BLM/AK/PT-02/026+2880+990

Draft Environmental Impact Statement

Renewal of the Federal Grant for the Trans-Alaska Pipeline System Right-of-Way

Volume 1: Chapters 1 through 3

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

July 2002

Executive Summary

ES.1 Background

The Trans-Alaska Pipeline System (TAPS) was constructed in 1974–1977 through the central portion of Alaska on a right-of-way (ROW) granted by federal, state, and private landowners. The Agreement and Grant of Right-of-Way for the Trans-Alaska Pipeline (Federal Grant) was issued on January 23, 1974, and the State Right-of-Way Lease (State Lease) was issued on May 3, 1974. Both the Federal Grant and State Lease are for a period of 30 years. On May 2, 2001, the Bureau of Land Management (BLM) of the U.S. Department of the Interior received an application from the current TAPS Owners to renew the Federal Grant for 30 years beyond the current expiration date.

The BLM determined that a decision to renew the Federal Grant would represent a major federal action under the National Environmental Policy Act (NEPA) and identified the need to prepare an environmental impact statement (EIS). A Notice of Intent to prepare an EIS was published in the *Federal Register* on July 31, 2001. This draft EIS (DEIS) was prepared to evaluate the impacts associated with current TAPS operations and the positive and negative environmental, social, and economic impacts of renewing or not renewing the Federal Grant.

The BLM is conducting its TAPS renewal effort in close cooperation with the State of Alaska, which is undertaking its own TAPS renewal process for the State Lease. In addition, the BLM is conducting government-to-government consultations with 21 substantially and directly affected Alaska Native Tribes pursuant to Executive Order 13175, as well as other required consultations.

ES.2 Description of TAPS

The TAPS consists of an 800-mile, 48-in.-diameter warm oil pipeline, 11 pump stations, Valdez Marine Terminal, and various support facilities. The pipeline crosses more than 800 rivers and streams and three mountain ranges. About half of the pipeline corridor traverses ice-rich soil that becomes unstable if thawed. To avoid exposing these soils to the warm pipe, 420 miles of the pipeline are aboveground and are supported by approximately 78,000 vertical support members. Where possible, the pipeline is buried in stable soils where thawing would not result in disturbed terrain or pipe settlement. However, special burial techniques were used in areas of thaw-unstable soils.

The pipeline crosses five seismic zones and is designed and constructed to withstand the most severe earthquake that could reasonably be expected in each zone. Valves are strategically placed along the pipeline to help control the flow of oil and to isolate sections of the line. All valves can be operated manually to maintain the pipeline and isolate spills. A gravel workpad was used for constructing portions of the TAPS; it now provides access and a work platform for surveillance and maintenance of the pipeline.

The 11 pump stations are similar in layout and design, although they have certain differences because of their locations and the tasks that are done there. They are housed inside structures for protection against the environment. The stations include pumps and turbine drivers, isolation valves, relief tanks with secondary containment, fuel handling facilities, station and pipeline control facilities, living quarters, office buildings, shops and warehouses, and other facilities for pipeline operation and maintenance. Seven stations are currently operating; the other four were placed on standby in 1996 and 1997 because of a decline in throughput and increased use of drag reducing agent. Most pump station functions are controlled from the Operations Control Center located at the Valdez Marine Terminal.

The Valdez Marine Terminal is the southern end of TAPS and is located on ice-free Port Valdez on Prince William Sound. Crude oil arriving at the Valdez Marine Terminal is measured at the East Metering Building and

then goes to storage tanks or can be directly loaded onto tankers. The terminal has four tanker-loading berths and storage facilities for 9.18 million barrels of crude oil. Ballast water removed from incoming tankers and all other oily water collected at the Valdez Marine Terminal is treated before being discharged to Port Valdez in accordance with existing permits. Vapor from tankers and crude oil storage tanks is piped to the vapor recovery and control system.

Additional TAPS facilities include 284 access roads (175 of which are included in the renewal application for the Federal Grant) that traverse state, federal, municipal, and private lands. A buried natural gas pipeline extends from the North Slope south to Pump Station 4 to provide gas for operations in pump stations north of Brooks Range. Finally, the TAPS has an extensive telecommunications network consisting of microwave, satellite, and fiber-optic cable systems to monitor and control pipeline operations.

ES.3 Scoping Process

A scoping process was conducted from July 31 to October 19, 2001, to obtain input on the scope for this EIS. During that period, the BLM invited the public and interested groups to provide information, suggest issues that should be examined, and express their concerns and opinions on all aspects of the proposal to renew the Federal Grant. Six public meetings were held at various locations throughout Alaska as a part of the scoping process.

More than 1,700 people participated in this process by providing comments, requesting information, attending public or Tribal government consultation meetings, or visiting the TAPS Renewal EIS Web Site. All comments, regardless of how they were submitted, received equal consideration. The results of the scoping process were documented in a report issued in November 2001. This document can be viewed at the TAPS Renewal EIS Web Site at http://tapseis.anl.gov.

ES.4 Alternatives

On the basis of information provided by the TAPS Owners in their renewal application and input received during the scoping process, three alternatives were identified for analysis in the EIS. These are defined as follows:

- To renew the Federal Grant for 30 years, which is the proposed action and the BLM's preferred alternative. Under this alternative, current operations would be authorized to continue for 30 more years. However, changes to the system's configuration and operation would continue to evolve to meet changing oil throughput, respond to changes in environmental conditions, and take advantage of new technologies for pipeline operations.

- To renew the Federal Grant for less than 30 years. Under this time-dependent alternative, current operations would be authorized to continue for some period less than 30 years. This alternative would allow for the consideration of environmental impacts whose effects could be influenced by the period for which the ROW is renewed.

- To not renew the Federal Grant, which is the no-action alternative. Under this alternative, TAPS operations would cease at the end of the current Federal Grant (January 22, 2004). The BLM would require the TAPS Owners to remove the TAPS and restore the ROW to a condition specified by the BLM. If this alternative were selected, an additional NEPA review would be conducted to examine options related to the extent of TAPS removal and ROW restoration and to the process to be used to conduct these activities.

These alternatives cover the full spectrum of future options for the TAPS, ranging from continued operation for an additional 30 years (the maximum period allowed under current regulations) to termination of operations, removal of the TAPS, and restoration of the ROW.

ES.5 Scope of Analysis

The analysis of environmental impacts in this DEIS is generally divided into three broad categories: physical environment, biological resources, and social systems. The scope of the assessment varies depending on the category being analyzed and the extent of the impacts. The analysis of impacts to the physical environment and biological resources addresses the widely varying environmental conditions associated with the full length of the pipeline corridor, including aspects of the marine environment. The TAPS has had a fundamental effect on the socioeconomic conditions of Alaska. Without a means to transport North Slope oil to market in a cost-effective manner, development and production of the North Slope oil fields would be impossible. The opportunities afforded by the jobs in the oil industry and the revenues to the State of Alaska that have resulted from oil production on the North Slope have transformed the state economy. For these reasons, impacts to social systems are generally assessed on a statewide level, although local impacts are identified and quantified as appropriate.

The analysis is limited to impacts associated with the continued operation or termination of the TAPS for the areas and resources that may be affected by one of the three alternatives. The time frame for analysis is generally 30 years (the time period associated with the proposed action), although shorter time periods are associated with the other two alternatives. The DEIS also addresses potential cumulative impacts associated with past, present, and reasonably foreseeable future actions that occurred, occur now, or would occur near the TAPS or within the areas affected by TAPS operations.

ES.6 Summary of Impacts

A brief summary of the impacts associated with the three alternatives is provided here.

ES.6.1 Proposed Action: Renew Federal Grant for 30 Years

The impacts of renewing or not renewing the Federal Grant can be divided into those associated with routine operations and those associated with spills. Some of the more significant environmental impacts from routine operations under the proposed action are described here. A more detailed summary of the impacts under the proposed action (and the other two alternatives) is given in the main body of the DEIS in Table 2.6-1. The environmental impacts associated with spills are described separately after the presentation of routine operational impacts.

ES.6.1.1 Routine Operations

ES.6.1.1.1 Physical Environment. Under the proposed action, impacts on geological resources, including the consumptive use of sand, gravel, and quarry stone, are not expected to change significantly from those experienced historically, and they would be localized near the TAPS and the operations material sites. Impacts to surface water and groundwater have also historically been small and local, and the magnitude of these impacts is expected to remain the same, since uses of surface water and groundwater are not expected to change significantly. Impacts to the marine environment are expected to be the same as those that have occurred historically and may decrease with decreasing throughput. Air quality impacts from emissions associated with continued TAPS operations are estimated to be similar to or less than those associated with previous operations, given the projected decrease in crude oil throughput. Although audible levels of noise are present at site boundaries near pump stations, these levels are barely distinguishable from background noise and well below levels that are considered problematic for human or ecological receptors. Current low levels of noise at site boundaries are expected to continue under the proposed action.

With a continuation of the current warming trend in Alaska, the risk of earthquake-triggered liquefaction and landslides is expected to increase. These events, although very unlikely, could potentially threaten the integrity of the pipeline, especially if an earthquake that was as big and as close to the pipeline as the 1964 Great Alaska Earthquake was to occur. Melting of permafrost along the ROW could change the number and size of thaw bulbs, but the range of variation in the number and size of thaw bulbs is expected to remain within the historical range observed.

Impacts to human health and safety would include risks to workers from industrial accidents and risks to members of the general public from airborne emissions of hazardous chemicals. The number of fatalities for TAPS workers is estimated to be less than one per year; over a 30-year renewal period, the estimated number of total fatalities would amount to approximately six. The number of recordable injuries is estimated to be between 125 and 153 per year, and the number of lost time injuries is estimated to be between 76 and 92 per year. No significant risks to members of the general public are expected from continued TAPS operations. Human health risks from inhalation of airborne emissions and ingestion of fish and shellfish would be below levels of concern identified by the U.S. Environmental Protection Agency.

