that might indicate leaks or other problems.

Supervisory control of the pipeline and the inlet-outlet monitoring system would rely upon a "dedicated" communication circuit linking various components. Control would be maintained from the Elk Hills Tank Farm with 24-hour personnel coverage.

If a major break were to occur, the pipeline would be immediately shut down and aerial and ground surveillance undertaken to determine the site of the leak. Crews would be dispatched to dike the area of the spill and to close appropriate block valves. The spill site would be protected from any ignition sources until the pooled oil could be removed by vacuum trucks and the break repaired. Oil-contaminated soil would be removed and disposed of in an acceptable manner and clean soil brought in to replace it as necessary. In the event of a spill entering one of the aqueducts, the San Joaquin Valley Pipeline Organization, which represents all major pipeline and most independent pipelines in the area, would aid in the cleanup effort. The organization has a supply of booms that can be placed across canals to limit the extent of spread in case of spill.

All fire protection for the pipeline proper would be provided by city and county units along the route. Explosions are unlikely since the most common causative factor -- basements near the pipeline in which leaking vapors accumulate -- are rare in the area. Contingency plans

would be prepared for control and restoration activities in the event of an accident or a spill along the pipeline.

b. Tank Farms

General. Because tank farms are widely used in industry, the state-of-the-art with respect to safety of operations is well developed. The major safety concerns at tank farms are spills and fire. The safety hazards associated with spills are mitigated by diking the tanks, usually individually, such that the entire contents of any tank can be contained within the diked area. Normally such containment is adequate, particularly with modern standards for discharge of accumulated water within containment areas. Fire is a more serious concern, consequently, fire prevention and firefighting capabilities are integral parts of tank farm operation.

Based upon the 4-year period (1971-1974), as reported annually in Hydrocarbon Processing, the frequency of occurrence of fire in tank farms is low; on the average, a large tank farm will experience one fire, with property damage exceeding \$1,000, every 100 years.

Floating-roof tanks, which are in common use for all large tanks, are among the safest for storage of petroleum or petroleum products. According to Hydrocarbon Processing, only 5 percent of all tank fires are attributable to floating-roof tanks. While fire-prone types of tanks (such as cone-roof and dome-roof tanks) require internal fire suppression systems, such systems are not required of floating-roof tanks because of their low incidence of fire. However, such internal fire suppression systems could be used as an additional protection.

In addition to internal suppression systems, fires in fixed-roof tanks with internal floaters can be fought initially with onsite foam extinguishing equipment (e.g., by injection of foam through the

bottom of the tank). If fire continues unabated, however, additional resources, including pumpers with foam or heavy water capabilities, must be employed. If these measures are not sufficient, and total tank involvement occurs, the tank fire may continue to blaze until the contents of the tank are consumed. In such a case, control measures are limited to cooling of the surface of adjacent tanks to prevent radiated heat from igniting them. Adequate water supplies are required for this latter purpose.

Elk Hills Tank Farm. Fixed-roof tanks with internal floaters would be used in the tank farm. This design minimizes vapor losses and reduces fire risks. Primary protection would be provided by mobile dry chemical fire extinguishers at the tank farm. Scheduled improvements in the existing water supply to the tank farm site would also increase the firefighting capability of the one pumper presently in use at the reserve. The Navy's unit operator is a member of the Cooperative Foam Program, operated by the Kern County Fire Department, as are other protection and refineries in the area; the capabilities of this area-wide protection service are shown in Appendix N. These resources are considered adequate to contain fires initially and, most importantly, to prevent involvement of more than one tank. In this region, the common practice in the event of tank farm fires is to allow tank contents to burn if initial containment is unsuccessful and concentrating the effort on preventing fire spread to other tanks.

Onsite personnel would be able to identify and locate any leakage and/or fires in the tanks, lines, or pumps within a few minutes of their origin. The fire control program for the reserve would include actions for the Elk Hills Tank Farm, the LACT station, and other tanks within the reserve. Onsite personnel would notify reserve fire control personnel and would conduct emergency tasks (e.g., closing down and isolating fire-involved areas). Berms would isolate individual tanks and reduce the spread of fires within the area. Fires involving the

pump station would be identified by the fire detection system with subsequent control and extinguishing by Reserve personnel. The pump station fire detector would shut down and isolate the pump from the tank farm and main pipeline in the event of fire. Pump-seal, leak-detection units would identify seal leakage and shut down and isolate the pump. The design would contain any oil spilled within the tank farm. Following seismic events, the tank farm system would be examined for damage and possible oil spillage.

Basic spill prevention measures would be provided by individually diking each tank to hold 110 percent of its capacity. The dikes and diked area would be paved or otherwise treated to minimize erosion and oil seepage into the ground. Manually-operated drainage valves would control release of any water from diked areas.

The Elk Hills Naval Reserve presently has both a Spill Prevention Control and Countermeasure Plan (SPCC) in compliance with EPA requirements and a contingency plan to implement necessary actions in the event of a spill. The present unit operator has prepared such plans and would be responsible for extending such plans to the new tank farm.

Coalinga Tank Farm. The Coalinga Tank Farm would also be constructed, under this proposed routing, at the terminus of the main line (M.P. 84) at Coalinga. This tank farm would be constructed to the same standards as the one at Elk Hills and would follow the same stringent operating standards, including preparation of SPCC's and contingency plans. Supplementary fire protection would be provided by the city and county jurisdictions adjacent to this tank farm (Appendix N).

The Coalinga Tank Farm would also be located near the proposed Coalinga Cargo Port. Accordingly, an application would have to be made through the Federal Aviation Administration to insure that the facility does not impinge upon the safety of the proposed airport. No serious conflicts are foreseen at this time.

13. Other Federal Activities

Other major federal lands near the proposed tank farms and pipeline route are the Elk Hills Naval Petroleum Reserve No. 1 and No. 2. Associated with the conveyance project, the government has been directed by Congress (PL 94-258) to increase production from the Elk Hills Reserves. Additional facilities and other related support and transportation projects would be coordinated with the proposed crude oil conveyance system.

Of lesser magnitude, the U.S. Department of Agriculture (Soil Conservation Service), is conducting and has conducted soil surveys for western Kern, Kings, and Fresno counties. These surveys and subsequent consultation assist in the proper development of cultivation and irrigation in the counties. The U.S. Department of Interior (Bureau of Reclamation and Fish and Wildlife Service) has assisted in the massive water supply and distribution systems of the West Valley and in endangered wildlife studies along the western side of the San Joaquin Valley.

The U.S. Fish and Wildlife Service and the California Department of Fish and Game operate recovery teams for the endangered blunt-nosed leopard lizard, California condor, and San Joaquin kit fox. The tank farms, pump stations, and pipeline would lie either within or near to the general distributional ranges, critical habitats, and known nesting or denning areas of these endangered species (Fig. 2-2).

The proposed Coalinga Cargo Port near the Coalinga tank farm site would be operated under the jurisdiction of the Federal Aviation Administration. The Department of Interior (Bureau of Land Management) controls some federal lands along the general project region, but these lands are largely west of the project area and are not directly involved in the proposed project.

II. EXISTING ENVIRONMENT OF
PROPOSED SITE

II. EXISTING ENVIRONMENT OF PROPOSED SITE

The environmental setting for the proposed tank farms and pipeline is quite similar to that of many areas in the southern end of the San Joaquin Valley. The valley floor is generally flat with a downward slope to the east and north (the long axis of the valley). Low hills are scattered along the flank of the Temblor Range and southern portions of the Diablan Range. The strongly seasonal climate and summertime degraded air quality are relatively similar across the valley and along the project. No perennial streams are located along or near the project area, although the Coalinga and Coastal (Avenal) Aqueducts are crossed by the pipeline. The Coalinga Aqueduct forms the western perimeter (upslope) of the Coalinga Tank Farm.

The biota of the project area includes the typical desert scrub and grasslands of the southern valley that extend into the upper Salinas Valley and Carrizo Plains. Wildlife is scant, but the endangered San Joaquin kit fox and blunt-nosed leopard lizard are located near the project and occasionally visit the storage sites. Riparian and aquatic biota are virtually nonexistent along the project, but some fish live in the aqueducts. Archaeological and other cultural resources are known to exist in the general area of the valley but none were found along the pipeline route or at the storage sites.

Land uses generally include petroleum development and production, grazing of livestock, dry cultivation, irrigated orchards and row crops, and transportation (e.g., roads, highways, pipelines, and electrical transmission lines). The tank farm sites and route lie at least 1 mile from the nearest town or concentration of structured land uses. The socioeconomic element near the project largely involves the overall economy of the West Valley (e.g., Kings, Fresno, and western Kern counties). The project does not involve a designated recreational area, although the more general aesthetic environment includes proximity to Elk Hills Road, State Highway 41, Big Tar Canyon Road, and Interstate 5 (roads designated for their scenic value).

A related factor to the project and its setting involves the present trend of changing land uses (e.g., range to farming) and environmental resources brought about directly and indirectly by the introduction of irrigation waters to the southern San Joaquin Valley. The future setting may involve greater areas of cultivation and irrigation converted from existing grazing and wildlife habitat. Similarly, the proposed Coalinga tank farm site has been located with the recognition of the proposed development of the Coalinga Cargo Port immediately to the east. The proposed airport would convert the existing cultivated setting to industrial uses (next 10 to 15 years). Old oil fields in the McKittrick-Blackwells Corner areas and Kettleman and Gujarral Hills may decline in production activity and slowly return to grazing and wildlife habitats.

A. Geological Resources

1. Physiography

The proposed sites and routes lie along the border of the Great Valley and Coast Ranges geomorphic provinces (Fig. 2-1). Most of the pipeline route crosses nearly flat or gently sloping alluvial fans and valleys. From the Elk Hills Tank Farm in Buena Vista Valley, the main

pipeline passes along the east side of Buena Vista and McKittrick valleys, across the northwest end of Elk Hills, into Antelope Plain, along the eastern edge of Pyramid Hills, through Kettleman Plain, along the eastern edge of Pyramid Hills, through Kettleman Plain, across Polvadero Gap, and along the east edge of Gujarral Hills to the Coalinga Tank Farm at the western edge of San Joaquin Valley. Elevations throughout most of the route range between 600 and 800 feet above sea level. The highest elevation along the route is approximately 1,150 feet along the western flank of Elk Hills. The low point is at the Coalinga Tank Farm -- approximately 440 feet.

2. Stratigraphy

The geologic formations exposed along the pipeline route consist of recent unconsolidated deposits of alluvial fans and Pleistocene and Pliocene age poorly consolidated sediments in the hills. The recent alluvial fan sediments were deposited primarily by intermittent streams emerging from the Coast Ranges. These sediments consist of gravel, sand, silt, and clay, with finer-grained sediments becoming predominant further away from the mountains. The Pleistocene and Pliocene sediments were deposited primarily in shallow inland seas, although some fresh-water beds occur in the Pleistocene sediments. A stratigraphic column of the geologic formations along the route is shown in Table 2-1.

3. Seismological Features

The proposed conveyance system parallels the topographic and structural features of the region. The San Andreas fault zone lies 18 miles west of the tank farm sites and 10 to 18 miles west of the pipeline route (Fig. F-1, Appendix F). A network of bedrock faults occur in the Tenblor and Diablo ranges within 4 miles of the pipeline route. However, no known active faults have been reported in these ranges (Jennings, 1975). The closest known active fault is the Buena Vista fault about

Table 2-1

STRATIGRAPHIC UNITS EXPOSED ALONG THE ELK HILLS-COALINGA ROUTE

GEOLOGIC AGE	FORMATION NAME	DESCRIPTION
Recent to Late Pleistocene	Alluvial fan deposits	Poorly sorted heterogeneous complex of silt and sand enclosing lenses and tongues of coarse sand and gravel. Coarse edge.
Pleistocene	Older alluvium	Remnants of old dissected stream-terrace and alluvial fan deposits, mapped only in the Kettleman Hills and Kreyenhagen Hills-Reef Ridge areas. Composed chiefly of silty sand with occasional lenses or stringers of coarse sand and gravel. Generally less than 15 feet thick.
Late Pliocene and Pleistocene	Tulare Formation	Unconsolidated to poorly consolidated continental deposits, generally poorly sorted. Predominantly silty materials containing lenses and stringers of coarse sand and gravel; locally contains thin beds of argillaceous limestone, marl, diatomaceous clay, marly silt, gypsiferous deposits and tuffaceous material. Top of formation indistinguishable from overlying Qf.
Middle to Early Pliocene	San Joaquin and Etchegoin Formations	San Joaquin Formation -- predominantly fine-grained, partially consolidated sediments of marine origin, silty sandstone, silt and clay with beds of sand/sandstone and gravel/conglomerate. Thin lenses of limestone occur locally in upper half of formation. Etchegoin Formation -- Sandstone, conglomerate, siltstone and shale of marine origin. Shale is common in the Elk Hills area, but generally absent in Kettleman Hills area.

Source: Wood and Davis (1959), Maher et al. (1975), and Woodring et al. (1940).

5 miles south of the Elk Hills tank farm site, however, movement along this fault is nonseismic fault creep. Although several faults associated within the Elk Hills are believed to have formed in Quaternary time or within the last 1.5 to 2 million years (Woodring, et al., 1940) and thus are considered potentially active (Jennings, 1975), there is no evidence that these faults would constitute a rupture hazard to the pipeline. These faults are located within a half mile west of the pipeline route near M.P. 10. No surface expression occurs along the route or at the sites.

Estimates of seismic events and force (Appendix F) suggest that a tremor producing a peak horizontal ground acceleration of 0.15g to 0.2g (acceleration of gravity, 32.2 ft/sec/sec) could be expected during a 25-year recurrence period and 0.3g for a 50-year event. The estimated maximum level of vibratory ground motion that could be expected along the route would be a peak horizontal ground acceleration during a major earthquake along the San Andreas fault.

The pipeline route and tank farm sites are located on nearly level terrain with no signs of landslides. Minor landslide potential may exist along the banks of stream washes that intersect the pipeline route. The soils and shallow underlying geological formations are generally compact and dry, except where cultivation has artificially introduced irrigation waters in limited quantities. Therefore, little potential exists for vibratory densification (i.e., compaction and settlement during seismic events) or liquefaction. The movement of ground by seismic lurching is generally restricted to the large channels or slopes, where the main pipeline would cross the west end of Elk Hills and several major channels (e.g., Zapato Chino Creek and Los Gatos Creek).

4. Nonseismic Hazards

Potential nonseismic hazards or constraints to the construction and maintenance of a pipeline to Coalinga include land subsidence, erosion or scouring at stream crossings, corrosive soils, and slope instability. Because the sediments and rock along the pipeline route are unconsolidated or poorly consolidated, excavation problems are unlikely.

Land Subsidence. Although land subsidence has occurred throughout much of the southwestern San Joaquin Valley, it has not been documented in the areas along the pipeline route except for one minor exception. The northernmost end of the pipeline (i.e., north of Polvadero Gap, Fresno County), including the proposed Coalinga Tank Farm, lies near the western edge of a large area of subsidence. Subsidence of about 1 foot or less has been measured in this area during the period 1943 to 1946 (Bull, 1975). This subsidence almost entirely has been due to withdrawal of groundwater for agricultural irrigation. In addition, subsidence of about 0.26 feet, due to withdrawal of petroleum from the Coalinga oil field, has been measured in the Anticline Ridge Area just west of the proposed tank farm. Subsidence due to hydrocompaction has occurred in many of the small alluvial fans along the western edge of the San Joaquin Valley, but no published documentation of the phenomenon or the potential for its occurrence exists for the Coalinga pipeline route. This does not mean, however, that the potential for hydrocompaction does not exist along the pipeline route.

Erosion. The pipeline could be subjected to erosion or scouring at stream crossings, but protective measures, such as burying the pipeline beneath the scour grade of the stream, would be employed. The streams in this portion of California are intermittent in flow, with most of the yearly flow occurring immediately after winter storms. The soils along the pipeline route are generally sandy or silty and thus subject to easy erosion, however, the relative flatness of the topography along the main pipeline route greatly reduces the potential for erosion.

Corrosive Soils. The soils along the pipeline route are generally considered only moderately corrosive to buried, unprotected steel pipe. Nevertheless, the entire pipeline would be protected from possible corrosion by a resistant coating.

5. Mineral Resources

Mineral resources that have been recovered in the vicinity of the pipeline route include petroleum, gypsum, sand, and gravel. Several major oil fields and numerous smaller fields have been developed throughout the length of the pipeline route. The major fields are, from north to south, Coalinga East Extension, Kettleman North Dome, North Belridge, South Belridge, Cymric, McKittrick, and Elk Hills. Gypsum in the form of gypsite (an impure, earthy mixture of gypsum, sand, silt, and clay that has formed at or near the surface) has been recovered in large amounts from the alluvial deposits in the Avenal Gap and the west side of Kettleman Hills, the west side of Lost Hills, and in the McKittrick area. Other smaller deposits of gypsite occur near Blackwells Corner and near Coalinga. As of 1962, this area was the largest producer of gypsite in the United States. Nearly three-fourths of all gypsite produced in California came from the deposits in Kern County. The gypsite is sold primarily in bulk for use as a soil conditioner. The unconsolidated alluvial fan deposits, as well as portions of the poorly consolidated sand and gravel beds, are potential sources of aggregate. A diatomaceous white silty clay bed near the bottom of the Tulare Formation has been prospected for Fuller's earth along the west flank of North Dome, Kettleman Hills, but no record of production exists.

6. Soils

Soils along the pipeline route and at the tank farm sites generally consist of well-drained loams or sandy loams. The soils of the nearly

flat plains consist primarily of the Panoche Association. These soils have moderate natural fertility and, when irrigated, are rated as Class I soils in the U.S. Soil Conservation Service Land Capability rating system. The areas of gently sloping alluvial fans and low hills underlain by the Tulare Formation are covered by soils of the Panoche Association (2% to 5% slopes). These soils also have moderate natural fertilities and are rated as Class II soils when irrigated. The soils occupying the upland areas along the pipeline route are primarily of the Kettleman Association (15% to 50% slopes). These soils have moderate natural fertility, but because of steep slopes and the potential for erosion these soils are rated Class VII.

7. Unique Geological Features

Freshwater and marine fossils, primarily mollusks, are abundant in several strata along the pipeline route. The mollusks of the lower Tulare Formation represent the largest known Pliocene freshwater fauna on the Pacific Coast. Other fossils contained in the Tulare Formation include marine mollusks, diatoms, and fragmentary fish remains. The San Joaquin, Jacalitos, and Etchegoin Formations contain marine mollusks, sand dollars, diatoms, fish remains, bone fragments of marine and land mammals, and land plant leaves.

B. Air Resources

1. Climate

The climatic parameters that are important in determining general and photochemical pollution potential are winds, mixing depths, and sunshine. Summer winds in the San Joaquin Valley are dominated by a light, prevailing northwesterly flow caused by the semipermanent high pressure system and by the flow of marine air from the ocean through the Sacramento-San Joaquin Delta area. Mixing depth is the depth of the

layer of air beneath the inversion level. During the summer, a persistent inversion exists in the San Joaquin Valley between 1,600 and 2,000 meters (5,200 to 6,600 feet) above sea level. Night and early morning inversion heights are generally lower but usually rise or dissipate with the heat of the sun. Sunlight during the summer months is abundant in the San Joaquin Valley because of the presence of a persistent high-pressure area. During the summer, the light winds, abundant sunlight, and shallow mixing depths lead to the accumulation of hydrocarbons and photochemical pollution.

A more detailed treatment of the San Joaquin Valley climate as it relates to air pollution is presented in Appendix-G.

2. Air Quality

Air emissions and ambient air quality are presently regulated by a combination of Federal, state, and local agencies (Appendix-H). The most significant regulations for petroleum projects include:

- o New Source Review procedures (including Prevention of Significant Deterioration) and New Source Performance standards of the U.S. Environmental Protection Agency
- o The Air Quality Maintenance Planning effort current underway involving Federal, state, and local entities in the San Joaquin Valley
- o The national and state ambient air quality standards
- o The New Source Review procedures proposed by the State Air Resource Board
- o Emission limits and controls required by local Air Pollution Control Districts

National ambient air quality standards have been promulgated for the following pollutants: carbon monoxide, sulfur dioxide, suspended particulates, nitrogen dioxide, nonmethane hydrocarbons, and photochemical oxidants. The latter pollutant is of particular concern because its high concentrations are a significant problem in the San Joaquin Valley. Oxidants form as a result of complex reactions between reactive hydrocarbons, nitrogen oxides, and sunlight. The project's primary emissions would be hydrocarbons and, consequently, impacts on existing oxidant concentrations would be the primary concern.

The National Ambient Air Quality Standard for oxidants is exceeded on a substantial number of days (93 in Bakersfield during 1975) in the San Joaquin Valley. The trend since 1971 has generally been increasing. The 1975 data show an apparent large decrease, but this represents a calibration change in the instruments and not improved air quality. General oxidant concentrations are higher in the eastern and southern portions of the valley. Recent studies by the California Air Resources Board (ARB) showed that oxidant concentrations in nonurban areas south of Bakersfield can be higher than those concentrations measured at the station in Bakersfield. The ARB study also showed that oxidants and possibly other pollutants caused significant damage to crops in the San Joaquin Valley.

Emission controls, especially on automobiles, are expected to reduce oxidant concentrations in the San Joaquin Valley in the near future. Population and automobile use will increase, however, and total emissions will catch up with the controls benefit, assuming existing technology. Sulfur dioxide sources are expected to increase in the future, due primarily to increased replacement of natural gas-driven pumps by fuel oil driven pumps and new steam injection units at reclaimed oil fields.

A more detailed discussion of the San Joaquin Valley air environment is presented in Appendix I.

C. Noise

The results of a noise survey (URS, 1976; Appendix J) and an analysis of topographic maps indicate that the Elk Hills and Coalinga tank farm sites have noise levels typical of a wilderness/rural environment. Similarly noise levels along the pipeline route are characteristic of those found in wilderness/rural areas except at several industrial sites (e.g., pumping stations, cotton gins) where higher noise levels exist. State Highway 33 represents a major background noise source (up to 58 dBA at 100 feet from the road) along 35 miles of the pipeline route.

D. Water Resources

The entire Elk Hills/Coalinga Conveyance System would be located within the boundaries of the Tulare Lake Basin. This basin is essentially closed, except for occasional surface and subsurface outflows to more northern basins. Surface and groundwater flows within the basin converge towards the basin's central valley floor. In the past, this convergence resulted in the development of several large lakes (e.g., Tulare, Buena Vista, and Kern lakes). However, upstream diversions, heavy groundwater pumping, and high evaporation rates have helped to reduce these lakes to their present status as essentially dry lakebeds.

While the water resources of the basin are quite large and the current utilization rates high (Appendix K), the project region has relatively limited water resources. Less than 6 percent of the basin's total surface flow originates from this western region (only 19,500 acre-feet/year). This flow occurs entirely in the form of intermittent streams that have sustained flows only during and immediately after

periods of heavy precipitation. These surface flows seldom reach the valley floor; instead, they percolate rapidly in their streambeds. This provides the primary source of recharge for West Valley ground waters. The quantity of water present in the westside ground-water system, however, appears to be quite limited.

Heavy pumping for irrigation has substantially lowered local water levels. Present water table levels range in depth from 100 to 400 feet below the land surface (California Department of Water Resources, 1975). Although little data exist about the quality of the ground water, what are available indicate that the quality of West Valley waters is generally poor. Surface flows have total dissolved solids concentrations in excess of 3,000 mg/l (California State Water Resources Control Board, 1975). The causes of this degradation in quality are not completely known, but natural and artificial factors contribute to the low quality of both surface and ground waters (e.g., evaporation, soil and bedrock leaching, excessive pumping, crop evapotranspiration, and irrigation leachate).

The most important water resource traversed by the project is neither surface nor ground water but rather imported water. The California Aqueduct generally parallels the pipeline route and supplies annually more than 500,000 acre-feet of high quality water to the general Tulare Lake Basin. Two laterals of this aqueduct are crossed by the proposed pipeline: the Coastal (or Avenal) Aqueduct near Devils Den (M.P. 49-50) and the Coalinga Aqueduct near Los Gatos Creek (M.P. 81).

E. Biological Resources

1. Vegetation

The dominant vegetational association that would be traversed by the project is the Lower Sonoran grassland. Several streams with

riparian and streambed vegetation cross the grassland at various locations along the pipeline route. The general characteristics of these communities are discussed in Appendix L. Less precipitation in the South Valley (Elford, 1970) has resulted in a vegetational gradient from the southern to the northern end of the pipeline route. The ground cover in the grasslands is much more sparse on and around Elk Hills than near Coalinga. Furthermore, grasses constitute a much larger proportion of the groundlayer vegetation at the northern end of the route than they do further south, where red-stemmed filaree (Erodium cicutarium) is dominant. Similarly, the riparian associations near Coalinga include characteristic riparian species, such as the Fremont cottonwood (Populus Fremontii) and other plants typical of moister regions in the northern part of the San Joaquin Valley, whereas the streamside vegetation near Elk Hills is only a denser association of the surrounding grasses, forbs, and shrubs.

Human activities have substantially modified the vegetation along the proposed project. Most native vegetation north of Blackwells Corner has been destroyed and replaced by crops; much of the rest is heavily grazed. Grazing has had two noticeable effects. Common saltbush (Atriplex polycarpa), the dominant shrub in the southern portion of the project area, is a highly desirable browse plant for livestock, and overgrazing has eliminated it from much of its former range throughout the San Joaquin Valley (Sankary and Barbour, 1972). Overgrazing has had a similar effect on this plant in the northern portion of the proposed project. Grazing has also enhanced the spread throughout the area of introduced plants, such as red-stemmed filaree.

Another aspect of human influence on the regional vegetation appears to be the ability of the small berms along roads and pipelines to trap the wind-dispersed seeds of Russian thistle or tumbleweed (Salsola kali). Dense colonies of this undesirable species have become established in many places and create new centers of dispersion of the plants.

Local variation in vegetation is most pronounced towards the southern end of the project area, where lack of moisture severely limits plant growth. Differences in topography, shading, and proximity to water are reflected in the density and composition of vegetation. In the shade produced by a saltbush plant and oilfield facilities, grasses were frequently observed to be green and in flower, whereas the exposed vegetation a few inches away was dead or dormant. North-facing roadside berms were usually covered with various grasses and forbs, while the south slopes receive more sunlight and supported little or no vegetation. Such differences may reduce the coverage and productivity of plants on the southwesterly-facing slopes of Elk Hills while increasing coverage and productivity of northerly-facing slopes north of McKittrick.

No rare and endangered plant species have been observed or reported on the proposed pipeline route. A population of cotton eriogonum (Eriogonum gossypinum), which is considered rare and endangered (Powell, 1974), has been reported approximately one-half mile north of the proposed tank farm site at Elk Hills (California Native Plant Society, 1976).

Field studies for this project area were performed in the early fall of an exceptionally dry year (November 1976), although some rain had preceded field observations and stimulated new growth. However, a greater number of identified plant species and greater understanding of the ecological processes could be developed when growing conditions become more favorable.

2. Wildlife

The wildlife composition in the proposed project area includes (1) two endangered species, (2) large populations of relatively undisturbed wildlife, and (3) nonnative and disturbance-tolerant wildlife in disturbed habitats and highly disturbed wildlife found near cultivated and

other disruptive land uses (e.g., highways, pump stations, and agro-industrial buildings). The two endangered species, the blunt-nosed leopard lizard and the San Joaquin kit fox, and the other wildlife along the corridor are listed in Appendix M. The tule elk reserve area is located outside of the project area (Fig. 1-4). The local distribution of wildlife generally relates to the type of habitat and density of vegetation (Appendix M). The ecological relationships of wildlife involve: (1) the vegetation which is used as food or which provides shelter; (2) the other animals with which particular animals may compete or exclude; and (3) the prey animals of the carnivores and raptors.

The San Joaquin kit fox and the blunt-nosed leopard lizard are federally and state-protected endangered species. The fox is known to visit or reside along the entire project area, while the lizard is known from near Taft and Blackwells Corner and may be expected at M.P. 0-37, 51-58, and 60-72. As indicated in Figure 2-2, the Elk Hills Reserves have been included in the recommended critical habitat for the San Joaquin kit fox. Under the direction of the U.S. Fish and Wildlife Service, the California Department of Fish and Game is participating on the San Joaquin kit fox recovery team. This team will be recommending several areas for inclusion as "critical habitats" for the kit fox and these areas include NPR-1 and NPR-2. The proposed Elk Hills Tank Farm is located within one of these habitat areas and the proposed pipeline passes through portions of the habitat area as shown on Figure M-1 and discussed below. Critical areas for the blunt-nosed leopard lizard include the general area of Elk Hills to Blackwells Corner. Federal regulations and guidelines provide for the protection and maintenance of these species.

The black-tailed jackrabbit, brush rabbit, turtle doves, quail, and pheasant are the only abundant game species in the project area. The raccoon, badger, spotted and striped skunks, and bobcat are the major furbearers in the area. The other vertebrates in the project area form

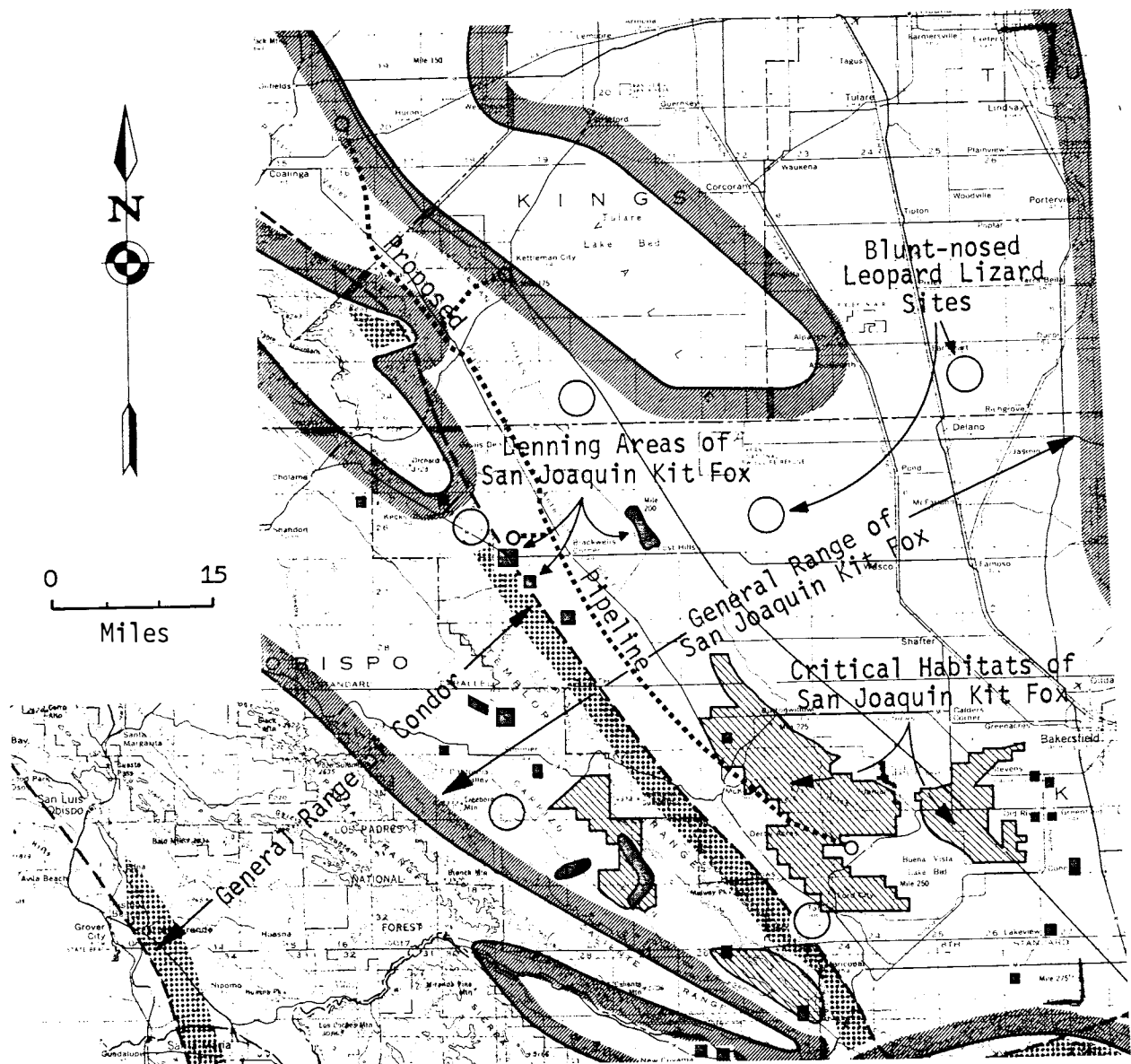


Figure 2-2. Distribution of Endangered Wildlife Species Along Elk Hills/Coalinga Corridor.

Source: California Department of Fish and Game, 1976, 1977.

a community quite similar to that which exists throughout the San Joaquin Valley, especially south of Fresno.

Wildlife in the project area are associated with specific types of habitat in the project area: alkali flats, desert scrub, grasslands, riparian woodland, and cultivated fields and orchards. Although the list of species for the project area and South San Joaquin Valley is smaller than those from denser vegetation of forest and chaparral, several important wildlife species are restricted to these natural habitats (e.g., the blunt-nosed leopard lizard, San Joaquin kit fox) or are at their southern- or northern-most range limits (e.g., San Joaquin antelope ground squirrel, pocket mouse, and kangaroo rat). Many birds only visit this area during the winter-spring months when vegetative productivity is most abundant.

The proposed site for the Elk Hills Tank Farm provides habitat for an open scrub wildlife community consisting of kangaroo rats, pocket mice, ground squirrels, the kit fox, several raptors, seasonally visiting small birds (e.g., swallows, hummingbirds, finches, etc.), and several reptiles. No den of the kit fox was found within the site, although fecal pellets and tracks were present and abundant. The blunt-nosed leopard lizard and its expected habitat were not found within the site. The lizard, however, has been reported within the general Elk Hills area.

The grassland and scrub habitat of the Elk Hills tank farm site extends along the pipeline route from M.P. 0 to M.P. 37. Between M.P. 0-11, the pipeline route passes through about 6 miles of recommended kit fox critical habitat. In several places, past oil field and pipeline construction has eliminated natural habitat within the 50-foot wide pipeline construction zone. From M.P. 37 to M.P. 51, the pipeline route passes through cultivated fields and orchards, and the only resident

wildlife consists of those bird species tolerant of disturbance associated with cultivation activities. The water sources in these areas attract many birds during the summer or during the dry fall-winter months like those of the last few years. The pipeline route traverses open, heavily grazed grasslands that contain few shrubs from M.P. 51 to M.P. 72. These areas provide some habitat for several birds, ground squirrels and kangaroo rats, occasional rattlesnakes, and other snakes and lizards that are fed upon by raptors and the kit fox.

From M.P. 72 to M.P. 84 and at the Coalinga tank farm site, the pipeline route crosses a combination of disturbed and heavily grazed grasslands and cultivated grain and cotton fields. The wildlife of this segment is identical to that of the earlier section, although this section appears to be more disturbed by cultivation and oil field activities (e.g., Gujarral Hills oil field). Along the entire route, the only riparian woodland occurs at Zapato Chino Creek (M.P. 78). Because of the water and denser vegetation (some trees and willow shrubs), greater numbers of passerine birds may be found near the creek than in the surrounding areas. Furthermore, the creek may also serve as a trail for larger wildlife species (e.g., rabbits, kit fox, bobcat, skunks, and badgers).

The habitat and wildlife of the Coalinga tank farm site are poor and generally reflect the past cultivation and aqueduct disturbance. The grassland and forbs and small shrubs attract only visiting passerine birds and an occasional hawk or owl overhead.

3. Aquatic Biota

The streams traversed by the pipeline route and near the two tank farm sites are intermittent and isolated from other natural waterways. Consequently, no fish exist in these streams, even during and following heavy rains. The Avenal and Coalinga aqueducts, California Aqueduct

extensions that would be crossed by the pipeline, support game and nongame fish populations characteristic of the California Aqueduct. White catfish are the dominant game fish in these extensions, although striped bass are also frequently found. Insignificant populations of green sunfish, black crappie, and largemouth bass, among others, are found as well. Carp and blackfish are the most prevalent nongame fish. Fishing pressure along the Avenal and Coalinga aqueducts is negligible.

4. Ecological Relationships

The ecological relationships of the biota along the proposed pipeline route and at the tank farms are defined by interactions of the plants, invertebrate, and vertebrate communities with each other and the physical and human environments of the area. The combination of the seasonal climate and geological history of the Coast Ranges has created a small desert environment in the southwestern portion of the San Joaquin Valley. This area is separated by the Tehachapi Mountains from a similar environment in the Mojave Desert to the southeast. The geological formations and derived soils tend to be porous, thereby quickly losing whatever rainfall that does fall to shallow groundwater tables or evaporation. Human uses of the land include grazing, oil production, and cultivation. Intense grazing has eliminated some native plants, introduced many foreign plants, and allowed graze-resistant native plants to expand. The grazing has also contributed to trampling and compaction of the soils, removal of litter, soil erosion, and rapid runoff of rain. These actions have reduced the fertility and productivity of the soils. Oil field development has cleared the disturbed vegetation, inundated some areas with oil, and introduced disturbances to wildlife. During the last 10 years, introduction of large irrigation systems has led to the conversion of on the order of 1,000,000 acres of desert grasslands that were previously used for grazing or were left alone.

These land uses and the physical elements of the environment have dictated the setting in which the native plants and wildlife have had to adjust in order to survive. Vegetation along the route reflects these uses and elements and consists of some introduced and native grasses and forbs and native shrubs in the southern segment of the project; predominately introduced grasslands and cultivated crops and orchards in the middle segment; and cultivated crops and small grasslands and riparian woodland areas in the northern segment. Shrubs and small trees are most abundantly found along the dry creeks or on steep northerly-facing slopes. A similar distribution occurs among the grasses and forbs along small ditches and hillocks. Some shrubs are scattered across the intervening grasslands. The high evapotranspiration of soil moisture and low available moisture maintains a very low ground cover below the shrubs. The seasonal rainfall provides a markedly seasonal availability of live roots and leaves for forage, but seed sources may persist for several months. Because of the past uses of the land, recolonization of native vegetation and the increase in density of the overall vegetative community, may take many decades, if not centuries, when grazing is halted. Recovery from the more intense oil field operations and cultivation would require intervals of hundreds to thousands of years.

The vegetation in the project area relates to the wildlife through several prominent pathways: food, shelter, and communication. Because of the relatively low vegetational value in the project region, the ground has become an important element in the shelter and communication of wildlife. The three major resident rodents of the region -- ground squirrels, gophers, and kangaroo rats -- feed on the roots, leaves, and seeds of the grasses, forbs, and shrubs. Their prominent shelter consists of burrows rather than vegetation. The open, low profile of the vegetation provides ideal conditions for movement and view of food and predators. The absence of dense root systems associated with trees and chaparral permits gophers to burrow easily through the soft soil. Other rodents and rabbits are more closely associated with dense vegetation.

Dense vegetation along creek channels, which provides more food from shrubs than the open grasslands and a protective cover from hawks and eagles, also permits coyotes, bobcats, and other ground-dwelling carnivores to attack from shorter distances.

Although the low productivity of the natural vegetation in the region does not support a large population of vertebrate herbivores, birds and rodents may be abundant during the spring. This low productivity, in turn, does not support a diverse carnivore and birds of prey population. During much of the year, and especially during the summer and fall, carnivores must expand their ranges and raptors must move to more productive areas. Resident carnivores (e.g., the kit fox, coyote, and bobcat) may depend on insects, fruits, leaves, carrion, and livestock for survival during the low period of productivity.

F. Archaeological, Historical, and Other Cultural Resources

The proposed project occupies an area of the South San Joaquin Valley that is noted for its archaeological remains in and around Buena Vista and Tulare lakes, its historic sites and structures of the early oil field industrial development on the west side of the South Valley (from the 1860's), and its paleontological resources of the McKittrick Tar Seeps and marine fossils of Kettleman Hills. No federal landmark or historic site, however, lies within the project area or vicinity. State landmarks in Kern, Kings, and Fresno counties generally are 3 or more miles from the project area. Surface indications of unregistered archaeological remains or sites were not found within the surveyed portions of the project tank farm sites and several high potential portions of the pipeline route. No known paleontological site of larger invertebrates or vertebrates occurs within the project area, although remains of microinvertebrates and plants probably exist in the many marine and terrestrial deposits near the surface. One fragment from a large fossil mammal was found near the pipeline route, 1 mile west of the Elk Hills Tank Farm.

The archaeological record of the South San Joaquin Valley has focused on the series of lakes and marshes in the central portion of the valley, including Buena Vista Lake. The Yokuts language group of Indians occupied this region and may be responsible for most archaeological remains found on or near the surface. The closest recorded site to the Elk Hills tank farm site lies 3 miles to the east, near the old Buena Vista Lake margin. Many other sites are recorded near the lake and further north and east on the central valley floor. From the proposed Elk Hills Tank Farm and along the pipeline to the proposed Coalinga Tank Farm, no recorded archaeological sites occur within 2 miles of the project; some sites are located around Tulare Lake, 2 to 5 miles west of the Coalinga segment of the pipeline (Holman and Chavez, 1976). A survey of the pipeline route and tank farm sites (Appendix R, [Holman and Chavez, 1976]) concentrated on the probable areas of archaeological remains (e.g., stream crossings), but no remains were found at or near the surface. Examination of in-progress trenching for a pipeline along State Highway 33 did not reveal any indications of subsurface archaeological remains or sites. No nationally registered archaeological sites or district lie in or near the project area.

The historical record of the tank farm sites and pipeline route begins with Fages's recorded trip to Buena Vista Lake and Elk Hills in 1772. The American Era followed the early Spanish and Mexican ranching period of the early 1800's and its landmarks on the west side of the South Valley include the first industrial development of oil processing and extraction: the Buena Vista Refinery, north of McKittrick. Oil fields, derricks, and "gushers" of the late 1800's and early 1900's became the major historic events and sites in the area. The proposed route and sites do not involve any substantial known or recognized historic landmarks or structures. Except for the California Aqueduct, no large structure lies within the project area, and most structures found within the project area are oil pipelines, storage tanks, wells, and roads. At M.P. 10, the pipeline route crosses the old route of the

railroad that served McKittrick. Only the old grade for the railroad track remains in the vicinity of the pipeline corridor. In the central portion of the pipeline route, the agricultural structures have been built recently (e.g., most less than 10 years ago), and have no special historic or architectural value.

Paleontological resources of the west side of the San Joaquin Valley have been known for several decades. Marine invertebrates (e.g., clams, coral heads, and sea urchins), marine vertebrates (whales, pinne-peds, and fishes), and terrestrial vertebrates (birds, mammoths, horses, and camels) have been found in the Kettleman Hills and lower flanks of the Temblor and Diablan Ranges west of the project area. Many of these fossils are preserved at the University of California, Museum of Paleontology, and the Los Angeles County Museum. The proposed sites and routes do not pass through or near any recorded paleontological sites. Absence of surface exposures of bedrock precludes any estimates of the potential for remains in the subsurface. One small fragment of a limb bone of a large fossil mammal was found at M.P. 5 and indicates the potential for large fossils in the vicinity of the Elk Hills tank farm site. The general geological character of known fossil sites in the project area further indicates that some potential for encountering remains in the sub-surface excavations (down to 9 feet below surface) exists between M.P. 0 and 11, 51 and 58, 63 and 66, 74 and 76, and 79 and 81.

G. Land Use

The land-use setting of the proposed tank farms and pipeline largely includes open grazing lands, tank farms, and oil fields in the southern portion of the project area; cultivation and grazing in the middle portion; and cultivation, grazing, oil fields, and tank farms in the northern portion. These lands lie within the western sections of Kern, Kings, and Fresno counties. The project does not directly involve any

major group of residences or incorporated areas and often lies adjacent to existing pipelines or road rights-of-way.

1. Kern County

The proposed pipeline in Kern County crosses lands primarily in oil field use with some light grazing. The Elk Hills tank farm site is adjacent to an existing Navy LACT unit. Approximately the first 10 miles of the route parallel an existing pipeline corridor. About 1 mile south of Carneros Pumping Station, the proposed route again joins an existing pipeline corridor (M.P. 29) and continues along that corridor to Blackwells Corner. Leaving the existing corridor, the proposed Elk Hills/Coalinga route parallels Highway 33 to the county border. Irrigated row crops and orchards along the route within Kern County lie between Blackwells Corner and the Temblor Pumping Station at M.P. 46. The few farm residences adjacent to this section of the route would experience temporary disturbance during construction.

2. Kings County

The pipeline corridor enters Kings County from the south to the east of and adjacent to the State Highway 33 right-of-way, and continues to parallel the highway to the intersection of Highways 33 and 41. At this intersection, the pipeline would pass under the roads and continue northward on the west side of Highway 33 in an existing pipeline corridor. The main pipeline would remain in this existing corridor to the northern Kings County border.

The major land uses along the main corridor are for grazing and dry and irrigated crops, with a few scattered residences and a filling station and cafe. A cluster of residences, including a farm labor camp, are located at the Kings/Kern County border, between M.P. 50 and 51 (Appendix C). The pipeline would be placed either between the Highway 33

right-of-way and bordering residences or between the bordering residences and the farm labor camp to the east. In either case, structures would not be relocated or permanently disturbed, although during a construction period of about a week, residents would be inconvenienced by the trench and disturbed by noise and dust. After construction, the landscape would be restored.

A filling station and restaurant are located at the northern quarter of the intersection of Highways 33 and 41. The pipeline would pass under this intersection and cause only slight disturbance to these establishments.

A single residence is located between the proposed corridor and Highway 33 just south of M.P. 60 (Appendix C). Residents here would experience inconvenience and disturbance during the construction phase.

The town of Avenal is the only population center in the vicinity of the proposed main pipeline route in Kings County. The town, with the exception of the airport, has developed to the east of Highway 33, while the pipeline would be approximately 1 mile to the west of Highway 33. Because of the distance of the project from significant structures or residences, no land-use incompatibility with either project construction or operation is expected.

3. Fresno County

In Fresno County, the proposed pipeline generally passes through the Gujarral Hills oil fields, cultivated fields, and vacant lands used for light grazing. The route crosses some agricultural land near Zapato China Creek, and some between Los Gatos Creek and the Coalinga tank farm site. The tank farm site is presently cultivated for dry crops (e.g., cotton).

H. Socioeconomics

1. Employment

The primary employment effects resulting from the proposed project would occur in Kern, Kings, and Fresno counties. The proposed pipeline route is near the established communities of Taft, McKittrick, Avenal, and Coalinga. Bakersfield is about 35 miles from the project's southern terminus and represents the only major metropolitan center within the project's probable sphere of effect.

In 1976, Kern County contained 139,200 employed persons. Major sectors of employment support are government (24 %), trade (20 %), and agriculture (17 %). Construction supports about 3 percent of the county's labor force. Unemployment within the county was 8.3 percent in 1976, improved from 9.4 percent a year earlier.

The most recent estimate of Kings County employment, made in January 1975, indicated a working population of 18,950. Considering the dormancy of this county, this estimate remains a good approximation of current employment. Government and agriculture employ the largest proportion of the county's workers (24.6 % and 23.4 %, respectively). The construction industry supports 2.3 percent of Kings County employees. Unemployment within the county was about 7 percent in 1975. No current estimate is available.

In July 1976, 202,300 people were employed in Fresno County. The major employing sectors of this group are agriculture (about 18% of the county's employment), retail and wholesale trade (21%), and government (20%). The construction industry, while not a primary employer, supports a substantial portion of the county's labor force (about 4%).

In July 1976, the unemployment rate was 8.7 percent, down from 10.1 percent a year before. This level of unemployment is lower than rates prevailing in the state, but they are higher than national rates.

2. Population

As of January 1976, 346,400 people resided in Kern County. This represents an increase of about 5 percent from 1970, a gain primarily attributed to new county births. Bakersfield contains a population of 77,700, up by about 12 percent since 1970.

There has been insignificant growth in the Kings County population since 1970. The 1970 population was 66,717; it is now 68,700. Although there has been a recent exodus of county residents, sufficient gains have been recorded from new births to offset this migration loss.

The population of Fresno County and one of its western communities, Coalinga, consists of:

	<u>1970</u>	<u>1975</u>	<u>1976</u>
Fresno County	413,329	445,000	448,600
Coalinga	6,161	6,175	6,150

3. Public Services and Utilities

Along the project area in Kern, Kings, and Fresno counties, public services and utilities are provided by all levels of government. Fire protection for the project corridor in Kern County is provided by the Kern County Fire Department, which has six stations whose service areas include the pipeline route. In Kings County, a county fire station at Avenal functions year-round and is supplemented in the summer by the California Division of Forestry Fire Station at Cottonwood Pass. Three county fire stations in Fresno County serve the tank farm site and the

northern portion of the pipeline corridor in conjunction with the Coalinga and California Division of Forestry fire stations located in Coalinga. Table N-1, Appendix N, gives manpower and equipment summaries and a map of fire station locations.

Police protection along the pipeline corridor is provided by the three county sheriffs' departments. In Kern County, sheriff substations are located at Wasco (six men), Buttonwillow (three men), and at Taft (five men). In Kings County, the sheriff at Avenal has seven assistants. In Fresno County, four deputy sheriffs are stationed in Coalinga. The cities of Taft and Coalinga each have their own police departments as well.

The school districts at either end of the pipeline route, the only sites of new permanent employment, currently have space for more students. Kern County school districts in the vicinity of Elk Hills have generally experienced declining enrollments during the past 6 years. For example, the Elk Hills Elementary School District had only 77 students enrolled in the fall of 1975. The elementary schools in the Coalinga Unified School District have experienced similar enrollment decreases, and at the present time one elementary school is not being used. Junior high enrollment in that district has remained somewhat stable and high school enrollment has been increasing. Specific trends are shown in Table N-2, Appendix N.

Solid waste in all three counties is collected in sanitary landfills. In Kern, three county landfill sites are located near the pipeline corridor at Lost Hills, Buttonwillow, and Taft. In Kings County, the Navy has their own sanitary landfill at Lemoore Naval Air Station, the Avenal Community Service District maintains a sanitary landfill near Avenal. Fresno County operates a sanitary landfill near Coalinga. Wastewater treatment plants are located near the pipeline corridor in Taft, Bakersfield, and Coalinga. Data on all of these waste management facilities are summarized in Table N-3, Appendix N.

4. Recreation

Recreation resources in Kern, Kings, and Fresno counties are located well away from the valley floor and the proposed pipeline route. In Fresno County, the primary recreational resources are the foothills of the Sierra Nevadas and the reservoirs located in them. The mountain and desert portions of Kern contains the county's primary recreational resources. In Kings County, the primary resource is the Kings River, in the northeast portion of the county.

5. Land Transportation

The pipeline and Elk Hills Tank Farm would cross or lie near state highways and county roads. In addition, the pipeline would run adjacent to State Highway 33 between Blackwells Corner and Reef Station. The Coalinga Tank Farm would lie to the west of Interstate 5.

The state highways crossed, from south to north, are State Highway 58 north of McKittrick, State Highway 33, north of McKittrick, State Highway 46 at Blackwells Corner, State Highway 41 at its junction with Highway 33, and State Highway 33 at Blackwells Corner, Temblor Pump Station, Reef Pump Station, and Kettleman Pump Station. Traffic volumes along Highway 33 and the other affected highways are presented in Table N-4, Appendix N. Highway 46 has the heaviest recorded traffic volumes; however, it and all the other highways are well below their estimated 2,000 vehicles-per-hour capacity.

The pipeline route would cross several Kern County roads including Elk Hills Road, Skyline Road, and Seventh Standard Road. In Fresno County, the pipeline would cross Sutter, Jayne, El Dorado, Tractor, Gale and Tornado avenues. Traffic volumes on all these roads are expected to be lighter than those volumes found on the state highways.

6. Fiscal Effect

Kern, Kings, and Fresno counties contain the five basic jurisdictions whose revenue flows would be influenced by the proposed pipeline and related facilities. The four tank farms all would be on unincorporated lands. The tank farm at the origin and terminus of the pipeline route are 5 to 8 miles from the incorporated municipalities of Taft and Coalinga, respectively. However, the route does not enter their jurisdictional boundaries.

The current distribution of revenues and expenditures for the three counties are shown in Table N-5, Appendix N. As is to be expected, property taxes represent a major revenue source for these counties (approximately 30% of the total). The other major revenues are those from state and federal agencies; these range from 30 to 50 percent of the counties' revenues. The largest expenditure categories are for public services: health and sanitation, public protection, and general governmental services.

7. Visual Quality

The visual character of the main and lateral pipeline corridors, and tank farm sites, is determined in large part by the geological characteristics of the area and the prevailing dry climate. Although portions of the routes are located in undulating, irregular terrain, most of the project area is located on the flat valley floors of the Antelope and Kettleman Plains. Some intensive cultivation of row and orchard crops exists between M.P. 37 and M.P. 51 of the main pipeline corridor, and near the Coalinga tank farm site, but vegetation in most of the study area consists primarily of scattered desert scrub. The main pipeline and lateral corridors are virtually treeless, except for some isolated specimens in the vicinity of Avenal and Coalinga, and the orchards mentioned above.

The resulting visual character of most of the study area is one of a rather barren landscape, interspersed in the middle and north by intensive agricultural cultivation, and bordered at the northern end by the small communities of Avenal and Coalinga. Large-scale, petroleum-related facilities, including tank farms, currently exist in the already industrialized areas at each end of the proposed main pipeline corridor (M.P. 37 and isolated sites to north), and at the ends of the proposed laterals.

Because of the low intensity land use in the study area, the project sites' distances from urban centers, and the limited visual corridors from which they may be seen, the general viewability of the project may be considered low. The main and lateral routes do, however, cross or pass in the vicinity of a number of major roads. Some of the roads have been designated as scenic highways or potential scenic highways by state and local authorities and are shown in their relationships to the proposed pipeline route and tank farm sites in Figure 2-3.

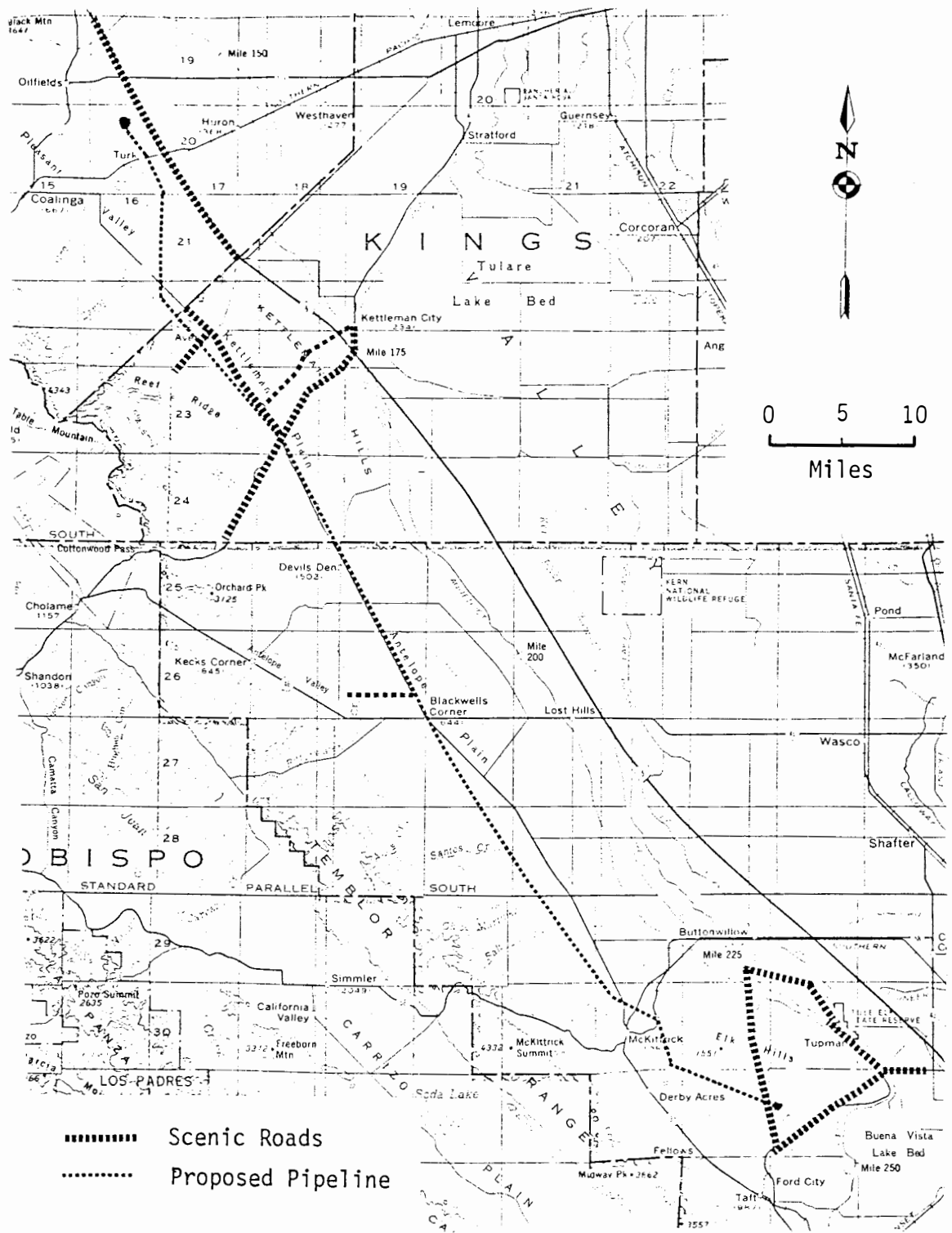


Figure 2-3. Scenic Roads Along Elk Hills/Coalinga Route.

