ALASKA NATURAL GAS TRANSPORTATION SYSTEM

Final Environmental Impact Statement

LOS ANGELES

MARCH 1976

U.S. DEPARTMENT OF THE INTERIOR

WASHINGTON, D.C. 20240

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This final Environmental Impact Statement has been prepared under the provisions of Section 102(2)(C) of the National Environmental Policy Act of 1969 (P.L. 91-190). Contact regarding the document should be addressed to:

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SUMMARY

( ) Draft   (x) Final Environmental Statement
United States Department of the Interior, Alaska Natural Gas Transportation System EIS Task Force

1. Type of action: (x) Administrative   ( ) Legislative

2. Brief description of action: Action pending is granting rights-of-way permits for crossing Federal lands. A 5,580-mile buried pipeline has been proposed to transport natural gas from Prudhoe Bay (Alaska) to markets in the lower United States. The pipeline, as proposed, would cross all, or portions of, Alaska; Yukon Territory, Northwest Territories, British Columbia, Alberta, and Saskatchewan (Canada); and Idaho, Washington, Oregon, California, Montana, North Dakota, South Dakota, Minnesota, Iowa, Illinois, Indiana, Ohio, West Virginia, and Pennsylvania. As proposed, all activities necessary for pipeline construction and operation will be phased over a seven-year period. Of all lands traversed by the proposal, 406 miles will involve lands under the jurisdiction of five Federal agencies, all of whom have permitting authority. Other permits or licenses also must be issued before construction may begin or the project becomes operational.

3. Environmental impact and adverse environmental effects: Because of the linear nature of the proposal, a wide spectrum of environmental impacts will occur if the pipeline is built. Impacts, which are detailed in the Overview and geographically-oriented volumes, will occur on climate, topography, geology, soils, water resources, vegetation, fish and wildlife, social and economic environments, land use and productivity, cultural resources, recreation and esthetics, and air quality (including noise). All impacts will not be adverse.

4. Alternatives considered: Alternatives covered include the courses of action open to the Secretary of the Interior to approve, deny, postpone, or accept and delay or deny part of the proposal; effects of gas deregulation and conservation; other natural gas sources; alternative energy sources and modes of transportation; and one major alternative transportation system involving an all-Alaska gas pipeline, liquefaction plants, and LNG tanker transport to the conterminous United States.

5. Comments have been received from the following: Comments were received from 23 Federal agencies, 35 State and local governments, Canada, 17 companies representing industry, 16 private organizations, 100 individual citizens, and three members of Congress. Comments from Federal agencies, State and local governments, Canada, private organizations, and members of Congress are reproduced in the Consultation and Coordination volume. Other comments will be reproduced and filed as a supplement to this statement at selected repository sites.

6. Date made available to CEQ and the public:

Draft statement: July 28, 1975
Final statement: MAR 1976

Note for Readers

This environmental impact statement was prepared in response to applications made to the Secretary of the Interior for permits to cross Federal lands with a natural gas pipeline. It identifies and evaluates environmental impacts that could be expected from construction and operation of the "Alaska Natural Gas Transportation System" as proposed by the consortium of companies listed in the Consultation and Coordination volume. It was prepared by an interdisciplinary team, most of whom are employees of the United States Department of the Interior.

Detailed construction designs and detailed plans for site restoration and system operation are not complete at this (proposal) stage of the project. For this reason, some of the impacts and mitigating measures are expressed in ranges of magnitude or qualified to reflect alternative situations.

The Secretary of the Interior considers a number of factors in reaching his decision regarding issuance or denial of right-of-way permits. The environmental impact analysis presented in this statement is an important but not necessarily the deciding factor. Alternative gas transportation systems proposals, United States-Canada diplomatic relations, national economic and risk analyses, national defense implications, energy efficiency analyses, and other factors must also be considered.

This statement is presented in nine volumes as follows:

Overview Volume	North Border Volume
Alaska Volume	Alternatives Volume
Canada Volume	Consultation and Coordination Volume
San Francisco Volume	Glossary Volume
Los Angeles Volume	

Alaska, Canada, San Francisco, Los Angeles and North Border Volumes are geographically oriented. The Overview Volume, Alternatives Volume, and Consultation and Coordination Volume are not geographically oriented in their coverage.

The following subject groupings are covered sequentially in each of the geographically oriented volumes and Overview:

1. Description of the proposal.
2. Description of the environment.
3. The environmental impact of the proposed action.
4. Mitigating measures proposed and additional measures considered.
5. Adverse effects which cannot be avoided should the proposal be implemented.

6. The relationship between local short-term uses of (man's resources) and the maintenance and enhancement of long-term productivity.
7. Irreversible and irretrievable commitments of resources associated with the proposed action.
8. Alternatives to the proposed route.

The reader can review particular segments of the proposed project selectively. For example, a reader interested only in impacts on North Dakota, could use the Overview Volume for the system "big picture," and the North Border Volume for coverage of his particular State. Similarly, a person interested primarily in ways of transporting natural gas could refer to the Alternatives Volume and satisfy his needs.

Following is a brief description of the coverage of each part:

Overview Volume - The Overview covers the Arctic Gas System proposal in its entirety. It will be most useful to those readers who want a system view and a broad concept of anticipated environmental impacts of the entire pipeline project.

Alaska Volume - This volume covers the 195-mile proposal of the Alaskan Gas Arctic Pipeline Company originating at Prudhoe Bay and terminating at the Alaska-Yukon Border and alternative routes.

Canada Volume - This portion of the environmental impact statement analyzes the 2,435-mile pipeline proposal of Canadian Arctic Gas Pipeline, Ltd., beginning at the Yukon-Alaska Border and proceeding generally southward to Caroline Junction in Alberta where it forks, one leg entering Idaho, near Kingsgate, British Columbia, and the other entering Montana, near Monchy, Saskatchewan. Discussions of route alternatives are also presented.

San Francisco Volume - This volume analyzes the 917-mile portion proposed by the Pacific Gas Transmission Company which passes through Idaho, Washington, and Oregon to Antioch, California. Discussions of route alternatives are presented.

Los Angeles Volume - This volume relates to the 414-mile portion proposed by Interstate Transmission Associates (Arctic) extending from the point of United States entry in Idaho to Rye Valley, Oregon. It also involves modifications to existing compressor stations in Oregon, Idaho, and Colorado. Discussions of route alternatives are presented. This volume also contains a discussion of the applicant's future proposal for an additional 760-mile pipeline passing through Idaho, Oregon, Nevada, and terminating at Cajon, California.

North Border Volume - This volume is an analysis of the 1,619-mile pipeline proposed by the Northern Border Pipeline Company. It covers the area from the United States-Canada border, crossing Montana, North and South Dakota, Minnesota, Iowa, Illinois, Indiana, Ohio, and West Virginia, to a termination near Delmont, Pennsylvania. Discussions of route alternatives are presented.

Alternatives Volume - This volume covers courses of action open to the Secretary of the Interior to approve, deny, postpone, or accept and delay or deny part of the proposal; effects of gas deregulation and conservation; other natural gas sources; alternative energy sources and modes of transportation; and one major alternative gas transportation system involving an all-Alaska gas pipeline, liquefication plants and tanker transport to the conterminous United States.

Consultation and Coordination - This volume describes and discusses the efforts made by the Department of the Interior to consult with and coordinate its work in the development of this statement. It includes the gathering of basic information for analysis, public meetings, public hearings, and efforts which have and will be made to assure that environmental impacts are adequately treated.

Glossary - This volume provides the reader with definitions of technical words or phrases used in the environmental impact statement.

the applicant's Tacoma proposal for an additional 700-mile pipeline passing through Idaho, Oregon, Nevada, and terminating at Cajon, California.

North Border Volume - This volume is an analysis of the 1,617-mile pipeline proposed by the Northern Border Pipeline Company. It covers the area from the United States-Canada border, crossing Montana, North and South Dakota, Minnesota, Iowa, Illinois, Indiana, Ohio, and West Virginia, to a terminus near Delmont, Pennsylvania. Discussions of route alternatives are presented.

Alternatives Volume - This volume covers courses of action open to the Secretary of the Interior to approve, deny, postpone, or accept and delay or deny part of the proposal; effects of gas demand/allocation and transportation; other natural gas sources; alternative energy sources and modes of transportation; and the major alternative gas transportation system involving an all-Alaska gas pipeline, liquefaction plants and tanker transport to the conterminous United States.

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1 DESCRIPTION OF THE PROPOSED ACTION

1.1 ARCTIC GAS PIPELINE PROJECT

1.1.5 Los Angeles Pipeline

1.1.5.1 Introduction

The Los Angeles Pipeline is a part of the proposed Alaska Natural Gas Transportation System (ANGTS) which will initially transport 4.50 bcf/d (billion cubic feet per day) of natural gas, 2.25 bcf/d from the Prudhoe Bay Field in Alaska and 2.25 bcf/d from the MacKenzie Delta area of the Northwest Territories, Canada, to industrial and population centers in Canada and the United States. The revised applications from the applicants are based on the assumption that the 2.25 bcf/d from the MacKenzie Delta area will be transported to Canadian markets and the 2.25 bcf/d from Prudhoe Bay will be transported to market areas in the United States. The Canadian Arctic Gas mainline can deliver 4.50 bcf/d when fully powered, while delivery and supply laterals have greater capacity. The total capacity of connecting facilities applied for also exceeds 4.50 bcf/d. Quantities above this will require additional facilities.

The Los Angeles Pipeline system is proposed by Interstate Transmission Associates (Arctic) [ITA(A)]. This association was formed by Pacific Interstate Transmission Company, a wholly owned subsidiary of Pacific Lighting Corporation, and Northwest Alaska Company, a wholly owned subsidiary of Northwest Energy Company.

The Los Angeles Pipeline will provide transportation for natural gas from a point on the Canada-United States border near Kingsgate, British Columbia, or Eastport, Idaho, to the Los Angeles area near Cajon, California.

The applicants, in the fourth supplement to the application with the Federal Power Commission, propose to construct a pipeline from Kingsgate to Stanfield, Oregon. This section would parallel the existing PGT (Pacific Gas Transportation Company) pipeline except for a short section in the Kootenai River Valley. South of Stanfield, the applicants propose to loop parallel portions of the existing pipeline of NPC (Northwest Pipeline Corporation) to Rye Valley.

The design capacity of the system initially will be 600 MMCf/d (million cubic feet per day). A total of 150 MMcf/d will be delivered into the existing Northwest Pipeline system at Spokane, Washington, and/or at Stanfield, Oregon.

Through the expansion and reinforcement of existing pipeline systems, approximately 450 MMcf/d of natural gas will be made available for ultimate use by consumers of Southern California Gas Company (SoCal). Of this volume, ITA(A) proposes to deliver 250 MMcf/d to PGT AT Stanfield. Under this proposal PGT would deliver this volume to PG&E (Pacific Gas and Electric Company) at its delivery point on the Oregon-California border, and PG&E would deliver like volumes into the system of SoCal. (No agreement has been reached between ITA(A) and PGT regarding this proposal.) The remaining 200 MMcf/d of gas will be delivered into the facilities of NPC at Rye Valley and like volumes will be made available to El Paso Natural Gas Company (El Paso) near Ignacio, Colorado. The 200 MMcf/d will be delivered to SoCal at the California-Nevada border near Blythe, California, through El Paso's existing system.

Six additional compressors at three existing compressor stations will be required on NPC's existing system to accomplish the transportation from Stanfield to Ignacio. These stations are located at Baker, Oregon; Caldwell and Mountain Home, Idaho. Minor modifications will be required at two existing NPC compressor stations at Kemmerer, Wyoming, and Pocatello, Idaho, so that flow through these stations can be reversed.

To accomplish the transportation from Ignacio to Blythe, one additional compressor unit will be required at each of three existing compressor stations on El Paso's existing system. These compressor stations are located near Blanco, New Mexico; Franconia and Wenden, Arizonia. Additional gas cooling facilities will be required at the existing compressor station near Flagstaff, Arizona. Also, modifications to meters, communications, supervisory, and telecontrol will be necessary.

Depending upon the terms of the final agreement between ITA(A) and PGT and the date when ITA(A) delivers natural gas to PGT at Stanfield, some additions could be required to PGT and PG&E's existing facilities between Stanfield and Cajon to accomplish the transportation of the 250 MMcf/d mentioned previously.

When additional sources of natural gas approaching 800 MMcf/d become available, ITA(A) states that they anticipate extending a pipeline system from Rye Valley to Cajon. (SoCal would construct the portion from the California-Nevada border to Cajon.) Compressor stations would also be required between Kingsgate and Rye Valley. This system would have a capacity of 1100 MMcf/d.

The 1100 MMcf/d system would serve a residential community with a population of approximately 9.4 million or about 2.7 million residences.

Refer to the Overview, Section 1.0V.1 for additional discussion of the ANGTS, natural gas reserves.

1.1.5.2 Location

The Kingsgate-Stanfield proposed pipeline preferred by Interstate Transmission Associates (Arctic), ITA(A), and Southern California Gas Company, SoCal, originates at the International Border near Kingsgate, British Columbia, and will join an existing pipeline at Stanfield, Oregon, with new pipe looping (paralleling) most of the existing system from Stanfield to Rye Valley, Oregon.

The proposed pipeline will cross three States -- Idaho, Washington, and Oregon. (See figure 1.1.5.2-1.)

Specific Route

Origin and Terminus

The proposed alignment would adjoin or generally parallel the route of an existing pipeline right-of-way of the Pacific Gas Transmission Company (PGT) for approximately 2.3 miles from the Canadian border near Eastport, Idaho, and thence west generally following U.S. Highway 95 westerly through Round Prairie to the town of Mount Hall, Idaho. The alignment then turns southward along the Kootenai River Valley approximately 29.1 miles where it rejoins the existing PGT pipeline right-of-way south of Bonners Ferry, Idaho. The proposed alignment then parallels the existing PGT pipeline right-of-way for approximately 248 miles to Stanfield, Oregon, where it

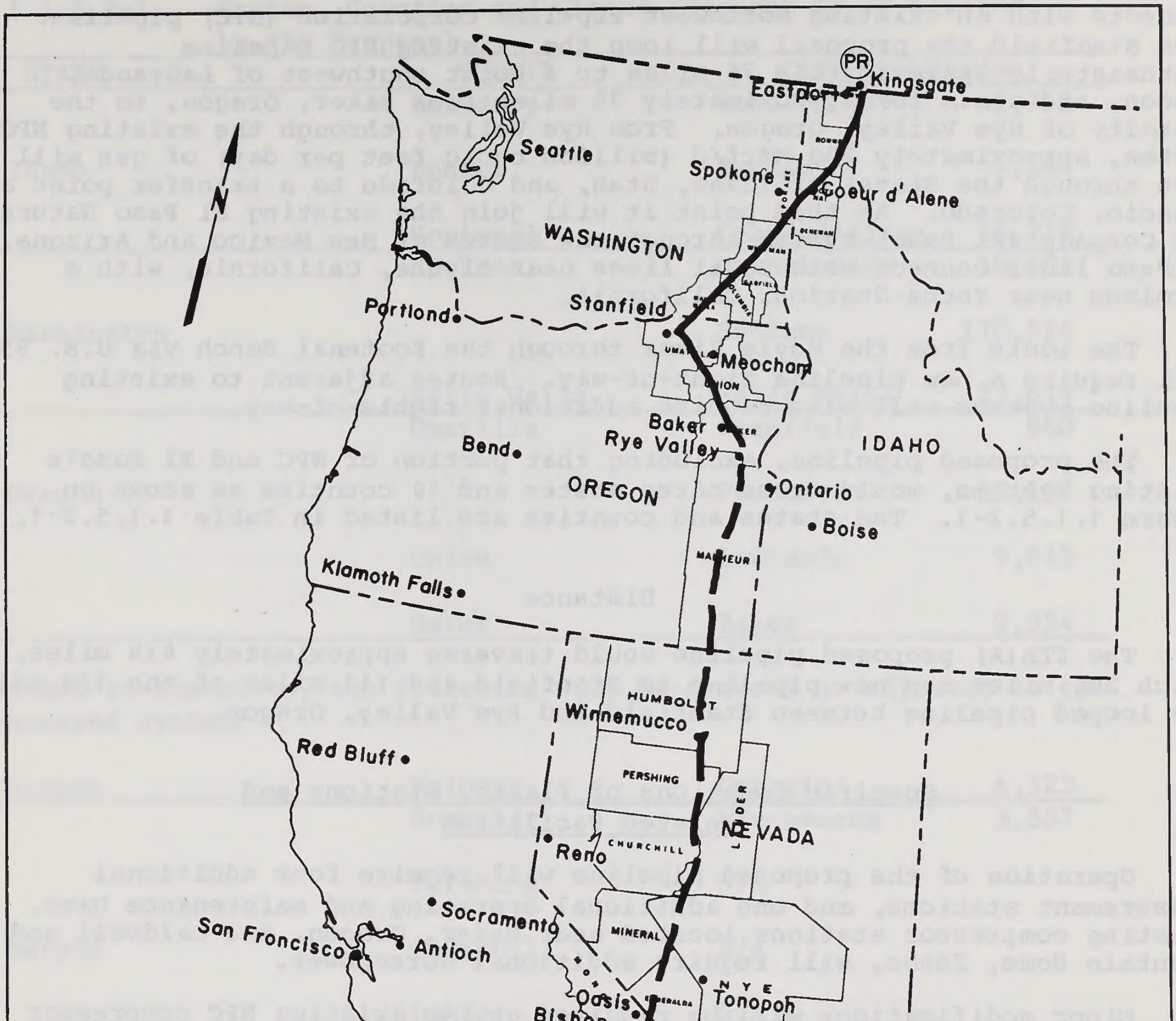

Figure 1.1.5.2-1 Project location map

connects with an existing Northwest Pipeline Corporation (NPC) pipeline. From Stanfield the proposal will loop the existing NPC pipeline southeasterly approximately 76 miles to a point southwest of LaGrande, Oregon, and again for approximately 35 miles from Baker, Oregon, to the vicinity of Rye Valley, Oregon. From Rye Valley, through the existing NPC system, approximately 200 MMcf/d (million cubic feet per day) of gas will move through the States of Idaho, Utah, and Colorado to a transfer point at Ignacio, Colorado. At this point it will join the existing El Paso Natural Gas Company (El Paso) system through the States of New Mexico and Arizona. El Paso lines connect with SoCal lines near Blythe, California, with a terminus near Yorba Station, California.

The route from the Moyie River through the Kootenai Bench via U.S. 95 will require a new pipeline right-of-way. Routes adjacent to existing pipeline systems will also require additional rights-of-way.

The proposed pipeline, excluding that portion of NPC and El Paso's existing systems, would cross three states and 10 counties as shown on figure 1.1.5.2-1. The states and counties are listed in Table 1.1.5.2-1.

Distance

The ITA(A) proposed pipeline would traverse approximately 414 miles, of which 280 miles are new pipeline to Stanfield and 111 miles of the 134 miles are looped pipeline between Stanfield and Rye Valley, Oregon.

Specific Locations of Plants, Stations and Related Facilities

Operation of the proposed pipeline will require four additional measurement stations, and one additional operating and maintenance base. Existing compressor stations located near Baker, Oregon, and Caldwell and Mountain Home, Idaho, will require additional horsepower.

Minor modifications will be required at two existing NPC compressor stations at Pocatello, Idaho, and Kemmerer, Wyoming, so that flow through these stations can be reversed.

One additional compressor unit will be required at each of three existing compressor stations on El Paso's existing system. These compressor stations are located near Blanco, New Mexico; Franconia and Wenden, Arizona. Additional gas cooling facilities will be required at the existing compressor station near Flagstaff, Arizona.

Standard cathodic rectifiers, insulating joints, and cathodic test installations will be placed along the pipeline as required.

Line markers will be installed at various crossing points such as fence lines, roads, property lines, powerlines, etc.

Mainline valves will be installed at maximum intervals of 15 to 20 miles, at all major river crossings, and at metering stations. These valves will be equipped with blowdown valves on either side with a stack line to a quick-opening end closure.

Table 1.1.5.2-1 States, Counties and Cities Adjacent to or Crossed by the Proposal.

STATE	COUNTY	CITY/Population	
Idaho	Boundary	Bonners Ferry	2,796
	Bonner	Sandpoint	4,144
	Kootenai	Coeur d'Alene	16,228
Washington	Spokane	Opportunity	16,604
		Spokane	170,516
	Walla Walla	Walla Walla	23,619
Oregon	Umatilla	Stanfield	960
		Pendleton	13,197
	Union	LaGrande	9,645
	Baker	Baker	9,354

In addition to the above, the following will be crossed or adjacent to the fully-powered system:

STATE	COUNTY	CITY/Population	
Oregon	Malheur	Ontario	6,523
Nevada	Humboldt	Winnemucca	3,587
	Pershing	N/A	
	Churchill	N/A	
	Lander	N/A	
	Nye	N/A	
	Esmeralda	N/A	
California	Mono	N/A	
	Inyo	Bishop	3,498
	Kern	Ridgecrest	7,629
	San Bernardino	Barstow	17,442
		Lenwood	3,832
		Victorville	10,845
		Apple Valley	6,702
		Hesperia	4,592
		San Bernardino	104,251

Relationship to Existing or Potential Sources and Systems

The most significant existing and potential gas delivery systems relate to PGT and the Pacific Gas and Electric Company (PG&E). This natural gas pipeline is the other West Coast "leg" of ANGTS. The 42-inch PGT and PG&E proposed pipeline (in addition to an existing 36-inch pipeline) will parallel the ITA(A) proposed pipeline for about 248 miles of the approximately 280 miles from Kingsgate, British Columbia, to Stanfield, Oregon. The two routes will diverge at this point, ITA(A) following southeasterly along NPC's existing line.

SoCal is a recipient of gas under ITA(A)'s proposal. Presently, SoCal receives some natural gas from onshore production in California, and from State and Federal offshore areas close to California. SoCal also receives natural gas from El Paso and other systems which may come from as far away as Canada, Utah, Texas, New Mexico, Oklahoma, Kansas, Colorado, and Louisiana. The small volume of gas SoCal obtains from Federal offshore areas is expected to decline until offshore drilling resumes. Traditional supplies, as well, are declining. The natural gas obtained from this ITA(A) proposal would help to significantly offset the declining supplies (Rand Corp. Report R-1793/1-CSA/RF Preliminary. Sept. 25, 1975).

Northwest Pipeline Corporation, which supplies portions of the Pacific Northwest and Southwest, is also experiencing declines in supplies from some sources. This proposal by ITA(A) will supply additional gas to NPC.

1.1.5.3 Facilities

Pipeline Description

Length, Diameter, and Thickness

The overall length of the proposed Kingsgate to Rye Valley pipeline is 280 miles from Kingsgate, British Columbia, to the vicinity of Stanfield, Oregon; the pipeline continues from Stanfield to the vicinity of Rye Valley, Oregon, by looping 111 miles of approximately 134 miles of an existing NPC pipeline. The outside diameter of all the pipe used will be 30 inches.

The basic pipe material proposed is API grade X-65 steel with a nominal yield and ultimate strength of 65,000 and 77,000 psi, respectively. Pipe thickness will vary from 0.469 to 0.688 inch depending on the class location.

Operating Pressure and Temperature

The entire pipeline will be designed for a maximum operating pressure of 1,440 psig (pounds per square inch, gauge). Proposed facilities will receive the gas at 1,440 psig at Eastport, Idaho. The gas will be received at Stanfield, Oregon, at 1,092 psig and leave at 821 psig. The Baker compressor station will receive the gas at 566 psig and compress it to 849 psig. It will be received at 479 psig at Caldwell and be compressed to 848 psig; at Mountain Home, the gas will be received at 437 psig and leave at 635 psig for transport to Ignacio, Colorado, through the existing system.

Temperatures of flowing gas from the Canadian border to Stanfield will be approximately 60°F. Leaving Stanfield the gas will be approximately 65°F. These are design temperatures and the actual temperatures may vary somewhat in accordance with ambient air and ground temperatures.

Description of Loops and Laterals

The Koontenai and Pend Oreille River crossings will be buried, utilizing bypass security (double) lines. An overhead cable suspension crossing and/or a buried underwater crossing are under study for the Snake River.

At Spokane, Washington, and Stanfield, Oregon, gas will be delivered to NPC and PGT, respectively. Also at Stanfield, the gas in excess of that previously delivered to NPC at Spokane and PGT at Stanfield will be routed into an existing NPC line for transportation to SoCal via Ignacio, Colorado.

The existing NPC line from Stanfield to Ignacio will have to be looped for 111 miles between Stanfield and Rye Valley to receive the additional gas.

Description and Operating Characteristics of Plants, Compressor Stations, and Related Facilities

Treatment, Measurement, and Compression

Treatment

The gas to be transported will undergo treatment in processing plants at Prudhoe Bay and Mackenzie Delta. Its percent of composition will vary slightly but the following analysis is expected:

Components	Percent
Methane	89.68
Ethane	5.22
Propane	2.45
Isobutane	.32
Normal butane	.47
Isopentane	.09
Normal pentane	.07
Hexane	.03
Heptane	.02
Carbon dioxide	1.00
Nitrogen	.65

Properties of the natural gas that will be monitored are moisture content, specific gravity, and fuel content in British thermal units.

The output from the hydrogen sulfide analyzer, moisture analyzer, gravitometer, and calorimeter will be automatically monitored and transmitted to the gas control center in Salt Lake City. It will not be necessary to directly transmit the total sulfur content of the gas stream to Salt Lake City; this information can be recorded at the location and forwarded to the control center on a daily basis. No sulfur or moisture analyzers are anticipated at the gas meter locations. A calorimeter and gravitometer at each of the salesmeter locations with the output signals transmitted to the gas control center are proposed.

The natural gas as received at the Canadian border will be pipeline quality. No additional processing, treating, or dehydration will be required.

Measurement

Four measurement stations will be constructed or enlarged along the proposed pipeline route: at the Canadian border; Spokane, Washington; Stanfield, Oregon; and Ignacio, Colorado. The stations will be fenced and all-weather access roads to the stations will be constructed, where needed. One of these stations will be installed within the fenced area of an existing station.

Compression

Under the proposed system, no compressor stations are proposed from the Canadian border to Stanfield, Oregon. Existing compressor stations near Baker, Oregon, and Caldwell and Mountain Home, Idaho, will receive additional compression horsepower.

The applicants state that the system has been designed to use gas reciprocating power units, which are more fuel efficient than turbine units. Identical equipment will be installed at each station. The horsepower additions will be 2,500 at station 11, 5,500 at station 12, and 3,000 at station 13. Minor modifications will be required at two existing compressor stations at Kemmerer, Wyoming, and Pocatello, Odaho, so that flow through these stations can be reversed.

Mainline Valves

Mainline block valves will be at intervals of 15 to 20 miles. For operational purposes, these valves will be equipped with blowdown valves on either side, with a stack line to a quick-opening end closure. Additional valves will be installed at compressor stations and at river crossings.

Pigging Facilities

The pipeline will be equipped with on-stream pigging facilities for cleaning purposes. This operation entails launching a spherical device into the pipeline (pig-launcher), pushing it along by the pressure of the natural gas, and cleaning the interior of the line. A special retriever facility (pig-catcher) captures the sphere and allows removal from the line.

Plant Sites and Buildings

Compressor Stations

Plans for each of the existing compressor stations include, but are not necessarily limited to, the following facilities:

- Gas reciprocating power units driving centrifugal gas compressors. These units will be automated for remote control operations.

- Other separate, prefabricated metal-clad buildings for such facilities as operating controls, instrumentation, automatic controls, gas-measuring equipment, and on-site natural gas powered electric generating equipment, offices, and maintenance shops.

- A plant blowdown stack with silencer equipment where appropriate.

- Tanks for the storage of waste oils, lubrication oils, and separator drains.

- An adequate water supply for utility and housekeeping purposes.

- If necessary, a well will be dug.

- A suitable waste disposal system (in compliance with local codes).

- If necessary, an all-weather access road leading from a nearby highway. Approximately 0.5 mile of 15-foot-wide all-weather road will be constructed within the grounds of each station to provide access to its facilities.

- A chain-link security fence surrounding each compressor station.

Landing Strips

None are required under the revised proposal.

Measurement Stations

Measurement station buildings will be prefabricated metal-clad buildings on a fenced site of 70 by 30 feet.

Operating and Maintenance Bases

One operating and maintenance base will be constructed in the community of Spokane, Washington. The base will consist of an office and warehouse building, a radio tower, and areas for pipe and material storage. A fenced site, 550 by 400 feet, will be required.

Communications

Facilities for remote control of facilities and communications will be installed along the proposed pipeline. A typical installation will include a microwave tower and prefabricated metal-clad building. The locations of the proposed facilities have not been identified at this time.

Cost of Facilities

The total estimated cost of the proposed pipeline system is $239,696,000 in 1975 dollars. These costs by applicant are: $223,557,000 for ITA(A); $7,724,000 for Pacific Interstate Transmission Company (El Paso); and $8,415,000 for NPC.

1.1.5.4 Land Requirements

Right-of-Way

Construction Right-Of-Way Length, Width, and Acreage

The total estimated land requirements for construction are shown in Table 1.1.5.4-1 and described here.

Table 1.1.5.4-1 Approximate Land Requirements of the Proposed Facility

PIPELINE		
New Right-of-Way		Approximate Acres
Canadian border to Stanfield, Oregon		3394
Stanfield to Rye Valley		1009
Existing Rights-of-Way Utilized		
Stanfield to Rye Valley		336
	Subtotal	4739
RIVER CROSSINGS		
All	Subtotal	20
OTHER FACILITIES		
Operating and Maintenance Base		5
Measurement Stations		4
Valves		1
Access Roads		6
	Subtotal	16
	Total	4775

		Land Allowed to Revegetate, or Revert to Prior Uses
Pipeline		
Canadian border to Stanfield, Oregon		3394
Stanfield to Rye Valley		1345
River Crossings		20
	Total	4759
NET LAND USE		
Acreage required minus land allowed to revegetate or revert	4775 - 4759 =	16

Pipeline

The right-of-way requirements are described by breaking the proposed alignment into two sections.

Canadian Border to Stanfield, Oregon--a segment 280 miles long with a new construction zone 100 feet wide (3,394 acres) mostly paralleling an existing PGT right-of-way.

Stanfield to Rye Valley, Oregon--a segment 134 miles long with a new construction zone 111 miles long; the width of this 111-mile zone is 100 feet (1,345 acres) paralleling or adjoining an existing NPC right-of-way, 25 feet (336 acres) will be on NPC's existing right-of-way and 75 feet (1,009 acres) will be new easements.

River Crossings

Table 1.1.5.4-2 presents a list of rivers that will be crossed by the proposed pipeline and their location by pipeline mile from the Canadian border (MP 0.0). Crossings at the Kootenai, Pend Oreille, and Snake Rivers are considered to be major river crossings.

The three major river crossings will each require an open construction area measuring approximately 200 feet along the river and 500 feet (2.3 acres) along the pipeline right-of-way on one bank. An area 200 by 300 feet (1.4 acres) on the opposite bank will be required for maneuvering construction equipment, stockpiling excavated river bottom material from dredging or excavation operations, and welding joints of pipe into strings preparatory for the crossing pull. Pipes will be welded into strings to minimize the amount of welding that will have to be done during the pulling operation.

The other nine rivers listed in Table 1.1.5.4-2 will each require 200- by 300-foot (1.4 acres) open construction areas on each bank. Thus, a total of 39.1 acres will be required for construction areas at these crossings. Of this total, approximately 19 acres will consist of the 100-foot zone generally used for overland construction, and the remaining 20 acres will be the additional area needed for river crossings.

All other streams will be crossed using standard dry land trenching techniques, and no construction areas will be required other than the 100-foot right-of-way.

Permanent Right-of-Way Length, Width, and Acreage

The total right-of-way requirement for construction will be approximately 4,739 acres. After construction is completed, right-of-way will generally be reduced to a 50-foot width (approximately 2,369 acres) for maintenance and operation.

Existing Rights-of-Way to be Utilized

The proposed pipeline, except for the 29.1-mile Moyie-Round Prairie-Kootenai leg, will parallel the existing pipeline of Pacific Gas Transmission Company for approximately 250 miles to Stanfield, Oregon. It would then loop 111 miles of Northwest Pipeline Corporation's pipeline

Table 1.1.5.4-2 River Crossings

RIVER	MILEPOST 1/
Moyie 2/	0 to 2.5
Kootenai	27
Pack	49
Pend Orielle	62
Spokane	112
Palouse	171
Snake	208
Walla Walla	258
Umatilla	302
Grand Ronde	338
Powder	387
Burnt	407

1/ Distance is measured mile, commencing with 0.0 at the Canadian border.

2/ Two crossings would be made.

between Stanfield and Rye Valley, Oregon, a total distance of approximately 134 miles.

Federal Land Requirements

Listed here are the federally administered lands that would be crossed by the proposed pipeline and future expansion. The Federal agency administering these lands is also indicated (see Table 1.1.5.4-3).

a) Kaniksu National Forest, Idaho; Umatilla and Wallowa-Whitman National Forest, Oregon. These lands are administered by the U.S. Department of Agriculture, Forest Service (11.89 miles).

b) National resource lands in Idaho and Oregon. These lands are administered by the Department of the Interior, Bureau of Land Management (8.26 miles).

c) Snake River and banks. These lands are administered by the Department of the Army, Corps of Engineers (less than 1 mile).

d) Umatilla Indian Reservation. Administered by DOI, Bureau of Indian Affairs (14.07 miles).

Besides dealing with those agencies having control over management of the land, there is a myriad of other governmental agencies with which the applicants will have to deal. Some of these include: Environmental Protection Agency, Federal Power Commission, U.S. Corps of Engineers, Occupational Safety and Health Administration, U.S. Fish and Wildlife Service, State, local and community governments.

<u>Plant, Station, and Related Facility Acreage</u>

Under the proposed plan, there will be no compressor stations from the Canadian border to Stanfield, Oregon. There will be 4 measurement stations, 1 operating and maintenance base, and approximately 18 mainline valves. Existing compressor stations and facilities will be utilized from Stanfield to Ignacio, Colorado, along NPC's existing system.

Existing Rights-of-Way to be Utilized

Approximately 70 acres are being used or will be required for the existing 3 compressor stations, 4 measurement stations, 1 operating and maintenance base, and approximately 18 mainline valves along the pipeline (table 1.1.5.4-1).

Each NPC existing compressor station is located on a site of approximately 20 acres, of which only 5 to 10 acres have been used for construction and operational purposes. The measurement stations will require approximately 2 acres, and the operating and maintenance base will require approximately 5 acres. Each valve will be located in a fenced area approximately 20 by 30 feet.

Table 1.1.5.4-3 Federal Land Requirements Involved in the Proposal

AGENCY	Total Miles	Perm. Acres	Constr. Acres	Total Acres	Percent of Project
U.S.F.S	11.89	72.06	72.06	144.12	3.04
Indian* (BIA)	14.07	84.82	84.82	169.64	3.58
BLM	8.26	50.09	50.09	100.18	2.11
SubTotals:	34.22	206.97	206.97	413.94	8.73
Project Totals:	391	2,369	2,370	4,739	

*While Indian Trust Lands are exempted from the definition of federal lands in the Mineral Leasing Act, as amended, the Secretary of the Interior is empowered to grant right-of-way permits involving these lands pursuant to 25USC323.

Related Land Areas Affected

Roads

Existing public and private roads will be used as much as possible for access to the permanent pipeline facilities. Mainline valves will be located close to those existing roadways whenever possible. Approximately 6 acres may be required along the proposed pipeline system for new permanent access roads.

Housing

Information indicates that the pipeline as proposed will not displace any housing. Construction of permanent buildings over the right-of-way will not be permitted.

1.1.5.5 Schedule

Duration and Phasing of Project Construction

The proposed pipeline will be constructed as one integral action. The pipeline and facilities from the Canadian border to Rye Valley, Oregon, will be constructed in 1 year, beginning in 1979. Delivery of natural gas is expected to begin upon completion and testing of the line and facilities.

Individual Facility Construction Times

Pipeline

Construction of the ITA(A) section of the proposed pipeline (MP 0 to 414) will use a minimum of three and a maximum of four spreads. A spread is a working unit of men (approximately 250) and equipment. The progress of construction is estimated to be as follows:

- Average progress: 5,000 feet per day per spread
- Progress in mountainous terrain: 3,000 feet per day per spread
- Progress in flat terrain: 7,000 feet per day per spread

Other associated facilities would be constructed concurrently by the pipeline.

Compressor Stations

No new compressor stations are to be built under the initial phase. Three existing compressor stations require a boost in horsepower and related modifications. Work will last 6 months on these modifications.

Measurement Stations, Operating and Maintenance Base

Construction of each measurement station, operating and maintenance base will require approximately 3 months and will be done concurrent by the pipeline and compressor stations.

Time Required for Preparation Functions

Relocation of Housing, Businesses, and Public Utilities

According to available information, no relocation of housing, businesses, or public utilities is anticipated.

Roads

Unsurfaced lightly traveled roads will be crossed by the open trench method, which usually requires 1 day. Provisions for detours will be made. Heavily traveled roads and railroad crossings will be made by horizontally boring beneath the surface. No interruptions in traffic should occur in the latter case.

Clearing and Grading

The right-of-way will require a construction zone cleared of brush, trees, tree stumps, high grasses, and fences to accommodate construction equipment and facilitate pipeline installation.

No separate time frame has been provided for clearing and grading, but is included in the 12 months total construction estimate.

Maintenance of Public Services During Construction

Pipeline crossings at unsurfaced, lightly traveled or rural roads will be made by the open trench methods. Installation, including repair and restoration of the surface at these crossings, will usually be completed within 1 day. In such cases, provisions will be made to detour or to allow passage of traffic while construction is under way.

Pipeline crossings at more heavily traveled surfaced roads and at railroad crossings would be made by horizontal boring at a specified depth beneath the surface. This method would be employed to prevent surface damage. To protect the pipeline from external loadings, either transmission pipe of a greater wall thickness or casing pipe will be used at these crossings. For all casings, the annular space between the two pipes will be sealed and the casing vented to the atmosphere.

The pipeline will normally be installed a minimum of 36 inches below the bottom of road or railway ditches. Stipulations imposed by landowners, State, Federal or other authorities might require additional depth of cover.

To avoid disturbances to irrigation ditches and levees, the pipeline will be routed over the top of the levee bank or be installed beneath the structure using a horizontally bored hole. When laying pipe over the top, the pipeline will be permanently supported by a structure capable of supporting the pipe weight.

Where construction procedures require the removal of such private structures as gates or fences, the property owner or tenant will first be advised of the action. During construction, temporary facilities will be constructed to replace the original. After completion of construction, the temporary structures will be removed and property restored.

Schedule of Currently Proposed Future Construction

A schedule has not been established for the fully powered system. The applicant has stated that the fully powered system will be constructed when the available volumes of natural gas exceed 800 MMcf/d.

1.1.5.6 Construction Procedures

Preparatory Procedures

Relocations

No relocation of houses, businesses, commercial or industrial facilities is anticipated.

Roads and Site Clearing

The pipeline right-of-way and facility sites will require a construction zone cleared of brush, trees, tree stumps, high grasses and fences, and will be graded to accommodate construction equipment and to facilitate pipeline installation.

Construction personnel will be required to restrict construction activities to the 100-foot-wide right-of-way, facility sites, and designated roads and trails.

Pipeline Construction Techniques

All proposed facilities will be designed, constructed, and operated in accordance with requirements of part 192, title 49, Code of Federal Regulations (49 CFR, part 192), "Transportation of Natural and Other Gas by Pipeline: Mininum Federal Safety Standards." These regulations set minimum design factors.

Prior to construction of the pipeline across waterways or land, applicable permits must be obtained from the U.S. Army Corps of Engineers, the U.S. Coast Guard, and as required by numerous other Federal, State, and/or local laws, regulations, and agencies. On private property, the applicant must deal with specific landowners.

Methods of construction of the pipeline will depend upon vegetation encountered, nature of the topography, geology, types of streams crossed, weather and climatic conditions, and manmade elements such as railroads, highways, canals, and levees and current technology and equipment of the pipeline industry, etc.

For the interested reader, an excellent treatise on pipeline construction and maintenance techniques is available in the publication "Oil Pipeline Construction and Maintenance, Second Edition, April 1973," issued by Petroleum Extension Service, Division of Extension, The University of Texas at Austin, Texas. The techniques described therein are similar in all major aspects to gas pipeline construction.

General pipeline construction consists of:

- Clearing the construction zone (right-of-way) of trees and shrubs

- Staking the trench centerline

- Digging the trench (with machines)
- Transporting the pipe to worksites
- Welding the pipe together
- Placing the pipe into the trench
- Backfilling the trench
- Hydrostatic (water-pressure) testing for leaks.

Consolidated rock areas normally require blasting before a trench can be made. This is true on land areas as well as in stream or river beds with little or no bottom materials over bedrock.

Backfilling in rocky trenches (on land or stream-bottoms) normally requires materials from borrow areas.

Other standard practices of the pipeline industry include installation of cathodic protection devices and factory or field coating pipe to retard external pipe corrosion. In water-saturated soils, pipeline buoyancy is controlled by weighting or anchoring the pipe.

Pipe

Pipe will be delivered to a railhead location near the pipeline route and then transported to the construction site by truck or the most appropriate means of transportation. Other materials required for construction, such as valves, fittings, and supporting equipment, will be supplied to the contractors from supply points designated by ITA(A).

Pipe may be furnished with shop- or yard-applied protective coating or bare, to be coated later by the contractor; if bare, the over-the-ditch pipe coating method using a good quality protective coating will be employed. Field joints will be made using protective-wrap flood coaters or their equivalent.

Trenching

Mechanical trenching machines capable of accurately following the centerline stakes will be used whenever possible in the trenching operations. In some situations, such as the presence of unstable soil or a high water table, a drag line, clam shell, or crawler backhoe might be employed to excavate the trench. Trench depths are normally such that the minimum cover above the pipe is 30 inches over land, 60 inches under water, and 24 inches in rock.

Topsoil is sometimes removed and piled separately from other trench materials. This normally occurs in areas which are under cultivation having rich topsoils with less fertile soil located 1 foot or more below existing grade. This is called double trenching or stockpiling.

Techniques capable of removing water from excavated areas of the pipeline during construction will vary depending on location and the type of water encroachment. Ground water encroachment into the excavated trench is usually handled by pumping to reduce water levels in the trench. Construction during periods of rainfall in areas with open trenches may occur. Methods to reduce water flow in the open trench, such as temporary dams, plugs, diversions, etc. may be required.

Trenching in rock may require several techniques. In standard practice, loose or unconsolidated rock is broken up by a ripper tooth pulled by a tractor. A backhoe or similar machine then removes the loose rock and soil from the trench. In consolidated rock areas, blasting is necessary. These areas will be matted when necessary to contain flying rock fragments.

River and Stream Crossings

Small Streams and Rivers

The extent of vegetation that must be cleared adjacent to streams and rivers would depend upon the character of the stream; the nature of the area surrounding the stream; the amount of trenching spoils, the excavation material to be stored on the banks, etc. Trench depth in all streams would allow for a minimum backfill cover of 60 inches.

The method of trench excavation used across small streams and rivers (see table 1.1.5.4-2 for river crossings) varies with stream characteristics. Excavation is normally accomplished by conventional bucket-type equipment operating from the banks. Sometimes midstream excavation is required. Intermittent streams and dry washes are trenched using mechanical trenching machines and methods previously discussed for open terrain.

Normally all trenching spoils are placed on adjacent banks and reused to backfill the trench after pipe installation. After pipe installation, the banks of the channel are backfilled. Retaining bulkheads, gabions, or other structures are sometimes installed along the shore.

In all bottomland and floodplain areas where the soil is stable, conventional pipe-laying techniques for crossing dry open lands will be used.

Large Rivers

Several methods can be used for installing the pipeline across large rivers. The flotation method of construction would commonly be used in this project to lay pipe across broad inundated areas.

The flotation method uses a stationary pipe assembly line working from a barge or on land adjacent to the prepared trench excavated by pontoon or barge-loaded dredging equipment. After the ditch is completed, pipe strings, which are welded together on the stationary assembly line, are coated and weighted. Flotation devices are attached, and the pipe section is pulled over the ditch as a continuous string. When crossing is achieved, the flotation devices are sequentially removed from the pipeline, allowing it to settle gently into the trench. All flotation devices are collected after separation and returned for reuse.

Blasting would likely be required at river crossings containing rock. Blasting may also be required where lenses of clay or other material, which could not be excavated by an orange-peel clam, cutter head, or spoon dredge, would make it necessary to blast to loosen and fracture the material for excavation. The size and direction of the charges placed would depend upon the quality of the rock.

Qualifications of blasters and use of blasting materials are closely regulated by many State and Federal agencies, including agencies of the Treasury and Interior Departments. Contractors are required to comply with applicable laws and regulations.

After the pipeline is positioned and prior to the previously discussed backfilling operations, a survey is run to determine the proper location of the pipeline below the river channel.

Most trenches are backfilled where the spoil is not unduly fluid. However, in rivers where normal currents provide natural filling, the trench might be left unfilled.

A method of backfilling rock areas is accomplished by depositing fine material in the upstream channel of the river and allowing it to settle into the trench and bed and shade the pipeline in the channel. Then the material excavated is redeposited in the trench. Rock riprapping or other techniques may be required tc stabilize stream bank trenching.

Channel diversion is another means of crossing rivers that have a relatively wide shallow flood-plain. This operation involves constructing an earthen or stone berm out from one bank to approximately midstream and back to shore, enclosing an area of previously subaqueous bottom. The contained area is then cleared of water, allowing the trench to be dry cut and pipe to be laid in the conventional dry land manner, with weighting or anchoring to offset its buoyancy. After the trench is backfilled, the berm is opened, transferred to the opposite bank of the river, and the process repeated.

Pipe Installation and Backfilling

Other construction activities, including welding of the pipe, follow trenching. All welding is subject to subpart E, "Welding of Steel in Pipelines," of DOT regulations, published in title 49 of the Code of Federal Regulations (49 CFR) part 192. After each weld is completed, it is visually inspected by the applicant inspection teams. Radiographic inspection of the welds is performed in accordance with DCT requirements. If any of the welds inspected either visually or radiographically fail to comply with DOT specifications, they are repaired or cut out of the pipeline and new welds made.

Construction activities are scheduled so that if over-the-trench coating is employed, the trench is ready for lowering the coated pipe immediately after the coating cools. All ditching spoils are temporarily placed on the narrow side of the right-of-way. Gaps, spaced at convenient locations, provide drainage and passage for landowners and animals. In rocky areas, padding in the bottom of the trench provides a uniform bearing for the pipe. The pipe is then covered with fine material prior to final backfilling of the trench. Operations in very rocky areas require the use of borrow pits in the vicinity of the right-of-way. Water settlements of the backfill for compaction purposes is performed to offset the possibility of delayed settlement of the backfill above the pipeline in those areas where this condition would be expected to occur. Usually this condition is encountered in farm areas or in areas where the soil contains a good deal of loam. Sometimes bridging of backfilling materials occurs, impeding uniform compaction or placement from the top of the pipe to the surface. Proper tamping of the backfill eliminates this problem.

Surplus spoils are crowned over the ditch in a berm tapered outward from the center, spread uniformly over the right-of-way, or both. As the backfill compacts, the berm settles approximating a natural grade contour.

All remaining trash, brush, or debris will be disposed of in an approved manner. During restoration, contour terrace construction or other techniques will be employed in areas where erosion is likely to occur.

Negative Buoyancy

"Floating" of the pipe may occur in some areas such as river crossings and other high water-table areas. Floating is countered by anchoring or weighting the pipe during construction.

Plants, Stations, and Related Facilities Construction Techniques

Compressor Station Construction

The proposed pipeline system will not require construction of compressor stations. Existing stations at Baker, Oregon, and at Caldwell and Mountain Home, Idaho, will receive added horsepower.

Construction of Measurement Stations, Operating and Maintenance Base

Construction of each measurement station and operating and maintenance base will require about 25 men.

Testing Procedures

Hydrostatic

After the completion of construction, the pipeline will be hydrostatically tested. This procedure consists of filling segments of the pipeline with water and pressurizing the pipe to a predetermined level to verify its integrity in accordance with subpart J of 49 CFR part 192. The predetermined level will be set to achieve a pressure equivalent to at least 90 percent of the minimum specified yield of the pipe at the point of highest elevation and not exceed a pressure equivalent to 110 percent of the minimum specified yield of the pipe at the lowest point of elevation in the section being tested.

The lengths of segments to be tested and location of test manifolds will be governed by the water available for testing, location of mainline valves, and the pressure head resulting from changes in the ground elevations along the line. Test segments will vary from an estimated 0.5 to 20 miles in length. Approximately 180,200 gallons of water per mile of 30-inch diameter pipe will be required. The test water will be pumped to succeeding segments to be reused as many times as practical, then discharged when no longer usable.

Sources of test water include rivers, creeks, or privately owned irrigation wells and ditches, requiring legal permission from authorized governing bodies or private individuals prior to using water from any of these sources.

Water used in hydrostatic testing will be accurately metered and filtered before it enters the pipeline to prevent entry of sand and other foreign matter.

Proposed test water withdrawal and disposal sites are shown on figure 1.1.5.6-1. Also see Table 3.1.5.5-2, Hydrostatic Test Schedule. Present plans for the first test segment are to obtain water for 208 miles of the pipeline from the Moyie River at MP 0.15 on the proposed line. The water obtained from the Moyie River will be used to test the proposed line from MP 0 to 208, the proposed point of crossing the Snake River, where the water will be discharged.

Water for another 130 miles will be obtained from the Snake River at MP 208 and the procedures previously outlined will be followed; the water will be used to test the line from MP 208 to 338, the crossing of the Grande Ronde River in Oregon. Water will be obtained from the Grande Ronde River to test the line from MP 338 to 355. At approximately MP 379, water from wells and irrigation facilities will be used to test the line to MP 414 and the water will be discharged at MP 407 on the Burnt River.

Air, Noise, and Water Quality

The maximum activity of equipment and personnel will occur during pipeline construction. Dust and odors caused during this period will be created primarily by the operation of dozers, welding machines, backhoes, trenchers, trucks, and other heavy vehicles and equipment.

<u>Work Force</u> (also see Sec. 1.1.5.5)

Source, Type, Skill Level, and Number

Pipeline

Construction of the pipeline requires three or four spreads totaling 750 to 1,000 men. A spread will extend 20 to 30 miles along the right-of-way. At the leading end a crew will be clearing the right-of-way of trees and brush, making a roadway for equipment. At the tail of the spread the crews will be backfilling, cleaning up, and revegetating where required. In addition, a pipeline inspection force of approximately 10 men will be required for each spread.

A maximum of approximately 30 percent of the total pipeline labor force is estimated to be available from urban and rural communities along the alignment. This 30 percent will be primarily unskilled labor. The remaining 70 percent will be skilled labor such as heavy equipment operators, foremen, welders, and others specifically skilled in pipeline construction. This 70 percent segment of the work force will be drawn from the nationwide labor force.

ITA(A) plans one phase of construction and plans completion in approximately 12 months.

Measurement Stations, Operating and Maintenance Base

Plans call for the construction of four measurement stations--one each at Eastport, Idaho; Spokane, Washington; Stanfield, Oregon; and Ignacio, Colorado. An operating and maintenance base will be required on the northern section of the pipeline at Spokane.

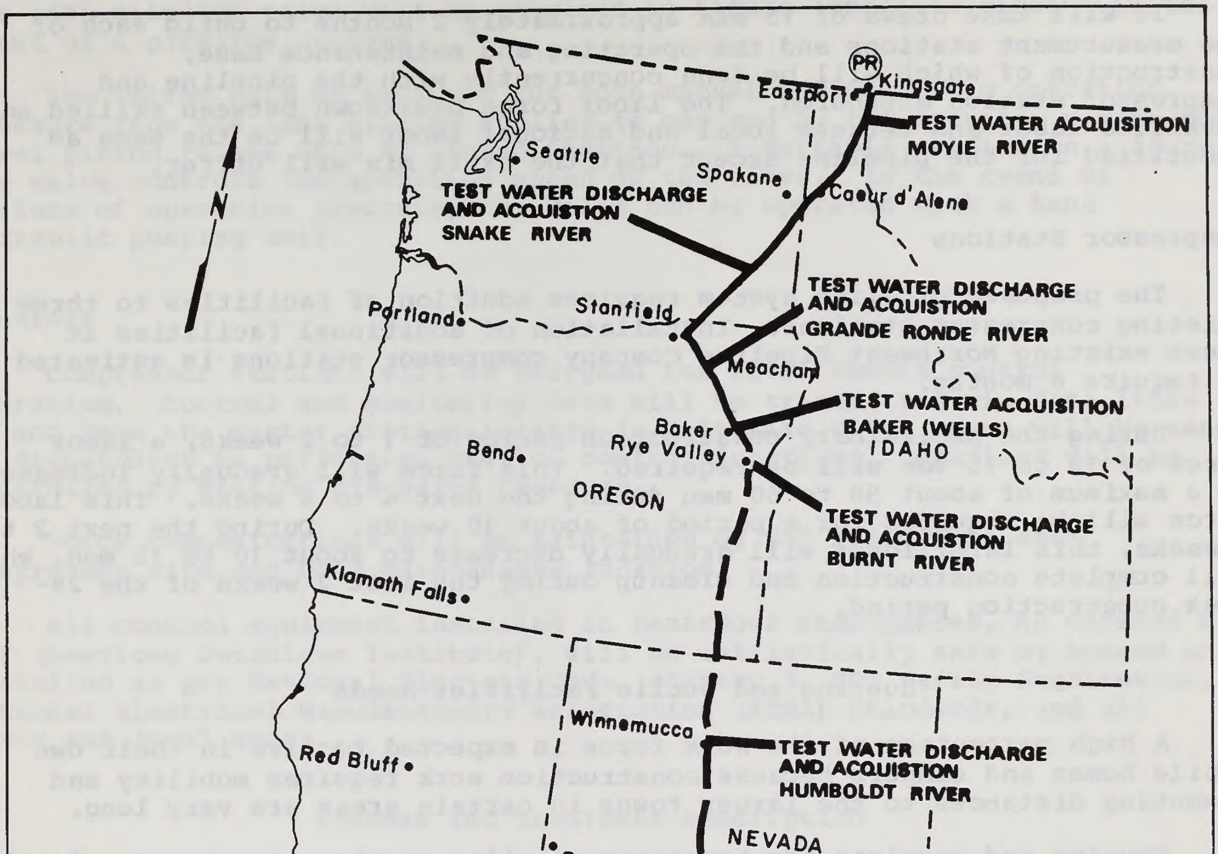

Figure 1.1.5.6-1 Test water disposal sites

It will take crews of 15 men approximately 2 months to build each of the measurement stations and the operating and maintenance base, construction of which will be done concurrently with the pipeline and compressor station expansion. The labor force breakdown between skilled and unskilled labor and between local and national labor will be the same as identified for the pipeline except that the skill mix will differ.

Compressor Stations

The proposed pipeline system requires addition of facilities to three existing compressor stations. Installation of additional facilities at these existing Northwest Pipeline Company compressor stations is estimated to require 6 months.

During the preliminary construction period of 1 to 2 weeks, a labor force of 10 to 15 men will be required. This force will gradually increase to a maximum of about 50 to 60 men during the next 6 to 8 weeks. This labor force will be required for a period of about 10 weeks. During the next 2 to 4 weeks, this labor force will gradually decrease to about 10 to 15 men, who will complete construction and cleanup during the last 2 weeks of the 24-week construction period.

Housing and Public Facilities Needs

A high percentage of the work force is expected to live in their own mobile homes and campers because construction work requires mobility and commuting distances to the larger towns in certain areas are very long.

Housing and services for transient pipeline construction personnel will generally be available in larger towns nearby, but travel distances might be 100 miles or more.

Construction in more remote areas might require work camps near the construction sites.

Occupational Safety and Health Act Procedures Applicable

ITA(A) pipeline contractors will comply with the pipeline construction guidelines published in section 2.69, part 2, General Policy and Interpretation, subchapter A, chapter 1, title 18 of the CFR, and with all OSHA regulations relevant to pipeline construction and operation. Idaho, Washington, and Oregon State and local construction codes and ordinances pertaining to pipeline construction and operation will be followed.

1.1.5.7 Operational, Maintenance, and Emergency Procedures

Technical and Operational Description

Valves, Controls, and Pipeline

Valves

Mainline block valves will be equipped with valves on either side with quick opening and closing features.

Design criteria for valving requires a valve that will fully open for onstream cleaning and has pressure differential closing ability. Devices for each mainline valve will be required to assure immediate closing in the event of a pipeline rupture.

The valves will be equipped for both manual and pneumatic operation. Pressure from the line will be applied to one end by the operator moving the power piston to the open or closed position. A variable orifice on a four-way valve controls the operating speed of the valve. In the event of failure of operating pressure, the valve can be operated with a hand hydraulic pumping unit.

Controls

Compressor stations will be designed for total remote control operation. Control and monitoring data will be transmitted via data links to and from the master station located in Salt Lake City. Data will be used by dispatchers in performing station control functions. Stations will be controlled by station discharge pressure.

Voice communications will be maintained by VHF radio from each compressor site and base maintenance location.

All control equipment installed in hazardous atmospheres, as defined by API (American Petroleum Institute), will be intrinsically safe or housed and installed as per National Electric Code, chapter 5, DOT Safety Requirement, National Electrical Manufacturers Association (NEMA) Standards, and all State and local codes.

Process and Treatment Description

The natural gas to be transported by the pipeline will have undergone treatment in processing plants prior to receipt by ITA(A). The natural gas as received at the Canadian border will be pipeline quality. No additional processing, treating, nor dehydration will be required.

Maintenance Procedures

Corrosion Checks

Data supplied by the applicants state that periodic records will be kept of all observed electrical potentials to indicate the status of all cathodic protection devices such as anodes, bonds, insulator joints, and the amount of electrical current required to provide protection by rectifiers. Periodic inspections will be made of the pipeline cathodic condition, and necessary adjustments to the electrical current will be applied by galvanic anodes and/or rectifiers. In all instances where the pipeline is exposed, inspections noting the surface condition of the coating and underlying pipe where the coating is lacking will be made. A report recording the conditions of the pipe and coating is standard pipeline practice.

Corrosion Prevention (Environmental Monitoring)

Company standards and manuals have been prepared describing procedures and checks to be made to determine the operating integrity of a cathodic rectifier protective system.

Detailed information concerning the type, size, and spacing of cathodic rectifiers and test installations to be installed on the pipeline have not been formulated. General design criteria for the cathodic protection facilities to be installed on the pipeline conform with the following:

1) One impressed current cathodic protection station is proposed for each compressor station site. Compressor sites are planned to be spaced approximately 80 to 100 miles apart along the pipeline. Rectifiers will be installed at the compressor sites because of the availability of generated on-site station power.

2) Additional impressed current cathodic protection stations are proposed to be installed between compressor station sites according to need. This need will be established by line drop survey of the current requirements after the pipeline is installed.

3) The impressed current stations will be supplemented locally as needed by the installation of 32-pound galvanic anode installations at hot spots or areas of low resistivity.

The typical rectifier installation planned for this facility is a 10 ampere, 30 volt output unit. The anticipated current requirement for the facility has been set at approximately 300 milliamperes per mile. Test installations of contact points will be installed at approximately 1-mile intervals. Additional test stations will be installed at selected locations as indicated by survey.

The applicant indicated that in areas of corrosive soils, the pipeline might be double coated and backfilled with sand for the length affected.

Route Surveillance

Periodic inspections of the pipeline will be made to detect conditions requiring preventive maintenance or that adversely affect the safety of the pipeline facilities.• Such surveillance includes inspections by land, air, or both. The pipelines are inspected from the air to detect construction or encroachment activities, erosion, dead vegetation that might be indicative of a leak or hazardous condition, the condition of the cathodic protection system, or other items affecting the integrity of the facilities. The minimum patrol frequency of the facility would be at least once a month.

All valves will be periodically inspected and maintained in an operative condition. Increases in population density will necessitate increased surveillance in the affected area.

Equipment Maintenance and Repair

Operation and maintenance procedures for the new facility will be established by the applicant. These procedures will incorporate all requirements of appropriate Federal, State and local codes, regulations, and ordinances, as well as safety standards developed by the gas pipeline industry.

Manuals on instruction and maintenance procedures will be provided to all operating personnel. The manuals contain detailed steps covering purging, pipeline pigging, and station operations including manufacturer's instructions for all installed equipment.

Building and Site Maintenance

Details for building and site maintenance have not been provided by the applicants.

Emergency Features and Procedures

Design Features for Geological, Meteorological, and Man-Induced Hazards

Design and construction criteria developed over the years by the pipeline industry are to be incorporated into the final system to enhance its ability to withstand possible natural and third-party accidents or catastrophes. Extensive pipeline systems in the major seismic zones of California provide a background of reliability and weaknesses in these systems. Modern, electric arc-welded pipe can withstand much greater stresses than older (2 years or more) acetylene-welded pipe.

Field engineering will be directed to yield design parameters, such as types of displacement, amount and orientation of displacements, and width of zone of faulting.

These data will be used to determine the appropriate probable fault shift. Design solutions may include dogleg sections to provide flexibility, pipe casings, pipe stress monitoring, and automatic valve closing features.

Double pipeline sections will be installed across the Kcotenai, Pend Oreille, and possibly Snake Rivers for security. Valves will be installed on both the main and bypass. These valves will have to be controlled by pressure sensors placed in the pipeline. The design concept will be to have line break controls on the mainline and bypass valves so that in the event of a major outage, the affected line valves will automatically close but not interrupt service on the alternate unaffected crossing.

Seismic design criteria for buildings will follow the Uniform Building Code as a minimum and will meet applicable local requirements.

Shutdown and Venting

The applicants state that comprehensive operating and maintenance manuals, including manufacturer's instructions for all installed equipment, will be provided for operating employees for all compressor stations. Employees will be familiar with such items as start and shutdown for normal and emergency procedures.

Emergency Contingency Procedures

Warning signs will be placed at all points of intersection with public rights-of-way and at other appropriate locations. The signs will be placed at the edge and facing the public right-of-way to indicate the presence of high-pressure gas. The telephone number of the owner and means of reporting unusual circumstances will be provided.

Whenever leaks, imperfections, or damages occur, they will be repaired or cut out and replaced by pretested materials of equal or greater strength and toughness characteristics. Only qualified welders and welding procedures will be employed.

Adequate procedural manuals, maps, diagrams, and records will be maintained for the use of operating personnel to determine response and contingency actions.

1.1.5.8 Future Plans

Abandonment of Facilities

Salvage and Disposal of Equipment

If the pipeline is removed, a salvage contractor staff of over 100 men will be required. The impact on the environment will be similar to that encountered during the construction phase of the project.

Plans for salvage of equipment have not been provided by the applicants, but it is assumed that if the facilities are abandoned, all above-ground facilities will be removed as well as the pipeline because the equipment and pipe represent a sizable investment.

Site Restoration

No plans have been provided describing site restoration.

Future Expansion

The proposed pipeline (Kingsgate, B.C., to Rye Valley, Oregon) and related facilities are being designed for the maximum 600 MMcf/d natural gas.

However, if gas volumes in excess of 800 MMcf/d (million cubic feet per day) become available to ITA(A), a fully powered system, connecting with the proposed pipeline in the vicinity of Rye Valley, Oregon, and extending to Cajon, California, will be constructed.

The primary purpose of the proposed fully powered system is to transport an additional 500 MMcf/d of natural gas from the Canadian border for distribution in the western United States. This would combine with the estimated 600 MMcf/d transported by the proposed system to make 1,100 MMcf/d for the total system. The fully powered system would make use of the proposed 30-inch pipeline from Eastport, Idaho, to Stanfield, Oregon. The looped segment from Stanfield to Rye Valley, Oregon, would be altered in that it would become one solid line to Rye Valley. From Rye Valley a new 30-inch pipeline would be constructed through Oregon and Nevada to connect with the proposed Southern California Gas Company pipeline from the border to Cajon, California.

ITA(A) proposes to build approximately 504 miles of 30-inch pipeline from Rye Valley, Oregon, to the Nevada-California border with an additional 23 miles of pipeline to connect loops in their proposed project between LaGrande and Baker, Oregon. SoCal, under the fully powered system, would be responsible for construction of approximately 242 miles of 30-inch pipeline from the Nevada-California border to Cajon, California.

The fully powered system would be operated and maintained in a manner similar to that described for the proposed line to Rye Valley. ITA(A)'s portion of the system would require construction of 12 compressor stations, 2 additional measurement stations, 2 area offices, 5 additional operating and maintenance bases, and 3 airstrips. SoCal's portion of the fully powered system (Nevada-California border to Cajon, California) would require 1 compressor station and 1 operation and maintenance base. Approximately 50 additional mainline valves will be needed along the length of the fully-powered system. Pigging facilities would be installed as necessary for line maintenance. Line markers, cathodic rectifiers, insulating joints, and cathodic test installations would be placed along the line at various locations.

Federal lands crossed by the fully powered system include:

1) Inyo and San Bernardino National Forest in California. These lands are administered by the Department of Agriculture, Forest Service (approximately 12 miles).

2) National resources lands in Oregon, Nevada, and California. These lands are administered by the USDI (Department of the Interior), Bureau of Land Management (approximately 570 miles).

3) Fort McDermitt Indian Reservation. These lands are administered by USDI, Bureau of Indian Affairs (less than 1 mile).

4) U.S. Naval Weapons Center, Department of the Navy (approximately 13 miles).

Numerous pipelines, highways, railroads, and electrical power facilities will be crossed by the fully powered system. The entire fully powered system would cross 5 states and 22 counties as shown in Figure 1.1.5.2-1. The states and counties are listed in Table 1.1.5.2-1. Figure 1.1.5.8-1 shows locations of proposed compressor station sites.

Operating pressures and temperatures would be higher in the fully powered system. With added compression stations, gas volumes would approach the 1,440 psig upon leaving compressor stations; however, air coolers would be installed at the compressor facilities. The gas could be cooled no lower than ambient air temperature. Hence, temperatures would be near ambient air temperature upon leaving the cooling facilities.

Under the fully powered system gas would be delivered to NPC's facilities at Spokane, Washington (approximately 250 MMcf/d), and at Rye Valley, Oregon (approximately 240 MMcf/d). The remaining gas would be fed into SoCal's system at the Nevada-California border (approximately 610 MMcf/d). The fuel used in operation of appurtenant facilities would, of course, be deducted from the system's deliverability.

The cost of the fully powered facility in 1975 dollars is estimated at $736,789,000. These costs will be shared by ITA(A) and SoCal, the cost being $611,483,000 and $125,306,000, respectively.

Rights-of-way for the fully powered system are described herein for that segment from LaGrande to Baker, Oregon, and from Rye Valley, Oregon, south to Cajon, California.

LaGrande to Baker, Oregon--a segment approximately 23 miles long and 100 feet wide (approximately 279 acres) paralleling or adjoining an existing NPC right-of-way, 25 feet (approximately 70 acres) of which would be on NPC's existing right-of-way and 75 feet (approximately 209 acres) of which wuld be new easements.

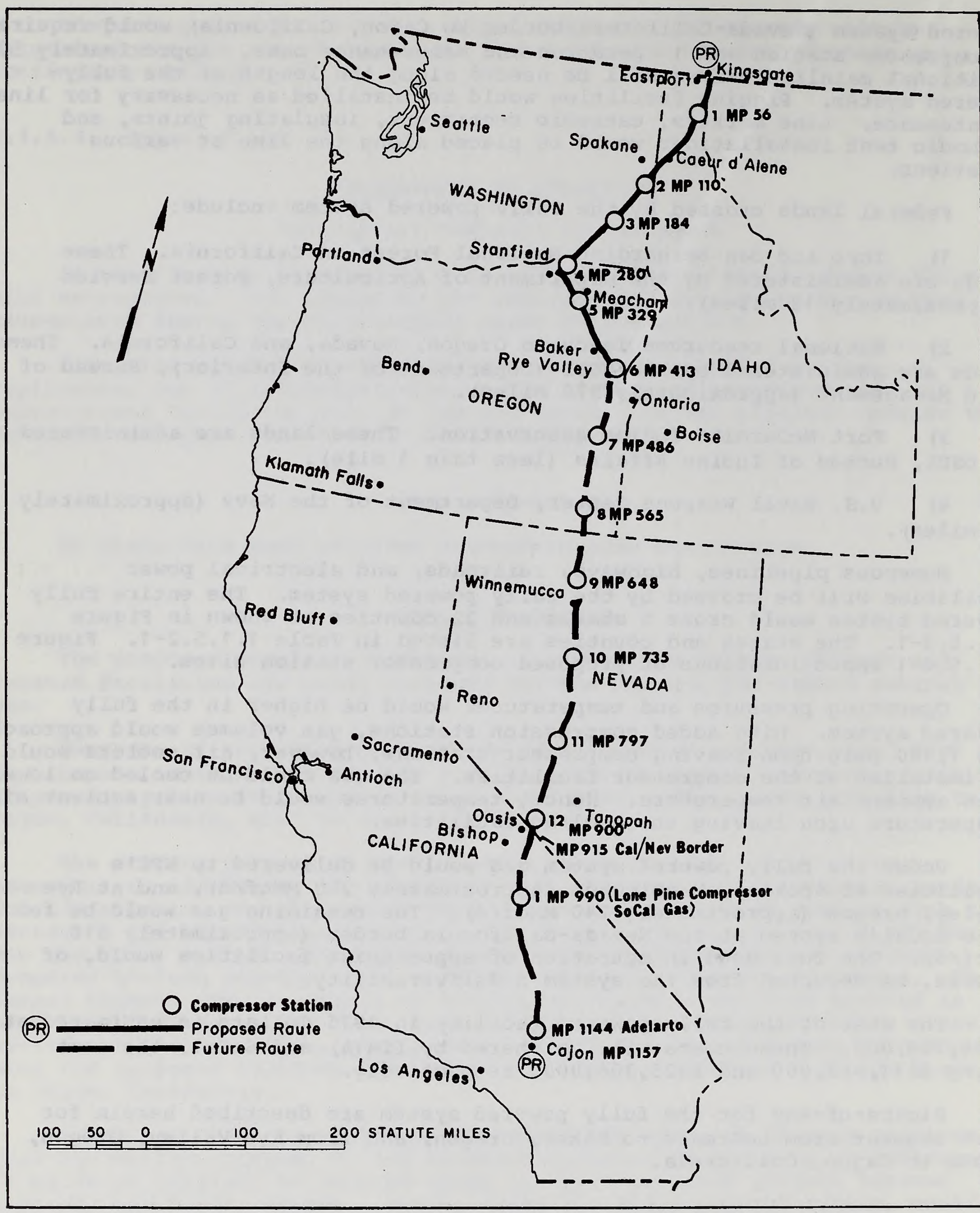

Figure 1.1.5.8-1 Proposed compressor station sites and milepost distances, fully powered system

Rye Valley, Oregon, to Nevada-California Border--a segment approximately 504 miles long with a new construction zone 100 feet wide (approximately 6,108 acres).

Nevada-California Border to Cajon, California--a segment approximately 242 miles long, with a new construction zone 100 feet wide (approximately 2,933 acres).

Permanent Right-of-Way

ITA(A) and SoCal would retain rights to use a 50-foot right-of-way along the entire fully powered system proposal. Hence, an additional right-of-way 769 miles long (approximately 4,660 acres) would be needed under the fully powered system. This would be a total of 7,029 acres needed as permanent right-of-way along the entire system.

Appurtenant facilities would require approximately 383 additional acres. This acreage would be necessary to provide for efficient operation of the fully powered proposal.

When volumes greater than 800 MMcf/d can be delivered to ITA(A), construction on the fully powered system will be undertaken. It is anticipated that this system can be fully operational in 1 year from start of construction.

Construction of compressor facilities is estimated to require 6 months. Aircraft landing strip construction would involve approximately 3 months. These activities would take place concurrently with pipeline construction. For construction of other facilities see Section 1.1.5.5.

Construction techniques insofar as trenching, facility construction, stream crossings, and pipeline laying will be done in a manner similar to that discussed in Section 1.1.5.6.

Hydrostatic testing would be done in a manner similar to that described in Section 1.1.5.6. Water will be obtained from the Burnt River in Oregon, the Humboldt River in Nevada, and small rivers, creeks, lakes and privately owned irrigation wells in California.

Noise, air, and water quality disturbance will be the same as described in Section 1.1.5.6.

Operational, maintenance, and emergency procedures will be similar to that described in Section 1.1.5.7.

1.1.5.9 Actions Involved

Federal

Numerous Federal authorizations will be required prior to project construction or operation. These include:

- Federal Power Commission: Certificate of Public Convenience and Necessity authorizing the construction and operation of facilities and the transportation of natural gas in interstate commerce from the northern border of Idaho to the California/Nevada border. These certificates are issued pursuant to section 7(c) of the Natural Gas Act.

- U.S. Department of the Interior and other Departments and agencies: Public Law 93-153, title I, section 28, parts (a) and (e) provides for the issuance of both long-term and short-term permits for pipelines and related facilities for all Federal agencies except across Indian lands and National Park Service lands. Federal agencies administering land along the pipeline route and subject to P.L. 93-153 are the U.S. Forest Service, the Bureau of Land Management, the Corps of Engineers, and the U.S. Naval Weapons Center.

Long-term or permanent use and right-of-way permits would be issued for the pipeline, valve sites, compressor stations, access roads, communication sites, and air strips. The above uses across the Federal lands include: approximately 582 miles of right-of-way for the pipeline; approximately 4,000 permanent acres in rights-of-way for air strips, compressor stations, communication sites, access roads, and pipeline route;and approximately 3,550 temporary acres. These short-term or temporary acres and permit needs are for construction zones, access roads, air strips, storage areas, camps, timber sales, and material sales. These Federal lands account for approximately 52 percent of the total land needs for the construction and maintenance of the Kingsgate to Los Angeles pipeline.

- Other Federal Agencies U.S. Coast Guard: A permit to cross the Snake River; and it will be an above-ground crossing, thus requiring U.S. Coast Guard approval. U.S. Environmental Protection Agency: Permits for discharge of test water and pollutants.

State

- California Public Utilities Commission: Issuance of a Certificate of Public Convenience and Necessity.

- Other State utility commissions

- State and county highway and road departments

- Fish and game departments

- Various departments of Natural Resources, Water Resources, Environmental, and/or land commissioners depending on State organization and responsibilities.

- County planning commissions, Boards of Adjustment, or other local land use control authorities. These vary between states and between counties within each state.

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2 DESCRIPTION OF THE EXISTING ENVIRONMENT

2.1 ARCTIC GAS PIPELINE PROJECT

2.1.5 Los Angeles Pipeline

The application of ITA(A) discussed in the Draft EIS was for a pipeline from the U.S.-Canadian border (between Eastport, Idaho, and Kingsgate, British Columbia) to Cajon, California. On October 23, 1975, ITA(A) submitted a revised proposal, as explained in Section 1.1.5, which proposes that the pipeline extend only from the U.S.-Canadian border to Rye Valley, Oregon, at present. The Rye Valley-to-Cajon segment is part of a planned future expansion. Nevertheless, certain environmental information on the Rye Valley-to-Cajon segment is in this final EIS.

Much of the description of the environment for the proposed Los Angeles pipeline is applicable to the proposed San Francisco pipeline. To avoid repetition of common descriptive material, reference is made to specific sections of the San Francisco material. Further, certain material on the proposed Los Angeles pipeline is discussed in the framework of the segments: Eastport-to-Rye Valley; Stanfield-to-Rye Valley; Eastport-to-Cajon; and Rye Valley-to-Cajon. The suffix "R" is used in the subsection number to designate the "future expansion" segment from Rye Valley to Cajon.

2.1.5E Eastport to Rye Valley

2.1.5E.1 Climate

Information on climatic conditions is in Section 2.1.4.1.

As described by the Koeppen Climate Classification System (Critchfield, 1966), the climatic divisions of Microthermal, Mesothermal and Dry will be crossed by the proposed pipeline route (ITAA proposal). Summary information for these stations is in Tables and Figures 2.1.5.1-1, 2.1.5.1-2 and 2.1.5.1-3. Figure 2.1.5.1-4 displays average annual number of days with dense fog and 2.1.5.1-5 shows a forecast of High Air Pollution Potential Days.

Temperature

Section 2.1.4.1 (San Francisco) describes typical temperatures along the proposed route. Table 2.1.5.1-2 and Figure 2.1.5.1-4 give temperatures along the proposed route.

The length of the freeze-free period, an indication of the length of the plant growing season, averages nearly 100 days along the proposed line.

Precipitation

The discussion regarding precipitation presented in 2.1.4.1 through the Columbia Plateau Province is adequate to cover ITA(A)'s application. Figures 2.1.5.1-2, 2.1.5.1-3, and Table 2.1.5.1-4 cover precipitation at selected points along ITA(A)'s proposal.

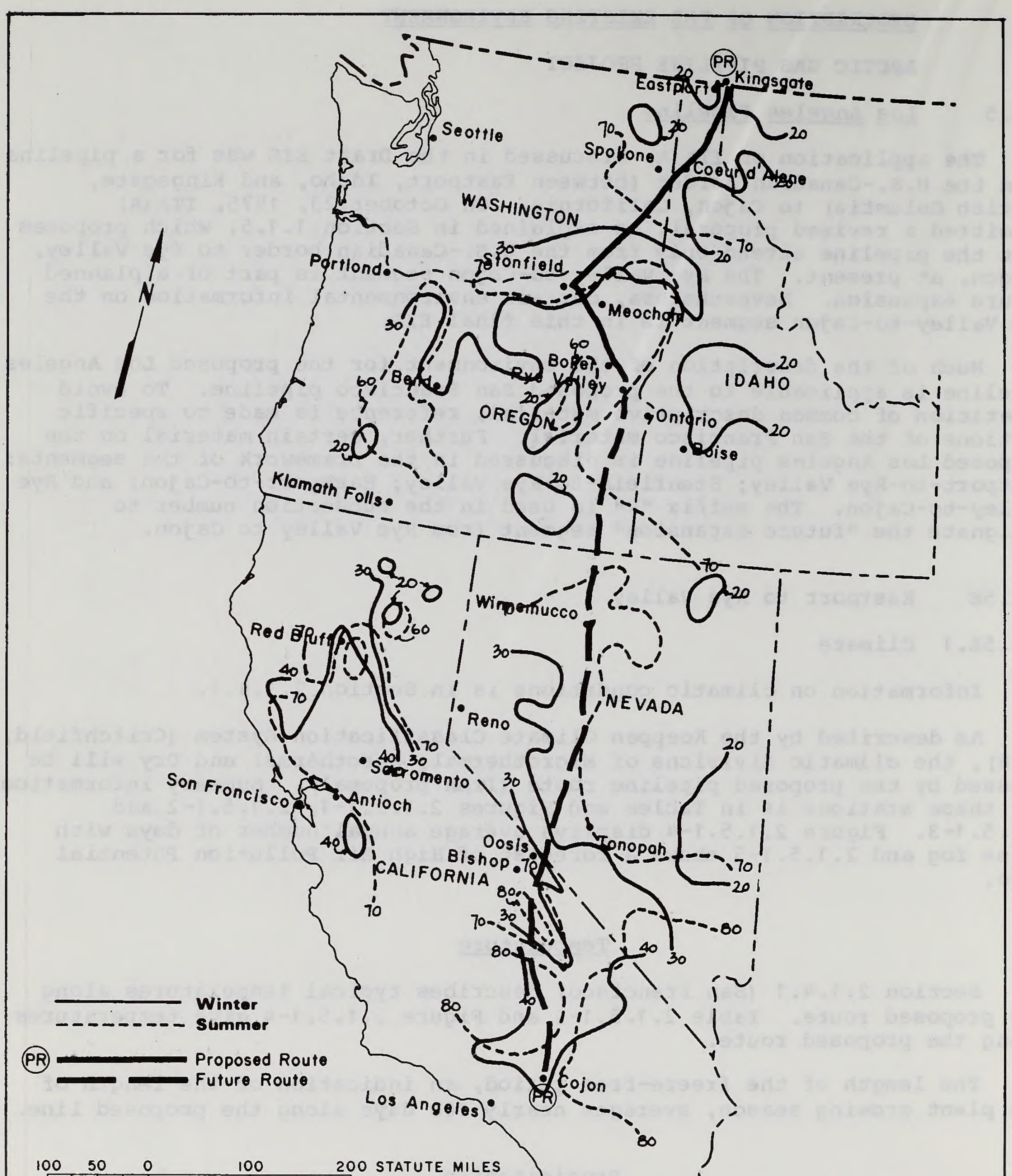


Figure 2.1.5.1-1 Average temperature along the pipeline

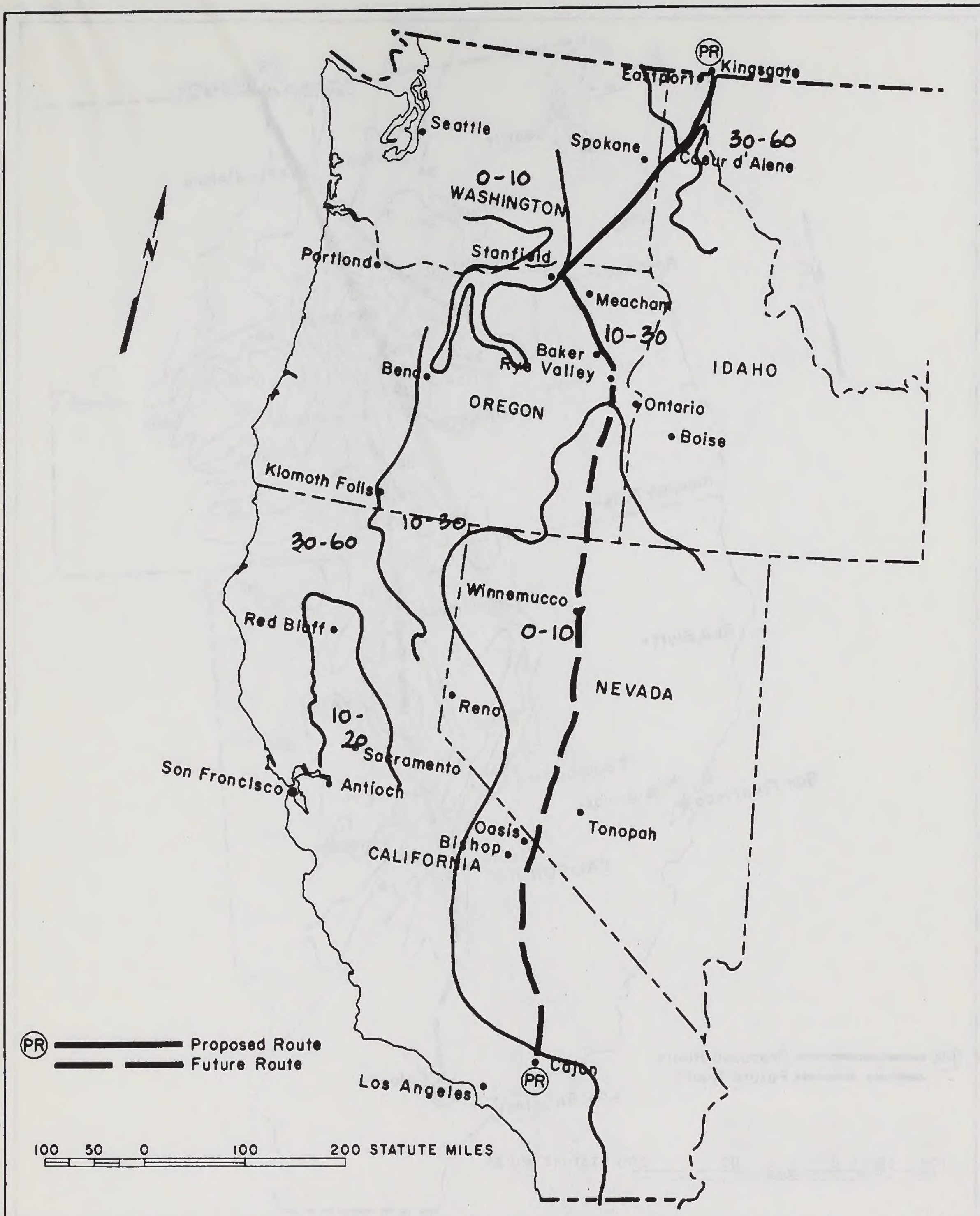


Figure 2.1.5.1-2 Precipitation along the pipeline, in inches

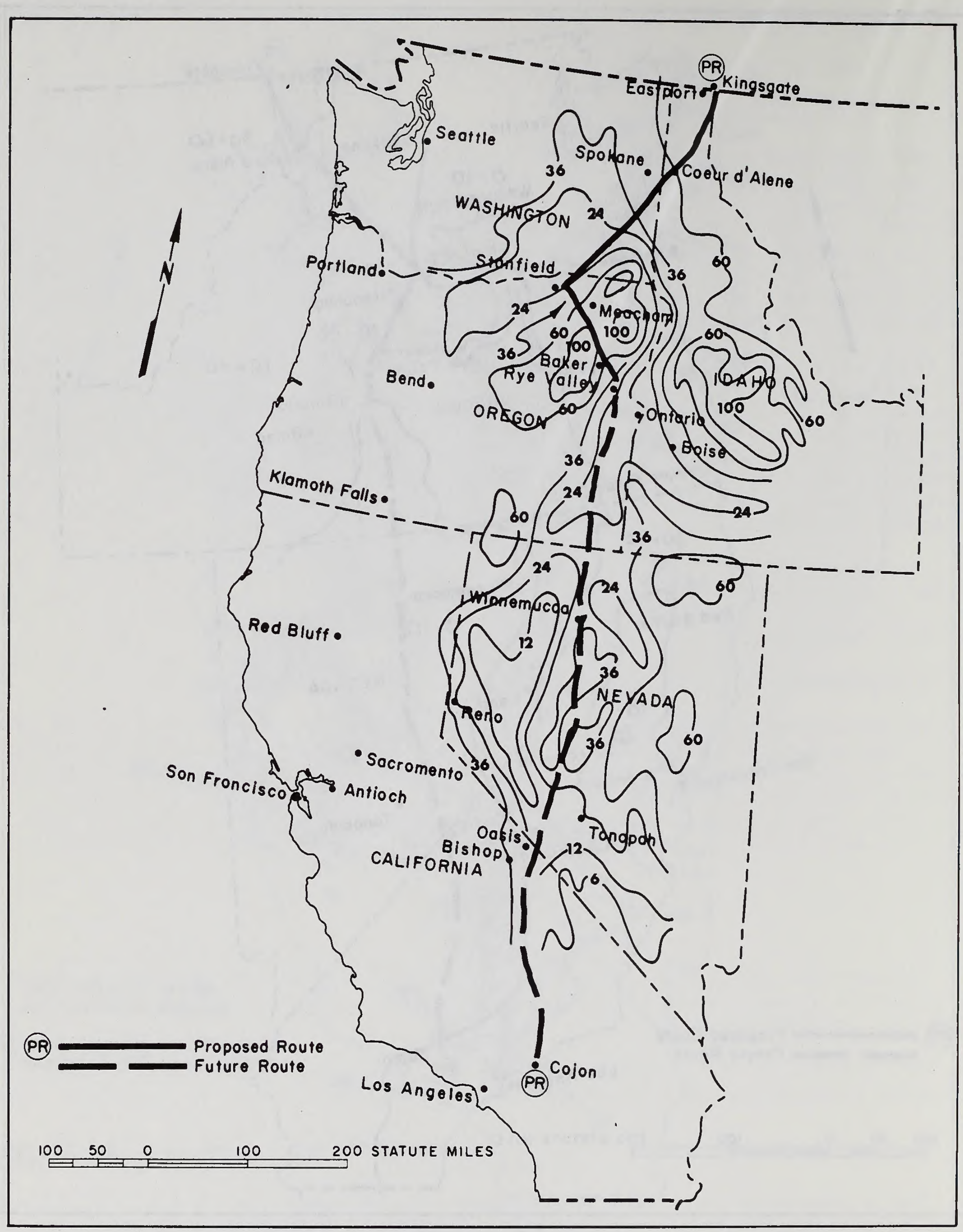


Figure 2.1.5.1-3 Average annual snowfall (inches) in the vicinity of the pipeline

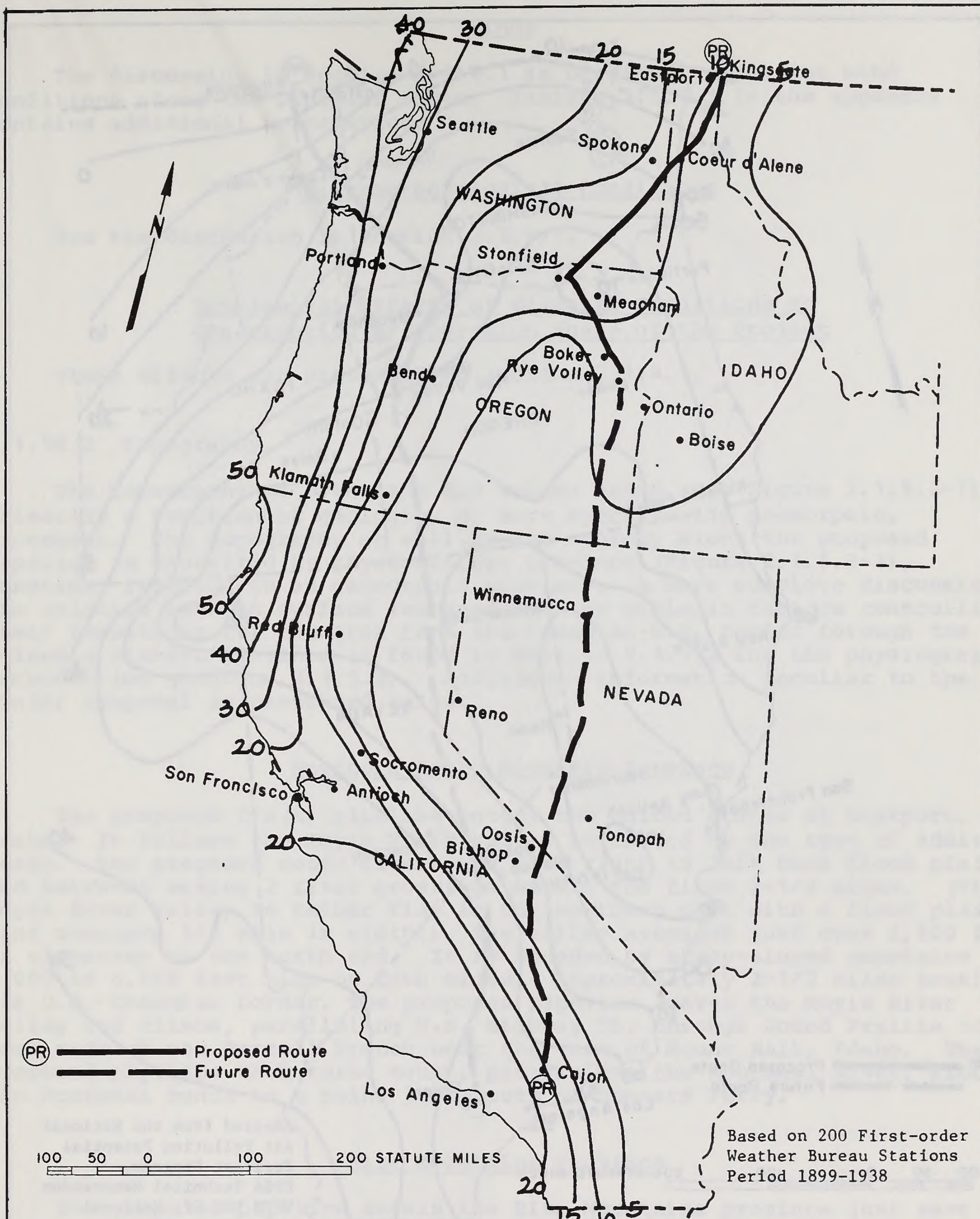


Figure 2.1.5.1-4 Average annual number of days with dense fog

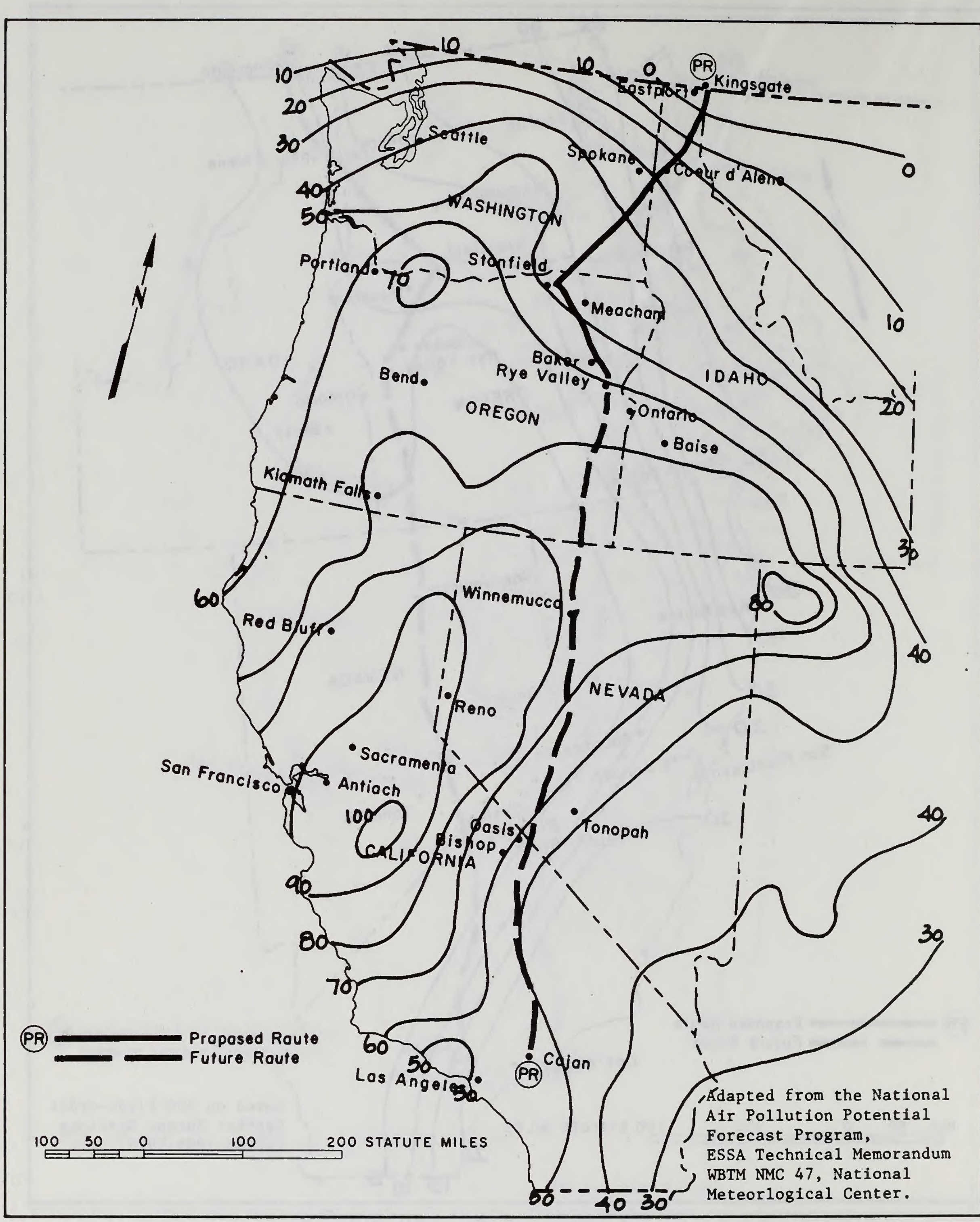


Figure 2.1.5.1-5 Forecast high air pollution potential days

Winds

The discussion in Section 2.1.4.1 is pertinent regarding wind conditions along the pipeline route. Table 2.1.5.1-5 in the appendix contains additional information.

Micrometeorological Conditions

See the discussion in Section 2.1.4.1.

Detrimental Effects of Climatic Conditions on Construction or Operation Phase of the Project

These effects are presented in Section 2.1.4.1.

2.1.5E.2 Topography

The topography of both land and subsea areas (see Figure 2.1.5.2-1) is primarily a function of geologic, or more specifically geomorphic, processes. The topography as well as the geology along the proposed pipeline is described by physiographic province (Figure 2.1.5.3-1), sometimes referred to as geomorphic province. A more complete discussion of the relation between surface features and the geologic factors controlling their formations for the area from the Canadian-U.S. border through the Columbia Plateau province is found in Section 2.1.4.2 and the physiography introduction (Section 2.1.5.3). Additional information peculiar to the ITA(A) proposal is presented below.

Northern Rocky Mountain Province

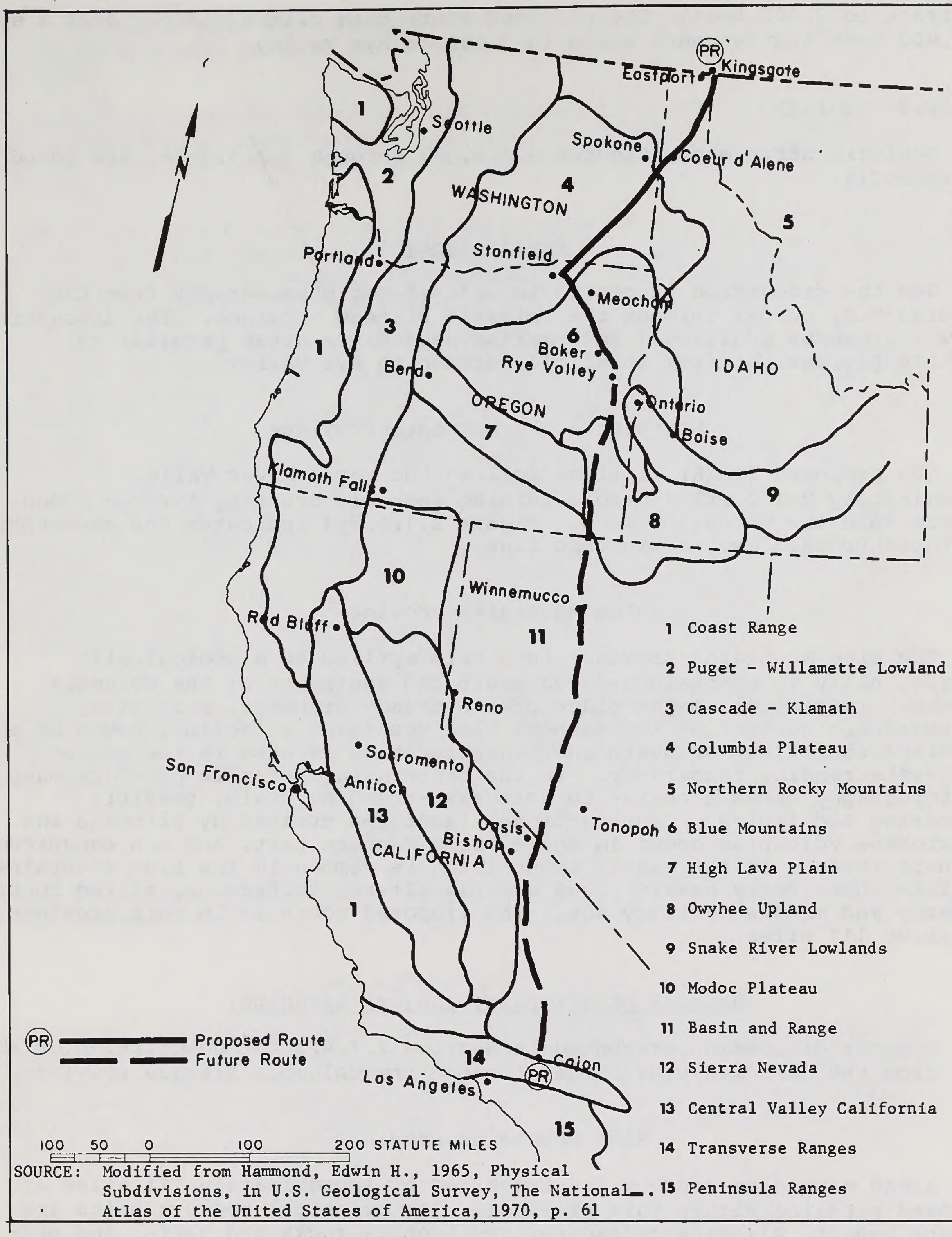
The proposed ITA(A) pipeline enters the United States at Eastport, Idaho. It follows the Moyie River valley southward to the town of Addie, Idaho. The proposed route alternates from right to left bank flood plains and terraces making 2 river crossings within the first 2-1/2 miles. (The Moyie River valley is rather flat in the northern part with a flood plain that averages 1/3 mile in width.) The valley averages just over 2,500 feet in elevation at the north end. It is bounded by steep-sloped mountains 4,000 to 6,000 feet high on both sides. Approximately 2-1/2 miles south of the U.S.-Canadian border, the proposed pipeline leaves the Moyie River Valley and climbs, paralleling U.S. Highway 95, through Round Prairie to the east side of the Purcell Trench near the town of Mount Hall, Idaho. The proposed pipeline then turns south, paralleling the Kootenai River, along the Kootenai bench to a point just south of Bonners Ferry.

Blue Mountains Province

The proposed pipeline enters the Blue Mountains province just east of Pendleton, Oregon. Turning more southerly the proposed pipeline crosses the Umatilla River, immediately encountering steep valleys and ridges trending northwesterly. Elevation increases markedly to over 3,000 feet and slopes are very steep. Climbing out of the Umatilla River the proposed pipeline trends southeasterly crossing Emigrant Hill to Meacham, Oregon. The proposed route then swings slightly to the west and after intersecting U.S. 30 it enters the broad, flat Durkee Valley 2 miles northwest of Durkee at an elevation of 2,800 feet descends to about 2,650 feet at Durkee, then ascends

Source: Raisz, Erwin; Landforms of the United States, 1954.

Figure 2.1.5.2-1 Physical landforms of the western United States



SOURCE: Modified from Hammond, Edwin H., 1965, Physical Subdivisions, in U.S. Geological Survey, The National Atlas of the United States of America, 1970, p. 61

Figure 2.1.5.3-1 Geomorphic provinces

a terrace to 2,800 feet. The proposed route then climbs steeply over a spur to 3,400 feet and descends again to 3,000 to Rye Valley.

2.1.5E.3 Geology

Geologic strip maps, Figures 2.1.5.3-2 through 2.1.5.3-16, are found in the appendix.

<u>Physiography</u>

See the discussion presented in 2.1.4.3 for physiography from the Canadian-U.S. border through the Columbia Plateau province. The discussion below represents additional information needed for areas peculiar to ITA(A)'s proposal or from Stanfield, Oregon to Rye Valley.

Northern Rocky Mountain Province

The proposed ITA(A) pipeline follows the Moyie River Valley approximately 2-1/2 miles before turning westerly crossing through Round Prairie into the Purcell Trench. Figure 2.1.5.3-1 indicates the geomorphic provinces crossed by the proposed line.

Blue Mountains Province

The Blue Mountains province is a term applied to a geologically diverse, hilly to mountainous area south and southeast of the Columbia Plateau. In general, major ridge crests trend northwest, reflecting physiographic control by the complex Blue Mountains anticline; south of the anticline the effect of Basin and Range faulting is seen in the north-northwest-trending topography. In the eastern part of this province much of the topography shows a north- to northeast-trending grain, possibly reflecting old faults. Constructional landforms created by Pliocene and Pleistocene volcanism occur in the extreme western part, and are conspicuous by their absence in the east. Landsliding is common in the Blue Mountains province where heavy basalt flows overlie altered tuffaceous, tilted rocks of early and middle Tertiary age. The proposed route is in this province for about 111 miles.

<u>Bedrock Stratigraphy and(or) Lithology</u>

See the discussion presented in Section 2.1.4.3 for description of the area from the Canadian-U.S. border through the Columbia Plateau province.

Blue Mountains Province

Areas mapped as bedrock are traversed by approximately 111 miles of proposed pipeline within this province. The principal bedrock units are Miocene basalt, Pliocene tuffaceous sedimentary rocks and tuffs, and pre-Tertiary igneous and sedimentary rocks, some of which are metamorphosed.

The Columbia River Basalt of Miocene age is a resistant rock which caps benches and hogbacks and outcrops on ridge crests and rims. Lithologically it is similar to the basalt of the Columbia Plateau province (see detailed description in discussion of bedrock geology of Columbia Plateau province). Structurally, however, it is more extensively faulted and folded, dipping as much as 10 degrees with even steeper attitudes along faults. The thinness of soil and(or) loess in some areas mapped as basalt may cause trenching difficulties.

Immediately south of Baker most of the bedrock mapped as Columbia River Basalt is sedimentary rock interlayered with the flows. It consists of loosely coherent sand, silt, and gravel which may be susceptible to landsliding.

Tuffaceous sedimentary rocks and tuffs of Pliocene age are traversed by most of the proposed pipeline route between Baker and the southern boundary of the Blue Mountains province. These rocks are semiconsolidated to well consolidated and may cause trenching difficulties.

Altered basic volcanic rocks and minor sedimentary rocks of pre-Tertiary age are crossed by the proposed pipeline route at several places north of Baker. Most of the volcanic rocks are highly sheared, chloritized, and silicified; locally they are schistose. Associated sedimentary rocks include chert, conglomerate, argillite, and limestone. Collectively, these rocks form low, rounded hills studded with sparse, craggy outcrops.

Small areas of pre-Tertiary argillite, tuff, and chert with subordinate limestone and greenstone appear as windows in overlying Tertiary rocks along the proposed pipeline route south of Baker. Areas underlain by these rocks are commonly mantled with chert clasts. Other pre-Tertiary rocks exposed along or near the proposed pipeline route in the Blue Mountains province include greens schist, serpentine schist, phyllite, marble, sandstone, slate, meta-gabbro, and quartz diorite.

Flows and breccias of rhyolitic to andesitic composition and Eocene to Oligocene age are exposed near but not across the proposed pipeline route southeast of Baker in T. 12 S., R. 42 E. These rocks commonly consist of cobbles and boulders in a friable matrix. Soft and easily eroded, they form subdued outcrops and topography.

Surficial Deposits

See the discussion presented in 2.1.4.3 for description of the area from the Canadian-U.S. border through Columbia Plateau Province.

Blue Mountains Province

The only significant amounts of surficial material to be encountered on this segment of the proposed route are in Grande Ronde Valley and Baker Valley, a total distance of about 20 miles. The material consists of stream channel and Holocene terrace and floodplain deposits. These deposits are comprised of silt, sand, and gravel. Most are unconsolidated and probably have poor cut-slope stability.

Mineral Resources

Section 2.1.4.3 describes mineral resources in the area from the Canadian-U.S. border through the Columbia Plateau Province.

Blue Mountains Province

Neither mining operations ncr, at present, economically attractive deposits are located on the proposed right-of-way. A few inactive operations are present within a few miles of the proposed route between Baker and Durkee, but none have ever had significant production. Since, however, the geologic environment adjacent to the proposed route is similar to nearby areas of mineralization, such areas and their mineral resources are briefly mentioned.

Pleistocene to Holocene placer deposits, from which notable amounts of gold and some platinum group minerals have been recovered, are widely distributed throughout the region. The largest and richest deposits have been found in streams that cross or flow from areas of pre-Tertiary rocks. Comparatively little unworked ground remains.

Mineral resources of Tertiary age include: (1) various forms of volcanic rocks, such as perlite, cinders, zeolitized tuffs, and rock usable as decorative dimension stone; (2) diatcmite, gypsite, and clays which are mostly interlayered with lake beds and tuffaceous sediments; (3) remnants of Eocene and Miocene gold-bearing placers; and (4) vein or impregnation-type cinnabar and gold-silver lode deposits.

Gold and silver occur in hydrothermal veins in pre-Tertiary metamorphosed sedimentary rocks and greenstone, and also in granodiorite, albite granite, serpentine, and gabbro. Limestone deposits suitable for cement and chemical-grade uses are of Triassic and Permian age, but small lenses and thin, local interbeds occur also in the Devonian and Jurassic sediments.

Copper, cobalt, molybdenite, scheelite, manganese, stibnite, and quicksilver form deposits of economic interest in the pre-Tertiary rocks though of a lesser degree than gold and limestone.

Geologic Hazards

See the discussion under 2.1.4.3 for general discussion and description of hazards in the area from the Canadian-U.S. border through the Columbia Plateau province.

Seismicity, Blue Mountains Province

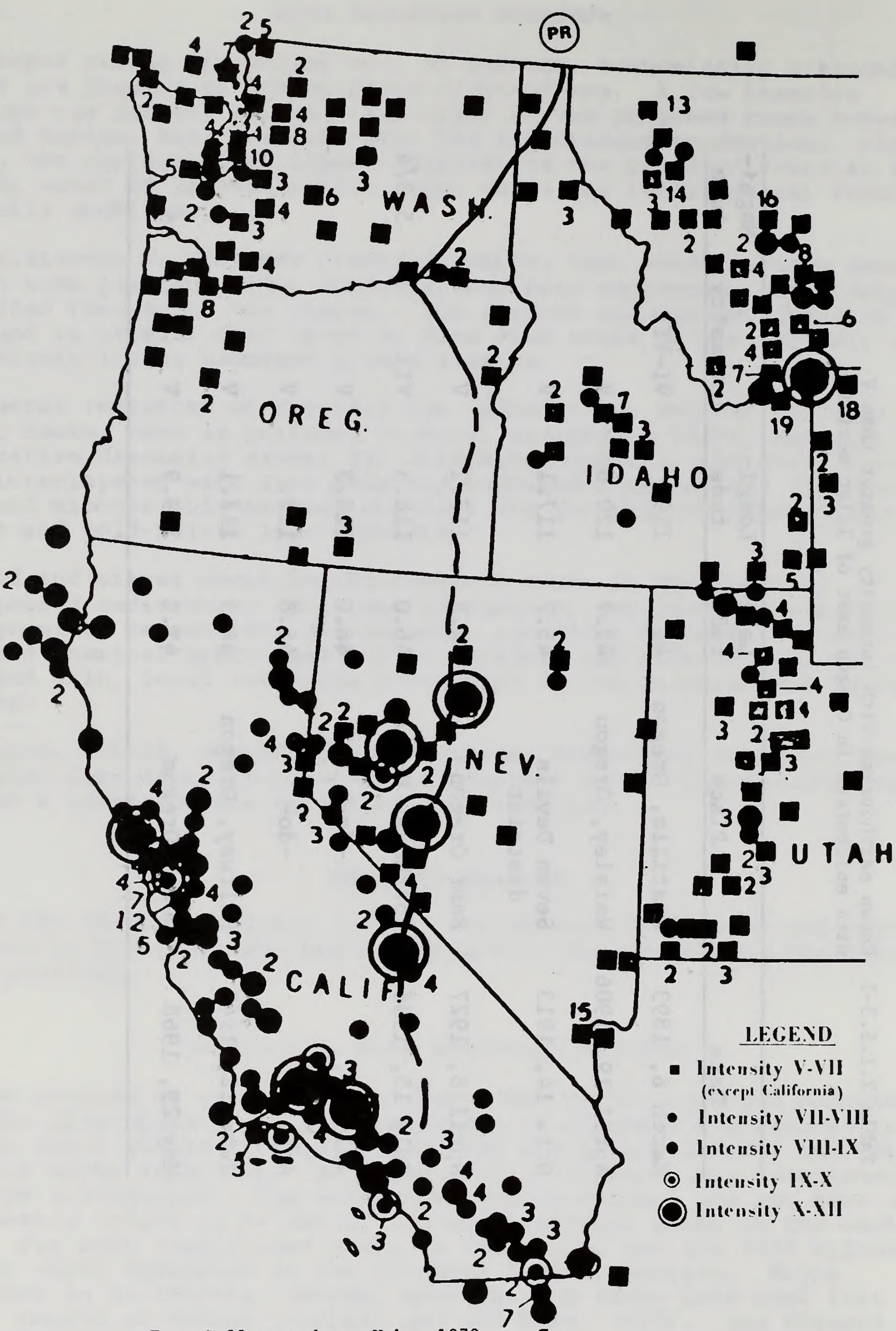
That portion of eastern Oregon traversed by the proposed pipeline lies in seismic risk zones 1 and 2. The number of recorded earthquakes in this region is small (Table 2.1.5.3-1) and most are of the minimal intensity (V) considered worth reporting. No known surface ruptures are associated with any of the earthquakes. The earthquake map by Coffman and von Hake (1973) shows eastern Oregon to be one of the most aseismic areas in the western states. The most significant quake in the region was the 1936 Milton-Freewater event described in the Columbia Plateau section. Major earthquakes in California, Nevada, Montana, and Idaho have been felt in this area but caused no damage (Coffman and von Hake, 1973). See Figures 2.1.5.3-17 and 2.1.5.3-18.

Landslides, Subsidence and Erosion

See the discussion under 2.1.4.3 for descriptions of the area from the Canadian-U.S. border through the Columbia Plateau province.

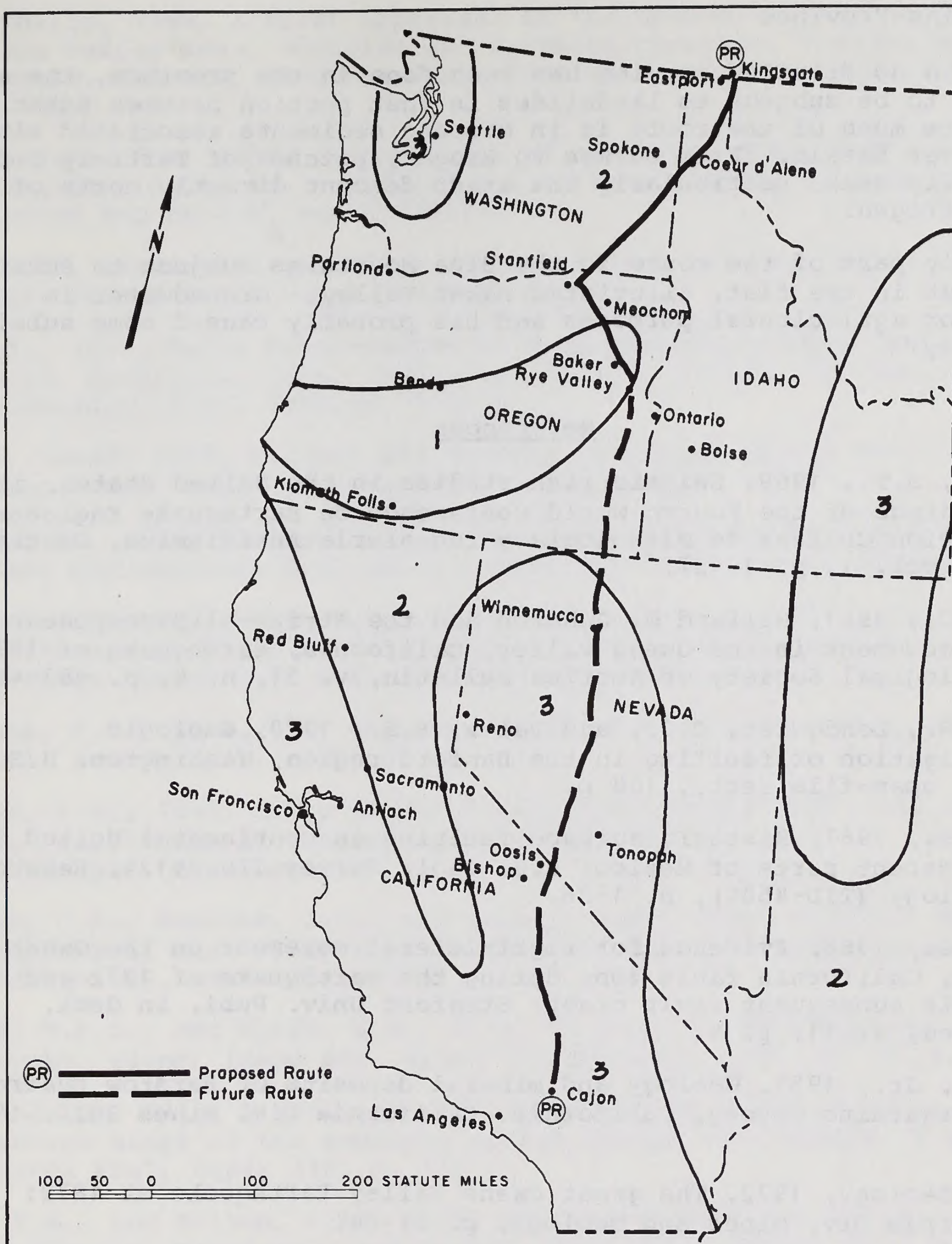
Table 2.1.5.3-1 Known earthquakes with intensity greater than V with epicenters in Oregon east of 121st meridian

Date	Place	Latitude	Longitude	Intensity	Magnitude
March 6, 1893	Umatilla, Oregon	46	119	VI-VII	
April 19, 1906	Naisley, Oregon	42.7	120.6	V	
Oct. 14, 1913	Seven Devils district	45.7	117.1	V	
April 8, 1927	East Oregon	44.8	117.2	V	
July 15, 1936	Northeast Oregon	46.0	118.3	VII	5 3/4
July 18,	-do-	46.0	118.3	V	
Aug. 4	-do-	45.8	118.	V	
June 12, 1942	Halfway, Oregon	44.9	117.1	V	
May 29, 1968	Adel, Oregon	42.2	119.9	V	4



From Coffman and von Hake, 1973

Figure 2.1.5.3-17 Earthquakes (intensity V and above) in the United States through 1970



EXPLANATION

SEISMIC RISK ZONES (After Algermissen, 1969)

ZONE 0 - No damage (not indicated on this map)
ZONE 1 - Minor damage; distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 seconds; corresponds to intensities V and VI of the M.M.* Scale.
ZONE 2 - Moderate damage; corresponds to intensity VII of the M.M.* Scale.
ZONE 3 - Major damage; corresponds to intensity VIII and higher of the M.M.* Scale.

This map based on the known distribution of damaging earthquakes and the M.M.* intensities associated with these earthquakes; evidence of strain release; and consideration of major geologic structures and provinces believed to be associated with earthquake activity. The probable frequency of occurrence of damaging earthquakes in each zone was not considered in assigning rating to the various zones.

* Modified Mercalli Intensity Scale of 1931.

Figure 2.1.5.3-18 Seismic risk zones in the region of the proposed pipeline route

Blue Mountains Province

Although no detailed mapping has been done in the province, the area most likely to be subject to landslides is that portion between Baker and Durkee, where much of the route is in Miocene sediments associated with the Columbia River Basalt. From Durkee to Brogan, patches of Tertiary sediments may be equally weak, particularly the steep descent directly north of Willow Creek near Brogan.

The only part of the route in the Blue Mountains subject to subsidence would be that in the flat, alluviated Baker Valley. Groundwater is withdrawn for agricultural purposes and has probably caused some subsidence in the valley.

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2.1.5E.4 Soils (Stanfield to Rye Valley, Oregon)

The proposed pipeline route, except for minor route adjustments, parallels the San Francisco pipeline proposal from the Canadian Border (Eastport, Idaho) to Stanfield, Oregon, a segment of 280 miles. From

Stanfield, Oregon the pipeline route proceeds to Rye Valley, Oregon, involving 111 miles of pipeline.

In the following sections the reader will be referred to Section 2.1.4.4 of the San Francisco report for a description of the soils which occur in the 280-mile pipeline segment (Eastport, Idaho to Stanfield, Oregon) where this pipeline route and the San Francisco pipeline parallel each other. The soils which are encountered from Stanfield to Rye Valley, Oregon are described below.

Soil Classification

The reader is referred to Section 2.1.4.4, San Francisco pipeline report, for the soil classification system discussion.

Soil Associations Along the Proposed Route

Idaho Soil Associations: See Section 2.1.4.4 and Figure 2.1.5.4-1.

Washington Soil Associations: See Section 2.1.4.4 and Figure 2.1.5.4-2.

Oregon Soil Associations: See Figure 2.1.5.4-3, Oregon Soil Associations, and Table 2.1.5.4-1, Selected Soil Characteristics in Oregon.

2.1.5E.5 Water Resources

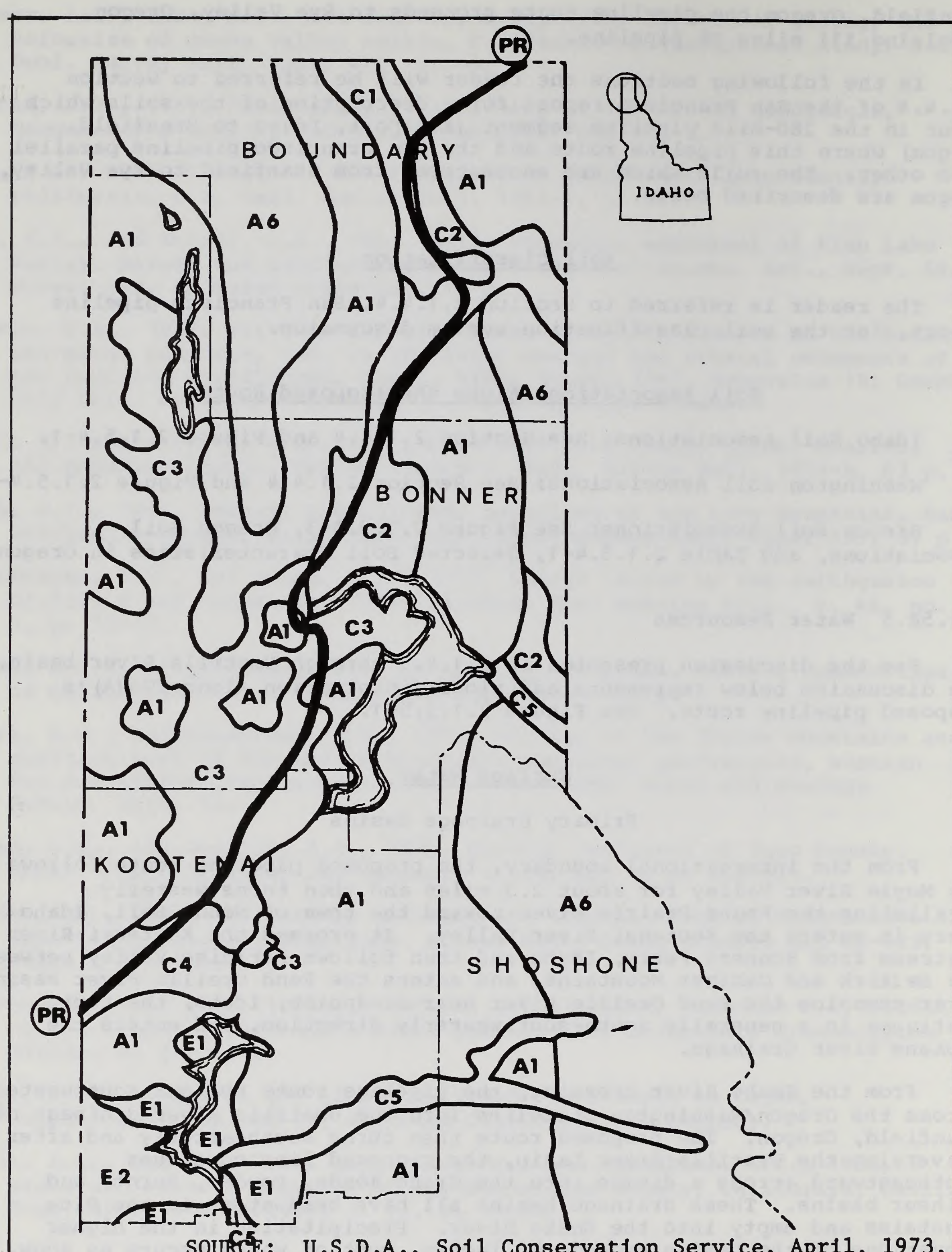
See the discussion presented in 2.1.4.5 through Umatilla River basin. The discussion below represents additional information along ITA(A)'s proposed pipeline route. See Figure 2.1.5.5-1.

Surface Water

Primary Drainage Basins

From the international boundary, the proposed pipeline route follows the Moyie River Valley for about 2.3 miles and then turns westerly paralleling the Round Prairie River toward the town of Mount Hall, Idaho where it enters the Kootenai River Valley. It crosses the Kootenai River upstream from Bonners Ferry, Idaho and then follows Paradise Valley between the Selkirk and Cabinet Mountains, and enters the Pend Oreille River basin. After crossing the Pend Oreille River near Sandpoint, Idaho, the route continues in a generally south-southwesterly direction, and enters the Spokane River drainage.

From the Snake River crossing, the pipeline route follows southwesterly across the Oregon/Washington Stateline into the Umatilla River drainage near Stanfield, Oregon. The proposed route then turns southeasterly and after traversing the Umatilla River basin, the proposed line continues southeastward across a divide into the Grand Ronde, Powder, Burnt, and Malheur basins. These drainage basins all have headwaters in the Blue Mountains and empty into the Snake River. Precipitation in the higher elevations of the basins exceeds 40 inches, most of which occurs as snow. Maximum flows of all these rivers occur during snowmelt runoff periods in the spring, whereas lowest flows occur during late summer or early fall. Many of these streams freeze or experience ice jamming during the winter, as temperature in the headwaters may drop below -40°F.



SOURCE: U.S.D.A., Soil Conservation Service, April, 1973.

Figure 2.1.5.4-1 Idaho soil associations

· Legend, Figure 2.1.5.4-1 Idaho Soil Associations

A. STONY MEDIUM TO COARSE TEXTURED, LIGHT AND DARK COLORED SOILS, MODERATELY STEEP AND STEEP MOUNTAINOUS--DOMINANTLY FORESTED.

A1 Shallow to deep, well-drained, slightly to strongly acid, stony silt loam soils that are moderately steep and steep, and formed in material weathered from metamorphosed and acid igneous rocks, glacial till, and volcanic ash--20 to 60 inches annual precipitation. (Huckleberry-Jughandle-Waits-Moscow)

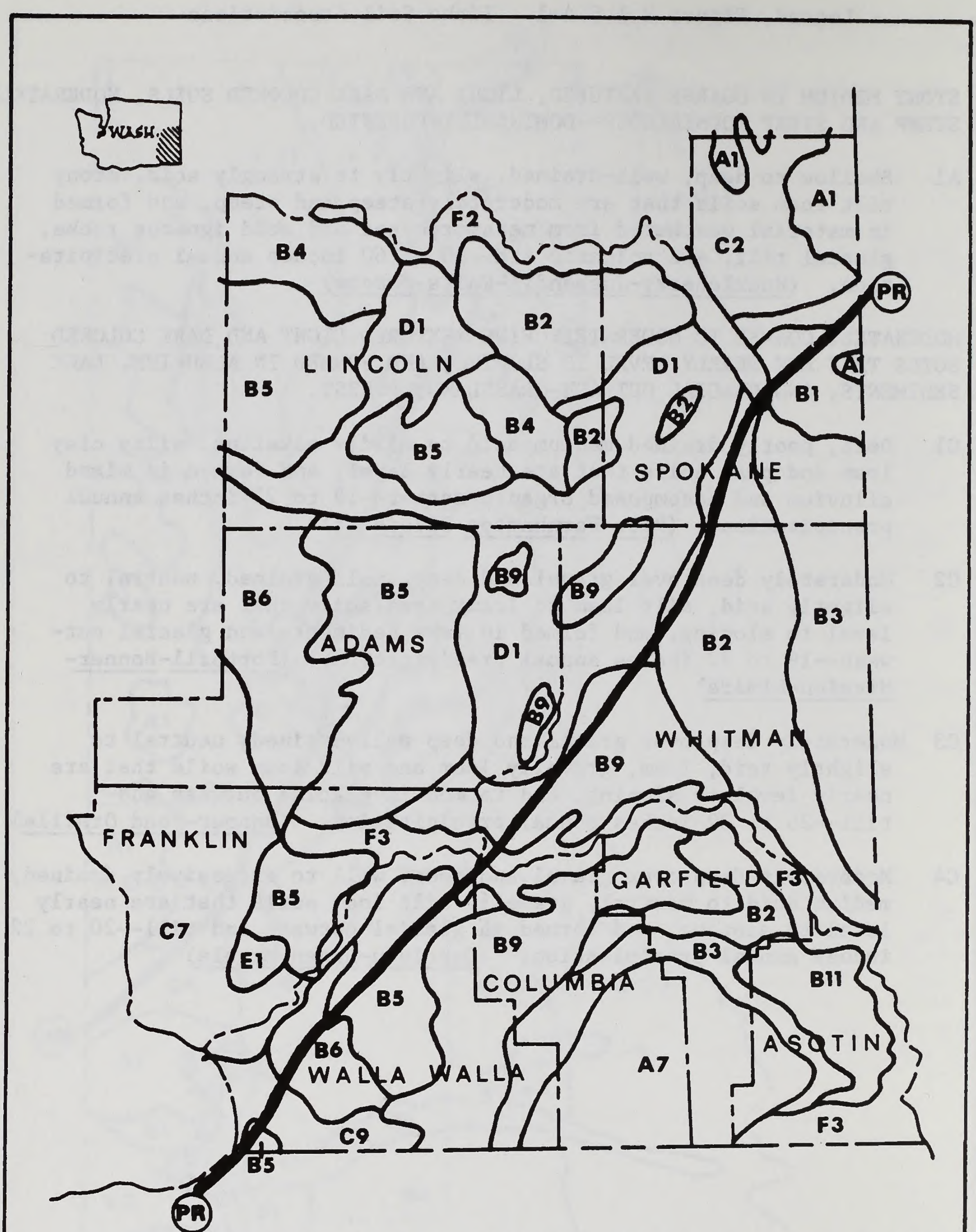
C. MODERATELY COARSE TO MODERATELY FINE TEXTURED LIGHT AND DARK COLORED SOILS THAT ARE NEARLY LEVEL TO SLOPING, AND FORMED IN ALLUVIUM, LAKE SEDIMENTS, AND GLACIAL OUTWASH-GRASSLAND, FOREST.

C1 Deep, poorly drained medium acid to mildly alkaline, silty clay loam and peat soils that are nearly level, and formed in mixed alluvium and decomposed organic matter--19 to 23 inches annual precipitation. (Ritz-Farnhamton-DeVoignes)

C2 Moderately deep over gravel and deep, well-drained, neutral to slightly acid, silt loam to loamy sand soils that are nearly level to sloping, and formed in lake sediments and glacial outwash--19 to 32 incles annual precipitation. (Porthill-Bonner-Mission-Elmira)

C3 Moderately deep over gravel and deep well-drained, neutral to slightly acid, loam, gravelly loam and silt loam soils that are nearly level to sloping, and formed in glacial outwash and till--25 to 32 inches annual precipitation. (Bonner-Pend Oreille)

C4 Moderately deep over gravel and deep, well to excessively drained, medium acid to neutral, gravelly silt loam soils that are nearly level to sloping, and formed in glacial outwash and till--20 to 22 inches annual precipitation. (Garrison-Hagen-Marble)



SOURCE: U.S.G.S., U.S.D.A., Soil Conservation Service
May, 1968.

Figure 2.1.5.4-2 Washington soil associations

Legend, Figure 2.1.5.4-2, Washington Soil Associations

B. SOILS OF NEARLY LEVEL TO VERY STEEP LOESSIAL UPLAND--DOMINANTLY GRASSLAND, WITH SOME SHRUBS.

B1 Deep, loam and silt loam soils formed in wind-laid silts and glacial till and outwash. (Freeman-Nez Perce-Naff)

B2 Deep, silt loam soils formed in wind-laid silts. (Athena-Tucannon)

B5 Shallow to deep, silt loam and loam soils formed in wind-laid silts, glacial outwash, and alluvium. (Ritzville-Willis-Starbuck)

B6 Shallow to deep, silt loam soils formed in wind-laid silts, old sediments, and glacial outwash. (Shano-Burke-Starbuck-Warden)

B9 Shallow to deep, silt loam and loam soils formed in wind-laid silts. (Walla Walla-Ritzville-Endicott-Kuhl)

C. SOILS OF NEARLY LEVEL TO STRONGLY SLOPING VALLEYS, TERRACES, PLATEAUS, AND TILL PLAINS--DOMINANTLY GRASSLAND, WITH SOME SHRUBS AND FOREST.

C3 Deep, sand, sandy loam, and loam soils, some of which are gravelly or stony, formed in glacial outwash--16 to 20 inches annual precipitation. (Garrison-Marble)

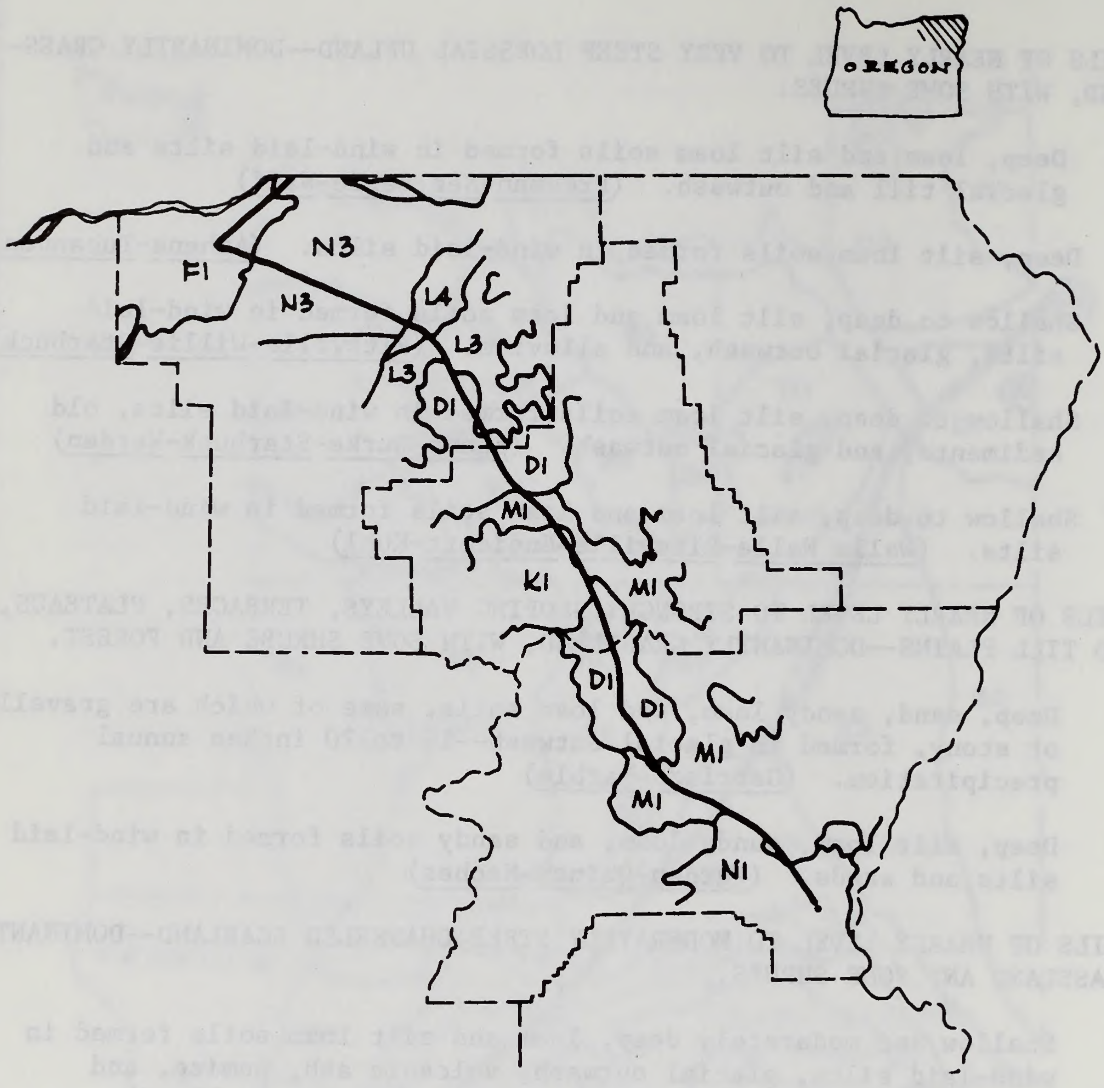
C9 Deep, silt loam, sandy loam, and sandy soils formed in wind-laid silts and sands. (Warden-Quincy-Naches)

D. SOILS OF NEARLY LEVEL TO MODERATELY STEEP CHANNELED SCABLAND--DOMINANTLY GRASSLAND AND SOME SHRUBS.

D1 Shallow and moderately deep, loam and silt loam soils formed in wind-laid silts, glacial outwash, volcanic ash, pumice, and weathered bedrock. (Hesseltine-Stratford-Benge-Rockland)

F. SOILS OF STEEP AND VERY STEEP CANYON BREAKS--GRASSLAND, FOREST, AND SHRUBS.

F3 Shallow to deep, sandy loam, loam, and silt loam soils, underlain by bedrock or sand and gravel at a depth of 20 to 40 inches, formed in colluvium, alluvium, and weathered basalt. (Kuhl-Starbuck-Magallon-Linville)



Source: Simonson, G. H., Soil Science Department, Oregon State University, August 1975.

Figure 2.1.5.4-3 Oregon soil associations

Legend Figure 2.1.5.4-3: Oregon Soil Associations

I. Soils of Valleys, Basins, and Lowland Plains:

Dark colored grassland soils of eastern intermountain valleys

D1. Dominantly deep, dark colored, nearly level soils of cool, subhumid to aemiarid terraces, till plains and floodplains. Poorly drained soils are common.

II. Forested Upland Soils:

Soils of eastern interior mountains with basic rock types and volcanic ash deposits

K1. Dominantly dark colored, medium to slightly acid, moderately deep, loamy and clayey soils and light colored, silty and loamy volcanic ash soils of cold, subhumid mountains and high plateaus. Shallow and stony soils are common.

III. Dark Colored Soils of Grassland-Steppe Uplands with Moderately Low Rainfall:

Soils of volcanic plateaus and plains with a loess mantle

L1. Dominantly moderately dark colored, deep, silty, gently to strongly sloping soils of warm to cool, semiarid plateaus and rolling hills.

L3. Dominantly dark colored, shallow and moderately deep, silty and often stony, steeply sloping soils of cool, subhumid, strongly dissected plateaus.

L4. Dominantly dark colored, deep, silty, moderately to strongly sloping soils of cool, subhumid plateaus and rolling hills.

Soils of hills, mountains and volcanic plateaus without a significant loess mantle

M1. Dominantly dark and moderately dark colored, clayey and loamy, often stony, moderately deep to shallow, soils of cool, subhumid to semiarid, sloping to steep dissected hilly terrain.

IV. Light colored Soils of Shrub-Glassland Uplands with Low Rainfall:

Soils of volcanic plateaus, plains and dissected sedimentary hills without a significant loess mantle

N1. Dominantly light colored, shallow, stony soils and moderately deep, loamy and clayey soils of cool, semiarid, sloping to steep plateaus and dissected sedimentary hills.

Table 2.1.5.4-1 Selected soil characteristics in Oregon

Soil Series	Land Position	Thickness of Surface Layer	Dominant Surface Texture	Subsoil Texture	Underlying Material	Depth to Bedrock	Soil pH	Permeability	Slope Group Percent
D1									
Lookout	Upland	6"	SIC	SICL	Hardpan	20-40"	6.6-7.8	Slow	0-60%
Ruckles	Upland	6"	VGC	VGC	Bedrock	<20"	6.6-7.3	Slow	0-65%
Catherine	Valley Bottoms	13"	SIL	SICL	Alluvium	>60"	6.6-8.4	Slow	0-3%
Ladd	Upland	9"	CL	SICL	SICL	>60"	6.1-7.3	Moderately Slow	0-15%
Baker	Upland	10"	SL	SCL	Hardpan	20-40"	6.6-9.0	Very Slow	0-15%
Umapine	Terraces and Flood Plains	4"	SL	VFSL	Alluvium	>60"	9.1- +	Moderate	0-3%
North Powder	Upland	6"	CL	SICL	Hardpan	20-40"	6.1-8.4	Moderate	0-60%
Keating	Upland	9"	SIL	SIL	Bedrock	20-40"	6.6-7.3	Slow	0-15%
F1									
Quincy	Uplands	15"	S	S	Sand	>60"	8.0-8.2	Very Rapid	0-25%
Walla Walla	Uplands	8"	SIL	SIL	SIL	>60"	7.9-9.0	Moderate	0-60%
K1									
Helmes	Upland	3"	SL	SIL	SICL	>60"	6.1-6.5	Slow	0-60%
Tolo	Upland	3"	L	L	SICL	>60"	6.1-7.3	Moderately Slow	0-60%
Klicker	Upland	4"	GL	GL	Bedrock	20-40"	6.1-6.5	Moderately Slow	0-60%
Anatone	Upland	6"	GL	GL	Bedrock	<20"	6.1-6.5	Moderate	0-60%
L1									
Ritzville	Uplands	9"	SIL	SIL	SIL	>60"	6.8-8.5	Moderate	0-65%
L3									
Gwin	Upland	6"	GL	GL	Bedrock	<20"	6.6-7.3	Moderately Slow	0-65%
Snell	Upland	6"	GCL	GCL	Bedrock	20-40"	6.6-7.3	Moderately Slow	0-65%
L4									
Walla Walla	Upland	8"	SIL	SIL	SIL	>60"	7.9-9.0	Moderate	0-60%
M1									
Ukiah	Upland	8"	SIL	SICL	Hardpan	20-40"	6.6-7.8	Very Slow	0-60%
Waha	Upland	13"	SIL	SICL	Basalt Bedrock	20-40"	6.4-6.8	Moderately Slow	0-25%
Encina	Upland	6"	SIL	SIL	SICL	>60"	6.6-7.8	Moderately Slow	0-60%
Salisbury	Upland	8"	SIL	SICL	Hardpan	20-40"	6.6-7.3	Slow	0-15%
N1									
Lovline	Upland	6"	SIL	SIL	Bedrock	20-40"	6.6-7.3	Moderate	0-60%
Locey	Upland	6"	SIL	SICL	Hardpan	20-40"	6.6-7.8	Slow	0-60%
Baldock	Flood Plain	9"	SIL	SIL	SICL	>60'	7.9-9.0	Moderately Slow	0-6%
Wingville	Upland	12"	SICL	SIC	SICL	>60"	7.9-9.0	Moderately Slow	0-6%

Soil Textrue: S--Sand; SI--Silt; C--Clay; L--Loam; G--Gravel

This table developed from: National Cooperative Soil Survey Reports, Soil Conservation Service.