ES.6.1.1.2 Biological Resources. Under the proposed action, impacts on terrestrial vegetation, wetlands, birds, and mammals would be a continuation of those currently associated with the TAPS. Impacts would be limited to the ROW and its immediate vicinity. Only individual animals would be affected; no adverse impacts to populations of a species are expected.

The TAPS ROW is close to aquatic habitats along much of its length. The proposed action could affect fish habitat, but it is not expected that these impacts would substantially affect fish populations during the renewal period nor would they be different from impacts that have occurred historically. The proposed action could also temporarily impede fish movement in some streams, but long-term effects on fish populations are not anticipated.

Continued operation of the TAPS would not be likely to adversely affect threatened, endangered, and protected species. Impacts to these species would continue to be within the range of those experienced over the past 25 years of operation. Impacts would result from ground-disturbing activities, operational noise, human disturbance, and release of effluents from the Valdez Marine Terminal into Prince William Sound. Impacts are not expected to produce population-level effects that are distinguishable from natural variation.

ES.6.1.1.3 Social Systems. The most significant economic impacts associated with the proposed action would be the revenues generated by North Slope oil production. An estimated 8.9 billion barrels of crude oil, at a value of $374 billion, are projected to be produced over the next 30 years. Federal income taxes and royalties associated with this production are estimated to be $11.4 billion over the 30-year renewal period. In addition, significant revenues would be paid to the State of Alaska and several local governments from the continued production and transport of North Slope oil through the TAPS under the proposed action, and substantial employment and contracting would continue.

The proposed action would play an important role in the continuing interaction between rural and Alaska Native sociocultural systems and lower-income Alaskans and the oil industry. Since the proposed action would be a continuation of ongoing activities, no major changes to these groups are expected. Many rural and Alaska Natives utilize state-funded public services and programs that are funded in part by the revenues paid to the state by the oil industry. Access to modern transportation and harvest technologies useful in subsistence and recreational hunting and fishing would continue, and no additional environmental justice concerns are anticipated.

Continued operation and maintenance of the TAPS may result in impacts to cultural and paleontological resources that would require mitigation on a case-by-case basis. However, these impacts are not expected to change significantly from those experienced historically.

Renewal of the Federal Grant is generally expected to have only minor impacts on recreational activities or use of federal and state designated Wilderness Areas, Parks, and Wild and Scenic Rivers near the TAPS, similar to currently existing impacts. Also, no major changes in current land use activities are expected. The northern and southern ends of the pipeline pass through the North Slope Borough and Valdez coastal zones, respectively. Pipeline operations and maintenance are currently permitted activities consistent with the coastal management plans for those zones and are in compliance with enforceable policies and applicable statewide standards. Future activities that would be conducted under the proposed action are not expected to alter this status.

ES.6.1.2 Spills

The projected impacts to the physical environment and biological resources from oil spills would vary depending on the amount of material spilled and the location of the spill. Spills could contaminate soil, surface water, and groundwater and affect biological resources associated with these media. For the most part, spills that are anticipated or likely to occur would be small and affect only small areas within the existing TAPS ROW or facility areas. The largest potential catastrophic spill to land (resulting from a hypothetical guillotine break in the pipeline) would affect about 84 acres. If such a spill occurred at one of the rivers crossed by the TAPS, a considerable length of the river downstream and possibly upstream could be affected (e.g., by depositing oil on the shoreline and impeding fish movement or survival). The area affected would depend on river flow at the time of the spill and cleanup response time. The largest (but very unlikely) spill at the Valdez Marine Terminal could affect about 2 miles of shoreline and up to about 2 square miles in Port Valdez.

A large oil spill on land would be expected to have localized effects on geological media, vegetative communities, and bird and mammal populations. However, these effects would not affect regional vegetation patterns or animal populations. Such a spill could have localized effects on fish populations in adjacent water bodies. Containment and cleanup of a land spill are expected to be rapid and effective and would substantially reduce the magnitude and duration of impact.

A large spill to water (either at one of the rivers crossed by the TAPS or at Port Valdez) could have more widespread effects. Many miles of river banks and beds could be coated with oil, requiring long-term cleanup efforts. Unless quickly contained, a large spill to a river could affect a large portion of the fish population, much of the shoreline riparian vegetation, and riverine wildlife (e.g., waterfowl and river otters). A large spill to Port Valdez could affect shoreline vegetation, fish communities, and a number of listed and protected species (a variety of marine mammals) that occur in Port Valdez. Impacts from oil spills to water could be minimized by proper planning, training, and surveillance and timely implementation of contingency activities.

The impacts to human health and safety from oil spills would be minor, provided appropriate measures were taken. It is expected that individuals would evacuate the areas near a spill, thereby minimizing the likelihood of inhalation exposures. Consumption of contaminated fish, shellfish, or marine mammals resulting from a spill to rivers or Port Valdez would be unlikely because if the contamination was noticeable (i.e., if the oil was visible or its smell was detectable), the food would not be eaten. Even if the food was not noticeably contaminated, consumption of the fish, shellfish, or marine mammals would not likely cause any adverse human health effects because there would be only a small amount of oil in the food.

The most significant economic impact of an oil spill would be the loss of oil revenues during the period when the pipeline was shut down for repair and cleanup. Shutting down the TAPS for a single day results in the loss of almost $3.5 million in royalties and production taxes to the State of Alaska. At the local level, spills would directly affect property taxes and would indirectly affect transfers made to local governments from revenues collected by the state. Expenditures made by local economies to clean up a spill could be large. Depending on its location and magnitude, a spill could also have impacts on recreation and tourism and on subsistence resources.

ES.6.2 Time-Dependent Alternative: Renew Federal Grant for Less than 30 Years

The impacts under this alternative on the physical environment and biological resources would generally be the same as those under the proposed action, although impacts on some resources would be reduced in proportion to the length of the renewal period. With a shorter renewal period, investment in new North Slope production would likely be reduced, which would have an adverse impact on domestic oil production, national energy security, the balance of trade, and overall economic activity. A shorter renewal period would reduce the flow of funds into state and local governments, thereby reducing their ability to implement a wide range of programs that have long operating lives.

ES.6.3 No-Action Alternative: Do Not Renew Federal Grant

The environmental impacts under the no-action alternative would result from the dismantlement of TAPS facilities, restoration of affected areas to conditions similar to the ones that existed before TAPS construction, and the subsequent absence of the TAPS. A range of dismantlement and restoration steps could take place. Final decisions on the removal and restoration of the TAPS and its associated components would involve an extensive analysis to ensure that all closure decisions would meet rigorous engineering and environmental considerations.

The environmental impacts associated with dismantlement under this alternative would generally be the same as they would be for any large construction project. Likely impacts would include releases of airborne particulates and elevated levels of noise; these impacts would be mitigated as necessary. Any impacts to the physical environment and biological resources would be localized to the vicinity of the facilities being removed or restored. Once the TAPS was dismantled and the ROW was restored, impacts from the TAPS on the physical environment and biological resources would gradually or, more commonly, abruptly diminish.

The economic impacts on Alaska and the United States would be very significant should the Federal Grant not be renewed. North Slope oil production would cease because there would be no cost-effective means of getting this oil to market. As a result, the gross state product would experience a decline of almost 40%. The loss of jobs, personal incomes, and tax revenues to the state would dramatically affect the lives of all Alaskans either directly (such as job loss) or indirectly (in reduced state services). North Slope oil production currently contributes about 18% to America's oil production, and the loss of this source of oil would negatively affect the nation's energy security and the balance of trade. In addition, there would be the loss of federal tax revenues and also a negative impact on the domestic marine transportation and shipbuilding industries.

ES.7 Mitigation Measures

Numerous mitigation measures are incorporated by the TAPS to minimize the environmental impacts associated with ongoing operations and to reduce the potential for oil spills. These include designs that ensure the efficient and safe transport of oil, measures that minimize the physical disturbance of ecosystems near the pipeline, measures that minimize releases of pollutants to the environment, operational procedures that quickly detect system problems and leaks, and protocols that respond to leaks and spills in a timely manner. Some of the more significant measures are highlighted in the following discussion.

Oversight of the TAPS is conducted by the Joint Pipeline Office (JPO), an umbrella organization that consists of six federal and seven State of Alaska agencies. The JPO and its member agencies are responsible for ensuring compliance with the requirements of the Federal Grant and State Lease and all other pertinent federal and state regulations. The Federal Grant and State Lease contain a number of requirements for mitigating potential environmental impacts. A description of the JPO and its functions is provided in Section 4.1.1,

and a copy of the Federal Grant is provided in Appendix F.

The TAPS was designed and constructed to have sufficient structural integrity to withstand arctic conditions for as long as oil can be economically extracted from the North Slope. The TAPS incorporates design features that address issues associated with operating a warm oil pipeline in permafrost conditions in a seismically active area. The aboveground pipeline was built in a flexible trapezoidal configuration to allow the longitudinal expansion of the pipe to be converted to lateral (sideways) movement; this configuration also accommodates pipe motion induced by an earthquake. Corrosion-protection measures, including the extensive use of impressed current, are incorporated in the belowground portions of the pipe. If there is a leak or rupture, the 177 valves along the pipeline can minimize the magnitude of oil releases by quickly isolating the leak and shutting down the flow of oil.