Source: U.S. Geological Survey, State of California, South Half,
Scale 1:250,000.

III. . RELATIONSHIP OF THE PROPOSED ACTION TO LAND-USE PLANS,
POLICIES, AND CONTROLS OF AFFECTED AREA

III. RELATIONSHIP OF THE PROPOSED ACTION TO LAND-USE PLANS, POLICIES, AND CONTROLS OF AFFECTED AREA

This section discusses the relationship of the proposed Elk Hills/Coalinga project to the land-use plans, policies, and controls of the jurisdictions in which the project facilities would be located. Whereas federal agencies are not required to conform to local or state land-use plans, policies, or controls, agencies commonly plan with an awareness of local issues and may give an informal presentation of the project to local agencies.

The proposed pipeline and tank farm sites are located in three counties: Kern, Kings, and Fresno. Because the facilities are not located on municipal, state, or federal lands (other than state highway lands), this discussion focuses first on the plans, policies, and controls of the three counties. Information is drawn from county plan elements, feasibility studies for proposed projects, and county zoning maps and ordinances. The proposed route was submitted to each county planning agency for review with the specific request that possible land-use incompatibilities be identified and other issues be brought to our attention for inclusion in the Environmental Statement. Their responses have been incorporated into the following discussion.

A. Kern County

The zoning along the proposed routes and at the Elk Hills tank farm site in Kern County is exclusively agricultural (A, A-1) except for a

1-mile section southeast of Blackwells Corner (M.P. 36). The zoning in this section includes single-family and multiple-family residential (R2PD, R), commercial and office (C2PD, LOD), mobile homes (MB), and floodplain zones. This reflects a specific plan for an employee community proposed but yet to be developed by Blackwell Land Company. Because the proposed route follows an existing pipeline corridor through this 1-mile section, the project would not represent a new land use. The Kern County Planning Department, in order to determine whether or not the proposed facilities were in conformance with their zoning ordinance and Williamson Act rules, submitted the question to their County Counsel. His answer, in a Kern County Office Memorandum dated 3 March 1977, stated several alternatives. The most promising, according to a county planner, is the following. Because the government pipeline is to be operated as a common carrier, it is classified as a public utility. The agricultural zoning districts and the Williamson Act rules allow public utility transmission lines, with right-of-way review by the Planning Director. A second likely alternative would be to amend the Zoning Ordinance to specifically provide for pipelines.

The Kern County Planning Director will decide on the appropriate action.

The County Planning Department has not identified county plans or policies that would suggest incompatibility of the proposed Coalinga pipeline route.

B. Kings County

Kings County does not have a current Land Use Element of their General Plan, but review of the Environmental Resources Management Element (1972) of the General Plan and the Avenal General Plan, Land-Use Map (1976), suggest that no plans or policies would be incompatible with the proposed pipeline in Kings County.

The zoning in Kings County is agricultural for the length of the pipeline corridor. If the government were to seek approval for the proposed pipeline in the county, they would have to submit information normally required for a conditional use permit from the Kings County Planning Commission.

C. Fresno

Review of the Coalinga Regional Plan prepared by the Fresno County Planning Department (1974) suggests that no conflicts exist between the proposed pipeline and the county plans and policies with the possible exception of the planned Coalinga Cargo Port. The cargo port is proposed by the City of Coalinga and Fresno County for a location adjacent to and on the west side of Interstate 5 and north of Phelps Avenue. The proposed pipeline corridor would be on the western edge of the airport site. According to current optimistic plans, construction on the Cargo Port could begin in 1978. Construction of the two projects, then, may be concurrent.

The tank farm would occupy approximately 80 acres of land west of the airport site and south of the Shell Oil tank farm. This site is designated as General Industrial Reserve on the Coalinga Regional Plan. Conceivably, the proposed tank farm could displace future development of airport-related industries in the long-term. Neither the City of Coalinga nor the Fresno County Planning Department, however, have identified this as a problem.

All lands through which the corridor passes in Fresno County are in an exclusively agricultural district. Petroleum pipelines and tank farms are permitted in this district subject to review and approval by the Planning Director. Several tank farms already exist in the Coalinga area. As mentioned previously, the government would provide information regarding the pipeline and tank farm to the Planning Department for their review and comment.

IV. PROBABLE IMPACT OF THE PROPOSED
ACTION ON THE ENVIRONMENT

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Beneficial and adverse impacts would occur as a result of both the construction and operation phases of the proposed project. Site-specific aspects of the construction would largely influence the biological, archaeological, historic, and visual elements of the environment. Construction would also increase employment and stimulate economic activity. Other elements such as geology and air quality would be less affected by construction. Effects of the operational phase would arise from both normal and abnormal operations. An important effect is the ability to deliver 200,000 B/D (expandable to 250,000 B/D) of crude oil for use in the United States. In general, however, the increased production of Elk Hills crude oil would be offset by decreased production of other California oil since the Elk Hills oil would be more competitive economically. In addition, if pipeline capacity would be made available for all of the Elk Hills crude oil through existing systems leading to the San Francisco Bay Area from Coalinga, some other California oil would be displaced and not able to reach markets. Normal operations and presence of the tank farms would degrade air quality and the aesthetic surroundings. Normal operations along the pipeline itself would have little or no adverse effects. Effects of abnormal operations generally center on possibilities of fire and oil spillage. Implemented and potential mitigation and compensation measures that reduce or eliminate adverse effects of the project are discussed with each environmental element.

Major operation impacts of the project would arise from an accidental spill of oil. Both tank farms would be enclosed by berms and drainage controls that would contain spillage. Onsite and nearby firefighting equipment and personnel would reduce the extent of fire effects. Spillage from the pipeline would be reduced by the valves and continuous monitoring of flow through the pipeline as well as routine patrolling of the pipeline and pump stations. The probable frequency, causes, size, and area of oil spills from project elements are discussed in Appendix D.

The potential spill volumes and their locations have been integrated into the Sensitivity Analysis discussed in Appendix E. This analysis assigns three major categories of spill (i.e., 5,000, 25,000, and 40,000 barrels) to each segment of the pipeline, determines the potential areas of direct effect, and relates these factors to the assigned values for the environmental resources. The resulting combinations of risk, area of effect, and resource value provide estimates of sensitivity level along the pipeline corridor (Appendix C). These analyses and the derived values may be reflected in the location of portions of the pipeline and placement of some block valves.

In addition to adverse effects resulting directly from the construction or operational phases of the project, cumulative environmental effects could occur. Consideration of cumulative effects combines the environmental elements of the existing conditions, those of the proposed project, and those of other proposed or associated projects at Elk Hills and near Coalinga. Development of petroleum production and required facilities at the Elk Hills Naval Petroleum Reserve would add to the effects of the proposed project. Hydrocarbon emissions would increase, the size and distribution of vegetation and critical habitat of the two endangered species would be reduced, and the visual setting would be changed. The proposed Coalinga Cargo Port (scheduled for earliest completion by 1979), in conjunction with a new tank farm at Coalinga, would

increase hydrocarbon and other emissions, disturb the local visual setting (particularly as seen from Interstate 5), and establish a predominate commercial use of the land in this immediate area.

As indicated in the introduction, transportation of the crude oil out of the Coalinga area to markets is not included since details of these markets are not yet defined. The market for crude oil in the future is greatly uncertain owing to the availability of north slope Alaskan crude oil and the reluctance of west coast oil companies to commit themselves for crude oil acquisition. Factors that will influence decisions of west coast oil companies concerning crude oil acquisition during the period of Elk Hills crude oil production include the following:

- o Government controls on production and export.
- o Supply stability.
- o Crude oil acquisition costs and profitability.
- o Technical factors.
- o Transportation availability and costs.
- o Contractual obligations and marketing systems.

These and other factors concerning the crude oil market situation on the west coast are presented in Appendix P.

A. Geological Resources

1. Construction

The consumption of mineral resources and increased erosion or hydrocompaction due to a leak or spill are the most significant geological impacts associated with the proposed project. The lack of steep slopes along the main route limits the potential for induced slope failure due to pipeline construction. Placement of the pipeline would

not preempt the use of the land for agricultural purposes; however, areas that are not now being irrigated could be potential areas for hydrocompaction. Thus, agricultural use of such lands may require additional measures once the pipeline is in place in order to avoid damage due to hydrocompaction. With the exception of possible gypsite deposits in the vicinity of Blackwells Corner, the pipeline would not interfere with known mineral deposits. Although no known unique features would be destroyed by the project, invertebrate fossils and possible fragments of vertebrate fossils might be uncovered or destroyed during pipeline construction.

Construction of the tank farms and pipeline would consume various types of mineral resources. Sand and gravel would be needed for pipe bedding, trench backfill, and access and maintenance roadways. Much of the excavated material would be suitable as trench backfill. Some gravel for bedding and berm material would be imported from local sources. Other mineral resources would be consumed in the production of pipe, valves, storage tanks, and asphalt and concrete.

Unless construction occurs during the winter or rainy season, increased erosion activity should be limited. However, in sloping terrain or at stream crossing the potential for erosion could be increased for some time until vegetation is reestablished. Leaks or ruptures in the pipeline could result in subsurface erosion or possibly hydrocompaction in loose soils.

2. Operation

The general context of the west side of the San Joaquin Valley indicates a moderately active structural regime associated with the San Andreas fault zone and the numerous minor faults, fractures, and uplifts in the region. The proposed construction activities of the tank farms and the pipeline would not induce any seismic or structural changes.

The impacts of the structural and seismic setting upon the proposed project would largely involve the impact of seismic tremors most probably originating from the San Andreas fault zone or other faults to the southeast. No faults with Quaternary displacement cross the pipeline route or tank farm sites, therefore the potential for pipeline or tank farm damage due to fault rupture does not exist, based on the existing available literature. Ground shaking produced by earthquakes may interfere with normal operations of the system. All facilities would be designed for accelerations of about 0.5g in order to minimize adverse effects of seismic movement, but, in California, design strengths may be exceeded (e.g., an event of 1.0g acceleration is possible). Greatest potential for adverse effects would occur where marked differentials in the strength of the materials exist between the ground and the facilities or between components within the facilities (e.g., valves and pipes, pumps and pipes, tanks and pipes, and pipe connections at sharp angles or between different sizes of pipes). Such sharp angles have been minimized, and all joints would be welded.

Effects from compaction, liquefaction, lurching, and induced landslides would be minimized by the relatively well-compacted and dry soil conditions at the tank farm sites and along the pipeline route. Crossings of channels and the steep terrain at the west end of Elk Hills would involve additional grading to minimize the potential for movement. Tank farm sites would be thoroughly explored for compaction and necessary foundation requirements for berms, tanks, and also for the pump stations.

3. Mitigation

To protect the pipeline from possible damage due to scouring at stream channel crossings, it would be buried below the scour line or encased in concrete. A revegetation program would be planned for the entire pipeline route and at the tank farm sites in order to establish

vegetation for erosion control purposes as soon as construction activities have ceased. To facilitate revegetation, excavated topsoil would be stockpiled for replacement. Construction on slopes and at stream crossings should coincide with the normal dry season, where possible. If construction in these areas, particularly at stream crossings, must take place during the rainy season, erosional control contingencies, such as water diversion structures or downstream sediment traps, could be implemented.

A detailed field survey should be conducted to evaluate the near-surface of hydrocompaction potential of the sediments along the pipeline route. If areas of potential subsidence are discovered, they should be pretreated in order to minimize the potential for further subsidence after the pipeline is in place (due to irrigation, flooding, or pipeline leaks).

The entire length of the pipeline would be coated for corrosion protection. Such coating and cathodic protection would minimize maintenance and the potential for leaks due to soil corrosivity.

The structural and foundation designs and the construction at the tank farms would be equal or greater in resistance to seismic shaking than are existing tanks. Welded steel tanks, X-ray inspection of pipe welds, and welded flanges of pipe-to-valve connections should reduce or eliminate some of the adverse effects of tremors. With any major tremor, the project would be shut down and all components checked in order to prevent minor leaks from becoming a major spill.

B. Air Quality

1. Construction

Air quality impacts during construction would result primarily from fugitive dust caused by wind-blown disturbed earth and emissions from

construction vehicles. Particulate concentrations are currently at high levels in the San Joaquin Valley, therefore any increase would be an adverse impact. Based on calculations, particulate concentrations generated by construction of the tank farm and pipeline would exceed the State of California 24-hour standard in the vicinity of the construction site (Appendix 0). Construction vehicle emissions generally present no significant problems off the construction site. Dust generation caused by construction was estimated to be an order of magnitude less than that generated by existing agricultural operations.

2. Operation

The primary operational impact of oil transport from Elk Hills to Coalinga would be hydrocarbon emissions from crude oil storage tanks. The project's major regulatory review for air quality would be the Federal New Source Review and the New Source Review regulations adopted by Kern and Fresno counties. These require the EPA to conduct a review of the project to determine if it would interfere with the attainment or maintenance of ambient air quality standards.

Hydrocarbon emissions from crude oil storage at Elk Hills and Coalinga were calculated based on methods developed by the American Petroleum Institute (API). EPA then used the API methods to develop their own emission factors. Study has shown the EPA factors to be too conservative and the general consensus of EPA and the California Air Resources Board (ARB) is that actual emissions rates are about 25 percent of the EPA factors for storage losses. This adjustment has been made to the values for this section. Hydrocarbon losses from crude oil withdrawal were also estimated from API methods revised by EPA (EPA, 1977). Further study of these losses has determined that actual emissions are about 90 percent less than the values derived using the EPA methods (Chicago Bridge and Iron, 1977). Thus, the emission values used in this section have been adjusted to reflect this data.

Using the above assumptions and a volume-to-mass relationship developed from Stevens Zone and Shallow Oil Zone crude vapor data, reactive hydrocarbon emissions from both tank farms were estimated. It was assumed that four 250,000-barrel tanks would be used to store the Stevens Zone crude and that one 250,000-barrel tank would be dedicated to Shallow Oil Zone crude at each tank farm.

The total reactive hydrocarbon emissions from each tank farm are shown in Table 4-1. These values assume that all C_3 and above parafins are moderately or highly reactive. This comprises 95 percent of the total emissions shown in Table 4-1.

Reactive hydrocarbon emissions (RHC) from both tank farms can be compared to existing basin emissions to determine the incremental increase that the project would cause. Assuming that hydrocarbons and oxidants are related, the incremental increase in oxidant concentrations can then be estimated. Due to the location of the tank farms, the meteorology of the area, and available emission inventories, the tank farm emissions were compared to their respective county emissions. The Coalinga tank farm emissions were compared to Kings County emissions because the comparison yielded the following results:

Table 4-1
ELK HILLS EMISSIONS IN COMPARISON WITH
COUNTY-WIDE EMISSIONS
(lbs/hr)

TANK FARM	REACTIVE HC	1980 REACTIVE HC IN RESPECTIVE COUNTIES	TANK EMISSIONS AS % OF COUNTY TOTAL
Elk Hills	10.7	13,417 (Kern)	0.08%
Coalinga	10.3	2,525 (Kings)	0.41%

In the event that the Federal government would select the Coalinga alternative for the transportation of Elk Hills crude oil, it may be necessary to effect emissions offsets for hydrocarbons. The tank farm emissions in each county are well below the ARB and individual county New Source Review emission limits for offsets. However, the EPA is expected to review the entire Elk Hills project, which would include the entire Elk Hills project, which would include the production of Elk Hills crude oil as well as its transportation. In that event, hydrocarbon emissions from the entire project would be considered and the Federal government would seek to effect hydrocarbon emissions offsets in the San Joaquin Valley Air Basin. A study is currently underway to determine potential sources for offsets. Such sources would include refineries, petroleum storage tanks, production wells, and dry cleaning establishments.

A more detailed treatment of the impacts in the San Joaquin Valley and San Luis Obispo County can be found in Appendix O.

3. Mitigating Measures

a. Implemented

The Federal New Source Performance Standards call for floating-roof tanks to be constructed when storing a product with the vapor pressure of crude oil. The tanks proposed for construction at Elk Hills and Coalinga would be double-sealed, floating-roof tanks. This is considered the best available control technology by the EPA for this type of petroleum storage.

b. Potential

Standard measures can be used to mitigate dust generation during construction. These include frequent watering of bare areas, clearing

the least amount of land possible, covering stockpiled materials, oiling or paving construction roads, and avoiding construction activities on the dry, windy days that occasionally occur in the San Joaquin Valley.

One additional measure could be implemented to reduce hydrocarbon emissions at the tank farms -- emissions reduction elsewhere in the basin. In order to lower emissions sufficiently so that the project would not be subject to New Source Review, emissions would have to be 15 lbs/hr or less.

Emissions reductions (or trade-offs) involve reducing emissions at or eliminating existing sources of hydrocarbons in the basin. The reduction in existing emissions should ideally be equal to or greater than the emissions from the new source. This measure has significant potential, especially in the San Joaquin Valley, where a substantial number of older, uncontrolled petroleum facilities exist. For example, the emissions from a fixed-roof tank are at least an order of magnitude higher than emissions from a floating-roof tank of comparable size. Therefore, the elimination of only one fixed-roof tank of approximately the same size as the proposed tanks would provide an emissions reduction that would offset the emissions from the floating-roof tanks proposed for Elk Hills.

C. Noise

1. Construction

Noise impacts from construction of the proposed tank farms and pipeline would be insignificant, except where the pipeline would pass near scattered farm residences (or labor camps) and the Polvadero Country Club. At these locations minor construction noise impacts would be expected (Appendix J).

2. Operational

Noise impacts near the tank farms and pump stations would be insignificant because there are no people near these locations.

D. Water Resources

1. Construction

The construction of the proposed Elk Hills/Coalinga Conveyance System would have few, if any, significant effects on the water resources of the study area in which it would be located.

Potential sources of construction impact would include ground-clearing operations that can result in increased rates of sediment and turbidity, use of local water supplies during construction and operation, disposal of rain and other waters, and accidental spills of fuels, lubricants, and hydrostatic test water. For the most part, the size of these impacts would be relatively small, even if no mitigation measures are undertaken. Based on the size of the construction crews, the consumptive use of water during construction should be insignificant. The likelihood of accidental spills would be reduced by the use of proper construction techniques. Only in the case of ground-clearing operations are specific mitigation measures necessary and these are already planned for implementation.

The construction operations would include the use of water to hydrostatically test the new storage tanks and the new pipeline to be constructed. Pipeline testing would be done in roughly 1-mile sections with each section of pipeline tested individually, the water drawn off and then reused. At Elk Hills and Coalinga, the largest tank is 250,000 barrels (10.5 million gallons) in capacity. Because the testing would last at least several days, the required water could be acquired over a

period of time so as to minimize the impact of its acquisition. Thus, it is unlikely that its acquisition would have any impact on local or regional water supplies.

During hydrostatic testing, the test water would tend to pick up any construction debris or mud left inside newly constructed pipeline segments and mill scale and small amounts of hydrocarbons from newly constructed sections. However, it is expected that the amount of material suspended or dissolved in the test water would be slight and that it would not have any significant impact on local receiving waters if it were discharged into them. Nonetheless, these test waters would be collected and then discharged to local surface waters only if they are in compliance with all applicable regulations.

Further discussion of these potential impacts and the factors affecting their significance is presented in Appendix K.

2. Operation

a. Normal

Normal operation and maintenance of the proposed pipeline and tank farms would require only limited amounts of water and should have little, if any, impact on the water resources of the study area or the basin.

Consumptive use of water by the project would be negligible because of the relatively few employees (24) required for its operation. The only other potential source of impact is tank farm runoff. Surface runoff from these facilities could lead to significant impacts on local surface waters. However, this impact would be minimized by proposed plans for collection and treatment of site runoff waters.

b. Abnormal

Abnormal operations, especially major spills of crude oil, do have the greatest potential for impact. In particular, spills into surface waters could have significant effects. However, most of the surface streams crossed by project facilities tend to be protected from significant impact due to the intermittent nature of their flows. Vulnerable man-made channels, such as the Coalinga Aqueduct, are protected by special design features. Thus, the impact of oil spills on all streams is considered to be minor. Similarly, because of both the physical properties of the oil to be transported and the structure of the local ground-water systems, the amount of intrusion that spilled oil might make into local ground waters should be relatively insignificant.

Further discussion of these potential impacts and the factors affecting their significance is presented in Appendix K.

3. Mitigation

A number of mitigation measures are currently listed as part of the project plans. Construction measures include the employment of sediment control measures, particularly in areas where project facilities impinge on natural or man-made waterways, and the avoidance of vulnerable portions of local aqueducts. This second measure has resulted in the preliminary location of the Coalinga Tank Farm on lands that are down-slope from the Coalinga Aqueduct and the location of aqueduct crossings at points where the aqueducts are within fully enclosed siphons. Similarly, as part of normal project operations, it has been proposed that all surface runoff generated within the boundaries of the four tank farms be collected and treated before discharge. Other proposed operational procedures that would help to minimize the impact of oil spills on local water resources include the monitoring of the pipeline by air (once a week) and by ground (annually) and the development of an oil

spill contingency plan that would provide for quick response to and cleanup of an oil spill should it occur.

E. Biological Resources

1. Vegetation

a. Construction

The only significant construction disruption of vegetation would occur during the grading of storage sites, digging of pipeline trenches, deposition of debris, and creation of access routes for construction equipment. Associated with these disturbances is the possible compaction of soil and a consequent long-term degradation of vegetational habitat.

The clearing and construction at Elk Hills tank farm site would destroy approximately 60 acres of grasslands and shrubs. Similar vegetation exists in the surrounding area, but these areas may be affected by the cumulative effects of other anticipated projects on the south side of Elk Hills.

The degree and significance of disturbance would vary with location. The first 37 miles of pipeline route traverse an essentially intact expanse of Lower Sonoran grassland (Appendix L). The 50-foot right-of-way would cross completely undisturbed land (e.g., southwest of the South Belridge Oil Field, from M.P. 13 to 27). The rest of this first portion of the pipeline, however, would be constructed in existing pipeline right-of-way, reducing the width of newly disturbed vegetation. The only other relatively undisturbed vegetation to be crossed by the pipeline lies 0.5 to 1.0 miles west of State Highway 33 in the Kettleman Plain, from pipeline M.P. 60 to 72. The right-of-way corridor would disrupt the vegetation in this region. The remaining land that the

pipeline would cross has been disturbed either by oil-pumping equipment and supporting development (M.P. 79 to 81) or by cultivation (M.P. 37 to 60, 72 to 79, and 81 to 85).

The total land area that would be disturbed by the project is approximately 800 acres; of this amount, approximately 320 to 400 acres are currently undisturbed vegetation.

In the above cases, the vegetation of the entire pipeline corridor would not be irreversibly destroyed. If the soil is not severely compacted, both the access roads and debris storage strip would probably revegetate. The extent of vegetation recovery would vary markedly because the efficacy of revegetation programs is dependent upon the rainfall in the years following project construction, the moisture-retaining capacity of the soil, and the subsequent traffic on the disturbed ground. If the fill above the pipeline is compacted, it would probably not revegetate rapidly. However, the fill would form a small mound or ridge with its northern side receiving less sunlight and losing less moisture than the surrounding land. The greater soil moisture may encourage revegetation more than could otherwise be expected.

The most significant disruption of vegetation would occur where the pipeline crosses streams. Potential damage is particularly severe at Los Gatos and Zapato Chino creeks, approximately 3 and 6 miles south of the Coalinga Tank Farm. Of these two sites, less damage is likely to occur at Los Gatos Creek. Because the pipeline and supports would be constructed over the channel and its banks, existing vegetation there would not be destroyed. Where the Coalinga Aqueduct passes through a siphon beneath Los Gatos Creek, revegetation has eliminated any evidence that construction had taken place below the top of the streambank. At Zapato Chino Creek, the proposed oil pipeline would be buried and require the clearing of all vegetation on both streambanks for at least 15 to 30 feet.

Small washes and swales would be crossed at numerous points along the pipeline route, especially at its southern end. As long as the land is recontoured to resemble the preconstruction topography, as planned, no adverse long-term effects should result.

Virtually no adverse impacts are associated with construction of the Coalinga Tank Farm. The site has been cultivated and supports little, if any, natural vegetation. Construction of the Elk Hills Tank Farm would destroy approximately 60 acres of Lower Sonoran grassland.

It is possible that small berms along access roads to the pipeline would encourage the establishment of dense colonies of Russian thistle. This is an undesirable impact.

No populations of rare and endangered plants have been observed or reported (California Native Plant Society, 1976) which would be injured by construction of the proposed conveyance and associated tank farms. Some populations of cotton eriogonum (Eriogonum gossypinum) have been reported within a few miles of proposed construction sites, but they are all uphill from the project area and would not be affected.

b. Operation

Few impacts would be associated with the normal operation of the proposed conveyance system. The only effects would be reduced revegetation by traffic on access roads for maintenance and inspection, but existing roads would primarily be used.

An oil spill may occur at some time during the operational life of the project. A spill from any of the storage tanks should be confined by the surrounding berm, but a spill from the pipeline would spread into the surrounding vegetation. The distance of travel and the area covered by oil in a maximum spill are discussed in Appendix D. The

oil is assumed to travel less than 1,000 feet from the pipeline and to affect less than 60 acres. Discussion of oil spill effects is generally based on reported effects (e.g., Baker, J. M., in Cowell, 1971; Wein and Bliss, 1973) from field observations on oil-contaminated sites in the vicinity of the project area, and the experiences with oil spills (URS).

The most ecologically important areas that could be affected by a spill are the riparian zones at Los Gatos (M.P. 81) and Zapato Chino Creeks (M.P. 78). Spilled oil would enter the creek bed, which supports little vegetation. All contaminated vegetation would be killed either by the oil or cleanup operations. Residues in the soil would inhibit but not prevent revegetation; some plants colonize natural oil seeps. Most residues should eventually be metabolized by soil bacteria, but the heaviest residues may physically interfere with revegetation of a disturbed zone. Areas whose vegetation has been eliminated as a result of any of the above processes would be subject to erosion.

Similar effects would be observed if spills occur in other regions. Buena Vista Creek (M.P. 5) has already been contaminated by oil. Asphalt covers many areas of the creekbed and has altered erosion. Although the creek has been disturbed, additional contamination would further prevent its revegetation and must be considered an impact. Grassland is also expected to revegetate slowly after a spill. In the southern portion of the pipeline route, oil would flow into the diffuse network of small drainage channels, and asphalt deposits may form in these. Because these small intermittent streams are the most productive microhabitats in the grassland, their preferential destruction must be considered significant.

If a large oil spill occurs, a fire may start. Ecosystem damages from fire in the southern portion of the project area would probably be restricted to the plants that have been contaminated by oil. The vegetation is too sparse to create any great danger of fire spread.

Burning may, in fact, enhance the rate of recovery of the affected region. Riparian habitats contain more shrubby growth and could be much more severely damaged. Grassland and cultivated regions to the north (e.g., near Avenal) could suffer considerable damage in a dry season.

c. Mitigation

The siting of the project's tank farms and pipeline route includes several mitigating measures. The most significant of these is the avoidance of vegetation that is relatively undisturbed. Any modifications of the route or sites would constitute mitigation if they would reduce the loss of existing native vegetation.

At pipeline crossings of riparian habitat (i.e., Zapato Chino Creek), the construction right-of-way should be reduced to 15 to 20 feet. All streamside vegetation should be considered valuable, and its destruction should be avoided. Heavy equipment movements in the streambed should be minimized.

Where destruction of riparian vegetation is unavoidable, the area should be regraded and revegetated. Because the requirements for artificial revegetation differ significantly from region to region, the Soil Conservation Service (SCS) of the U.S. Department of Agriculture (District Conservationist, Bakersfield, California) could provide guidelines for restoration.

The SCS could recommend procedures for revegetating the pipeline corridor, stabilizing the berms around oil storage tanks, and recontouring and revegetating the small surface drainage channels that would be disturbed by laying the portions of the pipeline towards its southern segment. The SCS may also recommend the desirability and techniques of avoiding creation of additional habitat for the Russian thistle (Salsola kali).

2. Wildlife

The impacts of the proposed project upon wildlife resources focus primarily upon the disturbance and destruction of supportive habitat for the San Joaquin kit fox. Furthermore, the adverse impacts of the project must also be viewed as a contribution to the cumulative effects of expanding cultivation of the desert scrub and the construction of associated field and production facilities at Elk Hills Naval Petroleum Reserve.

a. Construction

Assuming a complete land clearing and destruction of biota, construction of the Elk Hills Tank Farm and the pipeline, from M.P. 0 to 37, M.P. 51 to 72, and portions of M.P. 74 to 81, would remove about 250 acres of desert scrub and grasslands from the use and support of the kit fox. Of this total, 36 acres to be cleared occur within the area recommended as part of the fox's critical habitat. However, no den of fox appears threatened, and for about 20 miles (i.e., equivalent to an area of 70 acres) the construction zone lies within existing pipeline corridors. Thus, the potential adverse effects upon the fox and its critical habitat are lessened.

b. Operation

Except for maintenance roads that would be continuously disturbed, natural and induced restoration recovery in the grassland areas would return the pipeline corridor to habitats similar to those that presently exist. Loss of riparian habitat for wildlife at Zapato Chino Creek (M.P. 78) can be considered a substantial and adverse effect in an area where such habitat is unusual.

The relatively passive nature of the pipeline and tank farm operation would reduce the adverse effects of the normally operating project upon wildlife. Pump station noises, facility staff, and lights would have some disturbing effect upon the fox.

Operation of the Coalinga Tank Farm would have minimal adverse effects upon wildlife now using the site. The tank farm may be joined in the future by the proposed Coalinga Cargo Port. The effects of this airport would probably exceed those of the tank farm, although the facility would add to the area of effect. The airport and proposed and existing oil storage facilities would completely block the north-south ground-dwelling wildlife movement corridor between the Coalinga Aqueduct and Interstate 5. Such a blockage may expand the area of adverse impact, especially of the free-roaming kit fox that resides nearby and visits the proposed facility and airport area.

Operations of the Elk Hills/Coalinga Conveyance System could involve accidental spillage of oil along the pipeline and possibly fires at the tank farms. A maximum spill from the facilities and pipeline would be 40,000 barrels. Such a spill would inundate the downslope wildlife habitat. Of critical concern, spillage between M.P. 0 and M.P. 37 would temporarily remove 60 acres of habitat and some prey of the kit fox.

c. Mitigation

Mitigation measures for minimizing the effects of the proposed project include locating the Elk Hills tank farm site away from existing kit fox denning areas and placing the pipeline and tank farms next to existing facilities or other disturbed zones. The proposed route along existing pipelines also would serve to direct any oil spill away from any existing denning area downslope of the pipelines. The access roads and small graded berms would pass the oil into nearby drainage channels.

The adverse effects of these facilities may in part be compensated for by the acquisition and preservation of existing habitat elsewhere. In addition, the southwest sector of Naval Reserve No. 1 would be protected from further development by concentrating new development between the proposed facility and the nearby tank farms.

3. Aquatic Biota

Because no aquatic organisms occur within the intermittent streams traversed by the pipeline, the project would not affect the aquatic biota of the study area. Similarly the aquatic resources of the Coalinga and Avenal aqueducts would not be impacted. By crossing these aqueducts where they pass underground, encasing the pipeline, and allowing for gravity flow away from the open channels, the potential for any adverse effects associated with spilled oil is avoided.

F. Archaeological, Historical, and Other Cultural Resources

The proposed project has the potential to adversely affect archaeological and paleontological resources by disturbing and destroying remains in sites below the surface. Archaeological and paleontological remains may exist in several areas where the deep excavations may penetrate unexposed and relatively undisturbed strata or levels. Because no recorded historic site or landmark occurs within the proposed project sites and routes, historic resources would be unaffected.

1. Construction

During construction, the potential for encountering archaeological remains may be highest in the segments near existing creeks. These areas include: an unnamed creek at the west end of Elk Hills: M.P. 9 to 12; diffuse creeks draining west McKittrick Valley: M.P. 17; numerous creeks exiting from Temblor Valley: M.P. 20 to 25; creeks between

Antelope and Kettleman Plains near the Avenal Gap: M.P. 45 to 60; Big Tar Creek: M.P. 71; Canas Creek: M.P. 72; Zapato Chino Creek: M.P. 78; and Los Gatos Creek: M.P. 81. These potential areas near the creeks are located in areas with the least disturbance from cultivation and deep irrigation pipelines and culverts. Deep excavation may create significant adverse effects in these areas unless properly mitigated.

Paleontological remains most commonly are encountered in those areas that are away from the creeks and more recent alluvium. Geologic formations of the route and the site have varying potential for fossils, and their review indicates that the greatest potential lies in the segments around Elk Hills, Kettleman Hills, and Guajarral Hills. Marine invertebrate fossils would be the most commonly expected remains, although the peripheral location of the route and sites generally correlates with more recent and continental deposition of terrestrial vertebrates. The finding of a fossil mammal fragment supports the potential for remains along the pipeline route and at the storage site on the south side of Elk Hills.

The surveys for archaeological and paleontological remains provide information about these resources. Other positive beneficial effects may be derived from the geological, paleontological, and archaeological information and remains gained during excavations and borings if the project is implemented with sufficient mitigation.

2. Operation

Normal operation of the proposed project should have little or no adverse effects upon the archaeological, historical, and paleontological resources of the sites and the route. The potential for large oil spills does exist along the pipeline; such an abnormal event could inundate areas that have some archaeological and paleontological potential. If the oil or residue are removed by bulldozers, front-loaders,

or scrapers, some surface materials may be disturbed. Furthermore, if land-fill disposal is selected, the excavation of new or expansion of existing landfills for containment of the oil spill debris may disturb archaeological and paleontological materials.

3. Mitigation

Mitigation of the adverse effects of the project upon archaeological and paleontological resources largely involves the monitoring of deep excavations for foundations within the tank farm sites and for the pipeline trench. Arrangements could be made for the monitoring of excavations and the eventual preservation or removal of remains discovered during the monitoring. This type of monitoring has been selectively conducted for many pipelines and foundations sites and, if properly coordinated, generally does not interfere with the overall construction and operation schedule. An effective monitoring program would eliminate adverse effects and would provide beneficial effects. Further measures would include recording and publishing geological information from the deep and wide trench (ca. 8 to 9 feet deep x 5 feet wide).

G. Land Use

Many of the effects of construction and operation of this project on land use can be more accurately described as impacts on noise level, traffic, air quality, economics, aesthetics, or recreation. These potential impacts are discussed in this report in these latter sections. Impacts that change or disturb the use of land are discussed here.

Generally, the tank farm sites and the pipeline route were selected to minimize disturbance and loss of existing or future land use. The tank farm sites are all located adjacent to existing tank farms. Much of the route is located in existing pipeline corridors and oil fields.

The Coalinga Tank Farm will replace cultivated lands and is in the vicinity of a proposed air cargo port. Conversion of lands adjacent to the airport, including the proposed tank farm site, to industrial uses would be expected if the airport is built.

The agricultural lands crossed by the pipeline will be disturbed somewhat during the construction of the pipeline. Once the pipeline is built, however, cultivation of the land above the pipeline can continue without constraint as before.

H. Socioeconomics

1. Employment

a. Construction

The entire construction phase for the Elk Hills/Coalinga Conveyance System would be completed in 12 to 16 months. The bulk of construction activity would occur within a smaller 50-week interval. Labor rolls would peak at 450 to 500 workers between the eighth and sixteenth week of actual construction.

Four types of construction crews are anticipated. Site preparation would occupy two crews of perhaps 25 workers each for a period of 16 weeks. Tank farm construction would require an additional two crews of 30 persons each for 30 to 35 weeks. Electrical work would require a single crew of 10 for 25 weeks. Pipeline-related activity would require 5 to 10 crews of 30 to 40 workers for about 30 weeks.

Most of this work force would probably be drawn from the Bakersfield area within Kern County. The labor-related pressures arising from this project are relatively small in scale and short in duration. They are not expected to disturb the existing structure of the

metroeconomy. They would serve to briefly enhance the outlook for construction labor in the counties.

The trailing employment effects (secondary and tertiary) of the project would, like the primary effects, be short-lived but positive. They would derive from the infusion of spending that would follow new construction employment. Current estimates of the trailing effects of energy-related construction indicate that 1.3 to 1.9 times the number of primary employees would eventually realize support from construction wage re-spending. The lower limit of this range is most applicable to a project of this location, scale, and duration.

b. Operation

Twenty-four full-time jobs would be generated by the operational phase of the project. About 9 workers would work out of Coalinga; and 15 workers out of Elk Hills.

A slight positive impact would probably be realized by the communities of Coalinga and Avenal. Similarly positive employment effects would arise in the area of McKittrick and Taft.

The trailing employment effects of project operation would involve the equivalent of an additional 50 full-time regional employees.

c. Mitigation

No mitigation measures for construction- or operation-related employment impacts are required.

2. Population

a. Construction

Because the project would tend to employ members of an existing regional construction labor pool, no stimulation to the existing population is anticipated.

b. Operation

As described in the employment section, the project would provide support for about 24 primary workers together with their dependents and 50 secondary and tertiary workers and their dependents. Although it is limited, this project-associated support would contribute to the recent pattern of in-migration to Fresno County and counter Kern County's recent pattern of out-migration. Neither population impact is judged significant.

c. Mitigation

No mitigation is required for either construction or operation effects.

3. Public Services and Utilities

a. Construction

No temporary significant impacts would occur as a result of the construction phases of this project. No additional men or equipment would be required by local fire protection agencies or sheriff departments during construction. The construction would also have no impact on local school districts; no families would be moved to the construction sites because of the temporary nature of this activity.

Construction of the pipeline and related facilities would generate three basic types of wastes: excavation dirt, other solid wastes including excess construction materials, and the wastes from portable chemical toilets. Restoration procedures would include grading and leveling. Excess construction materials and other solid wastes would be disposed of in the local sanitary landfills identified in Table N-3, Appendix N, which are large enough to easily accommodate wastes from the project without significantly reducing their projected life spans. All counties crossed by the pipeline have restrictions on the disposal of wastes from chemical toilets (Table N-3, Appendix N). Before arranging for this service, the Federal government will obtain assurances from those responsible that the chemicals used are compatible with the restrictions of wastewater treatment plants in the three affected counties.

Water needed during the construction of the pipeline and related facilities (including hydrotesting) would be obtained from local municipal or community water supplies. Because the use of local water supplies would be temporary and the peak demand for hydrotesting would be obtained over several days, this water requirement would have no significant impact on local service districts or cities.

b. Operation

There would be no significant permanent impacts to local public services or utilities during operation. Fire protection at the Elk Hills tank farm site would be provided on site and supplemented when necessary by the Kern County Fire Department. Tanker trucks designed to combat oil fires with special foam are located at Taft, Buttonwillow, and Bakersfield. Response time for this equipment to reach Elk Hills is a minimum of 15 minutes. No additional men or equipment would be obtained by the county as a result of the potential emergency demands of this project.

No changes are foreseen in equipment or manpower requirements of the Fresno and Kings County Fire Departments as a result of this project. If a fire occurs at the Coalinga tank farm site, equipment and manpower can be drawn from the rest of the county, leaving a minimum amount of equipment at the backup locations. Similarly, the operation of the pipeline and storage tanks would have little effect on local sheriff services.

There would be a small increase in local school district enrollments. The project would generate approximately 24 permanent local jobs. Assuming a maximum in-migration of 45 persons, there would be approximately 8 new students enrolled in the Coalinga School District and 12 new students in the Elk Hills schools. As can be seen in Table N-2, Appendix N, these students would not affect the local school district's services.

The small amount of waste generated by the personnel at the tank farm sites and the small amount of water used during operation would not significantly affect the life span of the sanitary landfills at Coalinga and near Elk Hills or the water supplies of local communities.

c. Mitigation

During construction, the construction contractor would use only those chemical toilets whose wastes can be accommodated by local treatment plants. The Federal government would increase the water supply available at the Elk Hills tank farm site and provide dry chemical fire extinguishers to improve onsite firefighting capabilities in order to lessen the reliance on Kern County. In addition, the government is a member of the Cooperative Foam Program at Elk Hills. These resources are considered adequate to contain fires and prevent the spread of a tank fire to other tanks. For further detail, refer to the Risk Assessment and Spill Prevention discussions (Appendix D).

4. Recreation

The construction and operation of the proposed pipeline and tank farms would not affect existing or proposed parks or other recreational facilities.

5. Land Transportation

a. Construction

The pipeline would run adjacent to State Highway 33 for about 20 miles. Because the pipeline route must lie outside the highway right-of-way, traffic on the highway would be affected only by the construction vehicles that use it. No significant impact is expected.

The Federal government would conform to state guidelines by boring underneath the highway and enclosing the pipe in a casing at all highway crossings. Consequently any significant traffic impacts would be prevented at these intersections.

On roads with low traffic volumes, which most of them are, open trench crossings may be feasible. During construction of the trenches, one lane of traffic would have to remain open at all times with traffic control procedures implemented (e.g., flagmen). The traffic volumes are low enough to prevent a significant delay from occurring on any road where this procedure would be allowed.

b. Operation

No impacts upon land transportation would arise due to the operation of the proposed pipeline and tank farms.

c. Mitigation

The Federal government will conform to the normal requirements for boring the pipeline under all state highway crossings and under any county roadways that have significant traffic volumes. If open trenching across a roadway is allowed, traffic control procedures would be implemented. These measures would provide sufficient mitigation against any potential impact.

6. Fiscal Effect

Federally-owned and -operated projects receive special exemptions and these dominate the potential fiscal effects of the proposed pipeline and related facilities. Since the tank farms, pipeline, and pump stations, as well as the oil flowing through them, would be built, owned, and operated by the Federal government,* the capital equipment, land, and related inventories would not be subject to state or local taxation. Land title (for the tank farms) and rights-of-way for all other facilities associated with the pipeline would be acquired according to the Federal government's powers of eminent domain. The Navy is not subject to permit fees or state and local government permit requirements. However, as a matter of courtesy, the government provides the local jurisdictions with the information that might have otherwise been generated in permit applications.

a. Construction

There would be no significant direct and immediate fiscal cost impacts upon the local government resulting from proposed construction activities. The only significant cost to county governments would be that involved in reviewing the government's plans and providing informal

*The government would contract with a private firm to operate the facilities but would remain the legal operator.

feedbacks with regard to route selection and design. This is not required of county governments, but their own best interests dictate this review. Where public lands are acquired for rights-of-way, the government would perform all the construction-related activities and restore public lands (e.g., highway rights-of-way) to their original condition. The government would be responsible for insuring that new construction on both public and private lands conforms to federal guidelines; thus, counties are relieved of potential inspection costs.

No new county revenues would be generated by proposed construction activities since any associated permit and inspection fees cannot be levied against the Federal government. Private land owners would be reimbursed at fair market value for easements and damages or title land rights condemned by the government.

b. Operation

Only minor direct and immediate fiscal impacts on local government would result from operation of the proposed pipeline and related facilities.

The government would provide for operation, hazards monitoring, and security of all facilities. The only direct costs that counties may be subject to would be those associated with services provided during emergency situations (e.g., oil spills or large fires). These costs are dependent on particular hypothetical situations, and such costs would be reimbursed.

Removal of taxable lands from the county tax roles represents another potential cost. The pump station and tank farm at Elk Hills are proposed for existing government-owned land, and the pipeline route would be acquired as easements rather than simple title, which would preserve the taxability of associated private lands. In Fresno County,

however, up to 80 acres of land currently owned by Standard Oil Company (R16E, T20S, Section 9; portions northeast of the California Aqueduct) would be taken for government's use as the Coalinga tank farm site. The estimated fiscal effect of these acquisitions is shown in the Socio-economic Appendix N, Table N-6. Current taxes on these lands total approximately \$890 -- amounting to \$5,340 over the next six years. This potential revenue loss represents a minor impact to Fresno County's fiscal base and an insignificant loss to that of Kings and Kern.

c. Mitigation

Standard mitigation measures employed by the Federal government afford for a restoration of original surface lands whenever possible and a compensation to private owners for permanent loss sustained during construction or operation. The government typically negotiates with owners after all construction is complete, operation has begun, and evidence of loss is clear.

As a matter of courtesy, the government typically submits information for planning purposes to local jurisdictions that might have otherwise been generated in permit applications had it been a non-federal proposal. In order to mitigate costs to local government emergency services required in the case of fires or spills, the government will investigate arrangements for reimbursement of unusual costs with each county.

7. Visual Quality

Implementation of the proposed project would result in general visual impacts due to construction and operation of the main and lateral pipelines and storage facilities. However, these impacts would be minor since the project would involve relatively little permanent alteration of the visual environment, and would occur in relatively remote areas of generally low viewability and limited scenic sensitivity.

a. Construction

Pipeline construction would involve some localized, short-term visual impacts. These impacts, most of which are attributable to temporary storage of pipe, equipment, earth, and related materials in the vicinity of construction sites are expected to be insignificant. The pipeline-related construction activities with highest public viewability are expected to be those that occur in the central portion of the main pipeline route parallel to State Highway 33, in the northern portion of the route in the vicinity of Coalinga and Interstate 5.

b. Operation

Pipeline operation would involve little permanent visual impact, since it would be underground for virtually its entire route, and visually sensitive surface areas would be restored to pre-installation conditions. The only location where the pipeline facilities are expected to be visible is at its crossing of the Coalinga Aqueduct and Los Gatos Creek (M.P. 81-82). This crossing would be visible from the adjacent county road.

The Elk Hills and Coalinga tank farms would each consist of five tanks 210 feet in diameter and 40 feet high. Construction and operation of these facilities would be viewable primarily from neighboring roadways, especially Elk Hills Road at the south end of the route, and Interstate 5 at the north end of the route. Although the tank farms would constitute significant visual elements in their respective visual environments, and would be viewable from these scenic roadways, they would not appear incongruous with existing industrial and petroleum tank farms in the vicinities of the proposed sites.

The greatest potential visual impact from the proposed project would result from an accidental oil spill at the pipeline or storage

sites. The visual severity of such an event would depend on the magnitude of the spill, its location, and the speed and effectiveness with which it was cleaned up. The portions of the route with greatest sensitivity to a spill event are those at road crossings, especially scenic highway crossings; those that parallel State Highway 33, (M.P. 37-60); those in the vicinity of residential areas, particularly near Coalinga and Avenal; and those that occur in intensively cultivated agricultural areas, particularly in the central portion of the main route. Major spills in these areas would have locally catastrophic short-term visual effects, and could have continuing long-term significant impacts depending upon the effectiveness of cleanup operations.

c. Mitigation

Measures for mitigating the potential adverse visual impacts of project construction include the following:

- o Unobtrusive, visually screened storage of materials and equipment
- o Using dust-reducing soil stabilizers
- o Minimizing the duration of construction

Measures for mitigating impacts of project operation include the following:*

- o Restoring earth forms to conform with natural topography
- o Restoring exposed surfaces with native ground cover or, alternatively, treating them with cosmetic covering (e.g., aggregate) compatible in texture and color with the surrounding landscape
- o Unobtrusive siting and low-profile structural design elevations, as feasible
- o Natural or earth-colored and textured exterior finishes, particularly for storage tanks

*Measures for mitigating impacts due to spill are described in Appendices D and E.

- o Indigenous architectural styling of accessory structures

8. Growth Inducement

The opening of NPR-1 has associated with it four major project components:

- o Construction and operation of crude oil production facilities at Elk Hills
- o Transport and storage of liquefied petroleum gas
- o Transport of crude oil
- o Market disposition of crude oil and liquefied petroleum gas

While only the potential induced effects of the transport and storage of the crude oil are within the scope of this analysis, the additional and, in some cases, concurrent effects of the four projects may have cumulative regional and extraregional growth inducement effects. Growth inducement of the transport and storage of crude oil in isolation of the other three related projects are considered below.

a. Construction

There would be no significant change in the patterns of growth in Fresno, Kings, or Kern counties as a result of proposed construction activity. Major activity would be staged from locations around the cities of Taft, Avenal, and Coalinga, cities with economies that have previously accommodated similar petroleum-related construction. Furthermore, the intensity and duration of the proposed construction activities are small relative to the regional labor market; thus, existing local housing and related residential services are sufficient to accommodate anticipated levels of temporary increase.

b. Operation

As with the construction phase, the industrial and residential structure of the local economies of Taft and Coalinga (locations of permanent employment) would absorb the small increases in employment without any significant changes in their existing patterns of growth.

The existence of a new crude oil transport and storage system would have a growth-inducing effect only to the degree that its existence creates an impetus for other pipeline systems to locate along the same corridors. However, this effect would be minimal because pipeline transport systems are common to these counties and the existence of this corridor does not set a precedent.

The operation of large tank farms in the counties of Kern and Fresno and the expansion of existing tank farm in Kings and Kern counties may represent a constraint (negative growth inducement) upon the industrial growth. The ultimate effect depends upon the policies formulated by the individual Air Quality Maintenance Task Forces within these counties. The proposed tank farms represent significant hydrocarbon emissions (Appendix O) that would deter future private industries from locating in each county since local air quality standards are exceeded. Because policy is not yet established, these potential effects cannot be determined.

c. Mitigation

Cumulative regional and extraregional growth inducement effects of all phases of NPR-1 petroleum production and market disposition are currently being examined in a separate report and will be incorporated as soon as possible in the overall assessment process. In addition, the Federal government would coordinate its activities with county Air Quality Maintenance Task Forces, especially in Kern County.

V. ALTERNATIVES

V. ALTERNATIVES

The discussion of alternatives focuses on the types and levels of effects that may arise from alternative projects that fulfill the same overall objective as the proposed project: the conveyance of 200,000 B/D (expandable to 250,000) of oil from the Elk Hills Naval Petroleum Reserve to an access point for commercial markets. Only differences in the effects of each alternative relative to those of the proposed project are discussed. Alternative pipeline projects include different routes for conveyance of oil from Elk Hills to (1) the SOHIO and/or ARCO pipelines; and (2) the Naval base at Port Hueneme. An alternative conveyance approach is to dispatch unit trains north and south from Elk Hills. Alternatives that involve changes in the proposed project itself include alterations in the pipeline route and selection of different tank farm sites. Another alternative pipeline project includes the proposed project with the addition of intermediate tank farms and connection to existing pipelines leading to the San Luis Obispo County coast for tanker loading. Final alternatives include the postponement of construction and/or use of the pipeline in order to coordinate the project with statewide supply; and the cancellation of the project and continuation of existing conditions and trends (i.e., the future setting without project). Figure 5-1 presents an overview of the various alternatives considered.

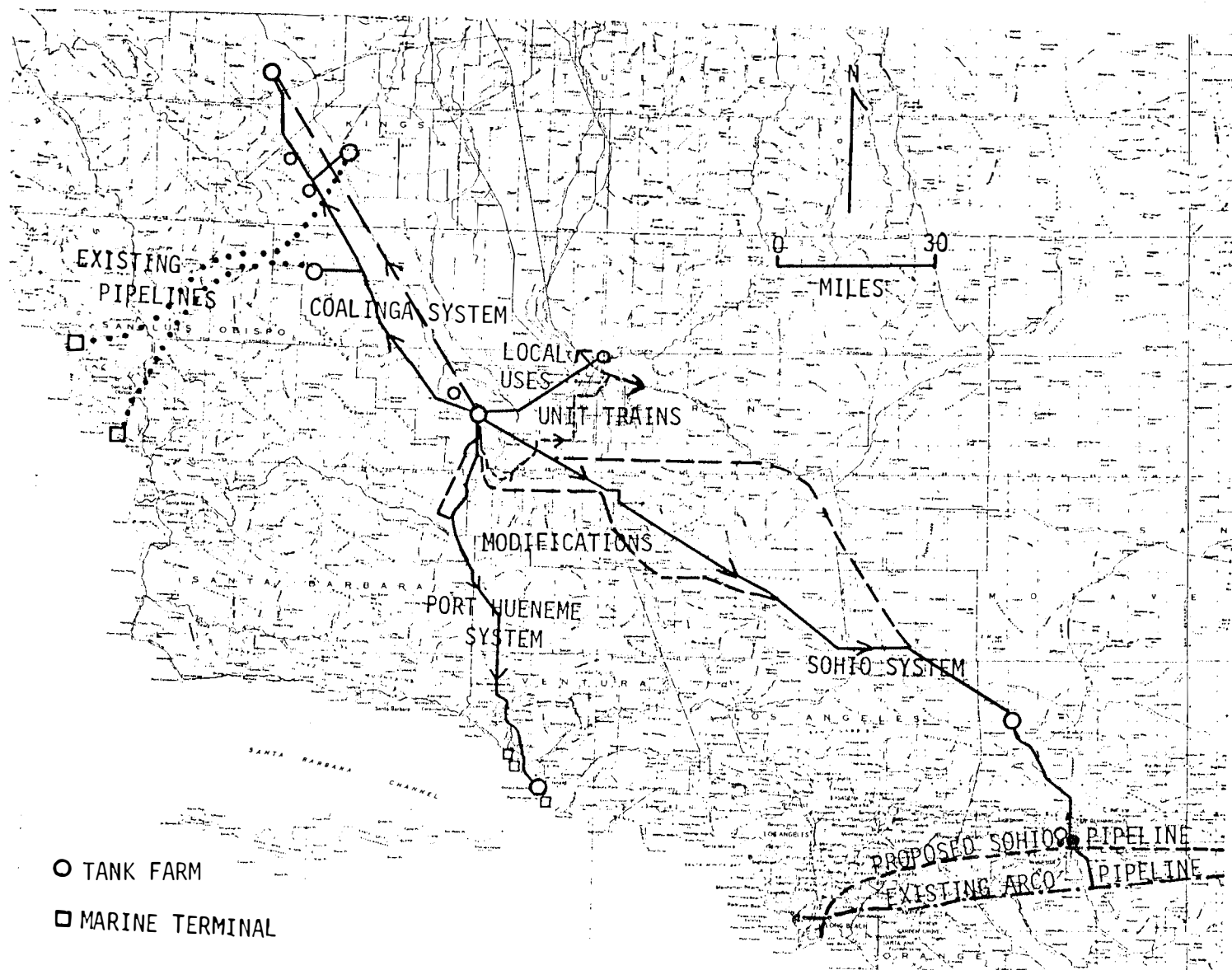


Figure 5-1. General Plans of Proposed Alternative Conveyance Systems from Elk Hills Naval Petroleum Reserve.

Source: U.S. Geological Survey, 1:1,000,000.

A. Elk Hills/SOHIO and/or ARCO Conveyance System

1. Description

The Elk Hills/SOHIO and/or ARCO Conveyance System would involve tank farms at Elk Hills and Rialto with 168 miles of interconnecting pipeline and a connection with either the proposed SOHIO Pipeline, the existing ARCO Pipeline, or both of these pipelines (Fig. 5-1). The Elk Hills Tank Farm would have the same general facilities and layout as it would with the Coalinga system. The Rialto Tank Farm would contain up to four floating-roof tanks with double seals. Pump stations would be located at the Elk Hills Tank Farm, on Tejon Ranch (at the north flank of the Tehachapi Mountains), at Llano (east of Palmdale), and at the Rialto Tank Farm. A total of 20 valves would be located along the overall pipeline. The resulting potential for oil spill would be about 7 miles of greater than 80,000 barrels, 61 miles of greater than 40,000 barrels, and 66 miles of greater than 10,000 barrels. Construction and operations staffs would be 460 and 31 persons, respectively. Total non-federal land requirements would be 400 acres with 25 miles of street/road/right-of-way involvement, and 60 acres of federal lands (San Bernardino National Forest and Bureau of Land Management). It should be pointed out that hook-up with the SOHIO Pipeline is dependent on completion of the SOHIO Pipeline, while the ARCO Pipeline is already available for use.

2. Comparative Effects

In general, the Elk Hills/SOHIO and/or ARCO Conveyance System would have a longer length and pass through more diverse environmental resources. Therefore construction and accidental spills would have a more adverse effect on this alternative's surroundings than would arise from the Elk Hills/Coalinga Conveyance System. In addition, this alternative would have the potential for spilling greater volumes of oil than the proposed

project. This alternative would, however, provide the major benefits of delivery flexibility and delivery of the crude oil directly to the central United States, where crude oil demand would exist. This alternative also would not involve marine facilities and associated tanker traffic. Presuming that NPR-1 crude oil would ultimately find markets in the central United States, this alternative would yield the lowest transportation cost and the lowest expenditure of energy for transport.

The Elk Hills/SOHIO and/or ARCO pipeline route passes through steeper terrain. As a result, more grading and land movement efforts would be required and erosion potentials would increase. Some areas have a higher potential for hydrocompaction and differential settlement than in the proposed project. The pipeline also crosses several active or reported faults (e.g., White Wolf, Garlock, San Andreas and San Jacinto faults) and two seismically active areas. These three geological features would increase the adverse effects of construction and the potential for operational spills over that expected for the Elk Hills/Coalinga route. Aggregate, fill, metals, and energy expenditures would be greater than those expected in the proposed project.

