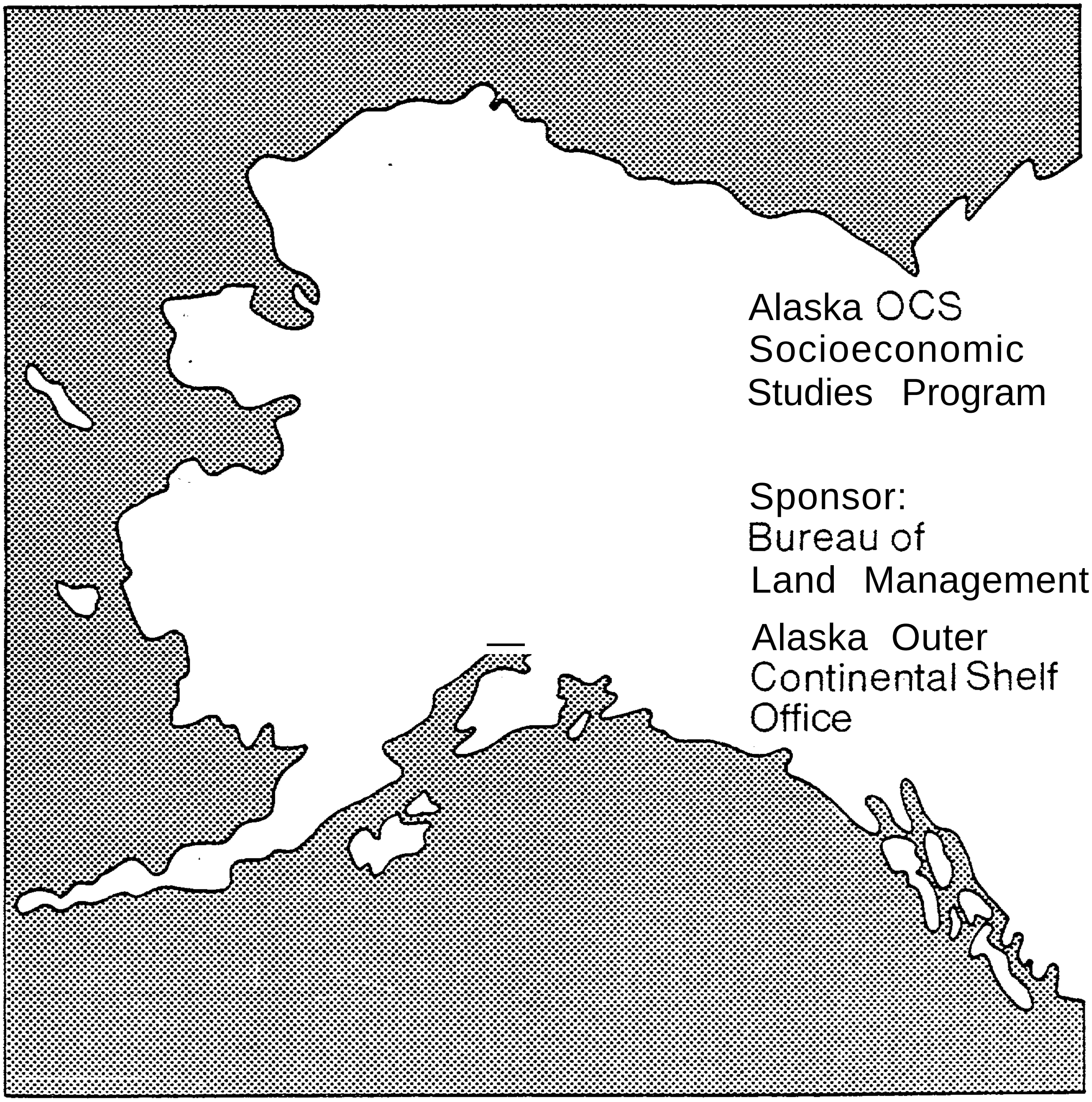
Technical Report
Number 52



Alaska OCS
Socioeconomic
Studies Program

Sponsor:
Bureau of
Land Management
Alaska Outer
Continental Shelf
Office

Bering-Norton
Petroleum Development Scenarios
Transportation Systems Analysis

The United States Department of the Interior was designated by the Outer Continental Shelf (OCS) Lands Act of 1953 to carry out the majority of the Act's provisions for administering the mineral leasing and development of offshore areas of the United States under federal jurisdiction. Within the Department, the Bureau of Land Management (BLM) has the responsibility to meet requirements of the National Environmental Policy Act of 1969 (NEPA) as well as other legislation and regulations dealing with the effects of offshore development. In Alaska, unique cultural differences and climatic conditions create a need for developing additional socioeconomic and environmental information to improve OCS decision making at all governmental Levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program (SESP).

The Alaska OCS Socioeconomic Studies Program is a multi-year research effort which attempts to predict and evaluate the effects of Alaska OCS Petroleum Development upon the physical, social, and economic environments within the state. The overall methodology is divided into three broad research components. The first component identifies an alternative set of assumptions regarding the location, the nature, and the timing of future petroleum events and related activities. In this component, the program takes into account the particular needs of the petroleum industry and projects the human, technological, economic, and environmental offshore and onshore development requirements of the regional petroleum industry.

The second component focuses on data gathering that identifies those quantifiable and qualifiable facts by which OCS-induced changes can be assessed. The critical community and regional components are identified and evaluated. Current endogenous and exogenous sources of change and functional organization among different sectors of community and regional life are analyzed. Susceptible community relationships, values, activities, and processes also are included.

The "third research component focuses on an evaluation of the changes that could occur due to the potential oil and gas development. Impact evaluation concentrates on an analysis of the impacts at the statewide, regional, and local level.

In general; program products are sequentially arranged in accordance with BLM's proposed OCS lease sale schedule, so that information is timely to decisionmaking. Reports are available through the National Technical Information Service, and the BLM has a limited number of copies available through the Alaska OCS Office. Inquiries for information should be directed to: Program Coordinator (COAR), Socioeconomic Studies Program, Alaska OCS Office, P. O. Box 1159, Anchorage, Alaska 99510.

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Alaska OCS Socioeconomic Studies Program

BERING-NORTON
PETROLEUM DEVELOPMENT SCENARIOS
TRANSPORTATION SYSTEMS ANALYSIS

Prepared for

Bureau of Land Management

Alaska Outer Continental Shelf Office

Prepared by

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and

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MARCH 1980

NOTICE

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to present and discuss transportation impacts of potential oil and gas development resulting from the proposed federal outercontinental shelf (OCS) lease sale number 57, located in the Bering Sea-Norton Sound area of Alaska. The study of transportation impacts is one of several key study elements of a larger integrated effort to evaluate the broad range of possible socioeconomic impacts of the Bering-Norton lease sale. In turn, this series of Bering-Norton studies is part of the Bureau of Land Management's (BLM) Alaska OCS Socioeconomic Studies Program (SESP), which seeks to evaluate all federal OCS lease sales planned for Alaska.

This study of regional transportation impacts was prepared for use by BLM decision makers in various steps of the federal OCS management process. Particular emphasis is placed on making the methodological and existing conditions sections of the report useful as input to the environmental impact statement (EIS) and secretarial issue documents (SID), which must be prepared for the Bering-Norton lease sale. In addition, the impacts information is expected to aid BLM's development of lease-sale stipulations and their long-range assessment of the transportation effects of federal lease-sale policy.

Two important limitations of this report effect its broader usefulness. The development of a "transportation plan" to deal with OCS issues was not a purpose of the study, nor was the study to investigate measures to ameliorate impacts. These limitations were imposed because many other factors, beyond those identified herein, will enter the federal decision making process. State and local governments, other agencies, or groups and individuals must be provided the opportunity to make independent assessments of alternatives and mitigating factors. In the federal OCS management process, the opportunity to present plans and suggest mitigating measures exists through the mechanism of the EIS. By making this report available, it is hoped that the information will be useful to these various non-federal entities as they plan for the proposed sale and respond to the federal government's decisions 'through the EIS.

1,2 Scope

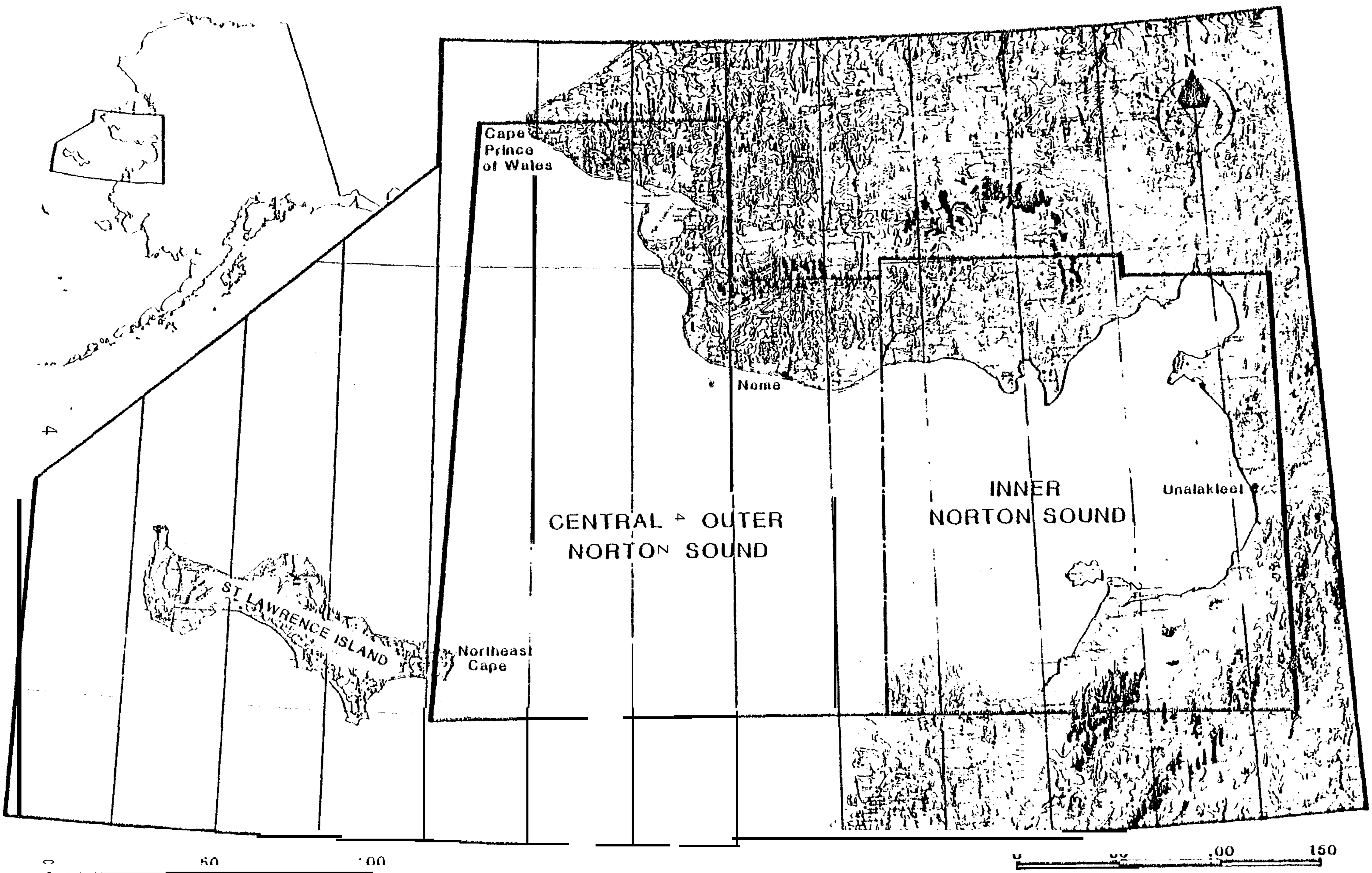
This study of transportation impacts concentrates on determining the effects of OCS development on regional transportation services and facilities. The evaluation attempts to compare an estimate of the future demand for transportation services and facilities associated with varying levels of intensity of OCS development against an estimate of the capacity of existing or planned services and facilities. Forecasts are prepared for each year following the lease sale up to the year 2000. Both the benefits and deficiencies noted in this comparison are considered impacts. The analysis seeks to bracket the range of potential impacts and, thus, deals with only the peak activity periods. The modes of travel to be examined are dependent upon the nature of the oil and gas activities in the region and existing transportation services and facilities. The areal extent of the study is determined by the systemic character of the modes to be examined.