The pipeline crosses 80 major rivers in either buried or aboveground mode. The crossings were designed to accommodate foreseeable erosion, scour, ice conditions, and river meanders. The design of the pipeline at river crossings and in floodplains was based on quantitative assessments of flow and scour and a qualitative analysis of potential changes over the life of the system. At certain locations where the pipeline crosses or parallels rivers, engineering structures were built to deflect the river's flow and protect the pipeline from erosion of the riverbank, riverbed, or floodplain.

Major sources of crude oil vapor emissions are controlled through vapor recovery and control systems at Pump Station 1 and the Valdez Marine Terminal. These systems minimize the amount of volatile organic compounds released to the atmosphere during TAPS operations. In addition, ballast water removed from incoming tankers and all other oily water collected at the Valdez Marine Terminal is treated prior to its discharge to Port Valdez in accordance with existing permits.

A number of other mitigation measures are also incorporated into the routine operations of TAPS. Detailed procedures and protocols ensure its safe operation and minimize the likelihood of accidents and spills. Routine monitoring, surveillance, and maintenance of all TAPS components and facilities are performed to preserve system integrity. Repairs and upgrades are made as their need is indicated by the results of these activities. The system's leak detection capability has been continually upgraded to remain consistent with improvements in the technology for operating oil pipelines.

ES.8 Conclusions

This DEIS is consistent with the requirements promulgated by the Council on Environmental Quality for implementing NEPA, as given in Title 40, Parts 1500–1508 of the *Code of Federal Regulations,* and with the BLM's policies and procedures for NEPA compliance. A scoping process was conducted to obtain input from individuals, public interest organizations, and governmental agencies, and this input was used to develop the alternatives and issues considered in the DEIS. The DEIS meets all administrative and procedural requirements, and it is being released for public review and comment at this time.

On the basis of the analysis of environmental impacts and other factors presented here, the BLM has identified the proposed action of renewing the Federal Grant for an additional 30 years as its preferred alternative. However, it might modify its choice after receiving comments on this DEIS. Since the pipeline, pump stations, Valdez Marine Terminal, and other related facilities are already constructed, continued operation of the TAPS should have minimal future environmental impacts. This conclusion is based on knowledge about the impacts and experience gained over the last 25 years of TAPS operation and the assumption that mitigation measures (including features designed to minimize the likelihood of future spills), upgrades to the monitoring system used to identify potential problems and leaks, vigilant oversight by regulatory agencies, and an aggressive maintenance program will all continue to be incorporated. The most significant environmental impacts associated with the TAPS already occurred when the pipeline was constructed.

The decision made by the BLM on the renewal application will be provided in the record of decision (ROD) that will follow the final EIS (FEIS). The ROD may mix elements of the alternatives developed and analyzed in the DEIS and FEIS.

DOCUMENT CONTENTS

VOLUME 1

Executive Summary
Chapter 1: Introduction
Chapter 2: Alternatives
Chapter 3: Affected Environment

VOLUME 2

Section 4.1: Existing Mitigation Measures
Section 4.2: Impacting Factors
Section 4.3: Proposed Action Alternative Analysis – Routine Operations
Section 4.4: Spills Analysis for Proposed Action
Section 4.5: Less-Than-30-Year Renewal Alternative Analysis
Section 4.6: No-Action Alternative Analysis

VOLUME 3

Section 4.7: Cumulative Effects
Section 4.8: Other NEPA Considerations
Section 4.9: References for Chapter 4
Chapter 5: Consultation and Coordination
Chapter 6: Review and Analysis of Comments Received on the Draft Environmental Impact Statement (Reserved for Final EIS)
Chapter 7: List of Preparers
Chapter 8: Glossary
Chapter 9: Glossary of Laws, Executive Orders, and Regulations Cited in This DEIS

VOLUME 4

Appendix A: Methodology Descriptions
Appendix B: TAPS ROW Map Atlas
Appendix C: Hazardous Materials and Waste Management
Appendix D: Subsistence in the Vicinity of the TAPS
Appendix E: ANILCA Section 810 Analysis of Subsistence Impacts
Appendix F: Federal Agreement and Grant of Right-of-Way for the Trans-Alaska Pipeline

CONTENTS

VOLUME 1

1 Introduction 1-1

1.1 Purpose and Need 1-1
1.2 Scope of the Decision and Analysis 1-2
1.3 Description of the TAPS and Its Surrounding Area 1-7
1.4 Relationships of the TAPS to BLM Policies, Plans, and Programs 1-15
1.5 References for Chapter 1 1-15

2 Alternatives 2-1

2.1 Introduction 2-1
2.2 Proposed Action — Renew Federal Grant for 30 Years 2-1
2.2.1 Projected TAPS Operation 2-1
2.2.2 Requirements and Responsibilities under the Federal Grant 2-2
2.2.3 Projected BLM Oversight 2-3
2.3 Time-Dependent Alternative: Renew Federal Grant for less than 30 Years 2-5
2.4 No-Action Alternative: Do Not Renew Federal Grant 2-5
2.5 Alternatives and Issues Considered but Eliminated from Detailed Analysis 2-5
2.6 Comparison of Alternatives 2-7
2.7 Reference for Chapter 2 2-7

3 Affected Environment 3.1-1

3.1 TAPS Background 3.1-1
3.1.1 History 3.1-1
3.1.2 Existing Infrastructure 3.1-3

3.2 Physiography and Geology 3.2-1
3.2.1 Arctic Coastal Plain 3.2-1
3.2.2 Arctic Foothills 3.2-1
3.2.3 Brooks Range 3.2-6
3.2.4 Chandalar Ridge and Lowland Section 3.2-6
3.2.5 Kokrine-Hodzana Highlands and Yukon-Tanana Uplands 3.2-7
3.2.6 Tanana Lowland 3.2-7
3.2.7 Northern Foothills and Alaska Range 3.2-7
3.2.8 Gulkana Upland 3.2-8
3.2.9 Copper River Lowland 3.2-8
3.2.10 Chugach Mountains 3.2-9

3.3 Soils and Permafrost 3.3-1
3.3.1 Descriptions of Soils and Permafrost Conditions by Physiographic Province 3.3-2
3.3.2 Geomorphic Processes Related to Soils and Permafrost 3.3-4
3.3.3 Existing Contaminated Sites 3.3-7

3.4 Seismicity 3.4-1
3.4.1 Seismicity and Faults 3.4-1
3.4.2 Seismic Hazards, Designed Seismic Zones, and Ground Motions 3.4-2

3.5 Sand, Gravel, and Quarry Resources 3.5-1

CONTENTS (Cont.)

3.6 Paleontology 3.6-1

3.7 Surface Water Resources 3.7-1
3.7.1 Hydrological Regions 3.7-1
3.7.2 Existing Conditions and Historical Impacts 3.7-5

3.8 Groundwater Resources 3.8-1

3.9 Physical Marine Environment 3.9-1
3.9.1 Location and Description 3.9-1
3.9.2 Bathymetry 3.9-2
3.9.3 Hydrography and Circulation 3.9-2

3.10 Marine Water Chemistry 3.10-1
3.10.1 General Marine Water Chemistry 3.10-1
3.10.2 Nutrients 3.10-1

3.11 Anthropogenic Influences on Physical Marine Environment 3.11-1
3.11.1 Discharges from the Valdez Marine Terminal 3.11-1
3.11.2 Trace Elements 3.11-3
3.11.3 Hydrocarbons 3.11-4
3.11.4 TAPS-Related Marine Transportation 3.11-6
3.11.5 Exxon Valdez Spill 3.11-8
3.11.6 Tsunamis 3.11-9

3.12 Climate and Metorology 3.12-1
3.12.1 Wind 3.12-1
3.12.2 Temperature and Humidity 3.12-1
3.12.3 Precipitation and Evaporation 3.12-2
3.12.4 Fog 3.12-2
3.12.5 Severe Weather 3.12-2
3.12.6 Atmospheric Dispersion Characteristics 3.12-2
3.12.7 Global Climate Change 3.12-12

3.13 Air Quality 3.13-1
3.13.1 Existing Emissions 3.13-1
3.13.2 Existing Air Quality 3.13-9

3.14 Noise 3.14-1

3.15 Transportation 3.15-1
3.15.1 Aviation Transportation Systems 3.15-1
3.15.2 Marine Transportation Systems 3.15-2
3.15.3 Rail Transportation Systems 3.15-2
3.15.4 Road Transportation Systems 3.15-3

3.16 Hazardous Materials and Waste Management 3.16-1
3.16.1 Hazardous Material Usage 3.16-1
3.16.2 Hazardous Waste 3.16-1
3.16.3 Solid Waste 3.16-2
3.16.4 Wastewater 3.16-2
3.16.5 Special Wastes 3.16-3

CONTENTS (Cont.)