Water resources would be somewhat more affected by this alternative than they would be by the Coalinga Conveyance System. In particular, this conveyance alternative would cross the California Aqueduct at two separate locations, parallel much of Cajon Creek, cross Lytle Creek, and terminate on the northern bank of the Santa Ana River. All four of these water bodies have a number of beneficial uses that might be adversely affected by construction and operation of this alternative.

Although large urban and cultivated areas would be traversed by the alternative pipeline, the potential loss of trees and chaparral in the Tehachapi Mountains, general desert scrub in the San Joaquin Valley, and desert scrub and Joshua trees in the Cajon Pass area represent a larger

adverse impact on vegetation than does the loss of smaller areas of grasslands and scrub with the proposed project. Wildlife along this alternative route are more diverse and generally more abundant than along the Elk Hills/Coalinga route. Consequently, effects upon the terrestrial biota would be greater and would cover more species. The alternative system would have less of an impact upon the endangered San Joaquin kit fox, but where it crosses the Mojave Desert, it would traverse the habitat of the endangered Mojave ground squirrel and the state protected desert tortoise. The tortoise may be affected by some loss of habitat, construction disturbance, and potential spills. Similar impacts would affect the ground squirrel. A few small aquatic communities exist in creeks on the south side of the Tehachapi Mountains and would be affected by construction of the pipeline and any oil spilled there during operation. Native fish in the Santa Ana River below the connection point with the SOHIO Pipeline could be adversely affected by an oil spill.

Archaeological and paleontological remains would be more commonly encountered along the Elk Hills/SOHIO and/or ARCO Pipeline route. Such effects of the alternative could be reduced to the same low level of impact associated with the proposed project.

The alternative pipeline would not follow existing corridors and land uses to the same extent as the proposed project, and therefore would be less consistent with current and potential land uses in the Mojave Desert area. The Elk Hills/SOHIO and/or ARCO route crosses more federal and urban lands than the Coalinga route. The alternative pipeline route crosses through the San Bernardino Forest. In addition, the alternative route passes through the cities of Palmdale, San Bernardino, Colton, and Rialto. Thus, the construction of this pipeline and any spills would cause temporary disruption of urban activities. Recreation may be temporarily interrupted in parts of the San Bernardino Forest during construction of the pipeline. The Elk Hills/SOHIO and/or ARCO alternative would not, however, affect coastal recreational resources.

During its initial year-long construction phase the Elk Hills/SOHIO and/or ARCO alternative would require similar work forces although the pipeline crews may be larger or employed for longer periods. Operational staff size for the alternative would be about the same as for the proposed project. The existing regional labor pool would comfortably support these labor requirements. Employment impacts would therefore be beneficial in character though insignificant in scale.

Impacts on public services are similar for the proposed project and this alternative except for waste disposal services. In San Bernardino three Bureau of Land Management landfills can accept wastes from chemical toilets. This would ease the problem of disposal of these wastes during the construction of this route.

The visual impacts due to construction and operation of the Elk Hills/SOHIO and/or ARCO alternative would be greater than those due to the proposed project. The alternative route would cross recreational and urban areas of greater viewability and visual sensitivity, including San Bernardino National Forest and portions of the urbanized areas of Palmdale and San Bernardino. Although the visual impacts of this alternative would be greater, they would not be prohibitively significant, since the pipeline would be buried for almost its entire route (except at aqueduct crossings and pump stations).

The employment impacts of the alternative would be little different from those of the proposed project. The initial construction phase of this alternative would probably require between 300 and 400 workers. Construction activity would be concentrated in pipeline installation tasks. Alternative operations would require 38 workers and would be more than that of the proposed project. Although the Elk Hills/SOHIO and/or ARCO alternative would have a relatively larger scale of employment impact than the Coalinga project, it nevertheless is of the same order of magnitude (it is also beneficial in character, but insignificant in scale compared to the general employment of the regions).

The alternative would involve a larger number of road crossings and construction adjacent to major roads and highways (i.e., State Highway 138) than the proposed project. Therefore, either greater delay and disturbance would occur or greater funds would be required to reduce or eliminate impacts of the alternative.

In the limited context considered in this report, the growth inducement of the alternative would be less than that of the Coalinga system. In general, the right-of-way precedents established by this alternative and the indirect effects of increased employment would be similar. New tanker activity and the potential for port expansion would be absent in the alternative.

B. Elk Hills/Port Hueneme Conveyance System

1. Description

The Elk Hills/Port Hueneme Conveyance System would consist of a tank farm at Elk Hills and one at Port Hueneme, a renovated and newly constructed marine terminal at Port Hueneme, 31 miles of new pipeline, and conversion and use of 53 miles of existing gas pipeline (Fig. 5-1). The storage tanks at both the Elk Hills Tank Farm and the Port Hueneme Tank Farm would have floating roofs with double roof seals. The terminal would have a ballast water recovery/disposal system. One pump station would be located at Elk Hills Tank Farm, one in the Elkhorn Valley, and two on the north side of the Los Padres National Forest. A series of 8 and 18 valves would be located along new and existing pipelines, respectively. The resulting potential for oil spill would be about 6 miles at greater than 15,000 but less than 26,000 barrels spilled, and 36.5 miles at greater than 5,000 barrels. Construction and operating staffs would be approximately 355 and 41 persons, respectively. Total non-federal land requirements would be 16 miles or 81 acres. In addition, 53 miles of an existing gas pipeline and about 100 acres of federal lands (Los

Padres National Forest and the Temblor section of the Bureau of Land Management) would be required.

2. Comparative Effects

This alternative is no longer considered feasible as a result of environmental problems and the review process of the Draft Environmental Impact Statement covering the Elk Hills/Port Hueneme Conveyance System. The primary environmental problem was the hydrocarbon emissions during tanker loading operations. The alternative was reviewed by the Department of Defense Explosive Safety Board since the proposed marine terminal site would be exposed to the hazards of on-going ordnance handling activities in the area. In addition, proposed facilities are being planned for location at Port Hueneme in support of the Space Shuttle Program at Vandenburg Air Force Base.

In the Draft Environmental Impact Statement, air quality impacts of the proposed project were analyzed. The most significant item would be the tanker loading operations which would contribute a total of about 2,000 pounds per hour of hydrocarbon emissions during hours of loading. These emissions were found to be capable of causing additional violations of oxidant standards in Ventura County.

In the review process, the Naval Sea Systems Command of the Department of the Navy recommended disapproval of the Elk Hills/Port Hueneme Conveyance System alternative for two basic reasons: (1) conduct of the proposed tanker operations in close proximity to ordnance handling operations was not considered prudent; and (2) concurrent operations of the proposed tanker loading and the proposed Air Force Space Shuttle Facilities was not considered practicable, compatible, or desirable. This recommendation was concurred by the Office of the Chief of Naval Operations, Department of the Navy and the Department of Defense Explosive Safety Board. The Elk Hills/Port Hueneme Conveyance System alternative was, therefore, abandoned in the interest of good planning.

C. Unit Train/Railroad System

1. Description

This system (Fig. 5-1) would require an extension of the existing Sunset rail line from Taft to Elk Hills, a rail loop and loading terminal, a tank farm at Elk Hills, and the daily arrival and departure of up to 8 unit trains consisting of 100 tank cars. This single tank farm at Elk Hills would have the same general facilities as that proposed for the Elk Hills/Coalinga system. The rail terminal would require additional lands adjacent to the tank farm. Approximately 7 miles of new track would be laid from Taft and the Sunset Railroad to the rail terminal with a loop for loading and holding tank cars. Trains from this loop would travel through Taft to Bakersfield; from there trains would travel north through the Central Valley and into the Bay Area and south to the Los Angeles area, and east along the major rail lines to the central United States. No pipeline, large pump stations, or block/check valves would be required for this alternative conveyance system. Construction and operating personnel have not been accurately defined for the Elk Hills site although the levels would be about 400 and 45 persons, respectively. Additional costs and personnel within the railroad operations would be the responsibility of those buying the oil from Elk Hills. The non-federal land requirements would be 100 acres from Taft to Elk Hills, and the federal land requirements of 200 acres at the Elk Hills Reserve.

2. Comparative Effects

The unit train or railroad concept has been successfully applied to coal and other dry bulk goods, but the transportation of oil by train is more expensive, includes a greater expenditure of energy, generates far greater risks from oil spills, greater exhaust emissions from the diesel locomotives, and greater noise and vibration effects upon the aesthetic setting of the project area and mainline tracks than those risks and effects from the proposed pipeline system.

The unit train alternative would replace the Coalinga Tank Farm with trains of approximately 100 tank cars. Hydrocarbon emissions from tank car loading would be less than the emissions of the Coalinga Tank Farm if a complete vapor recovery system were installed at the tank car loading terminal. If the vapor recovery system was not installed, hydrocarbon emissions from tank car loading would exceed the tank farm emissions by a substantial amount. Also, emissions would be generated from the locomotives.

In general, this alternative would have similar, low water resource impacts. Only a small amount of actual construction would be required and this construction would impinge only upon the intermittent Buena Vista, Broad, and Sandy creeks. This alternative does have a similar, if not somewhat larger, oil spill risk relative to the proposed project. The significance of such spills could, however, be lower since individual events would be of low volume. Even for a catastrophic event, the volume would be spread over a larger area and a sensitive water resource might not be affected by the entire volume. Owing to a more common occurrence of accidental spills, the alternative would present a higher fire hazard.

Railroad construction would require the loss of a somewhat greater amount of desert grassland and scrub vegetation in the Elk Hills area. The railroad spur route from Taft would create substantially greater effects upon the wildlife resources of the area, including the San Joaquin kit fox, than would the proposed project. Lights, noise, and general activity would have detrimental effects upon the fox and its general use of the Buena Vista Creek basin. The aquatic communities in the streams and rivers crossed by the railroad system would be adversely affected by oil spillage; no valuable aquatic resources are endangered by the proposed project.

Other than the increased land requirements at Elk Hills, this alternative would require less land, and directly involve only Kern County and the city of Taft. The new train route would cross oil fields and unused lands.

In both its construction and operational phases, this alternative would cause a lesser scale of employment impact than the proposed system. The conveyance requirements of this system in its operational mode could be accommodated by marginal and relatively efficient improvements to an existing infrastructure. The employment impacts of this alternative would be beneficial, but insignificant in scale.

Public services required would be minimal for this alternative, since the only facilities would be on Navy property. The Kern County Fire Department would still need to respond to fires at Elk Hills, as in the Coalinga alternative, but responsibilities to the other tank farms and intervening pipeline would be removed.

Traffic and noise disturbance and disruption of the alternative would be greater than those of the proposed project and center on State Highway 119, several roadways near Taft, and along the spur to Bakersfield. At grade crossings of roads, operations would create traffic delays during passage of the unit trains to and from Elk Hills. These adverse effects would be far greater than those of the proposed project.

The fiscal effects associated with this alternative would be different in character since there would be no acquisition of pipeline rights-of-way by the Navy. Instead, significant acreage would be privately acquired for a rail corridor and terminal adjacent to Elk Hills. Not only would property tax and possessory interest revenues be greater, but since the rail operations would probably be privately run, there would be significant revenues generated by county property tax, permit fees, and other state transportation and inventory fees.

The visual impacts of a Unit Train/Railroad alternative would be less than those of the primary alternative, since only one tank farm and relatively little transportation-related construction would be required. The principal visual effects would be due to new construction and increased transportation activities along the affected rail routes.

The amount of regional growth induced by this alternative is conjectural -- different in character but possibly of the same order of magnitude as the Coalinga system. The new rail terminal and loading activities could induce some local growth in and around Taft, and due to low rail transport costs, and the ability to handle many kinds of cargo, induce growth in nearby petrochemical industry. The potential increase in air pollutants in Kern County would remain a negative growth inducement.

D. Increased Local Uses

1. Description

Existing refinery capacity in the Elk Hills-Bakersfield area is 100,000 to 150,000 B/D. Increased local use of Elk Hills oil could involve expansion of existing refinery capacity at Bakersfield and of pipelines to these refineries. Such construction may exceed private capital available in the area, and the local refineries could require federal loans or subsidies. Planning for refinery expansions to handle Elk Hills oil would require careful consideration since production at NPR-1 could last for a limited period only (perhaps no more than 6 years). Products would be used locally or shipped out by rail and existing pipelines. Increased local uses would require expansion of local refinery capacity that is presently limited by air quality controls. Federal construction of new refinery capacity and sale of products may be possible, but would radically alter the basic concept and objectives of the project and the extent of PL 94-258. A possible exception to the air

quality restriction may involve the use of the Elk Hills oil in a synthetic natural gas plant that could be located at Elk Hills. Such a facility would require a larger federal land area and larger construction and operation staff.

2. Comparative Effects

The alternative would generate the same general environmental effects expected of any major industrial project, either as an expansion of existing facilities or as initiation of a new industrial center. These facilities would involve areas similar in size to that of the proposed project. However, the general action of the alternative would be far greater than that of the proposed project.

Increased local uses would require categorically greater consumption of geological resources as fuels, materials, and aggregate and greater consumption of operating energy than the proposed project. Erosion problems would be of similar magnitude to the overall conditions created by the proposed project, but the alternative would affect slope stability to a much smaller degree.

Increased local refinery uses would generate a substantial amount of new air pollutant emissions in southern San Joaquin Valley. Present refinery capacity is limited by air quality restriction. A synthetic natural gas plant would also produce a substantial amount of new emissions in the air basin. However, if the produced gas rather than the fuel oil were used in the basin, the net effect could be beneficial.

Increased local uses would impact water resources in the general Elk Hills area. The additional refinery capacity required to implement this alternative would consume large volumes of water. Pipelines from the Elk Hills Tank Farm would, in all likelihood, cross several major watercourses (i.e., the California Aqueduct, the Buena Vista Canal), and

these waterways would be subject to impact. This alternative would also promote local growth which, in turn, would lead to higher local water consumption and higher wastewater disposal volumes. These actions would be significant in some instances. However, the overall significance of these impacts and risks is expected to be less than that of the proposed project.

Some new localized disruption of vegetation and some reduction of air quality would be associated with increased local uses. Direct damages to vegetation is roughly equivalent to or less than that of the proposed project.

Construction of a pipeline to Bakersfield or facilities construction at Elk Hills would increase the adverse effects upon the local kit fox. Since several Elk Hills production-related facilities are planned, pipeline construction would have little importance on the south side of Elk Hills and would create fewer adverse effects than the proposed project. A substantial local facility on or near Elk Hills would generally create more direct, adverse effects than the proposed project, especially disruption of kit fox movement along the south side of Elk Hills.

Typical protection of crossings over the aqueduct would yield no construction or operating impacts from this alternative upon artificially maintained aquatic biota of the aqueduct. Since no marine facilities would be operated, the air quality impacts and increased tanker traffic associated with the existing terminals of the project would not occur with this alternative.

A pipeline to the Bakersfield area would proceed along the south side of the Elk Hills and up the Kern River corridor and would probably disturb more archaeological sites and remains than the proposed project, but far less paleontological resources. Similarly, a large processing

facility would have a far greater potential for disturbing remains than the proposed tank farms and pipeline.

The land required for this alternative would include private and federal lands at Elk Hills for a refinery or a synthetic natural gas plant or additional private lands near existing refineries at Bakersfield. The only public service significantly affected would be the Kern County Fire Department, which would have greater responsibility. Transportation effects in the Elk Hills area may be expanded more than the proposed project, although a pipeline and refinery expansion in Bakersfield would probably produce less adverse impacts and risks than those of the proposed project.

The employment impacts of the alternative would be greater than the proposed project during both construction and operational phases. Although no detailed labor forecasts have been developed for this alternative, it is probable that the employment impacts would be of the same description as the proposed project -- beneficial in quality and insignificant in scale.

The direct fiscal effects of this alternative, given that it is different in nature and only generally described, would be less than those arising from the Coalinga system. However, it is logical to assume that the indirect fiscal effects would be much greater because of increased industrial infrastructure and employment requirements.

The visual impacts of the alternative would probably be similar to those of the Elk Hills/Coalinga project. The effects would be primarily attributable to expansion of refinery facilities adjacent to existing facilities in the Bakersfield area and installation of relatively shorter interconnecting pipelines. No multiple tank farms or extensive pipeline construction would be required. Some increased rail traffic and use of existing product pipelines (or conversion of crude pipelines) would cause some aesthetic effects, but only along existing disturbed corridors.

Unlike the implications of the Coalinga system whose growth-inducing effects would come primarily from the establishment of increased harbor and tanker activity, this alternative implies a strong growth inducement as a consequence of increased activity among regional petrochemical industry. Such increases might be so great as to thrust certain local industrialized areas into the role of regional growth centers. The long-term growth inducement would be less certain, however, since the estimated Elk Hills reserves may not continue beyond 6 years (with possible 3-year increments thereafter if so directed by the President and approved by Congress). Increases in air pollution would be an important countervailing factor that would constrain growth in the affected counties.

The additional land areas involved at Elk Hills would either be federal land, while at Bakersfield private, industrially zoned land would be used by refinery expansion.

The employment impacts of increased local uses would be greater in magnitude than the proposed project during both construction and operational phases. New refinery construction would benefit construction trades, and eventually a larger employment base would be provided. However, these same benefits would hinder implementation of this alternative without federal assistance.

The direct fiscal effects of this alternative would be less than those arising from the Elk Hills/Coalinga system. However, the indirect fiscal effects would probably be much greater due to increased industrial infrastructure and employment requirements.

The visual impacts of the alternative would probably be primarily attributable to construction of the Elk Hills Tank Farm, expansion of

local refinery facilities, and installation of relatively short inter-connecting pipelines. If the refineries required additional lands and large new facilities, these would generally and adversely affect the visual setting of Bakersfield.

The description of this alternative implies strong direct and indirect inducements to growth. Growth inducement for selected petrochemical industries and related employment might be so great as to thrust certain local industrialized areas into the role of regional growth centers. The long-term growth inducement is less certain, however, since the estimated reserves at Elk Hills would not sustain growth beyond 5 to 10 years. Increases in air pollution would be a more powerful negative inducement to industrial growth in Kern County.

E. Changes within the Proposed Project

1. Description

The proposed project has involved several operational constraints that, if altered or overcome, would allow changes of pipe routing and tank farm siting. A straight line route for the pipeline would cross directly over the crest of Elk and Kettleman hills. This would shorten the total pipeline distance to 81 miles (saving 3.5 miles), but it would require one additional pump station near Kettleman Hills. As an additional variation, the Elk Hills Tank Farm could be located at the western end of the Naval reserve area rather than on the south side. Such a change would reduce both line length (by 8 miles) and pumping costs with other factors remaining much the same. Relocation of the Coalinga Tank Farm may involve local or regional changes. Local relocations could involve moving the tank farm to Gujarral Hills on the south side of Los Gatos Creek or to the west side of the Coalinga Aqueduct and closer to the existing Standard-Coalinga Tank Farm (3 miles west of the proposed site). Regional relocations could involve sites near Big Tar Creek

Pumping Station (2 miles southwest of Avenal) or near the Tidewater Reef Pump Station) 1 mile northwest of State Highway 41/33 junction) with a pipeline extension to Kettleman City (10 miles northeast of the Reef Station). These facilities relocations would reduce the amount of new pipeline construction from 3 to 20 miles and associated pumping costs while providing service to the same array of companies in the commercial market.

2. Comparative Effects

The alternative changes of the proposed project reflect environmental and operational features of the proposed system and its environmental setting. A straight line modification would slightly lessen the area of effect. However, the area affected by the changes would have substantially greater economic value, and the pipeline would not conform as closely with the surrounding land uses (except in the Kettleman Hills area) as the proposed route.

Alteration of the proposed project to a more direct alignment would result in slightly higher water resources risks. Such an alignment may require two crossings of the main channel of the California Aqueduct and several other important westside canals, and such crossings make waterways more susceptible to the potential effects of an oil spill.

Alternative pipeline alignments may involve less vegetation losses than the proposed project by incorporating greater cultivated areas. Alternative tank sites would involve the loss of more grassland vegetation in the northern route and less grassland and scrub at the Skyline Road location. Reduction of the pipeline length at the northern end would reduce the total grassland losses and eliminate the crossing of Zapato Chino and Los Gatos creeks. Reduction of the southern end by about 10 miles would substantially lessen the total grassland and scrub losses at Elk Hills. The latter alternative would substantially reduce the effects upon the San Joaquin kit fox.

Greater cultivated and less oil production/transportation land uses would be involved in the pipeline routing changes. The major visual effects of the alternative, apart from the short-term effects of pipeline construction, would be attributable to the tank farms. As proposed in the primary alternative, these tank farms would be located in areas already visually disturbed by similar petroleum-related industrial facilities. Any shortening of the pipeline route would require installation of the northern tank farm at relatively undisturbed sites, and would result in increased detrimental visual effects. Relocation of the Coalinga tank farm site to a location south of Avenal could be particularly detrimental, since local portions of State Highway 33 and 44 and Big Tar Canyon Road carry scenic designations.

F. Addition of Intermediate Tank Farms and Use of Existing Systems for Tanker Loading on the San Luis Obispo County Coast

1. Description

This system would include the proposed conveyance system with the addition of two intermediate tank farms and connection to existing pipelines and tanker loading facilities on the San Luis Obispo County coast (Fig. 5-2). Each of the intermediate tank farms would be supplied by a lateral pipeline leading from the main pipeline to Coalinga.

One intermediate tank farm (the Junction Station Tank Farm) would be located near Blackwells Corner, about 4 miles west of State Highway 33, and adjacent to the existing Union Oil Company of California Junction Pumping Station (Fig. 5-3). The lateral pipeline would be 8 inches in diameter and leave the main pipeline between M.P. 39 and 40. The lateral would be 3-4 miles long and have a remotely-controlled block valve immediately after leaving the main pipeline. The Union Oil facility includes a tank farm, pumping station, and connection with two 8-inch pipelines leading to Avila Beach on the coast (Fig. 5-2). Whereas it is

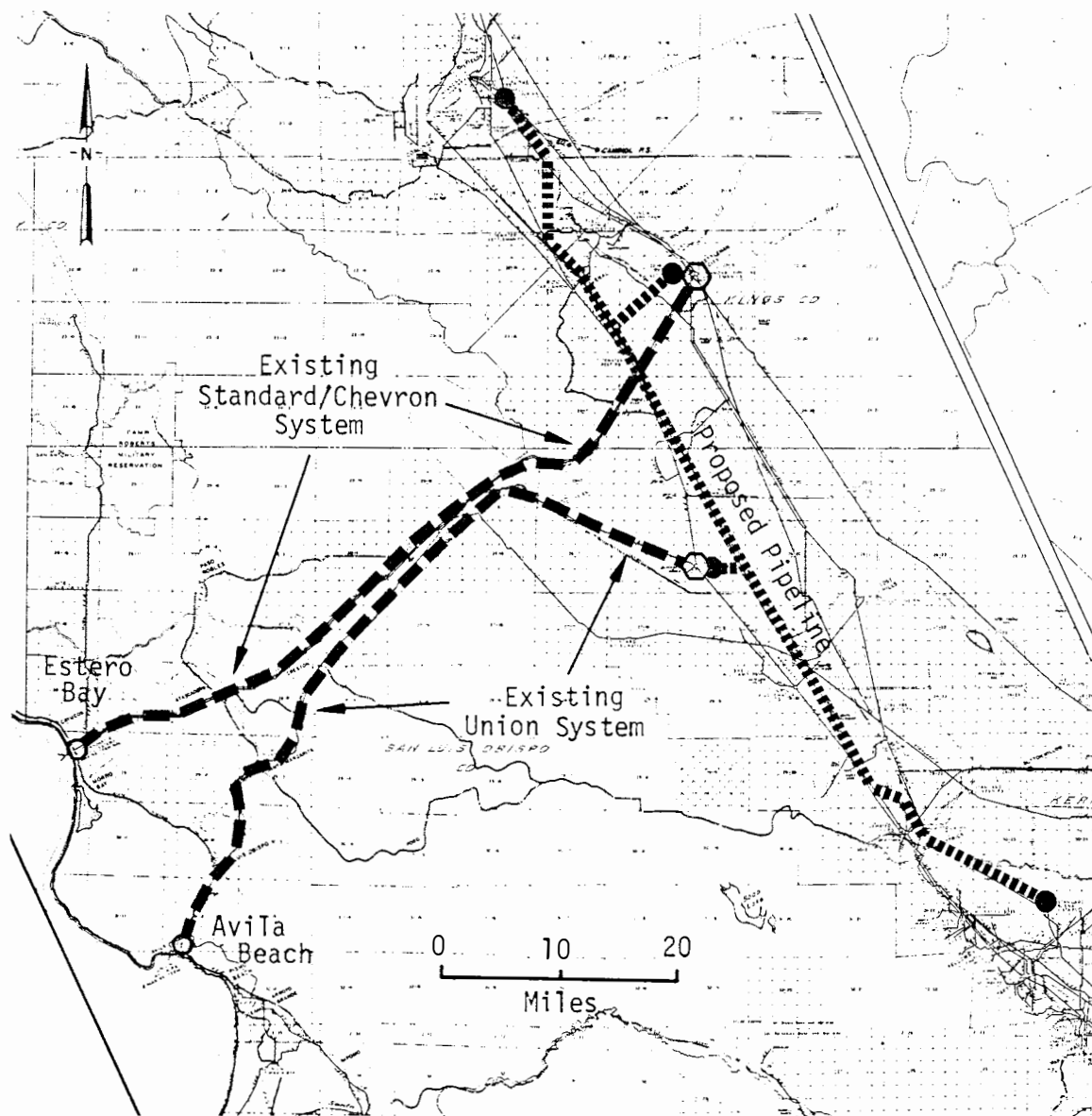


Figure 5-2. Existing Pump Stations and Pipelines to Estero Bay and Avila Beach
Source: URS Company, 1977.

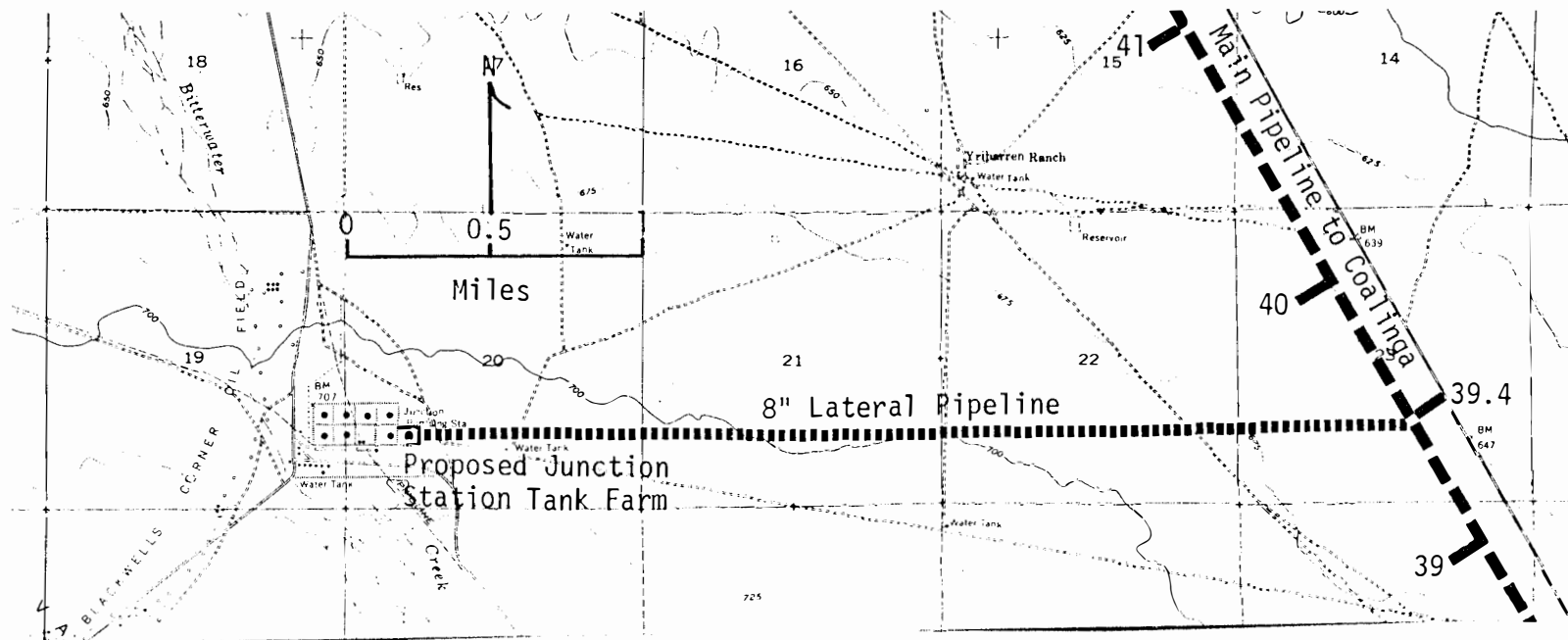


Figure 5-3. Local Area Map of Junction Station Tank Farm Site

Source: U.S. Geological Survey, Emigrant Hill Quadrangle and URS Company, 1977.

presumed that no new facilities would be required in the Union Oil system to handle crude oil from the proposed Junction Station Tank Farm, it is likely that new storage capacity would be required at Junction Pumping Station and at Avila Beach.

The Junction Station Tank Farm (Fig. 5-4) would receive up to 25,000 B/D of Shallow Oil Zone crude only from the main pipeline and provide 25,000 barrel storage in a floating-roof tank 67 feet in diameter and 40 feet high. The tank farm would include elements similar to those at Elk Hills, such as input and output metering stations with monitoring and control capability and interconnecting piping to the Union Oil facility with pumps capable of delivering 5,000 B/D to Union Oil. Of the two pipelines leading to Avila Beach, one is used exclusively for pumping in an easterly direction from Avila Beach and the other is used intermittently in both directions. Pumping rates out of the Union Oil Zone crude would be 24,000 - 26,000 B/D. Based on the above conditions, Union Oil would probably require additional storage for accumulation of the Shallow Oil Zone crude at the Junction Pumping Station and it has been indicated that such storage should be 200,000 barrels in capacity. Pumping through the Union Oil facility to Avila Beach would require use of five existing pumping stations. Three stations utilize natural gas/diesel engine driven pumps and two stations utilize steam driven pumps with steam generated in natural gas/diesel fueled boilers. At Avila Beach a new storage tank of 200,000 barrel capacity would probably be required to hold the crude for tanker loadings. The typical tanker loading rate at the Union Oil Avila terminal is 10,000 barrels per hour. In 1976, this terminal had a total throughput of approximately 8,700,000 barrels of petroleum and petroleum products with a total of 43 tankers involved. The 5,000 B/D of Shallow Oil Zone crude which would enter the Union Oil facility would not represent throughput in excess of existing system capacity, but would add approximately 1,800,000 barrels of new throughput annually for the Avila terminal, or an additional 9 tankers per year (assuming the same average size tankers as have been arriving).

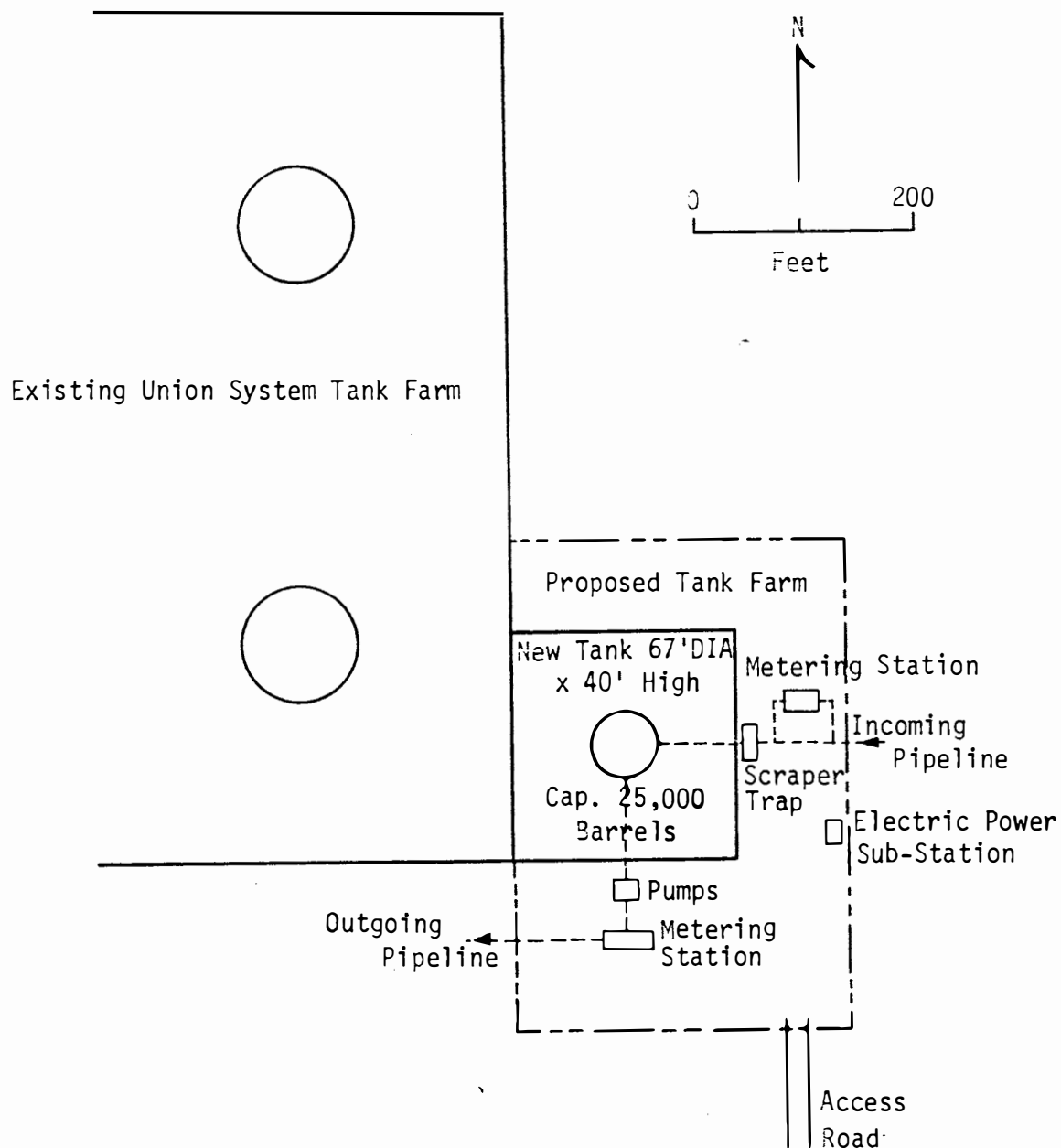


Figure 5-4. Layout of Facilities at Proposed Junction Station Tank Farm

Source: URS Company, 1977.

The other intermediate tank farm (the Kettleman City Tank Farm) would be located south of Kettleman City, just west of State Highway 41, and about 1 mile south of the Standard Pipe Line Company Kettleman Pumping Station (Fig. 5-5). The lateral pipeline would be 12 inches in diameter and leave the main pipeline between M.P. 60 and 61. The lateral would be 8-9 miles long and have a remotely-controlled block valve immediately after leaving the main pipeline. The Standard facility includes a tank farm, pumping station, and connection with a 10-inch crude oil pipeline leading to Estero Bay (Fig. 5-2) where a tanker loading terminal is operated by Chevron, U.S.A., Inc. The 10-inch pipeline has been used for crude oil transport along its entire length and a portion of its length was recently used for heavy crude shipment, but it is now out of service. Whereas it is presumed that no new facilities and/or repairs/renovations would be required in the Standard/Chevron system to handle crude oil from the proposed Kettleman City Tank Farm, it is likely that new storage capacity would be required at Estero Bay and the existing 10-inch pipeline would require renovation (new pipeline sections, testing, new valves, and new pumps).

The Kettleman City Tank Farm (Fig. 5-6) would receive up to 40,000 B/D of crude oil from the main pipeline and provide 200,000 barrel storage in tankage similar to the tank farm at Elk Hills, except tanks would be two in number, with dimensions as follows: one 40,000 barrel tank for Shallow Oil Zone crude (85 feet in diameter and 40 feet high) and one 160,000 barrel tank for Stevens Zone crude (155 feet in diameter and 48 feet high). The tank farm would include elements as at the Junction Station Tank Farm, except interconnecting piping would be to the Standard facility, with pumps capable of delivering 40,000 B/D to Standard.

Pumping rates out of the Standard facility to Estero Bay would be 40,000 B/D or more. The tanker loading rate at the Chevron Estero terminal is about 14,000 barrels per hour. In 1976, this terminal had a

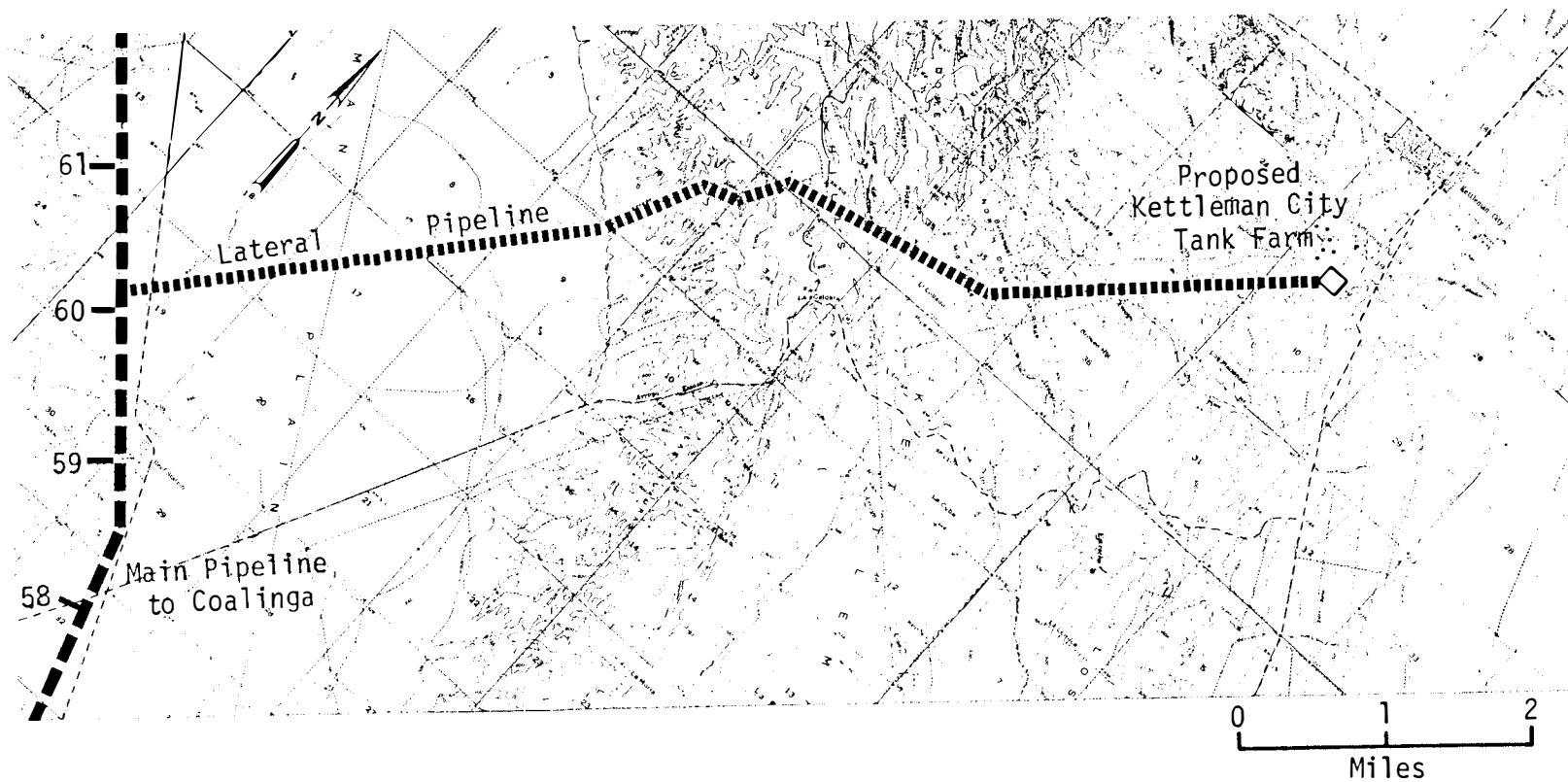


Figure 5-5. Lateral Pipeline and Kettleman City Tank Farm Site

Source: U.S. Geological Survey, Kettleman Plain and Los Viejos Quadrangles and URS Company, 1977.

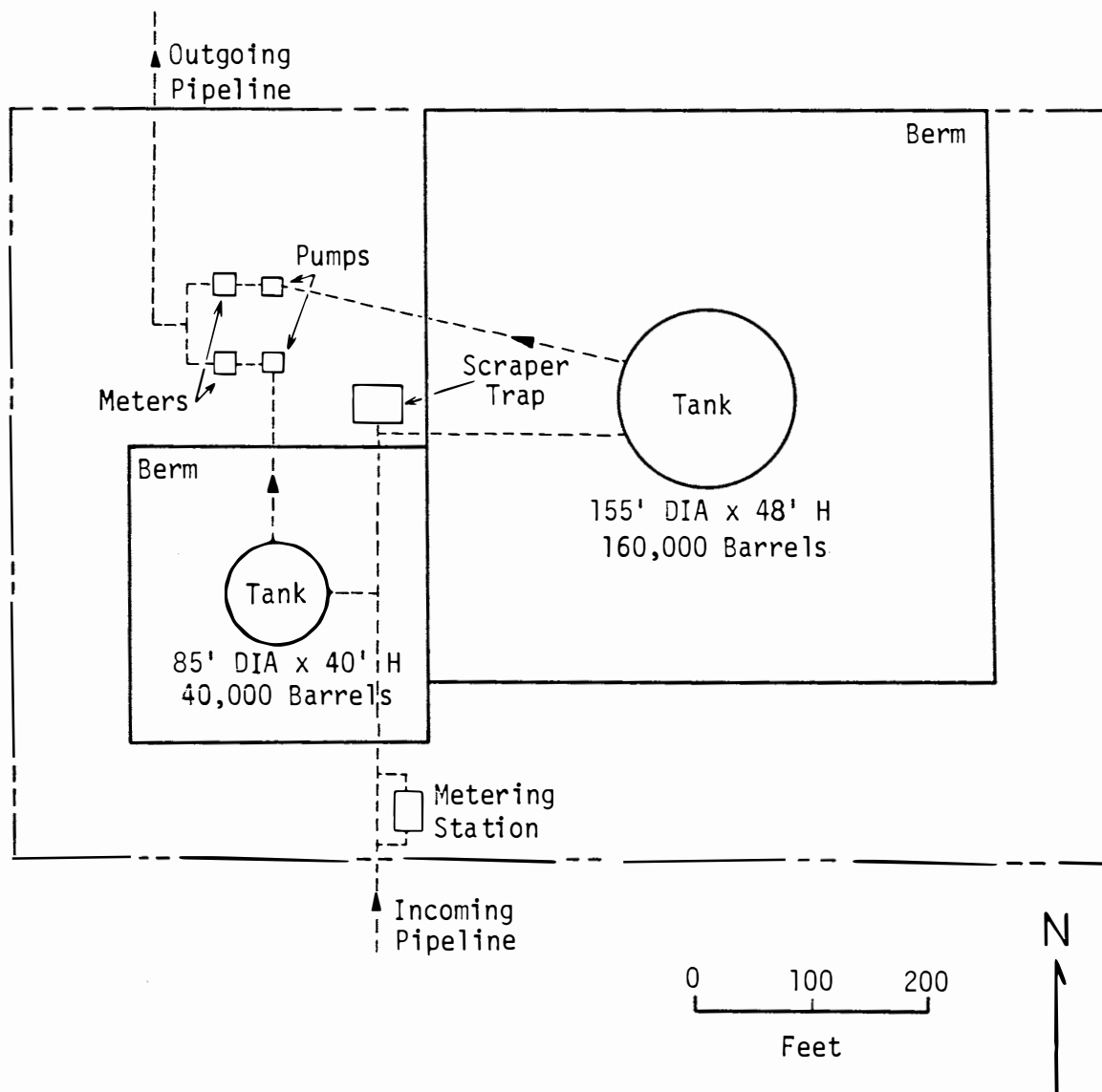


Figure 5-6. Layout of Facilities at Proposed Kettleman City Tank Farm
Source: URS Company, 1977.

total throughput of about 28,000,000 barrels of petroleum and petroleum products with a total of 183 tankers involved. The 40,000 B/D of crude from NPR-1 which would enter the Chevron facility would add about 15,000,000 barrels of new throughput annually for the Chevron terminal, or an additional 100 tankers per year (assuming the same average size tankers as have been arriving).

2. Comparative Effects

In general, this alternative would have higher levels of adverse effects during construction and operation of the project. Some incremental positive effects of increased employment would also result. Additional construction impacts would result during construction activities for the 2 added tank farm sites and the addition of about 12 miles of new pipeline. Operational effects would be greatly larger since this alternative clearly involves increased tanker loading emissions and tanker traffic. This alternative would, however, provide greater flexibility in delivery of the NPR-1 crude oil to markets and a better opportunity to reach markets outside of California.

Construction effects due to the intermediate tank farms themselves would be similar to those for the Elk Hills and Coalinga tank farms, but additive since the intermediate tank farms are not part of the basic proposed project. The importance of such effects would be low since the areas involved are relatively remote and adjacent similar facilities already exist. Construction effects from the lateral pipeline to the Junction Station Tank Farm would be fairly negligible, but the lateral pipeline to the Kettleman City Tank Farm has higher impact potential since the relatively steep slopes of the Kettleman Hills would be traversed and four streams would be crossed. In the event that new facilities and/or repairs would be required for the existing Union Oil and Standard/Chevron systems, additional construction effects would be evident.

Additional positive operational impacts which this alternative would present include the greater flexibility in delivery of NPR-1 crude oil to markets. Use of the existing pipelines to the coast would mean that less displacement of other California crude oil would occur in the pipelines leading north from Coalinga if capacity were made available from NPR-1 oil. In addition, use of tankers from the coast would permit NPR-1 oil to reach markets through the Panama Canal, if this were economically feasible.

Additional adverse operational impacts include increased tanker traffic (with associated environmental risks) and increased hydrocarbon emissions from the added tank farms and tanker loading operations. The most significant items would be the tanker loading emissions which would be 1,150 pounds per hour at Estero Bay and 546 pounds per hour at Avila Beach. These emission rates are going on now with current tanker loadings, but the use of these ports for NPR-1 crude oil would mean that such rates would occur more often. These emissions would be capable of causing additional violations of oxidant standards in San Luis Obispo County.

The tanker traffic resulting from this alternative at Avila Beach and Estero Bay would not represent new kinds of impacts at these ports since there is existing tanker traffic, but more tankers would visit every year and larger quantities of oil would leave the ports. At Avila Beach, the increase would be about 9 ships per year moving approximately 2 million barrels of oil. This would represent a 20 percent increase over recent traffic. At Estero Bay, the increase would be about 70 ships per year moving approximately 14 million barrels of oil. This would represent a 30 percent increase over recent traffic.

G. Postponement of Entire Proposed Project

1. Description

Congressional direction through PL 94-258 set the time by which the Federal government must develop a capability for producing and conveying up to 350,000 barrels of crude oil from the Elk Hills Naval Petroleum Reserve. Postponement of action to develop a conveyance facility would require congressional approval. California has existing and future crude oil supplies that far exceed its available refinery capacity (Appendix P). If the Elk Hills pipeline construction were delayed in order to phase its delivery to a California-directed supply/capacity schedule, the proposed system could be implemented at a later date. The only changes in the environmental effects may be the removal of possible sites and routes because of future changes in land use (e.g., the Coalinga Cargo Port). Other than the airport and some intensification of cultivation, no other physical changes are anticipated.

2. Comparative Effects

Most effects of the proposed facilities would be identical during the proposed or an alternative schedule. A primary effect would be that the crude oil from the Naval Petroleum Reserve would not be delivered into the national supply situation during postponement. It is conceivable that the west coast crude oil surplus situation would be resolved during postponement and the Elk Hills crude oil would then not displace other California oil. Changes of the setting would generally reduce adverse effects on natural elements because of earlier degradation by intervening projects. Effects upon human-related facilities and resources would be increased.

Postponement of the project would not substantially alter the geological effects of the proposed project, although some mineral resources may be in higher demand and lower supply. Therefore, the

alternative consumption of mineral resources may be the same but the importance greater than at present. Postponement would not significantly alter the risks of damage, fire, and spills during seismic tremors. Statistically, each day a major tremor does not occur, the probability of such an event occurring is reduced. However, the risks are commonly assumed to increase with every year without a major tremor (i.e., building up for an even bigger quake).

If the implementation of the project were postponed, the quality of the air affected by project would improve, initially. Oxidant concentrations, the pollutant most affected by project emissions, are expected to generally decrease until the 1980's. After the mid-1980's, concentrations would probably increase as population increases overcome the benefits of emission controls.

Postponement of the proposed project, while retaining its design and locations, would have few different effects. Postponement may allow other uses to preempt the proposed project uses at the Coalinga sites and along portions of the pipeline route. Some forecasted changes of land uses along the route would lessen the effects of the proposed project by another project replacing the "cause." Increased and intensified cultivation and the completion of the Coalinga Cargo Port may complicate the construction of the pipeline, although the presence of the airport would lessen the visual effects of the proposed project. These activities would further reduce the surrounding range of the San Joaquin kit fox, thereby making future implementation of the proposed project less of a threat to this range.

Barring major advances in pipeline construction/operation technology, postponement of the proposed project schedule would not affect the quality or scale of the project's employment impacts. The fiscal effects specified for the Elk Hills/Coalinga route would be eliminated over the short term. If the proposal is implemented within the next 10 years,

land development or government requirements would most likely not change enough to significantly affect the estimates of fiscal effect based upon immediate project implementation.

Any potential growth inducement from the project would be postponed until implementation. Many petroleum pipeline, terminal, and refinery-related proposals are presently being considered in California. A postponement of the decision to construct this pipeline and its related facilities would allow the future decision to be based upon the precedents established by these concurrent project proposals. Further, case studies of other current projects will yield a better knowledge of the probable areas of growth inducement that would be stimulated by a project of this nature.

H. Construction of Project But Postponement of Use

1. Description

Construction of the proposed project would satisfy the mandate under PL 94-258. Postponement of the use of the constructed project would not require congressional approval. Such postponement could be scheduled to correspond with resolution of the west coast crude oil surplus situation.

2. Comparative Effects

All of the construction effects would be identical to those of the basic proposed project since the construction schedule would be the same. One possible additional factor would be the need to perform additional hydrostatic testing of the pipeline after the postponement period to verify that no accidental damage had occurred during that period.

Crude oil from NPR-1 would not be delivered into the national surplus situation during postponement. If the crude oil surplus situation in California is resolved during the postponement period, it is possible that the Elk Hills crude oil would not displace other California oil during production and transportation.

During postponement, the quality of air affected by the project would improve, initially. Oxidant concentrations are expected to generally decrease until the 1980's. After the mid-1980's, concentrations would probably increase as population increases overcome the benefits of emission controls.

I. Cancellation of the Proposed Project

1. Description

Cancellation of the proposed project would require congressional approval. If approval were given to cancel further development of the conveyance system, further expansion of the production system would have to be cancelled unless private companies developed their own conveyance systems. The resulting future state without the project and associated production would resemble the existing state.

2. Comparative Effects

All potential adverse and beneficial impacts that would be associated with implementation of the proposed project would be eliminated with cancellation. A primary effect would be that the crude from the Naval Petroleum Reserve would not be delivered into the national supply situation and corresponding importation of foreign crude would continue, with adverse balance-of-payments effects. As in the postponement alternative, some future expansion of intensive, irrigated cultivation and the development of the Coalinga Cargo Port would convert existing land

uses to more intensive and structural forms. Oxidant concentrations without the project would probably follow the general trend set forth in the postponement alternative. No other future changes appear likely during the probably life of the project (25 to 30 years).

VI. ANY PROBABLE ADVERSE ENVIRONMENTAL
EFFECTS WHICH CANNOT BE AVOIDED
SHOULD PROPOSAL BE IMPLEMENTED

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The proposed construction and operation of the Elk Hills/Coalinga Conveyance System may create significant adverse effects upon air quality, terrestrial biota, and other California oil producers. No other natural or human environmental element appears to be adversely affected in any significant or substantial manner. Air quality of the basins may be affected by increasing hydrocarbon emissions. If potential mitigation measures are implemented, the effects would be eliminated or reduced to an insignificant level. Project construction would affect the recommended critical habitat of the San Joaquin kit fox by reducing its supportive habitat. In addition, it is possible that oil spills may occur near or flow into the denning areas of the fox. The Elk Hills crude oil would displace other California crude oil from markets.

Effects upon air quality would involve increased emissions of hydrocarbons into the south San Joaquin Valley Air Basin. The proposed project emissions from all tank farms were estimated to be a maximum of 21 pounds of reactive hydrocarbons per hour. If the emissions exceed the recommended 15 pounds per hour of total hydrocarbons, emission offsets could be effected. Such revised total emissions could be less than that commonly considered significant (i.e., less than 15 pounds per hour).

The proposed project does not directly affect the kit fox, since the species is probably not a resident of the project area. However, the Elk Hills Tank Farm and the pipeline route from M.P. 0-37, M.P. 60-72, and M.P. 74-81 involve habitat that is commonly used by the kit fox for foraging and shelter. The Elk Hills tank farm site and the pipeline route from M.P. 0-17 have been recommended for inclusion in the critical habitat of the kit fox and, as a result, effects in these areas have even greater significance.

Elk Hills crude oil would generally be more economically competitive than other California crude oils and would, therefore, displace these other oils unless the west coast crude oil surplus situation were resolved. In addition, since there is limited available pipeline capacity leading from Coalinga to the San Francisco Bay Area, if sufficient pipeline capacity is made available for all of the Elk Hills crude oil, other California oil would be displaced and unable to reach markets.

VII. RELATIONSHIP BETWEEN LOCAL
SHORT-TERM USE OF MAN'S
ENVIRONMENT AND MAINTENANCE
AND ENHANCEMENT OF LONG-TERM
PRODUCTIVITY

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PRODUCTIVITY

The short-term uses of the environment largely involve the effects of construction, a total area of approximately 640 acres along 85 miles of the pipeline route and at the storage sites, and continuing involvement of the tank farms. Oil spills represent a potential short-term use of the environment and could involve up to 160 to 200 acres of land and resources during a typical industrial life of 25 to 50 years.

About one-half of the land involved in the pipeline route would be returned to its previous uses within a period of a few weeks for cultivated lands and up to 5 years for recovery of native vegetation. The Elk Hills tank farm site and portions of the southern route segments would remain disturbed, and these areas represent a long-term loss in natural productivity. The central and northern sections of the pipeline route would result in the temporary loss of crop production and some permanent loss would occur at the Coalinga tank farm site. Crop losses would generally involve one production season, although about 80 acres of crop production from the Coalinga tank farm site would be lost for at least 25 years.

Long-term natural productivity within the project's area or the south San Joaquin Valley would be slightly reduced by the project. Since the transported crude oil would be delivered to the San Francisco

Bay Area or transshipped to southern California or elsewhere in the U.S, the long-term economic productivity and energy supply of the central California region would not be substantially enhanced. Long-term economic productivity would be maintained through long-term employment at the tank farms.

VIII. ANY IRREVERSIBLE AND IRRETRIEVABLE
COMMITMENTS OF RESOURCES THAT WOULD
BE INVOLVED IN THE PROPOSED ACTION
IF IMPLEMENTED

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The major irreversible and irretrievable change for this conveyance system is the commitment of resources -- specifically, electricity consumed by pumping the oil from Elk Hills to Coalinga, energy used in the production of materials and equipment, and in the construction of the tank farms and pipeline. Additional energy consumption for general operations of the tank farms would also represent an irretrievable commitment of resources. The materials used for the tanks, pumps and drivers, pipelines, and other facilities would not be permanently lost since they may retain a salvage value or may be reused.

Additional environmental resources may be committed to the proposed project through the clearing and long-term loss of vegetation. Such losses would be primarily concentrated in the first 20 miles of pipeline and at the Elk Hills Tank Farm. Some of this would be retrieved, since the pipeline right-of-way would naturally, or with planting, revegetate. At the Coalinga tank farm site, the cultivated ground would be converted to a tank farm, although its eventual removal would permit resumption of cultivation. Along most of the pipeline route, construction temporarily would reduce grazing productivity and crop production, and crop losses for one year would be irretrievable.

IX. CONSIDERATIONS THAT OFFSET ADVERSE
ENVIRONMENTAL EFFECTS

IX. CONSIDERATIONS THAT OFFSET ADVERSE ENVIRONMENTAL EFFECTS

Comparisons of beneficial and adverse effects of the proposed project are complex, because of the many different facilities. The beneficial effects involve the increased employment and induced economic activity within the local sphere. The study leading to this report and subsequent studies of the biological, geological, archaeological, and paleontological resources of the project area may contribute information to these fields of science and create beneficial effects. Provision of the domestically produced crude oil at a competitive price could reduce adverse effects of foreign tanker imports (e.g., higher risks and damages with foreign tankers) and the dependency for such imports from other political centers, with associated international balance of payments effects. Such beneficially effects, however, would only occur if the west coast crude oil surplus situation were resolved.