The proposed Bering-Norton Lease Sale, No. 57, currently scheduled for November, 1982, is the first lease sale scheduled for the Bering Sea OCS. The area initially identified for sale is described by the U.S. Geological Survey to be bounded in the east by longitude 162° W., in the west by longitude 170° W., in the north by latitude 65° N., and in the south by latitude 63° N. Along the shoreline of Norton Sound, the Seward Peninsula and northeastern St. Lawrence Island, the lease area boundary lies seaward of the three mile limit of state waters. This area covers approximately 40,000 sq. kilometers (15,444 sq. miles, Dames & Moore, 1980). For discussion purposes, the offshore area of Norton Sound is divided into an "Inner" and a "Central and Outer" segment, as shown in Figure 1.*

Due to the nature of potential oil and gas activities in this lease sale area, the transportation impacts analysis is focused on the City of Nome and its surrounding region, which is defined to ncorporate the Nome and Wade Hampton Census Divisions. The area inc' udes St. Lawrence Island, most of the Seward Peninsula, and the eastern and southern parts of Norton Sound south to the Yukon River Delta. Within this region people and some perishable goods travel by airplane, while most freight travels by boat. OCS oil and gas activities are dependent upon, and are therefore expected to affect both modes,

The City of Nome serves as the regional distribution center for both the aviation and marine modes of travel. Since it is anticipated to maintain this role throughout any of the prospective OCS development activities, Nome is treated as an entity in this report. The remainder of the

*This initial sale area is expected to be reduced during the tract selection process and possibly reduced further for environmental or other reasons at a later stage of the OCS decision making process.


N
Cape
Prince
of Wales
Nome
Unalakleet
CENTRAL + OUTER
NORTON SOUND
INNER
NORTON SOUND
ST LAWRENCE ISLAND
Northeast
Cape
0
50
100
150

FIGURE

Nome-Wade Hampton region, as both generator and recipient of this distributive junction, will also be treated as an entity. With the exception of Unalakleet local communities in the region are not dealt with individually. Because of the systemic characteristic of the marine and aviation modes of travel, the study also encompasses the City of Unalaska/Dutch Harbor, which is a major marine transshipment point for western Alaska; and the City of Anchorage, which is a major aviation transshipment point for the Nome-Wade Hampton region.

It should be noted that existing conditions data was gathered for the City of Kotzebue as a part of the early stages of this study. However, the purpose of this effort was to collect the data for a later transportation impacts study of an OCS lease sale proposed for the Chukchi Sea area. This information has been included in Chapter 3.

1.3 Content and Format of This Report

This report is structured to follow the general impact evaluation process of the Socioeconomic Studies Program. This process analyzes existing conditions and trends and uses these as the foundation for developing a "Base Case" alternative future. For each of several hypothetical petroleum development scenarios, the characteristics of the scenario are combined with those of the Base Case to create several "OCS cases." Each OCS case is then compared to the Base Case to identify the positive and negative impacts of OCS activities. A more definitive explanation of the SESP methodology can be found in the "Second Program Summary Report" (PMM&Co., 1980), A more definitive explanation of the methodology employed in this report is found in Append x B with an overview of methodology contained in Chapter 2.

As mentioned above, the beginning point of this study is the identification of existing conditions, which are presented in Chapter 3, together with an analysis of current trends. A forecast of these trends to the year 2000 and a brief description of the alternative future they portend is the focus of the Base Case, Chapter 4. A summary description of four possible petroleum development scenarios and their influence on the transportation system of the Base Case are presented in Chapters 5 through 8. These OCS cases represent: an "exploration only"* situation (Chapter 5); a "most likely" or "medium find" situation (.Chapter 6); and "Low Find" and "High Find" extremes of the range of potential conditions (Chapters 7 and 8, respectively).

Because some-terminology used in this study is unique to transportation impacts analysis, as an aid to the reader, a glossary of these terms is included as Appendix A.

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* The term "exploration only" implies that during the exploration phase no oil or gas is found in large enough quantities to be commercially recoverable, and no further development takes place.

2.0 METHODOLOGICAL OVERVIEW

2.1 Introduction

This chapter presents a brief overview of the methodology guiding this transportation impacts analysis. Included in this chapter is a brief background discussion of the SESP study impact process, of which the transportation impacts analysis is but one part. Significant within this process is the relationship to and dependence upon other studies in the process. Since the transportation impact study process is slightly . different from the transportation planning process, a brief discussion of the difference between the two is also presented. These discussions should provide sufficient background to understanding data presented in the next several chapters. A glossary of unique terms and a more detailed technical discussion of the methodology are included as Appendix A and Appendix B, respectively.

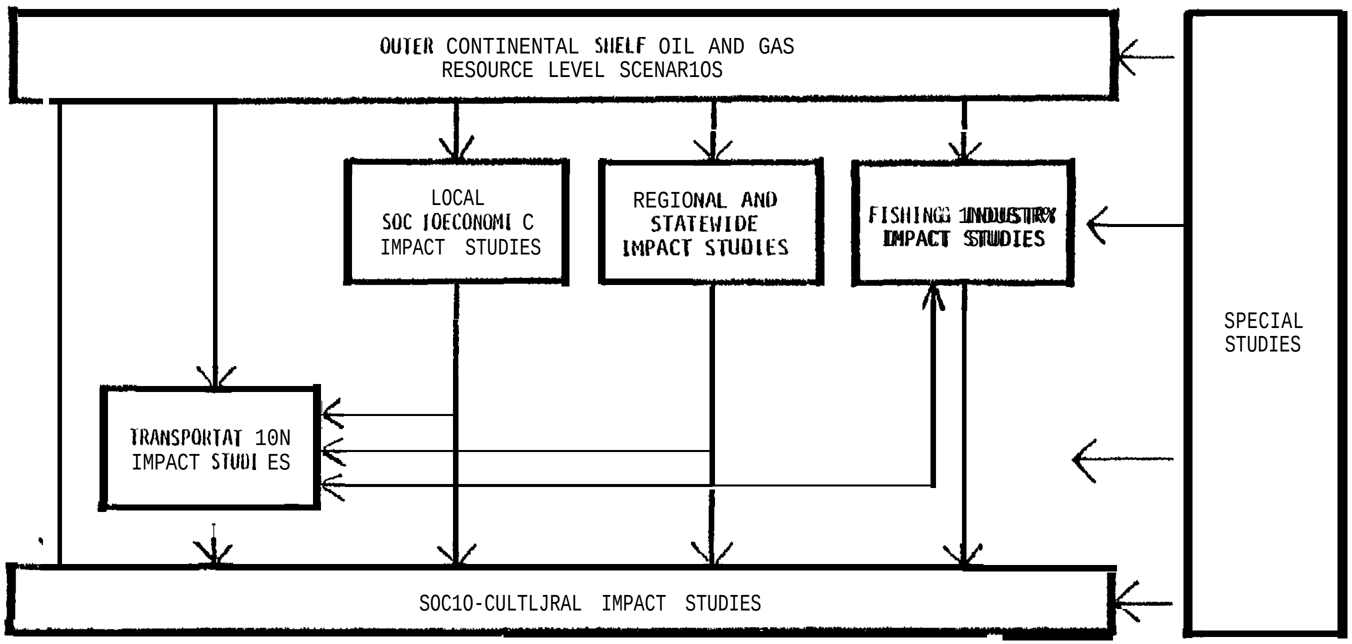
2.2 SESP Process

SESP studies are organized nto two major groupings: Core Technical Studies and Special Technical Studies. Core studies are labeled as such because they form the nucleus of the program and are directed at a lease-sale specific analysis of change induced by OCS activities. Special studies include case study analyses and other special investigations that tend to be program-wide in nature, but may be concentrated on a specific lease sale.

The core technical studies and directional flow of information among them are identified in Figure 2. The organization of these studies is based upon an SESP study method which focuses on a longitudinal investigation of the OCS oil and gas development process. This methodology encompass the assembly of predevelopment information and pre-sale forecasting of impacts and continues through post-sale monitoring of project development as it affects specific communities, regions, or the state as a whole. The pre-sale impacts analysis moves forward in two steps. The first step is the analysis and projection of OCS petroleum development activities (scenarios). These scenarios provide a description of expected OCS actions for several levels of resource finds and serve as the impacting agent in the second step, which is the impacts analysis. The post sale analysis is designed to identify the specific actions taken by the oil industry during . each phase of development and to define the specific responses of local , regional, and statewide organizations and agencies. This analysis of transportation impacts is part of the pre-sale information development

FIGURE 2

RELATION AMONG PRE-SALE SESP STUDIES



Source: Modified from Peter Eak and and Associates, 1979.

and impacts forecasting activities of the SESP.

4

Of particular interest to each of the pre-sale impact studies are the oil and gas development hypotheses which drive the impacts analysis. In the SESP, a scenario is defined as the sequence of petroleum development events in a lease sale area corresponding to a given level of potentially recoverable oil and gas resources. The forecast of petroleum development activities takes into account the particular needs of the petroleum industry in each development region and projects the human, material, economic, and environmental requirements of the offshore development. Depending on the level of recoverable resources, up to four scenarios are prepared for each lease sale. Each scenario corresponds to a different magnitude of resource find. These provide a range of potential direct employment and equipment characteristics together with a likely location of both in the lease sale area. In order of increasing magnitude of activities, the four scenarios are labeled "Exploration," "Medium Find," "High Find," and "Low Find." Each is mutually exclusive of the others.

In step two, which includes the various impact studies identified in Figure 2, the evaluation begins with an analysis of existing conditions by forecasting a base case situation. The base case assumes continuation of existing trends and also assumes that the planned lease sale being evaluated does not occur. Next, a set of forecast conditions assuming the sale does occur are prepared for each of the scenarios. Finally, each of the OCS forecasts is compared to the base case forecast to determine the extent of change attributable to each scenario.

The SESP is organized in an integrated manner so that the transportation impacts analysis depends heavily on the population and economic forecasts developed in the local, regional, and statewide socioeconomic studies. This flow of information within the program is illustrated in Figure 2 by the directional arrows. As the diagram illustrates, data generated in the transportation impacts study is also needed by contractors working on the sociocultural impacts analysis.

2.3 Transportation Impacts vs. Transportation Planning Studies

It is important at this point to note that the study program is not a planning study seeking alternative or mitigating solutions. Although the documents are being prepared for federal decision makers, the studies program will not make recommendations for action either to the federal government or to the affected communities. The reason for this is because many other factors beyond those identified by the studies program will eventually enter the decision making process. Consequently, program activities are focused solely on analysis. State, regional, and local governments, and other agencies or individuals are provided the opportunity to make their own assessments of alternatives or mitigations and must themselves determine the adequacies of these in dealing with projected impacts.

Since the SESP is not a planning program, the transportation impact assessment process (TIAP) differs in several important aspects from the standard, or normative, transportation planning process (STPP). A brief understanding of the differences between the processes, hopefully, will assist those who review this study. In particular, the discussion should aid in understanding the reasoning behind the organization and content of this study, and should allow the reader to be better able to use the results. In this regard it is important to note that the results of the TIAP and the STPP are never fully compatible, nor should they be, since they are designed to serve markedly different purposes. Nevertheless, they should be viewed as complimentary.

Table 1 shows a generalized methodology for both the STPP and the TIAP with comparable steps placed alongside each other. The most obvious difference between the two processes is that the STPP has two additional steps, namely, the development of transportation alternatives and the selection of a recommended plan and implementation strategy.

The purpose of the STPP is to generate short and long-range recommendations for transportation facilities, services, and policies that adequately meet transportation demands, taking into consideration financial, technical, socioeconomic, and environmental considerations. The ST?? is characterized as being action oriented in that the performing agency is expected to use the study results to reach specific conclusions and to make specific decisions. An STPP study is guided by a set of commonly agreed upon goals and objectives, which are prepared as an early part of the study and which are used to evaluate the results. While a range of possible conclusions may be evaluated, the final product is aimed at reaching an optimum solution.

TABLE 1

COMPARISON OF TRANSPORTATION PLANNING PROCESS
TO THE
TRANSPORATION IMPACT PROCESS

Transportation Planning Process		Transportation Impact Process	
Step	Description	Step	Description
1	Goals and Objectives	1	OCS Leasing Process
2	Inventory of Existing Conditions	2	Inventory of Existing Conditions
3	Development of Socio-economic Forecasts	3	Development of OCS Scenarios, Base Case, and OCS Cases
4	Forecasting of Transportation Demands	4	Forecasting of Transportation Demands for Base Case and OCS Cases
5	Development of Transportation Alternatives		---
6	Evaluation of Transportation Alternatives	5	Assessment of Transportation Impacts
7	Selection of Recommended Plan and Implementation Strategy		--

Source: Adapted from Peter Eakland and Associates, 1980

The TIAP, on the other hand, has a narrower focus from several perspectives. The scope, direction, and type of conclusions are externally directed in that study requirements are dictated by the OCS " leasing process, which incorporates federal laws and administrative regulations. The TIAP for the most part analyzes facilities and services separately rather than from a systems perspective, although all relevant elements of local, regional, and statewide transportation systems in the study area are considered. However, the TIAP stops short of identifying any transportation improvements not already publicly acceptable. In the end the TIAP does not produce a single product but instead a range of cumulative and incremental transportation impacts. Financial and environmental considerations, which are important to the STPP, are of limited concern in the TIAP.