3.17 Human Health and Safety 3.17-1
3.17.1 Occupational 3.17-1
3.17.2 Public 3.17-2

3.18 Terrestrial Vegetation and Wetlands 3.18-1
3.18.1 TAPS ROW 3.18-1
3.18.2 Beaufort Sea 3.18-20
3.18.3 Prince William Sound 3.18-21

3.19 Fish, Reptiles, and Amphibians 3.19-1
3.19.1 Fish 3.19-1
3.19.2 Reptiles and Amphibians 3.19-37

3.20 Birds 3.20-1
3.20.1 TAPS ROW 3.20-1
3.20.2 Beaufort Sea 3.20-5
3.20.3 Prince William Sound 3.20-7

3.21 Terrestrial Mammals 3.21-1
3.21.1 TAPS Row 3.21-1
3.21.2 Beaufort Sea 3.21-15

3.22 Threatened, Endangered, and Protected Species 3.22-1
3.22.1 TAPS Row 3.22-1
3.22.2 Beaufort Sea 3.22-10
3.22.3 Prince William Sound 3.22-15

3.23 Economics 3.23-1
3.23.1 North Slope Oil Production and World Oil Prices 3.23-1
3.23.2 National Economic Issues 3.23-1
3.23.3 State Economic Issues 3.23-5
3.23.4 Alaska Regional Economic Issues 3.23-14
3.23.5 Subsistence 3.23-17
3.23.6 Alaska Native Corporations 3.23-20

3.24 Subsistence 3.24-1
3.24.1 Community Harvest Patterns 3.24-2
3.24.2 Access to Subsistence Resources 3.24-23
3.24.3 Sport Harvests Versus Subsistence 3.24-24

3.25 Sociocultural Systems 3.25-1
3.25.1 Alaska Native Sociocultural Systems 3.25-1
3.25.2 Non-Native Rural Alaskan Sociocultural Systems 3.25-20

3.26 Cultural Resources 3.26-1
3.26.1 Archaeological Context 3.26-1
3.26.2 Known Cultural Resources 3.26-2
3.26.3 Traditional Cultural Properties 3.26-7
3.26.4 Historic Structures 3.26-7

3.27 Land Uses and Coastal Zone Management 3.27-1
3.27.1 Land Ownership and Uses 3.27-1
3.27.2 Coastal Zone Management 3.27-3

CONTENTS (Cont.)

3.28 Recreation, Wilderness, and Aesthetics 3.28-1
3.28.1 Recreation 3.28-1
3.28.2 Wilderness 3.28-9
3.28.3 Aesthetics 3.28-10

3.29 Environmental Justice 3.29-1
3.29.1 Minority Populations 3.29-2
3.29.2 Low-Income Populations 3.29-3

3.30 References for Chapter 3 ..... 3.30-1

VOLUME 2

4 Environmental Consequences 4.1-1

4.1 Existing Mitigation Measures 4.1-1
4.1.1 JPO Oversight 4.1-1
4.1.2 Design Features as Mitigation 4.1-8
4.1.3 Mitigation through TAPS Operational Controls 4.1-16
4.1.4 Spill Prevention and Response 4.1-28
4.1.5 Social, Cultural, and Economic Mitigation Features 4.1-38

4.2 Impacting Factors 4.2-1

4.2.1 Factors Resulting from the Existence of TAPS Facilities 4.2-1
4.2.2 Factors Associated with Routine TAPS Operations 4.2-2
4.2.2.1 Routine Pump Station Operation 4.2-2
4.2.2.2 Routine Valdez Marine Terminal Operation 4.2-3
4.2.2.3 Routine Operations of the Pipeline 4.2-3
4.2.2.4 Routine and Preventive Maintenance Actions 4.2-4
4.2.2.5 Repair Activities 4.2-6
4.2.2.6 Planned and Potential Upgrades 4.2-10
4.2.2.7 Health and Safety Impacts Associated with the Proposed Action 4.2-19
4.2.3 Impacting Factors Associated with Routine TAPS Operations during the Less-Than-30-Year Grant Renewal Alternative 4.2-20
4.2.4 Impacting Factors Associated with Planned Activities under the No-Action Alternative 4.2-21
4.2.4.1 Stoppage of Product Flow and System Cleaning 4.2-21
4.2.4.2 Removal of Aboveground Facilities 4.2-22
4.2.4.3 Revegetation and Restoration 4.2-24
4.2.4.4 Health and Safety Impacts Associated with the No-Action Alternative 4.2-24
4.2.5 Nonroutine Factors – Spills Hazards under the Proposed Action 4.2-25
4.2.6 Impacting Factors Associated with Nonroutine Events – Spills during the Less-Than-30-Year Renewal Alternative 4.2-28
4.2.7 Nonroutine Factors Associated with Unplanned Events: Spills during the No-Action Alternative 4.2-28

4.3 Proposed Action Alternative Analysis – Routine Operations 4.3-1
4.3.1 Physiography and Geology 4.3-1
4.3.2 Soils and Permafrost 4.3-1

CONTENTS (Cont.)

4.3.3	Seismicity		4.3-5
4.3.4	Sand, Gravel, and Quarry Resources		4.3-6
4.3.5	Paleontology		4.3-6
4.3.6	Surface Water Resources		4.3-7
4.3.7	Groundwater Resources		4.3-10
4.3.8	Physical Marine Environment		4.3-12
4.3.9	Air Quality		4.3-15
4.3.10	Noise		4.3-20
4.3.11	Transportation		4.3-21
4.3.12	Hazardous Materials and Waste Management		4.3-22
4.3.13	Human Health and Safety		4.3-35
	4.3.13.1	Occupational	4.3-36
	4.3.13.2	Public	4.3-38
4.3.14	Biological Resources Overview		4.3-43
4.3.15	Terrestrial Vegetation and Wetlands		4.3-44
4.3.16	Fish		4.3-49
4.3.17	Birds and Terrestrial Mammals		4.3-53
4.3.18	Threatened, Endangered, and Protected Species		4.3-59
4.3.19	Economics		4.3-64
	4.3.19.1	Assumptions Used in the Analysis	4.3-65
	4.3.19.2	National Economic Impacts	4.3-66
	4.3.19.3	State Economic Impacts	4.3-68
	4.3.19.4	Sensitivity of Impacts to Changes in TAPS Throughput and Changes in World Oil Prices	4.3-76
	4.3.19.5	Regional Economic Impacts	4.3-79
	4.3.19.6	Alaska Native Corporations	4.3-82
	4.3.19.7	Subsistence	4.3-82
4.3.20	Subsistence Impacts		4.3-82
4.3.21	Sociocultural Systems		4.3-87
	4.3.21.1	Alaska Native Sociocultural Systems	4.3-87
	4.3.21.2	Non-Native Sociocultural Systems	4.3-90
4.3.22	Cultural Resources		4.3-90
4.3.23	Land Use and Coastal Zone Management		4.3-91
	4.3.23.1	Land Use	4.3-91
	4.3.23.2	Coastal Zone Management	4.3-92
4.3.24	Recreation, Wilderness, and Aesthetics		4.3-93
	4.3.24.1	Recreation	4.3-93
	4.3.24.2	Wilderness	4.3-95
	4.3.24.3	Aesthetics	4.3-96
4.3.25	Environmental Justice		4.3-96
4.4	Spills Analysis for Proposed Action		4.4-1
4.4.1	Spill Scenarios		4.4-1
	4.4.1.1	Pipeline and Valdez Marine Terminal Spill Scenarios and Locations	4.4-2
	4.4.1.2	Transportation-Related Spill Scenarios	4.4-10
	4.4.1.3	Catastrophic Spills at Environmentally Important Pipeline or Valdez Marine Terminal Locations	4.4-14
4.4.2	Hydrological Analysis of Spill Events		4.4-23
4.4.3	Fire Analysis of Spill Events		4.4-24
4.4.4	Impacts of Spills on Environmental Receptors		4.4-34
	4.4.4.1	Soils and Permafrost	4.4-34
	4.4.4.2	Paleontology	4.4-38

CONTENTS (Cont.)

4.4.4.3	Surface Water Resources	4.4-39
4.4.4.4	Groundwater Resources	4.4-53
4.4.4.5	Physical Marine Environment	4.4-59
4.4.4.6	Air Quality	4.4-66
4.4.4.7	Human Health and Safety	4.4-71
4.4.4.8	Biological Resources Overview	4.4-99
4.4.4.9	Terrestrial Vegetation and Wetlands	4.4-99
4.4.4.10	Fish	4.4-103
4.4.4.11	Birds and Terrestrial Mammals	4.4-107
4.4.4.12	Threatened, Endangered, and Protected Species	4.4-111
4.4.4.13	Economics	4.4-117
4.4.4.14	Subsistence	4.4-120
4.4.4.15	Sociocultural Resources	4.4-123
4.4.4.16	Cultural Resources	4.4-125
4.4.4.17	Land Uses and Coastal Zone Management	4.4-126
4.4.4.18	Recreation, Wilderness, and Aesthetics	4.4-131
4.4.4.19	Environmental Justice	4.4-135
4.5	Less-Than-30-Year Renewal Alternative Analysis	4.5-1
4.5.1	Summary Description of the Less-Than-30-Year Renewal Alternative	4.5-1
4.5.1.1	Introduction	4.5-1
4.5.1.2	Spill Scenarios under the Less-Than-30-Year Renewal Alternative	4.5-1
4.5.2	Impact Analysis of the Less-Than-30-Year Renewal Alternative	4.5-5
4.5.2.1	Physiography and Geology	4.5-5
4.5.2.2	Soils and Permafrost	4.5-7
4.5.2.3	Seismicity	4.5-7
4.5.2.4	Sand, Gravel, and Quarry Resources	4.5-7
4.5.2.5	Paleontology	4.5-7
4.5.2.6	Surface Water Resources	4.5-7
4.5.2.7	Groundwater Resources	4.5-7
4.5.2.8	Physical Marine Environment	4.5-7
4.5.2.9	Air Quality	4.5-8
4.5.2.10	Noise	4.5-9
4.5.2.11	Transportation	4.5-9
4.5.2.12	Hazardous Materials and Waste Management	4.5-9
4.5.2.13	Human Health and Safety	4.5-10
4.5.2.14	Biological Resources Overview	4.5-11
4.5.2.15	Terrestrial Vegetation and Wetlands	4.5-11
4.5.2.16	Fish	4.5-12
4.5.2.17	Birds and Terrestrial Mammals	4.5-13
4.5.2.18	Threatened, Endangered, and Protected Species	4.5-14
4.5.2.19	Economics	4.5-14
4.5.2.20	Subsistence	4.5-15
4.5.2.21	Sociocultural Systems	4.5-15
4.5.2.22	Cultural Resources	4.5-16
4.5.2.23	Land Uses and Coastal Zone Management	4.5-16
4.5.2.24	Recreation, Wilderness, and Aesthetics	4.5-17
4.5.2.25	Environmental Justice	4.5-17
4.6	No-Action Alternative Analysis	4.6-1
4.6.1	Summary Description of the No-Action Alternative	4.6-1

CONTENTS (Cont.)