Adverse effects involve those associated with construction and normal operations and potential effects arising from abnormal functioning of the system (i.e., fires and oil spills). Construction effects largely involve the loss of vegetation and wildlife, with disturbance of the endangered San Joaquin kit fox and blunt-nosed leopard lizard. Adverse effects of normal operations would include the emissions of hydrocarbon vapor from the various tank farms and the disturbing presence of the large tanks at the tank farms.

A comparison of the relative significance of the adverse and beneficial effects suggests that the conveyance system would have a net positive effect on the overall environment. Other aspects of the Elk Hills Reserve production, marketing, and uses of oil would have far greater effects (e.g., air quality impacts and growth inducement) on both the local and state environments.

APPENDICES

APPENDIX A

EXCERPTS FROM PUBLIC LAWS 94-258 AND 95-91



Appendix A
Excerpts from Public Law 94-258

April 5

NAVAL PETROLEUM RESERVES ACT

P.L. 94-258

TITLE II—NAVAL PETROLEUM RESERVES

SEC. 201. Chapter 641 of title 10, United States Code, is amended as follows:

(1) Immediately before section 7421 insert the following new section:

“§ 7420. Definitions

10 USC 7420.

“(a) In this chapter—

“(1) ‘national defense’ includes the needs of, and the planning and preparedness to meet, essential defense, industrial, and military emergency energy requirements relative to the national safety, welfare, and economy, particularly resulting from foreign military or economic actions;

“(2) ‘naval petroleum reserves’ means the naval petroleum and oil shale reserves established by this chapter, including Naval Petroleum Reserve Numbered 1 (Elk Hills), located in Kern County, California, established by Executive order of the President, dated September 2, 1912; Naval Petroleum Reserve Numbered 2 (Buena Vista), located in Kern County, California, established by Executive order of the President, dated December 13, 1912; Naval Petroleum Reserve Numbered 3 (Teapot Dome), located in Wyoming, established by Executive order of the President, dated April 30, 1915; Naval Petroleum Reserve Numbered 4, Alaska, established by Executive order of the President, dated February 27, 1923 (until redesignated as the National Petroleum Reserve in Alaska under the jurisdiction of the Secretary of the Interior as provided in the Naval Petroleum Reserves Production Act of 1976); Oil Shale Reserve Numbered 1, located in Colorado, established by Executive order of the President, dated December 6, 1916, as amended by Executive order dated June 12, 1919; Oil Shale Reserve Numbered 2, located in Utah, established by Executive order of the President, dated December 6, 1916; and Oil Shale Reserve Numbered 3, located in Colorado, established by Executive order of the President, dated September 27, 1924;

“(3) ‘petroleum’ includes crude oil, gases (including natural gas), natural gasoline, and other related hydrocarbons, oil shale, and the products of any of such resources;

“(4) ‘Secretary’ means the Secretary of the Navy;

“(5) ‘small refiner’ means an owner of a refinery or refineries (including refineries not in operation) who qualifies as a small business refiner under the rules and regulations of the Small Business Administration; and

“(6) ‘maximum efficient rate’ means the maximum sustainable daily oil or gas rate from a reservoir which will permit economic development and depletion of that reservoir without detriment to the ultimate recovery.”

(2) Section 7421(a) is amended—

10 USC 7421.

(A) by striking out “of the Navy”;

(B) by striking out “and oil shale”;

(C) by striking out “for naval purposes” and inserting in lieu thereof “for national defense purposes”; and

(D) by striking out “section 7438 hereof” and inserting in lieu thereof “this chapter”.

(3) The text of section 7422 is amended to read as follows:

10 USC 7422.

“(a) The Secretary, directly or by contract, lease, or otherwise, shall explore, prospect, conserve, develop, use, and operate the naval petroleum reserves in his discretion, subject to the provisions of subsection

(c) and the other provisions of this chapter; except that no petroleum leases shall be granted at Naval Petroleum Reserves Numbered 1 and 3.

“(b) Except as otherwise provided in this chapter, particularly subsection (c) of this section, the naval petroleum reserves shall be used and operated for—

“(1) the protection, conservation, maintenance, and testing of those reserves; or

“(2) the production of petroleum whenever and to the extent that the Secretary, with the approval of the President, finds that such production is needed for national defense purposes and the production is authorized by a joint resolution of Congress.

“(c) (1) In administering Naval Petroleum Reserves Numbered 1, 2, and 3, the Secretary is authorized and directed—

“(A) to further explore, develop, and operate such reserves;

“(B) commencing within ninety days after the date of enactment of the Naval Petroleum Reserves Production Act of 1976, to produce such reserves at the maximum efficient rate consistent with sound engineering practices for a period not to exceed six years after the date of enactment of such Act;

“(C) during such production period or any extension thereof to sell or otherwise dispose of the United States share of such petroleum produced from such reserves as hereinafter provided; and

“(D) to construct, acquire, or contract for the use of storage and shipping facilities on and off the reserves and pipelines and associated facilities on and off the reserves for transporting petroleum from such reserves to the points where the production from such reserves will be refined or shipped.

Any pipeline in the vicinity of a naval petroleum reserve not otherwise operated as a common carrier may be acquired by the Secretary by condemnation, if necessary, if the owner thereof refuses to accept, convey, and transport without discrimination and at reasonable rates any petroleum produced at such reserve. With the approval of the Secretary, rights-of-way for new pipelines and associated facilities may be acquired by the exercise of the right of eminent domain in the appropriate United States district court. Such rights-of-way may be acquired in the manner set forth in the Act of February 26, 1931, chapter 307 (46 Stat. 1421; 40 U.S.C. 258(a)), and the prospective holder of the right-of-way is ‘the authority empowered by law to acquire the lands’ within the meaning of that Act. Such new pipelines shall accept, convey, and transport without discrimination and at reasonable rates any petroleum produced at such reserves as a common carrier. Pipelines and associated facilities constructed at or procured for Naval Petroleum Reserve Numbered 1 pursuant to this subsection shall have adequate capacity to accommodate not less than three hundred fifty thousand barrels of oil per day and shall be fully operable as soon as possible, but not later than three years after the date of enactment of the Naval Petroleum Reserves Production Act of 1976.

“(2) At the conclusion of the six-year production period authorized by paragraph (1) (B) of this subsection the President may extend the period of production in the case of any naval petroleum reserve for additional periods of not to exceed three years each—

“(A) after the President requires an investigation to be made, in the case of each extension, to determine the necessity for continued production from such naval petroleum reserve;

“(B) after the President submits to the Congress, at least one hundred eighty days prior to the expiration of the current production period prescribed by this section, or any extension thereof,

Investigation.

Report to
Congress.

a copy of the report made to him on such investigation together with a certification by him that continued production from such naval petroleum reserve is in the national interest; and

“(C) if neither House of Congress within ninety days after receipt of such report and certification adopts a resolution disapproving further production from such naval petroleum reserve.

“(3) The production authorization set forth in paragraph (1) (B) of this subsection, in the case of Naval Petroleum Reserve Numbered 1, is conditioned upon the private owner of any lands or interests therein within such reserve agreeing with the Secretary to continue operations of such reserve under a unitized plan contract which adequately protects the public interest; however, if such agreement is not reached within ninety days after the date of enactment of the Naval Petroleum Reserves Production Act of 1976 the Secretary is authorized to exercise the authority for condemnation conferred by section 7425 of this chapter.”.

(4) The first sentence of section 7423 is amended by deleting “of the Navy” and “or products”. 10 USC 7423.

(5) Section 7424 is amended— 10 USC 7424.

(A) by deleting “of the Navy” in the text of subsection (a) preceding clause (1);

(B) by deleting “and oil shale” in subsection (a) (1) in the text preceding subclause (A); and

(C) by deleting “in the ground” in clause (1) (A) of subsection (a).

(6) Section 7425 is amended by deleting “of the Navy”. 10 USC 7425.

(7) Section 7426(a) is amended by striking out “the Secretary of the Navy” and inserting in lieu thereof “Subject to the provisions of section 7422(c), the Secretary”. 10 USC 7426.

(8) The first and second sentences of section 7427 are amended by striking out “of the Navy”. 10 USC 7427.

(9) Section 7428 is amended by striking out “within the naval petroleum and oil shale reserves shall contain a provision authorizing the Secretary of the Navy” and inserting in lieu thereof “within Naval Petroleum Reserve Numbered 2 and the oil shale reserves shall contain a provision authorizing the Secretary”. 10 USC 7428.

(10) The first sentence of section 7429 is amended by deleting “of the Navy”. 10 USC 7429.

(11) The text of section 7430 is amended to read as follows: 10 USC 7430.

“(a) In administering the naval petroleum reserves under this chapter, the Secretary shall use, store, or sell the petroleum produced from the naval petroleum reserves and lands covered by joint, unit, or other cooperative plans.

“(b) Notwithstanding any other provision of law, each sale of the United States share of petroleum shall be made by the Secretary at public sale to the highest qualified bidder, for periods of not more than one year, at such time, in such amounts, and after such advertising as the Secretary considers proper and without regard to Federal, State, or local regulations controlling sales or allocation of petroleum products. Public sale.

“(c) In no event shall the Secretary permit the award of any contract which would result in any person obtaining control, directly or indirectly, over more than 20 per centum of the estimated annual United States share of petroleum produced from Naval Petroleum Reserve Numbered 1.

“(d) Each proposal for sale under this title shall provide that the terms of every sale of the United States share of petroleum from the naval petroleum reserves shall be so structured as to give full and

equal opportunity for the acquisition of petroleum by all interested persons, including major and independent oil producers and refiners alike. When the Secretary, in consultation with the Secretary of the Interior, determines that the public interests will be served by the sale of petroleum to small refiners not having their own adequate sources of supply of petroleum, the Secretary is authorized and directed to set aside a portion of the United States share of petroleum produced for sale to such refiners under the provisions of this section for processing or use in such refineries, except that—

“(1) none of the production sold to small refiners may be resold in kind;

“(2) production must be sold at a cost of not less than the prevailing local market price of comparable petroleum;

“(3) the set-aside portion may not exceed 25 per centum of the estimated annual United States share of the total production from all producing naval petroleum reserves; and

“(4) notwithstanding the provisions of subsection (b) of this section, the Secretary may, at his discretion if he deems it to be in the public interest, prorate such petroleum among such refiners for sale, without competition, at not less than the prevailing local market price of comparable petroleum.

“(e) Any petroleum produced from the naval petroleum reserves, except such petroleum which is either exchanged in similar quantities for convenience or increased efficiency of transportation with persons or the government of an adjacent foreign state, or which is temporarily exported for convenience or increased efficiency of transportation across parts of an adjacent foreign state and reenters the United States, shall be subject to all of the limitations and licensing requirements of the Export Administration Act of 1969 (83 Stat. 841) and, in addition, before any petroleum subject to this section may be exported under the limitations and licensing requirement and penalty and enforcement provisions of the Export Administration Act of 1969, the President must make and publish an express finding that such exports will not diminish the total quality or quantity of petroleum available to the United States and that such exports are in the national interest and are in accord with the Export Administration Act of 1969.

“(f) During the period of production or any extension thereof authorized by section 7422(c), the consultation and approval requirements of section 7431 (a) (3) are waived.

“(g) (1) Prior to the promulgation of any rules and regulations, plans of development and amendments thereto, and in the entering and making of contracts and operating agreements relating to the development, production, or sale of petroleum in or from the reserves, the Secretary shall consult with and give due consideration to the views of the Attorney General of the United States with respect to matters which may affect competition.

“(2) No contract or operating agreement may be made, issued, or executed under this chapter until at least thirty days after the Secretary notifies the Attorney General of the proposed contract or operating agreement. Such notification shall contain such information as the Attorney General may require in order to advise the Secretary as to whether such contract or operating agreement may create or maintain a situation inconsistent with the antitrust laws. If, within such thirty day period, the Attorney General advises the Secretary that a contract or operating agreement may create or maintain a situation inconsistent with the antitrust laws, then the Secretary may not make, issue, or execute that contract or operating agreement.

50 USC app.
2401 note.

Waiver.
Ante, p. 307.
Post, p. 311.
Rules and
regulations.

Contract or
operating
agreement,
notification.

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"(h) Nothing in this chapter shall be deemed to confer on any person immunity from civil or criminal liability, or to create defenses to actions, under the antitrust laws.

"(i) As used in this section, the term 'antitrust laws' means—

"Antitrust laws."

"(1) the Act entitled 'An Act to protect trade and commerce against unlawful restraints and monopolies', approved July 2, 1890 (15 U.S.C. 1 et seq.), as amended;

"(2) the Act entitled 'An Act to supplement existing laws against unlawful restraints and monopolies, and for other purposes', approved October 15, 1914 (15 U.S.C. 12 et seq.), as amended;

"(3) the Federal Trade Commission Act (15 U.S.C. 41 et seq.), as amended;

"(4) sections 73 and 74 of the Act entitled 'An Act to reduce taxation, to provide revenue for the Government, and for other purposes', approved August 27, 1894 (15 U.S.C. 8 and 9), as amended; or

"(5) sections 2, 3, and 4 of the Act of June 19, 1936, chapter 592 (15 U.S.C. 13a, 13b, and 21a).

"(j) Any pipeline which accepts, conveys, or transports any petroleum produced from Naval Petroleum Reserves Numbered 1 or Numbered 3 shall accept, convey, and transport without discrimination and at reasonable rates any such petroleum as a common carrier insofar as petroleum from such reserves is concerned. Every contract entered into by the Secretary for the sale of any petroleum owned by the United States which is produced from such reserves shall contain provisions implementing the requirements of the preceding sentence if the contractor owns a controlling interest in any pipeline or any company operating any pipeline, or is the operator of any pipeline, which carries any petroleum produced from such naval petroleum reserves. The Secretary may promulgate rules and regulations for the purpose of carrying out the provisions of this section and he, or the Secretary of the Interior where the authority extends to him, may declare forfeit any contract, operating agreement, right-of-way, permit, or easement held by any person violating any such rule or regulation. This section shall not apply to any natural gas common carrier pipeline operated by any person subject to regulation under the Natural Gas Act or any public utility subject to regulation by a State or municipal regulatory agency having jurisdiction to regulate the rates and charges for the sale of natural gas to consumers within the State or municipality.

Rules and regulations.

15 USC 717w.

"(k) The President may, at his discretion, direct that all or any part of the United States share of petroleum produced from the naval petroleum reserves be placed in strategic storage facilities as authorized by sections 151 through 166 of the Energy Policy and Conservation Act or that all or any part of such share be exchanged for petroleum of equal value for the purpose of placing such petroleum in such strategic storage facilities."

42 USC 6231-6246.

(12) Section 7431 is amended—

10 USC 7431.

(A) by inserting "(a)" immediately before "The Committees";

(B) by striking out "or oil shale" in clauses (1) and (2);

(C) by striking out "and oil shale" in clauses (2) and (3);

(D) by striking out "oil and gas (other than royalty oil and gas), oil shale, and products therefrom" in clause (3) and inserting in lieu thereof "petroleum (other than royalty oil and gas)"; and

(E) by adding at the end thereof the following new subsections:

"(b) (1) During the period of production authorized by section

Ante, p. 307.
Report to
congressional
committees.

Report to
Congress.

Reports to
congressional
committees.

7422(c), the Secretary shall submit to the Committees on Armed Services of the Senate and the House of Representatives any new plans or substantial amendments to ongoing plans for the exploration, development, and production of the naval petroleum reserves.

"(2) All plans or substantial amendments submitted to the Congress pursuant to this section shall contain a report by the Attorney General of the United States with respect to the anticipated effects of such plans or amendments on competition. Such plans or amendments shall not be implemented until sixty days after such plans or amendments have been submitted to such committees.

"(c) During the period of production authorized by section 7422(c), the Secretary shall submit annual reports as of the first day of the fiscal year to the Committees on Armed Services of the Senate and the House of Representatives, and such committees shall cause such reports to be printed as a Senate or House document, as appropriate. The Secretary shall include in such reports, with respect to each naval petroleum reserve, an explanation in detail of the following:

"(1) the status of the exploration, development, and production programs;

"(2) the production that has been achieved, including the disposition of such production and the proceeds realized therefrom;

"(3) the status of pipeline construction and procurement and problems related to the availability of transportation facilities;

"(4) a summary of future plans for exploration, development, production, disposal, and transportation of the production from the naval petroleum reserves; and

"(5) such other information regarding the reserve as the Secretary deems appropriate."

10 USC 7432.

(13) Section 7432 is amended to read as follows:

"§ 7432. Naval petroleum reserves special account

"(a) There is hereby established on the books of the Treasury Department a special account designated as the 'naval petroleum reserves special account'. There shall be credited to such account—

"(1) all proceeds realized under this chapter from the disposition of the United States share of petroleum;

"(2) the net proceeds, if any, realized from sales or exchanges within the Department of Defense of refined petroleum products accruing to the benefit of any component of that department as the result of any such sales or exchanges;

"(3) such additional sums as may be appropriated for the maintenance, operation, exploration, development, and production of the naval petroleum reserves;

10 USC 7433.

"(4) such royalties as may accrue under the provisions of section 7433; and

"(5) any other revenues resulting from the operation of the naval petroleum reserves.

"(b) Funds available in the naval petroleum reserve special account shall be available for expenditure in such sums as are specified in annual appropriations Acts for the expenses of—

"(1) exploration, prospecting, conservation, development, use, operation, and production of the naval petroleum reserves as authorized by this chapter;

"(2) production (including preparation for production) as authorized by this chapter, or as may hereafter be authorized;

"(3) the construction and operation of facilities both within and outside the naval petroleum reserves incident to the production and the delivery of petroleum, including pipelines and shipping terminals;

April 5

NAVAL PETROLEUM RESERVES ACT

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"(4) the procurement of petroleum for, and the construction and operation of facilities associated with, the Strategic Petroleum Reserve authorized by sections 151 through 166 of the Energy Policy and Conservation Act; and

"(5) the exploration and study of the National Petroleum Reserve in Alaska as authorized in title I of the Naval Petroleum Reserves Production Act of 1976.

"(c) The budget estimates for annual appropriations from the naval petroleum reserves special account shall be prepared by the Secretary and shall be presented to the Congress by the President independently of the budget of the Department of the Navy and the Department of Defense.

"(d) Contracts under this chapter providing for the obligation of funds may be entered into by the Secretary for a period of five years, renewable, at the option of the Secretary, for an additional five-year period; however, such contracts may obligate funds only to the extent that such funds are made available in annual appropriations."

(14) Section 7433(a) is amended by striking out "of the Navy".

(15) Section 7433(b) is amended by striking out "and oil shale".

(16) Section 7434 is amended by striking out "and oil shale".

(17) Section 7435(b) is amended by striking out "of the Navy".

(18) Section 7436(a) is amended by deleting "of the Navy, subject to approval of the President."

(19) Section 7438 is amended by striking out "Secretary of the Interior" wherever it occurs and inserting therefor "Administrator of the Energy Research and Development Administration"; and by striking out "of the Navy" wherever it occurs.

(20) The table of sections at the beginning of such chapter is amended—

(A) by inserting immediately before

"7421. Jurisdiction and control."

the following:

"7420. Definitions."

(B) by striking out:

"7432. Expenditures; appropriations chargeable."

and inserting in lieu thereof the following:

"7432. Naval petroleum reserve special account."

Approved April 5, 1976.

42 USC 6231-6246.

Ante, p. 303.
Budget estimates, presentation to Congress.

Contracts.

10 USC 7433.

10 USC 7434.

10 USC 7435.

10 USC 7436.

10 USC 7438.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 94-81 Pts. I, 2, 3 (Comm. on Interior and Insular Affairs) and No. 94-156 accompanying H.R. 5919 (Comm. on Armed Services) and No. 94-942 (Comm. of Conference).

SENATE REPORTS: No. 94-327 accompanying S. 2173 (Comm. on Armed Services) and No. 94-708 (Comm. of Conference).

CONGRESSIONAL RECORD:

Vol. 121 (1975): July 8, considered and passed House.

July 28, S. 2173 considered in Senate.

July 29, considered and passed Senate, amended, in lieu of S. 2173.

Vol. 122 (1976): Mar. 24, Senate agreed to conference report.

Mar. 31, House agreed to conference report.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:

Vol. 12, No. 15 (1976): Apr. 5, Presidential statement.

"(h) The Secretary shall, before taking action on any final standard under this section or any modification of or exemption from such standard, notify the Secretary of Energy and provide such Secretary with a reasonable period of time to comment thereon."

Notice.

TRANSFER FROM THE INTERSTATE COMMERCE COMMISSION

SEC. 306. Except as provided in title IV, there are hereby transferred to the Secretary such functions set forth in the Interstate Commerce Act and vested by law in the Interstate Commerce Commission or the Chairman and members thereof as relate to transportation of oil by pipeline.

Transportation of oil by pipeline.
42 USC 7155.
49 USC prec. 1 note.

TRANSFERS FROM THE DEPARTMENT OF THE NAVY

SEC. 307. There are hereby transferred to and vested in the Secretary all functions vested by chapter 641 of title 10, United States Code, in the Secretary of the Navy as they relate to the administration of and jurisdiction over—

certain naval petroleum reserves.
42 USC 7156.
10 USC 7421.

(1) Naval Petroleum Reserve Numbered 1 (Elk Hills), located in Kern County, California, established by Executive order of the President, dated September 2, 1912;

(2) Naval Petroleum Reserve Numbered 2 (Buena Vista), located in Kern County, California, established by Executive order of the President, dated December 13, 1912;

(3) Naval Petroleum Reserve Numbered 3 (Teapot Dome), located in Wyoming, established by Executive order of the President, dated April 30, 1915;

(4) Oil Shale Reserve Numbered 1, located in Colorado, established by Executive order of the President, dated December 6, 1916, as amended by Executive order dated June 12, 1919;

(5) Oil Shale Reserve Numbered 2, located in Utah, established by Executive order of the President, dated December 6, 1916; and

(6) Oil Shale Reserve Numbered 3, located in Colorado, established by Executive order of the President, dated September 27, 1924.

In the administration of any of the functions transferred to, and vested in, the Secretary by this section the Secretary shall take into consideration the requirements of national security.

TRANSFERS FROM THE DEPARTMENT OF COMMERCE

SEC. 308. There are hereby transferred to, and vested in, the Secretary all functions of the Secretary of Commerce, the Department of Commerce, and officers and components of that Department, as relate to or are utilized by the Office of Energy Programs, but limited to industrial energy conservation programs.

Industrial energy conservation programs.
42 USC 7157.

NAVAL REACTOR AND MILITARY APPLICATION PROGRAMS

SEC. 309. (a) The Division of Naval Reactors established pursuant to section 25 of the Atomic Energy Act of 1954, and responsible for research, design, development, health, and safety matters pertaining to naval nuclear propulsion plants and assigned civilian power reactor programs is transferred to the Department under the Assistant Secretary to whom the Secretary has assigned the function listed in section 203(a)(2)(E), and such organizational unit shall be deemed to be an organizational unit established by this Act.

42 USC 7158.
42 USC 2035.

APPENDIX B
CHARACTERISTICS OF CRUDE OIL AND
PROJECT DESIGN ELEMENTS

Appendix B

Characteristics of Crude Oil and Project Design Elements

1. Crude Oil Characteristics

The two basic types of crude oil from the Elk Hills field originate from two different depths or zones (the Shallow Oil Zone and the Stevens Zone). The two crude oils differ with respect to important characteristics such as specific gravity, viscosity, sulfur content, vapor pressure, and boiling temperatures. Even within each of the zones there is some variation in characteristics, but such variations are small compared to the differences between zones. The following table presents typical values or ranges of values for characteristics of the two crude oils.

2. Pump and Driver Characteristics

Owing to the differences in characteristics of the two types of crude oil (Table B-1), the pump requirements for each of these crude would also be different. Maximum pumping capability would be 200,000 B/D (expandable to 250,000) and the suction head requirement would be 125 feet. The pump and driver characteristics for the main line and transfer/charge pump would be as shown in Table B-2.

Table B-1
CHARACTERISTICS OF ELK HILLS CRUDE OIL

CHARACTERISTIC	CRUDE OIL ORIGIN	
	SHALLOW OIL ZONE	STEVENS ZONE
<u>Specific Gravity</u>	0.90 - 0.93	0.84 - 0.85
<u>Viscosity (SSU)*</u>		
@ 75°F	105 - 561	47.3
@ 100°F	61 - 330	38 - 41.3
@ 120°F	57.6 - 163	38.8
<u>Reid Vapor Pressure (psia)</u>		
@ 60°F	0.0	2.5
@ 100°F	2.5	8.2
@ 130°F	5.3	12.6
<u>Boiling Characteristics (°F)</u>		
Initial boiling point	133 - 261	86 - 106
Cumulative Volume %		
5	212	180
10	272	217
20	320	280
30	433	350
40	510	442
50	585	530
60	600	605
<u>Sulfur (weight%)</u>	0.44 - 1.02	0.33 - 0.49

*Saybolt Seconds Universal

Table B-2
PUMP AND DRIVER CHARACTERISTICS

PUMP USE	CRUDE OIL ORIGIN	
	SHALLOW OIL ZONE	STEVENS ZONE
Main pipeline	TDH*=1343 ft. (2 pumps in series, 1 as a spare)	TDH=710 ft. (1 pump, 2 as spares)
Elk Hills Transfer/charge	TDH=250 ft. (4000 GPM)	TDH=250 ft. (4000 GPM)
Coalinga Transfer	5834 GM P	5834 GM P
All	All pumps directly connected to electric driver motors	

*Total discharge head

APPENDIX C
ENVIRONMENTAL ATLAS

ATLAS LEGEND

Maps arranged from Elk Hills Tank Farm to pipeline terminus

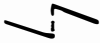
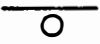
Scale: 1 inch = 0.75 miles

1 centimeter = 0.50 kilometers

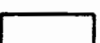
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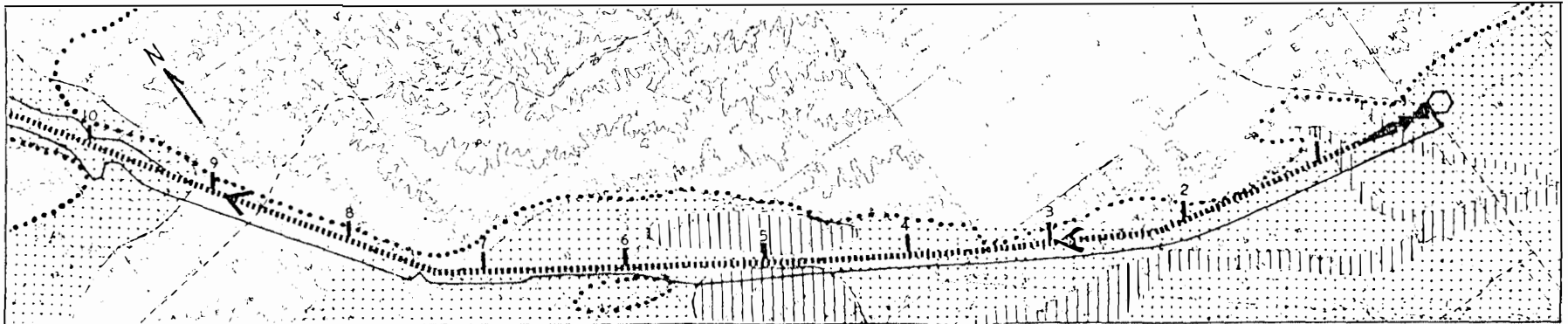
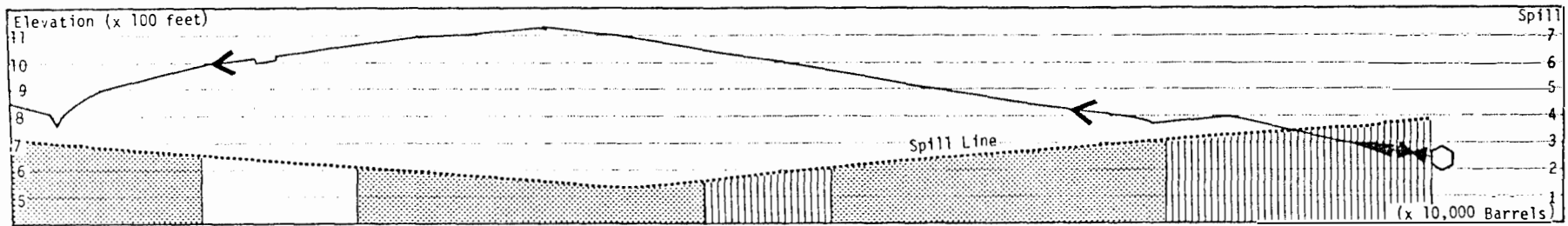
Sources: U.S. Geological Survey, 7.5 minute quadrangles

Upper Graph

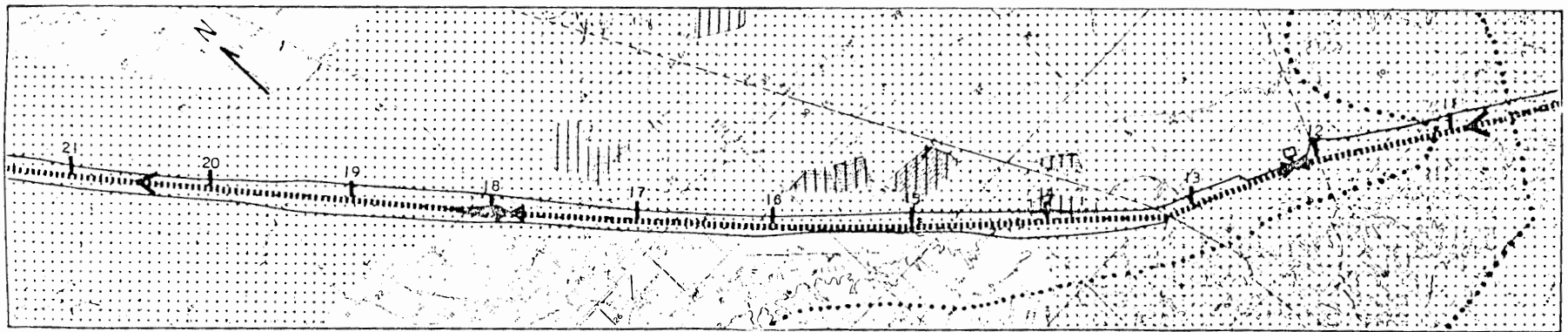
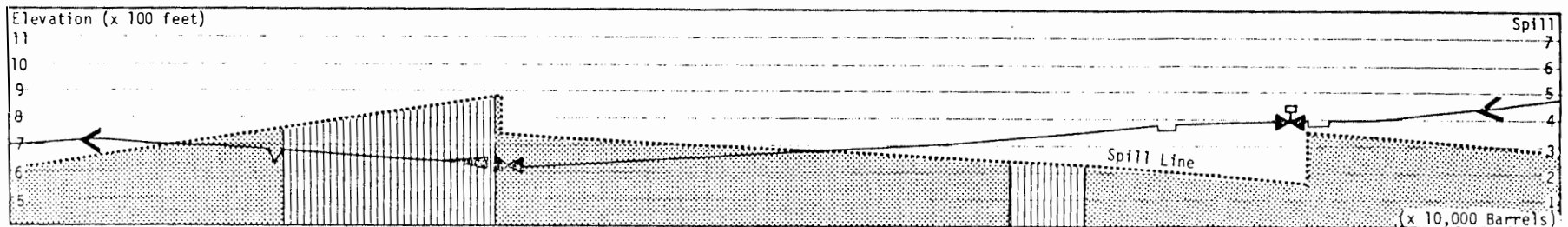
	Topographic profile (x 100 feet)		
	Transposition of elevation scale		
	Volume of potential oil spill (x 10,000 barrels)		
	Borings under roads and railroads		
	Stream crossings		
	Bridged crossings of aqueducts		
	Crossings of buried aqueducts		
	Flow direction		Pump stations
	Manual block valve		Remotely controlled block valve
	Pressure reducer		Check valve
	Low sensitivity		Moderate sensitivity
			High sensitivity

Strip Map

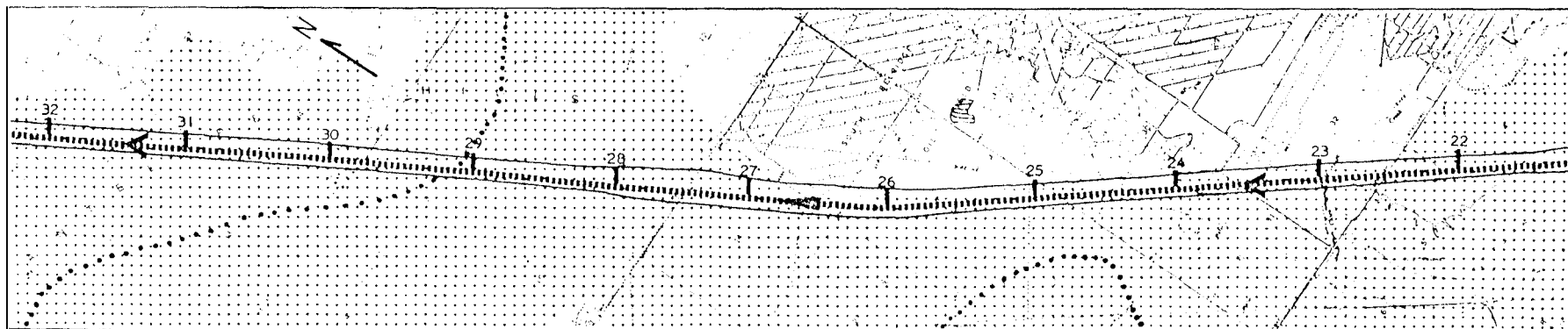
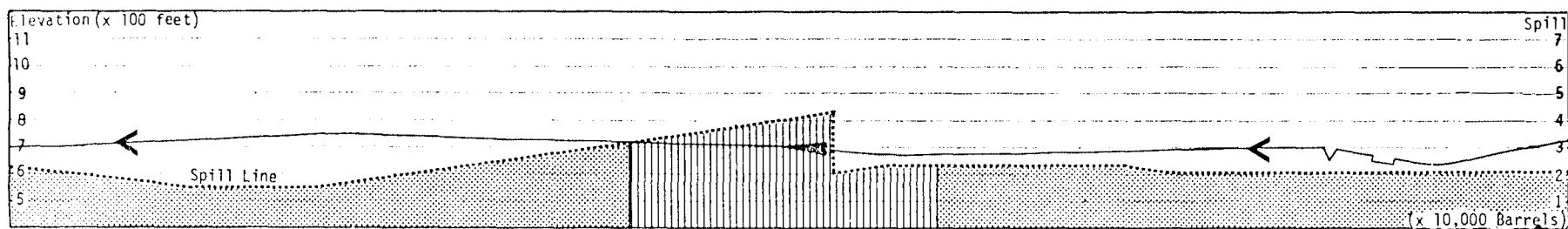
	North arrow		Existing pipeline to be used
	Proposed pipeline		Potential spill inundation area and flow direction
	Mile posts		Value sub-area
	Low resource value		Moderate resource value
			High resource value



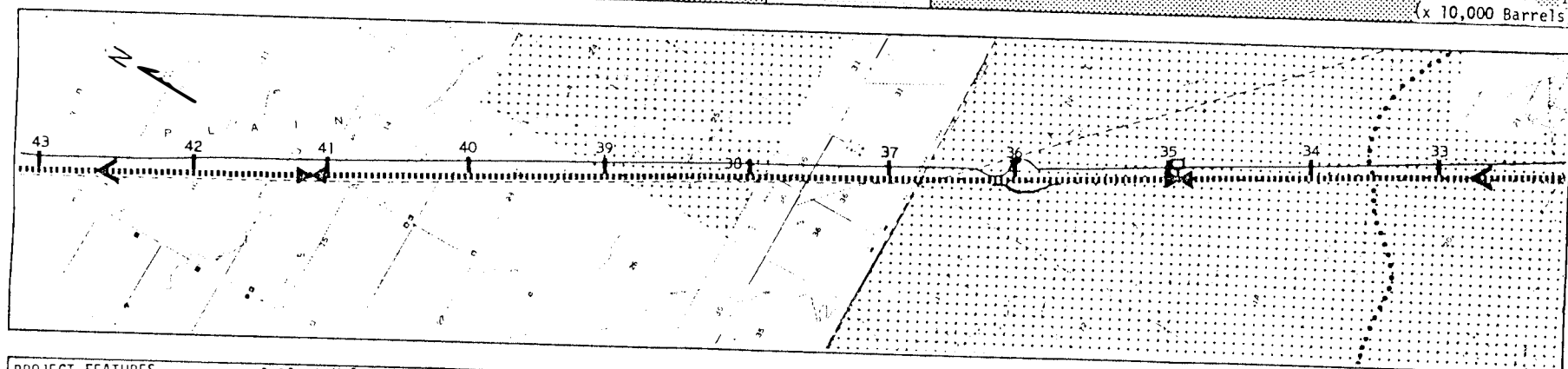
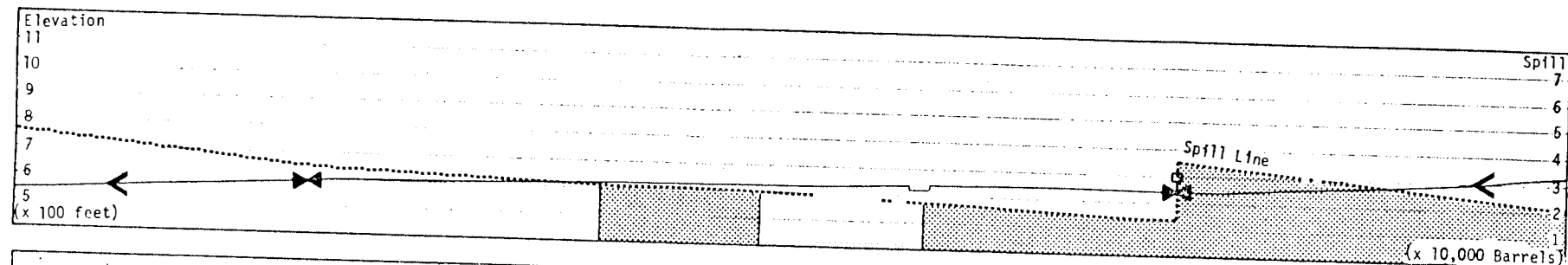
PROJECT FEATURES		Highest Control Point: 1,140 feet		Check Valve	Manual Block Valve
				Pump Station	Elk Hills Tank Farm
GEOLOGY & SEISMICITY	Late Tertiary formation at surface or below thin cover of alluvium				
	McKittrick Valley	Elk Hills	Buena Vista Valley		
HYDROLOGY	Unnamed creek from McKittrick Valley flowing to northeast		Buena Vista Creek		
BIOLOGY	Open grassland with barrens on steep, southerly-facing slopes and shrubs along gullies and ravines. Wildlife typical of grasslands. Both Reserve No. 1 and 2 considered as critical habitat for San Joaquin kit fox; several dens areas located near route.				
ARCHEOLOGY AND OTHERS	Moderate potential for archeological remains	High potential for fossils	Moderate potential for archeological remains and fossils		
LAND USE & TRANSPORT	Crossing Skyline Road	Paralleling existing pipelines	Several oil and gas pipelines but more open rangeland	Elk Hills Road and crossing	
SOCIOECONOMIC	Oilfields and pipelines in open rangeland	Elk Hills Naval Petroleum Reserve No. 1 on north and No. 2 on south	3-5 miles to Valley	Elk Hills Road county scenic road	
	Kern County 2 miles to McKittrick		5 miles to Taft, and 25 miles to Bakersfield		



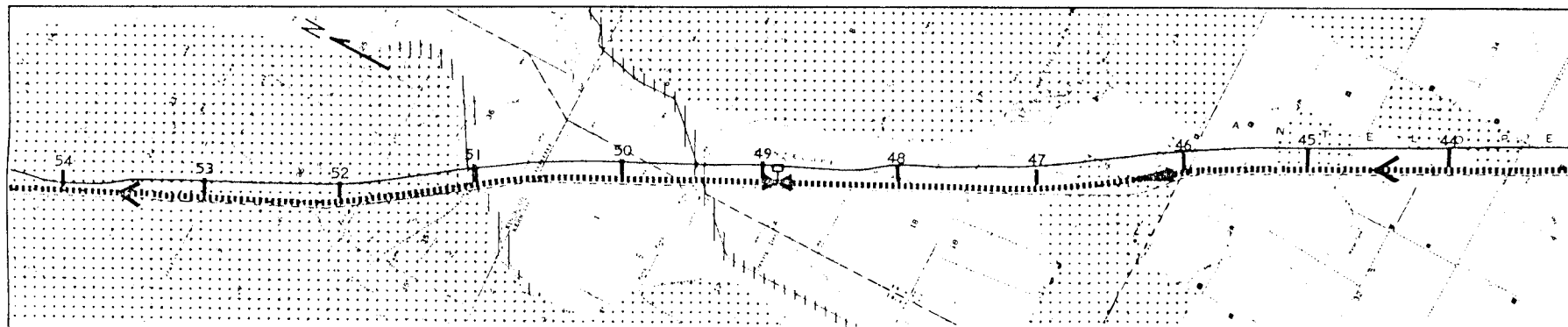
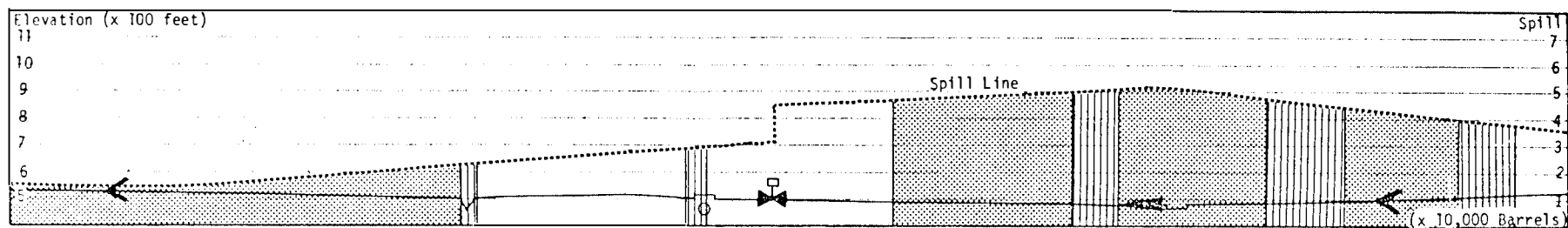
PROJECT FEATURES		Manual Block Valve Check Valve	Remote Control Block Valve
GEOLOGY & SEISMICITY	Thin alluvial deposits over shallow formations 10 miles from San Andreas fault and 35 miles from Cholame-Parkfield activity area		Thin alluvium over consolidated formations Late Tertiary formations in the unnamed hills to south
HYDROLOGY	Salt Creek	Upstream of produced water infiltration/disposal ponds	Numerous small gullies and ravines flowing northeasterly Major unnamed creek from McKittrick Valley
BIOLOGY	Open, short grasslands with some desert shrubs and typical grassland wildlife including known range of endangered SanJoaquin kit fox and California condor.		Open, short grasslands and barrens with typical grassland wildlife
ARCHEOLOGY AND OTHERS			Moderate potential for archeological and fossil remains
LAND USE & TRANSPORT	Crossing Lokern Road	Crossing many pipelines and oil field roads Highway 33 converging from east	Open rangeland with many oil fields and pipelines Crossing of State Highway 33 Crossing of State Highway 58
SOCIOECONOMIC	Kern County 10 miles to McKittrick 25 miles to Taft	Oil field	2 Miles to McKittrick 17 Miles to Taft



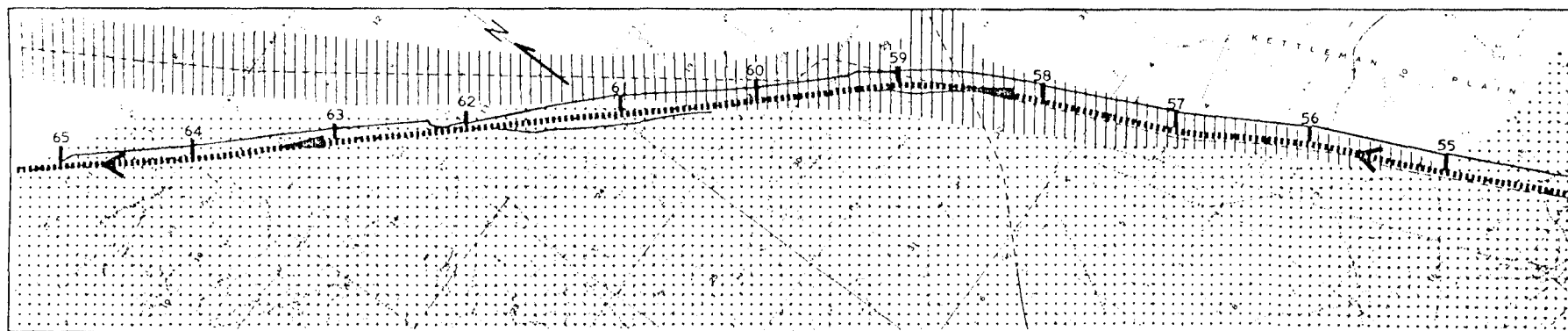
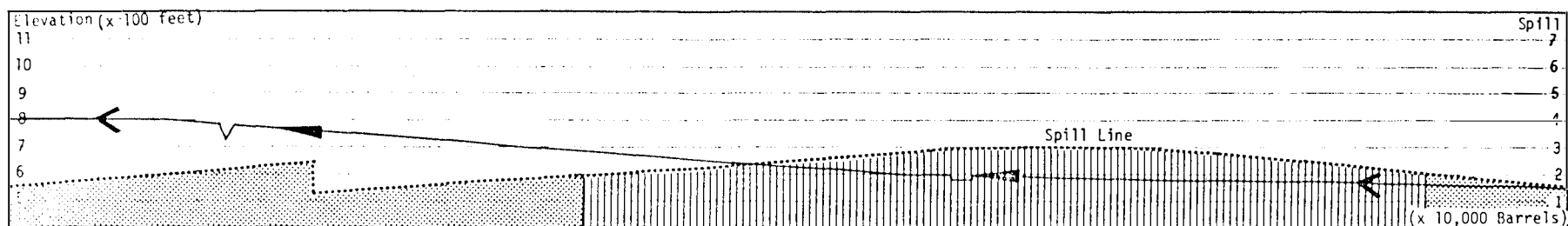
PROJECT FEATURES		Check Valve		
GEOLOGY & SEISMICITY	Consolidated late Tertiary formations North Belridge Oil Field	Thin alluvial screen over formations	Thin alluvial deposits over consolidated late Tertiary formations	
HYDROLOGY	Antelope Hills 12 miles to San Andreas fault, Belridge Hills	Small gullies and ravines draining to northeast between Belridge Hills	Santos Creek	Some produced water and infiltration ponds Chico Martinez Creek
BIOLOGY	Open, short grassland with desert shrubs Typical grassland wildlife with many endangered San Joaquin kit fox			
ARCHEOLOGY AND OTHERS	Moderate potential for fossils			
LAND USE & TRANSPORT	Carneros Pump Station	Open grazing rangeland and oil fields	Crossing many pipelines, field roads and Seventh Standard Road	Open rangeland and oil fields
SOCIOECONOMIC	North Belridge Oil Field Kern County	2-3 miles from Highway 33	South Belridge Oil Field	2 miles to Missouri Triangle 28 miles to Taft



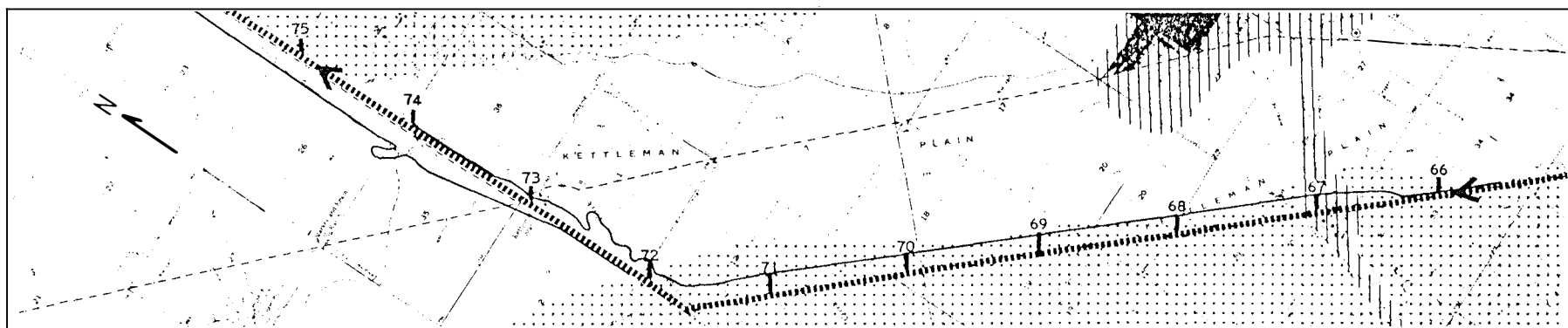
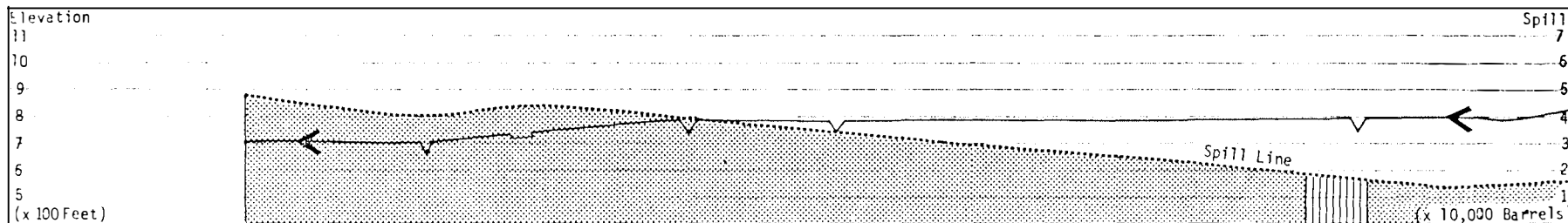
PROJECT FEATURES		Manual Block Valve		Remote Control Block Valve	
GEOLOGY & SEISMICITY	13 miles west to San Andreas fault; 20 miles to Cholame - Parkfield active area.	Alluvial deposits Antelope Plains	Alluvial deposits on southern Antelope Plain	Consolidated late Tertiary formations North edge of Antelope Hills	
HYDROLOGY	Intense irrigation from aqueducts and wells	General drainage to northeast.		Numerous small gullies and ravines	
BIOLOGY	Cultivated crops with disturbance-tolerant wildlife			Short grasslands with desert shrubs - good range for endangered San Joaquin kit fox and other grassland wildlife	
ARCHAEOLOGY AND OTHERS	Irrigated orchards attract many small birds			Numerous oil pipelines, one adjacent to route	
LAND USE & TRANSPORT	Irrigated row crops and orchards/vineyards	Crossing Highways 46 and 33	Roadside cafe and service station	Highway 33 diverges to east	Open rangeland with new cultivation farther east
SOCIOECONOMIC	Scattered farm residences and buildings	Blackwells Corner - 51 miles southeast to Bakersfield			North end of North Belridge Oil Fields
	Kern County 29 miles south to McKittrick, 44 miles to Taft	Scattered farm residences and buildings			Gas and Oil Fields



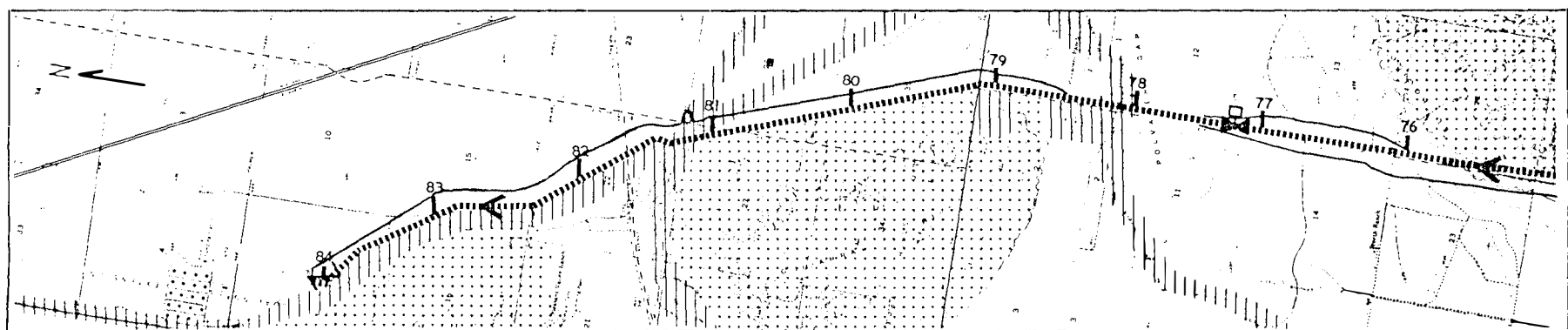
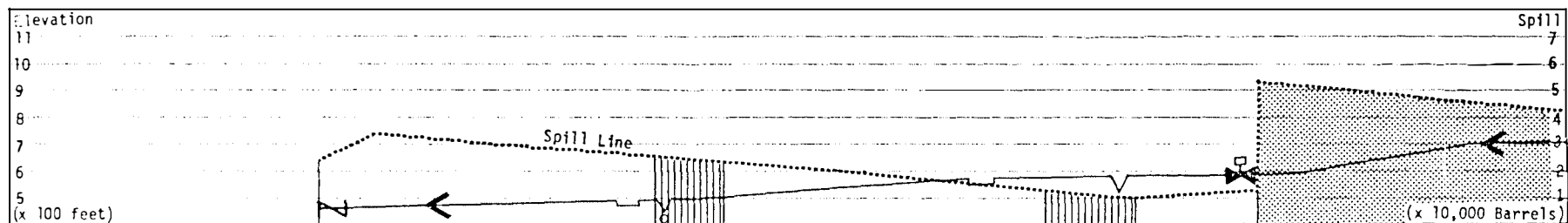
PROJECT FEATURES		Remote Control Block Valve Crossing of buried, enclosed aqueduct		Check Valve	
GEOLOGY & SEISMICITY	Shallow, consolidated late Tertiary formations - Pyramid Hills	Thin alluvial deposits Antelope Valley		Alluvial deposits Antelope Plain	
	About 15 miles west to San Andreas fault and major epicenters				
HYDROLOGY		Unnamed creek	Avenal or Coastal Aqueduct	Irrigated fields	
BIOLOGY	Open short grasslands with meager wildlife	Cultivated crops with disturbance-tolerant native and introduced wildlife		Cultivated crops with disturbance-tolerant native and introduced wildlife	
ARCHEOLOGY AND OTHERS	Moderate potential for fossils	Moderate potential for archeological remains			
LAND USE & TRANSPORT	Paralleling Highway 33 and existing pipelines	Cultivated croplands on large irrigated farms, some orchards		Tembler Pump Station (Getty)	
SOCIOECONOMIC	Open rangeland	Cultivated crops with irrigation		Parallels Highway 33 and existing pipelines	
	16 miles to Avenal 40 miles to McKittrick	Kings County	Kern County	Isolated farm residences farm buildings	Scattered farm residence and farm buildings Kern County



PROJECT FEATURES	Check Valve	Check Valve
	Secondary Control Point: 850 feet	
GEOLOGY & SEISMICITY	Consolidated late Tertiary formation Kreyenhagen Hills	Thin alluvial deposits over late Tertiary formations
	17 miles to San Andreas fault; 13 miles to major epicenters	Edge of Kettleman Plains
HYDROLOGY	Big Tar Creek	Alluvial deposits scattered over shallow consolidated late Tertiary formations. South end of Diablan Range
BIOLOGY	Open grasslands with many snakes and lizards, seasonal passerine birds, hawks, vulture, owls, jackrabbit, ground squirrel, gophers, kangaroo rats, and endangered San Joaquin kit fox	Open grasslands with some desert shrubs. Typical grassland wildlife with endangered San Joaquin kit fox
ARCHEOLOGY AND OTHERS	High potential for fossils.	Moderate potential for archeological remains
LAND USE & TRANSPORT	Paralleling State Highway 33 and existing pipeline	Reef Pumping Station and Getty and Standard pipeline
	Open range land to south and cultivation to north	Crossing of State Highways 33 and 41
SOCIOECONOMIC	5 miles north to Avenal	Cultivated croplands and open rangeland
	Kings County	Highway 41 - county scenic highway
	State Highway 33 - county scenic corridor	13 miles northeast to Kettleman City
		20 miles southwest to Cholame



PROJECT FEATURES						Alternative tank farm sites with gravity flow to Coalinga area
GEOLOGY & SEISMICITY	Consolidated late Cenozoic formation; Kettleman Dome and Hills, oil field	Alluvial deposits Kettleman Plains	15 miles from San Andreas fault and 30 miles from Cholame epicenter	Alluvial deposits on Kettleman Plains and at canyon mouths Consolidated late Tertiary deposits along flank of range Kettleman Plains and northeastern flank of Diablan Range		
HYDROLOGY	Canoas Creek crossing	Parallels Canoas Creek		Big Tar Creek		
BIOLOGY	Grasslands with jackrabbits, ground squirrels, kangaroo rats, gophers and endangered kit fox	Disturbed croplands	Grasslands with typical wildlife	Open grasslands and wildlife along range flanks Disturbed croplands and domestic pets from Avenal		
ARCHEOLOGY AND OTHERS	Moderate potential for fossils	Moderate potential for archeological remains.		High potential for archeological remains		
LAND USE & TRANSPORT	Open grazing on hills Parallels Sutter Avenue	Crossing of State Highway 33 Kettleman Pump Station Cultivated croplands	Parallels existing pipelines	Parallels State Highway 33 at 1-2 miles	General aviation airport Croplands to north and open rangeland to south of pipeline	Tar Canyon Road Tar Canyon Pump Station (Union)
SOCIOECONOMIC	Fresno County	12 miles north to Coalinga and 5 miles south to Avenal	Fresno County	Kings County	1 mile northeast to Avenal	Scenic corridor for county



PROJECT FEATURES	Coalinga Tank Farm	Pressure Reducing Valve and lowest elevation of route	Bridgement of creek and subsurface enclosed aqueduct	Remote Control Block Valve		
GEOLOGY & SEISMICITY	Alluvial deposits to east and consolidated late Cenozoic deposits		Guijarral Hills	Consolidated Late Cenozoic formation	Polvadero Gap Quarternary alluvium over consolidated formations	North end of Kettleman Dome and Hills, oil field
HYDROLOGY	Tank farm and pipeline along east side of Coalinga Aqueduct		Crossing of Los Gatos Creek and Coalinga Aqueduct		Zapato Chino Creek	
BIOLOGY	Highly disturbed cultivated lands with open grasslands to the west. General range of endangered San Joaquin kit fox		Disturbed, cultivated lands to East. Open grasslands on Guijarral Hills. General range and Den Areas of San Joaquin kit fox		Riparian Woodland on Creek	Cultivated cropland north and west of hills. Open grassland on Kettleman Hills.
ARCHEOLOGY AND OTHERS			High potential for archeological remains	Moderate potential for vertebrate fossils	High potential for archeological remains	Moderate potential vertebrate fossils
LAND USE & TRANSPORT	Shell-Califolia Tank Farm	Cultivated lands and proposed site of Coalinga Cargo Port east of aqueduct	Phelps Avenue. Southern Pacific track to Coalinga.	El Dorado Avenue	Jayne Avenue	Polvadero Country Club
SOCIOECONOMIC	Fresno County	Interstate 5: 1-2 Miles east of tank farm and pipeline	6 miles west to Coalinga	Oil field	Pipeline parallels east side of Sutter Avenue	Cultivated crops
			6 miles east to Huron			Open grazing and oil field
						Isolated farms

APPENDIX D
RISK ANALYSIS AND SPILL PREVENTION

Appendix D

Risk Analysis and Spill Prevention

1. Introduction

This assessment uses historical data to derive the probable risk associated with the proposed pipelines. Much of the information pertinent to such an analysis relates to the national level and, as such, must be applied with caution to a regional or local situation. The information can be interpreted, however, to provide reasonable estimates of the frequency, cause, and magnitude of spills that are likely to occur along the proposed pipelines during their lifetimes.