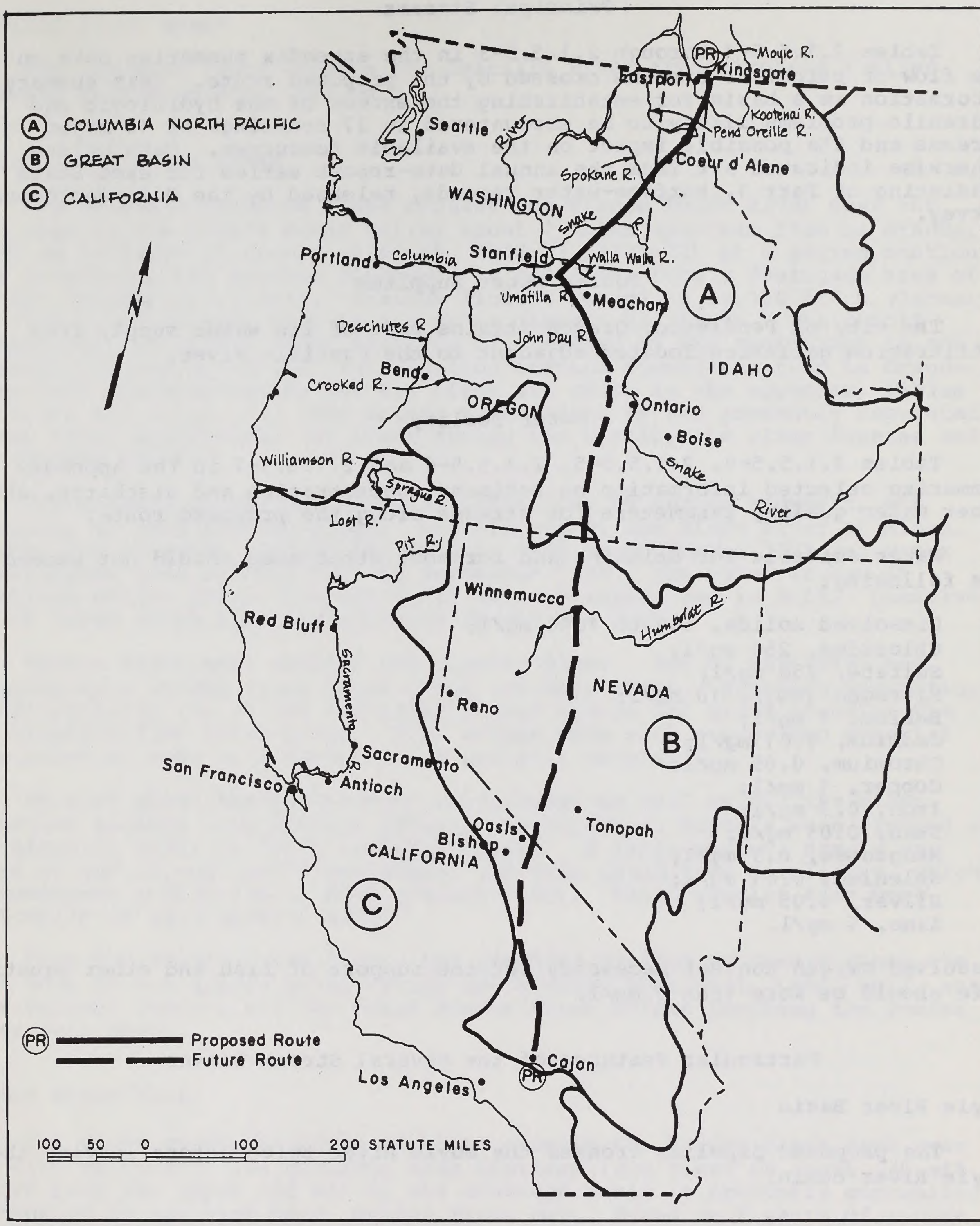


Figure 2.1.5.5-1 Major water basins in the western United States

Principal Streams

Tables 2.1.5.5-1 through 2.1.5.5-3 in the appendix summarize data on the flow of principal streams crossed by the proposed route. This summary information is a basis for establishing the extent of the hydrologic and hydraulic problems likely to be encountered in 27 crossings of 18 major streams and the possible impact on the available resources. Data unless otherwise indicated are from the annual data-report series for each State consisting of Part 1, surface-water records, released by the U.S. Geological Survey.

Public Water Supplies

The city of Pendleton, Oregon obtains part of its water supply from infiltration galleries located adjacent to the Umatilla River.

Water Quality

Tables 2.1.5.5-4, 2.1.5.5-5, 2.1.5.5-6 and 2.1.5.5-7 in the appendix summarize selected information on sediment concentration and discharge, and other water quality parameters for streams along the proposed route.

Water suitable for drinking and for most other uses should not exceed the following:

Dissolved solids, 500 to 1000 mg/l;
Chlorides, 250 mg/l;
Sulfate, 250 mg/l;
Nitrogen (NO_3), 10 mg/l;
Barium, 1 mg/l;
Cadmium, 0.01 mg/l;
Chromium, 0.05 mg/l;
Copper, 1 mg/l;
Iron, 0.3 mg/l;
Lead, 0.05 mg/l;
Manganese, 0.5 mg/l;
Selenium, 0.01 mg/l;
Silver, 0.05 mg/l;
Zinc, 5 mg/l.

Dissolved oxygen content necessary for the support of fish and other aquatic life should be more than 5 mg/l.

Particular Features of the Several Stream Basins

Moyie River Basin

The proposed pipeline crosses the Moyie River twice before leaving the Moyie River basin.

Kootenai River Basin

ITA(A)'s proposed pipeline crosses the Kootenai River approximately 3 miles downstream from Bonners Ferry, Idaho. This is approximately 6 miles downstream from Pacific Gas Transmission Company's existing and proposed pipeline crossings.

Umatilla River Basin

The proposed route crosses the Umatilla River approximately 4 miles upstream from Pendleton, Oregon.

Grande Ronde River Basin

The proposed pipeline route crosses the Grande Ronde River near the west edge of the Grande Ronde Valley about 7 miles upstream from La Grande. Based on 64 years of record (1903-15, 1918-23, 1925-72) at a gaging station near La Grande, the average discharge is 380 ft^3/s from a drainage area of 678 mi^2 (Figure 2.1.5.5-1). Maximum flow of record is 14,100 ft^3/s (January 30, 1965), and minimum flow is 3.9 ft^3/s (August 26, 1940). The runoff pattern for the Grande Ronde River is illustrated by the hydrograph in the appendix, Figure 2.1.5.5-2, for a gaging station downstream from La Grande. Other flow characteristics for the river are shown in the appendix, Tables 2.1.5.5-2 and 2.1.5.5-3. The Grande Ronde River is not presently regulated by any major reservoirs. At times during the winter, the river freezes and ice jamming occurs.

The streams of the Grande Ronde basin, fed by spring snowmelt, are generally of good quality water. One tributary, the Minam River at Minam, Oregon, has chemical records for January 1966 to September 1973 and water temperatures from October 1965 to September 1973. The water is low in dissolved solids (less than 100 mg/l) and turbidity, and is soft. Dissolved oxygen tends to be high and coliform levels are low.

Twelve sites were sampled for aquatic biota. Two of the sites had sluggish-type stream flow: Sheet Creek and Mill Creek. Riparian vegetation was principally low shrubs and light forest except for grass noted at the two sluggish-flow creek sites. Firm stream beds with coarse bed material were noted at each site except Sheep and Mill Creeks.

At most sites Plecoptera were conspicuous as well as all the other important benthic invertebrate groups. As expected, Diptera were clumped at the sluggish sites of Sheep and Mill Creeks. A large Diptera sample was noted at one of the Ladd Creek sites, but this could have Simuliidae, which is sometimes indicative of high quality water. Algae samples also were indicative of high quality water.

From the Grande Ronde River, the pipeline follows southward along the west edge of the Grande Ronde Valley and crosses Rock Mill, Ladd, Wolf, and Warm Springs Creeks, and the North Powder River before reaching the Powder River near Baker.

Powder River Basin

The route of the proposed pipeline crosses the Powder River once near the city of Baker. The drainage area upstream from Baker is about 230 mi^2. Runoff from the upper 165 mi^2 of the drainage basin is presently controlled by storage in Phillips Lake, behind Mason Dam. Based on 7 years of record (1965-72), the average discharge at the gaging station just downstream from Mason Dam is 98 ft^3/s (Table 2.1.5.5-1 in the appendix. Maximum discharge observed at the gage is 971 ft^3/s (April 30, 1965), which occurred before storage in the reservoir began in October 1967. On November 12, 1967, flow below the dam was reduced to zero.

The only sediment data available in the Powder River basin are from reservoir measurements. Yields are in the range of 0.1 to 0.2 acre-feet per square mile per year. The predominant sources of silt and clay are believed to be the drier, less densely forested upland areas subject to sheet and rill erosion (Pacific Northwest River Basins Commission, 1970). Land use practices in the Baker Valley are probably also an important factor in determining suspended-sediment concentrations and discharges. Based on general basin characteristics, concentrations should increase progressively along the route as the climate changes from semi-arid to arid. Sediment discharges will not necessarily increase due to the complex interaction between quantity of precipitation and the resulting density of vegetation cover. However, as mean annual precipitation falls below 10 to 12 in. per year, yields normally will decrease because of the clear dominance of the reduced quantities of surface flow in that range of precipitation.

Information on water quality of the Powder River is sparse. At the Baker station for the period of record, December 1969 to November 1971, dissolved solids ranged narrowly from 100 to 194 mg/l, hardness ranged below 100 mg/l, and turbidity was low. Dissolved oxygen exceeded 10 mg/l (Table 2.1.5.5-5 in appendix).

The streams in this basin flow through an arid region of eastern Oregon, and are sluggish, silt-laden, soft-bottom streams. Riparian vegetation consists of low grass and some shrubs. Typically, these streams are narrow and deep, making the use of Surber samplers impossible at many sites. Where samples were taken, benthic invertebrates showed clumping of Ephemeroptera and Diptera. Attached algae were sparse.

After crossing the Powder River, the proposed pipeline route continues south-eastward across Sutton and Alder Creeks and into the Burnt River basin.

Burnt River Basin

The proposed route crosses Burnt River south of Durkee. Flow in the Burnt River has been regulated by storage in Unity Reservoir since 1938. For 16 years of record (1956-72), the average discharge at a gaging station near Bridgeport, about 14 miles upstream from the crossing, is 105 ft^3/s. Average discharge is 126 ft^3/s at a gaging station about 20 miles downstream from the proposed crossing and 3 miles upstream from the river mouth at the Snake River (Table 2.1.5.5-1 in appendix). Maximum discharge at this downstream gaging station is 2,220 ft^3/s (December 22, 1964). Ice jams occur at times in the lower reach of the Burnt River, creating temporary backwater conditions and sudden, periodic releases of water. Flow characteristics for Burnt River near Hereford, just below Unity Reservoir, are shown in the appendix, Figure 2.1.5.5-3.

The streams of this basin have firm gravel and sand beds. The Burnt River crossings were the only sites where silt-size material was prominent. Generally, flows were rapid, except at two sites on Alder Creek where flow was sluggish and two streams were dry; French Creek and Shirttail Creek. Alder Creek had the largest numbers of benthic invertebrates of the streams sampled, and Burnt River the lowest numbers. Ephemeroptera was the predominant group of invertebrates in the samples taken from streams in the basin. Green algae were sparse, and diatoms were widely distributed. Blue-green algae were scarce with only three samples having three different genera.

After crossing the Burnt River, the proposed route follows southward across North and South Fork Dixie and Willow Creeks and into the Malheur River drainage.

Ground Water

See the discussion presented in 2.1.4.5 through the Columbia Plateau province (Walla Walla section).

Columbia Plateau (Walla Walla)

From the vicinity of Spokane, Washington, the proposed pipeline generally veers southward across the Walla Walla section of the Columbia Plateau to the general vicinity of Meacham, Oregon. Ground water occurs in four distinct aquifers: (1) locally and commonly perched in the so-called Palouse silt (loess) which extensively underlies the higher parts of the land surface; (2) in alluvial valley trains; (3) in the Columbia River basalt and (4) in the conspicuous alluvial fan of the Walla Walla River and Mill Creek.

Columbia Plateau (Blue Mountains Section)

From Meacham to the town of North Powder, Oregon, the proposed pipeline route crosses the "waist" of the Blue Mountains section of the Columbia Plateau, between La Grande and North Powder, Oregon. Here the regional aquifer is again the basalt of the Columbia River Group, with characteristics much as have been described for the Walla Walla section. The rocks are rather strongly folded, locally faulted, and intricately dissected. By inference, depth to water probably ranges greatly. Also, circulation of water in the basalt is likely to be controlled principally by structure, possibly in local cells between which there is little hydraulic continuity. In valley areas the basalt is overlain by water-bearing alluvial and lacustrine deposits. Potential ground water yield in the area is not well known and use generally is nominal.

One anomalous feature is the occurrence of thermal ground water at the southern flank of the Grande Ronde Valley, near proposed pipeline mile 310. Here, presumed valley-margin faults may afford a conduit for thermal water rising from deep and mingling with shallow water of ambient temperature from the valley fill. It is not known whether the thermal water zone reaches the pipeline route. If it does, any potential for pipeline corrosion probably would be aggravated by the greater water temperature.

Columbia Plateau (Payette Section)

Further south the proposed pipeline route traverses the Payette section of the Columbia Plateau to Rye Valley, Oregon. This section is dominated by relatively young volcanic rocks which are somewhat diverse in petrologic character, and which commonly cap or are intercalated with thicker sections of so-called lake beds (largely of fluvial and eolian origin). Virtually no specific information is at hand as to ground water occurrence along the route. General information is inferred from adjacent regions and from: (1) The moderately rugged topography, with lowland altitudes ranging from about 3,500 feet above sea level on the north to about 4,500 feet on the south, but with few extensive alluvial basins which might store water in considerable volumes; (2) the average precipitation, extensively no more than 10 inches yearly; and (3) the poorly developed drainage system, having few through-flowing perennial streams.

Thus, it may be expected that: (1) Depth to ground water will range greatly, from about 1,000 feet beneath the highest uplands to only a few feet beneath some lowlands; (2) potential yield to wells will be extensively no more than a few gallons, or tens of gallons, per minute and generally no more than a few hundred gallons per minute; and (3) dissolved-solids content will range widely, possibly from as little as 100 mg/l with calcium and bicarbonate the dominant ions, to as much as several thousand milligrams at shallow depth beneath local drainage sumps, with sodium, sulphate, and bicarbonate the dominant ions. Locally, the water may be thermal, indicating that any potential for pipeline corrosion might be aggravated. This section of the pipeline route is very sparsely settled and present water withdrawals are small and scattered.

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2.1.5E.6 Vegetation

Major Plant Formations, Associations, and Communities

Vegetation along the 280-mile-length of new pipeline from Eastport, Idaho, to Stanfield, Oregon, is similar to that described in Section 2.1.4.6, San Francisco pipeline. Figure 2.1.5.6-1 delineates the plant associations crossed by the proposed pipeline from Stanfield to Rye Valley, Oregon.

Table 2.1.5.6-1 depicts associations in relation to pipeline miles.

A list of plants which are common to the associations traversed by the pipeline route is included in the appendix.

Prairie Grassland Formation

Palouse Prairie Grassland Association

The Palouse Prairie Grassland will be traversed by 190 miles of the proposed pipeline in southeastern Washington and northeastern Oregon.

Desert Formation

Cold Desert Association

The proposed pipeline route will traverse 74 miles of the cold desert association in eastern Oregon.

Component Plant Communities of the Cold Desert Plant Association:

Range Site	Dominant Climax Species
Sodic bottom	Basin wildrye, saltgrass, greasewood
South exposure	Bluebunch wheatgrass, Sandberg bluegrass, big sagebrush

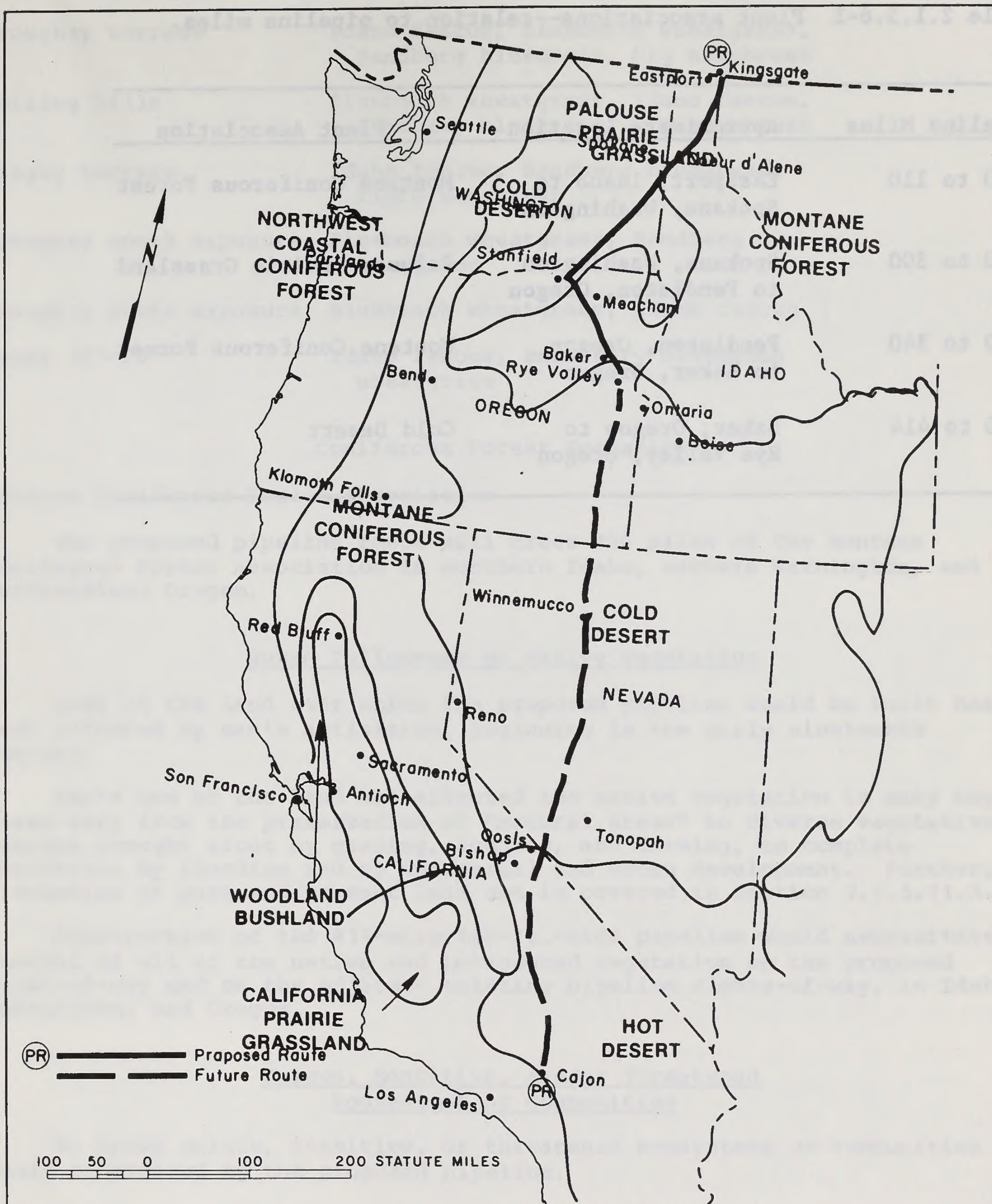

Figure 2.1.5.6-1 Plant associations of the western United States

Table 2.1.5.6-1 Plant associations--relation to pipeline miles.

Pipeline Miles	Approximate Location	Plant Association
0 to 110	Eastport, Idaho to Spokane, Washington	Montane Coniferous Forest
110 to 300	Spokane, Washington to Pendleton, Oregon	Palouse Prairie Grassland
300 to 340	Pendleton, Oregon to Baker, Oregon	Montane Coniferous Forest
340 to 414	Baker, Oregon to Rye Valley, Oregon	Cold Desert

Droughty terrace	Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, big sagebrush
Rolling hills	Bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, big sagebrush
Clayey terrace	Idaho fescue, Sandberg bluegrass, rigid sagebrush
Droughty south exposure	Bluebunch wheatgrass, Sandberg bluegrass
Droughty north exposure	Bluebunch wheatgrass, Idaho fescue
Loamy 16"-20"	Idaho fescue, snowberry bluebunch wheatgrass

Coniferous Forest Formation

Montane Coniferous Forest Association

The proposed pipeline route will cross 150 miles of the Montane Coniferous Forest Association in northern Idaho, eastern Washington, and northeastern Oregon.

Human Influences on Native Vegetation

Most of the land over which the proposed pipeline would be built has been affected by man's activities, beginning in the early nineteenth century.

Man's use of the land has affected the native vegetation in many ways. These vary from the preservation of "natural areas" to diverse vegetative changes brought about by grazing, logging, and farming, to complete denudation by flooding and by industrial and urban development. Further, discussion of past and present land use is covered in Section 2.1.5.11.A.

Construction of the 414-mile-100-ft.-wide pipeline would necessitate removal of all of the native and introduced vegetation on the proposed right-of-way and on the adjacent existing pipeline rights-of-way, in Idaho, Washington, and Oregon.

Unique, Sensitive, and/or Threatened Ecosystems or Communities

No known unique, sensitive, or threatened ecosystems or communities would be crossed by the proposed pipeline.

Terrestrial and Aquatic Plant Species

Data concerning plant species expected to be found along the proposed pipeline route are shown on Tables 2.1.5.6-2, 2.1.5.6-3, and 2.1.5.6-4 (see appendix).

Threatened and Endangered Species

Refer to Section 2.1.4.6, San Francisco pipeline.

2.1.5E.7 Wildlife

Dominant Wildlife Populations

Much of the quantitive data and judgments in this section are from personal communications with biologists from the Fish and Wildlife Service, Bureau of Land Management, Forest Service, and State Wildlife agencies. Records are on file in the U.S. Fish and Wildlife Service Area Office in Portland, Oregon.

Big Game Mammals

Eight big game mammals occur on or near the route. Population levels vary from one locality tc another and from one year to another and are directly related to habitat and climatic conditions. (See Figure 2.1.5.6-1 denoting plant associations.)

Deer

Both white-tailed and mule deer occur along the pipeline route. Mule deer occupy a broad range thrcughout much of the proposed route. They are very adaptable and thrive in both semi-arid vegetation and forested mountain slopes. On the other hand, white-tailed deer occur in greatest numbers in eastern Washington and northern Idaho, where their range overlaps that of mule deer (Mace, 1972a). White-tails are normally found in brushy openings, cut-over areas, and valleys; and in open forest bordering these habitat types.

White-tailed and mule deer occur in year-round ranges in the washes and draws north of the Snake River toward Spokane, Washington. Logging activities in the Tucannon River bottom lands, the Grande Ronde River Valley, and in the Oregon Trail (Highway I-80) areas northwest of La Grande, Oregon, have created space for growth of understory, shrubs, and grasses. This vegetaticn is browsing material for these large herbivores. However, intensive farming operations, and overgrazing by livestock along flood plains have severely reduced this food supply.

South of the La Grande area, where the proposed route would pass more arid land, the mule deer is the only deer commonly found. Mule deer may spend the summer at high elevations and in the winter, migrate down the slopes and into the valleys. The shrubs of both the shrubsteppe and salt desert shrub provide year-round food. Due to the varying quality of habitats and vegetation, more deer could be present in some areas than in others.

Elk

Rocky Mountain elk are generally found at higher elevations in the mixed coniferous forests of the Blue Mountains of Oregon, and the mountains of eastern Washington and northern Idaho, especially during the summer. They could winter in the lower mountain areas of the Moyie River Valley in Idaho and the rolling hills and flatlands of the lower Blue Mountains in Oregon.

The elk's diverse diet of browse and grass permits it to maintain favorable population levels in areas where deer numbers could be low. Competition between elk and deer herds could occur when deep snows force both groups to winter at lower elevations within a restricted range. Elk herds often increase at the expense of deer, because elk are larger which allows them to reach higher browse and to dig into deep snows to find grass. The population levels of both animals are directly related to the quality and quantity of their winter range (Mace, 1971).

Pronghorn Antelope

Pronghorn antelope require a very specific habitat dominated by grasses and short sagebrush (Mace, 1972b). This habitat has been greatly reduced in recent years by the expansion of cultivated lands, by brush control programs, and by extensive livestock grazing. These factors have changed the species composition cf grasses and have favored the growth of taller sagebrush forms. Since the pronghorn antelope is primarily dependent on short sagebrush for focd and prefers unobstructed vision for self-protection, the presence of taller shrubs of cultivated areas has forced them to abandon historically used range. Along the proposed route the largest herds would be found in southeastern Oregon.

Black Bear

Black bear are found on the forested mountain slopes of the proposed route in Idaho, Washington, and Oregon where logging has not significantly altered the landscape (Oregon State Game Commission (OSGC), Information-Education Division (I-ED), undated-a).

Wild Horses and Burros

There are none known along the proposed pipeline route.

Small Game and Fur-Bearing Mammals

Small game mammals include species which are, or formerly were, hunted mainly for sport because they are generally secretive, wary and therefore difficult to obtain; or because they are considered pests (Burt and Grossenheider, 1964). Except for rabbits, hares, squirrels, and occasionally opossums and raccoons, they are not generally considered good eating.

Jack rabbits would be found predominantly in the sagebrush and grassland areas along the proposed route. The jackrabbit was observed in various habitats and would be expected in others. It is a familiar animal of the open grassland and semiopen brushlands of the states. Although called jack rabbits, both the black-tailed and white-tailed jack rabbit are not rabbits, but hares.

Snowshoe hares usually occur in forested areas at higher elevations. Pygmy rabbits prefer sagebrush flats, rimrock, and foothills. Cotton-tail rabbits tend to inhabit rimrock, forest, irrigated land, and river bottom areas.

Yellowbelly marmots live in rimrock areas. Hoary marmots live at higher elevations. Innumerable other rodents would also be expected to be encountered along the proposed pipeline route.

Coyotes, skunks, weasel, badgers, red and gray fox, bobcats, and raccoons would occur along the entire proposed pipeline. Lynx tend to be restricted to higher elevation forests in Oregon, Idaho, and Washington. The coyote, gray fox, and bobcat range throughout the desert, shrubland, and open forest. The bobcat and the gray fox are considered to be beneficial predators, while the coyote probably causes losses to livestock, particularly sheep (Burt and Grossenheider, 1964).

At present, approximately 20 species of wildlife, found along the proposed route, are classified as fur-bearers, and many of these species are closely regulated by trapping laws (Mace, 1970b and NSBFGC, 1974). Since the 1940's trapping has been nearly eliminated as livelihood because of a steadily decreasing demand for furs and a continued movement of people to urban areas. High pelt values during the past few years have resulted in heavy trapping pressure on bobcat and coyote, while trapping for other species is mostly for sport. Populations of most fur-bearing animals could support a greater harvest than in recent years.

Among the numerous species of fur-bearers along the proposed route, the most important economically are water oriented species such as muskrat, beaver, and mink. Other species such as marten, fisher, wolverine, and lynx are found primarily in forested areas of Idaho, Washington, and Oregon. They are protected or strictly regulated, and are relatively rare.

Upland Game Birds

Upland game birds are abundant within the region and provide sport for the hunter and the naturalist (Masson and Mace, 1970; OSGC, I-ED, undated-b; and NSBFGC, 1974). Of the 12 species that could occur along the proposed route, 7 are native to the area and 5 have been introduced by game managers in an effort to maximize the use of available habitats. Three of the 5 introduced species--ring-necked pheasant, bobwhite quail, and Hungarian partridge--are truly farmland birds. Their population densities are directly related to the types of agricultural crops grown and the efficiency of the farming operations. Their distribution is limited to stream valleys with sufficient water for farming.

The California quail is one of the most popular upland game species among sportsmen and general public alike. They need water in some form throughout their lives. California quail nest in early spring. They usually select nesting sites within a few hundred yards of water. When not incubating eggs or brooding their young, quail roost in trees or tall bushes that afford them protection from many predators.

The introduced upland game species are largely dependent on waste grains, weed seeds, and insects for food, and on brushy stream bottoms, ditch banks, and fence rows for winter and escape cover. Chukar partridge, bobwhite quail and Merriam's turkey have been introduced in various locations to supplement the hunted native species.

The most successful introduction has been of the chukar partridge, which now inhabits sagebrush and rimrock areas over a large portion of the region (Christensen, 1970; and Masson and Mace, 1970). Chukars prefer rocky open hills and flats where annual rainfall ranges from 5 to 10 inches and have been sighted from below sea level to an altitude of 12,000 feet.

Wild turkey have been introduced into areas along the proposed pipeline in an attempt to extend their natural ranges. Most of the wild turkey introductions have been successful, although increases in population levels have been slow. Wild turkeys are generally found in the transitional zone between steepe vegetation and parklike forest.

Native upland birds are generally found in areas supporting indigenous forest and steppe vegetation. The forest grouse (ruffed, spruce, and blue grouse) require open forest with abundant brushy areas of fruit producing shrubs. Both the spruce and the blue grouse use the grassy openings of upper hill slopes, while the ruffed grouse remains close to the thick cover along dry streambeds and draws.

The native sharp-tailed grouse, sage grouse, mountain and California quail are closely associated with a number of native vegetation types. Populations of sharp-tailed grouse are restricted to areas covered by sagebrush and grass from east of the Cascades to northern Nevada. Sage grouse are generally restricted to the farmland areas of eastern Washington, southeastern Oregon, and the sagebrush plains and mountain meadows of Nevada. Presently, both of these species are threatened by sagebrush destruction, overgrazing and encroachment of cultivated farmland on their ranges.

The mountain quail is the largest native North American quail. Nesting and summer range areas are generally located at higher elevations, where snow occurs during the winter. It is necessary for mountain quail to move to lower elevations for cover and food during the winter. Movements may cover up to 50 miles and are primarily negotiated afoot.

Following is a summary of some areas along the proposed pipeline where specific upland game birds are prevalent.

The Kootenai and Spokane River Valleys contain pheasant; Hungarian partridge; valley quail, blue, spruce, ruffed, sharp-tailed, and sage grouse; and wild turkey. White-tailed ptarmigan occur along mountain crests. Between the Snake River and Spokane, both ring-necked pheasant and chukar partridge are abundant. In the Umatilla River Basin, the ringnecked pheasant is the most numerous upland game bird, followed by valley quail and chukar partridge. From near La Grande to around Little Valley (Oregon), ring-necked pheasant, chukar and California quail are the most important upland game species.

The mountain quail is widely distributed in mountainous areas containing suitable habitat.

Waterfowl and Other Migratory Birds

At least 25 species of ducks, geese, and swans, 8 species of cranes and herons, 9 species of gulls and terns, 26 species of shorebirds, and 18 species of other migratory birds are known to occur regularly and/or commonly in the vicinity of the proposed route.

Others have been observed, but only rarely (PNRBC, 1971-b; OSGC, I-ED, 1972b; Bertrand, Scott (undated); National Audobon Society, 1973; and Peterson, 1961, Storer and Usinger, 1963).

The lowland regions of the Pend Oreille, Snake River, Kootenai, Umatilla, Grande Ronde, Walla Walla, Palouse, and Spokane River basins in Washington and Oregon, are not generally considered important migratory waterfowl rearing areas, but they do provide excellent wintering and/or nesting grounds. The marshes, low-gradient streams and rivers, natural lakes, and man made reservoirs and irrigation ditches of these areas are used commonly by ducks, geese, grebes, and some cranes and herons (OSGC, I-ED, 1969; OSGC, I-ED, undated-c; I-ED, undated-d; and OSCG, I-ED, 1972a).

The McArthur Wildlife Management Area, Boundary County, Idaho and Farragut Wildlife Management Area near the Pend Oreille River in Kootenai County are owned by Idaho Fish and Game Department and managed for waterfowl. The area produces a moderate number of ducks and some geese. The wetlands just south of Pend Oreille Lake in Idaho provide habitat for waterfowl, though this area is not a high use wetland.

The Kootenai Flats in the Kootenai Valley northwest of Bonners Ferry were once extensive marshes. These served as major resting and feeding areas for migrating waterfowl including geese, swans, and numerous species of ducks. However, recent diking and agricultural development have substantially reduced the acreage of suitable waterfowl habitat (PNRBC, 1971b and USDI, FWS, 1965).

Lake Pend Oreille provides major resting and feeding habitat for waterfowl. Redhead and other diving ducks frequently winter on the lake.

The closed basins of Oregon and the wetlands of the upper Columbia and Snake Rivers of Washington are important resting and feeding areas for millions of migrating ducks within the Pacific Flyway. The additional irrigation and hydro-electric reservoirs constructed along the Snake River and its tributaries have caused an increase in the already large number of flocks wintering in the area. Conversion of more acres to dryland and irrigated farming has expanded winter waterfowl food supplies, especially for geese and some of the shorebirds. The fields east of Milton-Freewater, Oregon are a favorite feeding area for both ducks and geese.

In the Umatilla River Basin of Oregon, mallard, pintail, American widgeon, and green-winged teal ducks, and Canada geese are abundant. Less abundant are shovelers, scaup, and ruddy ducks and snow geese. The area is a significant resting and feeding area for migratory birds. In addition, some species nest in nearby reservoirs, marshes, rivers, and ponds (OSGC, undated-d). Some limited waterfowl habitat also occur east of La Grand, Oregon in the marshes and bottomlands of the Grande Ronde River and north of the Snake River in the Palouse River Valley of Washington (OSDC, NMFS, and USDI, FWS, 1972).

The Grand Ronde River Valley is not located on a major flyway, but it is used by substantial numbers of fall and spring migrant waterfowl. One species which nests in the wet meadows and marshlands is Wilson's snipe. Mallard ducks are the most heavily hunted species, though teal, shoveler, pintail, redhead and gadwall ducks, Canadian geese, and coots are also hunted. The Ladd Marsh Wildlife Management Area, four miles south of La Grande, is managed to increase the amount of habitat suitable for ducks and other waterfowl.

For other species of migratory game birds, mourning and ground dove, and the band-tailed pigeon, could occur along the proposed route. On the mourning dove could be found along the entire length. Mourning doves are numerous in the lowland and agricultural land along the proposed route through the summer and early fall, and are intensively hunted throughout their range. They prefer as habitat open woodland, prairies, desert, and agricultural areas, but are highly adaptable. There are more mourning doves today than in the past, as a result of changes in land use. These doves feed extensively on weed seed and waste grain and can often be found in large numbers in grain fields harvested in the fall. Doves require water daily and in drier regions may be restricted to areas where water occurs.

Band-tailed pigeons are found in mountainous areas of the proposed pipeline, migrating to the south each fall. The rock dove, or domestic pigeon, has gone wild and could be found along much of the proposed route.

Birds of Prey (Raptors)

Birds of prey that could occur in the region transected by the proposed pipeline, include: 2 species of eagle, 9 species of owls, 15 species of hawks and falcons, and the osprey. The turkey vulture, while not strictly a predator, is listed in this functional group for convenience (Bertrand and Scott, undated; OSGC, I-ED, undated-e; OSGC, I-ED, undated-f; Peterson, 1969; and USDI, Bureau of Land Management (BLM), 1971). Many of these birds occur near bodies of water and in cultivated fields, steppe, grassland, and other areas with low vegetative cover. In such open areas, these visually oriented predators, except for some owls which hunt at night by sound, are able to spot their prey from high altitudes. Birds of prey must hunt closer to the ground in forest and shrubland. Also, prey species, small mammals and birds are usually more abundant in grasslands than in forests.

Raptors enjoy a broad distribution in the region of the proposed route and one or more species occur along the entire pipeline route.

The bird hawks are characterized by long tails and rounded wings and are not soaring birds. As the name implies, their food is chiefly birds, but some small mammals are also taken. In the proposed pipeline route, the Goshawk, the sharp-shinned hawk, and Cooper's hawk could be resident and breeding.

The red-tailed, red shouldered, Swainson's, rough-legged, broad-winged, and ferruginous hawks are members of the buzzard hawk subfamily. These birds are characterized by broad wings and broad, relatively short, rounded tails. They habitually soar in wide circles and rest in trees. They are daylight hunters and feed mainly on rats, mice, rabbits, and occasionally small birds and reptiles (Peterson, 1961). Rough-legged and Swainson's hawks are relatively common along the proposed route.

The marsh hawk is widespread in open country along the proposed route and hunts primarily for rodents and small birds. They rest on the ground in sparse, shrubby open land or marsh.

Eagles are distinguished from buzzard hawks by their greater size and proportionately longer wings. A relatively rare species expected to occur in the region of the proposed route is the golden eagle. These birds are characterized by longer wings and the tendency to glide and soar in flight with only occasional wingbeats. They usually nest in tall trees or on the ledges or outcroppings of cliffs, generally in the mountains. The golden eagle eats mostly rabbits and large rodents (Peterson, 1961). Southern bald eagles are on the Federal list of "endangered species" and are discussed in the section on endangered species.

The prairie falcon, peregrine falcon, pigeon hawk, and Kestrel (sparrow hawk) are known to range along the proposed route. They are differentiated from other birds of prey by long, pointed wings and long tails. These birds inhabit open country, prairies, deserts, wooded stream areas, and farmland. They are daylight hunters and hunt primarily for birds, rodents and insects. Peregrine and prairie falcons are classified as endangered species by other Federal or State agencies.

Nine species of owls are known to occur along the proposed route. These include: the barn, burrowing, great-horned, long-eared, screech, saw-whet, flammulated, and pygmy owls. Owls are nocturnal birds of prey that primarily feed on rodents, birds, reptiles, fish, and large insects. Most species nest in tree hollows or other high places. Two of these owls, the burrowing and short-eared owls, habitually nest on the ground in abandoned rabbit hollows or rodent burrows (Peterson, 1961 and Robbins, Brunn, and Zim, 1966).

Turkey vultures are widespread and are scavengers.

Other Birds

Over 160 species of birds other than upland game, water-fowl, shorebirds, and raptors would be expected to occur regularly and/or commonly in all habitats along the pipeline route (Peterson, 1961, 1969; Jewett et al., 1953; OSGC, I-ED, 1969; OSGC, I-ED, 1972b; and National Audubon Society, 1973). Numerous other species are rare, occasional visitors, or otherwise uncommon. The most numerous number of species are found in forested areas, especially forests with open spaces all along the existing pipeline right-of-way and adjacent forest.

Reptiles and Amphibians

The reptile species known to occur in the region include 10 lizards, 25 snakes, and 2 turtles (Stebbins, 1954, 1962, 1972 and Savage, 1959). Some of the species have only limited range within the region. The western ring-necked snake is known to inhabit only a few locations along the Snake River, and the painted turtle is restricted to aquatic habitats such as lakes and streams.

The great basin, northern California and prairie rattlesnakes are poisonous snakes that could occur along the proposed route.

The common garter snake is found throughout the region in almost all habitats. The gopher snake occupies a great variety of habitats ranging from seashore areas to at least 9,000 feet.

The amphibians that could occur along the proposed route are restricted to aquatic or damp habitats. This is because they must lay their eggs in water and keep their skins damp to avoid dessication. Approximately 9 salamander species and 14 species of frogs and toads are known in the region.

Terrestrial Invertebrates

See the discussion presented in 2.1.4.7(10).

Aquatic Animals

See the discussion presented in 2.1.4.7(11).

Fish species are discussed below according to the specific bodies of water in which they occur.

Most of the aquatic resources of the region where anadromous fish occur could also support warm-water fish. The main sport fish of this region, in addition to anadromous species and stocked trout (especially rainbow), include: largemouth and smallmouth bass, crappie, yellow perch, and channel catfish (OSGC, I-ED, undated-g; and OSGC, I-ED, 1968). These are important in providing sport fishing to residents and nonresidents. Other species present are suckers, carp, northern squawfish, dace, chiselmouth, bullhead, and various shiners.

Fish species are discussed below according to the specific bodies of water in which they occur.

Kootenai and Pend Oreille Rivers--The Kootenai River is classified as a stream of nationwide importance from the border of British Columbia to Libby, Montana (PNRBC, 1971b and USDI, FWS, 1965). Originating in the Rocky Mountains along the eastern border of British Columbia, it flows south into Montana, approximately 190 miles downstream from its source. It then follows a U-shaped course in the northwest corner of Montana, flowing into Idaho, then northward into Canada.

The Pend Oreille River originates at Pend Oreille Lake in Idaho and flows in a northwesterly direction into British Columbia. The lake has an important commercial kokanee salmon fishery with an average annual harvest of approximately 80,000 pounds (Jeppson, 1963). It also supports a Kamloops trout sport fishery of national importance. Other important sport fish harvested include cutthroat trout and kokanee. Albeni Falls Dam, which regulates the water level of Pend Oreille Lake, and several other dams are constructed along the river's length.

The main sport fish of the Kootenai and the Pend Oreille Rivers are cutthroat, rainbow, brook, brown and Dolly Varden trout; kokanee salmon and whitefish. White sturgeon is limited to the Kootenai River. Both rivers are inaccessible to anadromous fish.

The distribution of sport fish in the Kootenai and Pend Oreille Rivers is limited by their habitat requirements. The cutthroat trout, which was previously widely distributed, is presently restricted to headwater areas where barriers and remote terrain have protected its natural habitat from extensive development. The rainbow trout, which is not native to these river systems, has been transplanted in considerable numbers. Another resident, the Dolly Varden trout, has successfully competed with exotic fish and maintains stable populations where there are adequate spawning tributaries. Remnant populations of grayling, introduced from the eastern slope of the Rockies, are still found in several tributaries of the Kootenai (PNRBC, 1971b and USDI, FWS, 1973). Both Kamloops trout (a variety of rainbow trout) and kokanee salmon inhabit Pend Oreille and would be expected to venture into the river mouth at the proposed pipeline crossing.

Rough fish, such as suckers, carp, squawfish, chubs, and various warm-water fish compete with and prey upon many of the desirable cold-water game fish species in the region.

Touchet River--This river is a secondary tributary of the Columbia, which it enters through the Walla Walla River. Few sport fish other than occasional steelhead occur in the Touchet due to its degraded water quality.

Many of the fish species now in the Snake River Basin have been introduced. These include largemouth and smallmouth bass, crappie, bluegill, yellow perch, channel catfish, black bullhead, and other panfish species. Among the introduced salmonids are kokanee and lake trout.

Snake River--This is the largest tributary of the Columbia River. Historically, the Snake River and its principal tributaries along the proposed route (the Grand Ronde, Palouse, Powder, and Burnt Rivers) were highly productive of desirable fish species. Anadromous fish included: chinook, coho, and sockeye salmon, Steelhead trout, and white sturgeon (IUSDC, NMFS, and USDI, FWS, 1972). Resident fish species of sport and commercial value included: whitefish, rainbow trout and Dolly Varden. Other non-game species, such as squawfish and suckers, were present but their populations did not seriously interfere with the more desirable species. Currently game species are still present but in greatly reduced numbers. Anadromous fish in particular have declined due to dams, farming, industrialization, and other changes.

At present chinook salmon and steelhead trout migrate past the proposed Snake River crossing site near Lyons Ferry. Chinook salmon migrate upstream from April to October, though the major run occurs from May through July. During the major run for the years 1969 to 1972, from 1,500 to 40,000 fish per month were reported to pass lower Monumental Dam, downstream from Lyons Ferry. The major steelhead runs occur in April and May, when about 2,000 to 20,000 fish per month were reported to pass the dam, and later in September and October when about 10,000 to 40,000 fish per month were reported. Downstream migration of juveniles of both species occurs during the spring months.

Umatilla River--This northeastern Oregon river is a principal east to west tributary of the Columbia River. Its drainage basin includes the Umatilla River, Meacham Creek, the Walla Walla River system and Mill Creek. Numerous species of fish inhabit these watercourses, including: large-mouth bass, rainbow and steelhead trout, Dolly Varden, whitefish, dace, sculpin, and squawfish. However, the basin does not support a large population of sport fish. Runs of anadromous summer steelhead in excess of 3,000 fish have been reported in the headwaters of the Umatilla and Walla Walla Rivers and receive the major fishing pressure in this area. Rainbow and Dolly Varden trout are also sought by fishermen.

Powder and Burnt Rivers--Based on available information, the Powder and Burnt Rivers are not considered significant recreational fisheries except by local residents. The Powder River has been degraded, at least in part, due to agricultural runoff.

Habitat Requirements and Limiting Factors of Major and/or Characteristic Terrestrial and Aquatic Species

See the discussion presented in 2.1.4.7. Additional discussion peculiar to ITA(A)'s proposal is presented below.

Aquatic Animals

The Columbia River and its tributaries dominate the proposed pipeline route.

Terrestrial and Aquatic Species

The most numerous general category of animals along the proposed route, both in number of species and individuals, would be the invertebrates, especially insects. No attempt is made to enumerate the thousands of species of invertebrates.

The vertebrates are enumerated in Table 2.1.5.7-1 in the appendix. There are 6 large herbivores, 1 large carnivores, 1 large omnivore, 68 small land mammals, and 14 bats for a total of 90 mammals.

The birds are the most numerous vertebrates with approximately 286 species. There are 28 wading and shore birds, 9 terns and gulls, 7 bitterns and herons, 25 ducks, geese, and swans, and 13 other water birds for a total of 82 water-related birds. There are 11 quail, grouse, and related birds, and 7 pigeons and doves. One vulture and the osprey are present. The 25 birds of prey are composed of 9 owls, 4 falcons, and 12 hawks and eagles. Song and other birds not included in the categories above include approximately 152 species.

Among the vertebrates there are 2 turtles, 20 lizards, and 27 snakes for a total of 49 species.

There are 24 amphibians including 9 salamanders and newts, 6 toads, 2 tree frogs, and 7 "water" frogs.

The fishes include 12 cold water species (mostly trout and salmon) and 31 cool and warm water fishes for a total of 43 species.

<u>Unique, Sensitive, and/or Threatened Populations</u>

These populations do not presently appear on official Federal or State lists, but are considered as unique because they are uncommon species within the area that would be traversed by the proposed route. They usually have small distributional ranges, localized or relic populations, and specific habitat requirements. Listed here are some of the more sensitive or unique species occurring along the pipeline route. A list of unique, sensitive and/or threatened species that would occur along the proposed route are shown in Table 2.1.5.7-2.

Some of the larger unusual mammals of concern along various parts of the proposed pipeline are: Mountain caribou in adjoining ranges of northern Idaho which could potentially be reintroduced to sites in the Moyie River basin; Canadian lynx, which may occasionally exist on or along the right-of-way; and grizzly bear in adjoining mountain ranges of northern Idaho.

Very little information is currently available about the Malheur shrew, except that it is considered to be unique and has a small zone of occurrence. Along the proposed route, the animal is known to occur in bogs, marshes, and riparian areas from the Blue Mountains of Washington into mid-Malheur County, Oregon (Burt and Grossenheider, 1964; Larrison, 1967, 1970; and Olterman and Verts, 1972).

The Northern bald eagle, classified by Oregon as threatened, is a species of critical concern over much of its range. In 1974, 143 nests were recorded in Oregon, of which 61 were active, producing only 43 young. Approximately 10 pairs are known from the Blue and Wallowa Mountains area (USDI-FWS, 1974). One recently active nest would be located very near the proposed pipeline.

The status of osprey populations is critical in the west. In Idaho, they are known to nest and feed along Lake Pend Oreille.

Table 2.1.5.7-2 Unique, sensitive, and/or threatened vertebrate populations expected to be encountered along the proposed pipeline route.

Common Name	Scientific Name	Occurrence along the Route
Woodland caribou	Rangifer tarendus	May range into Moyie River area from Canada
Bighorn (mountain) sheep	Ovis conadensis	Malheur County, Oregon Monte Cristo Range, Fish Lake Valley, Nevada
Grizzly bear	Ursus horribilis	May occur in remote areas of Idaho
Canadian lynx	Lynx lynx	May occur in remote areas of Idaho, Washington and Oregon
Kit fox	Vulpes macrotis	Southeastern Oregon through Nevada
Malheur shrew	Sorex sp.	Blue Mountains of Washington through mid-Malheur County, Oregon
Pale Kangaroo mouse	Microdipodops megacephalus	Deep Springs Valley, California
San Joaquin pocket mouse	Perognathus inornatus	Four Corners to Randsburg, California
Chisel tooth kangaroo rat	Dipodomys panamintinus	"
Northern bald eagle	Haliaeetus leuco cephalus alascanus	Generally occurs in Oregon and northward
Osprey	Pandion haliaetus	Lake Pend Oreille, Oregon and Owens River, California
Desert tortoise (western gopher)	Gopherus agassizi	Kramer Junction through El Paso Mountains, California
Southern rubber boa	Charina bottae (umbratica)	Southwestern San Bernardino County, California

Table 2.1.5.7-2 (Cont.)

Common Name	Scientific Name	Occurrence along the Route
Panamint alligator lizard	Gerrhonotus panamintinus	Inyo County, California
Tailed frog	Ascaphus truei	Wallowa Mountains of eastern Oregon
Black toad	Bufo exsul	Deep Springs Valley, Inyo County, California
White sturgeon	Acipenser transmontanus	Kootenai River, Idaho and Snake River, Washington

The white sturgeon is found in twc large rivers that would be crossed by the route, the Kootenai and the Snake River.

The wildlife species discussed above and others discussed in the section on Endangered Species does not by any means include all of the rare and endangered species of these taxons that would be found along the proposed route. Official lists are constantly being added to and revised. In all likelihood, there are species that would be found along the proposed route that are in greater danger of extinction than some of the species named on the state and possibly Federal lists.

Other taxons of animals not listed in this report also contain species that are rare or endangered. However, at the present time these groups are less well known than the more visible mammals, birds, reptiles, and fishes. One group, of which there is some available information, is the aquatic and semi-aquatic molluscs. The species cf concern are remnants of once larger populations that have shrunk because of the desertification process. Most live in and around springs and are very limited in distribution. Their survival is intimately associated with the existence of their particular spring or springs. Many springs have been capped or eliminated, and doubtless many species of molluscs indigenous to the springs have become extinct.

Several land mollusks are also rare or potentially endangered. These are found in variety of terrestrial habitats such as among stone outcroppings, organic debris, and live vegetation of various types.

Endangered Species

Table 2.1.5.7-3 lists species classed as endangered by the Federal Government that would occur along the proposed route (USDI-FWS, 1974).

The northern Rocky Mountain wolf could occur along the proposed route in remote areas. A verified specimen was taken near Baker, Oregon, in early 1974.

The American peregrine falcon and southern bald eagle range over the area where the proposed route would be constructed. There were sightings in 1974 at M.P. 206 where the pipeline would cross the Snake River. However, no known eyries would be located within one mile of the proposed pipeline.

A list of threatened wildlife species, a less critical classification than endangered, is in preparation and will be released in the future.

Table 2.1.5.7-4 lists animals classified by individual states as endangered that are along the pipeline route.

Cougars (mountain lions) would be found in all states along the proposed pipeline route. Populations are correlated to the location and density of deer, their principal food (OSGC, I-ED, undated-a). Preferring rugged and mountainous terrain, individuals would rarely venture near the proposed pipeline into the lowlands and grazing lands to prey on livestock and wildlife, except during severe winters.

Ord Kangaroo rats in Washington presently occur in a limited area, but are expanding their range. They have historically occurred and are presently found in the Burbank and Wallula areas in Walla Walla County south of the Snake River. Prior to the early 1950's, no kangaroo rats occurred north of the Snake River or east of the Columbia River. By 1956, the species was recorded occupying a range approximately 5 miles northeast and

Table 2.1.5.7-3 List of Federal endangered species occurring along the proposed pipeline route.

State	Common Name	Scientific Name	Remarks
Idaho	Northern Rocky Mountain wolf	Canis lupis irremotus	May occur in remote areas along the route.
	American Peregrine falcon	Falco peregrinus	May occur along the route.
Washington	" " "	" "	" " " " "
	Peregrine falcon	" "	May range along the route, known to nest and feed along Snake River in general where pipeline crosses.
Oregon	Northern Rocky Mountain wolf	Canis lupos irremotus	A recent (1974) confirmation of a Northern Rocky Mountain wolf killed near Baker suggests this species may again occur in remote areas traversed by the pipeline.
	Peregrine falcon	Falco peregrinus	May range along the route.
Nevada	Southern bald eagle	Haliaeetus	Possible visitor along route.
California	Peregrine falcon	Falco peregrinus	One pair observed in 1973 near Deep Springs Valley, Inyo County.
	Southern bald eagle	Haliaeetus leucocephalus leucocephalus	May be an occasional visitor to Owens Valley River area.

Table 2.1.5.7-4 Endangered animal species as listed by individual states that may occur along the proposed pipeline route.

State and Common Name	Scientific Name	Remarks
Idaho		
Tech. Rep M-74[1] lists the following endangered species		
Washington		
Tech. Rep. M-74-6 lists the following endangered species:		
Pigmy Rabbit	Sylvilagus idahoensis	Occurs in portions of Columbia basin crossed by the route
Whitetailed Jack rabbit	Lepus townsendi	Occurs in Whitman County crossed by the route
Cougar	Felis concolor	Occurs rarely along route
Ord Kangaroo Rat	Dipodomys ordi	Occurs near pipeline in vicinity of Pasco and Wallula
Aleutian Canada Goose	Branta canadensis leucopareia	May be an occasional visitor
Southern Bald Eagle	Haliaeetus leucocephalus leucocephalus	Very rare - status uncertain
Prairie Falcon	Falco mexicanus	Pipeline traverses habitat
Peregrine Falcon	F. peregrinus	Recent sightings near Snake River crossing
Spotted Owl	Strix occidentalis	Occurs in deep forests along the route

1/ Addor, E. E., J. K. Stolland, V. E. LaGrade, 1974. A user-accessed computer information system for environmentally sensitive wildlife. Vicksburg U.S. Army Engineers Waterways Experiment Sta. Tech. Rep. M-74-6. 3 Vols.

Table 2.1.5.7-4 (Cont.)

Common Name	Scientific Name	Remarks
Oregon		
Tech. Rep. M-74-6 cites the following endangered species:		
Spotted Bat	Euderma maculatum	May rarely occur along the route
Northern Rocky Mt. Wolf	Canis lupis irremotus	One specimen taken near near Baker - very rare
Aleutian Canada Goose	Branta canadensis leucopareia	An occasional migrant
Tule White-fronted goose	Anser albifrons gambelli	"
Southern Bald Eagle	Haliaeetus leucocephalus leucocephalus	Occasional visitor
Prairie Falcon	Falco mexicanus	Nest sites could be enountered
Peregrine Falcon	F. peregrinus	May rarely occur along the route
Spotted Owl	Strix occidentalis	Occur in deep forests along the route
Nevada		
Endangered Species Regulation No. 1 and Amendments State Board of Fish and Game Commissioners		
Spotted bat	Euderma maculatum	Occurs rarely along route
Prairie falcon	F. Mexicanus	Occurs along route
Greater sandhill crane	Grus canadensis	"

Table 2.1.5.7-4 (Cont.)

Common Name	Scientific Name	Remarks
California		
Endangered Wild Species, California Department of Fish and Game, 1973. At the Crossroads - a report on California's Endangered and Rare Fish and Wildlife		
Southern Bald Eagle	Haliaeetus lenococephalus	Occasional visitor to Owens River area
Mohave Ground Squirrel	Citellus mohavensis	Occurs in San Bernardino and Inyo Counties
Owens Tui Chub	Gila bicolo snyderi	Occurs upstream from the route in Owens River Valley
Owens Pupfish	Cyprinodon radiosus	"

northwest of the Snake River bridge near Pasco. It is assumed that the highway bridge on U.S. Highway 12 provided the means for their expansion. They now occupy a range approximately 20 miles northeast and northwest of the city of Pasco. They apparently are expanding their range at the rate of at least one mile per year.

The pygmy rabbit is a small sagebrush cottontail. They average about 10 inches in length compared to 14 to 15 inches for most other cottontails. Their range in Washington is limited to a portion of the Columbia Basin. Its existence is closely tied to unaltered sagebrush habitat.

The white-tailed jack rabbit is a hare of the transition zone where sagebrush and grassland meet. It ranges to the edge of the timberland in Whitman County, Washington and the edge of the Blue Mountains. Concentration of farming activities in this zone has greatly decreased usable habitat. The present trend toward better range management with less overgrazing should benefit this species and reduce further decline in their numbers.

The prairie falcon frequents habitats along the proposed pipeline route, including: canyons, plains, deserts, and open mountain areas. They nest in bare niches in cliffs and do not tolerate any disturbance within their nesting range. The Snake River crossing at M.P. 206 and upstream from the mouth of the Palouse River 2 miles west of one area used by prairie falcons.

The spotted owl, a very secretive bird is found in deep forests and would be found in the Idaho Section of the proposed pipeline. They are on the Washington and Oregon lists of endangered species but would be less likely to occur along the proposed route in these states.

Two birds listed by Washington and Oregon as endangered, the Aleutian Canada goose, and Tule white-fronted goose, are occasional migrants through these states and could occur along the proposed route.

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2.1.5E.8 Ecological Considerations

The reader is referred to Section 2.1.4.8 of the San Francisco report for this information.

2.1.5E.9 and 2.1.5E.10 Social and Economic Factors

This discussion of economic and social factors treats the 10 counties through which the pipeline would pass from the Canadian border to Rye Valley as one region and the 12 counties from Rye Valley to Cajon, California as a second region (Figure 2.1.5.9-1).

<u>History of Economic Development and Principal Economic Activities</u>

The economic development of the area is based on lumbering, mining, railroads, and wheat farming.

The City of Spokane is the economic center of the northern part of the area and of a larger intermountain area as well. Spokane began as a sawmill town, using water power of the Spokane River. It became a transportation center upon arrival of the Northern Pacific Railroad and, later, other railroads; and then a supply center for the Coeur d'Alene mining district in northern Idaho. Its biggest surge in development came with establishment of wheat farming in the Palouse Hills to the south and irrigation along the Columbia River to the east. It is now the marketing, trading, finance, and service center for the large wheat and cattle raising, mining, and lumbering area of eastern Washington and Western Idaho. It has developed a

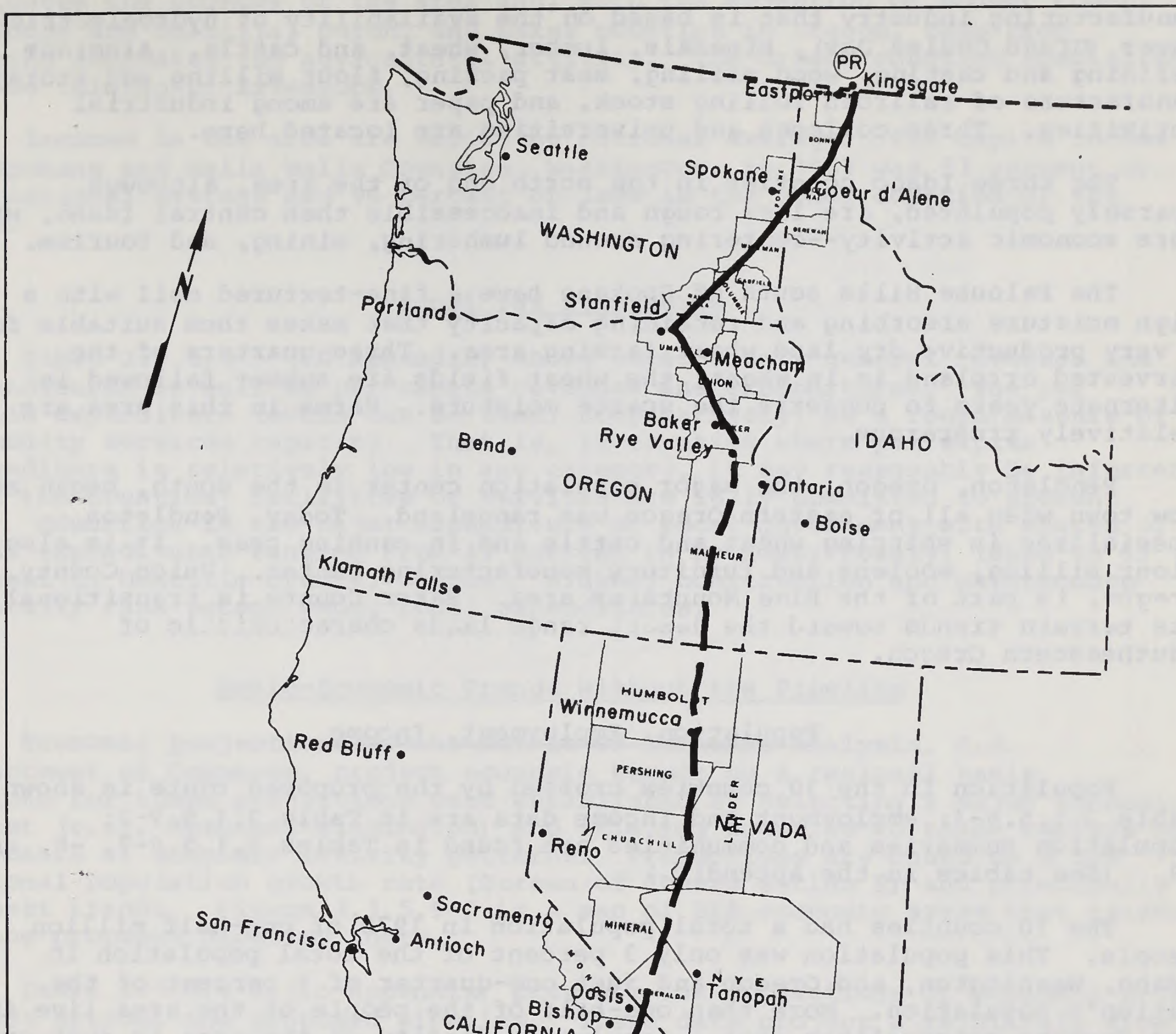

Figure 2.1.5.9-1 Socio-economic base map

manufacturing industry that is based on the availability of hydroelectric power (Grand Coulee Dam), minerals, lumber, wheat, and cattle. Aluminum refining and casting, wood milling, meat packing, flour milling and storage, manufacture of railroad rolling stock, and paper are among industrial activities. Three colleges and universities are located here.

The three Idaho counties in the north end of the area, although sparsely populated, are less rough and inaccessible than central Idaho, with more economic activity--centering around lumbering, mining, and tourism.

The Palouse Hills south of Spokane have a fine-textured soil with a high moisture absorbing and retaining capacity that makes them suitable for a very productive dry land wheat farming area. Three-quarters of the harvested cropland is in wheat; the wheat fields are summer fallowed in alternate years to conserve the scarce moisture. Farms in this area are relatively prosperous.

Pendleton, Oregon, the major population center in the south, began as a cow town when all of eastern Oregon was rangeland. Today, Pendleton specializes in shipping wheat and cattle and in canning peas. It is also a flour milling, woolens and furniture manufacturing center. Union County, Oregon, is part of the Blue Mountains area. Baker County is transitional as its terrain trends toward the desert range lands characteristic of southeastern Oregon.

Population, Employment, Income

Population in the 10 counties crossed by the proposed route is shown in Table 2.1.5.9-1; employment and income data are in Table 2.1.5.9-2; population summaries and communities are found in Tables 2.1.5.9-7, -8, and -9. (See tables in the Appendix.)

The 10 counties had a total population in 1970 of one-half million people. This population was only 3 percent of the total population in Idaho, Washington, and Oregon and just one-quarter of 1 percent of the Nation's population. More than one-half of the people of the area live in the Spokane metropolitan area. Population density of the area is just over one-half of the national average; the density ranges from 4 people per square mile in Boundary County, Idaho to 164 persons per square mile in Spokane County, Washington. The rate of population growth in the 1960-70 decade was 4 percent, less than one-third the national average during that period. Three counties experienced a decline in population during the period; three other counties had a zero or 1 percent rate of growth. Only two counties in the area had a growth rate equal to or above the national average. The rate of urbanization is about the same as the national average but, again, is concentrated in the Spokane area. The minority population is low, being about 3 percent in the area, and 4 percent in Spokane County (see Table 2.1.5.9-3). Communities along the proposed route are listed in Table 2.1.5.9-4. (See tables in the Appendix.)

The unemployment rate in this area is generally higher than the national rate, ranging from 50 percent greater in Spokane County to nearly three times as high in the northern Idaho counties. The employment data in Table 2.1.5.9-2 reflect the agricultural and lumbering orientation of this area's economy. Manufacturing employment is well below the national average of 25.9 percent. In Spokane County, only 12.5 percent of the labor force was engaged in manufacturing occupations. Only in the northern Idaho counties does the percentage of employment in manufacturing approach the national level. Most counties in the area tend to have a higher level of employment in government than does the Nation generally. Agriculture thus dominates the economy of the area and, with the exception of Bonner County in Idaho and Umatilla, Union, and Baker counties in Oregon, cash crop farming dominates the agricultural activity. The Oregon counties specialize in the raising of livestock.

Incomes in the area are below the national average. Per capita income in Spokane and Walla Walla Counties, Washington, in 1967 was 97 percent of the national average and 90 percent or less in the other counties of the area.

Local Tax Structures

Table 2.1.5.9-5 (in Appendix) shows total county general revenues and expenditures as well as per capita revenues and expenditures. The per capita expenditure levels can be used, comparatively, as a rough measure of community services capacity. That is, in counties where per capita expenditure is relatively low in any category, it may reasonably be inferred that the counties' facilities or services are fully committed to present use. Education is the major expenditure of local government with shares of total expenditures ranging from 39 percent in Boundary County, Idaho to 65 percent in Umatilla County, Oregon. Highway construction and maintenance generally rank second among local expenditures.

Socio-Economic Trends Without the Pipeline

Economic projections of the Bureau of Economic Analysis, U.S. Department of Commerce, project economic trends on a regional basis. Regions for these projections were established by selecting a major economic center (e.g., Spokane, Washington) and relating counties to these centers on the basis of economic activity patterns. Projections are based on a low national population growth rate (Bureau of Census series E) and principally on past trends. Figure 2.1.5.9-2 is a map of BEA economic areas that relate to the proposed pipeline route.

Table 2.1.5.9-6 (in Appendix) presents the projections of economic area trends without the proposed pipeline. These data project a relatively slow rate of growth in the area. Mining and agriculture are expected to be the slowest growth sector while finance, insurance, real estate, and services are expected to be fast growth sectors.

Solid Waste

Solid waste management along the route is typical of rural or sparsely populated areas of the United States; very little waste disposal along the route will be related to formally structured waste collection and disposal systems. Typical waste factors in rural areas follow:

-- Solid wastes generated by the living patterns of people in such low density areas are commonly 2-3 pounds per capita per day, much smaller than for typical urban situation.

-- Solid wastes generated by industrial activities are virtually nonexistent. Mechanical packer-type collection trucks are almost nonexistent. Some small communities have limited commercial collection services that might be utilized for special projects.

-- The waste generator will use his own conveyance to collect and transport waste and much will be disposed of on his own land.

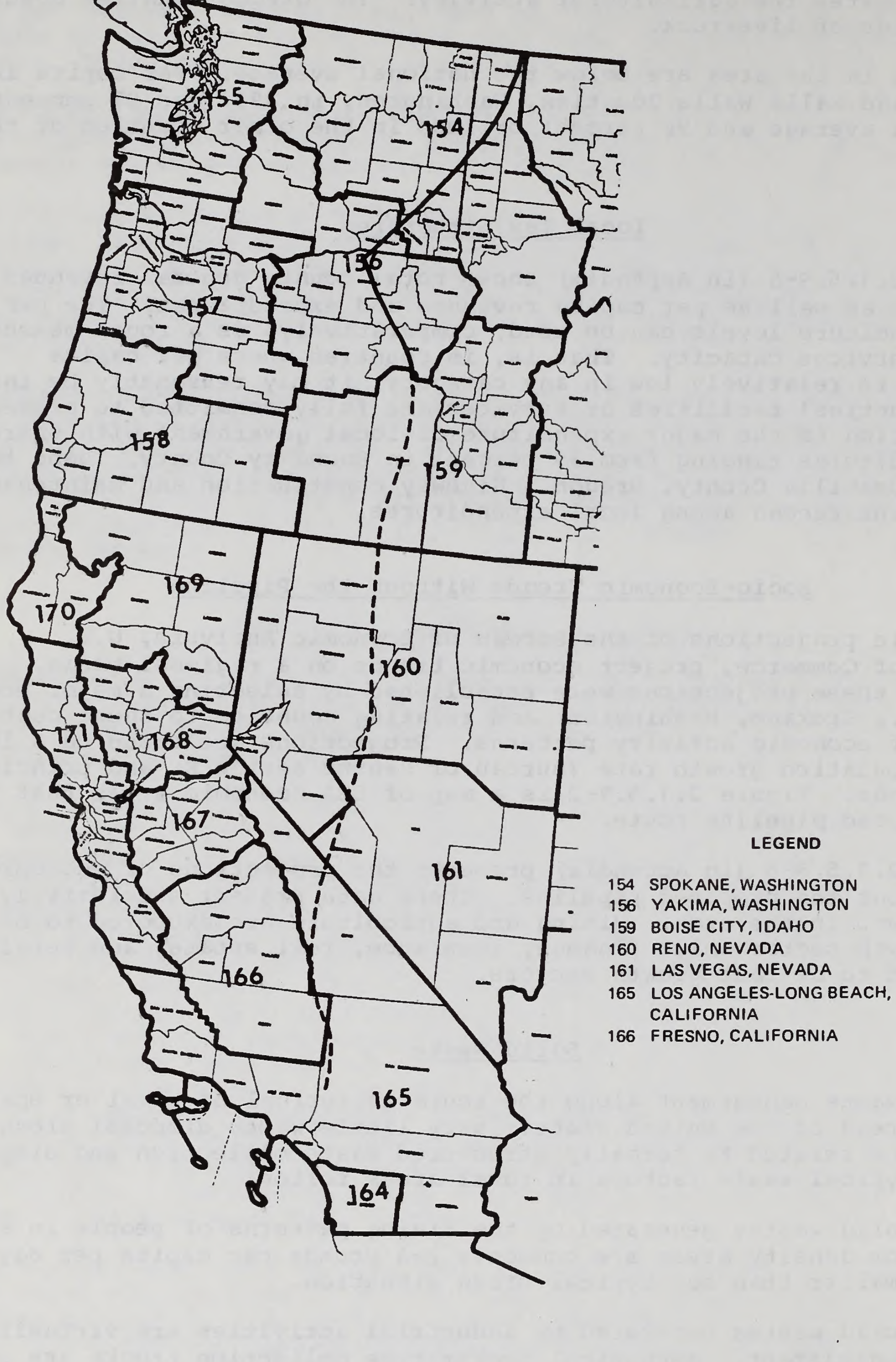

Figure 2.1.5.9-2 Bureau of economic analysis economic areas

-- A common means of disposal is open burning combined with local disposal. Local disposal in most cases is not a sanitary landfill that meets Federal, state and local regulations, but rather is more than likely to be a facility better described as an "open dump."

-- Because of the massive dilution capability of large blocks of land where few people are involved, there are quite often very few identified environmental degradation problems associated with the informal waste disposal system described above.

-- Hazardous and toxic wastes will be virtually nonexistent.

-- The biggest solid waste management problems that exist in an area that is primarily rural but that does contain a few small communities will be in the areas surrounding the small communities, and not in the rural areas themselves.

2.1.5E.11 Land Use

The proposed pipeline route will parallel the existing pipeline right-of-way for most of its entire 414 mile length. The total right-of-way requirement for construction will be approximately 4,775 acres, including a 100-foot-wide right-of-way and 36 acres for construction of river crossings and appurtenant pipeline facilities.

The pipeline route, except for minor route adjustments, parallels the San Francisco pipeline proposal from the Canadian Border (Eastport, Idaho) to Stanfield, Oregon, a segment of 280 miles involving approximately 3,394 acres. From Stanfield, Oregon the pipeline route proceeds to Rye Valley, Oregon involving 111 miles of pipeline and approximately 1,345 acres of right-of-way.

In the following sections the reader will be referred to the Land Use Section 2.1.4.11 of the San Francisco report for the 280 mile pipeline segment where this pipeline route and the San Francisco pipeline parallel each other.

Table 2.1.5.11-1 is a summary of land uses and other features within the proposed pipeline right-of-way.

<u>Historic Land Use Trends</u>

See Section 2.1.4.11, San Francisco Pipeline Report.

<u>Current Land Use</u>

Agricultural - Forestry

Land resource areas crossed by the proposed route are delineated on Figure 2.1.5.11-1. The reader is referred to Section 2.1.4.11, San Francisco Pipeline Report, for the narrative descriptions of the land resource areas B-8, -9, and -10; and E-43, -44 which are crossed by the Los Angeles pipeline proposal.

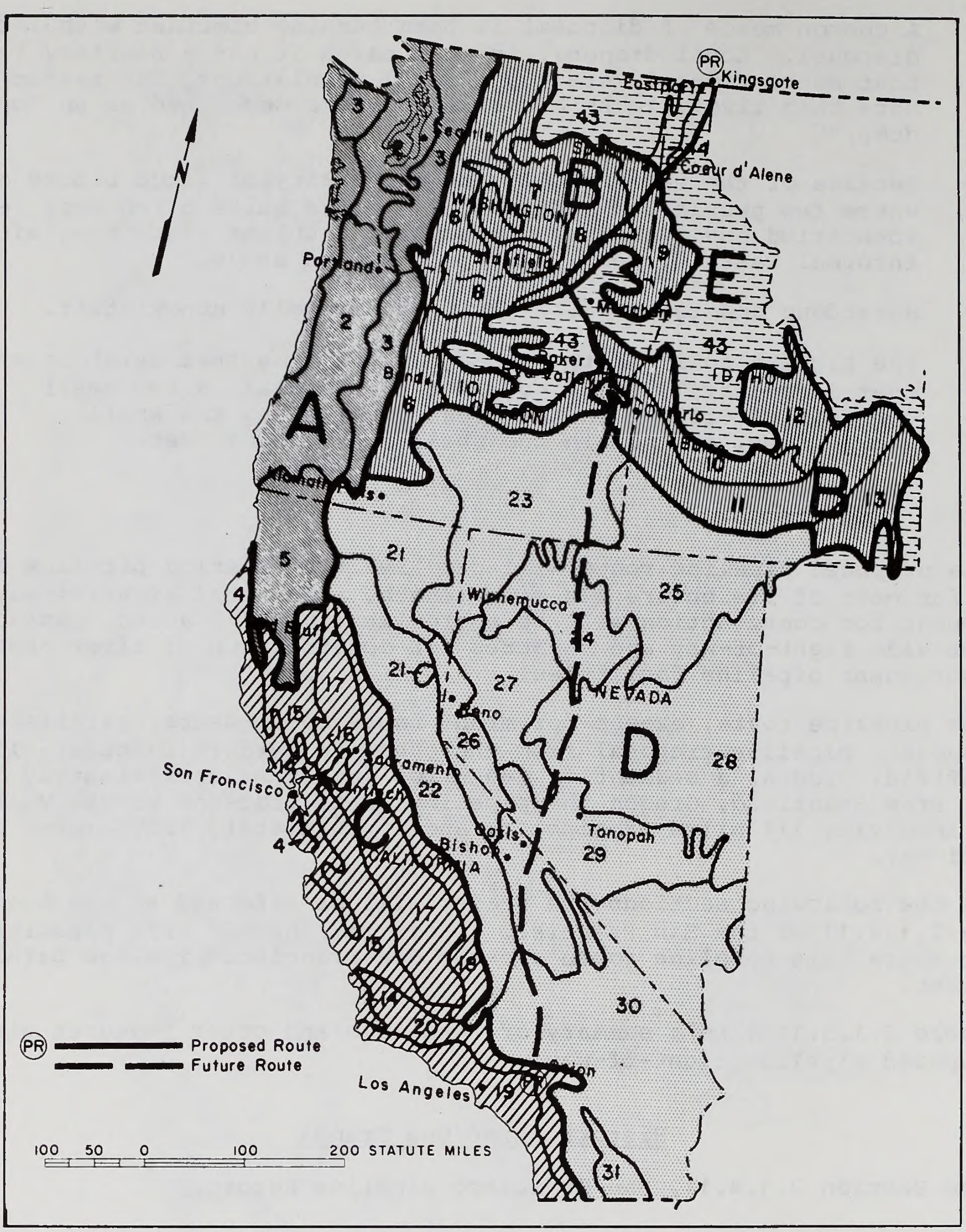

Figure 2.1.5.11-1 Land resource regions and major land resource areas

LEGEND

A NORTHWESTERN FOREST, FORAGE, AND SPECIALTY CROP REGION

1 Northern Pacific Coast Range and Valleys
2 Willamette and Puget Sound Valleys
3 Olympic and Cascade Mountains (Western Slope)
4 California Coastal Redwood Belt
5 Siskiyou - Trinity Area

B NORTHWESTERN WHEAT AND RANGE REGION

6 Cascade Mountains (Eastern Slope)
7 Columbia Basin
8 Columbia Plateau
9 Palouse and Nez Perce Prairies
10 Upper Snake River Lava Plains and Hills
11 Snake River Plains
12 Lost River Valleys and Mountains
13 Eastern Idaho Plateaus

C CALIFORNIA SUBTROPICAL FRUIT, TRUCK, AND SPECIALTY CROP REGION

14 Central California Valleys
15 Central California Coast Range
16 California Delta
17 Sacramento and San Joaquin Valleys
18 Sierra Nevada Foothills
19 Southern California Coastal Plain
20 Southern California Mountains

D WESTERN RANGE AND IRRIGATED REGION

21 Klamath and Shasta Valleys and Basins
22 Sierra Nevada Range
23 Malheur High Plateau
24 Humboldt Area
25 Owyhee High Plateau
26 Carson Basin and Mountains
27 Fallon - Lovelock Area
28 Great Salt Lake Area
29 Southern Nevada Basin and Range
30 Sonoran Basin and Range
31 Imperial Valley
32 Northern Intermountain Desertic Basins
33 Semiarid Rocky Mountains
34 Central Desertic Basins, Mountains, and Plateaus
49 (See E)
35 Colorado and Green Rivers Plateaus
36 New Mexico and Arizona Plateaus and Mesas
37 San Juan River Valley Mesas and Plateaus
38 Black, Hualpai, and Cerbat Mountains
39 Arizona and New Mexico Mountains
40 Central Arizona Basin and Range
41 Southeastern Arizona Basin and Range
42 Southern Desertic Basins, Plains, and Mountains

E ROCKY MOUNTAIN RANGE AND FOREST REGION

43 Northern Rocky Mountains
44 Northern Rocky Mountain Valleys
45 Alpine Meadows and Rockland
46 Northern Rocky Mountain Foothills
47 Wasatch and Uinta Mountains
48 Southern Rocky Mountains
49 Southern Rocky Mountain Foothills
50 San Luis Valley
51 High Intermountain Valleys

ADAPTED FROM:

LAND RESOURCE REGIONS AND MAJOR LAND RESOURCE AREAS OF THE UNITED STATES. 1963. USDA-SCS-HYATTSVILLE, MD. 1969.

Table 2.1.5.11-1 Existing land use within the 100-ft-wide right-of-way of the proposed pipeline route.

	Number of times pipeline crosses			Land use of 100-ft-wide right-of-way (percent)				
County	Waterways	Railroads	Paved Roads and Highways	Forest	Agriculture	Recreation	Conservation	Residential-Urban
Idaho								
Boundary	10	7	4	48	51	1	0	0
Bonner	5	5	6	44	56	0	0	0
Kootenai	2	5	5	28	72	0	0	0
Washington								
Spokane	21	6	14	0	89	0	7	4
Whitman	30	3	11	0	96	2	2	0
Columbia	1	1	2	0	100	0	0	0
Walla Walla	6	3	5	0	82	0	18	0
Oregon								
Umatilla	2	4	20	27	73	0	0	0
Union	10	1	9	71	39	0	0	0
Baker	25	4	17	5	95	0	0	0
Total	112	39	92	21	75	<1	3	<1

Source: WCC (ITA(A) Application 10/15/75)

Industrial

In addition to Section 2.1.4.11, San Francisco Pipeline Report, the proposed pipeline right-of-way will traverse areas zoned as industrial in the southwestern portion of Baker, Cregon.

Commercial Fisheries

No commercial fisheries use was identified within the proposed pipeline right-of-way.

Residential

The reader is referred to Section 2.1.4.11. In Oregon the proposed right-of-way traverses land zoned as "recreational-residential" in the southeastern portion of Umatilla County. The pipeline route also crosses land zoned as residential in the southwestern portion of Baker, Oregon.

Minerals

See Section 2.1.4.11.

Recreation

See Section 2.1.4.11.

Federal and State Reserves

The following information supplements Section 2.1.4.11.

Oregon

<u>Umatilla County</u>--Public lands within the 10-mile-wide corridor consist of the Cold Springs National Wildlife Refuge, the Umatilla Indian Reservation, Emigrant Springs State Park, and the Umatilla National Forest. The pipeline right-of-way will cross approximately 13 miles of the Umatilla Indian Reservation.

<u>Union County</u>--Public lands along the proposed pipeline route include a large portion of the Wallowa-Whitman National Forest north of La Grande, Hilgard Junction State Park west of Perry, and Red Bridge State Park. Approximately 5 miles of the right-of-way will traverse the Wallowa-Whitman National Forest.

<u>Baker County</u>--Public lands in the vicinity include portions of the Wallowa-Whitman National Forest and large areas of public domain. These latter areas are generally under multiple-use management administered by the Bureau of Land Management.

See Sections 2.1.5E.7 and 2.1.5E.13 for additional information on Federal and State reserves.

Transportation Facilities

The following figures depict transportation facilities in the proximity of the proposed pipeline route:

Figure 2.1.5.11-2: Major Highways

Figure 2.1.5.11-3: Primary Railroads

Figure 2.1.5.11-4: Commercial Air Service

Table 2.1.5.11-1 lists the number of times the proposed pipeline will cross major waterways, railroads, and paved roads and highways.

For additional information the reader is referred to Section 2.1.4.11 of the San Francisco Pipeline Report.

Transmission Facilities

The following figures locate various transmission pipelines in the proximity to the proposed route:

Figure 2.1.5.11-5: Natural Gas Pipelines

Figure 2.1.5.11-6: Crude Oil, LNG and Products Pipelines

Figure 2.1.5.11-7: Major Power Transmission Lines

The reader is referred to Section 2.1.4.11 for additional information on transmission facilities.

Land Use Planning

Table 2.1.5.11-2 lists the status of land use plans and zoning for the various counties involved in the proposed pipeline route.

Expected and Potential Trends

See Section 2.1.4.11.

2.1.5E.12 Archeology and Historical Resources

See the discussion presented in 2.1.4.12. The discussion below is particularly applicable to ITA(A)'s proposed project.

Potentially Significant Areas or Sites

Tables 3.1.5.12-1, -2, and -3 in Section 3 record archeological sites within the proposed corridor. No new field assessment was made to locate additional sites. To prevent vandalism, exact locations are unlisted.

Canadian Border to Snake River

This stretch of proposed pipeline was surveyed for archeological sites in 1960 and 1961 by Washington State University when the original pipeline

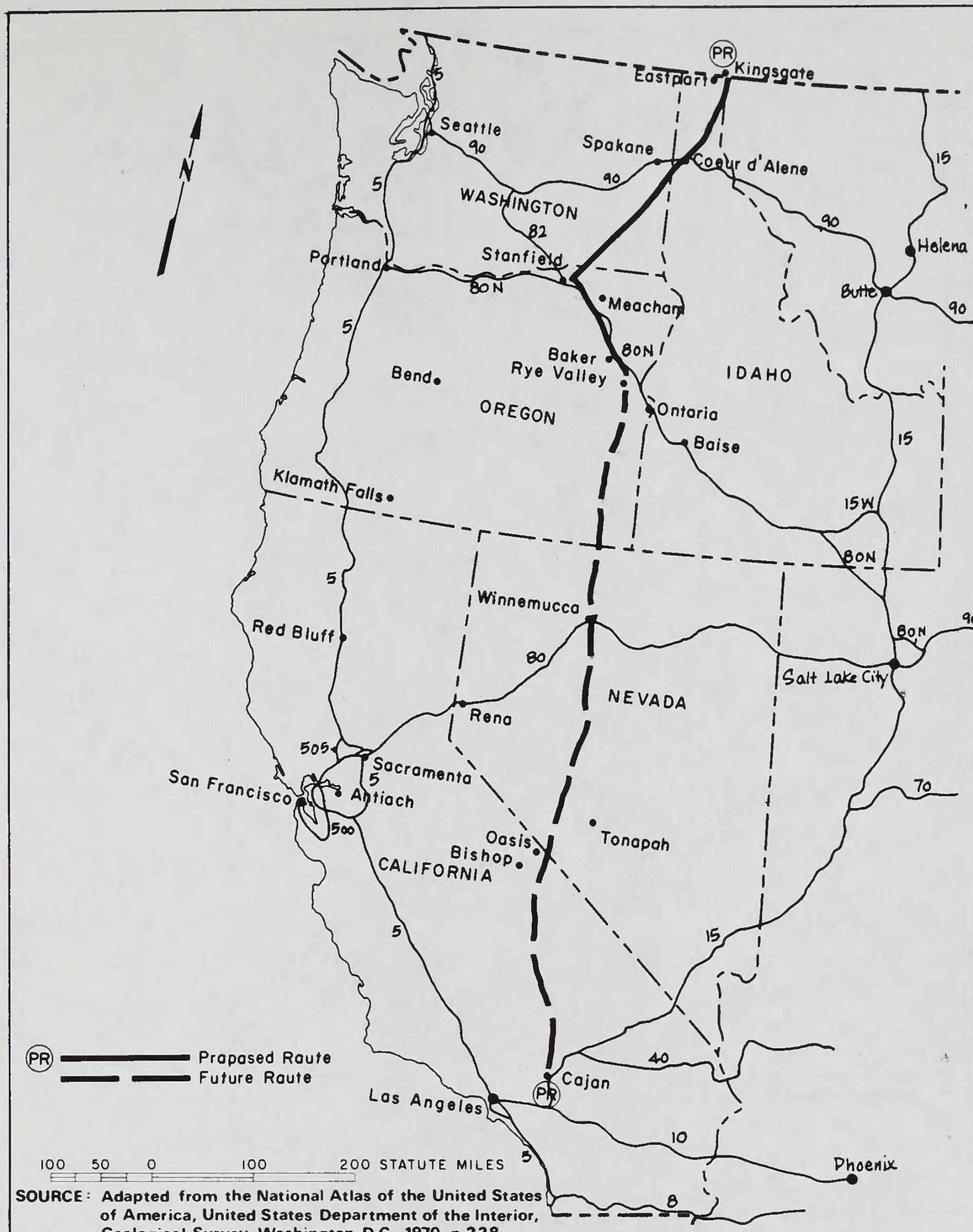

Figure 2.1.5.11-2 Interstate highways in proximity to the proposed route

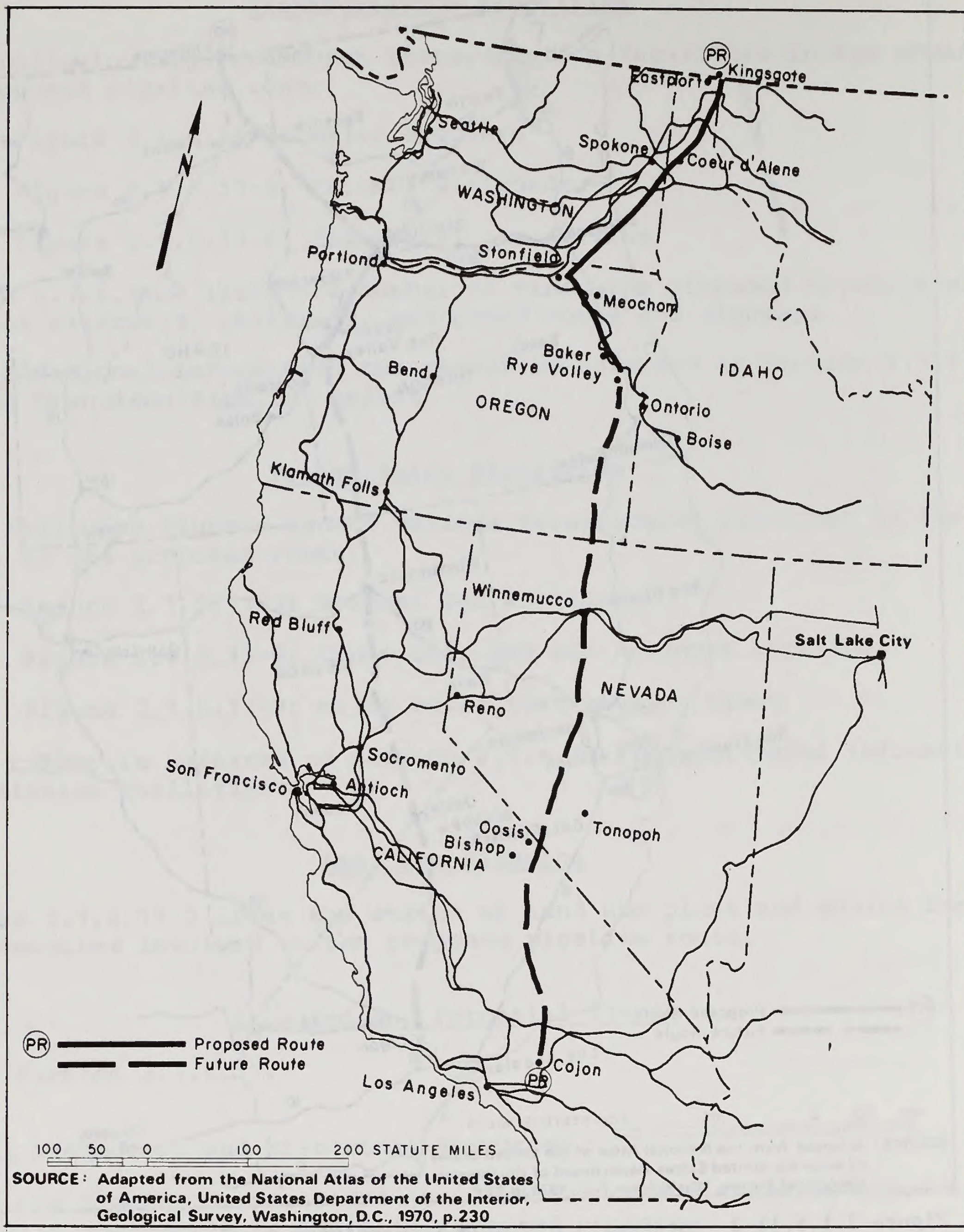

Figure 2.1.5.11-3 Primary railroads in proximity to the proposed route (1966)

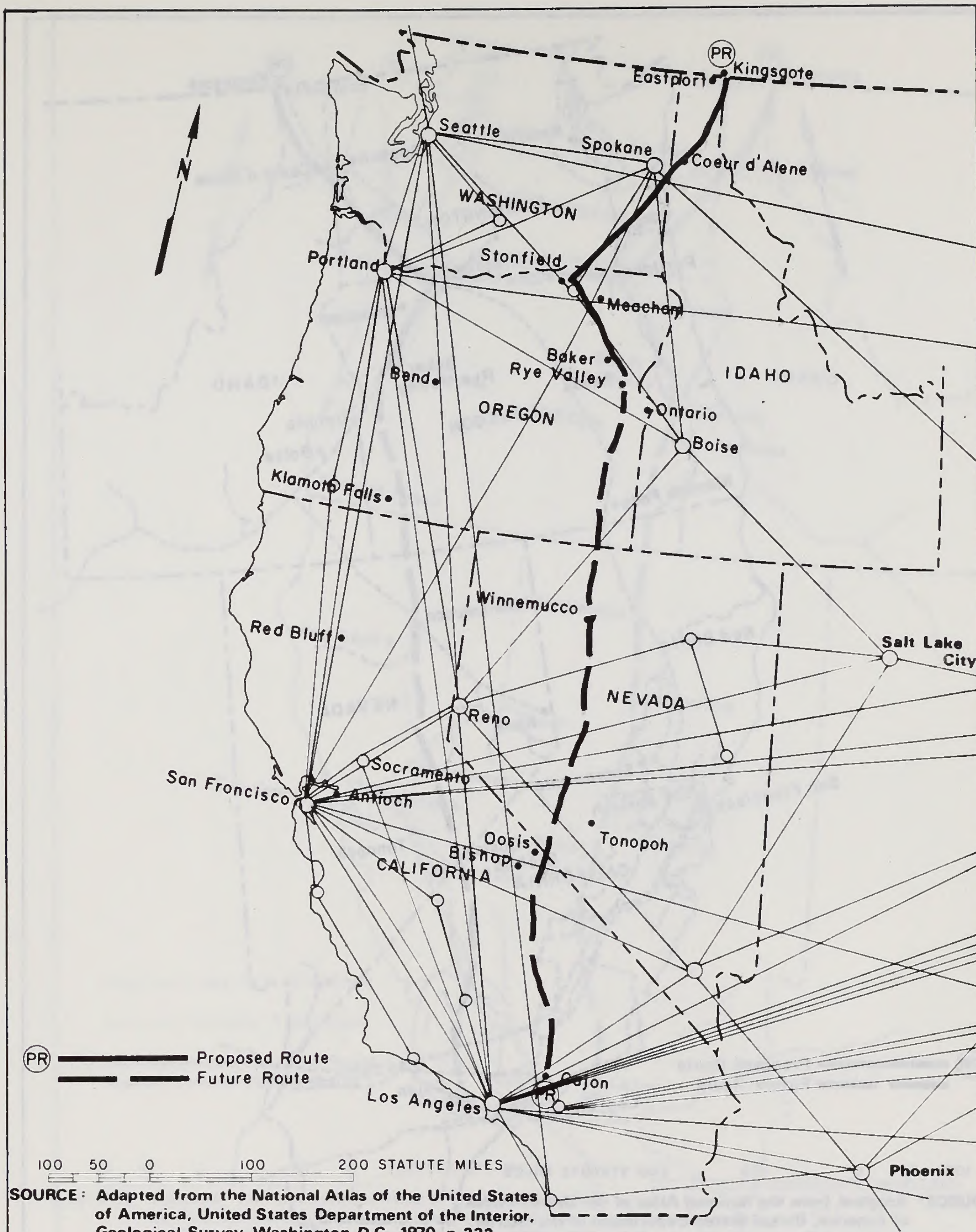

Figure 2.1.5.11-4 Commercial air service in proximity to the proposed route

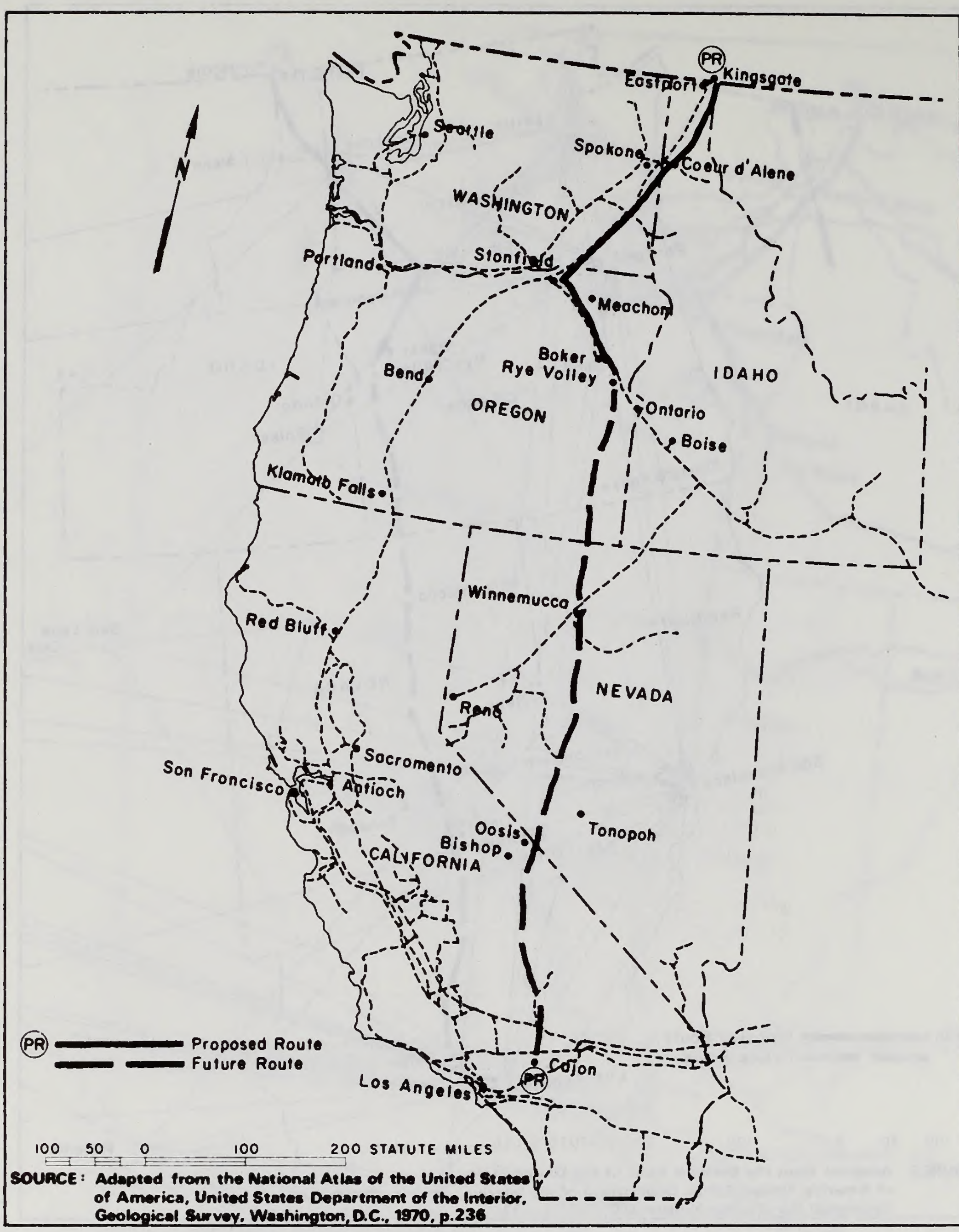

Figure 2.1.5.11-5 Natural gas pipelines in proximity to the proposed route (1967)

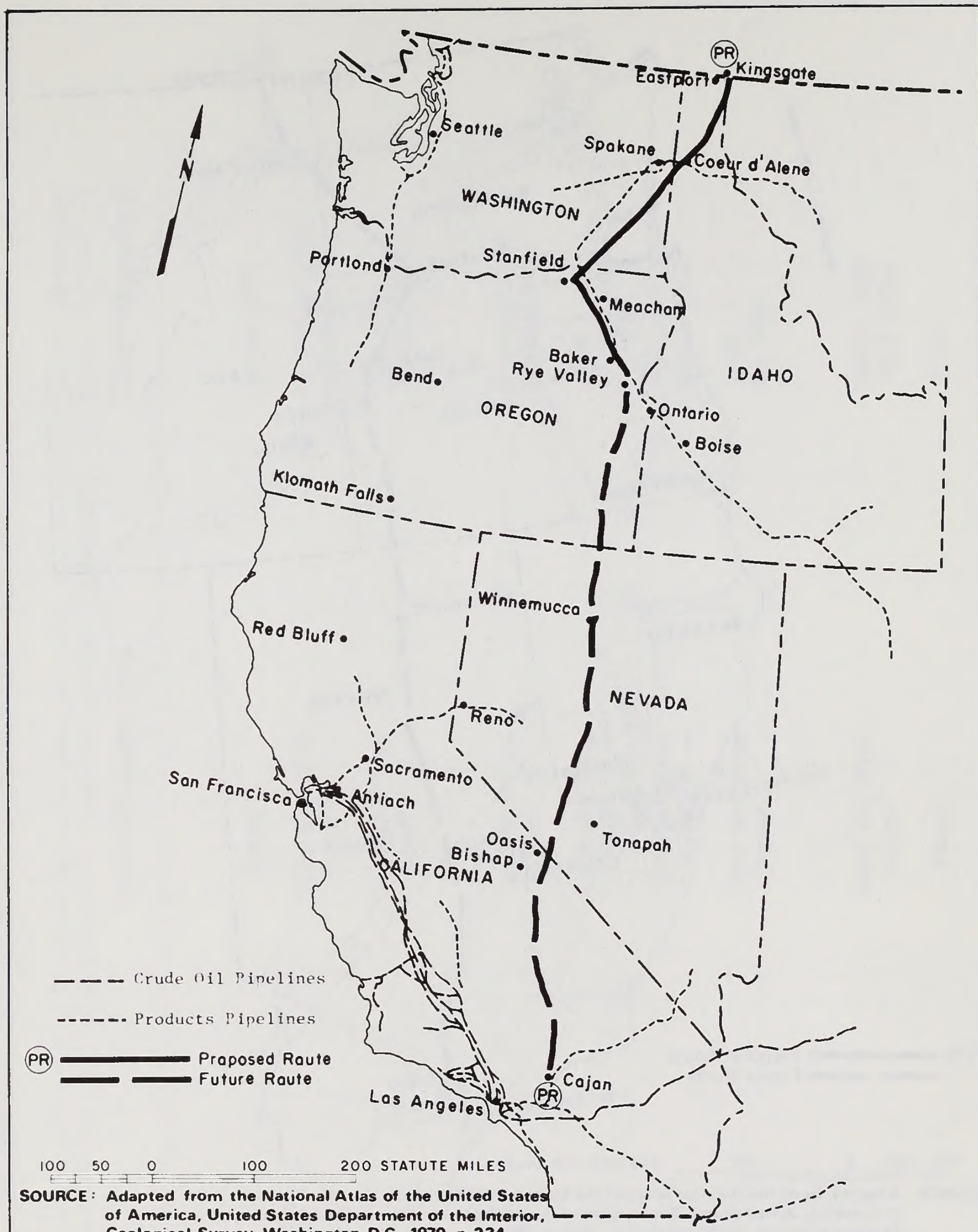

Figure 2.1.5.11-6 Crude oil and products pipelines in proximity to proposed route (1966)

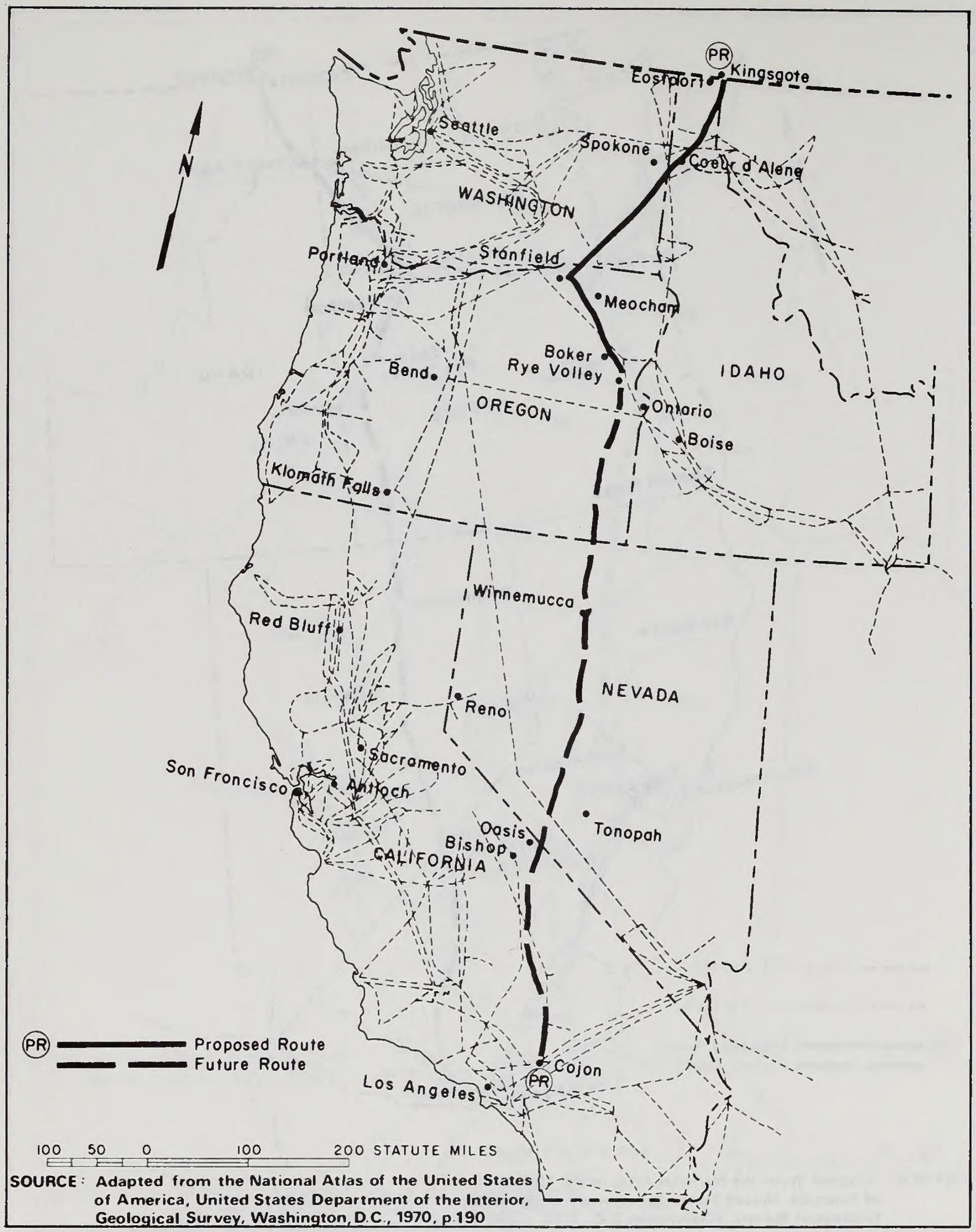

Figure 2.1.5.11-7 Major power transmission lines in proximity to proposed route (1968)

Table 2.1.5.11-2 Land use plans and zoning for involved project counties

County and State	Land Use Restriction	Date Implemented
IDAHO		
Boundary	Zoned	March 1971
Bonner	Land Use Plan	December 1969
	Zoned	December 1969
Kootenai	Land Use Plan	May 1971
	Zoned	August 1972
WASHINGTON		
Spokane	Land Use Plan	October 1968
	Zoned	August 1973
Whitman	Land Use Plan	1968
	Zoned	No Date
Columbia	Land Use Plan	February 1974
	Zoned	March 1962
Walla Walla	Land Use Plan	1968
	Zoned	No Date
OREGON		
Umatilla	Land Use Plan	April 1972
	Zoned	July 1972
Union	Zoned	1964
Baker	Zoned	February 1974

Source: Personal Communications, County Planning Commissions, 1974. (ITA(A) Application 10/15/75) was constructed (Daugherty, R.P., 1960). Later, the exposed trench was also examined for sites (Combes, J.D., 1962). Additional sites were reported by ITA(A) for a total of some 36 sites along this 5-mile wide proposed corridor. Potential for new sites to be found either on the surface or exposed in a trench is very small for this segment. All the known sites, even though partially excavated, still have a potential for providing additional scientific data. Only those sites destroyed by previous development or completely excavated lack this potential.

The most significant site in the area is Marmes Rockshelter which has produced the oldest human remains known in the western United States. There is good potential for similar sites in the region.

Snake River to Malheur River

Although only some seven known sites are indicated in Table 3.1.5.12-3 along this stretch of proposed pipeline, the area is relatively unknown archeologically. Archeological data gathered in this area will add much to our understanding of the prehistory of the area.

Background of General Area Which May Indicate Future Discoveries

Archeological

The proposed pipeline passes through two archeological culture areas: Plateau and Great Basin. The Plateau region is known to contain remains of the Old Cordilleran hunters and fishermen. Known site locations for the Plateau area tend to be river oriented, a pattern which was consistent well into historic times.

Historical

The historical background of the proposed pipeline is much the same throughout its length. Early British exploration and settlement occurred in Oregon and Washington. Early American exploration by fur trappers was followed shortly by governmental sponsored geographical explorations. Soon after came the mining boom of the mid-19th century followed by either farming activities or ranching. All three activities generally caused problems with the indigenous peoples and resulted in military intervention until the late 19th century. In the early 20th century, increased development of the water resources occurred in certain areas of Washington and Oregon as the result of railroad building in the late 19th century. Other transportation problems were constant throughout the development period and in some instances no real development has taken place since the closing of the gold and silver boom mines. Many of the historical events and resultant properties and sites along the proposed pipeline were short-lived, or of local importance only in a sparsely settled land, or too recent to have full historical importance. Old does not necessarily mean historic, but neither does lack of placement on a list of historical sites mean lack of historical significance.

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2.1.5E.13 Recreational and Esthetic Resources

See the discussion presented in Section 2.1.4.13. Discussion pertinent to ITA(A)'s application is presented below.

Recreation Facilities, Areas, and Resources

The proposed pipeline route will traverse 22 counties in 5 states. A concise general description of the recreation facilities, area, and resource opportunities of each state is set forth below.

Annual visitor use statistics for the recreation sites discussed herein are tabulated in Table 2.1.5.13-1 of Section C--Recreation use statistics and site locations. All data, where available, have been tabulated by state, agency, and site. Approximate recreation site locations are shown, by number, on Figure 2.1.5.13-1 of Section C.

Idaho

From the Canadian-Idaho border, the pipeline route follows the narrow valley floor of the Moyie River for approximately 2-1/2 miles to near Addie, Idaho. Approximately 85 percent of this land area is under Federal jurisdiction, and is administered by the Kaniksu National Forest. All but one percent of the remaining area is privately owned.

The northern half of the Moyie River Valley floor is devoted to grazing, cropland, and forest production while the southern half of the valley is principally forested land. One U.S. Forest Service Campground, Copper Creek, is located in the valley adjacent to the Moyie River (Copper Creek near Eastport). This 16 unit campground, along with the Moyie River and nearby forested lands, provides excellent opportunities for camping, picnicking, fishing, hunting, and hiking during the summer months.

The Moyie River segment, from the Canadian/Idaho border to its confluence with the Kootenai River, is designated as a potential addition to the National Wild and Scenic Rivers System.

Table 2.1.5.13-1 Annual visitor use statistics

STATE	ADMINISTERING AGENCY	RECREATION SITE NAME	LOCATION MAP NO. KEY 1/	VISITOR DAYS 2/ DAY USE	CAMPING	ALL USES	VISITS 3/ DAY USE	CAMPER NIGHTS	ALL USES	OTHER
Idaho	U.S. Forest Service	Cooper Creek	(1)			9,700				
		Meadow Creek	(2)			8,100				
	State Parks	Deep Creek	(3)							
		Farragut	(4)				17,390	19,484		
		Round Lake	(5)				11,030	6,205		
	Fish & Game Department	Farragut Wildlife Management Area	(6)							
	City of Post Falls	Post Falls City Park	(7)				32,468			
Washington	US Army Corps of Engineers	Ayers Junction	(8)						5,776	
		Lower Monumental Dam	(9)				55,914			
		Riparia	(10)						4,287	
		Texas Rapids	(11)						8,859	
	State Parks	Lyons Ferry	(12)						134,077	
		Palouse Falls	(13)						38,887	
	State Game Commission	Liberty Lake	(14)							
	County of Spokane	Liberty Lake	(15)						5,300	
	Private Enterprise	Lyons Ferry Marina	(16)						21,906	
Oregon	U.S. Forest Service	Anthony Lakes	(17)						13,300	
		Anthony Lakes Ski Area	(18)	33,400						
		Jubilee Lake	(19)	9,400	22,400					
		Marble Creek	(20)				1,000			
		Mason Dam	(21)				97,500			
		Moss Springs	(22)					1,800		
		North Fork Anthony	(23)						200	
		North Fork Catherine Creek	(24)				1,000			
		Spout Springs Ski Area	(25)	2,100						
		Target Meadows	(26)	500	1,900					
		Umatilla Forks	(27)		7,500					
		Union Creek (See Mason Dam)	(28)							
		Woodward	(29)	2,600	6,100					
	State Parks	Blue Mountain	(30)							
		Catherine Creek	(31)					2,887		
		Emigrant Springs	(32)				158,202	15,974		
		Farwell Bend	(33)				110,838	16,167		
		Hilgard Junction	(34)				102,560	5,633		
		Lake Owyhee	(35)				58,682	4,674		

Table 2.1.5.13-1 (cont.)

STATE	ADMINISTERING AGENCY	RECREATION SITE NAME	LOCATION MAP NO. KEY 1/	VISITOR DAYS 2/ DAY USE	CAMPING	ALL USES	VISITS 3/ DAY USE	CAMPER NIGHTS	ALL USES	OTHER
Oregon (con't)	State Parks (con't)	Ontario	(36)				71,784			
		Red Bridge	(37)				36,560			
		Succor Creek	(38)					1,308		
		Unity Lake	(39)				64,666	9,038		
	State Highway Division	Crooked Creek Springs	(40)							
		Dooley Mountain	(41)							
		Ladd Canyon	(42)							
		Snake River Slides	(43)							
		Weatherby	(44)							
	Wildlife Commission	Ladd Marsh	(45)				13,890			
		Boothman (see Ladd Marsh)	(46)				(1973 data)			
	City of La Grande	Morgan Lake	(47)				25,000			
	City of Milton Freewater	Marie Dorian	(48)							
Nevada	U.S. Forest Service	Big Creek	(49)			5,200				
		Bob Scott	(50)	11,900		(1973)				
		Kingston	(51)	(1973)		2,000				
		Lyle Creek	(52)			(1973)				
		Martin Creek	(53)							
		Peavine Creek	(54)			4,300 (1973)				
	State Parks	Ichthyosaur Scientific Monument	(55)						9,297	
California	U.S. Forest Service	Big Pine Triangle	(56)							
		Grandview	(57)		9,680					
		Gray's Meadow	(58)			19,800				
		Lone Pine Creek	(59)			11,880				
		Oak Creek	(60)		6,930					
	Bureau of Land Management	Alabama Hills	(61)						150,000	
		Goodale Creek	(62)		2,830					
		Symmes Creek	(63)		2,320					
		Tuttle Creek	(64)		6,295					
California (con't)	County of Inyo	Diaz Lake	(65)					22,000		
		Dirty Box	(66)							
		Independence Creek	(67)					6,558		
		Locust Grove	(68)					1,189		
		Portagie Joe	(69)					6,921		
		Sawmill Creek	(70)					2,140		
		Taboose Creek	(71)					14,736		
		Tinemaha Creek	(72)					18,868		

1/ This number corresponds to the number on Figure 2.1.5.13-1. Recreation Site Location Map, which follows this table.
2/ Each visitor day is equivalent to one (1) person spending 12 hours, three (3) persons spending four (4) hours, or any such combination equivalent to 12 hours.
3/ Each visit is equivalent to one (1) person spending one (1) day (day use) or one (1) night (camper night).

Figure 2.1.5.13-1 Recreation site location map

From a point near Addie, Idaho the pipeline turns westerly to the Purcell Trench and then southerly following the Purcell Trench for approximately 105 miles to the Washington/Idaho border. Approximately 96 percent of the land area over which this route passes is privately owned. Other land areas traversed include small parcels of the Kaniksu National Forest, and scattered parcels of Idaho State and national resource land.

Oregon

From the Washington/Oregon border, the proposed pipeline route traverses the most of eastern Oregon for approximately 154 miles. It enters Oregon northeast of Juniper, and extends southward through rolling croplands to Stanfield. From Stanfield, the line turns southwesterly to the foothills and western slopes of the Blue Mountains, through the Grande Ronde and Powder River Valleys to Rye Valley southeast of Baker. This covers a combination of publicly and privately owned lands, of which less than 10% are under Federal jurisdiction. Portions of the Umatilla and Wallowa-Whitman National Forests, and Umatilla Indian Reservation are also crossed in northeastern Oregon. All but a small percentage of the remaining area is privately owned farm and forest land.

Developed recreation sites provided by Federal and state agencies are primarily located in northeastern Oregon's two major mountain ranges: the Wallowa and Blue Mountains. The Wallowa Mountains extend east and west; the Blue Mountains extend north and south. Portions of five national forests lie within this region. The Wallowas (often called the "Alps of America"), a series of high jagged peaks, are among the major scenic and recreational attractions of the state. Dotted with hundreds of good fishing lakes and offering numerous outstanding views, this ruggedly beautiful mass of mountain has much the same gradeur as the Grand Tetons of Wyoming. The Blues, on the other hand, consist of moderately high terrain whose slopes are covered with stands of timber.

The proposed route does not pass over any developed recreation sites, and only a few are within 5 miles of its proposed location. However, the proposed location either parallels, or is in close proximity to, the primary access routes to most of this regions limited supply of developed sites and opportunities. Therefore, several of the sites warrant mentioning.

Morgan Lake, a City of La Grande recreation site, is adjacent to the pipeline route. The lake area includes facilities for picnicking and outdoor games. It provides excellent fishing; a boat launching ramp is available for public use.

Four U.S. Forest Service recreation sites, Jubilee Lake, Target Meadows, Umatilla Forks, and Woodward are located on the Umatilla National Forest near Tollgate. Seven other U.S. Forest Service recreation sites; Anthony Lake, Marble Creek, North Fork Anthony, Mason Dam, Union Creek, Moss Springs, and North Fork Catherine Creek, are located in the Wallowa-Whitman National Forest. Anthony Lake and North Fork Anthony are west of Haines, Marble Creek, Mason Dam and Union Creek west of Baker. Moss Springs and North Fork Catherine Creek are south of Union. These recreation sites and national forest resources facilitate camping, picnicking, hiking, fishing, boating, swimming, horseback riding, berry picking, hunting, and environmental and historical education. These recreational facilities are unavailable at some sites.

Ten Oregon State Parks; Blue Mountain, Emigrant Springs, Red Bridge, Hilgard Junction, Unity Lake, and Catherine Creek are located within the general vicinity of the proposed pipeline route. Blue Mountain and Emigrant

Springs near Interstate 80N a few miles west of the pipeline route. Red Bridge and Hilgard Junction are along Interstate 80N near La Grande. Unity Lake is 5 miles north of Unity, and Catherine Creek is southeast of Union. These State Parks provide opportunities for camping, picnicking, swimming, hiking, fishing, boating, and outstanding environmental and historical education. Again, however, not all of these opportunities are available at every site.

Five State Highway Rest Areas; Ladd Canyon, Dooley Mountain, Weatherby, Snake River Slides, and Crooked Creek Springs, are located within the general vicinity of the proposed pipeline route. Ladd Canyon is located along Interstate 80N south of La Grande, Dooley Mountain along State Highway 7 south of Baker, and Weatherby along Interstate 80N near Durkee.

Anothony Lakes and Spout Springs ski areas in the Blue Mountains offer good to excellent snow skiing. Tows and limited overnight facilities are provided. The Anthony Lakes are northwest of Baker, and Spout Springs is east of Tollgate.

The pipeline route closely parallels the proposed High Desert Trail for several miles and crosses it at least once near Rye Valley. This trail, if designated and developed, will most certainly receive heavy use by hikers and backpackers, particularly during the winter months.

The proposed pipeline route very closely parallels, and is within 2.5 miles of the Oregon Trail for a total of 64 miles as follows: from M.P. 320 to M.P. 365 (45 miles), and M.P. 358 to M.P. 414 (15 miles). Within these 60 miles are all or portions of five Oregon Trail segments, totaling 34 miles, which were found during a recent U.S. Bureau of Outdoor Recreation study to have high potential for preservation and historic interpretation. These five segments are Hilgard Junction, La Grande, Ladd Hill, White Swan Mine, and Sisley Creek segments. Collectively, they offer probably the best potential along the entire Oregon Trail route for establishment of scenic interpretive trails for hiking and horseback riding along visible wagon ruts. Much of the area here and in adjacent lands appear virtually untouched since passage of the last emigrant wagon. Also included within this 64 miles of Oregon Trail are historic sites associated with the Trail. Of these, three sites have high potential for historic interpretation and/or recreation (exceptional Oregon Trail ruts, emigrant graves, and an emigrant campground).

Eastern Oregon offers some of the best hunting in the state. Areas along the proposed route and surrounding vicinity provide a variety of hunting opportunities. Mule deer are the most abundant big game species and can be found almost anywhere along the route. Rocky Mountain elk thrive in most parts of the Blue and Wallowa Mountains and hunters from all over the nation annually try their luck at bagging one of these magnificent animals. Other big game species include black bear, mountain goats (no open season), and pronghorn antelope (no open season).

Upland game bird hunting opportunities are exceptionally good. Hungarian partridge, mountain and valley quail, and western mourning dove can be found almost anywhere along the proposed route. Chukar partridge are along the route north of La Grande. South of Baker, both Chukar partridge and Sage grouse are abundant. Blue and Ruffled grouse are plentiful, but limited to the Blue and Wallowa mountain areas. Ringneck pheasant are also plentiful, but concentrate their populations in and near grain and alfalfa fields, and other cultivated lands. Ringneck pheasant hunting is especially good in the Baker Valley from Baker north to North Powder, and on the fringes of Boothman and Ladd Marsh waterfowl areas south of La Grande. A limited population of Sharp Tailed grouse can be found along the pipeline route near Durkee.

Waterfowl, including ducks and geese are present in northeast Oregon. During the latter portion of hunting season large numbers of Mallards and Canadian Honkers congregate on the Snake River, Thief Valley Reservoir (northeast of North Powder), and Malheur Reservoir (southwest of Durkee). The best hunting is found in the Boothman Marsh, Ladd Marsh, the slough area of the Grande Ronde Valley, the Baker Valley and Keating area, and Eagle Valley around Richland.

Sport fishing for both anadromous and native species is good to excellent in northeast Oregon on larger rivers and streams. Spring Chinook salmon and summer steelhead can be caught on the Grande Ronde, while resident Rainbow trout are more plentiful and can be caught on the Powder and Grande Ronde Rivers and Catherine Creek. Early season trout fishing is primarily confined to irrigation reservoirs, ponds, and some lakes at lower elevations. Only a few streams are low enough in elevation to allow good spring trout fishing.

Esthetic, Scenic and Cultural Features

After aerial and ground reconnaissance of the proposed pipeline route, the esthetic environment along the route was divided into eight geographic landscapes containing a total of 25 type landscapes. The landscapes were then evaluated, using the technique described above. The variety of each landscape, both geographic and type, was defined by differences in vegetation patterns, landforms, rock formations, and waterforms. Sensitivity was evaluated by considering both the number and primary interests of landscape viewers. Each type landscape was then assigned a classification. A description of each landscape follows.

Moyie River Valley to Purcell Trench Valley (13 miles)

The geographic landscape between the Moyie River Valley and the Purcell Trench Valley is dominated by mountain ridges bounding a continuous sequence of narrow valleys from north to south. Although some peaks in the vicinity east and west of the proposed route attain heights in excess of 4,000 feet above the valley floors, ridges flanking the valleys rise only to an average of 3,000 feet, and diminish southward. Numerous small, swift-flowing clear streams drain through the mixed conifer forests on the mountain slopes, cross and parallel the valley floors, and become tributaries of the principal surface water systems, the Kootenai and Pend Oreille Rivers. Several large and prominent lakes are also situated within this geographic landscape. Much of the land in the broader valleys south of the Moyie River is used for agriculture and grazing. There are five type landscapes within this geographic landscape.

This valley is a steeply walled narrow gorge, only rarely exceeding 1/4 mile in width. Rock outcroppings, atop timbered mountain ridges to the east and west, tower an average of 3,000 feet above the valley floor. The Moyie River channel follows a meandering course south through the valley over a narrow rocky bed. The river runs swift and clear and there are a number of small waterfalls, rapids, pools, and potholes along its course. Occasional small farms are situated in the broader areas of the valley. All of these features combine to produce a considerably varied landscape of rock formations, landforms, and streams. Because of its scenic value, the Moyie River is under study by the U.S. Forest Service as a potential addition to the National Wild and Scenic Rivers System.

Recreation is a primary use of the Moyie River Valley. Both hikers and fishermen regularly enter it during the late spring, summer, and early fall months. Access to the valley is gained by U.S. Highway 95 from Eastport, and by an unsurfaced road paralleling the river to Moyie Springs.

Mount Hall, Idaho to the Pend Oreille River (43 miles)

From Mount Hall to the Pend Oreille River the proposed pipeline route follows a series of flat valleys comprising a northern extension of the Purcell Trench Valley. Each, however, is generally broader than the Moyie River Valley. Most mountains are withdrawn from the route vicinity and are viewed as background components. At this distance, the mixed conifer forests on the mountain flanks impart little variety to the generally uniform texture and color of the landscape. In cross-valley vistas, floor and wall vegetation often appear as one, introducing further uniformity and repetition. There is an overall lack of variety in the vegetation pattern and a similarity of topography to that in much of northern Idaho.

The proposed route follows or closely parallels U.S. Highway 95 for most of its route from the Mount Hall to Pend Oreille River landscape. This travel route is the primary link between metropolitan Spokane, Pend Oreille Lake, and other recreation areas to the north. More than 25 percent of the traffic on U.S. Highway is recreationally oriented and interested in the scenic qualities of the route.

Blue Mountains to La Grande (47 miles)

The proposed pipeline route passes through a landscape with considerable topographic variety including rolling foothills, steeply walled canyons, and several ridge lines. The vegetation patterns are a mosaic of meadows and woodlands. The meadows and differing timber stand densities lend variety in texture, form and color, especially in the fall months during seasonal color change.

The Blue Mountains offer great contrast to the open, rolling hill country to the west. The mountain and forest environment provides welcome visual relief to travelers heading east along Interstate 80N. Since this is one of the only major northwestern highways providing access to La Grande, Baker, and Idaho, it is heavily traveled.

La Grande to Rye Valley (66 miles)

This geographic landscape includes rugged hills, few trees, and few bodies of water. Its topographic relief occasionally exceeds 2,000 feet, with major slopes and valleys aligned from north to south. The Blue Mountains dominate the middleground and background of many landscapes.

La Grande to Baker (36 miles)

Foregrounds between La Grande and Baker are relatively uniform due to a lack of relief, and vegetation similarities of farm and grazing land traversed. This sameness, however, is often relieved by the above noted view of the Blue Mountains.

A relatively large number of people view this type landscape from Interstate 80N.

Baker to Rye Valley (40 miles)

The proposed pipeline route traverses through rugged hills between Baker and the Malheur River. These hills are quite variable in form. Their faces are cut by numerous ravines and gullies.

The vegetation patterns of this landscape are quite uniform and there are virtually no trees in the area. Shrub-steppe communities occupy almost all the land between Rye Valley and the Malheur River. Agricultural activities are limited to a few small, narrow valleys and give little contrast to the uniformity of the surrounding natural vegetation.

There are very few rivers or streams and virtually no lakes from Rye Valley to the Malheur River along the proposed route. The streams that are present add little to the variety of the landscape. The narrow band of riparian vegetation that flanks these streams offers little contrast in texture or color to the surrounding shrub-steppe communities.

The visual variety of the topography offsets the uniformity of the vegetation patterns and waterforms.

State Highway 26 is a major travel route in eastern Oregon; consequently, a relatively large number of people view the section of this geographic landscape which borders the road.

Recreation Use Statistics and Site Locations

Annual visitor use statistics for the recreation sites discussed in Section A of 2.1.5E.13 are tabulated in Table 2.1.5.13-1 by state, administering agency, and site. All data are for calendar year 1974 unless otherwise stated. Since data collection and analysis methodology differ substantially between various agencies, footnotes have been added for purposes of clarification and to help eliminate confusion where statistical data for a particular site have not been systematically kept by the administering agency, or where data are not available, the appropriate space has been left blank. Column 4 of this table is the location number key for Figure 2.1.5.13-1, Recreation Site Location Map. Cross referencing will be necessary to interpret this exhibit which follows Table 2.1.5.13-1.

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2.1.5E.14 Ambient Air Quality

<u>Level of Air Pollutants</u>

The polluting materials of principal interest in assessing air quality include nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), hydrocarbons and particulate matter. The standard unit of measurement is micrograms per cubic meter ($\mu g/m^3$), but gaseous pollutants that may occur in relatively high concentration may be expressed more conveniently in units of milligrams per cubic meter (mg/m^3). The national ambient air quality standards for these pollutants are shown in Table 2.1.5.14-1 and -3 in the appendix.

The proposed route passes through five Air Quality Control Regions (AQCR's). These are listed in Table 2.1.5.14-2 in the appendix and mapped on Figure 2.1.5.14-1, according to their respective priority levels. Priority I indicates that portions of the AQCR are in violation of the primary ambient air quality standard for the pollutant in question, and that significant emission control is needed. Priority IA denotes priority I classification near one major source only. Priority II indicates pollutant levels in excess of secondary standards but less than primary standards. Priority III indicates that pollutant levels are below secondary standards.

Particulate levels along the route often exceed the ambient air quality standards, for example at Spokane, where annual geometric means of 75.1 and 78.8 $\mu g/m^3$ were measured in 1974. The source of particulates is probably windblown dust. In general, particulate levels vary from 60 to 100 $\mu g/m^3$ in the region, and thus the region is sensitive to impacts from particulates. It should be noted that the States of Washington and Oregon have <u>primary</u> ambient air quality standards of 60 $\mu g/m^3$ for particulates.

Data on other air pollutants in the affected regions are few, but existing data tend to show that pollutant levels are low except at isolated points. Even in the industrial city of Spokane, the levels of gaseous air pollutants are within the primary standard (see Table 2.1.5.14-1); the maximum 24-hour SO_2 concentration in 1974, for example, was 172 $\mu g/cm^3$, even though the AQCR is Priority I with respect to SO_2 as a result of local industrial concentrations.

Sources of Pollution

The proposed route passes through or near forest land for part of its length, and lumbering is by far the most predominant industry except in the industrial basins of Spokane and Boise. The burning of lumber refuse is a major contributor to air pollution along the route.

Lumber refuse burning will contribute particulate matter and nitrogen oxides directly to the atmosphere, and will cause photochemical oxidants as a secondary effect. Therefore, the levels of suspended particulates may be relatively high along the route.

The Spokane area features two aluminum smelters, several aluminum foundries and processors, plus two iron and steel foundries, chemical plants, a paper mill, and several machinery manufacturers. There are no fossil fuel-burning power plants in the area since hydroelectric power is the universal energy source in the area.

Particulate levels are high along the route almost entirely as a result of wind blown dust. Particulate concentrations and priority levels of pollutants are found in Tables 2.1.4.14-4 and -5 in the appendix.

2.1.5E.15 Environmental Noise

Since much of the route traverses the same country as the San Francisco line, the description given in Section 2.1.4.15 is applicable here. For that portion of the line which is separate, the ambient sound levels may still be characterized by those given in Section 2.1.4.15A.

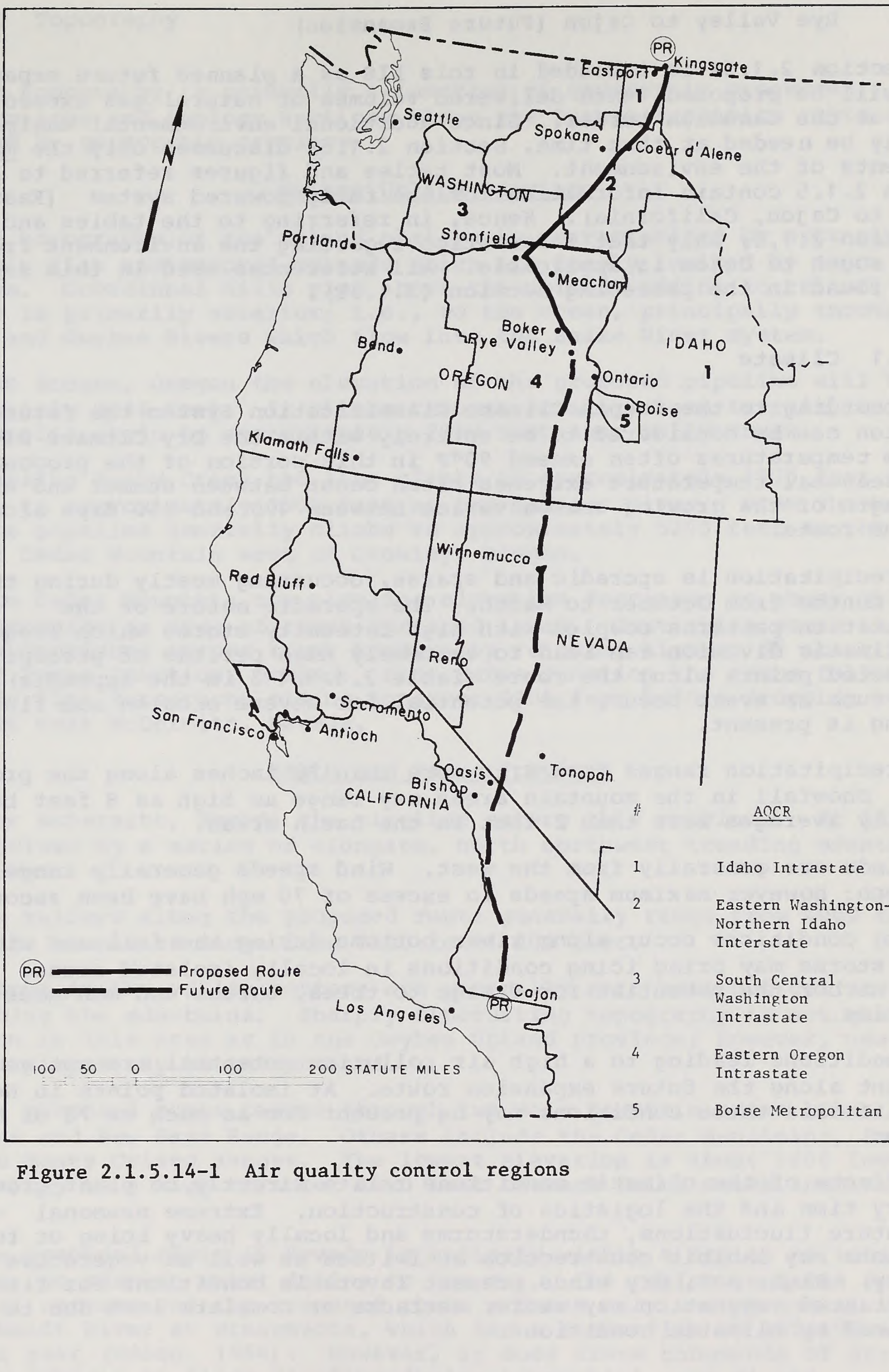

Figure 2.1.5.14-1 Air quality control regions

2.1.5R Rye Valley to Cajon (Future Expansion)

Section 2.1.5R is included in this EIS as a planned future expansion, which will be proposed, when delivered volumes of natural gas exceed 750 MMcf/d at the Canadian border. Since additional environmental analyses will probably be needed at that time, Section 2.1.5R discusses only the major components of the environment. Most tables and figures referred to in Section 2.1.5 contain information for the fully powered system (Eastport, Idaho, to Cajon, California). Hence, in referring to the tables and figures in Section 2.1.5, only that information regarding the environment from Rye Valley south to Cajon is applicable. All references used in this section can be found in the preceding section (2.1.5E).

2.1.5R.1 Climate

According to the Koepen Climate Classification System the future expansion can be considered to be entirely within the Dry Climate Division. Maximum temperatures often exceed 90°F in this portion of the proposal. Large seasonal temperature extremes often occur between summer and winter. The length of the growing season varies between 100 and 250 days along the proposed route.

Precipitation is sporadic and sparse, occurring mostly during the winter months from October to March. The sporadic nature of the precipitation patterns coupled with high intensity storms which frequent this climatic division can lead to extremely high periods of precipitation at selected points along the route (Table 2.1.5.1-3 in the appendix). Should such an event occur, the potential for severe erosion and flash flooding is present.

Precipitation ranges from 4 to more than 20 inches along the proposed route. Snowfall in the mountain areas may range as high as 8 feet but generally averages less than 2 feet in the basin areas.

Winds are generally from the west. Wind speeds generally range from 4 to 10 mph; however maximum speeds in excess of 70 mph have been recorded.

Fog conditions occur along river bottoms during the fall and winter. Sudden storms may bring icing conditions in locally isolated areas. These storms harbor the potential for damage to trees, shrubs and man-made facilities.

Conditions leading to a high air pollution potential are not generally prevalent along the future expansion route. At isolated points in Nevada and California these conditions may be present for as much as 70 or 80 days per year.

Effects of the climatic conditions relate directly to plant growth recovery time and the logistics of construction. Extreme seasonal temperature fluctuations, thunderstorms and locally heavy icing or fog conditions may inhibit construction activities as well as vegetative recovery. High, hot, dry winds present favorable conditions for fire. Newly planted vegetation may suffer setbacks or complete loss due to factors influenced by climatic conditions.

2.1.5R.2 Topography

The topography is primarily a function of geomorphic processes. Hence, the topography and geology sections along the future expansion route are discussed by geomorphic province.

Owyhee Upland Province

The topography of the upland plateau is characterized by extensive relatively flat undissected uplands which are deeply incised by major drainages. Occasional hills rise above the upland, adding to relief. Drainage is primarily exterior; i.e., to the ocean, principally through the Malheur and Owyhee Rivers which flow into the Snake River system.

Near Brogan, Oregon the elevation of the proposed pipeline will be approximately 2600 feet. It climbs through locally steep terrain, to 4000 feet dropping again to approximately 2700 feet near Bully Creek.

Crossing Bully Creek the line climbs to approximately 3100 feet before dropping to approximately 2500 feet at the Malheur River. From the Malheur River the pipeline generally climbs to approximately 5200 feet on the west slope of Cedar Mountain west of Crowley, Oregon.

From Cedar Mountain the pipeline elevation decreases to about 4500 feet before crossing an area of rough surfaced lavas. Continuing south the pipeline continues across rough topography reaching highway 95 about 8 miles south of Burns Junction, Oregon. From Burns Junction the route follows generally flat topography rising to about 5200 feet before dropping to about 4400 feet near McDermitt, Nevada.

Basin and Range Province

Near McDermitt, Nevada the pipeline enters this province. It is characterized by a series of elongate, north northwest trending mountains and valleys.

The valleys along the proposed route generally range from 4000 to 6000 feet while mountains range from 7000 to 11,000 feet.

Slopes in the valley bottoms are generally near zero but get steeper approaching the mountains. Sharply fluctuating topography is not generally as common in this area as in the Owyhee Upland province; however, near vertical slopes may be encountered.

The proposed route passes through two main mountain areas: Clan Alpine Mountains and New Pass Range. Others include the Cedar Mountains, Santa Rosa and Monte Cristo Ranges. The lowest elevation is about 3600 feet in Dixie Valley to a high of about 6500 feet between Smith Creek and Ione Valleys.

The proposed route in Nevada is entirely within a region of internal drainage; no surface water drains to the sea. The region contains few perennial streams and the proposed route crosses only one perennial river, the Humboldt River at Winnemucca, which has a streamflow of 155,400 acre-feet per year (Cohen, 1964). However, it does cross thousands of dry washes that are subject to flash flooding during torrential rain storms.

Within California the proposed line follows undulating topography with elevations ranging between about 4500 to 6000 feet. Crossing Fish Lake, Deep Springs and the Owens Valleys, the pipeline route turns southerly following the valley to Owens Lake. Here the route crosses the Owens River drainage of which most of the flow is diverted into the Los Angeles Aqueduct. The near flat surface along the west bank of Owens Lake is crossed and the proposed route then flolows gentle topography south. Broad valleys with relatively irregularly shaped low mountains constitute the topographical features of the Mojave Desert.

Just prior to crossing into the Mojave Desert, the route passes over the Garlock fault. Passing through the Mojave Desert the proposed route continues through moderate topography passing between the Rand and Lava Mountains. The proposed route crosses the west side of Cuddeback Lake about 6 miles north of Fremont Peak. From Adelanto the topography gently rises to about 4800 feet before dropping into the rough, broken badlands near Cajon, California.

2.1.5R.3 Geology

Landforms are described by physiographic province. See also the geologic strip maps, Figures 2.1.5.3-2 through -16 in the appendix.

Physiography

Owyhee Upland Province

The Owyhee Upland province is characterized by extensive upland flat areas which have been deeply incised by major drainages. This province is underlain by Miocene and younger volcanic rocks and continental sedimentary rocks which have been intensely faulted. These rocks are flat-lying or gently tilted, nonetheless they are intensely faulted by north-south normal faults. The amount of displacement is not great nor are the faults of great length; the resulting topography is one of rhombic slivers or blocks. As a result, the proposed route has a course with long, relatively flat segments separated by very steep short segments.

Basin and Range Province

The entire proposed pipeline route in Nevada lies within the Basin and Range physiographic province. The province is characterized by a landscape of quasi-parallel elongate ranges alternating with valleys floored by alluvial fan and playa deposits. Ranges are commonly 40 to 100 miles long, 5 to 15 miles across, and are separated by valleys, also about 5 to 15 miles across. The ranges originated when vertical movements along profound faults on one or both sides of the mountain block dropped the valley side down relative to the mountain. Historic earthquakes with surface rupture indicate that locally the tectonic forces that produced the basins and ranges are still active.

The proposed pipeline route in California parallels the western margin of the Basin and Range province, traverses the White-Inyo Mountains chain, the westernmost, largest, and highest of the ranges in the Basin and Range province, and passes down the Owens Valley. The segment of the White-Inyo range that is transected by the proposed route appears to be largely fault bounded, on the east by the northern continuation of the Death Valley-Furnace Creek fault zone, and on the west by a complex, distributive fault system that has produced a linear and strikingly abrupt topographic boundary with Owens Valley (Jennings, 1973).

Deep Springs Valley, which is traversed longitudinally by the proposed pipeline route, is a fault controlled, northeast-trending interior basin within the White Mountains. The southeast valley margin is marked by prominent scarps in the alluvial fill deposits and a linear and abrupt topographic break. The northwest side of the valley is less abrupt and has no visible scarps. Many northeast-trending faults have been mapped in the adjacent bedrock.

Owens Valley is a deep structural trough; a graben between the Sierra Nevada and the White-Inyo Mountains. Along the east side of Owens Valley the segment to be traversed by the proposed pipeline shows very few scarps in the valley, but geophysical studies suggest a buried fault zone (Pakiser and others, 1964) essentially coincident with the proposed pipeline route. Elsewhere in Owens Valley, scarps cutting alluvium are common, and are particularly well developed along the east front of the Sierra Nevada and down the center of the valley.