4.6.1.1 Description of Termination Activities and Long-Term Restoration of the TAPS ROW 4.6-1
4.6.1.2 Spill Scenarios under the No-Action Alternative 4.6-2
4.6.2 Impact Analysis of the No-Action Alternative 4.6-6
4.6.2.1 Physiography and Geology 4.6-6
4.6.2.2 Soils and Permafrost 4.6-7
4.6.2.3 Seismicity 4.6-8
4.6.2.4 Sand, Gravel, and Quarry Resources 4.6-8
4.6.2.5 Paleontology 4.6-8
4.6.2.6 Surface Water Resources 4.6-9
4.6.2.7 Groundwater Resources 4.6-13
4.6.2.8 Physical Marine Environment 4.6-15
4.6.2.9 Air Quality 4.6-18
4.6.2.10 Noise 4.6-25
4.6.2.11 Transportation 4.6-26
4.6.2.12 Hazardous Materials and Waste Management 4.6-28
4.6.2.13 Human Health and Safety 4.6-34
4.6.2.14 Biological Resources Overview 4.6-37
4.6.2.15 Terrestrial Vegetation and Wetlands 4.6-38
4.6.2.16 Fish 4.6-42
4.6.2.17 Birds and Terrestrial Mammals 4.6-45
4.6.2.18 Threatened, Endangered, and Protected Species 4.6-50
4.6.2.19 Economics 4.6-54
4.6.2.20 Subsistence 4.6-70
4.6.2.21 Sociocultural Systems 4.6-72
4.6.2.22 Cultural Resources 4.6-76
4.6.2.23 Land Uses and Coastal Zone Management 4.6-76
4.6.2.24 Recreation, Wilderness, and Aesthetics 4.6-79
4.6.2.25 Environmental Justice 4.6-83

VOLUME 3

4.7 Cumulative Effects 4.7-1
4.7.1 Introduction 4.7-1
4.7.2 Regions of Interest 4.7-3
4.7.3 Time Frames of Actions 4.7-13
4.7.4 Types of Actions 4.7-13
4.7.4.1 Oil and Gas Exploration, Development, and Production 4.7-19
4.7.4.2 Oil Refining 4.7-36
4.7.4.3 Oil Storage 4.7-36
4.7.4.4 Oil and Natural Gas Transportation 4.7-36
4.7.4.5 Habitation and Development 4.7-38
4.7.4.6 Transportation 4.7-42
4.7.4.7 Legislative Actions Related to Land Use 4.7-43
4.7.4.8 Land Management 4.7-44
4.7.4.9 Natural Resource Use 4.7-46
4.7.4.10 Petroleum and Hazardous Materials Spills 4.7-48
4.7.5 Impacting Factors of Reasonably Foreseeable Actions 4.7-56
4.7.6 Physical Environment 4.7-62
4.7.6.1 Soil and Permafrost 4.7-62
4.7.6.2 Sand, Gravel, and Quarry Resources 4.7-63
4.7.6.3 Paleontology 4.7-64

CONTENTS (Cont.)

4.7.6.4 Surface Water Resources 4.7-64
4.7.6.5 Groundwater Resources 4.7-67
4.7.6.6 Physical Marine Environment 4.7-70
4.7.6.7 Air Quality 4.7-72
4.7.6.8 Noise 4.7-73
4.7.6.9 Transportation 4.7-74
4.7.6.10 Wastes 4.7-75
4.7.6.11 Human Health and Safety 4.7-79
4.7.7 Biological Resources 4.7-87
4.7.7.1 Terrestrial Vegetation and Wetlands 4.7-87
4.7.7.2 Fish 4.7-89
4.7.7.3 Birds and Mammals 4.7-94
4.7.7.4 Threatened, Endangered, and Protected Species 4.7-102
4.7.8 Social Systems 4.7-108
4.7.8.1 Subsistence 4.7-108
4.7.8.2 Sociocultural Systems 4.7-111
4.7.8.3 Economics 4.7-115
4.7.8.4 Cultural Resources 4.7-118
4.7.8.5 Land Use and Coastal Zone Management 4.7-118
4.7.8.6 Recreation, Wilderness, and Aesthetics 4.7-120
4.7.8.7 Environmental Justice 4.7-123
4.7.9 Summary 4.7-123

4.8 Other NEPA Considerations 4.8-1
4.8.1 Unavoidable Adverse Impacts 4.8-1
4.8.2 Relationship Between Local Short-Term Uses of the Environment and Long-Term Productivity 4.8-1
4.8.3 Irreversible and Irretrievable Commitment of Resources 4.8-2
4.8.4 Mitigation of Adverse Effects 4.8-2

4.9 References for Chapter 4 ..... 4.9-1

5 Consultation and Coordination 5-1

5.1 Public Scoping 5-1
5.2 Government-to-Government Consultation 5-2
5.3 State of Alaska Coordination 5-2
5.4 Other BLM Planning Activities 5-2
5.5 Agency Consultation 5-3
5.6 References for Chapter 5 5-3

6 Review and Analysis of Comments Received on the Draft Environmental Impact Statement 6-1

7 List of Preparers 7-1

8 Glossary 8-1

9 Glossary of Laws, Executive Orders, and Regulations Cited in This DEIS 9-1

9.1 Federal Laws 9-1
9.2 Executive Orders 9-3
9.3 Federal Regulations 9-3

CONTENTS (Cont.)

9.4 State Laws 9-5
9.5 State Regulations 9-5

VOLUME 4

APPENDIX A: Methodology Descriptions A-1

APPENDIX B: TAPS ROW Map Atlas B-1

APPENDIX C: Hazardous Materials and Waste Management C-1

APPENDIX D: Subsistence in the Vicinity of the TAPS D-1

APPENDIX E: ANILCA Section 810 Analysis of Subsistence Impacts E-1

APPENDIX F: Agreement and Grant of Right-of-Way for Trans-Alaska Pipeline F-1

FIGURES

VOLUME 1

1-1	General Location of the TAPS	1-3
1-2	Land Ownership along the TAPS ROW	1-5
1-3	Topography and Major Physiographic Regions Associated with the TAPS	1-9
1-4	Example of a TAPS Pump Station	1-11
1-5	Valdez Marine Terminal	1-13
3.1-1	Water Use at TAPS Facilities, 1994–1999	3.1-7
3.1-2	Alaska Transportation Network	3.1-11
3.1-3	Operations Control Center at Valdez Marine Terminal	3.1-14
3.1-4	Valdez Marine Terminal	3.1-19
3.1-5	Port Valdez, the Town of Valdez, Valdez Narrows, the Hinchinbrook Entrance, and Tanker Routes	3.1-23
3.1-6	North Slope Producing Oil Fields	3.1-25
3.2-1	Terrain Map	3.2-3
3.4-1	Seismic Zones and Fault Crossings along the TAPS and Locations of Earthquakes Greater Than 5.5 in Magnitude That Have Occurred near the TAPS since Startup	3.4-3
3.4-2	Estimated Peak Ground Acceleration and Design Ground Acceleration for the Design Contingency Earthquake Used in TAPS Design	3.4-7
3.6-1	Alaska Chronology by Area	3.6-3
3.7-1	Hydrological Regions and Streams Crossing the TAPS ROW	3.7-3
3.9-1	Bathymetric Chart of Port Valdez Showing the Two Shallow Sills in the Valdez Narrows, the Steep North and South Slopes, the Flat Bottom, and the More Gently Rising Eastern End	3.9-3
3.9-2	Changes in Temperature and Salinity Distributions in Port Valdez	3.9-5
3.11-1	Annual Flow and Levels of Benzene, Toluene, Ethylbenzene, and Xylene and Total Suspended Solids for Valdez Marine Terminal Treated Ballast Water Discharges	3.11-2
3.12-1	Climatic Divisions of Alaska and Locations of Selected National Weather Service Stations along the TAPS ROW	3.12-3
3.12-2	Summary of Climate along the TAPS ROW	3.12-5

FIGURES (Cont.)

3.12-3 Wind Roses for Six National Weather Service Stations along the TAPS ROW and at Prudhoe Bay 3.12-9

3.12-4 Trends in Annual Average Temperatures at Six National Weather Service Stations..... 3.12-11

3.18-1 Major Vegetation Zones Crossed by the TAPS ROW 3.18-3

3.18-2 Wetlands in the Vicinity of the TAPS 3.18-5

3.19-1 Map Showing Major Waterways Discussed for Fisheries..... 3.19-7

3.21-1 Game Management Units in Alaska 3.21-3

3.21-2 Distribution of Caribou Herds in the Vicinity of the TAPS ROW 3.21-7

3.23-1 Alaskan Boroughs and Census Areas 3.23-3

3.24-1 Locations of Potential Affected Communities and Associated Harvest Areas 3.24-5

3.24-2 Harvest Totals for Separate Species over Time in the Vicinity of the TAPS 3.24-6

3.24-3 Sport Fishing Indicators North of Atigun Pass, 1983–1999..... 3.24-29

3.24-4 Sport Fishing Indicators between Atigun Pass and the Yukon River, 1995–1999 ..... 3.24-30

3.25-1 Alaska Native Regional Sociocultural Systems about the Time of Contact with Euro-Americans..... 3.25-3

3.25-2 Areas of Alaska Native Regional Corporations..... 3.25-17

3.26-1 Cultural Resource Areas..... 3.26-3

3.27-1 Locations of Conservation System Units along the ROW 3.27-7

3.27-2 North Slope Borough Coastal Zone..... 3.27-9

3.27-3 Valdez Coastal Zone..... 3.27-11

3.28-1 Delta River 3.27-5

3.28-2 Gulkana River 3.27-7

3.29-1 Census Block Groups with Minority Populations in Excess of 32.4% 3.29-5

3.29-2 Census Block Groups with Low-Income Populations in Excess of 9.6% 3.29-9

VOLUME 2

4.1-1 Typical Pipeline Details for Conventional Burial..... 4.1-9

4.1-2 Typical Pipeline Details for Special Burial 4.1-9

FIGURES (Cont.)