This analysis also considers measures that can minimize the occurrence and effects of pipeline-related accidents. Such measures must include the design of the pipeline and ancillary facilities, construction and testing of the pipeline, its operation and, finally, control and restoration efforts that may be implemented following a spill or accident.

2. Risk Assessment

a. Pipelines

Pipelines have long been recognized as the safest way to transport petroleum products. In one study (Standard Oil, 1974), petroleum pipelines were found to be 1,000 times safer than trucks, 200 times

safer than trains, and 30 times safer than barges. These results are attributable to the fixed and protected nature of pipelines -- that is, they are not exposed to the normal hazards of collision and/or loss of control.

Frequency. The best available information for estimating U.S. accident rates and causes is found in the Summary of Liquid Pipeline Accidents issued annually by the Office of Pipeline Safety (OPS) of the Department of Transportation (DOT). These data are compiled from accidents reported, as required by law, to the DOT by all Interstate Commerce Commission-regulated pipelines. Unfortunately, these data do not segregate the accident statistics for modern pipelines (less than 20 years of age). The data include virtually no inputs from existing California pipelines,* and statistical fluctuations from year to year may create short-term perturbations that, in the long term, can safely be ignored. To compensate for this last shortcoming in subsequent analyses, the information provided by the OPS has been averaged from 1968 through 1975. However, where definite trends are discernible in recent years, data averages for the period 1973 through 1975 are noted. This data base for U.S. crude petroleum pipelines is heavily weighted toward older systems, developed earlier in the century, and these systems would have attendant higher accident rates compared to modern pipelines.

Of the 222,355 miles of petroleum pipelines in the United States in 1974, about 34 percent were crude trunk lines and 34 percent product trunk lines. The remaining 32 percent were made up of crude oil-gathering lines. Although the pipeline miles are distributed relatively evenly among these lines types, the associated accident rates are not: crude oil trunk lines accounted for almost 60 percent of all

*Of the total in-place crude trunk lines in California as of January 1, 1974 (4,815) miles, an estimated 80 percent are neither common carriers nor participate in interstate routes. Nor are these lines regulated by the I.C.C. Hence, accidents on these lines are not included in the OPS data.

accidents. Thus, U.S. crude trunk lines are more prone to accident than are product pipelines. For the 8-year period (1968 through 1975), crude oil trunk lines accounted for an average of 199 spill accidents per year. In recent years (1973 through 1975), the averages dropped to 152 accidents per year. During the 1968-1975 period, spills from crude trunk lines have accounted for an average of 1.9 deaths per year and 2.9 injuries per year (primarily from asphyxiation or fire). The average loss of crude per accident for the 8-year period was 1,036 barrels, with a minimum for a given year of 673 barrels and a maximum of 1,774. No discernible trend in spill size is apparent.

The frequency of pipeline spills correlates directly to pipeline mileage (Standard Oil, 1974). This correlation allows the data to be evaluated in terms of accidents (or spill events) per mile of pipeline per year. Based upon the 8-year average, the accident rate for crude trunk lines is found to be 0.0027 per mile per year. Using the data for the period 1973 through 1975 only, the accident rate drops to .0020 per mile per year. However, because the majority of United States crude trunk lines are many years old, the .0020 value is not representative of newer pipelines.* Accordingly, a study of European pipelines (referenced in Standard Oil, 1974), most of which have been built in the last 20 years, suggests a considerably better record. Between 1966 and 1972, 61 accidents in Europe accounted for 39,300 barrels spilled from 7,850 miles of pipeline. This accident rate is only 0.0011 per mile per year, with an average spill size of 644 barrels.

A "worst-case" and a "likely-case" for spill frequency and size were developed based upon the OPS and European experience, using methodology applied in a recent study (Federal Power Commission, 1976).

*On the other hand, these accident rates are based upon the total U.S. pipeline network. Actually the accident rate should be based on only miles of I.C.C.-regulated trunk lines (these represent an estimated 80 percent of the total, which would serve to raise the accident rate.

The results of this analysis, shown in Table D-1, indicate that large spills of 40,000 barrels are predicted to occur only over a span of hundreds of years, even for the worst case. Thus, a major spill during the life (a minimum of 25 years) of the proposed pipeline is unlikely. This does not imply, however, that a spill of this magnitude could not occur, nor that contingency plans should not be devised to meet such an event.

A moderate spill of 5,000 barrels, as indicated in Table D-1, is likely to occur within the life of the proposed pipeline only for the worst case, whereas a small spill of 500 barrels is predicted to occur with some frequency for either case.

Causes. The OPS data on causes and sources of leaks in liquid pipelines (carrying both crude oil and petroleum products) can be used to ascertain the frequency and most probable location of the leaks in the proposed pipeline. On the average (over 8 years), 83 percent of the accidents occur in pipeline, 8.5 percent at pumping stations, almost 6 percent at tank farms, and the remainder elsewhere. In recent years, more accidents have been reported at tank farms and pumping stations, while less have been on pipeline.

The major causes of accidents in liquid pipelines are shown in Table D-2. Third-party accidents of line rupture by heavy equipment have become a more serious concern in recent years, presently accounting for almost 28 percent of all reported accidents. Equipment failure and incorrect operations by personnel are also increasing problems and account for almost 18 percent of all accidents today. Conversely, because of a concerted drive by the industry, external corrosion has decreased dramatically as a cause of accident in recent years. As additional lines that are coated and cathodically protected come into use, corrosion as an accident cause is expected to decline even further. Internal corrosion is primarily caused by "sour" crudes and remains fairly constant. Likewise, no significant change is anticipated in pipe failure attributable to welds or structural failure of the pipe itself.

Table D-1

FREQUENCY OF SPILLS BY SIZE
FOR AN 84-MILE CRUDE PIPELINE

SPILL SIZE (bb1)	MEAN TIME BETWEEN EVENTS	
	WORST CASE*	LIKELY CASE**
40,000	680 years	2,800 years
5,000	29 years	116 years
500	10 months	3 years

*Based on an annual accident rate of 0.0020/mile
and an average, for all spills, of 1,774 barrels.

**Based on an annual accident rate of 0.0011/mile
and an average, for all spills, of 1,036 barrels.

Table D-2

MAJOR CAUSES OF LIQUID PIPELINE ACCIDENTS

CAUSE	1969-1975	1973-1975
Heavy equipment rupturing line	23.7%	27.8%
Equipment or personnel failure	14.9	18.1
Corrosion		
• External	31.4	23.1
• Internal	6.0	5.7
Pipe weld or wall failure	<u>12.9</u>	<u>12.6</u>
	89.0%	87.3%

Source: Office of Pipeline Safety and URS Company.

Two other reported causes of pipeline accidents are also of interest. Vandalism is of concern when it occurs but is sporadic and, in any given year, has not accounted for more than 1.6 percent of the total accidents in crude lines. Natural causes, such as floods, lightning, cold weather, landslides, and earthquakes, fluctuate considerably from year to year and consequently have accounted for as little as 0.3 percent and as much as 5.1 percent of the accidents in any one year.

Special Causative Factors in the Study Area. Neither the State of California nor the San Joaquin Valley, in which the proposed pipeline is to pass, is adequately represented by the available statistics. Since accident data are not on file at either the state or pipeline company level, a number of pipeline operators in the San Joaquin Valley were contacted to determine special concerns and corrective actions that have been proposed or taken. These concerns focused on agricultural activity and earthquakes.

Third-party accidents attributable to various types of equipment rupturing of in-place lines in recent years have accounted for almost 28 percent of all accidents (Table D-2). At the national level, these third-party accidents can be further proportioned into the following activities:

o	Pipeline and cable construction	-- 19%
o	Earthmoving, grading, etc.	-- 25%
o	Drilling holes, farm plowing, and laying drain tile	-- 7%
o	Highway and roadwork	-- 15%
o	Miscellaneous or are unreported	-- 34%

Not surprisingly, for all accidents caused by equipment rupturing of lines, more than 90 percent occur in lines that have 40 inches or less of cover.

Because the San Joaquin Valley is one of the most intensively cultivated areas in the country, subsoiling techniques (i.e., breaking up deep soils) are widely used to improve the permeability of the soil and to increase productivity. Soil disturbance related to subsoiling has progressed from a 2- to 3-foot penetration to a present depth of 5 or more feet. The 5-foot depth is attained by large bulldozers dragging a deep-cutting single plow through the soil. As a result, pipelines have become increasingly subject to subsoiling accidents. Plows used on subsoiling, generally referred to as "San Joaquin Pipeline Detectors," have forced the complete removal of pipelines from some corridors and have led to recent industry proposals to bury all future lines at depths of 5 feet or more. Other third-party accidents also occur in the valley, but the agricultural-connected causes predominate.

Much of California is transected by many faults, including the famous San Andreas fault zone that runs virtually the length of the state. Since the problem of earthquake-related ground displacement has long been recognized, special attention has been made in laying pipeline through "earthquake country" and new codes designed to meet earthquake requirements have led to changes in pipeline design and construction. These changes include increasing the strength of the pipe through such areas and designing flexibility into the line itself, either by allowing it to "float" on the surface of the earth or burying it with considerable slack (American Petroleum Institute).

While complete documentation on the effects of earthquakes on pipelines is not available, sufficient information has been published or is available to suggest that given proper engineering, no serious risk of damage due to fault displacement should exist in this area. In a paper reviewing earthquakes prior to 1969 (Western Oil and Gas Association, 1969), pipeline ruptures in several major recorded earthquakes were minimal and limited to older pipelines constructed with the weaker acetylene welds. The 1971 San Fernando earthquake offered supporting evidence to this characterization. An 18-inch liquid line of modern

vintage, which passed close to the epicenter, was unscathed, whereas an adjacent older line failed at the acetylene welds. Interestingly, a number of gas transmission lines of modern design did not fare as well as oil lines, probably because of their lower mass, and therefore greater differences to enclosing soil and bedrock, and higher operating pressure.

b. Tank Farms

Because tank farms are widely used in industry, the state-of-the-art with respect to safety of operations is highly developed. The major safety concerns at tank farms are spills and fires. The safety hazards associated with spills are mitigated by diking the tanks, usually individually, such that the entire contents of any given tank can be contained in the event of a spill. Fire is a more serious concern. A spill into a diked area, ignition of the material spilled, and resultant flashback of the fire into the tank itself is the worst-case sequence of events. Explosion of vapor accumulated within or above the surface of the tank contents could also occur. Because of the potential for these and other fire-related events, fire prevention and firefighting capability are integral parts of tank farm operation.

Spill containment with the use of dikes is almost always adequate, but under certain circumstances, secondary containment may be inadequate (e.g., when hot oil mixes with water resulting in boilover). Thus, in environmentally sensitive areas, tertiary containment (e.g., dams and peripheral dikes), may be required.

Hydrocarbon Processing magazine annually reports fire losses for the hydrocarbon processing industry. For the 4-year period (1971-1974), an average of 2.75 fires per year with property damage exceeding \$1,000 were reported for the 210 tank farms. This amounts to approximately one fire for every 100 tank farms per year, equivalent to one fire per

tank farm every 100 years. In contrast, refinery fires average one fire per refinery per year.

Tank farms not associated with a specific operation (such as a refinery or bulk plant) are generally large and may handle one or more classes of products. Depending upon the age and purpose of the tank farm, a variety of structural types of tanks may also be found within the farm. In recent years, the floating-roof tank has been widely adopted for large tanks because of the economy of construction, reduction in vapor losses, and safety with respect to fire.

Fire safety at tank farms is primarily a function of the structural type of tank. Based upon a 3-year data base, floating-roof tanks accounted for only 5 percent of all tank fires; cone- and dome-roof tanks accounted for almost 82 percent. No significant differences were found between pantograph, tube, and fixed-roof tanks with internal floaters with respect to frequency of fire, although the fixed roof with internal floater is generally considered to be safer. While cone- and dome-roof tanks must be equipped with fixed foam internal fire protection systems, floating-roof tanks, having an excellent fire record, are not required to have such systems (Herzog, 1974).

Fires in floating-roof tanks normally break out around the peripheral seal and, if quickly attacked with portable extinguishing equipment, are generally successfully extinguished. However, if the fire is uncontrolled, the seal may burn out allowing additional vapors to escape; at worst, the floating roof can sink, creating total involvement over the liquid surface. When partial or total tank involvement occurs, the fire must be fought with pumpers equipped to use foam or heavy water. Often fires cannot be controlled and continue to burn until the fuel source is exhausted. A major concern associated with an uncontained fire in a tank farm is the radiation heating of adjacent tanks. Such heating is controlled by using water to cool exposed tank walls.

Although internal foam protection systems, which can be activated automatically or manually in the event of fire, are not required in floating-roof tanks, they can be and are used as a safety precaution. Such systems have a good record in quickly extinguishing the fires that do occur within floating-roof tanks.

3. Spill and Accident Prevention

In this section measures that are being taken in the proposed design, construction, and operation of the various components of the conveyance system are examined with respect to overall safety. Initially, the main pipeline from Elk Hills to Coalinga and ancillary tank farms are considered. The lateral pipelines to Junction Station and Kettleman City and the secondary carriers into which these laterals feed, are then evaluated. These secondary carriers include pipelines, tank farms, and marine terminals.

a. Main Pipeline

The proposed Elk Hills/Coalinga Pipeline would meet or in most cases, exceed basic design codes as outlined in the design criteria for "Liquid Petroleum Transportation Piping Systems" (American National Standards Institute, 1974), and the "Minimum Federal Safety Standards for Liquid Pipelines" as detailed in the Code of Federal Regulations (Department of Transportation, Title 49). These and other state and local requirements, where applicable, also prescribe standards for operating, maintenance, etc. The specific measures taken to control the major causes of accidents, as outlined in the previous section, are described in detail below.

A major consideration in pipeline safety measures is the magnitude of the design spill. The design spill is that quantity of oil that escapes before pumps and valves can be shut down, plus that oil

that remains in the line after shutdown and ultimately drains from the line. Design criteria are such that the design spill is kept as low as possible, particularly in environmentally sensitive areas. The design spill has been used as a determinant in the environmental sensitivity analysis (Appendix E) and is shown in the Environmental Atlas (Appendix C). As an indication that the design spill potential is sufficiently regulated, the proposed routing was analyzed to determine the fraction of route length potentially exposed to various size spills. The results are shown below:

<u>POTENTIAL SPILL</u> <u>(000s of barrels)</u>	<u>PERCENT OF</u> <u>LINE LENGTH</u>	<u>MILES</u>
40-43	2	1.5
30-40	9	7.8
20-30	17	13.8
10-20	43	36.4
< 10	<u>29</u>	<u>24.5</u>
	100	84 miles

Eighty-nine percent of the line has a design spill of 30,000 barrels or less, and less than 2 percent exceeds 40,000 barrels. The actual amount of the spill is likely to be lower than the design spill because quick shutdown of the line would reduce the dynamic loss (10 minutes has been assumed) for pump shutdown. The "manometer" or pooling effect "traps" oil within the line and reduces the actual loss. The maximum spill of 40,000 barrels is indeed credible since the four largest spills reported nationwide for the 8-year period were: 41,000, 40,000, 30,185, and 19,965 barrels.

Rapid shutdown of pipelines that experience leaks or ruptures is essential to minimize the size of spill, damage to property, and loss of life. To accomplish rapid shutdown, the system must incorporate one or more detection subsystems (which may rely on differential changes in pressure or flow) and automatic shutdown of pumps and key valves. A recent study (Mechanics Research, Inc., 1974) concluded that only liquid

spills in excess of 1,000 barrels resulted in death or injury and substantial property damage. Limiting the spill volume to less than 1,000 barrels during detection and shutdown can be accomplished, it was noted, by use of sophisticated input-output flow monitoring systems supplemented with remotely controlled valves at critical locations. Other ancillary systems would include over-pressure protection* and automated shutdown of pump stations (within 1 to 2 minutes). Overpressure protection devices would also report to the supervisory control center. These protective devices, coupled with a well-designed system configuration and management, would serve to alleviate any surge problems in the pipeline.

The proposed pipeline would include those features mentioned in the previous paragraph. Inlet (Elk Hills) and outlet (Coalinga) flow meters would transmit data every two minutes to the supervisory computer at Elk Hills. The system would have minimum-leak detection capability of 1 percent of the throughput of 200,000 barrels per day, or 1.4 barrels per minute. This amounts to a potential leak of 6 barrels in the 4 minutes required to detect and verify the leak or, at worst, about 14 barrels in the 10 minutes before the pumps would be stopped and the one remotely controlled valve closed. The inlet-outlet detector can also monitor somewhat smaller leaks through a preset level alarm, but would be unlikely to detect leaks of less than 0.5 percent of throughput on a 24-hour cumulative basis (i.e., 1,250 B/D). Leak rates between 500 and 1,250 B/D would most likely be caught in a period of a few days by inventory control measures, instigating further investigation. Smaller leaks probably would be found only when the escaping oil has saturated the ground and surfaced. Leak rates in excess of 10 B/D (equivalent to an 1/8-inch hole just downstream from a pump station) would most likely produce evidence visible by either foot or aerial reconnaissance within a few days of inception. If the leak occurs immediately following an

*Older pipelines often rely on pressure sensing at pump stations to provide information on both overpressure and "underpressure," the latter serving as an indicator of catastrophic ruptures in the line.

aerial survey (which are scheduled biweekly) and the oil accumulates (and is not noted by third party) until the next fly-over, the total spill could be quite appreciable (for a leak rate of 50 B/D the total over 14 days would be 700 B/D). Pinhole leaks (less than 1/4-B/D) could persist for long periods prior to discovery but would be unlikely to represent large cumulative losses.

The pipeline would be coated and provided with sufficient test points so that a cathodic protection system can be installed within the first year of operation. Internal corrosion is not foreseen as a problem since no sour crudes would be transported.

In the construction phase, all welds would be X-rayed to insure their integrity. After completion, the segment would be hydrostatically tested at 1.25 times the maximum operating pressure of the pipe (normal operating range is 72% of yield strength). The pipeline would be buried and held in place by riprap at the severaly dry washes along its routing and would cross two aqueducts where they are buried siphons. The pipeline does not cross any known major active faults.

Shutdown of the pipeline pumps and the remotely-controlled valves (five in the line itself) can be initiated from the main control center at Elk Hills. The pipeline also contains five check valves and two manual block valves that are readily accessible from nearby highways with a maximum estimated closure time of one hour after discovery of a major leak. A "dedicated" microwave circuit would be employed to insure a high degree of reliability in the communications network for the inlet-outlet flowmeter system and for operating the recently controlled valves.

Throughout most of the pipeline route, the top of the pipe would be buried a minimum of 36 inches (18 inches in bedrock areas),

with that portion going through or near deeply cultivated or irrigated lands covered by at least 4 to 5 feet of earth. This precaution is a double-safe feature, since the pipeline route is located to the west of Highway 33, within or near a number of oil production fields, in order to avoid existing and potential cultivated areas.

Once operational, the pipeline route would be flown once a week to check for any small leaks that may have surfaced and to note any construction or agricultural activity along the route that has not been reported. The pipeline would be well marked along its length with appropriate signs, and landowners would be notified of the exact route of the pipeline across their property and the location of any valves. Each marker would list a phone number that could be called by equipment operators in the area.* In addition to the weekly aerial surveillance, the pipeline would be surveyed on the ground annually to check for any surface indications of leaks or other trouble. Pipelines normally have a "break-in" of up to 3 years, during which time small leaks may develop so that more frequent walkovers may be required initially. These leaks normally develop into pinhole leaks discharging a few barrels a day until they are detected and repaired.

The deep burial of the pipeline in areas of intensive cultivation (roughly from M.P. 36 through 55) would reduce or eliminate third-party accidents. In other areas, surface activity is unusual, and third-party accidents are likely to be negligible. The potential compensation of the third-party accident is that the equipment operator breaching the line would recognize the need to create dikes to confine the spread of oil and would have the necessary equipment on hand.

*The "one-call" number system has been adopted with much success in some regions including northern and southern California. In this system the equipment operator has only to call one number to indicate his intended activity in the area. He is then told of all underground utilities in the area and the owners of these utilities are, at the same time, notified. At the present time the San Joaquin Valley does not have the one-call system.

If a major break occurred, the pipeline would be immediately shut down and aerial surveillance undertaken to determine the site of the leak (in a third-party accident, it probably would be reported by the perpetrator promptly). Crews would be immediately dispatched to dike the area of the spill and to shut down the block valves controlling uphill segments of the line. The spill site would be protected from any ignition sources until such time as the pooled oil can be removed by vacuum trucks and the leak itself repaired. Oil-contaminated soil would be removed and disposed of in an acceptable manner and clean soil brought in to replace it as necessary.

Ingress of spilled oil to water is unlikely. The water table in the San Joaquin Valley is deep and is not likely to be contaminated by surface spills. Much of the area is semi-arid (5 to 10 inches of rainfall per year) with water courses normally dry, and spills should not travel far down the dry channels. In the event that these creek beds are filled with water, some unavoidable downstream spread would occur.

It is most unlikely that any oil could enter the small aqueducts and other canals in the area. However, for such a contingency local pipeline companies have a loose-knit cooperative effort which would allow them to boom off the aqueducts to minimize spread. Recently, a simulated exercise was conducted, using plastic spheres simulating oil to determine the adequacy of this plan; it was conducted in the California Aqueduct with the cooperation of the aqueduct authorities. Although presently the Navy, through its operator is not involved in this cooperative effort, membership should be sought upon completion of the pipeline. Crude pipeline spills rarely result in fire or explosion. However, if such events occur, firefighting capabilities including foam

and light water are available on short notice from the several communities and counties through which the pipeline passes.*

In the event of a major earthquake in the area, the pipeline would be immediately shut down, aerial and ground surveillance undertaken, and the pipeline would be hydrostatically tested to insure its integrity. No potential landslide areas are located within the proposed corridors and thus are not a factor.

Contingency plans for the completed line should be prepared and made available to operating personnel. These plans should contain, at a minimum, sections on: emergency organization, response plans for both terminals and the pipeline including detection and containment, clean-up and restoration procedures, resource availability, reporting and documentation procedures, and training.

b. Elk Hills Tank Farm

Fixed-roof tanks with internal floaters would be used in the tank farm. This design minimizes vapor losses and reduces fire risks. Fire protection, primarily provided by the Kern County Fire Department, would be augmented by mobile dry chemical fire extinguishers at the tank farm. Scheduled improvements in the existing water supply to the tank farm site would also increase the firefighting capability of the one pumper presently in use at the Reserve. The Navy's unit operator is a member of the Cooperative Foam Program, operated by the Kern County Fire Department, as are other producers and refineries in the area; the capabilities of this area-wide protection service are shown in Appendix N. These resources are considered adequate to contain fires initially and, most importantly, to prevent involvement of more than one tank.

*Vapors from crude oil pipeline spills have been reported to have traveled up to 600 feet underground, causing explosions in basements. However, basements are most uncommon in California and few dwellings are found within this distance of the pipeline route. Hence, explosions that would result in personnel injury are considered most unlikely.

Onsite personnel would be able to identify and locate any leakage and/or fires in the tanks, lines, or pumps within a few minutes of their origin. The fire control program for the reserve would include actions for the Elk Hills Tank Farm, the LACT station, and other tanks within the reserve. Onsite personnel would notify reserve fire control personnel and would contact emergency tasks (e.g., closing down and isolating fire-involved areas). Berms would isolate individual tanks and reduce the spread of fires within the area. Fires involving the pump station would be identified by the fire detection system with subsequent control and extinguishing by reserve personnel. This pump station fire detector would shut down and isolate the pump from the tank farm and main pipeline in the event of fire. Pump-seal, leak-detection unites would identify seal leakage and shut down and isolate the pump. The design would contain any oil spilled within the tank farm. Following seismic events, the tank farm system would be examined for damage and possible oil spillage.

Basic spill prevention measures would be provided by individually diking each tank to hold 110 percent of its capacity. The dikes and diked area would be paved or otherwise treated to minimize erosion and oil seepage into the ground. Manually-operated drainage valves would control release of any water from diked areas.

The Elk Hills Naval Reserve presently has both a Spill Prevention Control and Countermeasure Plan (SPCC) in compliance with EPA requirements and a contingency plan to implement necessary actions in the event of a spill. The present unit operator has prepared such plans and would be responsible for extending such plans to the new tank farm.

The Coalinga Tank Farm would also be constructed under this proposed routing at the terminus of the trunk line (M.P. 84) at Coalinga. This tank farm would be constructed to the same standards as the one at Elk Hills and would follow the same stringent operating standards,

including preparation of SPCC's and contingency plans. Supplementary fire protection would be provided by city and county jurisdictions at this tank farm (Appendix N).

In addition, the Coalinga Tank Farm would be located near the proposed Coalinga Cargo Port. Accordingly, an application would have to be made through the Federal Aviation Administration to insure that the facility does not impinge upon the safety of the proposed airport. No serious conflicts are foreseen at this time.

APPENDIX E
SENSITIVITY ANALYSIS

Appendix E Sensitivity Analysis

Sensitivity is defined as the vulnerability of a resource to impact from an oil spill. Sensitivity is determined graphically by combining the environmental value of areas along the Elk Hills/Coalinga Conveyance System with the potential size and movement of a spill at any point. The resulting overlays, included in the Environmental Atlas, (Appendix C), represent a geographic sensitivity and inform the reader of potential low- to severe-impact areas. The "Sensitivity Analysis" presented herein forms the basis for comprehensive contingency planning. The analytical approach used involves three basic steps:

1. Estimate the potential risk, size, and probable overland movement for a maximum credible oil spill at any point.
2. Determine the environmental value ("V" rating) of the area.
 - a. Identify significant environmental parameters along the pipeline route. It should be noted that environmental value is determined independent of oil spill information.
 - b. On a relative basis, compare each of the chosen environmental parameters.
 - c. Rate the relative comparisons for all of the chosen parameters to determine an overall cumulative environmental value along the corridor.

3. Graphically combine Steps 1 and 2.c to assess where the possibility of oil spill damage coincides with a valuable environmental area. The resulting combinations are then assigned a sensitivity value ("S" rating) based upon the potential degree of environmental impact.

The approach to sensitivity analysis has been developed through experience with oil spills of various sizes and oil types that have occurred in both the aquatic and terrestrial environments. The analysis is unique in that the criteria used to determine environmental sensitivity are developed specifically for each individual case.

1. Determination of the Potential Area of Oil Spill Damage

The first step in determining the possible extent of oil spill damage is to determine potential spill size. For this purpose, two types of spills are considered -- those large enough to be detected automatically and those that are not. The area potentially contaminated by a spill large enough to be detected is a function of the amount of oil spilled, presence of water, slope and substrate at the site of the spill, type of oil, and a variety of other environmental factors. The analysis of spill size is based upon "worst-case" spill conditions.

Spill sizes have been divided into 10 classes as presented in Table E-1. These spill sizes are then correlated to spill magnitude estimations presented in the risk assessment analysis (Appendix D) and portrayed graphically in Figure D-1. The spill magnitude estimations of the Elk Hills/Coalinga pipeline route encompass 7 of the 10 spill classes (the solid horizontal lines on Fig. D-1). Based on these spill classes and conservative assumptions, approximate distances of spread over the ground surface can be calculated. The shape of an oil spill at small slope angles (up to 10 degrees) is assumed to be elliptical. Oil thickness is a variable function depending upon spill size, oil viscosity,

Table E-1
SPILL CLASSES AND THEIR SIZES, SURFACE AREAS, AND
PROBABLE FLOW DISTANCES FROM THE PIPELINE

SPILL CLASS	SPILL SIZE (BARRELS)	SPILL SURFACE AREA ¹ (Ft. ²)	SPILL FLOW LENGTH FROM PIPE CENTERLINE (FT)			
			ON A FLAT SURFACE ²	SLOPE LESS THAN 1° ³	SLOPE LESS THAN 5° ³	SLOPE LESS THAN 10°
1	Less than 2,000	97,000	180	260	350	530
2	2 to 5,000	220,000	260	400	530	790
3	5 to 10,000	410,000	360	540	720	1,100
4	10 to 15,000	580,000	430	650	860	1,300
5	15 to 25,000	920,000	540	820	1,100	1,600
6	25 to 40,000	1,400,000	670	1,000	1,300	2,000
7	40 to 55,000	1,900,000	770	1,200	1,500	2,300
8	55 to 75,000	2,400,000	880	1,300	1,800	2,600
9	75 to 100,000	3,200,000	1,000	1,500	2,000	3,000
10	Greater than 100,000	-	-	-	-	-

¹ Spill Area (ft²) = 112 (spill Volume [Bbls])^{0.89}

² Assuming Circular Flow

³ Assuming Variable Elliptical Flow

SOURCE: D. Mackay, "The Area Affected by Oil Spills on Land", The Canadian Journal of Chemical Engineering, Vol 53, April 1975.

soil permeability, etc. The area contaminated was calculated based on actual and experimental spill sizes. Table E-1 presents the maximum distance that spills of the nine spill classes could travel over the surface from the center line of the pipeline.

Plans now call for a computer detection system designed to monitor oil throughput on an instantaneous or cumulative basis. By computerized comparison of input and output, discrepancies (or leakage) greater than 1 percent of the total throughput (e.g., 1.4 barrels per minute as a worst case) can be detected quickly. The sensitivity of the system can be improved to 0.1 percent of the throughput by cumulative interpretation over periods of 24 hours or more. Leaks less than this threshold of detection would require monitoring of some other form. Operational plans include weekly surface inspection of the pipeline corridor and periodic hydrostatic testing.

Spills can occur that are small enough to escape detection by automatic detection equipment. If such a leak occurred (i.e., immediately after a routine surface inspection in the area not subject to public view), detection may not occur for up to one week. This lengthy period of nondetection of a spill would most likely occur in heavily vegetated areas. During such an interval, up to 1,250 barrels could be released without detection by automatic sensors.

The second step in the analysis of the possible extent of oil spill damage is to determine the direction of drainage and plot maximum spill distances from the pipeline for appropriate points along the corridor. Figure D-1 presents maximum design spill for the entire pipeline. Mileposts are placed along the upper horizontal axis of the figure so that spill size and topography can be referenced directly to the base maps.

The pipeline sections in which each of the nine spill classes may occur are thus depicted by mileposts. The spill corridor presented in the Environmental Atlas is the calculated potential area subject to

contamination by a maximum spill, with the exception of oil entering a waterway during the flow period. The downstream contamination will vary between streams having intermittent and year-round flow. The waterways most susceptible to oil contamination are noted by large arrows branching from the spill corridor and indicating the direction of spill movement.

The factors used in determining spill potential are presented in the lower information box of the Environmental Atlas and include active and inactive faults, dry wash, creek and river crossings, road crossings (especially those subject to normal maintenance), and agricultural areas where heavy equipment activity exists during certain seasons. This graphic presentation of spill potential allows the pipeline operator to locate those areas in which a spill is most likely to occur as well as the potential size of that spill.

2. Determination of Environmental Value

For the purpose of this analysis, environmental value has been defined in terms of productivity and demand for various social and natural resources. The six environmental parameters potentially affected by a spill are vegetation, wildlife, water supply (hydrology), recreation, economics, and visual quality. The criteria defining relative value for each environmental parameter are presented below.

The highest rating (V-1) denotes an area of high productivity or an area having unique or irreplaceable qualities. The middle rating (V-2) denotes an area that is necessary to the productivity of the local or regional ecosystem but is replaceable. The lowest rating (V-3) is assigned to those areas that are of low productivity and have little demand or use.

Value #1 Definitions

Vegetation

All populations of rare and endangered plants listed by the California Native Plant Society (1974), and protected plant communities (those plant communities acting as primary critical habitat for local wildlife and plant communities of high scientific value). High scientific value refers to disjunct populations that are separated from the range of major distribution, species at the limits of their range, regions of diverse floral composition, and regions of exceptionally high productivity or sensitivity (little or no recovery or extremely slow recovery following impact).

Riparian vegetation is considered primary critical habitat. Such vegetation is of great importance because it stabilizes the soil along streams and thereby protects downstream habitat. The term "riparian" is used in the broad sense and includes all vegetation that lies along major intermittent and all permanent streams.

Wildlife

Known or reported home ranges, den sites, or roosts of rare, threatened, and endangered species, and those species that have special protection. This category also includes areas of high species diversity and abundance and areas of unusual or unique occurrences (i.e., wildlife observed at range limits, or unusual abundance of wildlife).

Water Supply

Any surface water system that is necessary for water supply of potable uses, livestock watering, and irrigation.

Recreation

Lands with existing organized recreational uses, both public and private. These recreation areas are highly valuable because they provide local opportunities for spending leisure time.

Economic

Any lands offering a direct economic benefit to public or private ownership that would be lost to a significant degree because of a loss of function (e.g., physically unable to harvest) or time (e.g., fields unplantable during spring season).

Visual Quality

Areas readily visible from the pipeline corridor that have aesthetic values. These areas include wildlife preserves, wilderness areas, scenic highway corridors, and special areas of exceptional scenic or architectural quality.

Value #2 Definitions

Vegetation

Vegetational communities that (1) grow without aid from humans, and (2) have not been severely disrupted by development. On this particular route, the only communities that fulfill these characteristics are the grazed and ungrazed Lower Sonoran Grassland as defined by Twisselman (1967).

Wildlife

Areas containing the wildlife composition and abundance native to the area. These sites have undergone little or no disturbance, thereby maintaining much of the original characteristics of the land.

Water Supply

Any water system that is indirectly used as a supply source (i.e., surface ponding areas). This classification also includes aquifer recharge sites.

Recreation

Public lands with no specific recreation facilities. These areas are important for two reasons: they provide locations for unorganized recreation such as off-the-road vehicle travel, and they have the potential to be developed for other recreational areas. Other lands, specifically selected by local governments for future parks are also important for their potential to meet future recreational needs.

Economics

Any lands or facilities having an economic value subject to only an intermittent loss due to impairment of function or loss of time.

Visual Quality

Lands valuable for their scenic value by virtue of the uniqueness to local residents. These include recreational lands and residential, institutional and scenic open space.

Value #3 Definitions

Vegetation

Those areas that are urbanized or otherwise heavily developed or support cultivated crops. Such areas would take many years to return to a stable, self-maintaining condition.

Wildlife

Areas of disturbed wildlife (e.g., cultivated fields, urban-industrial areas), or very low wildlife productivity and use (e.g., have rock or open sand beaches and washes).

Water Supply

Water resources not used or appear not to be used. Also indicates potential absence of water resources in the area being studied.

Recreation

Private land providing recreation only for the individual owners. The value of these lands to the regional and local community is low from a recreational standpoint.

Economic

Lands having no discernible economic value.

Visual Quality

Lands of low-grade agricultural or industrial use. This includes vacant lands subject or zoned for building.

3. Application

The graphical combination of potential areas of contamination (spill corridor) and environmental value results in three levels of

relative environmental sensitivity to oil spill damage. The sensitivity ratings appear in the upper box of the Environmental Atlas.

The definition of each level of sensitivity is as follows:

- S_1 - A spill of any size in a severe impact area. Spills in these areas are of high priority and require immediate action. Areas so designated should be subject to prior contingency planning, which would include specific approaches designed to preserve the natural and social amenities in the spill corridor. S_1 areas may also require restoration activity.
- S_2 - Spills in these areas require cleanup but are not likely to require restoration activity. The areas require a general contingency planning effort.
- S_3 - Spills in S_3 areas may require cleanup activity but probably do not require detailed site-specific contingency planning. Any cleanup activity in an S_3 area would be aimed simply at removal and disposal of the oil by whatever means available. Spills in these areas should not receive priority for cleanup in the case of a massive spill involving large sections of pipeline. Any restoration that does occur would be of natural origin and not a result of any planned activities.

The analysis and graphic summary is designed to provide the basic environmental information for the development of a functional oil spill response plan. Incorporated in such a plan, the analysis would additionally provide the pipeline operator or emergency response coordinator with a quick, easy reference to manage pipeline emergencies.

4. State-of-the-Art Spill Technology

Any overland pipeline, regardless of the engineering sophistication or the terrain traversed, is susceptible to some degree of leakage or breakage at any point along its length. While the probability of an incident is extremely low, the loss volumes can be large and the associated environmental damage extensive. For this reason, it is necessary to consider emergency spill control actions. This is normally done by preparing an oil spill contingency plan -- a planning document designed to provide specific instructions and organization to reduce the effects of an oil spill. A properly prepared contingency plan projects the path and mechanism of effects during a spill and presents a plan for environmentally acceptable and cost-effective cleanup disposal and restoration operations. Development of an operational contingency plan is beyond the scope of this study. However, a perspective on the state-of-the-art in spill control, cleanup, disposal, and restoration as applicable to the conditions encountered along the proposed pipeline corridor is presented below.

a. Control Actions

Spills into Water Courses. Considerable research has been done on the development of oil-containment booms and other barrier systems. Generally, these systems, if properly deployed, provide effective containment in currents up to 1 to 1.5 knots. At greater current velocities or when overloaded, booms can be expected to fail. Test applications in the California Aqueduct suggest that response time requirements and flow performance are within realistic limits for water courses such as the Coalinga Aqueduct for most commercial booms.

Should a spill contaminate one of the many intermittent water courses during a period of flow, use of conventional booms would probably be impractical. Flow rates in such streams and rivers are generally in excess of the functional limits for any booms and the topography

makes it impossible to physically place the booms. The predominance of floating debris and the shallow geometry of the channel beds further limit the effectiveness of standard booms. Under such conditions, use of earthen barriers is similarly impractical. The only practical containment procedures involve the improvisation of permeable fences (i.e., placing a cyclone fence across the stream) that contain a sorbent/ filtering material such as straw.

Spills onto Land -- Horizontal Flow. Containment of land spills is conducted through rapid construction of berms and dikes (e.g., earthen sandbag).

Spills onto Land -- Percolation into Soil. Research is currently underway to develop agents that may be injected underground, thereby forming impermeable barriers. Consideration of the soil type and ground-water characteristics along the proposed route suggests that little potential exists for damage to the aquifer as a result of oil spreading underground.

b. Cleanup Actions

Oil-on-Water. For those areas easily accessible along the Elk Hills/Coalinga Pipeline (i.e., Coalinga Aqueduct), the most practical mechanism of recovery would employ either vacuum truck systems (septic tank pumpers) or tank trucks equipped with pumps. The only special attachment necessary for use of these locally available pieces of equipment is a simple, flattened suction head necessary to keep the recovered oil/water ratio as low as possible. Tank loads of recovered material are easily transported to reprocessing or disposal facilities.

In those areas that are not easily accessible, little action can be taken without incurring additional environmental damage. These areas are normally steep in gradient and would undergo significant flushing by natural processes. In the event of a spill entering such a

reach, provisions should be made for containing and recovering oil at the first downstream point of access.

Oil-on-Land. The vacuum technique outlined above can be employed on dry spills where pools of oil occur. In most cases, however, oil would soak into the soils or form a layer that is too thin for recovery in this fashion. Removal of oily soil can be accomplished by hand or with construction equipment as dictated by the nature of the area contaminated. In fairly level areas use of elevation scrapers is recommended. Depths of cut can be controlled to remove a minimum amount of soil thereby keeping the recontamination potential to a minimum. Motorgraders, bulldozers, and other construction equipment can also be employed but tend to be less efficient and may spread contamination.

In rocky areas or streambeds, light equipment or even manual labor may be required to reduce unnecessary removal of clean soil and to prevent the penetration of oil deeper into the soil profile. Final polishing of such areas would probably require sand blasting.

c. Disposal

A variety of possible means of disposal of oil and oil-contaminated material are possible. In terms of decreasing practicality they include:

Reclamation. If oil is recovered in a sufficient quantity and is relatively free from water and debris, reclamation at an appropriately equipped petrochemical facility may be possible. In almost any case, however, reclamation represents only a partial solution. Underlying contaminated soil would require additional treatment.

Landfilling. Depending on approval of state and local officials, it may be possible to dispose of small quantities of oil-contaminated debris in municipal landfills. In the event of larger

spills, landfill capacities, physical characteristics, and disposal requirements of some municipal facilities may prevent the disposal of recovered oil there. Special landfills may be required by statute for disposal of the oil (in particular, placement of the fill site on impermeable subsoils or formations).

Cultivation. Land-spreading and/or cultivation have been used for the disposal of spilled oil and contaminated soil. Primary processes involved include increased exposure to oil, oil-degrading bacteria found in the soil columns, and increased volatilization. While plants have been grown in cultivated disposal areas within 6 months, little is known about the movement of residual materials through the soil and uptake of oil fractions by plants. Additionally, significant quantities of air pollutants would be emitted in the event of larger spills.

Disposal by Burning/Pyrolysis. Actual burning may be technically feasible but unacceptable from an air pollution standpoint. Without considering proximity to a pyrolysis unit, disposal by this method would probably be impractical because of size and concentration of solids.

Chemical Cleaning. Portable devices capable of chemically processing sand have been devised and tested. These devices are, unfortunately, costly to operate and limited in capacity.

d. Restoration

Soil. Restoration may be required in areas where important vegetation is removed during cleanup. Since soil profiles in arid and semiarid regions can be thin, replacement of topsoil in some areas may be required to restore the original vegetation. Such action can involve extensive earthmoving expenses and may impact the borrow area.

Vegetation. Depending on the nature of the cleanup damage and the condition of the surrounding area, revegetation can be conducted in several fashions. The simplest of these is natural revegetation. If adequate soil and soil nutrients are available, the disturbed area should generally recover rapidly by natural reseeding. If it seems desirable to artificially augment the reseeding, or if a rare plant community is totally removed, a variety of mechanical seeding/planting devices or hydroseeders are available.

Wildlife. It is doubtful that restoration of wildlife would be required. Migration back into a disturbed area should be rapid providing the requisite habitat is available.

APPENDIX F
SEISMIC HAZARDS

Appendix F Seismic Hazards

1. Structural Setting

The geological structure along the southwestern margin of the San Joaquin Valley is dominated by the northwest-trending San Andreas fault zone. The San Andreas fault is a recognized major plate-tectonic boundary along which predominantly horizontal, right-lateral motions occur. The land west of the fault is gradually moving northwestward relative to the North American continent.

The project area roughly parallels the San Andreas fault zone at a distance varying between about 10 and 18 miles to the northeast of it (Fig. F-1). Within the Temblor and Diablo ranges that lie between the fault zone and the pipeline, bedding planes, folds, and a network of bedrock faults have marked parallelism to the San Andreas fault, suggesting a genetic relationship. However, no recently active faults have been reported in these ranges (Jennings, 1975).

A discontinuous trend of anticlinal folds parallels the main pipeline route on its northeast side. These folds are expressed topographically as a series of low ridges from Elk Hills to the Kettleman Hills. Intensive investigations in conjunction with oil exploration indicate that folding has been produced by geologically youthful and possibly continuing deformation. Several faults associated with the Elk Hills anticline are believed to have formed in Quaternary time, or within the last 1.5 to 2 million years (Woodring et al., 1940). The faults approach

to within half a mile west of the pipeline route near M.P. 10 (Appendix C). However, there is no evidence that these faults would constitute a rupture hazard to the pipeline.

Moderate seismic activity has recently been recorded in the Kettleman Hills. This seismicity may be associated with active tectonic folding along the western margin of the San Joaquin Valley. The earthquake magnitudes in the Kettleman Hills area appear to be insufficient to produce significant surface ruptures.

A close association between fault movements and earthquake occurrence is recognized in California. The size of the ground-surface rupture is related to the magnitude of the associated earthquake. Large, shallow earthquakes produce large ruptures. Moderate earthquakes of magnitude 5 to 6 produce small surface displacements, and small earthquakes produce none.

Active nonseismic fault creep is occurring along the Buena Vista fault about 5 miles south of the Elk Hills end of the pipeline (Fig. F-1). The sense of motion is thrusting towards the south on an almost east-west trending fault. This fault trace does not intersect the proposed route, therefore it is not considered to be a hazard to the pipeline.

Some of the other faults shown in Figure F-1 have visible topographic expression. However, they do not cross the pipeline route and none of them have been reported to be active (Jennings, 1975).

a. Seismically-Induced Ground Failures

The occurrence of seismically-induced ground failure depends upon the ground conditions as well as the intensity and duration of seismic shaking. The conditions on the tank farm sites and pipeline

route are favorable to stability during strong shaking owing to nearly flat topography, a low groundwater table, and generally well-compacted foundation materials. The majority of the route is underlain by granular alluvium of Holocene age (less than about 10,000 years). Approximately 20 percent of the route would be founded on weakly-lithified sedimentary rocks of the Tulare Formation of Pleistocene age, based on the geologic maps of Dibblee (1973) and Jennings and Strand (1958).

Landsliding. Strong earthquakes characteristically trigger many landslides and rockfalls on sloping and steep hillsides. Saturation of the ground from rainfall or springs can increase the susceptibility to ground failure.

The Elk Hills/Coalinga route is notably free of topographic relief capable of producing landslides. In addition, the prevailing semi-arid weather conditions make soil saturation a rare occurrence. Minor landslide hazards may exist if there are undercuts or steep banks along the many intermittent stream washes that intersect the pipeline route.

Vibratory Densification. When soils are strongly vibrated, they may experience a loss in volume with consequent subsidence of the ground surface. Subsidence is rapid and usually uneven due to heterogeneity within the soil layers. Granular soils of low density are particularly susceptible to densification.

Areas of possible soil compaction occur near the Elk Hills end of the pipeline and at about 1 mile northeast of M.P. 17 (Appendix C). It is not known if these areas are also susceptible to seismic ground failures. No densifiable soils have been identified affecting the pipeline route itself.

Liquefaction and Lurching. Liquefaction is the momentary transformation of soil from a solid state to a liquid state during vibratory ground motion. The soil then suffers a catastrophic loss of bearing strength. Lurching is a special case of liquefaction in which level ground moves laterally toward an unconfined surface such as a canal or stream bank.

In order for liquefaction to occur, the soils must be saturated. In addition, this phenomenon is restricted to sandy soils having low density and low clay content. Such a combination of ground water and soil conditions has not been identified along the pipeline route but may be found to occur locally during future exploration. The potential for soil liquefaction is small, but if liquefiable soils are encountered the hazard can be mitigated by adequate design.

b. Seismic Events and Forces

The seismic setting of the Elk Hills/Coalinga alignment is illustrated in Figure F-2. The epicenters are of earthquakes of magnitude 3.5 and greater that occurred between 1932 and 1974. The epicenters were compiled from earthquake catalogs for southern California (California Institute of Technology, 1976), northern California (University of California, Berkeley, 1976), and the central California coastal region (Gawthrop, 1975). The first two catalogs, which were provided on magnetic tape, are updated versions of catalogs published by Hileman et al. (1973), and Bolt and Miller (1975). The combined earthquake catalog is probably complete down to magnitude 4 over most of the region shown in Figure F-2.

Superimposed on the epicenter map are faults drawn from a California Division of Mines and Geology map entitled "Fault Map of California," compiled by Jennings (1975). All known active faults are

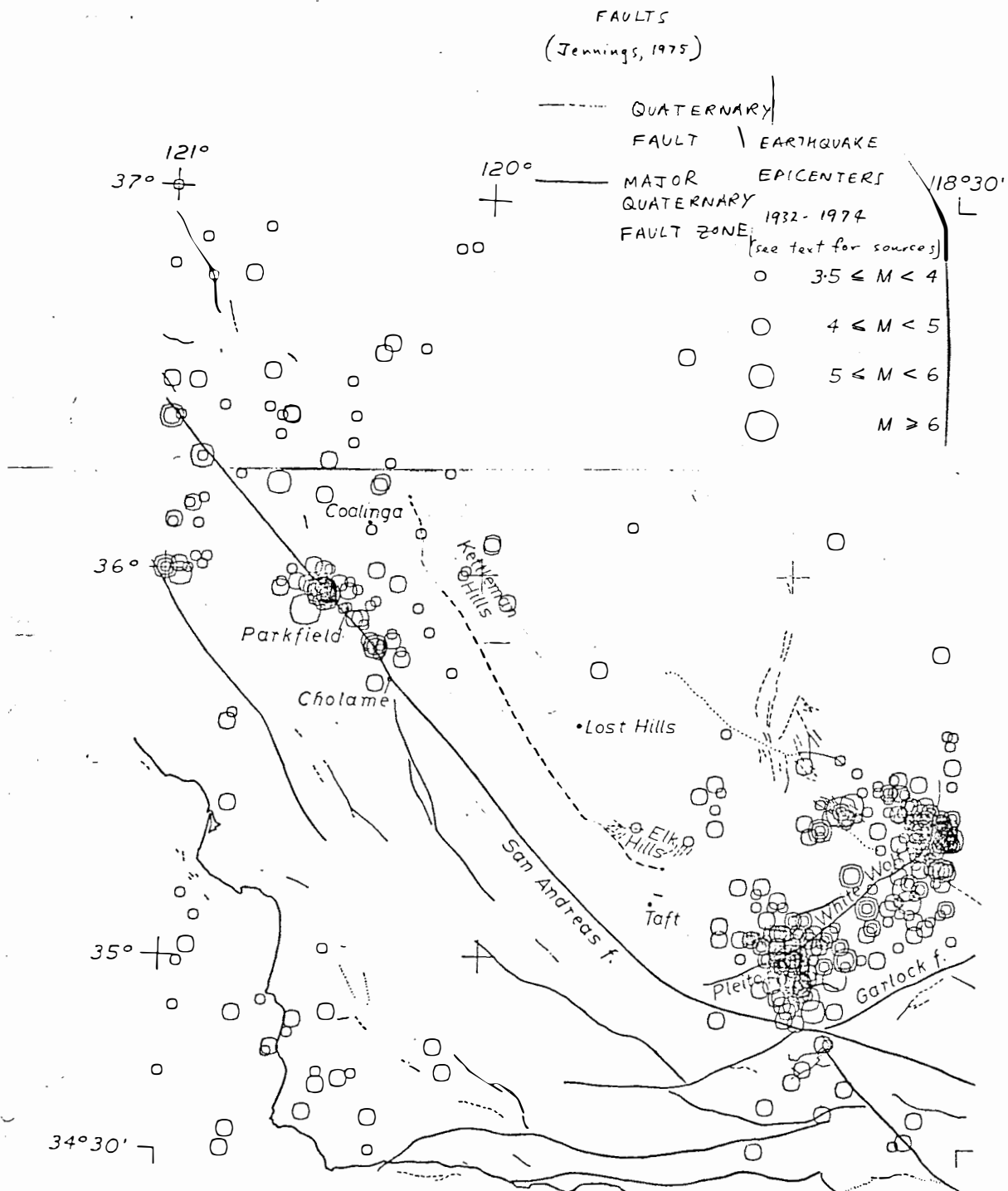


Figure F-2. Coalinga Route Seismic Setting.

Source: URS Company

included in the category "Quaternary fault," (i.e., fault showing evidence of surface displacement during the past 2 million years). Quaternary faults and major fault zones (several fractures) are indicated in Figure F-2 by light and heavy lines. Faults falling into Jennings's category "Pre-Quaternary displacement" are not shown on the map, although some of them may be active. None of the mapped faults crosses the alignment.

The relationship between earthquake occurrence and geologic structure in the southern California region has been the subject of numerous studies, notably by Allen et al. (1965). In summarizing the results of their study, Allen et al. concluded:

Of the large historic earthquakes that have been associated with surficial fault displacements, most and perhaps all were on major through-going faults having a previous history of extensive Quaternary displacements. The same relationship holds for most earthquakes down to magnitude 6.0, but smaller shocks are much more randomly spread throughout the region, and most are not clearly associated with any mappable surficial faults.

The foregoing statements are in accord with the historic record of seismic activity in the region of the Elk Hills/Coalinga Conveyance System. The larger historic earthquakes of the region are listed in Table F-1. Aside from the 1885 Monterey County earthquake, and some aftershocks of the 1952 Kern County earthquake, the larger historic earthquakes of the region have been restricted to the major Quaternary fault zones (i.e., the San Andreas and White Wolf faults). The proposed alignment runs sub-parallel to the San Andreas fault zone at distances ranging from 10 to 18 miles. At their nearest points, the Pleito and White Wolf faults lie approximately 30 miles south and southeast of the Elk Hills Tank Farm.

As seen in Figure F-2, epicenters of smaller earthquakes are concentrated along but not restricted to the major active fault zones.

Table F-1
LARGE HISTORIC EARTHQUAKES OF THE REGION

EVENT	DATE	MAGNITUDE	FELT AREA (thousands of square miles)	FAULT SHOWING SURFACE RUPTURE
Fort Tejon	1857 Jan 9	8+		San Andreas (rupture length ≈ 200 miles)
Monterey County	1885 Apr 11		125	
Parkfield	1901 May 2		40	San Andreas
Cholame	1922 Mar 10	6.5	100	San Andreas
Parkfield	1934 Jun 7	6.0	70	San Andreas
Kern County	1952 Jul 21	7.7	160	White Wolf
Aftershock	1952 Jul 21	6.4		
Aftershock	1952 Jul 21	6.1		
Aftershock	1952 Jul 28	6.1		
Aftershock	1954 Jan 12	5.9		
Parkfield	1966 Jun 27	5.5	25	San Andreas

Seismic activity of moderate magnitude occurs in the region between the San Andreas fault zone and the western margin of the San Joaquin Valley. Examples of this activity are the earthquake sequences of August 1975 near Coalinga and Lost Hills, and the Kettleman Hills earthquakes of January 1976. Epicenters of these earthquakes do not appear on the epicenter map, which covers the period 1932-1974. The main shocks of all three sequences were of magnitude 4.9. During the main shock of the Coalinga sequence on 2 August 1975, a peak acceleration of 0.13 was recorded nearby at the Pleasant Valley Pumping Plant (U.S. Geological Survey, 1976).

These recent earthquakes are among the largest that have occurred in the region between the San Andreas fault zone and the western margin of the San Joaquin Valley. In the framework of the conclusions drawn by Allen et al. (1965), large earthquakes (magnitude 6 or more) are not expected to occur in the region traversed by the proposed alignment. Consequently, these local earthquakes while they might produce locally strong ground motion would not subject the route to the hazards of significant surface rupture. Also, the local earthquakes along the alignment constitute a lesser strong motion hazard than do larger events occurring nearby on the major active fault zones, particularly the San Andreas fault zone.

c. Exposure to Strong Ground Motion

A calculation was made in order to assess, in quantitative terms, the exposure of the proposed alignment to strong ground motion. The results of the calculation are expressed in terms of the rate and probability of exceedance (for certain time intervals) of various levels of horizontal ground acceleration (Table F-2). Although the calculation was made specifically for the Elk Hills tank farm site, the results should apply fairly uniformly over the length of the proposed alignment and at the Coalinga site. This is because the route runs roughly parallel

Table F-2

RECURRENCE OF STRONG GROUND MOTION

PEAK HORIZONTAL GROUND ACCELERATION (g)	RATE OF EXCEEDANCE PER YEAR		PROBABILITY OF EXCEEDANCE IN ANY PERIOD OF T YEARS	
	CALCULATED FOR ELK HILLS TERMINAL	RECORDED AT TAFT (1951-1975)	T = 25	T = 50
.01	1.8	.6	1.0	1.0
.02	.66	.24	1.0	1.0
.05	.16	.12	.98	1.0
.10	.057	.04	.76	.94
.15	.032	.04	.55	.80
.20	.022		.42	.66
.25	.016		.34	.56
.30	.013		.28	.48
.40	.0092		.21	.37
.50	.0069		.16	.29
.70	.0041		.097	.19
1.00	.0020		.05	.10

to the San Andreas fault, and the surficial geology is fairly uniform along the length of the alignment.