The major physiographic features along this segment of the proposed pipeline from the Nevada border south to the Lone Pine area--the White-Inyo Mountains, Deep Springs Valley, and Owens Valley--owe their form and configuration largely to Pliocene or younger fault movements.

The proposed route passes onto the Mojave Desert just south of the Garlock fault, and traverses the west edge of a gentle east-sloping alluvial plain. This surface of low relief has a few hills and minor mountain ranges rising several hundred feet above the desert floor. South of Adelanto the physiography consists of a gentle north sloping alluvial plain. Within a few miles of the termination of the route a number of old beheaded northward-draining water courses are crossed. The former headwaters were captured by the south-flowing Cajon drainage.

Bedrock Stratigraphy and(or) Lithology

Owyhee Upland Province

Areas mapped as bedrock are traversed by 131 of the 160 miles of proposed pipeline within the Owyhee Upland physiographic province. The principal bedrock units are Miocene to Holocene volcanic lavas (100 miles) and semi-consolidated tuffaceous sedimentary rocks and tuff (31 miles).

The most noteworthy volcanic rocks traversed by the proposed route in the Owyhee Uplands province are thin flows of vesicular basalt near latitude 43°00' north. Formed during extrusion of lava in late Pleistocene or Holocene time, the blocky, rubbly surfaces of these flows are unmodified by erosion and weathering. Consequently, they may necessitate extensive blasting. The proposed pipeline route crosses nearly 3 miles of these flows.

The proposed route crosses approximately 11 miles of rhyolite, quartz-latite, and decite flows in the Owyhee Upland province. These rocks are flow-banded and flow-folded, or brecciated. Platy jointing is common, causing the rock to weather to slabs. Although deep soil or slabby debris mantle most of these rocks, bare outcrops which may require blasting, are locally abundant.

Semi-consolidated lacustrine and fluviatile tuffaceous sedimentary rocks, palagonite tuffs, and unconsolidated clay, silt, sand, and gravel are interbedded with the late Cenozic volcanic rocks of the Owyhee Upland province. Most of them should not cause trenching difficulties.

Only about 7 percent of the proposed pipeline route in Nevada lies in bedrock. The remainder is in Quaternary or latest Tertiary alluvial and lake deposits. Major areas of bedrock exposure crossed by the proposed pipeline are: (1) in an area between Pleasant Valley and Dixie Valley; (2) in the Clan Alpine Mountains; (3) in the New Pass Range; (4) at the south end of Ione Valley and in the Cedar Mountains; (5) in the Monte Cristo Range; and (6) in the hills south of Columbus Salt Marsh and at the north end of Fish Lake Valley.

Exposed rocks in these areas are mostly Tertiary in age, consisting of ash-flow tuffs and rhyolitic, andesitic, and basaltic lava flows as well as soft relatively unindurated sediments and tuffs. Most of the ash-flow tuffs are representative of this type of flow and have a hard welded zone bounded by unwelded, easily excavated zones. Even so, because of the hard welded zones and the presence of lava flows, extensive blasting will probably be necessary in the Clan Alpine Mountains, New Pass Range and possibly in the Monte Cristo Range. The mountains at the latter locality are lower and have relatively subdued topography, so the rocks may be more deeply eroded and more easily excavated.

The only major outcrop of pre-Tertiary rock is in the area between Pleasant Valley and Dixie Valley, where a segment of the route crosses less than a mile of limestone and dolomite of Triassic age. This particular unit also contains slate, conglomerate, and volcanic rocks; but, due to lack of detailed mapping, it is not known if these lithologies are present where the proposed route crosses the unit. The attitude is variable, but information is lacking about bedding characteristics and lithology to comment on cut slope stability.

About 8 miles south of the Nevada border, the proposed pipeline route passes from alluvium onto faulted Mesozoic granitic rock for about 4 miles between Fish Lake Valley and Deep Spring Valley. These outcrops are deeply weathered, bouldery, knobby exposures, and grus slopes that are in part alluviated. They are typical desert exposures of granitic rocks.

Immediately southwest of Deep Springs Valley the proposed route crosses a faulated and mildly contorted section of late Precambrian to Cambrian clastic and carbonate sedimentary rocks. These rocks are variously exposed for some 5 miles between Deep Springs Valley and the Waucoba Embayment. The same kinds of sedimentary rocks are also exposed from southwest of the embayment to where the pipeline route enters Owens Valley. The south-trending segment of the proposed pipeline route skirts the edges of similar bedrock exposures on the east side of Owens Valley for about 3-1/2 miles. From this point the proposed route passes through 1 mile of alluvium, and directly thereafter traverses 3 miles of basalt lava flows that have a hard, hackly upper surface. This latter stretch is likely to involve considerable blasting.

The remainder of the proposed pipeline route south to the compressor station in Owens Valley is across surficial deposits. It is unlikely that bedrock will be encountered south of the basalt area in the excavations contemplated.

From the compressor station south to the Garlock fault, most of the proposed pipeline route lies in Quaternary deposits; pre-Quaternary deposits underlie only three segments of the proposed route. One segment, about six miles long, lies west of Little Lake. It is on the east flank of the Sierra Nevada and in deeply weathered Mesozoic plutonic rocks. The second segment, which is approximately 4 miles long, lies south of Indian Wells Valley where the proposed route is underlain by Mesozoic plutonic rocks of the Rademacher Mining District. The third is a segment, about 1/2 mile long just north of the Garlock fault, where the pipeline cuts over a low ridge of plutonic rocks.

In the area south of the Garlock fault, the proposed pipeline route crosses 4 areas underlain by pre-Quaternary deposits. Immediately south of the fault, rocks of the western Summit Range crop out in low hills for a distance of about 1 mile. They are composed of Pliocene sandstone and volcanic rocks overlain by Pleistocene older alluvium and terrace gravel (Dibblee, 1967, fig. 68). The four miles of proposed route south of this range are in alluvium and low hills mapped by Dibblee as Quaternary gravels that lie about 200 feet above the surrounding alluvium, but the rocks in those hills appear much older than most rocks mapped as Quaternary. Along the south flank of the Lava Mountains, late Pliocene volcanic rocks overlying middle Pliocene sandstone crop out over a segment of the proposed route about 2 miles long. Some of these rocks have been hydrothermally altered, and hydrothermal activity continues to the present inasmuch as an active "steam well" lies approximately 200 feet south of the proposed pipeline route. The proposed route east and south of this area is in alluvium except for two stretches, each about 1 mile in length. One is west of the Fremont Peak area, the other, north of the Lockhart fault; both are underlain by Mesozoic plutonic and dike rocks.

From the vicinity of the Lockhart fault to the Kramer Hills, all of the proposed pipeline route is within alluvial deposits. Within the Kramer Hills the route crosses exposures of Cretaceous(?) quartz monzonite, Mesozoic metavolcanic rocks, and deformed sediments of the Oligocene(?)-Miocene(?) Tropicc Group. The metavolcanic rocks are principally quartz latite felsite. The Tropico Group consists of basalt and a wide variety of nonmarine lithologies including conglomerate, sandstone, shale, limestone, dolomite, chert, and tuff. Basalt flows include quartz-bearing basalt and small exposures of dacite (Dibblee, 1967).

Northwest of Adelanto the proposed route passes along the east side of Shadow Mountains crossing small exposures of highly deformed and metamorphosed Paleozoic(?) carbonate rocks which comprise much of the Shadow Mountains (Dibble, 1967 and Troxel and Gundersen, 1970).

<u>Surficial Deposits</u>

Owyhee Upland Province

Only minor amounts of surficial deposits are encountered along this segment of the proposed route; these consist principally of stream channel deposits and Holocene floodplain deposits along the major drainages. Willow Creek is one of the longest such crossings with a well-developed floodplain. As in the Blue Mountains province, these deposits are made up chiefly of silt, sand, and gravel, most of which are unconsolidated and probably have poor cut-slope stability.

Colluvium and landslide deposits have not been mapped in detail, therefore, their presence along the route is speculative at this time but probable. Certainly the lithology traversed is susceptible to landsliding in areas prone to heavy precipitation.

Basin and Range Province

About 93 percent of the proposed pipeline route in Nevada lies in Quaternary alluvial and lake deposits consisting of gravel, sand, silt, and clay derived from erosion of adjacent mountain masses.

Several of the valleys crossed or traversed by the proposed pipeline route were the site of Pleistocene lakes and their ancient shorelines are still visible. The route also crosses the sites of Pleistocene lakes in Dixie, Edwards Creek, and Smith Creek valleys, at Columbis Salt Marsh, and in Fish Lake Valley. Beach deposits, bars, and spits consisting of sand and gravel occur locally around the margin of these former lakes. Generally fine-grained material (silt and clay) deposited in the deeper parts of the lakes underlie flat-bottomed valleys and playas.

Most of the surficial deposits in Nevada are well suited for the construction of the pipeline. They are easy to trench, and, where dry, are highly stable. The main problems of stability appear to be in areas of high groundwater level where earthquakes could cause liquefaction and extensive ground failure (see discussion under Geologic Hazards). Such areas may be identified by the presence of phreatophytes, plants whose roots must tap perennial groundwater, and are traversed by approximately 37 miles of the proposed pipeline route in Nevada.

For the first 7 miles south of the California-Nevada border, the proposed pipeline route traverses alluvial sand and gravel that is largely fan material derived from the dominantly granitic terrain to the west. This material can vary greatly in grain size and may locally contain boulders several feet in dimension. Where the pipeline route bends to enter the White Mountains it crosses about 1 mile of uplifted and somewhat dissected older alluvial fan material that is, in part, quite coarse and may be, in part, carbonate cemented.

The surficial deposits in Deep Springs Valley are chiefly alluvial fan deposits of boulders, gravel, and sand derived largely from the granitic basement of the surrounding hills. In the western part of the valley, the fan material is likely to be finer grained where the bedrock is predominantly Precambrian and Cambrian sedimentary rocks. Much of the lower part of the valley is underlain by finer grained silt and clay of the playa.

Southwest of Deep Springs Valley, after crossing several miles of bedrock, the proposed pipeline route crosses Waucoba Embayment, some 3-1/2 miles of uplifted, dissected and faulted, in part carbonate-cemented fanglomerate. Some of these beds are firmly indurated (Knopf, 1918, p. 49). These fanglomerates generally overlie, but in part interfinger with lake beds that range from shaly siltstone to coarse sandstone that is in part tuffaceous (Nelson, 1966). These beds are not exposed along the proposed pipeline route, but could be present at shallow depths beneath the fanglomerates.

From the point where the proposed pipeline route enters Owens Valley to the latitude of Aberdeen, it traverses alluvial fan material derived from Paleozoic clastic and carbonate sedimentary rocks and Mesozoic granitic rocks with some admixture of Quaternary basalt. The fan material can vary considerably in grain size from large boulders to sand. South of Aberdeen the proposed route enters the finer grained valley-fill deposits of Owens Valley and stays in this unit until a few miles north of Lone Pine where it enters Quaternary lake deposits of ancestral Owens Lake. The valley fill and lake deposits are composed of variable amounts of sand, silt, and clay. In the interval south of Aberdeen, the proposed pipeline route makes several crossings of the Owens River channel. Near these crossings and possibly elsewhere along the valley, marshy, boggy conditions may prove a hindrance to excavation and construction activities. Similar conditions possibly could be present near the proposed pipeline route in the southwestern part of Deep Springs Valley.

The surficial deposits south of Owens Lake are mostly materials mapped as alluvium or older alluvium. The age of these deposits probably range from several hundred thousand years to last winter.

One section of the proposed pipeline route in alluvium, however, deserves special mention. It extends from the area south of Owens Lake, where the proposed route crosses U.S. Highway 395, to the area in the northern part of the Indian Wells Valley, where the proposed route recrosses the same highway. Except for the 6-mile stretch west of Little Lake (which is in Mesozoic plutonic rock), the proposed route lies in gravels that were derived from the extremely steep east slope of the Sierra Nevada. In many instances, they are exceedingly coarse. Boulders up to the size of an automobile are exposed on the surfaces of some fans and presumably also exist at depth.

One segment of the proposed pipeline which is in surficial deposits but not alluvium of the type described above is the section that begins at the compressor station in Owens Valley. Between the compressor station and the first intersection of the proposed pipeline route with U.S. Highway 395 (south of Owens Lake), the pipe would be buried in lacustrine sediments deposited in Owens Lake during late Pleistocene and Holocene time. These deposits have different properties from the alluvial deposits in two respects: (1) The water table in this segment of the proposed route is at the surface, and the proposed pipeline will rest in the sediments that are saturated with water, mostly a highly alkaline brine; (2) Some parts of this section are in mud (water-saturated silts and clays) which are unconsolidated, have high liquefaction potential when subjected to shaking, and little bearing strength under any circumstances. Without extensive drilling along the proposed route, it is not possible to estimate how much of this segment is in mud and how much is in sand and fine lacustrine gravel. One test hole, drilled in the Spring of 1966, penetrated to a depth of 6,920 feet. That hole is near the center of sec. 5, T. 18 S., R. 37 E., and about 3/4 of a mile east of the proposed pipeline route. Most of the hole penetrated beds of well-sorted sand, but the sediments between 40-foot and 140-foot depths were composed of soft clay; several additional thin layers of clay were penetrated at greater depths. Another core hole, about 2 miles east of the first described core hole, drilled by the U.S. Geological Survey in 1953 (Smith and Pratt, 1957), penetrated 920 feet of mud.

The site chosen for the compressor station (sec. 1, T. 16 S., R. 36 E.) is also likely to be underlain by water-saturated clay inasmuch as it is nearly in the center of the valley and within the area that was covered by water each time that Owens Lake expanded during Pleistocene pluvial periods.

Nearly all of the proposed pipeline route south of Kramer is within alluvial deposits. Most of these deposits are alluvial fan or fanglomerate, however, some 6 or 7 miles of lake beds are likely to be traversed along the west side of Cuddeback Lake. From there south, the proposed pipeline is in Pleistocene alluvial fan deposits which become progressively coarser southward along the proposed route to the terminus at Cajon.

Mineral Resources

Owyhee Upland Province

No known mineral resources exist along the proposed pipeline route in the Owyhee Upland section. Several wells produced small but significant flows of gas from shallow sands in the Idaho Group (Pliocene and Pleistocene). This gas has been used by ranches in the Snake River Plains for domestic heating and lighting.

Even though no other commodities are presently known to occur along the proposed route, the geologic environment and rock types along the route are similar to adjacent areas that contain deposits of value. Several of these should be briefly mentioned.

One of the more important nonmetallic minerals in the Owyhee country is gem-quality chalcedony (agate) that is much prized by "rockhounds" throughout the country. Some of the well-known areas where agatized material has been found are along Succor Creek and the Owyhee Reservoir (moss agate and thunder eggs), at Stinkingwater Mountain (petrified wood and agate), and in the Buchanan area (thunder eggs). Other potentially important nonmetallic minerals found within the Owyhee Upland are diatomite and pumicite beds at Harper and Drewsey, perlite deposits near Jordan Valley, optical calcite veins along the west side of the Owyhee Reservoir, salt brines near Vale and altered volcanic ash rich in potassium feldspar and zeolite deposits near Rome.

Basin and Range Province

The proposed pipeline route in Nevada lies within a major metal mining region. Total metal production within this 20-mile corridor is approximately $120 million. Mercury, gold, silver, copper, lead, zinc, tungsten, molybdenum, antimony, and manganese have been mined. The production is from outcropping Paleozoic, Mesozoic, and Tertiary rocks generally several miles to one side of the proposed pipeline route. No metal production has been reported from Quaternary alluvial or lake deposits along the proposed route.

Small quantities of nonmetallic minerals have also been produced near the proposed pipeline route. These include fluorspar, turquoise, barite, diatomite, borates and sodium compounds. Production of all these nonmetallic commodities has totalled less than $1 million within the 20-mile corridor along the proposed pipeline route.

Additional metallic and nonmetallic resources will doubtless be found near the proposed route of the pipeline, but areas near the proposed route do not appear to be any more favorable for the discovery of such resources than in other parts of Nevada.

Northern Nevada is considered a favorable area for the development of hydrothermal power. In particular, the area along the proposed pipeline route between Winnemucca and Dixie Valley contains several hot springs and lies within a region of high crustal heat flow, indicating a potential for hydrothermal power.

No oil and gas reserves are known in western Nevada, and the likelihood of finding such resources in the future are considered nearly nil.

Small mines and prospect pits are found within a few miles of the proposed pipeline route in the granitic rocks between Fish Lake Valley and

Deep Springs Valley. Small amounts of gold, silver, copper, and tungsten have been found, but production is negligible. Quartz veins have also been explored with minor success in the sedimentary rocks (particularly in the limestone) between Deep Springs Valley and Owens Valley. Some production of gold and silver has been reported from the Montezuma mine from a fault zone in the sedimentary rocks (Norman and Stewart, 1951, p. 180).

Along the front of the Inyo Mountains a number of small mines and prospects are found within 2 or 3 miles of the proposed pipeline route. There has been small production of gold and silver from these mines, from fissure veins in the granitic rocks. In addition, minor copper and tungsten has been found in contact metamorphic tactite deposits north of Kearsarge (Ross, 1965, p. 61).

It is extremely unlikely that any bedrock might be encountered in the proposed pipeline excavations in Owens Valley south of Aberdeen. The rare possibility exists that placer accumulations could be found in some of the valley-fill material near the mouth of Mazourka Canyon.

Potash has been found in lake deposits and brines near Deep Springs Lake. Excavation for the proposed pipeline segment that is near Deep Springs Lake might uncover similar low-grade potash-bearing material.

A pumice bed of undetermined thickness was reported to be exposed in a pit 20 by 30 (Norman and Stewart, 1951, p. 109) presumably near the northeast corner of Deep Springs Valley. The proposed pipeline route crosses one of the larger basalt masses and excavation might reveal more pumice. Pumice layers might also be uncovered where the proposed pipeline route crosses Waucoba Embayment and along the Inyo front north of Tinemaha Reservoir, but the possibility is low.

Sand and gravel layers of potential economic worth will undoubtedly be encountered in Fish Lake Valley, Deep Springs Valley, Waucoba Embayment, and Owens Valley. Possibly some of the excavated sand and gravel of suitable size distribution might be of use as road material for access and maintenance roads near the proposed pipeline route.

South of the Owens Valley compressor station, several nonmetallic deposits are being worked in the vicinity of the proposed pipeline, most notably the cinder quarry at Redhill. The chemical plants (soda ash) on the west shore of Owens Lake have been inactive for more than five years although a "harvesting" operation is currently active on the east shore. The mines in the Rademacher mining district (gold) are inactive as far as is known. Similarly, the mines in the Summit Diggings area (gold), at the west end of the Summit Range, are inactive. Prospects in the southern Lava Mountains (silver) have been inactive since the 1920's. The proposed pipeline passes a few miles east of the Atolia mining district (tungsten), but is not likely to disrupt any activities now in progress.

In this segment of the proposed pipeline, potential areas for future discoveries of mineral deposits seem limited to areas of previous mining. Some wollastonite layers (Troxel, 1957) may be of future economic interest.

Younger and older alluvial deposits contain potential for sand and gravel deposits, but the vast amounts of alluvial material make the possible deposits encountered by the pipeline of only minor economic importance.

Geologic Hazards

Seismicity

See Figures 2.1.5.3-17 and -18 for earthquake intensity and seismic risk zones along the entire pipeline route from the Canadian border to Cajon, California.

Owyhee Upland Province

The portion of eastern Oregon traversed by the proposed pipeline lies in seismic risk zones 1 and 2. The number of recorded earthquakes is small and most are of the minimal intensity (V) considered worth reporting. No known surface ruptures are associated with any of the earthquakes. The earthquake map by Coffman and van Hake (1973) shows eastern Oregon to be one of the most aseismic areas in the western States.

Basin and Range Province

The proposed pipeline route in Nevada lies within an area of high seismicity and the likelihood of earthquakes in excess of magnitude 6 (Richter scale) accompanied by severe ground shaking is great. Earthquakes that may have produced intensity X shaking have occurred along the proposed route at Pleasant Valley and Cedar Mountain, and two others about 25 miles west of the proposed route at Fairview Peak and Dixie Valley.

The Pleasant Valley earthquake of 1915 (magnitude 7.6) caused discontinuous ground breakage in a north-south zone about 40 miles long. The Cedar Mountain earthquake (magnitude 7.3) occurred in 1932. Ground rupture had a component of vertical displacement and right-lateral strike-slip displacement.

Historic earthquakes with ground rupture that have occurred in Nevada west of the proposed pipeline route between lat 38°-40°N. include: the 1869 Olinghouse earthquake (magnitude 7±0.5); the 1903(?) Gold King earthquake (magnitude unknown); the 1934 Excelsior Mountain earthquake (Magnitude 6.5) the two 1954 Rainbow Mountain earthquakes (magnitudes 6.6 and 6.8); the 1954 Fairview Peak earthquake (magnitude 7.1); and the 1954 Dixie Valley earthquake (magnitude 6.8). The largest of these, the Fairview Peak earthquake, caused ground rupture with a maximum of 14 feet right-lateral movement and 12 feet vertical movement.

Faulting of Quaternary age is widespread in Nevada (Slemmon, 1967), and cuts valley alluvial deposits and beach deposits of Pleistocene lakes. The proposed pipeline route approaches closely or crosses known Quaternary age faults in the Quinn River, Grass, Pleasant, Dixie, Smith Creek, Ione, and Fish Lake valleys. Detailed studies would doubtless reveal other areas of Quaternary faulting that should be evaluated as part of the proposed pipeline planning.

Liquefaction along the proposed pipeline route during a severe earthquake may occur where the groundwater level is less than 50 feet and the Quaternary alluvial or lake deposits traversed contain layers of saturated, loose, granular material. Liquefaction occurred near Fallon during the series of earthquakes in 1954 (Steinbrugge and Moran, 1956). Although data on the character of alluvial material along the proposed pipeline route is not sufficient to speculate on the possibility of liquefaction, skimpy information on groundwater levels estimated from plant distribution does indicate some areas of particular concern. They include at least 37 miles along the proposed pipeline route and are located in the Quinn River valley, the Humboldt River valley near Winnemucca, the northern part of Grass Valley, the southern part of Pleasant Valley, Edwards Creek Valley, Smith Creek Valley, Columbus Salt Marsh, and Fish Lake Valley.

The density of historic and Quaternary faulting clearly indicates the possibility of earthquake-related ground rupture and liquefaction along the proposed route in Nevada. The area from Pleasant Valley to Cedar Mountain is considered to have the highest risk of a severe earthquake. Ground rupture is most likely to occur in alluvium near the front of mountain ranges, and particular attention should be given to these areas. Although less likely, surface faulting can also occur far from mountain fronts.

Just south of the California-Nevada border, young-looking scarps crossed by the proposed route cut Quaternary alluvium both along the west side of Fish Lake Valley and the southeast side of Deep Springs Valley. Both of these zones of faulting are characterized by Jennings (1973) as showing Quaternary displacement (last 2 million years), but there is no record of movement during the last 150 years. The youthful appearance of some scarps suggests movements much closer to 150 years than 2 million years ago. Because of their youthful appearance, it is thought that potential movement on these fault zones in the future should be considered in pipeline planning. The Furnace Creek fault zone is crossed by the proposed pipeline route and the Deep Springs fault zone is closely paralleled by the proposed route for several miles.

Several related but discontinuous scarps with strong north to northwest trend, cut the Quaternary fanglomerate and lake deposits of the Waucoba Embayment (Nelson, 1966). The proposed pipeline route crosses this zone of faulting, which like the Furnace Creek and Deep Springs zones should be considered capable of reactivation.

Owens Valley is associated with a high degree of seismicity and numerous faults (Figure 2.1.5.3-19) that are classified as having been active in recent geologic time have been mapped. From the point where the proposed pipeline route enters Owens Valley east of Big Pine, south to the compressor station near Lone Pine, the route closely parallels the zone of ground breakage of probably the strongest historic earthquake in the conterminous United States (estimated magnitude 8.3). Generally referred to as the Owens Valley earthquake of 1872, it was accompanied by ground displacements both in a horizontal and vertical sense of 20 feet or more. The quake caused ground rupture along the parts of Owens Lake then covered by water (Bateman, 1961; Bonilla, 1967; California Geology, 1972; and Jennings, 1973). Bateman, 1961, provides a good summary reference to the location of the fault displacements and quotes accounts of the earthquake effects.

Near Tinemaha Reservoir the zone of 1872 breakage is about 2 miles west of the pipeline route. The due south segment of the proposed route here approaches to within about 400 feet of the line of breakage. The proposed pipeline route then turns southeast and slightly diverges from the zone of 1872 breakage so that at the latitude of Independence the proposed route is 1 mile east of the zone of breakage and at the compressor station the main trace is 2 miles to the west near the base of the Alabama Hills.

New evidence compiled by G.I. Smith of the U.S. Geological Survey during the preparation of this report indicates that the areas around Owens Lake probably suffered ground disruption during an earthquake which occurred at 3:01 a.m. on July 6, 1917. That quake had an intensity between 6 and 7 on the Rossi-Ford scale (J.M. Nordquist, CalTech, oral commun., 1974). It

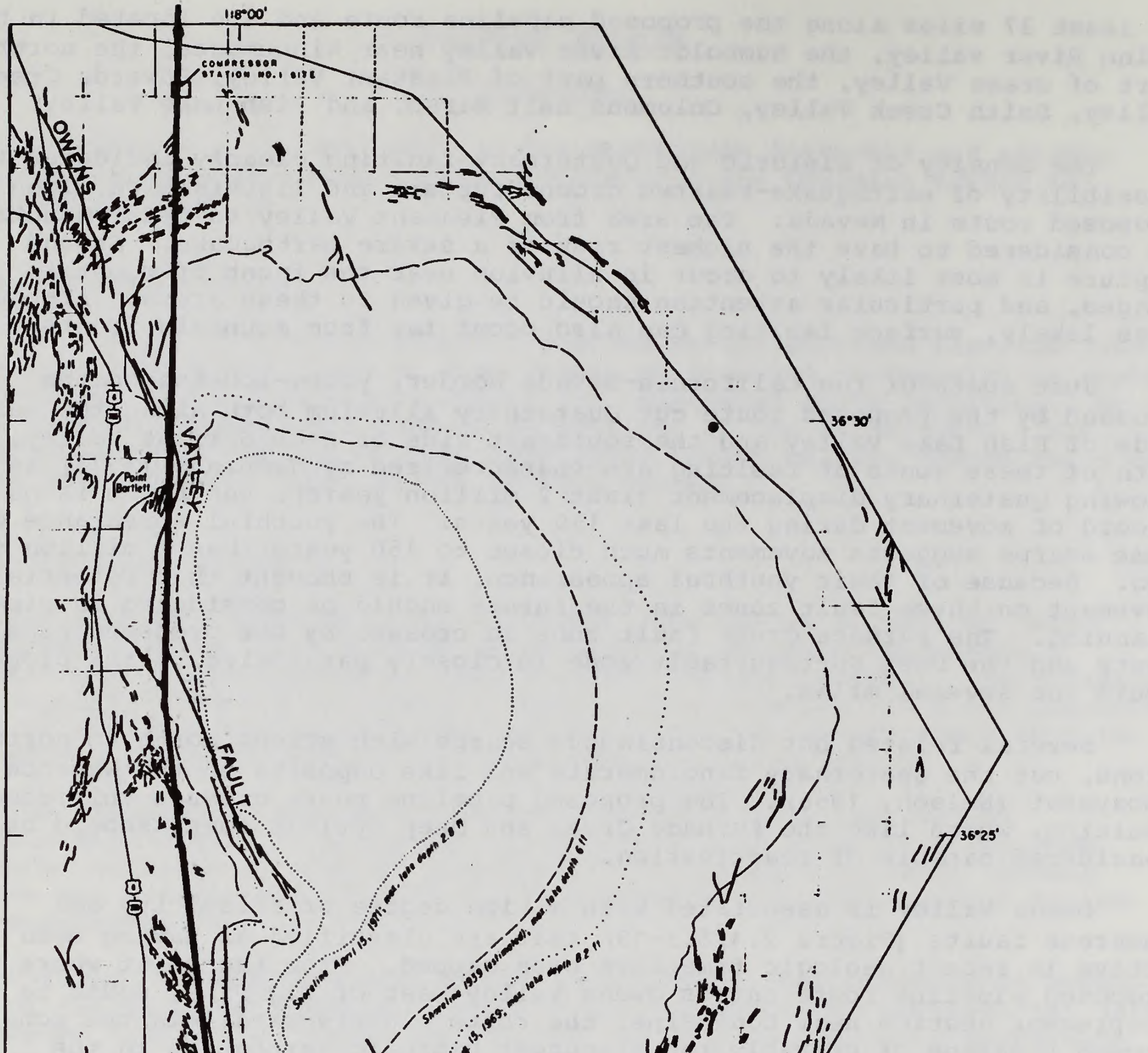

Figure 2.1.5.3-19 Map showing faults and shorelines around Owens Lake and proposed pipeline route

was tentatively cited as the cause of a 160-foot crack in the Los Angeles Aqueduct in an area south of Owens Lake.

Numerous small faults of unspecified size surrounding the lake and several scarps that extend continuously for distances of 1 to 3 miles onto the floor of the lake are shown by Carver (1970) who mapped them by inspection of low-angle sunlight aerial photographs taken in the mid-1960's.

The possibility of another earthquake that includes ground rupture along the west shore of Owens Lake occurring within the lifetime of the proposed gas pipeline should be considered in the planning of the proposed pipeline. The continuing seismicity of this area was demonstrated during early December 1974 when a large swarm of small quakes continued for more than a day.

The report by Carver (1970, p. 46-47, fig. 12) includes documentation of intense crumpling of lake sediments near Point Bartlett (sec. 1, T. 17 S., R. 36 E.). He demonstrates that the Owens Valley fault, which lies along the east edge of this point, has moved repeatedly since the lake beds were deposited. Dips of as much as 35° and displacement on sympathetic faults totaling 500 feet occur in lake beds dated by radiocarbon methods on snails as being 20,000 to 30,000 years old; the proposed pipeline route traverses this area.

Because of the sinuosity of the fault in this area, the proposed pipeline route crosses the Owens Valley fault zone as shown on Carver's map, three times, much like the line through a reversed dollar sign. The northern intersection is 1 mile north of Bartlett Point, the middle intersection is 1 mile south of that point, and the third is 3 miles further south.

Engineering of the proposed compressor station in Owens Valley should take into account that within the lifetime of the proposed pipeline there is: (1) a strong possibility of earthquakes having a Richter magnitude greater than 7; and (2) there may be substantial amplification of shaking due to water-saturated clays that probably underlie the site of the compressor station. The site chosen for the compressor station (sec. 1, T. 16 S., R. 36 E.) is likely to be underlain by water-saturated clay inasmuch as it is nearly in the center of the valley and within the area that was covered by water each time that Owens Lake expanded during Pleistocene pluvial periods.

Between the compressor station and the first intersection of the proposed route with U.S. Highway 395 (south of Owens Lake), the proposed pipeline would be buried in the Late Pleistocene and Holocene lacustrine sediments of Owens Lake. These sediments are saturated with water and are certain to undergo liquefaction during ground shaking. Some parts of this segment of the proposed pipeline will be in mud. Without extensive drilling along the route, it is not possible to estimate how much of this segment is in mud and how much is in sand and fine lacustrine gravel. A test hole drilled about 3/4 of a mile east of the proposed route penetrated chiefly well-sorted sand, but the sediments between the 40-foot and 140-foot depths were composed of soft clay.

The proposed pipeline route crosses the Garlock fault in sec. 36, T. 28 S., R. 40 E. The Garlock fault is considered capable of producing large earthquakes accompanied by large ground displacements. Dibblee (1967, fig. 68) shows the Garlock fault in this area cutting all but a few zones of recent alluvium. Mapping by Clark (1973) shows scarps having vertical dimensions of 1 to 3 feet in the vicinity of the proposed pipeline route crossing, and also several linear ridges and notches which are indicative of geologically recent displacements. Horizontal displacements evidenced by offset streams nearby indicate Quaternary displacements measurable in tens to hundreds of feet, with single event displacements of about 20 feet suggested by repeated measurements of this magnitude on offset streams.

Unpublished work by G. I. Smith of the U.S. Geological Survey along the south edge of Searles Valley (about 16 miles to the east) and the south end of Panamint Valley (about 35 miles to the east) suggests that the last displacement of the Garlock fault in those areas resulted in approximately 20 feet of left-lateral displacement, and 2 to 5 feet of vertical displacement. (The horizontal and vertical displacements indicated by this evidence are similar to those occurring in the 1906 earthquake near San Francisco which had an estimated magnitude in excess of 8.) Stratigraphic evidence indicates that the last displacement on the Garlock fault in those areas occurred more than about 500 years ago, but less than about 2,000 years ago.

The proposed pipeline route crosses the Brown's Ranch fault in sec. 31, T. 29 S., R. 42 E. That fault was apparently active in middle Pliocene to Pleistocene time but not in Late Pleistocene and Holocene time (Smith, 1964, p. 49). The proposed pipeline route crosses the Lockhart fault in sec. 10, T. 11 N., R. 6 W. It has been active in Late Quaternary time and breaks older alluvium (Dibblee, 1958, 1967, p. 43). This fault may be the northwest extension of the Lenwood fault. The Lenwood, like several other northwest-tending faults in the Mojave Desert, is known to be seismically active. All of the northwest-trending faults in the Mojave should be considered to have potential for movement, whether accompanied by earthquakes or not.

The proposed pipeline terminates approximately 3 miles from the main trace of the San Andreas fault. This segment of the San Andreas is considered capable of producing a magnitude 8 to 8.3 earthquake. In the event of such a shock, ground motion in the vicinity of the southern part of the proposed pipeline will be severe.

Landslides, Slumping, Subsidence and Erosion

Owyhee Upland Province

Although no detailed mapping has been done in the province, the area most likely to be subject to landslides along the route would be in the Miocene and Tertiary sediments.

The only part of the route subject to subsidence would be in the flat, alluviated valleys.

Basin and Range Province

The danger from landslides along the proposed route in Nevada is relatively low. The proposed route passes through only a few areas of rugged mountain topography and these areas in Nevada are not known to be particularly susceptible to landslide activity. A minor amount of landslide activity may be expected, however, in major traverses across mountain ranges, such as in the Clan Alpine Range, and in valley areas where the proposed route is close to and parallels the mountain front.

Along the proposed pipeline segment from the Nevada border south to the compressor station in Owens Valley, the only place where landsliding may pose a problem and where some landslides have already been delineated, is for the first 3 miles from the point where it enters Owens Valley. Landslide deposits extend for about 1 mile up the wash south of Mule Springs (Nelson, 1966). Other smaller landslide deposits have been mapped in this area on the steep, fault dissected west front of the Inyo Mountains. The right combination of conditions (such as heavy precipitation, or seismic activity) could reactivate some of these slides or initiate new ones.

Possible areas of landsliding lie to the west of Little Lake where the proposed route traverses the low ridge on the east slope of the Sierra Nevada. Topography there is steep, surface materials are unconsolidated, and several faults have been mapped parallel or subparallel to the mountain front (Jennings, Burnett and Troxel, 1962). All other parts of the proposed route appear to be on stable ground, although the steep terrane in the vicinity of the Garlock fault should be evaluated carefully.

No known occurrences of slumping or subsidence are known along the route in Nevada. However, the potential exists where fine-grained well-sorted and saturated lake deposits are present.

Two documented cases of subsidence come from the Basin and Range segment in California. Subsidence of about 1 foot has taken place beneath the concrete platform of a well near the northwest corner sec. 20, T. 5 S., R. 37 E., along the west side of Fish Lake Valley and essentially on one of the major traces of the Furnace Creek fault zone (Rush and Katzer, 1973).

Subsidence in the area of the proposed pipeline route is also reported in the vicinity of Owens Lake. There, 3 to 4 feet of settling is reported by Dub (1947, p. 5) between the time the lake began to desiccate in 1914 and the time of the 1938-39 reflooding of the lake.

Slumping does not appear to be a problem in this region with the possible exception of a segment about 2 miles long in the Indian Wells Valley which lies below the 2,250-foot contour. Soft lake sediments deposited in Pleistocene China Lake probably underlie much of this area, and settling caused by heavy groundwater pumping, and possibly shaking during earthquakes could be factors.

The entire route in Nevada is susceptible to infrequent but severe flash flooding. Such floods develop as the result of localized but extremely intense thunderstorm activity in mountain areas. Runoff is rapid because vegetative cover is sparse.

Intense flash floods have an incredible damage potential. Washes that have not seriously changed their configuration in hundreds of years may be deeply eroded during a single flash flood.

Some damage to the pipeline route due to flash flooding should be expected, but damage can be minimized by adequate provisions for drainage. Severe erosion might well rupture the pipe during an unusually intense flash flood.

The segment of the proposed pipeline route along the west side of Fish Lake Valley across Waucoba Embayment, and the northernmost segment along the east side of Owens Valley will be susceptible to local gully erosion. The area near the mouth of Mazourka Canyon might also be subject to gullying.

From Kramer south to Cajon Summit there should be no landslide problem. South from Cajon Summit to the southern terminous of the route, landslides are common in the Pliocene sediments. This part of the route should be free from slumping and subsidence, although gullying could be a problem between Cajon Summit and the southern terminus of the pipeline.

Other Geologic Hazards

Corrosion

An added factor to be considered in evaluating the segments of the pipeline route that cross Owens Lake is caused by the destructive effect of the alkaline brines on metal. The nature of the unconsolidated water saturated sediments in which the pipe will be bedded when combined with the corrosive ability of the brines, leads to a reasonably high possibility of leaks or total rupture of the pipe in this area during its lifetime.

Because many phreatophytes of desert marshes are halophytic, and much near-surface water is known to be saline, corrosive conditions are also likely along as much as 35-40 miles of the proposed route in Nevada. As at Owens Lake, this geologic risk is supplemented in corrosive areas in Nevada by the distinct possibility of earthquakes accompanied by amplification of seismic waves and liquefaction.

Another area where corrosion may be a problem is in the southern Lava Mountains, where the pipeline route lies very close to a currently active geothermal area. The pH of the condensed steam is 3.1 (W.R. Moyle, written commun., 1961).

Soft Ground

Experience along the west shore of Cwens Lake has shown that the surface sediments are dangerously soft. This is especially true near the edge where springs, active along the Owens Valley fault, keep the mud unconsolidated and extremely soft and treacherous. Where salt has formed a layer, the lake has a firmer surface, but this central zone is surrounded by wide mud-flats that do not have the bearing strength to support mechanized equipment either to lay the pipe or to repair potential leaks.

Volcanology

The Coso Mountains, southeast of Owens Lake, is the site of considerable Pleistocene volcanism. Although the youngest eruption is more than 10,000 years old, hot springs activity in the area is common. Recent work by W. A. Duffield of the U.S. Geological Survey, indicates the presence of a large arcuate fault in the vicinity of the most recent eruptions. This set of geologic conditions may indicate the incipient stages of caldera formation. If there is indeed magma beneath the area and the process of caldera development continues, the eruption of ashflow sheets may result.

Basalt flows of late Pleistocene or Holocene age are crossed by about 3 miles of the proposed pipeline in the Owyhee Upland province near latitude 43°00'N. Additional eruptions in this region are possible.

Other Hazards

Other considerations require that an area in the southern Lava Mountains be evaluated carefully, and possibly the pipeline should be rerouted about 1,000 to 2,000 feet to avoid it. Near Mountain Well (sec. 22, T. 29 S., R. 41 E.) the proposed pipeline route appears to be virtually superimposed on the well which provides water for a small pipeline that supplies the towns of Johannesburg and Randsburg. The possibility of gas leaks in the vicinity of operating electrical pumps, and possible contamination of the drinking water during construction or later pipeline malfunctions should be evaluated.

2.1.5R.4 Soils

The soils in Malheur County, Oregon are moderately alkaline, coarse loamy or silty, moderately deep and occur on semi-desert terraces and lakebeds. These soils are susceptible to severe soil loss by erosion. Practically all of the soil associations along this segment contain soils that are highly corrosive to untreated steel. Several soil associations have a high potential for shrink-swell. Productivity for all of the soils along this segment is low due to lack cf moisture. Revegetation of disturbed areas is difficult unless irrigation water is provided.

Soils along the potential route in Nevada occur on sodic floodplains and moderately sloping uplands to steep mountains. These soils are low in productivity, highly alkaline and weakly developed. Soil depth is shallow and generally underlain by cemented carbonate accumulation. Although vegetation is sparse, a gravelly mantle called "desert pavement" forms a protective layer against wind and water erosion on the surface. Soil drainage is pcor which results in high water runoff and flooding during the infrequent, high intensity, short duration thunderstorms that are common to the deserts. High runoff generally results in short duration floods that cause considerable damage to roads, highways, bridges, railroads, and other improvements. All of the soil associations in Nevada are susceptible to severe wind and water erosion when disturbed. All of the soils along this segment are highly corrosive to untreated steel. Many soils contain excessive amounts of alkali and sodium that are detrimental to all except the most tolerant plant species. Several soils along the route are subject to high shrink-swell hazards.

Soils along the potential pipeline in the California Desert occur on alluvial fan deposits and steep mountains developed in a semi-arid climate. These soils are weakly developed, shallow, high in sodium, and coarse laomy to sand in texture. Soil depth is shallow and generally underlain by a thin cemented clayey layer or cemented carbonate layer. Although vegetation is sparse, a gravelly mantle called "desert pavement" forms a protective layer against wind and water erosion on the surface.

Several soils along the route from the Nevada-California border to Cajon, California contain soils that are highly corrosive to untreated steel and subject to mass movement or landslides. Revegetaticn would be extremely difficult on the soils along this segment due to low productivity and lack of moisture.

2.1.5R.5 Water Resources

Surface Water

Primary Drainage Basins

From the Malheur River basin the route trends southward to the west of Owyhee River, into the Great Basin section of the Basin and Range province in Nevada. Annual precipitation over much of this area does not exceed 10 inches, except for in some isolated mountains where precipitation probably exceeds 20 inches.

Distinctive features of the Great Basin are the elongated, north-south-trending mountain ranges separated by basins, some interconnected, which are nearly level. The basins are sites of thick accumulations of sediment, are ringed by alluvial fans, and many are marked by playas at their topographic low points. Throughout the northern and western Great Basin, precipitation is concentrated in the winter and spring months, and averages from 4 to 10 inches annually over most of the proposed route. Mean annual runoff was not estimated because of lack of data, but is probably a fraction of an inch for most of the mountain areas.

Within Nevada the only channels crossed are ephemeral desert washes, with the exception of two perennial streams: the Quinn and Humboldt Rivers, each of which derives most of its runoff from high ranges within the topographic province. The upper reaches of the Quinn River veer north-south, parallel to the ranges, but the Humboldt River flows from east to west through gaps in the successive ranges and drains much of north-central Nevada before terminating at the Carson Sink.

The Quinn River is crossed by the proposed pipeline route near its headwaters, where the stream differs little from a large desert wash with perennial flow. Multiple braided channels divide and rejoin, with the main channel varying in position over a valley width of about a mile. The main channel of the Humboldt River meanders over a flood plain as much as two miles in width near the proposed pipeline crossing west of Winnemucca.

Between the Humboldt and Owens River basins, the pipeline continues along a series of valleys typical of the Great Basin section of the Basin and Range province. One is Grass Valley, which drains into the Humboldt River from the south and is the site of Leach Hot Springs. After crossing the White-Inyo Range, the route descends into Owens Valley, which drains the eastern escarpment of the Sierra Nevada.

Owens Valley is also an area of interior drainage, ending at Owens Lake at the south end of the valley. Development has remained static because of export of water to the Los Angeles area. Mean annual runoff ranges from over 30 inches in the Sierra Nevada to a negligible amount in the arid southern end of the valley.

The route south of Owens Lake continues along the base of the Sierra Nevada as it enters the Sonoran Desert section of the Basin and Range province. The western Mojave Desert is an area of broad intermontane areas of interior drainage, separated by irregular desert ranges, commonly connected only by broad divides of very low relief. Although annual precipitation is known to range from 5 to 6 inches over the proposed pipeline route, runoff information is sparse and limited to streams draining the San Bernardino Mountains at the southern margin of the desert (Troxell and Hofmann, 1954).

The variability of desert precipitation is illustrated by the fact that a single storm often represents all the rainfall in several months and occasionally in an entire year. Streamflow is consequently ephemeral, even in the Mojave River. The major drainage of the western Mojave receives runoff from the San Bernardino Mountains, the only significant contributing area. Troxell and Hofmann (1954) estimate that average annual runoff from most of the mountain ranges in the Mojave Desert rarely exceeds 0.2 inch.

Principal Streams

Tables 2.1.5.5-1 through 2.1.5.5-3 in appendix summarize data on the flow of principal streams crossed by the proposed route.

Public Water Supplies

From the Oregon Nevada border south, through the Humboldt and Tonopah regions of the Great Basin, about 1.2 million gallons per day were used for irrigation in 1965; all other uses amounted to about 100 mgd, or 10 percent of the irrigation load. Of the total, surface water provided 89 percent and ground water 11 percent.

Communities of more than 1,000 population along the pipeline route include Winnemucca, Tonopah, Bishop, Lone Pine, Rodgecrest, Boron, Barstow, Lenwood, Adelanto, Victorville, Apple Valley, and Hesperia. Most of these are several miles distant from the pipeline routes and some obtain their water supplies from the eastern slopes of the Sierra Nevada.

Water Quality

Table 2.1.5.5-4 in the appendix summarizes selected data on sediment concentration and sediment discharge. Tables 2.1.5.5-5 through 2.1.5.5-7 in the appendix summarize selected information on the chemical, physical, biochemical, and biologic quality of streams crossed by the pipeline route in terms of maximum and minimum values.

Water suitable for drinking and for most other uses should not exceed the following:

Dissolved solids, 500 to 1000 mg/l;
Chlorides, 250 mg/l;
Sulfate, 250 mg/l;
Nitrogen (NO_3), 10 mg/l;
Barium, 1 mg/l;
Cadmium, 0.01 mg/l;
Chromium, 0.05 mg/l;
Copper, 1 mg/l;
Iron, 0.3 mg/l;
Lead, 0.05 mg/l;
Manganese, 0.5 mg/l;
Selenium, 0.01 mg/l;
Silver, 0.05 mg/l;
Zinc, 5 mg/l.

Dissolved oxygen content necessary for the support of fish and other aquatic life should be more than 5 mg/l.

Data in Tables 2.1.5.5-4 through 2.1.5.5-6 in the appendix are from the annual data report series for each state released by the U.S. Geological Survey.

Particular Features of the Several Stream Basins

Malheur River Basin

The proposed crossing on Malheur River is near the gaging station at Little Valley. Average discharge at the gage is 199 ft^3/s from a drainage area of 3,010 mi^2 (Table 2.1.5.5-1). Maximum discharge of record at Little Valley is 12,300 ft^3/s (December 22, 1964), and minimum discharge is 6.8 ft^3/s (January 16, 1972). Runoff from the upper 1,540 mi^2 of the basin is controlled by the combined storage at Warm Springs and Beaulan Reservoirs. However, those reservoirs are sometimes filled when floods occur, thus reducing their effectiveness for flood control. Flow characteristics for the Malheur River are shown in Figure 2.1.5.5-4 in the appendix.

The Malheur is the last major stream crossed by the pipeline route that is not in an area of internal drainage. Sediment yields are similar to those of the Powder River drainage, but the peak and average suspended-sediment concentrations are probably higher.

The Malheur River basin is in an arid region in eastern Oregon. When field biological observations were made, three proposed stream crossings were dry and others had sluggish to rapid flow with sandgravel streambeds. Riparian vegetation consisted of short grass and willows with sage brush.

Only four crossings were sampled, three on the Malheur River and one on Crooked Creek. At each site Ephemeroptera were strongly clumped in large numbers. Only one Plecoptera was taken at one of the four sites and Diptera were not prevalent in the samples. The blue-green algae Lyngbya, Nostoc and Oscillatoria were collected at the Malheur River sites, while none were collected at Crooked Creek. Varieties of diatoms were abundant and green algae were more sparse.

From the Malheur River basin, the pipeline route progresses southward to the west of Owyhee River and crosses Dry and Crooked Creeks, tributaries of the Owyhee River. Periodically, Dry Creek carries heavy storm runoff. The pipeline route continues through the arid regions of southeastern Oregon, and crosses the state boundary into Nevada and the Quinn River basin.

Quinn River Basin

The proposed route crosses the Quinn River about 7 miles south of McDermitt. There are several diversions for irrigation upstream from the gage which reduce the flow during the summer. Average flow at the gaging station about 8 miles south of the crossing site is 32.6 ft^3/s, based on 24 years of record (1948-72) (Table 2.1.5.5-1 in appendix). Maximum flow of record is 1,580 ft^3/s (April 27, 1952), and there is no flow at times. Flood-frequency data for the station appear in Table 2.1.5.5-2, and flow-duration data are presented in Table 2.1.5.5-3 in appendix.

No biologic samples were taken because all the main stream and tributaries of the Quinn River were dry at the time of sampling. Water quality information is sparse.

After crossing the Quinn River, the proposed pipeline route continues south to the Humboldt River near Winnemucca, paralleling the Quinn River Valley for most of the distance and then crossing a low divide in the Santa Rosa Mountains. There it enters Paradise Valley.

Humboldt River Basin

At the Humboldt River, the proposed pipeline crosses downstream from Winnemucca. Based on 59 years of record (1894-1926, 1945-72), the average discharge of the Humboldt River near Comus is 296 ft^3/s (Table 2.1.5.5-1 in appendix). Maximum discharge is 5,860 ft^3/s (May 6, 1952) at the Comus gage (drainage area 12,100 mi^2), excluding the contribution from the little Humboldt River. There is no flow at times in some years at Comus. The actual flow at the proposed crossing is the combined flows from the Humboldt and Little Humboldt Rivers. However, because of the many diversions, it is impractical to reconstruct flow estimates for the crossing site. Flood-frequency data of the Comus station are shown in Table 2.1.5.5-2 in appendix.

No sediment data are available for the Humboldt River system other than a reservoir analysis from Rye Patch Reservoir, downstream from the proposed crossing. There, with a correction for trap efficiency, yield over a 35-year period prior to 1971 was in the range of 50-70 tons per sq. mi. per yr. (Rush and Rice, 1972). This figure appears low for such a large drainage basin within the Basin and Range province.

Water quality information for the Humboldt River near Rye Patch, Nevada is available for this irrigation network station for the periods 1951 to 1958 and 1962 to 1972 and show water temperature ranged from 25.5°C to 0.5°C.

Flow is regulated, and tends to maintain dissolved solids in the range 500 to 800 mg/l during the year. This is about a 2-fold increase over observed values at Comus upstream. This increase is attributed, principally, to local ground-water inflow and irrigation-return flow. The average dissolved oxygen content ranges from about 8 to 10 mg/l, which is suitable for spawning and growth of cold-water biota.

South of the Humboldt River chemical quality of the upstream reaches of intermittent streams is good. At the lower reaches of streams, especially playas, waters may be highly concentrated due to evaporation. Use is severely restricted.

At the proposed crossing the Humboldt River is a sluggish stream with a very soft mud streambed. Riparian vegetation consists of some tall willows and short grass. Few benthic invertebrates were collected, and aquatic earthworms were prevalent. No obvious signs of periphyton were noted, and no collections were made.

South of the Humboldt River, all stream courses crossed by the proposed pipeline route are ephemeral, with the exception of the Owens River. The route passes adjacent to Leach Hot Springs, 25 miles south of Winnemucca in Grass Valley. Other springs occur close the the pipeline and may yield small semi-permanent flows that are quickly absorbed in the alluvium.

During the occasional periods of surface flow, sediment concentrations probably range from approximately 500 mg/l to extremes well in excess of the 200,000 mg/l that represent flows approaching the fluidity of mudflows. There are no applicable sediment data for any of the basins south of the Humboldt River Basin to the route termination at Cajon, California except at Deep Springs Basin.

Deep Springs Basin

One of the intermontane basins crossed by the projected pipeline route has been studied in substantial detail. Deep Springs Valley can be used as an example of the terrain and surficial processes which are encountered over large segments of the route southward from southern Oregon. The following description is from Lustig (1965).

Ephemeral streams cross coalesced alluvial fans that encircle the flat central playa of Deep Springs Valley. Sediment on the fan surfaces shows a continuous gradation from boulder gravel at the apex of the fan, with individual particles as large as 4 feet in intermediate diameter, to silt on the playa. Sorting, as shown by the standard division of the granule-to-clay fraction, increases in a down-fan direction and toward the side of each fan unit. Thus, the pipeline route will encounter all size classes and distributions of sediment, from poorly-sorted boulders to windblown sand and silt.

Channels on the fans are well developed and active, and are as incised in Deep Springs Valley as anywhere along the pipeline route. Depths in the apex regions of the fans range from 20 to 200 feet below the fan surfaces. Terraces occur in some of the channels, indicating past periods of substantial aggradation.

Much erosion and deposition apparently is accomplished by mudflows, evidenced mainly by the texture of the deposits. Although rather infrequent, mudflows are believed by Lustig (1965) to be a primary way in which the fans have built outward into Deep Springs Valley.

Cottonwood Creek is a small, rapid flowing stream draining the east side of the White-Inyo Mountains adjacent to Deep Springs Valley. Although the stream is perennial within the range, surface flow rarely reaches down the fan. The streambed is composed of gravel. Diptera, Ephemeroptera, Trichoptera and two Plecoptera (both at one site) were collected. Diatoms were plentiful and many genera were observed. Only one green alga, Cladophora was found.

The largest stream entering Deep Springs Valley is Wyman Creek. Based on a series of water analyses in a study by Jones (1965), dissolved solids in Wyman Creek water ranged from 228 to 435 mg/l, consisting of mostly calcium magnesium and bicarbonate.

Owens River Basin

Most of the water yield of Owens Valley is exported to Los Angeles via aqueduct. At the proposed crossing, downstream from the aqueduct intake, flow is residual and locally derived. The flow at the crossing is wasted to Owens Lake, a large playa at the south end of Owens Valley, and is represented by the nearby record at Keeler Bridge near Lone Pine. Mean annual flow for the period of record (1927-72) is 24.9 ft^3/s (Table 2.1.5.5-1 in the appendix). The maximum flow of record is 1,360 ft/s (June 19, 1969), while the minimum is represented by no flow on many days. Floods with recurrence intervals of 50, 100, and 200 years may be expected to have peak discharges of about 4,700, 10,600, and 23,100 ft^3/s, respectively (Table 2.1.5.5-2 in the appendix). Flow-duration figures are not available because of the lack of tabulated low-flow data.

The water transported by the Los Angeles aqueduct consists mainly of runoff of high quality from the Mono Lake basin, north of the Owens River basin; but during the low-water season it also includes the more highly mineralized ground water that is pumped from wells in Owens Valley. The water that is sampled at the terminal of the Los Angeles aqueduct is, therefore, a conglomerate from more than one source. That water is of the sodium calcium bicarbonate type, soft to moderately hard, and generally of excellent chemical quality. However, the boron concentration at times exceeds 0.5 mg/l.

The intermittent, sluggish pond-type Owens River has a pond-like biota. It was not possible to obtain a Surber sample because the emergent vegetation was too thick to sample the mud bottom. Also, no periphyton were observed.

From Owens Lake southward, the pipeline route follows the base of the Sierra Nevada, passing Haiwee Reservoir, a storage facility for aqueduct water, and Little Lake, a small natural impoundment formed behind a young basalt flow. From this point to the terminus at Cajon, the proposed route follows broad intermontane areas lacking any data on the character or quality of surface flow in streams crossing the route. Runoff is only a fraction of an inch from the mountain areas, and stream channels are poorly developed. Near Cajon, the route crosses the California Aqueduct.

Mojave River Basin

The westernmost part of the Mojave River basin is crossed on the terminal leg of the proposed route. Because the Mojave River receives the bulk of its flow from the portion of the basin draining the San Bernardino Mountains, the character of the flow is not relevant to the pipeline route. The quality, however, is probably illustrative of typical surface water of the region during the few intervals when flow does occur.

Near Victorville the water in the Mojave River is of the calcium sodium bicarbonate type, ranges from soft to hard, and dissolved-solids content averages about 300 mg/l. Boron, at times, exceeds 100 mg/l. A few data on dissolved oxygen reveal concentrations of more than 7.0 mg/l. At the Mojave River station water temperatures range from 94°F in July and August, to 39°F in January.

Ground Water

Columbia Plateau (Payette Section)

From Milepost 325 the proposed pipeline route traverses the Payette section of the Columbia Plateau, about to M.P. 532. This section is dominated by relatively young volcanic rocks which are somewhat diverse in petrologic character, and which commonly cap or are intercalated with thicker sections of so-called lake beds (largely of fluvial and eolian origin). Virtually no specific information is at hand as to ground water occurrence along the route.

It may be expected that: (1) Depth to ground water will range greatly, from about 1,000 feet beneath the highest uplands to only a few feet beneath some lowlands; (2) potential yield to wells will be from a few gallons to several hundred gallons per minute; and (3) dissolved-solids content will range widely, possibly from as little as 100 mg/l with calcium and bicarbonate the dominant ions, to as much as several thousand milligrams at shallow depths beneath local drainage sumps, with sodium, sulphate, and bicarbonate the dominant ions. Locally, the water may be thermal, indicating that any potential for pipeline corrosion might be aggravated. This section of the pipeline route is very sparsely settled and present water withdrawals are small and scattered.

Basin and Range Province
(Great Basin and Sonoran Desert Sections)

Beginning at about M.P. 532 (21 miles north of the Oregon/Nevada boundary), and then southward across Nevada to the vicinity of Oasis, California, the proposed pipeline route traverses the Great Basin section of the Basin and Range province. All this section lacks stream drainage to the ocean. The area is arid to subarid, with average annual precipitation ranging commonly from less than one foot on lowland alluvial areas to as much as three feet in the higher mountains. Because of the higher precipitation in the mountains, recharge to the ground water system is highest there and on the alluvial apron where mountain streams debouch. Ground water flow is commonly toward the axis of the valley where ground water is discharged to the atmosphere by evapotranspiration. The amount of water moving through the ground water system each year is relatively small in relation to the total precipitation or the amount of ground water stored in the principal aquifer in each valley.

Where there is natural ground water discharge to the atmosphere by evapotranspiration, the depth to water is generally less than 50 feet and may be only a few feet in some areas during some parts of the year. The general ground water circulation pattern described above is locally modified where faults function as either barriers to flow or conduits. Hot springs are examples of the latter and are common in the proposed route area.

All but three of the 12 hydrographic areas either receive ground water inflow from an adjoining hydrographic area or are tributary to such an area. Edwards Creek, Smith Creek, and Monte Cristo Valleys are exceptions, being hydrologically isolated. Like streamflow on the alluvial apron, intervalley streamflow commonly contributes water to the ground water reservoir.

Quality of water in the valleys varies by location. Generally the better ground water is located under the alluvial apron and the adjoining parts of the valley floor. These are the principal areas where water has been developed, or could be developed, for irrigation. Beneath the valley floor where ground water is evapotranspired, dissolved-solids content of the water is commonly too high for many uses, including irrigation.

More complete descriptions of the hydrologic environment of these 12 hydrographic areas are published and their references are listed in Tables 2.1.5.5-8 and -9, in appendix, along with other geohydrologic information.

Ground water occurs in eight alluvium-filled valleys along the proposed 242 mile route of the pipeline between Casis and Cajon, California. The intervening mountainous areas between the valleys are underlain by consolidated sedimentary, igneous, and metamorphic rocks, mainly of Mesozoic age or older. These rocks contain only small quantities of recoverable ground water.

The total valley floor area of the eight alluvium-filled valleys traversed by the proposed pipeline is about 3,000 square miles. The water-bearing deposits in the valleys range in thickness from 30 to about 2,000 feet. Depending on local conditions, recharge infiltrates in the upper part of alluvial fans and stream channels at rates of less than 1-1/2 feet per day to more than 10 feet per day. The maximum depth to water occurs in the alluvial fan areas and the minimum in or near the playa areas.

2.1.5R.6 Vegetation

The potential future expansion of the pipeline from Rye Valley, Oregon to Cajon, California involves the desert plant formation.

Deserts are shrub-vegetated areas which generally occur in regions with less than 10 inches of annual precipitation, high evapo-transpiration rates, and marked extremes in weather. The vegetation is adapted to aridity, and bare earth is common, with little humus formed. Hot deserts are warm throughout the year and very hot in summer. The cold deserts have warm summers and cold winters.

The desert supports an extensive community of plants. Four life forms are common:

a) The annuals, which adapt to drought by growing only when moisture is adequate.

b) The succulents, such as the cacti, which adapt to drought by storing water.

c) The desert shrubs which have numerous branches originating from a short basal woody trunk, bearing small thick leaves that may be shed during prolonged dry periods.

d) Perennial grasses and forbs.

Unlike the grasslands and the forests, vegetative renewal in the desert is difficult and very slow.

The future expansion would traverse two plant associations: (1) the Cold Desert for 555 miles from Baker, Oregon to Oasis, California (M.P. 414 to M.P. 969) and (2) the Hot Desert for 191 miles from Oasis, California to Cajon, California (M.P. 969-M.P. 1160). See Figure 2.1.5.6-1.

A list of plants which are common to the future pipeline route are included in appendix, Tables 2.1.5.6-5 and -6.

2.1.5R.7 Wildlife

This section discusses those species which are known or are suspected to occur within or near the proposed route. The majority of the known species range over a broader area than the relatively narrow strip to be disturbed if the proposal is implemented.

Particular importance is attached to threatened and endangered species likely to occur along the route.

The California segment of the proposed route is unique in the wide diversity of life forms occurring within generally small geographic areas. Nowhere else along the route is the variety of side-specific habitat requirements so pronounced.

A large volume of data are displayed in this section. Depending on the reader's interest, he may wish to read part or all of it.

If interested only in the relative significance of wildlife occurrence as related to the pipeline proposal, his attention is directed to Sections 3.1.5, Impacts, and 4.1.5, Mitigating Measures.

Dominant Wildlife Populations

Much of the quantitive data and judgments in this section are from personal communications with biologists from the Fish and Wildlife Service, Bureau of Land Management, Forest Service, and State Wildlife agencies. Records are on file in the U.S. Fish and Wildlife Service Area Office in Portland, Oregon.

Big Game Mammals

Six big game mammals occur on or near the route. Population levels vary from one locality to another and from one year to another and are directly related to habitat and climatic conditions.

Deer

Both white-tailed and mule deer occur along the pipeline route. Mule deer occupy a broad range throughout much of the proposed route. They are very adaptable and thrive in both semiarid vegetation and forested mountain slopes. White-tails are normally found in brushy openings, cut-over areas, and valleys; and in open forest bordering these habitat types.

South of the Rye Valley area, where the proposed route would pass through more arid land, the mule deer is the only deer commonly found. Mule deer may spend the summer at high elevations and in the winter, migrate down the slopes and into the valleys. Mule deer are primarily browsing animals. The shrubs of both the shrub-steppe and salt desert shrub provide year-round food. In the spring and fall they graze on grasses, weeds and other green herbaceous plants. Due to the varying quality of habitats and vegetation, more deer could be present in some areas than in others.

Two of the six subspecies of mule deer in California are found in the region of the proposed pipeline. The Inyo mule deer is found in Inyo, Southern Mono, and northeastern Kern Counties and could be relatively common in Owens Valley. The California mule deer is found in and along the Tehachpi, San Gabriel, and San Bernardino mountain systems, as well as in other portions of the State (Dasmann, 1968).

Inyo mule deer tend to be migratory throughout their range, especially when weather forces them to leave their higher summer range for the winter range in the valleys and foothills. The breeding season for Inyo mule deer is in December and January, with fawning from early to mid-July. California mule deer tend to be migratory in areas where weather conditions cause range shifts. Their breeding season is in October on the coast to as late as mid-December in the mountains. Often, the subspecies of deer will intermingle while migrating.

Elk

Along the alignment, Tule elk, the smallest of American elk, is primarily restricted to the plains and foothills of the Owens Valley in California. The extent of their migration is no more than a seasonal shift between the valley floor and the adjacent foothills. About 70 miles of important Tule elk habitat are in the proposed pipeline route.

In 1933, Tule elk were first introduced into the Owens Valley from the San Joaquin Valley where market hunting and loss of habitat had nearly extirpated the animals. The elk flourished after their arrival here and it wasn't long before ranchers began complaining about elk induced crop and fence damages. As a partial solution, the Department of Fish and Game agreed to limit the elk herd to 300. Whenever the total number of elk counted in the aerial census exceeded 300, a public hunt was held to reduce them.

Opposition to these hunts grew and in 1971, the Fish and Game Commission revised its policy from 300 animals to 490. The Behr Bill, also enacted in 1971, prohibited hunts of the Tule elk until the populations within California totaled 2000, or the DFG could determine that, based on range carrying capacity, a maximum number had been reached in any given area. The last public hunt was held in 1969. So even though the Tule elk is legally defined as a game animal, hunting is no longer allowed.

Beginning in 1972, the CDFG and BLM undertook a five-year joint study to gather information on the distribution and food habits of the elk.

Considerable effort has especially been directed toward identifying "Critical Use Areas" (an area essential to the well-being of the animal) and any areas of competition with other animals, wild or domestic. A final report will be completed in 1977.

In 1972 CDFG transferred five elk from the Tupman Reserve near Bakersfield to an area southwest of Independence in Owens Valley that was considered good elk habitat but wasn't being utilized by any of the established elk herds. This transplant is called the Mt. Whitney Herd. Although several animals have periodically been observed in the area, the success of this transplant is still uncertain.

A preliminary evaluation of the 5-year study has noted that in order to maintain the habitat in a thriving condition and provide for all wildlife species, including the elk, the individual elk herds should be maintained within the following population levels:

	Minimum	Maximum
Bishop Herd	80	110
Tinemaha Herd	80	100
Goodale Herd	60	70
Independence Herd	70	90
Lone Pine Herd	60	80
Whitney Herd	40	60
	390	510

During the 9th annual Tule elk census and calf production count, held in August 1975, a total of 400 elk were observed. The following is a breakdown for the 6 elk herds.

	Bulls	Cows	Calves	Total
Bishop Herd	32	55	8	95
Tinemaha Herd	19	53	12	84
Goodale Herd	9	43	16	68
Independence Herd	15	60	11	86
Lone Pine Herd	21	34	12	67
Whitney Herd	0	0	0	0
	96	245	59	400

The 1975 overall herd composition ratio was 24 calves/100 cows/39 bulls; herd production was 17 percent. The 9 year average herd production is 22 percent.

Bighorn sheep and mountain lion are discussed in Section 2.1.5.7 E, "Endangered Species."

Pronghorn Antelope

Pronghorn antelope require a very specific habitat dominated by grasses and short sagebrush (Mace, 1972b). This habitat has been greatly reduced in recent years by the expansion of cultivated lands, by brush control programs, and by extensive livestock grazing. These factors have changed the species composition of grasses and have favored the growth of taller sagebrush forms. Since the pronghorn antelope is primarily dependent on short sagebrush for food and prefers unobstructed vision for self-protection, the presence of taller shrubs and cultivated areas has forced them to abandon historically used range. Along the proposed route the largest herds would be found in southeastern Oregon and northern Nevada.

About 62 miles of pronghorn winter range and kidding grounds are in the proposed pipeline route.

Wild Horses and Burros

Wild horses and burros are federally protected from harassment by man and are included in this section for convenience. In Oregon, they would occur along the proposed route in the valley just north of Burns Junction, and in Nevada, in Grass Valley, about 20 miles south of Winnemucca. They would be found near the proposed pipeline in the sand dunes of Paradise Valley a few miles north of Winnemucca.

According to a preliminary survey by the U.S. Forest Service, significant populations of wild horses exist in the Toiyabe, Shoshone, and Paradise ranges of the Toiyabe National Forest near the proposed pipeline. The status of these herds is being closely monitored, and the horses cannot be removed from their ranges or harassed in any way. Although survey data on wild horse herds is sparse, the U.S. Forest Service, Bureau of Land Management, Park Service, and China Lake Naval Weapons Center are conducting investigations to establish more specifically the habitat requirements and population characteristics of these animals.

Small Game and Fur-Bearing Mammals

Small game mammals include species which are, or formerly were, hunted mainly for sport because they are generally secretive, wary and therefore difficult to obtain; or because they are considered pests (Burt and Grossenheider, 1964). Except for rabbits, hares, squirrels, and occasionally opposums and raccoons, they are not generally considered good eating.

Jack rabbits would be found predominantly in the sagebrush and grassland areas along the proposed route. The black-tailed jack rabbit is the most abundant and widely distributed of all the rabbits and hares in California. This species was observed in various habitats and would be expected in others. It is a familiar animal of the open grassland and semiopen brushlands of the state and could be seen from below sea level in Death Valley up to 12,000 feet in the mountains, though it apparently does not live in the high Sierra Nevada.

The white-tailed jack rabbit is often found at moderate to high elevations in the Sierra Nevada and the White and Inyo Mountains. Although called jack rabbits, both of these species are not rabbits, but hares.

Hares are largely active at night and rest during the day in and around ground vegetation. They are vegetarians, feeding primarily on forbs, grasses, twigs, and bark, and have been known to do considerable crop damage in agricultural areas.

Snowshoe hares usually occur in forested areas at higher elevations. Pygmy rabbits prefer sagebrush flats, rimrock, and foothills. Cottontail rabbits tend to inhabit rimrock, forest, irrigated land, and river bottom areas. The Audubon cottontail is the most common rabbit of California, inhabiting the low-lying arid, semiarid, and open brush regions of the state. The Nuttail cottontail is found in streamside thickets, sagebrush covered hills, and rocky areas in open sagebrush country of the eastern portions of California. Its preferred diet is sagebrush, juniper, and grasses found in sagebrush areas. The young and adults use underground burrows, often those of rodents or snakes, for escape cover. Their diets consist of tender herbs, grasses, twigs, and leaves. When green feed dries up and the rabbits must eat dry food, water is a necessity. They are most active at night and generally seek cover in ground burrows by day.

Yellowbelly marmots live in rimrock areas. Hoary marmots live at higher elevations. The badger inhabits open grassland and desert and is a carnivore that depends primarily on rodents.

Coyote, skunk, weasel, red fox, bobcat, and raccoon would occur along the entire proposed pipeline. The coyote, gray fox, and bobcat range throughout the desert, shrubland, and open forest. Chiefly nocturnal in their habits, the coyote and gray fox are omnivores, eating primarily small mammals and occasionally insects, fruits, birds, and eggs. The bobcat prefers small mammals and birds and is known to eat carrion if it is not "tainted." The bobcat and the gray fox are considered to be beneficial predators, while the coyote may cause losses to livestock, particularly sheep (Burt and Grossenheider, 1964).

At present, approximately 20 species of wildlife, found along the proposed route, are classified as fur-bearers, and many of these species are closely regulated by trapping laws (Mace, 1970b and NSBFGC, 1974). High pelt values during the past few years have resulted in increased trapping pressure on bobcat and coyote, while trapping for other species is mostly for sport.

Among the numerous species of fur-bearers along the proposed route, the most important economically are water oriented species such as muskrat, beaver, and mink. These species are found along river systems north of Winnemucca, Nevada.

Of the protected species, pine marten and fisher could be present, though rare, in the higher forested region of the Sierra Nevada and White Mountains. Ringtailed cats are uncommon but have been reported in the rocky, brush covered slopes at higher elevations around Owens Valley. Kit foxes are found in open, sandy areas of the Mojave Desert, where they live in burrows and prey on rabbits, rodents, and insects.

Of the fur-bearers, the red fox occurrence is rare in the northern Owens Valley and surrounding mountains. Mink also are relatively uncommon, excepting the northern Owens Valley and surrounding mountain regions. Gray foxes, badgers, skunks, coyotes, and bobcats are widespread throughout the region of the proposed pipeline, though the abundance of each may vary with habitat.

Small Nongame Mammals

The predominant small nongame mammals occurring in the region of the proposed route are insectivores, bats, and rodents (Ingles, 1965; Larrison, 1967 and 1970; Burt and Grossenheider, 1964; and Hall and Kelson, 1959). Rodents, especially mice, voles, and gophers, are common in the cultivated lowland, floodplain, steppe, grassland, and desert shrub areas. Kangaroo rats and antelope ground squirrels are common in the creosote and salt bush desert shrub communities. Shrews tend to inhabit damp or forested areas. Ground squirrels, pikas, and chipmunks are generally found in sagebrush, steppe rimrock, and forest habitats. Various species of bats would be found throughout the proposed pipeline, usually foraging near open water, and roosting in caves and mine shafts, both vertical and horizontal.

Upland Game Birds

Upland game birds are abundant within the region and provide sport for the hunter and the naturalist (Masson and Mace, 1970; OSGC, I-ED, undated-b; and NSBFGC, 1974). Of the 17 species that could occur along the proposed route, 11 are native to the area and 6 have been introduced by game managers in an effort to maximize the use of available habitats. Three of the 6 introduced species--ring-necked pheasant, bobwhite quail, and Hungarian partridge--are truly farmland birds. Their population densities are directly related to the types of agricultural crops grown and the efficiency of the farming operations. Their distribution is limited to stream valleys with sufficient water for farming. Favorable Hungarian partridge habitat, for example, consists of large areas of dryland grain farms with adjacent sagebrush vegetation (PNRBC, 1971b).

The California quail, selected by the state legislature in 1931 as the official state bird of California, is one of the most popular upland game species among sportsmen and general public alike. They need water in some form throughout their lives, and prefer habitat composed of woodland-brush with interspersed grassy areas, such as occurs in the Owens Valley and the San Bernardino Mountains. California quail nest in early spring. They usually select nesting sites within a few hundred yards of water as young birds need water within 24 hours after hatching (Mallette, undated and McLean, undated). Numbers of quail vary from area to area depending upon the amount, quality, and distribution of food, water, and cover. When not incubating eggs or brooding their young, quail roost in trees or tall bushes that afford them protection from predators.

The introduced upland game species are largely dependent on waste grains, weed seeds, and insects for food, and on brushy stream bottoms, ditch banks, and fence rows for winter and escape cover. Chukar partridge, Gambel's quail, bobwhite quail, scaled quail, seesee partridge, snow cock, and crested tinamou have been introduced in various locations to supplement the hunted native species.

The most successful introduction has been of the chukar partridge, which now inhabits sagebrush and rimrock areas over a large portion of the region (Christensen, 1970 and Masson and Mace, 1970). Chukars prefer rocky open hills and flats where annual rainfall ranges from 5 to 10 inches. They have been sighted from below sea level in Death Valley to an altitude of 12,000 feet in the White Mountains and the Sierra Nevada. Chukars nest and roost on the ground, pairing off early in March and nesting in April and May. Their habitat is somewhat different from that of quail, so the two species exhibit little competition for food and nesting sites. The chukar is common in the deserts of Nevada and California.

The seesee partridge, snow partridge, and crested tinamou are currently being released in an attempt to establish them in huntable numbers (NSBFGC, 1974 and <u>Nevada Outdoors and Wildlife Review</u>, 1973).

Wild turkey and Gambel's quail have been introduced into areas along the proposed pipeline in an attempt to extend their natural ranges. The Gambel's quail, native to southern Nevada but introduced northward, is restricted to dense thickets of bramble and willow along creek banks. These thickets protect the quail's limited diet of weed and grain seed from destruction by livestock.

Native upland birds are generally found in areas supporting indigenous forest and steppe vegetation. The forest grouse (ruffed, spruce, and blue grouse) require open forest with abundant brushy areas of fruit producing shrubs. Both the spruce and the blue grouse use the grassy openings of upper hill slopes, while the ruffed grouse remains close to the thick cover along dry streambeds and draws.

The native sharp-tailed grouse, sage grouse, mountain quail, and California quail are closely associated with a number of native vegetation types. Populations of sharp-tailed grouse are restricted to areas covered by sagebrush and grass from east of the Cascades to northern Nevada. Sage grouse are generally restricted to the farmland areas of southeastern Oregon, and the sagebrush plains and mountain meadows of Nevada and California. Presently, both of these species are threatened by sagebrush destruction around strutting grounds and wet meadows, overgrazing, especially of wet meadows, and encroachment of cultivated farmland on their ranges. Four sage grouse strutting areas are known to exist on or near the proposed route and detailed studies would probably identify others. The four known areas are in Nevada as follows: (1) The SE 1/4 of Section 30, R. 38 E., T. 44 N., Mt. Diablo Meridian; (2) The NW 1/4 and SW 1/4 of Section 9 and NW 1/4 of Section 29, T. 19 N., R. 40E., Mt. Diablo Meridian; and (3) The SE 1/4 of Section 32, T. 11 N., R. 40E., Mt. Diablo Meridian; (4) The E 1/2 of Section 17, T. 12 N., R. 39 E., Mt. Diablo Meridian. Nesting occurs within 2 miles of these sites, so the area of importance is 4 miles in diameter.

The mountain quail is the largest native North American quail. Nesting and summer range areas are generally located at higher elevations, where snow occurs during the winter. It is necessary for mountain quail to move to lower elevations for cover and food during the winter. Movements may cover up to 50 miles and are primarily negotiated afoot. The birds fly only when confronted with such large natural obstacles as lakes. Quail that live in the lower, warmer areas do not appear to move nearly as far.

Scaled quail are found in the more arid brush and grassland in southeast Oregon and in Nevada. Although this quail has become somewhat adapted to feeding on agricultural grain crops, it could be adversely affected by intensive farming and overgrazing.

Following is a summary of some areas along the proposed pipeline where specific upland game birds are prevalent.

From Rye Valley to around Little Valley (Oregon), ring-necked pheasant, chukar and California quail are the most important upland game species. In the extreme southeastern part of Oregon and throughout Nevada, pheasant habitat is limited due to low rainfall. However, there could be huntable populations of pheasant at the proposed route crossing of the Quinn and Humboldt River Valleys. Because of the drier conditions along the more southern portion of the proposed pipeline, the chukar partridge tends to replace the ring-necked pheasant as the important game bird.

Gambel's quail is a close relative of the California quail, but it ranges more in the southeastern deserts of California; especially in San Bernardino County. Their preferred habitat in this area includes patches of quail brush, mesquite, and catclaw near water in the desert, valleys and hillsides. This species also prefers to roost in trees or tall brush at night (Mallette, undated).

The mountain quail is widely distributed in mountainous areas containing suitable habitat, including the Sierra Nevada and the White, Inyo, and San Bernardino Mountains. Ring-necked pheasants are marginally successful in Owens Valley, where they inhabit the grassy brush regions in the valley and the lower foothills. Most are replenished from game farm stock because natural reproduction is poor in the region.

Along the proposed route, sage grouse could only be found in the northern Owens Valley along the White Mountains, and on the eastern slope of the Sierra Nevada. They are restricted to the Great Basin sagebrush habitat, where they feed primarily on sagebrush. Blue grouse is a woodland, mountain bird found at higher elevations in the Sierra Nevada and White Mountains, including the area of Deep Springs Valley (Rue, 1973; McLean, undated; and Mallette, undated).

Waterfowl and Other Migratory Birds

At least 25 species of ducks, geese, and swans, 8 species of cranes and herons, 9 species of gulls and terns, 26 species of shorebirds, and 18 species of other migratory birds are known to occur regularly and/or commonly in the vicinity of the proposed route.

Others have been observed, but only rarely (PNRBC, 1971-b; OSGC, I-ED, 1972b; Bertrand and Scott, undated; National Audubon Society, 1973; Peterson, 1961; and Storer and Usinger, 1963). The Columbus salt marsh in southwestern Nevada is not generally considered as an important migratory waterfowl rearing area, but may provide some wintering and/or nesting grounds. The marshes, low-gradient streams and rivers, natural lakes, and man-made reservoirs and irrigation ditches along the route are used commonly by ducks, geese, grebes, and some cranes and herons (OSGC, I-ED, 1969; OSGC, I-ED, undated-c; I-ED, undated-d; and OSGC, I-ED, 1972a).

In Nevada and California except for the mallard, which is one of the main perennial waterfowl of the area, most of the water associated birds use the water of this region only as temporary resting spots as they pass on their northward or southward migrations. Areas which could be used as bird resting or feeding areas along the proposed pipeline include Owens Lake, Little Lake, Upper and Lower Haiwee reservoirs, Owens River, Tinemaha Reservoir, Duck Lake and Goose Lake near Independence, and the numerous springs, stock ponds, reservoirs and wells in the region. These water areas are of relatively little importance as breeding or wintering grounds because of lack of suitable long-term resting and feeding habitat. In addition, a few water birds may use the so-called "dry" lakes or playas, such as China Lake, Dry Lake, and Cuddeback Lake, when there is water in them, especially after a rainy winter.

Along the remainder of the proposed route the numbers of waterfowl are limited by the lack of suitable habitat. Some nesting and resting habitat does exist along the Humboldt River near Winnemucca, Nevada and in the Columbus Salt Marsh of southwestern Nevada (PNRBC, 1971b). Nesting and production of waterfowl in these areas is probably slight due to the small size of the streams and lack of available habitat.

Four other species of migratory game birds, mourning, ground, and white-winged dove, and the band-tailed pigeon, could occur along the proposed route. Only the mourning dove could be found along the entire length. Mourning doves are numerous in the lowland and agricultural land along the proposed route through the summer and early fall, and are intensively hunted throughout their range. They prefer as habitat open woodland, prairies, desert, and agricultural areas, but are highly adaptable. There are more mourning doves today than in the past, as a result of changes in land use. These doves feed extensively on weed seed and waste grain and can often be found in large numbers in grain fields harvested in the fall. Doves require water daily and in drier regions may be restricted to areas where water occurs.

Band-tailed pigeons are found in mcuntainous areas of the proposed pipeline, migrating to the south each fall. White-winged doves and ground doves are most often found near agriculture lands in the southern portion of the route and spend the winter in Mexico. The rock dove, or domestic pigeon, has gone wild and could be found along much of the proposed route.

Birds of Prey (Raptors)

Birds of prey that could occur in the region transected by the proposed pipeline, include: 2 species of eagles, 9 species of owls, 15 species of hawks and falcons, and the osprey. The turkey vulture, while not strictly a predator, is listed in this functional group for convenience (Bertrand and Scott, undated; OSGC, I-ED, undated-e; OSGC, I-ED, undated-f; Peterson, 1969; and USDI, Bureau of Land Management (BLM), 1971). Many of these birds occur near bodies of water and in cultivated fields, steppe, grassland, and other areas with low vegetative cover. In such open areas these visually oriented predators, except for some owls which hunt at night by sound, are able to spot their prey from high altitudes. Birds of prey must hunt closer to the ground in forest and shrubland. Also, prey species, such as small mammals and birds are usually more abundant in grasslands than in forests.

Raptors enjoy a broad distribution in the region of the proposed route and one or more species cccur along the entire pipeline route.

Hawks are often considered in twc groups or subfamilies, the bird hawks, Accipitridae, and the buzzard hawks, Buteonidae.

Bird hawk food consists chiefly of birds, but some small mammals are also taken. In the proposed pipeline route, especially in Owens Valley of California and surrounding mountains, the Goshawk, the sharp-shinned hawk, and Cooper's hawk cculd be resident and breeding. Goshawks are known to breed in the Deep Springs Valley areas of California (National Audobon Society, 1973).

The red-tailed, red shouldered, Swainson's rough-legged, broad-winged, and ferruginous hawks are members of the buzzard hawk subfamily. They feed mainly on rats, mice, rabbits, and occasionally small birds and reptiles (Peterson, 1961). Rough-legged hawks are relatively common in Owens Valley. They, as well as Swainson's hawks, nest in the valley.

The golden eagle is indigenous to the area. They usually nest in tall trees or on the ledges or outcroppings of cliffs, generally in the mountains. The golden eagle eats mostly rabbits and large rodents (Peterson, 1961). Southern bald eagles are on the Federal list of "endangered species" and are discussed in the section on endangered species.

The marsh hawk is widespread in open country along the proposed route and hunts primarily for rodents and small birds. They rest on the ground in sparse, shrubby open land or marsh.

The prairie falcon, pergrine falcon, pigeon hawk, and Kestrel (sparrow hawk) are known to range along the proposed route. These birds inhabit open country, prairies, deserts, wooded stream areas, and farmland. They are daylight hunters and hunt primarily for birds, rodents and insects. Peregrine and prairie falcons are classified as endangered species by either Federal or State agencies.

Nine species of owls are known to occur along the proposed route. These include: the barn, burrowing, great-horned, long-eared, screech, saw-whet, flammulated, and pygmy owls. Owls are nocturnal birds of prey that primarily feed on rodents, birds, reptiles, fish, and large insects. Most species nest in tree hollows. Two of these owls, the burrowing and short-eared owls, habitually nest on the ground in abandoned rabbit hollows or rodent burrows (Peterson, 1961 and Robbins, Brunn, and Zim, 1966). The flammulated owl is known to nest in the San Gabriel Mountains of California and could occur elsewhere near the southern end of the proposed route (National Audubon Society, 1973).

Turkey vultures are widespread scavengers. They are generally seen perched on dead trees or posts, or soaring in search of carrion.

Other Birds

Over 160 species of birds other than upland game, waterfowl, shorebirds, and raptors would be expected to occur regularly and/or commonly in one or more habitat types along the pipeline route (Peterson, 1961, 1969; Jewett et al., 1953; OSGC, I-ED, 1969; CSGC, I-ED, 1972b; and National Audubon Society, 1973). Numerous other species are rare, occasional visitors, or otherwise uncommon. The most numerous number of species are found in forested areas, especially forests with open spaces all along the existing pipeline right-of-way and adjacent forest.

Reptiles and Amphibians

The reptile species known to occur in the region include 18 lizards, 25 snakes, 3 toads, 2 frogs, 2 turtles, and a large land tortoise (Stebbins, 1954, 1962, 1972 and Savage, 1959). Some of the species have only limited range within the region. The western ring-necked snake is known to inhabit only a few locations along the Snake River, and the painted turtle is restricted to aquatic habitats such as lakes and streams.

The sidewinder is a poisonous snake that usually inhabits sandy flats and desert washes, especially where there are scattered bushes. Three other species of poisonous snakes could occur along the proposed route in California. These are the Mojave, western and speckled rattlesnakes.

The common garter snake is found throughout the region in almost all habitats. The gopher snake also occupies a great variety of habitats.

The amphibians that could occur along the proposed route are restricted to aquatic or damp habitats. This is because they must lay their eggs in water and keep their skins damp to avoid dessication. Approximately 9 salamander species and 14 species of frogs and toads are known in the region.

Terrestrial Invertebrates

Common terrestrial invertebrates that could occur along the proposed route include: worms, insects, spiders, mites, and other less well known groups of invertebrates, and constitute an essential part of the ecosystem and food sources, decomposers, predators, herbivores, disease vectors, parasites, etc.

Aquatic Animals

Snails, most species of crustaceans, and numerous larval and adult insects are the dominant invertebrates that occur in the aquatic habitats provided by reservoirs, marshes, slow-moving creeks and rivers, and irrigation ditches along the proposed route. These organisms tend to be somewhat less abundant in fast-moving or clean waters. Aquatic invertebrates are also an essential part of the ecosystem for the same reasons given for the terrestrial invertebrates. A meadow on the southwest shore of Owens Lake, about 1-1/2 miles north of Olanchea, is of particular significance as a relic area of Owens Lake, possibly dating as far back as the Plistocene era. The myrid invertebrate life utilizing this meadow could shed some light on the historic invertebrate life of ancient Owens Lake (Durham Guiliani, personal communication, 1975).

Fish species are discussed below according to the specific bodies of water in which they occur.

Oregon Creeks--South from Rye Valley, the proposed pipeline crosses a number of perennial streams. Among them are:

Stream	Approximate Pipeline Mile (From U.S.-Canadian Border)
North Fork of Dixie Creek	418
South Fork of Dixie Creek	420
Willow Creek	433
Poall Creek	434
Small unnamed creek just below small reservoir--just south of Poall Creek	435
Black Creek	436
Poison Creek	440
Cottonwood Creek	450
Bully Creek	453
Malheur River	458
Dry Creek	486
Crooked Creek	545
Crooked Creek	565

Of these, the important streams that the proposed pipeline would cross include: Bully Creek and the Malheur River, the Malheur Drainage Basin, and Crooked, McDermitt, and Oregon Canyon streams in the Owyhee Basin.

Bully Creek is regularly stocked with rainbow trout and supports heavy angling pressure every year. However, few trout are thought to inhabit the creek at the proposed crossing site.

At the proposed pipeline crossing site east of Harper, Oregon, the Malheur River supports primarily a warm-water fishery for channel catfish and brown bullhead. In addition, rough fish in the Malheur drainage include: suckers, squawfish, carp, sculpins, and shiners. Although rough fish inhabit all but the extreme headwaters of the system, population densities are greatest at lower elevations.

Irrigation storage demands upstream, and the characteristic low flows of the winter months, usually cause dewatering in this part of the Malheur River from approximately mid-October to the beginning of annual spring runoff.

The headwaters of the McDermitt and Oregon Canyon creeks of the Owyhee River Basin contain populations of rainbow trout. Sport fishing pressure on the lower stretches of these two streams is light and their importance as producers of game fish is minimal. Crooked Creek does contain a few rainbow trout and relatively large numbers of speckled dace. It has minimal importance as a sport fishing stream at present, but is being considered for habitat improvement within the coming year.

Other non-game fish generally found in streams of the Owyhee Basin include squawfish, shiners, and suckers.

Streams in southeast Oregon that would be crossed by the pipeline and that are not known to contain significant populations of fish, include: the north and south forks of Dixie Creek, Willow Creek, Poall Creek, Black Creek, Poison Creek, Little Willow Creek, and Dry Creek.

Sport fishing activity on the majority of the streams that would be crossed in southern Oregon is greatest in the spring and early summer months during spring runoff. This period is also the time of greatest reproductive activity for many of the resident game fish. Reservoir storage, irrigation demands, and low precipitation cause many of these creeks to flow intermittently by midsummer. Therefore, fish in these streams must migrate to the headwaters. For example, lower Oregon Canyon and McDermitt creeks contain fishable populations of brook and rainbow trout in spring and early summer, but are dry from approximately mid-July until spring runoff of the following year. During these dry months fish populations must concentrate upstream.

<u>Nevada Creeks</u>--The majority of the aquatic resources of Nevada are concentrated in the western and extreme southern portions of the state and would not be crossed by the proposed route. They consist primarily of several large natural lakes and man-made reservoirs.

Stream fishing in central Nevada is extremely limited along the proposal route. The proposed pipeline crosses only two streams in Nevada that flow year round, the Quinn and Humboldt rivers.

The Quinn River flows southwest out of Oregon through the Quinn River Valley. It eventually terminates as a desert sink lake in the Black Rock Desert region of Northwestern Nevada. The stream would be crossed near Fort McDermitt Indian Reservation. Sport fish found in the Quinn River include wild brown and brook trout. The stream is stocked annually with hatchery-reared trout. It is not a high-use sport fishing stream (Johnson, 1972).

The Humboldt River originates in the mountain ranges of northwest to north-central Nevada and flows generally southwestward through the state, terminating in sink lakes. Channel catfish and bullheads are found in the river near Winnemucca.

<u>California Streams</u>--The principal streams in the region traversed by the proposed route are the Owens and Mojave Rivers. Numerous small streams that drain the east side of the Sierra Nevada flow into Mono Lake and the Owens River. The route would cross two perennial streams, the Owens River and Cottonwood Creek, and numerous intermittent streams and washes.

Cottonwood Creek, located on the eastern slope of the White Mountains, is classified as a good aquatic habitat and maintains substantial natural populations of brown trout.

The Owens River, classified as poor aquatic habitat, contains populations of warm-water fish.

Habitat Requirements and Limiting Factors of Major and/or Characteristic Terrestrial and Aquatic Species

See discussion under 2.1.4.7 for general information relating to habitat requirements.

Unique, Sensitive, and/or Threatened Species

These populations do not presently appear on official Federal or State lists, but are considered as unique because they are uncommon species within the area that would be traversed by the proposed route. They usually have small distributional ranges, localized or relic populations, and specific habitat requirements. A list of unique, sensitive and/or threatened species that would occur along the proposed route are shown in Table 2.1.5.7-2.

In historical time, three subspecies of bighorn sheep, California bighorn (Ovis canadensis californiana), desert bighorn (O.c. nelsoni), and Rocky Mountain bighorn (O.c. canadensis), existed in rugged high country where the proposed pipeline would be constructed. Now, bighorn populations are greatly reduced because of overgrazing by livestock and burros, disease infection from domestic livestock, increased human activity in remote areas, and illegal hunting (Dasmann, 1968). The California bighorn is found in central Malheur County, Oregon at the head of Owyhee Reservoir, approximately 10 miles east of the route. Oregon has reintroduced the California bighorn sheep into parts of the species' original range. One introduction site lies near the proposed route at Leslie Gulch in central Malheur County, Oregon (Olterman and Verts, 1972). There are also potential introduction sites located along the proposed route in Nevada.

The Monte Cristo Range in Nevada, Last Chance Range, White and Inyo Mountains of California support remnant herds of bighorn sheep. The bighorn probably occurs along or near the proposed route into Fish Lake Valley, Nevada. Rocky Mountain bighorn no longer occur along the route.

The bighorn sheep is a wilderness species that is intolerant of human disturbance. While deer and elk have actually managed to expand their ranges in many places since the advent of civilization, the bighorn's history has been one of continual retreat (Dasmann, 1968).

Bighorn sheep are not intensely territorial and may wander from the top to the bottom of their desert ranges throughout the year to find food and water. However, when adequate food, water, and shelter are available, bighorns will establish broad-bounded home areas and may stay in the same area throughout their lives. The water source is the determining factor in the location of a home area, though loss of either food or water will cause the bighorns to abandon one area for another (Welles and Welles, 1961).

Bighorn sheep feed on various species of grass, sedges, forbs, and browse. The succulence of forage is of primary importance during the long, hot, dry periods of the year. At present, the chief means of improving their habitat is by developing water sources. The increased acreage of range made habitable for bighorns by providing new sources of water has been beneficial (Dasmann, 1968).

The Kit fox is a small desert dwelling fox that reaches the northern limit of distribution in southeast Oregon, it is believed to be on the verge of extinction (Olterman and Verts, 1972). It is listed as threatened in Oregon.

Very little information is currently available about the Màlheur shrew, except that it is considered to be unique and has a small zone of occurrence. Along the proposed route, the animal is known to occur in bogs, marshes, and riparian areas from the Blue Mountains of Washington into mid-Malheur County, Oregon (Burt and Grossenheider, 1964; Larrison, 1967, 1970; and Olterman and Verts, 1972).

There are several small rodents such as the pale kangaroo mouse (in Deep Springs Valley, California), San Joaquin pocket mouse and chisel-toothed kangaroo rat [between Four Corners (Kramer Junction) and Randsburg, California] and others that could be considered unique because of limited occurrence in specialized habitat.

The San Joaquin pocket mouse was found in the autumn of 1974 in a salt brush community. This record is a great extension of the geographic range into the Mojave Desert. This is the first time this species has been found in the desert.

Some local populations of osprey are stable, although nationwide populations appear to be declining. In the Owens Valley of California, increased osprey sightings have been made over the past few years. Consequently, nesting platforms were constructed on the west side of Tenemaha Reservoir at about M.P. 960.

The desert tortoise, designated as California's State reptile, is protected by the State of California, though it is not yet considered a threatened or endangered species. Increasing recreational use, highway construction and other man-related activities of its western desert habitat has resulted in a severe decline in their population. There is a band of high density tortoise populations that crosses the proposed pipeline route. This occurs from Kramer Junction on Highway 395, north through Randsberg, and the El Paso Mountains. The northern boundary of the high density habitat is on the southern edge of Indian Wells Valley. They also occur in the area of Boron, California near the proposed route.

The Panamint alligator lizard is a species that is fully protected by State law and has an extremely restricted distribution. Populations are limited to a few canyons in the Panamint, Nelson and Inyo Mountain Ranges of the eastern California deserts. The Panamint alligator lizard was recently (October 1974) discovered in Westguard Pass in dry, talus slopes.

The southern rubber boa is officially considered rare by California. Its range includes southwestern San Bernardino County, California, near the proposed route.

The black toad is restricted to a few areas in and around Deep (Buckhorn) Springs and Antelope Springs in Deep Springs Valley, Inyo County, California.

Official rare and endangered wildlife lists are constantly being revised. The desert areas of California undoubtedly contain additional, as yet undiscovered, species unique to very limited habitats.

Several land mollusks are also rare or potentially endangered. These are found in variety of terrestrial habitats such as amont stone outcroppings, organic debris, and live vegetation of various types.

Counties of California that would be crossed by the proposed route and have land mollusks classified as rare and endangered are Kern with 11 species and Inyo with one species (California Department of Fish and Game, 1973). It is not known if any of the molluscs would be encountered along the proposed pipeline, but the possibility exists.

Endangered Species

For obvious reasons, site-specific locations of threatened and endangered species are not revealed in this document. Section 4.1.5R, Mitigating Measures, explores procedures to protect them from possible adverse effects due to the proposal.

Table 2.1.5.7-3 lists species classed as endangered by the Federal Government that would occur along the proposed route (USDI-FWS, 1974).

The American peregrine falcon and southern bald eagle range over the area where the proposed route would be constructed. No known eyries would be located within one mile of the proposed pipeline. A pair which could have been nesting were observed near Deep Springs Valley, in 1973 (National Audubon Society, 1973).

Southern bald eagles are uncommon along the proposed route and are classified as occasional visitors (National Audubon Society, 1973). There is some overlap of range with the more common northern bald eagle. Generally the 41st parallel north is taken as the dividing line between the two subspecies.

Table 2.1.5.7-4 lists animals classified by individual states as endangered that are along the pipeline route.

Cougars (mountain lions) would be found in all states along the proposed pipeline route. Populations are correlated to the location and density of deer, and their principal food (OSGC, I-ED, undated-a). Preferring rugged and mountainous terrain, individuals will, on rare occasions, venture near the proposed pipeline into the lowlands and grazing lands to prey on livestock and wildlife, especially during severe winters.

The only known populations of the Mojave ground squirrel exist in the Victorville-Barstow-China Lake region of the Mojave Desert (CDFS, 1974). The Mojave ground squirrel occurs within the range of the antelope ground squirrel. The Mojave ground squirrel inhabits the scattered brush of this desert region, preferring areas of sandy or gravelly soil (Burt and Grossenheider, 1964). Accelerated urbanization and land use changes taking place in the Mojave River Basin and Antelope Valley are destroying much of its habitat. Capture, possession, or sale of this animal is prohibited. One individual of this species was captured and released in a Joshua tree woodland at the south end of Owens Valley. Other observations have occurred from about 12 miles south of Owens Lake south to Victorville.

The spotted bat is an extremely rare animal, only about 15 specimens have been collected (USDA, Forest Service, undated). This medium-sized black bat could possibly be found in the cliffs and canyons of central Nevada and other rugged terrain along the route. Almost nothing is known of its breeding and habitat requirements or natural range.

The prairie falcon frequents habitats along the proposed pipeline route, including: canyons, plains, deserts, and open mountain areas. They nest in bare niches in cliffs and do not tolerate any disturbance within their nesting range. They have been frequently observed in the Owens Valley of California where they nest in nearby rock mountain cliffs.

The greater sandhill crane migrates through Nevada and could occasionally stop at wet areas along the proposed route.

Two birds listed by Washington and Oregon as endangered, the Aleutian Canada goose, and Tule white-fronted goose, are occasional migrants through these states and could occur along the proposed route.

Two fishes listed as endangered by California, the Owens Tui Chub and Owens Pupfish have been collected in the Owens River drainage upstream from where the proposed pipeline would parallel the river. There is a very slight possibility that they could occur in the vicinity of the proposed route. The Owens Tui Chub has been collected in an 8-mile section of the old Owens River channel below Crawley Lake dam (approximately 45 miles upstream). The Owens pupfish is now confined to several small areas in Fish Slough and a small pond north of Big Pine. The nearest present known range is about 5 miles from the proposed pipeline.

2.1.5R.8 Ecological Considerations

The future expansion encounters two major ecosystems from Rye Valley, Oregon, to Cajon, California; i.e., the woodland-bushland and the desert ecosystems. An ecosystem is described as consisting of its physical components, air, water, soil, etc.; biotic components, vegetation, micro-organisms, macro-organisms; and their interrelationships and interdependencies. Components of the affected ecosystems are described in this chapter; however, an overall discussion of the ecosystem components must be gleaned from all chapters within the description of the environment.

1) The woodland-bushland ecosystem occurs as an ecotone between the California grassland and the California montane forest and as biological islands within the desert plant associations.

2) Desert ecosystems are exceptionally vulnerable to improper use and reflect this quickly through soil loss, community degradation and, if severely abused, overall failure of the system. Recovery in this xeric portion of the proposed route is usually extremely slow. This particular ecosystem is not well understood, however, soil and vegetative disturbance may cause the area to remain barren for several years following the disturbance, or undesirable vegetation, halogeton, etc., are likely to invade.

Precipitation is sparse, sporadic and varies considerably from year to year. Desert vegetation is correspondingly sparse as compared to more humid regions. Water is the major limiting factor in the production of green plant materials, which in turn limits available primary and secondary food sources.

The slow decomposition of vegetative matter in the desert ties up nutrients which could otherwise be used in generating new plant growth.

Man's overuse of this area, mostly through domestic livestock overgrazing has altered the ecosystem. Hence, an already strained system in most areas will be subjected to further disruption. The recovery towards a climax ecosystem will take much longer in the desert areas.

2.1.5R.9 Economic and Sociological Factors

The applicant proposes a possible future extension of the route from Rye Valley, Oregon to Cajon, California, a distance of 746 miles. It would pass through 12 counties in three states. The counties involved are Malheur, Oregon; Humboldt, Pershing, Churchill, Lander, Nye, Mineral, and Esmeralda, Nevada; and Mono, Inyo, Kern, and San Bernardino, California.

History of Economic Development and Principal Economic Activities

The area traversed by the proposed future extension of the route can be treated as a single area. It lies predominantly within the Basin and Range Province. With an average annual rainfall of less than 10 inches, it is the most arid geographic area in the United States. Drainage is internal to basins with streams disappearing in sinks or dry lakes on the alluvial floors. Economic activity is principally livestock farming, mining, and military. Tourism is important just outside the area at Reno and Las Vegas, Nevada. The southern end of the proposed route is near San Bernardino and the Los Angeles metropolitan area, the second largest population concentration in the United States and a widely diverse manufacturing, transportation, finance, education, and commercial center. Figure 2.1.5.9-1 shows the proposed placement of the future extension route.

Population, Employment, and Income

Several tables of data describe the socio-economic environment of this area. Population in the counties crossed by the pipeline is shown in Table 2.1.5.9-7, population of minority races in Table 2.1.5.9-8, and communities along the proposed route in Table 2.1.5.9-9. (These tables in the Appendix.)

The country through which the future extension of this line would pass is very sparsely inhabited except for portions of Kern and San Bernardino Counties, California. Total population in 1970 was over 1 million people, 18 percent of the three state total and less than one-half of one percent of the total United States population.

The two California counties, San Bernardino and Kern, contain 92 percent of all the people who live in the 12 counties along the route. Even in these counties, population densities are less than the national average, 40 per square mile in Kern County and 34 per square mile in San Bernardino. No other county has a population density greater than two persons per square mile and four of them have fewer than one-half person per square mile. Minority members of the population comprise 10-20 percent of the total in most counties with a large concentration in San Bernardino County which has 22 percent minorities in its population, the largest group being those of Spanish-American background.

This is a fast growth area, with most of the growth concentrated in the southern three counties. The 1960-70 rate of growth in population was 27 percent for the entire area compared to 13 percent for the Nation and 24 percent for the 11 western states. The population of San Bernardino County, California increased by 36 percent in the 1960-70 decade, Inyo County, California by 33 percent. Two small counties grew at faster rates, but on very small population bases. Six of the 12 counties in the area grew at a slower rate than the national average.

Because of the influence of San Bernardino and Kern Counties in California, the regional statistics indicate it is more highly urbanized than the national average with 82 percent of its people in urban areas compared to the national average of 72 percent. However this urbanization is almost entirely in San Bernardino (89 percent) and Kern (80 percent)

Counties. Only two other counties in the area, Humboldt, Nevada and Mineral, Nevada, have as much as 50 percent of their populations in urban areas. Five of the counties have no urban populations at all.

The unemployment rate in this area varies considerably, being generally equal to or below the national average in the Oregon and Nevada counties, higher than the national average in the California counties. The 1970 rate of unemployment was 6.1 percent in San Bernardino County, California, 4.4 percent for the Nation. As seen in Table 2.1.5.9-10 (in Appendix), the rate of employment in manufacturing in the area is very low with the exception of San Bernardino County where 19.1 percent of the labor force was engaged in manufacturing in 1970, compared to the national average of 25.9 percent. All counties in the area have a higher than national average share of their labor force employed in government. All counties except Mineral, Nevada and Kern and San Bernardino have a strong specialization is livestock raising.

Per capita incomes in the area also vary on both sides of the national average, but the area can be characterized as a prosperous one. Five counties have per capita incomes below the national average, the lowest being Malheur, Oregon with a level 79 percent of the national average in 1969. The highest per capita income was in San Bernardino County where income was 33 percent higher than the national average.

Local Tax Structures

Table 2.1.5.9-11 (in Appendix) shows total county general revenues and expenditures as well as per capita revenues and expenditures.

Socio-Economic Trends Without the Pipeline

Economic projections prepared by the Bureau of Economic Analysis, U.S. Department of Commerce, are among the best available that project economic trends on a regional basis. Regions for these projections were established by selecting a major economic center (e.g., Spokane, Washington) and relating counties to these centers on the basis of economic activity patterns. Projections are based on a low national population growth rate (Bureau of the Census series E) and principally on past trends. Figure 2.1.5.9-2 is a map of BEA economic areas that relate to the proposed pipeline route.

Table 2.1.5.9-12 (in Appendix) presents the projections of economic area trends without the proposed pipeline. These data project a slower rate of growth in the northern areas of the route, a rate twice as fast for the Los Angeles area, and a rate double the Los Angeles rate for the Reno, Nevada and Las Vegas, Nevada areas.

2.1.5R.11 Land Use

Historic Land Use Trends

In southeast Oregon and western Nevada the range livestock industry has thrived along with a fluctuating mineral economy. Where the proposed pipeline enters California, Fish Lake and Deep Springs valleys, livestock grazing has prevailed as the principal use. Small scale mining occurs in the side valleys.

Land in the Owens Valley was first irrigated by the Piute Indians. In early 1800's the miners' needs for food provided the incentive for intensive development of the area. Since then, the City of Los Angeles has acquired the water rights and associated lands. Farming and ranching, the principal uses, still are carried on to the extent they are compatible with the exporting of water to Los Angeles.

The general trend appears toward increased recreational use and increased mineral exploration and development. Toward the southern terminus of the proposed pipeline, recreation-residential use is expected to increase quite substantially.

Current Land Use

The future expansion of the pipeline from Rye Valley, Oregon to Cajon, California would traverse sections of Oregon, Nevada, and California. General land use within a 10-mile wide corridor centered on the pipeline alignment is described for each state.

The first segment of the future expansion of the pipeline route passes through eastern Oregon from Rye Valley to the Nevada border. The pipeline corridor crosses portions of the Malheur River Valley, the hilly open countryside of southeastern Oregon to the Nevada border.

Approximate land requirements for the fully-powered system can be found in Table 2.1.5.11-3.

Most of the land to be traversed through southeastern Oregon is rolling federal rangeland under the administration of the Bureau of Land Management.

Recreational facilities within the corridor are located primarily in the Malheur Basin where hunting is extremely popular. Upland game birds are plentiful throughout the area, and the rangeland has pronghorn antelope and mule deer.

The segment of the pipeline corridor in Oregon will probably retain its present land use pattern of farm and rangeland for the foreseeable future.

Nevada (323 Miles)

The proposed pipeline route in the state of Nevada follows a generally north-south direction from a point west of McDermitt at the Oregon border to Fish Lake Valley astride the California border. The alignment passes just west of Winnemucca on a southerly heading to Oasis, California. The arid land is mostly open range and desert. The vegetative cover is mostly northern desert shrub and salt desert shrub. A small amount of pinyon-juniper occurs near the alignment. The very limited amount of available water severely restricts the use of the land for agricultural production. Within the proposed pipeline right-of-way there is 26 miles of cropland and over 295 miles of pasture and rangeland. Information on detailed land use and ownership along the right-of-way is given in Table 2.1.5.11-4.

Due to the low level of precipitation, only small areas in a few of the northern Nevada valleys are used for dry farming. In the valleys of the Quinn and Humboldt Rivers, irrigation is carried on close to the streams. Hay and other animal feeds are the principal crops.

Rangelands play an important role in supplementing family income in the small communities. Both sheep and cattle utilize the rangelands. It is common practice for families to run a few head of livestock on the range in addition to their other operations. Lands used for grazing are also used

Table 2.1.5.11-3 Approximate land requirements for the fully-powered system.

Description		Approximate Acreage
New Right-of-Way:		
Canadian border to Stanfield, Oregon		3,394
Stanfield, Oregon to Rye Valley, Oregon		1,009
Rye Valley, Oregon to Nevada-California border		6,109
Nevada-California border to Cajon, California		2,933
Existing Right-of-Way Utilized:		
Stanfield, Oregon to Rye Valley, Oregon		336
	Subtotal:	13,781
River Crossings:		
All	Subtotal:	47
Other Facilities:		
Compressor Facilities (12)		240
Measurement Stations (5)		25
Area Offices (2)		0
Operating & Maintenance Bases (5)		25
Landing Strips (3)		110
Mainline Valves (approx. 77)		1.5
Access Roads		75
	Subtotal:	476.5
APPROXIMATE Total Acreage During Construction		14,304.5 acres

Table 2.1.5.11-4 Land use information along the pipeline right-of-way in Nevada.

County	Number of Times Pipeline Crosses				Ownership of 100-ft Right-of-Way				Land Use of 100-ft Right-of-Way					
	Waterways	Railroads	Paved Roads and Highways		State or County	Railroad*	Private	U.S. Government	Cropland	Mixed Forest	Pasture and Range	River	Railroad	Road
Humboldt	5	2	6	Percent	--	--	32	68	22	--	77.8	0.1	0.1	0.1
				Acres	--	--	317	673	218	--	770	1	0.2	0.7
Pershing	1	0	3	Percent	--	--	16.6	83.4	9.9	--	90.1	0.1	--	0.1
				Acres	--	--	122	614	73	--	663	0.1	--	0.3
Churchill	0	0	1	Percent	--	--	--	100	--	--	99.9	--	--	0.1
				Acres	--	--	--	396	--	--	396	--	--	0.1
Lander	0	0	4	Percent	--	--	--	100	--	--	99.9	--	--	0.1
				Acres	--	--	--	432	--	--	432	--	--	0.4
Nye	0	0	4	Percent	--	--	7.1	92.9	4.7	--	95.1	--	--	0.1
				Acres	--	--	36	473	24	--	484	--	--	0.6
Mineral	0	0	0	Percent	--	--	--	100	--	--	100	--	--	--
				Acres	--	--	--	143	--	--	143	--	--	--
Esmeralda	0	0	5	Percent	--	--	12	88	--	--	99.9	--	--	0.1
				Acres	--	--	85	625	--	--	709	--	--	0.5
Total	6	2	23						315		3597	1.1	0.2	2.6

* Included with Private

Source: WEI analysis of: Bureau of Land Management maps Great Basin Region Comprehensive Framework Study (1971) for many other purposes, including watershed, wildlife habitat and recreation.

The ownership of the land along the proposed pipeline right-of-way is about 89 percent Federal, with nearly all of the remainder in private ownership. The Federal land is almost all under the administration of the Bureau of Land Management. Much of the privately held land in Humboldt and Pershing Counties was given to the railroads in the form of land grants to encourage the railroad construction of the 1860's. The railroads were granted alternate odd numbered sections of land on each side of their mainline tracks for distance of about 20 miles. This has resulted in a checkerboard pattern of land ownership along both sides of the railroad right-of-way. At Winnemucca, Nevada the proposed pipeline corridor center line traverses within the city of limits. It passes through a developing subdivision, closely parallels Western Pacific Railroad's switch yards and then crosses the mainline and the highway strip commercial developments southwest of the city.

While mining is not as significant as it was during the last half of the 19th century, some is still carried on in the general area, particularly around McDermitt, Nevada, where relatively large deposits of mercury have been tapped.

The portion of the state of Nevada to be traversed by the proposed pipeline has not been used or developed for recreational purposes to any significant extent. Hunting is a major recreation activity with deer, antelope, rabbits, and upland game birds the most frequently sought game. Four of the streams (Quinn River, Humboldt River, Thomas Creek, and Smith River) contain trout and support some fishing. Most of the hunting and fishing in the area is carried out by the local populous. The higher regions to the west usually offer better opportunities to the visitor for sport fishing and trophy hunting.

The Humboldt and Toiyabe National Forest areas have a small amount of development for picnicking and overnight camping, but even on these lands potential for such development remains largely untapped. Future recreational facilities will probably be located primarily in these sparse pinyon-juniper forests.

California (242 Miles)

Southern California Gas Company's proposed pipeline would traverse sections of Mono, Inyo, Kern, and San Bernardino Counties and end at Cajon near San Bernardino. The company estimates its land requirements in Table 2.1.5.11-5.

The proposed pipeline right-of-way will traverse 10 miles of forest land and 231 miles of pasture and rangeland. Land ownership and use within California are shown in Table 2.1.5.11-6.

Desert shrub vegetation is typical along the proposed corridor. Wildlife habitat, recreation, and limited grazing are typical land uses. Very limited irrigated agriculture exists. Outside of mining activities and small public service businesses, no significant industrial or commercial use of the involved lands is made. Recreation-residential use has increased rapidly in the past 15 years. The towns of Big Pine, Lone Pine, China Lake, and Victorville along U.S. Highway 395 and the proposed pipeline route reflect the importance of the tourist and recreation trade. They are generally single-street towns that stretch out along the highway with a

Table 2.1.5.11-5 Approximate Land Requirements for the Proposed Facility Southern California Gas Company

Description	Acres (Approx.)
Construction	
Pipeline:	2933.0
New right-of-way (242 miles long, 100 feet wide), from Nevada-California border to Cajon, California	
Owens River Crossing:	1.4
In addition to 100 ft. right-of-way: 1.4 acres	
Compressor Station and Facilities:	
Compressor station: 20.0 acres	
Valves (Approx. 16): 0.2 acres	
Access roads: 3.0 acres	
Total land required during construction:	2957.6
Operation and Maintenance	
Land allowed to revegetate or revert to prior use:	2944 - 2949
New land use:	9 - 14

Table 2.1.5.11-6 Land use along the pipeline right-of-way (Southern California Gas Company).

County	Number of Times Pipeline Crosses: Waterways	Railroads	Paved Roads and Highways		Ownership of Right-of-Way: County or State*	Private	U.S. Government	Land Use of Right-of-Way: Cropland	Mixed Forest	Pasture and Range	River	Railroad	Road
Mono	0	0	1	Percent	0.2	--	99.8	--	--	99.8	--	--	0.2
				Acres	<1	--	97	--	--	97	--	--	<1
Inyo	1	2	4	Percent	24.4	48	27.6	--	5.7	94.2	<0.1	<0.1	<0.1
				Acres	364	715	412	--	85	1405	<1	<1	1
Kern	0	1	3	Percent	0.1	14.8	85.1	--	--	99.9	--	<0.1	0.1
				Acres	1	48	278	--	--	325	--	<1	1
San Bernardino	0	2	9	Percent	0.1	49.4	50.5	--	3.5	96.4	--	<0.1	0.1
				Acres	1	503	514	--	36	981	--	<1	1
Total	1	5	17	Acres					121	2808	<1	<1	4

Including City of Los Angeles

random series of motels, service stations, cafes, sporting good stores, and curio shops.

The proposed pipeline would parallel Owens Valley. This valley is a major north-south transportation corridor which connects the northern Great Basin with the Los Angeles area and provides access to the eastern flank of the Sierra Nevada. It is also the route of U.S. Highway 395, which extends from Carson City, Reno, and the interior West.

Federal and State highways parallel the proposed pipeline route. Three separate railroads are crossed by the proposal, the Southern Pacific, Atchison-Topeka and Santa Fe, and California Railroad. Interstate Highway 15 is crossed near the southern terminus.

The proposed right-of-way also parallels the Los Angeles aqueduct through Owens Valley to a point near the Inyo-Kern County line. Numerous electric transmission service lines traverse this area as well as natural gas, water lines and irrigation ditches.

Within the proposed corridor approximately 56% of the land is federally administered. These federal lands have been reserved for the China Lake Naval Test Station and Edwards Air Force Base. These military installations are used for landing fields, bombing and gunnery ranges and test stations. Two major Federal land agencies are the Forest Service on the Inyo and San Bernardino National Forest and the BLM national resource lands. Also, land is reserved in Owens Valley for the protection of the City of Los Angeles water supply.

The proposed corridor that crosses the southwest corner of the Naval Test Station (China Lake) and the very northeast corner of Edwards Air Force Base is under the flight paths of experimental aircraft being tested. The Naval Weapons Center near China Lake, California includes air-to-ground live weapons testing. Guided and unguided weapons are tested. The proposed pipeline location traverses a corner of the "fully instrumental range."

The State of California Code (Section 63502 and 65563) required counties to have developed comprehensive plans by June 30, 1973. Generally, zoning for the area is "DL" (Desert Living), which in San Bernardino County is a broad general category requiring site approval before development starts.

Recreational-residential use is expected to intensify. Mineral and geothermal exploration and development could also be expected to accelerate at least for the next 5 to 10 years.

Most counties have completed land use plans or have the County zoned. Table 2.1.5.11-7 shows status of planning for the counties the proposed pipeline crosses. Only Pershing and Nye counties in Nevada are lacking in a formal plan. Several counties are in the process of proposing more comprehensive land-use plans. Adjacent time was not available to analyze each county zoning as it relates to the proposed pipeline location.

2.1.5R.12 Archeology, History and Paleontology

List of Known Sites

Tables 3.1.5.12-1, -2, and -3 in the appendix are compiled from the Interstate Transmission Associates (Arctic) application dated May 14, 1974 and from additional information supplied by the State Historic Preservation Officers of the affected states and BLM District Offices. Those sites

Table 2.1.5.11-7 Status of land use planning in counties crossed by the proposed pipeline route.

State and County	Land Use Restriction	Date Implemented
IDAHO		
Boundary	Zoned	March 1971
Bonner	Land Use Plan	December 1969
	Zoned	December 1969
Kootenai	Land Use Plan	May 1971
	Zoned	August 1972
WASHINGTON		
Spokane	Land Use Plan	October 1968
	Zoned	August 1973
Whitman	Land Use Plan	1968
	Zoned	No date
Columbia	Land Use Plan	February 1974
	Zoned	March 1962
Walla Walla	Land Use Plan	1967
	Zoned	No date
OREGON		
Umatilla	Land Use Plan	April 1972
	Zoned	July 1972
Union	Zoned	1964
Baker	Zoned	February 1974
Malheur	Land Use Plan	1973
	Zoned	August 1973
NEVADA		
Humboldt	Zoned	August 1963
Pershing	None Adopted	-----
Churchill	Land Use Plan	September 1972
	Zoned	July 1973
Lander	Land Use Plan	1969
	Zoned	January 1968
Nye	None adopted	-----
Mineral	Land Use Plan	1974
	Zoned	September 1965
Esmeralda	Zoned	October 1970
CALIFORNIA		
Mono	Zoned	1970
Inyo	Land Use Plan	1968
	Zoned	May 1970
Kern	Land Use Plan	June 1972
San Bernardino	Land Use Plan	1966
	Zoned	May 1974

marked with asterisks are on the "National Register of Historic Places" or State registers.

Only recorded archeological sites within the proposed corridor are listed. No new field assessment has been made to locate additional sites. Exact location of sites is not given to provide some degree of security from vandalism, but records of specific locations are available from the office of the State archeologist of the state concerned.

Proposed or Planned Sites and Areas

In preparing the enclosed tables, all State Historic Preservation Officers concerned have been contacted for latest submissions to State and federal historic registers. Not all known historical and archeological properties have been evaluated for National Register status and unknown properties may be of register quality. Executive Order 11593 and the Advisory Council on Historic Preservation Procedures for the protection of historic and cultural properties (36CFR800) require that all cultural properties within the area of potential environmental impact be identified and evaluated both for determination of effect and for eligibility on the National Register of Historic Places.

Potentially Significant Areas or Sites

Archeological

Malheur River to Winnemucca

Records show 13 archeological sites on or near the proposed pipeline. Steward indicates (1938, Figure 1) that this was Northern Paiute territory. Though he has little information, he indicates at least one old village site near Winnemucca. The Ft. McDermitt Indian Reservation contains the descendants of some of the prehistoric inhabitants of the area. The area is little known and though sparsely settled in prehistoric times, is isolated and relatively untouched providing the archeologist with an important resource.

Winnemucca to Fish Lake Valley

The survey records indicate 11 sites along the proposed pipeline, one of them a cave with pictographs on the proposed pipeline. Steward (1938, pp. 100-109 and Figure 8) indicates high concentrations of prehistoric populations in Edwards Creek Valley (2 winter villages), Ione (1 winter village) and Smith Creek Valleys. Both Northern Paiute and Shoshoni are found here making the area an interesting workshop with potentials for intercultural contact studies.

Fish Lake Valley to Little Lake

This stretch of proposed pipeline goes through one of the most heavily prehistoric populated areas in the entire proposal. At least 10 archeological sites are recorded and a very heavy population was known during first historical times. Steward (1938, p. 62 and Figure 7) states that in 1870 there were eight Northern Paiute villages in Fish Lake Valley, eight more within Deep Springs Valley, and 26 winter villages in Owens Valley between Big Pine and Owens Lake. Bettinger (1973) found literally hundreds of sites of significance in the Owens Valley that indicate a long, heavy use of this favored area. Important sites are the Cottonwood Creek site on the west side of Owens Lake (Riddell, 1951), the type site for the Cottonwood projectile point series; the Rose Spring site (B-372), a deeply stratified site producing a relative dating technique through the use of point types (Lanning, 1963); and the Stahl site near Little Lake which has yielded material dating back 3,000 years in addition to evidence of some of the oldest house structures in the New World (Grant, Baird and Pringle, 1968).

The following is from an unpublished report provided by the San Bernardino County Museum.

In Fish Lake Valley campsites have been reported from the alluvial slope and valley floor below the West-side canyons including Chiatovich, Indian, Marble, Bushes, Aiken, McAfee and Cottonwood Creeks.

There are also major campsites in the sand dunes. These sites have yielded a wide range of artifacts to numerous avocationalists. There is no record of a scientific survey having been made of this region. It is possible that the cluster of sites at Cottonwood Creek would be the largest locality affected here.

Deep Springs Valley is surrounded by campsites, flaking stations and bedrock grinding stones. This is especially true in the Southwest sector and on the rim above the valley.

As the route leaves Deep Springs Valley and comes to the head of Soldier Canyon it passes directly through one of the largest and richest concentrations of Indian sites in the White-Inyo Mountains. Cultural remains include hunting sites, flaking stations, camp sites, petroglyphs, and grinding stones.

After the route turns down the Owens Valley it passes below and close to the similarly large, rich archeological locality of Harkness Flat. The projected corridor passes directly through the largest concentration of sites in Owens Valley--the Tinemaha Reservoir area. Here are flaking stations, campsites, hunting sites, etc. Campsites predominate in the area of the dam, and in the sand dunes north of the reservoir. East of the Owens River, occupation was particularly heavy. When the water level is lowered in the reservoir, projectile points and other artifacts are abundant. This was certainly one of the main occupation areas in Owens Valley and extensive excavation may be necessary.

The Poverty Hills also show heavy evidence of occupation and there are petroglyph sites. The area is one of many that are significant in Paiute legends.

Best known archeological sites between Tinemaha Reservoir and Independence are Taboose Creek, Black Rock Springs, Goose Land and Duck Lake. Paleo-Indian artifacts (which are 7,000 or more years old) are abundant, especially on the east side of Owens River. The concentration of archeological evidence reaches another peak as the pipeline corridor moves southward toward Owens Lake. Archeological evidence is virtually continuous along the Owens River and related bluffs and dunes. Paleo-Indian artifacts continue to be most numerous on the east side of the River and are found in particularly heavy concentrations around the dunes east and north of Lone Pine.

On the west side of the Valley, each major creek drainage yields sites. This is true along the way from Tinemaha Reservoir on Taboose, Black Rock, Sawmill, Oak Creek, Independence, Symmes, Shepherd, Bairs, George, Hogback, Lone Pine and Tuttle Creek. At Alabama Gates just north of Lone Pine there is a major site.

The lower shorelines above Owens Lake playa yield material from Paleo-Indian and Paiute occupations. Among the richest of these sites are those on the beaches at the northwest corner of the playa. There is a similar major site which extends for a mile along Owens River before it reaches the playa and then for an undetermined distance out into the playa.

There are campsites and petroglyphs along the east side of Owens Lake, and there are campsites, bedrock and boulder grinding-stone clusters and flaking stations along the west side of the lake. There are also burials along the modern railroad right-of-way north of Cartago.

There is an important site at the entrance to Cottonwood Creek, north of Ash Creek which has been excavated. Other sites are located about one mile west of the highway and five miles south of Olancha (Loco Road), known as the Price Ranch Site. Additional major sites include one to the west of Haiwee Reservoir, and others at the mouths of Five-Mile, Nine-Mile, Sand Canyon, Short Canyon and Indian Wells.

There are other major sites south of Haiwee Dam including Rose Springs, the Garden Site, Haiwee, and a cluster of sites including ones with pictographs in the area east of Gill's Oasis at Coso Junction.

Starting at the base of Haiwee Dam (near where the power lines come off the lava flow) and extending across the lava bench to circa six miles north of the Kern County line, sites include flaking stations, rock shelters, campsites, and petroglyphs.

The well-documented Stahl Site just north of Little Lake is the type site for Pinto-Basin-type Paleo-Indian material in the western Great Basin. There are numerous sites including rock shelters and petroglyphs in the area immediately around Little Lake.

Little Lake to Cajon Pass

Some 16 sites have been recorded along or near the proposed pipeline in this section. Types of sites lead one to deduce a less dense population, but constant use by peoples accustomed to the rugged environment of the Mojave Desert. Numerous petroglyphs have been recorded in the Coso Range lava flow area and the Big and Little Petroglyph Canyon Archeological District, a National Historic Landmark, is located to the east of this portion of the proposed pipeline. The proposed pipeline crosses through the extreme northeastern end of Last Chance Canyon Archeological District, a National Register of Historic Places property. Various sites, including petroglyphs, have been reported in the area between the south end of Lava Mountain and the north end of Red Mountain. Most significant of these is the Steam Well Petroglyph site situated in the center of the study corridor.

Cajon Pass was the principal route from earliest times between the Great Basin and the interior of southeastern California, and the Coastal Region. Archeological sites antedating 1000 B.C. to the present can be found principally along the length of Crowder Canyon.

Historical

Malheur River to Winnemucca

Except for the identification of specific historic routes, trails, and roads, this stretch holds little promise for other types of historic properties since it was sparsely populated and settled mostly by ranchers at a late date. The Indian Reservation community at Ft. McDermitt offers some possibility for identifying historical and cultural sites of importance to them in their history. Some sites of military history importance could be identified such as the route of Major Stein in the Bannock Wars of the late 19th century.

Winnemucca to Fish Lake Valley

Several early east-west immigration and access routes cross this lightly populated area and not all of them have been fully analyzed for historical importance or specifically identified.

The historically important Emigrant Trail, Pony Express Route, and Overland Stage Route cross this section of Nevada. Similarly, many settlements and developments associated with both mining and ranching abound along the proposed pipeline. Many of these are abandoned, or are on the verge of being abandoned, while the sites of others have been lost through time (Table 3.1.5.12-2).

Fish Lake Valley to Little Lake

This area offers more potential for identification of historic sites. It has had a fairly long and complex history, but until recently, has received little attention. The sites already listed and evaluated, some 13, indicate the potential for other sites.

Indian populations in the area have gained a renewed interest in their historical and legendary past. Potentials lie in the fields of mining; recent water conservation systems and "water wars" associated with their development; historical sites associated with early exploration; railroad building; and military occupation, in addition to those already known.

The following is from an unpublished report from the San Bernardino County Museum.

Historic ranches existed and to some extent still exist in many parts of Fish Lake valley. As with prehistoric campsites, water was the governing factor. Hence, ranches were usually established below canyons and near the central drainages.

Approaching Deep Springs Valley from the east, the projected corridor passes among several petroglyph sites and near the historic White Mountain City.

Coming out of Deep Springs Valley, the proposed route follows Soldier Canyon down to Owens Valley. It was a direct route to and from Owens Valley and Fort Independence and soldiers from Fort Independence had cabins and shops in the canyon. There were also ranches and settlements in and around lower Soldier Canyon. Near the mouth of the canyon is the historic site of Monola. To the east from Owens River, the mountain slopes and canyons are filled with mining history. Crysopolis, Union District, Montezuma Mine are just a few of the famous mines.

Equally significant are the major irrigation canals that made agriculture possible and brought food to the miners, and the Carson and Colorado Railroad. One of the sources of irrigation water was Sangers Slough. South of Tinemaha Reservoir, Black Rock Ditch and Stevens Canal were vital to agricultural development.

On the eastern slope immediately above the Valley was the historical Jack Black Mining District. Historic mining districts and agricultural developments line the Valley along the east side of the river. Union District, Waucoba and Russ Districts are famous, as are the Green Monster and Snow Caps Mines, and the related towns of Bend City, Kersarge and San Carlos.

Mining and agriculture form the basis for the historical heritage moving south toward Lone Pine and Owens Lake.

McIver Canal and Eclipse Ditch brought water to a line of ranches along the east side of the Valley. The Reward Mining District dominated the hills east of Manzanar on the railroad. The Eclipse Mines were equally important further south.

Owens Lake had a unique role in the history of the Valley. The sawmill built on Cottonwood Creek supplied lumber to the kilns just west of Owens Lake. Ships were built to carry lumber and charcoal to the smelters and mines in the Cerrc Gordo District. These boats brought bullion back. Smelters, mills, flumes, pipelines, kilns and wharves make Owens Lake and its shores a unique chapter in California history. One of the boats was built on the Owens River circa 1-1/2 miles upstream from the Lake.

Little Lake to Cajon Pass

Again, this is a sparsely occupied country now, but many sites associated with Spanish and American exploration, early mining activities, immigration, even World War II activities such as General Patton's use of the desert, remain to be analyzed and identified in terms of today's historical conservation needs. Cajon Pass is a prime example, being the major route from the north into Los Angeles Basin from time immemorial.

Paleontological

Fish Lake Valley to Little Lake

The following information is from an unpublished report from the San Bernardino County Museum.

Known fossil-bearing beds of Pliocene age were exposed in the vicinity of Circle Ranch, Esmeralda County, Nevada, in Fish Lake Valley. These beds also extend into the hills.

Further south in Fish Lake Valley, beginning near the Nevada/California line and extending southeastward along the west side of the Valley are known fossil-bearing deposits and probable fossil-bearing beds. Some are of Pliocene age, others are thought to be Pleistocene age. The area around Soldier Canyon is another Paleontological locality of unknown significance. A detailed survey is needed to determine Paleontological values.

The Coso Mountains east of Haiwee Reservoir contain famous Pliocene fossil beds. Vertebrate fossils alsc occur in ancient sediments above the lava flows just north of the Inyo County line. In the same area there are fossil-bearing deposits of probable Pleistocene age that are within the proposed pipeline route. One of these relates to Little Lake Creek and the other to the district between Five Mile and Sawtooth Canyons. Detailed surveys are needed to determine the significance and extent.

A major fossil locality of early and middle pliocene strata extends from the El Paso Mountains on the west to beyond Christmas Canyon (Searles Valley) on the east.

In addition to these major localities, Pleistocene fossils have been recovered in Owens Valley at numerous points including sites along Owens River below Hogback Creek, below Alabama gates and south of Lone Pine Station.

Background of General Area Which May Indicate Future Discoveries

Archeological

The proposed pipeline passes through two archeological culture areas: Great Basin, and South Coastal Californian.

South of about the Malheur River, the Great Basin has provided the archeologists some of the finest, earliest, perishable materials to analyze in the West from such caves as Roaring Springs and Catlow in southern Oregon and Leonard, Lovelock, and Humboldt in northern Nevada. Earlier still are some of the sites associated with the Pleistocene lake beaches throughout the basin. The Calico site in southeastern California, a lithic complex, may date back 100,000 years. There seems to be little change in the lifestyle of the Great Basin once the large pleistocene mammals disappeared. Hunting of small game, gathering of all manners of seeds and roots, winter "wiki-up" style house villages near water, and on the pinon-sage dividing line, summer gathering expeditions and periodic social get togethers in the winter seems to have lasted almost 10,000 years until the advent of European civilization. In conjunction with this life style, trails, campsites, sleeping circles, and rock art have provided vital information in a culture area that provides the archeologist with a laboratory of a simple untouched resource that can provide many answers to knowledge of human culture. Site density in the southern California section is known to run as high as 10 sites per square mile (Bettinger, 1973). The proposed pipeline in southern California passes along the eastern boundary of the several groups that constitute the California Coastal culture area. The upland or noncoastal groups in this culture were similar to the Great Basin culture in life style, but affected somewhat by closer and longer contact with the marine oriented coastal peoples. Some of the very early impetus for the development of the interior cultures may have come from these coastal areas and Cajon Pass is one of the principal routes of access. Trails, campsites, village areas, burials, and rock art have provided much of the past information. The present day impact of our civilization in the heavily populated coastal areas has about wiped out vestiges of this culture making the remaining sites that much more valuable.

Historical

The historical background of the proposed pipeline is much the same throughout its length except to substitute early British exploration and settlement of the Oregon (and Washington) territory for a similar Spanish endeavor in the California-Nevada region. The pattern then becomes one of governmental sponsored geographical explorations. Soon after came the mining boom of the mid-19th century followed by either farming activities where they could be supported, or ranching. All three activities generally brought about problems with the indigenous peoples and resulted in military intervention until the late 19th century. In the early 20th century, increased development of the water resources occurred in certain areas of Washington, Oregon, and California as the result of railroad building in the late 19th century. Other transportation problems were constant throughout the development period and in some instances, as in parts of Nevada, no real development has taken place since the closing of the gold and silver boom mines. Many of the historical events and resultant properties and sites along the proposed pipeline were short-lived, or of local importance only in a sparsely settled land, or too recent really to have full historical analysis. Old does not necessarily mean historic, but neither does lack of placement on a list of historical sites mean lack of historical significance.

Paleontological

The paleontological information along the proposed route is for the most part lacking. Preliminary studies have been conducted in a few areas, but future discoveries will undoubtedly be made throughout most of the area. What appears to be of special significance is Owens Valley and the surrounding area.

2.1.5R.13 Recreational and Esthetic Resources

Recreation Facilities, Areas and Resources

Oregon

From Rye Valley the proposed pipeline route traverses the length of eastern Oregon for approximately 180 miles. The future, fully-powered system would continue on through the Malheur River Valley and across the hilly open countryside of southeastern Oregon to the Oregon/Nevada border. This covers a combination of publicly and privately owned lands, of which approximately two thirds are under Federal jurisdiction (mostly National Resources Lands administered by the U.S. Bureau of Land Management in southeastern Oregon).

The southeastern part of Oregon, although dry and rugged plateau country without many developed recreation sites, provides a considerable amount of outdoor recreation opportunities. The Malheur-Owyhee upland consists of lava formations which are geologically older than those to the west. The eastern section of the region also has a number of spectacular canyons cut by the Owyhee River and its tributaries. The water resources of the region are used mostly for irrigation, primarily in the Snake River plain and the lower Malheur Valley. There are a few natural lakes, but several large reservoirs have been created, notably, Owyhee Lake south of Vale, Oregon.

The proposed route does not pass over any developed recreation sites, and only a few are within 5 miles of its proposed location.

One of the critical priority areas mentioned in this document is the identification and protection of outstanding scenic areas and waterways. Segments of the South Fork and main stem Owyhee River, although currently protected as Scenic Waterways under Oregon's Scenic Waterways System, are identified with other segments of the Owyhee as needing "national study" (for possible designation as a National Wild and Scenic River). Segments of the Malheur River is identified as needing "state study" (for possible designation as State Scenic Waterways). The proposed pipeline route crosses an identified segment of the Malheur River approximately 15 miles southwest of Vale, near Harper. The proposed route also passes within 2 miles of the canyon breaks now designated as part of the Owyhee River Scenic Waterway. These particular rivers not only provide outstanding natural and scenic qualities, but also seasonal opportunities for float trips by drift boat, canoe, kayak, and rubber raft.

The proposed route traverses Dry Creek Canyon, a steep walled and fairly deep canyon tributary to the Owyhee River, located in T. 23 and 24 S., R. 41 and 42 E., W.M. This area, presently free from disturbance, is inaccessible and exhibits primitive area qualities.

The pipeline route closely parallels the proposed High Desert Trail for several miles and crosses it at least once near Rye Valley. This trail, if designated and developed, will most certainly receive heavy use by hikers and backpackers, particularly during the winter months.

Eastern Oregon offers some of the best hunting in the state (see Section 2.1.5R.7).

Early season trout fishing is primarily confined to irrigation reservoirs, ponds, and some lakes at lower elevations. Only a few streams are low enough in elevation to allow good spring trout fishing.

Rock collecting opportunities are excellent near the proposed pipeline route, especially along the southeastern portion which is noted for its diverse geology. Quality geodes, thunder eggs and wood jasper can be found in the vicinity of the route west of the Owyhee River breaks near Skull Springs. Jasper agate and snake agate can be found near the Morrison Ranch along the Owyhee River east of Cedar Mountain, and just south of Rome, Oregon respectively.

Nevada

The proposed pipeline enters Nevada approximately 2 miles west of McDermitt on the Oregon Nevada border and, taking full advantage of this region's parallel north-south trending mountain ranges and intervening valleys, traverses southward through 10 major valleys for approximately 323 miles to the Nevada-California border.

Approximately 89 percent of the land along the pipeline route is under Federal jurisdiction and, with few exceptions, is administered by the U.S. Bureau of Land Management. Almost all of the remainder is privately owned. The proposed route passes just west of Winnemucca and Silverpeak, the only two sizeable communities near the Nevada portion of the proposed pipeline.

Development of outdoor recreation facilities has been relatively slow in this part of the West. Although the pipeline route would traverse over 300 miles of Nevada, only a few developed sites are located near it, and most of these are further than 20 miles away. However, for those who don't mind roughing it there are many pleasant out-of-the-way spots where you can pitch a tent or park a trailer.

Off-road vehicle use is extremely heavy along some of the proposed pipeline route, particularly in the sand dune area along the Little Humboldt River 10 miles north of Winnemucca and along a good portion of Fish Lake Valley. Outstanding opportunities for off-road vehicle activities are available all along the proposed route, and increased use of these arid lands for this purpose is anticipated.

The story of the early trails in Nevada can never be completely told. Most of the pioneers and early explorers were so busy trying to survive that they kept no records of their travels or, if they did, left journals too meager to be of much help. However, historians continue to follow up slim leads with good success, and many of the old routes are fairly accurately established. The Ogden Trapper Trails of 1828 and 1829, Bidwell-Bartleson Trail of 1841, Fremont-Talbot Trail of 1845, Donner Trail of 1846, Goose Creek-Humboldt River Trail, and Emigrant Trail all passed through the Winnemucca area. A second Fremont Trail of 1845 passed through central Nevada's Big Smokey Valley and the Pony Express Overland Mail Route traversed the entire state. Except for the Ogden Trapper Trail of 1828, all of these trails generally followed an east-west line. Since the pipeline route alignment is north-south through Nevada, the trail routes mentioned above are crossed at some point (including the Ogden Trapper Trail of 1828 since its route passed just west of and through Winnemucca heading north toward McDermitt). The Pony Express Overland Mail Route is crossed by the proposed pipeline route in the SW of Sec. 12 and the NE 1/4 of Sec. 23, T. 17 N., R. 39 E., M.D.M. The U.S. Bureau of Land Management is marking this segment of the trail in connection with the 1976 American Bicentennial celebration. Although exact pipeline route crossings of the other trail routes mentioned above are difficult to pin down, the following has been determined. The Ogden Trapper Trails of 1828 and 1829 (no visible remains), Bidwell-Bartleson Trail of 1841, Fremont-Talbot Trail of 1845, Donner Trail of 1846, Goose Greek-Humboldt River Trail, and Emigrant Trail all passed through the Winnemucca area, and are crossed by the proposed pipeline route approximately one mile west of Winnemucca in T. 36 N., R. 37 and 38 E., M.D.M. The other Fremont Trail of 1845 is crossed by the proposed route in T. 8 N., R. 38 E., M.D.M. at a point approximately 6 miles north of the Nye County line. These early trail routes provide outstanding opportunities for historical and educational interpretation.

Several historical sites and points of interest are located near the proposed pipeline route which provide opportunities for public visitation. Fort McDermitt, established in 1865, was the longest occupied Army post in Nevada, and troops stationed there participated in the California Modoc and Bannock Indian Wars. The Fort McDermitt site lies approximately 2 miles east of the pipeline route in McDermitt. Also located near Fort McDermitt is a memorial to Sarah Winnemucca Hopkins, daughter of Chief Winnemucca, a Paiute Indian. Four historic overland stagecoach sites, Castle Rock, New Pass, Paradise Wells, and Willow Point, are located in close proximity to the pipeline route (see Table 3.1.5.12-1 of Section 2 for location description). Nothing remains of either the Castle Rock, Paradise Wells or Willow Point stations, and their historical significance is considered minor and of local interest only. However, foundations and portions of station walls remain at the New Pass site and it is considered to be of regional and possible national significance. The State of Nevada has erected a historical marker at the site for interpretation purposes.

The Piper Peak area, located due east of the proposed pipeline route in T. 2 and 3 S., R. 36 and 37 E., M.D.M., has been identified as a potential primitive area by the U.S. Bureau of Land Management. If designated as a primitive area, opportunities will be available for hiking, backpacking, camping, and natural interpretation.

Nevada is famous for its ghost towns and old mining camps, and several are located throughout the region that would be traversed by the pipeline route. Table 3.1.5.12-2 lists those found near the route. These old sites are of interest to recreationists and amateur historians and many people search through the area for "valuable finds" such as purple bottles, and sundry remains of pioneer living. Not only does the search for relics continue, but many people find the settings unique for painting and photography.