4.1-3	Potential Vertical Support Member Movement	4.1-10
4.1-4	Typical Thermal Vertical Support Member	4.1-11
4.1-5	Smart Pig	4.1-18
4.1-6	Middle Fork Koyukuk River, MP 218, Where Monitoring Led to Follow-up Remedial Action Consisting of Bank Armoring	4.1-21
4.1-7	Middle Fork Koyukuk River, MP 217, where Monitoring Did Not Lead to Immediate Follow-up Action	4.1-22
4.1-8	Tazlina River Bridge, MP 686, Where Monitoring Led to Bank Armoring to Prevent Further Erosion	4.1-23
4.1-9	TAPS Oil Spill Contingency Resources	4.1-31
4.2-1	TAPS Corrosion Investigation Projects for Underground Main-Line Pipe	4.2-7
4.3-1	Ponding and Change of Local Surface Hydrology Adjacent to the TAPS ROW on the Arctic Coastal Plain	4.3-3
4.3-2	Historical and Projected Flows from the Ballast Water Treatment Facility Discharge and TAPS Throughput	4.3-14
4.3-3	Valdez Air Health Study Ambient Air Monitoring Locations	4.3-41
4.3-4	Alaska Gross State Product and Employment with Continued TAPS Operation	4.3-68
4.4-1	Locations and Descriptions of the Largest Historical Pipeline and Valdez Marine Terminal Oil Spills	4.4-11
4.4-2	East Tank Farm Facilities Potentially Affected in the Valdez Marine Terminal Fire Scenario	4.4-27
4.4-3	Boundary of the Watershed Area Affected by the Exxon Valdez Oil Spill	4.4-95
4.6-1	Alaska Gross State Product and Employment with TAPS Termination	4.6-58

VOLUME 3

4.7-1	Cumulative Assessment Approach for this DEIS	4.7-3
4.7-2	General Regions of Interest in Alaska for Cumulative Effects to Physical and Ecological Resources from the TAPS and Other Actions	4.7-5
4.7-3	Areas and Locations in the Beaufort Sea and North Slope Regions	4.7-7
4.7-4	Areas and Locations in Interior Alaska	4.7-9
4.7-5	Areas and Locations in the Prince William Sound Region	4.7-11

FIGURES (Cont.)

4.7-6	Oil and Gas Development on the North Slope over Time	4.7-21
4.7-7	Generalized Schematic of Prudhoe Bay Oil Production	4.7-34
4.7-8	Proposed Route of the Alcan Project	4.7-39

VOLUME 4

A-1	North Slope Crude Oil Production from 1988 to 2000	A-38
A-2	Projections of North Slope Crude Oil Production	A-38
A-3	Spill Frequency by TAPS Segment	A-40
A-4	Number of Spills by Size over TAPS Lifetime	A-40
D-1	Example of the Seasonality of the Subsistence Harvest in Copper River Basin	D-6
D-2	Changing Harvests over Time for Selected Resources in Stevens Village	D-7
D-3	Communities Considered in the TAPS ROW Renewal EIS	D-9
D-4	Geographic Extent of Exxon Valdez Oil Spill	D-11
D-5	Subsistence Harvest Areas Associated with Alatna	D-17
D-6	Subsistence Harvest Areas Associated with Anaktuvuk Pass	D-23
D-7	Subsistence Harvest Areas Associated with Chenega Bay	D-29
D-8	Subsistence Harvest Areas Associated with Chitina	D-33
D-9	Subsistence Harvest Areas Associated with Copper Center	D-37
D-10	Subsistence Harvest Areas Associated with Evansville	D-47
D-11	Subsistence Harvest Areas Associated with Gakona	D-51
D-12	Subsistence Harvest Areas Associated with Glennallen	D-57
D-13	Subsistence Harvest Areas Associated with Gulkana	D-63
D-14	Subsistence Harvest Areas Associated with Hughes	D-67
D-15	Subsistence Harvest Areas Associated with Kenny Lake	D-71
D-16	Subsistence Harvest Areas Associated with Manley Hot Springs	D-75
D-17	Subsistence Harvest Areas Associated with Minto	D-79
D-18	Subsistence Harvest Areas Associated with Nanwalek	D-85

FIGURES (Cont.)

D-19 Subsistence Harvest Areas Associated with Nuiqsut D-91

D-20 Subsistence Harvest Areas Associated with Paxson D-97

D-21 Subsistence Harvest Areas Associated with Rampart D-105

D-22 Subsistence Harvest Areas Associated with Stevens Village D-111

D-23 Subsistence Harvest Areas Associated with Tanana D-117

D-24 Subsistence Harvest Areas Associated with Tatitlek D-123

D-25 Subsistence Harvest Areas Associated with Tonsina D-131

TABLES

VOLUME 1

2-1	TAPS ROW Renewal DEIS Summary of Direct and Indirect Effects	2-8
3.1-1	Summary of Major Features of the Trans Alaska Pipeline System	3.1-4
3.1-2	Location and Characteristics of Water Wells along the TAPS ROW	3.1-8
3.1-3	Typical Sanitary Discharges from Pump Stations and Mobile Contingency Camp Facilities	3.1-9
3.1-4	Features and Capabilities of the TAPS Control System	3.1-14
3.1-5	Salient Aspects of the TAPS Fire Protection Response Team	3.1-15
3.1-6	TAPS Oil Spill Major Contingency Equipment	3.1-17
3.1-7	Summary of Facilities at Valdez Marine Terminal	3.1-20
3.2-1	Physiographic Provinces Crossed by the TAPS ROW	3.2-2
3.2-2	Geologic Time Line	3.2-2
3.2-3	Special Terms Used in Section 3.2	3.2-5
3.3-1	27 Active Contaminated Sites along the TAPS	3.3-8
3.3-2	Active Contaminated Sites at the Valdez Marine Terminal	3.3-11
3.4-1	Seismic Design Zones for Design Contingency Earthquake	3.4-5
3.4-2	Design Ground Motions for Design Contingency Earthquake	3.4-6
3.4-3	Peak Ground Acceleration and the Design Ground Acceleration for a Design Contingency Earthquake	3.4-6
3.4-4	Engineering Design Criteria of Pipeline for Ground Movement for Active Fault Zone Crossings	3.4-6
3.5-1	Active TAPS Operations Material Sites on Public Lands	3.5-2
3.6-1	Marine Invertebrate Fossils	3.6-5
3.6-2	Paleontological Sites near the TAPS ROW	3.6-5
3.7-1	Historical Activities Performed for River Control along the ROW	3.7-7
3.8-1	Six High-Priority Contaminated Sites along the TAPS ROW	3.8-4
3.11-1	Monitoring Schedules at Valdez Marine Terminal Required by NPDES Permit	3.11-3
3.12-1	Summary of Climatic and Meteorological Data at Six NWS Stations along the TAPS	3.12-7

TABLES (Cont.)

3.13-1 Stationary Emission Sources Installed at TAPS Pump Stations 3.13-2

3.13-2 Stationary Emission Sources Installed at Valdez Marine Terminal 3.13-4

3.13-3 Estimated Potential Emissions of Criteria Pollutants from Existing TAPS Facility Sources 3.13-6

3.13-4 Comparison of Estimated Potential Emissions from TAPS Facilities with Those from Major Facilities Located in Adjacent Areas 3.13-7

3.13-5 Estimated 2001 Emissions of Criteria Pollutants and VOCs from Vehicles Used for TAPS Operation 3.13-8

3.13-6 Estimated Potential Emissions of Hazardous Air Pollutants from TAPS Facility Sources 3.13-10

3.13-7 Inventory and Emissions of Ozone Depleting Substances from TAPS Facilities 3.13-11

3.13-8 National Ambient Air Quality Standards, Alaska Ambient Air Quality Standards, and Maximum Allowable Increments for Prevention of Significant Deterioration 3.13-12

3.13-9 Monitored and Modeled Ambient Data for Criteria Pollutants in and around TAPS Facilities 3.13-15

3.13-10 Ambient Air Quality Trends in the Prudhoe Bay Area 3.13-19

3.13-11 Ambient Concentrations of Hazardous Air Pollutants in the Valdez Area Prior to Installation of Tanker Vapor Recovery System at the Valdez Marine Terminal 3.13-20

3.14-1 Direction and Distance of Nearest Human Residence and Town from Each TAPS Facility 3.14-3

3.15-1 Average Daily Traffic Counts on the Richardson Highway for the Year 2000 ..... 3.15-4

3.17-1 Annual Incidence Rates of Occupational Injuries and Illnesses to TAPS Employees and Contractors, 1995-2001 ..... 3.17-3

3.17-2 Measures of PCBs in Tissues of Alaska Natives and Western Canadian Inuit 3.17-5

3.17-3 Measures of Mercury in Tissues of Alaska and Canadian Natives 3.17-7

3.17-4 Valdez Area Ambient VOC Concentrations and Risk-Based Guideline Levels 3.17-11

3.18-1 Wetland Systems and Classes along the TAPS ROW, Beaufort Sea, and Prince William Sound 3.18-2

3.18-2 Vegetation Types and Associated Landforms Found in Each Major Vegetation Zone Crossed by the TAPS ROW 3.18-7

3.19-1 Fish Species Occurring within Major Regions along the TAPS ROW 3.19-2

TABLES (Cont.)