In order to make such a calculation, distribution of seismic activity in time, space, and magnitude must be recorded along with the variation of ground motion amplitudes relative to earthquake magnitude and epicentral distance (or distance to the rupture surface, in the case of larger earthquakes). For the latter, the relations for peak horizontal ground acceleration as given by Gutenberg and Richter (1956) for alluvial sites in California were adopted. Peak acceleration was treated as a log-normally distributed quantity, with a geometric standard deviation of two.

Maximum magnitudes assigned to the major fault zones were 8-1/4 for the San Andreas, 7-3/4 for the Garlock and White Wolf faults, and 7 for the Plieto fault, following Greensfelder (1974). Earthquakes were assumed to be distributed randomly in time and along the lengths of the faults. The distribution of events over magnitude was taken to be

$$d \log 10^N / dM = -.86$$

where N is the frequency of events of magnitude M or more. This is the value determined by Allen et al. (1965) for the Southern California region as a whole.

An average recurrence interval of 200 years was assumed for magnitude 8 earthquakes on the San Andreas fault between Cholame and Cajon Pass. This is consistent with estimates by Wallace (1970) and Sieh (1976) deduced from long-term geologic evidence. For the faults in Kern County, the same recurrence interval was assumed for events of magnitude 7 or more.

Allen et al. (1965) pointed out that the historic record of seismicity is too brief to establish valid earthquake recurrence expectancies, except perhaps for the southern California region as a whole. In particular, the relative quiescence, during the period of instrumental recording, of the Garlock fault, and the Cholame-Cajon Pass segment of the San Andreas fault (which was ruptured in the 1857 Fort Tejon earthquake) belies their long-term activity.

Wallace (1970) in a study of the San Andreas fault, presented evidence for departures of the earthquake occurrence from randomness in time and along the length of the fault. Thus, the assumption of randomness used in the calculation may not be applicable. However, current information is not sufficient to demonstrate that the assumption will lead to biased estimate of ground-motion recurrence.

The results of the calculation for the Elk Hills Terminal, listed in Table F-2, are compared with the data recorded at Taft during the past quarter-century. Taft is situated about 6 miles to the southwest of the Elk Hills tank farm site. The largest accelerations at Taft were recorded during the Kern County earthquakes of 1952. Two of the largest aftershocks, following the main shock by only a few hours, were not recorded because they occurred before the accelerographs were reset. For these events, accelerations were estimated on the basis of the recordings of two subsequent aftershocks of similar magnitudes and locations.

The Taft data are quite similar to the results of the calculation for the Elk Hills tank farm site. This similarity is somewhat fortuitous in the sense that, according to the calculation, earthquakes on the San Andreas fault are by far the dominant cause of ground motion, while the Taft data are dominated by the Kern County earthquakes. This serves to illustrate that events over a few decades may differ considerably from what is expected on the basis of a long-term average.

At any point on the proposed route, the expected peak horizontal ground acceleration for a quarter-century period is 0.15g to 0.2g. The most likely cause of this level of ground motion would be an earthquake of magnitude 6 to 7 occurring on the San Andreas fault. In a half-century interval, the expected peak horizontal ground acceleration is about 0.3g, and would most likely be due to an event of magnitude 7 to 8 on the San Andreas fault. As shown in Table F-2, the calculation indicates that there is a possibility that peak horizontal ground accelerations as large as 1g could be caused along the alignment in the event of a major earthquake on the San Andreas fault. This estimate is not based directly on accelerograph data, which are lacking for distances within 25 miles of faults producing earthquakes of magnitude 7 and above. However, the estimate is consistent with the extrapolation of existing data for smaller earthquakes recorded in the near and far field, and for major earthquakes recorded in the far field.

2. Impacts

The seismic impacts related to the proposed Elk Hills/Coalinga Conveyance System may be divided into two categories: impacts of the project upon the existing seismologic regime and impacts of the seismologic regime upon the project. The first case includes possible changes in the level of seismic hazards due to the activities of man. For example, unconfined pumping of fluids, under high pressure, into stressed zones of rock may contribute to earthquake occurrence. Heavy surface loads or of extraction of fluids from the subsurface could also contribute to the severity of seismically-induced collapse. The proposed facilities would not involve concentrated surface loading or subsurface fluid injection and extraction. Therefore seismologic impacts of this kind would be negligible.

Impacts of the seismologic regime upon the project facilities would result from earthquake occurrence and fault motions that interfere with the safe and efficient operation, structural integrity, and aesthetic

appearance of the facilities. Seismic impacts can range from severe and widespread to minor and localized. An example of a minor impact would be a seismically-induced landslide that did not damage, but altered, the appearance and future stability of a fill slope.

a. Construction Impacts

The impact of the facilities upon the seismologic regime would be negligible. The ground surface loads imposed by the facilities would not affect the soil below depths of a few tens of feet. Loading effects upon the underlying soil would be even less since the pipeline is primarily buried along its entire length. Minor redistribution of the surface soils may result from trench and foundation construction; however, this would not result in significant additional surface loads. Berms would be constructed with sufficient side-wall slope in order to distribute the weight of fill over a large area and to maintain the strength of the berm.

Impacts of the seismologic environment upon the project facilities are considered to have a generally low hazard level. This is due to the distance between the facilities and major active faults and to the nearly flat topography, generally compact granular soils, and a low groundwater table which afford favorable foundation conditions along the proposed right-of-way.

Landslides. The additional forces imposed on sloping ground by strong earthquakes may cause landsliding. Steep natural slopes are notably absent along the Coalinga route and construction of cut-and-fill slopes is not anticipated. Minor landslide hazard may exist if there are steep banks along the intermittent stream washes that intersect the pipeline route. Any slopes that affect the pipeline would be laid back to a safe angle during construction. Therefore the impact due to seismically-induced landslides should be low.

Liquefaction and Lurching. Liquefaction occurs in saturated sandy soils having low densities and low clay content. These conditions have not been found along the pipeline route. However, if areas of liquefiable soils are encountered, liquefaction hazard would be mitigated by soils investigation and foundation design adequate to resist flotation, overturning, and settlement. Minimal impact due to liquefaction and lurching is expected along the conveyance system.

Densification. Granular soils may be densified by strong vibratory ground motions. The resulting subsidence experienced at the ground surface is rapid and uneven due to the varied nature of granular soils. Densification is not expected to have a significant impact upon the Elk Hills/Coalinga Pipeline because of the generally well-compacted nature of the alluvial soils along the pipeline route. If densifiable soils are encountered, susceptibility to this kind of subsidence would be assessed by soils investigations. Appropriate measures would then be taken to insure that damage to the pipeline does not occur in the event of such a soil failure.

b. Operational Impacts

Operation of the pipeline involves the action of pumps at several locations and the movement of oil through the pipe. These activities would have no effect upon the surrounding seismic environment.

The seismic impacts upon the pipeline considered here involve permanent ground deformation. These hazards would be present at all times, but the most significant impacts would be upon the operational phase.

Ground Rupture. The occurrence of a damaging earthquake is often accompanied by ruptures of the ground surface along the causative

fault zone. Structures located on an active fault trace may be subjected to large differential movements. There is no practical way to design rigid structures against this kind of deformation. However, pipelines can be effectively designed to protect them from rupture at fault crossings by providing for additional flexibility. Rigid structures such as pump stations and foundation footings should not be placed on a fault trace that may rupture in an earthquake.

The San Andreas fault is the major earthquake-generating fault in the vicinity of the pipeline route. The fault trends approximately parallel to the pipeline at distances greater than 10 miles. Therefore the San Andreas fault would not constitute a fault rupture hazard to the pipeline. No historically active faults have been reported crossing the Elk Hills/Coalinga alignment. This conclusion is based on the fault maps compiled by Dibblee (1973) and Jennings (1975).

Tectonic Creep. Gradual fault creep may occur without accompanying damaging earthquakes and sudden ruptures. Structures are more easily protected against damage due to this kind of slow deformation. Rigid structures should not be placed directly on the fault trace. More flexible structures, such as a pipeline, should be designed to facilitate repeated minor repairs at the fault crossing.

Active fault creep is taking place along the Buena Vista fault near the town of Taft (Fig. F-1) about 5 miles south of the Elk Hills end of the pipeline. The fault trace does not intersect the proposed alignment and thus would not endanger it due to creep deformation.

Elevation Changes. Permanent elevation changes may result from fault rupture, creep, or broad tectonic deformation. Such elevation changes could affect the pumping energy requirements for oil transmission. As discussed above, fault rupture and fault creep are not expected to affect the Coalinga alignment. It is probable that the effects related to tectonic warping would be imperceptibly slow and would not have an impact upon the pipeline during its expected life.

APPENDIX G
CLIMATE

Appendix G Climate

1. General Climatic Features

The general climate of southern California is dominated by the semi-permanent high-pressure area of the north Pacific Ocean and the topography of the area. The semi-permanent high-pressure area generally resides off the coast of California year-around; however, it moves north during the summer and south during the winter. The northern position of this high-pressure area effectively blocks most frontal storms during the summer while its southern position during the winter allows frontal storms from the north to pass through California. Because most precipitation in California is associated with frontal storms, nearly all precipitation occurs during the winter months. Large climatic variations can occur within relatively short distances because of the marked variability in topography throughout the state.

The anticyclonic (clockwise) flow associated with the semi-permanent Pacific high-pressure area creates a prevailing northwesterly wind over California during the summer months. Locally strong on-shore flow is associated with these northwesterly winds. During summer, thermal low-pressure areas (troughs) are formed inland because of intense heating. Conversely, air over the cold coastal waters is much cooler and denser. As a result, strong pressure gradients are established. The consequent strong on-shore flow occurs all along the coast and is usually associated with the formation of stratus clouds due to the relatively warm air

passing over cold offshore water. The distance of on-shore flow penetration depends on the magnitude of the thermal pressure gradient and topography.

Temperatures during the summer months are highly dependent on the extent of the marine on-shore flow. Temperatures on the coast are generally moderate while temperatures in the inland valleys, where there is little marine air penetration, are hot.

The general climatic features of southern California are conducive to photochemical oxidant pollution, especially in the summer. Winter climate is characterized by the frequent passage of frontal systems that dominate wind, precipitation, and temperature patterns. Conditions during the winter are generally not conducive to excessive photochemical oxidant formation.

The climatic parameters that are important in determining photochemical pollution potential are wind speed and direction, and the temperature inversion height, which together can be termed ventilation. Winds during the summer months have already been described as being a function of the semi-permanent high-pressure area offshore, the thermal pressure gradient, and topography. The magnitude of pressure gradients is dependent on synoptic (large scale) pressure system location, sometimes referred to as weather types. For example, occasionally the Pacific high-pressure cell moves eastward over the interior valleys, effectively cancelling the usual pressure gradient and creating stagnant, high-pollution potential conditions.

Temperature inversions occur when the usual atmospheric condition of decreasing temperature with height is reversed. In California, the summer months are characterized by a persistent subsidence inversion caused by the Pacific high-pressure system. The dense air of the high-pressure system is generally sinking and warming, trapping cooler air

near the surface beneath it. The warmer air on top of cooler air creates a stable condition, and pollutants emitted into the cooler layer beneath are prevented from escaping by the "cap" of warm air. This phenomenon, in combination with the enclosed topography of many California basins and valleys, and light winds, is conducive to the formation and accumulation of photochemical pollutants. Radiation inversions also occur frequently in southern California; however, they are usually broken by morning insolation and therefore play a minor role in photochemical oxidant formation.

2. Local Climate - San Joaquin Valley

The southern San Joaquin Valley has all the climatic characteristics of an interior California valley including hot, dry summers; cool, wet winters; relatively light winds; and a persistent elevated temperature inversion.

Wind directions, their frequency of occurrence, and average wind speeds as measured at Bakersfield are presented in Figure G-1. The data indicate that the prevailing wind direction during much of the year is from the northwest. The northwest direction is especially evident during the summer. A secondary east-to-southeast wind direction is evident during most of the year, most notably in the winter months. The northwesterly wind is caused by both macroscale flow around the semi-permanent high-pressure area and mesoscale flow of marine air through the Sacramento-San Joaquin Delta into the valley. The easterly to southeasterly winds are caused by both light down-slope drainage flow at night and stronger winds preceding winter storms. Although variations exist, the major prevailing directions recorded at Bakersfield apply to most other San Joaquin Valley locations.

Of particular concern are winds during oxidant episodes. The California Air Resources Board (ARB) maintains a file of streamline analyses

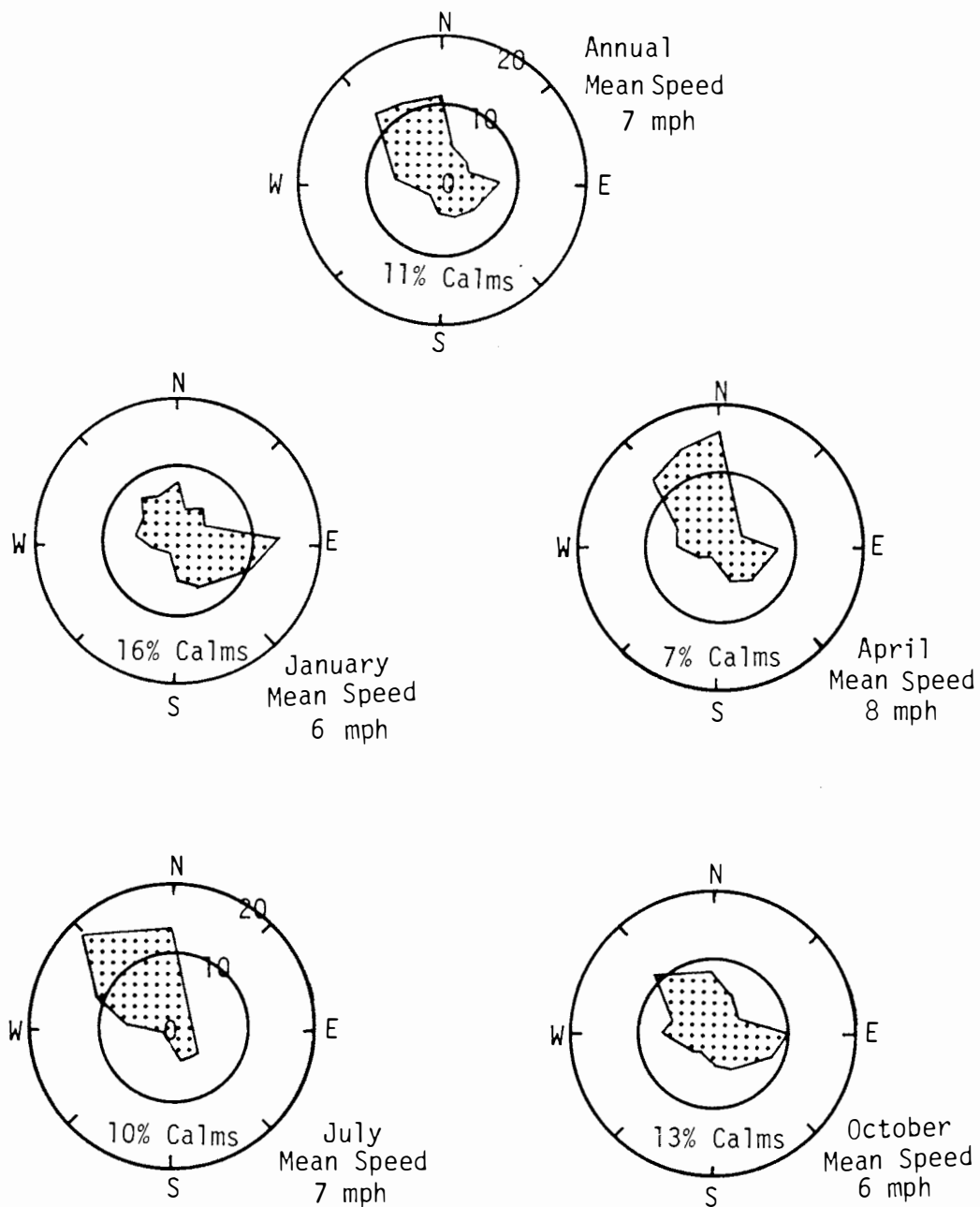


Figure G-1. Winds (Hourly %) in Bakersfield, California (1964-1973).
Source: U.S. Weather Service, Bakersfield.

prepared four times daily. This file was reviewed in an attempt to identify wind flow types during high oxidant periods. A review of selected high oxidant days during the summer of 1974 showed some major features of wind flow in the southern end of the valley on such days.

All days with high oxidants have relatively light winds, although the direction of flow tended to be one of two types -- southeast or northwest. Although light southeasterly winds occur most commonly at night or early morning, the southeasterly winds frequently persisted on high oxidant days. Light northwesterly winds also prevailed occasionally during high oxidant days. Both situations probably are due to a shift in the usual location of the Pacific high to the east, creating light, variable winds and limiting vertical mixing. While the southeasterly wind component is found frequently in Bakersfield on such days, it is rarely found on the west side of the valley in the Elk Hills area. Winds are usually northwesterly or westerly on the west side of the valley during the summer oxidant season according to the ARB streamline charts.

An unexpected circulation pattern frequently develops in the entire San Joaquin Valley on days with light winds conducive to oxidant formation. A counter-circulation develops, with the general northerly flow being maintained on the west side of the valley but a southerly flow occurring on the east side of the valley. The reversal in flow appears to generally occur between the Coalinga and Elk Hills areas and then proceeds to the north through Visalia. The circulation developed in late morning or early afternoon on the days examined and persisted throughout the day. On such days, an air pollution source near Coalinga could affect the Visalia area and points north.

The other important factor in assessing oxidant potential is elevated temperature inversions, which have been found to occur a substantial portion of the time in the San Joaquin Valley. Table G-1 presents mean mixing depths estimated for the San Joaquin Valley.

Table G-1
MEAN MIXING DEPTHS IN THE SAN JOAQUIN VALLEY
(Meters)

	MORNING	AFTERNOON
Winter	400	800-1,000
Spring	100	1,600-2,000
Summer	300	1,600-2,000
Fall	300	1,200-1,600
Annual	400	1,200-1,600

The morning mixing depths are generally much more restrictive than the afternoon; however, they are usually overcome early in the day because of heating. The afternoon elevated temperature inversions are much more stable, although they allow a greater mixing depth. The summer and fall mixing depths, which occur during the oxidant season, are relatively large compared to winter depths and depths at coastal locations. Oxidant episodes tend to occur when the mixing depth is more restricted than the mean values presented here. This situation is usually associated with a shift in the Pacific high-pressure system to a location over the valley rather than to the west of it.

APPENDIX H
AIR QUALITY REGULATIONS AND STANDARDS

Appendix H

Air Quality Regulations and Standards

The quality of the air is regulated by a number of government agencies. Federal, state, and local agencies have authority to limit emissions and consequent ambient pollutant concentrations through emission standards, land-use policies, and ambient air quality standards. The following discussion summarizes agency regulations that would concern an oil-transportation project.

1. Federal Regulations and Standards

The Environmental Protection Agency (EPA), established in 1970, is charged with establishing and enforcing standards, maintaining and analyzing the environment, conducting research and demonstrations, and assisting state and local government pollution control programs.

Probably one of the most significant pieces of legislation promulgated by the EPA was the establishment of national ambient air quality standards in 1971. Both primary and secondary standards were established. The primary standards were designed to protect public health. The secondary standards were designed to protect public welfare. Six of the most widespread pollutants had standards set which were not to be exceeded more than once per year for the appropriate averaging time. Table H-1 illustrates the national and California ambient air quality standards and provides a basis for the primary standard.

Table H-1
 AMBIENT AIR QUALITY STANDARDS APPLICABLE IN CALIFORNIA

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS CONCENTRATION	FEDERAL STANDARDS		BASIS FOR PRIMARY STANDARD
			PRIMARY	SECONDARY	
Photochemical Oxidants (Corrected for NO_2)	1 Hour	0.10 ppm	0.08 ppm	Same as Primary Std.	Prevention of eye irritation and possible impairment of lung function in persons with chronic pulmonary disease.
Carbon Monoxide	12 Hours 8 Hours 1 Hour	10 ppm - 40 ppm	- 9 ppm 35 ppm	Same as Primary Standards	Prevention of interference with oxygen transport by blood.
Nitrogen Dioxide	Annual Average 1 Hour	- 0.25 ppm	0.05 ppm -	Same as Primary Std.	Possible health effects could occur at slightly higher dosage. Produces atmospheric discoloration.
Sulfur Dioxide	Annual Average 24 Hours 3 Hours 1 Hour	- 0.05 ppm (in combination with oxidant levels over the state standard or particulate levels over the state standard) 0.5 ppm	0.03 ppm 0.14 ppm -	- - 0.5 ppm	Prevention of increase in chronic respiratory disease on long-term exposure.
Suspended Particulate Matter	Annual Geometric Mean 24 Hours	60 $\mu\text{g}/\text{m}^3$ 100 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$ 260 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$ 150 $\mu\text{g}/\text{m}^3$	Long continued exposure may be associated with chronic respiratory disease. Exposure to a combination of suspended particles and sulfur dioxide may produce acute illness.
Lead (Particulate)	30-Day Average	1.5 $\mu\text{g}/\text{m}^3$	-	-	
Hydrogen Sulfide	1 Hour	0.03 ppm	-	-	
Hydrocarbons (Corrected for Methane)	3 Hours (6-9 a.m.)	-	0.24 ppm	Same as Primary Std.	
Visibility Reducing Particles	1 Observation	Visibility to less than 10 miles when the relative humidity is less than 70%.	-	-	
Sulfates	24 Hours	25 $\mu\text{g}/\text{m}^3$	-	-	Aggravation of respiratory diseases such as asthma or bronchitis. This action is enhanced by the presence of ozone.
Ethylene	8 Hours 1 Hour	.1 ppm .5 ppm	- -	- -	

ppm = parts per million
 $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

Source: URS Company, 1978

The six pollutants identified by the EPA can be classified as primary and secondary. The primary pollutants, those that are emitted directly from a source, are carbon monoxide, sulfur dioxide, oxides of nitrogen, hydrocarbons, and suspended particulates. Secondary pollutants are formed when some of the primary pollutants, notably reactive hydrocarbons and oxides of nitrogen, combine with sunlight to form photochemical oxidants.

Photochemical oxidants is a name given to a group of oxidized pollutants, primarily ozone and peroxyacetyl nitrate (PAN), that result when reactive hydrocarbons, nitrogen oxides, and sunlight interact in a complex series of reactions. Rates of reactions that produce photochemical oxidants are sufficiently slow such that a number of hours is necessary to produce a profound effect. The process is also enhanced by light winds and topography that inhibit the dispersal of the necessary primary pollutants. Photochemical oxidants are the major air pollution problem in the San Joaquin Valley. Consequently, the potential impact of new sources of precursor pollutants (such as storage tanks) would be of major concern. A large source of the necessary primary pollutants, a dominant weather pattern of high pressure, light sea breezes, and a confined valley all combine to produce an adverse situation in the San Joaquin Valley.

Hydrocarbons (sometimes referred to as organic gases) are primarily a result of incomplete combustion arising from motor vehicles (82% in the San Joaquin Valley). However, a significant proportion (depending on the specific area) is contributed by petroleum-related industries such as refineries, storage tanks, gas stations, and use of organic solvents. This group of pollutants is important primarily because of the reactive species that can contribute to the formation of photochemical oxidants (smog). It is this particular group of pollutants that would be emitted with the movement of crude oil from the Elk Hills reservoir. The bulk of the hydrocarbons emitted from crude oil are of the paraffin class (C_1 - C_6 hydrocarbons).

Nitrogen oxides are a composite of nitric oxide (NO) and nitrogen dioxide (NO₂) formed as a result of high-temperature combustion. Motor vehicles are the primary source of nitrogen oxides in the project area (approximately 60%), while fuel combustion (natural gas and fuel oil) comprises much of the remainder.

Sulfur dioxide in the San Joaquin Valley is primarily emitted from major petroleum-based operations. Motor vehicles are a petroleum combustion-related source (approximately 10%), although the most recent concern related to automobile sulfur has been the formation of sulfates from catalytic mufflers.

Suspended particulates refer to atmospheric aerosols (liquid or solid) in the size range of approximately 0.1 to 15 microns in diameter. Particulates arise from a number of sources, the dominant source varying from region to region. The major sources in the project area include farming operations, mineral operations, incinerators, and the petroleum and lumber industries.

Carbon monoxide, a colorless and odorless gas, is the product of incomplete fuel combustion. The primary source in the project area is automobile exhaust, representing approximately 80 percent of all CO emissions. The remainder of the CO emissions comes primarily from industrial sources.

There are a number of other federal regulations in effect or planned that are relevant to projects involving potential air quality impacts. The EPA program specifically relating to petroleum storage tanks is referred to as the New Source Performance Standards (NSPS). The NSPS sets limits on the quantity of pollutants a new or modified source can emit or requires the use of best available control technology. In the case of petroleum storage tanks, the regulations have two restrictions based upon the properties of the products stored:*

*Environment Reporter, February 27, 1976. Section 60.110, 121:0410H-121:0410I.

If the true vapor pressure of the petroleum liquid, as stored, is equal to or greater than 78 mm Hg (1.5 psia) but not greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a floating roof, a vapor recovery system, or their equivalents.

If the true vapor pressure of the petroleum liquid as stored is greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a vapor recovery system or its equivalent.

Other major federal actions of importance to the Elk Hills project include the New Source Reviews, State Implementation Plans, Air Quality Maintenance Plans, and Prevention of Significant Deterioration.

The Federal New Source Review is a review process whereby emissions from a large new source must not interfere with the attainment or maintenance of ambient air quality standards. The EPA has the right to deny a construction permit if this stipulation is not met.

Section 110 of the Clean Air Act, as amended in 1970, directed each state to submit to the EPA a State Implementation Plan (SIP) for the achievement and maintenance of the federal ambient air quality standards. Due to changes required by EPA and insufficiencies in the plan, California has yet to complete its SIP. The plan calls for all standards to be achieved by May 1977, although extensions have been granted in some cases.

The newest plan of the Federal government administered by the EPA is called the Air Quality Maintenance Plan (AQMP). This is a long-range plan (10 years) for attaining and maintaining healthy levels of air quality for California's urban areas. The Federal Regulations (40 CFR 51.72, 51.18) require that the AQMP be developed in areas where the attainment or maintenance of the standards by 1977 are not predicted or where growth and development between 1975 and 1985 interfere with either

attainment or maintenance of the standards once they are achieved. The AQMPs are designed to be much more far-reaching than any other air quality control plans in that long-range land-use and transportation control plans will be comprehensively evaluated along with automobile and industrial source emissions controls. Currently, Kern, Fresno, and Tulare counties are designated as air quality maintenance areas (AQMA). Work plans to develop the AQMA are currently being completed in those counties.

The United States Congress recently passed the Clean Air Act Amendments of 1977 which incorporated several changes in air quality regulation. These changes include: statutory requirements for emission offsets and Prevention of Significant Deterioration (PSD) as part of the required New Source Review (NSR) procedures; delays in automotive emissions standards (except California); new attainment schedules for State Implementation Plans (SIP); and the requirement for federal agencies to comply with substantive and administrative requirements of state and local agencies.

The federal NSR procedures remain in effect until July 1, 1979, when states are required to develop an approved SIP for the EPA detailing their own procedures for attaining and maintaining ambient air quality standards. The NSR procedures include requirements for emissions offsets and Best Available Control Technology (BACT) in order to build new or modified major sources in nonattainment areas (those areas where standards are exceeded). They also require a new or modified major source to comply with PSD regulations in an attainment area. PSD regulations incorporate incremental limits of air quality deterioration depending upon the degree of development which regulatory authorities specify in specific geographical areas. There is also a requirement for BACT in the PSD regulations.

A major source in the context of these regulations is defined as any source which will emit more than 100 tons per year of any pollutant for the purposes of offsets. A new or modified source is subject to PSD if it is one of 28 specified source categories emitting more than 100 tons per year or any new or modified source emitting more than 250 tons per year of a particular pollutant if not a specified source.

The revised SIPs, scheduled to take effect by 1 July 1979, are required to develop a plan to meet National Ambient Air Quality Standards by 1982, or to show cause why the standards cannot be met by that time and thereby develop plans to meet the standards by 1987. The Air Quality Maintenance Plans (AQMPs) required by EPA will presumably serve as input into the revised implementation plans.

2. State Regulations and Standards

The Air Resources Board (ARB) has authority to: (1) control vehicular emissions; (2) establish air basins within the state; (3) set, attain, and maintain ambient air quality standards; (4) conduct research programs; and (5) cooperate with the Federal government. Many of the programs compliment existing federal programs. One of the most significant programs from the standpoint of the Elk Hills project is the ARB proposal on the review of new sources. It includes a requirement that no construction permits can be issued for new or modified facilities which emit more than 15 pounds per hour or 150 pounds per day of nitrogen oxides, organic gases, and other air contaminants where ambient standards are already exceeded. The regulation further states that the construction permit will be denied unless the best available control technology for reducing the pollution is used (if the project is to emit more than the 15 pounds per hour or 150 pounds per day). Exceptions to the rule include trade-offs for a net maintenance of or decrease in air pollutants. Elimination or reduction of existing high-emitting sources of the same pollutants within the air basin can be traded off against emissions generated from newly constructed sources.

3. Local Regulations and Standards

Kern, Fresno, and Kings counties have Air Pollution Control Districts that are responsible for controlling stationary sources of air pollution. For large sources such as petroleum storage tanks, local performance regulations are usually similar to federal regulations. Of note is the current ARB new-source review proposal that local APCD's have the option of adopting. To date, Kern, Fresno and Kings counties have not yet adopted the proposed ARB rule. They are required, however, to deny permits to any project that will interfere with the attainment or maintenance of air quality standards.

APPENDIX I
AIR QUALITY - PAST, PRESENT, AND FUTURE TRENDS

Appendix I

Air Quality Past, Present, and Future Trends

The counties of Kern, Fresno, and Kings may be affected by the proposed oil transport from Elk Hills to Coalinga. Thus, the San Joaquin Valley Air Basin could be affected.

An air basin is a region with distinctive meteorological and geographical characteristics. In recent years, control strategies appropriate to each basin have been established by the Basin Coordinating Councils or by the Air Resources Board. Figure I-1 illustrates the location of each air basin within California. The approximate routes of the pipelines from Elk Hills to Coalinga are sketched in. The Air Resources Board and each local district perform varying degrees of air quality and meteorological monitoring within each air basin. The air monitoring program, in particular, is geared to collect data on the existing air quality problems in each county. For example, the Bakersfield station is the only site in Kern County where all six major pollutants are measured whereas the Taft station monitors only particulates and the Delano station only oxidants.

Hydrocarbons are the primary pollutants to be emitted as a result of this project, and therefore, photochemical oxidants are the pollutant of greatest concern. The monitoring data presented herein will be geared toward representing existing oxidant levels in the potentially affected counties (Kern, Kings, Tulare, and Fresno). Some data on particulates will be presented as well since it is also a problem in the San Joaquin air basin.



Figure I-1. Location of Air Basins Within California.
 Source: Air Resources Board

Figure I-2 shows present and some past oxidant air monitoring stations in the San Joaquin Valley Air Basin. The isopleths show that the distribution of photochemical oxidants within the air basin increase as one approaches the easterly portions of the valley. This is primarily attributable to the complex transport mechanisms that take place in the southern San Joaquin Valley. As described in the section on climate and meteorology, many days of high oxidants are characterized by winds from the north along the western edge of the valley and southerly winds along the eastern edge. The general result is transport of oxidant precursors from the western portion of the valley to the eastern portion.

Table I-1 presents the historical oxidant conditions at four stations within the area of the proposed pipeline route. The table clearly suggests that oxidants are a major problem at these locations with a general upward trend until 1975. A new calibration technique introduced in June 1975, lowered all previous oxidant readings by 20 percent. As a result the number of days that the standard was exceeded decreased in 1975. In addition the decrease may have been partially attributable to meteorological conditions and should not be interpreted as a significant change in air quality.

Table I-2 presents the number of times that oxidant standard was exceeded by month for 1975. The data prior to 1 June are not adjusted for the calibration correction and therefore the totals are slightly high. The annual 1-hour maxima, however, occurred after 1 June and are accurate.

Figures I-3 and I-4 illustrate the diurnal and monthly variations at three selected San Joaquin Valley stations. Diurnal variations are similar for all three stations in that oxidant concentrations begin to increase quite rapidly in the mid-morning hours and drop sharply in the late afternoon. This is a typical diurnal distribution of oxidants,

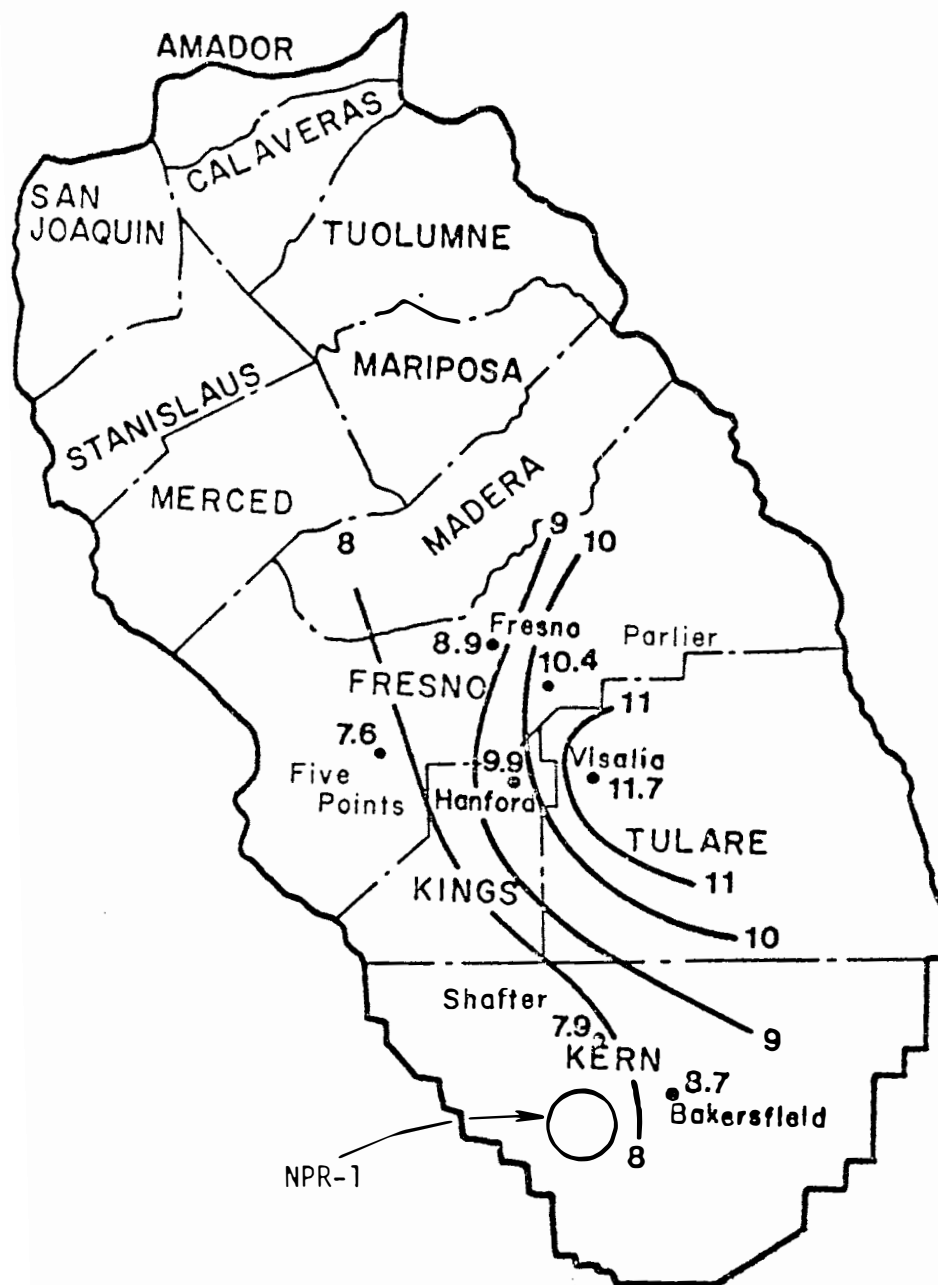


Figure I-2. Distribution of Oxidants in the San Joaquin Valley Air Basin (August 1972).

Source: Air Resources Board, "Air Quality in the San Joaquin Valley."

Table I-1
NUMBER OF DAYS OXIDANT STANDARD EXCEEDED
AT SPECIFIED STATIONS PER YEAR FOR 1971-1975

Station	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>
Bakersfield	108	83	126	142	93
Fresno	71	96	86	92	61
Parlier	-	134	114	129	137
Visalia	119	150	140	164	48

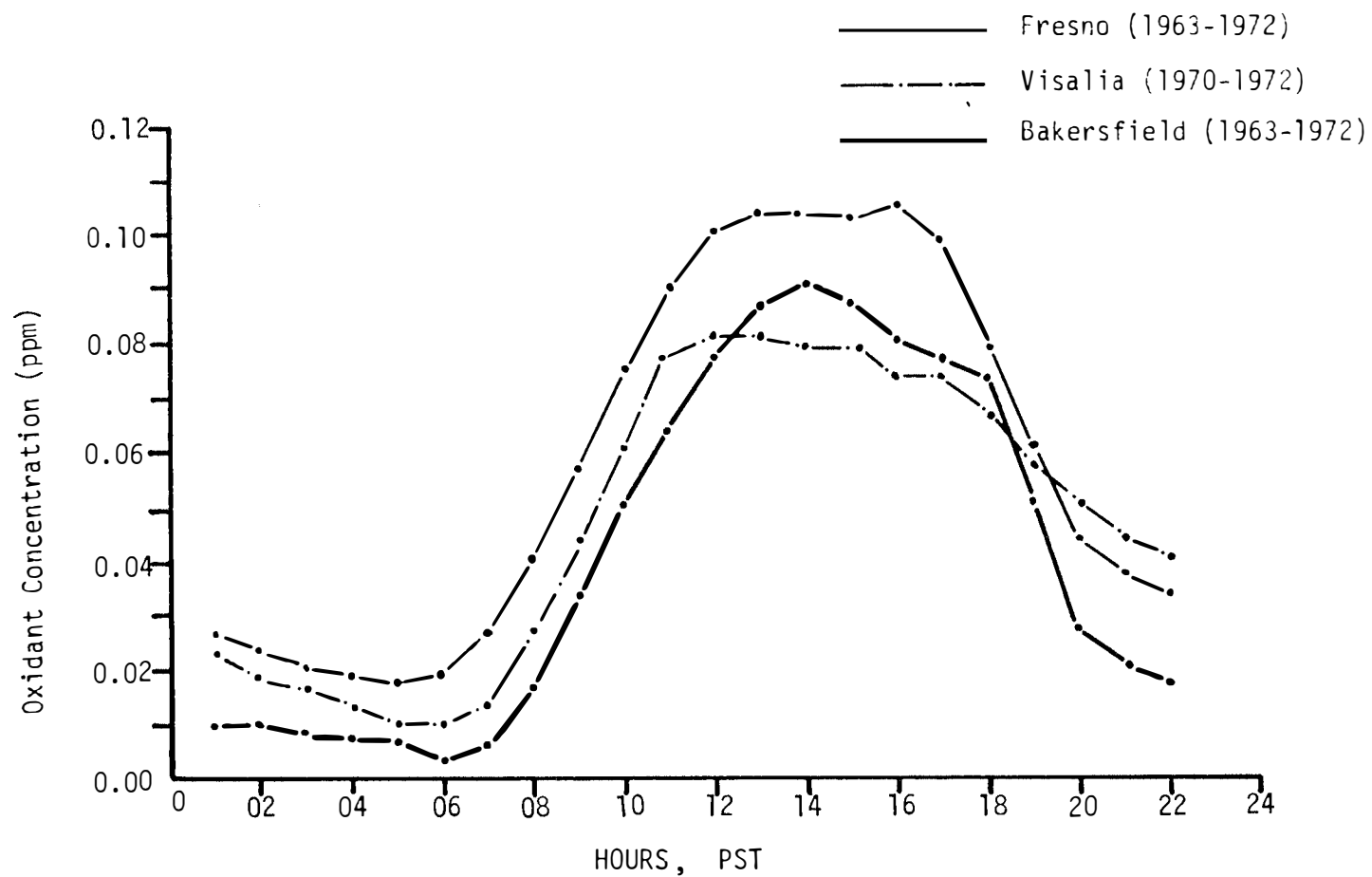
SOURCE: Air Resources Board

Table I-2
NUMBER OF DAYS OXIDANT STANDARD EXCEEDED AT
SPECIFIED STATION BY MONTH FOR 1975

MONTH	FRESNO	PARLIER	VISALIA	BAKERSFIELD	DELANO
January	1	2	1	0	-
February	2	4	2	0	-
March	1	3	1	0	-
April	2	4	0	0	-
May	13	22	15	14	12
June	7	21	10	16	4
July	7	23	7	24	8
August	9	26	3	24	12
September	15	21	6	8	0
October	4	9	3	7	3
November	0	2	0	0	1
December	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	61	137	48	93	40*
Annual 1-Hr Maximum (PPM)	.16	.19	.13	.19	.12

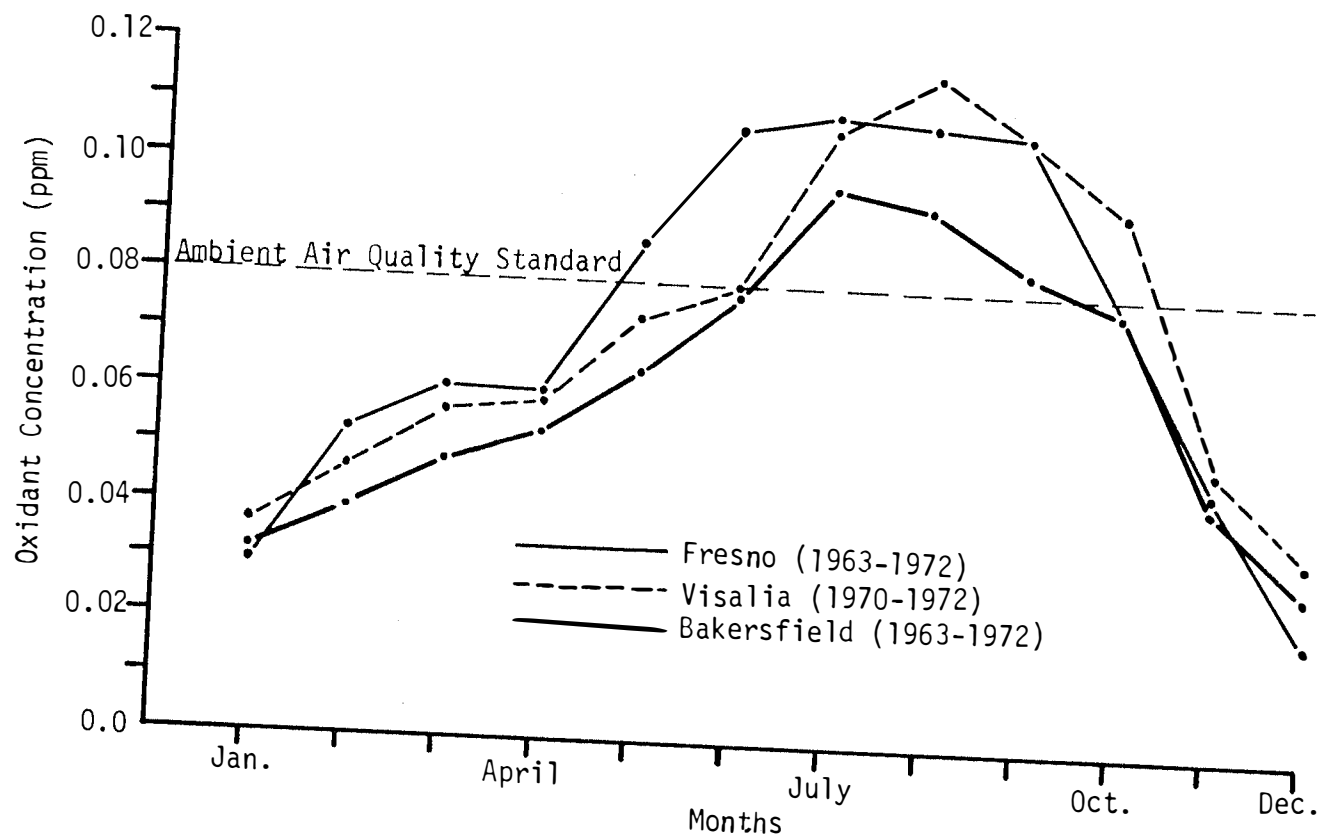
Source: California Air Quality Data, California Air Resources Board, 1975.

*Station Initiated in May, 1975.



Source: Air Resources Board

Figure I-3. Dirunal Oxidant Concentration Variation Averages for July, August, September 1972 at Three San Joaquin Valley Stations.



Source: Air Resources Board

Figure I-4. Monthly Oxidant Concentration Variation Average of Daily Maximum One-Hour Concentrations at Three Project Area Stations.

portraying the dependence of oxidant concentrations on maximum solar intensity. The similar distributions at all three stations imply that oxidants are caused primarily by local (San Joaquin Valley) emissions.

The monthly variation in oxidant concentration (Fig. I-4) illustrates the pronounced change in levels that occur during the year. The late spring, summer, and early fall comprise the typical oxidant season of abundant sunshine and other meteorological factors most conducive to oxidant formation.

Table I-3 presents the number of days the state 24-hour particulate standard of 100 micrograms per cubic meter was exceeded in 1975 at selected stations. Particulate standards are frequently exceeded at many locations in the San Joaquin Valley, primarily by agricultural operations and the mineral industry's extraction processes.

Table I-4 presents current hydrocarbon emissions in the San Joaquin Valley. Emissions due to petroleum-related operations represent a significant portion of total emissions, particularly in Kern County.

Future trends in air quality in the San Joaquin air basin are generally similar to those in many other regions of California. It is expected that oxidant levels will drop as more automobiles become equipped with devices to control oxidant precursors. However, this drop will eventually be offset by increasing population if present driving and growth trends continue. The current efforts of the air quality maintenance planning effort in Kern and Fresno counties are designed to deal with this situation. A potential future problem in the San Joaquin Valley involves the increase of sulfur dioxide concentrations. New sources of air pollution such as increased dependence on oil steam injectors at reclaimed oil wells may create an SO_2 problem in the future. Recent Air Resources Board studies have described significant crop damage caused by air pollution, possibly through synergistic effects between oxidants and SO_2 .

Table I-3
NUMBER OF DAYS SUSPENDED PARTICULATE VALUE
EXCEEDED $100 \mu\text{g}/\text{m}^3$ in 1975

MONTH	BAKERSFIELD	FRESNO	GOSHEN	KERN	PARLIER	TAFT	THREE RIVERS	VISALIA
January	4	2	1	0	1	2	0	4
February	1	1	1	0	1	0	0	1
March	5	1	4	0	1	1	0	4
April	1	0	3	0	2	0	0	2
May	5	4	4	1	-*	1	0	5
June	-*	3	5	-*	-*	-*	2	5
July	3	3	5	0	4	3	2	5
August	5	2	5	3	3	4	-*	4
September	5	4	4	3	-*	4	0	5
October	4	5	5	0	4	4	0	4
November	5	4	5	2	3	4	0	2
December	4	4	5	1	3	4	0	4
	<u>42</u>	<u>33</u>	<u>47</u>	<u>10</u>	<u>22</u>	<u>23</u>	<u>4</u>	<u>45</u>
Percent of Samples Above Standard	76	55	78	18	49	42	7	75

Source: California Air Quality Data, California Air Resources Board, 1975.

Note: Particulate samples are taken every 6 days or approximately 5 times per month or 60 times per year.

*Data not available.

Table I-4
1975 AIR POLLUTANT EMISSIONS
Tons/Day

Emission Sources	Organic Gases (hydrocarbons)							
	<u>Fresno Co.</u> Reactive* Total		<u>Kern Co.</u> Reactive Total		<u>Tulare Co.</u> Reactive Total		<u>Kings Co.</u> Reactive Total	
PETROLEUM								
Production	8.5	15.9	82.3	154	-	-	1.3	2.4
Refining	-	-	17.9	18.6	-	-	3.9	4.1
Marketing	6.1	6.4	10.5	11.1	3.2	3.3	0.4	0.4
SUBTOTAL	14.6	22.3	110.7	183.7	3.2	3.3	5.6	6.9
OTHER STATIONARY Sources	28.6	50.5	26	42	21.1	31.9	13.7	25
MOBILE SOURCES	49.4	54.2	35.4	38.8	22.2	24.3	11.3	12.4
TOTAL	92.6	127	172.1	264.5	46.5	59.5	30.6	44.3

Source: California Air Resources Board, 1975.

APPENDIX J
NOISE

Appendix J

Noise

1. Introduction

Noise has been described as "unwanted sound" or "sound without value." Both of these definitions suggest that a degree of subjectivity is inherent in the definition of noise. For example, what is acceptable in one area of a community may be unacceptable in another area, what is objectionable to one person may not be annoying to another, and what is tolerable during the day may not be at night. Despite the subjective nature of noise, however, it does affect the full range of human activities and, consequently, must be considered in local and regional planning.

To complicate matters further, noise levels are increasing in most urban areas of the country. This increasing noise environment is largely attributable to rising automation (larger and more numerous industrial plants, bigger and faster machines, etc.) and the increasing supply, demand, and variety of household goods (cars, appliances, shop tools, gardening equipment, etc.).

Laboratory and field studies have shown that noise can produce physiological stress in humans if critical noise levels, frequencies, and time durations are exceeded. The health effects of such stress vary from permanent physical impairment (e.g., loss of hearing) to subtle physiological changes (e.g., constriction of blood vessels and loss of sleep). Even when these health effects are minor, noise directly affects

the quality of life, and in a more subtle and indirect way, influences human behavior and performance.

The three primary factors that are used to describe environmental noise and its impact on people are intensity, frequency, and variation with time. For example, the pressure fluctuations that make up airborne noise are described in terms of intensity (the magnitude of the fluctuations) and frequency (the number of fluctuations per second).

The human ear is sensitive to a wide range of pressures and frequencies. Because the range of pressure is so great, a logarithmic scale is used to describe sound intensity. The sound pressure level is given in decibels (dB) and is defined as:

$$\text{dB} = 10 \log_{10} \left(\frac{P}{P_0} \right)^2$$

The value of the reference pressure (P_0) is 20 micro-Newtons per square meter ($20 \mu\text{N/m}^2$), which is approximately the threshold of hearing. The unit of measurement for frequency is cycles per second or hertz (Hz). The human ear is normally most sensitive to frequencies between 1,000 and 5,000 Hz.

Most of the sounds heard in the environment do not consist of a single frequency, but a range of frequencies, each with a different intensity or level. As a result, a relatively simple method of weighing the frequency components of environmental noise and combining them into a single number has been developed. This method seems to be an accurate means of relating human response to particular noise levels. The weighting system most commonly used is "A-weighting," and the resultant number is called the "A-weighted sound level" (dBA).

The A-level accurately describes the overall environmental noise at any particular instant, but, in fact, the level of environmental noise is composed of continual and sporadic noise sources. Continual noise sources (such as traffic, wind, and industrial plants) separated by a distance create a relatively stable background noise level in which no particular source can be readily identified and which slowly varies with the daily cycle of human activity. Superimposed on this background is a succession of noisy events of short duration (such as aircraft flyovers, household appliances, and barking dogs) which cause more rapid variations in the overall noise levels.

2. Derivation of Impact Criteria

Most criteria currently used to evaluate or control environmental noise are based on physiological data and community complaint and annoyance information. However, it is instructive to consider the preferences of the general population that are given in Table J-1.

The physiological effects of noise normally considered in establishing standards or criteria are speech, sleep, and task interference, physiological stress, and hearing damage. The degree of certainty in the dBA levels for these effects, given in Table J-2, varies from good to poor. The levels associated with hearing damage are well documented. The upper limit for 8-hour continuous exposure is 90 dBA under the Occupational Safety and Health Act of 1970 (OSHA).

Federal standards from the U.S. Department of Housing and Urban Development (HUD) and the U.S. Department of Transportation (DOT) are presented in Tables J-3 and J-4. The DOT standards are design goals for traffic-generated noise, and the predicted or measured noise level, L_{10} (noise level exceeded 10% of the time), is based on peak-hour traffic. HUD criteria are not separated into specific land-use categories because their primary concern is with the suitability of living quarters.

Table J-1
POPULATION PREFERENCES
REGARDING NOISE LEVELS

TYPE OF AREA	NOISE LEVELS (dBA)			
	DAY		NIGHT	
	WANT	ACCEPT	WANT	ACCEPT
Rural	35	45	25	35
Suburban	40	50	30	40
Urban, Residential	45	55	35	45
Urban, Residential plus Shops	50	60	40	50
Commercial	55	65	45	55
Industrial	60	70	50	60
Water Recreation, Restricted	45	45	35	35
Water Recreation, Unrestricted	55	55	45	45
Wilderness	30	20	20	20

Source: California State Department of Public Health.
January 1971.

Table J-2
ESTIMATES OF MAGNITUDE
OF NOISE EFFECTS

EFFECTS	NOISE LEVEL (dBA)	
	MODERATE	APPRECIABLE
Hearing Damage Risk	70	90
Speech Interference	45	60
Sleep Interference	40	70
Physiological Stress	70	90
Task Interference	55	75

Source: Bolt, Beranek, and Newman, December 1971. Noise from Construction Equipment and Operations, Building Equipment and Home Appliances. NTIS as National Tech. Information Document 300.1.

Table J-3

SUMMARY OF HUD NOISE CRITERIA
GENERAL EXTERNAL EXPOSURES
(dBA)*

UNACCEPTABLE

- Exceeds 80 dBA 60 minutes per 24 hours (L_4).
- Exceeds 75 dBA 8 hours per 24 hours (L_{33}).
(Exceptions are strongly discouraged and require a 102(2)C environmental statement and the Secretary's approval.)

DISCRETIONARY - NORMALLY UNACCEPTABLE

- Exceeds 65 dBA 8 hours per 24 hours (L_{33}).
- Loud, repetitive sounds on site.
(Approvals require noise attenuation measures, the Regional Administrator's concurrence, and a 102(2)C environmental statement.)

DISCRETIONARY - NORMALLY ACCEPTABLE

- Does not exceed 65 dBA more than 8 hours per 24 hours (L_{33}).

ACCEPTABLE

- Does not exceed 45 dBA more than 30 minutes per 24 hours.

*Criteria are applied at boundary.

Source: U.S. Department of Housing and Urban Development,
Noise Abatement and Control: Departmental Policy,
Implementation, Responsibilities, and Standards,
August 1971.

Table J-4

DOT DESIGN NOISE LEVEL/LAND-USE RELATIONSHIPS

LAND-USE CATEGORY	DESIGN NOISE LEVEL - L_{10}^*	DESCRIPTION OF LAND-USE CATEGORY
A	60 dBA	Tracts of lands in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	70 dBA	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas, and parks.
C	75 dBA	Developed lands, properties or activities not included in categories A and B above.
D	--	For requirements on undeveloped lands, see paragraphs 5.a(5) and (6) of PPM 90-2.
E	55 dBA	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

*Criteria are applied at boundary, peak traffic hour.

A recent EPA report recommends minimum levels of exposure to noise that would insure the public's health and welfare (Table J-5). These levels are presented in terms of a daily energy-average for various land uses. The term $L_{eq(24)}$ is the A-weighted energy-averaged noise level during a continuous 24-hour period, whereas L_{dn} weighs the L_{eq} between 10 p.m. and 7 a.m. by adding 10 dBA.

Although there is no legal requirement to comply with these criteria or recommendations, they will be used to assist in the evaluation of environmental impacts.

3. Derivation of Construction Noise Impact Criteria

Noise generated during construction differs from the operational noise of most projects because the character and duration of the noise sources are significantly different. Noise generated by construction activities is normally of short duration and highly variable, and therefore, is considered more annoying than a continuous noise level of long duration. Construction noise impact criteria are based upon speech interference, presented in Table J-2, and are related to intensity and frequency of occurrence. Whenever the noise level exceeds 60 dBA appreciable speech interference occurs. This upper level was established by assuming that noise-induced speech interference would be intolerable (at distances greater than 3 feet or 1 meter) for noise levels in excess of 60 dBA. Therefore, the higher the noise level over 60 dBA, the more disturbance will result, and the less steady the level of a noise, the greater the distraction and annoyance. Based on this information, construction noise impact criteria for noise-sensitive areas (hospitals, schools, residential communities, recreation areas, etc.) are shown in Table J-6.