The STPP is designed to be a continuing planning process for each study area. Its results are up-dated every three to five years as additional information becomes available. The TIAP, on the other hand, is undertaken only once for a given lease sale, although the direct transportation demands and impacts may extend twenty years or more after the lease sale is made. The same study area will be examined again only if a later lease sale is scheduled for the same place. Tine continuing aspect of the TIAP is that it sequentially assesses the cumulative and incremental impacts of OCS leases according to the Bureau of Land Management's proposed leasing schedule. Some overlapping of study areas will inevitably result from one study to the next, but otherwise, one study cannot be considered as a continuing effort of a previous study.

The focus of the TIAP on OCS-related activities and of the STPP on overall activities requires the use of different considerations in establishing a study area, deciding what information should be gathered, and disaggregating this information. Choice of study area for the STPP is heavily influenced by political and administrative boundaries, which is natural because of the process' orientation towards implementation. The STPP study area tends to be homogeneous. The TIAP, instead, largely ignores such boundaries and attempts to include all system related areas potentially impacted by a given OCS lease sale. The study area may not be geographically continuous. For example, Anchorage is included in all impact studies because the aviation system is oriented around the city and because certain administrative elements of OCS activities are located there.

The STPP inventory focuses on the use of facilities and services falling under the jurisdiction of agencies conducting the process. The TIAP focuses on all facilities and services, both public and private, which are potentially impacted by OCS-related transportation demands.

The differences influencing study area and inventory extend into the forecasting of socioeconomic conditions, which is step 3 in both processes. Socioeconomic conditions are disaggregate in the STPP by variables that influence the level and type of trip-making, such as sector employment, household income, and land density, It is difficult, if not impossible, to isolate the effects of individual development activities. Although a range of socioeconomic options is usually generated initially in the STPP, a single set of conditions is usually chosen for detailed analysis. In the TIAP, specific OCS activities and employment are separated from other activities. The OCS scenarios establish the timing, location, and character of development for a range of economic discoveries of oil and gas. Socioeconomic forecasts attempt to use the information to show the incremental influence of OCS activities on an extension of current trends and conditions.

The information developed in step 3 of each process is used to generate transportation demands by facility and route for each mode. As with the forecast of socioeconomic conditions, the TIAP disaggregate demands into direct OCS-related and population-related categories, while for the STPP, disaggregation is by such categories as trip purpose and handling category. The forecasting procedures are less complex for the TIAP since they do not have to take into account the implications of major transportation improvements such as those that will be developed in step 5 of the STPP.

The development of transportation alternatives (step 5) exists only in the STPP. The do-nothing alternative represents the lowest level of improvements and includes existing facilities and services and those that have been committed for implementation. In the TIAP, the transportation system in the non-OCS case closely resembles that of the do-nothing alternative. The only additional facilities included in the base case are those specifically included in the medium scenario of previous lease sa˙es. For the OCS cases, additional facilities are limited to those inc" uded in the scenarios for the OCS lease sale under consideration.

Step 6 of the STPP is evaluation of transportation alternatives and is comparable to step 5 of the TIAP, which is assessment of transportation impacts. "In the STPP, one set of socioeconomic conditions is arrayed against numerous transportation alternatives while for the TIAP one set of transportation conditions is arrayed against a range of OCS development conditions. In both the evaluation and impact assessment steps, the relationship of transportation supply to demand is first explored for each set of socioeconomic and transportation conditions. Then the differences between the sets are explored. The separate analyses for the TIAP concern cumulative impacts and those for the STPP concern the ability of the transportation alternative to provide for total transportation demands and to meet the study's goals and objectives.

The evaluation of alternatives in the STPP is a multi-dimensional task. Each alternative is treated as equally likely in the evaluation stage. Differences between alternatives are used to establish trade-offs. For the TIAP, emphasis in both the cumulative and incremental analyses is placed on the medium find OCS case, since it is the most likely. Two types of assessments are made: First, the character of the medium find OCS case is compared to that of the base case to determine likely differences or changes (impacts). Second, the character of the other OCS cases are compared against that of the medium find OCS case to determine relative degrees of greater or lesser impact.

In summary, the two processes have some similarities but in may ways are
9 only complementary. Intermediate information and observations developed

in the TIAP can be useful to those pursuing other transportation planning studies. Hopefully, an understanding of the purpose of the SESP and of the focus, direction, and methodology employed in this study will increase this report's usefulness.

3.0 EXISTING CONDITIONS

3.1 Introduction

The purpose of this chapter is to establish the current status of transportation facilities, services, routes and regulations that affect the Bering-Norton study area. The resulting description of baseline conditions and analysis of trends in transportation demand and supply will serve in later chapters of this report as the basis for forecasting transportation demands arid potential OCS impacts. Emphasis is placed on the City of Nome since Nome is expected to continue as the regional transshipment center, and because of this, the Nome area is likely to be a choice location for a principal OCS supply base. Baseline data was gathered and a more limited analysis was conducted for the City of Unalaska/Dutch Harbor and the Village of Kotzebue. This latter data was collected to aid in defining the western Alaska transportation system, but is primarily aimed at developing transportation system information for subsequent lease sale studies in the St. George Basin and Chukchi Sea lease sale areas.

The predominant modes of transportation in the Bering-Norton area are aviation and marine transportation. The discussion of each mode centers on:

- Terminal characteristics -- including:
  - facilities
  - navigation
  - usage
  - capacity
- Carriers -- including:
  - scheduled
  - contract

- Shipping rates and tariffs
- Applicable regulations and regulating agencies

3.2 Water Mode

The water mode of transportation in western Alaska providesan important service during a limited summer operating season. Virtually all commodities having low value to weight ratios, such as construction materials, petroleum products, and transportation and construction equipment, are shipped by this mode to and within western Alaska. With the exception of personal travel by small outboard engine-powered boats, water transportation in western Alaska is exclusively freight oriented. (WAATS, 1979)

Two types of vessels service western Alaska: Tug and barge and general cargo. Goods are shipped from Seattle, either directly to the many western Alaska communities, or indirectly through transshipment hub ports such as Kotzebue, Nome, St. Michael , Bethel, Dillingham, and Unalaska/Dutch Harbor, The linehaul movement of goods from Seattle is handled by oceangoing vessels, however, direct access to communities is restricted by shallow coastal areas. The exceptions are Unalaska/Dutch Harbor, which has deep draft capacity, and Bethel, which has medium draft capacity. Other hub communities are served by shallow draft lighters which ply between the linehaul vessels anchored in deeper water offshore and the communities. The transshipment of goods through the hub ports to other coastal communities is also handled by the shallow draft lighters. Due to the lack of public facilities in all but the hub ports, goods are delivered to most communities over the beach.

The following discussion presents in order the terminal characteristics, services, rates, and applicable institutional factors for the hub ports of Nome, Kotzebue, and Unalaska/Dutch Harbor.

3.2.1 MARINE TERMINALS

Each marine terminal point will be examined from several viewpoints to determine its present role in the overall marine freight system and its future potential, They are as follows: (1) available physical facilities and their dimensions including docks and unloading facilities; (2) water depth and navigational conditions, which limit the size of ships and barges that can use the facilities; (3) facilities usage and operations; and (4) an estimate of port capacity based on existing physical conditions and operating characteristics.

Table 2 provides an overview of terminal facilities available for the ports of Nome, Kotzebue, and Unalaska/Dutch Harbor. The fact that a port does not have certain facilities should not be interpreted to mean they need those facil ities. Each port's needs must be individually determined.

3.2.1.1 port of Nome

Facilities. The port of Nome is located at the mouth of the Snake River just west of the town center as shown in Figure 3.

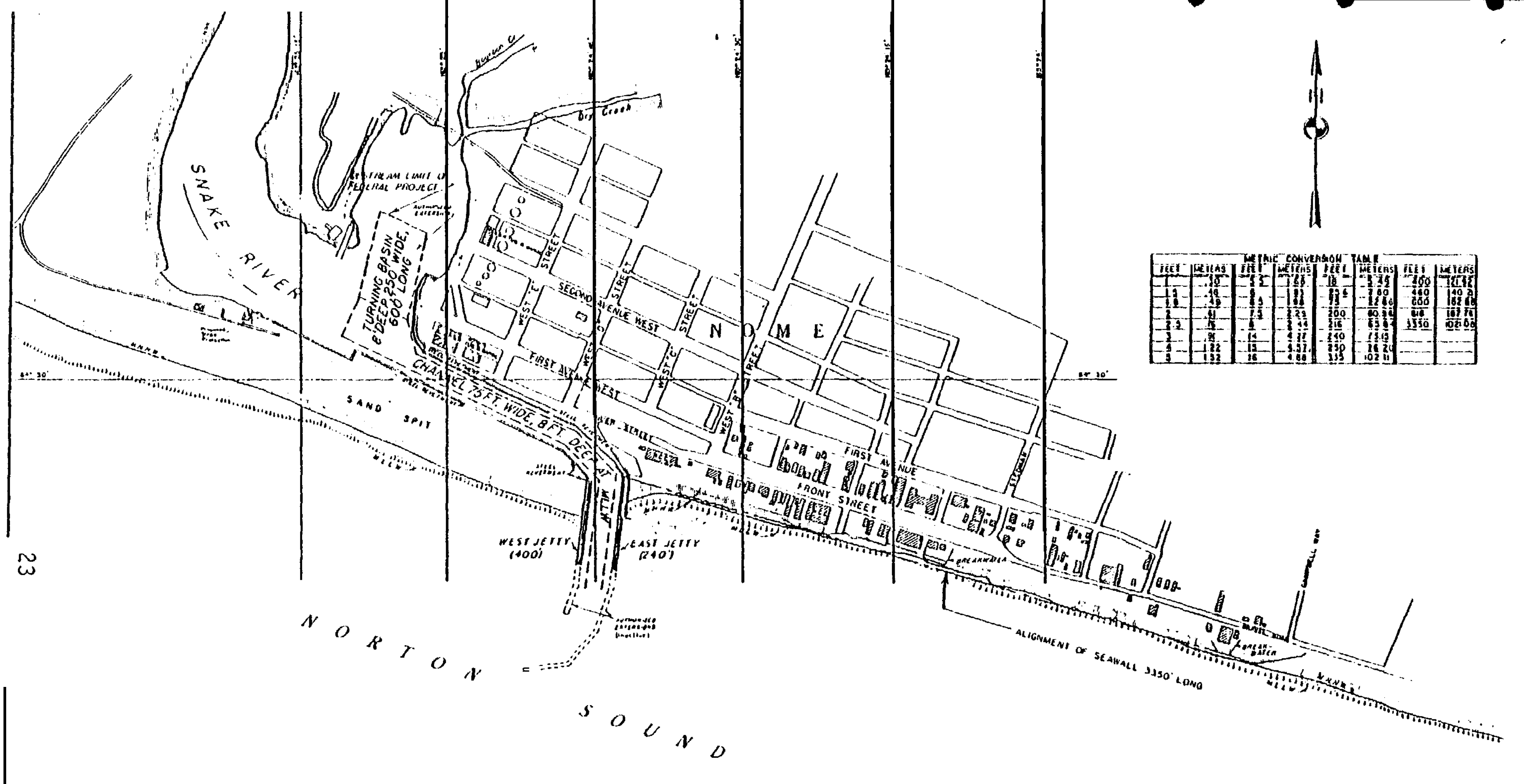
The harbor consists of two jetties: a west jetty and an east jetty. The west jetty is approximately 122 meters (400 feet) long and the east jetty is approximately 73 meters (240 feet) long. Both are constructed from concrete and steel. The jetties lead into a channel that is 23

TABLE 2.

MARINE FACILITIES 1NVENT0R%

	Nome	Kotzebue	Unalaska/Dutch Harbor
Breakwater	No	No	No
Dock	Yes	Yes	Yes
Berths	No	No	No
F1 oats	No	No	No
Freight Terminal	Yes	No	No
Freight Storage	Yes	Yes	Yes
Transshipment Point	Yes	Yes	Yes
Passenger Terminal	No	No	No
Boat Repair	No	No	No
Boat Launch	No	No	No
Availability of:			
Fueling Facilities	Yes	Yes	Yes
Customs	Yes	Yes	Yes

Source: State of Alaska, Office of Coastal Management. Coastal Inventory.