3.19-2 Fish Streams along the TAPS Corridor 3.19-10

3.20-1 Important Waterfowl Concentration Use Areas near the TAPS ROW 3.20-3

3.21-1 Important Moose Habitat Areas near the TAPS ROW 3.21-2

3.21-2 Harvest Summaries for Alaska Wildlife within the Game Management Units That Are Crossed by or Occur near the TAPS ROW 3.21-5

3.21-3 Caribou Herd Size, Harvest Summaries, and Limiting Factors for Herds Occurring near the TAPS ROW 3.21-6

3.22-1 Threatened, Endangered, and Protected Species That Could Occur in the Vicinity of the TAPS or in the Beaufort Sea or Prince William Sound 3.22-2

3.23-1 Trends in North Slope Oil Production and World Crude Prices 3.23-2

3.23-2 Alaska Population Statistics, 1970–2000 ..... 3.23-5

3.23-3 Alaska Gross State Product by Industry 3.23-6

3.23-4 Total Employment in Alaska by Industry 3.23-8

3.23-5 Unemployment Rates 3.23-9

3.23-6 State Personal Income and Alaska Permanent Fund Dividend 3.23-10

3.23-7 State Government Revenues 3.23-11

3.23-8 Local Government Revenues 3.23-12

3.23-9 State Government Expenditures 3.23-13

3.23-10 Local Government Expenditures 3.23-13

3.23-11 State Public Service Employment Data, 2000 ..... 3.23-14

3.23-12 Pipeline Corridor Region Population 3.23-15

3.23-13 Pipeline Corridor Region Employment by Industry, 1999 ..... 3.23-16

3.23-14 Pipeline Corridor Region Unemployment Rates 3.23-17

3.23-15 Pipeline Corridor Region Personal Income 3.23-18

3.23-16 Pipeline Corridor Region Local Government Tax Revenues, 2000 ..... 3.23-19

3.23-17 Pipeline Corridor Region Local Government Expenditures, 2000 ..... 3.23-20

3.23-18 Pipeline Corridor Region Local Education Data, 1999 ..... 3.23-20

3.24-1 Subsistence Resource Pounds Harvested per Capita in Directly Affected and Other Selected Rural Communities, Selected Recorded Year 3.24-7

TABLES (Cont.)

3.24-2 Percent Households in Directly Affected and Other Selected Rural Communities Participating in Subsistence Harvest, Selected Recorded Year 3.24-11

3.25-1 Directly Affected Villages in the Vicinity of the TAPS 3.25-6

3.25-2 Selected Characteristics of Regional Sociocultural Systems Shortly after Contact, in the Vicinity of the TAPS 3.25-7

3.25-3 Non-Native Rural Communities in the Vicinity of the TAPS 3.25-21

3.26-1 Prehistoric Context for Areas along the TAPS ROW 3.26-5

3.26-2 Alaska Historic Timeline 3.26-6

3.26-3 Cultural Resources Located along the TAPS 3.26-7

3.27-1 Conservation System Units in the Vicinity of TAPS 3.27-5

3.28-1 Visual Resources, Viewpoints, and Overlooks along the TAPS ROW Corridor 3.28-11

3.29-1 Minority and Low-Income Percentages for the State of Alaska, 29 Block Groups Intersecting the TAPS, and 45 Communities Likely To Be Affected Directly by Continued TAPS Operation, 2000 and 1990 ..... 3.29-7

VOLUME 2

4.1-1 Federal and State Agencies within the Joint Pipeline Office 4.1-2

4.1-2 Federal Grant Stipulations Related to the Mitigation of Impacts on Biological Systems 4.1-25

4.2-1 Planned Pump Station Upgrades 4.2-13

4.3-1 Potential Impacting Factors of the Proposed Action on Soil and Permafrost 4.3-5

4.3-2 Annual Volumes of APSC Waste and Total Volumes of All Wastes Received at Publicly Owned Landfills 4.3-29

4.3-3 Annual Occupational Hazard Rates Associated with Continued Operation of TAPS 4.3-37

4.3-4 Potential Human Health Risks Associated with Inhalation of Hazardous Air Pollutants in Valdez Area Ambient Air 4.3-40

4.3-5 Potential Impacts of the Proposed Action on Threatened, Endangered, and Protected Species 4.3-60

4.3-6 Projected North Slope Oil Production and World Crude Oil Prices 4.3-65

4.3-7 State Population Projections 4.3-69

4.3-8 Projected Alaska Gross State Product by Industry 4.3-70

TABLES (Cont.)

4.3-9	Projected Employment in Alaska by Industry	4.3-71
4.3-10	Projected Labor Force Participation, Employment, and Unemployment Rates	4.3-72
4.3-11	Projected State Personal Income and Alaska Permanent Fund Dividend	4.3-73
4.3-12	Projected State Revenues	4.3-74
4.3-13	Projected Local Revenues	4.3-75
4.3-14	State Government Expenditures	4.3-76
4.3-15	Local Government Expenditures	4.3-77
4.3-16	Forecasted Range for North Slope Oil Production	4.3-77
4.3-17	State Economic Effects of Changes in TAPS Oil Throughput Rates	4.3-78
4.3-18	State Economic Effects of Changes in Crude Oil Prices	4.3-80
4.3-19	Projected Pipeline Corridor Region Populations	4.3-81
4.3-20	Projected Pipeline Corridor Region Employment	4.3-81
4.3-21	Projected Pipeline Corridor Personal Income	4.3-83
4.3-22	Government-to-Government Interaction Summary	4.3-98
4.3-23	Summary of Anticipated Impacts Under the Proposed Action	4.3-100
4.4-1	Summary of Spill Scenarios for Continued Operation of the TAPS Pipeline	4.4-4
4.4-2	Summary of Spill Scenarios for Continued Operations of the TAPS Valdez Marine Terminal	4.4-7
4.4-3	Summary of Spill Scenarios for Continued Operation of the TAPS: Transportation Accidents	4.4-13
4.4-4	Airports within 10 Miles of the Pipeline	4.4-15
4.4-5	Milepost-Specific Maximum Guillotine Break Crude Oil Spill Volumes	4.4-18
4.4-6	Maximum Public Exposure to Soot and Fire Combustion Products	4.4-30
4.4-7	Maximum Worker Exposures to Soot and Fire Combustion Products, Valdez Marine Terminal Scenario 10	4.4-31
4.4-8	Thermal Radiation Exposures, Valdez Marine Terminal Scenario 10	4.4-31
4.4-9	Maximum Public Exposures to Soot and Fire Combustion Products, Pipeline Scenario 19b	4.4-35

TABLES (Cont.)

4.4-10 Maximum Public Exposures to Soot and Fire Combustion Products Close to the Fire, Pipeline Scenario 19b 4.4-36

4.4-11 Approximate Maximum Oil Discharges (bbl) at Major and Minor Elevated River Crossings Produced by a Guillotine Break in the Pipeline 4.4-42

4.4-12 River Parameters for Spill Analyses 4.4-43

4.4-13 Estimated Response Times for Various Spill Locations and a Guillotine Pipeline Break 4.4-44

4.4-14 Location of the Leading Edge of the Oil Slick at Estimated Response Times 4.4-44

4.4-15 Summary of Spill Results for a Worst-Case Anticipated Spill Scenario 4.4-45

4.4-16 Estimated Response Times for Various Spill Locations for a Likely Spill Scenario 4.4-47

4.4-17 Summary of Spill Results for a Worst-Case Likely Spill Scenario and a Small Hole 4.4-47

4.4-18 Summary of Spill Results for a Worst-Case Likely Spill Scenario and a Large Hole 4.4-48

4.4-19 Summary of Spill Volumes, Rates, and Drainage Times for River Crossings under Different Throughputs 4.4-50

4.4-20 Summary of Spill Analyses for a Worst-Case Very Unlikely Guillotine Break during High-Flow Conditions for Three Pipeline Throughput Levels 4.4-51

4.4-21 Summary of Spill Analyses for a Worst-Case Very Unlikely Guillotine Break during Low-Flow Conditions for Three Pipeline Throughput Levels 4.4-52

4.4-22 Belowground Segments of Pipeline in the Brooks, Alaska, and Chugach Ranges and Their Maximum Releases of Oil for a Guillotine Break 4.4-56

4.4-23 Maximum Release Volumes and Locations for a Belowground Guillotine Break Caused by a Landslide 4.4-58

4.4-24 GNOME Model Results for Spills to Port Valdez from the Valdez Marine Terminal 4.4-65

4.4-25 Spill Scenarios without Fire, Frequencies, Spill Volumes, and Receiving Media at Selected Spill Locations 4.4-68

4.4-26 Vapor Pressures and Weight Percents of Hazardous Air Pollutants in North Slope Crude Oil, Turbine Fuel, and Arctic Grade Diesel Fuel 4.4-70

4.4-27 Estimated Emission Rates of Hazardous Air Pollutants from Evaporation of Spilled Materials without Associated Fire 4.4-72

4.4-28 Alaska Cleanup Levels for Hydrocarbon-Contaminated Soil 4.4-76

4.4-29 Inhalation Impacts of Pipeline Spills: Maximum 1-Hour Pollutant Concentrations and Impact Distances 4.4-80

TABLES (Cont.)