Associated with visiting historic sites and mining camps, is the ever popular pastime of rock collecting. The variety of geologic formations and existence of semi-precious minerals makes central Nevada a foremost center of attraction for rock collectors, both professional and amateur.

Big game and upland bird hunting continues to top the list as the most popular outdoor recreation activity in Nevada. Mule deer is the predominant big game species and can be found virtually anywhere near the proposed pipeline route. However, they are most plentiful at higher elevations in Humboldt, Lander, and Esmeralda Counties. Desert bighorn sheep roam in Bunker Hill area of the Toiyabe Range south of Austin in Lander and Nye Counties, and in the Monte Cristo and Silver Peak Ranges of Esmeralda County near the southern portion of the Nevada segment of the proposed route. Only small, widely scattered herds of pronghorn antelope occur near the route. The Nevada Fish and Game Commission issues only a limited number of permits for hunting Desert bighorn sheep and pronghorn antelope.

Upland game bird populations near the proposed pipeline route are fairly good, with Chukar partridge, quail, Sage grouse, Ringneck pheasant, and western morning dove hunting opportunities available. Chukar partridge hunting has become outstanding in many areas near the route, while hunting the other upland birds continues to be good.

Four of the streams (Quinn River, Humboldt River, Thomas Creek, and Smith Creek) contain trout populations and support some sport fishing use. A majority of the fishing and hunting near the proposed route is enjoyed by the local populace, while higher elevations to the west usually offer better opportunities for non-resident sport fishing and trophy hunting.

California

From the Nevada/California border in Fish Lake Valley near Oasis, the pipeline route traverses California in a southerly direction for approximately 242 miles to a point where it terminates near Cajon, California.

From a recreational viewpoint, the California high desert area traversed by the proposed route provides many and varied recreational opportunities. Some of the more popular recreation activities include sight seeing, photography, painting, backpacking, camping, rock collecting, nature study, hiking, mountain climbing, hunting, shooting, sail-plane flying, picnicking, and off road vehicle (ORV) driving, both organized and non-organized. While camping and picnicking may require formal facility development, many people prefer the freedom of self-selected sites to participate in the activities of their choice.

No developed recreation sites operated by a federal, state, or local government agency are crossed by the proposed pipeline route. The route does cross a privately owned and operated motorcycle park, approximately 10 miles south of Ridgecrest near U.S. Highway 395.

Known historic sites in the vicinity of the pipeline route are listed in Table 3.1.5.12-1.

Desert wildflowers and wildlife entice many thousands of people to visit the region during the spring months. Areas along the proposed pipeline route which are of particular interest to these visitors include:

- The Alabama Hills: In favorable years, especially in May, there are outstanding displays of wildflowers throughout the Alabama Hills area. In addition to wildflowers, unusual rock formations attract visitors to this area. Many western movies and television programs have been filmed on location in this region. Located three miles west of Lone Pine, this area was designated by the Bureau of Land Management as recreation land in 1969.

- Haiwee: Located 4 miles south of Olancha, this area is known for its flame-colored desert mariposa, which usually blooms early in May. North of Haiwee, in early April, pepper grass forms a conspicuous green-gold mat.

- The area north and east of Little Lake: This area is a colorful garden with some unusual flowers--the gray, little reddish Bigelow Minulus, with flowers almost as large as the plants; the tall, wooly thistle sage, with flowers as beautiful as miniature orchids; several of the most beautiful desert lupines; and the rare, one-inch high pygmy poppy with shining white petals.

- The south end of Golden Valley: Located within the Lava Mountains northeast of Johannesburg, this area is touched by the pipeline route. This enclosed valley is an exceptionally scenic and significant natural area. In spring, the valley is noted for its expansive, spectacular wildflower blooms.

- From Fremont Peak to Yucca Forest Ranch: The Joshua Tree is the dominant component in the landscape.

- Oasis-Westgard Pass Area: This area is proposed by the Bureau of Land Management as a California Desert National Conservation Area.

- From Olancha to Cajon Pass: This area is also proposed by the Bureau of Land Management as a California Desert National Conservation Area.

Areas along the pipeline route which provide opportunities to observe wildlife include:

- Tinemaha Reservoir: Located between Bishop and Independence and about 1 mile west of the proposed pipeline route, this area provides opportunities for osprey observation.

- Tule Elk Calving Area: This area is located 1 mile west of the proposed route and 1.5 miles south of Tinemaha Reservoir. A viewpoint has been provided as a result of a cooperative project of the Interagency Committee on Owens Valley Land and Wildlife. This viewpoint affords the public opportunities to view the Tule Elk herd during the summer months.

- The area just south of Owens Lake: The rare Mojave ground squirrel may be observed in this area.

Weekend traffic is always heavy along U.S. Highway 395. The Inyo Forest and Mammoth Mountain regions are the primary fishing and snow skiing areas for millions of people in the Los Angeles Basin and south-central California. Also, U.S. Highway 395 is the major highway route between San Bernardino and Reno, Nevada.

The west side of Owens Valley is on the eastern flank of the Sierra Nevada Mountains. Here numerous camping, picnicking, and hiking opportunities are provided by the U.S. Forest Service, the Bureau of Land Management, and Inyo County. As previously stated, no developed recreation sites are located within the pipeline route.

Rock collecting is a popular activity throughout the region. A variety of minerals and gemstones are available and this area is particularly attractive to large groups who like to combine caravan camping with rock collecting.

Land sailing, glider flying, and model plane flying are recreational activities increasing in popularity in the California high desert area. These activities are pursued on dry, flat, relatively hard lake beds.

Probably the most controversial recreational activity in the high desert today is that of off-road recreation vehicle use. Off-road vehicle (ORV) users are as diverse in their preferences for use areas and the activities they participate in as the variety of vehicles they use. ORV users may be classified into three principal categories including: (1) those interested in activities or events, (2) the vehicle oriented user, and (3) the land oriented user. The land oriented user is interested in conquering the diverse terrain encountered and also has an appreciation for the remoteness of the area.

The Bureau of Land Management developed an interim critical management program for vehicle use on the California desert. This program is designed to accommodate recreation vehicle use and also to protect the fragile desert resources. The desert was segregated into 71 numbered areas designated as either open, closed or restricted to off-road vehicle use.

Esthetic Evaluation of Specific Landscapes

It is difficult to assess the visual environment of any area because of its qualitative nature. In an attempt to be as objective as possible, the character and visibility of the esthetic environment along the proposed pipeline route were quantified using a system developed by the U.S. Forest Service (Bacon, 1972). Refer to Section 2.1.5E.13, Recreational and Esthetic Resources for that portion from Rye Valley, Oregon to the Malheur River.

The following are evaluations of esthetic values of specific landscapes:

Malheur River (1 Mile)

The Malheur River is the largest river crossed by the proposed pipeline route in southeastern Oregon, which makes it more visually apparent than any other waterform in the landscape of this region. Also, the Malheur River Valley is used extensively for agriculture. These farmlands provide considerable contrast to the surrounding shrub-steppe vegetation.

State Highway 20, which runs along the Malheur River, is a major travel route in eastern Oregon; consequently, a relatively large number of people view the landscape. Therefore, this type landscape is given a Class 2 sensitivity rating.

Malheur River to the California-Nevada Border (457 Miles)

This geographic landscape is composed of a number of long, narrow valleys which are often bowl-shaped with either playas (old lake beds) or salt flats occupying the lowest part of the bowl. The mountains that flank these valleys are cut by numerous deep ravines and gullies. In several cases, these mountains rise at a grade of almost 24 percent, their peaks forming jagged, sawtoothed ridges (Tobin and Santa Rosa Ranges).

From the valley floors to the upper slopes of the mountains, vegetation ranges from salt desert shrub communities through shrub-steppe to pinion pine-juniper forests. This graduation in plant communities provides some variety in color and texture to the vegetation pattern of the landscape.

The Quinn and Humboldt Rivers are the only two perennial waterforms in the landscape. These rivers add little to the variety of the landscape as they are generally narrow and their banks have almost no height. The riparian vegetation flanking these waterforms generally blends in with the surrounding vegetation.

Major travel routes through the area are U.S. Highway 95 in Quinn River and Paradise Valleys, U.S. Highway 50 in Edwards Creek and Smith Creek Valleys, and U.S. Highway 95 and State Highway 6 in the Columbus Salt Marsh. A relatively large number of people view the landscape.

Fish Lake Valley to the Lava Mountains (161 Miles)

This geographic landscape is composed of a series of elongated, bowlshaped valleys flanked by steep mountain ranges. Except for foreground views (up to 1/2 mile), and the valleys exhibit essentially no relief and appear to be quite smooth and regular. The form of the bordering mountains contrast sharply with the form of the valleys. In some cases, the mountains are so steep that they look like walls. Severe erosion has created a wide variety of unusual forms and surface variations. The contours of the mountains are angular, and numerous ravines cutting the slopes create visually strong vertical lines which tend to draw attention to the valley floors. The elongated shape of the valleys, emphasized by the framing effect of the bordering mountains, creates a visual axis which directs the viewer's attention up the length of the valleys.

In many landscapes, vegetation and relief tend to restrict the area that can be viewed from any given point. In this geographic landscape, the general paucity and low form of the native vegetation, coupled with the lack of relief in the valleys, permit panoramic views from many places.

Form and line are the dominant visual elements in the landscape. Since vegetation is normally sparse, there is little texture except in foreground views. Color is generally provided by soil types and rock. These colors are normally subdued and add little variety to the landscape. There are, however, some cases where strongly contrasting color can be found in rock formations. In these cases, color becomes an important visual element. Color may become the most important element at certain times of the day, such as sunset or sunrise, when sunlight creates interesting color effects on many rock formations, or during the spring when plants are in bloom.

There are five type landscapes in this geographic landscape.

Fish Lake Valley (10 Miles)

In this landscape, broad alluvial aprons gradually descend to the valley floor from the Silver Peak Range to the northeast and from the White Mountains to the southwest. The orientation of these aprons, along with the strong vertical lines created by intermittent streams that flow from the mountains to the valley, tends to draw viewer attention from the valley floor. The framing effect of the bordering mountain ranges and the intermittent river running down the valley creates a strong visual axis which orients viewer attention along the length of the valley.

The mountains that flank Fish Lake Valley do not show as much relief as the mountains in other areas of the geographic landscape. Lines are generally subdued and there are few interesting forms or surface variations. The height of the mountains averages 2,000 feet and slopes are not steep.

Form and line are the dominant visual elements of this landscape, as texture and color add little variety.

Deep Springs Valley (18 Miles)

Deep Springs Valley is flanked by the Inyo Mountains on the south and east, and by the White Mountains on the north and west. These mountains rise abruptly as much as 3,500 feet above the valley floor. Numerous strong lines and angular forms created by erosion of the mountain faces contrast sharply with the relatively smooth, flat valley floor. The small size of the valley tends to emphasize and exaggerate the massiveness of the mountains. From most points, the vertical lines created by the intricate drainage patterns cut into the Inyo and White Mountains tend to draw viewer attention to the valley floor.

Deep Springs Lake at the southwestern end of the valley is the strongest single focal point within the landscape. All intermittent streams in the valley flow to it and visual lines created by their beds orient viewer attention.

Vegetation patterns add little to the variety of the Deep Springs Valley landscape. Pinon pine-juniper stands on the upper slopes of the bordering mountains add some color to the overall scenery.

White Mountains (3 Miles)

The lines and forms created by drainage patterns which cut the slopes of these mountains are subdued and relief is regular, resulting in smooth, even contours. Pinon pine-juniper stands on the higher slopes add color and texture.

Owens and Rose Valleys (90 Miles)

This landscape contains extreme visual prominence of the Sierra Nevada flanking the western side of the two valleys. These mountains rise abruptly as much as 7,000 to 10,000 feet above the valley floors at a grade of approximately 30 percent, giving the impression of being more a wall than a mountain range. Numerous strong lines and angular forms created by erosion of the mountain faces contrast sharply with the relatively smooth, flat valley floors.

From most points, the Sierra Nevada Range (and to a lesser extent the Inyo Mountains flanking the east side of the valleys) acts as a strong axis to orient viewer attention in a north-south direction along the valley floors. North-south lines created by the Owens River, the Los Angeles Aqueduct, and U.S. Highway 395 reinforce this visual axis.

Owens Lake becomes a prominent focal point for many views at the southern end of the Owens Valley. This dry lake provides considerable contrast to the tans and greens of the surrounding vegetation and soils.

There are several features in this type landscape which are relatively unique to the region, and consequently tend to attract viewer attention. The Owens River, Haiwee Reservoir, Little Lake, and the Los Angeles Aqueduct are the only perennial waterforms in the geographic landscape. Riparian vegetation along the Owens River and scattered cultivated fields also add unique shapes, lines, forms, and color to the landscape.

Most people viewing this landscape do so from U.S. Highway 395 which is presently designated as a California State Scenic Highway. This highway is used heavily by vacationers traveling between Los Angeles and the Sierra Nevada Range.

Indian Wells Valley (40 Miles)

The Sierra Nevada Range flanks the west side of Indian Wells Valley, rising 3,000 feet above the valley floor at a slope of approximately 15 percent. The highly eroded formatations and severe surface variations of the mountains add considerable variety in line and form to the landscape.

From most points, the Sierra Nevada Range dominantes this landscape. Besides these mountains, however, there is little variety in topography. Indian Wells Valley is broad and flat, and the mountains to the north, east, and south have a fairly low profile. Except when they are in near middleground views (1/2 to 2 miles), the mountains add virtually no variety in line or form.

Scattered stands of pinon pine and juniper on the upper slopes of the Sierra Nevada Range add color to the landscape. Vegetation on the valley floor is so sparse that it adds color and texture only to foreground views (up to 1/2 mile).

Although the Sierra Nevada Range adds considerable variety to the landscape, it is not sufficient to completely overcome the uniformity of vegetation pattern and the regularity of topography of the rest of the area.

Lava Mountains to Cajon (81 Miles)

Topography over most of this geographic landscape is relatively flat and uniform, thus eliminating landforms as an important visual component of many views. Mountains to the north and the south provide some variety to the landscapes, and erosion has proceeded for a long enough time that alluvium from the mountains in the north has filled the adjacent valleys. Peaks of the few remaining mountains rise only a thousand feet above the valley floors. Because of the lack of relief of the surrounding land, viewer attention is generally drawn to these isolated peaks. In the south, the San Gabriel and San Bernardino Mountains tend to dominate views as they are fairly high and have a wide variety of forms and lines.

Vegetation patterns are important in this geographic landscape. Joshua tree woodlands cover much of the landscape, providing variety in form, line, texture and color. These trees are scattered enough so that viewers are able to differentiate individuals in middleground as well as foreground views. The unusual linear forms of these plants result in a wide variety of lines and shapes that attract viewer attention. These vegetation patterns, coupled with the lack of variety in topography, tend to cause the viewer to ignore the background and focus attention on the Joshua trees in the foreground and middleground of most views. Chaparral and juniper on the slopes of the San Gabriel and San Bernardino Mountains add texture and some color to the landscape.

In general, color is not an important visual element in this landscape. Most color is provided by the tans and browns of different soil types. These colors are normally subdued and add little variety. Color may become an important element at certain times of the day, such as sunset or sunrise, when sunlight creates interesting color effects on landforms, or during the spring when plants are in bloom.

There are three type landscapes in this geographic landscape.

Lava Mountains to Fremont Peak (13 Miles)

The proposed pipeline route passes through a geologically old valley in this area. Alluvium has filled much of the valley and several passes between mountain peaks, giving the visual effect of a few isolated, steep hills on a relatively flat plain instead of a basin flanked by mountain ranges.

Because these few remaining mountain peaks provide the only form to the topography in most views, they become the focal point of viewer attention. In most instances, the mountains are darker in color than the soil of the surrounding plain. This is particularly true of Red Mountain, where the red hue of the mountain rock contrasts rather sharply with the tan soils surrounding it. This color contrast increases the influence of the mountains as the focal point of most views in the landscape.

As in most landscapes of this region, alluvial aprons descend to playas; in this case it's Cuddeback Lake, near the center of the valley. In many landscapes this descent is steep enough to draw viewer attention to the playa. This is not, however, the case in this landscape. Cuddeback Lake is not normally a strong focal point, but at certain times of the year, when the lake contains some water, it becomes an unusual component of the landscape and attracts much viewer attention.

Vegetation is sparse in this landscape and adds little texture except in foreground views.

People using off-road vehicles visit the area near Cuddeback Lake. Some of these people do not have a major interest in its scenic quality, but instead, derive most of their pleasure from driving (Bureau of Land Management, 1973).

Fremont Peak to Yucca Forest Ranch (58 Miles)

The proposed route passes through relatively uniform, flat land in this area. There is only an occasional butte or hill to attract viewer attention.

Color provides little variety to the landscape. Except when plants are in bloom, the predominant colors are the muted tans and gray-greens of desert vegetation and soils.

Generally, the dominant visual components in the landscape are Joshua trees. They are abundant and add considerable variety in form and line to the landscape.

For approximately 21 miles, the landscape is viewed from either U.S. Highway 466 or 395. These two highways, and particularly U.S. Highway 395, are major tourist routes in the region, and most of the people using them have a major interest in scenic quality.

Yucca Forest Ranch to Cajon (10 Miles)

The San Gabriel and San Bernardino Mountains dominate most views in this landscape. These mountains rise 2,000 to 5,000 feet above the floor of the Mojave Desert at a grade of approximately 14 percent in some places. There is considerable contrast in form between the high eroded mountains and the relatively flat desert. A great deal of contrast in color and texture also occurs between the chaparral and juniper vegetation covering the mountains and the relatively sparse vegetation of the desert. Looking south from the Mojave Desert, viewer attention is dominated by the strong lines and forms of the mountains. Looking north from the mountains, a viewer is provided panoramic scenes of the Mojave Desert. The contrast in line, form, color, and texture between the Mojave Desert and the San Gabriel and San Bernardino Mountains is great enough for this landscape to be judged Class A variety.

Recreation Use Statistics and Site Locations

Annual visitor use statistics are tabulated in Table 2.1.5.13-1 in the appendix, by state, administering agency, and site. All data is for calendar year 1974 unless otherwise stated. Since data collection and analysis methodology differs substantially between various agencies, footnotes have been added for purposes of clarification and to help eliminate confusion where statistical data for a particular site has not been systematically kept by the administering agency, or where data is not available, the appropriate space has been left blank. Column 4 of this table is the location number key for Figure 2.1.5.13-1, Recreation Site Location Map in appendix B. Cross referencing will be necessary to interpret this exhibit which follows Table 2.1.5.13-1 in appendix B.

2.1.5R.14 Air Quality

See the discussion presented in 2.1.5E.14. See also Tables 2.1.5.14-1, -2, -3, and -4 in the appendix.

2.1.5R.15 Environmental Noise

Future expansion of the Los Angeles pipeline will follow a route from Rye Valley, Oregon to Cajon, California which travels through essentially undeveloped or rural areas similar to the surroundings of the proposed San Francisco route. Therefore the ambient sound levels along the expansion route may be characterized by those presented in Section 2.1.4.15 for the San Francisco line.

3 ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

3.1 ARCTIC GAS PIPELINE PROJECT

3.1.5 Los Angeles Pipeline

Introduction

This section is divided into two subsections. The first is titled Eastport to Rye Valley, addresses the currently proposed project from Eastport, Idaho, to Rye Valley, Oregon, and uses designations 3.1.5E___. The second subsection addresses a potential continuation of the project from Rye Valley to Cajon, California, is titled Rye Valley to Cajon (Future Expansion), and uses designations 3.1.5R___.

3.1.5E Eastport to Rye Valley

The proposed pipeline project would begin at Eastport, Idaho, and end at Rye Valley, Oregon. It would be 390 miles long and disturb a total of 4,739 acres. All except 29.4 miles would parallel Pacific Gas Transmission Company (PGT) and Northwest Pipeline Company (NPC) existing right-of-way and pipelines. The 29.4 miles of new right-of-way would begin at M.P. 2.25 in the Moyie River of northern Idaho, cross westerly into the Kootenai River valley, and then extend southerly down the Kootenai valley where it would reconnect with the existing right-of-way at M.P. 31.6.

The most obvious direct physical impact remaining after construction will be visual contrasts reflected in terrain scars and vegetation. This will vary from masked in farming areas to evident in timbered and range areas. Potentially the most hazardous direct impact after construction would be gas leaks and explosion resulting in loss of life and property.

The following are summary impact highlights expected by environmental elements:

Summary Highlights

Climate, Topography, and Geology

The proposal will have negligible impacts on these elements. Conversely, these elements can have significant impacts on pipeline construction; therefore, they are critical in the design and timing of construction activities.

Soils

Soils would be susceptible to accelerated wind and water erosion on 4,775 acres with vegetative removal. The wind-deposited soils of southeast Washington and northeast Oregon are highly susceptible to wind erosion. Much of this area is being farmed, and continued farming would tend to lessen the impact of pipeline construction. However, the erosive characteristics would need to be recognized.

Soils are dried more quickly when directly over the buried pipeline. This may reflect in lessened crop yields or make reestablishment of vegetation more difficult.

Water Resources

Long-term effects of the proposal on subsurface waters are expected to be minimal; however, surface waters will be subjected to severe disturbance during construction activities, especially at river crossings.

The proposed route crosses approximately 35 perennial streams, creeks, and rivers between Eastport and Rye Valley. The major crossings are the Kootenai, Pend Oreille, and Snake Rivers. Activities which interfere with normal flows or lessen water quality would cause adverse impacts.

Burying pipeline under water normally causes the greatest direct impact to surface water quality through increased turbidity. This may last from a few days to several weeks, depending mostly on stream size, and is usually confined to a short stretch of stream.

More serious impacts result when water is contaminated through the introduction of lubricants, fuels, or other chemicals from accidents or leaky equipment. Coliform count could increase as a result of human activities adjacent to surface waters.

Access roads, cleared stream banks, and other offsite locations provide a potential erosion source. Hydrostatic testing of the pipeline may use up to 750,000 cu ft of water. Uncontrolled or massive accidental release of this much water into or near a water source would cause increased turbidity, and possibly generate active gully erosion.

Water flows, particularly on smaller streams, may be temporarily reduced during underwater crossings. Blasting at or near springs sometimes changes the flow--increasing, decreasing, or even stopping it.

Vegetation

The 100-foot wide construction right-of-way (4,775 acres) will be cleared of existing vegetation.

Agricultural lands within the right-of-way may lose one season's production.

Any timber removed (approximately 1,200 acres) can be harvested initially, but trees will not be allowed to regrow within the 100-foot wide right-of-way during the project life.

The applicant states that "approximately 80 percent of the disturbed land (3,820 acres) will be allowed to revegetate naturally and/or revert to its preconstruction use."

If the applicant utilizes natural revegetation, it will take plant succession many years to establish a plant community similar to what exists prior to construction.

The change in vegetation creates a "scar" along the right-of-way. This scar will vary from highly visible in timber to barely discernible in farmland.

Many exotic species planted by man establish more rapidly in the right-of-way than native species, thereby intensifying contrasts between the disturbed right-of-way and adjacent areas. This is particularly true in rangeland areas.

Wildlife

The most significant potential adverse impacts would be on fisheries resources caused by underwater river and stream crossings. Major streams are the Moyie, Kootenai, Pend Oreille, Walla Walla, Snake, Umatilla, and Grande Ronde. Dredging, trenching, and equipment travel create stream bottom disturbance at work sites. Siltation of spawning beds or interference with migrating game fish can occur, and reduce survival rates. Underwater blasting can stun and kill fish.

No known rare, threatened, or endangered wildlife species, aquatic or terrestrial, inhabit the proposed right-of-way; however, some of these species occasionally cross the area or are located nearby. Impacts will be negligible.

Any life forms unable to physically move out of the way of heavy equipment risk death, but such losses are considered negligible. These might include common burrowing animals, molluscs, some invertebrates, etc.

Since approximately 92 percent of the proposed route follows existing buried pipeline rights-of-way, no added significant impact to large mammals such as deer and elk are anticipated. The 8 percent of new pipeline right-of-way from M.P. 2.25 to 32 contains no identified critical habitats for any species.

Ecological Considerations

The microecosystems within construction zones will be severely disrupted, but this is not a significant impact. Little offsite interaction between ecological components is expected, and consequently the 4,775 acres involved are considered to produce negligible impacts within the regional ecosystems. Such items as fugitive dust and fumes from equipment will migrate from the work sites and interact to an unknown degree with ecological components found offsite.

Socioeconomic Factors

Pipeline construction will inject a significant amount of new money into communities along the route, especially the smaller towns near construction spreads, resulting in local inflation. Facets of new money inflationary economy will persist even after construction is completed, particularly where towns are isolated from the larger competitive urban centers.

Approximately 30 percent of the 750 to 1,000 construction workers can be supplied from local labor sources. Based on an average of $85 to $100 per man gross earnings, a daily payroll of $75,000 to $100,000 could be generated for approximately 50 weeks.

Longer term economic benefits will accrue to states and subdivisions through property taxes on improvements. A permanent crew will be stationed in Spokane for manning an operation and maintenance station.

During construction, significant amounts of money will be expended for fuels, goods, and services, inducing significant but temporary socioeconomic disruption to local communities.

Land Use

Existing buried gas pipelines will be paralleled except for 29.4 miles. These rights-of-way already reflect most of the impacts on land uses. Construction of another parallel line has little additional impact on land uses. The widening of existing rights-of-way would conflict to some degree with other existing or potential land uses. Pipeline safety regulations at various governmental levels set minimum allowable distances from high pressure gaslines for many types of developments. Hence, widening a right-of-way impacts some land uses such as housing subdivision developments.

The 29.4 miles from the Moyie River down the Kootenai valley would impact present land uses only nominally. Timber production on about 156 acres would be curtailed. Some potential land uses would be restricted. The route would closely parallel U.S. Highway 95.

Archeological-Historical

Archeology--Potentially, the most damaging impacts will occur to unknown sites randomly encountered during construction activities. They may be completely or partially destroyed. Lacking a systematic inventory, impacts cannot be accurately assessed. Thus, a systematic inventory of the archeology along the proposed route is a necessity. This measure, compounded with additional comprehensive mitigation procedures, could eliminate much of the potential impact.

The route from near Bonners Ferry, Idaho, to Stanfield, Oregon, was systematically surveyed by Washington State University in 1960-61 for Pacific Gas Transmission Co. The ITA(A) route is immediately parallel (except for approximately 29 miles) to the PGT one on this surveyed portion, and impacts could be similar to those encountered in the PGT line construction.

From Stanfield to Rye Valley, Oregon, the route follows an existing (Northwest Pipeline Company) pipeline. This route apparently lacked a systematic survey and is now disturbed. However, there may be salvageable archeology remaining.

The 29.4-mile route from the Moyie River to Bonners Ferry via Round Prairie lacks any known survey. This route traverses about 16 miles of cultivated lands in the Kootenai Valley and 13 miles across a mountain ridge top, mostly following the route of U.S. Highway 95.

Based on past finds, the route from the U.S.-Canadian border to Rye Valley, Oregon, has some potential for significant new archeological finds. Specific areas of archeological concentration that may be impacted are located along rivers and subsidiary drainages which prehistoric peoples frequented due to the availability of natural resources.

Historical--Concern was expressed over the pipeline crossing the Oregon Trail, the Grand Ronde River, Umatilla and Wallowa-Whitman National Forests, and through or near other sites. The Umatilla National Forest is completely bypassed on ITA(A)'s current proposal.

The Oregon Trail is presently crossed seven times between the Umatilla Indian Reservation and Rye Valley by the Northwest Pipeline Company existing line. The Oregon Trail is crossed several times by Interstate 80N in the same locale, as well as by an existing petroleum pipeline, powerline, and railroad.

The Oregon Trail, where presently crossed, exhibits no remnants of the emigration era. However, it passes close to some excellent remnants in the Ladd Canyon area between LaGrande and Baker, Oregon.

The overriding impact in all other cases would be one of right-of-way scarring being visible from historical sites, since no known sites lie directly on the proposed route. Considering the other nearby existing disturbances and route location, no significant additional impacts are expected along the route to historical values by widening of the existing right-of-way.

Recreational and Esthetic Resources

Implementation of the proposed project would cause temporary, periodic increases of noise, fumes, dust, vehicular traffic, and human presence during the construction period. These unavoidable adverse impacts, though a nuisance, would not create conditions which would severely limit opportunities to participate in outdoor recreation activities.

Basically, no really new access routes are being generated in this proposal. Only an additional 6 acres of land over a 413-mile project are needed for access roads. This represents about 1,000 feet of new road. Elsewhere, access is already provided or lies in very close proximity to existing roads and rights-of-way.

Visual impacts in the vicinity of Morgan Lake, Oregon, or from existing highways may be increased by widening existing rights-of-way for pipeline burial. A new swath will be created through timber for about 13 miles between the Moyie River westward to the Kootenai. The route southward through the Kootenai to Bonners Ferry passes predominantly under cultivated lands, moves down to the flood plain east of the river and will create negligible visual impact after one growing season.

Elsewhere, along existing rights-of-way of PGT and Northwest Pipeline Company, the visual impact will be potentially increased by widening the disturbance zone, although an estimated 75 percent is on cultivated lands.

Air Quality

Fugitive dust, combustion fumes from equipment, and burning of slash or other combustibles are the major air quality degraders during construction.

Wildfires resulting from careless construction activities or gasline leaks followed by ignitions are possible. After construction, three primary sources of pollutants are probable:

1) Nitrogen oxides (NO_x) from exhaust fumes at compressor stations,

2) Venting of gas (normal or accidental), and

3) Pipeline rupture.

All above situations may temporarily exceed ambient air quality standards. Areas affected may be microclimatic, as in a very small leak, or regional, as in a large forest or range fire triggered by construction or operation activities.

The gas pipeline transportation industry shows a remarkable safety record, and probabilities are very low (but not impossible) that accidents seriously affecting air quality will occur. (See section 3.OV.16.)

Noise

There will be both short-term impacts (from the construction phase) and long-term impacts (from the operational phase) associated with the proposed Eastport to Rye Valley line and the Future Expansion from Rye Valley to Cajon.

The construction phase impact will not be highly localized, but will affect large numbers of people over the entire period of construction. The pipe-hauling truck noise, associated with the Eastport to Rye Valley line is predicted to impact approximately 29,000 people. The pipe-hauling truck noise associated with the Future Expansion, is estimated to impact about 19,000 people. Noise from construction of the pipeline form Eastport to Rye Valley is anticipated to impact 1,900 people with day-night sound levels (L_{dn}) in excess of the U.S. EPA goal for protection of human welfare (55 dB). It is estimated that 900 of these people will be highly annoyed by the construction noise. The Future Expansion right-of-way construction is predicted to impact 500 people with L_{dn} greater than 55 dB and cause 200 people to be highly annoyed.

The major noise source during the operational phase of the project is the gas compressor stations. All but one of the stations are already existing along the proposed route. Five of these existing stations will have an increase in horsepower, which will result in increases in the distances at which residences will be impacted by an L_{dn} greater than 55 dB, ranging from 10 tc 425 feet. The estimated distance at which residences in proximity to the only new proposed station will be impacted by a normalized L_{dn} greater than 55 dB is 3,300 feet. The Future Expansion will involve construction of 13 new stations which will impact residence within distances of 5,400 feet with an L_{dn} greater than 55 dB.

Periodic venting of high-pressure gas will cause temporary sound levels of 108 to 115 dBA at 100 feet. Due to its short duration and infrequent occurrence, it would cause annoyance, but may not result in complaints.

3.1.5E.1 Climate

Extremes of climate can adversely affect pipeline construction activities. The frost line in the northern segment of the route extends 40 to 50 inches which could make winter or early spring trenching difficult. Spring in the lowland areas, especially in a wet year, would necessitate crossing many waterlogged areas where heavy equipment would be difficult to operate and where the trench would quickly fill with water. Construction at stream crossings during the spring runcff period could face the hazard of freshets which could quickly fill underwater trenches and which could make the flood plain unusable by heavy equipment. Operation of heavy equipment in wetlands and flood plains during wet periods would tend to compound soil compaction and vegetation destruction problems. Working during excessively high and prolonged wind periods increases fugitive dust problems.

From May to October, extended pericds of no rainfall and high temperatures ncrmally result in extreme dryness of vegetation and increased fire hazard conditions.

Climatic extremes also increase the stresses to which the pipe itself and the welded joints could be subjected, although buried pipe is essentially insulated from major temperature extremes. Provisions would have to be made in construction design for pipe steel which could stand up under potential frost heave stresses in the northern sections of the pipeline. Heavy rains and accelerated erosion may result in mass wasting, mudslides or streambed scouring causing the pipe bedding to be disturbed or the pipe to become exposed, and major pipeline stresses to result. These contingencies are normally incorporated in pipeline design. For further discussion of the effects of outside conditions on the pipeline, see Aerospace Report No. ATR-76 (7557)-4 Final Geotechnic Evaluation - Los Angeles Pipeline, December 1975.

The proposed project would impact the microclimate in the immediate vicinity of the pipeline; however, this is not expected to be a significant addition to the overall impacts.

3.1.5E.2 Topography

Minor impacts on topography would result directly from construction activities and indirectly from acceleration of natural processes that cause erosion and sedimentation, landslides, rockslides, rockfalls and flood scour.

Development of Erosion Hazard

The construction process would affect the erosion potential in three areas--along the trench, outside the trench but within the right-of-way, and outside the right-of-way.

Impacts could be expected from wind erosion, water erosion, and erosion caused by construction activities.

The wind would erode loose soil materials along the right-of-way. This material would be susceptible to wind erosion largely due to the destruction of the natural vegetation cover; partly because of the grinding and churning of equipment wheels and tracks; and partly because the orientation of the proposed route is nearly parallel to the prevailing wind direction. The activity of equipment would break down the larger fragments of soil and earth materials to finer particle sizes which could be eroded by the wind. Wind erosion would have considerably more effect on the topsoil than on the subsoil earth materials.

Despite the potential tonnage of soil that could be eroded by wind, the impact on the topography by soil erosion and its subsequent deposition would be negligible. The expected damage to the topography probably would consist of slight drifting in ditches and along fence lines.

The probability that wind erosion of sand in sandy soil areas would expose the pipeline to external damage is small (although this has occurred on PGT's pipeline west of Stanfield, Oregon).

The natural cohesion and vegetative cover of riverbanks would be disturbed by line excavation and other construction activities and would increase erosion at stream and river crossings.

Structures such as ramps, supports, berms and coffer dams built either as temporary or permanent facilities at river crossings would have a variable, often temporary, effect on erosion. The emplacement of a permanent structure, however, would likely have a permanent effect on topography downstream from the structure.

Accelerated erosion by running water (runoff) would take place largely through the action of slopewash (sheetwash) and its concentration into small rills and rivulets. The concentration would be due in part to small irregularities on the ground surface caused by the equipment used in laying the pipeline, and in part, by the crown, or ridge of soil, to be left above the trench to compensate for natural settlement of the backfill and conversely by the depression left where settlement exceeds the backfill material provided. The normal rate of erosion would be increased along the right-of-way during of the absence of protective vegetation. Moving surface water would erode loose topsoil readily and subsoil materials less readily because of their generally greater particle size.

Accelerated erosion of the subsoil by surface runoff would occur where the topsoil had been removed previously by erosion. The result would be gullying of slopes and increased cutting by small streams with accompanying reduction of vegetation and crop yield.

The possibility exists that accelerated surface runoff would remove enough soil material to cause serious loss of pipe support. This would cause stresses in the pipe that could lead to pipe failure.

Subsurface erosion by ground water could occur within the backfilled trench. This type of erosion occurs partly by solution and partly by the below-surface washing away of fine particles of earth materials. This process is called "piping" and occurs mostly in soils high in lime or with soluble components such as gypsum.

Slaking, or physical disintegration, is commonly caused by wetting and drying. This breakdown could affect some of the rock and earth materials that would be encountered along the route, increasing the rate of subsurface erosion. It alone could bring about sufficient loss of support of the pipeline to cause potential pipe failure. Some of the clays, silts, shales, siltstones and coal would break down in only one or two cycles, others will require numerous cycles. Materials that slake would mainly be encountered along that part of the route from the Canadian border to Rye Valley, Oregon.

<u>Inducement of Landslides and Rockfalls by Blasting and Trenching</u>

Blasting would probably be negligible as a factor in causing new landslides or renewed movement of now-stable landslide masses. It is possible that a mass of claystone, shale or siltstone that is on the threshold of slope failure might slide because the shock waves of blasting overcame or reduced the shear strength of the bedrock material to the point of failure. Moreover, the kinds of landslides generally present along the route occur in weak rocks which are thoroughly fractured near the ground surface. The fracturing would tend to absorb the shock of the blast, reducing its effect.

Because the trench should be less than 10 feet deep at nearly all points, the shallow placement of blasting charges would presumably affect landsliding mainly by transfer of shock parallel to the ground surface; vertical "jump" of the ground which might reduce the shear strength to zero would be acting almost wholly in a zone of loose or uncompacted material which would tend to absorb the shock, or be blown upward and outward.

Recontouring of Slopes

Cuts and fills to establish a level working surface for construction and maintenance activities on slopes crossed perpendicularly (lengthwise) by the pipeline would result in recontouring the slopes. Because steep slopes traversed by the proposed pipeline route are generally limited to stream valleys which are crossed perpendicularly, cuts and fills for right-of-way leveling would be largely restricted to the moderate slopes of the upland areas. Thus, recontouring for right-of-way leveling would be limited in degree and extent, depending upon the actual pipeline alignment. Such recontouring would be most prevalent in the part of the proposed route that lies within the Northern Rocky Mountain province.

Disposal of surplus soil from trenching and backfilling in centrally located piles scattered at sites adjacent to the proposed route would also result in recontouring. The size of the piles would depend on the volume of the soil to be cast off and on the spacing of the piles.

Permanent Changes in the Land Surface

Minor changes in the land surface would result from (1) the crown of spoil material over the trench backfill, (2) the foundation and drainage pads for structures, (3) those locations where the trench cannot be fully backfilled, (4) the disposal of surplus spoil in piles adjacent to the pipeline right-of-way, and (5) the cuts and fills for right-of-way leveling. The crown of spoil over the pipeline presumably would be as wide as the trench, and the crest would stand several inches above the general surface of the land adjacent to the right-of-way. In profile the crown thus would be convex. With time this crown would essentially disappear, and may actually be replaced by a similar form that is concave. The change in profile of the crest would be caused by the natural settlement of the loose backfill in the trench. As the presence of moisture is a significant factor in the rate of settlement, the process would be distinctly slower in that part of Nevada and California crossed by the proposed route. Considering the slow rate at which settlement takes place in that region, the crown could last for many years.

In a few situations, it may not be feasible to fully backfill the trench. For example, a near vertical valley wall or highway cut with layers of hard rock exposed would presumably have a vertical trench cut into the wall to receive the pipeline. The trench would not be filled completely and so would be apparent for the life of the pipeline. Presumably it would serve as a drainage channel for surface water runoff along the surface of the backfill and ground water flowing through the backfill.

3.1.5E.3 Geology

Introduction

The impact proposed on the geology of the route is expected to be minor. Conversely, the proposed pipeline could be significantly affected by a large variety of geologic processes. Impacts on the geologic environment and on the pipeline as a result of geologic processes can be summarized as follows.

Effect on Present and Future Mineral Resources and Production

Impacts of the pipeline on currently active mineral production along the proposed route would be minor because construction materials are readily available along most of the route. However, the pipeline may hamper future exploitation of small portions of some economic mineral deposits.

The potential for discovery of new mineral resources is small because of the shallow depth of the trenching (less than 10 feet) and the exposure of bedrock over only about 7 percent of the route. Some useful definition of occurrences of clay, sand, gravel, and other potentially economic surficial deposits would result.

Effects on Surface Drainage and Terrain

All disruption of surface drainage should be temporary, occurring only during construction.

Seismicity and Faulting

The proposed route lies within seismic risk zone 2 (moderate damage potential) except for the segment over the Blue Mountains, which is in seismic risk zone 1 (minor damage potential).

Historical records indicate some seismic risk along the proposed route. Obviously, an earthquake cannot be completely ruled out. A severe quake could rupture the completed line, with potential hazards resulting. These are discussed in the Overview volume.

Northern Rocky Mountains Province

The impact on the geologic environment caused by construction and maintenance activities related to the proposed pipeline would be minimal in the Northern Rocky Mountains province. Construction material such as sand and gravel would be readily available, since much of the area along the proposed route is underlain by glacial alluvial deposits. Terrain scars caused by extraction of an unspecified amount of construction material would occur.

Disruption of surface drainage should be temporary, occurring during construction, and of minimal impact. There would be no significant disruption of subsurface drainage, since most of the proposed pipeline is in highly permeable, relatively uniform glacial and alluvial material.

The seismicity of that part of the Northern Rocky Mountains province traversed by the proposed pipeline would be located in seismic risk zone 2. This indicates that no shaking due to earthquakes should exceed intensity VI along the proposed route. Also, there are no known faults that cut Pleistocene deposits in this region.

In the Moyie River valley, particular combinations of slope steepness, dip of beds, and lithologic character could give rise to landslides or other forms of slope failure but the possibility is considered low. Undercutting in some of these areas could make the rocks even more prone to failures. At present, detailed geologic maps are not available for this region. A more complete discussion of landslide potential in this area is in the section on Northern Rocky Mountains province of geologic hazards, Section 2.1.5E.3.

The impact of the proposed pipeline on currently active mineral production in the Northern Rocky Mountains would be low or zero. In recent years, considerable attention has been given to large, low grade occurrences of copper in formations of the Belt Supergroup. To date, however, none of these occurrences have been found in the Prichard Formation, the Belt unit traversed by the proposed pipeline. There are no indications that the area around the proposed pipeline might be more promising for this type of deposit than other areas.

Columbia Plateau Province

Disturbance of the geologic environment caused by construction and maintenance activities should be minimal in the Columbia Plateau province, with the possible exception of potential earthquake and earthquake-related damage to the pipeline.

The southern part of the Columbia Plateau province traversed by the proposed route is considered seismically active even though earthquakes there are infrequent. Two moderate earthquakes, both intensity VII, have occurred in this region near the proposed route. One occurred July 15, 1936, near Milton-Freewater, about 25 miles east and north of the proposed route. The other quake occurred on March 6, 1893, and was centered near Umatilla, about 6 miles west of the proposed route. This earthquake was felt over an area of 100,000 square miles. This general area is near the eastward projection of the Wallula Gap fault.

The Wallula Gap fault forms part of the Olympic-Wallowa lineament, a major topographic lineament in the Pacific Northwest. Although it is not known if this lineament is controlled by a major, through-going fault system, the presence of known faults such as the Wallula Gap fault, suggest that this possibility should be considered before construction across the lineament. The earthquake at Umatilla and the earthquake and associated ground cracking near Milton-Freewater, suggests that, whatever the nature of the Olympic-Wallowa lineament, northeastern Oregon should be considered an area of potential seismicity and possible ground failure.

Construction material, such as sand and gravel should be abundantly available along most of the proposed route. Terrain scars would occur due to removal of sand and gravel. Loess deposits, that cover much of the northern part of the Columbia Plateau province that would be traversed by the proposed pipeline, are thin (2 to 4 feet thick) in the southern part. In the area where loess is thin and no soil cover is developed, extensive blasting would be required to trench in bedrock.

Disruption of surface drainage would be temporary, occurring only during actual construction, if the surface of the land is returned to its pretrench configuration. Disruption of subsurface drainage should be minimal. If removed material is properly compacted over the buried pipeline, especially on steep slopes, accelerated erosion is unlikely to occur.

There would probably be no adverse impact on present or future mineral exploration or production in this physiographic province.

Blue Mountains Province

The initation and/or reactivation of landslides would be the most important potential disturbances that could be caused by construction and maintenance activities in the Blue Mountain province. The area most prone to ground failures of this sort is west, southwest, and south of LaGrande, Oregon. However, no landslides are evident on Northwest Pipeline Company's existing line in this area, which has been in service since 1961.

Disruption of surface drainage and siltation of streams at crossings would be temporary, occurring only during construction. There should be no adverse impact on present or future mineral exploration or production in the Blue Mountains province.

Most of this province is in seismic risk zone 1 (Algermissen, 1969), the lowest risk category. The best estimate, from present knowledge, is that this area would experience only low intensity ground shaking generated by distant earthquakes.

3.1.5E.4 Soils

Of all the natural physical resources affected by the proposed project the disturbance of the soil will create the most significant impacts, directly or indirectly, to the environment.

The destruction or reconstitution of the life-supporting topsoil will interfere with the natural processes of the functional ecosystems through which the pipeline passes. The loss or dilution of topsoils on agricultural lands will cause lasting reductions in crop production. The exposure of topsoils by removal of the vegetation will allow erosion from wind and water. Eroding soil particles will provide particulates that will contaminate the air and sediments to pollute streams.

In addition to impacts on the construction site there will be offsite disturbances from the excavation of bedding material and disposition of surplus materials from the pipeline trench. The quantities of these materials cannot be assessed until construction begins or detailed surveys are made. Likewise, the quality of subsoils and substrata materials to be excavated are not known for specific areas to be crossed by the project.

The purpose of this section is to discuss the soil related impacts that will occur as a result of implementing the proposed project. Although quantifications are not always possible the relative impacts anticipated or the range of losses to be expected are discussed.

Descriptions of the soil series likely to be encountered along the pipeline route are contained in section 2.1.5E.4. These descriptions have been interpreted in this section to determine the critical areas of soil related impacts that are likely to occur with project implementation. The quantity of each soil limitation factor which will be encountered by the pipeline is unknown. However, Figure 3.1.5.4-1 illustrates the location of the more dominant soil limitation factors which may be encountered along the various segments of the pipeline.

Tables 3.1.5.4-1, -2, and -3 list soil series that will create special impact problems along the proposed route.

Contamination of Topsoils by Excavation of Subsoils

As described in Section 2.1.5E.4 the proposed pipeline will cross many types of soils. As indicated in the Section 2.1.5E.4 tables, the topsoil varies from 1 to 6 inches thick in forested areas and from 6 to 20 inches in grassland and agricultural areas. Topscil or the "A" horizon is the organically enriched layer that has accumulated through many years of soil

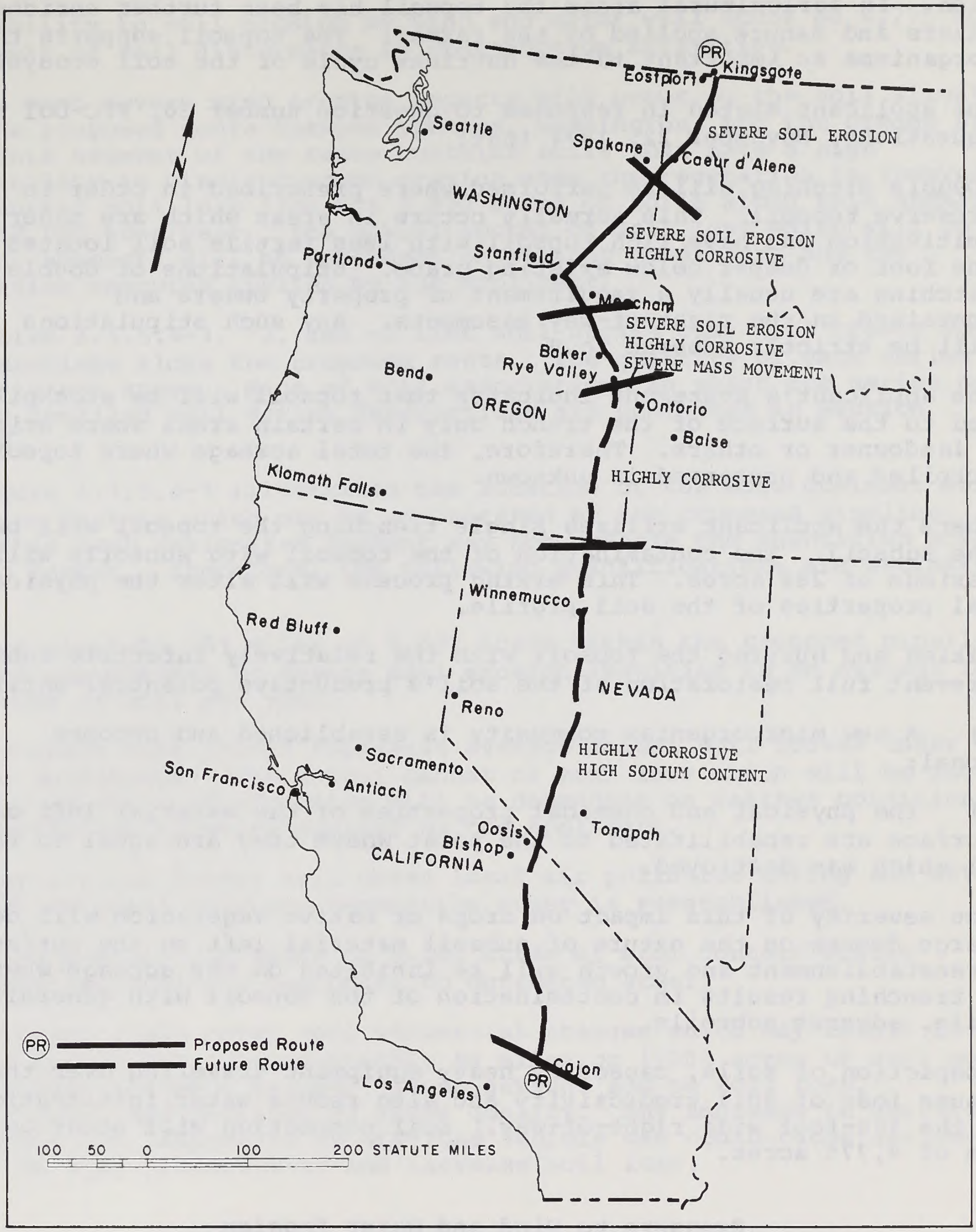

Figure 3.1.5.4-1 Dominant soil limitations

formation. In agricultural areas the topsoil has been further enriched with fertilizers and manure applied by the farmer. The topsoil supports the soil micro-organisms sc important to the nutrient cycle of the soil ecosystem.

The applicant stated in response to question number 30, FPC-DOI Task Force questions, November 22, 1974 that:

> "Double ditching will be performed where prescribed in order to preserve topsoil. This normally occurs in areas which are under cultivation and have rich topsoil with less fertile soil located one foot or deeper below existing grade. Stipulations of double ditching are usually a requirement of property owners and contained in the right-of-way easements. Any such stipulations will be strictly adhered to."

The applicant's statement indicates that topsoil will be stockpiled and returned to the surface of the trench only in certain areas where stipulated by the landowner or others. Therefore, the total acreage where topsoil will be stockpiled and preserved is unknown.

Where the applicant utilizes single trenching the topsoil will be mixed with the subsoil. The contamination of the topsoil with subsoils will occur on a maximum of 284 acres. This mixing process will alter the physical and chemical properties of the soil profile.

Mixing and burying the topsoil with the relatively infertile subsoil will prevent full restoration of the soil's productive potential until:

1) A new microorganism community is established and becomes functional;

2) The physical and chemical properties of the material left on the soil surface are rehabilitated to the point where they are equal to the topsoil which was destroyed.

The severity of this impact on crops or native vegetation will depend to a large degree on the nature of subsoil material left on the surface. Plant reestablishment and growth will be inhibited on the acreage where single trenching results in contamination of the topsoil with generally infertile, adverse subsoils.

Compaction of soils, caused by heavy equipment traveling over the soil, will cause loss of soil productivity and also reduce water infiltration within the 100-foot wide right-of-way. Soil compaction will occur on a maximum of 4,775 acres.

Exposure to Wind and Water Erosion

The construction of the proposed pipeline will cause impacts upon the natural inherent productivity and physical qualities of the soil. The construction process will result in disturbance of the soil within the proposed 391-mile long, 100-foot wide pipeline right-of-way (approximately 4,739 acres). This disturbance alters the soil's structural and chemical characteristics, microbiological activity, and soil-climate relationships which have been established over a long period of time.

An additional 36 acres will also be disturbed during construction of offsite facilities, i.e., access roads, river crossings, and other pipeline facilities. The extent and location of offsite facilities cannot be identified until final design is submitted by the Applicant. Increased susceptibility to soil erosion by wind and water will occur on 4,775 acres as a result of soil disturbance by construction activities.

The most severe wind erosion impacts will occur on the soil situated along the proposed route between Spokane, Washington, and the Oregon State line. This segment of the route contains soils that have a high susceptibility to wind and water erosion when the vegetation is removed. The potential soil loss from the 3,400 acres of soils along this segment is nearly 17,000 tons/year. The actual amount of soil loss which will be incurred, however, will be dependent on weather conditions and the conservation measures applied by the Applicant.

Tables 3.1.5.4-1, -2, and -3 list soil series that will create special impact problems along the proposed route. The quantity of each series crossed is not known. Maps of soil associations in which the series occur and more detailed soil series descriptions are contained in Section 2.1.5E.4.

Figure 3.1.5.4-1 illustrates the location of the more dominant soil limitation factors which may be encountered by the proposed pipeline. Every soil within each designated segment may not possess the identified soil limiting factor. Therefore, the following quantifications are estimates only.

Approximately 391 miles or 4,692 acres within the proposed pipeline route are susceptible to severe soil erosion resulting in an average loss of 23,460 tons of soil per year.

The above soil losses represent average annual soil losses under existing conditions. The actual amount of soil loss which will be incurred following pipeline construction will be dependent on weather conditions and the conservation measures applied by the Applicant.

Wind erosion losses will cause local air pollution during and after construction until adequate vegetation cover is reestablished.

Approximately 274 miles or 3,288 acres of siol contain acidic concentrations that are corrosive to untreated steel.

Cuts and fills cause soil structural changes which may result in mass movement and slides. Approximately 84 miles or 1,008 acres of soil contain a severe mass-movement hazard. These actions add to soil loss, sedimentation, and decrease in water quality. Any increase in surface disturbance and compaction by off-road vehicle use could cause serious impacts on soil productivity and increase soil loss.

Disruption of Agricultural Activities

The proposed pipeline right-of-way involves 3,554 acres of agricultural land. The disturbance on croplands due to pipeline construction will cause two major adverse impacts; the loss of crops during the construction year, and the reduction of soil productivity for a number of years.

It is difficult to assess the crop reductions that will occur after construction operations are completed. As previously indicated, areas where topsoil replacement will take place have not been specifically identified. Also, the degree of soil compaction will depend on the type of soil and moisture content at the time of construction.

Table 3.1.5.4-1 Soil Limitation Interpretations, Selected Soil Series, Idaho

Assoc.	Dominant Series	Corrosivity 1/	Shrink-Swell Potential 2/	Erosion Hazard 3/	Mass Movement 4/	Flooding 5/	
						Frequency	Duration
A1	Huckleberry	Low	Low	High	Moderate to severe	None	--
C2	Selle	Moderate	Low	Moderate	None	None	--
C2	Schnoorson	High	Moderate	Slight	None	Frequent	Very long
C3	Kootenai	Low	Low	Moderate	None to moderate	None	--
C3	Molly	Low	Low	High	None to moderate	None	--
C4	Garrison	Moderate	Low	Slight	None	None	--

Table 3.1.5.4-2 Soil Limitation Interpretations, Selected Soil Series, Washington

Assoc.	Dominant Series	Corrosivity[1/]	Shrink-Swell Potential [2/]	Erosion Hazard[3/]	Mass Movement[4/]	Flooding[5/] Frequency	Flooding[5/] Duration
B1	Garrison	Moderate	Low	Slight	None	None	--
B1	Spokane	Low	Low	Moderate to high	None	None	--
B1	Bernhill	Low	Low	Slight to moderate	Moderate	None	--
B2	Naff	Low	Moderate	Moderate	Moderate	None	--
B2	Palouse	Moderate	Moderate	Moderate to high	Moderate	None	--
B2	Palouse	Low	Moderate	Moderate to high	Moderate	None	--
B5	Ritzville	High	Low	Moderate or high	Moderate	None	--
B6	Adkins	High	Low	Moderate or high	None	None	--
B6	Ellisforde	High	Low	Slight to moderate	None	None	--
B6	Adkins	High	Low	Moderate or high	None	None	--
B9	Athena	Moderate	Moderate	Moderate to high	None	None	--
B9	Walla Walla	High	Low	Moderate to high	Moderate	None	--
C9	Quincy	Moderate	Low	High	None	None	--
C9	Sagemore	High	Low	Slight	None	None	--
F3	Anders	Moderate	Low	Moderate to high	None	None	--
F3	Kuhl	Moderate	Low	Slight to high	None	None	--
F3	Magallon	Moderate	Low	Moderate	Moderate	None	--

Table 3.1.5.4-3 Soil Limitation Interpretations, Selected Soil Series, Oregon

Assoc.	Dominant Series	Corrosivity[1/]	Shrink-Swell Potential [2/]	Erosion Hazard[3/]	Mass Movement[4/]	Flooding[5/] Frequency	Duration
D1	Ruckles	High	Moderate	Moderate	Severe	None	----
D1	Catherine	Moderate	Moderate	Slight	None	Occasional	Brief
D1	Ladd	Low	Moderate	Slight and moderate	Moderate	None	----
D1	Baker	High	Low	Slight	Moderate	None	----
D1	Umapine	High	Low	Slight	None	Occasional	Brief
D1	North Powder	High	Moderate	Moderate and high	Severe	None	----
D1	Keating	High	High	Moderate	Severe	None	----
F1	Walla Walla	High	Low	Moderate to high	Moderate	None	----
F1	Quincy	Moderate	Low	High	None	None	----
K1	Klicker	Moderate	Low	High	Severe	None	----
K1	Helmer	Moderate	Low	Moderate	Moderate	None	----
L1	Ritzville	High	Low	Moderate or high	Moderate	None	----
L3	Snell	High	Moderate	High	Moderate	None	----
L4	Walla Walla	High	Low	Moderate to high	Moderate	None	----
M1	Ukiah	High	High	Moderate	Moderate	None	----
M1	Encina	High	Moderate	High	Severe	None	----
M1	Lovline	Moderate	Moderate	High	Severe	None	----
M1	Baldock	High	Moderate	Slight	None	Occasional	Brief

1/ Corrosivity - of untreated steel. A rating of high means that untreated steel pipe buried in moist or wet soil has a high probability of damage. A high rating commonly indicates total soil acidity is $>$12m.e./100g soil, resistivity at field capacity is $<$2000 ohms/cm, or conductivity is $>$0.4 mmhos/cm at 25°C. "Low" is mostly moderately coarse and coarse, slightly acid to neutral soils. "Moderate" is: 1) sandy and sandy skeletal, mildly alkaline and medium acid soils; 2) coarse-loamy, coarse-silty and neutral to slightly acid soils; 3) sandy or sandy-skeletal, and neutral and slightly acid soils. "High" is all other soils.

2/ Shrink swell - a "high" potential indicates a hazard to maintenance of structures built in, on, or with materials having this rating. The Coefficient of Linear Extensivility (COLE) is $>$.06. Examples are soils in fine or very fine montmorillonitic families. Soils in fine-silty, fine-loamy, and clayey-skeletal families are rated as "moderate". All other textural families are rated as "low".

3/ Erosion Hazard - Slight, moderate, or high hazard where soil is bare.

4/ Mass Movement - <u>None</u>: No reasonable potential of mass movement in immediate landscape. Areas presently not in motion. Examples, flood plains and other areas with slopes less than about 5%.

<u>Moderate</u>: Possible mass movement with unusual combinations of climatic and/or crustal movements. Examples, piedmonts, pediments, footslopes, talus slopes, colluvial - alluvial interfaces in areas with slopes about 5 to 30%.

<u>Severe</u>: Probable mass movement with unusual combinations of climatic and/or crustal movements. Examples, mountains, fault scarps, rock slides, talus slopes in areas with slopes over about 30%. Underlying bedrock is commonly schist, marine shale, serpentine, severely weathered granite.

5/ Flooding - Frequency:
- None - No reasonable possibility of flooding
- Rare - Flooding unlikely but possible under abnormal conditions
- Common - Flooding likely under normal conditions
- Occasional - Less often than once in two years
- Frequent - More often than once in two years

Duration: (Note only if frequency is common or more)
- Very brief - Less than 2 days
- Long - 7 to 30 days
- Brief - 2 to 7 days
- Very long - 30 days

On areas where topsoil is replaced and soil compaction is not severe, crop production should be nearly normal the year following construction. Where topsoil is not replaced and soil compaction is severe, continuing crop reduction will depend upon the kinds of subsoil or substrate material left on the surface and the intensity of rehabilitation by the farmer.

Even where subsoils have good textural qualities, they will lack fertility.

In addition to crop reductions, the pipeline construction activities will create a variety of inconveniences for the farmer. Movement of farm machinery and tillage and harvesting operations will be complicated by the trenching through established fields. Compaction or subsidence of fill areas along the trench and the exposure of cobbles or gravel on the surface will all contribute to more difficult farming operations.

Pipeline construction occurring on irrigated farmland during the time when the land is not producing a crop would cause a relatively minor impact. However, disruption of the irrigation delivery system during the irrigation season would affect crop production on the entire area served by an irrigation system. Pipeline construction may necessitate releveling of irrigated land however, due to the difficulty of compacting the fill material to correspond with the adjacent undisturbed soil, several releveling efforts may be needed as the fill continues to settle.

Pipeline construction will conflict with the buried water distribution system pipelines of the East Green Acres Unit and Spokane Valley irrigation projects. As on non-irrigated cropland, construction activities will take land out of production for one growing season and reduce production for several years if topsoils are not replaced. Special care will be required to restore existing soil density and slope conditions so as not to interfere with the irrigation system.

Grazing land will be out of production during the construction year and will produce at a reduced rate for several years until new vegetation can be established. Construction activities will adversely affect grazing patterns since livestock will probably be reluctant to approach or cross the construction area. There will be the potential danger of animals falling into the open trench during construction.

Future abandonment impacts of the proposed pipeline could be negligible or significant depending upon procedures adopted. If capped and left in place, impacts upon the soil would be negligible. If the line were salvaged, the soils would again be disrupted causing reoccurrence of the above described soil impacts. In addition, backfill of the trench would require the removal of soil from borrow sites, and would further add to environmental modification with attendant impacts as described throughout this section.

3.1.5E.5 Water Resources

Environmental Impact on Surface Water

The surface water impacts are discussed in the following general order: (1) channel erosion, (2) sedimentation, including turbidity and suspended sediment, (3) water quality, and (4) aquatic biology.

Channel erosion, as a result of excavation, diversion, or constriction of the natural stream channel, would be an impact caused by pipeline construction. The natural cohesion and vegetative cover of banks would be disturbed by excavation and other construction activities at the crossing sites, with resultant increased erosion until bank slopes are stabilized or vegetation is reestablished. This recovery period would be 1 year or more. Thus, potential impact exists at the crossing of the major streams, illustrated in Figure 3.1.5.5-1, and at all minor stream crossings with surface flow at the time of construction. The volume of material that would be eroded is unknown. All streams crossed from Eastport to Rye Valley are indicated in Table 3.1.5.5-1.

Discharges of hydrostatic test water would cause substantial amounts of channel erosion, especially where released to dry channels or those with small surface flows. Single discharges of hydrostatic test water may be as much as 750,000 cubic feet. Massive or uncontrolled release of this much water conld induce local streambed erosion, or gullying, and create or augment surface flow for several miles. See Table 3.1.5.5-2 for Hydrostatic test schedule.

Where the pipeline is emplaced at a major stream crossing by the flotation method (probably at the Kootenai, Pend Oreille, and Snake Rivers), a small amount of streambed fill could occur downstream for distances less than approximately 500 feet. Where the excavation is allowed to fill by natural bedload transport, scour could occur for a short distance (less than 200 feet) upstream. Both these latter effects on streambed elevation would be temporary. Secondary effects of these and other impacts are addressed in the sections dealing with fisheries and vegetation.

Structures, such as ramps, supports, berms, and coffer dams, built either as permanent structures or temporary components of a crossing made by channel diversion, would have variable, unpredictable erosive effects in addition to causing local scour at the site of channel constriction. Diversion of flow would increase erosion downstream. It is unlikely, however, that the impact of channel erosion caused by structures would be serious.

Where the pipeline is laid across major streams by either the flotation process or channel diversion, the most important impact on surface water would be increases in suspended-sediment concentration and turbidity during the construction process. Effects on the biota are discussed below and in the sections on fisheries and vegetation.

Similar, but much more localized effects, would occur in sediment size classes coarser than silt. Most bed material at the crossing sites has a modal class in the sand and pebble-gravel ranges. These coarser grades of sediment disturbed by construction would move insignificant distances as bedload, causing small amounts of temporary fill immediately downstream from the crossing sites and small amounts of temporary scour upstream.

The potential for temporary impact by increased levels of suspended-sediment concentration and turbidity at major stream crossings is shown in Figure 3.1.5.5-1. These impacts would be temporary effects coincident with pipeline construction at each crossing site. The scale of impacts is defined as follows:

Low -- A low possibility of raising suspended-sediment concentrations or turbidity to either a level or for a duration that could cause significant detrimental effects--either esthetic, biologic, or on water use.

Moderate -- A moderate possibility as above.

High -- A high possibility as above.

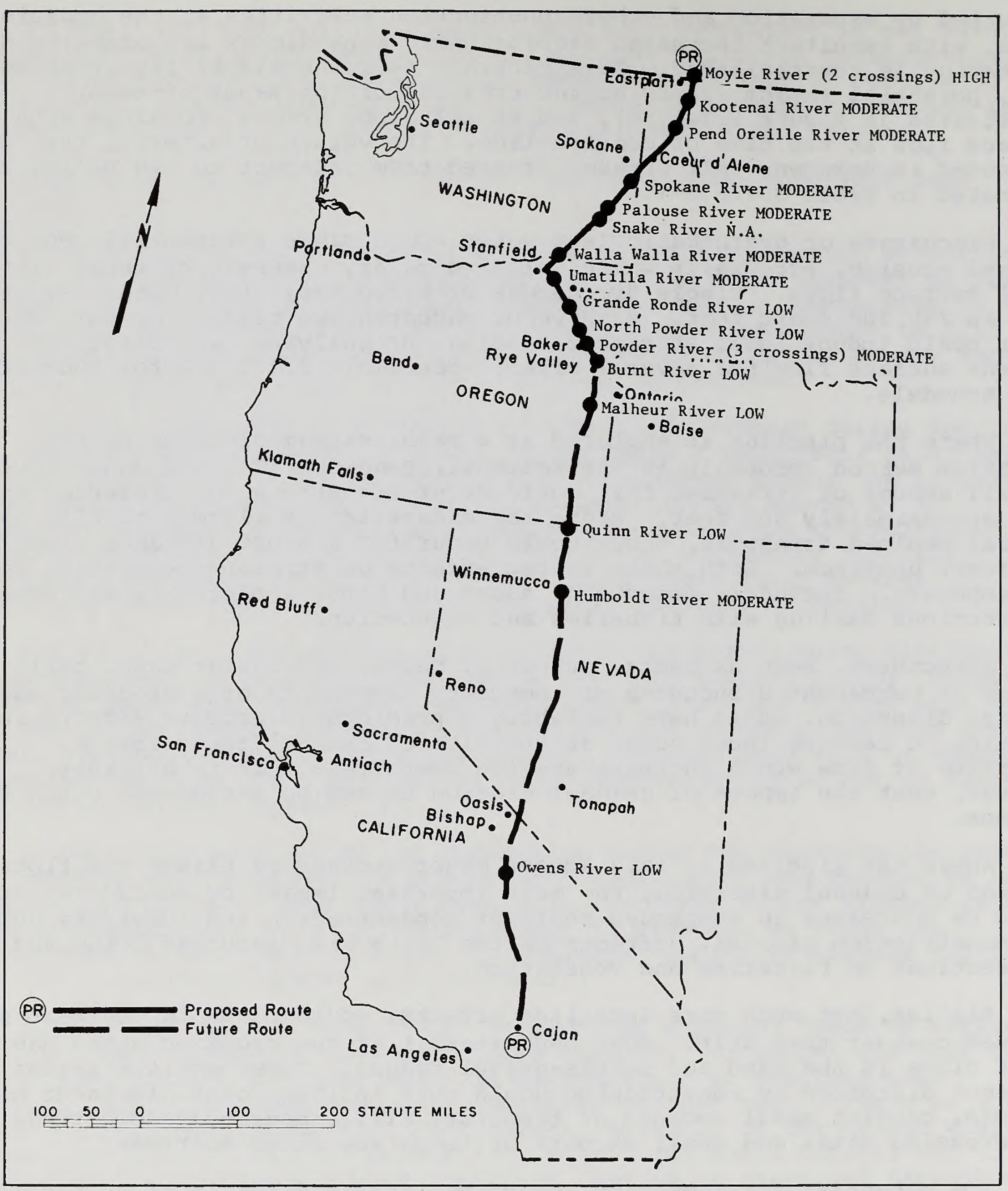

Figure 3.1.5.5-1 Relative impacts of pipeline construction on suspended-sediment concentrations and turbidity at major stream crossings

Table 3.1.5.5-1 Eastport to Rye Valley stream crossings.

Name	Milepost Reference	Land Status PVT	Land Status FED
Moyie River	0.2	-	USFS
Moyie River	1.05	x	
Round Prairie Cr.	4.3	x	
Round Prairie Cr.	9.2	x	
Brush Creek	15.4	x	
Rock Creek	17.5	x	
Fleming Cr.	21.7	x	
Kootenai R.	27.5	x	(Corps Engr)
Deep Cr.	40.8	x	
Deep Cr.	41.1	x	
Pack River	48.9	x	
Sandpoint Cr.	55.0	x	
Sand Cr.	56.0	x	
Syringa Cr.	58.8	x	
Pend Oreille R.	62.7	x	(Corps Engr)
Westmond Cr.	70.5	x	
Cocalolla Cr.	79.1	x	
Spokane River	112.9	x	
Rock Cr.	127.1	x	
Latah Cr.	130.4	x	
Pine Cr.	148.9	x	
Cottonwood Cr.	157.7	x	
Pleasant Valley Cr.	160.9	x	
Palouse R.	171.5	x	
Rebel Flt Cr	175.0	x	
Union Flat Cr.	184.6	x	
Snake R.	208.8	x	(Corps Engr)
Walla Walla R.	256.3	x	
Wildhorse Cr.	300.7	x	
Umatilla R.	303.5	x	
Meacham Cr.	322.9	x	
California Gulch	333.2		USFS
Railroad Gulch	333.9		USFS
Grande Ronde R.	338.3	x	
Ladd Cr.	351.7	x	
Powder R.	386.15	x	
Sutton Cr.	389.65	x	
Burnt R.	409.05	x	

Table 3.1.5.5-2 Hydrostatic test schedule.

River Name	Bank-to-Bank MLV Distance 4/	Test Water Intake/Discharge		River Crossing Jnder/Over	Reference by M.P.	Miles of Water Transport (1-way)
Moyie	-	Yes	No	x	0.15	-
Kootenai	0.2	No	No	x	27.5	-
Pend Oreille	0.7	No	No	x	62.7	-
Snake	0.4	Yes	Yes	? 1/	208.8	208.65 129.50
Grand Ronde	-	Yes	Yes	x	338.3) 355.4) 2/	17.10
Burnt	-	No	Yes	x	378.15) 413.05) 3/	34.90
					Total:	390.15

1/ Applicant is studying both over and under water crossings of Snake River.
2/ Water acquired and discharged at same point. Requires return flow from M.P. 355.4 back to M.P. 338.3. Snake River water discharged into Grande Ronde River.
3/ Water acquired from well at Baker compressor station (M.P. 378.15), used to test loop to M.P. 413.05, returned uppipe 7 miles to discharge in Burnt River (M.P. 406.05).
4/ Main line valve.

Many factors enter any subjective determination of the probability of significant impact by suspended-sediment or turbidity. Without detailed data, it must be assumed that construction would not coincide with the major spawning or hatching periods of anadromous fish. If construction and spawning or hatching periods were to coincide, the impact-possibility level would be high.

Although significance of impact does not correlate directly with absolute values of suspended-sediment concentration, ranges of the expected increases in concentration associated with the impact-possibility levels above can be estimated. At crossing sites with a low possibility of significant impact, suspended-sediment concentrations could increase by as much as a factor of 10 above those characteristic of periods of low-to-medium flow, and be generally less than 2000 mg/l. Concentrations at sites with a moderate possibility of significant impact could increase by as much as 50 times, and be less than 10,000 mg/l. High-impact levels would exceed those of moderate impact. The absolute values of suspended-sediment concentration are sensitive to so many variables that these figures must be regarded as order-of-magnitude estimates.

The average active period of construction at minor streams would be approximately 2 weeks, and at major streams on the order of 6 weeks. However, the overall periods of activity could range from a maximum of 1 month at minor streams, to as much as 3 months at major streams. Suspended-sediment concentrations and turbidity levels would be elevated for these periods and would return to normal gradually thereafter.

Burial depth at stream crossings versus maximum scour depth is significant for both pipeline integrity and effects on surface water. If the pipe were to be buried below scour depth and weighted, the security of the pipeline would be enhanced. Without these precautions the pipeline could be floated during a major flood and consequently be jeopardized as happened to PCT's pipeline in the John Day Canyon area in 1964-65. The exposed pipe, though severely stressed, did not rupture. In addition, replacement of the pipeline would again disrupt stream hydraulics, create turbidity, and impact stream ecosystems as described in the sections on fisheries and vegetation.

Flash flooding, characteristic of the drier, southern parts of the route (most sections south of the Washington-Oregon State line), has the potential to rupture the line by either large amounts of streambed scour or transport of very coarse sedimentary detritus. Floods of this size are not subject to normal hydrologic analysis because of their rarity.

Similar processes would operate at crossings of minor perennial streams. However, because construction would require a much shorter time interval, the total relative effect may not be greater.

It is impossible to measure the precise effects of erosion and sediment contribution from the construction sites. The effect would be temporary at most sites.

Other impacts include a possible increase in surface water temperature and consequent reduction in dissolved oxygen content caused by the removal of shading vegetation. Smaller streams in the northern forested sections of the pipeline route are especially susceptible to shading effects, which would be minimized in places where the angle, between the proposed pipeline route and the stream, approaches 90 degrees.

Downstream water quality at each river and stream crossing probably would be adversely affected for a short period during construction from the combined effects of earth movement on land and trenching and backfilling in streams. It is not expected that dissolved mineral content would change appreciably.

Prolonged increases in suspended-sediment concentration could cause an increase in biochemical oxygen demand and a lowering of dissolved-oxygen concentration. This is not usually critical in winter months when oxygen levels are at or near saturation in most streams, but could be severe at other times if sufficient organic material from riverbottom muds is resuspended. A further impact could result where waters below crossings are withdrawn for public supply or irrigation purposes, as in the Umatilla River.

Large and indiscriminant use of surface waters for test water supply could cause termporary drawdown and possible interruption of flow in small streams. Filtered withdrawal may impinge plankton and small fish along with other filtrate. Localized turbulence at the line inlets might suspend nearby bottom sediments during the filling operation.

The test water discharge from the pipe could be colored and have a relatively low content of iron oxide, other metals, or other suspended solids. These should settle rapidly, but would discolor receiving waters for the period of release.

During construction of the proposed pipeline, and operations of the compressor stations, thousands of gallons of fuel oils, greases, glycol, acid, cleaning solvent, possibly other petrochemicals, and other toxic materials would be used and stored at or near waterways. Water pollution problems could develop should those substances spill or leak into lakes or flowing water along the proposed pipeline route and result in concentrations in water as low as 1 milligram per liter. For example, numerous fish kills have been reported from petrochemicals and petroleum products containing toxic compounds. These are stable compounds that can remain in the aquatic ecosystem a long time. Oil and gasoline spills would occur during construction in an operation of this magnitude.

Methane gas from severe leaks or rupture of the pipeline would be quickly dissipated because of its low solubility in water. Small leaks of long duration would add small quantities of methane to water, a potentially explosive mixture where the water is a source of supply for industry or drinking-water systems. (Also see sections on fisheries, vegetation and hazards).

Prolonged increases in suspended-sediment, especially where a stream is crossed more than once or twice, would have a detrimental effect on the stream biota. Disruption causes shading, scouring, and burying of stream organisms and is especially severe if it occurs during periods of low flow. Populations of stream-bottom organisms (benthic invertebrates) generally reach maximum numbers in the spring before high runoff and again in the fall when many of the annual (univoltine) invertebrates complete their life cycle. Semiannual (bivoltine) species would be completely destroyed and would have to be repopulated from other parts of the stream.

A primary impact on surface and ground water supplies and a secondary impact on surface water and ground water quality would result from the addition of construction workers to local populations. Three to four construction spreads would work concurrently over the pipeline route. Using 100 gallons per day per man as a basis for water consumption, daily sources from 75,000 to 100,000 gallons would be required. Most of this would be returned in a polluted form via body wastes to surface and ground water.

However, sanitation facilities of local towns would have a bearing on the effects of this discharge.

If the proposed pipeline were abandoned, capped, and left in the ground, there would be no added impacts on water quality. If the pipeline were salvaged, impacts would be similar but less profound than those previously discussed in this section.

Environmental Impact on Ground Water

Along very nearly all its proposed route, from near Eastport, Idaho, to Rye Valley, Oregon, the proposed pipeline would be buried in the zone of aeration, substantially above the water table. Thus, virtually no interaction or major impact is anticipated between ground-water bodies and the pipeline, either during construction or operation.

The proposed pipeline should be appraised as a potential source of ground-water pollution by downward percolation. Such a potential seems virtually to be limited to the compressor station sites because, in the event of a ruptured pipeline elsewhere, released gas would vent upward rather than infiltrate downward. At the compressor stations, only a small source of hazard seems likely--specifically, spilled lubricant or indiscriminately disposed waste.

Noteworthy interactions are anticipated under two situations only: at river crossings and across wetlands or other areas where the pipeline trench would reach to and below the water table. At a river crossing, the pipeline trench would cut into any alluvial valley train and its contained underflow. Some such trains are sources of usable ground water, calling for protection against pollution. Ordinarily, adequate protection would be assured by keeping the construction site, during trenching and backfilling, free from all noxious waste products that do not oxidize or disintegrate rapidly. Also, the possibility of polluting a usable water source would be further diminished by the usual practice of constructing the crossings while river flow is near its minimum. At such times, ground-water head ordinarily would be somewhat greater than that of river water and so would tend to flush the pipeline excavation.

The crossing of the Spokane River in eastern Washington, with its extraordinarily large valley underflow, is undoubtedly the most vulnerable of all the crossings along the pipeline.

Wetlands, and other areas of shallow ground water, ordinarily do not afford usable water supplies. Their chief relevant effects are: (1) during construction, the pipeline trench would need to be dewatered; and (2) the operating pipeline might require protection against corrosion. These ground-water conditions would affect construction practices.

3.1.5E.6 Vegetation

Nature and Extent of Direct and Indirect Construction Impacts on Aquatic and Terrestrial Vegetation

The removal or disruption of existing vegetation on approximately 4,775 acres will be necessary to provide working space for emplacement of the proposed pipeline and ancillary facilities such as gauging stations, valves, and new roads. Table 3.1.5.6-1 depicts the amount and type of vegetation which will be affected by the proposed pipeline.

Table 3.1.5.6-1 Approximate miles of vegetative types crossed, Eastport, Idaho to Rye Valley, Oregon.

Pipeline Segment by Milepost (M.P.)	VEGETATIVE TYPE: Total Segment Distance	Cultivated	Lodgepole Pine	Douglas Fir	Ponderosa Pine	Hemlock/Cedar	Rangeland	Locale
0 - 32	32	19		13				Eastport to Bonners Ferry
32 - 209	177	126	29	15	2	5		Bonners Ferry to Snake River
209 - 280	11	60					11	Snake River to Stanfield, Ore.
280 - 324	44	24					20	Stanfield to Meacham, Ore.
324 - 413 1/	89	39	2	9	17		22	Meacham to Rye Valley, Ore.
Totals:	413	268	31	37	19	5	53	

1/ This segment includes 23 miles of existing pipeline from M.P. 355.40 to 378.15, between La Grande and Baker, Oregon which will not require any new construction.

Assuming a 100-foot-wide right-of-way, construction of the proposed pipeline will require approximately 4,739 acres of land. Approximately 36 acres will be used for: river crossings (20 acres); an operations and maintenance base (5 acres); measurement stations (4 acres); valve sites (1 acre); and access roads (6 acres).

Approximately 1,200 acres of the proposed right-of-way is timberland. After construction, this land will be allowed to revegetate, but not back to trees. Consequently, the impact of pipeline construction on these timberlands will persist for the life of the proposed project.

The applicant states that "approximately 80 percent of the disturbed land (3,820 acres) will be allowed to revegetate naturally and/or revert to its preconstruction use."

If the applicant utilizes natural revegetation it will take plant succession many years to establish a plant community similar to what exists prior to construction. The natural revegetation process will leave the soil susceptible to severe erosion losses for a long period of time, i.e., until plant succession establishes an adequate vegetative cover.

The 414-mile route from Eastport, Idaho, to Rye Valley, Oregon, requires 29 miles of "new" route, the remainder paralleling PGT and Northwest Pipeline Company existing rights-of-way. The adverse impact on the existing vegetation would be less severe along existing routes than if the proposed pipeline were to traverse an entirely new route. Also, approximately 23 miles between Baker and Rye Valley, Oregon, will not be disturbed.

The complete removal of all aquatic vegetation within the proposed pipeline route clearing limits can be expected. Excavation of the pipeline trench across perennial waterways would disturb the streambeds, resulting in downstream sedimentation. Sedimentation, although of short duration in most streams, would damage or destroy downstream aquatic vegetation. This would temporarily disrupt the food chain of aquatic animals, requiring their displacement until the aquatic plants have been reestablished.

There would be no direct impact on marsh vegetative communities located near the proposed pipeline. The proposed route skirts the small marshes between Naples and the Pend Oreille River in Idaho, and in the Liberty Lake-Saltese Flats area in Washington. Floating and partially or wholly submerged aquatic plants such as: yellow pond lily, water milfoil, sedges, rushes, and cattails are the major vegetative species in these swamps. In the event these wetlands were affected by soil erosion and sedimentation resulting from construction of the proposed pipeline, the adverse impact on aquatic plants would be temporary since natural reestablishment of these plants is relatively rapid.

Riparian plant associations destroyed by construction activities would also revegetate within several months if the topsoil is replaced from excavated areas. However, species such as: cottonwood, alder, hawthorn, and aspen would require several years to become reestablished, either through natural regeneration or by actual seeding and planting by the Applicant.

Major adverse impacts on terrestrial vegetation would result from construction of the proposed pipeline. These impacts would be evident for varied periods of time, depending upon the vegetative type affected.

The invasion of weed species would occur on all areas near the denuded pipeline route. This would pose potential problems, especially in the case of the invasion of noxious weeds and species that are extremely competitive with native vegetation. A rapid and successful invasion of undesirable annual brome grasses could prevent the reestablishment of native grasses, which are valuable as a food source to livestock and wildlife. Annual bromes inhibit the regrowth of shrubs, which are valuable as browse and cover. Plants belonging to the goosefoot, mustard, and sunflower families comprise a large percentage of weed species which would probably establish themselves on the cleared pipeline route.

Where the proposed route passes near agricultural lands, a much higher potential for invasion by weeds exists than in more remote areas. However, natural seed dispersion and transport mechanisms render any area susceptible to successful invasion by undesirable species.

Effects of Gas Leaks on Vegetation

Adverse effects of the operation of the proposed pipeline would be caused by pipeline failure resulting in massive gas releases with the potential for wildfire. For small leaks, the gas would be quickly warmed by ground and ambient air, so that no gas would collect at the surface. For larger leaks and pipeline rupture, there could be a toxic volume of cold gas near the proposed pipeline. Small leaks can be detected during the growing season, as natural gas kills vegetation in the immediate vicinity.

Persistent damage would not be expected if the leakage is detected and the necessary repairs made quickly. Rapid detection would be necessary to prevent the possibility of persistent damage to the environment. Studies by the Environmental Protection Agency indicate that an important source of damage to vegetation from hydrocarbons is attributable to the presence of ethylene.

3.1.5E.7. Wildlife

Much of the quantitative data and judgments in this section, unless specifically cited, are from personal communications with biologists from the Fish and Wildlife Service, Bureau of Land Management, Forest Service, and State wildlife agencies. Records are on file in the U.S. Fish and Wildlife Service Area Office in Portland, Oregon.

Impacts

There are several species of big game animals commonly or occasionally occurring along the proposed route. They include: white-tailed and mule deer, Rocky Mountain elk, Mountain caribou, moose, bighorn sheep, pronghorn antelope, and black bear. Mountain caribou and bighorn sheep are discussed in greater detail under "unique, sensitive, and/or threatened populations."

Construction during the spring through deer fawning grounds, elk calving grounds, or antelope kidding grounds would disrupt these essential activities and possibly cause the death of some newborn young. The precise location of such grounds along the proposed route is unknown at this time. Pipeline construction during the spring and fall at points where migration routes cross the proposed route would result in deer being diverted from their normal migration route. Being a mobile animal, they would merely bypass the disturbance, as they do during hunting seasons.

The proposed route provides no significant new access roads. All except 29 miles follow existing pipeline rights-of-way, the 29 miles of new rights-of-way parallel the existing ones and are within 1/4 mile of existing roads.

Many carnivores; i.e., small game and fur-bearing mammals, such as bobcat, lynx, wolverine, weasel, mink, marten, and fox generally have large home ranges over which they regularly move. Such areas could include several habitat types, particularly the mixed conifer forest and the riparian communities. The loss of a small portion of the home range along the proposed pipeline route would probably have a minimal impact on these species. Certain herbivores, such as rabbits, tend to have small ranges and are generally restricted to the region immediately surrounding their burrows. Where the pipeline construction zone passes through these territories, the impact on the individual animals would be greater. However, the impact on the species population would be temporary, because of the great reproductive potential of these herbivores. Some small game mammals such as rabbits would reinhabit the proposed route after construction.

Localized elimination of individual small mammals such as mice, ground squirrels, voles, shrews, and/or their habitats would occur along the proposed route. Most of these species have small home ranges and tend to retreat to their burrows when disturbed or threatened. However, the impact on the populations would be temporary, because of the high reproductive potential of most of these species and the subsequent rapid reinhabitation along the proposed route. Construction of the proposed pipeline would not appear to affect bats.

Until revegetation occurs, loss of habitat would minutely affect game birds such as grouse, pheasant, partridge, and quail. However,the impact would not be likely to cause a population decrease unless nests with eggs were destroyed.

Removal and destruction of grasses, shrubs, and trees from the proposed route would reduce the amount of food in the immediate area available to these birds. The destruction of small watering areas, such as springs and seeps, could have serious impact on local populations because watering sites are often the limiting factor in a particular locale.

Nests and broods of young game birds near the proposed route could be destroyed, and others within a few hundred feet could be abandoned due to the construction disturbance. Breeding-display sites of species of grouse could be disturbed, or physically altered, and thus rendered unsuitable.

Creation of "edge" may prove beneficial to many small animals, upland birds, etc. Edge is the meeting of two dissimilar vegetative associations.

The proposed pipeline would not directly affect a significant amount of habitat suitable for waterfowl and other migratory birds. Most marshes, small lakes, reservoirs, and similar bodies of water would be avoided. At the crossing points of most of the major rivers and streams and numerous smaller streams and creeks, there are no extensive resting or feeding areas for waterfowl. However, water associated birds would have a small amount of habitat adversely affected where the proposed pipeline crosses the Kootenai River flats. Construction noise, dust, human harassment, blasting and other construction related disruptions would have a negative effect on waterfowl near the proposed route, especially if construction occurred during nesting and rearing activities when nests could be abandoned or young become more vulnerable to predators. Adverse effects to waterfowl would practically cease once construction activities cease.

The loss of habitat could affect birds of prey in two ways, although these impacts are temporary and insignificant. First, where forests, steppe, salt desert shrub, and riparian vegetation are removed from the construction zone, the source of food, cover, and nest or den sites for resident small mammals, birds, reptiles, and amphibians would be eliminated. This results in a reduction of animal populations. A reduction in the amount of food available to the birds of prey, which tend to hunt over large areas (Snow, 1973; Craighead and Craighead, 1969) would also occur. However, small animals crossing the cleared space would be more readily observed by these birds, and thus could become more vulnerable. As the proposed route revegetated, both these effects would be minimized. Eventually, there would be an increase in prey species to preconstruction levels in forested areas because of the increased carrying capacity along the proposed route and associated forest edge. However, in dry areas revegetation would often be slow and prey populations would recover more slowly.

Secondly, there could be a short-term adverse impact on breeding activities and nesting of birds of prey, especially in forest areas. This impact could reach for some distance, possibly 1 mile or more on either side of the proposed route. The magnitude of the impact would decrease as distance increases (Snow, 1973). Trees along the proposed route containing owl nest holes or nests of other raptors would be removed. Some species along the proposed route could abandon their nests. In the case of common species with large populations such as red-tailed hawks, screech owls, or great horned owls, the loss of a few birds would be insignificant. This is because they are widespread, numerically abundant, and have high reproduction potential in a relatively short time.

The greatest impact from construction would be from downstream siltation and turbidity caused by construction at and in the vicinity of stream crossings. Lesser impacts would be from stream blockage by either construction at stream crossing or streamside debris, blasting in streams, and hydrostatic testing.

The impact on the anadromous fish of Washington and Idaho cannot be accurately predicted. Only one annual spawning run would be affected by the construction at any particular crossing. However, construction activity could damage or destroy important spawning substrate and other vital habitat for 6 months to 3 years.

At stream and river crossings along the proposed route where blasting is necessary, territorial fish, such as sunfish or trout, would be killed, injured, or stunned in the immediate vicinity. Schooling fish, such as whitefish or suckers, would probably have already vacated the pool by the time blasting occurred. Fish populations could suffer losses directly or indirectly by an increase in silt due to runoff from construction sites and a loss of vegetative cover. Construction activities that could increase siltation include: right-of-way clearing and grading, trenching, temporary storage of soil and substrate, backfill, access road construction, and stream crossing. Additional details are in section 3.1.5E.5.

While juvenile or adult fish may tolerate heavy concentrations of silt (Cordone & Kelly, 1961) and are able to move away from regions of high silt density, nonmobile eggs and fry may be damaged (Peters, 1962). Impact could be severe on salmon and trout, whose gravel spawning beds must be relatively free of sand and silt and not highly compacted. Even small amounts of fine material could be detrimental to the spawning and fry survival of these species. Excessive sand and silt cause low intragravel flows, resulting in decreased supplies of dissolved oxygen for egg and fry respiration. This could reduce fry survival by filling spaces in the gravel, thus preventing fish from emerging from the spawning bed. Silt is less damaging to warm water and/or rough fish adapted to living and spawning in turbid water.

Siltation increase could reduce the normal species and numbers of plants and dependent macrcinvertebrates (Gammon, 1970), which are food for such species as trout, perch, bass, and other vertebrate predators. The impact on invertebrates, most of which have short generations, would be temporary. These populations would return to normal levels within 6 months to 1 year after construction.

In the Snake River, the impact of siltation on trout, steelhead, or salmon spawning would be slight because most spawning is upstream from the crossing.

In the smaller streams traversing stable substrates, construction would cause only a small amount of siltation and the impact on sport fish would be limited. Mostly, these streams support cold water fisheries of rainbow trout. Many trout impacted by the pipeline crossing would emigrate to other habitats and fall prey to predation before they could readjust.

Several streams that would be crossed in the Snake River Basin contain populations of warm water fish, such as sunfish and catfish. These are generally more tolerant of an environmental disturbance like siltation than cold water sport fish. Warm water fish typically use a broader range of habitat types (need less living organic matter) and adapt more favorably to changing environmental conditions than do cold water species.

There would be a small loss of warm water fish due to pipeline construction. Fish would be somewhat more sensitive to silt during the spring and early summer spawning season. A fine-particle silt load in the river would be detrimental to the reproductive success of the fish trying to spawn downstream from construction.

The temporary gross physical disturbance and siltation of aquatic habitat from construction at river crossings is probably the most serious problem relative to construction. During the hydrostatic-testing phase of pipeline construction, large amounts (up to several acre-feet discharged at a rate of 10 cfs) of water are discharged in a relatively short period of time into water courses, temporary holding ponds, or onto nearby ground which drains into streams. The sudden discharge could cause excessive turbidity and siltation.

Unique, Sensitive and/or Threatened Populations

The Malheur shrew could be encountered in wet areas and along streambanks from the Blue Mountains of Washington to mid-Malheur County, Oregon. Little is known about these animals, therefore, the magnitude of impact cannot be predicted.

The northern bald eagle and osprey are both greatly reduced from former abundance along the proposed route. One known active northern bald eagle nest is located near the proposed route in the vicinity of Hilgard (Union County), Oregon. Osprey would be encountered along Lake Pend Oreille. Impacts are expected to be neutral.

The tailed frog could be encountered in the Wallawa Mountains of eastern Oregon. It inhabits clear, cold streams and would be adversely impacted if a stream crossing occurred on a stream inhabited by the frog. Warming of the water by stream blockage or destruction of aquatic vegetation and invertebrates by siltation could both affect it. Warming of the water would not last longer than the summer in which construction occurred.

The white sturgeon would be adversely affected downstream from the Kootenai River crossing for about 2 to 4 months during and shortly after the stream-crossing construction.

Endangered Species

None are known to be resident within the right-of-way route. Bald eagles and ospreys are found near the right-of-way, but considering the existing rights-of-way for pipeline, roads, and other utilities, new impacts would be minimal.

Other Minor Impacts on Terrestrial Ecosystems

The following minor impacts are generally of a short-term nature. Smoke from onsite burning of trees, slash, etc., could disturb birds, particularly those nesting in the area. This resulting adverse impact would be short term and insignificant on songbirds and other common species. The impacts could be long term and significant on large birds that might be nesting in the immediate area, especially birds of prey such as ospreys, eagles, and peregrine falcons. These latter birds are threatened or endangered and the loss of a few nests could eliminate the population in the affected area. The greatest concentrations of these birds and correspondingly the greatest amount of woody vegetation to be disposed of would usually occur adjacent to streams. The impact on mammals is expected to minimal and temporary.

Some dust would be raised by construction activity especially in arid areas that are cultivated or in the desert regions. In farm areas, dust would have relatively little impact on biological communities. In forest, shrub, and desert plant associations, dust clouds raised by equipment and the resulting dust covering vegetation could be esthetically objectionable, but would probably have a minimal biological impact. Wind and rainfall should be sufficient to remove most of the dust within days or weeks.

Upland Game Birds

Operations of the proposed pipeline would have a limited adverse impact on the upland game bird populations, except in the immediate region of the compressor and measurement stations. At these sites, human activity and noise could deter grouse and other birds from feeding or nesting.

References

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Peters, J.C. 1962. The Effects of Stream Sedimentation on Trout Embryo Survival. Project no. F-20-R. Montana Fish and Game Department.

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3.1.5E.8 Ecological Considerations

The impacts of the construction and operation of the proposed pipeline have been discussed for each ecological component under:

Climate - 3.1.5E.1
Topography - 3.1.5E.2
Geology - 3.1.5E.3.
Soils - 3.1.5E.4
Water Resources - 3.1.5E.5E
Vegetaticn - 3.1.5E.6
Wildlife - 3.1.5E.7

To assess the total impact of construction and operation of the proposed pipeline, the combined impact of the above seven ecological components must be considered simultaneously, since these components act and interact among themselves. The complexity and dynamics of an ecosystem are generally in direct proportion to its size; the larger the ecosystem, the more complex are the interactions of its components among themsleves and the more complex is their total reaction to their environment.

Construction and operation impacts on the many ecosystems traversed by the pipeline would be direct and indirect, as well as synergistic and cumulative. These impacts can develop a "multiplier" effect. Wherein, if one component of an ecosystem is adversely affected, such action will trigger adverse effects on one or more additional components. As an example, the removal of vegetation within the right-of-way clearing prior to trenching, pipe laying, and back-filling, would expose the topsoil to erosion. If the soil is eroded by water, the ecosystems above and below the disturbed area will be affected. Sediment will be deposited in live streams, disrupting the existing aquatic plant and animal life. Also, due to the loss of soil frcm the right-of-way area, it will become more difficult to reestablish suitable vegetative cover on the right-of-way.

It is not possible at this time to accurately assess and quantify the total ecological considerations of construction and operation of the proposed pipeline. Estimates and judgments can be made based solely on observations of the impacts resulting from the construction and operation of portions of the two existing pipelines which the proposed pipeline will parallel; 280 miles of existing PGT pipeline (from Kingsgate, British Columbia, to Stanfield, Oregon, and 133 miles of existing Northwest Pipeline Ltd. pipeline (from Stanfield to Rye Valley, Oregon). Nc known research or monitoring studies have been made of the ecological changes resulting from construction and operation of these existing pipelines.

3.1.5E.9 Economic Factors

Construction and operation of the proposed pipeline will have a minor and generally brief impact on the local economies along its route. These impacts will be most noticeable in the more sparcely settled areas of the route.

Impacts will arise from the laying of the pipeline itself, expansion of three compressor stations, construction of an operating and maintenance base and three measuring stations. Construction would take place simultaneously during a 12-month period from July 1979 to July 1980. These impacts will be short term during actual construction and longer term in the operation and maintenance of the facilities. Economic impacts will be seen in changes in employment, population, and income of the area; increased demand for housing; and community services and additions to local tax bases.

Employment

The proposed pipeline would be about 390 miles long from the Idaho-Canadian border to Rye Valley, Oregon. Of this distance, about 280 miles would parallel an existing pipeline, but on a separate right-of-way; the remaining distance from Stanfield to Rye Valley would actually be a looping of an existing pipeline sharing in part the same right-of-way as the existing line.

Pipeline construction requires a crew, or spread, of about 250 workers for each 100 miles of line constructed. The proposed line would thus require a minimum of three to a maximum of four spreads, about 750 to 1,000 workers, plus an inspection force of about 40. All spreads would work concurrently.

An estimated 30 percent of the workers could be hired from local labor pools while 70 percent, those requiring more specialized skills, would be hired from outside the local area. Thus, the number of local workers who could expect to find employment in construction of the pipeline would be 225 to 300, less than 1 per mile. This is not likely to affect local unemployment rates measurably.

No new compressor stations will be required, but the horsepower of three existing stations at Eastport, Idaho, Spokane, Washington, and La Grande, Oregon, will be increased to accommodate the new line. A work force of 10 to 50 men plus three inspectors will be required over a period of 6 months for construction at each of these stations. A large portion, perhaps all, of these crews will be hired locally.

The third element in the proposal is construction of an operations and maintenance base at Spokane and new or expanded measurement stations at Eastport, Idaho, Spokane, Washington, and Stanfield, Oregon. This construction will take place concurrently with the laying of the pipeline and will require about 25 workers at each of the 4 sites for a period of 3 months. Workers for these sites can likely be hired locally.

Longer term employment resulting from the construction of the pipeline will involve 15 operations and maintenance people, 10 in Spokane, Washington, and 5 at La Grange, Oregon. Even if these more permanent jobs induce an equal number of service jobs in these communities, the economic impact on local economies will be extremely small.

Table 3.1.5.9-1 lists the proposed pipeline mileage and related facilities by county. Table 3.1.5.9-2 summarizes the expected employment generated by the proposed pipeline.

Population

Permanent population effects are summarized in Table 3.1.5.9-3. Since the permanent population effects will be spread between two sizeable communities, the impacts on a particular community will be negligible.

The impacts of construction crews on housing and services in smaller isolated communities may be significant, if the crew plus their families exceed 10 percent of the resident population (see Table 2.1.5.9-4). Since the non-local work force of each spread would be about 150, some of whom will have families with them (see following subsection), there could be high population impacts temporarily (1 year) in communities having less than 4,000 residents. Only 9 of the communities along the proposed route had more than 4,000 residents in 1970. There is insufficient information available to determine which communities will be affected as the crews disperse along the proposed route.

Housing and Community Services

The total number of persons associated with each spread, including workers and their families, is likely to be between 300 and 500. A closer estimate is not possible because the decision of any individual family unit to move to the construction area would depend upon such variables as number of children, age of children, availability of housing and other services, expected length of stay (which depends on the sequence of pipeline spread construction), and the degree of permanency of their previous residence.

The number of family units with children would affect the demands placed on community services (schools, health service facilities, parks and recreation) and certain housing types (trailer courts and apartments) differently than would household units without children. Regardless of the final composition of family units, approximately 250 housing units of some type would be needed per spread. Past experience indicates that many construction workers provide their own housing in the form of mobile homes. Contractors may provide work camps in the more remote areas. There would be no need for construction employees to locate in a single community, and they will, therefore, most likely disperse along the 100-mile spread being worked.

Pressure on living quarters would not be expected to strain capacity anywhere along the line.

Description of impacts on community services beyond the preceding analysis is not possible without knowledge of specific living locations--this information is not available. The additional 15 or so units spread among 2 counties should pose no problems of availability or even construction.

Income and Trade

Construction worker income would be expected to average about $85 per day. While labor contracts are expected to include such fringe benefits as health insurance, vacation or leave, and sick leave, etc., it is estimated that each worker would work an average of 21 days per month, earning $1,785 per month. This estimate allows some time for travel between jobs. A spread of 250 men would work in one location for about six months. Multiplying the average earnings ($1,785/month) times the man-months of employment yields estimated pipeline construction income as shown in Table 3.1.5.9-4. For purposes of comparison, earnings in the contract

Table 3.1.5.9-1 Pipeline and related facilities

State	County	Approximate Pipeline Mileage	Compressor Stations*	New Measurement and Maintenance Stations
Idaho	Boundary	44	No	Yes
	Bonner	40	No	No
	Kootenai	26	No	No
Washington	Spokane	38	No	Yes
	Whitman	62	No	No
	Columbia	3	No	No
	Walla Walla	50	No	No
Oregon	Umatilla	66	No	Yes
	Union	26	No	No
	Baker	35	No	No
Total		390	0	3
Work Crews or Spreads		3-4		

*Under the fully powered system, compressor stations will be built at the following mileposts: #1 - MP-56, #2 - MP-110, #3 - MP-184, #4 - MP-266, and #5 - MP-328. In addition, 8 more compressor stations (see Table 3.1.5.9-9 under future expansion).

Table 3.1.5.9-2 Employment Summary

Work Objective	Probable Number of Employees	Probable Work Duration
Pipeline Construction	750-1,000	12 Months
Compressor Station Expansion	159	6 Months
Measurement and Maintenance Station Construction	100	3 Months
Operation and Maintenance	15	Permanent
Induced (Secondary)* Employment	6	Permanent

* Based on an average employment multiplier of 1.4 (estimated by means of a net trade flow model using data for the BEA regions described in section 2.1.5E.9).

Table 3.1.5.9-3 Population effects of pipeline related employment.

Permanent O & M Employment	Induced Employment	Total New Employment	New Households	Population Effects*
15	6	21	15	63

* Assumes a family or household size of three persons, with all of the new pipeline employees and their families coming from outside the "pipeline" counties.

Table 3.1.5.9-4 Income Generated by Pipeline Construction, Contract construction earnings, and total personal income 1/.

State /	County	Pipeline Mileage	Contract Construction Earnings 2/ ($1,000)	Total Personal Income 3/ ($1,000)
Idaho	Boundary	44	1,354	20,440
	Bonner	40	3,725	56,940
	Kootenai	26	10,802	140,160
Washington	Spokane	38	68,719	1,267,280
	Whitman	62	5,435	154,760
	Columbia	3	1,214	18,980
	Walla Walla	50	12,904	188,340
Oregon	Umatilla	66	9,006	183,960
	Union	26	3,480	80,300
	Baker	35	2,466	56,940
Total		390	119,105	2,168,100

1/ For purposes of comparison, all income data have been converted to 1975 dollars by use of GNP inflator/deflator factors obtained from Warton Economic Forecasting Associates. Adjustment does not include population changes from base year of measurement.

2/ Estimated from employment data of the 1970 Census of Population.

3/ 1970 Census of Population.

construction sector and total personal income of each county is also shown. Because construction workers are not permanent, they probably would not spend as much of their income locally as do residents. It is also possible that the county of domicile (and consequently income expenditure) is not the same as the county generating the income. For this reason, trade levels are shown only by region and state components in Table 3.1.5.9-5.

Using a somewhat arbitrary criteria of 10-percent change in an industry and a 1-percent change in an area statistic as a measure of significance, the data of Tables 3.1.5.9-4 and -5 can be interpreted in terms of expected monetary impacts. In all of the 10 counties, except Kootenai, Spokane, Walla Walla, Mono, Kern and San Bernadino, construction of the pipeline would add significantly to the income generated by the construction industry. In all counties except Kootenai, Spokane, Walla Walla, and Umatilla, pipeline construction would also contribute significantly to total personal income. Impacts on income would occur in the year of construction with some additional, but diminishing, effects in later years as the income enters the flow of local economic activity.

Income expenditures on goods and services are estimated in Table 3.1.5.9-5. Only 40 percent of the income generated is expected to be spent locally because of the high proportion of non-resident employees, who can be expected to spend less than normal amounts of income in the local area. As mentioned earlier, expenditures need not occur in the county generating the income. Consequently, the regional measures of Table 3.1.5.9-5 do not indicate significant impacts upon trade and service activity. Individual communities, however, may well experience significant changes in trade and service activity during the construction period. Where such impacts may accrue is unknown.

In addition to expenditures for goods and services by construction workers, each pipeline spread would generate other actions affecting the local economy. Transportation systems could be affected, as the contractor must have pipe delivered and stored along the pipeline route, preferably at 30-mile intervals. The pipe would be shipped by rail to several railheads along the route, then strung out along the right-of-way by truck. For each spread the contractor must also rent a yard for pipe storage, an equipment and maintenance shed, and field offices.

The contractor also could expect to spend $2,000 per day per spread for diesel fuel, or about $3,500 per mile. Purchasing arrangements would often be made with a local supplier. Estimates of expenditures for diesel fuel are also shown in Table 3.1.5.9-5. These estimates are based on present costs. At the time of construction the cost of fuel may be significantly different.

Income for permanent employees in 1977 would average an estimated $15,000 per employee. Pipeline O & M workers would receive about $17,000 per year while service or secondary employees would earn an estimated $12,500 per year. Table 3.1.5.9-6 summarizes the income impacts of the permanent employees. This income probably would be spread among the larger communities along the pipeline routes where these employees would likely live.

Another income-related impact is the loss of agriculture and forest production along the right-of-way itself. This topic is treated in detail as part of land use impacts (see Section 2.1.5E.11). While the biologic productivity of range land may be adversely affected within the right-of-way strip, there are no expectations that livestock stocking rates would be

Table 3.1.5.9-5 Estimated Goods and Services Expenditures and Total Retail and Services Receipts

Region / State	Retail & Service Receipts 1/ ($1,000)	Estimated Crew Expenditures 2/ ($1,000)	Contractor Fuel Expenditures 3/ ($1,000)
Region I [ITA(A)]			
Idaho	84,681	919	387
Washington	684,622	1,289	534
Oregon	154,706	1,059	444
Total	924,009	3,267	1,365

1/ Based on 1967 data from Tables 2.1.5.9-2 and -10.

2/ Applicant's revised estimate.

3/ Calculated at the rate of $3,500 per mile of pipeline.

Table 3.1.5.9-6 Income generated annually by pipeline related permanent employees.

Pipeline O & M Employees ($17,000/year)	Induced (Service) Employees ($12,500/year)	Total Annual Income
15	6	337,500

reduced. Consequently, any adverse economic effects to the livestock industry would be short, unmeasurable, or even non-existent.

Data on crop and forest land production are presented in Table 2.1.5.9-7. Production loss would likely extend for more than 1 year depending upon the type of crop affected, means of soil replacement, surplus soil disposal, amount of soil compaction, etc., in the pipeline construction process.

The value for forest land disturbed will not be entirely a loss as commercial timber will be harvested; the loss will be lost growth on the smaller unharvested trees. The permanent acreage lost to timber production, 300 acres (see 3.1.5E.11), would have yielded over a production cycle of 90 to 100 years, an equivalent value of $135,000 at 1975 prices.

State and Local Tax Base

During the construction phase, tax benefits to state and local governments along the pipeline would come primarily from sales and motor fuel taxes. These benefits would be transitory and have little significant long-term impact. Corporate taxes would also generate revenues to the states. While these sources of revenue may be important to the governments involved, it is worth noting that most of these revenues would come out of the salaries of construction and operational workers, and except for corporate purchases and taxes, do not represent additional increments of income to the proposed pipeline regions. New housing and business expansions resulting from the needs of new permanent employees would add slightly to the local property tax base.

Property taxes on the pipeline, compressor stations, and improvements would be the primary tax benefits to the governments through whose jurisdiction the pipeline passes. In most instances, tax benefits can be judged significant both on the basis of magnitude and because they will accrue annually, in some degree, for the life of the pipeline. The assessed valuation of the pipeline and improvements will be determined by the assessor's office in each county or by the State Tax Commission. In Oregon, the pipeline itself would be assessed by the Utilities Section of the Department of Revenue in Salem. The compressor stations, however, would be evaluated by the county assessor. Tax assessments are set by law at a certain percentage of the value.

Table 3.1.5.9-8 shows the assessed valuations of pipeline facilities as estimated by the applicant companies for the year 1980. For comparative purposes, total county assessed valuation and property tax receipts are also shown for the most current year available. County tax revenues derived from the proposed pipeline facilities are considered to be the most significant economic impacts on local areas to result from implementation of the proposed action.

Economic Trends and Development

Due to the short-term nature of pipeline construction, the limited number of permanent employees, and the fact that most of the gas transported by the pipeline would go into markets either away from or at the end of the regions, there is no current indication that ongoing trends will be changed or modified. Thus, the trends described in Section 2.1.5E.9 are expected to prevail with only minor pipeline influences stemming principally from local government revenues generated.

Table 3.1.5.9-7 Estimated Value of Crop and Forest Land Production of Proposed Pipeline Right-of-Way.

		Crop-land		Forest-land	
State	County	Acres 1/	Value 2/ ($1,000)	Acres 1/	Value 3/ ($1,000)
Idaho	Boundary	45	*	379	171
	Bonner	114	14	306	138
	Kootenai	139	12	131	59
Washington	Spokane	342	34	31	*
	Whitman	676	49	1	*
	Columbia	234	20	0	
	Walla Walla	238	28	0	
Oregon	Umatilla	159	24	180	81
	Union	110	13	168	76
	Baker	247	39	0	
Total		2,314	233	1,196	525

1/ WEI Analysis of Northwest Pipeline Corporation alignment ownership route maps (1973)

2/ Computed from average sales per acre, 1969.

3/ Computed at $30/MBF based on first quarter 1975 stumpage sales.

* Too small to estimate.

Table 3.1.5.9-8 Estimated Assessed Value of Pipeline Facilities Related Tax Base and Annual Revenues.

State	County	Pipeline Mileage	Pipeline Facilities 1/ Assessment ($1,000)	Pipeline Facilities 1/ Tax ($1,000)	County Total Assessment ($1,000)	County Total Property Tax ($1,000)
Idaho	Boundary	44	7,401	681	15,236 2/	1,245 3/
	Bonner	40	6,823	628	33,842	412
	Kootenai	26	4,154	436	59,543	1,537
Washington	Spokane	38	25,561	920	1,171,110 4/	32,522 5/
	Whitman	62	40,635	487	263,529	7,354
	Columbia	3	1,966	71	44,433	1,239
	Walla Walla	50	32,771	1,148	238,256	7,463
Oregon	Umatilla	66	99,165	2,877	437,965 6/	12,490 7/
	Union	26	14,410	257	214,752	4,551
	Baker	35	19,994	420	217,935	4,218
Total		390	252,880	7,925	2,696,601	73,031

1/ Estimated by applicant for year 1980.
2/ State of Idaho, State Tax and Property Tax Levies by County, 1974.
3/ Computed from assessed valuation.
4/ Equalized total assessed valuation, 1973.
5/ Washington Dept. of Revenue, Current Property Taxes by County, 1973.
6/ Oregon Dept. of Revenue, Summary of Assessment Rolls, 1973.
7/ Ibid, Comparison of Property Tax Levies by County, 1973-74 tax year.

Impacts of Gas Supply

The major economic and social impacts of this pipeline proposal will not devalue from the construction and operation of the pipeline itself, but from effects of the amount of energy it will make available in areas where the natural gas delivered through the pipeline will be marketed.

3.1.5E.10 Sociological Factors

Because of the close relationship between economic and sociological factors, most sociological impacts have been included in the economic discussion of section 3.1.5E.9 above.

Waste Generation

The initial part of the Los Angeles line will be constructed along the corridor of the San Francisco line for the most part. Consequently, the description of the waste generation problem given in Section 3.1.4.10 is applicable here. Since the San Francisco line would be constructed in an adjacent right-of-way and during the same time period, there may be an increase of solid waste disposal impact due to having two nearly simultaneous spreads near each other.

3.1.5E.11 Land Use

Pipeline construction would disrupt present land uses on approximately 4,775 acres. Restricted land use will occur on approximately 1,216 acres: 16 acres for permanent ancillary facilities, the remainder primarily forest lands will be kept out of timber production after initial clearing of the right-of-way. The restricted use would last for the life of the project.

Most of the counties through which the proposed pipeline will be constructed have regulations or ordinances pertaining to placement and construction of this type of facility. Most of these counties require approval by a planning or zoning authority or the county commissioners. In some cases, hearings must be held before a conditional use permit or waiver will be granted.

Land use impacts will occur on 3,581 acres of agricultural land, and approximately 1,200 acres of forest land. Land use impacts concerning agricultural operations, vegetation, and soils are described in Sections 3.1.5E.4 and 3.1.5E.6.

Most commercial timber lands traversed by the proposed pipeline are in Idaho and in the Blue Mountains in Oregon. During construction all of the 100-foot wide working area would be cleared on approximately 1,200 acres of forest areas.

Land use conflicts because of minimum offset distances from gas transmission lines appear between the proposed project and a Planned Unit Development in Kootenai County, Idaho, and the residential use area identified in the Spokane, Washington, Metropolitan Area Land Use Plan. (See Figure 3.1.5.11-1.)

At the Snake River in Whitman and Columbia Counties, Washington, plans are to develop dockage areas for industrial use and related systems. The proposed pipeline will cross this area. About 1/2 mile of river frontage

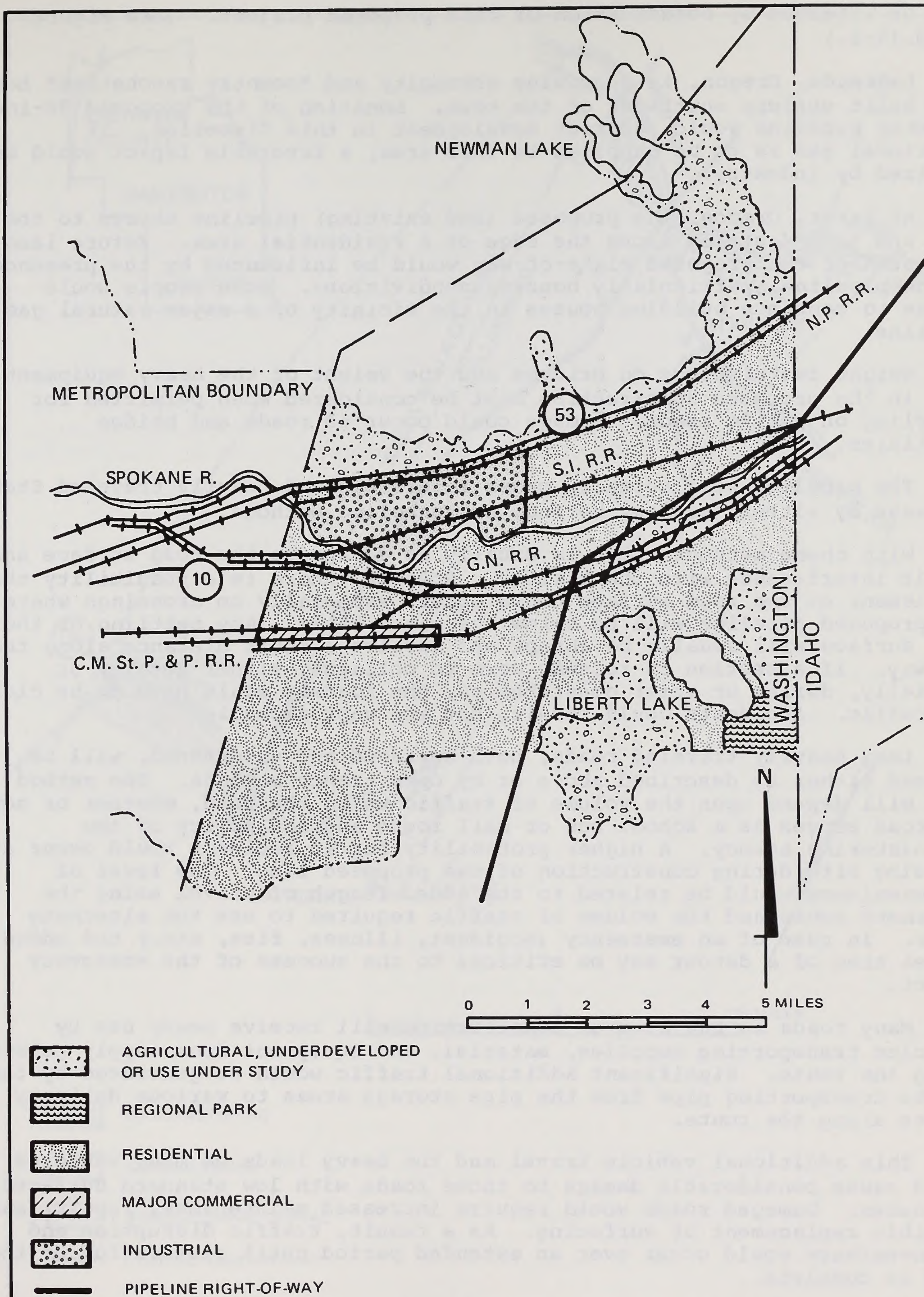

Figure 3.1.5.11-1 Spokane metropolitan area land use plan

will be affected by construction of this proposed project. (See Figure 3.1.5.11-2.)

LaGrande, Oregon, is a growing community and "country ranchettes" have been built upslope southwest of the town. Location of the proposed 30-inch diameter pipeline would restrict development in this direction. If additional gas is to be supplied to this area, a favorable impact could be realized by industry.

At Baker, Oregon, the proposed (and existing) pipeline skirts to the west and then easterly along the edge of a residential area. Future land use south of the proposed right-of-way would be influenced by the presence of the pipeline, particularly housing subdivisions. Some people would refuse to continue building houses in the vicinity of a major natural gas pipeline.

Weight restrictions on bridges and the weight of the heavy equipment used in the proposed construction must be considered when permitted for traveling on public roads. Damage could occur to roads and bridge facilities.

The pipeline will normally cross Interstate and heavily traveled State highways by either jacking, boring, or tunneling methods.

With these methods there is usually no damage to the road surface and little interference with the traffic. However, there is a possibility that settlement of the road surface could occur, especially on crossings where the proposed pipeline will be below the water table. Any settling of the road surface will usually be abrupt and involve a short distance along the roadway. If a section of roadway were to collapse, either totally or partially, during or after construction, the roadway would have to be closed to traffic. Accidents could result, but are unpredictable.

Less heavily traveled roads, both surfaced and unsurfaced, will be crossed either as described above or by open trench methods. The method used will depend upon the volume of traffic using the road, whether or not the road serves as a school bus or mail route and the policy of the administering agency. A higher probability for an accident would occur at a crossing site during construction of the proposed line. The level of inconvenience would be related to the added length of travel using the alternate route and the volume of traffic required to use the alternate route. In case of an emergency (accident, illness, fire, etc.) the added travel time of a detour may be critical to the success of the emergency effort.

Many roads in the area of construction will receive heavy use by vehicles transporting supplies, material, and equipment from supply points along the route. Significant additional traffic would be generated by the trucks transporting pipe from the pipe storage areas to various delivery points along the route.

This additional vehicle travel and the heavy loads on many vehicles would cause considerable damage to those roads with low standard surfaces and bases. Damaged roads would require increased maintenance, repair, and possible replacement of surfacing. As a result, traffic disruption and inconvenience would occur over an extended period until restoration of the road is complete.

In nearly all instances, the crossing of railroad tracks would be accomplished by the bore method. The analysis of impact is very nearly that outlined above for a major road crossing except that, if a collapse would

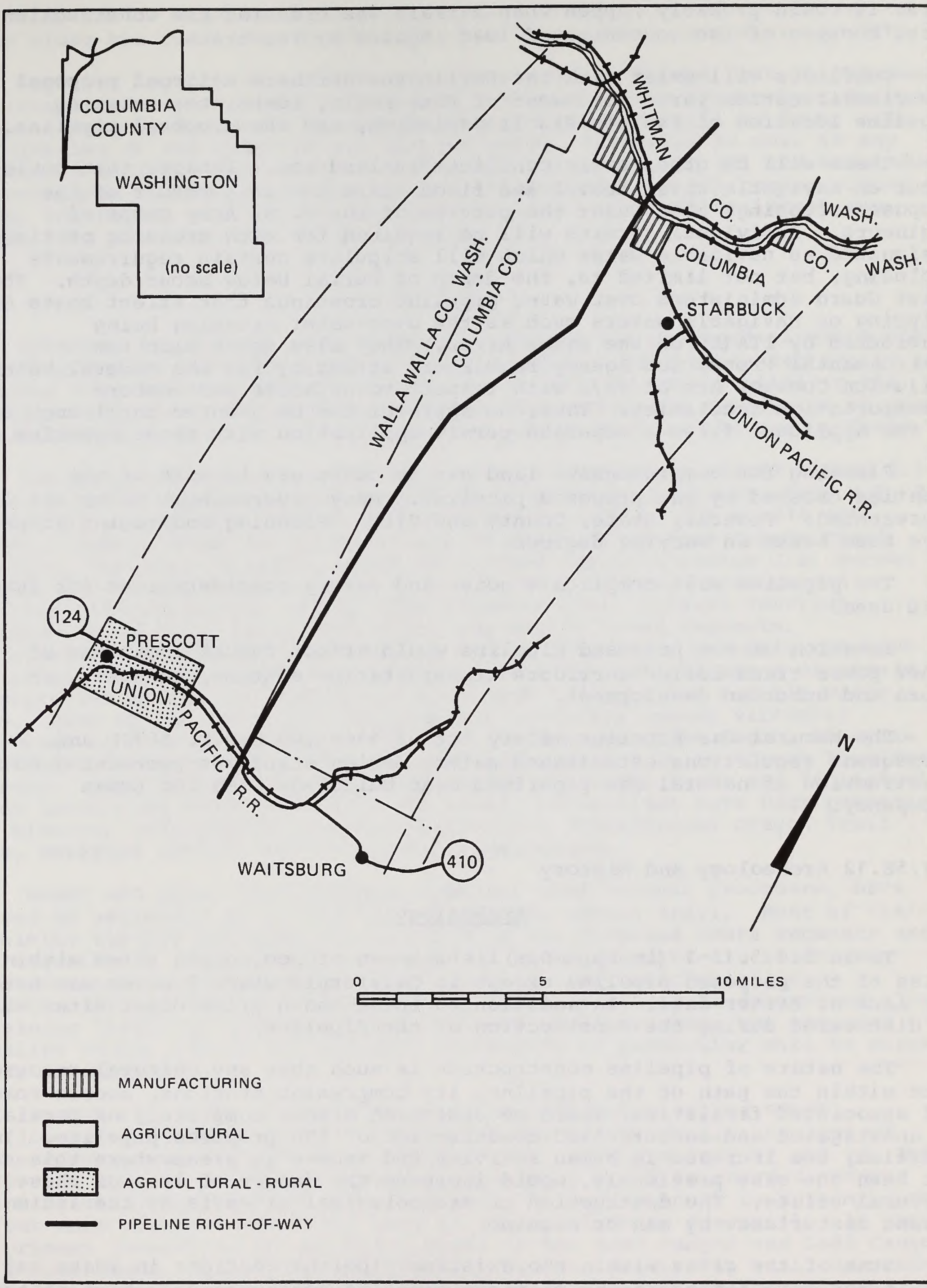

Figure 3.1.5.11-2 Columbia County, Washington, zoning map

occur it would probably happen when a train was crossing the construction site, because of the concentrated load imposed by the train.

Conflicts will exist with the Burlington-Northern Railroad proposal for new classification yards northwest of Post Falls, Idaho, the existing pipeline location of Pacific Gas Transmission, and the proposed pipeline.

There will be other basic conflicts in land use. Impacts that could occur on navigable river travel and flood plain use as a result of the proposed crossings come under the purview of the U. S. Army Corps of Engineers. Individual permits will be required for each crossing of rivers designated as navigable water which will stipulate certain requirements including, but not limited to, the depth of burial below scour depth. The Coast Guard administers over water pipeline crossings that affect boats or shipping on navigable waters such as the over-water crossing being considered by ITA(A) on the Snake River. They also share with the Environmental Protection Agency regulatory authority for the Federal Water Pollution Control Act of 1972 with respect to offshore and onshore transportation facilities. Thus, no approval can be granted until such time as the Applicant files a separate permit application with these agencies.

Planning for comprehensive land use is under way in most of the counties crossed by the proposed pipeline. Many governmental units are represented: Federal, State, County and City. Planning and zoning steps have been taken in varying degrees.

The pipeline will complicate noise and safety considerations for future land uses.

Location of the proposed pipeline would affect future locations of other power transmission corridors transportation systems, industry, or urban and suburban development.

The Natural Gas Pipeline Safety Act of 1968 (49 U.S.C. 1672) and subsequent regulations established safety design standards pertaining to the construction of natural gas pipelines near buildings used for human occupancy.

3.1.5E.12 Archeology and History

Archeology

Table 3.1.5.12-1 (in Appendix) lists known archeological sites within 2 miles of the proposed pipeline except in California where 5 miles was used for lack of better data. In addition to these known sites other sites will be discovered during the construction of the pipeline.

The nature of pipeline construction is such that any cultural resource site within the path of the pipeline, its compressor stations, access roads and associated facilities, would be destroyed either completely or partially by unmitigated and uncontrolled construction of the proposed pipeline. In addition, the increase in human activity and access in areas where this has not been the case previously, would increase the danger of loss of these cultural values. The destruction of archeological sites is by the action of ground disturbance by man or machine.

Some of the sites within the existing pipeline corridor in Idaho and Washington were tested during previous pipeline construction. Most of these sites still have value because few were completely excavated. This project was constructed in 1960 and new knowledge and techniques developed since that time can be expected to result in new information. Of course, untested sites along the remainder of the route can be expected to reveal new data.

Negative impacts on archeology sites result in damage that is permanent and irreplaceable. Mitigating measures can only lessen impact by reducing damage. Principal sources of damage from the pipeline will be from: (1) the clearing of the right-of-way and the actual trenching as well as any associated activity such as borrow pits and access roads; (2) new knowledge of previously unknown sites resulting in vandalism; and (3) better access to sites, increasing visitor and vandalism impacts. A positive impact may result from new data that is discovered.

History

Historic sites that occur within 2 miles of the proposed pipeline are listed in Tables 3.1.5.12-2 and -3 (in Appendix). From these Tables, it is apparent that several historic trails are crossed or are parallel to the pipeline corridor. The most important of these from the standpoint of the possibilities of impact are the migration routes such as the Oregon Trail.

The proposed pipeline route very closely parallels, and is within 2.5 miles of the Oregon Trail for a total of 64 miles as follows: from M.P. 324 to 365 (41 miles), M.P. 370 to 374 (4 miles), and M.P. 399 to 414 (15 miles). Within these 60 miles are all or portions of five Oregon Trail segments, totaling 34 miles, which were found during a recent U.S. Bureau of Outdoor Recreation study to have high potential for preservation and historic interpretation. These five segments are: Hilgard Junction, LaGrande, Ladd Hill, White Swan Mine, and Sisley Creek segments. Collectively, in addition to historic value, they offer probably the best potential along the entire Oregon Trail route for establishment of scenic interpretive trails for hiking and horseback riding along visible wagon ruts. Much of the trail and the adjacent landscape appear virtually untouched in this area since passage of the last emigrant wagon, in spite of existing Interstate 80, a railroad, and gas pipeline of Northwest Pipeline Company. Also included within the 60 miles of Oregon Trail are 16 historic sites associated with the trail. Of these, three sites have high potential for historic interpretation and/or recreation (exceptional Oregon Trail ruts, emigrant graves, and an emigrant campground).

Roads and other developments, together with natural processes, have erased an estimated 80 percent or more of the Oregon Trail. Most of the remaining visible portions are included in the proposed route segments and are therefore a unique resource. Many of these segments are relatively uninspiring scenically but are very important for their historic interpretation potential. Segments traversing a scenic landscape and also retaining their historic significance, such as those along the proposed pipeline route, are in the minority and worthy of particular care to ensure their preservation.

In several areas of Union County, the proposed pipeline comes perilously close to important segments of the Oregon Trail. An area of prime concern extends from Sec. 5 and 6, T5S, R39E, to Sec. 12 and 13, T4S, R38E. In this 6- or 7-mile section, the Oregon Trail is crossed several times by existing highways and pipelines. It is difficult to determine what effect more construction would have on this section of the trail. An area of primary concern to Oregon State Parks is the Ladd Canyon and Ladd Canyon Hill area (Secs. 12 and 13, T4S, R38E). At this point, the trail descends into Grande Ronde Valley and where excellent landmarks remain. There are approximately 1,000 feet of excellent visible wagon ruts and a snubbing tree (used to lower wagons down the canyon). Two unidentified graves are located in this area that date back to the Oregon Trail era. Also in the Ladd Canyon area, a name is carved into a rock wall dating from 1855. Oregon State Parks is considering the possibility of acquiring an easement and developing a hiking trail from the rest area on Interstate 80N up Ladd Canyon Hill, using the Oregon Trail remnants as the primary attraction.

In Umatilla County, the proposed pipeline closely parallels the Oregon Trail and Interstate 80 for approximately 6 miles (Sec. 2, 11, 13, 14, 24, 25 and 26, T1S, R35E), and actually crosses it at three points within a 6-mile radius of Meacham.

In Baker County, the proposed pipeline closely parallels the Oregon Trail from Gold Hill to Pleasant Valley. From Pleasant Valley to North Powder, the proposed pipeline is far enough away from the trail to pose no problem. Where the proposed pipeline route crosses visible segments of the Oregon Trail, a significant adverse impact upon pipeline construction would occur through destruction of wagon ruts and other historic remnants and through visual degradation caused by disturbance of the natural terrain.

Other historic areas include ghost towns, forts, campsites and exploration routes such as the Lewis and Clark route. Most historic structures occur in towns and therefore, should not be affected by the project. While no buildings appear to be directly in the path of the pipeline, historic structures may be camouflaged as remodeled buildings and lie near enough to the pipeline route for blasting, for example, to cause damage.

The type of impacts for historic areas are basically the same as those mentioned in the preceding discussion of archeological impacts, i.e., trenching, other construction, and vandalism resulting from new discoveries.

3.1.5E.13 Recreational and Esthetic Resources

Although scenic resources are an integral part of outdoor recreation, esthetic considerations have been, for the most part, separated from the following discussion and are treated more fully under <u>Esthetic, Scenic and Cultural Features</u> in this section. (See Figure 3.1.5.13-1.)

Implementation of the proposed project would cause temporary, periodic increases of noise, fumes, dust, vehicular traffic, and human presence during the construction period. These unavoidable adverse impacts, though a nuisance, would not create conditions which would severely limit opportunities to participate in outdoor recreation activities. Likewise, construction and operation of the proposed project would not be expected to severely limit the use, or have a significant impact upon, developed recreation areas and facilities. No parks or recreation areas lie directly in line with the proposed pipeline route.

Recreation

Impacts on recreation are limited to areas receiving extensive recreation use, such as hiking and hunting. The principal areas of this type are discussed as follows:

Figure 3.1.5.13-1 Areas of recreation and esthetic concern location map

Moyie River (Idaho)

The Moyie River segment, from the Canadian-Idaho border to its confluence with the Kootenai River, is one of the 27 rivers listed in the Wild and Scenic Rivers Act for study to determine its potential for addition to the National Wild and Scenic Rivers System. The pipeline would make two crossings of the Moyie River within the first 2.25 miles of the route in Idaho, which coincide with crossings of an existing pipeline. Since the U. S. Forest Service is presently studying the Moyie River under terms of the Wild and Scenic Rivers Act, a final decision on the adverse impacts of the pipeline cannot be made until this study is completed. However, the project will result in a major disturbance that may foreclose Wild and Scenic designation.

Snake River (Washington)

Where the proposed pipeline crosses Lower Monumental Reservoir on the Snake River, recreation activity occurs. Disturbance of the river's steep banks and construction of towers and support facilities to suspend the pipeline across the river would have a definite adverse effect on the area's scenic quality. ITA(A) is giving equal consideration to an underwater crossing. This would be particularly significant in that the entire Snake River gorge in Washington has been identified in the Washington State Recreation Trails Program as a water trail and hiking and horseback riding trail. During construction excessive siltration would reduce the recreational experience of boaters, fishermen, and swimmers utilizing the river and developed areas downstream from the crossing.

Lewis and Clark Trail (Washington)

The pipeline would cross the outward bound route of the Lewis and Clark Trail on the Snake River near its confluence with the Palouse River. This river junction is important to the interpretation of the proposed Lewis and Clark Historic Trail. However, the proposed crossing is not believed to be close enough to this site to have an adverse impact. The pipeline also would cross the homeward bound route of the Lewis and Clark Trail just west of Waitsburg, Washington, but it is not believed it would have an adverse impact.

Oregon Trail (Oregon)

The proposed pipeline route very closely parallels, and is within 2.5 miles of the Oregon Trail for 64 miles. Specific discussion can be found in the preceding section on history. Five segments along the Trail near the pipeline with high potential for interpretation are: Hilgard Junction, La Grande, Ladd Hill, White Swan Mine, and Sisley Creek segments. Collectively, they offer probably the best potential along the entire Oregon Trail route for establishment of scenic interpretative trails for hiking and horseback riding along visible wagon ruts.

Morgan Lake (Oregon)

The proposed pipeline route is located adjacent to Morgan Lake, a City of La Grande recreation site which provides facilities for picnicking and outdoor games, as well as excellent fishing opportunities. The significance of these impacts would depend on the time of year when construction crews would be in the Morgan Lake area, and on which side the existing right-of-way is widened. If construction were to occur from June through September, adverse impacts, though only temporary, would be quite significant.

If the pipeline route avoids heavily forested areas, the impact of the right-of-way on esthetics in the Morgan Lake area would be considered minimal.

Grande Ronde and Malheur Rivers (Oregon)

A publication titled "Oregon Areas of Environmental Concern," was prepared for the State of Oregon Executive Department in April 1973. One of the critical priority areas mentioned in this document is the identification and protection of outstanding scenic areas and waterways. Segments of the Grande Ronde and Malheur Rivers are identified as needing "State study" for possible designation as part of Oregon's Scenic Waterways System. The proposed pipeline route crosses the identified segment of the Grand Ronde River approximately 6 miles northwest of La Grande, and crosses the identified segment of the Malheur River approximately 15 miles southwest of Vale, near Harper.

Disturbance of these riverbanks to accommodate necessary trench excavation would have some impact on their natural character. Such disturbances would be a factor if and when these rivers are studied.

During construction, and especially during trenching operations, siltration and temporary turbidity would somewhat reduce esthetic and recreational experiences of hikers, boaters, fishermen and swimmers.

Proposed High Desert Trail (Oregon)

Impacts on the High Desert Trail in eastern Oregon cannot be accurately determined at this time since the trail route is only a proposal. However, the proposed pipeline route closely parallels the proposed trail route for several miles and crosses it at least once.

Esthetics

Esthetic values will be affected from the following project activities: clearing, ditching, spoil disposal, backfilling, creation of temporary roads and fences, operation of internal combustion engines and vehicles, operation of noise and vibration-producing equipment, and increased human activity. (See Figure 3.1.5.13-1.)

Impacts resulting from these activities would be:

- The alteration of topography
- The alteration of existing vegetaton forms
- The introduction of cleared or open areas in wooded areas
- The presence of compressor stations, measurement stations pipeline valves and communications tower
- A temporary increase in stream turbidity at river crossings
- Changes in existing wildlife habitats and behavior patterns
- An increase in noise, fumes, and dust levels.

Many of these impacts would be of a temporary nature and nonexistent after the contruction period. Other impacts, however, would be apparent for the life of the pipeline facilities and longer. The most difficult situation to assess relates to what degree widening of the existing right-of-way corridor has on esthetic values. For example, how much more damaging is a 100-foot-wide clearing than a 50-foot wide clearing?

The relative significance of an impact on esthetics would depend upon two conditions. First, and most important, is the inherent quality of the landscape. Second is the number of viewers, their interest in and sensitivity toward the landscape being viewed. The method of classifying landscapes is explained in Section 2.1.5E.12.

Visual impacts would be most apparent in forested areas and open range or desert country. Approximately 950 acres of commercial forest land would be disturbed by the pipeline right-of-way, of which about 800 acres are located in northern Idaho, and the balance is located in Oregon's Blue Mountains.

In forested areas, the pipeline right-of-way would be cleared of all trees, stumps, and understory vegetation. Although shrubs and grasses would be allowed to revegetate cleared areas, trees and taller woody plants would continually be removed for the life of the project. Height of surrounding trees would, in some cases, provide a "screen" or "buffer" for the cleared right-of-way, unless viewers are able to see directly down the cleared area or are observing the landscape from a higher elevation. Since forested areas usually occur in mountainous regions where diversity of topography, vegetation, water forms, and color often have inherent scenic or esthetic qualities, adverse impacts are often more pronounced because of the total landscape involved. In open range or desert country, natural vegetation is normally insufficient in height to "screen" cleared rights-of-way; thus, cleared areas are visible for long distances. Adverse impacts in open range or desert country could be apparent for a relatively long period due to the slow rate of revegetation in arid regions.

Visual impacts on agricultural lands, although very apparent during construction, would tend to abate as lands are brought back into production. Normally, most visible evidence of construction would be gone within a few years, but a viewer's discerning eye may spot slight differences in soil color and/or crop vigor.

Within many landscapes, regardless of variety/sensitivity classification, there are specific areas of concern where impacts on esthetics would be acute. Rivers, forested areas, and long stretches of open range or desert are particularly vulnerable to adverse impacts. Approximate locations of these areas are shown, by number, on Figure 3.1.5.13-1.

The proposed pipeline would cross several rivers (Section 1.1.5E.2) at the approximate milepost indicated. Crossings of the Kootenai, Pend Oreille, and Snake Rivers are considered to be major river crossings. These major crossings will require an open constructon area on one bank measuring approximately 200 feet along the river and 500 feet along the pipeline right-of-way, and an open construction area on the opposite bank measuring approximately 200 feet along the river and 300 feet along the pipeline right-of-way. This large area is needed for maneuvering equipment and stockpiling excavated material. All other rivers will each require an open construction area measuring approximately 200 feet along the river and 200 feet along the proposed pipeline right-of-way on both banks. Again, this large area is needed for maneuvering equipment and stockpiling excavated material. These river crossings, especially the Moyie, Kootenai, Pend Oreille, and Snake, would create significant adverse impacts on esthetics. Most individuals who hike, hunt, fish, boat, drive or otherwise travel in the vicinity of the crossings would have an interest in the scenic integrity of the landscape.

Soil erosion caused by construction of the pipeline would add significantly to the turbidity of the rivers at each crossing. This would result in temporary visual impacts and generally would be a nuisance to boaters, fishermen, swimmers, and others utilizing the rivers for recreation purposes.

The pipeline would traverse many miles of forested land, some of which would be readily visible from highways, rivers, recreation areas, and even residences. Right-of-way strips cut through scenic forests or timbered areas would have the effect of "tunnels" which would not only be very apparent, but would persist through the life of the project.

Most of the forested areas traversed occur in the northern portion of the proposed pipeline route, particularly Idaho and Oregon. Significant impacts would occur and be most apparent on forested segments of the following landscapes:

Moyie River Valley (Idaho) to Kootenai Valley via Round Prairie
Kootenai River to the Pend Oreille River (Idaho)
Pend Oreille Lake (Idaho)
Sagle Slough to the Purcell Trench Valley (Idaho)
Cocollala Lake (Idaho)
Purcell Trench Valley (Idaho)
Blue Mountains (Oregon)

Environmental impacts on cultural resources such as the Lewis and Clark Trail, Oregon Trail, and historic trails and sites of Nevada are discussed in Section 3.1.5E.13 (Recreation).

3.1.5E.14 Air Quality

Increased Air Pollutants

Gaseous Air Pollutants from Permanent Installations

The compressor stations along the route are the only installations that will emit air pollutants continuously. There are six stations along the route that are scheduled for augmentation in rated power. These are listed in Section 1.1.5.3. The largest additional horsepower is 9,100 horsepower at Wenden Station, Arizona, which will double the horsepower there.

At 100 percent rated load, stationary gas turbines emit a maximum of about 0.006 lb per horsepower-hour and a maximum of about 0.0009 lb CO per horsepower-hour (Hare and Springer, 1974; Springer and Dietzmann, 1975). Using these figures, it is possible to estimate the increased emissions at the six compressor stations involved:

Station	Increased HP	Additional NO_x emissions lb/hr	Additional CO emissions lb/hr
Mountain Home, Idaho	2,500	15	2.3
Caldwell, Idaho	5,500	33	5.0
Baker, Oregon	2,500	15	2.3
Blanco Plant, N.M.	1,070	6	1.0
Wenden Station, Arizona	9,100	55	8.2
Franconia, Arizona	3,540	21	3.2

Emissions of all other pollutants will be much less than these figures.

The highest NO_x emission rate measured for any gas turbine corresponds to a concentration of 71 ppm in the exhaust gas (Springer and Dietzmann, 1975). When this is corrected to 15 percent excess O_2, as a standard basis, as proposed by the U.S. Environmental Protection Agency, the highest equivalent NO_x emission rate is 130 ppm.

Air pollutants other than NO_x will not be emitted by the gas turbines in quantities that will cause any measurable impact on the environment. Natural gas will occasionally be emitted from leaks, venting and maintenance operations, but these will contribute no impact because the quantities are relatively small and the gas is much less dense than air.