METRIC CONVERSION TABLE							
FEET	METERS	FEET	METERS	FEET	METERS	FEET	METERS
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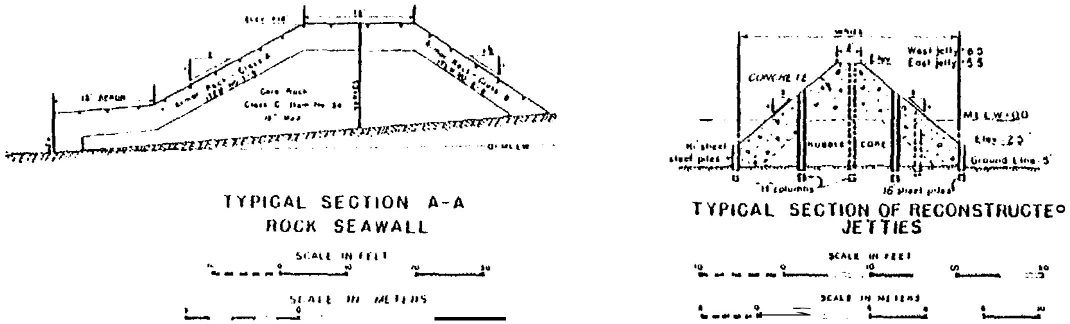
1.3	.40	6	1.83	25.6	7.80	460	140.21
1.6	.49	6.5	1.98	75	22.86	600	182.88
2	.61	7.5	2.29	200	60.96	[illegible]	167.64
2.5	.76	8	2.44	216	65.84	3350	1021.08
3	.91	14	4.27	240	73.15		
4	1.22	15	4.57	250	76.20		
5	1.52	16	4.88	335	102.11		



TYPICAL SECTION A-A
ROCK SEAWALL

TYPICAL SECTION OF RECONSTRUCTED JETTIES

NOTES: ELEVATIONS & SOUNDINGS ARE BASED ON M.L.L.W. 0.0'.
THIS LOCALITY SHOWN ON USC&GS CHARTS NO 9380 & 9385.

Figure 3.

PORT OF NOME LOCAT ON M

REVISED 1978

meters (75 feet) wide, flanked by a steel sheet pile revetment. The channel leads into a turning basin 76 meters (250 feet) wide; 183 meters (600 feet) long. The original jetties and revetments were completed in 1923, and were reconstructed to their current shorter length in 1940, at which time the turning basin was expanded to its present size. The Corps of Engineers originally built the port and continues to have responsibility for its maintenance. The channel and basin are authorized to be maintained at a depth of 2.4 meters (8 feet). However, the entrance channel is subject to rapid shoaling from littoral drift during storms and both the channel and turning basin are subject to siltation from the Snake River and Burbon and Dry Creeks. In August, 1977, the channel and turning basin were inspected and found to be about 1.4 meters (slightly less than 5 feet) deep. Up to 1979 the Corps of Engineers performed maintenance on the port. In 1979, dredging of the turning basin and channel went to competitive bid and the work is presently done through a contract with Doyon-Ghemonn of Fairbanks under Corps of Engineers supervision. The contract calls for 2.4 meters (8 feet) at mean lower low water (MLLW), but operational depth rarely exceeds 1.8 meters (6 feet). The controlling depth of the channel is 1.5 to 1.8 meters (5 to 6 feet).

The steel revetments located on both sides of the channel and easterly side of the turning basin provide high water protection for existing harbor facilities. These revetments extend 265 meters (870 feet) along the north and east bank of the entrance channel and turning basin, and about 277 meters (910 feet) along the south bank of the entrance channel and south shoreline of the Snake River. The north revetment of the turning basin functions as the only dock in Nome Harbor. The dock is owned by the City of Nome and is open to the public. The port will only accommodate small lighterage vessels with a draft of about 0.91 to 1.52 meters (3 to 5 feet). The 90 degree bend in the entrance channel restricts the length of such vessels to 61 meters (200 feet) or less. About 183 meters (600 feet) of' berthing space is available along the face of the revetment. This space provides three dry cargo berths along the channel and one combination bulk petroleum/dry cargo berth located in the turning basin.

A freight terminal and bulk petroleum terminal are adjacent to the dock. The freight terminal is owned and operated by Arctic Lighterage Company, but is situated on ground leased from the City of Nome. The freight terminal handles principally dry cargo containerized in 36 cubic meter (8 feet x 8 feet x 20 feet) seavans, building materials palletized on flat-racks, and limited contractors' equipment. The terminal is equipped with an 80 short ton (ST) capacity Manitowoc 4000 crawler crane, a smaller crawler crane used on board lighters when delivering to outlying communities, a 20 ST forklift, a number of smaller forklifts and other cargo handling equipment. There are two large warehouses for covered storage, measuring approximately 2,044 square meters (22,000 square feet) of which 223 square meters (2,400 square feet) are heated. One of these warehouses was built in the 1920's or early 1930's and is in poor condition. So poor is its condition that about 6,000 square feet of second floor space is unused under normal operating conditions, reducing the effective storage available to between 1,394 square meters and 1,486 square meters (15,000 square feet to 16,000 square feet). There are plans to replace the structure, but no time frame for doing so. Limited open storage is available for containers adjacent to the terminal, and within 3.22 to 4.83 kilometers (2 to 3 miles) of these facilities substantial open storage is available. However, the far away storage offers no security and goods are subject to theft and damage. When lightering linehaul vessels, the available equipment has the capacity to discharge 2,000 ST/day. However, tidal or other low water conditions in the channel control the loading of each lighter and effectively reduce this capacity.

The bulk petroleum terminal is owned by Chevron USA and operated by Arctic Lighterage Company. Bulk petroleum primarily consists of gasoline, kerosene, jet fuel, and distillate fuel oil. During World War II Nome was a refueling stop for the transshipment of Lend-Lease bombers to Russia and considerable bulk petroleum storage capacity was constructed at that time. Today, the bulk petroleum facilities have the capacity to store 24.6 million liters (6.5 million gallons or 154,762 bbl.) of petroleum products. The port has the capability of handling 35,000 bbl/day (approximately 4,900 tons) of liquid bulk petro cum. However, this capacity is also limited by the ability to move l ghters up the channel in shallow water.

The City of Nome would like to improve its existing port facilities. Two engineering studies have been completed that recommend a series of improvements. The first study entitled "Nome Barge Facility, 1974," by Gute and Nottingham proposed the development of barge facilities at two separate locations: Nome and Cape Nome to the east. Facilities would include a steel sheet pile dock with a water depth of about 8 meters (26 feet) at each location. The dock at Cape Nome would be protected by an armored causeway and the dock at Nome would be protected by a pre-stressed concrete causeway.

A more recent study (Nome Barge Facility, 1976) by CH2M HILL, proposed a 671 meter x 6.7 meter (2,200 feet x 22 feet) gravel causeway connected to a steel sheet pile dock with about 6 meter (20 feet) of water depth (dredged from 16 feet). This facility would be protected by a 244 meter (800 feet) armored rubble mound breakwater and requires annual dredging at the dock face. Either proposal is technically feasible; funding appears to be the roadblock that is preventing improvement to Nome's port facilities. The construction of either of these causeway/dock facilities would allow the direct unloading of dry bulk but not POL from oceangoing vessels. Lighterage activities would continue to be required for unloading linehaul tankers and for the distribution of dry cargo and POL to smaller communities in the region. The daily throughput capacity of the port 'would be increased using this type of operation, however, dry cargo is only about 22 percent of total throughput tonnage. T'he benefits of these docks could be greatly enhanced if bulk petroleum handling facilities were included.

Navigational Characteristics. Deep draft vessels and barges calling at the Port of Nome anchor approximately 1.6 kilometers (1 mile) offshore, When strong southerly winds are prevalent, vessels anchor up to 4.8 kilometers (3 miles) offshore as the holding ground at closer anchorage sites are poor. At these distances from shore, water depths vary from 9 meters (30 feet) to 18 meters (60 feet) respectively. These depths generally follow the contour of the shoreline, but ocean depths generally are erratic according to existing navigational charts.

The diurnal range. of the tide is 0.49 meters (1.6 feet). The flood sets eastward and the ebb sets northwestward. Norton Sound has relatively shallow water levels which are influenced more by winds than by tidal changes. About 3.2 kilometers (2 miles) offshore the t· dal current averages about one knot (1.85 kilometers/hour or 1.15 miles/hour and this force in combination with the wind has a greater impact on water depth than diurnal tides; as much as 1 meter (3 feet) below MLLW with a strong offshore wind. During extended periods of north or northeasterly winds, the depth of water at the jetty is reduced sufficiently enough to close the port. During the approximately 120 day shipping season from mid-nay through mid-September, it is estimated there are about 20 days when weather conditions are unsuitable for lightening. This situation occurs more frequently at the end of the season. For analysis purposes, this study assumes the port is closed about 20 percent of the time, leaving about 96 days of the 120 day shipping season available for port operations.

Figure 4 illustrates the dates of ice breakup and freezeup for selected Norton Sound communities. Table 3 illustrates various climatic conditions that exist in the vicinity of Norne on a month to month basis. 'Breakup usually occurs in Play and freezeup in November of each year, with the ice free season extending from about May 20 to October 20. In late spring and summer, fog and rain are prevalent. Fall and winter bring almost continual storms. Navigation in Norton Sound is considered unsafe between mid-October and early June due to ice conditions. Ice thickness has been estimated to be from approximately 1.0 meters to 1.3 meters (40 to 52 inches) with a crushing strength of 300 pounds per square inch.

Aids to navigation in the study include buoys and lights in various locations along the western coast. The name, description, operating season, and

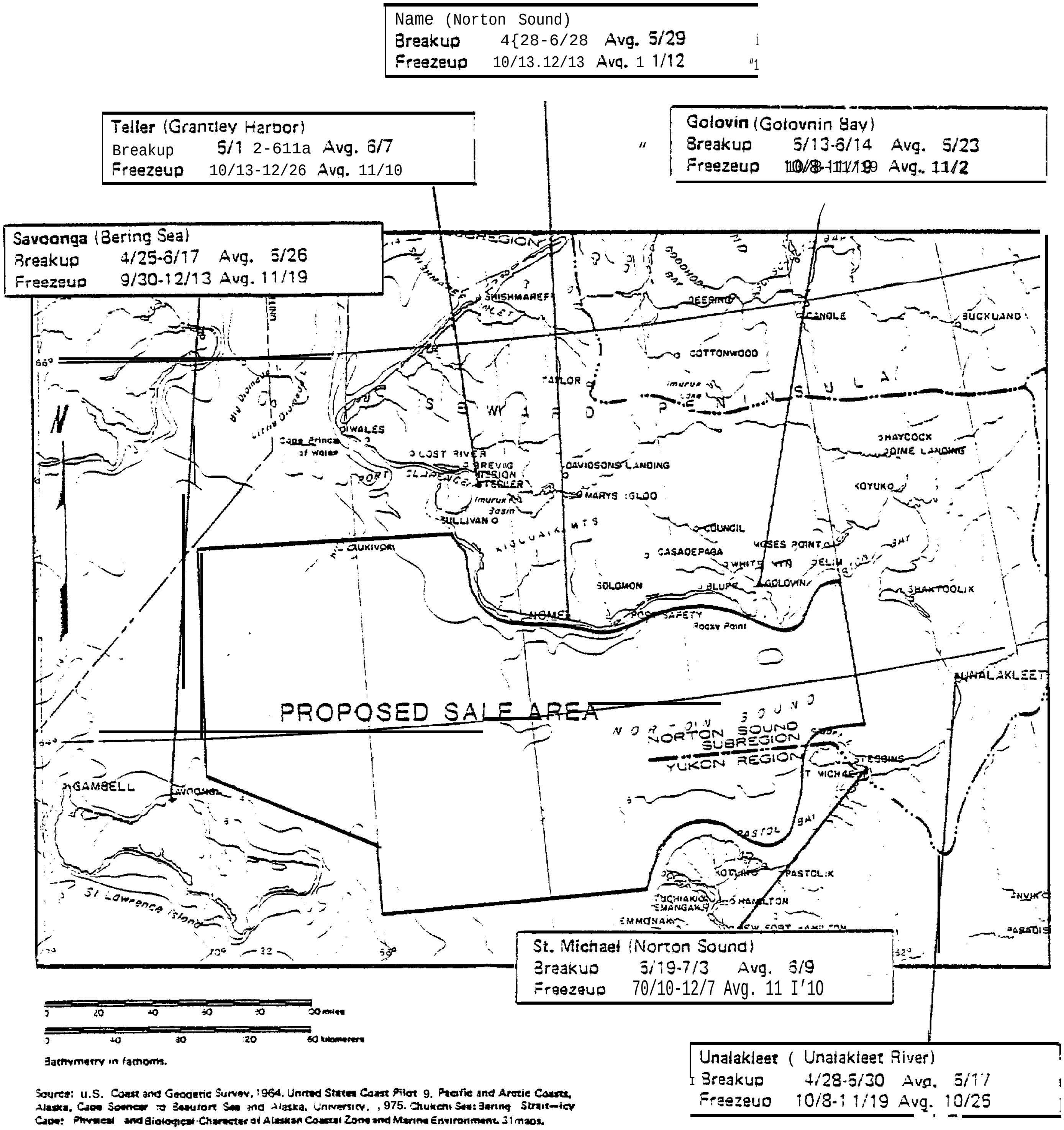


Figure 4

BREAKUP AND FREEZEUP DATA, NORTHWEST REGION

(Modified from Dames & Moore, 1380, as Modified from Selkregg, 1974, Figure 44)

TABLE 3

CLIMATIC CONDITIONS IN THE VICINITY

OF NOME, ALASKA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Ice Coverage (%)	88	100	88	88	62	25	--	--	--	--	75	75
Temp. Average (°F)	6	6	9	21	34	46	50	49	42	30	17	8
Temp. Low (°F)	-39	-42	-38	-27	-11	25	32	30	17	-3	-39	-41
Wind Mean Force	10	10	9	9	9	8.5	8.5	9	10	9.5	11	9
Wind Direction	E	NE	E	E	N	WSW	WSW	SW	N	N	N	E
Fog Avg. Days)	3	1	1	1	3	5	3	2	--	--	1	2

Source: Engineering Computer Optecnomics, Inc., Final Report to the federal State Land Use Planning Commission For Alaska on Potential Port Site Assessment, 1977.

location for each is well documented in U.S. Coast Guard Publication CG-162, "Light List, Volume III, Pacific Coast and Pacific Islands," 1979. Typically, the navigation lights are maintained during the period July 15 through November 1. Study area locations with buoys marking channels for entrances to bays and rivers include: St. Michael Canal, Unalakleet River, Kwiniuk River, Koyuk River, and Kotzebue (L. Berger, WAATS, 1979).