4.4-30 Inhalation Impacts of Valdez Marine Terminal Spills: Maximum 1-Hour Pollutant Concentrations and Impact Distances 4.4-83

4.4-31 Inhalation Impacts of Transportation Spills: Maximum 1-Hour Pollutant Concentrations and Impact Distances 4.4-86

4.4-32 Inhalation Impacts of Spills to Rivers: Maximum 1-Hour Pollutant Concentrations and Impact Distances 4.4-88

4.4-33 Near-Field Impacts of Crude Oil Spills with Associated Fire 4.4-91

4.4-34 Far-Field Impacts of Crude Oil Spills with Associated Fire 4.4-93

4.4-35 Foodchain Risk from Ingestion of PAH-Contaminated Shellfish Compared with Risk from Ingestion of Smoked Salmon 4.4-97

4.4-36 Estimated Proportions of Oil to Water under High- and Low-Flow Conditions for Hypothetical Guillotine Breaks at Selected River Crossings 4.4-106

4.4-37 Potential Impacts of Oil Spills on Threatened, Endangered, and Protected Species 4.4-112

4.4-38 Impacts of Spill Scenarios on Daily State Revenues in 2004 ..... 4.4-118

4.4-39 Summary of Anticipated Impacts under Spill Scenarios 4.4-138

4.4-40 Communities Within 4.0 km of the TAPS Possibly Experiencing High Human Health Impacts due to *Unlikely* or *Very Unlikely* Spills 4.4-140

4.4-41 Selected Communities Possibly Affected by Worst-Case *Very Unlikely* Guillotine Break during High-Flow Conditions, Gulkana and Copper Rivers 4.4-142

4.5-1 Summary of the Effects of the Renewal Period on Spill Scenarios 4.5-6

4.5-2 Summary of Anticipated Impacts under the Less-Than-30-Year Alternative 4.5-18

4.6-1 Possible Durations of Termination Activities and Long-Term Restoration under the No-Action Alternative 4.6-2

4.6-2 Summary of Spill Scenarios for the No-Action Alternative 4.6-3

4.6-3 Anticipated Potable Water Use during Termination Activities 4.6-11

4.6-4 Anticipated Process Water Use during Pipeline Dismantlement and Removal Phase 4.6-11

4.6-5 Estimated Potential Average Annual Emissions of Criteria Pollutants and Volatile Organic Compounds from Termination Activities 4.6-20

4.6-6 Estimated Potential Average Annual Emissions of Criteria Pollutants and Volatile Organic Compounds from Vehicular and Rail Traffic 4.6-22

TABLES (Cont.)

4.6-7 Estimated Potential Average Annual Emissions of Hazardous Air Pollutants from Termination Activities 4.6-24

4.6-8 Annual Waste Shipments during Pipeline Termination Activities 4.6-28

4.6-9 Maximum Annual Occupational Hazards Associated with Termination Activities under the No-Action Alternative 4.6-36

4.6-10 Estimated Sizes of Areas in Which the Aboveground Pipeline and Associated Workpad Are Located in Important Wildlife Habitats 4.6-47

4.6-11 Potential Impacts of the No-Action Alternative on Threatened, Endangered, and Protected Species 4.6-51

4.6-12 State Population Projections 4.6-58

4.6-13 Projected Alaska Gross State Product by Industry 4.6-59

4.6-14 Projected Employment in Alaska by Industry 4.6-61

4.6-15 Projected Labor Force Participation and Employment and Unemployment Rates 4.6-62

4.6-16 Projected State Personal Income and Alaska Permanent Fund Dividend 4.6-62

4.6-17 Projected State Revenues 4.6-64

4.6-18 Projected Local Revenues 4.6-65

4.6-19 State Government Expenditures 4.6-66

4.6-20 Local Government Expenditures 4.6-66

4.6-21 Projected Populations in Pipeline Corridor Region 4.6-68

4.6-22 Projected Pipeline Corridor Employment 4.6-68

4.6-23 Projected Pipeline Corridor Personal Incomes 4.6-69

4.6-24 Summary of Anticipated Impacts under the No-Action Alternative 4.6-84

VOLUME 3

4.7-1 Regions of Interest for the Cumulative Assessment 4.7-4

4.7-2 Potential Contributions to Cumulative Effects in the Beaufort Sea, North Slope, Interior Alaska, and Prince William Sound 4.7-14

4.7-3 Oil Fields Located in Alaska and the Arctic Outer Continental Shelf 4.7-31

4.7-4 Spill Scenarios for the North Slope 4.7-49

4.7-5 Transportation Spill Scenarios 4.7-52

TABLES (Cont.)

4.7-6	Spill Scenarios for Tanker Accidents in the Prince William Sound	4.7-54
4.7-7	Activities and Impacting Factors Associated with the Reasonably Foreseeable Actions That Would Contribute to a Cumulative Effect	4.7-57
4.7-8	Toxics Release Inventory Reportable Emissions for the State of Alaska in 1999	4.7-82
4.7-9	Cumulative Impacts to Threatened, Endangered, and Protected Species on the North Slope and Beaufort Sea	4.7-103
4.7-10	Cumulative Impacts on Threatened, Endangered, and Protected Species in Interior Alaska	4.7-104
4.7-11	Cumulative Impacts on Threatened, Endangered, and Protected Species in Prince William Sound	4.7-105
4.7-12	Summary of Anticipated Cumulative Impacts Under the Proposed Action	4.7-125
4.7-13	Summary of Cumulative Effects	4.7-129

VOLUME 4

A-1	Conceptual Model for the Effects of the Proposed Action, the Less-Than-30-Year Renewal Alternative, and No Action on Biological Resources	A-17
A-2	Economic and Demographic Impact Parameters Examined for the Proposed Action, Less-Than-30-Year Renewal Alternative, and No-Action Alternative	A-21
A-3	Types and Properties of Oil	A-35
A-4	Event Frequency Classifications	A-36
A-5	Physical Constants for Ice-Melt Calculation	A-44
A-6	Past, Present, and Reasonably Forseeable Future Actions	A-50
C-1	Summary of EPCRA Tier II Report for Calendar Year 2000	C-6
C-2	Hazardous Wastes Generated at the Mainline Refrigeration Unit 2, Northstar Terminal, and VALDEZ Marine Terminal in 1998–1999	C-11
C-3	Solid Waste Disposal Sites Currently Used by APSC	C-17
C-4	APSC Recycled Waste Types, Sources, Disposition, and Amounts	C-19
C-5	Ballast Water Treatment Facility Influent Sources at Valdez Marine Terminal	C-21
C-6	Ballast Water Treatment Facility Effluent Flow Averages in 2000	C-26
C-7	Discharges Addressed in the Linewide NPDES Permit for 1998	C-27
C-8	Sanitary Waste Treatment Plant Effluent Flow Averages for 2000	C-28

TABLES (Cont.)

C-9	Typical Effluent Flows of Sanitary Wastewater at Various Sites in 1997	C-30
C-10	Amounts of Medical Wastes and Solid Wastes Burned in APSC Incinerators in 2000	C-33
C-11	Contaminated Soil Stockpiled at the Valdez Marine Terminal	C-37
C-12	North Slope Injection Wells	C-40
D-1	Communities in Proximity to the TAPS, Demographic and Subsistence Overview	D-13
D-2	Subsistence Harvest Summary for Alatna in 1998	D-16
D-3	Subsistence Harvest Summary for Allakaket/Alatna in 1982	D-19
D-4	Subsistence Harvest Summary for Allakaket in 1998	D-20
D-5	Subsistence Harvest Summary for Anaktuvuk Pass in 1993	D-21
D-6	Subsistence Harvest Summary for Chenega Bay in 1993	D-26
D-7	Subsistence Harvest Summary for Chitina in 1987	D-32
D-8	Subsistence Harvest Summary for Copper Center in 1987	D-36
D-9	Subsistence Harvest Summary for Cordova in 1997	D-40
D-10	Subsistence Harvest Summary for Evansville in 1998	D-43
D-11	Subsistence Harvest Summary for Bettles/Evansville in 1982	D-44
D-12	Subsistence Harvest Summary for Gakona in 1987	D-50
D-13	Subsistence Harvest Summary, Glennallen in 1987	D-54
D-14	Subsistence Harvest Summary for Gulkana in 1987	D-60
D-15	Subsistence Harvest Summary for Hughes in 1982	D-66
D-16	Subsistence Harvest Summary for Kenny Lake in 1987	D-70
D-17	Subsistence Resources Harvested by Residents in the Manley Hot Springs and Eureka Area in 1996	D-73
D-18	Subsistence Harvest Summary for Minto in 1984	D-78
D-19	Subsistence Harvest Summary for Nanwalek in 1997	D-82
D-20	Subsistence Harvest Summary for Nuiqsut in 1993[a]	D-88
D-21	Subsistence Harvest Summary for Paxson in 1987	D-94

TABLES (Cont.)

D-22	Subsistence Harvest Summary for Port Graham in 1997	D-100
D-23	Subsistence Harvest Summary for Rampart in 1993	D-103
D-24	Subsistence Harvest Summary for Stevens Village in 1984	D-108
D-25	Subsistence Harvest Summary for Tanana in 1987	D-114
D-26	Subsistence Harvest Summary for Tatitlek in 1997	D-120
D-27	Subsistence Harvest Summary for Tazlina in 1987	D-126
D-28	Subsistence Harvest Summary for Tonsina in 1987	D-129
D-29	Subsistence Harvest Summary for Wiseman in 1991	D-134