The behavior of NO_x emissions in the atmosphere can be estimated from the dispersion correlations compiled by the U.S. Environmental Protection Agency (Turner, 1970). From formula 3.3 of this document, and with dispersion coefficients given by (Ecology and Environment, 1974)

$$\sigma_y = A \cdot x^B$$

$$\sigma_y = A' \cdot x^{B'}$$

then the downwind distance at which the maximum pollutant level will be experienced is given by

$$x_{max} = \left[\frac{H^2 \cdot B'}{(A')^2 (B+B')}\right]^{\frac{1}{2}B'}$$

where H is the effective height of the emitting source in meters. It is appropriate to consider a "worst case" situation, assuming that winter conditions apply, and that the most stable atmospheric conditions prevail, with an effective stack height of H = 20 m. For this case,

$$x_{max} = 1{,}560 \text{ m}$$

$$(C_{NO_x})_{max} = 8.5 \ \mu g/m^3$$

where x_{max} = downwind distance at which maximum pollutant level is experienced, at ground level.

$(C_{NO_x})_{max}$ = ground level concentration of NO_x at distance x_{max}.

This estimate is very sensitive to the value of the effective emission height, H. For example, if the effective emission height could be increased by 50 percent, by means of (e.g.) imparting sufficient velocity to the exhaust gas, then this estimated concentration is reduced to about one-quarter of the value given above.

On an annual average basis, the concentration of NO_x contributed to the environment by the planned compressor stations will be on the order of 1 $\mu g/m^3$ at each compressor station location. This estimate is based on an assumption of an effective emission release height of H = 20 m.

Permanent Contributions of Dust

Several portions of the pipeline route are susceptible to creation of particulate air pollution as a result of wind erosion of disturbed soil, including two particularly sensitive sections in the Columbia River basin totaling about 300 miles in length. Such sources of pollutant approximate a classical "line source" when the wind blows across it at right angles. For the case of worst atmospheric stability (i.e., highest atmospheric mixing rate), the wind erosion from freshly excavated sites along the route may produce atmospheric dust concentrations that are relatively high near the source, as estimated by formula 5.20 of Turner, 1970. The maximum dust concentrations may approach 200 $\mu g/m^3$, but they will typically fall to low levels (ca. 10 $\mu g/m^3$) within 1 mile (PEDCO, 1968).

Air Pollution from Combustion of Fuels by Vehicles

During construction operations along the proposed route, a total consumption of about 5.3 million gallons of gasoline and diesel fuel is anticipated. Combustion of this fuel is capable of generating about 1.4 million pounds of nitrogen oxides (NO_x) and about the same amount of CO. The generation of sulfur dioxide will be about 9,500 lb, and of hydrocarbons about 6,000 lb. These figures are based on reported emission factors for construction vehicles (Hare and Springer, 1973).

If several construction vehicles are concentrated at a single point for an extended period, under the most stable atmospheric conditions, there is a possibility that NO_x concentrations may approach the limits imposed by the National Ambient Air Quality Standards. However, this possibility is remote. In addition, there is no reasonable possibility that any air pollutants other than NO_x will approach objectionable levels.

3.1.5E.15 Environmental Noise

Construction Phase

The construction phase would produce indirect and direct noise impacts. The indirect noise impact would be due to the road traffic generated by the project, and the direct impact would be the construction site noise.

Road Traffic

The primary cause of noise impact due to road traffic would be the heavy diesel trucks hauling construction equipment and pipe. Since most of the construction equipment would remain on the site, except when hauled around major waterway obstacles, the pipe hauling operation would likely create the largest noise impact. The storage areas have not been identified, but railroad delivery points can be reasonably identified and related to potential haul roads for access to the pipeline right-of-way. The majority of haul roads would be rural dirt roads where, even though the population density is low, the ambient noise levels also are very low so that audibility of the trucks would extend for long distances.

It is not possible to make a detailed estimate of the total noise exposure of the local populace to the hauling truck traffic, but several communities have been found through which these hauling trucks could pass enroute to the construction site. They are shown in Table 3.1.5.15-1. Despite the rural nature of the route there are still a significant number of people (28,729) who would be exposed to the noise of these diesel trucks. There would be several trips per hour on a normal workday during the period pipe is being hauled through a community. It is likely that some annoyance would arise which would be related to the combination of noise, dust and other factors. Since there are no criteria for this type of annoyance, no specific evaluation of the impact can be made.

Right-of-Way Construction

Construction of the pipeline along the right-of-way would require large numbers of heavy equipment which would operate as groups doing various phases of the construction. Most of this equipment would be diesel engine powered. Typical noise levels (in dbA at 50 feet) of construction equipment are given in Figure 3.1.5.15-1. These are levels that are found while the equipment is performing its task and would represent those levels observed on the pipeline construction site. It is estimated that the welding equipment would be acoustically similar to stationary air compressors.

The energy mean of L_{eq} values measured at 24 sites during excavation (corrected to a distance of 50 ft) is 84 dB. Using this value as representative of the day-night sound level (L_{dn}) at 50 feet (since there is no nighttime construction planned), it is predicted that a total of 1,881 people reside within an area which will be impacted by a L_{dn} in excess of the U.S. EPA goal (55 dB) for protection of human welfare. Therefore, it is predicted that a total of 895 people will be highly annoyed by the construction noise and 63 households will make complaints about it. Table 3.1.5.15-2 provides the impact of pipeline construction noise on people as a function of the states through which the proposed pipeline will travel.

Blasting and Vibration

Drilling and blasting would be required where trenching through rock cannot be accomplished by ripping and removing the loose material with a backhoe. The detonation of explosive materials induces transient motion in the rock which is then transmitted through the surrounding rock and through any overlying or underlying strata. It is this motion, referred to as ground motion, which directly or indirectly damages structures. Direct damage to structures occurs when the motion produces stress levels sufficient to cause structural failure such as cracking of foundations, loosening of mortar and other damage to the primary structure. Safe limits of ground motion from blasting for structures, building components, and sensitive equipment have been established at an acceleration level of 38.6 inches per second per second from 5 to 15 Hz and a velocity level of 0.4 inch per second above 15 Hz. Below these levels structural failure generally does not occur but rather a secondary effect may occur --the settlement or compaction of soil caused by ground motion.

Under sustained vibratory loads or repeated impacts such as caused by blasting operations, the internal structure of soils may change, thereby producing settlement of surface or possibly a reduction in strength, It is

Table 3.1.5.15-1 Communities Potentially Noise Impacted by Pipe-Hauling Trucks

State	Communities (population)	Estimated Population Exposed
Idaho	Rathdrum (741), Athol (190), Careywood (25), Cocolalla (20), Westmond (unk), Algoma (unk), Colborn (50), Samuels (unk), McArthur (unk), Bonners Ferry (2,796), Addie (unk)	3,922
Washington	Bolks (unk), Prescott (242), Tucannon (unk), LaCrosse (426), St. John (575), Mt. Hope (unk), Freeman (100)	1,403
Oregon	Crane (100), Baker (9,354), LaGrande (9,645), Meachan (120), Gibbon (80), Milton-Freeman (4,105)	23,404
Total		28,729

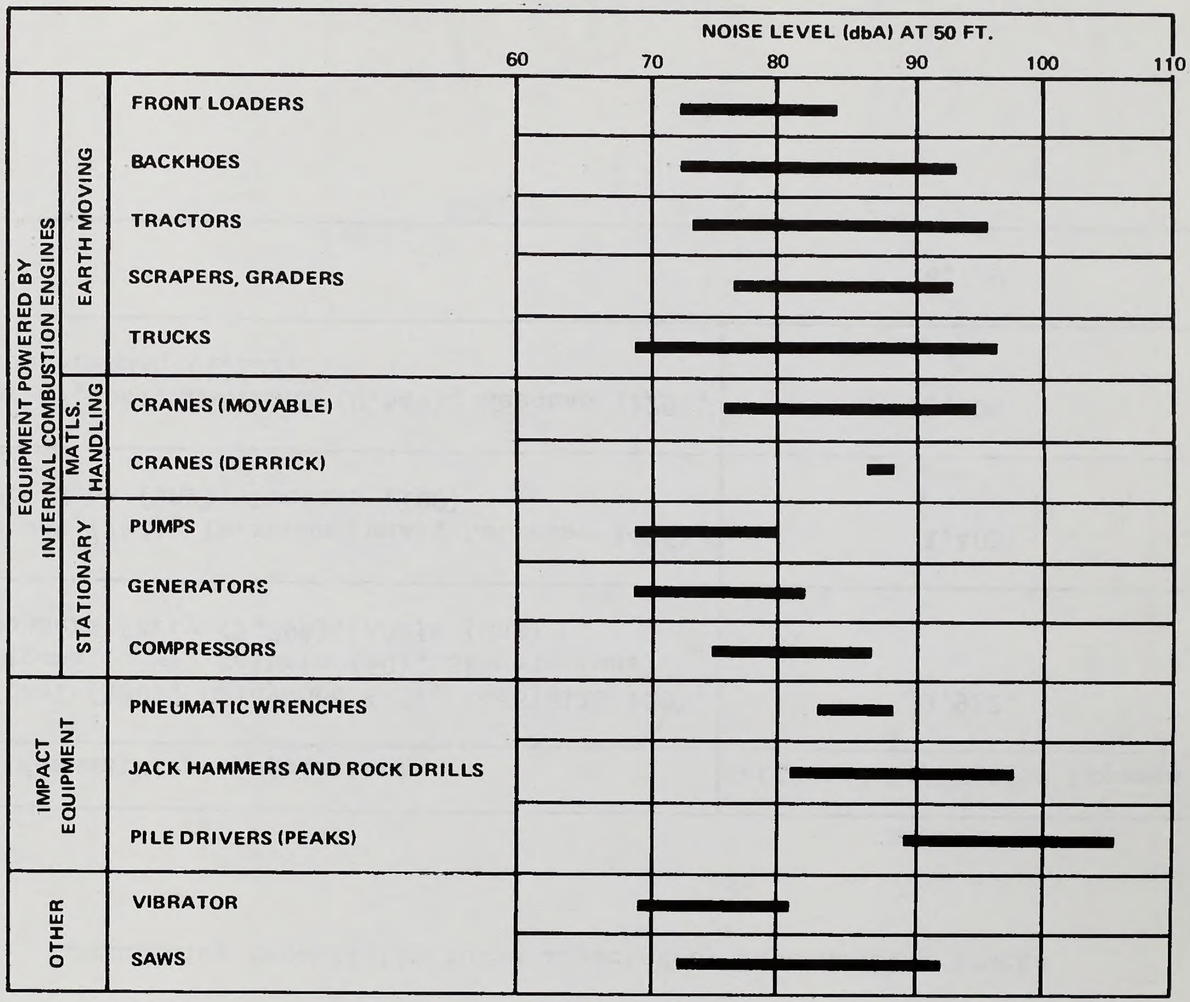

Figure 3.1.5.15-1 Construction equipment noise ranges

Table 3.1.5.15-2 Impact of Pipeline Construction Noise on People

State	Estimated Number of People Residing Within L_{dn} >55 DB*	Estimated Number of People Who Will Be Highly Annoyed	Estimated Number of Complaints
Idaho	1,318	479	38
Washington	309	144	11
Oregon	254	272	14
Total	1,881	895	63

* A day-night sound level (L_{dn}) of 55 dB has been identified by the U.S. EPA as the maximum level permissible for protection of human welfare.

The correction factors for normalizing L_{dn} cancel out.

well known that loose, saturated cohesionless soils are particularly susceptible to compaction by impacts or vibration.

For example, damage from traffic-induced ground motion in medieval cathedrals of England and Wales has been investigated and predominant cracking and settlement were reported within those structures located adjacent to roads even though the ground motion levels were substantially below those specified above as safe limits.

Blasting at river crossings would have a fatal effect on nearby aquatic animals.

Blasting would be required at several stretches along the right-of-way, such as in areas glacially eroded in Purcell Trench and Moyie River Valley, Idaho. No buildings along the route appear to be close enough to be damaged by blasting. Safety aspects of blasting are discussed in Section 4.1.5.4. Since the route will parallel a proposed and an existing line in Idaho and part of Washington, that belongs to Pacific Gas Transmission Company and Pacific Gas and Electric Company, there is a possibility that blasting may have severe adverse effects on any existing lines. On February 21, 1973, in Coopersburg, Pennsylvania, blasting nearby caused the shock failure of a 50 psig, 8-inch diameter gas line (Nat. Trans. Safety Board Report PAR 74-1). The concern for blasting stems from the fact that earth strains, since 1961, on the existing pipeline have resulted in unknown weld stresses superimposed on construction-induced stresses and known design stresses. If these stresses have all been positive, the dynamic blasting stresses may be sufficient to cause failure. Although the possibility exists, it is likely to have low probability of occurrence.

Ground vibration caused by construction equipment and hauling trucks are estimated to be sufficiently small at any vibration-sensitive buildings that no adverse impact can be identified. See Section 3.1.5E.2 for the effects of blasting and vibration on creating rockfalls and landslides.

Compressor Station Construction

Construction of the compressor stations would entail only small amounts of grading; most of the activity would be hauling of materials and construction of the buildings. Those activities would be of short duration and spread out over several months, starting with clearing the site to installing the compressors. Due to the low population density, very few complaints, if any, are expected.

Operation Phase

Compressor Station

The major potential noise sources of significance during the operational phase of the project would be the compressor stations which are long-term continuous and fixed noise sources. There will be construction of one new gas compressor station at Franconia, Arizona, and the horsepower of five existing stations will be increased. Table 3.1.5.15-3 indicates the increase in the distance at which residences will be impacted by a day-night sound level (L_{dn}) in excess of the U.S. EPA goal of 55 dB, chosen to protect human welfare. No data were available to enable calculation of the number of people residing within these distances of the stations.

Table 3.1.5.15-3 Impact of Changes in Existing Gas Compressor Station Noise Levels

Station Number	Approximate Station Location or Name	Status	hp	Distance (ft) at which Residences will be Impacted by L_{dn} >55 dB*	Increase in the Distance (ft) at which Residences will be Impacted by L_{dn} >55 dB
11	Mountain Home, Idaho	Existing	6,000	1,375	125
		Proposed	8,500	1,500	
12	Caldwell, Idaho	Existing	4,500	1,175	425
		Proposed	10,000	1,600	
13	Baker, Oregon	Existing	4,500	1,175	200
		Proposed	7,500	1,375	
?	Blanco Plant, New Mexico	Existing	67,730	3,100	10
		Proposed	68,798	3,110	
?	Wenden Station, Arizona	Existing	9,100	1,550	350
		Proposed	18,200	1,900	
?	Franconia, Arizona	Non-Existing	0	0	3,300
		Proposed	3,540	3,300	

* A day-night sound level (L_{dn}) of 55 dB has been identified by the U.S. EPA as the maximum level permissible for protection of human welfare.

** L_{dn} has been normalized to correct for quiet, rural communities (10 dB) and for no prior experience with the noise (5 dB) at this station location; these correction factors do not apply to the other station locations, because there are already existing stations there.

In Oregon, State law requires that such a station make a fifty percentile level of 50 dBA or less.

Existing Station 13, in Oregon, must comply with that law.

Blowdown

Periodic venting of high-pressure gas from the compressor stations or along the line wculd cause temporary but severe increases in sound level (Table 3.1.5.15-4). These blowdowns would occur because of an emergency or as a part of maintenance checks or repairs. Blowdown of a compressor, or a pipeline section ending at a compressor station (unit blowdown), would occur at the station. Blowdown of a pipeline section would occur at each end of the section. It is estimated that the maximum noise would occur over most of the period which is about 45 minutes for the pipeline and 5 minutes for the compressor. Planned blowdowns are expected to occur about once per year.

Based on this data, ambient levels, and the approximate attenuation data given in Section 2.1.5E.15, it is estimated that such a blowdown would be near 70 dB at 3 miles. Due to its relative short duration and infrequent occurrence it would cause annoyance but may not result in complaints to authorities.

The number of occurrences of blowdowns per year is not expected to increase as a result of this proposed action, therefore no increase in impact from blowdown noise is predicted.

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Table 3.1.5.15-4 Blowdown Noise*

Distance (ft.)	Station Blowdown 16" Valve Vent	10" Valve Vent	Unit Blowdown
100	115 dBA	113 dBA	108 dBA
300	105 dBA	104 dBA	98 dBA
1,000	94 dBA	93 dBA	87 dBA
3,000	84 dBA	82 dBA	75 dBA

* No silencing measures taken.

3.1.5E.16 Hazards from Pipe Failure

The possibility of loss and damage due to pipe rupture is discussed in the Overview volume.

3.1.5R Rye Valley to Cajon (Future Expansion)

Introduction

This section considers and identifies all known impacts as a result of construction and maintenance of the proposed future expansion from Rye Valley, Oregon, to Cajon, California. Related facilities such as compressor stations and access roads are considered under the fully-powered system; i.e., from the Canadian Border to Cajon, California. Impacts are based upon the information contained in Sections 1.1.5 and 2.1.5R.

The impacts identified in this section do not consider mitigative measures. Direct, indirect, onsite and offsite impacts are identified and where possible are site specific and quantified.

Determination of impacts on the environment that would result from construction and operation of the proposed project involves consideration of several variables that cannot be predicted with certainty. The exact pipeline route location, detailed, engineering design specifications, and specific construction procedures and rehabilitation technique are determinants of impact that are not fully known at this stage of the project planning. In this section, impacts are specifically identified and quantified where available information permits. Where variables are involved, a range of impacts is indicated.

The impacts along the proposed pipeline could be of long- or short-term effect. As used in this section, short-term impacts will be generally less than 5 years, duration. These are often associated with construction, and usually can be mitigated or will abate themselves. Long-term impacts are those which are difficult, or impractical to abate. They will last the life of the project or longer.

3.1.5R.1 Climate

The proposed future expansion would have no significant impact on the macroclimate. The microclimate would be impacted in the immediate vicinity of the pipeline; however, it is not expected to be a significant impact.

Extremes of climate would, however, adversely affect pipeline construction activities. Spring in the lowland areas, especially in a wet year, would necessitate crossing many waterlogged areas where heavy equipment would be difficult to operate and where the trench would quickly fill with water. Construction at stream crossings during the spring runoff period could face the hazard of freshets which could quickly fill underwater trenches and which could make the floodplain unusable by heavy equipment. Operation of heavy equipment in wetlands and floodplains during wet periods would tend to compound soil compaction and vegetation destruction problems.

High winds across the northern segment could cause delays in construction of communications towers. These natural climatic construction hazards could be avoided to some extent by scheduling construction activities to avoid unsuitable weather conditions.

During winter operation, the area along the pipeline would be warmer than surrounding areas which may cause the ground along the pipeline to be free of snow cover earlier. This could have some effect upon the vegetation along the pipeline route and would change the local environment for any life along the pipeline route.

From May to October, extended periods of no rainfall and high temperature would result in extreme dryness of vegetation and fire hazard conditions.

Climatic extremes also increase the stresses to which the pipe itself and the welded joints could be subjected. Provisions would have to be made in construction design for pipe steel which could stand up under frost heave stresses at extremely low temperatures in the northern sections of the pipeline and concurrently to withstand the stresses from high pressure gas. Where heavy rains cause erosion, mass wasting, mudslides or streambed scouring which in turn causes the pipe bedding to be disturbed or the pipe exposed, major stresses could be involved. To provide an adequate safety margin against pipe failure careful attention will have to be given to pipe design and the materials which are used. For further discussion of the effects of outside conditions on the pipeline, see Aerospace Report No. ATR-75 (7946)-3 "Artic Gas Pipeline Project - Los Angeles Pipeline Geotechnic Evaluation" dated 24 February 1975 (Appendix D).

3.1.5R.2 Topography

Impacts on topography would result directly from construction activities and indirectly from acceleration of natural processes that cause erosion and sedimentation, landslides, rockslides, rockfalls, and flood scour.

Development of Erosion Hazard

The construction process would affect the erosion potential in three areas--along the trench; outside the trench, but within the right-of-way; and outside the right-of-way limits.

Impacts could be expected from wind erosion, water erosion, and erosion caused by construction activities.

The wind would erode loose soil materials along the right-of-way. This material would be susceptible to wind erosion largely due to the destruction of the natural vegetation cover; partly because of the grinding and churning of equipment wheels and tracks; and partly because the orientation of the proposed route is nearly parallel to the prevailing wind direction. The activity of equipment would break down the larger fragments of soil and earth materials to finer particle sizes which could be eroded by the wind.

For example, a potential soil loss of 25,000 tons per year by wind and water erosion is estimated for soils situated within the 300+ mile segment in Nevada.

Wind erosion of disturbed soil on the Inyo National Forest in California will most likely occur.

Despite the large total tonnage of soil that could be eroded by the wind, the impact on the topography by soil erosion and its subsequent deposition would be negligible. The expectable damage to the topography probably would consist of slight drifting in ditches and along fence lines.

The probability that wind erosion of sand in sandy soil areas would expose the pipeline to external damage is small. The possibility exists but the likelihood is small to negligible, that wind erosion would remove enough sand to cause serious loss of pipe support. Were this to happen, it would cause stresses on the pipe that could lead to pipe failure.

The natural cohesion and vegetative cover of riverbanks would be disturbed by line excavation and other construction activities and would increase erosion at stream and major river crossings.

In the arid regions of Nevada and California, the impact from construction could be of relatively long duration because of the slow rate of revegetation.

Accelerated erosion of the subsoil by surface runoff would occur where the topsoil had been removed previously by erosion. The result would be gullying of slopes and increased cutting by small streams with accompanying reduction of vegetation and crop yield. Some of the eroded soil materials would be deposited downslope which would tend to build alluvial fans. These fans also reduce agricultural production by their inundating of the vegetation in the fan area -- an area which could be from a few feet to as much as 100 yards across.

The possibility exists, but the likelihood is small, that accelerated surface runoff, like wind erosion, would remove enough soil material to cause serious loss of pipe support.

Erosion of the floor of stream channels can be initiated by uneven backfilling. Once erosion has started, it progresses in a headwater direction, not only in the main channel but up each tributary in succession. Once this cycle of erosion reaches the uppermost parts of the drainage basin, equilibrium among the processes of erosion, transportation and deposition is reestablished.

Subsurface erosion by ground water could occur within the backfilled trench. Erosion would be in part by solution and in part by the below-surface washing away of fine particles of earth materials ("piping"). The broken character of the backfill exposes more surface to ground water than the material originally had; this promotes a somewhat faster erosion rate in backfilled material. It is not possible at this time to estimate the amount of material that would be removed by subsurface erosion. However, experience elsewhere has demonstrated, reportedly, that the process can cause pipe failure by removal of support.

A moderate hazard of subsurface erosion would exist where the trench penetrates into clay, silt, shale, siltstone, or coal and these materials are used as pipe bedding. The hazard is negligible where the pipe is bedded in backfill of sand or gravel, limestone, dolomite or sandstone.

Slaking, or physical disintegration, is commonly caused by wetting and drying. This breakdown could affect some of the rock and earth materials that would be encountered along the route, would increase the rate of subsurface erosion and by itself could bring about sufficient loss of support of the pipeline to cause potential pipe failure. Some of the clays, silts, shales, siltstones, and coal would break down in only one or two cycles; others will require numerous cycles. Materials that slake would mainly be encountered along that part of the route from Rye Valley, Oregon, to Nevada.

Inducement of Landslides and Rockfalls by Blasting and Trenching

Blasting to facilitate excavation would probably be necessary, particularly in the walls and floors of valleys and in places on the upland ridges. Blasting also will be needed in crossing the Inyo Mountains from Deep Springs Valley to Owens Valley, California, and in the basalt hard lava rock on the east side of Owens Valley.

Blasting would probably be negligible as a factor in causing new landslides or renewed movement of now-stable landslide masses. It is possible that a mass of claystone, shale or siltstone that is on the threshhold of slope failure might slide because the shock waves of blasting overcame or reduced the shear strength of the bedrock material to the point of failure. Moreover, the kinds of landslides generally present along the route occur in weak rocks which are thoroughly fractured near the ground surface. The fracturing would tend to absorb the shock of the blast reducing its effect.

Because the trench would be less than 10 feet deep at nearly all points, the shallow placement of blasting charges would presumably affect landsliding mainly by transfer of shock parallel to the ground surface; vertical "jump" of the ground which might reduce the shear strength to zero would be acting almost wholly in a zone of loose or uncompacted material which would tend to absorb the shock, or be blown upward and outward.

Blasting can induce rockfalls in two ways: (1) the shock could loosen pieces of rock that would fall or (2) the shock can weaken or cause the loss of support beneath a loose rock mass, permitting it to fall. The probability that blasting could cause rockfalls is small to moderate along the entire pipeline.

For additional information regarding the impact of the pipeline on landslides and rockfalls, and of landslides and rockfalls on the pipeline, see Section 3.1.5R.3.

Recontouring of Slopes

Cuts and fills to establish a level working surface for construction and maintenance activities on slopes crossed perpendicularly (lengthwise) by the pipeline would result in recontouring the slopes. Because steep slopes traversed by the proposed pipeline route are generally limited to stream valleys which are crossed perpendicularly, cuts and fills for right-of-way leveling would be largely restricted to the moderate slopes of the upland areas. Thus, recontouring for right-of-way leveling would be limited in degree and extent, depending upon the actual pipeline alignment.

Disposal of surplus soil from trenching and backfilling in centrally located piles scattered at sites adjacent to the proposed route would also result in recontouring. The size of the piles would depend on the volume of the soil to be cast off and on the spacing of the piles. These are impossible to estimate at the present time.

Permanent Changes in the Land Surface

Permanent changes in the land surface would result from (a) the crown of spoil material over the trench backfill, (b) the foundation and drainage pads for structures, (c) those locations where the trench cannot be fully backfilled, (d) the disposal of surplus spoil in piles adjacent to the pipeline right-of-way, and (e) the cuts and fills for right-of-way leveling.

The crown of spoil over the pipeline presumably would be as wide as the trench, and the crest would stand several inches above the general surface of the land adjacent to the right-of-way. In profile the crown thus would be convex. With time this crown would essentially disappear, and may actually be replaced by a similar form that is concave. The change in profile of the crest would be caused by the natural settlement of the loose backfill in the trench. As the presence of moisture is a significant factor in the rate of settlement, the process would be distinctly slower in that part of Nevada and California crossed by the proposed route. Considering the slow rate at which settlement takes place in that region, the crown could last for many years.

Foundation and drainage pads for structures are likely, especially in areas of high water table. In Nevada ground-water levels are less than 50 feet from the surface in the Quinn River Valley, the Humboldt River Valley, and southward a distance of at least 37 miles along the proposed route. Pads are likely to differ in horizontal dimensions; they may be from 1 to perhaps as much as 5 feet high. Some may be wedge-like in form to compensate for surface slope. Construction material could be either loose or compacted to engineering specification, depending on the intended use. These manmade features are unlikely to introduce problems because of their small size, their site and function, specific design, and the properties of the crushed rock or earth material commonly used for construction.

In a few situations, it may not be feasible to fully backfill the trench. For example, a near vertical valley wall or highway cut with layers of hard rock exposed would presumably have a vertical trench cut into the wall to receive the pipeline. The trench would not be filled completely and so would be apparent for the life of the pipeline. Presumably it would serve as a drainage channel for surface water runoff along the surface of the backfill and ground water flowing through the backfill. Deep Springs Valley in California could present this situation.

3.1.5R.3 Geology

Introduction

Construction of the proposed project would have impacts on the surficial materials and bedrock within the proposed pipeline trench, and along and near the route.

The impact of the proposed pipeline on the geology is expected to be minor. Conversely, the proposed pipeline could be significantly affected by a large variety of geologic processes. Impacts on the geologic environment and on the pipeline as a result of geologic processes can be summarized as follows. They are discussed in detail in succeeding sections.

Effect on Present and Future Mineral Resources and Production

The impact of the pipeline on currently active mineral production along the proposed route would be minor because construction materials are readily available along most of the route. However, the pipeline may hamper future exploitation of small portions of some economic material deposits if the line is located directly over a presently unknown deposit.

The potential for discovery of new mineral resources is small because of the shallow depth of the trenching (less than 10 feet) and the exposure of bedrock over only about 7 percent of the route. Some useful definition of occurrences of clay, sand, gravel, and other potentially economic surficial deposits would result.

Effects on Surface Drainage and Terrain

All disruption of surface drainage should be temporary, occurring only during construction. Terrain scars would be caused by extraction of construction materials (sand, gravel, volcanic cinders, clinkers, etc.), and unless filled, would be permanent features of the landscape.

Potential for Effects on Pipeline by Geologic Hazards

Seismicity and Faulting

Segments of the proposed route, especially in nearly all of Nevada and California, are included in zones of significant potential future seismicity and possible ground failure. All of the proposed route in Nevada and California is located in seismic risk zone 3 (major damage corresponds to intensity VIII and higher of the Modified Mercalli intensity scale).

That portion of the route in eastern Oregon is in seismic risk zone 2 (moderate damage). Zones of historically active faulting are crossed in Pleasant Valley and the Cedar Mountains area, both in Nevada, and Owens Valley in California. Details of these hazards are discussed in the following section and in the hazards section.

Slope Failures

Slope failures are of a wide variety, including: landslides, rockslides, mud and debris flows. These would be a potential hazard over most of the proposed route and in many rock types. Even in areas not in a high risk seismic zone, ground shaking sufficient to initiate landslides could be possible. The chief hazardous areas are located in Fish Lake and Owens Valleys.

Volcanism

The possibility of a future eruption is present in the Coso Mountains, where considerable Pleistocene volcanism has occurred and hot spring activity is common. Although the possibility is considered remote, it cannot be discounted completely.

Flash Floods

Flash floods would have a large potential for damage to the proposed pipeline. Bank (lateral) erosion, streambed (vertical) scours, and transportation of extremely coarse sedimentary detritus could cause pipeline damage.

The probable effects of pipeline rupture are: 1) rapid gas release, temporarily creating a hazard in the immediate vicinity for a period of 60 minutes prior to shutdown; 2) potential fire hazard, affecting an area of 1 to 10 miles depending on winds, and vegetation conditions; 3) unknown loss of vegetation and animal life nearby.

Numerous breaks of natural gas pipelines occurred as a result of the February 9, 1971 earthquake in San Fernando Valley in southern California. In a 26-inch gas pipeline, 9 breaks occurred, and in 16-inch lines over 50 breaks occurred. Several fires resulted and one explosion blowout cratered the immediate area of rupture.

It should be noted that the pipelines that broke were old, gas-welded lines. No modern, electric-welded pipelines in the same area and subjected to the same shock ruptured.

Owyhee Upland Province

The disturbance of the geologic environment caused by construction and maintenance activities should be minimal in the Owyhee Upland province. Along 3 miles of the route near latitude 43°00', extensive blasting may be necessary in the young basalt flows at the surface. Lack of available sand and gravel in some parts of the province could necessitate hauling this material if it is needed for construction.

Colluvium and landslide deposits have not been mapped in detail, therefore, their presence along the route is probable but speculative at this time. The lithology traversed would be susceptible to landsliding if an earthquake occurred during heavy intense precipitation. Some natural and cut slope failures could occur in the Tertiary sedimentary rocks. Although the Owyhee Upland province is not in a high risk seismic zone, ground shaking strong enough to initiate landslides could occur due to its proximity to the seismically active Basin and Range province. The impact on present and future mineral exploration and production appears to be low.

Basalt flows of late Pleistocene or Holocene age are crossed by about 3 miles of the proposed pipeline in the Owyhee Upland province near latitude 43°00'N. Additional eruptions in this region are possible.

Basin and Range Province (Nevada portion)

The potential impacts on the environment in Nevada can be considered in two categories: a) those related to the disruption of the terrain due to construction and maintenance of the proposed pipeline and b) those related to breakage of the proposed pipeline due to catastrophic events such as earthquakes or large floods.

Disruption of the ground in a semiarid region, such as Nevada, causes scars that do not heal quickly. Wagon roads, for example, some of which are 50 to 100 years old, are still clearly visible in some parts of the state. Tire tracks from four-wheel drive vehicles or from motorcycles remain for years in off-road areas. The scars from the proposed pipeline construction will be visible in most areas for many tens of years and in mountain areas for hundreds of years.

Much of the route crosses areas of relatively low ground slope where accelerated erosion due to disruption of soil and vegetation would be only a minor problem. More intense, or even severe, erosion could be expected in local areas in mountains.

Disturbances caused by: procuring construction material, disposal of excess spoils, instability of slopes, and disruption of surface and subsurface drainage would have only small and local impact on the environment. At most places along the route in this province, there would be no excess spoils. Slope instability should be at a minimum because most of the route is over relatively flat ground. Where slopes would be encountered they appear to be formed in stable rock. Drainage in this region is completely internal (not to the sea, but to dry lakes) and most drainages carry water only part of the year, if at all.

Breakage of the proposed pipeline could be expected from either ground rupture or liquefaction during a moderate to severe earthquake; or from a catastrophic flood. The proposed pipeline crosses an active seismic region where ground rupture has occurred during several earthquakes in the last hundred years. The proposed route itself passes through two areas of historic faulting, the 1915 faulting in Pleasant Valley and the 1932 faulting in the Cedar Mountains area. Similar faulting could be expected along the proposed route within the lifetime of the pipeline. This faulting would most likely occur in the region, including Pleasant Valley on the north, and Cedar Mountain on the south, but could occur elsewhere. Ground disruption could be as much as 10 feet vertically and 5 feet horizontally, judging from displacements during past seismic events. Such ground breakage would most likely rupture the proposed pipeline.

Soil liquefaction is an equally likely cause of pipeline rupture during an earthquake, especially along the 37 miles of proposed pipeline which cross areas of phreatophytes. Sections of the pipeline through these areas would also be subject to corrosion by saline ground water.

Ninety three percent of the proposed pipeline route in Nevada lies in Quaternary alluvial and lake deposits which have little mineral resource potential. Mineable placer gold deposits occur in Quaternary alluvium locally in Nevada, but none are known along the proposed route. Borate and sodium compounds have been mined from playa deposits crossed or lying near the proposed pipeline route on Columbus Salt Marsh and in Fish Lake Valley. Production from these deposits was small and the potential for future production is considered slight. Drilling might locate hidden borate deposits or lithium brines, but such a likelihood is considered small. Even if found, mining of such deposits probably would not be greatly inhibited by the presence of the proposed pipeline.

Areas along the proposed route where bedrock is exposed or is buried under only a shallow cover of alluvium are the most likely places for the discovery of mineral resources. Bedrock outcrops occur along only about 7 percent of the proposed route (see accompanying geologic strip maps), and these bedrock areas are not significantly rich in minerals. The possibility that the proposed pipeline would disrupt any future mining activity is considered small.

<u>Basin and Range Province (California portion)</u>

The possible impact on the pipeline by movement along active faults and the subsequent impact on the environment if the pipeline ruptured certainly must be considered high for the entire length and width of Owens Valley. The obvious zone of 1872 breakage is naturally a candidate for further movement in the future. Young looking Quaternary scarps elsewhere in Owens Valley suggest a wide and long zone of structural breakage in the past.

Fault creep and sudden breakage must be considered in this valley. Bonilla (1968) suggests that fault creep could have taken place after the 1872 break, based on offset measurements made recently. A detailed discussion of seismicity in the Owens Valley is found under seismicity in the geology section on the Basin and Range province.

Engineering of the compressor station in Owens Valley should take into account that within the lifetime of the proposed pipeline, there would be a) a strong possibility of earthquakes having a Richter magnitude greater than 7; and b) substantial amplification of shaking due to water saturated clays that probably underlie the site of the compressor station. The site chosen for the compressor station (sec. 1, T. 16S., R. 36E) is likely to be underlain by water saturated clay inasmuch as it is nearly in the center of the valley and within the area that was covered by water each time that Owens Lake expanded during Pleistocene pluvial periods.

Between the compressor station and the first intersection of the proposed route with U.S. Highway 395 (south of Owens Lake), a distance of about 18 miles, the proposed pipeline would be buried in the Late Pleistocene and Holocene lacustrine sediments of Owens Lake. These sediments are saturated and are certain to undergo liquefaction during ground shaking.

Due to the marshy, boggy conditions in the southwestern portion of Deep Springs Valley, soil liquefaction during an earthquake would occur here also.

The Garlock fault and the Lenwood-Lockhart fault should be considered active. The Garlock fault is especially considered capable of producing large earthquakes accompanied by large ground displacements, and creep could occur along the Lenwood-Lockhart. The proposed pipeline terminates approximately 3 miles from the main trace of the San Andreas fault. This segment of the San Andreas fault is considered capable of producing a magnitude 8 to 8.3 earthquake on the Richter scale. In the event of such a shock, ground motion in the vicinity of the southern part of the proposed pipeline would be severe. Possible ground failure due to liquefaction in the Cuddeback Lake sediments could occur.

Induced slope failure could occur in the area of the landslide near Mule Spring, near the north end of the south trending proposed pipeline segment in Owens Valley, in the alluvial deposits of the Waucoba Embayment, and to a lesser extent along the west side of Fish Lake Valley.

Similar problems could also be encountered where water saturated alluvial deposits are traversed along the channels of Owens River. This could involve collapse of steepened slopes or undercutting and washing connected with water flowing or oozing out of the cut banks near the river.

Slope failure induced by seismic shaking could occur in the steep bluffs developed in young gravels near the southern terminal of the proposed pipeline.

Intense flash floods have an incredible damage potential, and if the entire length of the pipeline is considered, they would occur more often than earthquakes. Boulders many feet in diameter can be transported for miles, deep channels can be quickly cut in washes that ordinarily carry water only once or twice a year, and in extreme cases, only once or twice a century. Washes that have not seriously changed their configuration in hundreds of years could be deeply eroded during a single flash flood. Severe erosion could well rupture the pipe during an unusually intense flash flood.

The segment of the proposed route along the west side of Fish Lake Valley just south of the Nevada-California border, the segment across Waucoba Embayment, and the northernmost segment along the east side of Owens Valley would be susceptible to extensive local gully erosion. In these three areas the "up drainage" side of the pipeline route contains abundant channel fill material and slope wash that is ready to be flushed downstream by the infrequent, but intense localized cloud bursts that occur in this region. Probably the most susceptible area to flash flood is that segment of the proposed pipeline along the east flank of the Sierra Nevada south of Owens Lake to the north end of Indian Wells Valley. To a somewhat lesser degree this process could also occur in Deep Springs Valley.

An added factor to be considered in evaluating the segment of the pipeline route that crosses Owens Lake would be the destructive effect of alkaline brines on metal. Chemical engineering experience at Searles Lake, which has similar brine, has shown that the life expectancy of metal pipes, pumps, vehicles, etc. is much lower than in other types of environments. The nature of the unconsolidated water-saturated material in which the pipe would be bedded and the great likelihood of heavy shaking from nearby earthquakes, combined with the corrosive ability of the brines, leads to a combination of factors which elevate the geologic risks along this part of the route to high levels. There would be a reasonably high possibility of leaks or total rupture of the pipe in this area during its lifetime.

A second area where corrosion could be a problem is in the southern Lava Mountains where the pipeline route lies very close to a currently active geothermal area. The pH of the condensed steam is 3.1 (W. R. Moyle, written commun., 1961). This could cause corrosion by acidic vapors and subsequent leaks in the pipeline.

Experience along the west shore of Owens Lake has shown that the surface sediments are dangerously soft. This is especially true near the edge where springs, active along the Owens Valley fault, keep the mud unconsolidated and extremely soft and treacherous. Several incidents over the past several years have resulted in personnel sinking to hip depth in the very soft sediments along parts of the west shore. Where salt has formed a layer, the lake has a firmer surface, but this central zone is surrounded by wide mud flats that do not have the bearing strength to support mechanized equipment either to lay the pipe or to repair potential leaks.

The Coso Mountains, southeast of Owens Lake, is the site of considerable Pleistocene volcanism. Although the youngest eruption is more than 10,000 years old, hot spring activity in the area is common and the possibility of a future eruption cannot be completely discounted. If an eruption were to occur and cause the pipeline to rupture, the impact of the pipeline rupture on the environment compared to that of the eruption would probably be small.

Near Mountain Well (sec. 22, T. 29S., R. 41E.), south of the Garlock fault, the proposed pipeline appears to be virtually superimposed on the well which provides water for a small pipeline that supplies the towns of Johannesburg and Randsburg. There is a possibility of gas leaks in the vicinity of operating electrical pumps and contamination of drinking water during construction or later pipeline malfunction.

The proposed pipeline from Deep Springs Valley to Owens Valley traverses a section of Late Precambrian to Middle Cambrian sedimentary rocks that is within a classic geologic study area. This is near the type area of the Lower Cambrian for North America; the Waucoban was first defined by C. D. Walcott in 1908 (Nelson, 1962, p. 139). Pipeline excavation would disrupt the outcrops.

3.1.5R.4 Soils

Contamination of Topsoils by Excavation of Subsoils

The applicant stated in response to question number 30, FPC-DOI Task Force questions, November 22, 1974 that:

"Double ditching will be performed where prescribed in order to preserve topsoil. This normally occurs in areas which are under cultivation and have rich topsoil with less fertile soil located one foot or deeper below existing grade. Stipulations of double ditching are usually a requirement of property owners and contained in the right-of-way easements. Any such stipulations will be strictly adhered to."

The applicant's statement indicates that topsoil will be stockpiled and returned to the surface of the trench only in certain areas where stipulated by the landowner or others. Therefore, the total acreage where topsoil will be stockpiled and preserved is unknown.

Where the applicant utilizes single trenching the topsoil will be mixed with the subsoil. The contamination of the topsoil with subsoils will occur on a maximum of 550 acres. This mixing process will alter the physical and chemical properties of the soil profile.

Mixing and burying the topsoil with the relatively infertile subsoil will prevent full restoration of the soil's productive potential until:

1) A new micro-organism community is established and becomes functional;

2) The physical and chemical properties of the material left on the soil surface are rehabilitated to the point where they are equal to the topsoil which was destroyed.

The severity of this impact on crops or native vegetation will depend to a large degree on the nature of subsoil material left on the surface. Plant reestablishment and growth will be inhibited on the acreage where single trenching results in contamination of the topsoil with generally infertile, adverse subsoils.

Compaction of soils, caused by heavy equipment traveling over the soil, will cause loss of soil productivity and also reduce water infiltration within the 100-foot wide right-of-way. Soil compaction will occur on a maximum of 9,300 acres.

Exposure to Wind and Water Erosion

Construction of the pipeline will cause impacts upon the natural inherent productivity and physical qualities of the soil. The construction process will result in disturbance of the soil within the 746-mile long pipeline right-of-way (approximately 9,000 acres). This disturbance alters the soil's structural and chemical characteristics, microbiological activity, and soil-climate relationships which have been established over a long period of time.

An additional 300 acres will also be disturbed during construction of offsite facilities, i.e., access roads and other pipeline facilities. The extent and location of offsite facilities cannot be identified until final design is submitted by the Applicant. Increased susceptibility to soil erosion by wind and water will occur on 9,300 acres as a result of soil disturbance by construction activities.

The most severe wind erosion impacts will occur on the soils situated along the 325-mile long route (approximately 3,900 acres) in Nevada. This segment of the route contains soils that have a high susceptibility to wind and water erosion when the vegetation is removed. The potential soil loss from the soils along the Nevada segment is estimated at 25,000 tons/year. The actual amount of soil loss which will be incurred, however, will be dependent on weather conditions and the conservation measures applied by the Applicant.

Wind erosion losses will cause local air pollution during and after construction until adequate vegetation cover is reestablished.

Cuts and fills cause soil structural changes which may result in mass movement and slides. These actions add to soil loss, sedimentation, and decrease in water quality. Any increase in surface disturbance or compaction by off-road vehicle use could cause serious impacts on soil productivity and increase soil loss.

Figure 3.1.5.4-1 illustrates the location of the dominant soil limitation factors which may be encountered along the pipeline route.

Disruption of Agricultural Activities

The disturbance on croplands due to pipeline construction will cause two major adverse impacts; the loss of crops during the construction year, and the reduction of soil productivity for a number of years.

It is difficult to assess the crop reductions that will occur after construction operations are completed. As previously indicated, areas where topsoil replacement will take place have not been specifically identified. Also the degree of soil compaction will depend on the type of soil and moisture content at the time of construction.

On areas where topsoil is replaced and soil compaction is not severe, crop production should be nearly normal the year following construction. Where topsoil is not replaced and soil compaction is severe, continuing crop reduction will depend upon the kinds of subsoil or substrate material left on the surface and the intensity of rehabilitation by the farmer.

Even where subsoils have good textural qualities, they will lack fertility.

In addition to crop reduction, the pipeline construction activities will create a variety of inconveniences for the farmer. Movement of farm machinery and tillage and harvesting operations will be complicated by the trenching through established fields. Compaction or subsidence of fill areas along the trench and the exposure of cobbles or gravel on the surface will all contribute to more difficult farming operations.

Pipeline construction occurring on irrigated farmland during the time when the land is not producing a crop would cause a relatively minor impact. However, disruption of the irrigation delivery system during the irrigation season would affect crop production on the entire area served by an irrigation system.

As on non-irrigated cropland, construction activities will take land out of production for one growing season and reduce production for several years if topsoils are not replaced.

Grazing land will be out of production during the construction year and will produce at a reduced rate for several years until new vegetation can be established. Construction activities will adversely affect grazing patterns since livestock will probably be reluctant to approach or cross the construction area. There will be the potential danger of animals falling into the open trench during construction.

Future abandonment impacts of the proposed pipeline could be negligible or significant depending upon procedures adopted. If capped and left in place, impacts upon the soil would be negligible. If the line were salvaged, the soils would again be disrupted causing recurrence of the above described soil impacts. In addition, backfill of the trench would require the removal of soil from borrow sites, and would further add to environmental modification with attendant impacts as described throughout this chapter.

3.1.5R.5 Water Resources

Environmental Impact on Surface Water

The surface water impacts are discussed in the following general order: (a) channel erosion, (b) sedimentation, including turbidity and suspended sediment, (c) water quality, and (d) aquatic biology.

Channel erosion, as a result of excavation, diversion, or constriction of the natural stream channel, would be a hazard of pipeline construction. The natural cohesion and vegetative cover of banks would be disturbed by line excavation and other construction activities at the crossing sites, with resultant increased erosion until bank slopes are stabilized or vegetation is reestablished. This recovery period would be 1 or more years. Thus, potential impact exists at the crossings of the major streams, illustrated in Figure 3.1.5.5-1, and at all minor stream crossings with surface flow at the time of construction. The volume of material that would be eroded is unknown.

Discharges of hydrostatic test water would cause substantial amounts of channel erosion, especially where released to dry channels or those with small surface flows. Single discharges of hydrostatic test water may be as much as 750,000 cubic feet. Massive or uncontrolled release of this much water could induce local streambed erosion, or gullying, and create or augment surface flow for several miles.

Where the pipeline crosses the four major rivers, the excavation will be allowed to fill by natural bedload transport. Scour could occur for a short distance (less than 200 feet) upstream, but this effect on streambed elevation would be temporary. The release of water used for hydrostatic testing of the line would also trigger increases in turbidity. Secondary effects of these and other impacts are addressed in the sections dealing with fisheries and vegetation.

Most bed material at the crossing sites has a modal class in the sand and pebble-gravel ranges. These coarser grades of sediment disturbed by construction would move insignificant distances as bedload, causing small amounts of temporary fill immediately downstream from the crossing sites and small amounts of temporary scour upstream.

The potential for impact by increased levels of channel erosion, suspended-sediment concentration and turbidity at major stream crossings is shown in Figure 3.1.5.5-1. These impacts would be temporary effects coincident with pipeline construction at each crossing site.

The average active period of construction at minor streams would be approximately 2 weeks, and the four major streams will be on the order of 6 weeks. However, the overall periods of activity could range from a maximum of 1 month at minor streams, to as much as 3 months at major streams. Suspended-sediment concentrations and turbidity levels would be elevated for these periods and would return to normal gradually thereafter. A noteworthy secondary effect is the potential increase in turbidity and sediment transport caused by increased off-road vehicular activity in small stream channels. This increased vehicle activity would be a result of the increased access provided by the cleared pipeline right-of-way.

After burial of the pipe, remaining irregularities from the equilibrium bed configuration would be smoothed--over several days for large streams and fine bed material, or at the time of the next major rise for smaller streams and those with bed material coarser than sizes transported during normal flows. Effects would vary with both size and sorting of bed material. Ephemeral streams crossed by the proposed pipeline route in Nevada and California show natural channel armoring in which bed erosion has temporarily ceased at a surficial layer of coarse sediment forming the stream bottom. The effects of channel disturbance would be more pronounced in streams with armored bed material, providing flow occurs during the construction interval.

The aspect of burial depth at stream crossings versus maximum scour depth is significant for both pipeline integrity and effects on surface water. If the pipe were to be buried below scour depth and weighted, the security of the pipeline would be enhanced. Without these precautions the pipeline could be floated during a major flood and consequently jeopardized. In addition, replacement of the line would again disrupt stream hydraulics, create turbidity, and impact stream ecosystems as described in the sections on fisheries and vegetation.

Flash flooding has the potential to rupture the line by large amounts of streambed scour or transport of very coarse sedimentary detritus. Flood events of the frequencies necessary to cause these phenomena are not subject to normal hydrologic analysis because of their rarity. Consequently, they are treated as geologic events and are discussed in Section 3.1.5R.3. Results of pipeline rupture are discussed in the Overview volume.

Similar processes would occur at crossings of minor perennial streams. The majority of channels crossed in Nevada and California are ephemeral and, because the concentration of most of the flow usually occurs in as little as 1 to 3 percent of the annual period, the channels probably would be dry at the time of construction. If flow does occur, suspended-sediment concentrations would be increased by construction. However, the increase would occur on top of the high natural concentrations that occur in these streams.

The compressor station site at Lone Pine would have minimal impact on water resources as the nearby Owens River is only running residual water from the aqueduct at that point before it empties into Owens Lake.

Other impacts include a possible increase in surface water temperature and consequent reduction in dissolved oxygen content caused by the removal of shading vegetation.

Downstream water quality at each river and stream crossing probably would be adversely affected for a short period during construction from the combined effects of earth movement on land and trenching and backfilling in streams. It is not expected that dissolved mineral content would change appreciably, but effects could include dissolved-oxygen depression. This is not usually critical in winter months when oxygen levels are at or near saturation in most streams, but could be severe at other times if sufficient organic material from river-bottom muds is resuspended. A further impact could result where waters below crossings are withdrawn for public supply or irrigation purposes.

Large and indiscriminant use of surface waters for test water supply could cause temporary drawdown and possible interruption of flow in small streams. This is an especially important problem at the Humboldt River, which must serve as the source of 60 to 100 pipeline miles (1.5 to 2.3 million cubic feet) of test water for all points to the south. Filtered withdrawal may impinge plankton and small fish along with other filtrate. Localized turbulence at the line inlets might suspend nearby bottom sediments during the filling operation.

Test water discharge could cause siltation of fish eggs, fry and other aquatic organisms if critical times of the year are not considered. Also, the test water discharge from the pipe could be colored and have a relatively low content of iron oxide, other metals, or other suspended solids that should settle rapidly, but would discolor receiving waters for the period of release.

Methane gas from severe leaks or rupture of the pipeline would be quickly dissipated because of its low solubility in water. However, small leaks of long duration would add small quantities of methane to water, a potentially explosive mixture if the gas becomes entrapped in drinking water system pipes.

Surface and ground water supplies could potentially be impacted from the addition of construction workers to local populations. Seven to nine construction spreads would work concurrently over the pipeline route. Using 100 gallons per day per man as a basis for water consumption, daily sources of 200,000 to 225,000 gallons would be required. Most of this would be returned in a polluted form via body wastes to surface water and ground water. Sanitation facilities of local towns would have a bearing on the effects of this discharge, however.

The possibility of contaminating municipal supplies would exist near Mountain Well (sec. 22, T. 29s., R. 41E.) in California. 22, T. 29S., R. 41E.) in California. The proposed pipeline route is virtually adjacent to the well providing the water supply for the towns of Johannesburg and Randsburg. Contamination of the water supply during and after construction would be a potential impact.

If the proposed pipeline were abandoned, capped, and left in the ground, there would be no added impacts on water quality. If the pipeline were salvaged, impacts would be similar but less profound than those previously discussed in this section.

Environmental Impact on Ground Water

Along very nearly all its proposed route, from Rye Valley, Oregon, to Cajon, California, the proposed pipeline would be buried in the zone of aeration, substantially above the water table. Thus, virtually no interaction or major impact, is anticipated between ground-water bodies and the pipeline, either during construction or operation. In principle, cutting and backfilling the pipeline trench might modify infiltration capacity at the land surface. Further, water discharged from hydrostatic tests of the pipeline might locally infiltrate the land surface and potentially percolate to the water table. However, aggregate effect on recharge to an entire aquifer system probably would be too small to be demonstrated; such effect as occurs seems more likely to be advantageous than the opposite, by increasing rather than diminishing infiltration.

The proposed pipeline should be appraised as a potential source of ground-water pollution by downward percolation. Such a potential seems virtually to be limited to the compressor station sites because, in the event of a ruptured pipeline elsewhere, released gas would vent upward rather than infiltrate downward. At the compressor stations, only a small source of hazard seems likely--specifically, spilled lubricant or indiscriminately disposed waste.

Noteworthy impacts are anticipated under two situations only: at river crossings and across wetlands or other areas where the pipeline trench would reach to and below the water table. At a river crossing, the pipeline trench would cut into any alluvial valley train and its contained underflow. Some such trains are sources of usable ground water, calling for protection against pollution. Ordinarily, adequate protection would be assured by keeping the construction site, during trenching and backfilling, free from all noxious waste products that do not oxidize or disintegrate rapidly. Also, the possibility of polluting a usable water source would be further diminished by the usual practice of constructing the crossings while river flow is near its minimum. At such times, ground-water head ordinarily would be somewhat greater than that of river water and so would tend to flush the pipeline excavation. This may not be true of the Quinn and Humboldt Rivers during parts of the year when the two streams lose water to the ground-water system, however.

At major river crossings the pipeline, if unweighted and not buried below scour depth, would float out of place should the streambed scour during heavy runoff. In this circumstance, the pipeline and its encasement would act as a dam, partial or complete, against ground-water underflow. Commonly, however, only a fraction of the underflow's cross-section would be so dammed, and the effect on potential ground-water supply would scarcely be detectable a few hundred yards downstream.

Wetlands, and other areas of shallow ground water, ordinarily do not afford usable water supplies. Their chief relevant effects are: (a) during construction, the pipeline trench would need to be dewatered; and (b) the operating pipeline might require protection against corrosion.

Effects of pipeline construction, operation, and maintenance on the ground-water reservoir can be minimized if good practice is followed in disposal of any sewage, contaminated test water, and waste by-products of pipeline construction. Interaction between the ground-water environment and the pipeline are likely under two circumstances and may be considered exceptions to normal conditions. First, if the pipeline is located in or near an area that may subside, due to clay compaction (as large scale pumping reduces head within the ground-water system), pipeline rupture will occur. Such a rupture probably would have only minor effects on the ground-water reservoir, however. Secondly, in geothermal areas, such as Leach Hot Springs (M.P. 654), and in Smith Creek Valley (M.P. 746), unspecified interaction between the ground-water system and the pipeline could result. In the area of spring discharge, ground-water temperatures at shallow depth may approach boiling. In addition to these two sites, other unknown geothermal sites may be encountered.

Because of the relation between streams and the ground-water reservoir, reductions in in streamflow volume or water quality would ultimately have a parallel effect on the ground-water reservoir. Therefore, in evaluating the impact on ground-water reservoir, effects on streams noted in the section on surface water impacts should be considered.

3.1.5R.6 Vegetation

<u>Nature and Extent of Direct and Indirect Construction Impacts on Aquatic and Terrestrial Vegetation</u>

The removal or disruption of existing vegetation on approximately 9,300 acres will be necessary to provide working space for emplacement of the proposed pipeline and ancillary facilities such as gauging stations, valves, and new roads.

Assuming a 100-foot-wide right-of-way, construction of the proposed pipeline will require approximately 9,000 acres of land. Approximately 300 acres will be used for ancillary pipeline facilities.

Approximately 300 acres of the proposed right-of-way is timberland. After construction, this land will be allowed to revegetate, but not back to trees. Consequently, the impact of pipeline construction on these timberlands will persist for the life of the proposed project.

The Applicant states that:

> All rights-of-way disturbed either indirectly by passage of construction equipment or directly by trenching and backfill will be reseeded if necessary or allowed to revegetate by natural encroachment of plant species from adjacent undisturbed areas that will not interfere with future access or maintenance. Some portions of the right-of-way, especially the more arid areas, will be less prone to natural regeneration than others. In these areas, replanting and reseeding will be done in accordance with requirements of the state and federal agencies having jurisdiction.

If the Applicant utilizes natural revegetation it will take plant succession many years to establish a plant community similar to what exists prior to construction. The natural revegetation process will leave the soil susceptible to severe erosion losses for a long period of time, i.e., until plant succession establishes an adequate vegetative cover.

The complete removal of all aquatic vegetation within the proposed pipeline route clearing limits can be expected. Excavation of the pipeline trench across perennial waterways would disturb the streambeds, resulting in downstream sedimentation. Sedimentation, although of short duration in most streams, would damage or destroy downstream aquatic vegetation.

Riparian plant associations destroyed by construction activities will revegetate relatively rapidly if the topsoil is replaced from excavated areas. However, species such as cottonwood, alder, hawthorn, and aspen will require many years to become reestablished, either through natural regeneration or by actual seeding and planting by the Applicant.

The loss of protective vegetative cover increases water runoff and soil erosion. Clearing of vegetation would eliminate primary biological productivity, which is the production of the annual crop of plant materials that form the base of terrestrial food webs. Therefore, the food available to small colonies of herbivorous animals, such as small rodents, would be slightly decreased for at least one growing season.

The invasion of weed species will occur on the right-of-way and all areas near the denuded pipeline route. This would pose potential problems, especially the invasion of noxious weeds and species that are extremely competitive with native vegetation. A rapid and successful invasion of undesirable annual brome grasses could prevent the reestablishment of native grasses, which are valuable as a food source to livestock and wildlife. Annual bromes inhibit the regrowth of shrubs, which are valuable as browse and cover. Plants belonging to the goosefoot, mustard, and sunflower families comprise a large percentage of weed species that probably would establish themselves on the cleared pipeline route.

New compressor stations, gauging stations, and other ancillary facilities will be constructed. Their normal operation and use will not adversely affect the vegetation on and near the proposed route.

Effects of Gas Leaks on Vegetation

Adverse effects of the operation of the proposed pipeline would be caused by pipeline failure resulting in massive gas releases with the potential for wildfire. For small leaks, the gas would be quickly warmed by the ground and ambient air, so that no gas would collect at the surface. For larger leaks and pipeline rupture, there could be a toxic volume of cold gas near the proposed pipeline. Small leaks can be detected during the growing season, as natural gas kills vegetation in the immediate vicinity. Persistent damage would not be expected if the leakage were detected and the necessary repairs made quickly. Rapid detection would be necessary to prevent the possibility of persistent damage to the environment.

3.1.5R.7 Wildlife

Much of the quantitative data and judgments in this section, unless specifically cited, are from personal communications with biologists from the Fish and Wildlife Service, Bureau of Land Management, Forest Service, and State wildlife agencies. Records are on file in the U.S. Fish and Wildlife Service Area Office in Portland, Oregon.

Nature and Extent of Direct and Indirect Construction Impacts on Fish and Wildlife

A partial list of construction actions that could create impacts on wildlife include erosion, sedimentation, stream flow restriction, noise, presence of construction workers, timing of construction, test water discharge, blasting, creation and use of borrow pits, trenching, equipment storage (pipe, etc.), clearing, burning, presence of the cleared pipeline route, grading, stockpiling of excavated material, removal of oxygen in the water, and use of herbicides.

The evaluation of project construction effects on fish and wildlife and their habitats was made by analyzing the above actions on the various categories of wildlife, while taking into consideration impacts on cover, food, breeding, nesting and rearing young and, in some categories, migration and winter range.

The six actions that appear to have the greatest potential adverse impacts are, in descending order: clearing of the proposed route, timing of construction, blasting, trenching, use of herbicides, and erosion. All other actions pose minor threats to wildlife.

In considering the categories of wildlife that could be adversely impacted, the greatest construction impacts would be to unique, sensitive, and/or threatened populations and endangered species. Categories with a moderate potential for adverse impacts include big game mammals, small game and fur-bearing mammals, upland game, birds of prey, reptiles and amphibians. A lower impact would occur to waterfowl, other birds, and small nongame mammals. A detailed analysis of impacts on major wildlife categories follows. Only a partial inventory of wildlife population density exists along the proposed route, so that numerical losses or gains could be assessed only in a general way.

Big Game

There are five species of big game animals commonly or occasionally occurring along the proposed future expansion and all probably would be impacted. They include white-tailed and mule deer, tule elk, bighorn sheep, and pronghorn antelope. Bighorn sheep are discussed in greater detail under "unique, sensitive, and/or threatened populations."

Long-term construction effects on big game habitats would be slight. Clearing of the proposed route would have significant adverse impacts on big game for the first few years.

A large portion of the proposed route would pass through deer winter range. Clearing for the proposed pipeline would destroy this habitat and cause loss of winter deer food and cover. Later, "edge effects" along the right-of-way would improve deer habitat.

Construction activities in winter range during a particularly cold winter would have a decidedly greater adverse impact on displaced animals than if construction occurred during a mild winter as displaced animals would have difficulty in finding new feeding areas and would have to compete with deer already present. Brogan Canyon and Cottonwood Creek Canyon, near Brogan, Oregon, are both critical deer winter ranges. Cedar Mountain, located about 30 miles north of Burns Junction, Oregon, is another important deer concentration area. The precise location of all such grounds along the proposed route is unknown at this time.

The proposed pipeline would cross two known deer migration routes. They are in the Ione Valley of Nevada and Owens Valley in California. Others are no doubt present, but have not been identified. Pipeline construction during the spring and fall at the point where these migration routes cross the proposed route probably result in deer being diverted from their normal migration route due to the open trench, aboveground storage of the pipe, and presence of construction crews and equipment.

Construction during the spring through deer fawning grounds, elk calving grounds, or antelope kidding grounds would disrupt these activities and possibly would cause the death of some newborn young; the precise location of all such grounds along the proposed route is unknown at this time.

In the cold desert of eastern Oregon and northern Nevada, big sagebrush occurs in vast uniform stands. Clearing a strip through the area would allow for breaks in the monotype and provide an opening for the growth of other plant types. Diversified vegetative types favor all big game animals as well as most other wildlife species.

Tule elk in the Owens River Valley of California would be disturbed by construction activities, especially if they occurred during the winter when the elk are concentrated in the lower elevations. They also would temporarily lose some habitat along the proposed route, which would cross about 70 miles of their range. The Bishop Tule elk herd calving grounds would be bisected by the proposed pipeline. If construction occurred during the spring, the effect on this elk herd could be extremely harmful. Likewise, the Big Pine herd calving area is traversed by the proposed pipeline. The three other herd units (Tinnemaha, Independence and Lone Pine) will also have at least a portion of their area of use transected, causing at least a temporary change in time and area of utilization.

Potentially the most harmful impact to big game would be the provision of access, via the cleared pipeline route, for off-road vehicles. This would occur to some extent even though the applicant proposes to construct barriers at points where the pipeline crosses well-traveled roads. Such barriers would not completely exclude vehicular travel. One such area is the pipeline crossing of the Inyo Mountains in California that could impact a bighorn sheep population.

The proposed route would pass through some areas of big game habitat that presently have a limited number of roads and other clearings. This restricted public access has tended to create big semiwilderness areas that act as population reservoirs from which animals can move to fill underutilized habitats. They also provide protection from the invasion of man.

Three semiwilderness areas in vital big game habitat bisected by the proposed route are: mule deer winter range (7 miles) about 12 miles west of Vale, Oregon; pronghorn winter and kidding range (19 miles) between Cedar Mountain and Burns Junction, Oregon; bighorn sheep range (6 miles) in the Monte Cristo Range, Nevada. However, there are additional semiwilderness areas along the proposed route that are in less critical habitat; e.g., Malheur County of Oregon, plus much of the proposed route in Nevada south of M.P. 730 (Dixie Valley, Pershing County). Also, between Red Mountain and Victorville in California, the proposed pipeline passes through approximately 42 miles that are free of man-made developments and access roads.

In the desert areas of Oregon and Nevada, big game depends heavily on watering areas for survival during the summer and fall. Natural seeps, springs and creeks provide not only water during the dry season, but are often surrounded by wet meadows that contain succulent food plants. The location of such wet areas along the proposed route is not well-known at this time. It is probable that several such areas are near the proposed route and would be permanently lost due to construction of the pipeline. Such loss could be caused by disruption of subsurface drainage to the seeps and springs or outright digging up of the sites for pipeline emplacement. The loss of such watering sites not only would reduce big game numbers, but other desert wildlife populations. The only spring known to be on the proposed pipeline route is at M.P. 767, near where the Churchill/Lander County border is crossed. The removal of riparian vegetation at stream crossings during construction also would adversely impact some wildlife populations.

Another harmful impact of the proposed pipeline on big game would be the long-term loss of portions of the short sagebrush community in alkaline flats located in eastern Oregon and northern Nevada. The disturbance of soil and drainage in these flats would reduce the abundance of important big game food plants in localized areas. Since nearby undisturbed short sage alkaline flats probably would already be fully utilized by big game, especially antelope, the net effect would be a reduction in available big game food.

In the Nevada desert, the proposed pipeline would pass through areas containing mature juniper trees. In such areas, these trees often provide the only significant big game cover for several miles. Removal of such trees along the proposed route would destroy this cover feature during the construction period and for many years thereafter.

Clearing for pipeline construction could also result in revegetation of some undesirable species of plants, such as Halogeton glomeratus. This species is present in Nevada now and is one of the first species to become established in disturbed areas. It does not become established or compete with native grasses and forbs in undisturbed areas. Halogeton, when eaten by range cattle or sheep, can cause sickness or death, and it may have similar effects on other herbivores such as antelope, deer, elk, and bighorn sheep.

Wild horses and burros occur along the proposed route near Burns Junction, Oregon, Grass Valley, 20 miles south of Winnemucca, Nevada, and on the Inyo National Forest east of Owens Valley. They would move out of the area during construction and should not be seriously affected.

Small Game and Fur-Bearing Mammals

Many of this group are carnivores: bobcat, coyote, badger, wolverine, weasel, mink, marten, and fox. They generally have large home ranges over which they regularly move. Such areas normally include several habitat types. The loss of a small portion of the home range along the proposed pipeline probably would have a minimal impact on these species. Certain herbivores, such as rabbits, tend to have small ranges and generally are restricted to the region immediately surrounding their burrows. Where the pipeline construction zone passes through these territories, individual animals would be impacted; however, the impact on the species population would be minimal because of the great reproductive potential of these herbivores.

Small Nongame Mammals

Localized elimination of individual small mammals such as mice, ground squirrels, voles, shrews, and their habitats would occur along the proposed route. Most of these species have small home ranges and tend to retreat to their burrows when disturbed or threatened. However, the impact on the populations would be temporary because of the high reproductive potential of most of these species and the subsequent rapid reinhabitation along the proposed route. There will be slight shifts in species composition due to the change in vegetative habitat. Mice, rats and voles, which thrive in grass and forb vegetation, would be benefited while forest dwelling tree squirrels and shrews would lose habitat.

In semi-arid areas such as portions of southeastern Oregon that contain one major vegetation type, such as sagebrush, breaking up this vegetation results in replacement with a variety of plants. Many small mammal populations would benefit from this action.

In the arid areas of Nevada and California, revegetation to conditions prior to construction would take up to 50 years or longer, and would result in some loss of habitat. Some reduction in small mammal populations dependent on the present vegetative type would occur.

Construction of the proposed pipeline would not appear to affect bats unless abandoned mine shafts, tunnels or caves harboring bats along the route are disturbed.

Upland Game Birds

Until revegetation occurs, loss of habitat would adversely affect game birds such as grouse, pheasant, partridge, and quail. However, the impact would most likely cause a relatively insignificant decrease in any population within the right-of-way. Any decrease should be temporary, except in arid areas where revegetation could take 50 years or more.

Removal and destruction of grasses, shrubs, and trees from the proposed route would reduce the amount of food in the immediate area available to these birds. The destruction of small watering areas, such as springs and seeps, could have serious impact on local populations because watering sites often are the limiting factor in a particular locale. Sage grouse, in particular, are extremely dependent on wet meadows, especially the young birds.

Nests and broods of young game birds near the proposed route could be destroyed, and others within a few hundred feet could be abandoned due to the construction disturbance. Breeding-display sites of species of grouse could be disturbed or physically altered and, thus, rendered unsuitable. Known sites are located in parts of Humboldt, Lander and Nye Counties, Nevada. Sagegrove breeding activities would be interrupted if construction occurs during the spring months in these areas.

Waterfowl and Other Migratory Birds

The proposed pipeline would not directly affect a significant amount of habitat suitable for waterfowl and other migratory birds. Most marshes, small lakes, reservoirs, and similar bodies of water would be avoided. At the crossing points of most of the major rivers and streams and numerous smaller streams and creeks, there are no extensive resting or feeding areas for waterfowl.

Construction noise, dust, human harassment, blasting, and other construction-related disruptions would have a negative effect on waterfowl near the proposed route, especially if construction occurred during nesting and rearing activities when nests could be abandoned or young become more vulnerable to predators. Adverse effects to waterfowl would practically cease once construction activities cease.

Birds of Prey (Raptors)

The loss of habitat could affect birds of prey in two ways, although these impacts generally would be temporary. First, where forest, steppe, salt desert shrub, and riparian vegetation would be removed from the construction zone, a reduction in numbers of small mammals, reptiles, and amphibians available to birds of prey (Snow, 1973) would also occur. However, small animals crossing the cleared space would be observed more readily by these birds and, thus, could become more vulnerable. As the proposed route revegetated, both these effects would be minimized.

Second, there could be a short-term adverse impact on breeding activities and nesting of birds of prey, especially in forest areas. This impact could reach for some distance, possibly 1 or more miles on either side of the proposed route. The magnitude of the impact would decrease as distance increases (Snow, 1973). Trees along the proposed route containing owl nest holes or nests of other raptors would be removed. Some species near the proposed route could abandon their nests.

Overall the effect of construction of the proposed pipeline would be minimal to common raptors (endangered species of raptors are discussed separately under Endangered Species).

Other Birds

The loss of habitat would have a slight, temporary adverse impact on songbirds and most other birds foraging along the proposed route during construction. For most species, the area involved would probably be only a small proportion of the total area in which they normally forage.

Most reptiles and amphibians would escape from the path of construction equipment, but some would be killed or injured, particularly those who may have retreated to dens along the proposed route. The impact would be temporary and minimal as other individuals invade the region following revegetation.

The loss of aquatic habitat would have an adverse impact on other species in a few local areas. For example, pools inhabited by frogs and salamanders could be altered to such an extent that the entire pond ecosystem would be lost.

Terrestrial Invertebrates

Except for moths, butterflies, and other groups of winged insects, most species of invertebrates along the proposed route probably would not escape right-of-way clearing. However, the impact on total populations of these species would be insignificant, because most are widespread and numerically abundant, with high reproduction potential and short generation time.

Aquatic Animals

The greatest impact from construction would be from downstream siltation and turbidity caused by construction at and in the vicinity of stream crossings. Lesser impacts would be from stream blockage by construction at stream crossings or streamside debris, blasting in streams, and hydrostatic testing.

At stream and river crossings along the proposed route where blasting is necessary, some fish could be destroyed. Fish populations could suffer losses directly or indirectly by an increase in silt due to runoff from construction sites and a loss of vegetative cover. It should be kept in mind, however, that the natural silt load in the rivers and streams crossed by the pipeline can be very high, particularly during runoff periods.

Therefore, the percent of increase due to construction of the pipeline probably is not too significant in most cases.

Some fish species could be somewhat more sensitive to an increased siltload during the spring and early summer spawning season, which could be detrimental to the reproductive success of the fish trying to spawn downstream from construction. As maximum spring runoff siltloads coincide with the spawning season, any additional silt added to the stream due to construction activity at this time may increase the total concentration beyond the tolerance level of fish and other aquatic life. Fish nests continually silted could be abandoned, invertebrate populations reduced, and young fish extending their search for food could be subjected to greater predation. Construction activities that could increase siltation include right-of-way clearing and grading, trenching, temporary storage of soil and substrate, backfill, access road construction, and stream crossing. Additional details are in the water resources section.

While juvenile or adult fish may tolerate heavy concentrations of silt (Cordone and Kelly, 1961) and are able to move away from regions of high silt density, nonmobile eggs and fry may be damaged (Peters, 1962). Impact could be severe on salmon and trout, whose gravel spawning beds must be relatively free of sand and silt and not highly compacted. Even small amounts of fine material could be detrimental to the spawning and fry survival of these species. Excessive sand and silt cause low intragravel flows, resulting in decreased supplies of dissolved oxygen for egg and fry respiration. This could reduce fry survival by filling spaces in the gravel, thus preventing fish from emerging from the spawning bed. Silt is less damaging to warm water and/or rough fish adapted to living and spawning in turbid water.

Siltation increase could reduce the normal species and numbers of plants and dependent macroinvertebrates (Gammon, 1970), which are food for such species as trout, perch, bass, and other vertebrate predators. The impact on invertebrates, most of which have short generations, would therefore be temporary.

In the smaller streams traversing stable substrates, construction would cause only a small amount of siltation and the impact on fisheries would be limited.

There would be some impact on fish and other aquatic organisms as the proposed route crosses only four major perennial streams: the Quinn and Humboldt in Nevada, Malheur in Oregon, and Owens River in California. The Quinn River is intermittent where the pipeline would cross it. There are no trout present in the river at or below the crossing. There would be some damage to trout in the Malheur River with adverse effects in the form of invertebrate reduction. The Humboldt River, which has both cold water and warm water fish, and the Owens River, a warm water stream, would not be greatly affected. Warm water fish would migrate out of the construction vicinity, although there could be some small loss of "put and take" trout in the Humboldt River.

The temporary gross physical disturbance and siltation of aquatic habitat from construction at river crossings probably is the most serious problem relative to construction. However, other construction problems exist. During the hydrostatic testing phase of pipeline construction, large amounts (up to several acre-feet discharged at a rate of 10 cfs) of water are discharged in a relatively short period of time into water courses, temporary holding ponds, or onto nearby ground that drains into streams. The sudden discharge would cause excessive turbidity and siltation. An additional danger is the drying of a small stream that serves as the water source.

The loss of aquatic habitat would have an adverse impact on other species in few local areas. For example, pools could be altered to such an extent that the entire pool ecosystem would be lost.

Unique, Sensitive and/or Threatened Populations

Bighorn sheep in the Monte Cristo range of Esmeralda County, Nevada (M.P. 851 to 873), would be disturbed during construction. This animal is extremely sensitive to man and approximately 6 miles of its range would be crossed.

The harmful impact to bighorn sheep of improved access via clearing for the proposed pipeline would be especially severe. This population is isolated in a de facto wilderness area and its numbers are declining. If off-road vehicles are provided with improved access to this population, the animals would suffer increased harassment and additional illegal hunting. The same is true for the bighorn population in the Inyo Mountains, California. This would include Soldier Canyon, through which the proposed route passes.

There are two other areas on or near the proposed route in Oregon and Nevada that would be potential sites for introduction of bighorns or the expansion of existing populations. One is the Owyhee River Canyon in Oregon. The proposed pipeline would pass very close to this portion of the canyon from M.P. 505 to 530. Any improvement of access to this portion of the canyon would reduce the potential for the successful spread of the bighorn population living about 35 miles to the east. Improved vehicle access also would reduce the potential success of new bighorn introductions near the proposed pipeline. The other possible bighorn sheep introduction area along the proposed pipeline would be in the Clan Alpine Mountains, Nevada, from M.P. 747 to 755. Historically, bighorns were found in all the areas mentioned above. With proper land management, these areas would be suitable for future bighorn introductions.

The proposed route would cross the range of the kit fox in extreme southeastern Oregon and in much of Nevada and California. The impact of construction on this animal would be minimal as the kit fox would merely vacate the immediate area during construction, and later return.

The Malheur shrew could be encountered in wet areas and along stream banks from Rye Valley to mid-Malheur County, Oregon. Little is known about these animals but some impact should be anticipated. In all likelihood, they would lose some habitat where streams are crossed.

Three small rodents, the pale kangaroo mouse, San Joaquin pocket mouse, and chisel-toothed kangaroo mouse could be potentially encountered in California, the former in Deep Springs Valley and the latter two between Four Corners (Kramer Junction) and Randsburg. The magnitude of impact could not be predicted because of the lack of specific knowledge about the location of populations along the proposed route. Any alteration of native vegetation by the proposed route likely would be detrimental because the existence of these animals is tied closely to specific types of vegetation.

Both the northern bald eagle and osprey are greatly reduced from former abundance along the proposed route. No known active nests are located in the vicinity of the proposed route.

Osprey would be encountered in the Cwens Valley of California at about M.P. 960 near Tinemah Reservoir. Nesting platforms have been erected and currently are being utilized by osprey. Construction activities during the nesting season probably would disrupt this activity.

Three reptiles--the desert tortoise, Panamint alligator lizard, and southern rubber boa--would be encountered in the southern California desert area. In general, effects would be adverse because these reptiles are dependent on native vegetation. Losses of vegetation would reduce habitat. Revegetation probably would take 50 or more years to recover in this arid area. Desert tortoise habitat would be encountered from about Kramer Junction on Highway 395 north through Randsburg and the El Paso Mountains. The tortoise is the California State reptile. Tortoise populations have been declining because of habitat degradation due to overgrazing and off-road vehicles. Indiscriminate shooting and highway fatalities also have reduced the numbers of these long-lived reptiles.

The Panamint alligator lizard would have range crossings in the Inyo Mountains from about M.P. 935 to 945. Southern rubber boa range includes southwestern San Bernardino County near the southern terminus of the route.

The black toad (Bufo exsul) is found in and around Deep Springs and Antelope Springs in Deep Springs Valley, Inyo County, California. The proposed route traverses the valley and passes within approximately one-fourth mile of two bog springs, one or both of which are Bufo exsul breeding areas. An adverse effect on this amphibian is possible as construction activities might alter the hydrologic regime that the species is dependent upon.

The tailed frog could be encountered in the Wallawa Mountains of eastern Oregon. It inhabits clear, cool streams and possibly could be adversely impacted by a stream crossing. Warming of the water by stream blockage or destruction of aquatic vegetation and invertebrates by siltation could both affect it.

Rare aquatic mollusks occur in Nye County, Nevada, and Inyo County, California, with 7 and 10 species, respectively. They would not be directly affected because the springs would not be crossed by the proposed route. However, there is a possibility that springs could be visited and mollusks destroyed by construction workers or by the public as a result of increased access afforded by clearing of the proposed route.

Eleven species of land mollusks in Kern County and one species in Inyo County, both crossed by the proposed route, are classified as rare and endangered by California (CDFG, 1973). It is not known if any of the mollusks would be encountered. These animals are highly adapted to their environment and alteration, however slight, would affect them adversely.

Endangered Species

Endangered species could be especially impacted since they lead a somewhat precarious existence at best. General disruption, intrusion, and increased human activity and access is highly detrimental to those species requiring seclusion. Endangered species are in delicate balance with the existing environment, and any change is apt to be detrimental.

Sixteen species of mammals, birds, reptiles, amphibians, and fish classified as endangered by Federal or State governments have been identified as either definitely or potentially occurring along the route of the fully-powered system (Figure 3.1.5.7-1).

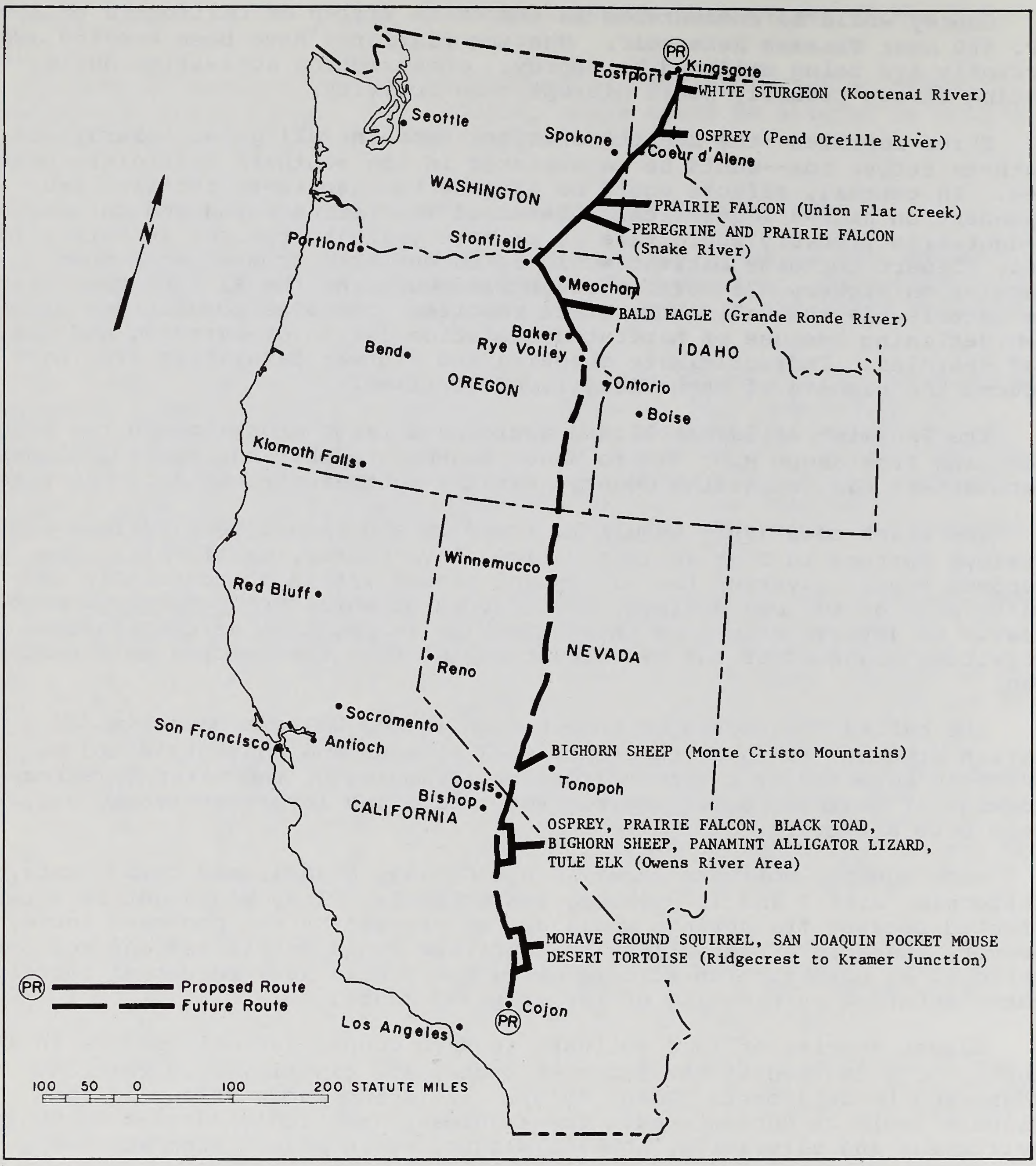

Figure 3.1.5.7-1 Critical areas where unique, sensitive, threatened and/or endangered species will be encountered

Along the proposed future expansion route, the habitat of several endangered species would be crossed. The mohave ground squirrel would have its habitat degraded within the proposed route. Scattered populations of the animal could be encountered from about the vicinity of China Lake to Victorville, California.

The spotted bat, if it should occur in the vicinity of the proposed route, could be affected by any disturbance to mine shafts or caves along the route that are inhabited by this extremely rare bat.

Peregrine and prairie falcons and bald eagles probably would abandon nesting or feeding sites up to 1 mile away from construction due to construction noise and general disturbance (Snow, 1973).

Loss of actual or potential nest sites by removal of large trees would have a long-term adverse effect on falcons and eagles. Logging, burning of slash, and related activities would be disturbing and possibly cause nest abandonment. Loss of a few nests or fledglings could represent a significant population loss in the affected area. Because of critical nesting tolerances of these species, the loss of nesting habitat would represent a major problem but is not anticipated along the future expansion, due to the lack of timbered area the route would pass through.

Rare and endangered birds of prey could abandon their nests when nearby construction activity or blasting occurs. This type of impact on the rarer eagles, peregrine falcons, prarie falcons, and osprey could have a deleterious effect on their population.

The pipeline construction would not affect the Owens tui chub and Owens pupfish, both of which are found 5 to 50 miles upstream from where the proposed route first approaches the Owens River near Big Pine.

Other Minor Impacts on Terrestrial Ecosystems

The following minor impacts generally are of a short-term nature. Smoke from onsite burning of trees, slash, etc., could disturb birds, particularly those nesting in the area. This resulting adverse impact would be short term and insignificant on songbirds and other common species. The impacts could be long term and significant on threatened or endangered birds that might be nesting in the immediate area, especially birds of prey such as ospreys, eagles, and peregrine falcons. The loss of a few nests could eliminate the population in the affected area. The greatest concentrations of these birds and, correspondingly, the greatest amount of woody vegetation to be disposed of usually would occur adjacent to streams and on mountain passes. The impact on mammals is expected to be minimal and temporary.

Some dust would be raised by construction activity, especially in arid areas that are cultivated or in the desert regions. In farm areas, dust would have relatively little impact on the biological communities. In forest, shrub, and desert plant associations, dust clouds raised by equipment and the resulting dust covering vegetation could be esthetically objectionable but probably would have a minimal biological impact. Wind and rainfall should be sufficient to remove most of the dust within days or weeks.

Nature and Extent of Direct and Indirect Operation and Maintenance Impacts on Fish and Wildlife

This section addresses impacts under the fully-powered system concept; i.e., if the proposed future expansion of the pipeline from Rye Valley, Oregon, south to Cajon, California, becomes a reality, two new compressor stations will be constructed north of Rye Valley to complement the three stations already existing. From Rye Valley to Cajon, eight new stations will need to be constructed.

The operation and maintenance actions that create fish and wildlife impacts are use of access roads, operation of facilities, increased public access, pipeline break, storage tank accidents, sewage disposal, lowering of soil fertility, presence of the cleared right-of-way, noise, erosion, sedimentation, surveillance and monitoring, and potential retrenching for repair.

The actions that appear to have the greatest impact, in order of importance, are increased public use, erosion, retrenching for repair, and storage tank accidents.

Because natural gas pipelines require only minimal maintenance, there should be limited impacts due to normal operation. One exception would be the detrimental effect on big game and rare and endangered species resulting from increased human access and disturbance.

Access to sites of possible pipeline malfunction would be gained from existing roads and trails, or along the proposed route. New access roads would be constructed only as a last resort. New roads would have an adverse impact on wildlife. Their effects would be similar to the effects of the original pipeline construction, but on a reduced scale.

Probable operational impacts on wildlife under the fully-powered system are described in greater detail below.

Big Game

The heated gas of the present PGT pipeline passing through the pipe warms the soil above it and melts the surrounding snow. This allows grasses and forbs to grow there during an environmentally harsh time of the year. The heat from the line dries out the vegetation earlier in the spring than other nearby forage, but food usually is fairly plentiful by that time. The attraction of deer to this winter food supply has an adverse impact on the animals where the present pipeline passes near U.S. Highway 95 just south of the Canadian border (M.P. 0 to 2 and 41 to 47). There, the deer present a traffic hazard to passing winter motorists, resulting in the death of deer, injuries to people and damage to vehicles, fences, etc. In new rights-of-way this could also become a problem such as along U.S. Highway 395 in California.

Retrenching along the proposed pipeline to repair future breaks or leaks in the proposed pipeline is expected to be a rare occurrence. Retrenching would remove the vegetation from a local area of the proposed pipeline and disrupt animal activities near the construction site. Also, clearing a lane through regrown areas along the proposed route for vehicle access to the repair site would encourage increased access to the area by off-road vehicles. However, these effects would be confined to only a few miles at most, as very little of the proposed future expansion passes through timbered areas where the vegetation would need to be periodically removed to provide access.

Permanent facilities associated with the project (e.g., compressor stations and access roads) would remove a small amount of habitat from big game use for the life of the project. The loss of habitat would not be of much significance except in two instances in which it occurs in winter range. Compressor station number 6 (M.P. 413.0 -- Rye Valley, Oregon) would affect mule deer winter habitat and the southern California Gas Company compressor station (M.P. 988.9 -- Lone Pine, California) would affect Tule elk. A splinter group from the Lone Pine Tule elk herd has become established in the same area where the proposed compressor station would be located.

More habitat could be lost through avoidance of the area than actual physical displacement by the "fenced in" area. Noise as a detrimental impact would vary among the various wildlife species, some species being more sensitive than others. Table 3.1.5.7-1 lists compressor stations and indicates probable impacts.

Small Game and Fur-Bearing Mammals

In forested areas, following revegetation, foraging wildlife species such as rabbits should reflect slight increase in numbers along a half-mile strip on either side of the proposed route. This is due to the increased edge effect and prevention of forest regrowth by right-of-way maintenance. The population of predator species such as weasels, coyotes and bobcats also may be slightly improved because of the increased availability of prey species. Predators like coyotes and foxes probably would concentrate more along the proposed route than in the broken forests. In arid, nonforested areas there would be little change in preconstruction population levels.

Small Nongame Mammals

Operation and maintenance of the proposed pipeline would have little effect on small nongame mammals in arid areas. However, in forested areas, right-of-way maintenance would not allow tree regrowth. Therefore, populations of those species that are not forest dwellers such as most mice and rats would be maintained at greater numbers than before construction.

Upland Game Birds

Operations of the proposed pipeline would have a limited adverse impact on the upland game bird populations, except in the immediate region of the compressor and measurement stations. At these sites, human activity and noise could deter grouse and other birds from feeding or nesting.

Along the rest of the proposed route these birds would invade the cleared areas as they revegetate. In the cultivated areas, there would be little change in the populations of upland game birds such as pheasant and quail. When the first agricultural crop is planted after construction, the habitat along the proposed route would be similar to that of the surrounding area. In the uncultivated steppe, 1 to 5 years would be required to reestablish grasses and small shrubs along suitable sections. Up to 50 or more years would be required to revegetate the arid region. Repopulation would not depend on climax vegetation, but would begin as soon as most of the ground had regrown a vegetation cover of some type. In forested areas, revegetation by grasses, shrubs, and small trees would have a beneficial impact.

Table 3.1.5.7-1 Probable impact of compressor stations--physical presence, operation, and maintenance--on wildlife.

Compressor station number, milepost, and name	Wildlife impacted	Magnitude of impact
Number 1, M.P. 56.0 Sandpoint (Idaho)	Waterfowl-wet area adjacent to site near Pend Oreille Lake-impact mostly noise and activity	1
Number 2, M.P. 110.3 Spokane (Wash.)	No significant wildlife impact anticipated	0
Number 3, M.P. 184.3 LaCrosse (Wash.)	Waterfowl-wet area adjacent to site-Prairie falcon nesting along Union Flat Creek, 1 mi away-impact mostly noise	2
Number 4, M.P. 265.6 Stanfield (Ore.)	No significant wildlife impact anticipated	0
Number 5, M.P. 328.0 Meacham (Ore.)	No significant wildlife impact anticipated	0
Number 6, M.P. 413.0 Rye Valley (Ore.)	Muledeer winter range-physical displacement, noise, and activity	2
Number 7, M.P. 486.7 Antelope Flat (Ore.)	No significant wildlife impact anticipated	0
Number 8, M.P. 565.4 Blue Mountain (Ore.)	Muledeer winter range 1 mi away-impact mostly noise	1
Number 9, M.P. 648.2 Winnemucca (Nev.)	Site is within kit fox and chukar partridge habitat, wild horses-physical displacement, noise, and activity	2
Number 10, M.P. 735.9 Cain Mountain (Nev.)	No significant wildlife impact anticipated	0
Number 11, M.P. 797.2 Peterson (Nev.)	No significant wildlife impact anticipated	0
Number 12, M.P. 900.4 Fish Lake Valley (Nev.)	No significant wildlife impact anticipated	0
Number 13, M.P. 90.0 Lone Pine (Calif.)	Site less than 1 mi from Owens River and Owens Lake-Tule elk, prairie falcon, waterfowl-physical displacement, noise, and activity	3-4

Relative magnitude based on 0=no impact, 1=very minor impact, 2=light impact, 3=moderate impact, and 4=severe impact.

Waterfowl and Other Migratory Birds

Waterfowl using water areas along the proposed route would be little impacted by pipeline operation and maintenance. Waterfowl should become accustomed to the level and cycle of noise disturbance of the compressor stations and any impacts on them would be minimal.

Birds of Prey (Raptors)

The physical presence, noise, and associated human activities of compressor stations would repel many raptors, especially those species, such as eagles and falcons, that already are rare. However, maintenance of subclimax vegetation along the proposed route probably would be slightly beneficial in forested areas. Most raptors probably would concentrate more along the proposed route because of increased numbers and availability of prey species. An exception would be raptors, such as the spotted owl, that prefer deep forests.

Other Birds

Operation of the proposed pipeline would have a beneficial impact on song and other small birds. As described for upland game birds, the revegetation in forest areas probably would be slightly beneficial for many species. Like upland game birds, they would benefit from an increase in food, nest sites, and habitat diversity.

Construction through floodplain and riparian areas will rapidly revegetate to native vegetation. But the water table could be lowered in a small riparian area by digging a trench through it for the pipeline, therby losing the riparian vegetation type.

Reptiles and Amphibians

Operation of the proposed pipeline would not have a significant impact on reptiles and amphibians.

Terrestrial Invertebrates

There would be an increase in a number of species such as grasshoppers that inhabit open areas where the proposed pipeline traversed forests. There would be a simultaneous decrease in shade and moisture loving invertebrates like the millipede.

Aquatic Animals

Normal operation of the proposed pipeline would have limited direct effects on fish and other aquatic organisms. Reexcavation or washouts of the proposed pipeline and disturbance of floodplain areas along the proposed route could have severe adverse impacts on the affected ecosystems by causing turbidity and siltation that would destroy eggs and fry of fish and invertebrates.

The major indirect fishery impact from improved access would be potential degradation of wilderness fishing experiences in some remote streams. Some fish populations in headwaters that presently are relatively inaccessible would be exposed to increased fishing pressure. Additionally, improved human access to salmon and trout spawning areas could result in destruction of spawning fish and their progeny. However, since the proposed pipeline from Rye Valley to the Canadian border would follow an existing right-of-way that already provides increased access, except for a 32-mile section between Bonners Ferry and Addie, Idaho, where new construction would occur, the additional right-of-way and extra width should provide only slightly increased access. From Rye Valley to Cajon would all be new right-of-way construction.

Unique, Sensitive, and/or Threatened Populations

Any increase in human activity or noise level would tend to be detrimental to the precarious existence of those species encountered along the proposed pipeline. Species in this category that are most sensitive include bighorn sheep, lynx, northern and southern bald eagles, and osprey.

Endangered Species

Endangered species could be especially impacted since they lead a somewhat precarious existence at best. Any disruption of their habitat probably would be detrimental. General disruption, intrusion, increased human activity and access and compressor station noise would be highly detrimental to those species requiring seclusion. Endangered species are in delicate balance with the existing environment, and any change is apt to be detrimental.

Sixteen species of mammals, birds, reptiles, amphibians, and fish classified as endangered by Federal or State governments have been identified as either definitely or potentially occurring along the proposed route in Tables 2.1.5.7-3 and -4. The most sensitive species include the northern Rocky Mountain wolf, cougar (endangered in Washington), American peregrine falcon, and prairie falcon.

Species that would receive indirect adverse effects from human activities include, in addition to those listed above, pygmy rabbit, white-tailed jackrabbit, Ord kangaroo rat, Mohave ground squirrel, southern bald eagle, and spotted owl. The adverse effects would include such things as habitat destruction as by off-road vehicle disturbance during breeding or rearing seasons, killing of individual animals by man or dogs, disruption of breeding and nesting, and malfunction of the pipeline system that might cause contamination to critical habitats such as that of the black toad in Deep Springs Valley, which could potentially be wiped out.

Species that probably would not receive a significant impact from operation and maintenance activities include the spotted bat, Aleutian Canadian goose, Tule white-fronted goose, greater sandhill crane, Owens tui chub, and Owens pupfish.

Other Impacts

If the pipeline is terminated or abandoned, the removal of pipe and associated facilities would have impacts on fish and wildlife. They would be similar to those of construction. Some species would be destroyed or disturbed in the short term. In the long term, there would be a shift in species inhabiting the area due to revegetation. Whereas the open area benefits such animals as deer, mice, and rabbits, the wilderness habitat benefits such animals as lynx, wolverine, and some squirrels.

If only the aboveground facilities are removed, the right-of-way would revert to natural conditions sooner. Therefore, wilderness species would move in sooner than if the pipe were removed. Where the climax vegetation already occurs, termination and abandonment should have only minimal impacts on the fish and wildlife. A beneficial impact would occur in those areas where critical fish and wildlife habitats have been adversely impacted by increased public use. Those areas that would revert back to forest habitat would again exclude off-road vehicles. This beneficial impact would result whether or not the pipe is removed.

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3.1.5R.8 Ecological Considerations

The impacts of the construction and operation of the proposed pipeline have been discussed for each ecological component under climate, topography, geology, soils, water resources, vegetation, and wildlife.

To assess the total impact of construction and operation of the proposed pipeline, the combined impact of the seven ecological components listed above must be considered simultaneously, since these components act and interact among themselves. The complexity and dynamics of an ecosystem generally are in direct proportion to its size; the larger the ecosystem, the more complex are the interactions of its components among themselves and the more complex is their total reaction to their environment.

Construction and operation impacts on the many ecosystems traversed by the pipeline will be direct and indirect, as well as synergistic and cumulative. These impacts can develop a "multiplier" effect wherein, if one component of an ecosystem is adversely affected, such action will trigger adverse effects on one or more additional components. As an example, the removal of vegetation within the right-of-way limits prior to trenching, pipe laying, and backfilling would expose the topsoil to erosion. If the soil is eroded by water, the ecosystems above and below the disturbed area will be affected. Sediment will be deposited in live streams, disrupting the existing aquatic plant and animal life. Also, due to the loss of soil from the right-of-way area, it will become more difficult to reestablish suitable vegetative cover on the right-of-way.

It is not possible at this time to accurately assess and quantify the total ecological considerations of construction and operation of the proposed future expansion. Estimates and judgments can be made based solely on observations of the impacts resulting from the construction and operation of portions of the two existing pipelines that the proposed, fully-powered system would parallel: 280 miles of existing PGT pipeline (from Kingsgate, British Columbia, to Stanfield, Oregon) and 133 miles of existing Northwest Pipeline Ltd. pipeline (from Stanfield to Rye Valley, Oregon). No known research or monitoring studies have been made of the ecological changes resulting from construction and operation of these existing pipelines.

3.1.5R.9 Economic Factors

The economic and social impacts of construction and operation of the future extension of this pipeline so closely parallel those discussed for the Idaho-Canadian border to Rye Valley, Oregon, section of the line that most of that discussion will not be repeated here; however, tables presenting quantifiable differences are presented.

The future expansion of this pipeline would extend 735 miles across 12 counties in Oregon, Nevada, and California, from Rye Valley, Oregon, to Cajon, California. In addition to the extent of pipe required, eight compressor stations and four measurement stations would be constructed. Extension of the line also would require construction of additional facilities along the Canadian border to the Rye Valley portion of the line.

Employment

Table 3.1.5.9-9 (in Appendix) lists the proposed pipeline mileage and related facilities by county. Table 3.1.5.9-10 (in Appendix) summarizes the expected employment generated by the proposed pipeline.

Population

Permanent population effects are summarized in Table 3.1.5.9-11 (in Appendix).

Housing and Community Services

The pressure on housing, retail facilities, recreation, and other public services would be quite strong, although brief, along all portions of the line except the San Bernardino area because of the small size of communities in the area.

Income and Trade

A comparison of income and expenditures generated by construction of the pipeline and present incomes in counties and states through which the pipeline would be built is seen in Tables 3.1.5.9-12, -13, and -14 (in Appendix). Again, because of the small economic size of some of the counties involved, the impact of construction will be large. Another income related impact is the potential loss in agricultural production along the right-of-way itself. Data on cropland production are presented in Table 3.1.5.9-15 (in Appendix).

State and Local Tax Base

Table 3.1.5.9-16 (in Appendix) shows the assessed valuations of pipeline facilities as estimated by the applicant companies for the year 1980 and compares them with current assessed valuations and tax receipts.

Economic Trends and Development

Long-term economic trends of this area will not be altered by construction of this pipeline.

3.1.5R.10 Sociological Factors

Waste Generation

The waste generation along the future extension should be that typical of the more rural areas. The discussion of Section 3.1.4.10 is applicable here except that since very little of the route is timbered, the brush and timber removed will be considerably less.

3.1.5R.11 Land Use

Pipeline construction for the fully-powered system would disrupt present land uses on approximately 13,400 acres. Restricted land use will occur on approximately 700 acres from ancillary pipeline facilities. Approximately 1,200 acres of commercial timber will be lost from production. The restricted use will last for the life of the project.

Most of the counties through which the proposed pipeline will be constructed have regulations or ordinances pertaining to placement and construction of this type of facility. In some cases, hearings must be held before a conditional use permit or waiver will be granted.

Current Land Use

Agriculture

The impact of the proposed pipeline construction upon farmlands would depend upon the crops and farming system in the locale concerned.

All vegetation on the 100-foot wide right-of-way on pasture and rangeland in eastern Oregon, Nevada, and California will be cleared during construction of the proposed pipeline.

The only commercial timberlands traversed by the pipeline in the proposed future expansion are in the Inyo National Forest in California. During construction all of the 100-foot wide working area would be cleared on approximately 300 acres of forest land.

Pipeline construction activities will interfere with logging operations. Blocking of access will occur for short periods of time while the pipe is being laid.

Residential, Commercial, and Industrial

The proposed pipeline will affect industrial, commercial, and residential uses in Winnemucca, Nevada, and the California desert living areas. Intensive studies will be required to quantify specific impacts.

At Winnemucca the proposed pipeline right-of-way crosses within the city limits, closely parallels the railroad switchyards, and traverses a strip of commercial developments southwest of the city. A housing subdivision is expanding north and west of the proposed pipeline near M.P. 666 in Section 19, T. 26N, R. 38E.

Land uses involving human occupancy are sensitive to noise, dust, and heavy equipment activity that will occur during construction of the proposed project. Duration of the impact at a given point could be expected to last from 3 days to 1 month depending upon construction scheduling.

Transportation and Transmission Facilities

Interstate and heavily traveled State highways normally would be crossed by jacking, boring or tunneling methods.

With these methods, there usually is minimal damage to the road surface. However, there is a possibility that settlement of the road surface would occur, especially on those crossings where the proposed pipeline will be below the water table. Any settling of the road surface usually will be abrupt and will involve a short distance along the roadway. If a section of roadway were to collapse, totally or partially, during or after construction, the roadway would have to be closed to traffic. Accidents could result but are unpredictable.

During construction with one of the methods above, there will be some interference and possible delay of traffic on the roadway due to slow-moving vehicles traveling on or along the roadway and vehicles entering or leaving the roadway.

Less heavily traveled roads, both surfaced and unsurfaced, will be crossed as described above or by open trench methods. A higher probability for an accident would occur at a crossing site during construction of the proposed line. The level of inconvenience would be related to the added length of travel using the alternate route and the volume of traffic required to use the alternate route. In case of an emergency (accident, illness, fire, etc.), the added travel time of a detour might be critical to the success of the emergency effort.

Many roads in the area of construction will receive heavy use by vehicles transporting supplies, material, and equipment from supply points along the route. A great amount of traffic will be generated by the trucks transporting pipe from the pipe storage areas to various delivery points along the route.

This additional vehicle travel and the heavy loads on many vehicles would cause considerable damage to those roads with low standard surfaces and bases. Damaged roads would require increased maintenance, repair, and possible replacement of surfacing. As a result, traffic disruption and inconvenience would occur over an extended period until restoration of the road is complete.

In nearly all instances, the crossing of railroad tracks would be accomplished by the bore method. The analysis of impact is very nearly that outlined above for a major road crossing except that if a collapse would occur, it would probably happen when a train was crossing the construction site because of the concentrated load imposed by the train.

There will be other basic conflicts in land use. Five river crossings are proposed from Rye Valley, Oregon, to Cajon, California. Impacts that could occur on navigable river travel and floodplain use as a result of the proposed crossings come under the purview of the U.S. Army Corps of Engineers. Individual permits will be required for crossings of each river designated as navigable water, which will stipulate certain requirements including, but not limited to, the depth of burial below scour depth.

Land Use Planning, Policies, and Potential Trends

Planning for comprehensive land use is underway in most of the counties crossed by the proposed pipeline. Many governmental units are represented: Federal, State, County, and City. Planning and zoning steps have been taken in varying degrees.

Location of the proposed pipeline will affect future locations of other power transmission corridors, transportation systems, industry, or urban and suburban development. Also, the pipeline will complicate noise and safety considerations for future land uses.

The Natural Gas Pipeline Safety Act of 1968 (49 U.S.C. 1672) and subsequent regulations established safety design standards pertaining to the construction of natural gas pipelines near buildings used for human occupancy. These principles will be valid when considering such future construction adjacent to the proposed project, if installed. In such an instance, safety considerations will enter into decisions and investigation for construction for human occupancy.

Other Land Use

An Air Navigation Site administered by the Federal Aviation Administration in Section 13, T34S, R39E, Wellamette Meridian (near Rome, Malheur County, Oregon) could be adversely impacted by blasting, other forms of vibration or incompatible radio frequencies.

3.1.5R.12 Archeological, Historic, and Other Unique Values

Impacts

Archeological and historical sites are finite, nonrenewable resources; impacts on these resources may result in damage that is irreversible. Mitigating measures can lessen impact by avoiding or reducing resource damage. Since ground survey of the proposed pipeline route has not been done, there is a significant lack of pertinent culture resource data upon which to base impact assessments. Principal sources of damage from the pipeline will be from the clearing of the right-of-way and the actual trenching as well as any associated activity such as borrow pits and access roads, new knowledge of previously unknown sites resulting in vandalism, and better access to sites increasing visitor and vandalism impacts.

Destruction of Potential Sites

There are enough sites of known historical and archeological value along the proposed route to guarantee that others of various values will be encountered. The nature of pipeline construction is such that any cultural resource site within the path of the pipeline, its compressor stations, access roads, and associated facilities would be destroyed either completely or partially by the proposed pipeline. In addition, the increase in human activity and access, in areas where this has not been the case previously, would increase the danger of loss of these cultural values. For archeological sites, the destruction is by the action of ground disturbance by man or machine. For historical sites, the impact could be more indirect, leading to destruction of properties, particularly buildings, by shaking due to explosions, use by humans connected with construction, vandalism, and degradation by impact of pipeline structures. Archeological sites can be similarly impacted by nonconforming pipeline structures and plant species.

Effect on Known Sites

The effect on known sites is similar to the impact on potential sites. Adequate mitigation measures should lessen impact on known and potential cultural resources. On the whole the available data are insufficient to make any but the most crude estimates of potential impact, and these estimates indicate the probability of high impacts in certain areas.

Present and existing sites are of two types: those that have been previously tested and those not tested. Several previously tested sites are within the existing pipeline right-of-way in the Owens Valley area. These sites still have values remaining because they were not completely excavated and were done within the knowledge and techniques of the 1960s. Therefore, there are values remaining in all of the known sites along the proposed pipeline that could be adversely affected by construction activities.

Increased Accessibility to Potential Sites

Much of the area through which the proposed pipeline would pass has little or no access. Increased access would be detrimental because of related increases in vandalism. The result would be a serious loss in historical and archeological values.

Increase in Number of Sites Known

Some increase in knowledge would accrue from studies resulting from the proposed pipeline and from unknown sites discovered as a result of pipeline activities both on the surface and hidden beneath the ground.

Evaluation Summary

The following is an evaluation of the various segments of the pipeline:

Malheur River to Winnemucca (206 miles)

There are no known archeological sites located on the proposed pipeline. One historic site is on the pipeline (Table 3.1.5.12-2 No. 19), Paradise Wells, and the Emigrant Trail would be crossed (Table 3.1.5.12-2

No. 20). The latter probably is not identifiable near Winnemucca. Total impact for all cultural resources is unknown.

Winnemucca to Fish Lake Valley (221 miles)

Fremont's Route (Table 3.1.5.12-2 No. 24), the Overland Stage-Pony Express Road (Nos. 21 and 22) and one cemetery would be crossed by the proposed pipeline. The Overland Stage-Pony Express Road is identifiable and has structures associated with it that are off the pipeline. The cemetery is identified on a USGS map and probably has only nonhistoric interest to local people. One cave with pictographs near Spring Creek (Table 3.1.5.12-1 No. 38) is on the pipeline route and the potential for uncovering other sites exists.

Fish Lake Valley to Little Lake (150 miles)

This is a high impact area because possible impacts are known and potential archeological sites are high. Several historic sites would be impacted. The route would cross a Toll Road in Soldier Canyon (Table 3.1.5.12-2 No. 32), the Carson and Colorado Railroad bed (No. 31), and would go through the site of Chrysopolis (No. 33), a mining town and another immigrant-associated site. The potential for other impacted prehistoric and historic sites in this region, one heavily inhabited for the last 10,000 years, is considerable.

Little Lake to Cajon (121 miles)

Most of the impact would occur in the Cajon Pass area (Table 3.1.5.12-2 Nos. 38, 39 and 40) for both archeological and historic sites.

3.1.5R.13 Recreational and Esthetic Resources

Recreation Facilities, Areas and Resources

Although scenic resources are an integral part of outdoor recreation, esthetic considerations have been, for the most part, separated from the following discussion and are treated more fully under esthetics in this section.

Comments regarding the environmental impacts of the proposed project on specific recreation facilities, areas, and resources are discussed. First, however, a general statement concerning the proposed project's overall impact on the recreation resource is provided.

Implementation of the proposed project would cause temporary, periodic increases of noise, fumes, dust, vehicular traffic, and human presence during the construction period. These unavoidable adverse impacts, though a nuisance, would not create conditions that would severely limit opportunities to participate in outdoor recreation activities. Likewise, construction and operation of the proposed project would not be expected to severely limit the use, or have a significant impact upon, developed recreation areas and facilities. However, once constructed, project roads and rights-of-way would be used by the general public to gain access into areas that previously were inaccessible or relatively undisturbed. In some areas, the impact of new access would prove beneficial in that additional resources would be made available for public use and enjoyment. Extensive recreational uses that usually depend on motorized travel to reach an area of interest are likely to benefit most from improved or new access. In this category are fishing, hunting, hiking, rock collecting, off-road vehicle driving and snowmobiling. This benefit, however, must be qualified.

If intensive use or development occurs in the recreationist's area of interest and adversely affects those resources available, the area's attraction is certainly likely to decrease. Given access and time, the public and its pressures may destroy the very things they sought in the first place. Project access roads and rights-of-way would directly or indirectly create significant impacts on the long-term productivity of areas along the pipeline route. From Rye Valley to Cajon, uncontrolled access could prove particularly deleterious tc portions of the Owyhee Plateau in Oregon; the Monte Cristo Range, Silver Peak Range and the Piper Peak area in Nevada; the Inyo Mountains, Lava Mountains and Golden Valley in California; and the creosote and salt desert shrub areas in Nevada and California.

The proposed project, if implemented, would have far greater impacts on some recreation areas and resources than it would on others. The following comments are directed at areas of particular concern. Approximate locations of these areas are shown, by number, on Figure 3.1.5.13-1.

If the pipeline route avoids heavily forested areas, the impact of the right-of-way on esthetics in the Morgan Lake area would be considered minimal.

Malheur River (Oregon)

A publication titled "Oregon Areas of Environmental Concern" was prepared for the State of Oregon Executive Department in April 1973. One of the critical priority areas mentioned in this document is the identification and protection of outstanding scenic areas and waterways. A segment of the Malheur River is identified as needing "State study" for possible designation as part of Oregon's Scenic Waterways System. The proposed pipeline route crosses the identified segment of the Malheur River near Harper, approximately 15 miles southwest of Vale.

Disturbance of these riverbanks to accommodate necessary trench evacuation would have some impact on their natural character. Such disturbances would be a factor if and when these rivers are studied.

During construction, and especially during trenching operations, siltation and temporary turbidity would somewhat reduce esthetic and recreational experiences of hikers, boaters, fishermen, and swimmers.

Owyhee River (Oregon)

The proposed pipeline route passes within 2 miles of the west bank of the Owyhee River. Certain segments of the Owyhee River have been designated as Scenic Waterways under Oregon's Scenic Waterways Act (ORS 390.805 to 390.925) and are described as follows:

> The segment of the South Fork Owyhee River in Malheur County from the Oregon-Idaho border downstream approximately 25 miles to Three Forks where the main stem of the Owyhee River is formed, and the segment of the main stem Owyhee River from Crooked Creek (six miles below Rome) downstream a distance of approximately 45 miles to the mouth of Birch Creek.

The entire Owyhee River Scenic Waterway, in its two segments, is classified as a Natural River Area.

In order to preserve the river and related adjacent lands in an essentially primitive condition, no new structures or improvements which are visible from the river, other than those erected or made in connection with the existing agricultural uses, or those needed for public outdoor recreation or for resource protection will be permitted. Commercial public service facilities, including resorts and motels, lodges and trailer parks, and additional dwellings which are visible from the river will not be permitted.

On January 3, 1975, President Ford signed into law an amendment to Section 5(a), P.I. 90-542, designating for potential addition to the National Wild and Scenic Rivers System, the South Fork Owyhee River, Oregon, and the main stem Owyhee River from the Oregon-Idaho border downstream to Owyhee Reservoir.

The above amendment was set forth in Senate Bill 3032, which also provides that rivers designated for potential addition to the National Wild and Scenic Rivers System shall be studied, with reports submitted to Congress not later than October 2, 1979.

Construction, operation, and maintenance of the pipeline and appurtenant project works could have possible adverse impacts on the river and surrounding vicinity.

Historic Trails (Nevada)

The Ogden Trapper Trails of 1828 and 1829, Bidwell-Bartleson Trail of 1841, Fremont-Talbot Trail of 1845, Donner Trail of 1846, Goose Creek-Humboldt River Trail, and Emigrant Trail all passed through the Winnemucca area. A second Fremont Trail of 1845 passed through central Nevada, as did the Pony Express Overland Mail Route. These early trail routes provide outstanding opportunities for historical and educational interpretation. The proposed pipeline crosses all of these historic trails as it traverses north and south through Nevada. These crossings may reduce future opportunities for historical interpretation, particularly if pipeline access roads and rights-of-way allow uncontrolled public travel on the historic trail beds.

Primitive or Near Primitive Areas

Such areas would include: Blue Mountains and Owyhee Plateau (Oregon); Monte Cristo Range, Silver Peak Range, and Piper Peak Area (Nevada); Inyo Mountains, Lava Mountains, and Golden Valley (California); and Creosote Shrub and Salt Desert Shrub Areas (Nevada and California).

Pipeline access roads and right-of-way would provide off-road vehicle access into previously inaccessible or relatively undisturbed portions of these particular geographic regions. All these regions exhibit primitive or near primitive qualities. Uncontrolled public use of such improved or new access would have far-reaching ramifications on their existing environment. Coupled with the adverse impacts on esthetic resources would be the degradation of vegetative communities, loss of wildlife habitat, and subsequent decline of both native plant and animal populations. The introduction of noise, fumes, dust, vehicular traffic, and human presence in these remote and relatively undisturbed areas would certainly lower the scientific, educational, and recreational values now available.

U.S. Highway 395 (California)

U.S. Highway 395 in California, traversing north-south along the eastern base of the Sierra Nevada Range and through the Mojave Desert, has been designated a State Scenic Highway. The proposed pipeline route generally parallels this segment of U.S. Highway 395 for approximately 200 miles. Pipeline access roads and right-of-way would have adverse impacts on the scenic qualities of these two major and heavily traveled highways, particularly U.S. Highway 395 in California.

Esthetics

An adverse visual impact on esthetics is defined as any visible alteration of the existing environment. Significant impact producing actions during site preparation and construction would include clearing, ditching, spoil disposal, backfilling, creation of temporary roads and fences, operation of internal combustion engines and vehicles, operation of noise and vibration-producing equipment, and increased human activity.

Impacts resulting from these activities would be:

- The alteration of topography,
- The alteration of existing vegetation forms to invader types,
- The introduction of open areas where there had been vegetation associations,
- The presence of fences around the compressor stations, measurement stations, pipeline valves, and communication towers,
- A temporary increase in stream turbidity at river crossings,
- Changes in existing wildlife habitats and behavior patterns, and
- A temporary increase in noise, fumes, and dust levels.

Many of these impacts would be of a temporary nature and nonexistent after the construction period. Other impacts, however, would be apparent for the life of the pipeline facilities and longer.

The relative significance of an impact on esthetics depends upon two conditions. First, and most important, is the inherent quality of the landscape. Second is the number of viewers and their interest in and sensitivity toward the landscape being viewed. The method of classifying landscapes is explained in Section 2.1.5E.13.

Visual impacts would be most apparent in forested areas and open range or desert country. Approximately 300 acres of commercial forest land would be disturbed by the pipeline right-of-way in California's Inyo National Forest. In forested areas, the pipeline right-of-way would be cleared of all trees, tree stumps, and understory vegetation. Although shrubs and grasses would be allowed to revegetate cleared areas, trees and taller woody plants would continually be removed for the life of the project. Height of surrounding trees would, in some cases, provide a "screen" or "buffer" for the cleared right-of-way unless viewers were able to see directly down the cleared area or were observing the landscape from a higher elevation. Since forested areas usually occur in mountainous regions where diversity of topography, vegetation, waterforms, and color often have inherent scenic or esthetic qualities, adverse impacts are often more pronounced because of the total landscape involved. In open range or desert country, natural vegetation is normally insufficient in height to "screen" cleared rights-of-way, thus, cleared areas are visible for long distances. Adverse impacts in open range or desert country could be apparent for a relatively long period due to the slow rate of revegetation in arid regions.

Visual impacts on agricultural lands, although very apparent during construction, would tend to abate as lands are brought back into production. Normally, most visible evidence of construction would be gone within a few years, but a viewer's discerning eye might spot slight differences in soil color and/or crop vigor.

Table 3.1.5.13-1 (in Appendix) shows the variety/sensitivity classifications, in total miles, as determined for each landscape using the methodology previously described in Section 2.1.5E.13. Also refer to section 2.1.4.13 for definitions.

The pipeline right-of-way and appurtenant project structures and facilities would have varying degrees of impact on the existing environment and visual resources. The overall impact on a particular landscape may be significant, moderate, or slight depending upon its relative variety and sensitivity. Generally, most people will consider a landscape classified A as more scenic than one classified C. Also, more people will view a landscape classified 1 than a landscape classified 3. Consequently, an impact will have more significance on a landscape classified A1 than on a landscape classified C3.

The cumulative effect of visual impacts is best illustrated by grouping the landscapes under three general impact categories: significant, moderate and slight. Each category is set forth below.

Significant Impacts (196 miles)
Deep Springs Valley (18 miles of A2)
Owens and Rose Valleys (90 miles of A1)
Yucca Forest Ranch to Cajon (10 miles of A1)

Moderate Impacts (568 miles)
Rye Valley to Highway 26 (10 miles of B3)
Highway 26 (1 mile of B2)
Highway 26 to the Malheur River (35 miles of B3)
Malheur River (1 mile of B2)
Blue Mountain to Winnemucca (100 miles of B2)
Winnemucca to Highway 50 (124 miles of B3)
Highway 50 (1 mile of B2)
Highway 50 to Highway 95 (79 miles of B3)
Highway 6 to California-Nevada border (33 miles of B3)
White Mountains (3 miles of B2)
Indian Wells Valley (40 miles of B1)
Lava Mountains to Fremont Peak (13 miles of B2 and B3)

Slight Impacts (355 miles)
Malheur River to Burns Junction (78 miles of C3)
Burns Junction to Blue Mountains (32 miles of C2)
Fish Lake Valley (10 miles of C2)
Fremont Peak to Yucca Forest Ranch (58 miles of C1 and C3)

Within many of these landscapes, regardless of variety/sensitivity classification, there are specific areas of concern where impacts on esthetics would be acute. Rivers, forested areas, and long stretches of open range or desert are particularly vulnerable to adverse impacts. Approximate locations of these areas are shown, by number, on Figure 3.1.5.13-1.

The proposed pipeline would cross several rivers (Section 1.1.5.2) at the approximate milepost indicated. River crossings will require an open construction area measuring approximately 200 feet along the river and 200 feet along the proposed pipeline right-of-way on both banks. This area is needed for maneuvering equipment and stockpiling excavated material.

Soil erosion caused by construction of the pipeline would add significantly to the turbidity of the rivers at each crossing. This would result in temporary visual impacts and generally would be a nuisance to boaters, fishermen, swimmers, and others utilizing the rivers for recreation purposes.

The pipeline would traverse several hundred miles of open range and/or desert, most of which would be readily visible from roads and highways in southeastern Oregon, Nevada, and California. Cleared rights-of-way would be visible for long distances, and visual impacts would occur and be most apparent on the following California landscapes: Deep Springs Valley, Owens and Rose Valleys, Indian Wells Valley (portions), and Yucca Forest Ranch to Cajon.

3.1.5R.14 Air Quality

Increased Air Pollutants

Gaseous Air Pollutants from Permanent Installations

The compressor stations along the proposed route are the only permanent installations that will emit air pollutants continuously. There are 10 new compressor stations to be constructed, which have been listed in Section 1.1.4.3. The largest is station 10, with 13,922 horsepower.

Each of these compressor stations will emit about 0.15 to 0.2 ton per day of NO_x and 125 to 170 lb per day of CO, depending on its horsepower, but practically no other air pollutants will be emitted.

These emission estimates are based on emission factors that have been published in recent reports sponsored by the U.S. Environmental Protection Agency (Hare and Springer, 1974) and the American Gas Association (Springer and Dietzmann, 1975), which indicated that NO_x is emitted from gas turbines at a maximum rate of about 0.50 lb NO_x per million Btu, and CO at a rate of about 0.20 lb CO per million Btu.

The highest NO_x emission rate measured for any gas turbine corresponds to a concentration of 71 ppm in the exhaust gas (Hare and Springer, 1974). When this is corrected to 15 percent O_2 in accordance with standards proposed by EPA, the highest equivalent NO_x emission rate is 130 ppm.

Air pollutants other than NO_x will not be emitted by the turbines in quantities that will cause any measurable impact on the environment. Natural gas occasionally will be emitted from leaks, venting and maintenance operations, but these will contribute no impact because the quantities are relatively small and the gas is much less dense than air.

The behavior of NO_x emissions in the atmosphere can be estimated from the dispersion correlations complied by EPA (Turner, 1970). From formula 3.3 of this document (Ecology and Environment, 1974), and with dispersion coefficients given by

$$\sigma y = A \bullet xB$$

$$\sigma z = A' \bullet xB'$$

then the downwind distance at which the maximum pollutant level will be experienced is given by

$$x_{max} = \left[\frac{H^2 \cdot B'}{(A')^2 (B+B')} \right]^{½B'}$$

where H is the effective height of the emitting source (in meters). It is appropriate to consider a "worst case" situation, assuming that winter conditions apply, and that the most stable atmospheric conditions prevail, with an effective stack height of H = 20 m. For this case,

$$x_{max} = 1,560 \text{ m}$$

$$(C_{NO_x})_{max} = 8.5 \text{ μg/m}^3$$

where

x_{max} = downwind distance at which maximum pollutant level is experienced, at ground level.

$(C_{NO_x})_{max}$ = ground level concentration of NO_x at distance x_{max}.

This estimate is very sensitive to the value of the effective emission height, H. For example, if the effective emission height could be increased by 50 percent, by means of (e.g.) imparting sufficient velocity to the exhaust gas, then this estimated concentration is reduced to about one-quarter of the value given above.

On an annual average basis, the concentration of NO_x contributed to the environment by the planned compressor stations will be on the order of 1 μg/m³ at each compressor station location. This estimate is based on an assumption of an effective emission release height of H = 20 m.

Permanent Contributions of Dust

Several portions of the pipeline route are susceptible to creation of particulate air pollution as a result of wind erosion of disturbed soil, including practically the entire length of the Nevada portion of the route (about 300 miles) and a portion in the Columbia River basin. Such sources of pollutant approximate a classical "line source" when the wind blows across it at right angles. For the case of worst atmospheric stability (i.e., highest atmospheric mixing rate), the wind erosion from freshly excavated sites along the route may produce atmospheric dust concentrations that are relatively high near the source, as estimated by formula 5.20 of Turner, 1970. The maximum dust concentrations may approach 200 μg/m³, but they will typically fall rapidly to low levels (ca 10 μg/m³) within 1 mile (PEDCo, 1968).

Air Pollution from Combustion of Fuels by Vehicles

During construction operations along the proposed route, a total consumption of about 12 million gallons of gasoline and diesel fuel is anticipated. Combustion of this fuel is capable of generating about 4.5 million pounds of nitrogen oxides NO_x and about the same amount of CO. The generation of sulfur dioxide will be about 30,000 lb, and of hydrocarbons about 20,000 lb. These figures are based on reported emission factors for construction vehicles (Hare and Springer, 1973).

If several construction vehicles are concentrated at a single point for an extended period, under the most stable atmospheric conditions, there is a possibility that NO_x concentrations may approach the limits imposed by the National Ambient Air Quality Standards. However, this possibility is remote. In addition, there is no reasonable possibility that any air pollutants other than NO_x will approach objectionable levels.

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3.1.5R.15 Environmental Noise

Construction Phase

The construction phase would produce indirect and direct noise impacts. The indirect noise impact would be due to the road traffic generated by the project, and the direct impact would be the construction site noise.

Road Traffic

The primary cause of noise impact due to road traffic would be the heavy diesel trucks hauling pipe. The majority of haul roads would be rural dirt roads where, even though the population density is low, the ambient noise levels also are very low, so that audibility of the trucks would extend for long distances.

It is not possible to make a detailed estimate of the total noise exposure of the local populace to the hauling truck traffic, but several communities have been found through which these hauling trucks could pass en route to the construction site. They are shown in Table 3.1.5.15-5. Despite the rural nature of the route there is still a significant number of people (18,812) who would be exposed to the noise of these diesel trucks. There would be several trips per hour on a normal workday during the period pipe is being hauled through a community. It is likely that some annoyance would arise which would be related to the combination of noise, dust and other factors. Since there are no criteria for this type of annoyance, no specific evaluation of the impact can be made.

Ground vibration caused by construction equipment and hauling trucks is estimated to be sufficiently small at any vibration sensitive buildings that no adverse impact can be identified. See Section 3.1.4.2 for the effects of blasting and vibration on creating rockfalls and landslides.

Right-of-Way Construction

Construction of the pipeline along the right-of-way would require large numbers of heavy equipment that would be operated as groups doing various phases of the construction. The energy mean of L_{eq} values measured at 24 sites during excavation (corrected to a distance of 50 feet) is 84 dB (New York State Department of Environmental Conservation, 1974). Using this value as representative of the day-night sound level (L_{dn}) at 50 feet (since no nighttime construction is anticipated), it is predicted that a total of 494 people reside in an area that will be impacted by L_{dn} in excess of the Environmental Protection Agency's goal (55 dB) for protection of human welfare (EPA, 1973). It is also projected that a total of 198 people will be highly annoyed by the construction noise and 15 households will complain. Table 3.1.5.15-6 provides the impact of pipeline construction noise on people as a function of the states through which the future expansion of the pipeline will pass.

Blasting and Vibration

Drilling and blasting would be required where trenching through rock cannot be accomplished by ripping and removing the loose material with a backhoe. Safe limits of ground motion from blasting for structures, building components and sensitive equipment and the possibility of damage at ground motion levels lower than those generally accepted as safe (due to soil compaction and settlement) are discussed in Eastport to Rye Valley, Section 3.1.5E.15.

Blasting will be required for two 3-mile stretches in the Owyhee uplands and the Owens Valley. Unspecified distances of blasting will be necessary in the Clan Alpine Mountains, the New Pass Range and the Monte Cristo Range. No buildings along the route appear to be close enough to be damaged by blasting. Safety aspects of blasting are discussed in Section 4.1.4.4.

Table 3.1.5.15-5 Communities Potentially Noise Impacted by Pipe-Hauling Trucks -- Future Expansion

State	Communities (population)	Estimated Population Exposed
Oregon	Brogan (100)	100
Nevada	Dyer (unk) Mina (300) Luning (unk) Gabbs (unk) Ione (unk) Fallon (unk) Salt Wells (unk) Frenchman (unk) Eastgate (unk) Willemucca (3,587) Oravada (30) McDermit (200)	4,277
California	Victorville (10,845) Kramer Junction (unk) Searles (unk) Inyokem (800) Lone Pine (1,800) Independence (950)	14,435
Total		18,812

Table 3.1.5.15-6 Impact of Pipeline Construction Noise on People - Future Expansion

State	Estimated Number of People Residing Within L_{dn} >55 dB*	Estimated Number of People who will be Highly Annoyed	Estimated Number of Complaints
Oregon	5	4	0
Nevada	257	116	8
California	232	78	7
Total	494	198	15

* A day-night sound level (L_{dn}) of 55 dB has been identified by the U.S. EPA as the maximum level permissible for protection of human welfare.

The correction factors for normalizing L_{dn} cancel out.

Compressor Station Construction

Construction of the compressor stations would entail only small amounts of grading; most of the activity would be hauling of materials and construction of the buildings. Those activities would be of short duration and spread out over several months, starting with clearing the site to installing the compressors. Due to the low population density, very few complaints, if any, are expected.

Operation Phase

Compressor Station

The major potential noise sources of significance during the operational phase of the project would be the compressor stations, which are long-term continuous and fixed noise sources. Thirteen new compressor stations will be constructed as part of the future expansion of the Los Angeles pipeline.

Table 3.1.5.15-7 indicates the predicted distances from the stations at which people will be impacted by normalized day-night sound levels (Ldn) in excess of the levels recommended by the EPA for protection of human welfare. No data were available to enable calculation of the number of people residing within these distances of the stations.

In Oregon, State law requires that such stations make a fifty percentile level of 50 dB, or less. The stations in Oregon (station numbers 4 through 8) must comply with this level.

Blowdown

Periodic venting of high-pressure gas from the compressor stations or along the line would cause temporary but severe increases in sound level (refer to Section 3.1.5E.15, Table 3.1.5.15-4). These blowdowns would occur because of an emergency or as a part of maintenance checks or repairs.

It is estimated that the maximum noise would occur over most of the period, which is about 5 minutes for a station blowdown and 45 minutes for a pipeline blowdown. Station blowdowns are expected to occur about once per year.

It is predicted that such a blowdown would be audible for 15 miles and would be near 70 dB at 3 miles. Due to its relatively short duration and infrequent occurrence, it would cause annoyance but may not result in complaints to authorities.

References

New York State Department of Environmental Conservation, 1974, "Construction Noise Survey." April.

U.S. Environmental Protection Agency, 1973, "Public Health and Welfare Criteria for Noise." Document 550/9-73-002. July.

Table 3.1.5.15-7 Impact of Gas Compressor Station Noise on People - Future Expansion

Compressor Station Number	hp	Distance (ft) at which Residences will be Impacted by a Normalized $L_{dn} > 55$ dB*
1	15,725	5,400
2	15,810	5,400
3	15,980	5,400
4	16,405	5,400
5	16,868	5,700
6	14,960	5,400
7	14,450	5,375
8	14,280	5,350
9	14,110	5,350
10	14,875	5,400
11	13,430	5,300
12	14,195	5,400
13	14,875	5,400

* A day-night sound level (L_{dn}) of 55 dB has been identified by the U.S. EPA as the maximum level permissible for protection of human welfare. L_{dn} has been normalized to correct for quiet, rural communities (10 dB) and for no other prior experience with the noise (5 dB) at these station locations.

3.1.5R.16 Hazards from Pipe Failure

The possibility of loss and damage due to pipe rupture is discussed in the Overview volume.

4 MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

4.1 ARCTIC GAS PIPELINE PROJECT

4.1.5 Los Angeles Pipeline

The applicant has indicated he will execute certain mitigating measures through timely coordination with required regulatory agencies and bodies, landowners and various resource managers.

Proper assessment of the proposals for mitigation requires the reader to be acutely aware of these facts:

1) There is no on-ground location of the line, hence a lack of site-specific information.

2) The applicant plans to complete specific line location and engineering design after receipt of a Certificate of Public Convenience and Necessity from the Federal Power Commission.

3) FPC will not grant a Certificate of Public Convenience and Necessity pursuant to Section 7(c) of the Natural Gas Act until all required permits or other authorizations have been received.

4) Federal, State and other regulatory and public land management agencies will not grant their respective permits and easements until they are assured that mitigatory measures will be incorporated in final contract specifications.

5) Private capital will not be available to finance the expensive detailed planning and design until management is assured (by issuance of the basic FPC Certificate) the project is approved.

Item 4 above is a critical element in the completing of the other items.

This section is organized to identify an impact, state the applicants' proposed mitigating measures, if any, analyze the applicants' proposal, reach a conclusion, and if applicable, list additional mitigating measures.

An EIS does not establish stipulations. Stipulations are made a part of permits and contracts. Mitigating measures described herein provide a base which flags the more significant mitigative measures that should eventually evolve into specific stipulations.

The various governmental bodies can stipulate permits or other granting documents; the pipeline company can stipulate their contract requirements as to specific performance of their contractors. These procedures in themselves then become a potent mitigative force.

4.1.5E Eastport to Rye Valley

The initial phase, Eastport to Rye Valley lies within three States, is 413 miles long, requiring 391 miles of new pipeline laying, falling 94 percent on privately owned lands, involving hundreds of private landowners, dozens of State, county and municipal bodies, utility companies, and Federal agencies.

The Eastport-Rye Valley proposal has eliminated the following adverse impacts identified in the draft EIS:

Six crossings of the Moyie River in northern Idaho downstream from M.P. 2.25 (two crossings remain between M.P. 0.0 and 2.25).

Crossing the Touchet River in southeast Washington, all crossings of the Powder and Malheur Rivers in Oregon.

Approximately 78 miles of "new" potential access from the Snake River Crossing in southeast Washington due south to Meacham, Oregon.

The previous need for two new compressor stations and associated noise and air quality controls, equipment operation, human activity, etc.

Potential impacts to segments of the Oregon Trail from Ladd Canyon (Sec. 31, T. 4S, R. 39E.) to 2 miles south of the Powder River (Sec. 24, T. 8S, R. 39E.) in Baker County, Oregon--a distance of approximately 23 miles.

4.1.5E.1 Climate

Impact of the Proposed Pipeline on Climate

1) Negligible impact is identified

2) Proposed by Applicant - none

3) Analysis - none

4) Conclusion - negligible impact

5) Additional Measures - none

Impact of Climate on the Proposed Pipeline

Climatic impacts can have a very significant impact on design, construction, and maintenance activities.

Proposed by Applicant

Proposed facilities will be designed, constructed, and operated in accordance with the requirements of Part 192, Title 49, Code of Federal Regulations, "Federal Rules and Regulations for Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards." The pipeline will be designed and constructed according to the 1973 "ASME Guide for Gas Transmission and Distribution Piping Systems," published by the American Society of Mechanical Engineers.

Interstate Transmission Associates (Arctic) [ITA(A)] and their Contractors will comply with the requirements of "Docket Number R-360, Pipeline Construction Guidelines, Order Number 407 as Section 2.69 adds to Part 2, General Policy and Interpretation, Subchapter A, Chapter 1 of Title 18 of the Code of Federal Regulations" and with all Occupational Safety and Health Act (OSHA) regulations relevant to pipeline construction and operation. Also, the pipeline will receive full corrosion protection and periodic ground and aerial surveillance during its period of operation.

Analysis

Timing of pipeline activities and resultant impacts are greatly influenced by climate. Working in midwinter, during the spring runoff at water crossings, on soil which is beginning to thaw, or during violent thunderstorms can initiate adverse impacts to the environment and pose a greater or lesser threat to life and property.

Conclusion

More specific information relating to scheduling of construction events is needed to provide correlation with normally occurring climatic events such as the seasons and associated weather.

Additional Measures

The applicant should submit a construction plan to the Secretary of the Interior detailing the entire operation; the Secretary of the Interior should review and stipulate any mitigating measures associated with climate not adequately covered. A specified time for each (the applicant and Interior) to respond should be established and followed, to allow for realistic construction scheduling.

4.1.5E.2 Topography

Impacts to topography would normally be minimal as a result of the pipeline. Potential of landslides and erosion exists.

Proposed by Applicant

Landslides and erosion caused by sidehill cuts on steep slopes are the principal potential causes of impact on the topography. Risk of incurring these effects will be reduced by alignments to avoid landslide and erosion susceptible sites, by rapid restoration of disturbed areas, and by controlling surface water runoff during the trenching period.

The surface of the terrain will be restored to its approximate original contour with two exceptions. The backfill over the trench will be rounded to a 6- to 12-inch crown to compensate for subsidence that may occur with time and seasonal freezing and thawing. Erosion of steep slopes will be minimized by using a series of terraces to direct runoff at an angle to slopes rather than directly downslope, thereby reducing the water velocity and potential erosion.

Analysis

Landslides occurring on private lands could affect adjacent Federal lands. Federal agencies should be apprised of all areas susceptible to mass land movement over the entire proposed route.

All right-of-way restoration action on Federal lands should be accomplished under the direction and approval of the agencies involved.

Conclusion

The mitigation is adequate provided the land managing agency is advised of potential landslide hazards avoided during on-ground alignment.

Additional Measures

None.

4.1.5E.3 Geology

Geologic features such as deep canyons, earthquakes, faults, wide rivers, mountain ranges, unstable rock masses, etc., create specific engineering and design challenges. The impact cannot be fully assessed until site specific details are known.

Proposed by Applicant

None.

Analysis

The Applicants have an existing buried pipeline (Northwest Pipeline Co.) in similar terrain, and will follow the PGT existing route from Stanfield to Bonners Ferry.

Conclusion

No new problems should be encountered from Rye Valley to Bonners Ferry. Industry has demonstrated the capability to construct effective pipelines through many geologic environments. However, special care should be exercised in certain locations.

Additional Measures

The mitigation of geologic impacts for the Eastport to Rye Valley route are generally similar to those described in the section 4.1.5R.4, Rye Valley to Cajon, under Topography and Geology.

4.1.5E.4 Soils

Proposed by Applicant

"Revegetation methods might include such general measures as soil reparations . . ."

"In soil reparation, the topsoil would be removed and preserved during grading and trenching operations. Following backfill, a seedbed would be provided by redistributing the stored topsoil over the right-of-way."

The applicant also stated in response to question number 30, FPC-DOI Task Force questions, November 22, 1974 that:

"Double ditching will be performed where prescribed in order to preserve topsoil. This normally occurs in areas which are under cultivation and have rich topsoil with less fertile soil located one foot or deeper below existing grade. Stipulations of double ditching are usually a requirement of property owners and contained in the right-of-way easements. Any such stipulations will be strictly adhered to."

The applicant has expressed adoption of the Federal Power Commission's Guidelines for pipeline restoration (CFR Title 18, Section 2.69).

Analysis

Storage and replacement of topsoil is considered the most vital single factor in restoring vegetation and reducing soil erosion, water and air pollution and losses of productive potential. Limiting the application of this practice to areas where landowners specifically require it does not assure minimizing the adverse effects of soil disturbance associated with pipeline construction.

Additional Measures

To minimize impact on soils, the best available measure must be applied to each potential impact problem. These measures must be made part of a detailed, site specific construction and/or rehabilitation plan.

Double trenching should be utilized to preserve topsoil unless it can be demonstrated that spreading subsoil on the surface would have little impact on productivity of the corridor.

Chiseling or subsoiling can be effective in alleviating soil compaction and should be used. These measures, however, will not correct conditions related to surface disposal of clay subsoil excavated from the trench.

Specific soil erosion control measures should be implemented to control soil erosion during and after construction of the proposed pipeline.

The applicant does not state any specific measures to mitigate soil compaction caused by construction operations.

If the applicant, as stated in section 4.1.5E.6, utilizes natural plant succession to re-establish a vegetative cover, the soil will be susceptible to severe erosion losses for a long period of time.

Although the applicant has adopted the FPC Guidelines for pipeline restoration, the document is written only as a guide and implementation is not mandatory. Therefore these guidelines must not be the sole basis for construction and restoration practices.

(See Section 3.1.5E.4 for description of soil impacts.)

4.1.5E.5 Water Resources

Temporary adverse impact through an increase in turbidity is the major concern to water quality.

A danger also exists of polluting the water from petroleum products used in machines working at water crossings, or increasing coliform count from human waste.

Proposed by Applicant

The most significant impact on water quality will be the temporary increase in suspended solids and turbidity at stream and river crossings. Because increased sediment load is unavoidable and occurs naturally during periods of high runoff, no monitoring of water quality during the construction or operational phases is planned. In conformance with applicable permits, several measures can be employed during construction to minimize sediment suspension.

These include use of low diversion structures to dry cut crossings of shallow streams, placement or subaqueous trench spoil in suitable streambank storage areas, installation of straw filtration barriers along streambanks, construction of siltation barriers to reduce velocity of surface runoff on steep grades, construction of temporary bridges at sites of repeated shallow stream crossings by construction machinery, and post-construction stabilization of streambanks. Where crossings occur upstream of reservoirs or water supply inlets, users of this water will be notified of the approaching construction.

Water to be used for hydrostatic testing of the pipeline will be withdrawn from sources selected in order to avoid excessive drawdown or flow interruption. The test water will be discharged at points determined by the acceptability of receiving waters in accordance with applicable permits. Any discharge water with observed excessive suspended solids, iron oxide flakes, or color will be clarified in settling basins constructed at the point of discharge. All discharge rates will be controlled to preclude erosion of the banks or beds of receiving waters. Wherever possible, test water will be reused.

Chemical toilets will be provided at appropriate locations for use during all site preparation and construction activities. During the operational period, approved sanitary waste disposal facilities will be provided at the compressor stations.

Analysis

The effects of construction at perennial stream crossings cannot be determined without water quality testing.

Conclusion

The mitigation can be judged adequate only on a site-specific basis. The major probable adverse impact--increased sedimentation--cannot be gauged without sampling the water before, during and after construction.