Facilities Useage. The principal user of Nome's harbor and dock facilities is the commercial lighteraging activity associated with the movement of dry cargo and bulk petroleum into Nome and the transshipment of some of these products to other coastal communities in the Norton Sound region and beyond (hereinafter referred to as "outports"). The extent to which the lighteraging activities use Nome's facilities is dependent upon the volume of goods moved, the number of linehaul vessels that call on the port, the demand for goods shipments to outports and the size and type of equipment available to lighter and transship the various goods. The following discussion focuses on these different aspects of facilities usage.

Each year nine common carrier dry cargo linehaul vessels, three or four contract dry cargo linehaul vessels, and three or four contract linehaul tanker barges arrive at Port Nome. One vessel, the North Star III, is a general cargo ship while the rest are barges with companion tugs. Each dry cargo linehaul vessel carries from 70 to 150 seavan type containers or flatracks, while tanker barges carry from 30,000 bbl to 100,000 bbl of liquid bulk petroleum products. These linehaul vessels anchor offshore for a period of 1-1/2 to 3 days and are offloaded to a variety of lighterage vessels, The size of barges that operate in western Alaska range from 73.1 meters by 18.3 meters (.240 by 60 feet) with a capacity of 4,000 ST to "superbarges" that measure 121.9 meters by 30.5 meters (400 by 100 feet) with a capacity of 17,000 ST. Loaded drafts of these barges range from 4.9 meters to 6.1 meters (.16 to 20 feet). An example of a superbarge that calls on Nome is the "Alaska," which is 120.4 meters by 24.4 meters (395 by 80 feet) with a capacity of 12,000 ST. However, more typical of the kinds of barges that call on Nome are the "Foss 286-1" and "Foss 287", which called on Nome in 1979. Respectively, these barges are 87.2 meters by 23.2 meters (286 by 76 feet) with a capacity of 7,000 ST and 87.2 meters by 23.2 meters (286 by 76 feet) with a capacity of 5,700 ST. For analysis purposes, this study assumes a linehaul dry cargo barge to nave an average capacity of about 6,000 ST and a tanker about 7,000 ST.

Accompanying linehaul tugs range in size from 2,000 horsepower (hp) to 9,000 hp, with a draft of 3.65 meters to 4.27 meters (12 feet to 14 feet). These tugs typically move the barges at speeds between 8 and 10 knots.

The North Star III is a converted "Victory" class cargo ship build during World War II (1945). The ship is government-owned and operated and transports cargo to private individuals and Bureau of Indian Affairs (BIA) facilities throughout western Alaska. The tonnage capacity for dry cargo and liquid bulk and other characteristics of this ship are identified in Table 4. It is important to note this ship carries four of its own lighterage craft LCM (6)) which aid in lightening cargo over the beaches for many of the 56 communities it visits each year. Three of the LCM(6) type vessels have a dry cargo capacity of 22 long tons (24.2 ST). The fourth LCM has been

TABLE 4

CHARACTERISTICS OF BUREAU OF INDIAN AFFAIRS
SHIP NORTH STAR 111

Length	138.7 meters (4S5 ft.)
Full Load Draft	8.7 meters (28.5 ft.)
Deadweight Tonnage	11,431 ST (10,206 long tons)
Cargo Space - Dry Cargo	11,894 cubic meters (420,000 cu. ft.)
Cargo Space - Liquid Bulk	3,217,250 liters (850,000 gals.)
Lighterage Craft	4 LCM landing craft
Power Plant	5,850 hp-diesel
Cruising Speed	16 knots
Ship's Crew	41 officers and men
Passenger Space	5

Source: Western and Arctic Alaska Transportation Study, 1979; Louis Berger & Associates, Inc.

fitted with a removable cargo oil tank of 32,176 liters (8,500 gallons), a hydraulically driven reel of buoyant 3 inch diamenter hose and a 946 liter per minute (250 gallons per minute) transfer pump. During the first of its two voyages each year the ship also carries a 56,781 liter (15,000 gallon) oil scow on board which is push-towed to shore by the LCM tanker. Additional operating data is provided in the later discussion of the various carriers.

The lighteraging serv ces provided at the Port of Nome are a contract service principally oriented to the unloading and loading of linehaul vessels that call on the port (see Figure 5). These lighteraging services deal primarily with dry cargo seavan containers; neobulk palletized loads, including 1,000 gallon export tanks of liquid natural gas; construction and transportation equipment; and liquid bulk petroleum products. The trans-shipment function is a secondary service which deals with dry cargo break-bulk commodities and liquid bulk petroleum. From Port Nome this secondary service is provided to coastal villages from Shishmaref to Hooper Bay on a nonscheduled contract basis. Areas in Norton Sound from Elim south to Scammon Bay, including communities up the Yukon River to St. Marys, are also served by another lighterage service from St. Michaels.

The shallow draft equipment employed by lighteraging companies permits considerable operational flexibility, which is necessary to meet the varying operating conditions and variable demands. The variety of sizes of tugs and barges employed permits tailoring the vessel combination to fit the season's anticipated routing, schedules, traffic, and operating conditions. The major problems encountered are the uncertainty of the time of ice break-up


Lightering in Kotzebue Sound

Photo: Steve and Delores McCutc.

FIGURE 5
EXAMPLE OF LIGHTERS AND TUGS IN OPERATION

Source: Comprehensive Development Plan, Kotzebue, Alaska; Alaska State Housing Authority, March, 1971.

and freeze-up, seasonal fluctuations of 'water levels in the Snake River channel due to climatic conditions and year-to-year variation in depths at coastal landing points due to wind conditions (L. Berger & Assoc. WAATS, 1979) .

Lighteraging services are provided daily during the shipping season, weather permitting. The lighters range in size from 18.3 meters to 7.3 meters (60 feet by 24 feet) with a capacity of 100 ST to 48.8 meters by 14.0 meters (160 feet by 46 feet) with a capacity of 1,190 ST. The drafts of these barges range from 0.3 meters to 0.9 meters (1 foot to 3 feet) when unloaded up to 0.9 meters to 2.4 meters (3 feet to 8 feet) 'when fully loaded. At the present time the following lighters are available in Nome:

- Two (2) -- approximately 24.4 meters (80 feet) long barges each with a rated capacity of about 200 ST. Each is constructed with compartmentized tanks to haul various bulk liquids and deck space for dry cargo. These barges are principally employed in serving linehaul tankers because on board pumps are of high capacity. The barges are also highly maneuverable in narrow channels and on beaches and are employed on at least half of the outport trips. Each barge is estimated to have an average practical capacity of 1,500 bbl (210 ST).
- One (1) -- approximately 36.6 meter (120 feet long barge with a rated capacity of about 560 ST. This barge can also haul bulk liquids and dry cargo. This barge's basic utility is as a dry cargo barge because its pump is rated lower than the 24.4 meter (80 feet) barges. It is also used on the other half of the outport trips. This barge is estimated to have average practical

capacity of about 1,300 bbl (182 ST) when used as a tanker and about 350 ST when used for dry cargo.

- One (1) -- approximately 45.7 meter (150 feet) long barge with a rated capacity of about 1,000 ST. Like the 36.6 meter (120 feet) barge, it is constructed to carry both bulk liquids and dry cargo although its principal use is for servicing dry cargo linehaul vessels. It has little utility in outport deliveries because it is difficult to control on the beach, although it is used for this purpose on occasion. This barge is estimated to have an average practical capacity of 1,400 bbl (196 ST) when used as a tanker and about 500 ST when used to carry dry cargo.

Additional lighters are brought to Nome with the linehaul vessels. The sizes and numbers of barges brought in is dependent on cargo demands, Two lighters are used to offload cargo so that one is discharging from the linehaul barge at the same time the other is discharging ashore. If two or more linehaul vessels arrive at the anchorage on the same day, they are worked simultaneously, if possible. Otherwise, they are worked sequentially based on arrival. There is little waiting time to unload linehaul vessels other than for weather delays, Each lighter makes an average of four to six trips per day for dry cargo linehaul barges and six to eight trips per day for linehaul tanker barges.

When performing transshipment services for coastal village customers, every attempt is made to utilize the full capacity of the lighter. Normally, cargo is stored in Nome until a sufficiently large enough load is accumulated to make the deliveries profitable, although an attempt is made to deliver all received goods during the same shipping season. Depending upon the cargo delivery requirements a small capacity crawler crane (15 tons to 25 tons capacity) and appropriate forklift equipment are placed on the barge with the cargo to aid offloading at destination villages. Tugs move the barge from village to village at rates of about 5 to 6 knots. Once off the beach from a coastal village, the tug awaits high tide, moves the barge on to the beach and unloading proceeds. With the next high tide after unloading is completed, the barge is moved to the next village. Occasionally, a barge is moved too far on the beach or the wind blows a barge too far up the beach and it is stranded. In such a situation considerable effort is sometimes required to refloat the barge. Should weather problems develop during the course of village deliveries, the barge is anchored offshore to sit out the storm and is then moved to the next offshore delivery point.

The tugs used to push-tow the various lighter barges in western Alaska are also shallow draft vessels capable of operating in as little as 0.9 meters (3 feet) of water. Their power ranges from 330 hp. to 660 hp. At present there are two tugs located at Nome: the 440 hp. "SINUK" which is 16.8 meters (55 feet) long, 4.3 meters (14 feet) wide, with a 1 .2 meter (4 feet) draft when loaded; and the 330 hp. "NANUK II", which is 17.1 meters (56 feet) long, 4,3 meters (14 feet) wide, with a 1.8 meter (6 feet) draft when loaded.

The total level of commercial vessel activity in the Port of Nome for the years 1972 through 1977 is identified in Table 5. Shown in Table 5 are the dry cargo and tanker lighters and accompanying tug activities

Table 5.

ANNUAL COMMERCIAL VESSEL ACTIVITY
NOME HARBOR
1972 - 1977

Year	Inbound			Outbound		
	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Tow or Tug
1972	29	248	271	30	248	269
1973	8	171	215	7	172	217
1974	14	4	19	18	4	19
1975	13	172	214	13	174	215
1975	18	29	16	18	31	15
1977	210	7	318	205	6	316

Source: Corps of Engineers, ‘Waterborne Commerce Statistics.

by direction inbound and outbound to the harbor. These reflect both linehaul and transshipment lightering activities. No explanation is available for the marked difference in dry cargo and tanker activity in 1977 versus prior years.

Throughput tonnage data for the Port of Nome over the period 1970 to 1977 is shown in Table 6. Also illustrated is annual tonnage data for the five largest commodity groups and the remaining commodity classifications treated collectively. Petroleum products dominate the various commodity groups and average approximately 78 percent of the annual total. The remainder of the five largest commodity groups each average approximately 4 percent to 5 percent of the annual total, while the "all other" group averages about 2 percent of the annual total.

Because the forecast methodology employed in this study utilizes a population based growth factor approach, it is desireable to analyze past trends in annual per capita throughput tonnage. This analysis is presented in Table 7. When annual per capita throughput tonnage is averaged over the period 1970 to 1977, this produces a rate of 3.08 tons per capita per year. If the data for 1972 and 1977 are excluded, because they appear as abnormalities in the trend, a rate of 2.59 tons per capita per year is produced. Upon reviewing available data for these two years, no particular discernible cause for the large jumps in tonnage could be found. It is suspected that these may be due to recording errors as discussed further below. On the other hand, there may be legitimate, but hidden, reasons for these surges. Consequently, a higher rate of 3.00 tons per capita per year will be selected for forecasting purposes.