Table J-5

YEARLY AVERAGE* EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO
PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

MEASURE	INDOOR			OUTDOOR		
	ACTIVITY INTER- FERENCE	HEARING LOSS CONSIDERATION	TO PROTECT AGAINST BOTH EFFECTS (b)	ACTIVITY INTER- FERENCE	HEARING LOSS CONSIDERATION	TO PROTECT AGAINST BOTH EFFECTS (b)
Residential with Out- side Space and Farm Residences	L_{dn} $L_{eq}(24)$	45 70	45	55 70	70	55
Residential with No Outside Space	L_{dn} $L_{eq}(24)$	45 70	45			
Commercial	$L_{eq}(24)$	(a)	70	(a)	70	70(c)
Inside Transportation	$L_{eq}(24)$	(a)	70	(a)		
Industrial	$L_{eq}(24)(d)$	(a)	70	(a)	70	70(c)
Hospitals	L_{dn} $L_{eq}(24)$	45 70	45	55 70	70	55
Educational	$L_{eq}(24)$ $L_{eq}(24)(d)$	45 70	45	55 70	70	55
Recreational Areas	$L_{eq}(24)$	(a)	70	(a)	70	70(c)
Farm Land and General Unpopulated Land	$L_{eq}(24)$			(a)	70	70(c)

Source: EPA

CODE

- Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity.
- Based on lowest level.
- An $L_{eq}(24)$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than an L_{eq} of 60 dB.

NOTE: Explanation of identified level for hearing loss: the exposure period which results in hearing loss at the identified level is a period of 40 years.

* Refers to energy rather than arithmetic averages.

Table J-6

CONSTRUCTION NOISE IMPACT DETERMINATION

DURATION OF NOISE (Minutes)	NUMBER OF OCCURRENCES PER HOUR OVER 60 dBA		
	LESS THAN 5	5 TO 10	MORE THAN 10
Less than 1	Small	Moderate	Large
1 to 3	Moderate	Large	Significant
More than 3	Large	Significant	Significant

Source: URS

The most prevalent noise sources at construction sites are equipment powered by internal combustion engines. Earthmoving equipment, cranes, concrete mixers, dump trucks, pumps, electric power generators, and air compressors radiate noise levels of 70 to 95 dBA at 50 feet from the equipment. Pumps, generators, and compressors are generally stationary sources that radiate fairly constant noise levels when operating. Mobile sources, however, radiate varying noise levels depending on operating conditions and loads. Typical ranges of noise at a variety of construction projects are presented in Table J-7.

The noise levels experienced at a particular location depend upon the distance from the construction activity and the nature of intervening terrain or other obstructions over or through which the sound must travel. As a general rule, noise levels will decrease by 6 dBA every time the distance from the source is doubled. For example, if the noise level is 78 dBA at 50 feet from an air compressor, it will be approximately 72 dBA at 100 feet, and 66 dBA at 200 feet. Intervening obstructions may reduce noise levels by a few decibels or, under special circumstances, by more than 20 dBA. Finally, a factor of 15 to 30 dBA can be applied to people inside buildings that have closed windows.

During pipeline hole-digging and ground-clearing phases, rocky formations are encountered on the site that are too large and too hard to be broken up with tractors equipped with rippers and backhoes. Jackhammering or blasting is needed to break up this material. Possible impacts associated with blasting include sudden pressure changes that are transmitted through the air as noise or through the earth as ground vibration. Normally, the effects of blasting are annoying because they are unpredictable and highly variable.

The effects of increased and varied noise levels upon wildlife are largely unknown. Some preliminary scientific research, however, indicates that many animals that rely on their auditory system for courtship

Table J-7

TYPICAL RANGES OF NOISE LEVELS AT CONSTRUCTION
SITES WITH 50 dBA AMBIENT, TYPICAL OF
SUBURBAN RESIDENTIAL AREAS

SITE	DOMESTIC HOUSING	OFFICE BUILDING	INDUSTRIAL	PUBLIC WORKS
Ground Clearing	83* 8	84 7	84 9	84 8
Excavation	88 8	89 6	89 6	88 7
Foundations	81 10	78 3	77 4	88 8
Erection	81 10	87 6	84 9	79 9
Finishing	88 7	89 7	89 7	84 7

*The large number is the average noise level; the small number below it is the standard deviation from the average.

Source: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations, Building Equipment and Home Appliances. December 1971.

and mating, locating prey, detecting predators, staking out territories, recognizing young and mate, nesting, etc., are threatened to a greater extent by unrecognized and increased noise than are species that use other senses. Studies also show that many species eventually adapt to different and increased noises if they prove to be non-threatening. Except in those cases where a relationship between construction noise and an adverse effect upon a species can be identified (e.g., with the California condor), determining the impact of construction activities upon wildlife must be a subjective rather than objective process.

4. Noise Survey

Limited noise level measurements along the proposed Coalinga Pipeline were conducted by URS during the week of November 21, 1976. These measurements were made to determine the current noise environment in the general vicinity of the tank farms and pumping station. Although some noise measurements were made at rural locations, the major emphasis of the survey focused on areas where increased noise level from construction or pump station operation could result in a noise impact.

URS measurements were made with a battery-powered Brüel and Kjaer Type 166B/S45 sound level meter equipped with windscreen. The "A-weighting" scale set on slow response was used for all measurements. Sampling periods were 15 to 30 minutes for 4 sites. The results of the survey are presented in Table J-8 for L_{90} , L_{50} , and L_{10} (noise levels exceeded 90, 50, and 10 percent of the time, respectively).

A quick review of the results of Table J-8 indicates that current noise levels are within population preferences and noise guidelines given in Tables J1, J-3, J-4, and J-5. The noise levels along most of the pipeline route, therefore, are indicative of a wilderness/rural environment.

Table J-8
RESULTS OF NOISE SURVEY

SITE	DATE	STARTING TIME	LOCATION	NOISE LEVELS (dBA)		
				L ₉₀	L ₅₀	L ₁₀
1	11-23-76	4:00 p.m.	Elk Hill Pump Station	37	40	47.5
2	11-23-76	4:30 p.m.	Elk Hill Tank Farm	40	41	43.5
3	11-23-76	5:30 p.m.	Rural Area North of Taft	36	38.5	49
4	11-24-76	9:30 a.m.	One Mile South of Coalinga Tank Farm	35.5	37	38.5

Source: URS, November 1976.

5. Noise Impacts

a. Construction

Construction noise is of particular importance when it occurs in or near schools, hospitals, and residential and recreational areas because of annoyance and disturbance factors. The noise levels experienced at particular locations, however, depend upon the distance to the construction activity and the nature of intervening terrain or other obstructions through which sound must travel to reach the receiver. As a general rule, noise levels will decrease by 6 dBA per doubling of distance from the source. Intervening obstructions may reduce noise levels by a few decibels or, under special circumstances, by more than 20 dBA. Finally, a factor of between 15 and 30 dBA can be applied for people inside buildings with closed windows.

Theoretically, noise generated during ground clearance and excavation, the noisiest phase of construction, will average 84 dBA at a distance of 50 feet from the site with a peak noise level of 100 dBA. Allowing for noise attenuation with distance, outdoor speech interference or noise impact are expected within 800 feet of the pipeline working zone. When blasting is required, noise levels may exceed 110 dBA (peak noise level). Exact noise impacts are difficult to ascertain because of the many variables associated with blasting.

Upon examining current land-use maps of areas along the Coalinga Pipeline, only scattered farm residents (or labor camps) and the Polvadero Country Club are considered noise-sensitive areas. The construction noise impacts to these sensitive receptors, however, would be mitigated by the speed of pipeline construction.*

*Pipeline construction is estimated at 4,000 feet per day in mountains, 8,000 feet per day in valleys, and 1,000 feet per day in urban areas.

Construction noise impact resulting from tank farm and pump station construction would be insignificant because the area does not have nearby noise-sensitive receptors.

b. Operational

The only operational impact that may result from the project is noise generated by the pump station. Depending upon the size, type, and manufacturer of the pumps, which are unknown at this time, exposed pumps have been found to generate noise levels from 70 to 90 dBA 3 feet from their source. The operational impacts associated with such pumps, however, would be insignificant because noise-sensitive receptors are absent or are located at considerable distances from the site.

APPENDIX K
WATER RESOURCES

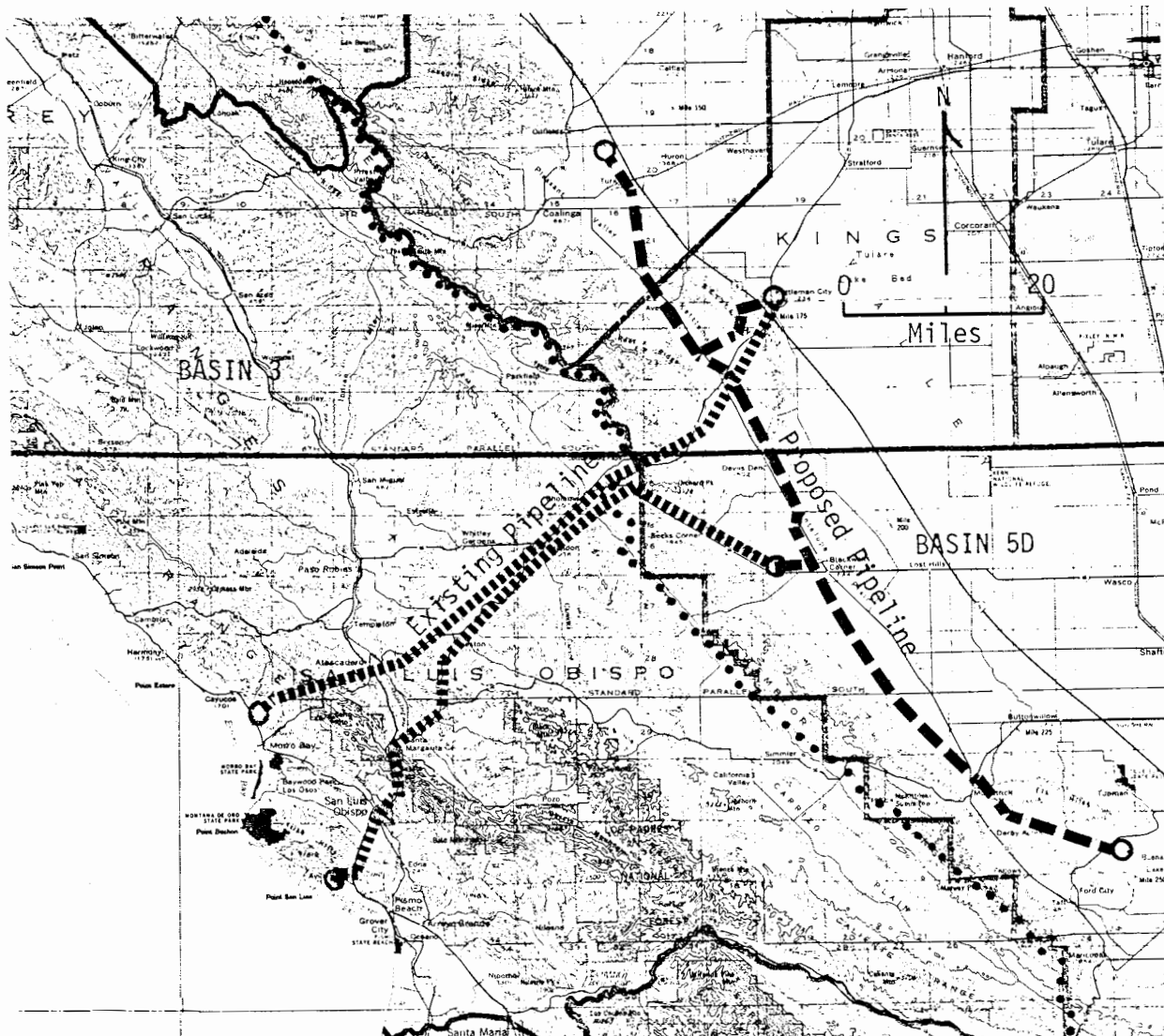
Appendix K Water Resources

1. Environmental Setting

The Elk Hills/Coalinga conveyance corridor is situated in the Tulare Lake Basin (Basin 5D). The areal extent of this basin, which is shown in Figure K-1, encompasses the southern half of the San Joaquin Valley. The alternative intermediate tank farms and connection to existing pipelines to the San Luis Obispo coast are also shown on Figure K-1.

a. Surface Water

Surface flows within the Tulare Lake Basin originate primarily from the more mountainous areas that make up its boundaries. These flows tend to converge toward the valley floor. In the past, this convergence has resulted in the development of a number of large lakes in the basin's central valley where excess surface waters would accumulate. Because of high evaporative rates (more than 60 inches/year on the valley floor) and the relatively low levels of rainfall within the basin, these lakes frequently dried up, especially during the dry summer months (SWRCB, 1975). This pattern has been further exacerbated by upstream diversions to the point that most of the lakes now exist exclusively as dry lakebeds.



..... Basin Divide

Figure K-1. Water Basins for Coalinga System
Source: State Water Resources Control Board, 1975.

Of the surface flow that does occur, the bulk of it is on the basin's east side. Approximately 94 percent of the natural runoff reaching the valley floor is contained within the flows of the Kern, Tule, Kaweah, and Kings rivers, all of which are on the east side. In contrast to these perennial rivers, the westside streams are intermittent and normally only have sustained flow during and shortly after extended periods of heavy rainfall. Flows originating from the entire west side (the proposed project includes only about two-thirds of this area) amount to only 24,000 acre-feet per year. For the most part, these western streams serve to recharge the unconfined ground-water system on the west side with their flows percolating rapidly into the ground long before they reach the central valley floor. Thus, of the numerous small streams observed along the conveyance corridor, most disappear only a short distance after their intersection with the corridor.

The quality of waters within the basin is variable. Flows in the major watercourses of the eastside tend to be of excellent quality. In contrast to these streams, flows draining the basin's west side tend to be somewhat poorer in quality. This quality reduction is primarily attributable to the higher total dissolved solids (TDS) concentrations that can be found in these ephemeral streams. The TDS levels and annual flows for major westside streams flowing through or near the conveyance corridor are presented in Table K-1. As is evident from the table, neither streamflow quality nor quantity for the conveyance corridor are high.

b. Ground Water

Three distinct bodies of ground water underlie the Tulare Lake Basin. They are from the surface downward: (1) the unconfined/semi-confined aquifer that overlies the relatively impermeable E-clay layer (where that layer is present); (2) the confined aquifer that underlies this layer; and (3) the saline connate waters that are found in the marine formations underlying the confined aquifer.

Table K-1

AVERAGE ANNUAL RUNOFF AND AVERAGE TOTAL DISSOLVED SOLIDS
OF WESTSIDE STREAMS

HYDROGRAPHIC UNIT	WATERSHED	UNIMPAIRED AVERAGE ANNUAL FLOW (000's acre-ft)	DRAINAGE AREA (sq mi.)	AVERAGE TDS (mg/l)
Westside-North	Los Gatos Cr.	4.0	118	800
	Worthan Cr.	2.5	88	1,000
	Jacalitos Cr.	1.5	56	1,000
	Zapato Cr.	2.0	58	800
	Avenal Cr.	<u>2.8</u>	<u>64</u>	500
	Subtotal	12.8	384	
Westside-South	Avenal Cr. (portion)	0.7	16	500
	Bitterwater Cr.	3.5	118	3,200
	Santos Cr.	1.0	46	3,000
	Buena Vista Cr. (portion)	<u>1.5</u>	<u>62</u>	3,400
	Subtotal	6.7	242	
	TOTAL	19.5	626	

Source: State Water Resources Control Board, 1975, Water Quality Control Plan Report, Tulare Lake Basin (5D).

The unconfined aquifer extends throughout the basin's central valley. The confined aquifer, on the other hand, is limited primarily to the central and western portion of the valley floor. While both confined and unconfined ground-water zones blend imperceptively into one essentially unconfined zone along all edges of the confining E-clay layer, the main recharge area for the confined aquifer is located along the eastern margin of the valley. In the vicinity of the conveyance corridor, the unconfined aquifer is the dominant ground water body.

Ground water movement within both of the two main aquifers tends to be toward the valley's central trough. Because of the high amount of recharge that takes place along the valley's eastern margins, this movement is most evident for the eastern portions of the basin. This pattern has been somewhat modified by the continuing high levels of groundwater extraction. The local effect of this overdraft on the aquifers of the westside area has been a significant lowering of the local water table. Well data collected by the California State Department of Water Resources (1975) indicate that unconfined ground water levels in the vicinity of the conveyance corridor range in depth from 100 to 400 feet below the surface. This overdraft has resulted in some localized reversals in flow gradients away from the valley trough and toward areas of heavy pumping.

The general mineral type of ground water in the western portions of the basin is primarily chloride or sulfate. The quality of this water ranges from good to poor, with TDS concentrations in excess of 5,000 mg/l in many areas (SWRCB, 1975). This westside water also contains boron in excess of 1.0 mg/l, chloride in excess of 500 mg/l, and sulfate in excess of 1,000 mg/l. These concentrations make most of this water, particularly in the vicinity of the conveyance corridor, unsuitable for agricultural or domestic use. While the causes of this degradation are not completely known, these high concentrations of chemical pollutants appear to be naturally occurring and not attributable to the actions of man.

c. Imported Water

The major imported water facilities in the Tulare Lake Basin are: (1) the California Aqueduct of the State Water Project; (2) various units of the Central Valley Project (i.e., the Friant-Kern Canal, the Delta-Mendota Canal, and the San Luis Drain); and (3) the Cross Valley Canal.

Of these three projects, only the California Aqueduct and some of its laterals are of major significance to this project. The California Aqueduct runs roughly parallel to the proposed conveyance route and two of its laterals, the Coalinga and Avenal aqueducts, actually cross the corridor. The water transported in the California Aqueduct originates from the Sacramento-San Joaquin Delta. Seven water agencies within the basin have contractual agreements with the state for water deliveries of 1,349,300 acre-feet per year from the aqueduct at full project development. Flows in the aqueduct in 1971 that were slated for delivery within the Tulare Lake Basin amounted to slightly more than 500,000 acre-feet. The quality of this imported water is generally excellent with TDS levels of roughly 220 mg/l.

d. Beneficial Uses

With the exception of waters transported by the California Aqueduct, the existing and potential uses of the above waters are rather limited. This limitation is primarily due to the limited quantities available and/or poor quality of these waters. Thus, with the exception of aqueduct waters which are acceptable for most uses, waters in this portion of the Tulare Lake Basin are usable only for irrigation and ground-water recharge.

2. Impacts

a. Impact Criteria

The criteria used in analyzing the level of water resources impact resulting from the construction and operation of this project are as follows:

A hydrologic impact is defined as any alteration in surface or ground water flows or change in the rate of ground-water recharge. The significance of an impact is based on how marked the change will be and how the change affects other related processes such as sedimentation and water quality.

A water quality impact is similarly defined as any change in the quality of surface or ground waters. Such an impact is considered to be significant if the change causes either: (1) water quality objectives, as delineated in the Basin Plans, to be exceeded; or (2) substantial water quality degradation, even though the objectives are met, to occur. In most cases, substantial degradation is considered to have occurred if the beneficial uses of a particular water body are severely hampered.

b. Construction

The construction of the proposed Elk Hills/Coalinga Conveyance System would have few, if any, significant impacts on the water resources of the study area. The only streams that could be potentially impacted during project construction are the streams crossed by the conveyance corridor (e.g., Buena Vista, Bitterwater, Avenal, Zapato and Los Gatos creeks). All of these streams are intermittent at the points at which they are crossed.

The laying of a pipeline across any of these streams would have some potential for disturbance, primarily in the form of a localized increase in suspended sediment levels. However, the small size and the limited number of beneficial uses that are attributable to these waters

would reduce the significance of such increases. Because of the hydrologic patterns in the Tulare Lake Basin, the impact of sediment increases can be further reduced through mitigation (e.g., limiting construction to periods of low or no streamflow). Moreover, because of the passive nature of the completed pipeline, any changes in sediment loading that do occur would be limited entirely to the period of construction.

The construction of the Elk Hills and Coalinga tank farms also would have some potential for local watershed disturbance. This construction would require extensive clearing and grading operations which would remove existing ground cover and make both sites subject to higher rates of erosion. However, planned erosion control measures would in all likelihood reduce the amount of sediment lost to insignificant levels, thereby minimizing the likelihood of impact on local surface waters. Construction of either the tank farms or the pipeline would not have any impact on study area ground waters.

Construction activities would require substantial quantities of water, either from local water systems or wells constructed specifically for this project. These activities would include hydrostatic testing water, drinking water for project personnel, water for dust abatement, and water for concrete mixing and other miscellaneous uses.

Construction operations would include the use of water to hydrostatically test the new storage tanks and the new pipeline to be constructed. Pipeline testing would be done in roughly 1-mile sections with each section of pipeline tested individually, the water drawn off and then reused to test the following section. Because of the smallness of each test section, only about 20,000 cubic feet (0.15 million gallons) of water would be required to carry out each test. While some loss or spillage is to be expected, it is anticipated that the total amount of water required to carry out complete testing of the pipeline would not exceed 0.5 million gallons. Storage tank testing would be

done one tank after another with the water drawn off and re-used. At Elk Hills and Coalinga, the largest tank is 200,000 barrels (8.4 million gallons) in capacity. Because the testing would last at least several days, the required water could be acquired over a period of time so as to minimize the impact of its acquisition. Thus, while the actual source of this test water has not yet been specified, it is unlikely that its acquisition would have any impact on local or regional water supplies.

During hydrostatic testing, the test water would tend to pick up any construction debris or mud left inside newly constructed pipeline segments and mill scale and small amounts of hydrocarbons from newly constructed sections. However, it is expected that the amount of material suspended or dissolved in the test water would be slight and that it would not have any significant impact on local receiving waters if it were discharged into them. Nonetheless, these test waters would be collected and then discharged to local surface waters only if they are in compliance with all applicable regulations.

While not presently quantifiable, the next largest factor would probably be the use of water for dust abatement. This use is generally nonconsumptive and, as a result, project use of water for dust abatement should have no effect on the water resources of the total drainage basin. The use of water for drinking is, on the other hand, consumptive. However, based on the expected number of personnel required for project construction (approximately 500 workers), the average quantity consumed during such activities (1 gallon/day/person), and the maximum length of the project (16 months), the total amount of water consumed in this way would be less than 200,000 gallons. Similarly, the total amount of water required by other consumptive construction activities, such as concrete mixing, is expected to be small. Thus, the amount of water consumed as a result of project construction would have little or no impact on the total basin water supply.

As part of normal construction practice, specially contracted chemical toilets would be provided at all construction sites. As a result, degradation of local water quality due to organic pollution from human wastes would be avoided. There is some potential for localized water contamination if spillage of oil, fuel, or chemical solutions occurs during the construction process. Such occurrences can be reduced or eliminated if proper construction techniques are followed. Special care would be required where the pipeline crosses existing aqueducts (i.e., the Coalinga Aqueduct at Los Gatos Creek and the Avenal Aqueduct at California Route 33).

c. Operation (Normal)

Normal operation and maintenance of the proposed pipeline and tank farms should require only limited amounts of water and should have little, if any, impact on the water resources of the basin. During normal project operation, water would be needed for sanitation and drinking water supplies for personnel operating the project facilities. This water would be drawn either from local wells or nearby municipalities. Based on a total staff of 24 people and an expected usage per person of 8 to 25 gallons per day, the total daily water requirement would be between 192 and 600 gallons. Such a limited demand would have essentially no effect on either local or basin-wide water resources.

Project facilities, especially the proposed pipeline, would place no demands upon local water resources. The only potential area for impact would be from surface runoff at the tank farms at each end of the pipeline.

It is likely that the area within the tank farms would have an appreciable amount of oils, solvents, and/or crude oils on its surface as a result of normal day-to-day operations. Rainwater falling on these areas can be expected to pick up minor amounts of these substances. If

this water were allowed to be discharged to local drainage systems, significant impacts would be likely. Fortunately, the current designs for the tank farms include collection and treatment facilities for these waters. Thus, no significant impact is expected.

d. Operation (Abnormal)

Abnormal project operation, in particular the occurrence of leaks and spills of the crude oil being transported, has the greatest potential for significant adverse impact.

The impact of an oil spill from project facility would depend primarily upon the location and size of the spill. The following discussion will only address the potential vulnerability of specific basin water resources to a major oil spill (i.e., greater than 25,000 barrels). Whether such a spill occurs is a function of both the risk potential of a particular section of the conveyance system and the topography in which it lies (see Appendices D and E).

Because of the limited water resources of the western Tulare Lake Basin, it is expected that the occurrence of a major oil spill would have relatively little effect on these resources. In general, if a spill did occur, it would tend to affect only land areas. While there is some possibility that spills could enter local surface waters, this possibility is limited to the infrequent periods when surface flows are present in the streams traversed by the project (e.g., Buena Vista, Bitterwater, Avenal, Zapato and Los Gatos creeks). If a spill event did coincide with a period of surface flow, adverse impacts could result. Waters contaminated with crude oil would in most cases be unusable for irrigation. However, while such an event is significant on a very local level, it does not pose a major threat to the water resources of this western region, especially in light of the oil-spill control techniques that have been incorporated into the project.

Similarly, it is expected that the vulnerability of local ground-water resources to oil contamination is limited. Both the physical properties of the oil (i.e., its immiscibility relative to water) and the structure of local ground-water systems would tend to prohibit significant intrusion of the oil into local ground waters. In particular, the depth of ground water levels in the project area and the filtering capacities of the overlying soils work to limit the amount of oil that might enter.

APPENDIX L
VEGETATIONAL COMMUNITIES



Appendix L

Vegetational Communities

This appendix describes the general characteristics of the natural vegetational communities that would be affected by the pipeline. The word "natural" should not be taken to mean "present before any human influence was exerted on the area." Many dominant species (e.g., Bromis rubens, Erodium cicutarium, and annual species of Festuca) were introduced by humans. "Natural" here means "growing and self-maintaining without help from human activity."

The two communities of the project area -- the Lower Sonoran grassland and the riparian -- are defined here somewhat differently from that in the literature. Although the Lower Sonoran grassland closely resembles the vegetation of that name described by Twisselman (1967), the definition has been expanded to include the similar vegetation types of western Kings and Fresno counties. As a result, this grassland community contains elements of the Upper Sonoran grassland of Twisselman (1967) and the valley grassland of Munz and Keck (1968). Because the riparian community of the project area differs from the riparian woodland discussed by Ornduff (1974), it has been classified on the basis of location and function, which, in this dry region, is essentially the same as that of the more extensive riparian woodlands further north. The functional bases for classification include stabilizing streambanks, reducing surficial runoff into the streams, and providing habitat for wildlife. Under this classification scheme, even the vegetation of streambeds is included within the riparian community.

Throughout the Lower Sonoran grasslands, red-stemmed filaree (Erodium cicutarium) is a dominant herbaceous component. Red brome (Bromis rubens) is also common. According to Twisselman (1967), Festuca macrostachys var. simulans, a native fescue, is another dominant component of this community. Many fescue seedlings were seen throughout the study area, but specific identification of the early growth stages was not possible.

In the northern portion of the study area, Russian thistle (Salsola kali) is the most common shrub. Throughout the study area south of Antelope Plain, common saltbush (Atriplex polycarpa) is by far the most dominant shrub. A species of goldenbush (Haplopappus), (probably narrow-leaf goldenbush [H. linearifolius]), white burrobrush (Hymenoclea Salsola), white bursage (Franseria dumosa) and locoweed (Astragalus sp.) are also relatively common.

The riparian community, as defined above, varies widely. At Los Gatos and Zapato Chino creeks, more moisture is apparently available than elsewhere. Tamarisk (Tamarix aphylla) is present at the proposed pipeline crossing of Los Gatos Creek, and Fremont cottonwood (Populus Fremontii) is found along both of these creeks. Tobacco tree (Nicotiana glauca), lenscale (Atriplex lentiformis), and mule fat (Baccharis viminea) are also present in these locations. At Zapato Chino Creek, a substantial population of mistletoe (Phoradendron sp.) is parasitizing the cottonwoods, and a lateral slough is filled with sunflowers (Helianthus sp.).

Certain features are characteristic of the riparian regions throughout the study area. The vegetation is more luxuriant than elsewhere. Grasses and shrubs grow more densely and display more variety than in the adjacent land. Russian thistle and common horehound (Marrubium vulgare) are common components of these communities along the pipeline route.

In the drier regions of the southern portion of the project area, the creekside vegetation closely resembles the vegetation of the surrounding

lands. The bladderpod (Isomeris arborea) and the rabbitbrush (Chrysothamnus sp.) are shrubs that appear to preferentially inhabit the creeks.

A list of species observed and reported (Twisselman, 1967) in the vegetational communities discussed above appear in Table L-1.

Table L-1
PLANT SPECIES

SPECIES	DISTURBED REGIONS	HABITAT	
		GRASSLAND	RIPARIAN
<u>Allium</u> <u>Howellii</u>		x(T)	
<u>Amsinckia</u> <u>tesselata</u>		x	
<u>Atriplex</u> <u>lentiformis</u>			x
<u>A.</u> <u>polycarpa</u>		rd	
<u>A.</u> <u>semibaccata</u>			x
<u>Artemesia</u> <u>tridentata</u>			x
<u>Astragalus</u> <u>lentiginosus</u> var. <u>nigricalyeis</u>		x(T)	
<u>A.</u> <u>oxyphysus</u>		x(T)	
<u>A.</u> <u>sp.</u>		x	
<u>Avena</u> <u>barbata</u>		x(T)	
<u>Baccharis</u> <u>viminea</u>			x
<u>Brassica</u> <u>campestris</u>	x		
<u>Bromus</u> <u>rubens</u>	x	rd	x
<u>Cirsium</u> <u>sp.</u>	x		
<u>Chrysothamnus</u> <u>sp.</u>			x
<u>Datura</u> <u>meteloides</u>			x
<u>Eatonella</u> <u>Congdonii</u>		x(T)	
<u>Eremalche</u> <u>Parryi</u>		x(T)	
<u>E.</u> <u>kernensis</u>		x(T)	
<u>Eriogonum</u> <u>gossypinum</u>		re	
<u>E.</u> <u>nudum</u> var. <u>indictum</u>		x	
<u>Erodium</u> <u>cicutarium</u>	x	d	x
<u>Festuca</u> <u>macrostachys</u> var. <u>simulans</u>		d(T)	
<u>F.</u> <u>reflexa</u>		x(T)	
<u>F.</u> <u>sp.</u>		x	
<u>Franseria</u> <u>dumosa</u>		x	x
<u>Gilia</u> <u>tricolor</u> ssp. <u>diffusa</u>		x(T)	
<u>Haplopappus</u> cf. <u>linearifolius</u>		x	x
<u>Helianthus</u> <u>sp.</u>			x
<u>Hordeum</u> <u>leporinum</u>		x	x
<u>Hymenoclea</u> <u>salsola</u>		x	x
<u>Isomeris</u> <u>arborea</u>			x
<u>Lasthenia</u> <u>chrysostoma</u>		x(T)	

Table L-1

PLANT SPECIES
(continued)

SPECIES	HABITAT		
	DISTURBED REGIONS	GRASSLAND	RIPARIAN
<u>Lepidium dictyotum</u>		x(T)	
<u>L. sp.</u>		x	
<u>Linanthus liniflorus</u> ssp.			
<u>pharnaceoides</u>		x(T)	
<u>Lupinus nanus</u> var. <u>Menkerae</u>		x(T)	
<u>Malacothrix californica</u>		x(T)	
<u>Malva neglecta</u>	x		
<u>Marrubium vulgare</u>			x
<u>Nicotiana glauca</u>			x
<u>Opuntia Treleasei</u>		x(T)	
<u>Populus Fremontii</u>			x
<u>Phoradendron</u> sp.			x
<u>Salsola kali</u>	x	x	rd
<u>Schismus arabicus</u>		x(T)	
<u>Sisymbrium Irio</u>		x(T)	
<u>Tamarix aphylla</u>			x
<u>Trichostema ovatum</u>		x(T)	
<u>T. sp.</u>		x	
<u>Trifolium</u> sp.		x	
<u>Xanthium</u> sp.			x

Key: X = present
 rd = regionally dominant
 re = rare and endangered species (California Native Plant Society 1974)
 d = dominant throughout
 (T) = reported by Twisselman (1967).

SOURCE: URS, November 1976.



APPENDIX M
WILDLIFE OF THE ELK HILLS/COALINGA
CONVEYANCE SYSTEM

Appendix M
Wildlife of the Elk Hills/Coalinga Conveyance System

1. Composition and Distribution

Wildlife resources of the proposed project area in Elk Hills, within 3 miles west of State Highway 33, the northern end of the Kettleman Hills, and north of the Gujarral Hills, have been reviewed and sampled. Wildlife composition along the project area has been listed (Tables M-1, M-2, and M-3). Records of wildlife species are based upon direct field observations, known occurrences, and wildlife-habitat associations known from other areas of the San Joaquin Valley and central California. Field observations were made during 4 days in late November 1976, with generally heavy overcast and cold night temperatures. Rain-years of 1975-1976 and 1976-1977 may be two of the worst droughts of record in Central California, and thus wildlife observations may be distorted. Most field effort was directed at the southern 40 miles of the more than 80+-mile-long project area; the northern half has more cultivation and less access.

The general composition of vertebrates along the route is quite similar to any of the grasslands and desert scrub in the Southern Coast Ranges and the San Joaquin Valley. Absence of moisture eliminates most amphibians, while the absence of rocky areas reduces the number of lizards and snakes. Many birds are only seasonally abundant, and only a few occupy the open, short grasslands. The common resident wildlife along the project area consists of the burrowing rodents and rabbits:

Table M-1

AMPHIBIANS AND REPTILES FOUND OR EXPECTED
ALONG THE WESTERN SAN JOAQUIN VALLEY AND THE ELK HILLS/COALINGA PROJECT CORRIDOR

	FOOT- NOTE	ELK ¹ HILLS	COALINGA		FOOT- NOTE	ELK ¹ HILLS	COALINGA
Western spadefoot toad		0	0	California striped			
California western toad		0	0	<u>whipsnake</u>		0	0
Blunt-nosed leopard lizard ²		0	0	Western patch-nosed snake		0	-
Coast horned lizard		0	0	Glossy snake		0	0
Desert horned lizard		0	0	<u>Gopher snake</u>		0	0
Desert spiny lizard		0	-	<u>Common king snake</u>		0	0
Western fence lizard		0	0	California mountain			
<u>Side-blotched lizard</u>		0	0	king snake		-	-
Yucca night lizard		0	-	Long-nosed snake		0	0
Western skink		0	0	Western (aquatic) garter			
Gilbert's skink		0	0	snake		-	0
<u>Western whiptail</u>		0	0	Common garter snake		0	0
Foothill alligator lizard		0	-	California black-headed			
California legless lizard		0	0	snake		0	0
Western worm snake		0	-	<u>Spotted night snake</u>		0	0
Racer		0	0	Western rattlesnake		0	0
<u>Common whipsnake</u>		0	0				

¹Two major areas along the corridor separated at about MP 51, Devils Den.

²Rare, threatened, or endangered species.

KEY: o = known or expected occurrence
 - = those species found in both areas
 _ = common or abundant

Source: URS Company.

Table M-2

TERRESTRIAL BIRDS FOUND OR EXPECTED ALONG
THE WESTERN SAN JOAQUIN VALLEY ALONG
THE ELK HILLS/COALINGA PROJECT CORRIDOR

	FOOT- NOTE	KEY		FOOT- NOTE	KEY
Turkey vulture	1	o	Screech owl	1,3	o
(California condor)	2	-	Great horned owl	1	o
White-tailed kite	1	o	Burrowing owl	1,3	o
Sharp-shinned hawk	1,3	o	Long-eared owl	1	o
Cooper's hawk	1,3	o	(Poor-will)		-
Red-tailed hawk	1	o	(Common nighthawk)	3	-
Red-shouldered hawk	1,3	o	(Lesser nighthawk)		-
(Swainson's hawk)	1,3	-	White-throated swift		o
Rough-legged hawk	1,3	o	(Black-chinned hummingbird)		-
Ferruginous hawk	1,3	o	Anna's hummingbird		o
Golden eagle	1	o	(Rufous hummingbird)		-
Bald eagle		o	(Allen's hummingbird)		-
Marsh hawk	1,3	o	Belted kingfisher		o
Prairie falcon	1,3	o	Common (Yellow- and Red- shafted) flicker		o
Merlin		o			
Sparrow hawk	1,3	o	Acorn woodpecker		o
California quail	1	o	Lewis' woodpecker		o
(Mountain quail)	1,3	-	Yellow-bellied (Red- breasted) sapsucker		o
Ring-necked pheasant	1	o	Hairy woodpecker	3	o
(Sandhill crane)		-			
Rock dove		o	Downy woodpecker		o
Mourning dove	1	o	Nuttall's woodpecker		o
Spotted dove	1	o	(Western kingbird)		-
Roadrunner		o	(Ash-throated flycatcher)		-
Barn owl	1,3	o	Black phoebe		o

1 - Protected Species.

2 - Threatened or Endangered Species.

3 - Birds Listed on "Blue List" (Arbib, 1976).

Key: _____ = Birds commonly or abundantly observed or expected along the corridor.

() = Birds expected but not observed during "Christmas Bird Counts," usually summer residents.

o = Reported occurrences in area are summarized from "Christmas Bird Counts" of the National Audubon Society and published in annual volumes of American Birds.

Table M-2

TERRESTRIAL BIRDS FOUND OR EXPECTED ALONG
THE WESTERN SAN JOAQUIN VALLEY ALONG
THE ELK HILLS/COALINGA PROJECT CORRIDOR
(continued)

	FOOT- NOTE	KEY		FOOT- NOTE	KEY
<u>Say's phoebe</u>		0	Blue-gray gnatcatcher		0
(Olive-sided flycatcher)		-	<u>Ruby-crowned kinglet</u>		0
<u>Horned lark</u>		0	<u>Water pipit</u>		0
(Tree swallow)		-	<u>Phainopepla</u>		0
(Bank swallow)		-	<u>Loggerhead shrike</u>		0
(Rough-winged swallow)		-	<u>Starling</u>		0
(Barn swallow)		-	<u>Hutton's vireo</u>		0
(Cliff swallow)		-	(Solitary vireo)		-
(Purple martin)		-	(Warbling vireo)		-
<u>Scrub jay</u>		0	Black-and-white warbler		0
<u>Common raven</u>		0	Orange-crowned warbler		0
<u>Common crow</u>		0	(Nashville warbler)		-
(Mountain Chickadee)		-	(Yellow warbler)		-
<u>Plain titmouse</u>		0	<u>Yellow-rumped (Myrtle and</u>		
<u>Common bushtit</u>		0	<u>Audubon) warbler</u>		0
White-breasted nuthatch		0	Black-throated gray warbler		0
Red-breasted nuthatch		0	(Townsend's warbler)		-
Brown creeper		0	(Hermit warbler)		-
(Wrentit)		-	Common yellowthroat		0
<u>House wren</u>		0	<u>House sparrow</u>		0
(Winter wren)		-	<u>Western meadowlark</u>		0
Bewick's wren	3	0	(Hooded oriole)		-
Long-billed marsh wren		0	(Scott's oriole)		-
Canon wren		0	(Bullock's oriole)		-
<u>Rock wren</u>		0	Red-winged blackbird		0
<u>Mockingbird</u>		0	Tricolored blackbird		0
<u>California thrasher</u>		0	Brewer's blackbird		0
(Le Conte's thrasher)		-	Brown-headed cowbird		0
(Sage thrasher)		-	(Western tanager)		-
<u>Robin</u>		0	(Black-headed grosbeak)		-
Varied thrush		0	(Blue grosbeak)		-
Hermit thrush		0	(Lazuli bunting)		-
<u>Western bluebird</u>		0	Evening grosbeak		-
<u>Mountain bluebird</u>		0	Purple finch		0
Townsend's solitaire		0	<u>House finch</u>		0

Table M-2

TERRESTRIAL BIRDS FOUND OR EXPECTED ALONG
THE WESTERN SAN JOAQUIN VALLEY ALONG
THE ELK HILLS/COALINGA PROJECT CORRIDOR
(continued)

	FOOT- NOTE	KEY		FOOT- NOTE	KEY
Pine siskin		o	Sage sparrow		o
American goldfinch		o	Dark-eyed (Oregon or		
Lesser goldfinch	3	o	slate-colored) junco		o
(Lawrence's goldfinch)		-	(Chipping sparrow)		-
(Red crossbill)		o	(Brewer's sparrow)		-
(Green-tailed towhee)			(Black-chinned sparrow)		-
Rufous-sided towhee		o	White-crowned sparrow		o
Brown towhee		o	Golden-crowned sparrow		o
Savanna sparrow		o	(White-throated sparrow)		-
(Grasshopper sparrow)	3	-	Fox sparrow		o
Vesper sparrow		o	Lincoln's sparrow		o
Lark sparrow		o	Swamp sparrow		o
Rufous-crowned sparrow		o	Song sparrow		o
(Black-throated sparrow)		-			

1 - Protected Species.

2 - Threatened or Endangered Species.

3 - Birds Listed on "Blue List" (Arbib, 1976).

Key: _____ = Birds commonly or abundantly observed or expected along the corridor.

() = Birds expected but not observed during "Christmas Bird Counts," usually summer residents.

o = Reported occurrences in area are summarized from "Christmas Bird Counts" of the National Audubon Society and published in annual volumes of American Birds.

Source: URS Company.

Table M-3

MAMMALS KNOWN OR EXPECTED ALONG THE WESTERN SAN JOAQUIN VALLEY
AND THE ELK HILLS/COALINGA PROJECT CORRIDOR

	FOOT- NOTE	ELK ¹ HILLS	COALINGA ¹		FOOT- NOTE	ELK ¹ HILLS	COALINGA ¹
Opossum		0	0	Pinyon mouse		0	0
Ornate shrew		0	0	Deer mouse		0	0
Broad-handed mole		0	0	Southern grasshopper mouse		0	0
Bats		0	0	Dusty-footed woodrat		0	0
Black-tailed hare	3	0	0	Desert woodrat		0	0
Audubon (Desert)				California meadow mouse		0	0
Cottontail	3	-	0	Norway rat		x	x
Brush rabbit	3	-	0	Black rat		x	x
San Joaquin antelope				House mouse		x	x
ground squirrel	2	0	0	Dog		x	x
Beechey ground squirrel		0	0	San Joaquin kit fox	2	0	0
Botta (Southern)		0	0	Gray fox	3	0	0
pocket gopher		0	0	Coyote	3	0	0
Little pocket mouse		0	0	Raccoon	3	0	0
San Joaquin pocket mouse	2	0	0	Long-tailed weasel	3	0	-
San Joaquin (Fresno)				Badger	3	0	0
kangaroo rat	2	0	0	Striped skunk	3	0	0
Giant kangaroo rat	2	0	0	Spotted skunk	3	0	0
Western harvest mouse		0	0	Cat		x	x
Brush mouse		0	0	Bobcat	3	0	0

- 1 - Two major areas along the corridor separated at about MP 51, Devils Den.
2 - Rare, Threatened, or Endangered, and those of unique distribution.
3 - Game or furbearing mammals.

KEY: 0 = known or expected occurrence
x = introduced species or no value
- = species found or expect in both areas
_ = common or abundant

Source: URS Company.

ground squirrels, gophers, pocket mice, kangaroo rats, black-tailed jackrabbits, and brush rabbits. The low abundance and general character of wildlife do not support large predator populations, although good ground visibility may attract raptors, coyotes, foxes, and bobcats.

Several important vertebrate species are restricted to the region of the project area and require additional discussion. The endangered blunt-nosed leopard lizard is generally limited to the San Joaquin Valley and the adjacent valley grasslands in San Luis Obispo County. The California Department of Fish and Game (1971, 1972, 1974, 1976) and Bury (1972) summarized the status and distribution of the endangered blunt-nosed leopard lizard. According to Bury, the major threat to the leopard lizard, California legless lizard, the San Joaquin whipsnake (subspecies), and the California tiger salamander is the continued land conversion of undisturbed habitat to cultivated fields along the west side of the San Joaquin Valley and on the adjacent Carrizo Plains. The legless lizard, whipsnake, and salamander are considered to be depleted (i.e., reduced to abnormally low populations, but not formally designated for special protection). Either additional studies should be undertaken to determine their present status or these species should be designated as rare. The California condor has been reported from the Temblor Range and may travel into the southern project area when foraging.

The past distribution records of the endangered Fresno or San Joaquin kangaroo rat (Culbertson, 1946; Grinell, 1922; Hall and Kelson, 1958; Hoffman, 1974; Ingles, 1965) indicate that the rat may be encountered within the project area or vicinity. When more detailed field sampling is conducted within the project area, verification of their presence may be made.

The San Joaquin kit fox, and individual foxes killed along roads either within or adjacent to the project area have been reported by the California Department of Fish and Game (1971, 1972, 1974, 1976), Howard

Leach (personal communications and map, 1976), Jensen (1972), Laughrin, (1970), Morrell, (1971, 1972, 1975) and Waithman, (1974a, 1974b). During the field survey, night observations of the fox within 3 miles west of the Elk Hills tank farm site and general distribution and droppings clearly indicate that the fox uses the project area. No dens were found and none have been reported in the project area, although some areas have not been examined from the ground. Leach, California Department of Fish and Game (personal communication, November 1976), will recommend portions or all of the Elk Hills Naval Reserve No. 1 and No. 2 for inclusion in the "critical habitats" of the kit fox (Fig. 2-2). Such designation and the known occurrence of the fox within the proposed project area would require compliance with distributed guidelines pertaining to Section 7 of the Endangered Species Act of 1973 (U.S. Fish and Wildlife Service, Washington, 22 April 1976).

The San Joaquin antelope ground squirrel, San Joaquin pocket mouse, a subspecies of the California pocket mouse, a subspecies of Heermann's kangaroo rat, San Joaquin kangaroo rat, and giant kangaroo rat are also known to occur in the southwestern San Joaquin Valley (Hall and Kelson, 1958; Ingles, 1965). Populations of these species are isolated and are under the threat and effect of conversion of their habitats to cultivated croplands. Eventually these species may be designated as rare, threatened, or endangered species.

2. Wildlife Mitigation Measures

Because of the preliminary nature of the field surveys conducted along the Elk Hills/Coalinga project area, a major mitigation measure, if this project is approved, could consist of additional field surveys in the southern third of the pipeline route. Such a survey would accurately identify burrows and dens that could be avoided by construction teams.

In order to insure the safety of the kit fox and other unique species, some shallow sumps could be excavated in the adjoining service trails for the pipeline route in the southern third of the route. Sumps, small ridges, or culverts would contain and direct any accidental oil spill away from the dens and burrows on the flats and into the small gullies and creek beds.

To positively mitigate or compensate for loss of habitat in and around Elk Hills, the southwestern portion of Elk Hills and selected private lands (to be purchased) that contain kit fox denning areas could be permanently set aside as a kit fox refuge; preservation of at least 300 acres, and more probably 600 acres, of existing habitat may compensate for the loss of nearly 300 acres of habitat at the Elk Hills tank farm site and the first 40 miles of the pipeline route.

APPENDIX N
SOCIOECONOMICS

Appendix N
SOCIOECONOMICS

TABLE N-1
FIRE PROTECTION MANPOWER AND EQUIPMENT

LOCATION	JURISDICTION	ALL YEAR?	MEN	EQUIPMENT
<u>Fresno</u>				
Huron	A	yes	2	1 engine
Pleasant Valley	A	yes	4	1 engine, 1 tanker, 1 squad
Oil Field	A	yes	2	1 engine
Coalinga	C	summer	14	2 engines, 1 bulldozer
Coalinga	B	yes	12 fulltime 19 volunteers	2 ambulances 3 engines
<u>Kings</u>				
Cottonwood Pass	C	summer	7	1 engine
Avenal	A	yes	2	1 engine, (pumper)
Kettleman City	A	yes	2	1 engine, (pumper)
<u>Kern</u>				
Lost Hills	A	yes	2	1 engine, 1 pickup ²
Annette	A	no ³ /	1	1 engine
McKittrick	A	yes	2	1 engine, 1 pickup
Buttonwillow	A	yes	2	1 engine, 1 pickup
Fellows	A	yes	2	1 engine, 1 pickup
Taft	A	yes	5	2 engines, 1 tanker, 1 pickup

A Foam Trailer is located in Bakersfield at station 44 and another is in Kings County.

1. Through an arrangement between the county and the state, the Three Fresno County stations are partially manned by California Division of Forestry Personnel.
2. Pickups carry a size 200 tank.
3. Annette station is open from April to August

* A = County
B = City
C = California State Division of Forestry

- SOURCES: 1) Fresno County Fire Department, Personal communication, November 1, 1976.
2) Kings County Regional Planning Agency, 1976. Kings County Public Safety Element.
3) Kern County Fire Department, Pers. comm. November 15 and 23, 1976.

Table N-2
ENROLLMENT BY SCHOOL DISTRICT

KERN COUNTY, SCHOOL DISTRICTS FALL ENROLLMENTS						
	FALL 1970	FALL 1971	FALL 1972	FALL 1973	FALL 1974	FALL 1975
<u>Elementary</u>						
Buttonwillow	384	395	383	375	370	366
Elk Hills	83	103	91	93	84	77
McKittrick	39	35	34	38	39	38
Taft City	2,108	2,009	1,893	1,832	1,823	1,820
<u>High</u>						
Taft Union	1,127	1,116	1,131	1,044	1,023	1,033

COALINGA UNIFIED SCHOOL DISTRICT, JUNE ENROLLMENTS							
	1971	1972	1973	1974	1975	1976	Fall, 1976
<u>Elementary</u>							
Coalinga	998	937	932	870	836	859	843
Huron	531	496	456	448	487	475	458
Junior High	421	408	408	422	429	398	417
High School	653	637	692	660	653	697	774

SOURCES: 1. Coalinga Unified School District. Annual Enrollment Summaries
 2. Kern County Superintendent of Schools. Finance and Personnel Statistics, 1976.

Table N-3
WASTE MANAGEMENT FACILITIES

SANITARY LANDFILLS							
	COALINGA	LEMORE (NAVY)	AVENAL	BUTTONWILLOW	LOST HILLS	TAFT	KETTLEMAN CITY
Life Span (years)	55	15+	20	15	134	34	20
Fill rate (tons/day)	15-20	28	10-12	16	5	51	.3
Chemical Toilet wastes accepted?	yes ¹ /	NO	NO	NO	NO	NO	NO
WASTEWATER TREATMENT PLANTS							
	COALINGA	TAFT		BAKERSFIELD			
Plant Capacity (MGD)	2.2	1.2		22.5 ² /			
Current Peak (flow)	1.1	.89		13 ³ /			
Treatment	Primary and Secondary	Primary and Secondary		Irrigation			

Notes: 1. If heavy phenols are used as disinfectants, these waters are not allowed.
2. As of April 1, 1977. -- 2 plants.
3. Approximate

SOURCES: 1. Fresno County Health Department, personnel communication, Nov. 17, 1976.
2. Avenal Community Service District, personal communication, Nov. 18, 1976.
3. City of Bakersfield, personal communication. Nov. 18, 1976.
4. Taft City Wastewater Treatment Plant, pers. comm. Nov. 18, 1976.
5. Environmental Section, Western Division Naval Facilities Engineering Command, pers. comm., Nov. 19, 1976.
6. Kern County Solid Waste Fact Sheet
7. Kings County Regional Planning Agency, 1976. Solid Waste Management Plan.

Table N-4
1975 TRAFFIC VOLUMES

ROADWAY	AVERAGE DAILY TRAVEL (ADT)	PEAK HOUR
Highway 33 (Jct. Route 58, McKittrick North)	850	150
Highway 33 (At Blackwell's Corner)	830	150
Highway 33 (At Devil's Den Road)	710	130
Highway 33 (Jct. Route 41)	900	170
Highway 58 (Jct. Route 32, McKittrick North)	420	40
Highway 46 (At Blackwell's Corner)	3,700	700
Highway 41 (Jct. Route 33)	2,200	400

Source: CALTRANS, 1975 Traffic Volumes on California State Highways.

Table N-5

RECENT DISTRIBUTION OF INCOME AND EXPENDITURES BETWEEN BUDGETARY CATEGORIES
IN FRESNO, KERN, AND KINGS COUNTIES

INCOME 1976-1977 FISCAL YEAR					
FRESNO (FY 76-77)		KERN (FY 76-77)		KINGS (FY 75-76)	
Federal	19.3	Other Govt. Agencies	33.4	Other Govt. Agencies	52.2
State	25.2		-		-
Property Taxes	28.5	Property Taxes	30.7	Property Taxes	33.4
Surplus & Rev. Share	12.1	Surplus	15.8	Interest & Other Rev.	4.2
Service Charges	5.4	Service Charges	11.1	Service Charges	3.4
Other Tax	5.6	Other Tax	5.2	Other Tax	4.7
Licenses, Fines, Etc.	3.9	Licenses, Fines, Etc.	3.8	Licenses, Fines, Etc.	2.1
TOTAL	100.0	TOTAL	100.0	TOTAL	100.0
(\$191,217,000)		(\$202,978,000)		(\$23,785,000)	
EXPENDITURE 1976-1977 FISCAL YEAR					
FRESNO (FY 76-77)		KERN (FY 76-77)		KINGS (FY 75-76)	
Environ. Manag.	116.3	Health & Sanit.	16.0	Health & Sanit.	11.9
Human Services	53.7	Public Assistance	28.4	Public Assistance	36.1
Justice Services	17.7	Public Protection	22.1	Public Protection	21.5
Education & Rec.	4.0	Education & Rec.	3.7	Education & Rec.	4.3
Fiscal Services	3.3	Debt & Reserves	3.3	Interest on Notes, Etc.	0.0
Admin. Services	2.8	General Govt.	19.0	General Govt.	15.0
Misc.	2.2	Public Ways & Fac.	7.5	Public Ways	11.2
TOTAL	100.0	TOTAL	100.0	TOTAL	100.0
(\$191,217,000)		(\$202,978,000)		(\$23,379,000)	

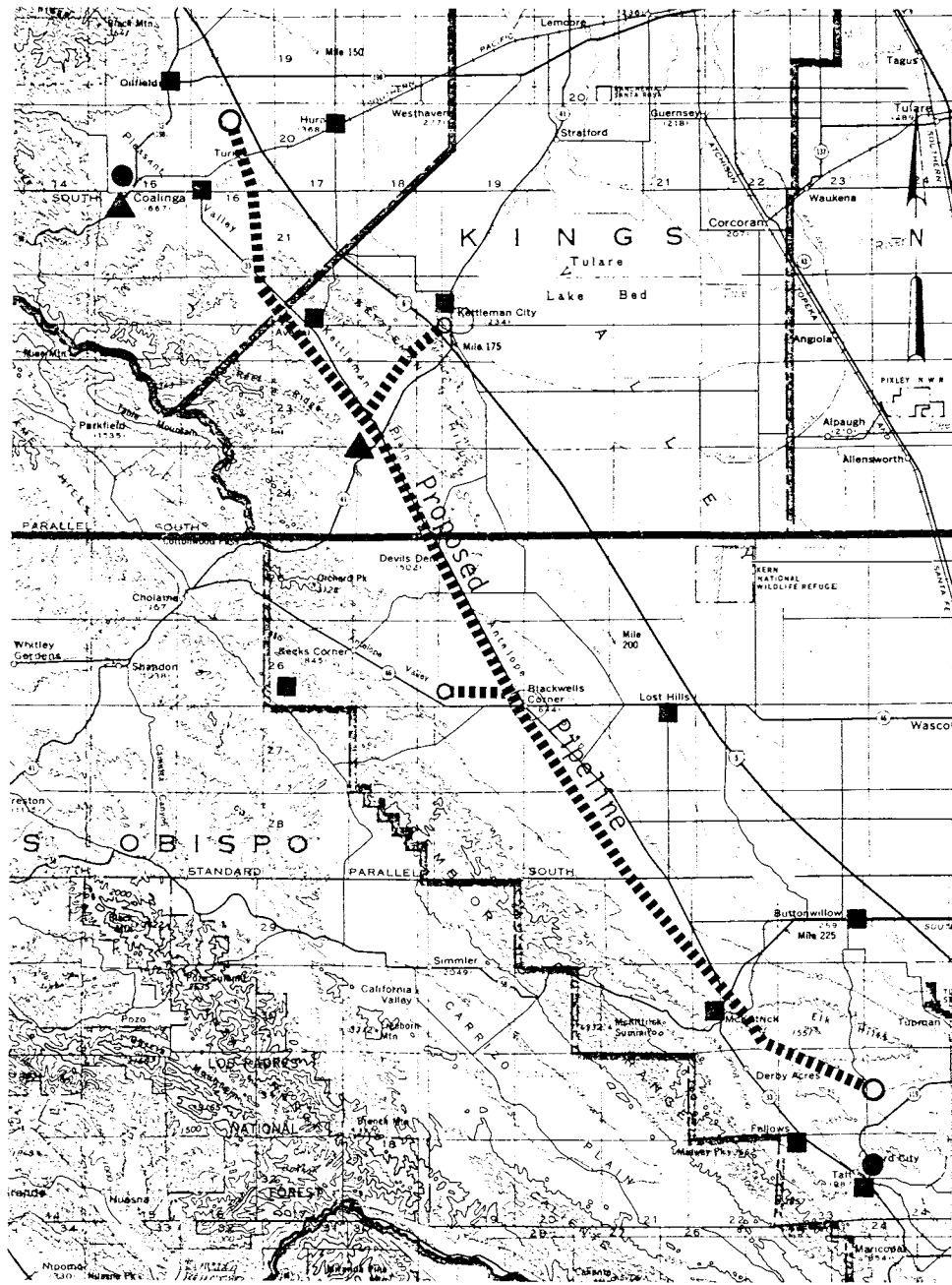
- Source: 1. Fresno Administrative Office, "1976-1977 Fresno County Budget." October 21, 1976.
 2. Board of Supervisor and Auditor-Controller, Final Budget 1976-1977: County of Kern, July 30, 1976.
 3. Board of Supervisors and County Administrative Officer, Final Project: 1976-1977, and Financial Report: Year Ending June 30, 1976. June 1976.