Additional Measures

Water should be sampled for daily sediment load and coliform count, during construction and at stream and river crossings.

4.1.5E.6 Vegetation

Proposed by Applicant

The applicant's proposed mitigation measures for vegetation impacts are as follows:

> "All rights-of-way disturbed either indirectly by passage of construction equipment or directly by trenching and backfill will be reseeded if necessary or allowed to revegetate by natural encroachment of plant species from adjacent undisturbed areas that will not interfere with future access or maintenance. Some portions of the right-of-way, especially the more arid areas, will be less prone to natural regeneration than others. In these areas, replanting and reseeding will be done in accordance with requirements of the state and federal agencies having jurisdiction.
>
> Revegetation methods might include such general measures as:
>
> -drill seeding
>
> -restorative techniques
>
> -stockpiling of vegetation for small animal habitat
>
> -mulching
>
> -minimum removal of vegetation
>
> -appropriate selection of seed mixes
>
> -additional agricultural techniques."

The applicant also states that "approximately 80 percent of the disturbed land (3,820 acres) will be allowed to revegetate naturally and/or revert to its preconstruction use."

Analysis

If the applicant utilizes natural revegetation it will take plant succession many years to establish a plant community similar to what exists prior to construction. The natural revegetation process will leave the soil susceptible to severe erosion losses for a long period of time, i.e., until plant succession establishes an adequate vegetative cover.

The revegetation measures proposed by the applicant are adequate for establishing a satisfactory vegetative cover within an acceptable period of time with additional measures.

(See Section 3.1.5E.6 for vegetation impacts.)

Additional Measures

The applicant should apply intensive soil conservation measures, including the revegetation of all non-cropland areas disturbed by construction of the pipeline.

Revegetation measures should be part of a detailed, site specific rehabilitation plan.

4.1.5E.7 Wildlife

<u>Impacts of the Proposal</u>

Destruction of habitat, movement of mobile animals from, and direct annihilation of less mobile animals within the construction zones will result. Some animals will move well away from the construction noise and related activities. Rehabilitation measures can provide vegetative benefits to habitats like edge and species mixtures. No rare and endangered species are known to live entirely within the proposed route, but the proposed route includes the general range of some species; i.e., bald eagles, ospreys, pygmy rabbits, Malheur shrew, Rocky Mountain wolf.

<u>Proposed by Applicant</u>

All practical measures will be taken to mitigate the short- and long-term impacts on vegetation and wildlife within or near the proposed pipeline corridor. An environmental coordinator will be available to advise on the scheduling of construction in order to minimize environmental damage and disturbance.

Construction personnel will be directed to remain within the right-of-way and existing or designated roads and trails in order to restrict impact to the 100-foot wide construction right-of-way and to minimize general disturbance and damage. When the pipeline is laid and covered in a given stretch of the route, all personnel and equipment will move on and there will be no prolonged activity in the area.

Additional measures include avoiding disturbance of nest sites, breeding grounds, and similar areas; minimizing siltation in watercourses; and avoiding sensitive fish spawning or migration areas, as deemed necessary by appropriate Federal and State agencies.

Local wildlife specialists of State game departments and other concerned Federal and State agencies will be given the opportunity to review the alignment and to determine its proximity to biologically sensitive areas, such as sage grouse strutting grounds which are used in March and early April, raptor eyries, carnivore dens, fish spawning grounds, and local populations of rare or endangered species. Consideration will be given to alterations in the route or changes in schedule, where, in the opinion of these specialists, important species might be affected.

After consultation with these officials, and on their recommendations, known breeding areas of important mammals, birds, and fish will be avoided where possible. This would also include known dens of bear, fox, cougar, wolverine, and other carnivores, most of which occur in forests or higher mountain and rimrock regions. Nest sites, especially tall dead trees utilized by large raptors, will be avoided where possible.

If possible, construction in the area will be scheduled to avoid breeding seasons. If known sage grouse strutting grounds or other bird display grounds cannot be avoided, or if previously unknown ones are discovered during or after clearing and construction, special care will be taken to restore the terrain as nearly as possible to its previous condition.

To the extent possible, siltation in rivers, creeks, lakes, and other water bodies and watersheds will be reduced by the techniques presented in Section 4.1.5 of the applicant's application to FPC, Docket Number CP74-292, revised 10/15/75. River crossings will be made in accordance with permits issued by the Federal and State agencies having jurisdiction.

If a submerged crossing of the Snake River is made, it will take place as directed by the Washington State agencies having jurisdiction, probably in August when the chinook salmon run has diminished and prior to the fall steelhead run. At this time there are few juvenile anadromous fish in the Snake River; flow is relatively low, allowing silt to settle within a short distance; and many populations of invertebrates are at relatively low levels.

Analysis

Basically a sound approach. Needs strengthening so that nest sites, raptor trees, or any rare and endangered species discovered to be living within the right-of-way will be avoided. The U.S. Corps of Engineers, as well as State of Washington, will be involved in an underwater crossing of the Snake River.

Conclusion

Acceptable with the addition of the additional measures cited below.

Additional Measures

Personnel from the local fish and game and administering resource agency should be present during field alignment of the route to assure that critical species or habitat can reasonably be avoided.

Minor route diversions may be necessary to avoid wetland areas, big game wintering areas, nesting and denning trees, productive aquatic habitat areas, and other critical areas of natural habitat. Elk, moose, and deer winter ranges and elk calving areas identified in Section 3.1.5E.7 should be avoided during critical periods. Critical periods for winter ranges would be December to March.

Explosives should not be detonated in the vicinity of fish and wildlife reproductive activity, such as near fish spawning or incubation activities, bird nesting, big game fawning areas, or other critical habitat.

At all stream crossing locations, precautions should be taken to minimize the number of trees, especially the more valuable types of trees such as, raptor nesting trees, denning trees, etc., which would have to be removed.

In order to assure that natural movement of wildlife is not hindered or diverted by the construction, it will be necessary to schedule and locate pipeline storage, trenching, and filling to avoid conflicts with critical wildlife requirements along the route.

Peregrine and prairie falcon, eagle, and osprey nesting and use areas should be avoided from mid-February through July. The avoidance of construction during critical periods may be ideal mitigation, but may be difficult due to work scheduling problems.

Sage grouse strutting areas that are found along the route in eastern Oregon and Nevada should not be disturbed from mid-March to mid-May. Again work scheduling may make this difficult.

Increased wildlife conflict through additional access can be reduced by effective road closures and obliteration. This is especially important in semi-wilderness areas, and those areas where threatened or endangered species occur. Methods should be coordinated with overall vehicle use goals for the area.

Immediate revegetation of disturbed areas would help reduce introduction of undesirable species of plants. Eradication of undesirable species should be considered in maintenance work.

Wildlife food and cover plant species should be included in seeding mixtures for soil holding purposes and for maintaining erosion control effectiveness.

Plant species established next to highways and major travelways should be selected so as to not attract and endanger wildlife.

Effective smoke management planning in debris disposal and dust abatement control would help reduce air pollution conflicts with wildlife.

Every precaution should be taken to avoid disturbing wet meadow areas as these habitats are often small, limited in number, and are extremely critical habitat for a variety of wildlife species.

Scattering of small brush piles where fire hazards are not a potential problem would be desirable for maintaining small game and other wildlife cover.

4.1.5E.8 Ecological Considerations

Mitigation of ecological impacts is discussed under the separate resource topics of this section.

4.1.5E.9 and 10 Economic and Sociological Factors

These two elements are interdependent and are jointly addressed.

The major impacts relate to hiring approximately 30 percent of the work force (25 to 300 men) locally, and a significant injection of new money into the communities along the route through payrolls and the purchasing of goods and services.

Adverse impacts may include a rise in incidents between law enforcement people and pipeline workers, relating to an increase in prostitution, drinking, etc. Cost of living may increase to inflationary levels. In smaller communities, available lodging may be in short supply, especially during the summer tourist season. This may mean an increase in mobile home style living enroute.

<u>Proposed by Applicant</u>

None is specifically identified.

Analysis

The major impacts should be short-lived, since the project is planned for 1-year completion. Impacts may be lessened after the summer tourist trade slackens.

Conclusion

The beneficial impacts should outweigh the adverse impacts.

Additional Measures

None.

4.1.5E.11 Land Use

Proposed by Applicant

"Existing public and private roads will be used to the maximum extent possible for access to permanent pipeline facilities. All private roads to the right-of-way will be equipped with fences and locked gates to prevent unauthorized access to the restored right-of-way by recreational vehicles.

Crossings of most hard-surfaced roadways will be horizontally bored to avoid disturbing the road surfaces and traffic flows. Irrigation ditches, levees, and canals will not be permanently altered by construction activities. Warning signs will be placed at all intersections of the pipeline rights-of-way.

The special requests and preferences of landowners along the alignment will be given full consideration during all phases of pipeline activities. Following the initial pipeline construction period, all temporary land use licenses will terminate. Intersection Transmission Associates (Arctic) will retain a permanent right-of-way. The land will be allowed to return to its original use where compatible with operation of a buried pipeline."

Analysis

The applicant's proposal will mitigate the majority of land use impacts within the right-of-way. Some activities, such as boring under railroads and highways, may cause temporary disruption of the facility. Agricultural land may be out of production for one growing season.

The crossing of other existing rights-of-way such as highways, power transmission lines, irrigation ditches and canals, and municipal water lines requires specific construction techniques and close coordination with the owners of such rights-of-way to assure such utilities, structures, and roads are adequately protected.

All uses of land for the proposed right-of-way and pipeline require either the consent of a private landowner or a permit from a host of governmental entities.

Additional Measures

None.

4.1.5E.12 Archeological, Historic, and Other Unique Values

Impacts

The major adverse impact, regardless of land ownership, results when known or unknown cultural values are destroyed by pipeline activities.

Proposed by Applicant

Visible sections of the Oregon Trail and early settlers' homes and buildings in the Grande Ronde Valley will be avoided during pipeline construction. This will mitigate any possible adverse impact.

Most of the proposed pipeline route in Oregon has not been surveyed for archeological resources. Before construction, the right-of-way will be surveyed by professional archeologists and excavated where necessary. Discovery of previously unknown archeological sites would be a beneficial result of such efforts.

All members of the construction crew will be informed that archeological sites may be found. Such artifacts as arrowheads, stone knives, grinding stones, charcoal ash, animal bones, burned bones, shells, matting, basketry, fire-cracked rock, human bones from burials, and unusual changes in the soil of trench walls will be noted. Surface signs including mounds of rock, stone circles, depressions, unnatural surface configurations, rock art (pictographs and petroglyphs) will also be reported. If any archeological material is discovered, a professional archeologist will be contacted. Every effort will be made to prevent destruction of any archeological find.

Analysis

The applicant states excavation (where necessary) will be used as a mitigating measure. Excavation or salvage should not be the only consideration. Leaving sites undisturbed (in situ) for later study may be desirable. The dependence upon untrained construction crew members is not a substitute for a fully accredited archeologist or historian.

Conclusion

The applicant's proposal is basically sound, but needs clarification regarding procedures, timing, qualifications, and other matters.

Additional Measures

Section 4.1.5R.4 discusses additional measures.

4.1.5E.13 Recreational and Esthetic Resources

Major impacts relate to construction noise, dust, fumes and visual esthetics. At stream crossings there is the additional impact of increasing turbidity of the water. All impacts except visual esthetics are temporary and short-lived. During operation and maintenance there are intermittent activities such as aerial and ground surveillance of the line, venting of gas, and possible repairs.

Proposed by Applicant

After removal of debris and scrap from the construction zone, the new right-of-way will be fine-graded to its approximate preconstruction contour. All exposed banks at river crossings will be backfilled, stabilized, or otherwise restored to the extent practical.

Where the right-of-way crosses farmland, mitigation of esthetic impact will not be necessary, since any tilled land disturbances will be plowed under and replanted the following crop season. The replacement of topsoil in these areas should maintain uniform soil fertility and, upon regrowth, a continuity of vegetative appearance.

To lessen the prominence of the right-of-way through steppe and shrub-steppe vegetation, all cleared areas other than those within the compressor station compounds will revegetate with grasses. Small native species will also be allowed to reinvade these areas.

Where the right-of-way clearings cross woodlands, the visual impact may be pronounced, as revegetation will be limited to grasses and small plants. A seeding program may be successful in re-establishing the natural elements of color and, perhaps, texture within the limits previously mentioned, but will be unable to restore these areas to preconstruction line and form.

It is recognized that mitigating measures other than seeding may be needed in several instances to lessen the esthetic impact of the cleared right-of-way through forested areas of the new route in the Blue Mountains, and possibly in similar locations elsewhere along the alignment where viewer sensitivity may be high. Several techniques intended to screen foreground and middle ground views of the right-of-way at road crossings are being considered for use. The techniques used will be determined by onsite conditions and the requests of regulatory agencies. These techniques could include preservation of existing vegetative screens by extending the length of road borings or by reducing the right-of-way width at road crossings, and the re-establishment of screens by planting. All such measures will be implemented at the direction and with the guidance of appropriate government agencies.

Areas of special significance are discussed in the following paragraphs:

Canadian-Idaho Border to Kootenai River Flood Plain. Most views of the right-of-way from roads through this landscape will be foreground, middle ground, and lateral views. Impact would be lessened by screening of the right-of-way.

Similar measures will be taken at the crossing of the access road to Robinson Lake campground. Campers, however, will view the crossing while exploring the area on foot. Cleared areas at the crossing will be minimized.

Pend-Oreille Lake. The right-of-way will be screened from view by plantings where it crosses roads. Screening, however, will not be sufficient fcr boaters on the Pend Oreille River, who will view the right-of-way north and south of the river along timbered hills. In this case, the impact will be mitigated to some extent by planting grasses and small shrubs within the right-of-way where it breaks the horizon, and by preserving all trees in the right-of-way which do not interfere with construction operations.

Moravia to Pend Oreille River and Southern Plain of Purcell Trench. The majority cf the people viewing these landscapes will do so from automobiles on roads. The right-of-way will be viewed laterally from roads in this area. This impact will be mitigated by screening next to the roads.

Slagle Slough to Scuthern Plain of Purcell Trench and Blue Mountains. Most of the views of the right-of-way from roads in this area will be lateral views and impact will be mitigated by screening as described above.

Where views of the right-of-way are frontal, screenings will not be effective. If feasible, leaving some large trees in the right-of-way during construction will mask the linear effect.

Analysis

The applicant's proposal does not address fugitive dust or other preventive measures not related to reseeding or replanting. Some of these are shown in "Additional Measures." Landowners, Federal Agencies, or local governmental agency lands may be crossed, and the EIS is a tool to aid them in their plans with the applicant.

Conclusion

The applicant's proposal is adequate as to reseeding. Some additional measures are needed to strengthen it.

Additional Measures

A straight edge effect should be avoided, especially through trees, by selective remcval or retention of trees at key visual points. This necessitates working with landowners and agency people in early planning stages.

Fugitive dust can be controlled to a large extent by the application of water. It may be necessary in extremely dry, hot, windy weather to suspend operations if dust exceeds air-quality standards.

Open burning of debris will be controlled by permit.

The applicant, landowners, agencies, and rural fire departments should develop joint fire plans in the event of wildfire from any construction or maintenance activities.

Emission standards from engines, noise levels and ambient air-quality standards are set by the National Environmental Protection Act, the Occupational Health and Safety Act, and State governments. They are enforced by State environmental agencies, the U.S. Office of Safety and Health Administration, and the Environmental Protection Agency.

4.1.5E.14 Air Quality

Impacts are related engine emissions of vehicles, equipment and compressor stations, dust, smoke from fires, and other operation and maintenance functions.

Proposed by Applicant

Where required, meteorological data will be collected in the vicinity of the compressor station sites to calculate downwind concentrations of emitted pollutants. Ambient air quality may also be monitored prior to construction and operation of the new ccmpressor facilities.

Operation of the compressor stations will incorporate the best practicable technology tc minimize environmental impacts and to ensure maximum safety during operation. Monitoring and inspection programs will be conducted on a periodic basis to ensure that all equipment is functioning properly and that procedures relating to safety and operational integrity are being followed by employees of the facility.

Analysis

The "where required" needs clarification; will National or State ambient air-quality standards rule?

The proposal is adequate to set up a monitoring program at compressor stations. The legal body who may require such monitoring must be identified -- FPC, EPA, or other as appropriate.

Conclusion

Adequate as far as it goes. Needs some additional measures.

Additional Measures

Adopt the measures relating to air quality discussed in Section 4.1.5E.13, Recreational and Esthetic Resources.

4.1.5E.15 Environmental Noise

Impacts are related to construction noises, mostly mechanized equipment and some blasting; operation and maintenance noises like compressor stations, venting gas from pipes, and equipment used in repairing or maintaining operations. The only really continuous noise is from compressor station engines.

Proposed by Applicant

An ambient noise monitoring program will be conducted where considered necessary at the augmented compressor station sites prior to construction. Noise measurements will be made on the dB(A) scale and on each octave band.

During site preparation and construction, noise will be generated by the operation of construction equipment or, in the case of blasting, from the construction activities themselves. Appropriate measures, promulgated by the Occupational Safety and Health Act (OSHA), will be taken to ensure that workmen and the general public are not exposed to detrimental levels of noise or air pollutants from the source. Construction equipment will be muffled or otherwise attenuated to minimize noise emissions.

The operational noise levels of the proposed compressor stations will be within all OSHA requirements. All compressors will be housed in buildings with consideration given to interior acoustics. Silencers will be installed on the air intake and exhaust ducts of all power units and blowdown stacks where appropriate at each station. Ambient noise data and the distances to the nearest residences will be considered when determining the initial noise suppression measures required for each compressor station.

Analysis

The Applicant has stated he will comply with all pertinent noise regulations. No problems in compliance with any of the applicable regulations were foreseen.

The Applicant has estimated the mean noise level at the compressor station boundaries to be less than 70 db(A) at 450 feet from the compressors. This level of noise did not include the additive effect of a blowdown. Station designs will include noise suppression devices on all prime movers to ensure meeting environmental requirements.

Construction noise was not evaluated in detail by the Applicant. While this noise would be transient, it could be of a high level (when blasting, for instance) and should be evaluated with respect to its level and impact on the environment. Suppression devices will be installed on some of the equipment, if necessary, to meet applicable regulations.

The gas blowdown noise, which may occur in an emergency when one of the valves has to be opened to release pipeline gas or when the compressor shutdown system is checked, would have a high sound level. While this noise will occur only once or twice a year per station the level will be controlled by silencers, if necessary, to meet OSHA requirements.

Conclusion

Procedures to control noise will be provided in accordance with pertinent local, State or Federal government codes.

There is little or no impact on the environment by noise generated during construction. Noise effects on the environment may be underestimated.

Additional Measures

Location of compressor stations and blowdown valves away from populated areas will lessen any noise impacts associated with these items.

4.1.5E.16 Hazards

Impacts

The injury or death of humans is the ultimate impact. This includes people engaged in the construction, maintenance, operation and possibly salvage of the line, as well as others not associated with the pipeline, either onsite or offsite, directly or indirectly injured from pipeline activities.

Proposed by Applicant

The applicant has addressed health, safety and construction codes in Sec. 9.2 of their environmental report prepared May 8, 1974.

Section 1.6 of their application to FPC, Docket No. CP74-292, revised October 15, 1975, addresses operating and maintenance procedures. These include training of their personnel in assigned tasks, pipeline surveillance, repairs, cathodic projection inspection and maintenance, purging, pigging, storage of combustibles and other chemicals, and security.

Analysis

The applicant is experienced in pipeline construction. The construction crews will face the hazards common to many other construction industries, inclement weather, working around heavy machinery, handling explosives and flammable liquids, working in ditches, around and across large bodies of water, etc.

During operation and maintenance of the system, explosion, fire, and death from gas leaks and ruptures become a dominant potential hazard.

The pipeline industry construction methods and operation and maintenance procedures are highly regulated by a host of governmental agencies. Quality control is maintained internally by established and tested procedures of the industry, concurrent with new evolving technology. These controls and procedures reduce the probability of a pipeline system failing, but do not entirely eliminate the possibility.

Conclusion

The pipeline system as proposed by the applicant has a remote probability of rupture followed by fire, explosion and human injuries and deaths.

The applicants' proposals are adequate but can be strengthened by adopting the following additional measures.

Additional Measures

All mainline block valves should automatically close when sensing a pressure drop. Block valves should be used on either side of active earthquake faults. The number of mainline block valves should be more closely spaced in areas of higher population density.

Cooperative firefighting agreements should be prepared between the applicant and firefighting organizations throughout the route.

4.1.5R Rye Valley to Cajon (Future Expansion)

In this section, the mitigating and/or environmental control measures proposed by the applicants are discussed and Department of the Interior's conclusion as to their effectiveness is stated. Additional geotechnical or environmental contrcl measures not proposed by the applicant, but that if applied would significantly reduce impacts are also discussed.

The applicants' proposals for mitigating and/or environmental control measures are summarized in Sections 4.1.5R.1, .2, and .3. Section 4.1.5R.4 discusses additional measures.

The mitigating measures, guidelines, rules, and regulations referred to are developed fcr broad application throughout the proposed future expansion. Many items are conditionally applicable and could be interpreted as not necessary fcr the project. The proposed project crosses a variety of resources. Specific site-planning is needed for the resources involved. Such planning should utilize interdisciplinary teams with local experience. Team composition should vary depending on the area and the type of resources affected.

Agencies administering respective Federal lands and programs should review and approve final location, design, and contractual requirements prior to construction. Similarly, operation and maintenance plans should be reviewed and apprcved by responsible agencies.

4.1.5R.1 Monitoring Construction and Operation of the Project as Proposed by Applicants

Engineering and Construction Criteria

Proposed by Applicants

Proposed facilities will be designed, constructed, and operated in accordance with the requirements of Part 192, Title 49, Code of Federal Regulations, "Federal Rules and Regulations for Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards." The pipeline will be designed and ccnstructed according to the 1973 "ASME guide for Gas Transmission and Distribution Piping Systems," published by the American Society of Mechanical Engineers.

Interstate Transmission Associates (Arctic) [ITA(A)], and Southern California Gas Company (SoCal) and their Contractors will comply with the requirements of "Docket Number R-360, Pipeline Construction Guidelines, Order Number 407 as Section 2.69 adds to Part 2, General Policy and Interpretation, Subchapter A, Chapter 1 of Title 18 of the Code of Federal Regulations" and with all Occupational Safety and Health Act (OSHA) regulations relevant to pipeline construction and operation. Also, the pipeline will receive full corrosion protection and periodic ground and aerial surveillance during its period of operation.

Analysis

The guidelines are insufficient by themselves to assure minimizing impacts from engineering design and construction criteria. The applicants have proposed to design, construct, and operate the pipeline in compliance with Federal and State law. See Section 4.1.5R.4 for additional measures.

Criteria for special precautions should be followed when in the proximity of mines, oil wells, railroads, highways, transmission lines, pipelines, or other private or public facilities whose operation or presence could constitute a hazard to the pipeline.

Criteria should be established for the trench bottom, specifying inspection procedure, and the conditions that require bedding material (such as percentage of rock and hardness of rock).

The properties of bedding material; procedures for the method, thickness, and density (compactness) of its installation; and details of inspection required prior to lowering-in the pipeline should be established.

The Applicant should provide an operation and maintenance plan for the pipeline. This plan should cover all phases of operation including: purging and startup; normal operation; routine and special maintenance; emergency shutdown; response to leaks, rupture, compressor or measurement station outage; response to out-of-tolerance conditions; contingency plans for various outage durations; and government and private organizations to be notified.

Monitoring of all construction and rehabilitation practices is needed. Thorough and frequent on-the-ground visual inspections are required to assure satisfactory compliance. Accurate records of the monitoring should be maintained and inspections should be continuous during clearing, construction, and revegetation phases.

Cooperative efforts between the teams, the Applicants and their contractors are mandatory for effective mitigation.

Land Use

Proposed by Applicants

Existing public and private roads will be used to the maximum extent possible for access to permanent pipeline facilities. All private roads to the right-of-way will be equipped with fences and locked gates to prevent unauthorized access to the restored right-of-way by recreational vehicles.

Crossing of most hard-surfaced roadways will be horizontally bored to avoid disturbing the road surfaces and traffic flows. Irrigation ditches, levees, and canals will not be permanently altered by construction activities. Warning signs will be placed at all intersections of the pipeline rights-of-way. In addition, SoCal proposes that gaps will be provided at convenient points in the temporary spoil banks to permit passage of residents and animals.

The special requests and preferences of landowners along the alignment should be given full consideration during all phases of pipeline activities. Following the initial pipeline construction period, all temporary rights-of-way beyond the 50-foot width would revert to the original ownership. Both Southern California Gas Company (SoCal) and ITA(A) would retain an easement for a permanent 50-foot right-of-way, and would hold title only to the land for the compressor station facilities. The land would be allowed to return to its original use where compatible with operation of a buried pipeline.

Analysis

The measures proposed are not inclusive enough in such areas as: access control on public lands, rehabilitation of temporary rights-of-way, and reconstruction needs of roads before use. Additional mitigation measures which are needed are discussed in Section 4.1.5R.4.

Land Features

Proposed by Applicants

Landslides and erosion caused by sidehill cuts on steep slopes are the principal potential causes of impact on the geological component of the environment. Risk of incurring these effects will be reduced by alignments to avoid landslide and erosion susceptible sites, by rapid restoration of disturbed areas, and by controlling surface water runoff during the trenching period.

The surface of the terrain will be restored to its approximate original contour with two exceptions. The backfill over the trench will be rounded to a 6- to 12-inch crown to compensate for subsidence that may occur with time and seasonal freezing and thawing. Erosion of steep slopes will be minimized by using a series of terraces to direct runoff at an angle to slopes rather than directly downslope, thereby reducing the water velocity and potential erosion.

Analysis

Landslides occurring on private lands could affect adjacent Federal lands. Federal agencies should be apprised of all areas susceptible to mass land movement over the entire proposed route. All right-of-way restoration action on Federal lands should be accomplished under the direction and approval of the agencies involved.

Species and Ecosystems

Proposed by Applicants

All practical measures will be taken to mitigate the short- and long-term impacts on vegetation and wildlife within or near the proposed pipeline route. An environmental coordinator will be available to advise on the scheduling of construction in order to minimize environmental damage and disturbance.

Construction personnel will be directed to remain within the right-of-way and the existing or designated roads and trails in order to restrict impact to the 100-foot wide construction right-of-way and to minimize general disturbance and damage. When the pipeline is laid and covered in a given stretch of route, all personnel and equipment will move on and there will be no prolonged activity in the area.

Additional measures include avoiding disturbance of nest sites, breeding grounds and similar areas; minimizing siltation in water courses; and avoiding sensitive fish spawning or migration areas as deemed necessary by appropriate Federal and State agencies.

Local wildlife specialists of State game departments and other concerned Federal and State agencies will be given the opportunity to review the alignments and to determine their proximity to biologically sensitive areas, such as sage grouse strutting grounds which are used in March and early April, raptor eyries, carnivore dens, fish spawning grounds, and local populations of threatened or endangered species. Consideration will be given to alterations in the route or changes in schedule where, in their opinion, important species might be affected.

After consultation with these officials, and on their recommendations, known breeding areas of important mammals, birds, and fish will be avoided where possible. This wculd also include known dens of bear, fox, cougar, wolverine, and other carnivores, most of which occur in forests or higher mountain and rimrock regions. Nest sites, especially tall dead trees utilized by large raptors, will be avoided where possible.

If possible, construction in the area will be scheduled to avoid breeding seasons. If known sage grouse strutting grounds or other bird display grounds cannot be avoided, or previously unknown ones are discovered during or after clearing and construction, special care will be taken to restore the terrain as nearly as possible to its previous condition.

Analysis

The applicants will comply with the requirements of Federal and State Wildlife Agencies to mitigate the adverse effects on wildlife and their habitat. Additional needed measures are discussed in Section 4.1.5R.4. The proposed mitigaticn measures are not inclusive enough in timing, minor route changes, and other mitigation to be identified through an interdisciplinary team approach.

Archeology

Proposed by Applicants

The pictograph case on Spring Creek in Nevada will be avoided during pipeline construction.

Most of the proposed pipeline route has not been surveyed for archeological resources. Before construction, the right-of-way will be surveyed by professional archeologists and excavated where necessary. Discovery of previously unknown archeological sites would be a beneficial result of such efforts.

All members of the construction crew will be informed that archeological sites may be found. Such artifacts as arrowheads, stone knives, grinding stones, charcoal ash, animal bones, burned bones, shells, matting, basketry, fire-cracked rock, human bones from burials, and unusual changes in the soil of trench walls will be noted. Surface signs including mounds of rocks, stone circles, depressions, unnatural surface configurations, and rock art (pictographs and petroglyphs) will also be reported. If any archeological site is discovered, professional archeologists will be contacted. Every effort will be made to prevent destruction of any archeological find.

Analysis

The applicants' proposals need to be bolstered to adequately meet legal requirements and professional standards especially in preconstruction surveys, surveillance, and recovery. Procedures developed by the Advisory Council on Historic Preservation (36 CFR 800) and the Secretary of the Interior for implementing the Historic Preservation Act of 1966, Executive Order 11593 and the Reservoir Salvage Act, as amended by the Historical, Archeological, and Scientific Preservation Act of 1970 (Public Law 93-291) must be followed. See Section 4.1.5R.4 for needed measures.

Esthetics

Proposed by Applicants

After removal of debris and scrap from the construction zone, the new right-of-way will be fine-graded to its approximate preconstruction contour. All exposed banks at river crossings will be backfilled, stabilized, or otherwise restored to the degree practical.

Where the right-cf-way crosses farmland, mitigation of esthetic impact will not be necessary, since any tilled land disturbances will be plowed under and replanted the following crop season. The replacement of topsoil in these areas should maintain uniform soil fertility and, upon regrowth, a continuity of vegetative appearance.

To lessen the prcminence of the right-of-way through steppe and shrubsteppe vegetation, all cleared areas other than within the compressor station compounds will revegetate with grasses. Small native species will also be allowed to reinvade these areas.

Where the right-of-way clearings cross woodlands, the visual impact may be pronounced as revegetation will be limited to grasses and small plants. A seeding program may be successful in re-establishing the natural elements of color and perhaps texture within the limits previously mentioned, but will be unable to restore these areas to preconstruction lines and form.

It is recognized that mitigating measures, other than seeding, may be needed in several instances to lessen the esthetic impact of the cleared right-of-way through forested areas of the new route where viewer sensitivity may be high. Several techniques intended to screen fore and middle ground views of the right-of-way at road crossings are being considered for use as determined by onsite conditions and the requests of regulatory agencies. These techniques could include preservation of existing vegetative screens by extending the length of road borings or by reducing the right-of-way width at road crossings, and re-establishment of disturbed screens by planting. All such measures will be implemented at the direction and with the guidance of appropriate government agencies.

Analysis

The proposed mitigation measures are not inclusive enough in landscape management plans and the coordinating efforts. Additonal measures are discussed in Section 4.1.5R.4.

Air, Noise, Water Quality

Proposed by Applicants

Air Quality

Where required, meteorological data will be collected in the vicinity of the compressor station sites to calculate downwind concentrations of emitted pollutants. Ambient air quality may also be monitored prior to construction and operation of the compressor facilities.

Monitoring and inspection programs will be conducted periodically to ensure that all equipment is functioning properly and that procedures for safety and operational integrity are being followed by employees of the station.

Noise

An ambient noise monitoring program will be conducted where considered necessary at a number of compressor station sites prior to construction. Noise measurements will be made on the dB(A) scale and on each octave band.

During site preparation and construction, appropriate measures, promulgated by the Occupational Safety and Health Act (OSHA), will be taken to ensure that workmen and the general public are not exposed to detrimental levels of noise or air pollutants from the source. Construction equipment will be muffled or otherwise attenuated to minimize noise emissions.

Operational noise levels of the proposed compressor stations will be within OSHA requirements and any local codes or zoning regulations. The compressor will be housed in a building with carefully designed interior acoustics. Air intake and exhaust ducts of the power unit will have silencers. When determining the initial noise suppression measures required for the compressor stations, ambient noise data and the distance to the nearest resident will be considered.

Water Quality

The most significant impact on water quality will be the temporary increase in suspended solids and turbidity at stream and river crossings. Since increased sediment load is unavoidable and occurs naturally during periods of high runoff, no monitoring of water quality during the construction or operational phases is planned. In conformance with applicable permits, several measures can be employed during construction to minimize sediment suspension.

These include use of flow diversion structures to dry cut crossings of shallow streams, placement of subaqueous trench spoil in suitable bank storage areas, installation of straw filtration barriers along streambanks, construction of siltation barriers to reduce velocity of surface runoff on steep grades, construction of temporary bridges at sites of repeated shallow stream crossings by construction machinery, and post-construction stabilization of streambanks. Where crossings occur upstream of reservoirs or water supply inlets, their users will be notified of the approaching construction.

Water to be used for hydrostatic testing of the pipeline will be withdrawn from sources selected to avoid excessive drawdown or flow interruption. The test water will be discharged at points determined by the acceptability of receiving waters in accordance with applicable permits. Any discharge water with observed excessive suspended solids, iron oxide flakes, or color will be clarified in holding basins constructed at the point of discharge. All discharge rates will be controlled to preclude erosion of the banks or beds of receiving waters. Wherever possible, test water will be reused.

Chemical toilets will be provided at appropriate locations for use during all site preparation and construction activities. During the operational period, approved sanitary waste disposal facilities will be provided at the compressor stations.

Analysis

In addition to complying with the above and applicable Federal, State, and local requirements, detailed plans are discussed under 4.1.5R.4, Additional Measures, should be utilized. These would include: water-quality testing, controlling factors that may threaten the pipeline integrity, and reducing water-quality degradation.

4.1.5R.2 Restoration and Enhancement as Proposed by Applicants

<u>Management Practices</u>

Proposed by Applicants

All rights-of-way disturbed, either indirectly by passage of construction equipment, or directly by trenching and backfill that will not interfere with future access or maintenance, will be reseeded if necessary, or allowed to revegetate by natural encroachment of plant species from adjacent undisturbed areas. Some portions of the right-of-way, especially the more arid areas, will be less prone to natural regeneration than others. In these areas, replanting and reseeding will be done in accordance with requirements of the State and Federal agencies having jurisdiction.

Revegetation methods might include such general measures as:

- double trenching
- drill seeding
- restorative techniques
- stockpiling of vegetation along edge of rights-of-way
- mulching
- minimum removal of vegetation
- appropriate selection of seed mixes
- additional agricultural techniques.

These are briefly described below.

In double trenching, the topsoil would be removed and preserved during grading and trenching operations. Following backfill, a seedbed would be provided by redistributing the stored topsoil over the right-of-way.

In drill seeding, plant seeds are mechanically placed at the proper depth to ensure good cover of the seed and the best chance of successful establishment. The surface broadcast technique may be considered where appropriate. In areas of high erosion potential (such as steep slopes and rock outcroppings), special restorative techniques will be used, including good general engineering practices and special requirements of particular agencies.

Where permissible and deemed appropriate, trees and brush cut from the right-of-way may be dozed to the edge of the right-of-way at regular intervals. This could provide important escape cover for indigenous wildlife species such as grouse, quail, and rabbits.

Shrubby species could be ground back into the right-of-way topsoil as mulch and possible seed sources.

The complete removal of plants could be reduced to a minimum, allowing the root systems of those individuals not directly impacted by the trench to resprout, thus increasing the recovery rate.

A seeding mixture including native species and/or exotics, as deemed appropriate by the administrative agency having jurisdiction, would be used to revegetate the right-of-way.

Additional special management practices such as mulching for erosion control, fertilizing, irrigation, selection of plants of low palatability, protection of seedlings, and reseeding of unsuccessful locations will be done if required by the appropriate agency.

Additional considerations relating to the mitigation of impact in specific vegetation and habitat types encountered along the right-of-way could also include the techniques discussed below or others as required by State or Federal agencies.

Pinyon - Juniper Woodland

The major impact in the pinyon-juniper associations is the visibility of the right-of-way after tree removal during the construction process. The total removal of ground cover is a shorter term impact, and a reseeding program would aid in mitigation of this impact and in prevention of increased erosion.

Re-establishment of the shrub and grass layer would be increased if a seeding mixture were used containing at least big sagebrush, fourwing saltbrush, Indian ricegrass, sand dropseed (if available), and an introduced species, crested wheatgrass. Protection of existing trees will be encouraged during construction. Large trees in the right-of-way will be avoided if possible.

Steppe

Reduction in cover, lowering of production, and visual disturbance are negative impacts due to construction in the steppe association. Such negative impacts may continue in the drier areas for up to 15 years, and possibly more if mitigating measures are not taken. There is a high probability of completely restoring the site within 5 to 10 years if immediate reseeding and other mitigation measures are taken. Range reseeding has been accomplished in steppe-like vegetation in the past, utilizing proper management techniques.

Topsoil will be stockpiled and used to cover the filled pipeline trench, then reseeded with a mixture of species reflecting the composition of the local vegetation when possible. Needle-and-thread, bluebunch wheatgrass, Idaho fescue, sandberg bluegrass, three-tip sagebrush, and snowberry will be included if available or if required by the appropriate government agency.

Much of the steepe region traversed by the pipeline route is presently under cultivation for agricultural purposes. No major mitigating measures are planned since any disruption of the vegetation (crop) will be plowed under and replanted the following season. However, topsoil will be stockpiled and used to cover the filled pipeline trench in order to prevent a decrease in soil fertility.

Shrub-Steppe

Impacts and mitigating measures in the shrub-steppe associations are similar to those in the steppe vegetation associations, but full recovery may be somewhat slower.

Topsoil will be stockpiled and used to cover the filled pipeline trench. A seeding mixture including the native species (bluebunch wheatgrass, needle-and-thread, Idaho fescue, big sagebrush, rabbitbrush, and bitter brush) and reflecting the composition of the local vegetation will be used, depending on availability or official requirements. If junipers are removed, attempts will be made to reestablish seedlings in the area of removal if such action is found to be appropriate by the agency having jurisdiction.

Salt Desert Shrub

These associations occur in the more arid areas of the pipeline route in Nevada. Immediate reduction in coverage, lowering of production, and severe visual disturbance are negative impacts due to construction in the salt desert shrub associations. Such negative impacts may continue up to 20 years unless mitigation procedures are utilized. There is high probability of completely restoring the site within 10 years if immediate reseeding and other mitigation measures are taken. Successful range reseedings have been accomplished in similar areas with proper range management.

The topsoil will be stockpiled and used to cover the filled pipeline trench, then reseeded with a mixture of native species including big sagebrush, four-wing saltbush, Indian ricegrass, sand dropseed, squirrel tail, needle-and-thread, and galleta grass, if available. A cultivated cool season annual could be used to produce rapid cover and prevent erosion.

In those desert shrub areas dominated by such species as blackbrush, greasewood, shadscale, winterfat, etc., these and other major component species could be added to the seed mixture to reflect the local species composition if available and/or required by the proper governmental agency.

Creosote Bush Scrub

Impacts and mitigation for creosote bush scrub are similar to those for the salt desert shrub. The seeding mixture should include creosote bush, bursage, rabbitbrush, galleta grass, squirrel tail, and needle-and-thread and should reflect the local species composition, if possible.

Chaparral

The impacts of pipeline construction on chaparral are reduction in cover, lowering of production, and severe visual disturbance. Such negative impacts may continue for up to 15 years, or more, unless mitigation procedures are used. On the other hand, if such procedures are used, restoration will be well along within 10 years. The seeding mixture should include the native species chamise, hollyleaf cherry, scrub oak, redberry, California buckwheat, muhly grass, and poppies. Additional species should be added to the mixture to reflect the local species composition. Cultivated cool season grasses could be used to produce rapid cover and prevent erosion.

Riparian

The major impact on the riparian habitat crossed by the pipeline will be the visibility of the right-of-way after construction. The slow growth rates of tree species may cause the disturbance to be visible for 10 or more years. Seeding of various grasses and shrubs may enhance the recovery rate of the understory. Larger individual trees might be allowed to remain in order to reduce the damage to the vegetation and break up the "fairway" appearance of the right-of-way.

Analysis

The Applicants' proposed mitigation methods for revegetation are too generalized. There is no indication of when rehabilitation is to take place, plant species selection is vague, no mitigation for compacted soils is indicated, no systematic monitoring plan is proposed, and there is indication that some areas would be allowed to revegetate naturally.

The Applicant should be required to submit detailed revegetation plans for approval by the agencies, which are responsible for each jurisdiction. Additional plans would be needed for the removal and disposition of vegetation throughout the length of the route. Specific plans to be considered (including timing, plant species, composition, soil rehabilitation, and monitoring) are discussed under additional measures in Section 4.1.5R.4.

4.1.5R.3 Safety and Emergency Measures to be Implemented During Construction and Operation as Proposed by Applicants

Proposed by Applicants

Federal, State and Local Requirements

The minimum Federal safety standards for transportation of natural and other gas by pipeline were issued by the Department of Transportation, Office of Pipeline Safety Operations and Occupational Safety and Health Act (OSHA). These are the minimum standards for health and safety which must be utilized in the construction of a natural gas pipeline.

Numerous State and local laws, regulations, and codes pertain to health and safety. Each State and county differs in many laws, regulations and codes. To the extent that Federal regulations do not preempt the field, such State and local regulations will be observed.

Procedures that will be taken to assure compliance with Federal, State, local and industry regulations and codes include:

1) Inclusion or reference to such regulations and codes in contract specifications for construction of ITA(A) and SoCal's pipelines and appurtenances.

2) ITA(A) and SoCal personnel will be provided with a current edition of pertinent codes and will be instructed to familiarize themselves with the codes.

3) Procedures presently established by ITA(A) and SoCal will be utilized and updated as needed.

Analysis

The applicants gave no detailed discussion to show how the safety provisions of the various laws are to be met. The various potential safety hazards, regulations covering them, and mitigating measures, are discussed more fully in Section 4.1.5R.4.

4.1.5R.4 Additional Measures Which May be Used to Further Reduce Environmental Impacts

The following mitigating or environmental control actions comprise measures not proposed by the Applicants, but would if applied, significantly reduce adverse environmental effects. These include environmental control actions which would be stipulated by the Government on Federal lands and are equally applicable to other lands.

In the discussion of additional mitigation measures, it will be necessary to duplicate certain items mentioned by the Applicants and listed in Sections 4.1.5R.1 and .2. In many cases the Applicant has left the determination of specific, mitigation measures for later stages of project development up to the agency or landowner responsible for the lands involved. Due to the project's lineal magnitude, many variables are involved in determining exact mitigating measures. The measures stated often relate to several resources at the same time. Detailed planning of these measures should include specialists with needed disciplines. Interdisciplinary teams experienced with the locale involved should be consulted in the development of specific plans for the proposed project. Plans should include landscape management, site restoration and rehabilitation, transporation, etc. Specifications set forth in various plans should then be transmitted into contract specifications and applied to the designated portions of the proposed project.

Specific site design and construction packages should be submitted to the responsible agencies for review and approval prior to the commencement of construction at any site. Once the FPC grants permission to construct the pipeline, specific design details and the exact location of the pipeline will be determined in compliance with all applicable State, Federal and local permits and regulations.

Climate

Mitigation measures related to climate are covered under other parts of this section such as soils and vegetation.

Topography and Geology

Route Location

Mitigating measures necessary to reduce erosion and sedimentation should be included in construction of the pipeline route as much as possible on ridgetops or below the toe of slopes. Cutting across drainageways along the side slopes should be avoided to minimize accelerated soil loss by gullying, concentrated surface water flow, and mass soil movement on steeper slopes.

All landslide and mass wasting hazard areas along the pipeline route should be identified prior to construction. Heavy blasting using the simultaneous detonation of many charges should be avoided on hazard areas. Existing mines, quarries, caves, or other installations in the vicinity of the pipeline right-of-way that could be affected by blasting or other pipeline construction activity should be identified and the probable effects assessed. Modifications should be made as needed.

Allowable load criteria for each landslide bench traversed by the proposed pipeline with supporting analysis should be developed. Precautions should be taken to prevent reactivation of movement of all parts of identified landslides. In areas of known landsliding, monitoring to detect any ground movement should be done. Observation wells should be drilled to provide data on internal drainage, monitor ground-water level and pore pressure, provide internal drainage from the inside of the slide mass, and provide data on the source of any subsequent land movement.

The applicants have said that upon receipt of a permit from the FPC to construct the pipeline, they will conduct a geotechnical study of the pipeline route as required. Based on the results of this study, all potential landslide areas will be avoided whenever possible. Where a potentially unstable area cannot be avoided, appropriate precautions will be taken.

The stabilization method for the specific slopes should be defined, based on the Applicants' and industry-wide experience, and approved prior to construction.

Special surveillance, inspection, and design measures should be implemented in areas involving critical slopes and areas. A careful examination of possible water-saturated soil and the bedrock at the proposed Owens Valley compressor site should be made to determine the site amplification hazard. If necessary, the station should be relocated.

Drainage patterns should be restored within the season they are disturbed. Cuts, fills, waste and borrow areas should be rehabilitated in accordance with approved plans. The applicants have stated that they will consult local experts in developing these procedures.

The applicants have stated that when the route is surveyed, minor rerouting will avoid all extremely steep slopes. All vertical walls will be avoided, and the trench will always be completely backfilled.

Seismic Risk

Active faults in the field crossed by the pipeline should be identified. Appropriate seismic designed construction at such crossings should be used. All available data on earthquakes should be used to prepare estimates of seismic risk for seismic risk Zones II and III presented in a form such as the Average Regional Seismic Hazard Index (ARSHI), and used to formulate appropriate seismic design specifications. The design should specify resistance to seismic shock in terms of peak acceleration (g) magnitude Richter Scale, and the duration in seconds of the shock wave train above a minimum acceleration level, nominally 0.05 g. Structural design should be completed to minimize risk of pipeline failure. Areas along the route susceptible to seismic liquefaction and strong ground motion should be inventoried and a plan presented stating what measures will be adopted (rerouting or special construction methods) where these conditions are found.

The applicants have stated that upon receipt of a permit from the FPC to construct the pipeline, they will conduct a geotechnical study of the route as required. The results of this study will be used as input in the final design of the pipeline to mitigate any potential problems resulting from seismic activity.

Reshaping Right-of-Way

The reshaping of excavated areas should conform to adjacent terrain. The topography should be reshaped to achieve the best ecological conditions;

meet proper drainage and hydrologic patterns and conditions; and present a pleasing landscape. Unusual, objectionable, or unnatural landforms are to be avoided.

Limits on machinery operation and erosion potential are considered essential to the rehabilitation success and maintenance of surface land values (U.S.D.A. Soil Conservation Service, 1971). Some other limitations of various slope classes are listed below.

Surplus rock should be set aside and redistributed on the right-of-way in small, irregular clusters or it could be hauled away to predetermined disposal sites. It should not be left in long, narrow berms.

Level to gentle slopes, 0 to 20 percent, can be reclaimed for irrigated cropland, urbanization, grazing, wildlife habitat, and recreation, including water impoundments. Various land use values may be limited to some extent within this slope class. Erosion hazards and influence on revegetation is minimal. Mechanical treatment, planting, and seeding would only be slightly limited by steepness of slopes approaching 20 percent.

Moderately steep slopes, 20 to 33 percent, can be reclaimed for grazing woodland, orchards, recreation, and wildlife habitat, including water impoundments. Light agricultural machines can be used for rehabilitation in most cases. Moderate erosion hazards will be experienced. Revegetation can be successfully established and maintained with a well-defined rehabilitatiion plan.

Quite steep slopes of 33 percent plus have limited use potential. Grazing may be permitted and suitable wildlife habitat may be established. Use of machinery is restricted. Revegetation of these slopes may be difficult and severe erosion hazards persist, unless stabilizing structures are used.

Soils

Material Sites

Topsoil from material sites should be stockpiled prior to removal of borrow material. After each material site is utilized in accord with an approved site rehabilitation plan the site should be reshaped, the topsoil replaced, and the disturbed area revegetated. Borrow areas should not be located where they could comprise a hazard to pipeline integrity. The applicants will restore material sites on State and Federal lands in accordance with all applicable permits.

Sedimentation

Studies or investigations are needed to determine present turbidity and suspended solids in major streams and rivers crossed by the pipeline. Monitoring stations should be installed to monitor decreases or increases in turbidity. Streams and rivers should be monitored prior to, during, and following the construction phase.

A companion study which documents aquatic ecosystem composition at points downstream from construction should also be undertaken. Aquatic ecosystems should be sampled preceding, during, and following construction.

Results of these studies will be used as an information base in this and future actions of a similar nature. Information provided will enable a more precise definition of timing and methods for pipeline installation.

Soil Erosion and Mass Movement

Detailed soil surveys should be taken immediately on those specific soils which indicate severe erosion hazard or susceptibility to mass movement. These surveys should be made available to all agencies and landowners involved. Survey information would be used to design special construction or erosion control practices; or possible, relocation of the route in those situations where hazards could not be resolved.

Restoration

The Applicant indicates that mitigation measures will not be necessary where the right-of-way crosses farmland, since all disturbances will be plowed under and replanted with crops the following season. The applicants indicate they will consider special requests and preferences of landowners. Past experience with a similar pipeline project has proven that agricultural lands disturbed by trench construction <u>do</u> have differences in soil color and productivity from similar surrounding lands. Besides stripping and restoring topsoil, Applicants should be required to fertilize the scarified and trenched portions of the right-of-way to restore soil fertility. The Applicants indicate they will take into full consideration all specific requests and preferences of private landowners and requirements of jurisdictional agencies for public lands during construction of the pipeline.

To minimize impacts from topsoil contamination, all topsoil of the A and B horizons should be removed and preserved during grading and trenching operations along the entire route. Following backfill, the topsoil should be redistributed over the disturbed area. Proper compaction of fills to the same density as surrounding undisturbed soils would hasten restoration. Even with careful stockpiling, there will be inevitable mixing of upper and lower soil horizons during backfilling. This will cause redistribution of nutrients to lower, inaccessible zones.

Vegetative restoration, initiated within the same season as soil disturbance takes place, will minimize soil losses through wind and water erosion. On public lands the applicants will comply with all applicable permit requirements. During revegetation work, local experts will be consulted.

Snow-fencing, straw bales, or other means should be used to minimize wind erosion on highly susceptible lands such as cultivated fields. Snow fences and straw bales will mechanically slow and eventually halt most wind erosion. The snow fences will also produce snow drifts providing additional moisture to grass seedings later in the growing season.

Corrosive Soils

All corrosive soils along the pipeline route should be identified. Special protective methods should be designed and employed in each area, with special emphasis on the Columbus Salt Marsh area and all soils in Nevada high in acidic concentrations.

The pipeline should be monitored for corrosion control. Corrosion protection equipment should be inspected at intervals of not more than 2 months, and a permanent record of operational data should be made. Whenever any portion of the pipeline is exposed or cut for any reason, the pipe should be inspected for active internal and external corrosion.

Water Resources

River and Stream Crossings

Impacts of river crossings should be lessened by: (1) minimizing the time required for stream crossing; (2) prior site preparation; (3) taking precautions to minimize the number of trees which would have to be removed; (4) locating stream crossings perpendicular to the stream flow; (5) employment of temporary erosion control measures; (6) maintaining flow of the streams and irrigation canals during crossings; (7) laying pipe beneath the scour depth of the streams; and (8) limiting trenching and pipelaying operations to periods of lowest stream flow. Detailed plans should be submitted to appropriate agencies for approval.

The Applicant would submit such detailed plans to appropriate agencies for approval prior to the construction of the pipeline across water courses. The plan should include, but not necessarily be limited to: (1) mitigation measures to reduce suspended-sediment concentration, turbidity, and channel erosion; (2) monitoring of suspended-sediment concentration and turbidity in surface water and of water quality of hydrostatic-test releases: (3) mitigating measures to provide water users with acceptable water quality downstream from pipeline crossing if construction across water courses make water quality and volume unacceptable downstream; and (4) checking depth of pipeline burial at crossing sites where exposure by scour during flooding is a threat to the integrity of the pipeline.

Appropriate pipe-anchorage systems should be used in areas where potentially high ground-water levels could cause flotation of the pipeline. The interaction of the pipeline and thermal water should be avoided.

Also, the Applicants should present their analytical and engineering approach for pipeline crossing of the rivers, selecting specific cases of steep, unstable riverbanks; flood plains; and rivers subject to scouring hazard. The Applicants' data should describe the method of slope stabilization and revegetation selected for each case, the negative buoyancy provision of pipe in rivers and flood plains, and the burial depth to prevent scour exposure.

Any special features, such as pipe weighting and depth of burial to be adopted in traversing dry washes subject to flash flooding should be provided by applicants. Interstate Transmission Associates (Arctic) should submit this information for the Malheur River and Willow Creek.

Oils, chemicals, sewage, or other pollution materials should be stored under strict control. All contaminants should be collected and hauled to waste disposal sites and in accordance with the Spill Prevention Containment and Countermeasure Requirements (40 CFR 112), rather than burning within the right-of-way. None of these materials should be allowed to reach watercourses. Each crossing of navigable waters would require a U.S. Army Corps of Engineers and/or U.S. Coast Guard permit, besides applicable State permits. In evaluating these specific permit applications, other Federal or State agencies, such as the U.S. Fish and Wildlife Service, may require additional mitigation procedures or relocation of crossing sites based on more detailed onsite studies.

Hydrostatic Testing

Hydrostatic tests should be conducted based on a testing plan that will protect the natural environment from any harmful effects. The plan should include:

The source and volume of water to be used for each test segment of the pipeline should be specified. If water is withdrawn from a lake or flowing stream, the withdrawal should be done in accordance with regulations of the appropriate jurisdictional authority. Where feasible, water should be pumped from previous hydrostatic tests sections to the next. Water intakes should be screened to prevent entrapment of fish. Intake rates should be established to minimize impingement of plankton and small fish. When the test is completed, the water should be discharged at a rate which minimizes erosion.

The discharge points and manner in which the water from each segment will be disposed of, including the amount and rate of discharge, the needed water clarification, the location of sumps or other holding facilities, and the first stream which the discharged water will enter should be submitted as a part of the overall construction operating plan. Releases would occur only after inspection and testing for quality and in accordance with Federal, State, and local regulations. If the test water is discharged into a dry waterway (intermittent streams) the discharge rate is not to be greater than what would be experienced during normal flowing conditions.

No hydrostatic testing should be authorized until the plan is approved by the responsible agencies. Settling ponds are required to settle out particulates before water is introduced into streams. Any chemicals, oils, etc., which the testing water would take up while being used should be described.

Surface Drainage Patterns

The Applicants should restore surface drainage patterns along the pipeline route to preconstruction conditions. Wherever closed depressions existed on a bench, these depressions will be regraded to permit runoff of the surface water over the edge of the slope.

Wetlands Protection

Corridors which minimize wetland degradation will be utilized to the fullest extent possible.

<u>Vegetation</u>

Detailed mitigation plans for vegetative removal, disposition, and rehabilitation are needed. The plans should be approved in writing, prior to permit approval, by representatives of the Federal Agencies involved. During revegetation of the right-of-way, local experts will be consulted.

Clearing

In the removal of vegetation, brush blades on motorized brush removal equipment should be utilized to keep topsoil disturbance to a minimum. In all areas the Applicant should be required to remove all vegetative cover and stockpile the topsoil prior to the excavation of cuts and fills. Some areas may require the use of hand removal of vegetation, where mechanical equipment would cause excessive soil compaction and erosion. To reduce soil compaction, removal of topsoil and vegetation should be limited to times when soil moisture does not exceed 25 percent. If this is not possible due to tight construction schedules, then all compacted areas should be ripped. All rare and/or endangered plant species found within the right-of-way clearing limits should be removed from the clearing limits and transplanted near the right-of-way.

Vegetative Disposal

This material should be removed from rights-of-way without undue delay and may be disposed of by: (1) mechanical chipping and mulching; (2) disposal at a sanitary landfill; (3) burning where permitted and appropriate; (4) burial along the right-of-way where permitted; (5) stockpiling of brush for small game cover; (6) sale of logs to commercial operators for construction use or firewood; (7) logging for pipeline construction needs, and at the specific direction of the landowner or agency. Disposal method should be in accord with an approved plan.

Revegetation

Revegetation and other erosion-control measures should be promptly implemented to restore soil stability and vegetation damaged or destroyed by construction. Time of revegetation should be coordinated with the appropriate administrative agency or landowner. Rehabilitation efforts should commence immediately following construction. Certain areas may have to be seeded more than once to obtain a suitable stand.

Mixtures including native species and/or exotics, as deemed appropriate by the landowner or administrative agency having jurisdiction, should be used to revegetate the right-of-way, and other denuded areas.

Species selection is extremely important since reconstituted sites may differ significantly from surrounding areas. Where it is desirable to re-establish natural plant communities, seed and plant materials for native species should be selected to resemble original composition as closely as possible. It is important that undesirable exotic species not be introduced.

Widespread revegetation with introduced species could establish monoculture communities that would seriously affect existing ecosystems. Plants with high palatability factors could cause high concentrations of livestock and wildlife along the revegetated right-of-way. This upsets normal feeding patterns and frequently destroys the new vegetation along the right-of-way. Fencing may be necessary in extremely fragile sites to prevent over grazing by wildlife and livestock.

Several seeding methods are available for planting grasses and legumes. Drilling the seed using readily available farm equipment should be used where possible. Broadcast seeding can be used for small or relatively inaccessible areas. Broadcast seed should be covered by raking, harrowing, or other means. On sites where seeding alone may not be sufficient, other techniques such as the planting of shrubs or trees, protective matting, rip-rap, sediment-retention structures, and terraces should be used.

In the restoration of the right-of-way, mulching and fertilization should be added where required, to help assure revegetation and control of erosion. No area should be completely left to rehabilitate on its own.

Natural rehabilitation should augment, and be supplemental to, man's efforts to re-establish vegetation on disturbed areas. All heavily compacted areas should be mechanically "ripped" to achieve a suitable base for revegetation purposes.

For best results in revegetation and erosion control efforts, locally available expertise should be fully utilized. Criteria for revegetation and land rehabilitation should be obtained from local Soil Conservation Districts, County Extension Offices, State Universities, Federal and State agencies, and others.

Mulching

Vegetation can be established only with difficulty on soils being rapidly eroded. Replaced topsoil is characteristically loose, friable, and susceptible to both wind and water erosion. Mulches increase infiltration, reduce erosion, soil movement, evaporation, soil surface temperatures, and materially enhance revegetation potential, especially where poor soil texture conditions exist. Mulches are most effective in areas where annual precipitation is between 9 and 14 inches. (National Academy of Science, 1974).

Mulch composed of plant residues or other suitable materials should be required as part of seedbed preparation. Acceptable mulching materials are grass, hay, manure, and small grain straw. Other types of mulch material such as straw mat, fine wood fiber, excelsior mesh, plastic mesh, wood chips, gravel, and jute mesh can be used. The type, rate, and anchorage of mulch should be determined by specific site characteristics.

Where wind erosion is a serious hazard, mulching or matting is necessary to protect spoil piles before seeding and to protect seeds and seedlings after revegetation.

Fertilizing

Maintenance of vegetation on disturbed areas depends to a large extent upon soil fertility. Applying manure, sewage sludge, other organic material, or commercial fertilizers will materially enhance the soils capability to supply plants with water and nutrients. The effectiveness of nitrogen fertilizers, however, is dependent on the amount of moisture available. It is generally considered that annual precipitation should be at least 10 to 12 inches to receive benefits from commercial fertilizer on rehabilitation areas. The type of fertilizer and rate of application should be determined to achieve effective revegetation and reestablishment of original productivity.

All cleared right-of-way areas should be treated with commercial or organic fertilizers in sufficient quantities that soil fertility meets or exceeds that which existed before disturbance on those areas where fertilization would produce beneficial results.

Vegetation Monitoring

The Government should monitor vegetative removal and revegetative operations on the right-of-way in conjunction with the Applicants.

a) Rationale - to assure that the contractor restricts his work area within the right-of-way clearing limits, begins revegetation action by prescribed methods, and follows landscape prescriptions.

b) The monitoring method should be visual inspection.

c) The length of time involved in the monitoring should be continuous until both phases are completed.

d) The form and organization of results should be shown through the contracting inspectors' log and summary reports.

e) Disposition and assessibility of results should be through logs and reports. These would be the basis for work acceptance. (Both logs and reports would be available for public inspection.)

f) Conclusions or action to be taken based on monitoring data should provide basis for corrective action by the Applicants if required.

Agricultural Operations

When the pipeline is constructed across irrigated lands, it will be necessary to consult with landowners and the Bureau of Reclamation on appropriate design, timing, restoration, preservation, and construction procedures to avoid adverse effects this construction may have on irrigation operations.

Wildlife

Passage of Fish

Uninterrupted movement and safe passage of fish should be assured. Any artificial structure or any stream channel change that would cause a barrier to fish should provide for a fish passage structure or facility that meets all Federal and State requirements.

Pump intakes should be screened to prevent harm to fish.

Intake rates should be established to minimize impingement of aquatic life.

Abandoned water diversion structures should be plugged and stabilized to prevent trapping or stranding of fish.

If material sites are approved adjacent to, or in certain lakes, rivers, or streams, it will be necessary to construct levees, berms, or other suitable means to protect fish, fish passage, and water quality.

Culverts should be installed to provide for fish passage.

Fish Spawning Areas

Channel changes should be avoided in fish spawning areas.

Fish spawning areas should be protected from sediment where soil material is expected to be suspended in water as a result of construction activities. Settling basins should be constructed to intercept silt before it reaches streams or lakes, whether or not fish spawning areas would be directly affected by the sediment.

The crossings of watercourses, sloughs, and wet areas should be avoided during fish spawning periods or at other times critical to their life cycles.

Fisheries

Existing pipeline crossings of streams should be reviewed to determine actual impacts on streams. Present experience indicates that frequency of breaks is minimal and that impacts resulting from such breaks are insignificant. Methane is not soluble in water; therefore, gas from a minor leak would escape almost immediately into the atmosphere. For additional mitigating measures see Section 4.1.5E.7.

Ecological Considerations

See Section 4.1.5E.8.

Economic and Sociological Factors and Land Use

Isolated Camps and Waste Disposal

In isolated areas of Oregon, Nevada, and California it may be necessary to develop work camps for workers and storage of construction materials. These camps should be developed only where necessary. Uncontrolled individual camping should be avoided. On Federal lands work camps would be developed in accordance with permits issued by the agencies administering those Federal lands.

There are several measures that should be taken to mitigate the adverse impacts associated with waste disposal. Most of these measures relate to the construction phase. Because waste disposal is site specific, the only practical means to identify and mitigate disposal problems is to require that a waste management plant be developed by the Applicant. It should be submitted to the cognizant agency and be based on a detailed assessment of the waste problems at the state of proceedings where it is feasible to make a detailed evaluation. This plan should set forth policy and such details as is necessary to minimize environmental degradation along with needed site rehabilitation. For the purposes of such a plan, it is necessary to properly define solid wastes and construction related wastes.

For purposes of application of Federal solid waste regulations, "solid wastes" means garbage, refuse, sludges, and other discarded solid materials resulting from industrial and commercial operations and from community activities. It does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste-water effluents, dissolved materials in irrigation return flows, or other common water pollutants.

For purposes of application of city, county, State and other regulatory agency regulations over solid wastes, definitions are contained in the various regulatory documents. Specific mitigating measures to be included in this plan are given below.

Stripped Materials and Waste Earth

This material should be either removed from the right-of-way or, in certain cases, be utilized on the site. Careful route selection should minimize the generation of these materials. Removal should include: (1) disposal at a sanitary landfill or approved site; or (2) being end hauled to other locations for fill material. Use on the right-of-way should include: (1) spreading along the pipeline route when the material does not contain rocks over 1 inch in diameter or is not excessively acidic; or (2) use as leveling materials for other areas of construction. Temporary access over streambanks should be made through use of fill ramps rather than by cutting through streambanks, unless otherwise approved. Ramps should be removed upon termination of use, and materials shall be disposed of in accordance with the Waste Management Plan.

Excess Construction Materials

These materials should be removed from the right-of-way and disposed of by: (1) reuse at other points of the construction; (2) disposal at a sanitary landfill; (3) sale to salvage dealers; (4) burning where applicable and where permitted; (5) burial on or near the right-of-way where permitted; and (6) offer the materials to the local population.

Human Generated Wastes

Associated primarily with the construction phase, will be large numbers of people who will generate both solid and liquid wastes. The handling of these wastes cannot be left solely to the small communities adjacent to the construction right-of-way. In many instances these communities cannot or will not be able to handle the problem, specifically in the financial sense. To mitigate this impact, waste management factors should be considered prior to selection of any housing for employees or support personnel. To mitigate the solid waste collection problem it may be possible to: (1) hire a commercial hauler or use the subcontractor as a hauler; or (2) leave the material on the site. To facilitate disposal, the contractor could: (1) use existing garbage disposal systems such as sanitary landfills; (2) use landfills specifically developed by the Applicant to handle the wastes from the transitory construction crews; or (3) attempt to recycle or reuse materials.

Off Right-Of-Way Traffic

Detrimental off-road use which would occur because of new and improved access roads to the pipeline should be controlled where access cannot be obliterated.

Control devices, such as gates, should be installed to restrict unplanned use. The locations of control devices should be determined in cooperation with landowners or appropriate agencies.

The Applicant should not operate mobile ground equipment off the pipeline right-of-way, access roads, state highways, or authorized areas; unless approved in writing by the landowner or administrating authority.

Transportation Facilities

Access plans for existing roads and new construction should be developed, reviewed, and approved in conjunction with appropriate landowners and/or agencies prior to construction.

Existing public and private roads should be used to the maximum extent possible to avoid new construction. Respective landowners and/or agencies should be kept informed of the construction intentions.

The Applicants should be required to widen, where necessary, and maintain all existing roads used in pipeline construction and operation in at least as good a condition as they were in prior to construction. Any new access roads built by the applicant over Federal lands must be built to the specifications of the agencies involved.

Construction of fences and gates (with locks) on private roads leading to the right-of-way "to prevent unauthorized access to the restored right-of-way by recreation vehicles," is a sound mitigating measure which will, if properly done, deter some unauthorized use. Similar measures can discourage the general public from gaining access to the "restored right-of-way" from public roads. Unless the right-of-way itself is fenced, gated, barricaded, or otherwise restricted at public road crossings in conjunction with the proposed mitigating measure, the public will have relatively uninhibited access.

Pipeline construction crossings of most hard-surfaces and traffic flows, pipelines, ditches, levees, and canals should not be permanently altered by construction activities. Warning signs should be placed at all intersections of the pipeline rights-of-way.

All other road crossings should be completed within an 8-hour period. If work cannot be completed in this time period, the Applicant should provide temporary crossings in order to allow traffic to pass through the area until the road is returned to its original condition. Restoring unneeded access roads to near natural conditions will be required. Selection, construction and use of airstrips and communication sites should be by permit from respective Federal and State regulatory agencies.

Farming, Ranching, and Irrigation Areas

When the pipeline is constructed through irrigated lands, it will be necessary to consult with landowners and the Bureau of Reclamation on appropriate design, construction, and restoration procedures to avoid adverse effects this construction may have on irrigation operations.

The pipeline should be buried deep enough in all agricultural areas to prevent interference with existing and planned agricultural systems. Generally, a minimum cover over the pipe of 3 feet is required.

When crossing range lands, fences should not be left open in order to prevent escape of livestock. Cattleguards could be used temporarily or permanently. Open trenches could cause livestock injuries and should be guarded against by hiring someone to patrol the open ditch. Provisions should be made to allow movement of livestock and farm equipment across constuction areas.

When crossing orchards and forested areas, right-of-way widths should be minimized to leave as many trees as possible and to avoid damage to roots of adjacent trees.

Other Land Uses

The possible damage by blasting to the Air Navigation Site in section 13, T 34S, R. 39E, Williamette Meridian (near Rome, Malheur County, Oregon) administered by the Federal Aviation Administration can be mitigated by implementation of the measures outlined in Section 4.1.5.4 (Flammable or Explosive Materials). Minor realignment of the pipeline and compressor stations would mitigate any conflict with the FAA Air Navigation Site.

The special requests and preferences of landowners along the alignment should be given full consideration during all phases of pipeline activities. Following the initial pipeline construction period, all temporary rights-of-way beyond the 50-foot width would revert to the original ownership. Both Southern California Gas Company (SoCal) and ITA(A) would retain an easement for a permanent 50-foot right-of-way, and would hold title only to the land for the compressor station facilities. The land would be allowed to return to its original use where compatible with operation of a buried pipeline.

Archeological, Historic, and Other Unique Values

General Requirements

Archeological and historical survey work must be done at the same time the pipeline is staked so that on-the-ground decisions to avoid or salvage the archeological and historical resources can be made.

An archeologist should monitor the pipeline trench to minimize the damage to hidden and unpredictable finds of archeological and historical resources. To provide for the highest and best use of the archeological and historical resources in these cases, these resources must be salvaged, in lieu of destruction, by professionally approved research design methods. Archeologists can and will identify possible historically important sites along with archeological values, if such provision is made. Historical sites require the services of a historian to best salvage the values inherent in them if they are to be salvaged or otherwise preserved. Surveillance of the archeological and historical resource stipulations must be coordinated with Federal, State, and local agencies having an interest in the land and/or the resources. All their views should be considered so that the best decisions concerning the resource can be made. Consideration must be given to the data and materials recovered as a result of the mitigating action. Funds for laboratory work, research, curatorial work, storage, and publication of results must be provided to complete the job of mitigation and to comply with legal intent.

Additional Measures

The Applicant should be required to employ an archeologist approved by the Department of the Interior to survey for surface archeological and historical values on and near the pipeline. The survey should be done at the time the right-of-way and its supporting facilities, including new roads, are identified on the ground so that any presently unknown archeological and historical sites encountered can be avoided by alteration of the pipeline route or by contracting for the scientific excavation of these sites. The archeologist should also inspect the pipeline trench for subsurface archeological sites concurrently with the trenching operation.

The Applicant should comply with procedures to nominate sites for the National Register of Historic Places, under Public Law 93-291, Section 106 of the Historic Preservation Act of 1966, Executive Order 11593 and 36 CFR

800. All such compliance should be in coordination with the State Historic Preservation Officer and with all Federal, State and local agencies and organizations interested in the land and/or the resource.

All surveys and excavations should be done under a research plan reviewed by at least three peers from institutions other than his or her own, by the Federal, State or local agencies interested in the land and/or the resource, and the State Historic Preservation Officer as well as approved by the Secretary of Interior under Public Law 93-291.

All known or discovered historic and archeological resources should be inventoried and evaluated, prior to construction. A protective buffer zone along any known historic trail segments (located within one-fourth mile either side of the right-of-way) will be established on the ground by the Applicant and the representatives of appropriate State and Federal Agencies. The State Historical Preservation Officer should also be contacted to approve protection of sites and facilities situated on State and private lands.

All identifiable historic roads and trails with visible remains of the road or trail should be crossed with a minimum area of disturbance or avoided. This may require passing the pipeline underneath the road or trail without disturbing the surface on either side of the historic road or trail.

Where historical or archeological resources, sites, and properties cannot be avoided, the Applicant, in consultation with the archeologist, the State Historic Preservation Officer, and/or the affected Federal, State or local agency should secure the services of a Departmentally approved historian or archeologist to document the findings. The report is to be made available to the State Historical Preservation Officer, the Applicant, and the landowner or appropriate agency.

If suggested mitigation measures are carried out, there is no need for liability or compensation. The Antiquities Act of 1960 provides fines and imprisonment for violations which would occur if the mitigation and additional measures are not carried out.

Recreational and Esthetic Resources

The proposed mitigation measures are far too general. Landscape management plans need to include the following specifics:

Timing - when rehabilitation efforts will be made

Techniques - specific techniques to be employed

Species - what species will be used in revegetation (should be Native)

Screening - specific methods to be employed (height, color, composition density, etc.)

Onsite conditions - specific conditions requiring mitigation work.

If a natural vegetation screen cannot be left, the planting of native shrubs or low-growing trees, should be accomplished to provide screening. Compressor stations should be landscaped and screened from highways and for noise abatement. Buffer strips of shrubs and trees should be preserved between all types of construction sites and waterfowl-use areas.

Designated Areas

No construction activity in connection with the pipeline system should be conducted within one-half mile of any officially designated Federal, State, or municipal park, wildlife refuge, research natural area, recreation area, recreation site, or any registered National Historic Site or National Landmark, unless such activity is approved in writing by the administering agency.

Esthetic - Scenic

To lessen the visual impact of the clearing (mostly of a line nature) the following methods of right-of-way location and establishment of clearing limits should be implemented.

1) Clearing width should be varied by scalloping to decrease line effect.

2) Natural openings should be followed where possible, to decrease the line effect.

3) Islands of vegetaion should be left where possible in wider clearings to break up line impact.

4) The edge of right-of-way should be feathered to decrease "wall effect" where practical. The responsible government agencies will need to determine whether the mitigation of the esthetic impact by feathering outweighs additional impact created by the procedure.

Trees and other vegetation cleared from the right-of-way should be disposed of as required by regulatory agencies. Unsightly tree stumps which are adjacent to roads and other areas of public use should be cut close to the ground and/or removed. Right-of-way should not be cleared to the mineral soil, where possible. Where mineral soil exposure does occur in visible areas of the right-of-way, the topsoil should be replaced and stabilized by the planting of appropriate native species of grass, shrubs and other vegetation and properly fertilized where required.

Buffer strip techniques should be used to screen foreground and middle ground views of right-of-way at road, railroad, and river crossings, where at all practicable. As to techniques to screen foreground and middle ground views, the clearing should be done in such a way that a screen of natural vegetation remains in the right-of-way on each side of the road or river. Where possible, a buffer strip of timber should be left between the right-of-way and major routes of travel. As a general rule, no vegetative cover should be cut or removed within a minimum 500-foot strip between State highways and material sites.

In natural vegetation, if clearing is such that a screen cannot be left, the planting of native species of plants or low-growing trees should be accomplished to provide screening. Compressor stations should be landscaped to screen sites from highways and major travel ways.

Buffer strips of shrubs and trees should be preserved between construction sites and waterfowl-use areas, where at all practicable.

Where the right-of-way crosses farmland, mitigation of the esthetic values impacted will be necessary. Here proper backfill procedures must be followed to prevent settlement or trenching. Topsoil should be retained and replaced. The surface should be fine graded, fertilized, and revegetated with plant species approved by the landowner.

Air Quality

There are a number of measures that can be implemented in order to mitigate the adverse effects of air quality degradation. The sources of air quality reduction include construction-related engine-powered equipment, compressor stations, burning materials, windborne dust, and other operation or maintenance functions. Possible mitigating measures are given below.

Fugitive Dust

Fugitive dust emissions can be largely eliminated if "reasonable precautions" are applied. Generally accepted precautions shall consist of:

Water or dust retardant application;

Covering of dusty haulage loads;

Paving or other dust-free surfacing of roads;

Planting suitable vegetation; and

Following stated requirements on numerical restrictions on dust fall.

Fugitive dust emissions will be most prominent during construction operations. Principal sources of fugitive dust will be excavation operations, and traffic on access roads, the right-of-way, and haulage roads. All of these will be aggravated by wind. During excavation and primary earthmoving stages, there are practically no measures that can be employed to reduce the release of dust from ground breaking and transfer of earth.

After excavated earth has been loaded aboard trucks for hauling, the fugitive dust emissions should be almost completely eliminated by application of water to roadways, and by covering or water application to loads. Heavily used roads and access ways should be treated by application of oil or a similar dust retardant as a long-term means of suppressing fugitive dust.

When construction and installation of the pipeline is completed, fugitive dust should be eliminated completely by suitable revegetation to grass and other vegetation.

Combustion Products

Particulate Matter

Since properly tuned and operated engines emit negligible particulate matter, it is a minor problem. The impact that does occur could be mitigated by requiring proper vehicle engine maintenance. The gas turbines of the compressor stations would not emit particulates during steady operation, and thus no mitigating measures are recommended.

Open burning operations could emit significant amounts of particulate matter. These emissions should be minimized by adopting the following procedures:

1) Employ open burning of land-clearing wastes and construction wastes only when no sanitary landfills are within reasonable hauling distance.

2) Avoid open burning of dangerous materials (e.g., chemicals, solvents, pesticides, explosives), cily and asphaltic materials, and plastic materials.

3) Open burning should be conducted as far frcm populous areas as possible, and in no case closer than 1,000 feet to any inhabited residence.

4) No open burning should be permitted in river valleys or other confining geographical features.

5) Employ open burning only during daylight hours, and only when atmospheric conditions are conducive to rapid dispersion of pollutants (Class C atmospheric stability or better).

6. Fires for the comfort of personnel should be confined to burners designed and manufactured for this purpose, which employ fuel refined for this purpose.

Nitrogen Oxides

The principal method of reducing the impact of nitrogen oxide emissions is to maximize their dispersion in the atmosphere. Generally, this is achieved by providing exhaust stacks that are as tall as possible. Dispersion is necessary because there is no demonstrated, commercially available technology that will significantly reduce NO_x emissions from engines fired by fossil fuels.

Valleys resist dispersion and therefore must be protected by avoiding concentrations of emissicn sources (vehicles).

Carbon Monoxide

Although carbon monoxide (CO) emissions are not expected to make any significant contributicns to ambient air pollution, their impact should be minimized by measures that insure the closest possible approach to complete combustion. These measures include tuning of vehicle engines, steady operation of compressor engines (operating at the optimum conditions of combustion efficiency), and the use of "good practice" in management of fires employed in trash disposal and comfort of construction personnel.

Hydrocarbons

These will appear only to the extent that construction and transfer vehicles emit hydrccarbons as a result of inefficient combustion fuel (diesel or gasoline). Therefore their impact should be reduced by the same techniques employed to reduce carbon monoxide emissions. There is no significant emission of hydrocarbons from gas turbines, and thus no mitigating measures are necessary.

Air Pollution Alerts

The entire route is within a geographic region that features low minimum mixing heights (500 meters or less). Temperature inversions can be expected to exist much of the time, especially during the winter months, in mountain valleys. Therefcre the possibility of severe air pollution incidents is greatly enhanced. If alerts are given, all mobile equipment should cease operation for the duration of the alert and all fixed installations shall carefully monitor their facilities to insure compliance with local law.

Gas Discharge

Any necessary discharge of natural gas should be restricted to periods of favorable weather when no atmospheric inversions are anticipated and winds will provide good ventilation.

Monitoring Effects at Compressor Stations

State air quality regulations fcr compressor stations in each state in which they are located should be met. A rigorous study of NO_2 and CO ground level emissions should be made promptly at each proposed compressor station site to remove discrepancies in currently deficient data. The studies should include, but not be limited to: (1) pollution emission rates so that independent calculations can be made, i.e., Btu/cubic foot of fuel, fuel use, load factors for each unit and estimated emission factors for each pollutant; (2) equation used in computing ground level concentrations (for conformance with) Federal or State standards; and (3) meteorological values (the basis for their selection and the locations at which measurements were made).

Environmental Noise

The primary noise impact is sound emitted by engine powered heavy equipment, thus the primary mitigating measure should be mufflers. Since the U.S. Environmental Protection Agency has recently adopted noise standards for trucks used in interstate commerce, these standards should be applied to all offsite diesel engine pcwered trucks to be applied by specification with the construction contractors. Pipe hauling should be restricted to daylight hours in the mcre populous areas. Air compressors should meet U.S. Environmental Protection Agency standards. Annoyance from construction noise is greatest during evening hours. In order to mitigate the disturbance, construction should be avoided between 9 p.m. and 6 a.m.

Since blasting results in environmental noise of serious nature and ground vibration of large magnitude, control of explosives used is important. An explosives management plan is to be submitted to the cognizant agency when detailed knowledge of the need for and the potential adverse effects of any blasting are known. The plan should set forth policy and should include blasting techniques; blasting locations; methods for avoiding rockfalls and landslides; and damage to structures, people, and wildlife, particularly aquatic. Minimizing charge size, and blasting only during the day should be required.

Sound from the compressor stations and venting would be the only environmental noise problem during the ncrmal operational phase. All of the 13 proposed stations will be constructed in essentially rural or undeveloped areas which presently are very quiet. The distances at which residences will be impacted by a normalized L_{dn} greater than 55 dB can probably be reduced from 5,400 to 3,900 feet by acoustically treating the compressor building and by treating the turbine intakes and exhausts with additional silencing equipment (beyond the standard manufacturer's measures). These mitigative measures should be engineered to reduce the sound levels of the stations by a minimum of 8 dBA.

All stations should be designed to meet the noise regulations established by the state or county they are located in.

In particular, it is important to put the exhausts and fans on the far side of the station buildings from the nearest residential area.

Gas blowdown from a high pressure line would create a very intense noise source (see Section 3.1.5E.15) that could be heard for many miles. These vents should be equipped with mufflers that do not permit the gas to pass straight through. Minimum reduction should be 30 dB; the specific design, however, must depend on the proximity of people with regard to the State of Oregon regulations.

Hazards

Fire

Grass and Woodland Fires

Grass fires in grasslands and brush fires in wooded areas traversed by the pipeline route may occur as a result of construction activities or failure of the pipe. (See Part I, Overview for further discussion of this subject.) With an adequate fire protection program in compliance with OSHA and the creation of firebreaks between the right-of-way and the woods or fields adjacent, such hazards can be severely reduced.

Debris Fires

Accidental or deliberate burning of debris during construction, such as brush, trees, and excess construction materials, can get out of control and pose a hazard onsite and offsite. An adequate fire protection program and removal of waste from the site expeditiously can reduce the danger.

Fire Control Measures

The Applicant should be required to develop fire prevention and control plans with the Federal and State agencies responsible for such action. These plans should cover, among other items, the training of company personnel in forest and range firefighting, and the availability of firefighting equipment, including portable radios having frequencies used by the fire control agencies.

Also, the Applicant should be required to maintain adequate firefighting equipment and trained manpower to combat wildfires caused by construction and operation of the pipeline.

Flammable or Explosive Materials

Explosives Use

Explosives will be necessary for trenching along certain parts of the pipeline route.

The hazards of blasting to humans are well known, the hazards to aquatic life are less well known. Consequently there are numerous regulations, Federal, State and even local, which control their use. Subpart U of the Occupational Safety and Health Act (29 CFR 1926) gives detailed instructions to minimize explosive use hazards, and 26 CFR 181 deals with transportation of explosives.

A use and storage plan for explosives should be developed and submitted to the several cognizant agencies. In particular, the locations of blasting should be identified, the charge size should be known, the methods for minimizing the hazard to aquatic life at stream crossings should be used, location and security procedures should be undergone for storage of explosives and precautions should be taken for use of explosives near high electric fields. Of particular importance is the security of explosives from radical social elements. This plan would permit verification of legal compliance as well as permit assurance that nearby structures or pipelines would not be damaged, or that landslides or rockfalls would not be initiated.

Oil and Gas Spills

There may be occasion, during construction or operation, where flammable liquid petroleum products may be spilled and be a fire hazard. Compliance with 29 CFR 1926.150 on fire protection programs, 29 CFR 1926.152 on storage of flammable liquids, and 29 CFR 1926.252 on removal of waste should insure minimizing these hazards.

Plans for storage of oil or other combustible material must be developed and filed with EPA and other appropriate agencies. Approval of these plans is required.

Land Use

Land use conflicts or safety hazards between the pipeline and its location on the U.S. Navy China Lake Test Station and the railroad marshalling yard at Winnemucca, Nevada, should be carefully evaluated and resolved. It appears the hazards could be mitigated by relocation of the pipeline or by other methods such as special engineering design.

Proximity to High-Voltage Lines

The pipeline would cross under several power transmission lines and the right-of-way will abut existing and proposed transmission lines for several miles. There are several potential hazards associated with this. Corona discharge at the surface of a conductor or between two conductors and the same transmission line could be hazardous. During construction of the pipeline, hazardous potentials could be developed on mechanical equipment or the pipeline if they are improperly grounded. Ground mats and insulating gloves may be necessary if proper grounding cannot be guaranteed. During the operation phase, the electromagnetic field of the transmission line can induce potentials on the line that will result in accelerated corrosion and potential for leaks. A proper cathodic protection system can reduce this adverse effect.

Fault currents caused by the voltage surges of lightning or powerline faults can cause arcing and would create temporary excess potentials on the pipeline that can be reflected in danger to any personnel in contact with the line. The applicants have stated that they have developed procedures with the Bonneville Power Administration for crossing under high-voltage power lines.

Class Changes

Regulations under 49 CFR 192 classify land use by a numerical class scheme. The class rating depends on the number of occupied buildings near the pipeline. The spacing of mainline block valves and maximum pipe pressure is determined by the class. Periodic inspection to determine class is required by 49 CFR 192.179, and it gives specific instructions for subsequent action to improve safety should a class change occur. These rules appear sufficient to minimize the safety hazard.

Construction Activity Requirements

Trench Collapse

Trenching operations will occur in all types of soil and rock, in both wet and dry lands, and in wet and dry weather. These factors and the proximity of heavy construction equipment to the trench can be the cause of trench collapse. Under ordinary conditions there will be no need for anyone to be in the trench, since all work on the pipe is done prior to lowering. There will be occasions, however, when someone may have to enter the trench. For example: to repair a weld shown to be poor; to repair a damaged wrapping; to make tie-ins at river crossings; or to make a bore. Because of this possibility, the provisions of Subpart P, 29 CFR 1926, Excavations, Trenching and Shoring of the Occupational Safety and Health Act would apply. That subpart is quite detailed and appears to be adequate to provide reasonable safety on the present project. Criteria should be established for those safety precautions to be taken where workers are required to enter the trench.

Open Trench

For a short period during construction, the trench would remain open and would be a menace to cattle and children. A safety hazard of this type is well recognized and the present construction must comply with paragraphs 200, 201, and 202 of 29 CFR 1926 regarding signs, signals, flagmen and barricades. These provisions appear adequate to cover the present construction.

Bridge Failure

Since much of the pipeline is to be in rural areas, the local bridges may not be adequate to carry the heavy hauling trucks and construction equipment. Failure of these bridges under load could pose a serious safety hazard. Means must be found for determining the <u>actual</u> load capacity of each local bridge to be crossed, and if it is deemed marginal, means for circumventing the bridge must be developed.

Landslides and Rockfalls

The areas of potential landslides and rockfalls along the route must be identified. The discussion in sections 2.1.5R.3 and 3.1.5R.2 covers this topic area. Identification, avoidance, or special design should minimize these hazards.

Blowdown Stacks

Criteria should be furnished for locating line and compressor station blowdown stacks to minimize danger of ignition of the gas released to the atmosphere, and any potential problems in this regard along the pipeline route.

Lightning Protection

Lightning protection should be provided for buildings and other aboveground facilities in accordance with ANSI C5.1, Lightning Protection Code (1968).

Shutoff Valves

Automatic shutoff valves should be installed that would be activated by an accelerated decrease in line pressure, namely, a pipe rupture.

Transportation of Injured

Proposed means for transportation of personnel injured on the site should be submitted. Distances to the nearest hospitals should be identified and transportation plans developed.

Welding

The welding process has a number of potential safety hazards associated with it, ranging from mechanical and electrical injuries to fires. Paragraphs 252, 351, and 352 of 29 CFR 1926 control these activities and appear adequate to insure reasonable work safety.

Mechanical Equipment Operations

Welds

Welds are an important and weak link in the integrity of a pipeline. Excessive stresses applied to the pipe, coupled with a welding flaw, can result in pipe rupture. The causes of such stresses and the hazardous consequences of rupture are discussed in Part I, Overview. Subpart E of 49 CFR 192 details the safety requirements for welded steel pipes. The Applicant would be required to use a "holiday" (leak) detector over the entire pipe length to detect flaws in the pipeline coating.

Construction Faults

The handling and installation of the pipe, if done in a sloppy or poorly supervised way, can add residual stresses to the pipe which would enhance the possibility of pipe rupture. Paragraphs 317, 319, 325, and 327 of 49 CFR 192 cover possible faults in installation which must be complied with and appear to be adequate for the pipeline.

Microwave Towers

Although no specific heights are known as yet for the microwave towers, their separation distance suggests they may be between 100 and 300 feet in height. In rural areas these would be the tallest structures, and would pose an air safety hazard, particularly to crop dusting aircraft. Day and night marking as an obstacle must be done in conformance with State and Federal Aviation Administration Regulations.

Corrosion

Corrosion of the pipe, being a major factor in failure, can pose a safety hazard. Paragraph 465 of 49 CFR 192 requires that corrosion protection equipment be inspected at intervals of not greater than 2 months. Annual surveys of pipeline voltages must be made to insure that cathodic protection systems are functioning. Patrols required by 49 CFR 192.705 will reveal the encroachment of power transmission lines or other activities that may enhance corrosion.

Overpressure

Overpressuring of the pipeline could occur over a long term in an attempt to increase flow, or over a short period as a transient response to changing flow conditions. In either case, there is potential for pipe rupture (see Part I, Overview). Because this is an important safety hazard, 49 CFR 192 paragraphs 105, 197, 199, 201, and 203 cover means for avoiding such danger. These sections must be complied with, and appear to be adequate for the future expansion of the line.

Block Valve Failures

Because of the massive volume of natural gas in the pipeline, a serious safety hazard would occur if the mainline block valves failed to close. Title 49 CFR 192.179 specifies the separation of the block valves and requires that the valve be readily accessible and protected from tampering. Compliance with this regulation only, would be insufficient to insure adequate safety. The mainline block valves must be automatically activated upon a decrease of pipeline pressure. In addition there must be a test procedure to insure that the system is operative.

Station Hazards

Since a number of activities would occur at compressor stations and since the piping would have a number of bends and connections, there would be several opportunities for safety hazards. Fire and explosion hazard is by far the most serious. Paragraphs 163, 165, 167, 169, 171 and 173 of 49 CFR 192 address the station safety problem, and these provisions are applicable to the project. The station must be designed of noncombustible materials and have two exits per floor. All wiring must conform to the National Electrical Code. The exterior of the building must be free for movement of fire equipment, and gates must open outward. The station must have automatic compressor shutoffs and should have a high liquid level alarm to prevent slugs of liquid from passing through the compressor. The station must have internal gas detectors, be able to keep out further entrance of gas, and be capable of ventilation. Present plans call for these stations to be unmanned so the safety hazard is restricted to equipment, occasional maintenance crews, and nearby homes. The stations are fairly remote from habitation. No statutory provisions exist to require remote monitoring of unmanned station operation with regard to safety, and such monitoring should be required.

Weather and Outside Forces

Earthquake, Subsidence, Accidental Contact, Landslides, and Floods

These occurrences can result in pipe rupture and the consequent safety hazard. This topic is discussed more fully in Section 3.1.5R.3 and the measures to control and mitigate these dangers appear in other sections. The monumental impact of a pipe rupture and the procedures for responding to it are not well developed, especially for such a large project as this. The capability of a rural fire department to adequately respond to a massive pipe rupture, explosion, and fire, along the line or in a compressor station is seriously in dcubt. More than an educational program is required to resolve this problem. The Materials Transportation Board notice 75-1 of March 25, 1975 proposes upgrading paragraph 615 on Emergency Plans. Although leaving much leeway to the pipeline operator, it further defines those actions required to minimize the potential hazards from pipeline failure.

General Measures to be Taken to Reduce the Risks from Hazards

Precautionary Signs, Shields and Barricades

Paragraphs 200 and 202 of 29 CFR 1926 detail the types of signs and barricades required and the section totally discusses the requirement for use of these devices during construction activities. All major aboveground facilities such as compressor stations, microwave towers, metering stations, and mainline block valves must be fenced during the operational phase to prevent general access and must have precautionary signs. The pipeline itself must be clearly marked at road and water crossings and at other points where potential digging may occur, in accordance with 29 CFR 192.707.

Restricted Access

Access must be restricted to all major aboveground facilities of the pipeline by appropriate barricades during the operational phase. During construction, the site itself must have restricted access to avoid inexperienced personnel from injuring themselves or others. The pipe storage areas must be restricted. Any explosive storage areas must be securely locked, and special precautions must be taken at blasting sites to restrict access. Partially disrupted highway crossings must have flagmen in conformance with 29 CFR 1926.201.

Hazardous Material Areas

Explosive storage must be done in conformance with 29 CFR 1926, 909 and 26 CFR 181, and transportation must conform with 29 CFR 1926.902. Due to the severe safety hazard associated with explosives, an explosives use plan must be submitted to cognizant authority at the initiation of construction.

Due to their size, extreme weight and need for extensive manipulation, the pipe sections will pose a potential safety hazard. Pipe storage areas have not been identified, but access to them must be restricted if they are used, and stacking must be in conformance with 29 CFR 1926.250.

Extreme Weather Shelters

Construction crews should be experienced with the weather conditions encountered along the route. It is highly unlikely that any special precautions need to be taken in this regard.

Transportation of Injured

The main concern would be during the construction phase of the project, and compliance with 29 CFR 1926.50 is required. This paragraph requires that proper equipment for prompt transporation of injured persons shall be provided. No specific plans for such equipment have been submitted to date.

Fire Control Measures

A fire protection program is required during the construction phase by 29 CFR 1926.150. No program has been submitted to date. Fire hazards have been discussed relative to flammable materials, grass and woodland fires. Each of these specific areas must be included in such a program.

Additional Measures

Eye and face protection, welding goggles, ear defenders, hard hats, dust filters, x-ray guards and ventilation would have to be provided where necessary to prevent injury in compliance with 29 CFR 1926 during construction. Power operated hand tools must comply with paragraph 302; construction equipment must meet the requirements of Subparts N and O. Life jackets must be supplied to crews on major river crossings (1926.106). During operation, employees are to be protected by compliance with 29 CFR 1910, the Occupational Safety and Health Act.

Measures Taken by Applicant to Assure Minimal Adverse Impact During an Emergency Condition

No specific information was supplied by the Applicant. The subsections above discuss many of the safety hazards and the regulations related to them, that must be followed by the Applicant.

Applicable Local, State or Federal Building Codes

The Applicant would be required to design, construct and operate all facilities in accordance with all applicable building codes. Most applicable Federal regulations have been referenced in this report in appropriate sections. No attempt has been made to list all applicable State and local building codes.

4.1.5R.5 Minor Alignment Changes

Use of Minor Alignment Change for Mitigation

Minor alignment changes could be used as an effective measure to reduce environmental impacts of the pipeline. A detailed analysis of natural resources, land use, and cultural factors along the right-of-way is required. Also, the absence of certain detailed information on the expansion route, such as access roads, spoil areas, storage areas, and other requirements closely related to relocation, demonstrates the need for additional detailed analysis.

These information shortages can best be obtained through the use of technical interdisciplinary teams which would review route location and design, analyze specific environmental information, and make recommendations as to preferred route locations. The teams should include a wide range of professional and technical expertise which would be capable of accurate assessment of all factors along the route. The teams should be made up of representatives from Federal and State agencies which have responsibilities with regard to the proposal, and other from universities or other sources as required.

Authorization on the project should be withheld until the Secretaries of Interior and Agriculture have reviewed documented reports that identify all reasonable mitigation relocations, including their ramifications. Unresolved final locations would be subject to the final decision of the above Secretaries.

Identified Minor Alignment Changes

During the analysis of the proposed future expansion action, numerous comments were received from Federal and State field offices with regard to minor route relocations. These are summarized in the following section. The route relocations identified appear to be viable and logical options which are available at this time. Major alignment changes have been addressed in the Route Alternatives to the Proposed Action.

Southeastern Oregon

Field review of the proposed route by the Vale BLM District identified several critical areas which would be crossed in southeastern Oregon (Figure 4.1.5.4-1). These have been identified as follows:

1) Brogan Canyon - A critical deer winter range.

2) East slope of Cottonwood Mountain - The future expansion route would be high enough on the slope to present an adverse visual impact which would be viewed for a considerable distance.

3) Cottonwood Creek Canyon - A deer winter range and nesting area for Golden Eagles.

4) Little Valley Canyon - Much of the soil in this area is of a light fragile diatomaceous type which could present erosion problems.

5) Dry Creek Canyon - this is a deep canyon with precipitous walls and is inaccessible where the proposal would cross. This would require building a fairly extensive access road in an area susceptible to flash flooding and presently free of man's disturbance.

6) Cedar Mountain - an important deer concentration area with extensive rock outcrops which could present severe construction problems.

7) Red Butte Area - the proposed line would have severe visual impact in an area identified as having excellent scenic qualities.

8) Bull Creek Canyon - this is a steep canyon which would be scarred by the proposal affecting the esthetics of the area.

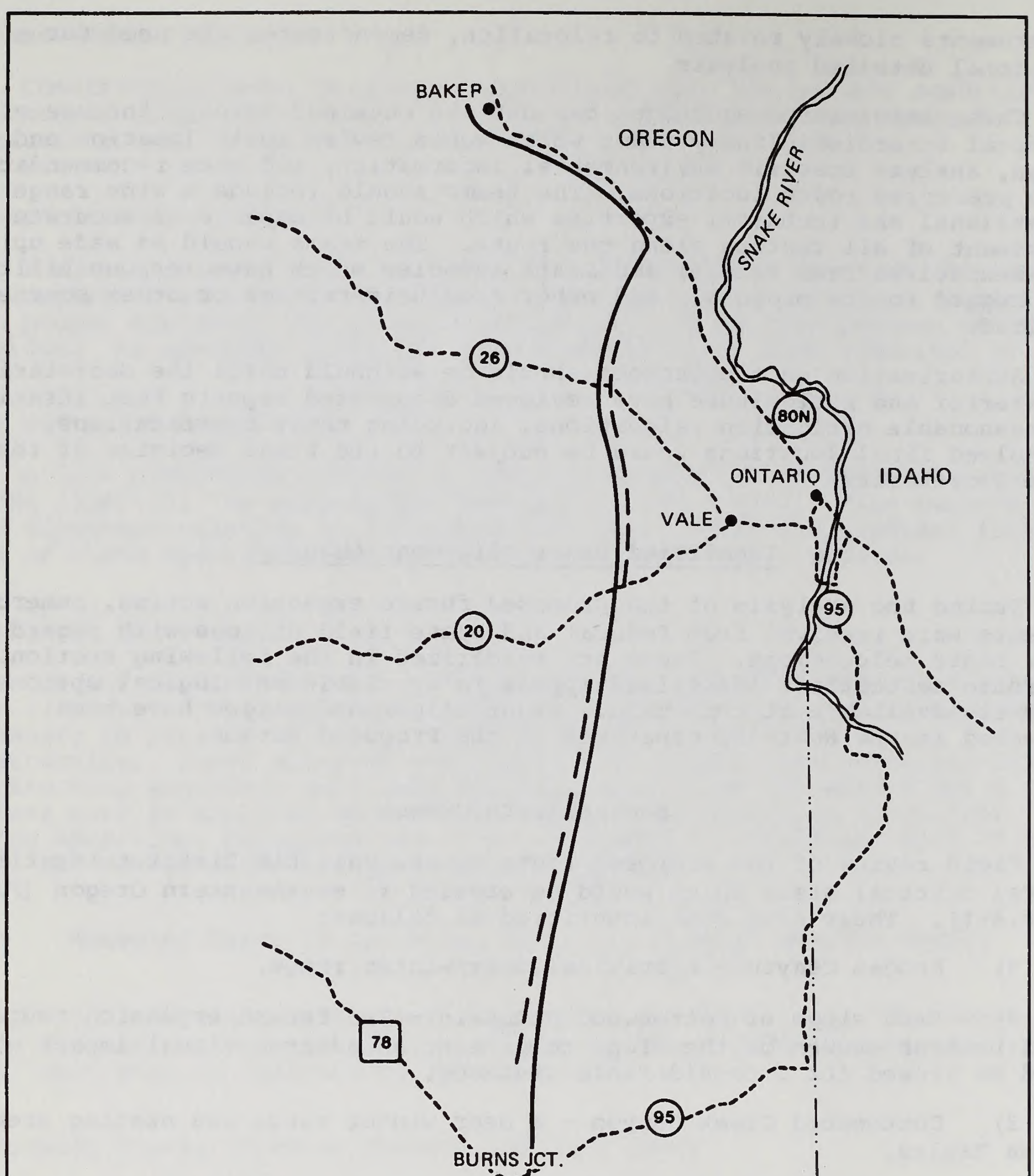


Figure 4.1.5.4-1 Proposed minor alignment map; southeastern Oregon

Resource impacts identified in items 1 through 8 appear to be very significant.

The route relocations deserve intensive analysis to determine feasibility as mitigating measures.

North Central Nevada

The expansion route crosses U.S. Highway 95 in Sec. 3, T. 41N., R. 37E., crosses on or near the steep face of the Santa Rose Mountains, and follows along the east side of the highway for a distance of approximately 7 miles, where it recrosses U.S. Highway 95. Construction of this 7-mile segment in the proposed location would have an adverse esthetic impact (Figure 4.1.5.4-2).

It appears possible to relocate the pipeline route on the west side of U.S. Highway 95 along this entire segment, thereby mitigating adverse esthetic impacts. This route relocation should receive detailed analysis.

Southern California

Between Red Mountain and Victorville the expansion pipeline passes through approximately 42 miles that are relatively free of man-made developments and access roads at the present time (Figure 4.1.5.4-2). To avoid the impact of introducing a pipeline and access roads into this undisturbed area, the right-of-way could be relocated to follow the route of an existing PG&E pipeline which passes to the west of Red Mountain and parallel to U.S. Highway 395. This route relocation would parallel U.S. Highway 395 all the way from Red Mountain to the terminating point at Cajon. This route relocation deserves further study.

Dixie Valley, Nevada

A Sierra Club representative stated that emphasis should be placed upon identifying corridors and management plans from the outset, to encourage common corridors if they are consistent with State and Federal land use policies. For a route relocation in Nevada, the representative suggested the following route to minimize environmental damage, and follow existing transportation corridors:

> From a general pipeline location near Winnemucca the alternative route would head southwest following the existing Dixie Valley road to Highway 50, following Highway 50 to State Highway 23, then parallel to Highway 23 to Highway 95, and then follow Highway 95 to Coaldale Junction (Figure 4.1.5.4-2).

This also would provide better access for construction crews. The route relocation deserves intensive analysis to determine feasibility and mitigating measures.

Southern California Desert Route

Another recommended route was to follow Highway 95 south from Mina, Nevada to the vicinity of the desert south of Death Valley, thence to Cajon Pass (Figure 4.1.5.4-2). The recommended route relocation was suggested to avoid about 24 plant species that reach

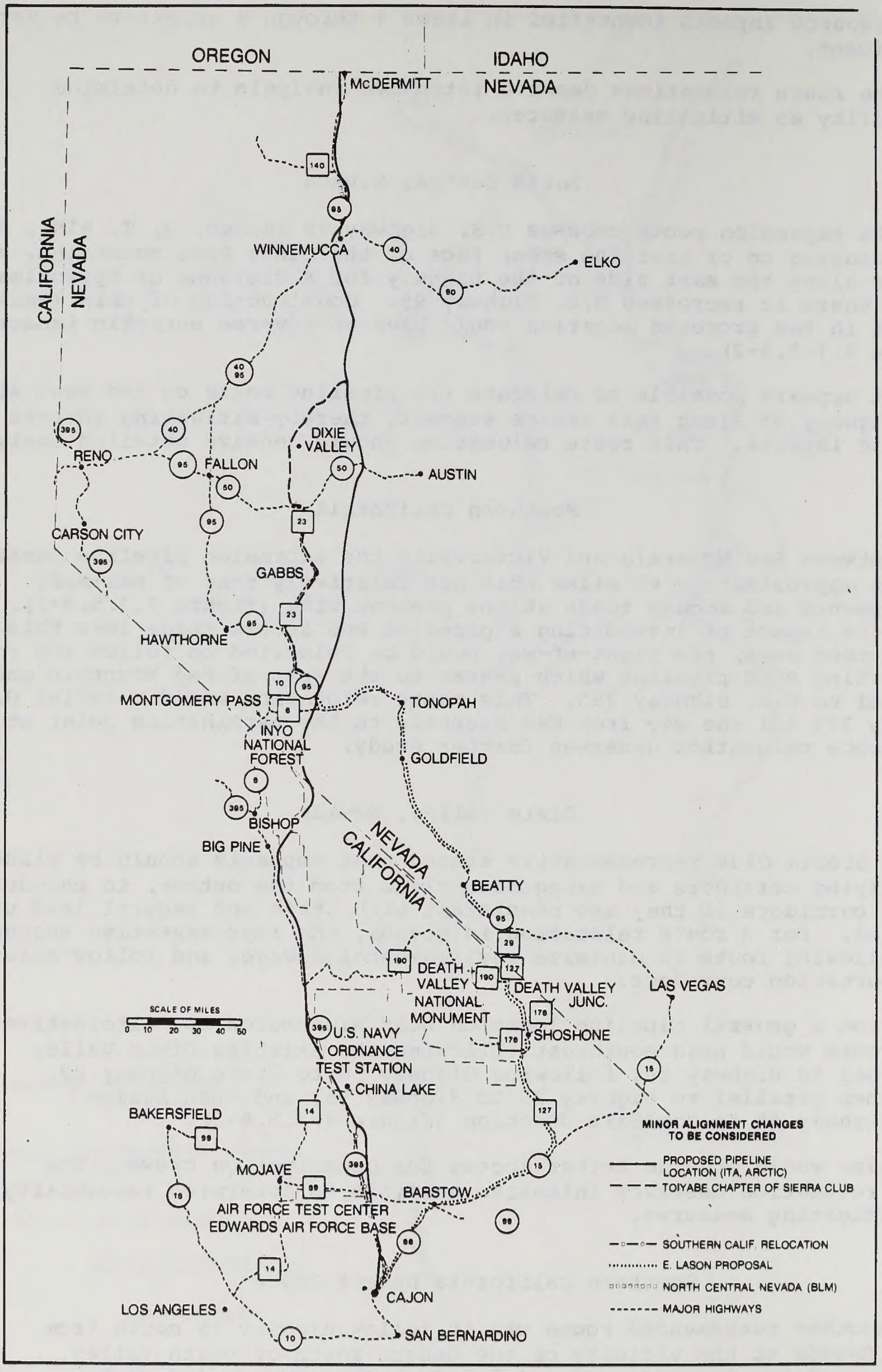


Figure 4.1.5.4-2 Proposed minor alignment map; Nevada-California relocations

their northern or southern limits in their geographic distribution. This route relocation should receive detailed analysis.

5 ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

5.1 ARCTIC GAS PIPELINE PROJECT

5.1.5 Los Angeles Pipeline

Introduction

This section is divided into two subsections. The first addresses the currently proposed project from Eastport, Idaho, to Rye Valley, Oregon, and uses designations 5.1.5E._. The second subsection addresses a potential continuation of the project from Rye Valley to Cajon, California, is titled "Future Expansion," and uses designations 5.1.5R._.

This section summarizes the residual adverse effects which cannot be avoided should the proposal be implemented and recommended mitigating measures are applied during construction, operation, and maintenance of the project.

Unavoidable adverse impacts to ecological systems would be reduced by mitigation efforts. The residual adverse effects would be reduced by mitigation efforts. The residual adverse effects vary in magnitude and intensity along the proposed pipeline by resource. No attempt is made to compare the relative magnitude of impacts between resources. Judgmental comparisons are made within the summaries for each section, (e.g., wildlife).

To provide a logical means of cross referencing, this Section is identically organized to the basic outline of Section 3.1.5, Environmental Impact of the Proposed Action. This basic outline is followed even in cases where no residual adverse effects on a resource are anticipated; in such cases, a brief statement is provided noting this fact.

5.1.5E Eastport of Rye Valley

5.1.5E.1 Climate

The proposed project will have no significant adverse effects on the climate.

5.1.5E.2 Topography

Unavoidable effects on the topography follow.

- Minor changes in the land surface will be caused by the reworking of disturbed soil in and adjacent to the trench by wind and water.

- Minor changes in the land surface will result from the crown of spoil over the trench backfill.

- Terraces designed to divert sheetwash and gullying on steep slopes will constitute an unavoidable change in topography.

- Sidehill cuts on moderate slopes made during construction will be mitigated in part by early restoration to the original land contour of the disturbed area. The restored area will not look the same as the original surface but if restoration is successful the effect on the topography should be minor.

5.1.5E.3 Geology

Consumption of geologic resources during pipeline construction will be limited to minor amounts of sand and gravel, crushed rock and Portland cement (from limestone).

Production of future geologic resources will be limited in the vicinity of the pipeline. Lost resources would lie within the limits of the right-of-way unless the pipeline could be relocated or otherwise supported in a stable manner. A surface operation for resources that extends across the right-of-way would have increased cost by being divided into two parts unless the pipeline is rerouted.

5.1.5E.4 Soils

Unavoidable soil impacts will include:

- Reduced soil productivity;

- Soil erosion by wind and water;

- Destruction of the soil profile;

- Air and water pollution by soil particles;

- Increased downstream sedimentation;

- Soil disturbance, compaction, and alteration of soil chemical and structural characteristics.

Reader is referred to Section 3.1.5E.4 for additional information.

5.1.5E.5 Water Resources

Basically, unavoidable adverse water resource related impacts can be expected at the crossings of the major streams, in channel equilibrium, stream bank disturbance, diverted flow, increased turbidity, suspended sediment and bedload transport, increased soil erosion, increased surface water temperatures, lowered dissolved oxygen concentrations, interrupted stream flows, water quality degradation, and loss of stream biota. The more significant unmitigated effects would involve channel equilibrium, increased sedimentation and turbidity, and stream biota.

Potential for low level, long-term increased turbidity and sediment transport will result from the increased access provided to off-road vehicles by the cleared proposed pipeline corridor. This possible adverse effect would be most pronounced in forested areas of Idaho, Washington, and northeastern Oregon.

Increased soil erosion potential would be caused by clearing of right-of-way areas in terrain with highly erodible soils. Mitigation measures could reduce, but not eliminate this impact.

Minor increases in surface water temperatures would be caused by the removal of shading vegetation at stream crossings. This impact, lacking in mitigation measures, would be confined to the heavily forested portions of the proposed route in Idaho and northeastern Oregon. Temperature would not be a factor on portions of the route south of the proposed crossing of the Grande Ronde River.

There would be temporary interruptions of flow in streams and depletion of local water sources resulting from withdrawals of water for hydrostatic testing. Filtration may impinge organisms. Again, mitigation measures can reduce these adverse impacts, but it is doubtful if risks can be eliminated completely.

Test-water releases with coloration containing moderately low content of iron oxide and other metals or suspended solids, would be unavoidable.

There would be a magnification of adverse effects on a stream biota as a result of timing of construction. Organisms would be more severely affected by turbidity and sediment deposition if construction occurred in the spring or fall. Ideally, it should be possible to keep the impact on biota at a minimum by construction during winter and summer months. From a practical standpoint, however, ideal timing will not be possible, and, as a consequence, biologic impacts of construction over some parts of the pipeline route would necessarily be at a maximum. Detailed quantifications are not available and impacts would be variable.

5.1.5E.6 Vegetation

Implementation of the proposed pipeline and ancillary facilities will cause the following unavoidable adverse effects:

- Removal and/or disruption of existing vegetation;

- Alteration of plant communities;

- Loss of vegetative production;

- Loss of protective vegetative cover resulting in soil erosion by wind and water;

- Removing forest lands from the production of timber for the life of the project;

- Impairment of esthetic quality by removal and/or disruption of existing plant communities.

Vegetation impacts are discussed in detail in Section 3.1.5E.6.

5.1.5E.7 Wildlife

The proposed project would have adverse effects on nearly all wildlife species along the route. These would involve death of individuals or loss of habitat. Habitat losses would be long term on some of the more arid lands. Population losses would be more critical during breeding, nesting, and migration periods.

The remainder of this discussion concerns the residual adverse effects brought about by construction, operation, and maintenance of the project even with the full implementation of mitigation measures proposed by the applicants and additional measures given consideration by an environmental assessment team.

Construction activities could be timed so that they would not occur at certain critical areas during critical periods. Construction across and near streams would cause siltation and turbidity despite all precautions. Salmon would be affected the greatest, trout intermediate, and warm water fish least. Egg and fry stages are the most sensitive.

Blasting in rivers and steams would kill some fish within areas being blasted despite mitigation measures. This impact has only local significance.

Compressor station noise is unavoidable and is disturbing to birds of prey, especially eagles and falcons. Stations involved in the proposal exist at Baker, Oregon, Caldwell and Mountain Home, Idaho. Adverse effects of compressor stations on big game and other wildlife is uncertain.

5.1.5E.8 Ecological Considerations

Unavoidable ecological effects are discussed in the specific resource topics presented elsewhere in this section.

5.1.5E.9 and 10 Economic and Sociological Factors

Certain of the adverse impacts upon people and community structures identified in Section 3.1.5.9 would unavoidably occur if the pipeline is constructed. The degree of adversity will vary from community to community depending upon the number of construction workers and their families residing in individual communities, how long they stay, the size of communities, and services available. The variables are too imprecisely known to predict degree and location of economic and social impacts which would result from temporary population increases during pipeline construction. In general terms, the resulting impacts could be expected to be most severe in communities of eastern Oregon. Adverse community impacts could last from 6 to 18 months.

Unavoidable community impacts could include one or more of the following:

1) over-crowding of transient housing

2) insufficient availability of tourist accommodations

3) over-use of trailer and camping facilities

4) unauthorized camping

5) demands upon services (e.g., recreation, medical, dental)

6) demands upon water, sewer facilities, and possibly schools in excess of capacity

7) problems related to public safety

8) stress among the resident population and tension between residents and non-residents

9) price increases for some goods and services

10) increase in prostitution and incidents with lawmen.

5.1.5E.11 Land Use

The following unavoidable adverse land use impacts will be experienced: 1) change and/or disruption of present land uses on approximately 4,775 acres; 2) increased restrictions of future land uses; 3) increased access to undeveloped areas; 4) conflicts with present land use plans; 5) increased traffic on existing transportation facilities.

Many of the unavoidable adverse land use effects are discussed in the resource topics presented elsewhere in this section.

5.1.5E.12 Archeological, Historic, and Other Unique Values

See Section 3.1.5E.12 for a detailed discussion of potential impacts.

Archeologic

Even with full implementation of proposed and additional mitigation measures, pipeline construction would still create some losses of archeological and historical values. Residual adverse effects would be threefold: first, actual material losses would occur as a result of destruction during discovery and accidental burying; second, forced resource utilization may not allow enough time for proper planning and this could result in poor research use of archeological and historical values; and third, increased public access to discovered archeological and historical areas may encourage vandalism of these resources.

Loss of archeological and historical resources would be sustained even with everyone's best efforts. Some archeological materials would be buried during construction and only through serendipity would they be found. During discovery, some of the values would undoubtedly be destroyed.

Historic

No unavoidable adverse impacts are predictable, as with archeological values, a random intercept of unknown historical items or locations could occur, and damage or loss result before the facts are known. Examples might include items of historical age such as pioneer weapons, tools, or other utensils, unmarked graveyards, etc.

In summary, archeological and historical resources are nonrenewable. Unavoidable impacts tend to have a cumulative effect on the resource as a whole. Some items of material culture would be made available to the public for viewing in museums and educational institutions while other items would be destroyed in discovery due to methods used in finding them. Archeological and historical sites destroyed by the project would no longer be available for any use or study.

5.1.5E.13 Recreational and Esthetic Resources

The predominant unavoidable adverse effects are esthetic: the temporary noise and dust associated with construction near recreation areas such as Morgan Lake near LaGrande, Oregon, reopening scars along the existing pipeline route, especially from Baker to Meacham, Oregon, and creation of a new swath between the Moyie and Kootenai River Valleys are the major adverse effects.

The pipeline construction and subsequent activities are no bar to recreation pursuits, but qualities such as quiet and solitude will be temporarily disrupted.

5.1.5E.14 Air Quality

There will be unavoidable but temporary reduction in local air quality due to combustion emissions of construction vehicles and dust generated on the right-of-way and by pipe hauling trucks. The impact will be confined to a zone within 1 mile of the source for dust, the remaining emissions will mix with the generally clear air to produce a temporary degradation in air quality.

The combustion emissions of the compressor stations will be long-term, with large amounts of NO_x generated during the lifetime of the project, but because of atmospheric dispersion, the concentrations will be low. The unavoidable impact, therefore, is a long-term massive emission of pollutants to contribute to those from other sources.

Venting of the pipeline or rupture will release large quantities of gas for a short time. Because of the high probability of fire, the impact will be combustion products of the gas and that from any forest or grass fires caused.

5.1.5E.15 Environmental Noise

Even if all suggested mitigation measures are implemented, increased noise levels would still occur as a result of the proposed action.

Assuming trucks are brought into compliance with the recently promulgated EPA regulations, they will still produce sound levels between 86 and 90 dBA at 50 feet (depending on their speed) in otherwise quiet rural communities. This impact would not be highly localized, but it would affect large numbers of people (about 29,000) over the entire period of construction.

Construction equipment with properly fitted mufflers will still produce high sound levels in the vicinity of the construction site, ranging from 76 to 101 dBA, but it is presently economically impractical to quiet them further.

The new compressor station required at Franconia, Arizona, will impact any residences within 2,000 feet with a normalized L_{dn} of 55 dB, even with an acoustically treated compressor building and additional silencing turbine intake and exhaust. The impact of additional horsepower at existing stations can probably be completely mitigated.

It is probably feasible to muffle blowdown noise by approximately 30 dBA. Even with this degree of attenuation the blowdown would be audible for several miles. This would be a long term but very infrequent noise impact.

5.1.5E.16 Hazards from Pipe Failure

Hazards are a function of risk that could be reduced or increased. Some damage to life and property should be expected, which is discussed in section 3.OV.16.

5.1.5R Rye Valley to Cajon (Future Expansion)

This section summarizes the residual adverse effects which cannot be avoided should the proposed future expansion from Rye Valley, Oregon, to Cajon, California, be implemented and if the Applicants' proposed and Department of the Interior's additional mitigating measures, as discussed in Section 4, are applied during construction, operation, and maintenance of the project. An estimate is also made, whenever possible, of the residual adverse effects which cannot be avoided if only those mitigating measures specifically proposed by the Applicants are applied. Because the Applicants' proposed mitigating measures are often vague, general and open-ended, residual adverse effect estimates are based on the analysis sections as presented in Section 4.1.5R.

Unavoidable adverse impacts to ecological systems would be reduced by mitigation efforts. The residual adverse effects vary in magnitude and intensity along the proposed pipeline by resource. No attempt is made to compare the relative magnitude of impacts between resources. Judgmental comparisons are made within the summaries for each section, (e.g., wildlife).

For ease of reading and to provide a logical means of cross referencing, this section is identically organized to the basic outline of Section 3.1.5R, Environmental Impact of the Proposed Action. This basic outline is followed even in cases where no residual adverse affects on a resource are anticipated; in such cases, a brief statement is provided noting this fact.

5.1.5R.1 Climate

The proposed project should have no significant adverse effects on the climate.

5.1.5R.2 Topography

The proposed project will have negligible topographic effects. The most significant topographic changes would be landslides, waste sites, the crown of spoil over the backfilled trench, and stream crossings. Unstable areas along the pipeline route which are inducive to landslides are described in Section 3.1.5R.3, Geology.

5.1.5R.3 Geology

Construction of the proposed pipeline would have virtually no effect on the surrounding geologic environment if proper construction and restoration procedures are observed. The intensity of unmitigatable impacts on the geologic environment on the proposed facility varies. It is related to the severity of geologic activity in a given area. Impacts include loss of pipe support, pipeline breakage or rupture, along with damage to compressor and measuring stations, airfields, and roads. The most significant would involve pipeline rupture and the resultant damage by fire or explosion.

In western Nevada, the Owens Valley, the Mojave Desert, and at the pipeline terminus near Cajon, the proposed pipeline would cross areas of high seismicity and accompanying ground displacements.

At places in these areas of high seismicity where a high water table and fine-grained sediments coincide, liquefaction may occur during severe ground shaking. The west side of Owens Lake is a good example of such a place. There, the proposed pipeline will have to be buried in fine-grained water-saturated lacustrine deposits that will undergo liquefaction and, subsequently, considerable ground amplification during a moderate to strong earthquake.

Flash floods caused by local thunderstorms during the summer could wash out and/or rupture the proposed pipeline where it traverses the eastern flank of the Sierra Nevada Mountains in the Owens Valley. These flash floods are of a short duration, highly localized, and extremely powerful. Flash floods of this sort have broken the Los Angeles aqueduct, washed out bridges, and damaged U.S. Highway 395 repeatedly in the past. Again, this is a case of the geologic environment affecting the proposed pipeline, and if breakage were to occur, the proposed pipeline would subsequently affect the environment.

5.1.5R.4 Soils

Even with full application of the Applicants' proposed and Department of the Interior's additional mitigating measures, unavoidable soil impacts would include: loss of soil productivity; wind and water erosion; destruction of natural soil horizons, parent material, and soil characteristics; and the soil's corrosive effect on the pipeline. Soil productivity losses will be long lasting and the most significant.

More fully, the adverse effects which could not be avoided as a result of proposed pipeline construction primarily include loss of soil productivity of productive agricultural lands during and shortly after construction (until successful rehabilitation and restoration treatment practices are completed), and actual loss of soil by severe wind erosion.

Construction activity would create an unavoidable loss of soil moisture from watersheds as soils are compacted, infiltration decreased, and runoff increased.

In addition, the development of offsite facilities such as material sites for sand and gravel, compressor stations, power lines, access and service roads, equipment storage areas, fences, water pipelines, waste disposal sites, and maintenance stations will adversely affect soil productivity and increase erosion hazards, soil loss, dust pollution, and sediment yield. The extent and location of offsite facilities cannot be determined until final design information is submitted by the Applicants.

5.1.5R.5 Water Resources

Basically, unavoidable adverse water resource related impacts can be expected at the five crossings of the four major streams, in channel equilibrium, streambank disturbance, diverted flow, increased turbidity, suspended sediment and bedload transport, increased soil erosion, increased surface water temperatures, lowered dissolved oxygen concentrations, interrupted stream flows, water quality degradation, and loss of stream biota. The more significant unmitigated effects would involve channel equilibrium, increased sedimentation and turbidity, and stream biota.

Following is a discussion of the more significant unavoidable adverse effects on water resources along the pipeline route.

1) Some effects on channel erosion and bank disturbance of stream channels would be unavoidable during construction. Most adverse effects would represent only a short-term disturbance of channel equilibrium (e.g.,

the local scour and fill associated with subaqueous trenching) and would disappear with time (usually by the next high water or within 1 year). Both technique and timing of construction can reduce these effects, but not eliminate them.

2) Changes in stream position and pattern caused by ramps, supports, and other structures may divert flow during construction. In a meandering stream, a new downstream pattern of erosion-deposition loci may be triggered. However, most of this change can be expected to occur within the confines of the natural flood plain of the stream.

3) Increases in turbidity, suspended sediment, and bedload transport would increase during construction. Both stream biota and esthetics would be affected. Where bed material is fine grained (with a high clay and silt content) but sufficiently heterogeneous to keep the cohesive properties of the clay-size fraction from forming a stable bottom, a large volume might need to be excavated, especially if trenching is done at a high or intermediate flow. Coarser grades of sediment (sand-size and above) would be transported comparatively short distances. There would be no way to mitigate this effect entirely, the seriousness of which would also depend on the level of natural suspended sediment at the time of construction.

4) Increased soil erosion potential would be caused by clearing of right-of-way areas in terrain with highly erodible soils. Mitigation measures could reduce, but not eliminate this impact.

5) Minor temporary depressions in dissolved oxygen concentration, and additions of toxic substances from leakage of fuel, cleaning agents, other wastes, and bacterial contamination would occur following accidental waste discharges into flowing waterways.

6) There would be temporary interruptions of flow in streams and depletion of local water sources resulting from withdrawals of water for hydrostatic testing. Filtration may impinge organisms. Again, mitigation measures can reduce these adverse impacts, but it is doubtful if risks can be eliminated completely.

7) There would be a magnification of adverse effects on stream biota as a result of timing of construction. Organisms would be more severely affected by turbidity and sediment deposition if construction occurred in the spring or fall. Ideally, it should be possible to keep the impact on biota at a minimum by construction during winter and summer months. From a practical standpoint, however, ideal timing will not be possible, and, as a consequence, biologic impacts of construction over some parts of the pipeline route would necessarily occur. Detailed quantifications are not available and impacts would be variable.

The Department of the Interior's additional mitigation measures, as presented and discussed under Section 4.1.5R.4, Soils, would help to alleviate adverse effects on stream biota if undertaken.

Use of only the Applicants' proposed water resource mitigation measures is likely to permit increased residual adverse effects on water resources from two main sources: hydrostatic testing (water intakes and discharges) and onsite disposal of water polluting wastes.

The Department of the Interior's additional measures, as discussed in the mitigation Section 4.1.5R.4, point out the need for a hydrostatic testing plan. Without proper planning, hydrostatic testing could cause depletions of small streams and surface waters, promote excessive erosion in dry channel waterways (intermittent streams), and introduce pollutants into previously clean streams and waterways.

In summary, residual adverse effects on water resources would be primarily short term (during the construction period of about 1 year) and should diminish with the success of vegetative rehabilitation as discussed in the next section.

5.1.5R.6 Vegetation

The removal of all vegetation from the proposed pipeline right-of-way and related facility areas would have several unmitigable effects. Among these are initial crop losses (forest and agricultural), reduced productivity, modified plant communities, reduced acreage in vegetation, and esthetically distracting plant patterns. Reduced vegetative productivity and distractive esthetic patterns would be long lasting and the most significant.

Pipeline construction would require 100 percent removal of the vegetative cover along the entire length of the proposed future expansion. With the extensive mitigation measures proposed by the Applicants and considered by the Department of the Interior, revegetation on much of the area is anticipated within a few years after construction activities terminate. However, not all areas could be easily rehabilitated within this short period of time. As discussed under section 5.1.5R.4, soils, wind erosion, compaction, topsoil destruction, and alkali and sodium laden soils would make revegetation efforts very difficult, if not impossible, in some areas.

The "tunnel" effect of the proposed pipeline right-of-way as it passes through forested areas cannot be avoided, but the visual impact can be softened to some degree by feathering and scalloping the right-of-way, and planting indigenous tree species along proposed right-of-way, edges.

There would be areas on the right-of-way in desert regions of Oregon, Nevada, and California which could take decades to revegetate as the topsoil is thin, it is high in concentrations of alkali and sodium, and its productivity promotes very slow vegetative growth.

Impacts of vegetative removal on land use, agriculture, water quality, fish and wildlife, and esthetics are treated in other sections.

5.1.5R.7 Wildlife

The proposed project would have adverse effects on a variety of wildlife species along the route. These would involve either death of individuals or loss of habitat. Habitat losses would be long term on some of the more arid lands. Population losses would be more critical during breeding, nesting, and migration periods.

Of the unavoidable adverse effects discussed, the most serious include 1) loss of habitat from right-of-way clearing and disturbance; 2) siltation and turbidity from stream crossings and erosion; and 3) wildlife disturbance, harassment, and habitat destruction resulting from increased human access.

Mitigation measures proposed by the Applicants broadly cover subjects of concern to wildlife resources. However, these measures are quite general and lack specific detail. Thus, it is difficult, at best, to determine their potential effectiveness. In general, the Applicants' proposed mitigation measures would substantially reduce, but not completely alleviate, impacts to wildlife.

In Section 4.1.5E.4, Additional Measures considered by the Department of the Interior, emphasis is placed on assigning an interdisciplinary environmental assessment team the task of preparing onsite evaluations of critical areas, and recommendations on minor route relocations, engineering measures, and other mitigation measures to lessen or remove impacts. Also, several critical areas for further study are indicated. If the proposed mitigation measures of the Applicants, along with specific recommendations of the interdisciplinary environmental assessment team are carried out, adverse effects on wildlife resources will be kept to a minimum.

The remainder of this discussion concerns the residual adverse effects brought about by construction, operation and maintenance of the project even with the full implementation of mitigation measures proposed by the applicants and recommended by an environmental assessment team.

Table 5.1.5.7-1 lists potentially unavoidable adverse effects, actions that create them, duration of time they would last at each affected site, and the wildlife affected.

It would be impossible to miss critical periods for all wildlife species, because every month of the year is critical for some species. Thus, many species would be disrupted during breeding, reproducing, rearing, or migrating periods. Most adverse effects would last until populations again reached equilibrium with their environment.

Right-of-way construction activities and associated noise could disrupt "sensitive" species such as bighorn sheep in Nevada's Monte Cristo Range and in the Inyo Mountains in California.

Right-of-way clearing and trenching would cause the greatest damage to the greatest number of species. Nearly all species would receive some damage, either in the death of individuals from construction activities or in the loss of habitat (which would result in a population decline). Most habitat would be restored within 5 or 10 years, but there would be some long-term habitat losses lasting 50 years or more in some of the more arid regions such as in the California desert.

Construction across and near streams would cause severe siltation and turbidity despite all precautions. A reduction in invertebrates and reproduction success of fish would be the most significant impact that could not be completely avoided.

The impacts on fish populations in three streams in Nevada and California with flows of 25 to 300 cfs could not be completely mitigated.

Blasting in rivers and streams would kill some fish within areas being blasted despite mitigation measures. However, this impact has only local significance.

Discharging hydrostatic testing water could cause a quick rise in siltation and turbidity that would be harmful, especially to animals in small streams. Adverse effects would probably be of shorter duration than those created by stream crossing construction activities.• Adverse effects from hydrostatic test water discharge could be a local problem in southeastern Oregon and perhaps a few small streams elsewhere along the route.

Table 5.1.5.7-1 Unavoidable impacts resulting from construction, operation, and maintenance of the proposed project

Action	Impact	Duration of affects 1/	Animals Affected
Timing of construction	Disruption of breeding, reproduction, and migration	1 - 3 months	Most vertebrates, but especially big game
Right-of-way construction activities and noise	Disturbance of breeding, reproduction, migration, etc.	1 - 5 months	Big game, birds of prey
Right-of-way clearing and trenching	Loss of habitat (particularly vegetative cover)	2 - 5 years in forests	All terrestrial animals
		5 - 50 years in arid lands	" " "
Construction at and near streams	Siltation and turbidity	1 - 3 years	Fish (especially eggs and fry), and invertebrates
Stream blockage	Block fish migrations	1 - 3 months	Anadromous fish
Blasting in streams	Destruction of eggs, fry, and fish	1 week or less	Fish (all stages)
Hydrostatic testing			
a. pumping	Reduce or stop water flow	1 - 2 days	Fish and invertebrates
b. discharge	Siltation and turbidity	1 - 3 months	" " "
Increased human access (including operation and maintenance activities)	Disturbance, habitat destruction by ORV's	Life of project	Primarily rare and endangered species, big game, birds of prey
Compressor station noise	Disturbance	Life of project	Primarily birds of prey
Retrenching for repair of pipeline breaks			
a. on land	Similar effects to right-of-way clearing	2 - 5 years in forests	All terrestrial animals
		5 - 50 " " arid lands	" " "
b. at stream crossings	Siltation and turbidity	1 - 3 years	Fish (especially eggs and fry), and invertebrates

1/ Duration at each location

Increased public access and activities by the Applicants' employees, in conjunction with operation and maintenance, would have a serious impact. Barriers are only slightly effective in preventing off-road vehicles (ORV's) from gaining entrance to rights-of-way. ORV use would disturb and harass wildlife as well as destroy habitat, particularly vegetative communities.

Big game, birds of prey, and threatened and endangered species would be the groups most seriously affected. Adverse effects would certainly inhibit long-term productivity in critical areas.

Compressor station noise would be unavoidable and would disturb birds of prey, especially eagles and falcons. The station at Owens River (California) could displace birds from present habitat. Adverse effects of compressor stations on big game and other wildlife is uncertain.

Pipeline breaks, although accidental and not anticipated, are likely to occur at some time causing unavoidable adverse effects. Pipeline breaks on land would be relatively harmless in themselves unless accompanied by explosions or fire, but retrenching would create small scale impacts similar to those experienced during original clearing and trenching activities. However, pipeline breaks at a stream crossing would be more serious than a land break because retrenching the pipeline would result in downstream siltation and turbidity similar to that experienced during original crossing activities.

5.1.5R.8 Ecological Considerations

With respect to ecological factors, residual adverse effects which cannot be avoided are treated in the discussions of the several specific resource topics presented elsewhere in this section. Minor cumulative, synergistic, and multiplier effects could be expected throughout the project.

5.1.5R.9 and 10 Economic and Sociological Factors

Construction Phase

Certain of the adverse impacts upon people and community structures identified in Section 3.1.5R.9 would unavoidably occur if the pipeline is constructed. The degree of adversity, although generally expected to be minor, will vary from community to community depending upon the number of construction workers and their families residing in individual communities, how long they stay, the size of communities, and services available. The variables are too imprecisely known to predict degree and location of economic and social impacts which would result from temporary population increases during pipeline construction.

Unavoidable community impacts could include one or more of the following:

1) over-crowding of transient housing

2) insufficient availability of tourist accommodations

3) over-use of trailer and camping facilities

4) unauthorized camping

5) demands upon services (e.g., recreation, medical, dental)

6) demands upon water, sewer facilities, and possibly schools in excess of capacity

7) problems related to public safety

8) stress among the resident population and tension between residents and non-residents

9) price increases for some goods and services.

Compensation paid by Applicant companies for agricultural loss may indemnify the landowner, but the loss of physical production would remain. However, the loss of crop production represents only 0.05 percent of the crop production of the counties through which the pipeline would pass. Therefore no significant adverse effects on crop supplies or prices could be expected. Similarly, lost timber production represents an extremely small percent of the annual harvest and consequently no price or supply effects could be expected.

Operation Phase

No significant adverse economic or social impacts that cannot be mitigated are expected as a result of operating the proposed pipeline.

5.1.5R.11 Land Use

A multitude of unmitigated land use impacts which will involve 7,752 acres along the future expansion would be experienced. These include 1) change in present land use patterns; 2) disruption of present land uses; 3) increased restrictions of future land uses; 4) lowered crop production, forage losses, and lost forest production; 5) interrupted operation of irrigation systems; 6) increased access to undeveloped areas; 7) conflicts with present land use plans; 8) reduced air quality; 9) increased traffic on existing transportation facilities; and 10) increased solid wastes.

Long-term adverse effects would include changed land use, reduced land productivity, and increased access to undeveloped areas.

With respect to land use, many of the residual adverse effects which cannot be avoided are treated to some degree in the discussions of the several specific resource topics presented in other sections.

Additional mitigation measures considered by the Department of the Interior are presented in Section 4.1.5R.4. The proposed mitigation measures of the Applicants along with more specific additional measures of the Department of the Interior could achieve a reduction in adverse effects on land use.

Following is a summary of the more significant unavoidable adverse effects on land uses along the pipeline route.

Agriculture Croplands

Nearly all croplands crossed by the future expansion are located in Oregon. Nevada and California have less than 1 percent of the cropland crossed.

Although disturbed lands are to be replowed and planted, soil productivity would be reduced for an indefinite period. This represents a long-term decrease in soil fertility. The magnitude or extent of actual productivity loss would depend on specific conditions in specific areas, and the restoration practices employed after construction.

Forest Lands

The only commercial forest lands that would be disturbed on the future expansion route is in California's Inyo National Forest. Rehabilitative success varies between forest types and conditions, and it may not be possible to restore some areas to their original level of forest productivity. Even with careful rehabilitation measures, some sites, such as steep (80 percent or greater) south facing slopes, may remain inadequately stocked long after project termination. Thus, long-term productivity of some areas would be adversely affected.

Rangelands and Pasture

Nearly 9,300 acres of pasture and rangelands in eastern Oregon, Nevada, and California would be cleared of all vegetation during pipeline construction. For the most part, this land is arid desert, and because of the vegetation and climatic conditions of this region, revegetation on disturbed soils could be extremely slow and difficult. Therefore, forage and browse for domestic and wild animals previously available would be lost for an indeterminate period of time.

Primitive Values

The pipeline right-of-way would cross isolated areas between northeastern Oregon and southern California which exhibit primitive or near primitive values. The cleared right-of-way strip would look very similar to a dirt access road and would certainly invite use by the general public for off-road vehicle travel. Such use in previously inaccessible or relatively undisturbed areas would, by its very nature, create adverse effects which could not be avoided, regardless of mitigation measures proposed or recommended. Once disturbed, the long-term productivity of these primitive or near primitive areas would likewise be adversely affected.

Residential, Commercial and Industrial

The proposed project would have adverse effects on industrial, commercial, and residential uses in the Winnemucca area in Nevada, and the desert in southern California.

Noise levels would be raised in urban areas during construction periods and noise from the compressor station in Owens Valley and from valves scattered along the pipeline right-of-way would have unavoidable adverse effects on nearby residents for the life of the project.

The pipeline right-of-way would cross the southwestern part of the Naval Test Station near China Lake, California. The U.S. Navy indicates there may be an unmitigable conflict between the proposed project and the present use of the area (a bombing range).

Minerals and Material Sites

Borrow areas would have to be developed or reopened during construction. Materials utilized would be unavailable for other projects. Additional areas would be lost to vegetative production.

Transportation and Transmission Facilities

Increased traffic on existing highways and access roads cannot be avoided. Additional vehicular use and the heavy loads on many vehicles could cause considerable damage to roads with low standard surfaces and bases. Damaged roads would require increased maintenance, repair, and possible surface replacement. As a result, temporary and sporadic traffic disruption and inconvenience would occur over an extended period until road rehabilitation is completed.

Where the proposed pipeline right-of-way parallels or intersects existing transmission facilities such as high-voltage transmission lines and water or gas pipelines, conflicts may occur.

Hazards from shock and/or explosion may exist during construction and operation. Leaking natural gas could be ignited by a spark created during a charge buildup on the pipeline system.

Land Use Trends

The proposed project would have some residual adverse effects on future land uses of areas adjacent to project facilities. It may affect urban growth or future locations of roads, other pipelines, power transmission lines, and industrial development.

5.1.5R.12 Archeological, Historic, and Other Unique Values

Even with full implementation of proposed and recommended mitigation measures, pipeline construction would still create some losses of archeological and historical values. Residual adverse effects would be twofold: first, actual material losses would occur as a result of destruction during discovery and accidental burying; second, forced resource utilization may not allow enough time for proper planning and this could result in poor research use of archeological and historical values.

Archeological and historical resources are nonrenewable. Unavoidable impacts tend to have a cumulative effect on the resource as a whole. Some items of material culture would be made available to the public for viewing in museums and educational institutions while other items would be destroyed in discovery due to methods used in finding them. Archeological and historical sites destroyed by the project would no longer be available for any use or study.

5.1.5R.13 Recreational and Esthetic Resources

With full application of all of the Applicants' proposed and the Department of the Interior's additional mitigating measures, some residual adverse effects could not be avoided as a result of pipeline construction. The most significant nonmitigable adverse effects would be the provision of access into areas exhibiting primitive values which were previously inaccessible or relatively undisturbed, and the degradation of visual resources along the proposed pipeline route, especially in areas being considered for their special recreation qualities.

Once constructed, project roads and rights-of-way could be used by the general public to gain access into some areas which were previously inaccessible or relatively undisturbed. The cleared right-of-way strip would look very similar to a dirt access road and would certainly invite use by the public for off-road vehicle travel. Regardless of mitigation measures proposed by the Applicants or recommended by the Department of the Interior, given time and easy access, the public and their pressures would disturb, and no doubt destroy, much of the primitive values now available. Losses of primitive values would be unavoidable, irreversible, and irretrievable.

The project would have a decided impact on visual resources and esthetic degradation would be unavoidable in many areas. Visual impacts would be most apparent in forested areas and open range or desert country.

In the open range or desert country of Oregon, Nevada and California, natural vegetation adjacent to the right-of-way would be insufficient in height to "screen" the right-of-way, thus, cleared areas would be visible for long distances. Residual adverse effects, resulting from project construction, in open range or desert country would be apparent for a relatively long period of time due to the slow rate of revegetation in arid regions.

With particular respect to the Malheur River, short-term use of the riparian environments may have far reaching ramifications on the long-term productivity as wild and scenic rivers or waterways.

Visual impacts on agricultural lands, although very apparent during construction, would tend to abate as lands are brought back into production. Normally, most visible evidence of construction would be gone within a few years, but a viewer's discerning eye might spot slight differences in soil color and/or crop vigor long after construction.

In summary, the general adverse effects on esthetic resources, which could not be avoided should the pipeline project be implemented include: 1) strong lines and changes in colors, forms, and textures due to right-of-way construction in forested areas and open range or desert country; 2) introduction of forms, lines, textures, and colors into natural environments due to construction of compressor stations, gauging stations, blowdown valves, fences, airstrips, and access roads; 3) introduction of open areas where there had been vegetative associations; and 4) changes in color due to soil disturbance and rehabilitation efforts with non-native species.

5.1.5R.14 Air Quality

When ground is broken for the pipeline, there would be no means of preventing dust release in the event of high winds. Dust problems might also be expected from heavy access road use.

During operation, there would be three adverse effects which could not be avoided: exhaust gases from compressor stations; venting of gas (deliberate or automatic); and accidental pipe rupture. Of the three, accidental pipe rupture is the only unmitigable impact of any consequence.

5.1.5R.15 Environmental Noise

Even if all suggested mitigation measures are implemented, increased noise levels would still occur.

Construction noise would be temporary in nature. Noise from compressor stations would tend to be permanent and long lasting. Blowdown noise would be long term, but not significant.

5.1.5R.16 Hazards from Pipe Failure

Hazards are a function of risk that could be reduced or increased. Some damage to life and property should be expected, which is discussed in Section 3.1.5R.16.

The Applicants have stated their intention to follow all OSHA and Pipeline Safety Act regulations, and comply with all applicable Federal and State permits and regulations in designing and constructing the pipeline. To this, the Department of the Interior has added pages of further safety specifications, particularly in the area of geotechnic investigations to permit design and construction of a pipeline that would carry gas safely. Based on presently available statistics, it is estimated that an unavoidable break would occur less often than once in 8 years.

6 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

6.1 ARCTIC GAS PIPELINE PROJECT

6.1.5 Los Angeles Pipeline

The Los Angeles pipeline is discussed in two segments. The segment from Eastport, Idaho to Rye Valley, Oregon is designated by the suffix "E"; the segment from Rye Valley to Cajon, California, by the suffix "R".

6.1.5E Eastport to Rye Valley

6.1.5E.1 Definitions

This section analyzes and compares the tradeoffs that will result from construction and use of the proposed pipeline and the potential productivity of the environment. Short-term is that period during which the project would be constructed and operated. Long-term is that period following project abandonment. The definition of time periods in this section may differ from those used in other sections.