TABLE 6

PORT OF NOME
THROUGHPUT TONNAGE FOR
PERIOD 1970 TO 1977

	LARGEST COMMODITY GROUPS						
Year	Petroleum Products[1]	Food Products[2]	Commodities	Lumber and Wood Furniture Products[4]	Building Products[5]	All Other[6] Commodity Groups	Annual Total
1970	13,244	2,095	1,373	2,015	1,753	371	20,951
1971	15,809	1,584	399	1,329	1,353	357	27,331
1972	35,523	2,375	697	1,296	2,258	490	43,149
1973	23,302	1,319	1,086	1,195	1,194	686	28,782
1974	22,581	2,335	1,289	1,353	2,921	1,335	32,314
1975	25,720	1,414	933	939	2,043	307	31,356
1976	23,022	1,359	1,560	1,476	1,185	422	29,524
1977	43,260	1,371	5,317	2,195	1,768	1,507	56,418

NOTES:

1. Petroleum Products include gasoline; jet fuel; distillate fuel oil; kerosene; lubricating oils and greases; asphalt and tar; liquefied gases; Naptha; and petroleum solvents.

2. Food Products include fresh fruits and tree nuts; fresh and frozen vegetables; meat; dairy products; prepared fish and shellfish; prepared fruit and vegetable juice; grain mill products; alcoholic beverages; groceries; and miscellaneous food products.

3. Commodities include a broad variety of items such as stereos, pots and pans, etc.

4. Lumber and wood furniture products include lumber; plywood; furniture and fixtures; pulp and paper products; timber posts; piling; and worked wood.

5. Building products include asphalt building materials; rubber and miscellaneous plastic products; building cement; structural clay products; iron and steel shapes; fabricated metal products; and electrical and nonelectrical machinery.

6. The Other group includes transportation equipment, such as motor vehicles, ships, boats; iron and steel scrap; chemical products, such as paints and basic chemicals; fertilizer; sand and gravel; textiles; salt; fresh fish other than shellfish; coal; nonferrous ores; and other miscellaneous manufactured products.

SOURCE: Corps of Engineers, Waterborne Commerce Statistics, Part 4.

TABLE 7

PORT OF NOME
ANNUAL PER CAPITA THROUGHPUT TONNAGE - 1970 to 1977

Year	Tonnage[1]	Regional Population[2]	Throughput Tonnage Per Capita
1970	20,951	9,700	2.16
1 97?	27,931	9,700	2.26
1972	43,149	10,000	4.31
1973	.28,782	10,300	2.79
1974	32,314	10,700	3.02
1975	31,356	11,100	2.82
1976	29,624	12,000	2.47
1977	56,418	11,800	4.78
Average Annual Per Capita Throughput Tonnage (All years included)			3.08
Average Annual Per Capita Throughput Tonnage (Excluding 1972 and 1977)			2.59

Notes : 1) Corps of Engineers, Waterborne Commerce Statistics

2) Alaska Department of Commerce and Economic Development, Numbers, Basic Economic Statistics of Alaska Census Division.

The most recent breakdown of throughput tonnage by origin-destination is for 1977. This data are Illustrated in Table 8 for a variety of commodity class-fications With the exception of some petroleum products and the movement of construction related machinery, all commodities originate in the Seattle area. The destination of goods that originate in Nome (e.g., gravel and fish) or are transshipped through Nome varies widely. The data also show that outbound tonnage exceeded inbound tonnage for 1977, but this makes no sense when compared to the character of Nome's economy. When the data in Table 8 are examined more closely, several discrepancies appear for which there is no explanation. For example, distillate fuel oil, commodity code 2914 in the petroleum products group, with a throughput of 25,323 tons (approximately 45 percent of total throughput tonnage) is illustrated as being primarily an outbound commodity: 3,223 tons inbound, 22,100 tons outbound. According to Arctic Lighterage Company (personal communication), this relationship is normally just the reverse; Nome consumes virtually all the linehaul inbound tonnage.* The company's 1980 projected tonnage demands, shown in Table 9, are considered more representative of normal relationships of inbound and outbound tonnages.

From a methodological perspective, it is necessary to adopt a standard relationship between throughput tonnage and its principal components: dry cargo tonnage and liquid bulk tonnage. It is also necessary to adopt

* Many goods that pass through Nome's economy are exported to other communities in the region when goods are purchased in Nome's stores and shipped to the Bush by air. See Figure B-2.

TABLE 8

PORT OF NOME
1977 COMMODITY TONNAGE BY ORIGIN AND DESTINATION

Group	Commodity Classification Code	Title	Inbound Commodities Origin	Inbound Commodities Tonnage	Throughput Tonnage[1]	Outbound Commodities Tonnage	Outbound Commodities Destination
	0911	Fresh Fish, Except Shellfish	--	--	508	508	Foreign
	1442	Sand, Gravel, Crushed Rock	--	--	250	250	Bering Sea North
	2031	Fish and Shellfish, Prepared			381	381	Foreign
Food Products	2081	Alcoholic Beverages	Seattle	70			
			LWC[2]	325	395	--	--
	2094	Groceries	Seattle	696			
			LWC	772	1,476	3	Bering Sea North
Lumber and Wood Furniture Products	2414	Timber, Posts, Poles, Piling	Seattle	34	34	--	--
	2421	Lumber and	Seattle	792			
	2431	Veneer, Plywood, Worked Wood	LWC	838	1,650	20	Bering Sea North
	2491	Wood Manufactures, Nec.	Seattle	338			
			LWC	130	469		Bering Sea North
	2511	Furniture and Fixtures	Seattle	14			
			LWC	28	42	--	--
Chemical Products	2819	Basic Chemicals and Products Nec.	Seattle	25	25	--	--
	2851	Paints	Seattle	14	14	--	--
	2891	Miscellaneous Chemical Products	Seattle	4	4	--	--
Petroleum Products	2911	Gasoline	LWC	10,532[3]			
			Iliuliuk	585	17,310	5,788	Local
						253	Pribilofs
						142	Bering Sea North
	2912	Jet Fuel	Iliuliuk	568	568	--	--
	2914	Distillate Fuel Oil	Iliuliuk	3,223	25,323	21,317	Local
						31	Pribilofs
						202	Bering Sea North
	2916	Lubricating Oils & Greases	Seattle	3	3	--	--
	2921	Liquefied Gases	Seattle	56	56	--	--
	2951	Asphalt Building Materials	Seattle	6	6	--	--
	2991	Petroleum and Coal Products, Nec.	Seattle	420			
			LWC	23	443	--	--
	3011	Rubber and Misc. Plastic Products	Seattle	7	7	--	--
	3241	Building Cement	Seattle	52	52	--	--
Building	3251	Structural Clay Products	Seattle	1	1	--	--
	3291	Misc. Nonmetallic Mineral Products	Seattle	324	324	--	--
	3375	Iron, Steel Shapes, Except Sheet	LWC	15	15	--	--
	3411	Fabricated Metal Products	Seattle	394	420	[illegible]	Seattle
						7	Bethel
	3511	Machinery, Except Electrical	Seattle	153			
			LWC	54			
			Bethel	14			
			Bering Sea North	210	476	35	Bering Sea North
	3611	Electrical Machinery and Equipment	Seattle	5			
			LWC	9	14	--	--
Transportation Equipment	3711	Motor Vehicles, Parts, & Equipment	Seattle	145			
			LWC	135			
			Bethel	2	304	4	Anchorage
						18	Bering Sea North
	3731	Ships and Boats	Seattle	4	4	--	--
	3791	Misc. Transportation Equip.	Seattle	17	17		
	4112	Commodities, Nec.	Seattle	379			
			LWC	232			
			Anchorage	2	5,317	4,361	Local
						1	Anchorage
						2	Kodiak
						33	Pribilofs
						68	St. Michael
						189	Bering Sea North
TOTALS				22,170	56,418	34,248	

Notes: 1) Throughput tonnage is the sum of inbound and outbound commodities.

2) "LWC" represents the Lake Washington Canal.

3) To convert barrels of petroleum products to tonnage, the Corps of Engineers uses a factor of 1 ton = 7.15 bbl. This factor averages the varying weights among different petroleum products.

Source: Corps of Engineers, Waterborne Commerce Statistics.

TABLE 9

PORT OF NOME
PROJECTED 1980 TONNAGE BY LINEHAUL HANDLING CATEGORIES

	INBOUND	THROUGHPUT	OUTBOUND
Dry Cargo	6,000 - 8,000 ST	7,200 - 9,200 ST	1,200 ST
Bulk Petroleum	25,175 ST[2]	26,574 ST	1,399 ST
	(180,000 bbl)	(190,000 bbl)	(10,000 bbl)
TOTALS	31,175 - 33,175 ST	33,774 - 35,774 ST	2,599 ST

NOTES: 1. Throughput tonnage is the sum of inbound and outbound commodities.

2. The relationship 1 Ton = 7.15 bbl is used to convert barrels to short tons. This factor averages the varying weights among different petroleum products.

SOURCE: Arctic Lighterage Company

a standard relationship for the inbound and outbound characteristics of throughput tonnage. When the data from Tables 6-9 are evaluated for this purpose, the results are illustrated in Figure 6, Parts A-F.

Part A of this figure identifies the typical relationship between dry cargo and bulk petroleum as a percentage of throughput tonnage. Parts B and C identify the inbound/outbound relationship for bulk petroleum and dry cargo respectively, and in Part D, the combination of Parts A, B, and C are shown. The directional splits for Parts B and C are largely based on projected 1980 data as illustrated in Table 9. Part D is derived by multiplying Part A data by Parts B and C data. Figure 6 , Part E, illustrates the average percentage of total tonnage for bulk petroleum and dry cargo that is sent to and consumed by the City of Nome or transshipped from there by another mode. Part E is derived from Part O by subtracting the outbound tonnage from the inbound tonnage. Figure 6, Part F, illustrates the tonnage transshipped to outports and is derived directly from Part D. This information will be used to determine Port Nome's operating capacity in the next section and is the beginning point for the various forecasts developed in later chapters.

Capacity. In Nome, the capacity of the harbor and dock facilities to provide for a commercial goods transportation service is in part a function of the variables identified below. One variable more than the others affects the ability of the Port to grow beyond a certain extent. The current characteristics of these variables has been presented and discussed in past sections. In the discussion that follows, the influence

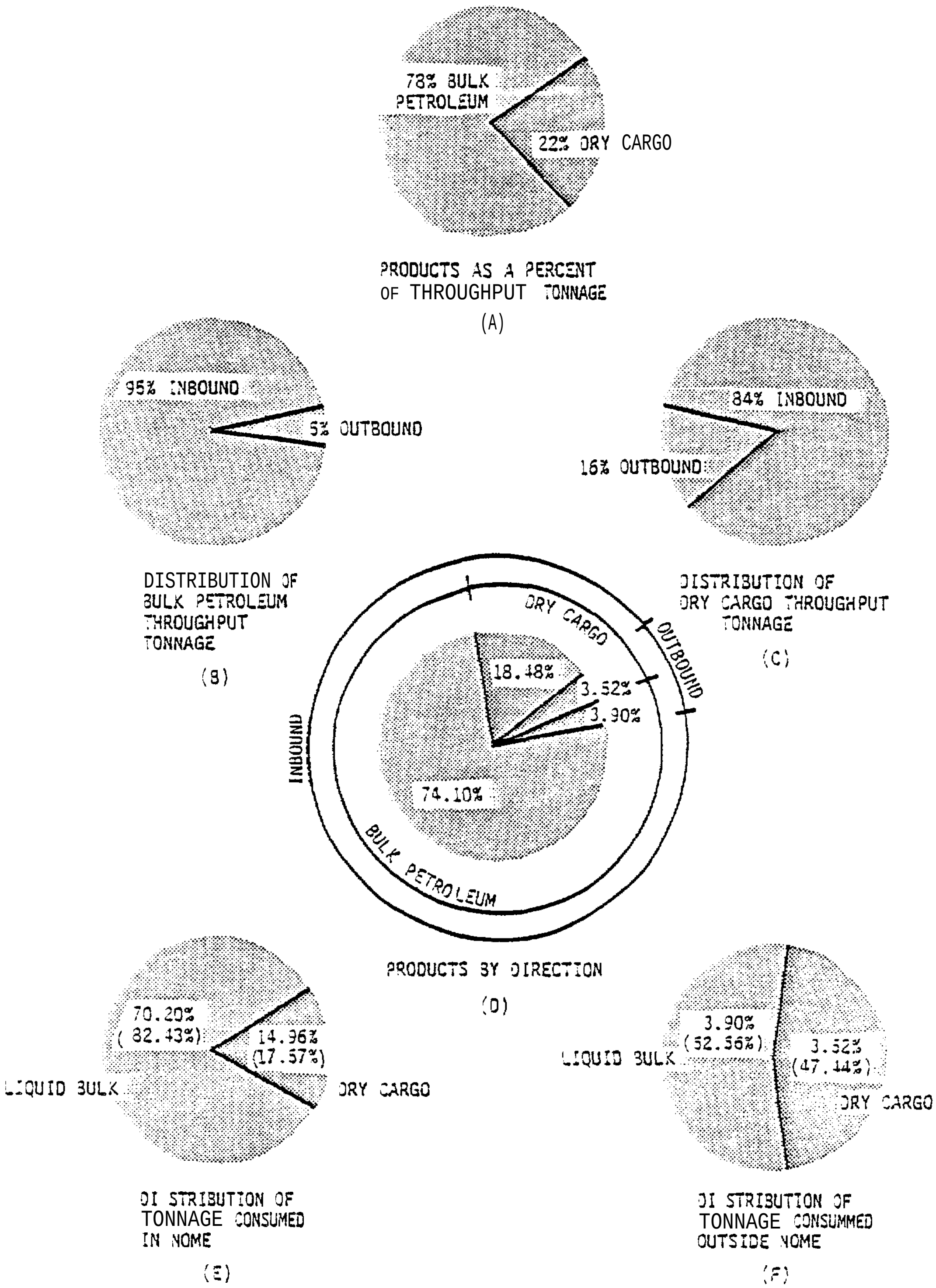


FIGURE 6

ASSUMED INBOUND-OUTBOUND RELATIONSHIP FOR DRY CARGO AND LIQUID BULK COMMODITY GROUPS AS A FUNCTION OF THROUGHPUT TONNAGE

SOURCE : PMM&Co.