Table N-6

ESTIMATES OF PROPERTY TAX REVENUES LOST
TO COUNTIES DUE TO NAVY ACQUISITION
OF PRIVATE LANDS

	COUNTY		
	FRESNO	KINGS	KERN
Approximate Acreage	80.0	13.5	4.0
Under Williamson Act Contract	YES	YES	YES
Approximate Assessed Value Per Acre	\$135.00	\$125.00	\$126.00
Average Tax Rate Per \$100.00	8.19	10.76	7.71
Approximate Annual Property Tax	885.00	182.00	39.00
Annual Property Tax Loss Over The Next 6 Years	5,310.00	1,092.00	234.00

Source: Mr. Paul Caufield, Assessor's Office, Fresno County, Personal Communication, December 14, 1976. Tax Assessor's Office, Kings County, Personal Communication, March 24, 1977. Mr. Bevier, Assessor's Office, Kern County, Personal Communication March 25, 1977.



- County
- City
- ▲ Cal. Div. of Forestry

0 10 20
Miles

Figure N-1. City, County, and State Fire Stations Along the Coalinga Route

APPENDIX 0
AIR QUALITY IMPACTS

Appendix 0

Air Quality Impacts

1. Construction

Air quality impacts during construction would result primarily from fugitive dust caused by windblown disturbed earth and emissions from construction vehicles. Construction at both the pipeline and tank farm sites would be a concern, particularly in the San Joaquin Valley, because of the already dusty conditions there.

A fugitive dust emissions factor for heavy construction activities is presented in the U.S. Environmental Protection Agency publication "Compilation of Air Pollutant Emission Factors, Supplement No. 5." The factor is estimated at 1.2 tons/acre/month based on empirical studies. In order to determine an emission rate for the project, it was assumed that the 1.2 tons would be emitted 8 hours/day, 5 days/week. To determine a spatial configuration, it was assumed that the emissions would occur along a pipeline corridor 50 feet wide. Estimates of diffusion were made using a simple line source diffusion equation (Turner, 1970). These estimates were then used to determine the order of magnitude of suspended concentrations. The estimates indicated that suspended particulate concentrations close (~100 meters) to the site could reach high values. An actual concentration value is not given here because of the large uncertainty in the source terms used. However, it is safe to assume that the state 24-hour ambient air quality standard for suspended particulates would be exceeded often in the vicinity of pipeline

construction sites. Particulate concentrations within and in the vicinity of tank farm construction sites would be of the same order of magnitude as those at pipeline construction sites.

In order to put the impact of dust generation due to construction activity in perspective, it is useful to look at dust generation from another prevalent activity in both air basins (i.e., agricultural operations). The EPA publication "Compilation of Air Pollutant Emission Factors, Supplement No. 5" contains emission factors for agricultural tilling operations. Using the same silt content and precipitation/evaporation index that was used in estimating the heavy construction fugitive dust emission factor, one can estimate the amount of fugitive dust released from an acre of agricultural tilling. The estimate showed that the rate of dust emission during agricultural tilling is approximately an order of magnitude higher than the rate during construction operations. Therefore, construction operations in general are not as dusty as agricultural operations, though they may last somewhat longer.

Heavy-duty vehicles used during construction would also contribute air pollutants. In order to quantify the pollutants generated by construction vehicles, one would need to know the type of vehicles that would be used as well as the amount of their use. Since neither is known at this stage of the project, it is difficult to estimate construction vehicle emissions with any accuracy. However, experience with similar projects indicates that construction vehicle emissions do not create a significant adverse impact off the construction site. Therefore, there is no apparent reason to assume that construction vehicle emissions would present a significant problem in this project.

2. Operation

The primary operational impact of oil transport would be hydrocarbon emissions from crude oil tank farms. Hydrocarbons, particularly

those of the reactive variety, participate in photochemical reactions to form oxidants and are of major concern. Other less significant sources of air pollution would be emissions from the pipeline pumps.

Tank Emission Calculation. The Elk Hills Tank Farm would contain five tanks, each with capacities of 250,000 barrels (210 feet diameter, 40 feet high). One tank would normally be reserved for denser Shallow Zone crude and four would be used for lighter Stevens Zone crude. The Coalinga Tank Farm would also contain five tanks of 250,000 barrel capacity with four reserved for Stevens crude and one reserved for Shallow crude. All of the tank covers are proposed to be floating roof with primary metallic shoe seals and secondary seals extending from the roof to the tank wall.

The most widely used method for calculating hydrocarbon emissions from storage tanks was developed by the American Petroleum Institute (1972A). This method has recently been revised by the Environmental Protection Agency (EPA, 1977). An emission equation correlates various parameters (i.e., tank diameter, vapor pressure, type of construction, color, and wind speed) with empirical measurements of tank emissions.

There are two major sources of hydrocarbon losses from petroleum storage tanks: standing storage losses and withdrawal losses. Study has shown that actual hydrocarbon losses are much less than the EPA emission factors predict. The EPA and the California ARB have reached a consensus that storage losses are approximately 25 percent of the calculated emission factors (Chicago Bridge and Iron, 1977). Withdrawal losses for crude oil are estimated at 10 percent of the EPA emission factors which were developed for gasoline (Chicago Bridge and Iron, 1977). These adjustments are reflected in the emissions calculations in this section.

In order to accurately convert the volume loss estimates into a mass loss estimate, the constituents of the vapor phase should be known. Such information is available for both of the Elk Hills crude oils in terms of mole percent:

	<u>Stevens Mole %</u>	<u>Shallow Mole %</u>
CO ₂	0.02	3.78
Methane	0.69	46.07
Ethane	3.08	3.04
Propane	52.63	30.87
i Butane	8.95	3.53
n Butane	21.86	6.87
i Pentane	8.35	2.69
n Pentane	2.25	1.30
Hexane (C ₆ +) <u>2.23</u>	<u>2.23</u>	<u>1.81</u>
	100	100

Assuming that mole percent and mass percent of the vapor phases are equivalent (by application of the perfect gas law), a weighted mass or molecular weight of the vapor phase of each crude can be obtained by multiplying each mole percent by the molecular weight of each constituent. This procedure yielded vapor molecular weights of 42.3 lb/lb-mole for Stevens crude and 34.4 lb/lb-mole for the Shallow crude.

Using the derived molecular weights in the EPA emission factor equation, hydrocarbon emissions in mass per unit time can be calculated. The estimates assume that both crudes will be stored at 90°F at both tank farms and that the average wind speed is 6 mph at the Coalinga tank farm site and 7 mph at the Elk Hills site. The derived true vapor pressure of Stevens crude is therefore 9.0 psia and 2.2 psia for Shallow crude. The estimates for both storage and withdrawal hydrocarbon losses are shown in Table 0-1.

Table 0-1
REACTIVE HYDROCARBON EMISSIONS (RHC) FROM PROPOSED
SAN JOAQUIN VALLEY TANK FARMS
(lbs/hour)

TANK FARM	RHC EMISSIONS
Elk Hills	10.7
Coalinga	10.3

Only a portion of total hydrocarbon emissions (e.g., C_3 and above paraffins) are moderate or highly photochemically reactive according to the ARB classification. Based on the constituents of the vapor phase of both Shallow and Stevens crude, the C_3 and above hydrocarbons represent approximately 95 percent of the total mass. Therefore, moderate or highly reactive hydrocarbons comprise about 95 percent of the total hydrocarbon emissions.

Impact on Oxidant Concentrations. The interactive impact of hydrocarbon emissions on oxidant concentrations is a difficult element to determine. Diffusion models have been developed that account for the complex interactions involved in the photochemical process. However, the data inputs required in terms of area-wide emissions and meteorology make their use infeasible except in areas where such data have already been compiled. These necessary inputs have not been compiled in sufficient detail for the San Joaquin Valley.

A second potential method is to use a simple diffusion model to estimate downwind reactive hydrocarbon concentrations, comparing those concentrations with the national non-methane hydrocarbon standard. One must exercise care when using such a method, however, since the relevant concentration is at a distance far enough downwind to assure

that the hydrocarbons have been mixed in the vertical layer and have had time to react.

The final method that can be used to estimate the impact of hydrocarbon concentrations on oxidant concentrations is what is commonly referred to as the proportional technique. This technique is at best semi-quantitative, as it assumes that an incremental increase in hydrocarbon emissions in a given air basin will result in an equal incremental increase in oxidants. Despite the limitations of the proportional technique, it will be used in this study in order to estimate the magnitude of effects from the tanks' emissions on oxidant concentrations.

The smallest geographical breakdown of emissions available in the San Joaquin Valley is by county. Therefore, the analysis is limited by the fact that project emissions cannot be compared with an emissions unit any smaller than countywide. An examination of the location of the source and the meteorology of the tank farm areas can yield the most useful comparisons to make.

The Elk Hills Tank Farm is located on the west side of the San Joaquin Valley in Kern County and lies in an area of northwesterly winds during the summer oxidant season. Therefore, emissions would be transported to the south and east, into the southernmost part of the San Joaquin Valley. The emissions would probably not be transported directly to the Bakersfield area because of its distance and direction from the Elk Hills site. The more likely impact area is that area south of Bakersfield (e.g., Wheeler Ridge) where high oxidant concentrations have been recorded due to existing transport from the Bakersfield area. Since the major emissions of Kern County tend to move to the same area, emissions from the proposed tanks can be compared with Kern County emissions.

The Coalinga Tank Farm is located on the west side of the San Joaquin Valley in southern Fresno County. It also lies in an area of northwesterly winds during the summer oxidant season. Emissions therefore would be transported to the south and east initially. Emissions from the tank farm would rarely affect areas to the northeast in Fresno County due to the lack of wind in that direction. It was hypothesized in Appendix G that emissions could be carried from the west side to the east side of the valley with the counter-circulation that frequently develops. While this is true, the distances involved (greater than 50 miles) would not be conducive to maximum oxidant formation. Visalia, on the east side of the valley, records some of the highest oxidant concentrations in the valley. This is probably due to its downwind proximity to the Fresno urban area, however, since there appears to be a lack of significant sources at present on the west side to cause significant elevated oxidant concentrations. It seems most likely, therefore, that emissions from the Coalinga Tank Farm would mix with Kings County emissions and affect oxidant concentrations within or just downwind of Kings County.

Tank emissions could spread further and affect the southern and eastern San Joaquin Valley during extended periods of stagnation (e.g., 3 to 5 days). Maximum impact upon oxidants due to tank emissions, however, would be realized downwind from the tank farm several hours after release. Therefore, the most useful comparison to make is Coalinga storage facility emissions with Kings County emissions.

Table 0-2 presents a comparison of Elk Hills RHC emissions with Kern County RHC emissions, and also Coalinga emissions with Kings County emissions. Although it was reasoned previously that the comparisons were appropriate ones to make, the variability inherent in transport phenomena could vary the background air pollution with which tank farm emissions would mix. The comparison, then, serves only as an order-of-magnitude estimate of the impact of tank emissions.

Table 0-2

ELK HILLS AND COALINGA TANK FARM RHC EMISSIONS
IN COMPARISON WITH 1980 KERN AND KINGS COUNTY RHC EMISSIONS
(lbs/hour)

TANK FARMS	TANK FARM RHC	KERN CO. RHC	KINGS CO. RHC	PERCENT OF COUNTY
Elk Hills	8.9	13,417	-	0.07%
Coalinga	8.6	-	2,525	0.34%

As can be seen from the table, the estimates for percent contribution to Kern and Kings counties differ by a large amount, even though tank farm emissions in both areas are nearly identical. This is due to the existing low RHC emission rate in Kings County. Although the percent contribution is larger in Kings County than in Kern County, oxidant concentrations are probably lower in Kings than in Kern County. Therefore, the affect of tank farm emissions on oxidant concentrations in both areas would probably be similar. The 0.07 percent and 0.34 percent contributions are significant considering that the oxidant standard is presently exceeded in the San Joaquin Valley. Although the contribution of tank farm emissions is relatively small, they would undoubtedly cause a small increase in downwind oxidant concentrations and possibly a small number of additional oxidant standard violations.

A check was made on the order of magnitude estimate by calculating downwind reactive hydrocarbon concentration and comparing that concentration with the non-methane hydrocarbon standard. Assuming a light wind (2 mph), hydrocarbon emissions would be transported approximately 4 miles in 2 hours, a minimum time for significant oxidant

formation. Under condition of moderately unstable atmospheric conditions (C stability as defined by Pasquill), the hydrocarbons would be relatively well mixed in the vertical at 4 miles downwind. The estimated 1-hour RHC concentration at 4 miles, under the above atmospheric conditions, is 0.042 ppm as methane. This concentration is small compared to the 0.24 ppm non-methane HC standard, which implies that neither of the tank farm emissions would cause the oxidant standard to be exceeded in and of themselves. There would be a small additive effect, however, to existing hydrocarbon and oxidant concentrations, which is consistent with the conclusion of the previous analysis.

The county-wide emissions inventories used for comparison represent average emissions in the year 1980, since the project is expected to be completed in 1979. The general trend in hydrocarbon emissions is generally downward because of increasing motor vehicle emission controls and additional stationary source controls. New future sources of hydrocarbons could slow or reverse the present trend, such as increased petroleum production in the San Joaquin Valley. Emissions from petroleum production and related operations, such as the proposed Elk Hills petroleum production, would create an impact on oxidant concentrations in addition to emissions from the tank farm. Such cumulative impacts will be discussed at the end of this section.

The Air Quality Maintenance Planning (AQMP) effort, currently underway in Kern and Fresno counties, will consider the cumulative impact of additional petroleum-related activities. The regulatory power embodied in the AQMP has not been defined as yet, however.

Current regulations that the project would have to meet include the Federal New Source Review. A determination would have to be made by the Environmental Protection Agency whether the project would interfere with the attainment or maintenance of the National Ambient Air Quality Standards. If the EPA rules that the project would interfere,

it can require additional mitigating measures to reduce emissions before a permit is granted. It is the conclusion of this analysis that the project would interfere with the attainment of the NAAQS for oxidant levels since that standard is already violated throughout the San Joaquin Valley.

3. Cumulative Impacts

In the event that the Federal government would select the Coalinga alternative for the transportation of Elk Hills crude oil, it may be necessary to effect emissions affects for hydrocarbons. The tank farm emissions in Kern and Fresno counties are below the ARB, EPA, and individual county new source review emission limits. However, the EPA is expected to review the entire Elk Hills project, including the production of crude oil and its transportation. In that event, hydrocarbon emissions would be well in excess of the EPA New Source Review limit on emissions from a new project. The Federal government, therefore, would seek to effect emissions offsets in the San Joaquin Valley Air Basin.

A study is currently underway to determine potential sources for offsets. Such sources could include refineries, petroleum production and storage facilities, government installations, and dry cleaning establishments.

APPENDIX P
ELK HILLS CRUDE OIL MARKETS
AND MARKETING FACTORS

Appendix P
Elk Hills Crude Oil Markets and Marketing Factors

This appendix examines the potential markets and marketability of Elk Hills crude oil. Of fundamental significance to these marketing questions are the characteristics of the oil itself: its physical properties, the quantities in which it would become available, its potential distribution as determined by its conveyance systems, and the legal and economic constraints upon its sale.

Elk Hills Crude Oil

Physical Properties. Elk Hill crude oil is of two types, Shallow Oil Zone (Shallow Zone) and Stevens Zone. The principal physical properties of each type are contrasted with those of Alaskan North Slope crude oil in Table P-1. The two Elk Hills crude oils have similarly low sulphur contents, but differ significantly from each other in weight: Shallow Zone oil is relatively heavy while Stevens Zone oil is relatively light.

Production. The Navy estimates that peak production of Elk Hills crude oil would be between 250 and 300 MB/D,* while Standard Oil Company if California estimates that peak production would be only 200 MB/D.**

*Thousands of barrels per day.

**Biennial Report: Fossil Fuel Issues Report, Part II: The Elk Hills Naval Petroleum Reserve and California Energy Planning, California Energy Resources Conservation and Development Commission, November 1976 (hereinafter referred to as CERC), p. 12.

This range of estimates represents only 57 to 86 percent of the 350 MB/D pipeline capacity required by Congress to be available by 1979, and 5.3 to 8.3 percent of the total crude oil projected to be available for processing on the west coast* in 1982.**

Table P-1

PHYSICAL PROPERTIES OF ALASKAN NORTH SLOPE
AND ELK HILLS CRUDE OILS

CRUDE OIL TYPE	GRAVITY (API°)	SULPHUR CONTENT (%)
Alaskan North Slope ¹	26.8	1.04
Elk Hills ²		
Shallow Zone	20-26	.4-1.0
Stevens Zone	35-36	.3-0.5

¹Source: Chemical Engineering, 17 March 1977, p. 83.

²Sources: U.S. Energy Research and Development Administration, Bartlesville Energy Research Center, November, 1976, and U.S. Department of the Navy, Officer in Charge of Naval Petroleum Reserve in California, November 1976.

PL 94-258. On 5 April 1976 Congress passed the Naval Petroleum Reserves Production Act of 1976 (PL 94-258), which included provisions for the administration and development of the Elk Hills Naval Petroleum Reserve. The Act required the Navy to begin production at Elk Hills at the "maximum efficient rate" by mid-1976, and to continue production until 1982, with possible extensions to 1985 and beyond. Although the Act does not mandate specific production levels, it does require that a

*As used herein, "west coast" refers to Petroleum Administration for Defense District V (PADD V), a seven-state area including Alaska, Washington, Oregon, California, Arizona, Nevada, and Hawaii.

**California and the Disposition of Alaskan Oil and Gas - A Working Paper, California State Lands Commission, June 1976 (hereinafter referred to as SLC), Appendix 1.

crude oil transportation system, sufficient to accommodate not less than 350 thousand barrels per day (MB/D) of Elk Hills crude oil, be operational by April 1979.

Among the provisions of PL 94-258 that may affect the marketability of Elk Hills crude oil are the following:

- o Contracts for sale are limited to periods of no more than one year
- o No contract may be awarded which would result in any person obtaining control, directly or indirectly, over more than 20 percent of the estimated United States share of Elk Hills production
- o Up to 25 percent of the United States share of production may be set aside for sale to small refiners
- o New pipelines built to transport Elk Hills crude oil must be common carriers.

Conveyance Systems. Transportation of Elk Hills crude oil to its potential markets would be provided through available capacities of existing pipeline networks and through one or more new conveyance systems required to be operational by 1979. These proposed alternative systems are described in detail in the text of this EIS. Briefly, they consist of the following:

- o Pipeline facilities for transporting 200 MB/D from Elk Hills to a connection with the proposed SOHIO Pipeline at Rialto, which would transport crude oil to Midland, Texas, for possible distribution to Midwest Gulf Coast, Great Plains, and Eastern markets
- o Pipeline facilities for transporting 200 MB/D from Elk Hills to pipeline connections at Coalinga for transporting oil to the San Francisco Bay Area.

West Coast Crude Oil Surplus

During the mandated period of Elk Hills crude oil production, the dominant characteristics of the west coast crude oil market is expected to be a surplus, brought on primarily by the influx of Alaskan North Slope crude oil. This anticipated surplus is best illustrated by comparing projections of available refinery capacities and crude oil production.

The California State Lands Commission's estimates of aggregate capacities of west coast crude oil refineries are shown in Table P-2; its estimates of total crude oil to become available to these refineries are shown in Table P-3. Comparison of the two tables reveals projected surpluses of 300 to 600 MB/D in 1978, and 750 to 900 MB/D in 1982. These projections are supported by those of other forecasters, whose estimates are shown in Table P-4. Although the ranges of these estimates vary considerably, due to a number of presently irreducible uncertainties, forecasters agree unanimously that the west coast faces a substantial crude oil surplus during the mandated period of maximum Elk Hills crude oil production.

Factors Affecting Crude Oil Acquisition Patterns

The determination of the probable markets for Elk Hills crude oil in a west coast surplus situation requires an understanding of the factors that determine the acquisition patterns of its potential purchasers -- the oil companies. The Federal Energy Administration has identified the following key considerations as determinants of these patterns:*

Crude oil acquisition costs and relative profitabilities. A major objective of oil companies is to maximize profits by minimizing crude

*U.S. Federal Energy Administration, North Slope Crude: Where To? How?, October 1976, pp. 145-159 (Hereinafter referred to as FEA).

Table P-2
WEST COAST (PADD V) REFINING CAPACITY (MB/D)¹

	1974 ²	1978	1982
<u>DEMAND</u>			
PADD V Petroleum Products	2,200	2,800	3,200
<u>SUPPLY</u>			
Refining Capacity ³	2,354	2,354	2,800
Forecasted New Capacity ⁴	--	400-500	300-400
Total Capacity	<u>2,354</u>	<u>2,750-2,850</u>	<u>3,100-3,200</u>
Crude Processed at 81% in 1974 (at 90% in 1978-82) ⁵	1,900	2,475-2,550	2,800-2,900
Net Product Imports, Natural Gas Liquids, etc., to meet demand	<u>300</u>	<u>250-325</u>	<u>300-400</u>
Total Supply	<u>2,200</u>	<u>2,800</u>	<u>3,200</u>

¹Source: SLC, Appendix 1.

²1974 data per Bureau of Mines, "Monthly Petroleum Statement," December, 1974, and January, 1975. The category, "Net Product Imports. . .to meet demand," includes net offshore imports 40 MB/D, imports from other PADD districts 116 MB/D, NGPL 60 MB/D, refinery gain 76 MB/D, and stock changes 7 MB/D.

³1978 refining capacity additions include 350 MB/D Standard Oil (California) plus 50-150 MB/D for other possible additions, expansions, and de-bottlenecking which may occur. 1974 refining capacity has been carried over to 1978 and 1982 despite the fact that a 30 MB/D plant which operated during 1974 has now been closed.

⁴1982 refining capacity additions were selected to preserve the historical relationship between total demand and refining capacity.

⁵In view of both the changing product demand slate and the addition of new refining capacity, an assumption of high refining utilization is quite optimistic. Due to refinery turnarounds and downtime, 90 percent utilization is representative of an efficient refining operation. Selection of a lower utilization would, of course, result in a larger crude surplus.

Table P-3

WEST COAST (PADD V) CRUDE SUPPLY (MB/D)¹

	1974 ²	1978	1982
Crude Processed ³	1,900	2,475-2,550	2,800-2,900
Crude Source			
California Production	890	850	750
Alaskan Cook Inlet	190	150	150
Other U.S. Districts ⁴	45	-	-
Canadian Imports ⁵	190	100-0	-
Other Foreign Imports ⁶			
Persian Gulf and Other Sour Crudes	310	-	-
Indonesian and African Sweet Crudes	275	450-550	500
New California Production			
Offshore	-	0-75	350-400
Elk Hills	-	100-250	-
Alaskan North Slope	-	1,200	1,800-2,000
Total Crude Available for Processing	1,900	2,850-3,075	3,600-3,800
West Coast Crude Surplus	-	300-600	750-900

¹Source: SLC, Appendix 1.

²1974 data per Bureau of Mines, "Monthly Petroleum Statement," December, 1974. California production includes 2 MB/D Elk Hills.

³Crude production forecasts for 1978-82 are SOHIO estimates. The DeGolyer and MacNaughton (Independent Petroleum Consultants) report, "Prediction of Oil Production Rates from Petroleum Administration for Defense District V," confirms the forecast. DeGolyer and MacNaughton projects the following: 1978: total production 2,271 MB/D of which 1,200 MB/D represents North Slope Alaska, 208 MB/D represents other Alaska, and 863 MB/D California; 1982: total production 2,955 MB/D of which 1,700 MB/D represents North Slope Alaska, 412 MB/D represents other Alaska, and 843 MB/D California. The DeGolyer and MacNaughton figures exclude Elk Hills. SOHIO PADD V totals excluding Elk Hills are 2,250 MB/D in 1978 and approximately 2,925 MB/D in 1982.

⁴Crude from other U.S. districts has been eliminated in 1978-82.

⁵Canadian imports are assumed to drop into the range 0-100 MB/D consistent with Canada's announced export curtailment and FEA allocation plans.

Table T-3 (cont.)

⁶ Foreign crude imports are determined as follows: we have assumed that all sour crude refining capacity not filled by California sour crude will be filled by North Slope or Elk Hills production, thus, displacing all imports of sour foreign crude. Due to both refinery configuration and product specifications, however, sweet crude imports will continue to be imported to supplement sweet California and Cook Inlet production. Assuming new refinery capacity to be 100 percent sour and that product sulfur specifications will not be tightened, sweet crude import requirements can be estimated from historical data. Prior to the Arab oil embargo world crude oil prices were such that sour foreign crudes were the most economic crudes, and refinery utilization was normal. In the first ten months of 1973, 826 MB/D foreign crude was imported of which 386 MB/D was sour and 440 MB/D sweet. Thus, in 1978-82 approximately 550 MB/D sweet crude (440 MB/D plus 50 MB/D to replace Cook Inlet decline plus 45 MB/D to replace other U.S. districts) must be imported from Canada and offshore to balance refinery runs.

Table P-4

FORECASTS OF WEST COAST (PADD V) CRUDE OIL SURPLUS (MB/D)¹

FORECASTER	1978	1980	1982	1985
Sohio	320-600	-	660-960	-
Exxon	552	697	-	1,797
Rand (Med Use, Med Prod)	320	-	-	751
A.D. Little (Best)	-	689	-	805-1,395
Standard Oil Company (California)	-	600	-	600
Arco	300-400	500-600	-	850
Federal Energy Administration	600	900-1,100	-	700-1,300

¹Source: CERC II, p. 13.

oil acquisition costs. These costs vary considerably from country to country, but generally consist of two components: production costs, and government royalties and taxes.

Stability of supplies. The commercial success of oil companies depends upon their abilities to maintain product supplies to their customers during crude oil shortages and to find outlets for excess crude oil during periods of oversupply. As a result, long-term supply continuity and security has had a commercial value that oil companies have considered in making their acquisition decisions. The Arab oil embargo gave added weight to considerations of supply stability. Companies must now be concerned not only with the risk of supply interruptions due to technical breakdowns, but also with the threat of embargoes. The principal protection against such interruptions is diversification of supply sources.

Technical Factors. In general, oil companies seek to optimize their combinations of crude oil streams and refinery capabilities to provide the product yields best suited to their markets, while maintaining flexibility to adjust to variable seasonal and economic factors.

Transportation costs and availabilities. The availabilities of tanker, port, pipeline, and related crude oil transportation facilities, and the relative costs of using them, are also major factors influencing crude oil acquisition patterns. Because of a current international tanker surplus, tanker availability is not likely to be a major consideration on a worldwide basis for the next 5 to 10 years. However, domestic shipments may face some constraints due to the requirements of the Jones Act that American-built, owned, and operated vessels be used between American ports.

Tax and Financial Considerations. Oil companies must weigh the relative tax advantages of alternative crude oil supply sources in

determining their acquisition patterns. Historically, foreign tax credits have played significant roles in determining companies' profitabilities, since investments in some countries offer significant tax advantages over investments in others. Similarly, a company's overall financial condition may influence its acquisition decisions. For example, the heavy debt service requirements incurred by companies investing in the Trans-Alaska Pipeline System provide them with strong incentives to maximize their uses of North Slope crude oil.

Marketing Contracts and Systems. The flexibility of supply sources is constrained by requirements of refineries for steady supplies of crude oil. If these supplies are not available through a company's own sources, it must seek long-term contracts with other private domestic companies, OPEC government companies, or other foreign sources. In making such arrangements, refiners place implicit values on the security of their supplies. The structure of a company's marketing system also constrains its crude oil acquisition decisions, since companies generally serve established markets and may not be organized to market in unfamiliar areas.

Relationships Between Foreign Governments and International Oil Companies. Governments of oil-producing countries have recently begun imposing production and export restrictions on company production operations. These restrictions have curtailed the flexibilities of companies to expand or reduce production and raise or lower prices. While further supplies of imports to the west coast will reflect these changing circumstances, oil companies crude oil acquisition patterns may be expected to reflect historical patterns for the next 5 to 10 years.

In order to maintain degrees of both stability and flexibility in crude oil supplies, acquisitions by most oil companies are secured through contracts or other long-term arrangements and are supplemented by purchases on the open market. The mix of these acquisition methods

varies widely from company to company, depending upon commercial strategies and established relationships with supply sources. Within the operating constraints on available supplies, transportation alternatives, and commercial strategies, oil companies have strong incentives to seek minimum long-term average crude costs consistent with long-term supply assurances and specific market conditions.

Within this overall framework of crude oil acquisition decision factors, however, oil company decision-makers face major uncertainties concerning future crude oil production and production potentials; international crude oil prices; changing demands for refinery products; refinery economics; energy system uncertainties concerning availabilities, costs, and regulations for other fuels; and the eventual fates of various proposed transportation alternatives for alleviating the projected west coast crude oil surplus. Because of these uncertainties, and the resulting natural reluctance on the part of oil companies to speculate on their own future acquisition patterns, it is impossible to predict with assurance the market response to future Elk Hills crude oil offerings. In spite of these uncertainties, however, some general observations concerning future distribution of Elk Hills crude oil may be suggested.

California Refineries

The most immediate potential markets for Elk Hills crude oil consist of California refineries. These refineries and their locations, processing limitations on sulphur content and gravity, throughput capacities, and known expansion plans are shown in Table P-5.

Present Markets

Several California refiners are presently Elk Hills customers, and may be considered to be likely future market prospects since their

Table P-5
CALIFORNIA REFINERIES¹

Legend

* = Share in Alaskan North Slope Oil
() = Nonoperating

COUNTY	CITY	COMPANY	GRAVITY REQUIRED (API)	SULFUR LIMIT (% WEIGHT)	PRESENT REFINERY CAPACITY (B/D)	PLANNED (B/D)	COMPLETION DATE
Contra Costa	Hercules	Gulf Oil	54	0.2	(27,000)	Sold to Coastal States Gas Corporation. Built for Bolivian crude which is unavailable.	
	Martinez- Avon	Phillips Petroleum Co.	Any	1.8	110,000*	The sale of this facility to the Oil Shale Corp. is in progress. (TOSCO)	
		Shell Oil Co.			100,000		
	Martinez	Urich				30,000 new.	1979
	Richmond	Standard Oil Co. of California	Any	Any	190,000*	175,000-crude distil- lation and desulfur- ization -- Arabian or Alaskan.	1976
	Rodeo	Union Oil of California	13-36	2.0	<u>111,000</u>		
CONTRA COSTA SUBTOTAL					538,000	<u>205,000</u>	

Table P-5 (cont.)

COUNTY	CITY	COMPANY	GRAVITY REQUIRED (API)	SULFUR LIMIT (% WEIGHT)	PRESENT REFINERY CAPACITY (B/D)	PLANNED (B/D)	COMPLETION DATE
Kern	Bakers- field	Kern Co. Refinery, Inc.	25-30	1.5	15,900		
		Mohawk Petroleum Co.	28	1.0	22,100	30,000-crude distil- lation to replace existing refinery, also hydrodesulfurizer -- Additional crude to be Alaskan North Slope or Elk Hills.	Proposed
		Road Oil Sales, Inc.			1,500 (1,100)		
		Sabre Oil and Refining Co.	20-35	2.0	3,500		
		San Joaquin Oil Co.	26 Maximum	Any	29,300		
		Standard Oil Co. of California	30-32	1.0	26,000*		
		Sunland Refinery Corp.	20-35	1.0	15,000		
		Tenneco			(1,200)	No plans for start-up.	
		Toscopetro Corp.	20	1.5	40,000		

Table P-5 (cont.)

COUNTY	CITY	COMPANY	GRAVITY REQUIRED (API)	SULFUR LIMIT (% WEIGHT)	PRESENT REFINERY CAPACITY (B/D)	PLANNED (B/D)	COMPLETION DATE
Kern	Oildale	West Coast Oil Co.	12-30	0.7	15,000		
		Wilco Chemical Corp.	13-15	1.5	11,000		
		KERN COUNTY SUBTOTAL			180,500	30,000	
Kings	Hanford	Beacon Oil Co.	25-35	1.0	12,100		
Los Angeles	Carson	Atlantic Richfield Co.	10-70	1.3	185,000*		
		Fletcher Oil and Refining Co.	29-36	0.3	20,000		
		Golden Eagle Refining Co., Inc.	17-40	1.0	13,000	28,500-increase to handle Alaskan crude.	Proposed
	El Segundo	Standard Oil Co. of California	Any	Any	230,000*	175,000-crude distillation and desulfurization.	1976
	Long Beach	Edgington Oil Refineries, Inc.	20-25	Any	29,500		

Table P-5 (cont.)

COUNTY	CITY	COMPANY	GRAVITY REQUIRED (API)	SULFUR LIMIT (% WEIGHT)	PRESENT REFINERY CAPACITY (B/D)	PLANNED (B/D)	COMPLETION DATE
Los Angeles	Newhall	Newhall Refinery Co., Inc.	17-25	1.3	11,500		
	Paramount	Douglas-Continental Oil Co.	27-31	2.5	35,000	11,000	1975-76
	Sagus	Lubrication Co. of America	19	0.5	500		
	Santa Fe Springs	Powerline Oil Co.	25-35	1.5	46,000	Undetermined moderni- zation.	
		Gulf Oil Co.	29-31	1.3	51,500	Undetermined moderni- zation.	
	Signal Hill	MacMillian-Ring- Free	20-35	1.5	12,200		
	South Gate	Lunday-Thagard Refinery Co.	33-34	1.5	3,222	3,278	1976
	Torrance	Mobil Oil Corp.	20-25	1.5	123,500		
	Wilmington	Champlin Petroleum Co.	17-23	1.5	30,700		
		Shell Oil Co.	30	1.0	96,000		
		Texaco, Inc.	20-35	2.0	75,000		
		Union Oil of California	18-40	1.8	<u>108,000</u>		
	LOS ANGELES COUNTY SUBTOTAL				1,070,622	<u>217,778</u>	

Table P-5 (cont.)

COUNTY	CITY	COMPANY	GRAVITY REQUIRED (API)	SULFUR LIMIT (% WEIGHT)	PRESENT REFINERY CAPACITY (B/D)	PLANNED (B/D)	COMPLETION DATE
San Diego	City of Carlsbad	Pacific Resources, Inc.				100,000 B/D-New Refinery -- Alaskan crude.	
San Luis Obispo	Arroyo Grande	Union Oil of California	12-24	5.0	41,000		
Santa Barbara	Santa Maria	Douglas Oil Co. of California	10-12	5.0	9,500		
Solano	Benicia	Exxon Co., USA	13-40	1.6	88,000*		
Ventura	Oxnard	California Oil Purification				15,000	1976
		Edgington Refinery	9-22	Any	2,500		
		STATE TOTAL			1,942,222	567,778	

Source: SLC, Table 2.

supply logistics and processing routines are already established. However, present sales contracts, which expire in February 1979, carry no guarantees or commitments for future sales or purchases. These present Contracts for Sale, for both California and out-of-state buyers, are shown in Table P-6.

Prospective Markets

In addition to its present buyers, there are a number of other possible markets for Elk Hills crude oil.

Under the SOHIO/ARCO alternative, 200 MB/D of Elk Hills crude oil would initially be piped to Midland, Texas, where it would enter a pipeline system supplying refineries in the Great Plains, the upper Midwest, the East, and the Gulf Coast. This transportation alternative is the most flexible of the pipeline alternatives, and would deliver crude oil to Texas at lower transportation costs than would marine shipping alternatives. It would also have the potential marketing advantage of moving the majority of Elk Hills crude oil production out of the oil-saturated west coast market to domestic refinery markets facing potential crude oil deficits. No California crude oil markets would be supplied by this alternative.

The Elk Hills/Coalinga alternative would afford the least marketing flexibility of the proposed transportation alternatives. Its pipeline would have the capacity to deliver 200 MB/D to existing pipelines carrying crude oil to the San Francisco Bay Area. However, a sales study conducted by the Navy in 1976 indicated an aggregate interest in only 25 MB/D (Stevens Zone) on the part of Bay Area refiners.* While this figure may not be representative of their actual future interest in Elk Hills crude

*Navy, "Sales Study Summary", March 1977.

Table P-6
 AWARDS OF CONTRACTS FOR SALE OF ELK HILLS CRUDE OIL
 (Feb. 1978 - February 1979)¹

B'YER	LOCATION	AMOUNT (B/D)
Powerine Oil Company	Los Angeles	19,500
Fletcher Oil & Refining Company	Los Angeles	3,000
Newhall Refining Company, Inc.	Los Angeles	3,000
U.S.A. Petrochem Corporation	Ventura	11,500
Beacon Oil Company	Hanford	6,500
Pacific Resources, Inc.	Honolulu	19,500
Chevron U.S.A., Inc.	(All of California)	19,520
Sunland Refinery Corporation	Los Angeles	10,000
Mohawk Petroleum Corporation, Inc.	Bakersfield	6,275
TOTAL		98,795

¹Source: Department of Energy, Office of Public Affairs, Washington, D.C. 20461, Weekly Announcements, Vol. 2, No. 9, Week Ending March 15, 1978.

oil, it cannot be considered a positive indicator of a sizable Bay Area market. In the absence of such a market, it is conceivable that Elk Hills crude oil might be shipped from Bay Area terminals. However, this possibility is not contemplated by the present alternative, and is not discussed here.

In the event that the Coalinga alternative is implemented, marine shipment of Elk Hills crude oil to other domestic ports, including those in the Pacific Northwest, would also be possible. Under either alternative, the relatively "sweet" (low sulfur) Stevens Zone crude might be used by Pacific Northwest refiners in place of sweet Indonesian or Canadian imports, which are now being curtailed.

If a "Northern Tier" or "Trans-Provincial" pipeline alternative is implemented to supply American oil to northern tier refiners cut off from sweet Canadian imports,* it may also be possible to partially substitute Stevens Zone crude oil, although it is questionable whether either of these possible pipelines would provide a "competitive outlet" for Elk Hills.**

Marine shipment of Elk Hills crude oil from San Francisco could also reach refineries in the Los Angeles area. These refineries now receive more than 45 MB/D of Elk Hills production and have indicated spare refinery capacities of over 30 MB/D according to the Navy's 1976 sales study.*** While these figures also indicate some refinery interest, they do not suggest the existence of ready major market.

Under none of the proposed alternatives would Elk Hills crude oil be transported directly to California's San Joaquin Valley refineries. These refineries have a combined throughput capacity of approximately

*Washington, Idaho, Montana, North Dakota, Minnesota, and Wisconsin.

**CERC, p. 45.

***Navy, "Sales Study Summary," March 1977.

192 MB/D, 10 percent of the state total. Thus, both collectively and individually, the San Joaquin Valley refineries are relatively small. Because none of the transportation alternatives examined in this EIS is intended to deliver crude oil to them, they will continue to depend primarily upon existing transportation facilities for future Elk Hills crude oil deliveries. Primarily because of these transportation and refinery capacity constraints, the potential future market for Elk Hills crude oil in the San Joaquin Valley may also be considered limited.

Another possible outlet for surplus west coast crude oil is the Far East. Since west coast refinery capabilities are inadequate to handle the projected crude oil supply, since pipelines to other domestic markets have not been built, since "shutting in" domestic production, especially Alaskan production, is economically untenable, and since the costs of shipping Alaskan oil to Gulf and East Coast ports is prohibitive, some oil companies have urged the export of Alaskan North Slope crude oil to Japan or Korea.* This measure, as well as the Northern Tier, or Trans Provincial, or SOHIO pipeline alternatives, would remove some Alaskan oil from the west coast surplus situation, and presumably would result in a general enhancement of the west coast marketability of Elk Hills crude oil.

Another factor that could enhance this marketability is a possible increased requirement on the part of west coast refiners to mix domestic sweet crude oil, such as Stevens Zone oil, with their "sour" (high sulfur) Alaskan crude supplies.** This requirement could result from constraints on feed stock sulphur content due to refinery equipment limitations, production slate demands, or air quality regulations.

*Testimony of Thomas B. Sleeman, Union Oil Company, and M.H. McConnell, Phillips Oil Company, at an FEA public hearing held in San Francisco on 22 March 1977, as quoted in the San Francisco Chronicle, 23 March 1977, p.7. Federal Legislation would be required to permit implementation of this measure.

**In Section I the term "sour" crude oil is used and in that place the more technical aspects of hydrogen sulfide content and corrosion aspects are discussed.

Although these considerations could enhance the general marketability of Elk Hills crude oil on the west coast, their prospects and implications are too uncertain to permit translation into more definite market probabilities at this time.

Summary

The marketing prospects for Elk Hills crude oil in California appear neither very certain nor very bright. Current sales contracts expire in February 1979 (new contracts would then be initiated) and by then shipments of North Slope crude are expected to reach 1.2 MMB/D. Thus, the west coast will almost certainly be entering a period of crude oil surplus with a concomitant saturation of west coast markets. While some present Elk Hills customers may be expected to maintain their acquisition patterns, and other San Francisco and Los Angeles area refiners have expressed some interest or capacity to make future acquisitions, there is now no firm indication that California demand for Elk Hills crude oil will approach its availability at full production.

Although the marketability of Elk Hills crude oil on the west coast could be enhanced by implementation of proposals to move Alaskan oil to other domestic or foreign markets, or by the possible suitability of Stevens Zone crude oil as mixing stock for Alaskan oil at some west coast refineries, the prospects and implications of these possibilities are now too uncertain to permit translation into definite market probabilities.

APPENDIX Q
BUREAU OF LAND MANAGEMENT,
MANAGEMENT FRAMEWORK PLAN

Appendix Q
Bureau of Land Management,
Management Framework Plan



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
800 Truxtun Avenue, Room 311
Bakersfield, CA 93301
Phone: (805) 861-4191
Office hours: 7:30 a.m. to 4:00 p.m. weekdays

IN REPLY REFER TO

1122.3
(C-1615)

Ms. Mary Ann Dewey
U.R.S. Research Company
155 Bovet Road
San Mateo, CA 94402

RECEIVED
DEC 22 1976
URS RESEARCH

Dear Ms. Dewey:

Enclosed is the information which you requested regarding BLM managed lands which the proposed Elk Hills/Port Hueneme pipeline would be likely to cross.

If that route is chosen, we will likely restrict new pipelines to existing corridors. The only existing corridor which would be reasonably close to the Navy's needs is outlined in orange on the enclosed map.

The corridor may also be seen on the U.S.G.S. Taft, Maricopa, Elkhorn Hills and Cuyama 7.5 minute quadrangle maps. We appreciate your willingness to consider our desires in your report.

Sincerely,

H. Edward Lynch, Jr.
Caliente Resource Area Manager

Enclosures: (3)
1 - Map(TC SE¼)
2 - MFP recommendations
3 - Excerpts from PL 94-579



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MANAGEMENT FRAMEWORK PLAN
STEP 2 - MULTIPLE USE RECOMMENDATIONS AND SUPPORTING ANALYSIS

Planning Unit Name Temblor-Caliente

Activity Lands (scenic corridors)

Multiple Use Recommendation(s)

9. Retain all NRL within the identified scenic corridors along State Routes 166 and 33 in S.L.O. county and 119 and Elk Hills Road in Kern County in their natural undeveloped condition. Develop strong stipulations to protect these values for all mineral leases issued within these corridors.

Analysis

9. This recommendation is in agreement with Step I lands activity No. 9 and recreation activity No. 4.

The Kern County general plan identifies portions of State Highway 119 as a county scenic highway; and state routes 33 and 66 are identified as being eligible for such designation (see lands portion of the URA).

It is the Bureau policy to protect and maintain high scenic values on NRL adjacent to or near major travel routes, and to cooperate with other federal, state and local agencies and other interested groups in this effort (I.M. 68-331; BLM 2030; E.O. 11278).

Conflicts

Minerals: Development and exploration may be handicapped by stipulations attached to any lease issued in scenic zones.

Step III Management Decision

Accepted

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MANAGEMENT FRAMEWORK PLAN
STEP 2 - MULTIPLE USE RECOMMENDATIONS AND SUPPORTING ANALYSIS

Planning Unit Name Temblor-Caliente

Activity Lands - Right-of-Ways(unit wide)

Multiple Use Recommendation(s)

3. All existing rights-of-way in the planning unit should be analyzed with consideration of establishing corridors for utility, road and highway and other right-of-way needs. Once the corridors have been identified, all new right-of-way facilities will be restricted to these corridors, and existing r/w facilities outside identified corridors will be relocated or their facilities modified by special stipulations upon expiration of current r/w grants.

Analysis

3. This recommendation is a combination of portions of lands Step I activity recommendations 2 and 3.

The random establishment of right-of-ways in this planning unit has, in many instances, resulted in negative impacting the scenic values of ridge lines along travel routes.

At this time areas such as the Freeborn Hubbard Hills and large blocks of the Temblor and Caliente Mountain ranges have no right-of-ways granted. Establishing right-of-way corridors in the planning unit could protect the scenic and open space values in these areas. Additionally this recommendation has received broad support from the public and other agencies.

Conflicts

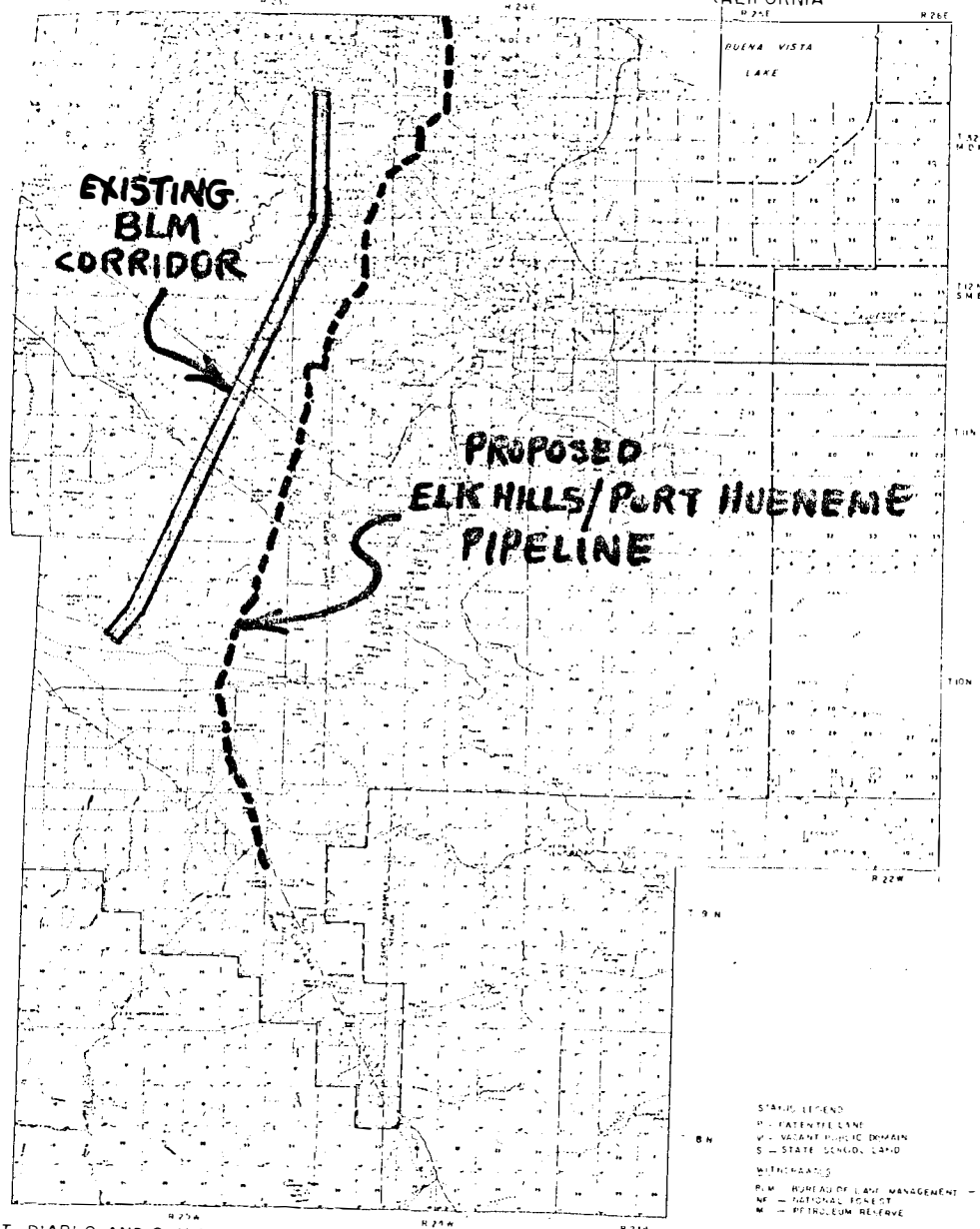
Minerals: development of r/w corridors may conflict with exploration and development of oil and gas leases as well as mineral exploration.

Lands: This recommendation would place additional limits on what constitutes a potential communication site. (Step II lands recommendation No. 1)

Step III Management Decision

Accepted

Pragmatically, major road systems and utility lines as they now exist will become the "corridors". Since they are established, the controversy on location, if it existed, has essentially disappeared; however, the recommendation is sound and R/W's should be analyzed toward objectives of consolidation.



STATUS LEGEND

P - PATENTED LAND
 V - VACANT PUBLIC DOMAIN
 S - STATE SCHOOL LAND

WITHHOLDINGS

P.M. - BUREAU OF LAND MANAGEMENT - *Elk Hills/Port Hueneme Pipeline*
 NF - NATIONAL FOREST
 M - PETROLEUM RESERVE

MT. DIABLO AND SAN BERNARDINO MERIDIANS

1/2" = 1 MILE

01-02

TEMBLOR-CALIENTE PLANNING UNIT SE-1/4

APPENDIX R
ARCHAEOLOGICAL SURVEY OF THE ELK HILLS/
COALINGA PROJECT IN CENTRAL CALIFORNIA

Appendix R
Archaeological Survey of the Elk Hills/Coalinga
Project in Central California

This appendix is an abridged report of an archaeological survey conducted by Miley Holman and David Chavez, San Francisco (qualified archaeologists).

1. Preface

Protection of the precise location of archaeological sites is important to the preservation of these sites from uncontrolled excavation and destruction. Therefore, maps prepared for the following report have been deleted, but they are available to qualified persons and researchers. Uncontrolled access to portions of this report, particularly maps and text containing specific site locations, may result in extensive damage to important historical and archaeological resources as indicated within the body of this document.

2. Archaeological Background

The initial phase of this investigation was conducted at the Archaeological Resources Section, Department of Parks and Recreation, Sacramento. Records, maps, and documents that indicate the location, nature, and condition of all recorded archaeological resources in the general environs of the project area were researched.

Site survey records, as well as the appropriate maps for sections of the following counties were up to date and available at the Sacramento facility: Fresno and Kings. Site survey records for Kern County were examined as well; however, the maps for this county was not available in Sacramento, as they were at the regional offices for the purposes of updating. Therefore, archaeological maps and records at Bakersfield College, Bakersfield, California, were reviewed for the appropriate sections of Kern County.

Records and maps at the various institutions indicate that the following archaeological resources are recorded within the general vicinity of the pipeline routes and project facilities locations; these sites have been located on the maps available to qualified persons and researchers and have been generally located on the maps of Appendix C:

Fre-36, Fre-49; located southwest of the Coalinga tank site and west of the pipeline route in the vicinity of the Guijarral Hills (Maps 1 and 2).
Kin-26; located on Reef Ridge, adjacent to the Sulphur Spring Canyon, west of the pipeline route and Reef Station (Map 4).

Kin-28, Kin-29, Kin-30, Kin-31 and Kin-238; located east of the Kettleman Hills and several miles east of the pipeline route (Maps 5 and 7).

Ker-82 thru Ker-89, Ker-171, Ker-179, Ker-324; located east of the pipeline route in the vicinity of the South Belridge Oil Field, and north of the Elk Hills Reserve tank site and Pump Station (Maps 15, 16, and 17).

Ker-124 thru Ker-126, Ker-50, Ker-529 thru Ker-531; located northeast of the Elk Hills Reserve area (Maps 15, 17, and 18).

Ker-119, Ker-240, Ker-329, Ker-118, Ker-64, Ker-122, Ker-328, Ker-59, Ker-33, Ker-43, Ker-39, Ker-40, Ker-41, Ker-60 and five unnumbered sites; located on the approximated old shoreline of Buena Vista lakebed, east of the Elk Hills Reserve location (Map 19).

The above-mentioned archaeological sites are described in the survey forms in various manners, ranging from "burial mounds" type sites, to "surface scatters" of culturally associated lithic materials. The following notations are presented concerning several areas containing sites that would be affected by the proposed facilities as they are presently located:

The Tule Elk state game reserve area and the canal areas northwest of the reserve are characterized by numerous sites; this area is relatively distant from the Elk Hills reserve area and the McKittrick Valley pipeline route (Maps 16, 17, and 18).

The Pepper Grass Valley area, northeast of the Antelope Plain pipeline route; and the Tulare lakebed area, northeast of the Kettleman Plain pipeline route (Maps 5 and 7).

The Pleasant Valley, Los Gatos Creek area west of the Coalinga tank site and pipeline route (Maps 1 and 2).

These general areas must certainly be considered as highly sensitive regarding the occurrence of prehistoric cultural resources. Other areas that can be regarded as having varying potentials for containing archaeological resources and are located within the general environs of the proposed facility are:

The entire Buena Vista Valley, west of the Buena Vista lakebed, including the area designated for the Elk Hills tank and pump station site. This area was likely innundated at least seasonally up to the present 400 to 500 foot contour levels, during prehistoric times; such a phenomena would establish a high potential for cultural resources throughout this valley along the 400 to 500 foot contours (Maps 14, 15, and 19).

The entire Elk Hills area has been characterized by reports of "grinding bowls," stone tools, and petroglyphs on the part of local inhabitants; petroglyphs have been reported in the hills surrounding the town of McKittrick as well (Maps 14 and 15).

Petroglyphs have been reported by locals in the hills adjacent to the Temblor Valley as well (Map 12).

3. Field Reconnaissance

The field reconnaissance of the proposed tank site locations and conveyance system was conducted from 17 November 1976, through 4 December 1976. The proposed pipeline route consists of approximately 85 miles, all of which could not be surveyed under the limits of the present study. Therefore, a sample reconnaissance of the designated pipeline corridor was conducted. Several factors were of immediate importance in determining the areas to be surveyed: environmental conditions that would be conducive to prehistoric phenomena; accessibility of property; and, of course, known locations of archaeological sensitivity.

In view of such considerations, the following areas along the pipeline route were investigated:

Los Gatos Creek, where it crosses the pipeline route, adjacent to Eldorado Avenue, south of the Coalinga tank site (Map 2).

Zaptato Chino Creek, where it crosses the pipeline route, in the vicinity of Polvadero Gap (Map 2).

Canoas and Garza Creeks, where they cross the pipeline route, between the town of Avenal and Kettleman Station (Map 3).

Big Tar Creek, where it crosses the pipeline route in the vicinity of the Kettleman Plain, north of Reef Station (Map 4).

Several miles of open trench adjacent to Highway 33 and the pipeline route, as it runs through the Antelope Plain.

Chico Martinez and Salt Creeks, where they cross the pipeline route, in the vicinity of the south Belridge oil field (Map 12).

A section of property adjacent to the Temblor Valley, where the pipeline crosses Highway 33 and Highway 54, north of the town of McKittrick (Maps 13 and 14).

A small section of property where the pipeline route crosses Skyline Road, adjacent to the McKittrick Valley (Map 14).

Sections of the Buena Vista Valley, in the immediate vicinity of Buena Vista and Broad Creeks, where the Elk Hills tank site and pumping station is located (Map 15).

During the inspection of these areas, particularly close attention was given to the potential presence of those features that indicate the existence of prehistoric cultural activities: changes in soil color, composition and texture, indicating the occurrence of midden; unusual ground contours or changes in vegetation patterns; the presence of fire-cracked rock, obsidian, and chert flaking wastes; the presence of charcoal and charred faunal remains; and the occurrence of any artifactual materials.

4. Conclusions and Recommendations

During the course of the sample field investigations, no new unrecorded archaeological resources were encountered nor were any existing archaeological resources found to be impinged upon by the proposed pipeline route. This archaeological field reconnaissance of the Elk Hills/Coalinga project facilities constitutes a sample survey of the total proposed project area. A detailed archaeological survey of areas that contain environmental settings conducive to prehistoric cultural activities will be made after the pipeline route has been surveyed and staked.

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