6.1.5E.2 Environmental and Resource Values Affected by the Proposed Action

Soil Productivity

Disturbance and mixing of the soil surface along the 391-mile proposed pipeline will reduce soil productivity. Trenching, backfilling, and compaction will alter the soil's physical, chemical and structural characteristics.

The soil's capacity to support plant life, both agricultural crops and native plant species, will be impaired during and after construction. Following construction, redevelopment of the soil's characteristics will be accelerated by appropriate mitigating measures. Soil characteristics will substantially recover after a long period of time. In the short term, crop production will be less.

As the proposed line progresses into drier regions, the time frame for soil development will be longer. In the long-term, soil productivity will return to preconstruction levels.

Vegetation

Vegetation along the proposed route is varied. It includes annual cultivated crops, annual forbes and grasses, perennial grasses, shrubs, and mature timber stands. Most of the existing vegetation will be allowed to return with the exception of trees which will not be allowed to grow directly over the proposed pipeline. The short-term effect on grasslands and croplands will be limited to the construction season and several years following construction. Timberlands will be impacted for the duration of the project. It is assumed that timberlands would be allowed to revegetate upon abandonment of the project, hence long-term effects would be negligible.

Wildlife

Commonly Occurring Species

Short-term and long-term effects of the proposed pipeline will be minimal to most wildlife species. These effects will, for the most part, be closely associated with the effects upon the soil, water and vegetation.

Most species of wildlife will utilize the new forage found in the first season of growth. In some forested areas, the edge effect created by the project will probably create a greater diversity of wildlife species than existed prior to the project, hence a short-term increase.

Overall, the major short-term effect on wildlife will be to cause emigration from the area during construction and for a period afterwards until revegetation permits return. Non-mobile burrowing species may be eliminated. In the long-term, construction of the proposed pipeline will have virtually no impact on commonly occurring species.

Unique, Sensitive, Threatened and/or Endangered Species

These species of plants and wildlife are those which have been greatly reduced in numbers and distribution. Further reduction or possible extinction of certain species may occur through habitat destruction, or merely through increased human activities associated with or following the proposed construction.

Losses to species falling in this category cannot be quantified at this time because exact route locations are unknown. However, some effects may be felt by: chisel tooth Kangaroo rat, pygmy rabbit, whitetailed jackrabbit, osprey, peregrine and prairie falcons, northern and southern bald eagles.

Though impacts on rare or endangered species are not expected to be significant, it is remotely possible that unforeseen circumstances could cause loss of habitat or prevent the use of habitat to a degree that species extinction could occur. This would be a loss in both short-term and long-term productivity and diversity of the ecosystem.

Archeological and Historical

Pipeline construction may result in some losses of archeological or historical values. However, archeological or historical values which are now unknown and perhaps would never be discovered in the absence of the project could be unearthed by the proposed project.

Consequently, short-term use and long-term productivity would be affected in two ways. Archeological or historical values may be lost because of construction techniques. However, certain values heretofore unknown may be found and preserved for investigation and interpretation thereby enhancing man's knowledge of archeological and historical events.

Recreation and Aesthetics

Construction activities along the proposed route may degrade, or in some instances inhibit, the pursuit of recreational activity along portions of the proposed route for short periods. Hence, there will be the short-term loss of recreational pleasures experienced during the construction phase.

Visual resources would be significantly affected. Forested areas would be permanently scarred for the life of the project and the more arid areas would have visible scars for longer periods of time. Hence, short-term use would be affected for varying periods of time, depending upon the environment's ability to regenerate its aesthetic appeal. The long-term productivity, assuming the ecosystem will be allowed to reestablish itself upon abandonment of the project, would not be affected significantly. This will be true only on those areas not developed as roads or access lanes. Along portions of the route which do develop as access lanes, long-term productivity from an aesthetic standpoint will be reduced.

Air and Water Quality

Air quality may be affected by noxious gases and dust generated by construction activities. These will occur only under the short-term use for the most part. Long-term productivity will be affected only negligibly. The proposed route does pass through areas where soils are significantly affected by wind erosion. However, most of this area if not all, is currently under cultivation. Consequently, particulate matter added to air quality in this area resulting from pipeline construction and after rehabilitation is considered insignificant.

Air quality degradation as a result of gas leaks, accidental fires and compressor station emission may be significant for a short period. Due to the low level of emissions and the short duration and unlikely occurrence of the first two degradations, long-term effects will be negligible.

Water quality will be affected only during construction activities and during hydrostatic testing. The effects will be of very short-term duration. There will be no long-term productivity effects on water quality.

Economic and Social

Construction employment and income effects will be short-term in nature. Small "multiples" in effects may be felt in local areas as a result of permanent, new employees engaged in operation and maintenance of the proposed line. Negative short-term effects may also be felt through inflated prices, possibly prostitution, and conflict between local residents and pipeline employees. Positive effects would result from tax payments to local governments and increased money flowing through local economies.

Long-term effects, economically and culturally, may be felt by the Umatilla Indian people. This may be caused through construction activities, royalties and taxes paid to the Indian people.

Health and Safety

Short-term impacts may be caused during construction activities. Since the pipeline will be buried, future impacts should be avoided. Hence, no long-term effects.

Pipeline ruptures or leaks could cause short-term effects until repaired. Some effects could involve substantial losses to human, wildlife and vegetative populations. Other than sociological effects in the human populations, long-term effects from these sources would not be significant.

Should the pipeline remain in place upon abandonment, long-term affects may be felt in the fcrm cf caveins along the proposed route.

6.1.5E.3 Restrictions cn Future Options and Needs

Land Use

Land use in the permanent right-of-way will have restricted uses for the duration of the project. Trees, shrubs and buildings will be restricted from the right-of-way. Noises associated with the pipeline may limit land use adjacent to the noise sources.

Industrial development, transportation corridors and movement of other energy sources may be affected by the proposed route.

Facilities associated with the pipeline will prohibit other land uses on these areas.

The above examples are short-term uses. Land uses would resume after abandonment of the project, hence long-term effects would be negligible.

Primitive Values

Isolated areas along the pipeline which might be considered as exhibiting primitive or semi-wilderness qualities would be lost in the short-term. Should the areas return to the primitive or semi-wilderness state upon project abandonment, no long-term effects would be noted.

Mineral Resources

Mineral exploration in the immediate vicinity of the pipeline would be curtailed. This would be a short-term effect and, following abandonment of the project, no long-term effects would be noted.

6.1.5E.4 Benefits of Energy

Short-term effects of the proposal would be the supply of the natural gas to Pacific North and Southwest and California. While the life of the project cannot be defined, the supply would be provided at a time when serious shortages have been predicted.

Natural gas, being a relatively clean fuel, has less impact on the environment. Hence, short-term productivity would be enhanced.

Long-term productivity will be severely affected as the natural gas reserves are completely exhausted and other forms of energy are needed. Technological advances will be needed to supplement or replace natural gas as an energy source in the not too distant future.

6.1.5R Rye Valley To Cajon (Future Expansion)

6.1.5R.1 Definitions

The objective of this section is tc analyze inter-temporal tradeoffs that would result from construction of the segment of pipeline from Rye

Valley, Ore., to Cajon, Calif. This is planned "future expansion." The short-term impacts are evaluated in terms of their ramifications on long-term productivity of the environment. In most of the resources or values discussed, short-term is that period during which the project would be constructed and operated. Long-term is an indeterminate time period related to environmental quality for future generations, generally after project salvage or abandonment.

The reader should note the distinction between time periods used here compared to those used in preceding sections. Time periods used in this section are more extensive and relate to future environmentally oriented points of view.

6.1.5R.2 Environmental and Resource Values Affected by the Proposed Action

Soil Productivity

Disturbance and mixing of the soil surface along the 746-mile planned future expansion would reduce soil productivity. The trenching, backfilling, and compaction operation would alter the soil's physical, chemical, and structural characteristics.

The soil's ability to support plant life, both agricultural crops and native plant species, will be impaired during and after construction. Soil characteristics will substantially recover after a long period of time. In the short-term, crop production will be less.

Vegetation

Most of the right-of-way will be returned to its prior use after construction with the exception that tall woody plants will not be allowed to grow in a narrow strip over the proposed pipeline. With this exception, the short-term use of the right-of-way will have minimal effects on long-term regional vegetative productivity.

Wildlife

Commonly Occurring Species

Long-term consequences of constructing and operating the proposed pipeline would be minimal to most wildlife species and a few species would actually be benefited. An exception would be several of the "unique, sensitive, threatened, and endangered species" to be discussed separately.

As a result of natural succession of native vegetation, habitat of terrestrial animals would eventually be restored to pre-project levels.

In many arid areas along the stretch from Rye Valley, Oregon to the southern terminus there would be long-term losses to commonly occurring species due to lack of complete revegetation. In summary, short-term effects on most wildlife species will be emigration from the right-of-way during construction, with a gradual immigration as the area revegetates. There will be virtually no evident long-term effects on wildlife.

Unique, Sensitive, Threatened, and/or Endangered Species

Unique, sensitive, threatened and/or endangered species are those that have been greatly reduced from former abundance and in many instances are almost extinct. Any loss of endangered animals is very significant in that once a breeding population reaches a low level the genetic genepool becomes so reduced that a "comeback" might not be possible, even if all other limiting factors are removed.

Losses connected with the proposed action cannot be quantified at this time because exact route locations are unknown, but could possibly occur to some of the species. The following species are considered most likely to be impacted: bighorn sheep, chisel tooth kangaroo mouse, San Joaquin pocket mouse, peregrine and prairie falcons, northern and southern bald eagles, osprey, desert tortoise, and southern rubber boa.

Though minimal impacts to rare or endangered species are anticipated, reduction in range and population represent a loss in both short-term and long-term productivity and diversity of the ecosystem. Hence, loss of an entire population would represent a significant effect on the short-term use of the environment and its long-term productivity.

Archeological and Historical

Short-term use of the pipeline right-of-way may result in the loss of archeological and historical values as outlined in previous sections of this statement. These losses are related primarily to the rapid pace of project construction, which limits time needed to make detailed investigations and studies of newly discovered sites.

Long-term values would be reduced to the extent that the archeological and historical resources lost would not be available for the interpretation, education, enjoyment and heritage of future generations. Sites discovered and properly investigated, prior to, and during project construction, would add to long-term values of these irreplaceable resources.

Recreation and Aesthetics

Construction activity inconveniences to the recreationist are considered short-term as the loss of recreational pleasures will be experienced only during the construction phase.

In some areas, the impact of new access would prove beneficial to recreationists in that additional resources would be made available for public use and enjoyment. The most significant impacts on long-term productivity would occur in those areas which were inaccessible to motor vehicles prior to project construction. Once these areas are opened to public use via project access roads and rights-of-way, the impacts that would result could prove to be deleterious to the natural environment.

Short-term use of the environment for project purposes would have a decided impact on visual resources. In some areas long-term productivity would be affected for an indeterminate time period.

Another impact on long-term productivity would occur in forested areas where the proposed pipeline would not only necessitate clearing of all trees and tall woody vegetation, but would also require continued removal of natural reproduction (trees) for the life of the project. An indeterminate time period, after project abandonment, would be necessary for these forest lands to adequately revegetate and take on the appearance of their surrounding environment.

Air and Water Quality

Air quality may be affected by noxious gases and dust generated by construction activities on a short-term basis. Long-term impacts on productivity would be negligible.

Pipeline construction across streams and rivers would increase siltation and sediment yield. Assuming that the necessary practices to reduce soil movement at stream and river crossings are conducted, the impact upon water quality would be short-term.

Since the construction period is considered to be short-term, construction and hydrostatic testing uses of the water resources would be a short-term impact and would not be expected to affect the long-term productivity. The amount of water required for the operation and maintenance of the proposed pipeline would be small and no long-term effects beyond the lifetime of the planned project are expected.

Economic and Social

Construction employment and income effects would be short-term in nature. Small "multiplier" effects could be induced in local areas as a result of permanent new operation and maintenance employees. The major effect on long-term productivity would result from the increase in local taxes paid directly by the pipeline companies. A flow of funds, sustained over the period of operation could provide local governments with a substantial revenue source. Negative short-term effects may also be felt through inflated prices, prostitution and conflicts between local residents and pipeline employees.

Health and Safety

Short-term impacts may be caused by pipeline ruptures or explosions. No long-term impacts of any significance can be foreseen.

6.1.5R.3 Restriction on Future Options and Needs

Land Use

Land in the permanent pipeline right-of-way will have some restrictions on use during the life of the project. Within the right-of-way no trees, brush, and/or buildings will be allowed.

During the project life, or short-term, the presence of the route will affect adjacent uses because of considerations for safety, noise, and aesthetics. The pipeline could affect the location of roads, other energy transportation systems, or industrial development.

Additional ancillary facilities of the pipeline would prohibit other land uses on the areas occupied by these facilities.

In the long-term, following project salvage or abandonment, the proposed route could again change land use. Many alternatives would be available at that time. Depending on needs in the long-term time period, the existence of the pipeline could contribute to long-term productivity by providing a space for those needs.

Primitive Values

Existing isolated areas along the route exhibit certain primitive or semi-wilderness qualities.

Pipeline construction and improved access would destroy primitive values along the route. The long-term productivity of these areas as semi-primitive wildlife habitat or recreation would be lost.

Mineral Resources

In the upper basin area of Nevada, there is current production of copper and other metals. Other areas of the route are not considered to have high mineral potential. Construction of the pipeline could limit or constrain the development of minerals along the proposed route and adjacent lands. While the pipeline is in operation, development of minerals would be restricted. In the long-term, following salvage or abandonment the proposed pipeline would no longer constrain mineral development.

6.1.5R.4 Benefits of Energy

Short-term benefits of the pipeline planned for future expansion would be the supply of approximately 1,200 MMcf/d of natural gas to the service areas of ITA(A) and SoCal over an estimated 20-year period. This supply would be provided at a time when serious energy shortages have been predicted.

Natural gas is a relatively clean fuel. Therefore, short-term productivity would be enhanced under relatively favorable conditions. Long-term productivity will be severely affected as the natural gas reserves are exhausted and other forms of energy are needed.

7 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES IF THE PROPOSED ACTION IS IMPLEMENTED

7.1 ARCTIC GAS PIPELINE PROJECT

7.1.5 Los Angeles Pipeline

The purpose of this section is to describe those resources that will be irretrievably lost as a result of the project. Resources means human as well as material and biological, renewable and nonrenewable, salvagable and non-salvagable. The time span includes efforts and resources used to date, to be expended during construction, operation, maintenance and abandonment of the project, and a reasonable time beyond abandonment (perhaps 150 years).

Items discussed in Sections 3.1.5, Environmental Impacts, Section 4.1.5, Mitigating Measures and 5.1.5, Adverse Impacts Which Cannot be Avoided, are supportive to most conclusions presented in this section. They will not be repeated herein.

The Los Angeles pipeline is discussed in two segments. The segment from the U.S.-Canadian border between Kingsgate, B.C., and Eastport, Idaho, to Rye Valley, Oregon, is designated by the suffix "E"; the segment from Rye Valley to Cajon, California, by the suffix "R."

7.1.5E Eastport to Rye Valley

7.1.5E.1 Damages from Natural Catastrophe or Man-Caused Accidents

Loss of Quantities of Natural Gas

Pipeline rupture would release massive amounts of gas, far greater than any leaks or venting. The rupture event is described in Part I Overview. Assuming an instantaneous closing of valves, a 20-mile segment of pipe would release 67 MMcf of gas.

Loss of Materials (Pipe, Compressor, Storage Tanks, and Other Materials)

The greatest potential loss from an accident would be the destruction of much or all of a compressor station or adjunct tanks. Pipeline losses would consist of from one to a very few sections and would be insignificant.

Possible Loss or Injury to Human Populations

Accidental deaths and/or injuries could occur during the construction and operation of the project. A pipeline rupture, and the resulting fires, explosions, and accidents is possible during pipeline operation. The loss of life is not expected to be great because of the sparsely settled region. Natural events, such as earthquakes, floods or landslides could cause such failures. Hazards from electrical shock also would exist in these sections of the proposed pipeline which transect or parallel high voltage transmission lines.

Accidental deaths and injuries resulting from the project would be an irretrievable commitment of human resources. Even though intensive safety precautions are undertaken, the hazard cannot be completely mitigated.

Destruction or Damage to Surrounding Property

An explosion resulting from a pipeline rupture would have an estimated total damage radius of 250 feet and a partial damage radius of 600 feet. Because of the sparsely settled terrain of the proposed route, no significant damage would be expected to property other than that of the Applicant.

Destruction of Vegetation and Wildlife

Obviously, accidental destruction of individual plants and animals is an irretrievable loss as to those individuals, but both are renewable resources. Except in the extremely remote probability of complete destruction of an entire population, no other irretrievable losses are identified.

7.1.5E.2 Project Structures Unlikely to be Removed

It appears that all project features will be dismantled upon eventual abandonment and only those materials which are impractical to recover will be discarded. With the rapid reduction of world resources, it appears likely that the steel in the pipeline, compressor stations and other features will be recovered and reused. The only materials to be lost are likely to be lumber, cinder block, concrete and asphalt. A loss of materials from borrow areas would occur to refill the trench since the originally removed material will not be available.

7.1.5E.3 Resource Extraction

Natural Gas Resources to be Used

Construction of the proposed pipeline would involve the irreversible commitment of approximately 220 billion cubic feet of natural gas per year for an anticipated 20 to 25 year period. This would amount to a total commitment of over 5.4 trillion cubic feet. Of this, approximately 2.5 percent or 0.13 trillion cubic feet would be expended by operation of the compressor facilities.

Minerals and Materials

The proposed pipeline would commit approximately 113,000 tons of steel pipe. In addition, materials would be required for fittings, compressors, and other equipment. An unknown quantity of other minerals such as sand and gravel would be utilized and thus become unavailable for other uses.

7.1.5E.4 Destruction of Cultural, Archeological, Scenic or Historical Sites and Esthetics

Loss of archeological and historic values could be expected as outlined in previous sections. The use or destruction of this cultural resource is a cumulative loss impeding the interpretation of the resource at some future time. Values destroyed would be irreplaceable and lost to society for all time.

Throughout the project's life and for an indefinite period thereafter the visual resource would be impacted by introducing strong lines and changes in color and texture. This would be most evident in mountainous timbered areas and in arid areas with a slow vegetative reproductive capability. Old scars would be reopened and widened where the project parallels existing pipelines. There would be some minor alterations of topography, especially in rugged terrain, that would represent an irreversible commitment.

7.1.5E.5 Elimination of Wildlife Species

Individual creatures killed, directly or indirectly, as a result of construction, operation, maintenance, or abandonment of the project are irretrievably lost.

The most significant loss would be the remote possibility of the random destruction of an entire species, either through habitat destruction, direct mortality, or both.

Most species found along the proposed route are either fairly common, highly mobile, or living off the proposed route. Ultimately, since both wildlife species and their habitat are renewable resources over time, the potential for significant irretrievable loss is small.

Improved access to the area is not a consideration between Rye Valley and the U.S.-Canadian boundary.

7.1.5E.6 Irrevocable Changes in Land Use

None are identified. Land use is a function of man. Man utilizes methods such as legal documents, zoning, ordnances and land use plans to control uses. Upon abandonment of the project, these legal constraints can be modified to reflect the current situation.

7.1.5E.7 Commitment of Materials and Human Resources

Construction Materials

Of the major materials and supplies to be consumed or utilized during construction, and listed in Section 1.1.3.6, only the 213,000 tons of steel of the pipeline might be practically recoverable. The irretrievable commitments of materials include concrete, diesel fuel, gasoline, lube oil, and grease used directly on the job. In addition significant secondary expenditures will probably occur due to construction commuter traffic, administrative traffic, federal and state officials flying in to inspect the project.

Use of Labor Force for Construction Period

Using the work force estimates given in Section 1.1.3.6, approximately 750-1000 man-years of effort will be expended in the direct construction of the project. It is virtually impossible to estimate the number of man-years of effort involved with secondary aspects of the project such as the use of a bulldozer driver in a county sanitary landfull to cover up the project debris.

The applicant and federal agencies have expended many man-years of effort on the proposal to date, and additional manpower and materials will be consumed in operating, maintaining and abandoning the project.

7.1.5R Rye Valley to Cajon (Future Expansion)

7.1.5R.1 Damages From Natural Catastrophe or Man-Caused Accidents

Loss of Quantities of Natural Gas

Pipeline rupture would release massive amounts of gas, far greater than any leaks or venting. The rupture event is described in Part I Overview. A typical block contains about 10 MMcf of gas. Assuming an instantaneous closing of valves, a 20-mile segment of the pipe would release 67 MMcf of gas.

Loss of Materials (Pipe, Compressor, Storage Tanks, and Other Materials)

The greatest potential loss from an accident would be the destruction of much or all of a compressor station or adjunct tanks. Pipeline losses would consist of one to a very few sections and would be insignificant.

Possible Loss or Injury to Human Populations

Accidental deaths and/or injuries could occur during the construction and operation of the project. A pipeline rupture, and the resulting fires, explosions, and accidents are possible during pipeline operation. The loss of life is nct expected to be great because of the sparsely settled region. Natural events, such as earthquakes, floods and landslides could cause such failures. High risk areas from earthquake potentials are in western Nevada, the Owens Valley, Mojave Desert, and near Cajon in California. Flash floods are common in the Owens Valley where the route traverses the flank of the Sierra Nevada Mountains. Hazards from electrical shock also would exist in those sections of the proposed pipeline which transect or parallel high voltage transmission lines.

Accidental deaths and injuries resulting from the project would be an irretrievable commitment of human resources. Even though intensive safety precautions are undertaken, the hazard cannot be completely mitigated.

Destruction or Damage to Surrounding Property

An explosion resulting from a pipeline rupture would have a total damage radius of about 250 feet and a partial damage radius of about 600 feet (Section 3.1.5R.16). Therefore, because of the sparsely settled terrain of the route, no significant damage would be expected to property other than that of the Applicant.

Destruction of Vegetation

If ignition cccurred during the summer, a subsequent range or forest fire could be expected. Danger from these factors would not be considered great.

7.1.5R.2 Project Structures Unlikely to be Removed

Practically all of the pipeline and facilities can be removed if so desired. An exception could be the concrete slabs and supports for compressor station equipment.

The manner of abandonment of this project would be determined by the Federal Power Commission in accordance with Section 7(b) of the Natural Gas Act, 15 USC 717f(b) and regulations of the Materials Transportation Board. It would have to conform to regulations developed in the interim period. The Applicant stated that if the cost of salvage were not to equal or exceed the sale value of the recovered pipe, the line would be removed and sold.

If and when abandonment would become necessary, the proposed pipeline could be removed. The pipe trench would be restored to the original contour with material from the right-of-way and from borrow areas agreed upon with landowners or from commercial sources.

It appears that all project features could be dismantled upon eventual abandonment and only those materials which are impractical to recover would remain. With the rapid reduction of world resources, it appears likely that the steel in the proposed pipeline, compressor stations, and other features could be recovered and reused. The only material to be lost is likely to be lumber, cinder block, concrete, and asphalt.

7.1.5R.3 Resource Extraction

Fuels and Energy Utilized During Construction

Petroleum fuels that would be used for transport of pipe and materials and for construction of the proposed pipeline are estimated to require 8 to 10 million gallons. This represents an irreversible commitment, unavailable for other uses. Another substantial commitment would be the coal and electrical energy used to manufacture the steel.

Minerals and Materials

The proposed pipeline would commit approximately 387,000 tons of steel pipe. In addition, materials would be required for fittings, compressors, and other equipment. An unknown quantity of other minerals such as sand and gravel would be utilized and thus become unavailable for other uses.

7.1.5R.4 Erosion

Loss of Topsoil

Construction of the proposed pipeline would result in irretrievable losses of topsoil by soil erosion and mixing with subsoils. Losses of topsoil will in turn reduce productivity of the land for native vegetation, crops, livestock, and wildlife.

Effects on Aquatic Ecosystems and Water Quality

There would be no significant permanent or irreversible effects on either aquatic ecosystems or water quality.

7.1.5R.5 Destruction of Cultural, Archeological, Scenic or Historical Sites and Esthetics

Loss of archeological and historical values could be expected as outlined in previous sections. The use or destruction of this cultural resource is a cumulative loss which adds to problems of interpreting the resource at some future time. Values destroyed would be irreplaceable and lost to society for all time.

From a scenic or esthetic standpoint, providing access into areas which are presently inaccessible or relatively undisturbed could result in significant irreversible and irretrievable commitments of resources. To the extent that roadways exist in the vicinity of the proposed right-of-way, construction of the pipeline would not increase this possibility.

There would be some relatively minor alterations of topography, especially in rugged terrain, that would represent an irreversible commitment.

7.1.5R.6 Elimination of Wildlife Species Habitat

Loss of an entire population of unique, sensitive, or endangered species of either plants or animals would represent both an irretrievable and irreversible loss. The likelihood of this occurring due to pipeline construction is, however, remote.

<u>Cutting Nesting Trees</u>

No presently known nesting trees or sites would be destroyed, although the proposed pipeline could pass close enough to several known nesting sites so as to render them uninhabitable if construction occurred during the nesting period.

<u>Loss of Cover in Nesting, Feeding or Breeding Areas</u>

The loss of production of wildlife during the period from start of construction until revegetation is complete would be an irretrievable commitment of resources. This would include loss of opportunities to view, hunt, and otherwise enjoy the wildlife that would have been produced during that period.

<u>Damage to Aquatic Habitat</u>

Aquatic habitat is expected to fully recover from the effects of construction. The potential loss in production of fish during construction, due to siltation and turbidity, would be an irretrievable commitment of that resource.

<u>Effects of Noise and Air Pollutants</u>

Effects of gas emissions and noise from construction and the continuing activities connected with operations and maintenance, especially compressor station noise, could cause some wildlife reductions in the immediate area of the right-of-way. This would be an irretrievable loss during the life of the project only.

Right-of-Way Maintenance

As a whole, it is expected that right-of-way maintenance effects on wildlife would be about neutral, with no long-term irretrievable commitments.

Influx of People Into Sensitive Wildlife Areas

Increased access provided by the proposed route to the extent that this would occur could disturb sensitive species and cause a decline in some populations. This impact would last through the life of the project and beyond.

7.1.5R.7 Irrevocable Changes in Land Use

Several isclated areas would be crossed which presently have primitive values because they are undeveloped and relatively inaccessible. The proposed pipeline would disturb the natural conditions in these areas and provide access which would result in some irrevocable changes in land use.

7.1.5R.8 Commitment of Materials and Human Resources

The Project could irretrievably commit over 1,200 man-years of labor during construction.

8 ALTERNATIVES TO THE PROPOSED ACTION

8.1 ALTERNATIVE GAS PIPELINE ROUTES

8.1.5 Los Angeles Pipeline

Background

The applicants studied three major routes between the Canadian border and southern California in their original application. They have included a new proposed route in their last filing (December 1975) with the FPC.

Two alternatives, the East and West alternatives, were considered by the applicants under their original application. Also, alternatives from near the Canadian border to approximately Bonners Ferry, Idaho, and from the Snake River to Meacham, Oregon, have become alternatives under the new filing.

The East and West alternatives were considered by the companies under their original application and were discussed in the Draft EIS. These are no longer considered viable. Both alternatives would have significantly higher environmental impacts than the applicant's proposed route. The East alternative would cross a bombing range in Nevada which is extremely hazardous and is prohibited under the terms of the Executive Order which withdraws lands for this purpose. By the companies' own admissions, these alternatives have been ruled out as viable alternatives and will be treated no further.

The Department of the Interior (DOI) has looked at the alternative of a pipeline parallel to the existing and proposed PGT-PG&E pipeline from Kingsgate, B. C., to southern California via Antioch.

In addition, several minor route adjustments have been suggested. These merely consist of moving the pipeline a few to several miles from the proposed route to mitigate such things as loss of critical wildlife habitat, avoidance of unique geology, soils, or other phenomena.

8.1.5.1 Moyie River

The Moyie River alternative would consist of following an existing PGT-PG&E pipeline right-of-way from Kingsgate, British Columbia, to just south of Bonners Ferry, Idaho. This route is shorter than the proposed route, but does traverse a route through the Moyie River Valley, crossing the Moyie River eight times. The Moyie River and valley is being studied for inclusion under the Wild and Scenic Rivers Act.

Proposed Alternative

This alternative would involve the construction of approximately 35 miles of pipeline adjacent to or upon an existing PGT-PG&E pipeline right-of-way from the Canadian border to just south of Bonners Ferry, Idaho. Size and design capacities would be comparable with the proposed route.

Description of the Environment

See the discussion presented in sections 2.1.4.1 through 15 for those parts applicable to the Moyie River Valley.

Environmental Impacts

See the discussion presented in sections 2.1.4.1 through 16 for those parts applicable to the Moyie River Valley.

One impact which keeps surfacing is the fact that construction of another pipeline through the Moyie River Valley represents an ominous threat to the integrity of the valley ecosystem. It is true that an impact will occur to many components of the system. However, it should be pointed out that four utility corridors presently exist in the Moyie River Valley; i.e., a pipeline right-of-way, a high-voltage transmission line right-of-way, a roadway, and a railway.

Mitigating Measures in the Proposed Action

See the discussion presented in sections 4.1.4.1 through 4 for those parts applicable to the Moyie River Valley.

Adverse Effects Which Cannot be Avoided Should the Proposal be Implemented

See the discussion presented in sections 5.1.5E.1 through 16 for those parts applicable to the Moyie River Valley.

Short-Term Use and Long-Term Productivity

See the discussion presented in 6.1.4.1 through 8.

Establishment of an additional corridor through the Moyie River Valley will impact various components of the ecology either during construction or during the life of the project. However, in the long term, should establishment of vegetation be allowed to continue after abandonment, effects of the project will be negligible.

Irreversible and Irretrievable Commitments of Resources if the Alternative is Implemented

See the discussion presented in 7.1.4.1 through 8.

Complete failure of the pipe could result in the loss of volume of natural gas between mainline valves. This would be an irretrievable loss of energy which may have been used as home heating, cooking, and generation of other power.

In terms of energy lost, that which is needed to manufacture the building materials for the pipeline (lumber, bricks, steel, etc.) as well as that needed for installation of the facilities (man-hours, fossil fuels, gravel, etc.) would be lost. However, if the steel pipe were recovered upon abandonment of the project and reused, some energy benefits may be derived over leaving the pipe in the ground.

8.1.5.2 Snake River to Meacham, Oregon Alternative

This alternative was part of the proposed route under the original filing. (See figure 8.1.5.2-1). Since the new filing with the FPC, this has become an alternative.

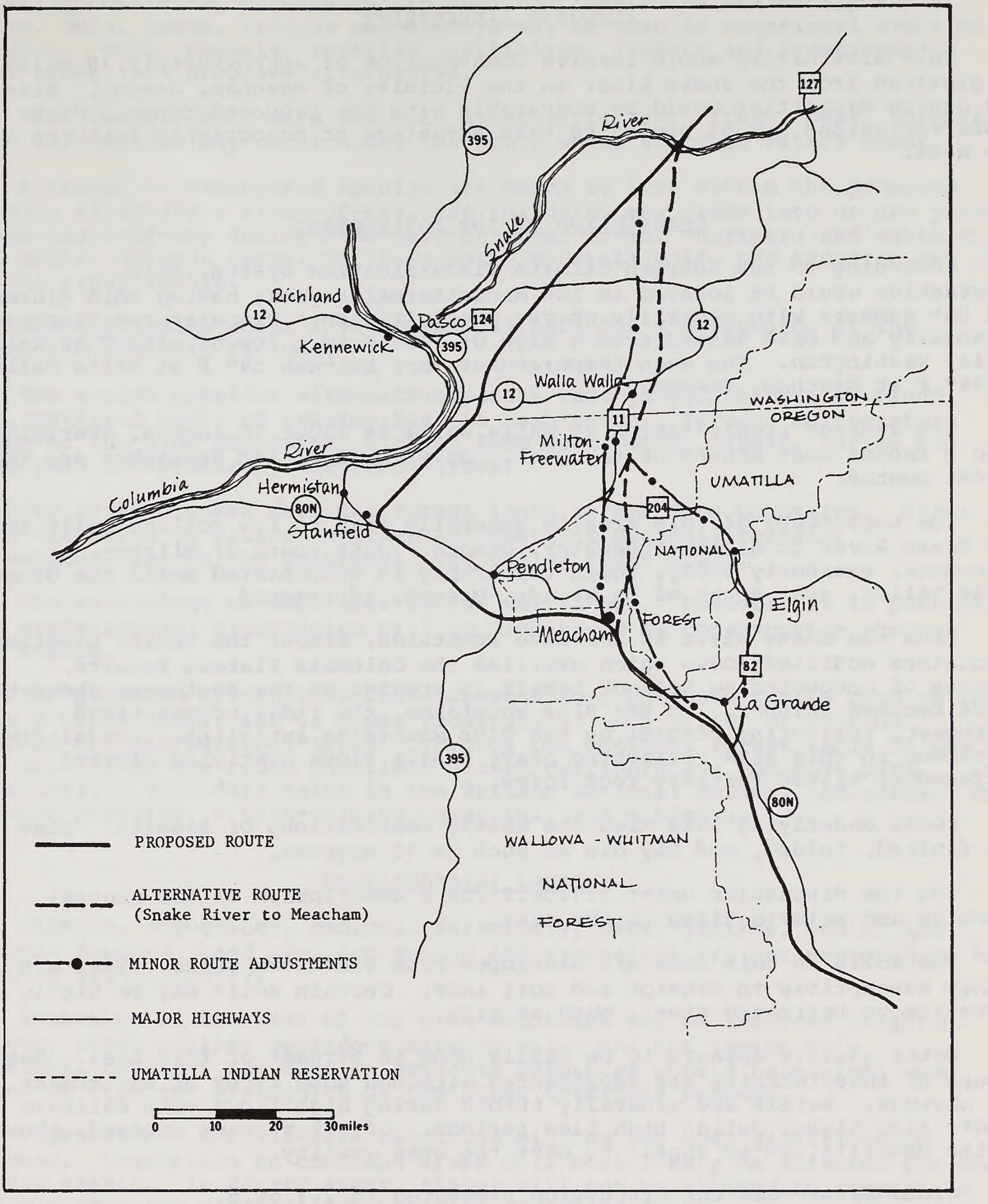


Figure 8.1.5.2-1 Snake River to Meacham Alternative

Proposed Alternative

This alternative would involve construction of approximately 70 miles of pipeline from the Snake River to the vicinity of Meacham, Oregon. Size and design capacities would be comparable with the proposed route. Minor route variations may be needed to take advantage of topographic features in the area.

Description of the Environment

According to the Koeppen Climate Classification System, this alternative would be located in the Microthermal region; having cold winters and hot summers with generally sparse precipitation. Temperatures fluctuate seasonally and have varied from a high of 113° F to a low of -16° F at Walla Walla, Washington. The mean temperatures vary between 54° F at Walla Walla to 44° F at Meacham, Oregon.

The average precipitation at Walla Walla is about 16 inches, averaging 1 to 2 inches most months of the year. July, August, and September are the driest months.

The topography of this area is generally flat to low rolling hills from the Snake River to Milton-Freewater, Oregon. Just south of Milton-Freewater, extremely steep, rough topography is encountered until the Grande Ronde Valley, just south of La Grande, Oregon, is reached.

From the Snake River to the Blue Mountains, almost the entire pipeline encounters modified loess which overlies the Columbia Plateau Basalts. Chances of encountering bedrock basalt is greater to the southwest where the loess becomes thinner. In the Blue Mountains, the ridge crests trend northwest, reflecting control by the Blue Mountains anticline. Landsliding is common in this area reflecting heavy basalt flows overlying altered tuffaceous, tilted Tertiary rock forms.

Rocks underlying this area are mostly combinations of basalts. Some are faulted, folded, and may dip as much as 10 degrees.

See the discussion under 2.1.5E.3 for a description of the mineral deposits and seismic risks in the area.

The soils in this area are developed from windblown silts. They are highly susceptible to erosion and soil loss. Certain soils may be highly corrosive to untreated steel, such as pipe.

Water quality appears to be fairly good in streams of this area. Most groups of invertebrates are represented although some types of enrichment are obvious. Waters are generally turbid during high flows with coliform counts also higher during high flow periods. Of all streams crossed, those of the Umatilla system appear to have the best quality.

Groundwater--See the discussion presented in 2.1.5E.5.

Vegetational communities crossed by this alternative include the Coniferous Forest Formation and the Prairie Grassland Formation.

Principal wildlife species which may be found along the route of this alternative include: white-tailed and mule deer, elk, antelope, rabbits, hares, marmots, coyotes, skunks, badgers, foxes, bobcats, and raccoons. Upland game birds include: ring-necked pheasant, bobwhite quail, hungarian partridge, chukar partridge, ruffed, spruce and sage grouse. Some waterfowl use will occur along streams and in isolated reservoirs and marshy areas. Eagles, owls, hawks, falcons and ospreys may be seen as occasional users of the area. Other mammals, reptiles, amphibians, insects and crustaceans occur along this proposed alternative.

Fish include both warm and cold water varieties. Trout, bass, crappie, perch and catfish may cccur along the route where suitable waters occur.

Although no endangered species are known to live within the proposed pipeline alternative right-of-way, the following may cross into or use parts of the right-of-way during some part of their lives: northern and southern bald eagle, Malheur shrew, northern Rocky Mountain Wolf, ord kangaroo rat and the pygmy rabbit.

See discussion under 2.1.4.9 and 2.1.5E.9 for a discussion of the social and economic factors.

The entire pipeline alternative passes through agriculture cropland with scattered areas of grazing land in Washington. Through northeastern Oregon to the Blue Mountains, similar land uses occur. Wheat, barley and field peas are primarily the crops grown.

The route crosses National Forest lands in the Blue Mountains. These lands are parts of Wallowa-Whitman and Umatilla National Forests. Recreational use is the principal land use of these areas.

The archeology of this area is not well known. However, it is possible some archeological discoveries will be discovered by construction through this region.

The proposed alternative route crosses some historic trails such as the Lewis & Clark trail; and in close proximity (3 to 5 miles) of various historic and recreational sites. Through the National Forest lands in the Blue Mountains, the route parallels access corridors for the most part. Other utility corridors exist in the Whitman National Forest, including: an existing pipeline, a high-voltage powerline, and a highway.

Environmental Impacts

Climate, topography, geology, seismicity, water quality, social and economic factors, land use, archeology and recreation are not expected to be impacted significantly.

Esthetics in the area of the Blue Mountains may be impacted slightly. However, other utility corridors already exist and the impact this additional corridor may have on esthetic resources should be minimal when looked at from the standpoint of the other corridors present.

Vegetational and wildlife resources will be the most significantly affected. Vegetation in cropland areas will most likely be affected for one growing season. In forest areas, timber will not be allowed to revegetate directly over the pipeline for the life of the project.

Most wildlife will emigrate from the area during the construction period. However, following revegetation, wildlife populations could increase utilizing additional succulent vegetation which would become available.

Soils will be disturbed on the pipeline during the trenching and backfilling operations. Ccmpaction caused by movement of machinery will occur to adjacent soils. This may result in reduced soil productivity, although lands under cultivation should quickly regain their ability to produce crops.

Construction may cause soil desiccation which would hinder vegetative growth, especially in drier climates.

Mitigating Measures

See the discussion under 4.1.5E.1 through 4 for mitigating measures applicable to this alternative.

Adverse Effects Which Cannot be Avoided Should the Proposal be Implemented

See the discussicn presented under 5.1.5E.1 through 16.

Short-Term Use and Long-Term Productivity

See the discussion presented in sections 6.1.5E.1 through 8.

Irreversible and Irretrievable Commitments of Resources if the Project is Implemented

See the discussion presented in 7.1.4.1 through 8 and 8.1.5E.1.

8.1.5.3 Kingsgate to Quigley Station, California, via Antioch, California

This alternative is a route parallel to the existing and proposed PGT-PG&E pipelines from Kingsgate to southern California via Antioch. From Antioch to Quigley station, the pipeline would follow or where possible use existing facilities. (See figure 8.1.5.3-1.)

This alternative is not a proposal which has been explored by the applicants. Rather, the Department of the Interior developed it in conjunction with the impact statement. Consequently, much data for this alternative are lacking. If existing facilities can be utilized from Antioch south to Los Angeles, California, this route would result in virtually no impacts.

Proposed Alternative

This alternative would involve construction of a pipeline and associated facilities from Kingsgate, British Columbia, to Antioch, California (approximately 917 miles). From Antioch, existing facilities would be used to Quigley Station (approximately 368 miles) just north of Los Angeles, California. Should the use of existing facilities prove infeasible, a pipeline and associated facilities could be built along existing rights-of-way from Antioch to Quigley Station, California.

Description of the Environment

See the discussion presented in 2.1.4.1 through 15 for the parts applicable from Kingsgate, B.C., to Antioch, California.

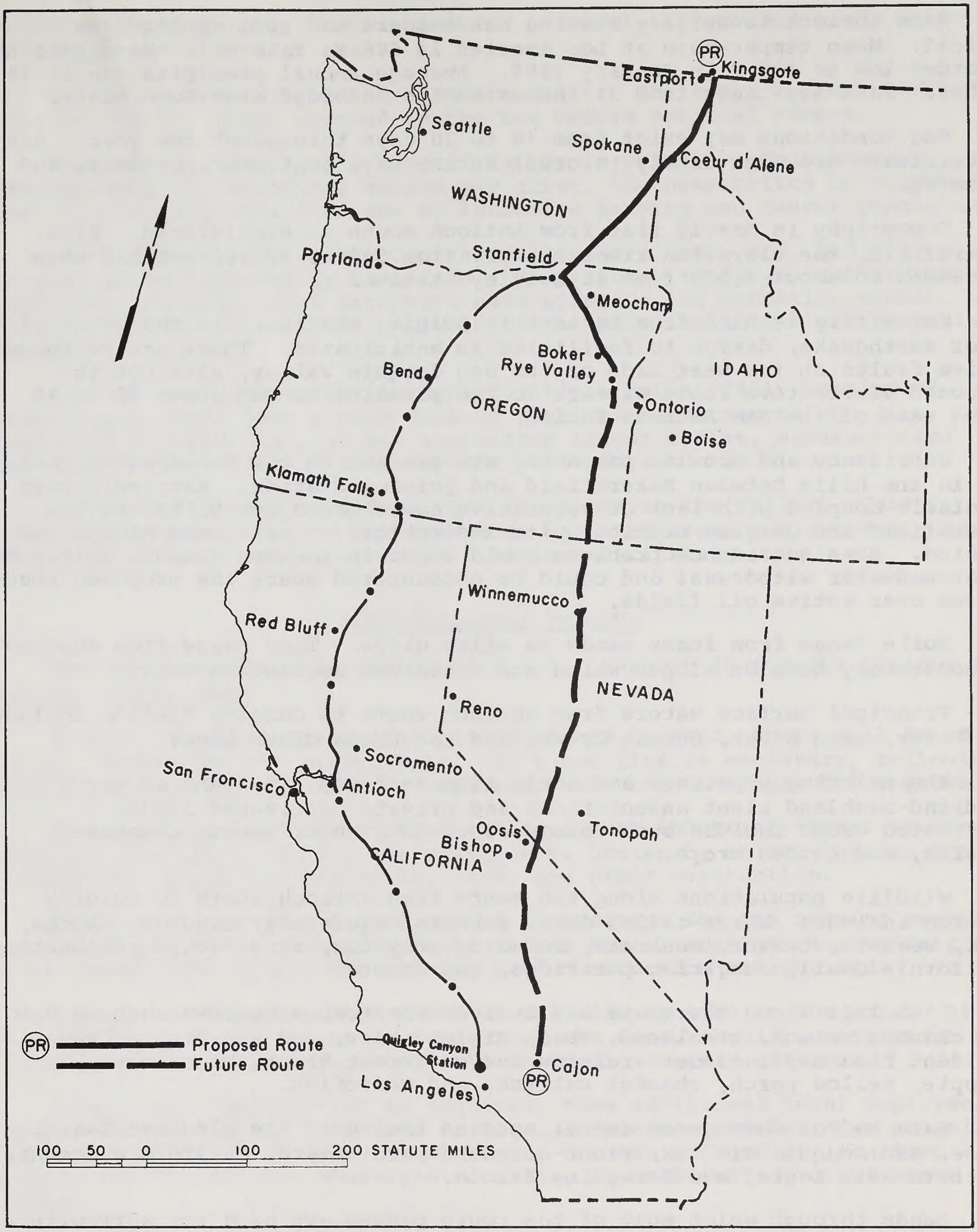


Figure 8.1.5.3-1 Stanfield to Quigley Station via Antioch Alternative

From Antioch to Quigley Station hct summers and cool winters are typical. Mean temperature at Los Angeles is 64° F; this will range from the recorded low of 28° F in January 1949. Average annual precipitation is 14 inches. This may range from 31 inches as the recorded high to a trace.

Fog conditions may exist from 10 to 20 days throughout the year. Air "inversions" are most likely to occur during May, September, October, and November.

Topography is nearly flat from Antioch south to Bakersfield. From Bakersfield, the elevation rises sharply from 500 to 4,000 feet and then decreases to about 1,500 feet at Quigley Station.

Seismicity is high from Antioch to Quigley Station. In the event of a major earthquake, damage to facilities is anticipated. There are no known active faults on the west side of the San Joaquin Valley, although the proposed alternative route appears to run parallel to and about 30 to 40 miles east of the San Andreas fault.

Subsidence and erosion potential are present in the San Joaquin Valley and in the hills between Bakersfield and Quigley Station. Extremely high rainfalls coupled with lack of vegetative cover makes the hills between Bakersfield and Quigley Station quite susceptible to mass land slumps and erosion. Some subsidence problems could occur in the San Joaquin Valley due to groundwater withdrawal and could be encountered where the proposed route passes over active oil fields.

Soils range from loamy sands to silty clays. They range from shallow to moderately deep on slopes which are described as flat to steep.

Principal surface waters from Antioch south to Quigley Station include: Old River, Kern River, Gorman Creek, and the Santa Clara River.

The existing pipelines and their rights-of-way are found in the woodland-bushland plant associations and private cultivated lands. Cultivated crops include such things as cotton, sugar beets, tomatoes, alfalfa, and garden crops.

Wildlife populations along the route from Antioch south to Quigley Station include: black-tailed deer, rabbits, squirrels, coyotes, skunks, mink, weasels, beaver, muskrats, bobcats, gray fox, ring-necked pheasants, California Quail, Hungarian partridge, and others.

Fish life along the route may include anadromous species such as coho and chinook salmon, steelhead, shad, striped bass, and Pacific Lamprey. Resident fish may include: rainbow and cutthroat trout, black bass, crappie, yellow perch, channel catfish, and whitefish.

Rare and/or endangered animal species include: the Aleutian Canada goose, San Joaquin Kit fox, Blunt-nosed Leopard Lizard, California Condor, Southern Bald Eagle, and Peregrine Falcon.

Lands through which most of the route passes are used for agricultural purposes. These provide economic sustenance to owners of these lands as well as the people who work the lands. The lands also provide food for a large number of people.

As mentioned previously, intensive agriculture is the primary use of the lands from Antioch south to Bakersfield. Many food crops as well as some livestock production occur on these lands. The area between

Bakersfield and Quigley Station is used primarily as grazing land, watershed protection and a natural area.

The route generally follows Interstate 5. There are approximately 12 miles of Federal lands crossed in the Los Padres National Forest.

Most of the land in the Central Valley is private. Consequently, although many archeological values may exist, the possibility of recovering these values is complicated due to intensive farming and denser populations.

Most of the lands in the Central Valley have been, are, and will continue to be impacted by human use. Powerlines, roadways, cultivated croplands, and artificial waterways have affected the esthetic, scenic, and cultural values of the lands. Little cf the pristine nature of the valley remains.

Ambient air quality varies considerably. During fall, burning of agricultural lands adds a good deal of particulate matter to the air. Large numbers of vehicles and, as one approaches larger cities, manufacturing production firms also add considerable pollutants to the air.

Sound levels vary depending upon locations in the valley. Quiet, serene environments may be found in more isolated areas and extremely noisy areas may be found near Interstate 5 or larger cities.

Environmental Impacts

See the discussion presented in 3.1.4.1 through 16 for the impacts to Antioch, California.

Should the existing natural gas pipelines be used, there will be no further impacts on the environment. If a new line is necessary, following existing rights-of-ways will be utilized, reducing environmental impacts.

Seismic activity represents the single most important threat to the pipeline integrity. Should the pipeline be broken by an earthquake, the possibility exists for explosion, fire, and other destruction.

Impacts on cultivated lands would be apparent for one growing season. Since many fields in this area raise two or three crops per annum, only part of one crop would be affected should new construction be required.

Negligible impacts would occur on wildlife species in the area. At the most, some may move a short distance from the area, should construction be necessary. Nonmobile species will be the most severely affected.

Should new construction be required, some additional local employment may become available. Conflicts of local enforcement authorities as well as localized inflation may occur. There may be some effects on localized housing facilities with shortages occurring as construction crews move through.

Waste disposal, noise level, and air quality are some of the problem areas which will have higher impacts if construction is necessary.

Should this alternative become viable, all impacts south of Stanfield, Oregon, would be eliminated.

Mitigating Measures in the Proposed Action

See the discussion presented in sections 4.1.4.1 through 4 for those parts to Antioch. Those measures discussed therein are also applicable from Antioch south to Quigley Station.

Adverse Effects Which Cannot be Avoided Should the Proposal Be Implemented

See the discussion in sections 5.1.4.1 through 16 for those parts applicable to Antioch.

If existing facilities are used, no impacts will occur. Should new construction be required, for the entire length, a cleared area 100-feet wide and about 368 miles long (4,460 acres) will need to be cleared and graded.

A scar would be visible for many years in the more arid portions of the environment. Revegetation of these areas may never be fully reestablished.

There may be some loss to archeological values which might exist along the route should construction be necessary. Some losses to recreational and esthetic resources would also occur.

Short-Term Use and Long-Term Productivity

See the discussion presented in sections 6.1.4.2 through 4. Most of those mentioned will apply from Antioch to Quigley Station.

Irreversible and Irretrievable Commitments of Resources if the Project is Implemented

See the discussion presented in 7.1.4.1 through 8. Many of the items discussed are applicable from Antioch south to Quigley Station. Note: Two other alternatives may exist: (1) combining the PGT-PG&E proposal from Kingsgate to Antioch with the ITA(A) alternative from Kingsgate to Antioch into one large pipeline, and (2) combining the PGT-PG&E proposal with the ITA(A) proposal into one large pipeline as far as the Snake River or Stanfield. These are discussed in Overview, Section 8.OV.3.

8.1.5.4 Minor Route Changes

These are minor route changes suggested to alleviate various problems which may be caused by the Snake River to Meacham route alternative. All of these route changes involve changing this route alternative no more that 5 to 20 miles. Hence, climate, topography, etc., are basically the same for the minor route as for the proposed project.

The only significant route adjustments in the vicinity of the proposal are those associated with this alternative (see figure 8.1.5.2-1) discussed in section 8.1.5.2.

The two eastern minor route changes, i.e., through the Umatilla National Forest, follow existing transportation corridors. The two western minor route changes will route the pipeline to areas where impacts regarding erosion, soil movement, and esthetics will be significantly lower. The farthest west route change parallels and may adjoin an existing Northwest

Pipeline Company feeder line from Walla Walla, Washington, to the vicinity of Emigrant Springs, Oregon.

Environmental Impacts

Climate, topography, geology, seismicity, water quality, social and economic factors, land use, archeology and recreation are not expected to differ from those for the alternative.

Esthetic impacts will be affected along all the minor route changes. Along those transportation corridors utilized by travelers, the esthetic impact may be more noticed than in other areas. However, corridors do exist in these areas and the impact will not be as great as if there were no corridors.

Vegetation and wildlife resources will be affected similarly to those described for the alternative.

Soils disturbance will be similar to those described for the alternative.

For mitigating measures, adverse effects, etc., see the discussion under the Snake River to Meacham, Oregon, alternative (section 8.1.5.2).

8.1.5.5 Comparison of Route Alternatives in 8.1.5.1 through 3

The major quantifiable differences are displayed in Table 8.1.5.5-1.

The subjective impacts and mitigations have been discussed in the immediately preceding parts of this section, 8.1.5.

The Snake River to Meacham, Oregon, alternative leaves the Snake River following a southerly course, passing just east of Walla Walla, Washington, to the vicinity of Meacham. This route is 36 miles shorter than the proposed route, however almost 70 miles of new corridor will be constructed under this alternative. Approximately 958 acres of habitat will be cleared and graded; 479 acres would remain as permanent right-of-way.

The proposed route is approximately 36 miles longer than this alternative; however, nc new corridors would be opened. Approximately 1,394 acres of habitat would be cleared and graded; 697 acres would remain as permanent right-of-way for inspection purposes.

Environmentally, new impacts would be located between the Snake River and Meacham, Oregon.

Environmentally, following PGT's route to Stanfield, then NPC to Rye Valley, creates no significant new environmental impacts.

8.1.5.6 Route Alternatives to the Proposed Future Expansion

Description of the Environment

Introduction

In addition to the proposed route, there are three alternative pipeline corridors between Ione Valley in Nevada and the Red Mountain region in

Table 8.1.5.5-1 Comparison of alternatives: Eastport to Rye Valley

Alternatives	Miles Pipeline	No. Compressor Stations	No. M.L.V.	No. Minor River Crossings	Miles adj. Existing Util. Corridor	Miles Cultivated Area	No. Mountain Pass Crossings	ASSOC. FACILITIES: No. Comm. Towers	RESOURCES PERMANENTLY COMMITTED (Acreage): Pipeline R.W.	RESOURCES PERMANENTLY COMMITTED (Acreage): M.L.V.	RESOURCES PERMANENTLY COMMITTED (Acreage): Metering Stations	RESOURCES PERMANENTLY COMMITTED (Acreage): Comm. Tower	SLOPES (miles): Gentle 1-10%	SLOPES (miles): Steep 10-25%	SLOPES (miles): Very Steep 25%	Seismic Zones (miles): Greater 5.5	Seismic Zones (miles): Less 5.5
Moyie River Alternative	20	0	1	8	20	5	0	Unk.	242	.01	2	Unk.	20	--	--	0	20
Proposed Route	32	0	1	2	12	19	1	Unk.	388	.01	2	Unk.	31.5	.5	--	0	32
Snake River to Meacham, Oregon Alternative	79	0	3	13	10	37	0	Unk.	958	.04	2	Unk.	71	7	1	79	0
Proposed Route	115	0	5	4	115	84	0	Unk.	1,394	.07	2	Unk.	108	7	--	115	0

California. These alternative routes along with the proposed route are illustrated in figure 8.1.5.6-1.

Alternative Route 1 (A-B-F-D-E) branches off the proposed route about 2 miles north of the Columbus Salt Marsh. This route goes around the north and west side of the Columbus Salt Marsh and intersects Highway 6 at the pass between the Candelaria and Volcanic Hills. This route then generally follows Highway 6 over Montgomery Pass, through Queen Valley to the California-Nevada border. From the border, the route then traverses Benton, Hammel, Chalfant, and Owens Valleys to Big Pine where it would then follow the proposed route (A-B-C-D-E) to Cajon, California.

Alternative Route 2 (A-H-I-J-E) branches off the proposed route at the north end of Ione Valley, travels in a generally southeasterly direction along the east side of the Royston Hills, through Big Smoky Valley, and crosses Highway 6 about 7 miles west of Tonopah, Nevada. This route then heads due south, passing about 2 miles west of Goldfield, Nevada, where it then swings to the southwest, crosses Highway 3, goes over the Slate Range and enters California at the north end of Death Valley. In California this route skirts the northern end of Death Valley National Monument, over the Last Chance Range, down the eastern side of Saline Valley, through Grapevine Canyon, and along the western side of Panamint and Searles Valleys to Red Mountain.

Alternative Route 3 (A-H-J-E) branches off the second alternative route at the California-Nevada border, traversing the northern end of Death Valley National Monument. After passing through Racetrack Valley, this line leaves the Monument and rejoins the second alternative at the south end of Saline Valley. From Red Mountain south to Cajon, alternative routes 2 and 3 would follow the proposed route.

Climate

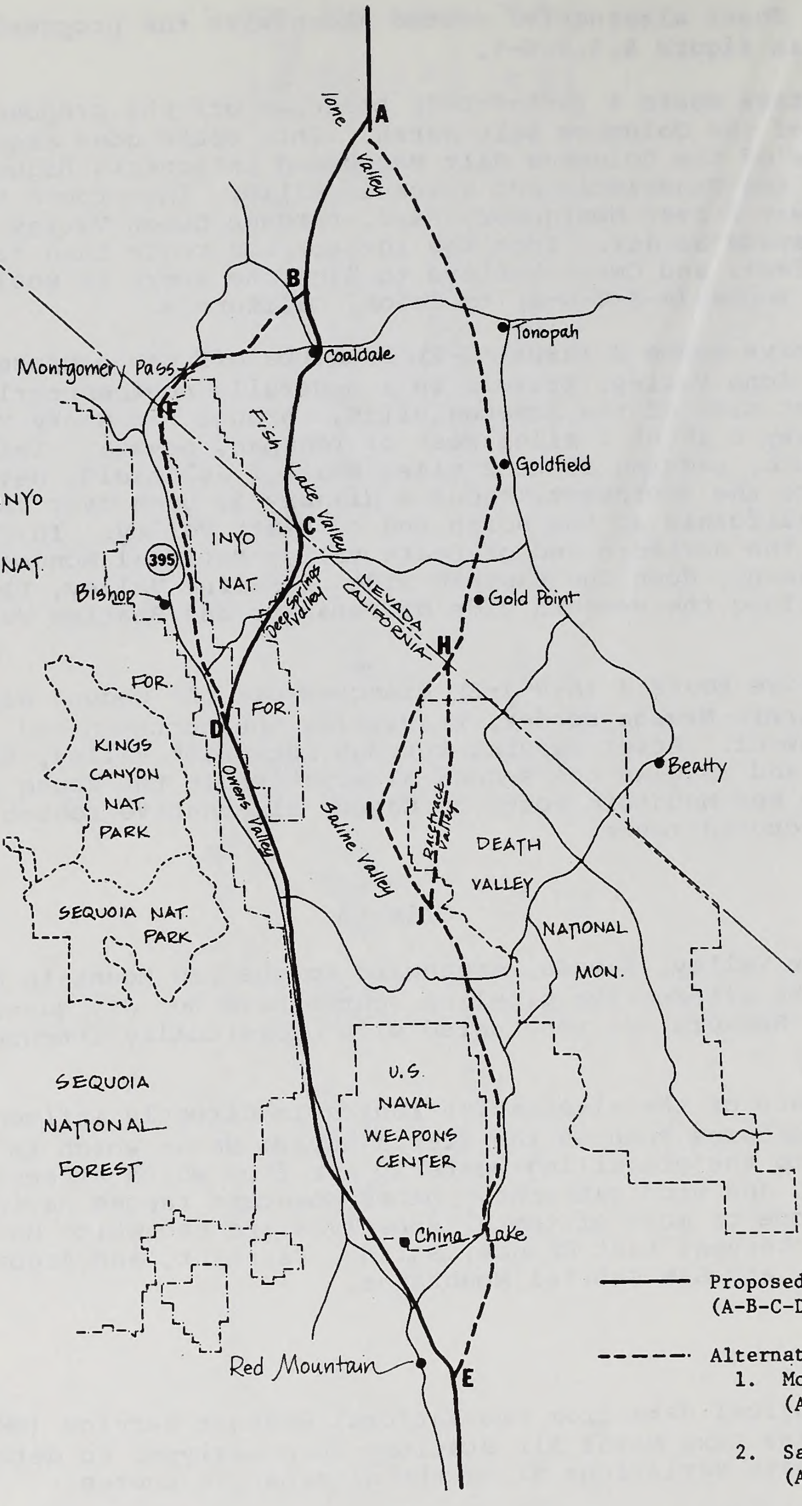
From Ione Valley, Nevada, southward to the Red Mountain area in California, the alternative pipeline routes have hot dry summers and cool wet winters. Summers are punctuated with occasionally intense thunderstorms.

The climate of the alternative routes is directly influenced by major topographic features such as the Sierra Nevada Range which is situated at right angles to the prevailing westerly air flow which affects temperature, precipitation, and wind patterns. Other mountain ranges having a localized influence on one or more of the alternatives are the White Mountains, Inyo Mountains, Montezuma, Last Chance, Saline, Panamint, and Argus Ranges, and El Paso, Lava, and San Gabriel Mountains.

Temperature

Meteorological data from two National Weather Service (NWS) stations--Bishop and China Lake Naval Air Station--were analyzed to determine the extent of climate variations along the alternative routes.

During the summer the area is influenced by hot, dry air of continental origin. During the cooler season of the year, the air is either cool and dry (of continental origin) or cool and moist (of marine origin) accompanied by cloudy skies and widespread light precipitation. The air is hot in the summer and comparatively mild during the winter. Daily ranges of temperature of 30° to 40° F occur in all seasons of the year, especially



Proposed Route (A-B-C-D-E)

Alternative Routes
1. Montgomery Pass (A.B.F.D.E)
2. Saline Valley (A-H-I-J-E)
3. Racetrack Valley (A-H-J-E)

Highways

Figure 8.1.5.6-1 Ione Valley to Red Mountain Alternative pipeline routes

accompanying dry air. Variations in temperature because of elevation are also great.

Monthly and annual temperature statistics for Bishop and China Lake Naval Air Station are presented in Tables 8.1.5.6-1 and -2 (in Appendix). There is a considerable range in the extremes at both stations and along the alternative routes in general. At Bishop, temperatures range from 109° to -6° F; at China Lake the range is 115° to 0° F; and at Tonopah, 104° to -15° F. Temperatures above 100° F occur about 22 days during July at China Lake, similar frequencies of days above 100° F may be expected over most of the alternative routes. In the Deep Springs Valley area, nighttime temperatures may fall below zero for several weeks during midwinter and occasionally exceed 100° in the summer.

Precipitation

Precipitation along the alternative routes is light, averaging from 4 to 9 inches per year. Most of the precipitation falls in the cooler season of the year. Occasionally there are heavy showers during the summer; they usually occur in the mountains and may be accompanied by local flooding. Tables 8.1.5.6-3 and -4 in Appendix present the annual total precipitation data for the alternative routes vicinity. Total annual precipitation in the area is generally light, averaging 4 to 5 inches over most of it. However, substantially greater amounts (about 40 inches) occur in the mountain areas. In Deep Springs Valley, of the 4.5 to 5 inches of annual precipitation, about one-third falls as snow and the rest as rain. The average annual precipitation at Independence is 4.97 inches and at Keeler, on the west shore of Owens Lake, is 2.98 inches.

Climatological records for China Lake indicate that the maximum recorded 24-hour precipitation is 1.03 inches and occurred in November 1946, while 3.64 inches have fallen in a 24-hour period at Bishop in 1967.

Winds

Table 8.1.5.6-5 in Appendix presents the mean recurrence interval for extreme winds 30 feet above the ground. These expected values are three locations near the alternative routes and were computed by Thom (1968). However, it should be noted that the rugged terrain along the alternative routes could induce localized winds in excess of these point values. Such a combination of meteorological and terrain conditions could produce localized winds in the 100- to 125-mph range anywhere along the alternative routes.

Destructive Storms

The occasional occurrence of short duration, high intensity storms can produce flash floods in the larger drainages resulting in mass movement of soil and large boulders onto the alluvial fans in the valley bottoms.

Topography and Geology

Alternative Route 1 leaves the proposed future expansion route west of the Monte Cristo Range and traverses the northwest edge of Columbus Salt Marsh at an average elevation of about 4,600 feet. This alternative travels in a southwesterly direction to the California-Nevada border, passing between the Candelaria Hills and Volcanic Hills. It then climbs over Montgomery Pass (about 7,000 feet) at the north end of the White Mountains and drops gradually into the valley on the west side of that range at about 6,000 feet. The White Mountains culminate in White Mountain Peak at an elevation of 14,246 feet, more than 9,000 feet above the Owens Valley floor. Alternative 1 then heads south through Benton, Hammil, and Chalfant Valleys and enters the Owens Valley just north of Bishop. This alternative route continues south and southeast through the relatively flat Owens Valley, joins Highway 395 about 6 miles northwest of the town of Big Pine. It then parallels U.S. Highway 395 on the east side and rejoins the proposed future expansion route about 4 miles south of Tinemaha Reservoir at an elevation of 4,000 feet.

This alternative traverses numerous alluvial fans along the margin of the White Mountains with slopes of up to 450 feet per mile. The west face of the White Mountains rises very sharply to over 13,000 feet at the heads of these fans.

This alternative route is entirely in the Basin and Range physiographic province which is characterized by internal drainage. The Owens River and its tributaries are main drainages for the area traversed by the alternative.

Between Columbus Salt Marsh and the north end of the White Mountains, the route appears to cross a variety of Tertiary volcanic rocks and possibly a minor amount of Paleozoic rock. Total distance of bedrock traversed appears to be less than 6 miles. The last 6 miles in Nevada and all of the alternative route in California is in alluvial material. This material is semiconsolidated to unconsolidated and is probably very coarse grained and bouldery on the fans at the base of the White Mountains.

Several small faults are crossed between Columbus Salt Marsh and the north end of the White Mountains. Some of these cut late Tertiary and (or) Quaternary deposits. It is not known if these faults are presently active. Within California, Alternative Route 1 crosses no known active faults. However, three lines of evidence: 1) the steep straight front face of the White Mountains, 2) segments of faults in Quaternary alluvium, and 3) known active faults within 1 mile of the south end of the alternative indicate that this is a seismically active area (see 2.1.5R.3, Geologic Hazards, for discussion of seismicity in Owens Valley).

Alternative 1 will cross no mineral deposits known to be actively worked and will disrupt no known mining operations near the route.

Alternative Route 2 departs from the proposed route at the south end of Ione Valley at an elevation of about 6,200 feet. It passes over irregular topography of low relief on the east side of the Royston Hills and continues south-southeastward across Big Smokey Valley (low point at alternative route crossing is about 4,900 feet). Most of the irregularity in topography is due to the route going in and out of small dry washes. This alternative continues southward across a low divide (elevation about 5,300 feet) and into a closed depression at the north end of the Montezuma Range. The alternative route then traverses a divide between Montezuma Peak and Goldfield (elevation about 6,400 feet) and turns southwestward for about 25 miles over low relief topography to the Slate Range. It crosses the range in a low saddle (about 5,400 feet) and drops steadily to about 3,000 feet in Death Valley, crossing the California-Nevada State line about half way between. This alternative route then climbs out of Death Valley and over rugged and steep slopes of the Last Chance Range to an elevation of about 6,500 feet. It then drops into a valley spur off of Saline Valley and into Saline Valley proper, descending gradually to a low point of about 1,400 feet. This alternative route then turns southeast climbing gradually at first and then over steep rugged parts of Grapevine Canyon to an elevation of about 6,000 feet. This alternative route then traverses equally rugged topography dropping into Panamint Valley. It follows the west side of the valley reaching a low point of 1,600 feet about where it crosses State Highway 190.

About 25 miles south of the highway crossing, this alternative route climbs about 1,000 feet across rugged topography and enters Searles Valley. It follows the west side of the valley, passing west of Searles Lake (dry most of the year) and the town of Trona at an elevation of about 2,000 feet. It continues south and then southwest across relatively even topography. About 17 miles south of Searles Lake the route crosses the Garlock Fault where it follows a low but rugged spur (average elevation 3,000 feet) of the Lava Mountains and intersects the proposed route just east of Red Mountain at an elevation of 2,700 feet.

The entire Alternative Route 2 is in the Basin and Range physiographic province which is characterized by internal drainage (all water goes into closed depressions, none reaches the sea).

From the point it departs from the proposed route, Alternative Route 2 will cross no bedrock for about 65 miles, staying in Quaternary alluvium to a point just north of Goldfield, Nevada. There, about 6 miles of late Tertiary and (or) early Quaternary volcanic rocks are traversed. Some blasting might be required to trench this area. About 12 miles southwest of Goldfield, an area of bedded clay and silt is encountered. From there, the route crosses only alluvial material to Slate Ridge, which is underlain by granitic rock and welded ash-flow tuffs; both could require blasting, especially the latter. Lower Paleozoic formations are the next bedrock encountered along the route; these are found in the Last Chance Range in California. Without question, extensive blasting will have to be done in this area. No bedrock is encountered in Saline Valley, but extensive granitic rock must be crossed in Grapevine Canyon. In the Panamint Valley no bedrock is crossed. Between Panamint and Searles Valleys, Alternative Route 2 crosses Paleozoic rocks and young basalt flows. Blasting will probably be necessary here and in Grapevine Canyon. Quaternary lake beds and alluvium are crossed in several places in Searles Valley, and late Tertiary sedimentary and volcanic rocks are crossed in the Lava Mountains, the last bedrock outcrop encountered before this alternative route rejoins the proposed route.

Alternative Route 2 passes within 5 miles of several important mineral deposits. Most of that part of Nevada traversed by this alternative route has high mineral potential and active exploration is going on at present. Some of the more important areas along the route are: Tonopah (over $100 million in silver produced), Goldfield (over $100 million in gold produced), and Searles Lake (various salts valued in excess of $1 billion).

Where this alternative route traverses the north end of Death Valley, it crosses the Furnace Creek fault zone which is considered active. From geologic and (or) seismic evidence, several other faults crossed by the route should be considered active: (1) a fault near Lower Warm Springs in Saline Valley, (2) a fault up Grapevine Canyon, (3) a fault along the west side of Panamint Valley, (4) the Garlock fault (see section 2.1.5R.3, Geologic Hazards, for discussion of seismic potential of the Garlock Fault).

Flash floods in desert areas have a tremendous potential for erosion and might excavate a buried pipeline. Areas that might be susceptible to this danger are: (1) in the Last Chance Range; (2) Grapevine Canyon area, (3) the west side of Panamint Valley, and (4) the east side of the Argus Range.

If the pipeline were buried in the alkaline brines in Searles Lake, corrosion problems would almost certainly result.

Alternative Route 3 diverges from Alternative Route 2 at the northeast edge of Death Valley on the California-Nevada border at an elevation of about 3,800 feet. It trends almost due south across Death Valley National Monument and climbs gradually up the canyon west of the Cottonwood Mountains. After passing through a saddle between the Last Chance Range and the Cottonwood Mountains (elevation 5,000 feet), this alternative route descends gradually into Racetrack Valley (elevation 3,700 feet). It then continues southward down a very steep scarp to the mouth of Grapevine Canyon where it rejoins Alternative Route 2 at an elevation of about 3,200 feet.

Paleozoic rocks are crossed north and south of Racetrack Valley and granitic rocks south of Racetrack Valley; in all no more than 5 miles of rock are crossed, the rest of the alternative route is in alluvium. The route appears to miss Racetrack Playa in the center of Racetrack Valley. The Furnace Creek fault zone is crossed by this alternative route in Death Valley.

Soils

The soils crossed by the three alternative routes belong to the Haplargid Great Soil Groups. They occur on alluvial fan deposits and steep mountains developed in a semiarid climate. These soils are poorly developed, high in sodium, and coarse loamy to sand in texture. Soil depth is shallow and generally underlain by a thin cemented clayey layer or cemented carbonate layer. Although vegetation is sparse, a gravelly mantle called "desert pavement" forms a protective layer against wind and water erosion on the surface.

The soil associations found along the alternative routes contain highly corrosive soils to untreated steel and are subject to mass movement or landslides. Revegetation would be extremely difficult on the soils found along the alternative routes due to low productivity and lack of moisture.

Water Resources

Surface Water

The alternative routes follow several interior basins within the Great Basin. The basins are sites of thick accumulations of sediment, are ringed by alluvial fans, and many are marked by playas at their topographic low points.

Alternative Route 1 traverses the basins of Columbus Salt Marsh and Benton, Hammil, Chalfant, and Owens Valleys. Alternative Route 2 follows Big Smokey, Death, Saline, Panamint, and Searles Valleys. Alternative Route 3 goes through Death and Racetrack Valleys. All of these valleys drain internally and are characterized by dry lake beds during most of the year.

The only major stream within the area of the alternative routes is the Owens River which is crossed by Alternative Route 1. Two small perennial streams, Big Pine and Tinemah Creeks, are also crossed by Alternative Route 1. Numerous small, intermittent streams are crossed by the three alternative routes. Some of the more significant intermittent streams crossed by Alternative Route 1 are Marble, Pellisier, Birch, Willow, and Piute Creeks that drain the western flank of the White Mountains to Owens Valley.

Intermittent streams crossed by Alternative Route 2 are Peavine Creek and Oriental Wash in Nevada, and Death Valley Wash and Teagle Wash in California. Alternative Route 3 also crosses Death Valley Wash.

Alternative Route 1 passes close to the Columbus Salt Marsh, Orchard Spring, and Fish Slough. A refugium has been built at Fish Slough for the endangered Owens Valley Pupfish.

Alternative Route 2 passes near Upper Warm Springs in Saline Valley where an attempt is being made to establish the Devils Hole Pupfish. A refugium has been constructed at the spring for their purpose. Lower Warm Springs is an important recreation attraction that receives many visitors, especially during the winter months when the weather in Saline Valley is still relatively warm. These hot springs are used for bathing. On the other side of Saline Valley is a spring and marsh that forms an important ecological site which attracts a wide variety of birds and other wildlife in an otherwise extremely dry area. Sand Spring and Little Sand Spring in Death Valley are also located near this alternative route.

Alternative Route 3 does not pass near any significant surface water.

Ground Water

The area the three alternative routes pass through is arid to subarid, with average annual precipitation ranging from less than 1 foot on lowland alluvial areas to as much as 3 feet in the higher mountains. Because of the higher precipitation in the mountains, recharge to the ground-water system is highest there and on the alluvial apron where mountain streams debouch. Ground-water flow is commonly toward the axis of the valley where ground water is discharged to the atmosphere by evapotransporation.

For a more detailed discussion on water resources within the area of the alternative routes, including public water supplies, water quality, particular features of the several stream basins, and ground water refer to 2.1.5R.5.

Vegetation

Refer to section 2.1.5R.6 for a vegetative description along the preferred routes. This information is generally applicable for all of the alternative routes. Additional vegetation data are provided below.

Five plant associations occur along the alternative routes. These include Joshua tree woodland, creosote bush scrub, salt desert shrub, sagebrush scrub, and pinyon-juniper woodland.

Joshua tree woodland occurs in the area of Lee Flat on Alternative Routes 2 and 3 and pinyon-juniper woodland occurs on the higher elevations and north facing slopes of the Nelson Range north of Lee Flat. Sagebrush scrub forms the understory of the pinyon-juniper and Joshua tree woodland in the Lee Flat-Nelson Range area. Salt desert shrub is found near the sinks and in poorly drained sites in the valleys traversed by the alternative routes. Creosote bush scrub is the dominant vegetation type on the well drained soils along alternative routes.

Alternative Routes 2 and 3 pass through regions of high plant endemism with many unique species, as does the proposed route. Twelve species of plants considered to be rare and endangered occur in relatively undisturbed Saline Valley. Death Valley National Monument also contains many rare species and some of these would be expected to occur along the Alternative Route 3. The alternative routes pass through vegetation which is relatively less disturbed than the vegetation along the proposed route.

Where Alternative Rcute 2 crosses the Last Chance Range, a concentration of rare and relatively rare plant species occur (DeDecker, 1975). These include:

Aristida glauca (Nees) Walp.
Astragalus panamintensis Sheld.
Blepharidachne kingii (Wats.) Hack.
Buddleja utahensis Cov.
Cymopterus gilmani Mort.
Eriogonum gilmanii S. Stokes
Hecastocleis shockleyi Gray
Mimulus rupicola Cov. & Grant
Notholaena jonesii Maxon
Penstemon calcareus Bdg.
Salvia funerea Jones
Scrophulophila rixfordii (BDG.) M.& J.
Viguiera reticulata Wats.

In addition to the above is a new genus and species, the first new genus to be found in California for many years, was recently discovered there. Such a concentration of rare and unusual plant species would indicate the possibility of rare forms of fauna dependent on them. Much scientific attention will undoubtedly be focused in this area.

Wildlife

Refer to section 2.1.5R.7 for an overview of the alternative route area. In general, there are fewer species and fewer individuals of terrestrial animals in most functional groups along Alternative Routes 2 and 3 than there are along the proposed route or Alternative Route 1 through Owens Valley. Wildlife species composition and abundance along Alternative Routes 2 and 3 are similar to the Mojave Desert section of the proposed route.

The two main big game species along Alternative Routes 2 and 3 are desert bighorn sheep and Inyo white-tailed deer. The desert bighorn sheep are protected from hunting. Both species are described in some detail in 3.1.5R.7. The California Department of Fish and Game (1974) does not have population estimates for the herd of desert bighorn sheep in the Last Chance Range in Inyo County; but sightings have been numerous and a systematic population survey is being planned. The Inyo mule deer also inhabit the Last Chance Range in Inyc County.

There are no wild burros or wild horses in Owens Valley. However, Saline and Death Valleys are inhabited by one of the major remaining populations of the wild burro. In addition, wild horses have recently been introduced into Death Valley.

The burro was introduced into Death Valley many years ago and has readily adapted to the sandblasting gales, high temperatures, perennial drought, and general scarcity of water in the valley. Burros eat mesquite and have an almost uncanny ability to find waterholes in desert and mountain areas (Ingles, 1965). Wildlife biologists have contended for many years that burros foul desert waterholes and compete directly with desert bighorn sheep, so the two species cannot co-inhabit the same ranges (Buechner, 1960; Dixon and Sumner, 1939). However, a comprehensive study funded by the

National Park Service (Welles and Welles, 1961) found no evidence to support any of these claims. On the contrary, it was found that some of the most substantial populations of bighorn in the Death Valley region were feeding in the same areas and watering at the same springs as the burros. The exact nature of the interaction, if any, of desert bighorn and wild burros is still not clearly understood.

The degree to which recently introduced wild horses have established themselves in Death Valley is not known. Both wild burros and wild horses are protected by law and cannot legally be taken for sport or commercial purposes.

Most of the same species of small game, nongame, and furbearing animals occur on all three alternative routes. There are more water-oriented species such as mink on Alternative Route 1, while strictly desert species such as the antelope ground squirrel are more common on the other two alternative routes. Though data are not available, it is probable that there are fewer species such as house mice, rats, and wildcats on Alternative Routes 2 and 3 than on Alternative Route 1.

Birds of prey tend to forage over rather large areas and can easily cross mountain ranges, valleys, and other expanses. The rugged, relatively inaccessible mountains of the White, Inyo, Last Chance, Cottonwood, Argus, Sierra Nevada, and other mountain ranges provide the protection and isolation for nesting activities. The valleys and lower foothills are inhabited by numerous prey species (rodents, snakes, lizards, small birds, etc.) and are ideal foraging areas for raptors. Owens Valley provides species for those raptors that prey on waterfowl, water-oriented birds, and fish; in all other respects, however, routes are similar with regard to birds of prey.

Approximately 60 species of waterfowl and other migratory birds are known to occur, some only occasionally, in the general region of the alternative pipeline routes (Birds of Death Valley National Monument, undated). Aside from the Mallard, which is the only perennial waterfowl of the area, waterfowl and water-oriented birds make use of the centers of this region only as temporary resting spots during their seasonal migrations (Jaeger, 1971). Waterfowl and other migratory birds use as resting areas the Saline and Panamint playas, Columbus Salt Marsh, Searles Lake, Cuddeback Lake, Harper Lake, and the numerous springs and wells within the region. Most of these water areas are dry much of the year and fill only after a heavy rainfall. They are of virtually no importance as breeding or wintering grounds, but they do provide some resting and feeding habitat.

There are relatively few upland species on Alternative Routes 2 and 3, primarily because of the lack of water and suitable cover. Gambel's quail and chukar partridge inhabit the region, as do mourning doves. Audubon cottontail rabbits and jackrabbits are abundant; the cottontails live in the hills and around water; and jackrabbits are found throughout the valleys.

There are about 200 species of migratory and resident birds in the area from the valley floors to the mountain peaks.

The reptiles and amphibians along Alternative Routes 2 and 3 are similar to those in the Mojave Desert, with a few exceptions. The rare black toad is confined to Deep Springs Valley and lives near the proposed route. The desert horned lizard is found along the entire length of Alternative Routes 2 and 3 but only on the Mojave Desert section of the proposed route.

The alternative pipeline routes through Death, Saline, Panamint, and Searles Valleys and the Mojave Desert do not intersect any perennial streams or directly threaten the status of any of the numerous springs near the corridor.

Of the rare or endangered wildlife species listed by the California Department of Fish and Game (1974) and by the Department of the Interior (1973), four are known to occur in the region of the two eastern alternative pipeline routes. Three of the species, the Mojave ground squirrel, the prairie falcon, and the peregrine falcon, are natives.

The only known populations of the rare Mojave ground squirrel exist in the Victorville-Barstow-China Lake region of the Mojave Desert (California Department of Fish and Game, 1974). This small, desert-dwelling ground squirrel is closely related to the antelope ground squirrel, with which it has to compete. The Mojave ground squirrel inhabits the scattered brush of this low desert region, preferring areas of sandy or gravelly soil (Burt and Grossenheider, 1964). Accelerated urbanization and land use changes taking place in the Mojave River Basin and Antelope Valley are destroying much of its habitat. Capture, possession, and/or sale of this animal are prohibited by State law.

The endangered Devils Hole Pupfish, which is not native to California, has been introduced into Upper Warm Springs in Saline Valley in an attempt to safeguard its dwindling numbers. Alternative Route 2 passes next to this spring. Before transplantation to Upper Warm Springs, this pupfish lived only in Devils Hole. Possibly from removal of water from the aquifer for irrigation, fish populations in the spring have continually been threatened (Department of the Interior, 1973). Therefore, transplanting has evolved as an effort to save these unique fish. The success of the attempted introduction is not yet known, but Upper Warm Springs has been fenced and is closed to the public to give the species every opportunity for survival. Should the initial introduction fail, additional attempts to introduce the Devils Hole pupfish may again be made in Upper Warm Springs or in other hot springs that would be suitable habitat.

The prairie falcon and the peregrine falcon, which are included in the Department of the Interior's list (1973) of threatened species of birds, may hunt for food in the major valleys and may nest in the inaccessible cliffs, especially in the Last Chance Range. The United States Bureau of Land Management has prepared a report specifically related to increased use of recreational vehicles in the California desert. The report lists wildlife species whose existence could be threatened or stressed by increased pressures from off-road vehicle activity. Those species indicated for regions along the alternative pipeline routes include the Desert tortoise, kit fox, Panamint chipmunk, prairie falcon, Panamint alligator lizard, Devils Hole pupfish, desert bighorn, and the Mojave ground squirrel (BLM, 1973; Department of the Interior, 1973).

The Alternative Route 1 through northern Owens Valley, comes close to several other rare or endangered species that the other alternative routes would not impact. Several tule elk herds roam in the northern section of Owens Valley, especially near Bishop, California. The Owens pupfish is restricted to slow-moving shallow water in Fish Slough north of Bishop and a small pond north of Big Pine, both near the Owens River. Much of its previous habitat has been eliminated by drainage and drying of the marshy areas as a result of exporting water; in some areas populations have decreased because of competition with other fish. The Owens tui chub is considered an endangered species. At present, the only pure population of this fish lives in an 8-mile section of the old Owens River below Crowley

Lake Dam, north of Bishop. Throughout much of its habitat, it has hybridized with another tui chub, Gila bicolor obesa.

Ecological Considerations, Economic Factors, and Sociological Factors

Refer to sections 2.1.5R.8, -9, and -10 for a general overview of the ecological, economic, and sociological factors for the region crossed by the three alternative routes.

There are approximately 200 plant species in the area of the three alternative routes. Approximately 50 of these are perennial and 150 are annual plants. The perennial plants include five grasses and the remainder, shrubs. The perennials are widely spaced, seldom exceeding 10 percent total ground cover density. When a warm, early spring follows a wet winter, the interspaces support a dense and varied crop of annual herbaceous plants. Such a condition can be expected on a long-range average of 1 in 5 years. This vegetative cover provides a forage and cover base for 57 kinds of reptiles, 154 species of birds, and 67 species of mammals. As the vegetative resources respond to the weather conditions, the animal populations respond to the vegetative production. Those smaller, short-lived species of desert animals can, within one to three growing seasons, repopulate depleted habitat areas when weather conditions are right. Longer lived species such as the desert tortoise and chuckwalla respond more slowly.

Desert ecosystems are fragile. Revegetation of disturbed areas may require 50 or more years for perennial plants to reestablish. Should severe compaction accompany the disturbance, an even longer recovery period may be required.

Owens Valley has a larger economic infrastructure than any other area along the alternative pipeline routes. Alternative Routes 2 and 3 do not pass near any communities with a population over 500 people.

Land Use

Refer to section 2.1.5R.11 for a general land use overview. Further detail is given below.

Desert shrub vegetation is typical along the three alternative routes. Wildlife habitat, recreation, and limited grazing are typical land uses. Very limited irrigated agriculture exists, more so for Alternative Route 1, as it traverses the length of Owens Valley.

Generally, zoning for Alternative Routes 2 and 3 is Desert Living with recreational-residential use expected to intensify. Alternative Route 2 would enter Saline Valley through a pass on the south end of the Saline Range and then follow the east side of Saline Valley. This area has been proposed as a Closed Area to off-road vehicle travel by the BLM.

Alternative Route 1 follows existing corridors almost its entire length. Montgomery Pass and Owens Valley have major highway, railroad, and utility corridor rights-of-way as well as more urban development than the other alternatives.

The proposed route runs for 13 miles through the China Lake Naval Weapon Center testing range. This area is contaminated with high explosive materials. Where the proposed route enters California and passes through

Fish Lake and Deep Springs Valleys, livestock grazing has prevailed as the principal land use.

Paleontological, Archeological, Historical

Refer to section 2.1.5R.12 for an overview of the general area the alternatives are located in. The San Bernardino County Museum Association has done a preliminary records search of known or potential sites along the alternative routes.

Table 8.1.5.6-6 (in Appendix) is a listing provided by the San Bernardino County Museum showing archeological resources which might be disturbed along the alternative routes. The exact locations were not given to avoid possible vandalism. The checklist is not complete because portions of the route have not been field surveyed by archeologists.

Any more detailed archeological field work necessary will be conducted after the project has been approved and a precise route has been chosen.

Recreation and Esthetic Resources

Refer to section 2.1.5R.13 for a general overview of the area crossed by the three alternatives.

The alternative routes are located in country whose use is predominantly recreation. The main types of recreation are related to off-road vehicles. The last 15 years have shown a tremendous increase in this use. Other recreational land uses include sightseeing, upland bird hunting, and rock-hounding.

Alternative Route 2 crosses a proposed primitive area in the Lava Mountains and the Pinnacles National Natural History Landmark south of Searles Lake.

Alternative Route 3 crosses the northwest corner of Death Valley National Monument. Within the Monument, the route transects the Racetrack playa. The Racetrack has been classified as an "Outstanding Natural Feature" zone because of its geological and educational values.

Air Quality and Environmental Noise

Refer to sections 2.1.5R.14 and -15 for an overview of the area traversed by the pipeline routes.

At present little specific data exist for ambient air quality in the region being analyzed. The near future should see the collection of measurable data for analysis of atmospheric conditions over the entire area.

It appears that air quality is decreasing in the Mojave Desert as a result of advection of polluted air from the Los Angeles lowland, and in Owens Valley, population increases are decreasing the air quality. The degree and extent of the advected air has yet to be determined.

Industrial plants at Boron and Trona have a degree of air pollution associated with them. The effects are significant locally, especially when low level inversions develop and pollutants are added to those advected from outside areas.

See figure 2.1.5.14-1 for a listing of the air pollutants of primary interest and a summary of their importance.

Environmental Impacts

The major potential environmental impacts that would be caused by construction of the pipeline along one of the three alternative routes or the proposed route are discussed in a comparative manner so that the reader may better determine which of the routes would have the least impact on the environment. The major quantifiable differences are displayed in table 8.1.5.6-7 for the three alternative routes and the proposed route.

Climate

Pipeline construction along any of the routes will not affect the climate, nor will the climate have any significant impact on the pipeline.

Topography and Geology

Corrosion of the pipeline would be most apt to occur on Alternative Route 1 at the Columbus Salt Marsh, and on the proposed route where it crosses the west shore of Owens Lake because of the high saline and alkaline concentrations.

The possibility of the pipe being excavated by flash floods is about equal for the various routes, as they all parallel the base of mountain ranges for considerable distances.

There are several places along the various routes where trenching would be extremely difficult and would require blasting. The proposed route would encounter the greatest difficulty as it crosses the Inyo Mountains to Owens Valley and along the east side of Owens Valley where basalt rock would be encountered.

The seismically active nature of the Owens Valley area has the potential for the greatest environmental impact. If an earthquake caused the pipeline to rupture, especially near the town of Bishop or Big Pine, the impact could be disastrous. All of the routes cross faults, with relatively equal likelihood of pipeline damage due to earthquakes.

Alternative Route 2 passes through an area of active mining at Searles Lake. There may not be room for the pipeline to pass between the foot of the Argus Range and the mining operation. If the pipeline were buried between the chemical plant and the lake, the mining operation would be disrupted.

The slopes from Racetrack Valley to Grapevine Canyon along Alternative Route 3 and the proposed route descending the Inyo Mountains to Owens Valley are extremely steep. The possibility exists of downslope soil movement rupturing the pipeline.

Due to the marshy, boggy conditions in parts of Deep Springs Valley and Owens Lake on the proposed route, soil liquefaction during an earthquake would undoubtedly occur with possible pipeline breakage.

Near Deep Springs Valley the proposed route cuts through a classic geologic study area.

Table 8.1.5.6-7 Comparison of alternatives: Ione Valley to Red Mountain.

Alternatives	Miles Pipeline	Compressor Stations	M.L.V.	Major River Crossings	Miles adj. Existing Util. Corridor	Mountain Pass Crossings	Comm. Towers	Miles Perm. Roadway
Montgomery Pass Alternative 1 (A-B-F-D-E)	266	2	13	2	155	2	Unknown	<1
Saline Valley Alternative 2 (A-H-I-J-E)	252	2	13	1	114	3	Unknown	<1
Racetrack Valley Alternative 3 (A-H-J-E)	248	2	13	1	129	3	Unknown	<1
Proposed Route (A-B-C-D-E)	254	2	13	2	106	2	Unknown	<1

	RESOURCES PERMANENTLY COMMITTED (Acreage)						SLOPES (miles)			Seismic Zones (miles)	
Alternatives	Pipeline R.W.	Assoc. Facilities	Compressor Stations	M.L.V.	Metering Stations	Comm. Tower	Flat 10%	Gentle 1-10%	Steep 10-25%	Greater 5.5	Less 5.5
Montgomery Pass Alternative 1 (A-B-F-D-E)	3,224	<1	40	<1	2	Unknown	149	76	41	266	--
Saline Valley Alternative 2 (A-H-I-J-E)	3,055	<1	40	<1	2	Unknown	135	99	18	252	--
Racetrack Valley Alternative 3 (A-H-J-E)	3,006	<1	40	<1	2	Unknown	155	75	18	248	--
Proposed Route (A-B-C-D-E)	3,079	<1	40	<1	2	Unknown	120	94	40	254	--

Soils

The disturbance of croplands due to construction will cause two major adverse impacts--the loss of crops during the construction year and the potential loss of soil productivity for an indeterminate number of years. The greatest impact would be on the proposed route which passes through Deep Springs Valley, which is farmed by Deep Springs College, and the Alternative Route 1 that crosses some agricultural land in the north end of Owens Valley.

Water Resources

The only major stream within the area of the alternative routes is the Owens River which is crossed by Alternative Route 1 and the proposed route. Numerous small intermittent streams are crossed by the three alternatives and proposed route.

Although Alternative Route 1 passes close to the Columbus Salt Marsh, Orchard Spring, and Fish Slough, minimal impacts will occur due to pipeline construction. Likewise, the proposed route passing near Tinemaha Reservoir should not impact any osprey nesting if construction is conducted some time other than the nesting season.

On the other hand, Alternative Route 2 passes by Upper and Lower Warm Springs. Upper Warm Springs will undoubtedly continue to be used in the future as a refugium for desert pupfish, and Lower Warm Springs attracts a large number of people because of the warm temperatures during the winter and its relatively undisturbed nature, as is the whole of Saline Valley. The pipeline in this dry country would cause a scar that would remain for years.

Vegetation

Alternative Routes 2 and 3, and the proposed route all pass through regions of high plant endemism with many unique species. The potential for destroying rare plants and their habitat is great. Alternative Route 1 does not pass through any known unique or critical areas of vegetation. Revegetation would be extremely difficult along Alternative Routes 2 and 3, and much of the proposed route, due to the low soil productivity and lack of moisture. The Alternative Route 1 crosses more productive soils and would therefore revegetate easier.

Wildlife

The major big game species on Alternative Routes 2 and 3, and the proposed route, are desert bighorn sheep, that are protected from hunting, and Inyo white-tailed deer. The bighorn sheep potentially impacted by these two alternatives are located in the Last Chance Range and the Inyo Mountains. Bighorn sheep are also in the Monte Cristo Range which is crossed by the proposed route. Since any human disturbance is extremely detrimental to this species, pipeline construction and access roads would disrupt the animals and open presently relatively inaccessible areas to recreationists. The resultant loss of their already limited habitat will undoubtedly result in further population reductions.

Wild horses and burros, also protected by law, are found along Alternative Routes 2 and 3, and the proposed route.

In general, there has been less long-term human disturbance and habitation along Alternative Routes 2 and 3, therefore native species populations and habitat are closer to a natural state. As Alternative Route 2 progresses down a wash toward Warm Springs, along the edge of Saline Valley, up Grapevine Canyon, and down Panamint Valley, it crosses or touches upon a number of specialized desert habitats in a relatively primitive region.

The endangered Devils Hole Pupfish have been introduced into Upper Warm Springs in Saline Valley. Alternative Route 2 passes next to this spring and could possibly impact this critical habitat.

The Owens pupfish and the Owens tui chub are threatened with extinction. Both populations are near Alternative Route 1, but should not be impacted by the pipeline. Other threatened wildlife species whose existence could be stressed by increased recreational use from the pipeline access roads of Alternative Routes 2 and 3, and are not found in significant numbers if at all along Alternate Route 1 or the proposed route are the desert tortoise, Panamint chipmunk, Panamint alligator lizard, and the Mojave ground squirrel.

The proposed route and Alternative Route 1 could have a short-term impact on the Tule elk herds in Owens Valley during the year of construction. Alternative Route 1 passes near the Bishop herd calving area, and both the Alternate Route 1 and proposed route pass through the Tinemaha herd calving area. The proposed route also passes through the Independence herd calving and wintering area, and the Lone Pine herd wintering area.

The rare black toad is found only in Deep Springs Valley and could be impacted by the proposed route.

Ecological Considerations and Economic and Sociological Factors

The ecological impacts would be less severe on Alternative Route 1. The other alternatives are entirely within the desert where vegetative responses to any disturbance takes considerably longer than they would in, for example, Owens Valley.

As Alternative Route 1 and the proposed route travel through Owens Valley, which has a larger economic infrastructive than any other area along Alternative Routes 2 and 3, it is logical to assume that the communities in Owens Valley would be able to absorb the economic impact of the construction crews more readily than the small communities along the two more easterly alternative routes. Since the construction crews will be relatively small and will not be in the area long, this impact will only be short term.

Land Use

Alternative Route 1 would have the least amount of impact on land use as existing corridors are on or near most of the proposed route.

The proposed route crosses a portion of the China Lake Naval Weapons Center testing range, therefore both access and egress of construction personnel and equipment would be subject to stringent restrictions for safety reasons. Further, the continuous contamination from testing involving high explosive material would constitute a hazard to construction and maintenance personnel from which the Naval Weapons Center would require complete indemnity.

Deep Springs College, in Deep Springs Valley, would be disrupted by the proposed route. The site for the college was chosen for its isolation. The disruption of this isolation by pipeline construction activities would have a significant, even if brief, effect on the college program.

The primitive desert environment was also a prime factor in the college site selection. The pipeline scar would undoubtedly impact the environment esthetically and would be extremely distressing to the college setting.

Alternative Route 2 would pass through a proposed closed area, and Alternative Route 3 goes through a national monument. Both would have significant adverse land use impacts.

Paleontological, Archeological, Historical

Based on reports from the San Bernardino County Museum and local experts, Alternative Route 1 would have the least impact on known and potential paleontological, archeological, and historic sites.

Recreation and Esthetic Resources

Alternative Route 3 cuts through Death Valley National Monument. Except where necessitated as a condition of establishment, where required by law, or where required to serve park utility systems, transportation corridors and rights-of-way for private or corporate entities are not allowed in natural and historic parks. Death Valley is designated as a natural area.

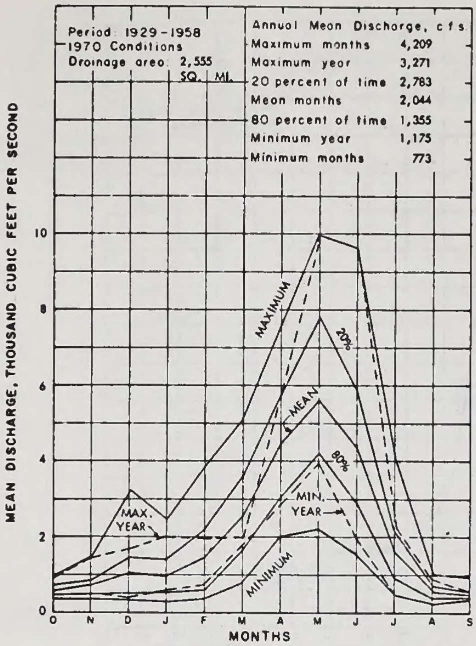
The Alternative Route 3 also crosses Racetrack playa, a unique natural feature that would be adversely impacted.

Alternative Route 2 would adversely impact the Lava Mountains primitive area and the Pinnacles National Natural History Landmark south of Searles Lake. Construction of the pipeline would destroy the primitive nature of the former and the scenic quality of the latter.

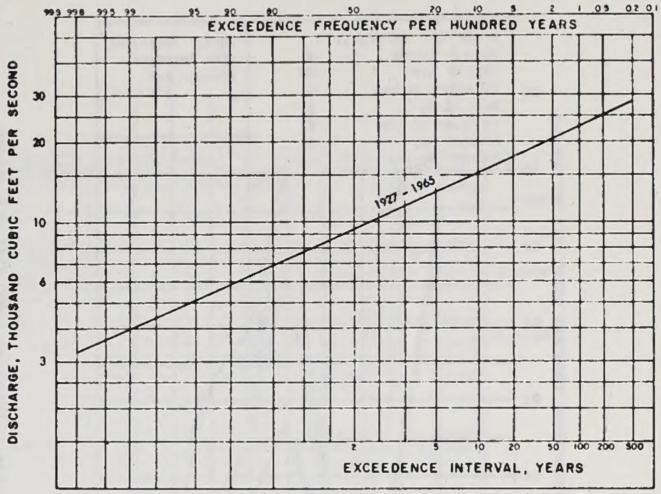
Alternative Route 1 would appear to have the least amount of adverse impacts esthetically as it traverses an area that has already had greater impacts from man's presence relative to the other alternatives. A short-term impact is likely on the recreationists utilizing the Owens River and surrounding area during pipeline construction.

The proposed route would traverse relatively undisturbed areas that would be detrimental esthetically, but on the other hand, as with Alternative Routes 2 and 3, new country would be made available to the recreationist via the pipeline access roads.

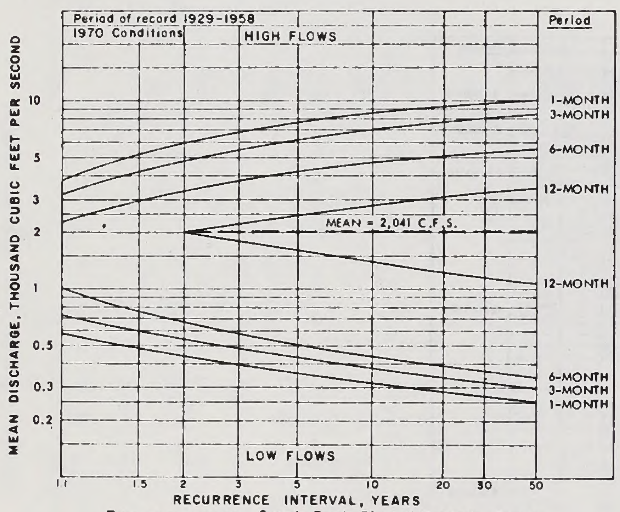
APPENDIX



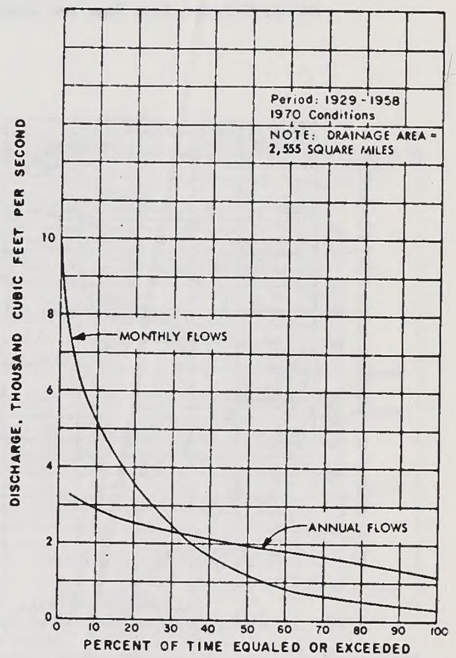
Monthly discharge, Grande Ronde River at Rondowa, Oregon



Frequency curve of annual peak flows, Grande Ronde River at Rondowa, Oregon



Frequency curves, Grande Ronde River at Rondowa, Oregon



Duration curves, Grande Ronde River at Rondowa, Oregon

Figure 2.1.5.5-2 Flow characteristics of the Grande Ronde River at Rondowa, Oregon

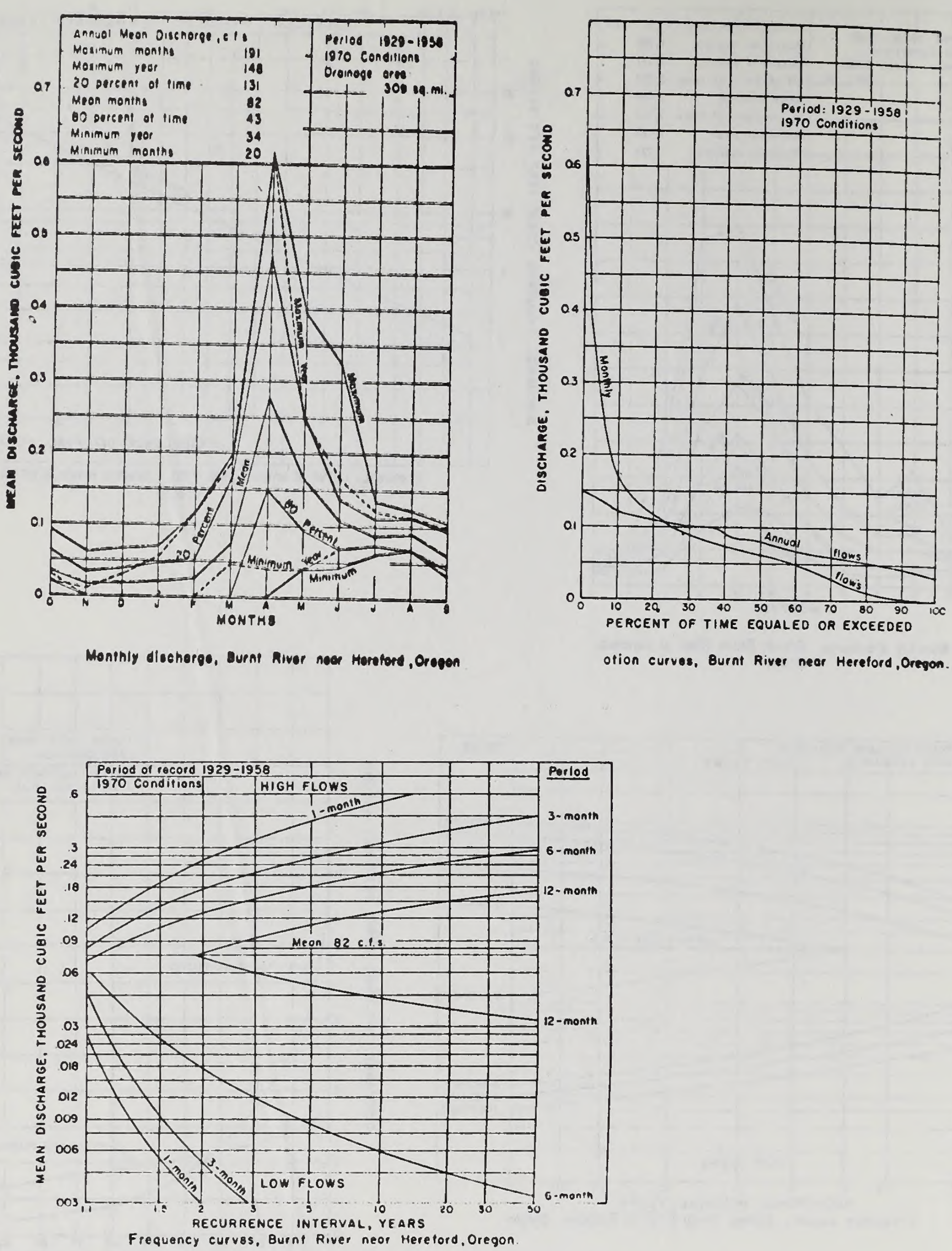
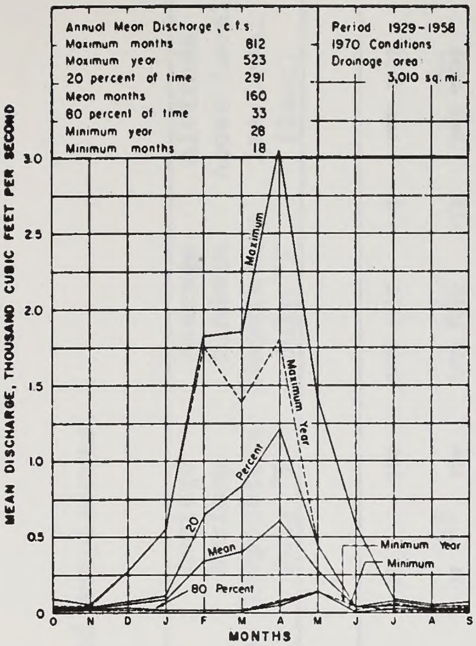
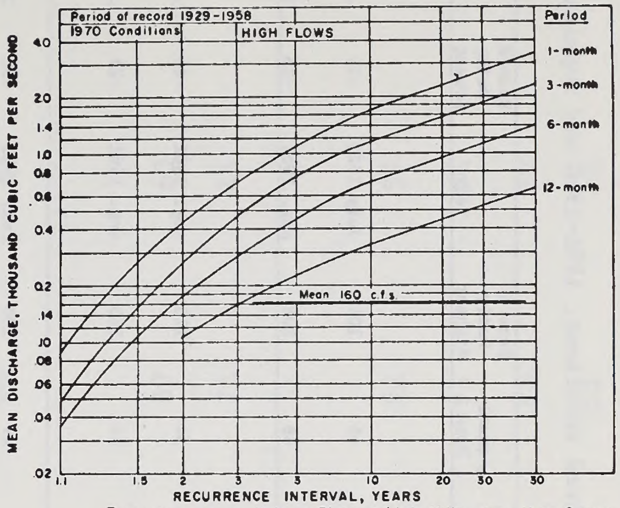


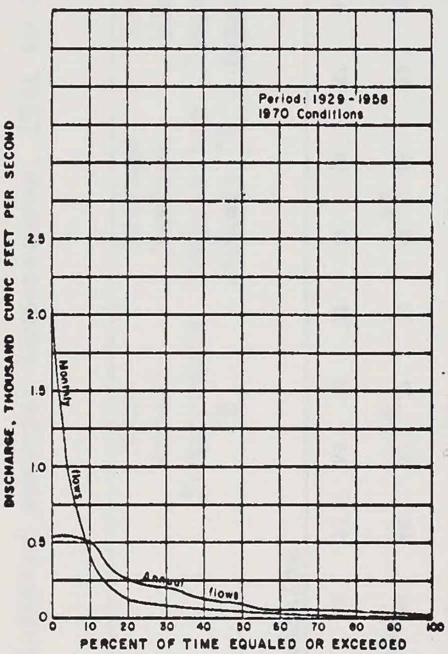
Figure 2.1.5.5-3 Flow characteristics of the Burnt River near Hereford, Oregon



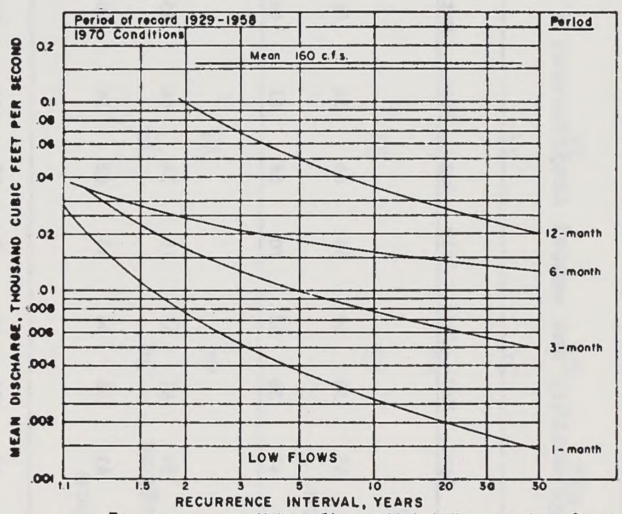
Monthly discharge, Malheur River at Little Valley nr. Hope, Oregon.



Frequency curves, Malheur River at Little Valley near Hope, Oregon.



Duration curves, Malheur River at Little Valley near Hope, Oregon.



Frequency curves, Malheur River at Little Valley near Hope, Oregon.

Figure 2.1.5.5-4 Flow characteristics of the Malheur River at Little Valley near Hope, Oregon

Table 2.1.5.1-1 Average monthly ana annual temperatures (°F.) at selected locations, 1931-1960 and supplements

Location	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Mean	Record Daily Highest	Year	Record Daily Lowest	Year
Northern Rocky Mountain Province																	
Sandpoint, Idaho	26	31	36	45	53	59	65	64	56	46	35	29	46	104	July 1923	-31	Jan. 1950
Spokane, Washington	25	30	38	47	56	62	70	68	61	49	36	30	48	108	Aug. 1961	-25	Dec. 1968
Columbia River Province																	
Walla Walla, Washington	33	38	47	54	61	67	76	74	66	55	42	38	54	113	Aug. 1961	-16	Jan. 1957
Meacham, Oregon	26	29	33	41	48	54	63	62	56	46	34	30	44	105	Aug. 1961	-23	Jan. 1963
Basin and Range Province																	
Winnemucca, Nevada	28	34	39	47	56	64	74	70	60	49	38	30	49	108	July 1931	-36	Jan. 1937
Tonopah, Nevada	31	36	41	48	57	67	74	72	64	53	41	33	51	104	July 1960	-15	Jan. 1962
Bishop California	37	41	48	55	63	70	77	74	68	57	46	39	56	109	July 1972	- 6	Jan. 1955

Table 2.1.5.1-2 Selected seasonal temperatures, 1931 to 1960 and supplements.

Location	Mean Annual Temperature °F	Average Maximum Temperature January °F	Average Minimum Temperature January °F	Average Maximum Temperature July °F	Average Minimum Temperature July °F	Altitude Above Level Sea Level (feet)
Northern Rocky Mountains Province						
Sandpoint, Idaho	46	32	19	83	48	2,100
Spokane, Washington	48	31	19	86	55	2,357
Columbia Plateau Province						
Walla Walla, Washington	54	39	27	89	63	949
Meacham, Oregon	44	33	19	78	49	4,050
Basin and Range Province						
Winnemucca, Nevada	49	37	18	92	56	4,299
Tonopah, Nevada	51	44	17	91	56	
Bishop, California	56	54	20	98	55	4,108
China Lake, California	64	58	29	102	70	

Table 2.1.5.1-3 Means and extremes of precipitation (inches) for period of record at selected locations.

Location	Mean Annual Precipitation	Maximum 24 Hour	Maximum Month	Minimum Month	Mean Annual Snowfall
Sandpoint, Idaho	33	2.39 Jan. 1954	11.99 Dec. 1933	.00 ________	73
Spokane, Washington	17	2.07 June 1964	5.71 May 1948	.01 July 1960	58
Walla Walla, Washington	16	2.02 June 1923	4.52 June 1953	.00 July 1953	20
Meacham, Oregon	12	1.49 June 1947	3.23 Dec. 1964	.00 Aug. 1955	157
Winnemucca, Nevada	9	1.64 Oct. 1951	5.23 Mar. 1884	.00 July 1947	28
Tonopah, Nevada	4.4	1.52 Feb. 1968	2.65 ________	.00 ________	_____
Bishop, California	5.7	3.64 Feb. 1969	8.93 Jan. 1969	.00 ________	8.8
China Lake, California	2.6	1.03 Nov. 1946	2.14 ________	.00 ________	_____

Table 2.1.5.1-4 Estimated maximum point precipitation (in inches) for selected durations and occurrence intervals for selected places.

Interval	2 yrs.			10 yrs.			25 yrs.			50 yrs.			100 yrs.		
Duration	1 hr	24 hr	10 days	1 hr	24 hr	10 days	1 hr	24 hr	10 days	1 hr	24 hr	10 days	1 hr	24 hr	10 days
Idaho-Canada Border	0.3	1.4	2.8	0.6	2.3	5.0	0.8	2.4	5.5	0.9	2.9	5.8	1.0	3.0	6.1
Spokane, Washington	0.4	1.5	2.5	0.7	2.2	3.9	0.8	2.4	5.8	0.9	2.9	6.0	1.0	3.0	6.1
Walla Walla, Washington	0.4	2.0	2.5	0.8	2.8	4.0	0.9	2.9	5.0	1.1	3.0	6.0	1.2	3.9	7.0
Ontario, Oregon	0.4	1.0	1.9	0.6	1.5	2.9	0.7	1.8	3.0	0.9	2.0	3.2	1.0	2.0	3.4
Oregon-Nevada Border	0.3	0.9	1.6	0.5	1.4	2.6	0.6	1.5	3.0	0.8	2.0	3.5	0.9	2.1	3.7
Winnemuccan, Nevada	0.3	1.1	1.8	0.6	1.5	3.0	0.7	1.6	3.4	0.8	2.0	4.0	0.9	2.1	4.2
Tonopah, Nevada	0.4	1.1	1.5	0.6	1.5	2.8	0.7	1.6	3.1	0.8	2.1	3.8	0.9	2.2	4.0
Nevada-California Border	0.4	1.1	1.5	0.7	1.5	2.8	0.8	1.6	3.0	1.0	2.1	3.9	1.1	2.2	4.0
China Lake, California	0.4	1.0	1.7	0.7	1.9	3.6	1.0	2.5	4.0	1.3	2.7	4.2	1.4	2.8	5.0
Adelanton, California	0.4	6.0	8.0	1.6	4.0	10.0	1.8	10.0	14.0	2.0	12.0	20.0	2.5	15.0	21.0

Sources: Herschfield, David M., 1961. Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 Hours and Return Periods from 1 to 100 Years. Technical Paper 40, U.S. Weather Bureau, Washington, D.C.

Miller, J.F., 1964. Two-to Ten-Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States. Technical Paper 49, U.S. Weather Bureau, Washington, D.C.

Table 2.1.5.1-5 Mean hourly wind speed (miles per hour).

Month	Spokane, Washington	Walla Walla, Washington	Winnemucca, Nevada	Red Bluff, California
January	8.0	5.1	8.1	9.0
February	8.8	5.5	8.6	9.3
March	9.5	6.2	8.8	9.7
April	9.5	6.1	8.6	9.5
May	8.4	5.7	8.1	9.2
June	8.5	5.5	7.8	9.3
July	7.9	5.4	7.5	8.0
August	7.8	5.1	6.9	7.6
September	7.7	4.7	7.0	7.9
October	7.7	4.5	7.1	8.4
November	7.9	4.8	7.5	8.4
December	8.3	5.2	7.5	8.4
Year	8.3	5.3	7.8	8.7
Maximum	56 (Nov. 1950)	67 (Nov. 1958)	69 (Dec. 1941)	68 (Oct. 1962)

Table 2.1.5.5-1 Flow data of selected streams.

Station Number	Station Name	Drainage Area (mi^2)	Period of Record	Mean Flow (ft 3/s)	Maximum Flow (Ft 3/s)	Minimum Flow (ft 3/s)
12307500	Moyie River at Eileen, Idaho	755	1925-1972	888	11,000 (5-20-54)	40 (11-27-36 and 12-17-64
12322000	Kootenai River at Porthill, Idaho	13,700	1928-1972	16,120	125,000 (6-1-48)	1,380 (2-8-36)
123292300	Pack River near Colburn, Idaho	124	1958-1972	333	4,370 (5-30-69)	15 (9-23-67)
12395500	Pend Oreille River at Newport, Washington	24,200	1903-1941 1952-1972	25,990 (regulated)	136,000 (6-15-13, 6-21-33, & 6-12-72)	1,280 (9-1-61)
12422500	Spokane River at Spokane, Washington	4,290	1891-1972	6,904 (regulated)	49,000 E (5-31-94)	95 (9-19-56)
13351000	Palouse River at Hooper, Washington	2,500	1951-1972	610	33,500 (2-4-64)	0 (several days)
13353000	Snake River below Ice Harbor Dam, Washington	108,500	1907-1917 1962-1972	-- (regulated)	298,000 (5-29-13)	0 (8-27-65)
14018500	Walla Walla River near Touchet, Washington	1,657	1951-1972	584	33,400	0
14020000	Umatilla River above Meacham Creek near Gibbon, Oregon	131	1933-1972	224	4,910 (1-29-65)	16 (11-9-65)
13319000	Grande Ronde River at La Grande, Oregon	678	1903-1915 1918-1923 1925-1972	380	14,100 (1-30-65)	3.9 (8-26-40)

Table 2.1.5.5-1 (Cont.)

Station Number	Station Name	Drainage Area (mi^2)	Period of Record	Mean Flow (ft 3/s)	Maximum Flow (ft 3/s)	Minimum Flow (ft 3/s)
13275300	Powder River near Sumpter, Oregon	168	1965-1972	98.0 (regulated)	971 (4-30-65)	0 (11-12-67)
13275000	Burnt River at Huntington, Oregon	1,093	1928-1932 1956-1959 1962-1972	126 (regulated)	2,220 (12-22-64)	0 (at times)
13220000	Malheur River at Little Valley, near Hope, Oregon	3,010	1949-1972	199 (regulated)	12,300 (2-24-57)	6.8 (1-16-72)
10353500	Quinn River near McDermitt, Nevada	1,100	1948-1972	32.6	1,580 (4-27-52)	0 (some days)
10327500	Humboldt River at Comus, Nevada	12,100	1894-1909 1910-1926 1945-1972	286	5,860 (5-6-52)	0 (at times)
10285700	Owens River at Keeler Bridge near Lone Pine, California	2,604	1927-1972	24.9 (regulated)	1,360 (6-19-69)	0 (many days)

E Estimated

Table 2.1.5.5-2 Floods of selected recurrence intervals for selected streams

Station Number	Station Name	Discharge (ft ^{3}/s)	Recurrence intervals (yrs)
12307500	Moyie River at Eileen, Idaho	11,400	200
		11,000	100
		10,700	50
12422500	Spokane River at Spokane, Washington	48,900	200
		46,600	100
		44,000	50
13351000	Palouse River at Hooper, Washington	42,000	200
		36,900	100
		31,900	50
14018500	Walla Walla River near Touchet, Washington	63,400	200
		48,400	100
		36,400	50
14020000	Umatilla River above Meacham Creek near Gibbon, Oregon	6,110	200
		5,380	100
		4,700	50
1331900	Grande Ronde River at La Grande, Oregon	13,000	200
		11,100	100
		9,480	50
10353500	Quinn River near McDermitt, Nevada	2,450	200
		2,190	100
		1,890	50
10327500	Humboldt River at Comus, Nevada	7,200	200
		5,970	100
		4,870	50
10285700	Owens River at Keeler Bridge, near Lone Pine, California	23,100	200
		10,600	100
		4,700	50

Source: U.S. Geological Survey written communication, 1974

Table 2.1.5.5-3 Flow duration for selected stations (U.S. Geological Survey written communication, 1974).

Station Number	Station name	Years of Record	Discharge in ft^3/s, equalled or exceeded a given percent of time						
			99%	90%	70%	50%	30%	10%	1%
12395500	Pend Oreille River at Newport, Washington	1904-1912 1929-1941 1953-1962	4,830	7,500	10,900	15,700	25,100	59,200	98,800
12422500	Spokane River at Spokane, Washington	1892-1972	950	1,540	2,210	3,790	7,830	17,900	29,800
13351000	Palouse River at Hooper, Washington	1952-1972	1.6	26	73	188	571	1,660	5,690
13353000	Snake River below Ice Harbor Dam, Washington	1963-1972	15,500	22,000	29,200	37,300	57,900	126,000	199,000
14018500	Walla Walla River near Touchet, Washington	1952-1972	4.3	14	36	326	722	1,470	3,780
13319000	Grande Ronde River at La Grande, Oregon	1906-1912 1914-1915 1919-1923 1927-1972	9.5	22	42	100	350	1,100	3,000
13275300	Powder River near Sumpter, Oregon	1966-1972	0.4	3.0	7.0	26	130	300	450
13220000	Malheur River near Little Valley, near Hope, Oregon	1961-1972	16	34	53	100	165	280	1,800
10353500	Quinn River near McDermitt, Nevada	1950-1972	0.2	0.5	0.8	1.1	4.5	90	520

Source: U.S. Geological Survey written communication, 1974

Table 2.1.5.5-4 Suspended sediment data for selected streams.

Station Number	Station Name	Drainage Area (sq. mi.)	Sampling Frequency	Period of Record	Sediment Concentration Maximum daily (mg/1)	Sediment Concentration Minimum daily (mg/1)	Sediment Discharge Maximum daily (tons)	Sediment Discharge Minimum daily (tons)
12318500	Kootenai River near Copeland, Idaho	13,400	D	1966-1972	740 (5-1-66)	1 (many days)	155,000 (5-1-66)	5 (1-31-72)
13351000	Palouse River at Hooper, Washington	2,500	D	1961-1971	46,000 (2-5-63)	No flow (several days)	2,110,000 (2-5-63)	No flow (several days)
14018500	Walla Walla River near Touchet, Washington	1,657	D	1962-1970	61,200 (2-5-63)	No flow (several days)	3,230,000 (12-23-64)	No flow (several days)
14013600	Mill Creek below Blue Creek near Walla Walla, Washington	91	D	1962-1972	8,000 (12-23-64)	less than 1 (several days)	59,300 (12-23-64)	less than 0.50 (many days)
14033500	Umatilla River near Umatilla, Oregon	2,290	D	1962-1970	39,800 (7-27-65)	1 (several days)	438,000 (1-30-65)	less than 0.005 (4-15,16-68)

D: daily sampling

Table 2.1.5.5-5 Summary of water quality data for selected surface waters crossed by the proposed route

	Discharge (ft^3/s)	Bicarbonate (HCO^3)	Sulfate (SO^4)	Chloride (Cl)	Hardness (Ca.Mg)	Specific cond.	Diss. solids (180°C)	pH	Turbidity	Temperature	Total Nitrogen (N)	Total Phosphorus (P)	Diss. Oxygen (DO)	Biochem oxygen demand (BOD)	Imm. coliform
		mg/l	mg/l	mg/l	mg/l	umhos 25°C	mg/l	units	units	°C	mg/l	mg/l	mg/l	mg/l	Col/ 100ml
Kootenai River near Copeland, ID; October 1971 to June 1972															
Max.	47,600	149	31	4.0	150	311		8.3	30	9.5	0.67	.15	13.7	1.8	380
Min.	2,840	66	7.1	.4	65	137		6.0	1	0	.08	.03	11.4	.1	12
Kootenai River at Leonia, ID; October 1971 to June 1972															
Max.		151	33	5.1	160	314		8.2	30	19	2.3	.18	14.5	2.5	1,100
Min.		78	3.3	.7	74	133		6.4	1	0	.11	.03	10.1	.6	17
Spokane River at Spokane, WA; October 1972 to September 1973															
Max.	6,880		12		85	260		6.2	6	18.4	.41	.20	14.0	15.0	>4,000
Min.	385		7.7		27	70		6.8	0	1.7	.08	.00	9.1	.5	100
Hangman Creek at Mouth at Spokane, WA; October 1972 to September 1973															
Max.	400		24		170	440		8.7	1,300	21.2	7.8	.18	14.6	4.6	47,000
Min.	1.6		7.1		37	110		7.2	0	.6	.16	.01	9.9	.4	180
Snake River near Clarkston, WA; October 1971 to September 1972															
Max.	208,000	171	51	17	152	441		8.1	50	14.5	.64	.27	13.7	4.4	
Min.	31,900	20	2.9	.1	12	57		6.4	2	2	.14	.04	10.8	1.4	
Palouse River at Hooper, WA; October 1972 to September 1973															
Max.	1,690					400		8.9	170	29.5	1.1	.59	13.4		
Min.	26					146		7.2	8	2.4	.07	.10	8.2		
Touchet River at Touchet, WA; December 1970 to September 1971															
Max.	2,550	259	16	15	180	507		8.0	1,400	29.9	4.3	.75	13.2		30,000
Min.	6.6	29	2.0	1.9	23	61		7.2	1	.0	.10	.090	6.0		100
Powder River Near Baker, OR; December 1969 to November 1971															
Max.			12	3	92		194	7.9	16	17			12.3	2.4	620
Min.			8	1	53		100	7.2	2	0.5			10.2	0.6	60
Humboldt River near Ryepatch, NV; October 1971 to September 1972															
Max.	688	359	94	230	190	1,430		8.5		22.0	.83	.18			
Min	19	246	68	78	160	881		8.1		2.5	.31	.07			

Table 2.1.5.5-6 Available historical water quality data for rivers crossed in the northern portion of the proposed route.

	Pend Oreille River at Newport, WA 10/65 - 9/66		Spokane River at Seven-Mile Bridge near Spokane, WA 10/67-9/68	Palouse River at Hooper, WA		Snake River below Ice Harbor Dam, WA		Walla Walla River near Touchet, WA	
				10/65-9/66	10/67-9/68	10/65-9/66	10/67-9/68	10/65-9/66	10/67-9/68
Dissolved O_2									
Min	7.6	7.7	7.0	---	---	10.2	6.6	10.9	6.2
Mean	10.0	9.9	10.1	---	---	11.2	10.9	11.2	10.9
Max	12.3	13.5	15.8	---	---	12.9	14.1	12.0	13.2
Coliforms MPN/100 ml									
Min	23	0	430	---	---	36	21	110	22
Mean	291	129	1,446	---	---	299	---	722	5,121
Max	2,400	430	4,600	---	---	930	24,000	2,400	24,000
Dissolved solids (residue at 180°C or calculated)									
Min	79	84	51	88	92	75	---	100	101
Mean	101	94	72	167	164	177		257	287
Max	106	102	142	273	272	256	---	514	518
Specific conductance umhos at 25°C									
Min	137	143	69	112	128	120	87	133	124
Mean	166	163	113	258	252	287	252	394	434
Max	180	175	231	439	429	418	389	778	802
Hardness (ca, Mg) mg ($CaCO_3$/1									
Mean	79.5	79.3	47	94	89	96.8	84.5	140	145
Ca									
Mean	22	--	Range of 7.2-23	23	22	24	21	35	34
HOO_3 Mean	92.3	--	--	135.6	127.1	116.9	106.3	174.9	174.5
NO_3 Mean	0.2	--	Range of 0.1-3.7	4.4	4.3	1.6	1.1	1.8	1.1

Table 2.1.5.5-7 Quality of surface water at miscellaneous stations of the Humboldt subregion

	pH	DO (mg/1)	BOD (mg/1	Ortho Phosphate PO_4 (mg/1	Nitrate NO_3 (mg/1)	Ammonia NH_3 (mg/1	Coliform Colonies/100 ml (Total)	Coliform Colonies/100 ml (Fecal)
HUMBOLDT RIVER NORTH OF ELKO NEVADA								
No.	2	2	2	2	2	2	2	1
Max.	8.3	8.6	1.5	0.08	0	0	TNTC	12
Min.	8.1	8.2	0.9	0.02	"	"	TNTC	12
Mean	8.2	8.4	1.2	0.05	"	"	TNTC	12
Period	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1968
HUMBOLDT RIVER AT GAGING STATION BETWEEN ELKO AND CARLIN, NEVADA								
No.	1	1	1	1	1	1	1	-
Max.	8.4	9.2	3.0	5.3	0	0	TNTC	-
Min.	"	"	"	"	"	"	TNTC	-
Mean	"	"	"	"	"	"	TNTC	-
Period	1967	1967	1967	1967	1967	1967	1967	-
HUMBOLDT RIVER SOUTH OF HOT SPRINGS BELOW CARLIN, NEVADA								
No.	1	1	1	1	1	1	1	-
Max.	8.4	10.4	2.3	0.06	0	0	TNTC	-
Min.	"	"	"	"	"	"	TNTC	-
Mean	"	"	"	"	"	"	TNTC	-
Period	1967	1967	1967	1967	1967	1967	1967	-
HUMBOLDT RIVER NORTH OF WINNEMUCCA, NEVADA								
No.	2	2	2	2	2	2	2	1
Max.	8.5	8.9	1.9	0.40	0	0	TNTC	10
Min.	8.4	7.9	1.5	0.25	"	"	TNTC	"
Mean	8.5	8.4	1.7	0.32	"	"	TNTC	"
Period	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1968
HUMBOLDT RIVER BELOW RYE PATCH RESERVOIR, NEVADA								
No.	2	2	2	2	2	2	2	1
Max.	8.6	8.5	1.0	0.20	4.0	0	TNTC	4
MIN.	8.6	7.0	0.8	0.10	0	"	TNTC	"
Mean	"	7.8	0.9	0.15	2.0	"	TNTC	"
PERIOD	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1967-1968	1968

Table 2.1.5.5-8 Principal characteristics of ground water basins in Nevada.

Hydrographic area	Mile marker (approximate)	Traversed lithology (general)	Probable range in depth to water along route	Report reference	Ground water development near pipeline alinement	Other geohydrologic features of note
			BLACK ROCK DESERT REGION			
Quinn River Valley in Nevada	553-601	Older alluvium Younger alluvium	10-100 0-10	Huxel, 1966 Visher, 1957	Large-scale irrigation	Quinn River
			HUMBOLDT RIVER BASIN			
Paradise Valley	601-620	Older alluvium	5-100	Harrell and Moore, 1970 Eakin and Lamke, 1966 Loeltz, Phoenix and Robinson, 1949	do.	--
Humboldt River basin Winnemucca segment	620-629	Younger alluvium Older alluvium	0-10 100-200	Eakin and Lamke, 1966	Minor	Humboldt River
Grass Valley	662-685	Younger alluvium Older alluvium	10-150 100-200	Eakin and Lamke, 1966 Cohen, 1964	Minor	Pipeline route crosses geothermal area (Leach Hot Spring) mi 654
			CENTRAL REGION			
Pleasant Valley	662-685	Younger alluvium Older alluvium Consolidated rock	10-150 20-200 variable	Cohen and Everett, 1963	Minor	--
Dixie Valley	685-715	Younger alluvium Consolidated rock	10-100 variable	Cohen and Everett, 1963	Minor	--

Table 2.1.5.5-8 (Cont.)

Hydrographic area	Mile marker (approximate)	Traversed lithology (general)	Probable range in depth to water along route	Report reference	Ground water development near pipeline alinement	Other geohydrologic features of note
		CENTRAL REGION--Continued				
Edwards Creek Valley	715-732	Younger alluvium Consolidated rock	10-400 variable	Everett, 1964	Minor	--
Smith Creek Valley	732-768	Younger alluvium Older alluvium Consolidated rock	10-200 100-400 100-300	Everett and Rush, 1964	Minor	Pipeline route passes near geothermal area at mile 746
Ione Valley	768-806	Older alluvium Younger alluvium Consolidated rock	50-400 20-30 variable	Everett and Rush, 1964	Minor	--
Monte Cristo Valley	806-826	Alluvium Consolidated rock	60-400 variable	Van Denburgh and Glancy, 1970	Minor	--
Columbus Salt Marsh Valley	826-848	Alluvium Consolidated rock	0-400 variable	Van Denburgh and Glancy, 1970	Minor	Pipeline route crosses edge of wet playa
Fish Lake Valley in Nevada	848-877	Younger alluvium Older alluvium Consolidated rock	0-40 30-60 variable	Rush and Katzer, 1973 Eakin, 1950	Moderately large scale irrigation	--

Table 2.1.5.5-9 Principal characteristics of ground water basins in California

Location and Extent		Geology					Occurrence			
Basin	Area of valley floor (square miles)	Water-bearing units[1]	Depth of principal aquifer, in feet below ground surface		Principal recharge areas		Depth to water, in feet below land-surface datum			Pressure areas
			To top	To bottom	Location	Rate of recharge	Date	Maximum	Minimum	
Fish Lake Valley	70	Qa QT	0	85	Fans of Sylvania and White Mountains	Moderate		88	45	
Deep Springs Valley	40	Qa	0	775	Fans of White Mountains	Moderate		261	Flowing	Confinement near Deep Springs Lake
Owens Valley	1,030	Qa, QT	0	1,187	Fans and moraines of the Sierra Nevada and the Inyo Mountains	Moderate to high		127	Flowing	Local confinement near Bishop Independence
Rose Valley	60	Qa	0	176	Fans of Sierra Nevada	Moderate to high		142	Flowing	
Indian Wells Valley	520	Qa	0	1,958	Fans on east side of Sierra Nevada	Moderate to high	10-22-66 8-7-62	 585	Flowing	Area around China Lake
Cuddeback Valley	130	Qa	0	300	Fans on east and west sides of valley	Moderate	3- -55	190	30	Area around Cuddeback Lake
Harper Valley	510	Qa	0	452	Fans fringing valley	Moderate	5- -55 10- -52	 330	Flowing	Area around Harper Lake
Upper Mojave River valley	600	Qa	0	1,000	Mojave River above Victorville and fans of San Gabriel and San Bernardino Mountains	High	10-26-67	680	7	Some confinement in small local areas

(cont.)

Basin	Ground-water movement: Direction	Ground-water movement: Structures affecting movement	Ground-water movement: Subsurface inflow and outflow	Water quality: Range of temperature (°F)	Water quality: Chemical quality: Principal ions	Water quality: Chemical quality: Range of dissolved solids (parts per million)	Utilization: Present (1967) use of ground water	Utilization: Withdrawal capacity of wells (gallons per minute): Maximum	Utilization: Withdrawal capacity of wells (gallons per minute): Average	Principal references[2]
Fish Lake Valley	Northward into Nevada	Faults may affect flow	No known inflow Outflow to Nevada		Ca Mg HCO_3	220-365	Irrigation Domestic Stock			California Department of Water Resources (1964b).
Deep Springs Valley	Toward Deep Springs Lake	Faults may affect flow	No known inflow or outflow		Ca HCO_3	1-200,000	Irrigation Stock	700		California Department of Water Resources (1964b).
Owens Valley	Toward Owens Lake	Faults may act as barriers	Possible inflow from Long Valley No known outflow.		Ca Na HCO_3	100-400	Domestic Irrigation Exported for municipal	3,120	1,500	California Department of Water Resources (1964b).
Rose Valley	Southward	Volcanic rocks at Little Lake	Inflow from Owens Valley. Outflow not known		Ca Mg Na HCO_3	350-1,300	Domestic			California Department of Water Resources (1964b). Thompson (1929).
Indian Wells Valley	Generally eastward	Several faults	Probable inflow from Coso Valley Outflow to Salt Wells Valley	63-93	Ca Na HCO_3 Cl	141-232,000	Military Irrigation Domestic	3,800	815	California Department of Water Resources (1964b). Moyle (1963). Thompson (1929).
Cuddeback Valley	Southward	None known	No known inflow Possible outflow to Harper Valley	70-72	Na HCO_3 Cl	375-4,730	Military	450	400	California Department of Water Resources (1964b, 1966). Kunkel (1956). Thompson (1929).
Harper Valley	Toward Harper Lake	Lockhart fault	Inflow from Middle Mojave River Valley and possibly from Cuddeback Valley No known outflow	64-77	Na HCO_3 SO_4 Cl	316-14,700	Irrigation Domestic			California Department of Water Resources (1964b, 1966). Kunkel (1956). Thompson (1929).
Upper Mojave River Valley	Northward		Inflow from El Mirage Valley. Outflow to Middle Mojave River Valley.	60-74	Ca Na HCO_3 SO_4 Cl	85-2,760	Irrigation Domestic Industrial	3,600	630	Bader and others (1958). California Department of Water Resources (1964b, 1966). Thompson (1929).

[1] Qa, younger alluvial deposits of late Pleistocene and Holocene age; QT, older alluvial deposits of late Tertiary and Quaternary age.

[2] Complete citations listed in Bader (1969)

Table 2.1.5.6-2 Montante forests (M.P. 0 to M.P. 110 and M.P. 300 to M.P. 340).

Typical Plants

Coniferous forest species

Western white pine	Pinus monticola
Ponderosa pine	Pinus ponderosa
Lodgepole pine	Pinus contorta
White bark pine	Pinus albicaulis
Western larch	Larix occidentalis
Douglas-fir	Pseudotsuga menziesii
Engelmann spruce	Picea engelmannii
White fir	Abies concolor
Grand fir	Abies grandis
Subalpine fir	Abies lasiocarpa
Pacific yew	Taxus brevifolia
Western hemlock	Tsuga heterophylla
Western redcedar	Thuja plicata

Deciduous forest and understory species

Ceanothus	Ceanothus fendleri
Pacific willow	Salis lasiandra
Paper birch	Betula papyrifera
Thinleaf alder	Alnus tenuifolia
Red alder	Alnus rubra
Black cottonwood	Populus trichocarpa
Quaking aspen	Populus tremuloides
Rocky mountain maple	Acer glabrum
Black hawthorn	Crataegus douglasii
Common chokecherry	Prunus virginiana
Bitter cherry	Prunus emarginata
Service berry	Amelanchier alnifolia
Rocky-mountain ash	Sorbus scopulina
Cascara	Rhamnus purshiana
Red-osier dogwood	Cornus stolonifera
Snowberry	Symphoricarpos occidentalis
Buffalo berry	Shepherdia canadensis
Bitterbush	Prushia tridentata

Forbs

Cinquefoil	Potentilla spp.
Strawberry	Fragaria spp.
Butterweed	Senecio triangularis
Goldenrod	Solidago spp.

Table 2.1.5.6-2 (Cont.)

Yarrow	Achillea millefolium
Bracken fern	Pteridium aquilinum
Pachistima	Pachistima myrsinites
Elk sedge	Carex geyerii
Ross sedge	Carex rossii
Grasses	
Slender wheat grass	Agropyron tenerum
Bunch wheat grass	Agropyron spicatum
Bunch fescue	Festuca scabrella
Idaho fescue	Festuca idahoensis
Western fescue	Festuca occidentalis
Pinegrass	Calamagrostis rubescens
Macoun's reedgrass	Calamagrostis macouniana
Canada bluegrass	Poa compressa
Thurber needlegrass	Stipa thurberiana
Western needlegrass	Stipa occidentalis
Columbia needlegrass	Stipa columbiana
Bluebunch wheatgrass	Agropyron spicatum
Beargrass	Nolina bigelovii
Elmer needlegrass	Stipa elmeri

Table 2.1.5.6-3 Palouse prairie grassland (M.P. 110 to M.P. 300).

Typical Plants

No significant trees.

Forbs or shrubs

Stiff sagebrush (rigid)	Artemisia rigida
Large-flowered brodiaea	Brodiaea douglassi
Yellow fritillary	Fritillaria pudica
Purple-eyed grass	Sisyrinchium inflatum
Pigweed	Chenopodium album
Pigweed amaranth	Amaranthus retroflexus
Slender fringe-cup	Lithophragma bulbifera
Sticky geranium	Geranium viscosissimum
Dwarf hesperochiron	Hesperochiron pumilus
Yarrow	Achillea millefolium
Sedges	Carex spp.
Camass	Camassia quamash
Blue flag	Iris missouriensis
Wild onions	Allium spp.
Mustard	Brassica spp.
Big sagebrush	Artemisia tridentata
Bitterbrush	Purshia tridentata

Grasses

Blue grama	Bouteloua gracilis
Six weeks fescue	Festuca octoflora
Blue bunch fescue	Festuca idahoensis
Mountain brome	Bromus carinatus
Smooth brome	Bromus intermis
Downy brome grass	Bromus tectorum
Foxtail brome	Bromus rubens
Bulbous bluegrass	Poa bulbosa
Kentucky bluegrass	Poa pretensis
Pine bluegrass	Poa scabrella
Annual bluegrass	Poa annua
Sandberg bluegrass	Poa secunda
Foxtail barley	Hordeum jubatum
Darnel grass	Lolium temulentum
Italian ryegrass	Lolium multiflorum
Bluebunch wheatgrass	Agropyron spicatum
Junegrass	Koeleria cristata
Squirreltail grass	Sitanion hystrix
Tall oatgrass	Arrhenaterum elatius
Spike trisetum	Trisetum spicatum
Wild oats	Avena fatua
California oatgrass	Danthonia californica

Table 2.1.5.6-3 (Cont.)

Common velvetgrass	Holcus lanatus
Creeping bentgrass	Agrostis palustris
Field sandbur	Cenchrus pauciflorus
Yellow foxtail	Setaria lutescens
Barnyard grass	Echinochloa crusgalli
Crabgrass	Digitaria sanguinalis
Timothy	Phleum pratense
Redtop	Agrostis palustris
Needle and thread	Stipa comata
Idaho fescue	Festuca idahoensis
Indian ricegrass	Oryzopsis hymenoides
Thurber needlegrass	Stipa thurberiana
Wyeth buckwheat	Eriogonum heracleoides

Table 2.1.5.6-4 Cold desert (M.P. 340 to M.P. 414).