of the most important aspects of these factors on potential throughput tonnage growth is presented. The variables affecting capacity are:

- Physical layout and dimensions of the harbor and approaches, including navigational characteristics.
- Physical layout and dimensions of the various docks, berths, and storage facilities in the harbor.
- Number, type, capacity, and use of equipment available on:
  - docks
  - linehaul vessels
  - lighters
- Number, type, capacity, and use of the linehaul vessels and lighters.
- The character of transportation demands for:
  - offloading/loading of linehaul vessels versus
  - transshipment and delivery of goods to outports

Based on the foregoing discussions of the Port of Nome, the most important factors limiting capacity are:

- Climatic conditions limiting operations to four summer months.
- Shallow water depths in the entrance channel, which influences the use of lighters and restricts their operating capacity.
- The physical limits of existing dry cargo and bulk petroleum storage facilities, which, although not at capacity, appear to be near capacity.
- The size of lighters and their liquid bulk pumping equipment, which in combination with navigational restrictions, influences utilization of the lighters.

- Although demand for outport deliveries is small in volume, it takes a disproportionate amount of time and effort when compared against the linehaul function.

When viewed collectively, the critical variables influencing capacity are the storage facilities and utilization of the lighters. In the discussion that follows the capacity and utilization of the storage facilities and lighters, the port's basic equipment, is used to determine the port's capacity.

As discussed earlier, the dry storage facilities consist of 1,400 square meters (15,000 square feet) of covered storage, 223 square meters (2,400 square feet) of which is heated. The bulk petroleum storage consists of about seven tanks of varying sizes with total capacity of 24.6 million liters (153,762 bbl). Arctic Lighterage Company estimates only 20 percent of the dry cargo requires covered storage and much of that for only a short time. The remaining 80 percent is stored outside in the seavan containers until customers (typically merchants) require the contents. Goods are typically picked up by individuals and households in Nome within 24 to 36 hours after the container reaches port. If the older structures are replaced, capacity should increase adequately enough to handle normal growth in Nome for the foreseeable future. If necessary, a new container storage area can be developed at Nome's old airport. In addition to needing a new building, adequate security must also be provided at that site. Such areas could be used for the dry bulk materials (mud, pipe, etc.) for OCS operations without requiring a new structure. Thus, while dry cargo is a current operations problem, it seems resolvable without major impact on port capacity.

The liquid bulk storage, however, is a quite different problem. Total inbound fuel deliveries already exceed the storage capacity by about 23 percent. This is possible because some of the fuel is transshipped to outports and some is used during the summer months. By replacing both throughout the shipping season, the community can start the winter with full tanks. As long as total demand can be replenished during the shipping season, the capacity of the storage tanks is adequate. Shortages are likely to occur for products whose demands are increasing rapidly. For example, demands for jet fuel are reaching the capacity-replenishment limits and with the start of new service to Nome this summer, all demands may not be met. There are no plans at present to enlarge the bulk petroleum facilities.

The capacity of the lighteraging operations must be viewed from two perspectives: The linehaul function and the coastal delivery function. In the following analysis we look first at the time it takes the existing lighteraging equipment to unload anticipated 1980 inbound tonnage. Using this time as a percentage of total time available in the shipping season, the maximum capacity is assessed. The sensitivity of the analysis to the results is also included. As shown in Table 9, inbound tonnage expected in 1980 is 180,000 bbl of liquid bulk petroleum and up to 8,000 ST of dry cargo. If the various lighter combinations for linehaul operations can achieve their advertised daily discharge capacity of 35,000 barrels per day and 2,000 ST per day, then the bulk petroleum can be unloaded in about six good weather days and the dry cargo in four good weather days, a total of ten days out of a shipping season of approximately 96 good weather days. If these barge combinations could operate at these capacities and relative proportions of time for all 96 days, they could lighter 281,958 ST (2.02 million barrels) of bulk petroleum and 36,522 ST of dry cargo for a total throughput capacity of 318,480 ST. However, the lighters are not 100 percent efficient, which is required to meet the daily discharge capacity. Nor are the linehaul loads such that full capacity can be utilized all the time The bulk character of a light object may use more space than weight thus restricting capacity use. It is estimated that the reduction in capac ty is as much as 50 percent so that instead of ten days, it is more likely to take 20 or more days to linehaul the 1980 inbound tonnage. In this example, with the port performing only a linehaul function, total throughput tonnage is therefore reduced to about 160,000 ST. The 1980 inbound tonnage is about 21 percent of this volume.

However, the port has functions other than serving linehaul vessels, particularly the need to deliver goods to outports. This transshipment function further reduces the capacity of the port based on existing equipment. Deliveries are made to outports two or three times over the course of a summer season. About half of the trips are made by one of the 24.4 meter (80 feet) barges (loaded capacity of 100 ST) and half are made by the 36.6 meter (120 feet) barge. Each barge is assumed in this analysis to be loaded 60 percent dry cargo and 40 percent oil by weight. During 1979, which was a major school construction season in many coastal villages, barges were loaded about 70 percent dry cargo and 30 percent oil by weight (Arctic Lighterage Company) . The practical capacity of each barge, as as presented earlier, is reduced by about 20 percent before loading because of the need to have a crane and forklift equipment on board. The amount of tonnage expected to go to outports in 1980 is 1,400” ST (10,000 barrels) of bulk petroleum and 1,200 ST of break-bulk and containers of dry cargo. At the reduced capacities and assuming that each trip averages at least two days due to the slowness of the tugs and the need to await tides, seven trips are required by each barge. Given these assumptions, the best time that could be achieved for transshipment of the expected 1980 outport-destined tonnage is 14 good weather days.

If the 1980 cargo can be linehauled in 10 good weather days and the outports serviced in 14 such days, the capacity of the port is the ratio of 96 over 24 times the 35,775 STof expected 1980 throughput or 143,100 ST. Then, 1980 throughput tonnage is 25 percent of available capacity. However, if the efficiency of the outport deliveries is such that more trips are required, or because of the dry cargo storage capacity, the seavans cannot be stripped rapidly and repacked for transshipment, or for both or other reasons, the port’s capacity declines rapidly. For example, if outport deliveries take an average of three days and an extra day is added for replacing and loading the outport barges, this situation coupled with 50 percent efficiency in the linehaul operation produces a ratio of 96 over 48 multiplied by 35,775 STor 71,550 ST. In this case, the capacity declines 25 percent and the 1980 throughput tonnage now uses 50 percent of available capacity. This latter situation, while perhaps not modeling the existing conditions precisely, appears to be indicative of the time currently spent on linehaul and outport deliveries. The conclusion is that the port probably operates at capacity about half the time, particularly during periods when port equipment is responding to linehaul arrivals. "Even if the analysis errors and existing operations are a greater percentage of capacity, it appears that the port can handle a moderate level of additional growth using existing equipment, particularly if the storage and transfer facilities are improved. However, if a new dock facility which includes bulk liquids handling capabilities is constructed, the situation will improve considerably.

3.2.1.2 Port of Kotzebue

Facilities. The City of Kotzebue is situated at the northwestern tip of the Baldwin Peninsula in Kotzebue Sound in an area identified as the Kobuk region (see Figure 7). As shown in Figure 8, the port facilities are located at the north end of the community. The port does not have a natural harbor.

Arriving oceangoing vessels anchor 4.8 to 9.7 kilometers (3 to 6 miles) southwest of Cape Blossom, which is approximately 24.1 kilometers (15 miles) south from Kotzebue. A 19.3 kilometer (12 mile) channel leads from the anchorage to the port's dock. Generally, lightening craft transport cargo from the anchorage to the dock via the channel. However, under good weather conditions, once linehaul barges have been unloaded to the point where their draft is less than 1.8 meters (6 feet), they can be brought up the channel to the dock and unloaded directly.

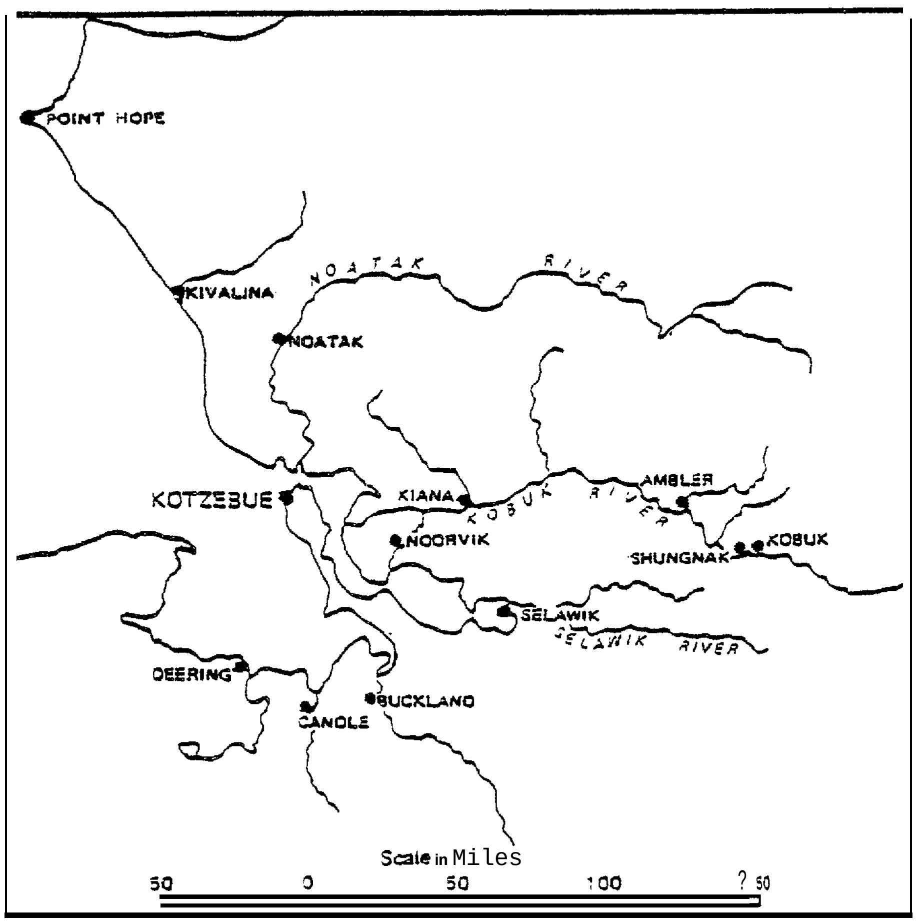
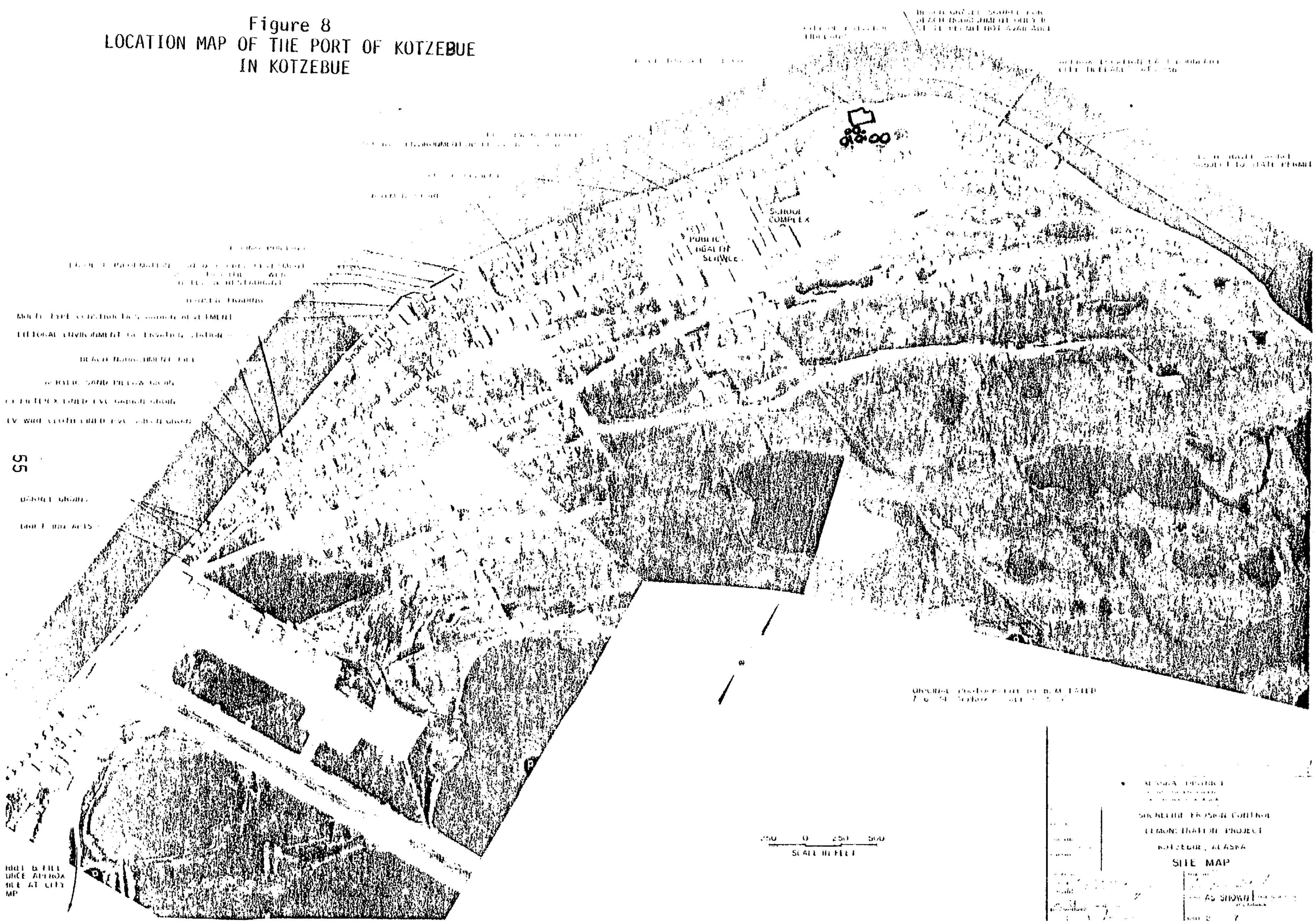