Trees	
Western yellow pine	Pinus ponderosa
Western juniper	Juniperus occidentalis
Shrubs	
Rigid sagebrush	Artemisia rigida
Desert mountain mahogany	Cercocarpus ledifolius
Squaw currant	Ribes erythrocarpum
Plateau gooseberry	Ribes velutinum
Fern bush (Desert sweet)	Chanaebatiaria millefolium
Buckbrush	Ceanothus cuneatus
Gray ball sage	Salvia dorrii subsp. carnosa
Gray rabbit brush	Chrysothamnus nauseosus
Big sagebrush	Artemisia tridentata
Spineless horsebrush	Tetradymia canescens
Antelope bush (Bitterbrush)	Purshia tridentata
Greasewood	Sarcobatus vermiculatus
Snowberry	Symphoricarpos occidentalis
Forbs	
Desert lily	Calochortus marcrocarpus
Buckwheat spp.	Eriogonum spp.
Dock spp.	Rumex spp.
Smartweed spp.	Polygonum spp.
Lupine	Lupinus spp.
Western blue flax	Linum perenne spp. lewisii
Phacelia spp. (Fiddlenecks)	Phacelia spp.
Monkey flower	Mimulus spp.
Ashy penstemon	Penstemon cinereus
Penstemon	Penstemon spp.
Desert paintbrush	Castilleja linariaefolia
Arrow-leaved balsam root	Balsamorhiza sagittata
Aster	Aster spp.
Daisy	Erigeron spp.
Grasses	
Blue bunch fescue	Festuca idahoensis
Downy brome (Cheat)	Bromus tectorum
Bluebunch wheatgrass	Agropyron spicatum
Squirrel-tail grass	Sitanion hystrix

Table 2.1.5.6-4 (Cont.)

Soft chess	Bromus mollis
Wild barleys	Hordeum spp.
Needle grasses	Stipa spp.
Blue grasses	Poa spp.
Fescue	Festuca spp.
Idaho fescue	Festuca idahoensis
Basin wildrye	Elymus cinereus
Saltgrass	Distichlis stricta
Sandberg bluegrass	Poa secunda

Table 2.1.5.6-5 Cold desert (M.P. 414 to M.P. 968).

Typical Plants

Trees	
Western yellow pine	Pinus ponderosa
Western juniper	Juniperus occidentalis
Shrubs	
Rigid sagebrush	Artemisia rigida
Desert mountain mahogany	Cercocarpus ledifolius
Squaw currant	Ribes erythrocarpum
Plateau gooseberry	Ribes velutinum
Fern bush (Desert sweet)	Chanaebatiaria millefolium
Buckbrush	Ceanothus cuneatus
Gray ball sage	Salvia dorrii subsp. carnosa
Gray rabbit brush	Chrysothamnus nauseosus
Big sagebrush	Artemisia tridentata
Spineless horsebrush	Tetradymia canescens
Antelope bush (Bitterbrush)	Purshia tridentata
Greasewood	Sarcobatus vermiculatus
Snowberry	Symphoricarpos occidentalis
Forbs	
Desert lily	Calochortus marcrocarpus
Buckwheat spp.	Eriogonum spp.
Dock spp.	Rumex spp.
Smartweed spp.	Polygonum spp.
Lupine	Lupinus spp.
Western blue flax	Linum perenne spp. lewisii
Phacelia spp. (Fiddlenecks)	Phacelia spp.
Monkey flower	Mimulus spp.
Ashy penstemon	Penstemon cinereus
Penstemon	Penstemon spp.
Desert paintbrush	Castilleja linariaefolia
Arrow-leaved balsam root	Balsamorhiza sagittata
Aster	Aster spp.
Daisy	Erigeron spp.
Grasses	
Blue bunch fescue	Festuca idahoensis
Downy brome (Cheat)	Bromus tectorum
Bluebunch wheatgrass	Agropyron spicatum
Squirrel-tail grass	Sitanion hystrix

Table 2.1.5.6-5 (Cont.)

Soft chess	Bromus mollis
Wild barleys	Hordeum spp.
Needle grasses	Stipa spp.
Blue grasses	Poa spp.
Fescue	Festuca spp.
Idaho fescue	Festuca idahoensis
Basin wildrye	Elymus cinereus
Saltgrass	Distichlis stricta
Sandberg bluegrass	Poa secunda

Table 2.1.5.6-6 Hot desert (M.P. 968 to M.P. 1160).

Typical Plants	
Single-leaf pinyon	Pinus monophylla
California juniper	Juniperus californica
Utah juniper	Juniperus osteosperma
Ephedra	Ephedra fasciculata
Joint firs	Ephedra spp.
Mormon tea	Ephedra virdis
Red-stem filaree	Erodium cicutarium
Creosote bush	Larrea tridentata
Athel	Tamrix tetrandra
Hydra stick-leaf	Mentzelia affinis
Blazing star	Mentzelia spp.
California poppy	Eschscholzia californica
Desert candle	Caulanthus inflatus
Tansy-mustard	Descurainia pinnata spp. manziesii
Wall flower	Erysimum capitatum
Peppergrass	Lepidium flavum
Bush peppergrass	Lepidium fremontii
Cholla	Opumtia spp.
California buckwheat	Eriogonum fasciculatum
Sulpher-flowered buckwheat	Eriogonum umbellatum var. clorothamnus
Shadscale	Atriplex confertifolia
Four-wing saltbush	Atriplex canescens
Parry saltbush	Atriplex parryi
Allscale	Atriplex polycarpa
Spine scale	Atriplex spinifera
Torrey saltbush	Atriplex torreyi
Winterfat	Eurotia lanata
Spiny hopsage	Grayia spinosa
Red sage	Kochia americana
Tumbleweed	Salsola kali
Greasewood	Sarcobatus vermiculatus
Iodine bush	Sueada torrevana
Bigberry manzanita	Arctostaphylos glauca
Spiny menodora	Menodora spinescens
Gilia	Gilia latiflora
Great Basin gilia	Gilia micromeria
Golden gilia	Linanthus aurens
Granite gilia	Leptodactylon pungens spp. halli

Table 2.1.5.6-6 (Cont.)

Lupine	Lupinus spp.
Western birch	Betula occidentalis
Scrub oak	Quercus dumosa
Arroyo willow	Salix lasiolepis
Willow	Salix spp.
Field primrose	Oenothera campestris
Brown-eyed primrose	Oenothera claviformis
Desert ceanothus	Ceanothus greggii var. perplexans
Desert ceanothus	Ceanothus crassifolius
Skunkbush	Rhus trilobata
Desert parsley	Lomatium mohavense
Southern sil-tassel	Garrya veatchii
Chaparral honeysuckle	Lonicera interrupta
Goldenhead	Acamptopappus sphaerocephalus
Burrobush	Ambrosia dumosa
Low sagebrush	Artemisia arbuscula
Bud sage	Artemisia spinescens
Big sagebrush	Artemisia tridentata
Goldfields	Baeria chrysostoma
Broad-flowered chaenactics	Chaenactis stevoides var. brachypappa
Gray rabbitbush	Chrysothamnus nauseosus
Sticky-leaf rabbitbush	Chrysothamnus viscidiflorus
California coreopsis	Coreopsis californica
Leafy-stemmed corapsis	Coreopsis caliopsidea
Virgin river encelia	Encelia virginensis spp. actoni
Stenotopsis	Haplopappus linearifolius
Desert narrow-leafed goldenbush	Haplopappus linearifolius var. interior
Cheesebush	Hymenoclea salsola
White layia	Layia glandulosa
Mojave aster	Machraeranthera tortifolia
Shrubby butterbush	Sencio douglasii
Cotton thorn	Tetradymia axillaris
Littleleaf horsebrush	Tetradymia glabrata
Narrow-scaled felt-thorn	Tetradymia stenolepis
Joshua tree	Yucca brevifolia
Bluedicks	Brodiaea pulchella
Soft cheat	Bromus mollis
Cheat grass	Bromus tectorum
Indian rice grass	Oryzopsis hymenoides
Desert needlegrass	Stipa speciosa

Table 2.1.5.6-6 (Cont.)

Smooth yerba santa	Eriodictyon trichocalyx
Purple-mat	Nama demissum var. demissum
Baby-blue eyes	Nemophila menziesii
Common phaelia	Phacelia distans
Yellow throats	Phacelia framontii
Fiddleneck	Amsinckia intermedia
Tessellate fiddleneck	Amsinckia tessellata
Wing-nut cryptantha	Cryptantha pterocarya
Anderson desert-thorn	Lycium andersonii var. deserticola
Peach thorn	Lycium cooperi
Fremont's desert thorn	Lycium fremontii
Rabbit thorn	Lycium pallidum var. oligospermum
Coyote tobacco	Nicotinana attenuata
Desert tobacco	Nicotiana trigonophylla
Desert paintbrush	Castilleja chromosa**
Chuparosa	Beloperone californica
Desert lavender	Hyptis emoryi
Bladder sage	Salzaria mexicana
Thistle sage	Salvia carduaceae
Chia	Salvia columbariae
Desert sage	Salvia dorrii
Mojave sage	Salvia mohavensis
Chamise	Adenostoma fasciculatum
Mountain mahogany	Cercocarpus betuloides
Desert mountain mohogany	Cercocarpus ledifolius
Blackrush	Coleogyne ramosissima
Holly-leaf cherry	Prunus ilicifolia
Mojave antelope bush	Purshia glandulosa
Mohave dalea	Dalea arborescens
Fremont dalea	Dalea fremontii var. minutifolia
Nevada dalea	Dalea polyadenis
Deerweed	Lotus scoparius
Desert birds-foot	Lotus tomentellus
Royal desert lupine	Lupinus oderatus
Hairy royal desert lupine	Lupinus oderatus var. piosellus

Table 2.1.5.7-1 Wildlife species known to exist along the proposed pipeline route.

Common Name	Scientific Name
Mammals	
Elk	Cervus elaphus
Mule deer	Odocoileus hemionus
White-tailed deer	O. virginianus
Moose	Alces alces
Mountain sheep	Ovis canadensis
Pronghorn	Antilocapra americana
Black bear	Ursus americanus
Mountain lion	Felis concolor
Lynx	Lynx lynx
Bobcat	L. rufus
Red fox	Vulpes vulpes
Kit fox	V. macrotis
Gray fox	Urocyon cineroargenteus
Coyote	Cania latrans
Raccoon	Procyon lotor
Virginia opossum	Didelphis virgniana
Yellow-bellied marmot	Marmota flaviventris
Western gray squirrel	Sciurus griseus
Douglas' squirrel	Tamiasciurus douglasi

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Red squirrel	T. hudsonicus
Northern flying squirrel	Glaucomys sabrinus
Snowshoe hare	Lepus americanus
White-tailed jack rabbit	L. townsendii
Black-tailed jack rabbit	L. californicus
Nuttalls' cottontail	Sylvilagus nuttallii
Brush rabbit	S. bachmani
Desert cottontail	S. audubonii
Pygmy rabbit	S. idahoensis
Ringtail	Bassariscus astutus
Marten	Martes americana
Fisher	M. pennanti
Ermine	Mustela erminea
Long-tailed weasel	M. frenata
Mink	M. vison
Wolverine	Gulo gulo
Western spotted skunk	spilogale gracilis
Striped skunk	Mephitis mephitis
Badger	Taxidea taxus
River otter	Lontra canadensis
Beaver	Castor canadensis
Muskrat	Ondatra zibethicus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Broad-booted mole	Scapanus latimanus
Coast mole	S. orarius
Trowbridge shrew	Sorex trowbridgii
Merriam's shrew	S. merriami
Pacific water shrew	S. bendirii
Ornate shrew	S. ornatus
Masked shrew	S. cinereus
Mt. Lyell shrew	S. lyelli
Dusky shrew	S. obscurus
Vagrant shrew	S. vagrans
Glacier Bay water shrew	S. alaskanus
Desert shrew	Notiosorex crawfordi
Little brown myotis	Myotis Lucifugus
Long-eared myotis	M. evotis
Yuma myotis	M. yumanensis
Small-footed myotis	M. leibii
Fringed myotis	M. thysanodes
California myotis	M. californicus
Long-legged myotis	M. volans
Big brown bat	Eptesicus fuscus
Western pipistrelle	Pipistrellus hesperus
Silver-haired bat	Lasionycteris noctivagans

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Hoary bat	Lasiurus cinereus
Red bat	L. borealis
Spotted bat	Euderma maculatum
Rafinesque's big-eared bat	Plecotus rafinesquii
Brazilian free-tailed bat	Tadarida brasiliensis
Big free-tailed bat	T. macrotis
Western mastiff bat	Eumops perotis
White-tailed antelope squirrel	Ammospermophilus leucurus
Nelson's antelope squirrel	A. nelsoni
Townsend's ground squirrel	Spermophilus townsendii
Washington ground squirrel	S. washingtoni
Richardson's ground squirrel	S. richardsoni
Belding's ground squirrel	S. beldingi
Columbia ground squirrel	S. columbianus
Rock squirrel	S. variegatus
California ground squirrel	S. beecheyi
Mohave ground squirrel	S. mohavensis
Golden-mantled ground squirrel	S. lateralis
Alpine chipmunk	Eutamias alpinus
Least chipmunk	E. minimus
Yellow-pine chipmunk	E. amorenus
Panamit chipmunk	E. panamintinus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Colorado chipmunk	Eutamias quadrivittatus
Red-tailed chipmunk	E. ruficaudus
Townsend's chipmunk	E. townsendii
Merriam's chipmunk	E. merriami
Cliff chipmunk	E. dorsalis
Northern pocket gopher	Thomomys talpoides
Mountain pocket gopher	T. monticola
Townsend's pocket gopher	T. townsendii
Botta's pocket gopher	T. bottae
Little pocket mouse	Perognathus longimembris
San joaquin pocket mouse	P. inornatus
Great Basin pocket mouse	P. parvus
White-eared pocket mouse	P. alticolus
Long-tailed pocket mouse	P. formosus
Desert pocket mouse	P. penicillatus
San Diego pocket mouse	P. fallox
California pocket mouse	P. californicus
Spiny pocket mouse	P. spinatus
Panamint kangeroo rat	Dipodomys panamintinus
Stephen's kangeroo rat	D. stephensi
Merriam's kangeroo rat	D. merriami
Ord's kangeroo rat	D. ordii

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Agile kangeroo rat	Dipodomys agilis
Chisel-toothed kangeroo rat	D. microps
Desert kangeroo rat	D. deserti
Dark kangeroo mouse	Microdipodops megacephalus
Pale kangeroo mouse	M. pallidus
Northern grasshopper mouse	Onychomys leucogaster
Southern grasshopper mouse	O. torridus
Western harvest mouse	Reithrodontomys megalotes
Cactus mouse	Peromyscus eremicus
California mouse	P. californicus
Canyon mouse	P. crinitus
Deer mouse	P. maniculatus
Brush mouse	P. boylii
Pinon mouse	P. truei
White-throated woodrat	Neotoma albigula
Desert woodrat	N. lepida
Dusky-footed woodrat	N. fuscipes
Bushy-tailed wodrat	N. cinerea
Heather vole	Phenacomys intermedius
Gaper's redback vole	Clethrionomys gapperi
Meadow vole	Microtus pennsylvanicus
Montane vole	M. montanus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
California vole	Microtus californicus
long-tailed vole	M. longicaudus
Water vole	Arvicola richardsoni
Sagebrush vole	Lagurus curtatus
Norway rat	Rattus norvegicus
Black rat	R. rattus
House mouse	Mus musculus
Western jumping mouse	Zapus princeps
Porcupine	Erethizon dorsatum
Pika	Ochotona princeps

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Birds[2]	
Bald eagle	Haliaeetus leucocephalus
Golden eagle	Aquila chrysaetos
Red-tailed hawk	Buteo jamiaicensis
Rough-legged hawk	B. lagopus
Swainson's hawk	B. swainsoni
Ferruginous hawk	B. regalis
Broad-winged hawk	B. platypterus
Red-shouldered hawk	B. lineatus
Cooper's hawk	Accipiter cooperii
Goshawk	A. gentilis
Sharp-shinned hawk	A. striatus
Marsh hawk	Circus cyaneus
Osprey	Pandion haliaetus
Prairie falcon	Falco mexicanus
American kestrel	F. sparverius
Peregrine falcon	F. peregrinus
Merlin	F. columbarias
Turkey vulture	Cathartes aura
Barn owl	Tyto alba
Burrowing owl	Speotyto cunicularia
Great-horned owl	Bubo virginianus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Long-eared owl	Asio otus
Screech owl	Otus asio
Short-eared owl	Asio flammeus
Saw-whet owl	Aegolius acadicus
Flammulated owl	Otus flammeolus
Pygmy owl	Glaucidium gnoma
Yellow-billed cuckoo	Coccyzus americanus
Roadrunner	Geococcyx californianus
lesser nighthawk	Chordeiles acutipennis
Common nighthawk	C. minor
Poor-will	Phalaenoptilus nuttallii
Vaux's swift	Chaetura vauxi
White-throated swift	Aeronautes saxatalis
Broad-tailed hummingbird	Salasphorus platycercus
Calliope hummingbird	Stellula calliope
Annas's hummingbird	Calypte anna
Black-chinned hummingbird	Archilochus alexandri
Costa's hummingbird	Calypte costae
Rufous hummingbird	Selasphorus rufus
Belted kingfisher	Megaceryle alcyon
Common flicker	Colaptes auratus
Pileated woodpecker	Dryocopus pileatus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Lewis' woodpecker	Asyndesmus lewis
Yellow-bellied sapsucker	Sphyrapicus varius
Williamson's sapsucker	S. thyroideus
White-headed woodpecker	Dendrocopos albolarvatus
Hairy woodpecker	D. villosus
Downy woodpecker	D. pubescens
Black-backed three-toed woodpecker	Picoides arcticus
Northern three-toed woodpecker	Picoides tridactylus
Gila woodpecker	Centurus uropygialis
Ladder-backed woodpecker	Dendrocopos scalaris
Nuttall's woodpecker	D. nuttallii
Eastern kingbird	Tyrannus tyrannus
Western kingbird	T. verticalis
Say's phoebe	Sayornis saya
Ash-throated flycatcher	Myiarchus cinerascens
Traill's flycatcher	Empidonax traillii
Dusky flycatcher	E. oberholseri
Western flycatcher	E. difficilis
Western wood pewee	Contopus sordidulus
Olive-sided flycatcher	Nuttallornis borealis
Weid's crested flycatcher	Myiarchus tyrannulus
Black phoebe	Sayornis nigricans

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Nam
Gray flycatcher	Empidorax wrightii
Vermillion flycatcher	Pyrocephaslus rubinus
Horned lark	Eremophila alpestris
Violet-green swallow	Tachycineta thalassina
Tree swallow	Irodoprocne bicolor
Bank swallow	Riparia riparia
Rough-winged swallow	Stelgidoptervx ruficollis
Barn swallow	Hirundo rustica
Cliff swallow	Petrochelidon pyrrhonota
Purple martin	Progne subis
Gray jay	Perisoreus canadensis
Steller's jay	Cyanocitta stelleri
Black-billed magpie	Pica pica
Common raven	Corvus corax
Common crow	C. brachyrhynchos
Pinnon jay	Gymnorhinus cyanocephalus
Clark's nutcracker	Nucifraga columbiana
Scrub jay	Aphelocoma coerulescens
Black-capped chickadee	Parus atricapillus
Mountain chickadee	P. gambeli
Plain titmouse	Parus inornatus
Verdin	Auriparis flaviceps

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Common bushtit	Psaltriparus minimus
White-breasted nuthatch	Sitta carolinensis
Pygmy nuthatch	S. pygmaea
Red-breasted nuthatch	S. canadensis
Brown creeper	Certhia familiaris
Dipper	Cinclus mexicanus
Cactus wren	Campylorhynchus brunneicapillus
House wren	Troglodytes aedon
Winter wren	T. troglodytes
Long-billed marsh wren	Telmatodytes palustris
Cannon wren	Catherpes mexicanus
Rock wren	Salpinctes obsoletus
Bewick's wren	Thryomanes bewickii
Sage thrasher	Oreoscoptes montanus
Mockingbird	Mimus polyglottos
Bendire's thrasher	Toxostroma bendirei
Le Conte's thrasher	T. lecontei
Crissal thrasher	T. dorsale
California thrasher	T. redivivum
Wrentit	Chamaea fasciata
American robin	Turdus migratorius
Hermit thrush	Catharus guttata

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Swainson's thrush	Catharus ustulata
Mountain bluebird	Sialia currucoides
Townsend's solitaire	Myadestes townsendi
Western bluebird	Sialia mexicana
Varied thrush	Ixoreus naevius
Golden-crowned kinglet	Regulus satrapa
Ruby-crowned kinglet	R. calendula
Blue-gray gnatcatcher	Polioptila caerulea
Black-tailed gnatcatcher	P. melanura
Water pipit	Anthus spinoletta
Phainopela	Phainopopla nitens
Bohemian waxwing	Bombycilla garrulus
Cedar waxwing	B. cedorum
Northern shrike	Lanius excubitor
Loggerhead shrike	L. ludovicianus
Common starling	Sturnus vulgaris
Solitary vireo	Vireo solitarius
Warbling vireo	V. gilvus
Bell's vireo	V. bellii
Yellow-throated vireo	V. flavifrons
Gray vireo	V. vicinior
Golden-winged warbler	Vermivora chrysoptera

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Orange-crowned warbler	Vermivora celata
Nashville warbler	V. ruficapilla
Yellow warbler	Dendroica petechia
MacGillivray's warbler	Oporornis tolmiei
Yellowthroat	Geothlypis trichas
Yellow-breasted chat	Icteria virens
Wilson's warbler	Wilsonia pusilla
Virginia's warbler	Vermivora virginiae
Lucy's warbler	V. luciae
Myrtle warbler	Dendroica coronata
Black-throated gray warbler	D. nigrescens
Black-throated blue warbler	D. caerulescens
Townsend's warbler	D. townsendi
Hermit warbler	D. occidentalis
Northern water thrush	Seiurus noveboracensis
American redstart	Setophaga ruticillo
Black and white warbler	Mniotilta varia
House sparrow	Passer domesticus
Bobolink	Dolichonyx oryzivorus
Western meadowlark	Sturnella neglecta
Yellow-headed blackbird	Xanthocephalus xanthocephalus
Red-winged blackbird	Agelaius phoeniceus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Northern oriole	Icterus galbula
Brewer's blackbird	Euphagus cyanocephalus
Brown-headed cowbird	Molothrus ater
Ovenbird	Seiurus aurocapillus
Common Grackle	Quiscalus quiscala
Scott's oriole	Icterus perisorum
Orchard oriole	I. spurius
Hooded oriole	I. cucullatus
Western tanager	Piranga ludoviciana
Summer tanager	P. rubra
Hepatic tanager	P. flava
Indigo bunting	P. cyanea
Black-headed grosbeak	Pheucticus melanocephalus
Lazuli bunting	Passerina amoena
Evening grosbeck	Hesperiphona vespertina
Purple finch	Carpodacus purpureus
Cassin;s finch	C. cassinii
House finch	C. mexicanus
Pine grosbeck	Pinocola enucleator
Gray-crowned rosy finch	Leucosticte tephrocotis
Common redpoll	Acanthis flammea
Pine siskin	Spinus pinus
American goldfinch	S. tristis

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Lawrence's goldfinch	Spinus Lawrencei
Red crossbill	Loxia curvirostra
White-winged crossbill	L. leucoptera
Green-tailed towhee	Chlorura chlorura
Rufous-sided towhee	Pipilo erythrophthalmus
Brown towhee	P. fuscus
Savannah sparrow	Passerculus sandwichensis
Grasshopper sparrow	Ammodramus savannarum
Vesper sparrow	Pooecetes gramineus
Lark sparrow	Chondestes grammacus
Darkeyed junco	J. hyemalis
Tree sparrow	Spizella arborea
Chipping sparrow	S. passerina
Brewer's sparrow	S. breweri
White-crowned sparrow	Zonotrichia leucophrys
Fox sparrow	Passerella ilicaca
Lincoln's sparrow	Melospiza lincolnii
Song sparrow	M. melodia
Lapland longspur	Calcarius lapponicus
Snow bunting	Plectrophenax nivalis
Blue grosbeak	Guiraca caerulea

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Lesser goldfinch	Spinus psaltria
Albert's towhee	Pipilo aberti
Lark bunting	Calamospiza melanocorys
Black-throated sparrow	Amphispiza bilineata
Sage sparrow	A. belli
Gray-headed junco	Junco caniceps
Black-chinned sparrow	Spizella atrogularis
Golden-crowned sparrow	Zonotrichia atricapilla
Harris' sparrow	A. guerula
Long-billed curlew	Numenius americanus
Upland plover	Bartramia longicauda
Semipalmated plaver	Charadicus semipalmatus
Snowy plaver	C. alexandrinus
American golden plaver	Pluvialis dominica
Spotted sandpiper	Actitis macularia
Willet	Catoptrophorus semipalmatus
Greater yellowlegs	Totanus melanoleucus
Lessor yellowlegs	T. flavipes
Least sandpiper	Erolia minutiua
Baird's sandpiper	E. bairdii
Dunlin	E. alpina
Western sandpiper	Ereunetes mauri

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Stilt sandpiper	Micropalama himatopus
Short-billed dowitcher	Limnodromus griseus
Long-billed dowitcher	L. scolopaceus
Marbled godwit	Limosa fedoa
Common snipe	Capella gallinago
Solitary sandpiper	Tringa solitaria
Sanderling	Crocethia alba
Whimbrel	Numenius phaeopus
Redhead	Aythya americana
Canvasback	A. valisineria
Ring-necked duck	A. collaris
Lesser scaup	A. affinis
Bufflehead	Bucephala albeola
Common goldeneye	B. clangula
Ruddy duck	Pxuira jamaicansis
Hooded merganser	Lophodytes cucullatus
Common merganser	Mergus merganser
Red-breasted merganser	M. serrator
Wood duck	Aix sponsa
Fulvous tree duck	Dendrocygna bicolor
Virginia rail	Rallus limicola
Sora	Porzana carolina

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Common gallinule	Gallinula chloropus
American coot	Fulica americana
Ground dove	Columbigallina passerina
Band-tailed pigeon	Columba fasciata
Rock dove	C. livia
White-winged dove	Melopelia asiatica
Mourning dove	Zenaidura macroura
Spotted dove	Streptopelia chinensis
Ringed turtle dove	S. risoria
Sandhill crane	Grus canadensis
Common loon	Gavia immer
Red-throated loon	G. stellata
Willson's phalarope	Steganopus tricolor
Northern phalarope	Lopipes lobatus
American avocet	recurvirostra americana
Black-necked stilt	Himantopus mexicanus
Herring gull	Larus argentatus
California gull	L. californicus
Ringbilled gull	L. delawarensis
Bonapartes's gull	L. philadelphia
Forster's tern	Sterna forsteri
Least tern	S. albifrons

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Common tern	Sterna hirundo
Caspian tern	Hydroprogne caspa
Black tern	Chlidonias niger
Whistling swan	Olor columbianus
*Canada goose	Branta canadensis
White-fronted goose	Anser albifrons
Snow goose	Chen caerulescens
Ross' goose	C. rossii
Mallard	Anas platyrhynchos
Gadwall	A. strepera
Pintail	A. acuta
Green-winged teal	A. crecca
Blue-winged teal	A. discors
Cinnamon teal	A. cyanoptera
American widgeon	A. americana
Shoveler	Spatula clypeata
Western grebe	Aechmophorus occidentalis
Horned grebe	Podiceps auritus
Eared grebe	P. caspicus
Pied billed grebe	Podilymbus podiceps
White pelican	Pelecanus erythrorhynchos
Double-crested cormorant	Phalacrocora auitus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Great blue heron	Ardea herodias
Green heron	Butorides virescens
Black-crowned night heron	Nycticorax nyciticorax
American bittern	Botaurus lentiginosus
Least bittern	Ixobrychus exilis
Snowy egret	Leucophoyx thula
Common egret	Casmerodiius albus
Wood ibis	Mycteria americana
White-faced ibis	Plegadis chihi
Killdeer	Charadrius vociferus
Blue grouse	Dendragapus obscurus
Ruffed grouse	Bonasa umbellus
Spruce grouse	Canachites canadensis
Sage grouse	Centrocercus urophasianus
Sharp-tailed grouse	Pedioecetes phasianellus
Chukar	Alectoris chukar
Hungarian partridge	Perdix perdix
Bobwhite quail	Colinus virginianus
Gamble's quail	Lophortyx gambelii
Mountain quail	Oreortyx pictus
Ring-necked pheasant	Phasianus colchicus
See see partridge	Ampoperdix griseogularis

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Snow partridge	Tetrograllus himalayensis
California quail	Lophortyx californicus
Scaled quail	Callipepla squamata
Merriam's turkey	Meleagris gallopavo
Crested tinamou	Eudromia elegans

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Reptiles[3]	
Painted turtle	Chrysemys picta
*Western gopher turtle	Gopherus agassizi
Crested lizard	Dipsosaurus dorsalis
Gridiron-tailed lizard	Callisaurus draconoides
Chuckwalla	Sauromalus obesus
Mogave fringe-toed lizard	Uma scoparia
Collared lizard	Crotophytus collaris
Leopard lizard	C. wislizeni
Desert spiny lizard	Sceloperus magister
Western fence lizard	S. occidentalis
Sagebrush lizard	Urosaurus graciosus
Side-blotched lizard	Uta stansburiana
Short-horned horned toad	Phrynosoma doglassi
Snub-nosed horned toad	P. platyrhinos
Banded gecko	Coleonyx variegatus
Yucca might lizard	Xantusia vigilis
Western skink	Eumeces skiltonianus
Gilbert's skink	E. gilberti
Tessellated race runner	Cnemidophorus tigris
Northern alligator lizard	Gerrhonotus coeruleus
Red-backed alligator lizard	G. multicarinatus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Footless lizard	Anniella pulchra
Dwarf blind snake	Leptotyphlops humilus
*Rubber boa	Charina Bottae (umbratica)
California boa	Lichanura roseofusca
Western ring-necked snake	Diadophis amabilis
Sonora leaf-nosed snake	Phyllorhynchus decurtatus
Racer	Coluber constrictor
Whip snake	Masticophis flagellum
California striped whip snake	M. lateralis
Striped whip snake	M. taeniatus
Western patch-nosed snake	Salvadora hexalepis
Glossy snake	Arizona elegans
Gopher snake	Pituophis catenifer
King snake	Lampropeltis getulus
Coral king snake	L. zonata
Long-nosed snake	Rhinocheilus lecontei
Western garter snake	Thamnophis elegans
Common garter snake	T. sirtalis
Ground snake	Sonora semiannulata
Shovel-nosed snake	Chionactis occipitalis
California balck-headed snake	Tantilla eiseni
Utah black-headed snake	T. utahensis

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
California lyre	Trimophodon vandenburghi
Night snake	Hypsiglena torquata
Prairie rattlesnake	Crotalus viridis
Sidewinder	C. cerastes
Speckled rattlesnake	C. mitchelli
Shield-headed rattlesnake	C. scutulatus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
	4
Amphibians	
Pacific giant salamander	Dicamptodon ensatus
Tiger salamander	Ambystoma tigrinum
Long-toed salamander	A. macrodoctylum
California newt	Taricha torosa
Van Dyke's salamander	Plethodon vandykei
Eschscholtz's salamander	Ensatina eschscholtizi
California slender salamander	Batrachoseps attenuatus
Pacific slender salamander	B. pacificus
Arobreal salamander	Aneides lugubris
Hammond's spadefoot	Scaphiopus hammondi
Western toad	Bufo boreas
Woodhouse's toad	B. woodhousei
Southwestern toad	B. Microscaphus
Red-spotted toad	B. punctatus
*Black toad	B. exsul
Pacific tree-frog	Hyla regilla
Canyon tree-frog	H. arenicolor
Tailed frog	Ascaphus truei
Bullfrog	Rana catesbeiana
Green frog	R. clamitans
Leopard frog	R. pipiens

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Western spotted frog	Rana pretiosa
Yellow-legged frog	R. boylei
Red-legged frog	R. aurora
Coho salmon	Oncorhynchus kisutch
Sockeye salmon (kokines is non-anadromous form)	O. nerka
Chinook salmon	O. tshawytscha
Rainbow trout (Steelhead is anadromous form)	Salma gairdneri
Cutthroat trout	S. clarki
Brown trout	S. trutta
Brook trout	Salvelinus fontinalis
Dolly varden	S. malma
Lake trout	S. mamaycush
Arctic grayling	Thymallus arcticus
Whitefish	Prosopium species
Cisco	Coregonus species
Pacific lamprey	Entosphenus tridentatus
River lamprey	Lampetra ayresi
Green sturgeon	Acipenser medirostris
White sturgeon	A. transmontanus
American shad	Alosa sapidissima
Carp	Cyprinus carpio
Chub	Gila species

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Dace	Rhinichthys species
Shiver	Notropis species
Northern squawfish	Ptychocheilus oregonenis
Sucker	Catostomus species
*Cui-ui	Chasmistes cujus
White catfish	Ictalurus catus
Brown bullhead	I. nebulosus
Channel catfish	I. punctatus
Black bullhead	I. melas
*Pupfish	Cyprinadon species
Topminnow	Fundulus species
Mosquito fish	Gambusia affinis
Sacramento perch	Archoplites interruptus
Green sunfish	Lepomis cyanellus
Bluegill	L. macrochirus
Redear sunfish	L. microlophus
Pumpkinseed	L. gibbosus
Smallmouth bass	Micropterus dolomieui
Largemouth bass	M. salmoides
White crappie	Pomoxis annularis
Black crappie	P. nigromaculatus

Table 2.1.5.7-1 (Cont.)

Common Name	Scientific Name
Walleye	Stizostedion vitreum
Yellow perch	Perca flavescens
Sculpin	Cottus species
Northern pike	Esox lucius

* Indicates that a rare or endangered species or subspecies occurs along the proposed pipeline route.

References to common and scientific names of wildlife along route.

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Table 2.1.5.9-1 Population summary.

County	ACTUAL 1950	1960	1970	%-Chg 60-70	Pop/Sq Mile 1970	URBAN 1970	% of Total	%-Chg 60-70	RURAL 1970	%-Chg 60-70
United States			203,212,877	13.3	57	149,361,464	73.5		53,851,413	
Idaho		667,191	712,567	6.9	9	386,924	54.3		325,643	
Washington		2,853,214	3,409,169	19.6	51	2,475,057	72.6		934,112	
Oregon		1,768,687	2,091,385	18.3	22	1,403,319	67.1		88,066	
11 Western States	19,561,114	27,193,698	33,373,365	24	29	28,070,978	83	32	5,666,387	-5
Region	420,573	487,133	507,597	4	33	367,361	72	8	140,236	-2
Bonner-Idaho	14,853	15,587	15,560	0	9	4,144	27	-5	11,416	2
Boundary	5,908	5,809	5,484	-6	4	2,796	51		2,688	-54
Kootenai	24,947	29,556	35,332	20	28	16,228	46	14	19,104	25
Columbia-Wash.	4,860	4,569	4,439	-3	5	2,596	48	-11	1,843	11
Spokane	221,561	278,333	287,487	3	164	246,261	86	5	41,226	-5
Walla Walla	40,135	42,195	42,195	0	33	30,969	73	8	11,207	-18
Whitman	32,469	31,263	37,900	21	18	23,173	61	47	14,727	-5
Umatilla-Oreg.	1,703	44,352	44,923	1	14	22,195	49	-3	22,728	6
Baker	16,175	17,295	14,919	-14	5	9,354	63	-6	5,565	-24
Union	17,962	18,180	19,377	7	10	9,645	50	7	9,732	6

Table 2.1.5.9-2 Salient socio-economic data for counties traversed

	Counties									
	Boundary Idaho	Bonner Idaho	Kootenai Idaho	Spokane Washington	Whitman Washington	Columbia Washington	Walla Walla Washington	Umatilla Oregon	Union Oregon	Baker Oregon
Civilian labor force	2,152	5,533	13,006	107,328	14,281	1,868	16,840	17,596	7,199	5,690
Percent unemployed	12.1	12.6	9.6	6.9	3.5	10.0	6.5	7.1	9.7	9.6
Percent employed in industry										
Manufacturing	21.4	20.9	22.4	12.5	3.1	19.2	9.5	15.7	18.2	11.1
Wholesale, retail trade	20.7	21.8	22.0	25.4	15.7	15.9	19.7	20.6	20.8	22.4
Services	7.7	6.5	8.7	9.4	5.9	4.5	7.8	5.9	6.3	5.9
Educational services	7.4	7.1	7.1	9.5	37.2	4.2	16.9	8.3	12.7	8.8
Construction	7.1	7.7	8.4	5.6	3.5	6.2	8.0	5.8	5.6	5.4
Government	22.0	19.1	16.0	16.1	42.8	17.3	24.8	23.0	21.2	17.2
Median family income (1969)($)	7,681	7,559	8,295	9,456	9,099	8,466	9,490	8,638	8,718	7,557
Per capita income (1969)($)	2,478	2,450	2,705	3,015	2,785	2,855	3,040	2,795	2,793	2,585
Year-round housing units (1970)	2,164	5,920	12,962	99,439	11,456	1,766	14,488	15,999	6,906	5,807
Rental vacancy rate (%)	9.4	9.4	10.0	7.2	4.0	21.4	8.3	9.7	4.9	12.5
County general revenue (1967) ($ million)	2.5	3.2	6.6	67.3	8.4	1.8	10.8	15.2	4.5	4.8
Property taxes ($ per capita)	208	124	90	85	79	102	95	174	140	163
Retail estab. (1967)	61	198	405	2,174	313	66	388	489	223	207
Sales ($ thousands)	6,739	20,753	48,306	473,000	48,313	7,893	73,481	83,149	29,881	29,788
Service estabs. (1967)	45	124	294	1,761	179	42	278	309	113	110
Receipts ($ thousands)	501	2,276	6,106	70,681	4,149	498	6,607	7,186	1,952	2,750
Wholesale estabs. (1967)	7	29	42	621	84	20	100	80	47	31
Sales ($ thousands)	1,739	5,196	13,085	675,239	53,797	9,343	72,528	45,406	20,119	14,023
Farms (1969)	308	502	522	2,076	1,468	258	800	1,284	678	626
Value of prod. sales ($ thous.)*	3,152	2,991	5,577	22,814	47,805	9,648	35,267	53,867	11,478	11,752
Distribution of sales (%)										
Crops	42.9	9.4	59.1	57.3	83.7	91.6	67.1	37.8	46.9	14.8
Dairy products	15.9	33.7	11.1	11.9	0.4	**	1.2	1.0	1.7	8.8
Livestock and products	35.4	49.5	24.5	17.0	15.5	8.0	29.7	59.6	50.4	75.5
Poultry and products	***	0.8	2.1	13.4	0.3	0.1	1.9	1.3	0.2	0.2

*For farms with sales of $2,500 and over. Source: County and City Data Book, 1972.

Table 2.1.5.9-3 Population of minority races by county.

Region/County	Total Minority Race Population				Rural Minority Populations			
					Farm		Non-Farm	
	Spanish a/	Indian	Negro	Other	White	Other Race	White	Other Race
Bonner, Idaho	-	66	1	63	2,037	17	9,159	88
Boundary, Idaho	-	63	3	3	1,040	50	2,407	75
Kootenai, Idaho	-	188	13	72	2,249	22	16,640	193
Columbia, Washington	469	7	4	10	882	-	990	-
Spokane, Washington	2,894	1,988	2,989	2,336	7,443	28	32,866	672
Walla Walla, Washington	1,077	171	481	359	3,136	-	8,088	74
Whitman, Washington	436	102	64	695	5,366	14	9,351	30
Umatilla, Oregon	746	976	221	200	4,912	266	17,044	559
Baker, Oregon	-	31	25	53	2,148	0	3,375	42
Union, Oregon	-	84	75	139	1,669	5	7,994	64

a/ Reported only for counties with 400 or more.

Source: 1970 Census of Population

Table 2.1.5.9-4 Communities along proposed route.

STATE County Community	LOCATION Approximate Miles from Pipeline	POPULATION 1960	 1970
Idaho		667,191	713,008
Boundary		5,809	5,484
Eastport	1	(a)	100(b)
Moyie Springs	1	196	203
Bonners Ferry	2	1,921	2,796
Naples	1	697	651
Bonner		15,587	15,560
Elmira	11	(a)	20(b)
Colburn	1	(a)	50(b)
Kootenai	2	180	168
Ponderay	2	230	275
Sandpoint	1	4,355	4,144
Cocolalla	1	(a)	20(b)
Careywood	1	(a)	25(b)
Kootenai		29,556	35,332
Athol	1	214	190
Rathdrum	1	710	741
Hauser	2	127	349
Post Falls	2	1,983	2,371
Coeur d'Alene	7	14,291	16,228
State Line	1	33	22
WASHINGTON		2,853,214	3,411,900
Spokane		278,300	287,487
Newman Lake	3	(a)	100(c)
Otis Orchards	4	750	1,200
Greenacres	1	2,074	2,324
Opportunity	4	12,465	16,604
Spokane	4	184,000	170,516

Table 2.1.5.9-4 (cont.)

STATE / County / Community	LOCATION Approximate Miles from Pipeline	POPULATION 1960	POPULATION 1970
Freeman	1	(a)	100(c)
Valleyford	3	(a)	80(c)
Rockford	5	369	327
Fairfield	5	367	416
Spangle	5	208	179
Waverly	4	(a)	48(c)
Whitman		31,263	37,900
Rosalia	2	585	569
Malden	3	292	219
St. John	1	545	575
Endicott	1	369	333
Lacrosse	1	463	426
Columbia		4,569	4,439
Starbuck	7	(a)	216
Walla Walla		42,195	42,176
Prescott	3	(a)	242
Waitsburg	4	1,010	953
Dixie	4	250	200
Walla Walla	3	24,536	23,619
College Place	5	4,031	4,510
OREGON		1,768,687	2,091,385
Umatilla		44,352	44,923
Milton-Freewater	4	4,110	4,105
Weston	4	783	660
Athena	4	950	872
Pendleton	25	14,434	13,197
Gibbon	1	(a)	80(b)
Meacham	2	(a)	120(b)
Union	1	18,180	19,377
Kamela	1	(a)	10(b)
Hilgard	1	(a)	15(b)
La Grande	7	9,014	9,645
Union	1	1,490	1,531
North Powder		399	342
Baker		17,295	14,919
Baker	1	9,986	9,354
Durkee	1	(a)	65(b)

(a) Not available
(b) From National Atlas 1970
(c) From National Auto Club Map of Washington

Source: Population Data from U.S. Census, 1960 and 1970.

Table 2.1.5.9-5 County tax and selected expenditures, 1967

Item	Counties									
	Bonner Idaho	Boundary Idaho	Kootenai Idaho	Columbia Washington	Spokane Washington	Walla Walla Washington	Whitman Washington	Umatilla Oregon	Baker Oregon	Union Oregon
General Revenue (Thous. $)	3,154	2,458	6,593	1,765	67,324	10,788	8,385	15,230	4,820	4,548
From Property Taxes	1,879	1,080	2,839	488	22,289	4,045	2,579	7,788	2,604	2,654
General Expenditure (Thous. $)	3,316	1,711	6,506	1,769	67,326	10,895	7,583	14,689	5,161	4,720
Per Capita Amounts										
General Revenue	208.88	472.67	209.32	367.64	255.79	253.24	258.00	339.95	301.24	239.35
From Property Taxes	124.45	207.60	90.14	101.67	84.69	94.94	79.36	173.83	162.74	139.67
General Expenditure a/	219.62	329.04	206.54	368.54	255.80	255.76	233.33	327.88	322.58	248.43
on Education	133.71	126.36	116.94	151.93	147.32	143.64	143.64	213.94	204.13	144.92
on Highways	34.11	55.84	31.41	82.17	27.73	36.13	38.84	28.37	47.02	35.27
on Hospitals	-	-	-	47.40	3.04	.82	-	28.43	-	-
on Police Protection	7.84	7.68	7.56	7.46	11.90	8.41	7.74	9.38	9.26	9.29
on Sewage	1.81	.81	2.90	5.98	3.32	3.67	2.23	4.44	2.20	7.20
on Parks and Recreation	1.28	-	2.32	3.11	6.96	5.47	3.59	2.49	1.53	1.52
on Housing and Renewal	-	-	-	-	-	.23	-	1.25	-	-

a/ Will not add since detail is not complete.

Source: Census of Governments, 1966-67.

Table 2.1.5.9-6 Projection of economic area trends without proposed pipeline: 1980, 1990, and 2000

	Spokane - 154				Yakima - 156			
		% Change				% Change		
	1970	1970-1980	1970-1990	1970-2000	1970	1970-1980	1970-1990	1970-2000
Population	687,982	3	3	3	407,607	1	1	3
Total Employment	248,909	14	15	19	148,212	13	16	21
Earnings per Worker (1967 $)	6,613	22	57	101	6,576	23	57	101
Total Earnings (Million 1967 $)	1,646	40	81	140	975	39	82	144
Agr., For. and Fish	195	21	29	45	147	16	22	34
Mining	29	5	4	11	1,291	32	47	70
Contract Construction	115	39	73	121	584	39	78	133
Manufacturing	262	40	79	129	159	37	73	120
Trans., Comm. and Util.	107	32	66	114	59	31	66	119
Trade (Wholesale and Retail)	294	34	67	118	166	33	64	111
Fin., Ins. and R.E.	64	64	128	217	27	67	141	244
Services	228	63	135	239	161	63	135	246
Government	352	43	93	166	195	45	104	190

Source: WRC-OBERS Projections, 1972 (Series E).

Table 2.1.5.9-7 Population summary, future extension area.

	TOTAL					URBAN			RURAL	
COUNTY	1950	1960	1970	% Chg 60-70	POP/SQ Mile 1970	1970	% of TOTAL	% Chg 60-70	1970	% Chg 60-70
11 Western States	19,561,114	27,193,698	33,737,365	24	29	28,070,978	83	32	5,666,387	- 5
Region		862,483	1,091,493	27		897,756	82		229,010	
Inyo, Calif.	11,658	11,684	15,571	33	2	3,498	22	22	12,073	37
Kern		291,984	329,162	12	40	263,329	80		65,833	
Mono		2,213	4,016	81	1		0		4,016	81
San Bernardino	281,642	503,591	684,072	36	34	611,701	89	63	72,371	-44
Churchill, Nevada	6,161	8,452	10,513	24	2	2,959	28	8	7,554	32
Esmeralda	614	619	629	2			0		629	2
Humboldt	4,838	5,708	6,375	12	1	3,587	56	4	2,788	24
Lander	1,850	1,566	2,666	70			0		2,666	70
Mineral	5,560	6,329	7,051	11	2	3,539	50	25	3,512	1
Nye	3,101	4,374	5,599	28			0		5,599	28
Pershing	3,103	3,199	2,670	-17			0		2,670	-17
Malheur, Oregon	23,223	22,764	23,169	2	2	9,143	39	19	14,026	- 7

Source: 1970 Census of Population

Table 2.1.5.9-8 Population of minority races by county, future extension area.

	TOTAL MINORITY RACE POPULATION				MINORITY RURAL POPULATIONS			
					Farm		Non-Farm	
REGION/COUNTY	Spanish a/	Indian	Negro	Other	White	Other Race	White	Other Race
Inyo, Calif.	-	1,170	24	105	385	11	10,483	1,221
San Bernardino	109,262	3,456	28,883	9,885	6,297	152	59,873	3,002
Churchill, Nevada	429	419	135	166	1,502	50	5,619	383
Esmeralda	-	28	1	0	4	0	455	0
Humboldt	622	519	62	59	658	69	1,770	399
Lander	-	138	1	4	190	12	2,288	176
Mineral	443	582	473	63	284	115	2,534	633
Nye	-	227	41	34	293	14	5,127	165
Pershing	-	126	4	27	441	5	2,071	153
Malheur, Oregon	2,546	83	97	78	5,893	420	7,563	150

a/ Reported only for counties with 400 or more.

Source: 1970 Census of Population

Table 2.1.5.9-9 Communities along proposed route in future extension area.

STATE County Community	LOCATION Approximate Miles From Pipeline	POPULATION 1960	 1970
OREGON			
Malheur		22,764	23,169
Brogan	1	(a)	100(b)
Vale	25	1,491	1,448
Ontario	40	5,101	6,523
Harper	4	(a)	100(b)
NEVADA		285,311	488,738
Humboldt		5,708	6,503
McDermitt	2	100	200
Orovada	1	(a)	30
Winnemucca	1	3,453	3,587
Pershing		3,199	2,670
Churchill		8,452	10,513
Lander		1,566	2,666
Austin	20	500	300
Nye		4,374	5,599
Tonopah	41	1,679	1,716
Mineral		6,329	7,051
Mina	21	(a)	300(b)
Basalt	16	(a)	(a)
Esmeralda		619	629
Goldenfield	66 (via 6 & 95) 59 (via 3 & 95)	300	185

(a) Not available
(b) From National Atlas 1970

Source: Population Data from United States Census 1960, 1970

Table 2.1.5.9-9 (cont.)

STATE County Community	LOCATION Approximate Miles From Pipeline	POPULATION (1970)
CALIFORNIA		
Mono		
Oasis	1	26
Inyo		
Bishop	22	3,498
Big Pine	7	950
Independence	5	950
Owenyo	1	10
Lone Pine	3	1,800
Keeler	13	80
Bartlett	1	N.A.
Cartago	1	75
Olancha	1	260
Coso Junction	1	N.A.
Little Lake	1	25
Kern		
Inyokern	3	800
Ridgecrest	3	7,629
China Lake	3	N.A.
Johannesburg	4	300
Randburg	6	175
Boron	9	2,000
San Bernardino		
Red Mountain	3	100
Kramer Junction	3	70
Barstow	30	17,442
Hinkley	20	100
Lenwood	13	3,834
Adelanto	2	2,115
Oro Grande	10	700
Victorville	10	10,845
Apple Valley	15	6,702
Hesperia	8	4,592
Cajon	1	25
San Bernardino	15	104,251

(a) Not available
(b) From National Atlas 1970

Source: Population Data from United States Census 1960, 1970

Table 2.1.5.9-10 Salient socio-economic data, future extension area

	OREGON	NEVADA						
	Malheur County	Humboldt County	Pershing County	Churchill County	Lander County	Nye County	Mineral County	Esmeralda County
Civilian labor force	8,741	2,733	1,111	3,577	1,050	2,465	2,898	221
Percent unemployed	4.6	2.6	4.6	7.1	1.8	2.8	2.6	5.4
Percent employed in industry*								
Manufacturing	12.8	2.0	4.5	5.4	2.2	2.5	9.1	22.4
Wholesale, retail trade	20.3	19.4	27.5	22.1	11.0	17.0	14.9	3.3
Services	5.2	16.9	8.5	8.5	8.1	19.4	5.5	12.4
Educational Services	11.1	8.2	5.3	7.4	7.7	4.8	5.6	1.9
Construction	6.0	9.7	3.4	9.2	2.8	16.9	1.9	24.4
Government	17.8	21.3	18.9	27.7	23.9	25.1	60.5	24.4
Median family income (1969)($)	7,567	8,788	9,170	8,263	8,707	10,218	10,172	8,454
Per capita income (1969)($)	2,377	3,005	3,074	2,854	2,659	3,844	3,200	3,456
Year-round housing units - 1970	7,529	2,394	1,117	3,710	907	2,093	2,478	395
Rental vacancy rates (%)	5.7	9.2	15.8	4.8	8.4	6.4	5.7	41.0
County general revenue (1967) ($ million)	7.8	2.7	1.6	5.2	.9	2.2	2.1	.2
Property taxes $ per capita	151	148	249	152	179	205	67	233
Retail establ. (1967)	285	98	53	111	36	76	81	10
Sales ($ thousands)	42,556	15,538	6,245	16,802	3,735	8,927	8,754	216
Service estabs. (1967)	176	82	36	88	33	32	42	2
Receipts ($ thousands)	4,733	3,726	1,106	1,906	1,076	10,395	1,876	**
Wholesale estabs. (1967)	56	18	7	12	4	6	5	--
Sales ($ thousands)	41,787	5,160	2,548	3,567	498	1,127	582	--
Farms	1,357	140	102	423	66	126	21	19
Value of farm prods. sales (1969) ($ thousands)	42,786	9,305	12,578	9,150	2,099	2,152	222	440
Distribution of sales (%)								
Crops	53.4	23.3	19.2	15.9	15.0	34.7	63.4	13.9
Dairy products	6.9	**	--	18.9	--	.1	0	--
Livestock and products	39.6	74.5	80.8	65.2	85.0	65.2	36.6	86.1
Poultry and products	**	**	**	**	--	.1	0	--

* May not add to 100% due to exclusion of white collar workers and double counting of government workers.
** Withheld to avoid disclosure.

Source: County and City Data Book, 1972

Table 2.1.5.9-10 (cont.)

	CALIFORNIA			
	Mono County	Inyo County	Kern County	San Bernardino County
Civilian labor force	1,870	6,292	117,390	237,718
Percent unemployed	5.7	5.4	6.7	6.1
Percent employed in industry*				
Manufacturing	1.9	3.9	7.6	19.1
Wholesale, retail trade	20.9	22.6	21.7	21.5
Services	25.3	12.4	7.9	8.2
Educational Services	6.6	6.6	8.6	9.0
Construction	14.5	10.0	6.5	7.1
Government	30.0	28.1	20.0	20.3
Agriculture and Fisheries	7.0	4.0	12.0	3.0
Median family income (1969) ($)	10,340	9,964	8,936	9,439
Per capita income (1969) ($)	3,317	3,634	2,820	4,134
Year-round housing units - 1970	2,494	6,080	109,815	249,333
Rental vacancy rates (%)	28.4	4.1	7.2	6.2
County general revenue (1967) ($ million)	3.1	8.8	161.7	277.7
Property taxes $ per capita	415	264	222	189
Retail establ. (1967)	88	244	3,118	5,366
Sales ($ thousands)	6,468	37,848	542,176	975,071
Service estabs. (1967)	116	189	2,193	3,805
Receipts ($ thousands)	6,467	5,963	81,042	123,835
Wholesale estabs. (1967)	2	26	466	610
Sales ($ thousands)	**	11,640	429,716	538,498
Farms (1969)	34	90	1,712	2,395
Value of farm prods. sales (1969) ($ thousands)	861	2,815	304,460	131,734
Distribution of sales (%)				
Crops	13.8	3.4	58.1	12.2
Dairy products	--	8.5	3.8	44.6
Livestock and products	76.9	88.0	37.1	15.0
Poultry and products	--	0.0	1.0	28.2

* May not add to 100% due to exclusion of white collar workers and double counting of government workers.
** Withheld to avoid disclosure.

Source: County and City Data Book, 1972

Table 2.1.5.9-11 County tax and selected expenditures, 1967, future extension area.

	COUNTIES									
ITEM	Malheur Ore.	Churchill Nev.	Esmeralda Nev.	Humboldt Nev.	Lander Nev.	Mineral Nev.	Nye Nev.	Pershing Nev.	Inyo Calif.	San Bernardino Calif.
General Revenue (Thous. $)	7,769	5,235	247	2,679	930	2,130	2,216	1,594	8,806	277,747
from Property Taxes	3,657	1,487	117	1,022	413	449	924	673	3,561	118,733
General Expenditure (Thous. $)	7,360	5,248	220	4,143	833	2,059	2,222	1,451	8,433	272,595
Per Capita Amounts										
General Revenue	321.04	534.15	494.55	388.29	404.25	317.90	492.35	590.23	625.27	441.64
from Property Taxes	151.10	151.76	233.45	148.06	179.45	66.95	205.24	249.21	263.74	188.79
General Expenditures a/	304.13	535.52	439.55	600.42	362.05	307.33	493.67	537.38	624.67	433.49
on Education	197.18	155.12	--	361.21	151.01	175.28	161.89	182.72	230.84	221.12
on Highways	18.78	23.98	76.33	36.89	41.02	13.48	50.18	61.27	64.79	20.70
on Hospitals	9.88	58.11	--	62.71	31	56.52	47.68	91.37	127.58	12.61
on Police Protection	5.93	14.48	47.89	20.68	30.31	11.49	88.95	29.18	14.43	15.30
on Sewage	3.42	1.82	--	7.08	1.98	3.11	6.67	.48	1.13	4.10
on Parks and Recreation	2.93	5.92	7.48	5.97	5.71	.92	4.70	6.74	10.87	6.03
on Housing and Renewal	--	--	--	--	--	--	--	--	--	4.83

a/ Will not add since detail is not complete.

Source: Census of Governments, 1966-67

Table 2.1.5.9-12 Projection of economic area trends without proposed pipeline: 1980, 1990, and 2000, future extension area.

	BOISE CITY - 159				RENO - 160			
		% Change				% Change		
	1970	1970-1980	1970-1990	1970-2000	1970	1970-1980	1970-1990	1970-2000
Population	266,946	2	10	15	208,468	26	57	84
Total Employment	104,277	17	26	36	88,990	37	71	103
Earnings per Worker (1967 $)	6,387	24	58	102	7,961	21	52	91
Total Earnings (Million 1967 $)	666	45	101	176	708	67	160	290
Agr., For. and Fish	914	1	10	24	316	16	30	50
Mining	916	31	53	86	300	16	42	71
Contract Construction	452	40	88	151	496	76	164	280
Manufacturing	102	60	128	209	324	85	184	313
Trans., Comm., and Util.	447	39	84	147	554	62	149	272
Trade (Whols. and Retail)	121	50	94	158	111	59	137	243
Fin., Ins. and R.E.	309	70	150	257	332	87	211	387
Services	848	71	166	302	213	79	190	346
Government	144	40	106	194	152	65	172	322

Source: WRC-OBERS Projections, 1972 (Series E).

Table 2.1.5.9-12 (cont.)

	LAS VEGAS - 161				LOS ANGELES - 165			
		% Change				% Change		
	1970	1970-1980	1970-1990	1970-2000	1970	1970-1980	1970-1990	1970-2000
Population	3,320,283	23	49	70	10,452,658	12	25	34
Total Employment	132,811	34	57	80	4,160,179	23	37	53
Earnings per Worker (1967 $)	7,821	21	52	92	7,990	20	51	90
Total Earnings (Million 1967 $)	105	63	140	247	332	50	108	192
Agr., For. and Fish	(D)	-	-	-	527	17	30	48
Mining	8,240	-02	+03	15	190	4	5	12
Contract Construction	923	44	103	179	177	50	107	184
Manufacturing	427	58	133	231	924	36	77	132
Trans., Comm., and Util.	695	69	157	274	210	57	126	221
Trade (Whols. and Retail)	143	57	124	217	585	43	89	155
Fin., Ins. and R.E.	367	103	224	394	185	69	156	281
Services	(D)	-	-	-	626	69	151	275
Government	196	56	135	243	546	51	121	218

(D) Withheld to avoid disclosure

Source: WRC-OBERS Projections, 1972 (Series E).

Table 2.1.5.14-1 Ambient air quality standards.

Pollutant	Federal Primary	Federal Secondary	Idaho	Washington
Sulfur oxides--				
annual arithmetic mean	80 $\mu g/m^3$	60 $\mu g/m^3$		60
24-hour concentration	375 "	260 "		
Particulate matter--				
annual geometric mean	75 "	60 "		
24-hour concentration	260 "	150 "		
Carbon monoxide--				
8-hour concentration	10 mg/m^3	10 mg/m^3		10
1-hour concentration	40 "	40 "		40
Photochemical oxidants--				
1-hour concentration	160 $\mu g/m^3$	160 $\mu g/m^3$	Same as Federal	
Hydrocarbons-- (corrected for methane)				
3-hour concentration (6-9 a.m.)	160 $\mu g/m^3$	160 $\mu g/m^3$		
Nitrogen oxides--				
annual arithmetic mean	100 $\mu g/m^3$	100 $\mu g/m^3$		
Particle Fallout				5 g/m^2-month

Table 2.1.5.14-2 Priority levels for five atmospheric pollutants

AQCR	Priority Classification for Particulates	SO_2	NO_2	CO	Hydrocarbons
Idaho Intrastate	I	III	III	I	III
Eastern Washington-Northern Idaho Interstate	I	IA	III	I	III
South Central Washington Intrastate	I	III	III	III	III
Eastern Oregon Intrastate	II	III	III	III	III
Boise Metropolitan	I	III	*	*	**

*Priorities not yet established.

**Not measured.

Table 2.1.5.14-3 Ambient Air Quality Standards

Pollutant	Federal*		Idaho**	Oregon***	Washington**	California**	Nevada**
	Primary	Secondary					
Sulfur oxides--							
annual arithmetic mean	80 $\mu g/m^3$	60 $\mu g/m^3$	Same as Federal	60 $\mu g/m^3$	60 $\mu g/m^3$		60 $\mu g/m^3$
24-hour concentration	365 $\mu g/m^3$	260 $\mu g/m^3$		260 $\mu g/m^3$		.04 ppm	260 $\mu g/m^3$
3-hour concentration				1300 $\mu g/m^3$			1300 $\mu g/m^3$
Particulate matter--							
annual geometric mean	75 $\mu g/m^3$	60 $\mu g/m^3$	"	60 $\mu g/m^3$	60 $\mu g/m^3$	60 $\mu g/m^3$	60 $\mu g/m^3$
24-hour concentration	260 $\mu g/m^3$	150 $\mu g/m^3$		150 $\mu g/m^3$	140 $\mu g/m^3$	100 $\mu g/m^3$	150 $\mu g/m^3$
24-hour concentration****				100 $\mu g/m^3$			
Carbon monoxide--							
8-hour concentration	10 mg/m^3	10 $\mu g/m^3$	"	10 mg/m^3	10 $\mu g/m^3$	10 ppm (12 hr.)	10 $\mu g/m^3$
1-hour concentration	40 mg/m^3	40 $\mu g/m^3$		40 mg/m^3	40 $\mu g/m^3$	40 ppm (1 hr.)	40 $\mu g/m^3$
Photochemical oxidants--							
1-hour concentration	160 $\mu g/m^3$	160 $\mu g/m^3$	"	160 $\mu g/m^3$	160 $\mu g/m^3$	1 ppm	160 $\mu g/m^3$
Hydrocarbons-- (corrected for methane)							
3-hour concentration (6-9 a.m.)	160 $\mu g/m^3$	160 $\mu g/m^3$	"	160 $\mu g/m^3$	160 $\mu g/m^3$		160 $\mu g/m^3$
Nitrogen oxides--							
annual arithmetic mean	100 $\mu g/m^3$	100 $\mu g/m^3$	"	100 $\mu g/m^3$	100 $\mu g/m^3$	.25 ppm	100 $\mu g/m^3$
Particle Fallout							
industrial areas				10 g/m^2/month			
residential and commercial areas				5 g/m^2/month			
all areas					5 g/m^2/month		
Calcium oxide--							
suspended particulates				20 $\mu g/m^3$			
fallout				0.35 g/m^2/month			
Lead							
monthly arithmetic mean				3 $\mu g/m^2$			
Hydrogen sulfide						.03 ppm	

* U.S. Environmental Protection Agency
** State Air Quality Control Agencies
*** Department of Environmental Quality, Oregon Air Quality Report, 1974
**** Not to be exceeded more than 15% of the time in any calendar month

Table 2.1.5.14-4 Priority Levels for Five Atmospheric Pollutants

A Q C R	Priority Classification for				
	Particulate	SO_2	NO_2	CO	Hydrocarbons
Idaho Intrastate	I	III	III	III	III
Eastern Washington-Northern Idaho Interstate	I	IA	III	I	III
South Central Washington Intrastate	I	III	III	III	III
Eastern Oregon Intrastate	II	III	III	III	III
Nevada	IA	IA	III	III	III
Great Basin Valley Intrastate	III	III	III	III	III
Southeast Deserts Intrastate	I	III	III	III	I

Table 2.1.5.14-5 Particulate Concentrations for 1974

Sampling Station	Particulates annual geometric mean concentration µg/m³
Idaho	
Coeur d'Arlene	71.3
Lewiston	101.2
Washington	
Clarkston	103.6
Colfax	70.5
Davenport	57.7
Pasco	77.0
Spokane	75.1,78.8
Walla Walla	59.9
Oregon	
Baker	57.4
Bend	45.0
Pendleton	73.3
Nevada	
Fallon	105
Gabbs	119
Hawthorne	101
California	
Mojave	71.3
China Lake	47.1

Source: From state air quality control agencies.

Table 3.1.5.9-9 Pipeline and Related Facilities, Future Extension Area

State	County	Approximate Pipeline Mileage	Compressor Stations	Measurement Stations, etc.
Oregon	Malheur	170	Yes (2)	Yes (airstrip)
Nevada	Humboldt	82	Yes	Yes
	Pershing	60	Yes	No (airstrip)
	Churchill	32	No	No
	Lander	35	Yes	No (airstrip)
	Nye	42	No	No
	Mineral	12	No	No
	Esmeralda	60	Yes	Yes (2)
California	Mono	8	No	No
	Inyo	123	Yes	No
	Kern	27	No	No
	San Bernardino	84	No	No
Total		735	7	4 (3 airstrips)
Work Spreads		4		

Table 3.1.5.9-10 Employment Summary, future extension area

Work Objective	Probable Number of Employees	Probable Work Duration*
Pipeline Construction	1,070	12 months
Compressor Station Construction	212	12 months
Measurement and Maintenance Station Construction Airstrips (3)	53	4 months
Operation and Maintenance**	81	Permanent
Induced (Secondary) Employment	32	Permanent

* Assumes that each spread works only two 100-mile segments. Actual employment may extend over several years, especially for compressor station construction.

**Based on an average rate of .11 O&M employees/mi. of completed pipeline.

Table 3.1.5.9-11 Population effects of pipeline related employment, future extension area

Permanent O&M Employment	Induced Employment	Total New Employment	New Households	Population Effects*
81	32	113	81	339

*Assumes a family or household size of three persons with all of the new pipeline employees and their families coming from outside the "pipeline" counties.

Table 3.1.5.9-12 Income Generated by Pipeline Construction, Contract construction earnings, and total personal income. Future extension area 1/.

State	County	Pipeline Mileage	Pipeline Construction Income 2/ ($1,000)	Contract Construction Earnings 3/ ($1,000)	Total Personal Income 4/ ($1,000)
Oregon	Malheur	170	5,100	3,925	80,300
Nevada	Humboldt	82	2,479	2,997	27,740
	Pershing	60	1,961	521	14,600
	Churchill	32	754	3,386	43,800
	Lander	35	1,371	299	10,220
	Nye	42	990	5,630	32,120
	Mineral	12	282	693	33,580
	Esmeralda	60	2,007	622	2,920
California	Mono	8	188	2,849	18,980
	Inyo	123	3,398	7,072	78,840
	Kern	27	636	78,381	1,356,340
	San Bernardino	84	1,979	163,705	3,007,600
Total		735	21,145	259,080	4,707,040

1/ For purposes of comparison, all income data have been converted to 1975 dollars by use of GNP inflator/deflator factors obtained from Warton Economic Forecasting Associates. Adjustment does not include population-employment changes from base year of measurement.

2/ Based on 1977 labor cost estimates per mile of pipeline plus construction of compressor and maintenance stations.

3/ Estimated from employment data of the 1970 Census of Population.

4/ 1970 Census of Population.

Table 3.1.5.9-13 Estimated goods and services expenditures and Total Retail and Services Receipts 1/, Future Extension Area

State	Retail and Service Receipts 2/ ($1,000)	Estimated Crew Expenditures 3/ ($1,000)	Contractor Fuel Expenditures 4/ ($1,000)
Oregon	189,822	2,040	939
Nevada	136,853	3,938	1,131
California	3,024,079	2,480	847
Total	3,350,754	8,458	2,917

1/ For purposes of comparison, all data have been converted to 1975 dollars by use of GNP inflator/deflator factors obtained from Warton Economic Forecasting Association.

2/ Based on 1967 data from Tables 2.1.5.9-2 and -10

3/ Forty percent of pipeline construction income of Tables 3.1.5.9-12.

4/ Calculated at the rate of $3,500 per mile of pipeline.

Table 3.1.5.9-14 Income generated annually by pipeline related permanent employees, future extension area.

Pipeline O&M Employees ($17,500/year)	Induced (Service) Employees ($12,500/year)	Total Annual Income
81	32	$1,817,500

Table 3.1.5.9-15 Estimated value of crop and forest land production of proposed pipeline right-of-way, future extension area

State	County	Crop Land Acres 1/	Crop Land Value 2/ ($1,000)	Forest Land Acres 1/	Forest Land Value 3/ ($1,000)
Oregon	Malheur	170	40	0	
Nevada	Humboldt	218	20	0	
	Pershing	73	*	0	
	Churchill	0		0	
	Lander	0		0	
	Nye	24	*	0	
	Mineral	0		0	
	Esmeralda	0		0	
California	Mono	0		85	*
	Inyo	0		0	
	Kern	0		36	*
	San Bernardino	0			
Total		485	60	121	

1/ WEI Analysis of Northwest Pipeline Corporation alignment ownership route maps (1973)

2/ Computed from average sales per acre, 1969.

3/ Computed at $30/MBF based on first quarter 1975 stumpage sales.

*Too small to estimate.

Table 3.1.5.9-16 Estimated Assessed Value of Pipeline Facilities Related Tax Base and Annual Revenues, Future Extension Area

State	County	Pipeline Mileage	Compressor Stations	Pipeline Facilities 1/ Assessment ($1,000)	Pipeline Facilities 1/ Tax ($1,000)	County Total Assessment ($1,000)	County Total Property Tax ($1,000)
Oregon	Malheur	170	2	107,187	2,465	292,698 2/	6,250 3/
Nevada	Humboldt	82	1	16,757	687	44,306 4/	1,876 5/
	Pershing	60	1	12,650	430	27,540	958
	Churchill	32	-	5,973	245	42,711	3,666
	Lander	35	1	7,052	282	23,500	934
	Nye	42	-	8,213	304	48,600	1,897
	Mineral	12	-	2,987	131	19,250	963
	Esmeralda	60	1	12,639	556	10,404	451
California	Mono	8	-	*	65	70,035	5,216
	Inyo	123	1	*	424	79,700	6,662
	Kern	27	-	*	351	1,084,343	114,182
	San Bernardino	84	-	*	1,161	1,842,848	204,890
Total		735	7	---	7,101	3,585,935	347,945

*Not available.

1/ Estimated by applicant for year 1980.
2/ Oregon Department of Revenue, Summary of Assessment Rolls, 1973.
3/ Ibid, Comparison of Property Tax Levies by County, 1973-74 tax year.
4/ Net valuation 1973-74 tax year.
5/ Estimated total ad valorem tax distribution for 1974-75.

Table 3.1.5.12-1 Known archeological sites along the proposed pipeline route

*National or State Register +Known Research Potential

Site No.	Location	Description	Distance from Pipeline (miles)
	Idaho		
1	1 mile south of Eastport, near Moyie River	+Village of sub-terranean houses (10-BY-1) tested	0.2
2	Bonners Ferry, Moyie River	+Fishing station and camp (10-BY-2) tested	1.5
3,4	2.5 miles north of Elmira, on Highway 95 (northern tip of a small lake)	+(10-BY-3 and 10-BY-4) tested	0.5
5	T50N, R5W	?	2
	Washington		
6	*Spokane County (47°27'31"- 117°34'00")	Turnbull-Pines Rock Shelter	near
7	*Spokane County (47°41'24"- 117°3'53")	Horse Slaughter Camp	near
8	2.5 miles north-west of Rosalia at PGT compressor yard (Station #6)	+Campsite tested (45-SP-4)	0
9	6 miles south-west of La Crosse on Highway 3	campsite	2
10	Palouse River, near confluence with Snake River	Marmes Rock Shel-ter, the earliest known burial site in the northwest, and perhaps in the Western Hemisphere	2

Table 3.1.5.12-1 (cont'd)

Site No.	Location	Description	Distance from Pipeline (miles)
11,12, 13,14 15,16	Palouse River near confluence with Snake River	Rock shelter with storage pits	2
17	Palouse River, near confluence with Snake River	Mesa top with 23 storage pits	2
18	Palouse River, near confluence with Snake River	McGregor Cave: a cave with storage pits	2
19	Palouse River near confluence with Snake River	Porcupine Cave: a cave with storage pits	2
20	Snake River, 3 miles west of confluence of Palouse River	Campsite	2
21	Snake River, 1 mile west of Lyons Ferry	Campsite	2
22	2 miles south-west of Lyons Ferry	Squirt Cave, excavated	2
23	Snake River at Lyons Ferry		1
24,25	Snake River at confluence of Toucannon River	+Talus burials and campsite (45-CO-1)	1.6
26	Alkali Flat Creek 7.5 miles north of Snake River	Important archeolo-gical-paleontolo-gical sites	1.6
	<u>Oregon</u>		
27	3/4 mile east of Brogan	Pictographs painted with red pigment	2

Table 3.1.5.12-1 (Cont'd)

Site No.	Location	Description	Distance from Pipeline (miles)
	Nevada		
28	Buffalo Creek at entrance to Buffalo Canyon, 1.8 miles east of Highway 95 and 36 miles south of Oregon border	Aboriginal camp	2
29	0.8 mile east of Highway 95 at a point 38.8 miles south of Oregon border	Petroglyph	0.4
30	0.8 mile west of junction of Highway 95 and 8B	Aboriginal camps and chipping stations	0.8
31	1 mile west of Highway 95 at a point 1.5 miles south of junction of Highways 95 and 8B		1
32,33	1.6 miles west of Highway 95 at a point 8.8 miles south of junction of Highways 95 and 8B	Aboriginal camps and chipping stations	1.4
34	2.2 miles west of Highway 95 at a point 10.5 miles south of junction of Highways 95 and 8B	Aboriginal camps and chipping stations	2

Table 3.1.5.12-1 (cont'd)

Site No.	Location	Description	Distance from Pipeline (miles)
35	1.8 miles east of Highway 95 at a point 13 miles south of junction of Highways 95 and 8B	Aboriginal camps	2
36, 37	Confluence of Little Humboldt and Humboldt Rivers	Aboriginal camps	0.6 to 1.2
38	On Spring Creek 56.5 miles south of Winnemucca	Cave decorated w/red and yellow picto graphs	0
39	Mouth of Spring Creek	Aboriginal camps	1
	California (All within 5 mi. of ROW)		
40 (INY-1456)	Wacoba Mt. USGS 15'	Site surrounds Tinemaha Reservoir Projective points & large obsidian bifaces present	
41 (INY-1454)	Independence USGS 15'	Pottery, projectile points, knives, manos and metals present	
42 (INY-1455)	Independence USGS 15'	Similar items as Inyo 1454	
43 (INY-1448)	Independence USGS 15'	17 rock shelters reported. Rockwalls, projectile points, manos, and metates present	
44 (INY-1459)	Independence USGS 15'	Chipped stone, manos, metake fragments, and pottery	
45 (B-2) (INY-2)	Olancha USGS 15'	Ethnographically known Paiute Village site. Referred to in Steward (1938)	
46 (INY-1538)	Haiwee Reservoir USGS 15'	Lithic scatter w/projectile point	
47 (B-372 INY-372)	Haiwee Reservoir USGS 15'	Rose Spring site/wdeep stratified middle deposit. An important type site	

Table 3.1.5.12-1 (cont'd)

Site No.	Location	Description	Distance from Pipeline (miles)
48 (INY-115)	Little Lake USGS 15'	Projectile points and pottery present	
49 (B-182 INY-182)	Little Lake USGS 15'	Stahl site - rock shelter and village site w/some of the oldest house structures in the new world	
50 (KER-249)	Ridgecrest USGS 15'	Small rock shelter w/associated lithic material	
51 (RM-1)	Randsbur 15'	"Steam Wells" Petroglyphs. In Red Mountain Planning Unit	
52 (SBr-211)	Randsburg USGS 15'	Petroglyph site described in Steward (1929)	
53 (SBr-212)	Randsburg USGS '	Petrog yph site described in Steward (1929)	
54 (B333 & 334)	Randsburgh USGS 15'	Unknown, no information available	
55 (SBr-543)	Fremont Peak U GS 15'	Lithic scatter, chalcedony flakes and one mano	
56 (SBr-544)	Fremont Peak USGS 15'	Lithic scatter, chalcedony flakes and schist mano and one obsidian projectile point	
57 (SBr-546)	Fremont Peak USGS 15'	Lithic scatter, jasper flakes, and chalcedony projectile point	
58 (B-199)	Hawes USGS 15'	Unknown, no information available	
59 (*SBr-115)	Cajon USGS 7.5'	Occupation site w/all orders of data including stonebeads, projectile pts., ground stone and chipped stone tools	
60 (*SBr-114)	Cajon USGS	Occupation site w/all orders of data	
61 (SBr-113)	Cajon USGS 7.5'	Occupation site w/roasting oven features, pottery, shell chipped and ground stone tools present	

Table 3.1.5.12-1 (cont'd)

Site No.	Location	Description	Distance from Pipeline (miles)
62 (*SBr-421)	Cajon USGS 7.5'	"Sayles site," furtherest inland manifestation of the "Millingstone Horizon" complex. Extensive village site	
63 (SBr-425)	Cajon USGS 7.5'	Ethnographically known village site of "Muscapiabit"	
64 (SBr-425)	Cajon USGS 7.5'	All classes of data	
65 (SBCM 64)	Cajon USGS 7.5'	Special use sites w/metates and manos	

Table 3.1.5.12-2 Known historical sites within the proposed pipeline corridor

*= National or State register sites.

Site No.	Location	Description	Distance from Pipeline (miles)
	Idaho		
1	Bonners Ferry (MP 18)	*Site of first ferry across Kootenai River (1826)	1
	Washington		
2	Idaho-Washington border at Liberty Lake to Washington-Oregon border at Walla Walla	*Kentucky Trail (1864-1872). Pipeline intersects route of Kentucky Trail approximately 1 mile northeast of Rosalia	0-5
3	Rosalia (MP 147)	*Steptoe Battlefie d. Col. Steptoe defeated by the Indians (1858)	1
4	Approximately 2 miles south of La Crosse	*Texas Road (1865-1880)	0
5	Lyons Ferry	*Mullen Road (1859-1880)	1.5
6	Lyons Ferry	Marmes Rockshelter	1
7	Snake River pipeline crossing	*Lewis and Clark Trail (1804)	0
8	Touchet River crossing	*Lewis and Clark Trail (1805)	0
	Oregon		
9	Milton-Freewater	*Fremont's Route	Crosses
10	Deadman's Pass	*Whitman Route	Crosses

Table 3.1.5.12-2 (cont'd)

Site No.	Location	Description	Distance from Pipeline (miles)
11	Grande Ronde Valley	One of the earliest agricultural areas in Oregon	0
12	La Grande	*Oregon Trail	0-1.5
13	Durkee	Important relay station on the Umatilla-Boise Basin stage and freight route	0.6
14	Rattlesnake Spgs. State Park	Associated with Oregon Trail	1
15	Crooked Creek Vicinity	*Oregon Central Military Road	Crosses
	Nevada		
16	Highway 395 at McDermitt	*Fort McDermitt established in 1865, longest occupied Army post in Nevada. Troops participated in California Modoc wars and Bannock Indian War	2
17	U. S. 95 from McDermitt to Winnemucca	Route taken by Peter Shene Ogden	No visible remains of trail
18	At Combination School in McDermitt	*Memorial to Sarah Winnemucca Hopkins, daughter of Chief Winnemucca of the Paiute Indians	2
19	1.6 miles north of junction of Highways 95 and 8B	*Early stagecoach stop called Paradise Well Stage Station	0

Table 3.1.5.12-2 (Cont'd)

Site No.	Location	Description	Distance from Pipeline (miles)
20	Winnemucca	Emigrant Trail	0
21	Highway 50 at Rock Creek	Castle Rock Station, an overland stage stop	2
22	New Pass	Early stage and telegraph station	0
23	Berlin	*Only site where fossilized remains of Ichthyosaur (a marine reptile) are to be found in the world	2.5
24	At approximate pipeline mile 800	*Fremont Trail (1845)	0
	California		
25	3 miles northeast of Independence	*Fort Independence, established 1862	2
26	Kearsarge Station	*Bend. City Site, early settlement	
27	Near Lone Pine	*Cottonwood Charcoal Kilns	
28	State 190 at U.S. 395	*Site where Jayhawker group of Death Valley 49'ers burned their wagons, 1849	0
29	North Lone Pine	*Grave of 14 earthquake victims, 1872	2.5
30	15 miles south of Lone Pine on Cottonwood Creek	*Colonel Sherman Stevens built a sawmill and flume, 1873	0.2
31	Owens Valley	Carson and Colorado Old Railroad Bed	Crosses

Table 3.1.5.12-2 (cont'd)

Site No.	Location	Description	Distance from Pipeline (Miles)
32	Soldier Canyon	Old Toll Road	Crosses
33	Owens Valley	Chrysolopolis, old abandoned mining town and ruin	
34	Olancha Creek near Olancha	*First silver mill and furnace in Owens Valley, 1862	0.8
35	Garlock	*Early Town Site	
36	Near Garlock	20 mule team road Borax from Death Valley	
37	Summit Valley	Guapiabit	0.75
38	Cajon Pass	*Important transportation route (pass)	0
39	Cajon Pass	*Santa Fe-Salt Lake monument	1
40	Cajon Pass	*Stoddard-Waite monument	1
41	West Cajon	*Mormon Trail monument	1

Table 3.1.5.12-3 Ghost towns and mining camps of Nevada within the proposed pipeline corridor.

Site No.	Town	County	Location	Distance from Pipeline (miles)
1	Willow Creek	Humboldt	1 mile north-northwest of US 95 at a point 18 miles north of its junction with SR 140	0.5
2	Rebel Creek	Humboldt	3/4 mile east of US 95 at a point 14 miles north of its junction with SR 140 (44 miles north of Winnemucca)	.75
3	Cane Springs	Humboldt	1 mile southeast of SR 140 at a point 2-1/4 miles west of junction with US 95 (23 miles north of Winnemucca)	3
4	Paradise Well	Humboldt	East side of US 95 at a point 1 mile north of junction with SR 8B (25 miles north of Winnemucca)	0
5	Winnemucca	Humboldt	Junction of US 95 and I-80	1
6	Goldbanks	Pershing	1/2 mile west of the Winnemucca-Dixie Valley Road, at a point 39 miles south of Winnemucca	2
7	Kennedy	Pershing	48 miles south of Winnemucca	3.2
8	Ione	Nye	Eastern terminus of SR 91 at a point 24 miles east of Gabbs	4
9	*Berlin	Nye	2 miles south of SR 91 at a point 18 miles east of Gabbs	2.3
10	Union	Nye	1-1/4 miles southeast of Berlin	5
11	Grantsville	Nye	5 miles east-southeast of SR 91 at a point 18 miles east of Gabbs	4.5
12	Coaldale	Esmeralda	1 mile north of junction of US 95	1

Source: Paher, Stanley W., 1970. Nevada Ghost Towns and Mining Camps. Howell-North Books.

Table 3.1.5.13-1 Landscape variety/sensitivity classifications in miles.

LANDSCAPE	CLASS A VARIETY			CLASS B VARIETY			CLASS C VARIETY		
	Sensitivity Class								
	1	2	3	1	2	3	1	2	3
Rye Valley to Highway 26						10			
Highway 26					1				
Highway 26 to Malheur River						35			
Malheur River					1				
Malheur River to Burns Junct.									78
Burns Junction to Blue Mtn.								32	
Blue Mountain to Winnemucca					100				
Winnemucca to Highway 50						124			
Highway 50					1				
Highway 50 to Highway 95						79			
Highway 95 to Highway 6					10				
Highway 6 to the California-Nevada Border						33			
Fish Lake Valley								10	
Deep Springs Valley		18							
White Mountains					3				

Table 3.1.5.13-1 (cont.)

	CLASS A VARIETY			CLASS B VARIETY			CLASS C VARIETY		
	Sensitivity Class								
	1	2	3	1	2	3	1	2	3
Owens and Rose Valleys	90								
Indian Wells Valley				40					
Lava Mountains to Fremont Peak					10	3			
Fremont Peak to Yucca Forest Ranch							21		37
Yucca Forest Ranch to Cajon	10								
GRAND TOTALS:	178	18	-0-	91	192	285	21	67	267

Table 8.1.5.6-1 Monthly means and extremes of temperature: Bishop, California.

Month	Mean Daily Max. (°F)	Mean Daily Min. (°F)	Mean (°F)	Record Daily Highest (°F)	Year	Record Daily Lowest (°F)	Year	Mean No. of Days Maximum Is 90°F & Above	Mean No. of Days Maximum Is 32°F & Below
Jan.	53.7	19.8	36.8	77	1948	-6	1955	0	1
Feb.	58.1	24.3	41.2	78	1951	-2	1969	0	*
Mar.	65.8	29.3	47.6	87	1966	9	1971	0	0
Apr.	73.5	36.7	55.1	92	1961	15	1953	*	0
May	81.9	43.2	62.6	101	1951	25	1964	5	0
June	90.7	48.9	69.8	109	1954	29	1967	18	0
July	98.0	55.2	76.6	109	1972	40	1955	30	0
Aug.	96.3	52.2	74.3	106	1972	37	1959	27	0
Sep.	89.8	46.5	68.2	106	1950	26	1948	18	0
Oct.	77.5	37.3	57.4	95	1964	16	1970	1	0
Nov.	65.0	26.5	45.8	84	1960	5	1958	0	0
Dec.	56.1	22.4	39.3	78	1958	-4	1967	0	*
Year	75.5	36.9	56.2	109	July 1972	-6	Jan. 1955	96	1

Length of Record: 30 years for means, 25 years for extremes.

*Less than 0.5

Source: U.S. Department of Commerce, ESSA, 1972. *Local Climatological Data, Annual Summary with Comparative Data for Bishop, California.*

Table 8.1.5.6-2 Monthly means and extremes of temperature: China Lake, California.

Month	Maximum	Minimum	Mean	Record Daily Highest	Year	Record Daily Lowest	Year	Mean No. of Days Maximum Temperature Is 100°F and Above
Jan.	57.7	29.0	43.2	77	1948	0	1963	0
Feb.	63.8	34.4	49.0	83	1968	14	1965	0
Mar.	68.6	39.7	54.2	92	1966	17	1966	0
Apr.	77.3	47.6	62.7	98	1966	28	1963	0
May	85.4	55.4	70.4	107	1951	34	1967	0.9
June	95.0	63.3	79.4	114	1961	42	1954	9.4
July	101.9	70.2	86.2	115	1972	52	1964	22.2
Aug.	100.2	68.1	84.2	110	1967	53	1960	18.9
Sep.	94.0	61.0	77.5	110	1955	40	1948	7.7
Oct.	82.7	49.8	66.3	102	1964	32	1966	0.3
Nov.	68.0	37.7	52.6	88	1962	18	1964	0
Dec.	58.8	29.8	44.1	86	1964	2	1962	0
Average	79.4	48.8	64.2	115	July 1972	0	Jan. 1963	59.4

Source: U.S. Department of Defense, 1973. *Summary of Meteorological Observations, Surface, 1945-1972.* Naval Weather Service Environmental Detachment, Asheville, N.C.

Table 8.1.5.6-3 Precipitation data: Bishop, California.

Month	Average Inches Monthly	Maximum Inches	Year	Minimum Inches	Year	Maximum 24 hr Period Inches	Maximum 24 hr Period Year
Jan.	0.99	8.93	1969	0.00	1966	3.32	1952
Feb.	0.98	6.01	1969	T	1967	3.64	1969
Mar.	0.55	2.05	1952	0.00	1972	1.24	1952
Apr.	0.46	2.26	1956	0.00	1962	1.47	1956
May	0.02	1.30	1962	T	1970	0.95	1953
June	0.09	0.55	1963	0.00	1971	0.26	1963
July	0.12	0.70	1968	0.00	1963	0.48	1967
Aug.	0.12	0.61	1965	0.00	1957	0.38	1963
Sep.	0.19	0.53	1950	0.00	1970	0.46	1962
Oct.	0.43	1.58	1957	0.00	1970	1.05	1957
Nov.	0.53	2.59	1960	0.00	1962	1.79	1950
Dec.	1.18	5.79	1966	0.00	1962	3.35	1966
Annual	5.66	8.93	Jan. 1969	0.00	Mar. 1972	3.64	Feb. 1969

T = Trace

Length of Record: 25 years for means and extremes

Source: U.S. Department of Commerce, ESSA, 1972. *Local Climatological Data, Annual Summary with Comparative Data for Bishop, California.*

Table 8.1.5.6-4 Precipitation data: China Lake, California.

Month	Average Inches Monthly	Maximum Inches	Minimum Inches	Maximum 24-hour Period Inches	Maximum 24-hour Period Year
Jan.	0.45	2.13	TR	0.85*	1952
Feb.	0.40	1.58	0.0	0.89	1963
Mar.	0.20	1.77	0.0	0.89	1952
Apr.	0.12	0.94	0.0	0.88	1956
May	0.14	2.13	0.0	0.99	1945
June	0.02	0.29	0.0	0.29	1960
July	0.03	0.18	0.0	0.18	1950
Aug.	0.08	0.71	0.0	0.56	1963
Sep.	0.27	2.14	0.0	0.92	1963
Oct.	0.12	0.81	0.0	0.58**	1963
Nov.	0.34	2.03	0.0	1.03	1946
Dec.	0.44	1.13	0.0	0.93	1947
Annual	2.61	Sep. 2.14	0.0	1.03	Nov. 1946

*0.91 Jan. 1954 (incomplete month)

**0.75 Oct. 1945 (incomplete month)

Source: U.S. Department of Defense, 1973. *Summary of Meteorological Observations, Surface, 1945-1972*, Naval Weather Service Environmental Detachment, Asheville, N.C.

Table 8.1.5.6-5 Mean recurrence interval for extreme winds.

Recurrence Interval (years)	Wind Speeds (mph) at 30 ft Above Ground: California-Nevada Border	China Lake	Adelanto
2	50	45	40
10	60	55	48
25	65	62	50
50	72	68	63
100	76	73	69

Maximum recorded wind speed: 81 mph

Source: Thom, H.C.S., 1968. "New Distribution of Extreme Winds in the United States," Journal of the Structural Division, Proceedings of the American Society of Civil Engineers. Vol 94 No. 7: 1787-1801.

Table 8.1.5.6-6 Partial list of archaeological sites along the alternative routes.

Site No.	Location	Distance From Pipeline	Description
SBCM-129	Crowder Canyon	2.1	Early Milling Stone Culture-Currently being excavated by San Bernardino County Museum
SBCM-112	Crowder Canyon	2.1	Same
SBCM-130	Crowder Canyon	2.1	Same
SBCM-128	Crowder Canyon	2.1	Same
SBCM-70	Crowder Canyon	2.1	Same
SBCM-0	Cajon Pass Summit	at site	Several sites recently discovered, no site number assigned. Early Milling Stone Horizon.
SBCM-2242	Helendale Ranch	5.0	Campsite
SBCM-2241	Wild-Quarry	7.0	Workshop Area, Specialized Quarry site.
SBCM-87	Mojave River	6.5	Campsite
SBCM-84	Wild Crossing	7.5	Campsite
SBCM-803	Mojave River	8.0	Campsite
SBCM-13	Las Flores	5.0	Campsite
SBCM-67	Victorville	4.5	Petroglyph, Campsite
SBCM-192	Kramer Hills	at site	Workshop Area, Specialized Quarry site
SEVERAL - ALL LISTED UNDER SAME NUMBER AT PRESENT			Workshop Area, Specialized Quarry sites.
SBCM-207	Kramer Hills	.4	Workshop Area, Specialized Quarry site
SBCM-347	Westend	.3	No data
SBCM-349	Between Salt Wells and Pinnacles	.2	Campsite

Table 8.1.5.6-6 (cont.)

Site No.	Location	Distance From Pipeline	Description
SBCM-350	Layton Springs	2.0	Campsite
SBCM-2223	Bird Springs	5.1	Campsite
SL 25 X	Trona	2.0	Campsite
NS 24 X	Trona	2.0	Campsite
XX 39	Trona	2.0	Cave
SBCM-238	Red Mountain	1.1	Campsite and Petroglyphs
-584	Red Mountain	1.3	Petroglyphs
1553	Red Mountain	1.5	Campsite and Petroglyphs
-346	Red Mountain	1.2	Campsite
SBCM-930	Knight Canyon	at site	Workshop Area,Specialized Quarry site
SBCM-932	Knight Canyon	at site	Workshop Area, Specialized Quarry site
SBCM-933	Knight Canyon	at site	Workshop Area,Specialized Quarry site
SBCM-926	Snow Canyon	at site	Workshop Area, Specialized Quarry site
SBCM-931 A-F	Ash Hills	at site	Workshop Area, Specialized Quarry site
SBCM-939	Panamint Spgs.	.3	Campsite
SBCM-912	Panamint Butte	3.2	Campsite
SBCM-937	Panamint Lake	2.5	Campsite

Table 8.1.5.6-6 (cont.)

Site No.	Location	Distance From Pipeline	Description
SBCM-788-796	Panamint Dunes	1.1	Many important sites
SBCM-934	Panamint Dunes	1.1	Many important sites
SBCM-894-909	Panamint Fault	2.5	Many important sites
SBCM-928	Panamint Fault	2.0	Many important sites
SBCM-914	Panamint Fault	2.0	Many important sites
SBCM-910	Panamint Fault	2.0	Same
SBCM-911	Panamint Fault	2.0	Same
SBCM-917	Towne Pass Road	2.0	Rock Alighment
SBCM-918	Town Pass Road	2.0	Rock Alignment
SBCM-779	Grapevine Canyon	2.0	Campsite

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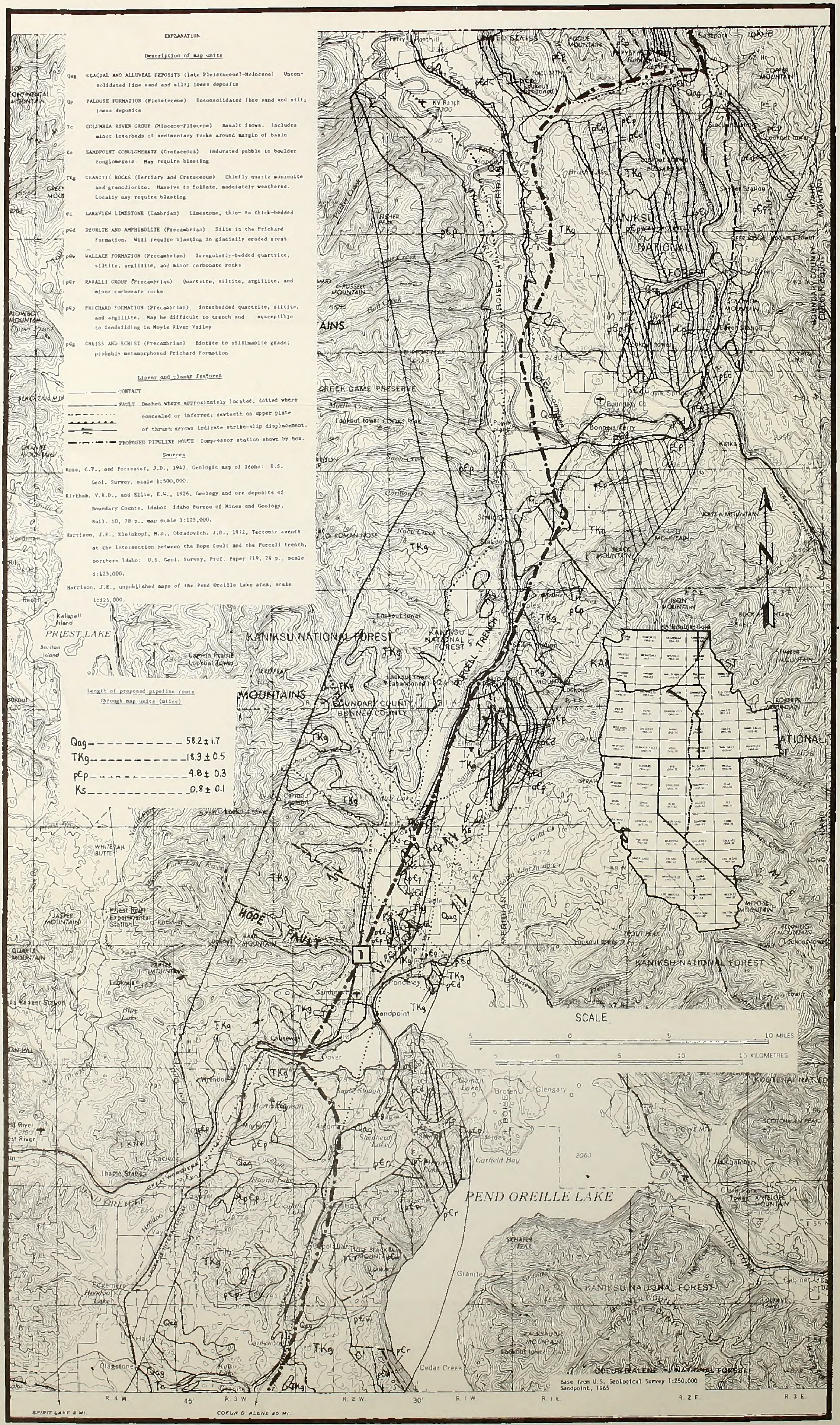

Figure 2.1.5.3-2 Geological strip map (Sandpoint)

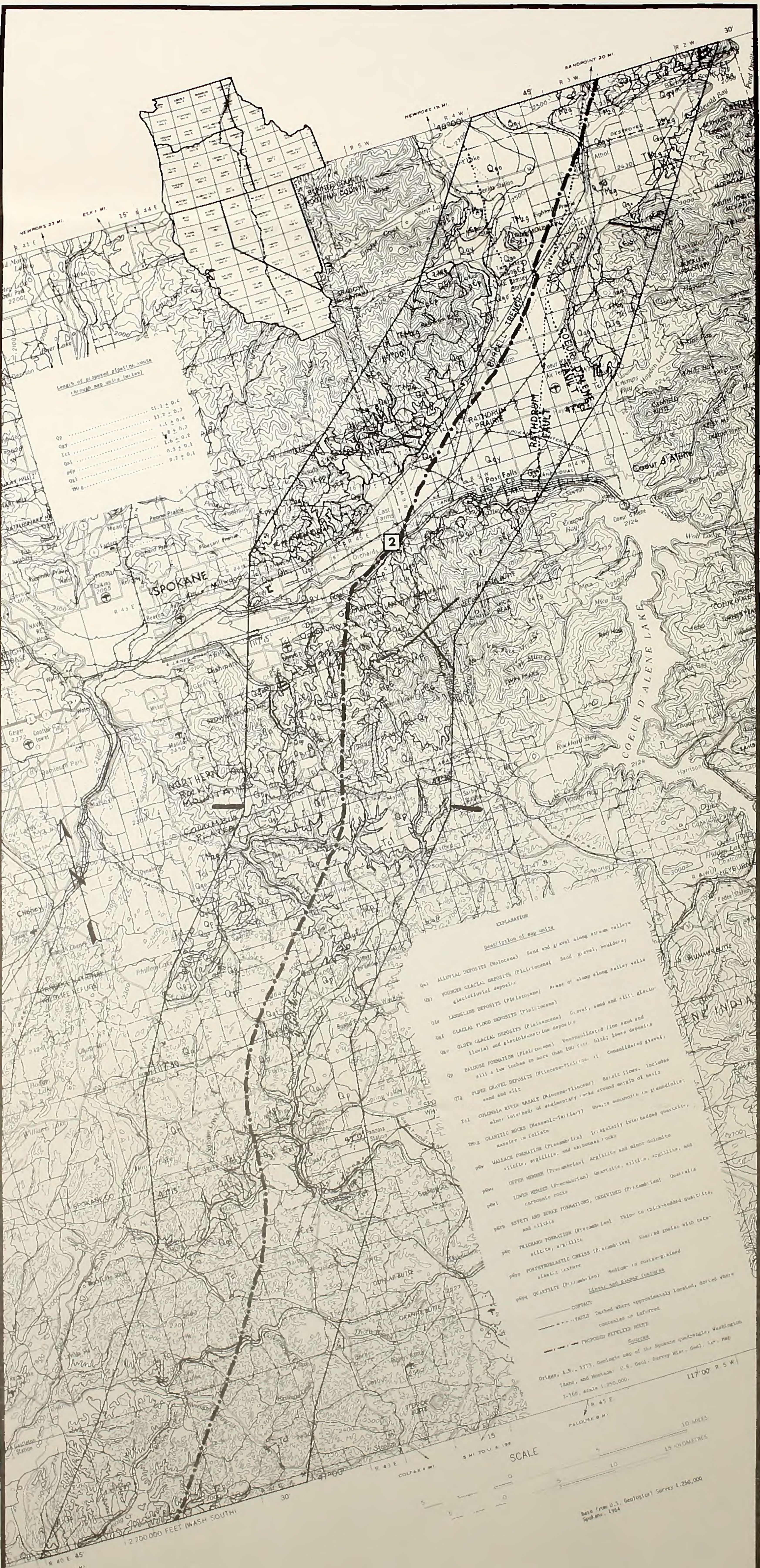

Figure 2.1.5.3-3 Geological strip map (Spokane)

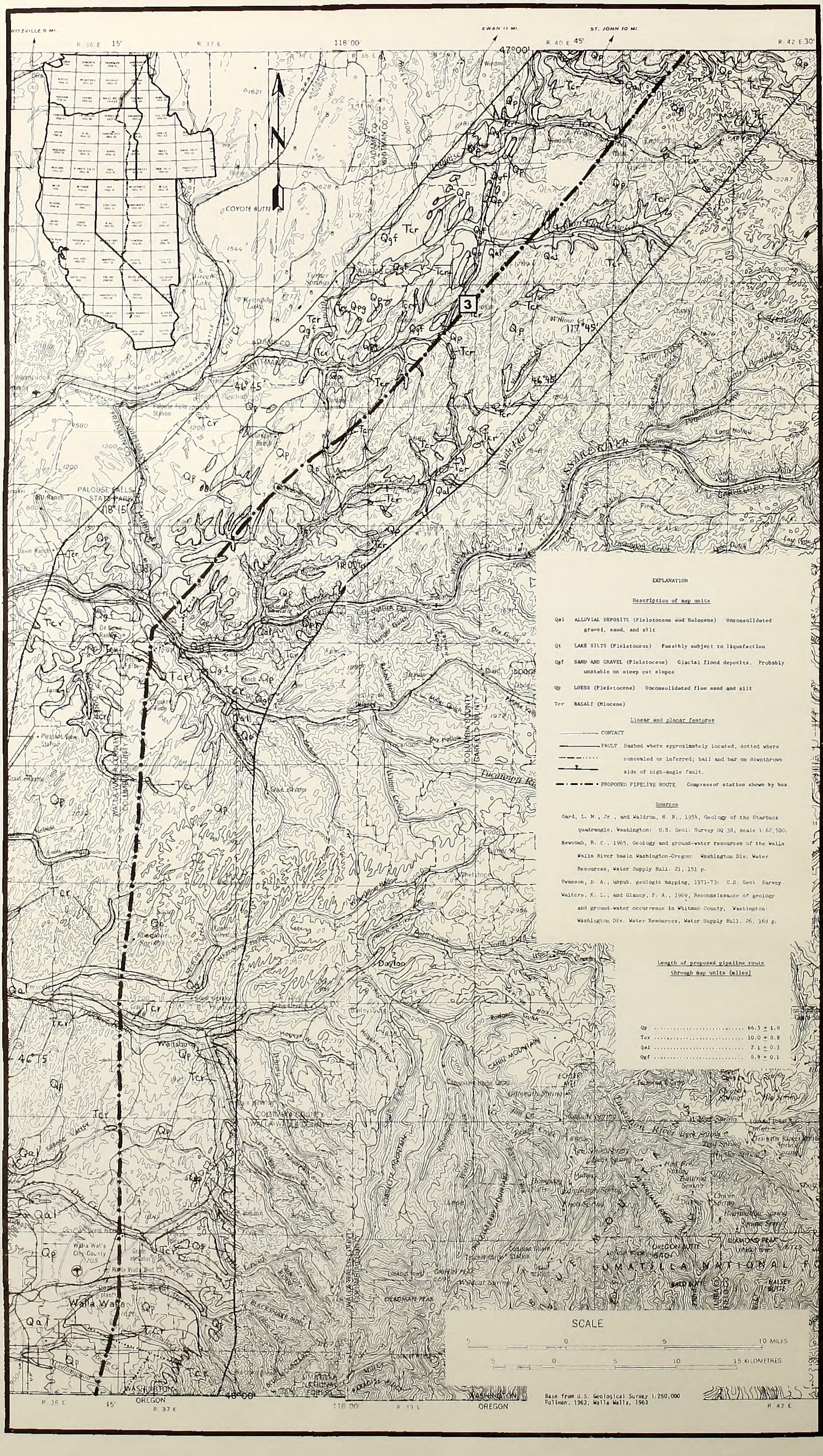

Figure 2.1.5.3-4 Geological strip map (Pullman-Walla Walla)

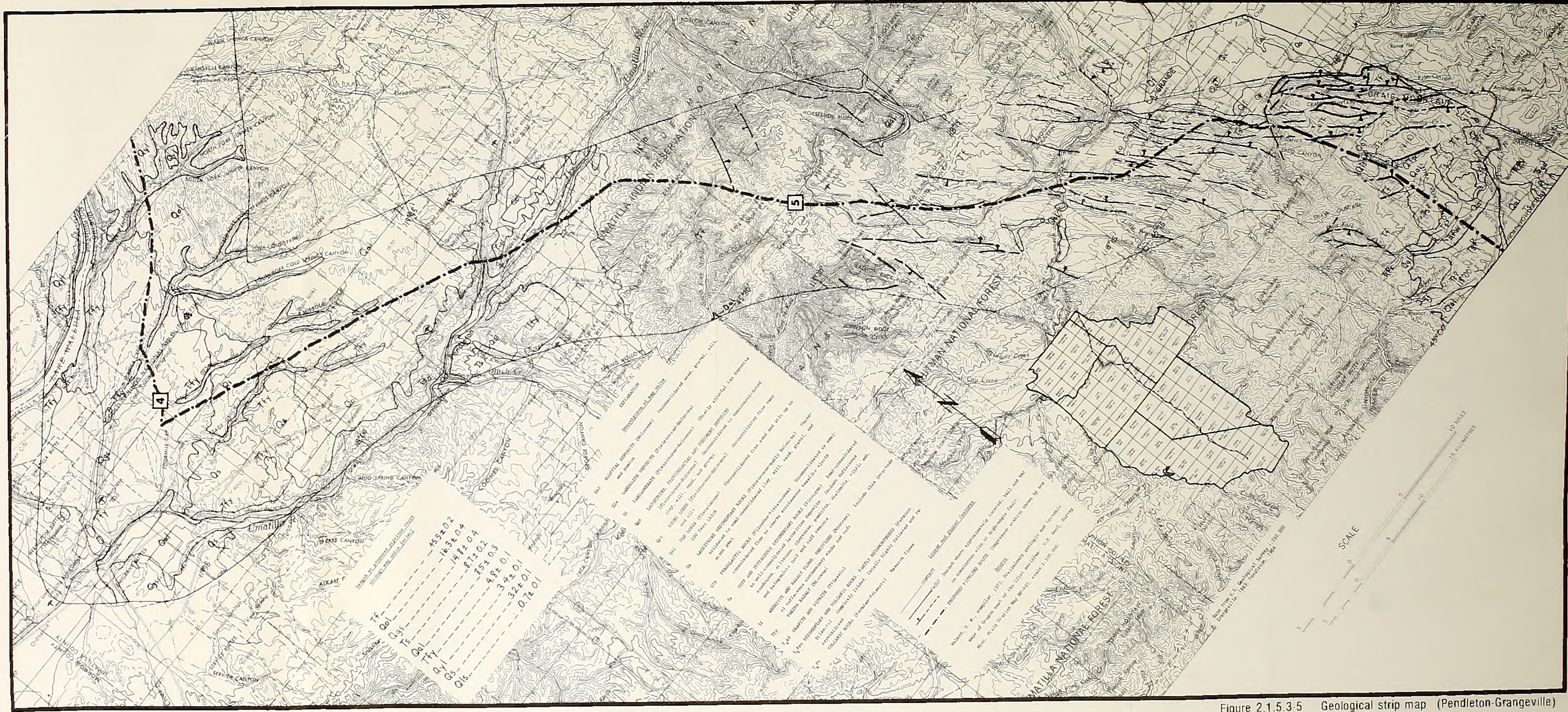

Figure 2.1.5.3-5 Geological strip map (Pendleton-Grangeville)

Figure 2.1.5.3-6 Geological strip map (Baker)

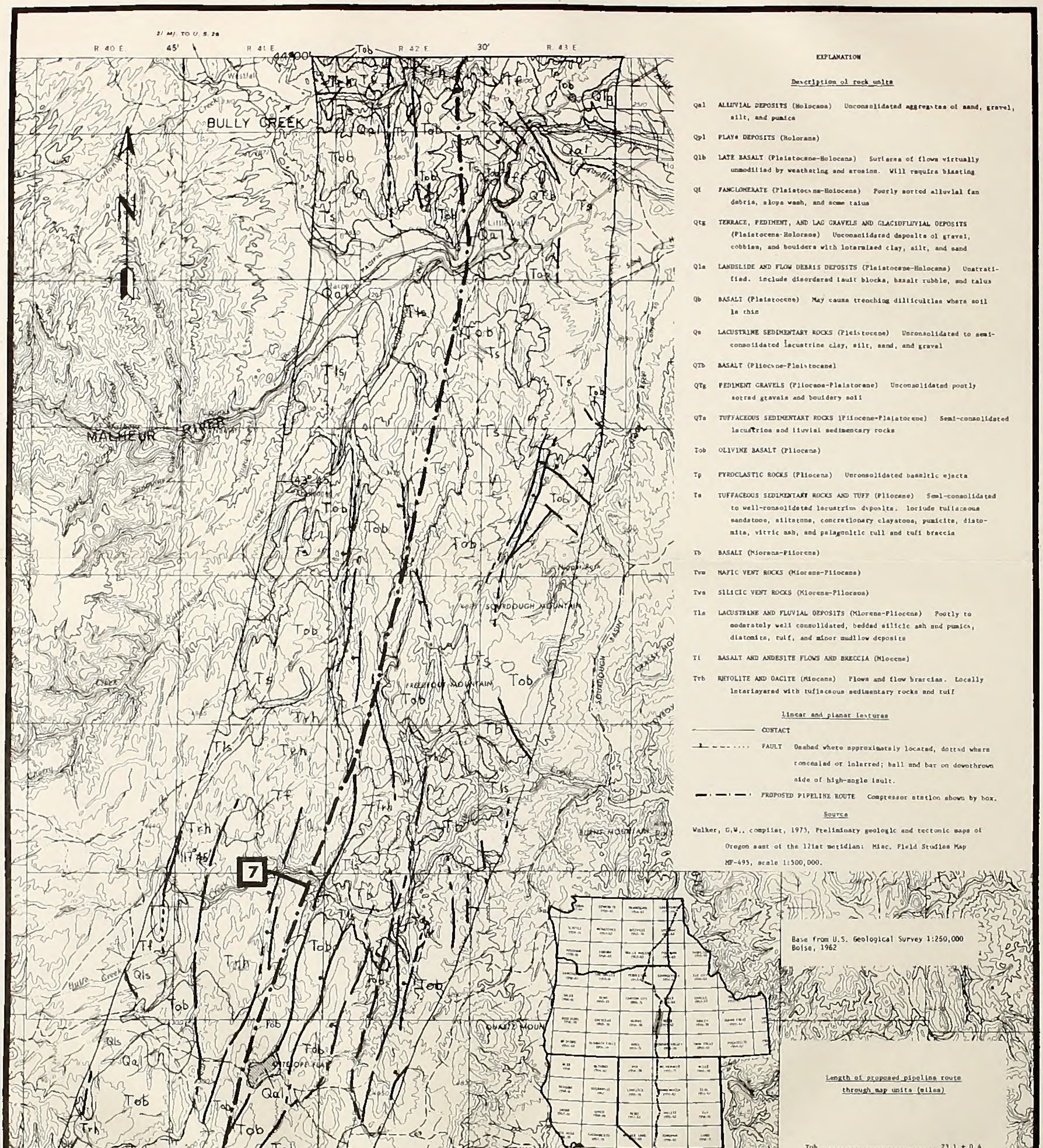

Figure 2.1.5.3-7 Geological strip map (Boise)

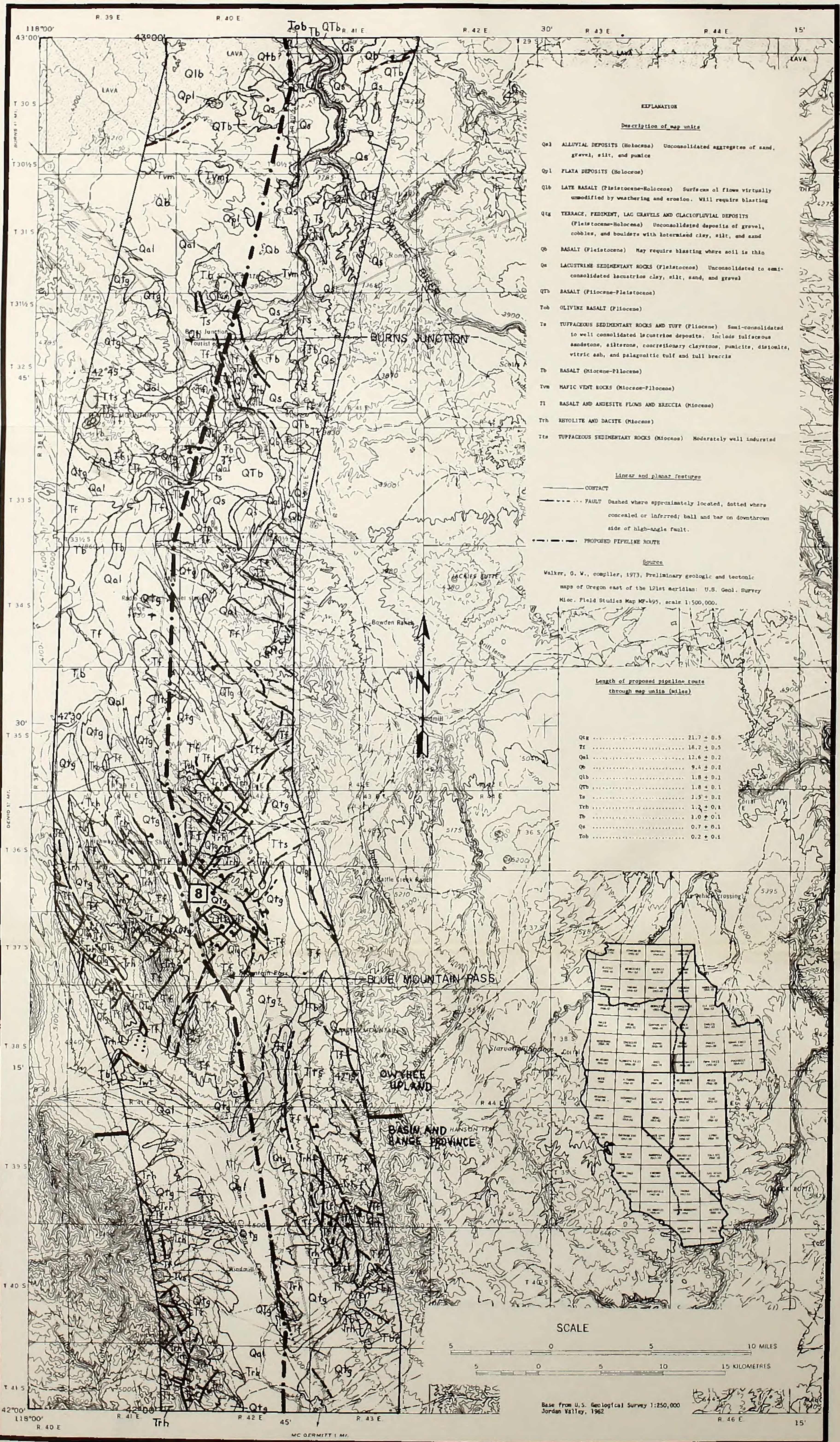

Figure 2.1.5.3-8 Geological strip map (Jordan Valley)

EXPLANATION

Description of map units

Qa ALLUVIAL DEPOSITS (Pleistocene-Holocene) Phreatophytes (marsh pattern) designate potential areas of high water table, corrosive sediments, and liquefaction. Severe erosion likely along washes during intense flash floods

QToa OLDER ALLUVIAL DEPOSITS (Pliocene-Pleistocene)

QTb BASALT FLOWS (Pliocene-Pleistocene) Locally includes maar deposits

Tt3 WELDED AND NON-WELDED TUFFS (Miocene)

Ts3 TUFFACEOUS SEDIMENTARY ROCKS (Miocene)

Tr3 RHYOLITIC FLOWS AND SHALLOW INTRUSIVE ROCKS (Miocene)

Tba ANDESITE AND BASALT FLOWS (Miocene)

Tr2 RHYOLITIC FLOWS AND SHALLOW INTRUSIVE ROCKS (Oligocene-Miocene)

Ta2 ANDESITE FLOWS AND BRECCIAS (Oligocene-Miocene)

Tri RHYOLITIC INTRUSIVE ROCKS (Tertiary)

Kgr GRANITIC ROCKS (Cretaceous)

Mzgr GRANITIC ROCKS (Triassic-Cretaceous)

JT_Rs SHALE, MUDSTONE, SILTSTONE, SANDSTONE, CARBONATE ROCK, AND MINOR VOLCANIC ROCK (Triassic-Jurassic)

Linear and planar features

——— CONTACT

FAULT Dashed where approsimately located, dotted where concealed or inferred; ball and bar on downthrown side of high-angle fault.

PROPOSED PIPELINE ROUTE Compressor station shown by box.

Sources

Cohen, Philip, 1964, Water in the Humboldt River valley near Winnemucca, Nevada: Nevada Dept. Conserv. and Nat. Resources, Bull. 27, p. 21, 24, map scales approx. 1:300,000.

Harrill, J. R., and Moore, D. O., 1970, Effects of ground-water development on the water regimen of Paradise Valley, Humboldt County, Nevada, 1948-1968, and hydrologic reconnaissance of the tributary areas: Nevada Dept. Conserv. and Nat. Resources, Bull. 39, plate 1, map scales 1:250,000 and approx. 1:125,000.

Huxel, C. J., Jr., Parkes, J. E., and Everett, D. E., 1966, Effects of irrigation development on the water supply of Quian River valley area, Nevada and Oregon, 1950-1964: Nevada Dept. Conserv. and Nat. Resources, Bull. 34, plates 1, 3, map scale 1:250,000.

Stewart, J. H., and Carlson, J. E., compilers, 1974, Preliminary geologic map of Nevada: U.S. Geol. Survey, Misc. Field Studies Map MF-609, scale 1:500,000.

Length of proposed pipeline route through map units (miles)

QToa	41.1 ± 0.4
Qa (xatophyte areas)	14.0 ± 0.4
Qa (phreatophyte areas)	11.2 ± 0.1
Tba	3.3 ± 0.1
QTb	1.4 ± 0.1
JT_Rs	0.3 ± 0.1

SCALE

Base from U.S. Geological Survey 1:250,000 McDermitt, 1971

Figure 2.1.5.3-9 Geological strip map (McDermitt)

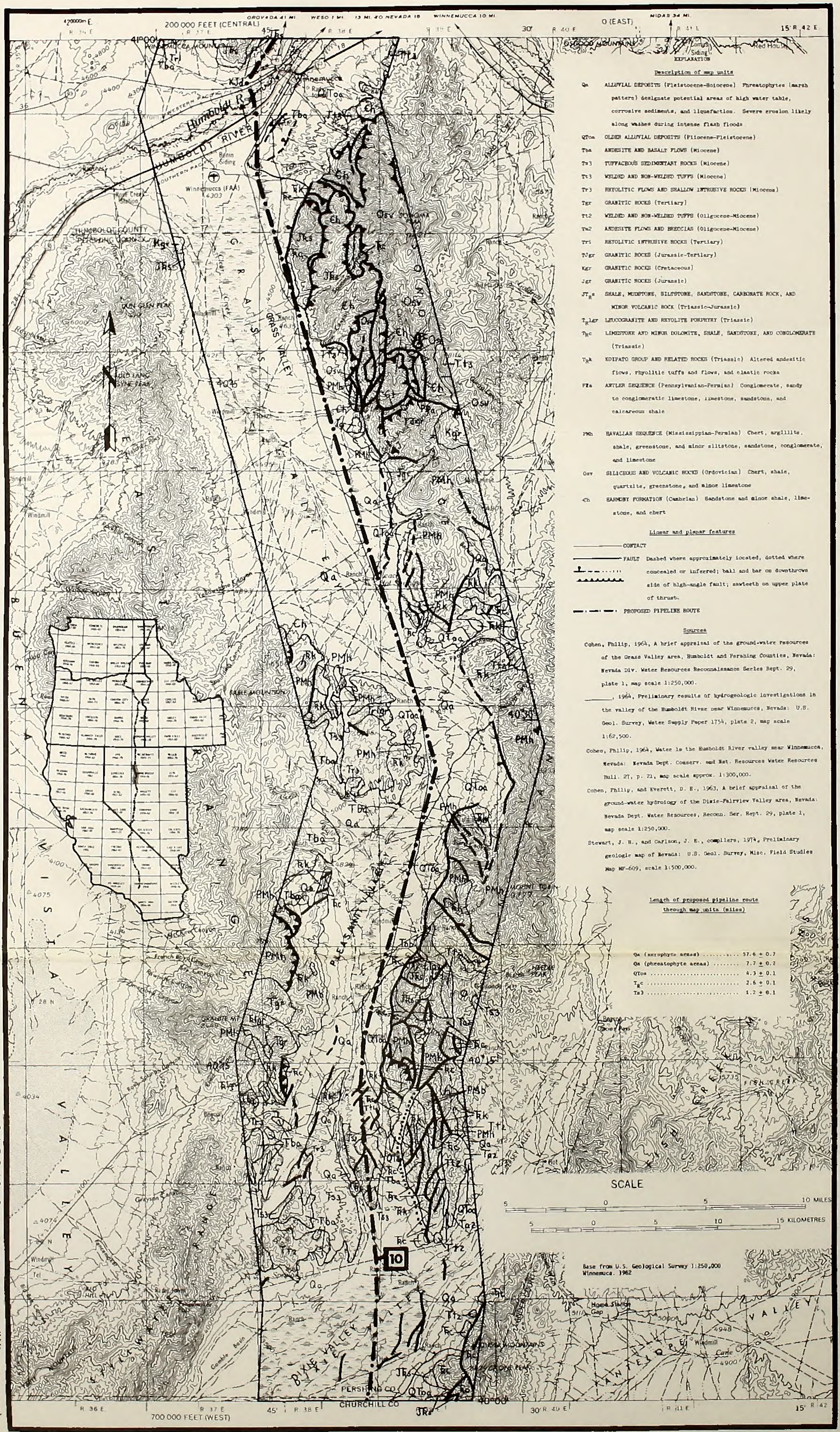

Figure 2.1.5.3-10 Geological strip map (Winnemucca)

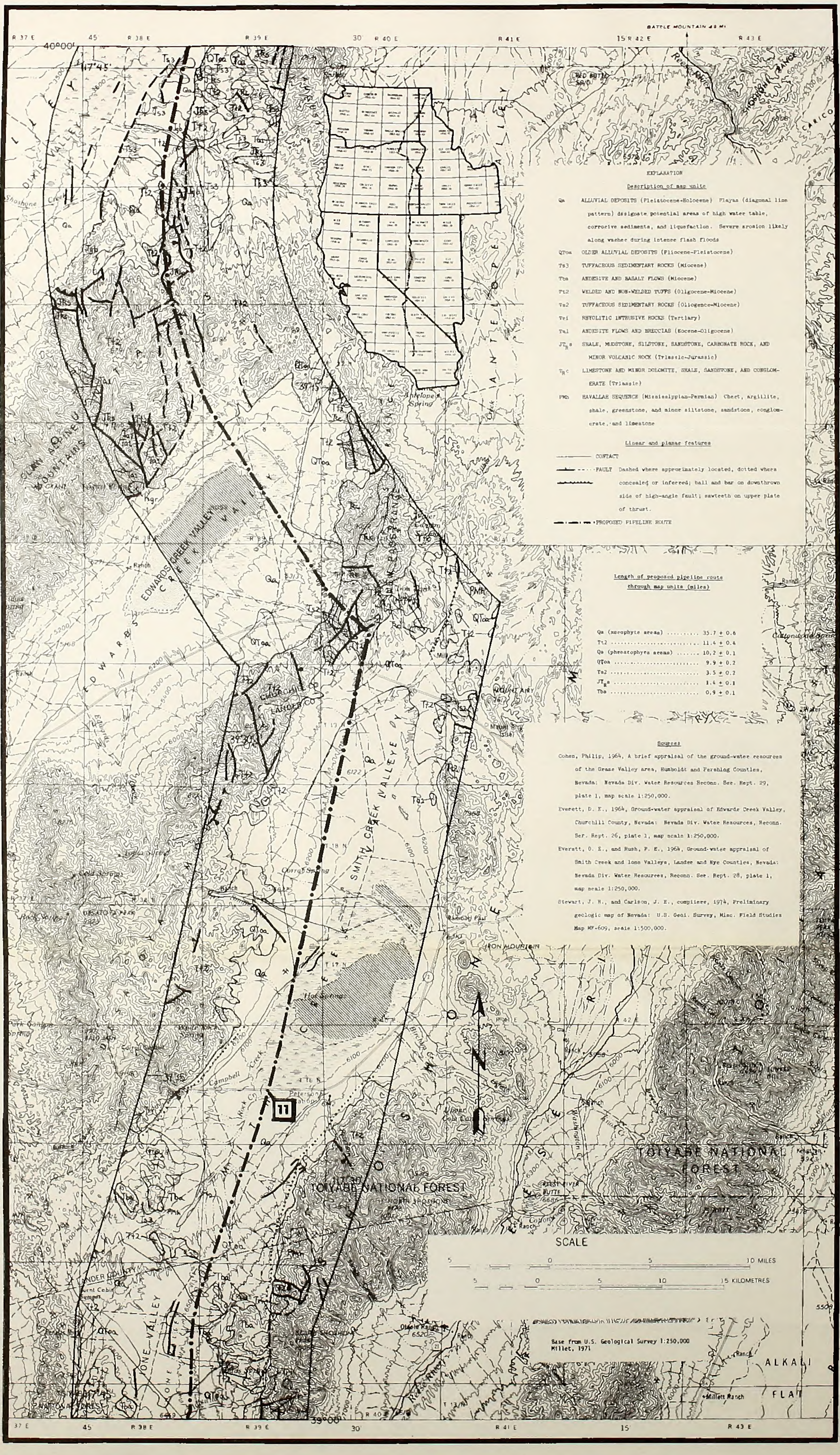

Figure 2.1.5.3-11 Geological strip map (Millett)

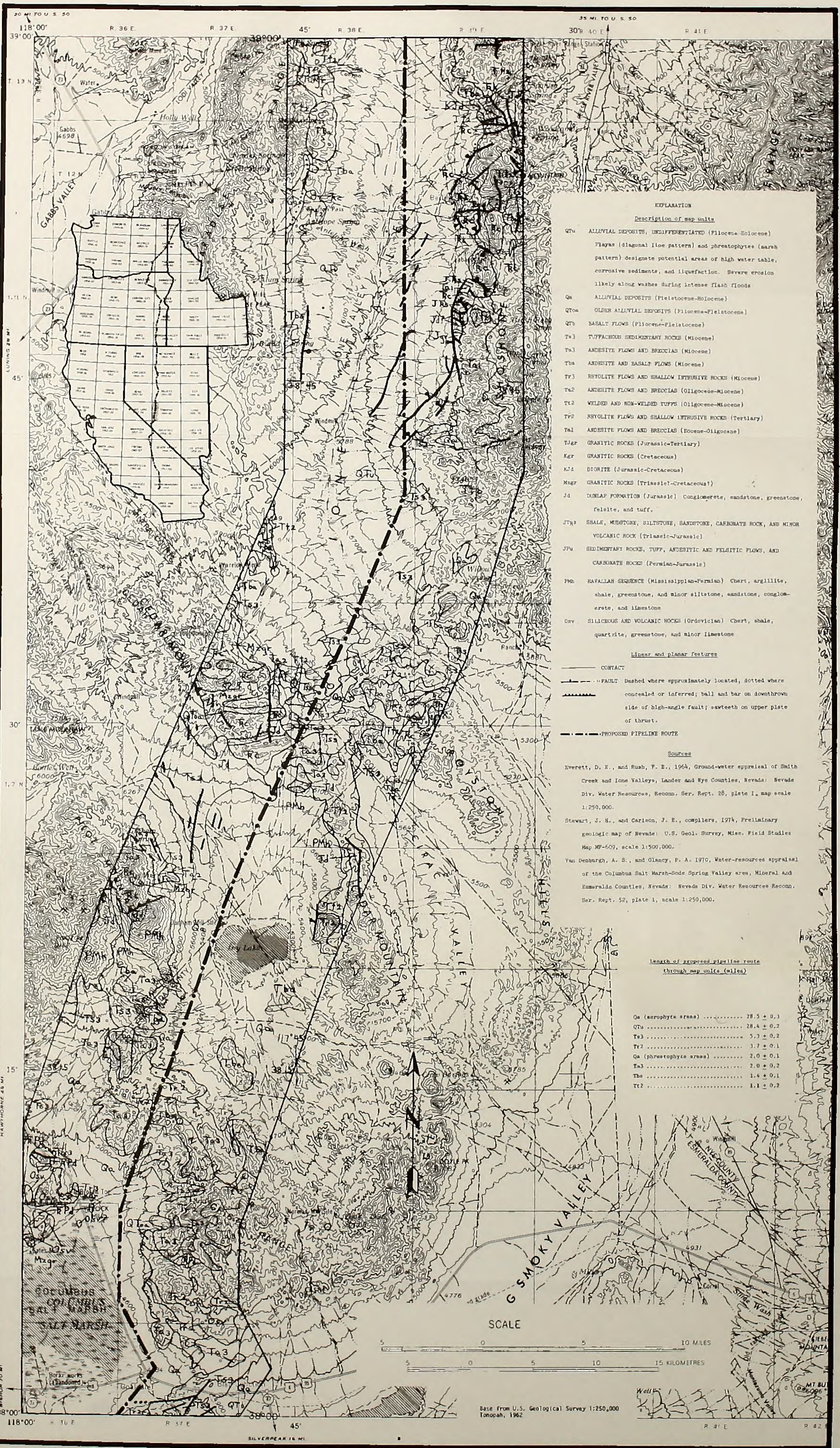

Figure 2.1.5.3-12 Geological strip map (Tonopah)

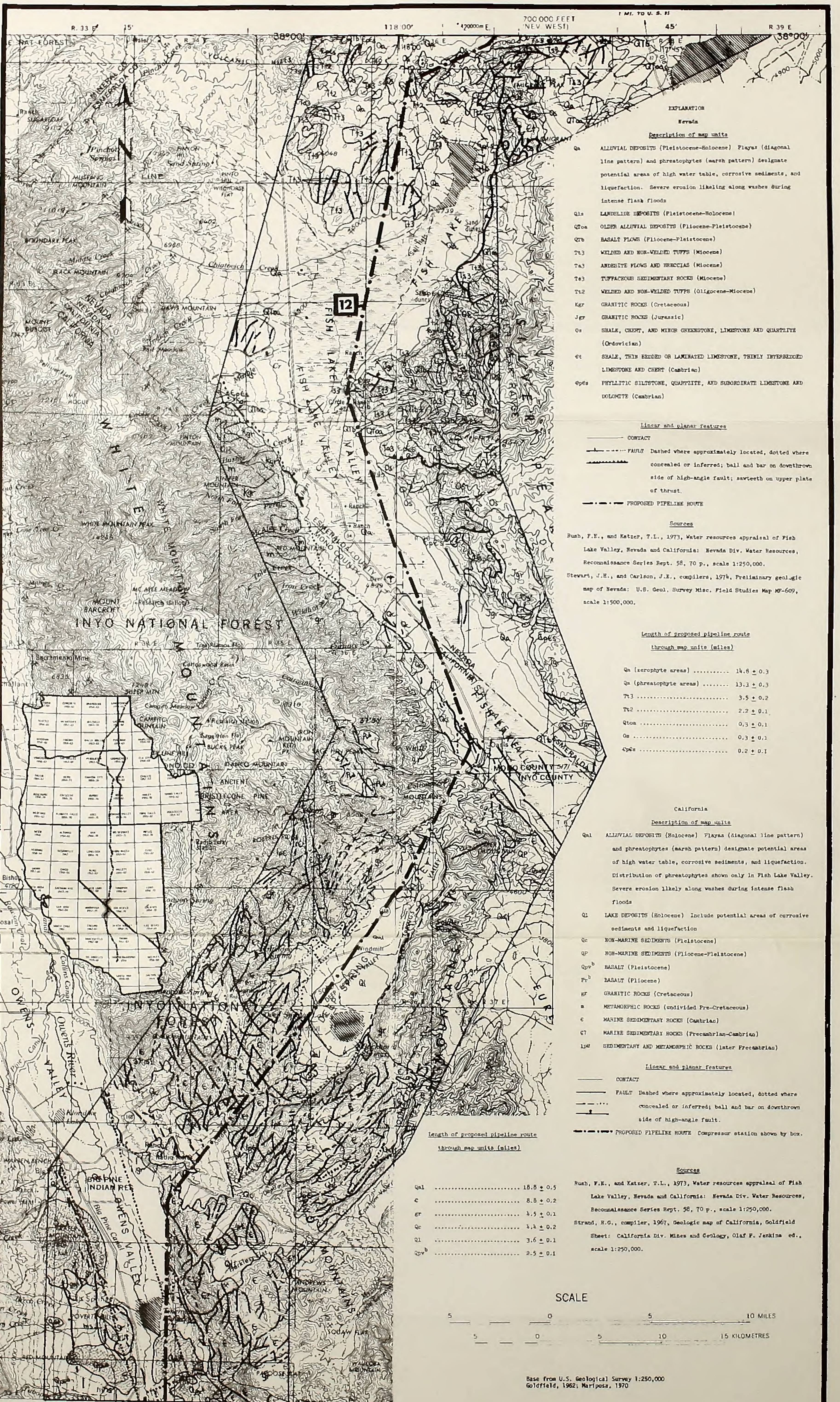

Figure 2.1.5.3-13 Geological strip map (Goldfield-Mariposa)

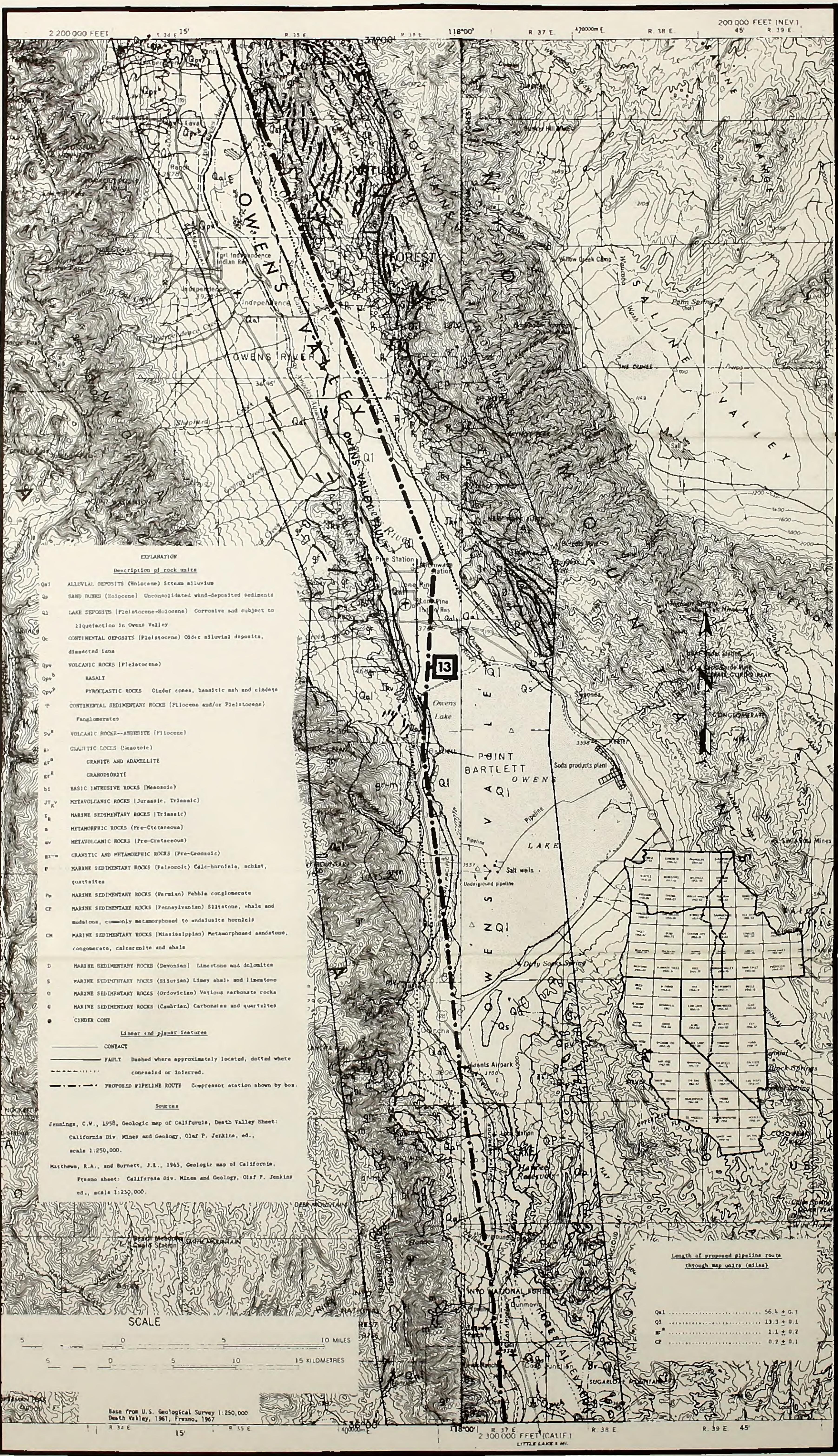

Figure 2.1.5.3-14 Geological strip map (Fresno-Death Valley)

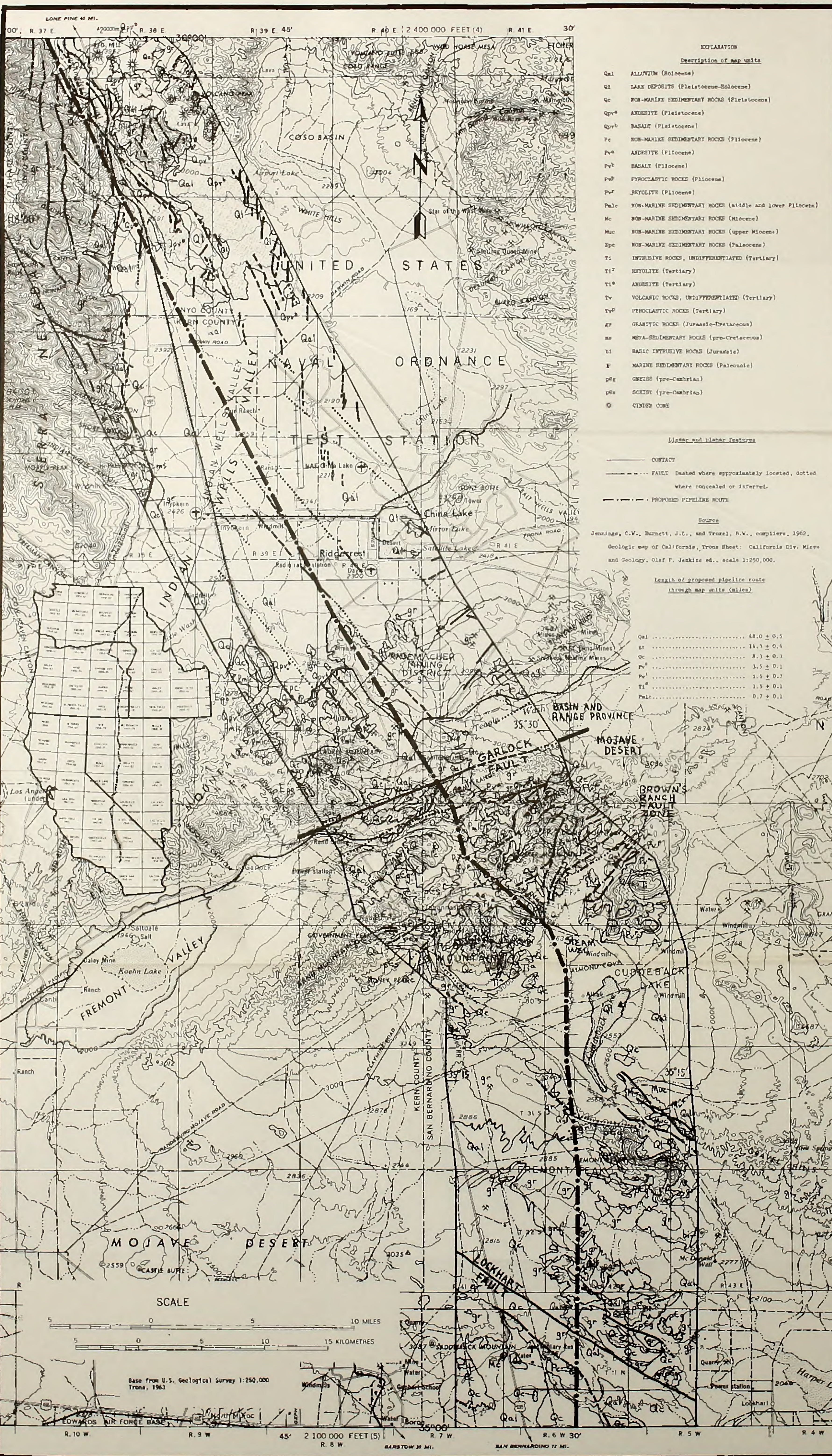

Figure 2.1.5.3-15 Geological strip map (Trona)

Figure 2.1.5.3-16 Geological strip map (San Bernardino)