Figure 7

LOCATION MAP OF KOTZEBUE AND KOBUK REGION COMMUNITIES

Source: Comprehensive Development Plan, Kotzebue, Alaska; Alaska State Housing Authority, March 1971.

Figure 8
LOCATION MAP OF THE PORT OF KOTZEBUE
IN KOTZEBUE



The dock consists of steel sheet pile bulkhead with earth backfill. The face of the bulkhead is 67 meters (220 feet) long and its height above water is approximately 1.8 meters (6 feet). Water depth at the face of the bulkhead varies from 6 to 8 feet. The facility has one dry cargo berth; one combination dry cargo/liquid bulk berth, and one Ro/Ro berth for small river barges that will be completed by August 1980. About 113 meters (390 feet) of berthing space is available. Adjacent to the dock is a freight terminal and bulk petroleum terminal. The dock and freight terminal are owned and operated by Arctic Lighterage Company. The terminal is equipped with an 80 ST capacity, Manitowoc 4000 crawler crane, several small cranes, a 25 ton forklift, a number of smaller fork-lifts, and other cargo handling equipment. The freight terminal handles primarily dry cargo containerized in 36 cubic meter (8 feet X 8 feet X 20 feet) seavans and flatracks, limited contractor's equipment, and other break-bulk cargo. Cargo is stored adjacent to and on the docking facilities. Arctic Lighterage Company reports there is room 'or 250 to 300 containers on the revetment. Container cargo destined for villages on the Noatak River, Kobuk River, Selawik Lake, and along Kotzebue Sound is stripped from containers in the terminal and delivered up river as break-bulk. Storage capacity consists of 929 square meters (10,000 square feet) of covered storage and slightly less than 465 square meters (5,000 square feet) of open storage area. The open storage is primarily used for empty containers and contractor's equipment. Like Nome, the equipment has the capacity to discharge 2,000 ST/day, however, Arctic Lighterage reports an unloading rate of 1,000 to 1,200 ST in an 18 hour period in calm seas (L. Berger, WAATS, 1979). The bulk petroleum terminal is owned by Chevron USA and operated by Arctic Lighterage Company. Bulk petroleum consists of three grades of gasoline, diesel fuel, aviation fuel, and heating fuel.

Several proposals have been made to improve Kotzebue's port facilities. They Include the construction.of a sheet pile bulkhead for vessels with 2.4 meter (8 feet) draft; a sheet pile bulkhead and dredged channel for vessels with up to 6.1 meters (20 feet) draft; and an armored breakwater with a jetty extending 1524 meters (5,000 feet) into the sea, a 9.1 meter (30 feet) deep dredged channel , an operating and storage area, a gravel transfer dock in Hotham Inlet and a 48.3 kilometer (30 mile) road to Kotzebue, (WAATS, 1979). Cost of these proposed port improvements range from approximately $1 mill ion to $20 mill ion. Annual dredging is included for each proposal to keep the channel leading to Kotzebue clear. To implement these port improvements, the economy of Kotzebue would require a major growth stimulus, such as large scale mineral sexploitation. According to the WAATS study, this is not likely to occur.

Navigational Characteristics. Kotzebue Sound is a shallow embayment with depths of 11 meters to 16.5 meters (36 to 54 feet). However, it is filled with sediments and the shoreline is very shallow with depths of 5.5 meters (18 feet) as far as 8.1 kilometers to 14.5 kilometers (5 to 9 miles off-shore. The diurnal tidal range is about 0.5 meters (1.6 feet). Winds in excess of 50 m.p.h. have raised the water level up to 1.5 meters (5 feet) above the tidal high. Current from tides is less than 0.8 kilometers per hour (0.5 miles per hour) and is not a factor in navigation; however, a non-tidal flow has been observed with a maximum velocity of 3.7 kilometers per hour (2.3 miles per hour). Due to shallow water, winds can overcome tidal current, making navigation difficult.

Table 10 identifies the earliest, latest, and average dates of ice breakup and freezeup for the Kotzebue area. Generally., Kotzebue Sound is open to navigation from late June to mid-October. The percentage of ice coverage, average low temperature, mean wind speed and direction, and average number of fog days on a monthly basis for Kotzebue is shown on Table 11. Ice thickness is reported to be 1.3 meters (50 inches) during a hard winter (ECO, 1977).

TABLE 10

DATES OF ICE BREAKUP AND FREEZEUP

IN THE VICINITY OF KOTZEBUE

	Average	Earliest	Latest
Breakup	"5/31	5/17	6/18
Freezeup	10/23	1 0/02	11/05

Source: Engineering Computer Optecnomics, 1977

TABLE 11

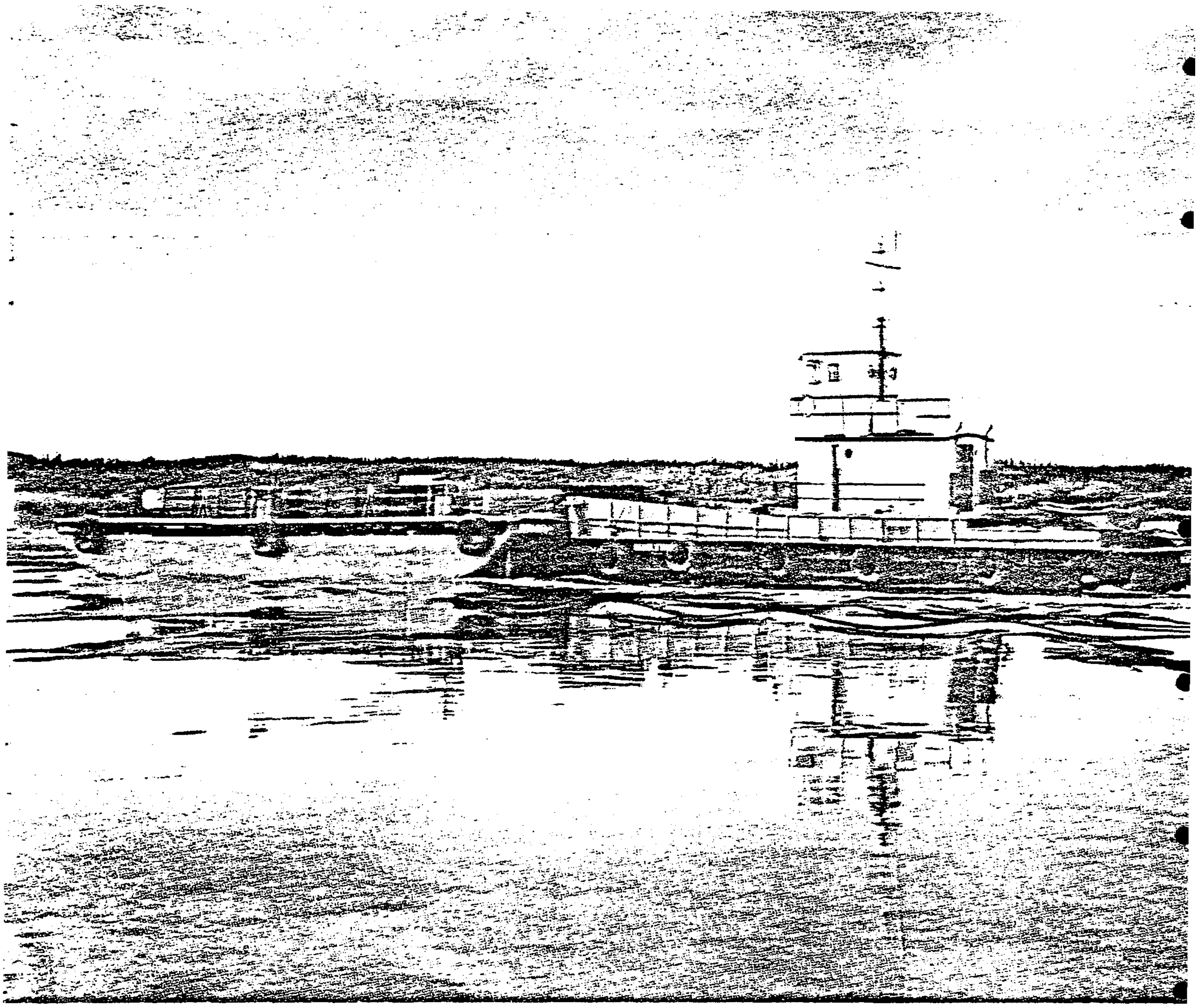
CLIMATIC CONDITIONS IN THE VICINITY OF KOTZEBUE, ALASKA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Ice Coverage	100	100	100	100	87	60-72	36	Free	Free	87	100	100
Temp. Average (°F)	-6.6	-4.7	-1.6	13.8	29.6	43.3	52.6	50.7	40.9	25.5	7.5	-3.7
Temp. Low (°F)	-47	-48	-48	-44	-18	20	34	31	17	-9	-36	-47
Wind Mean Force	12.6	11.9	11.0	11.2	9.0	10.5	11.2	11.6	11.2	11.6	12.4	10.9
Wind Direction	E	E	E	ESE	W	W	W	W	E	ENE	E	NE
Fog (Avg. Days)	1	1	1	2	4	5	3	1	1	1	[illegible]	1

Source: Engineering Computer Optecnomics, Inc. > Final Report to the Federal State Land Use Planning Commission for Alaska on Potential Port Site Assessment, 1977.

In the early spring, snow and ice melt in the Noatak and Kobuk Rivers can also affect navigation. The transportation operating season normally extends from June 1, when ice in the Noatak River breaks up, to September 30 when freezeup commences. On breakup of the Noatak, the spring runoff provides enough water for only ten to fifteen days in which to complete annual deliveries of petroleum and general cargo to the village of Noatak. Once the water drops, the river becomes unnavigable until the next breakup although occasionally heavy rains will bring the river up to operating depths for a few days ˙ate in the season. (luring the second half of June, Hotham Inlet, Selaw˙k Lake, and the Kobuk and Selawik Rivers all become ice free. This is the only reliable period to service the upper Kobuk River villages of Kobuk, Shungnak, and Ambler. Kobuk is the most distant location on the river, about 402 kilometers (250 mi 1 es) from Kotzebue. River depths as shallow as .76 meters to .91 meters (2.5 feet to 3 feet) are routinely experienced during these operations and specialized small tugs and barges must be used. Other villages on the lower Kobuk and Selawik Rivers can be served at any time during the ice free season. Depths on the lower river will vary from 1.2 meters to 1.5 meters (4 feet to 5 feet).

Facilities Usage. In the early parts of the operating season when deliveries must be made while the rivers are still navigable, as many as five small shallow draft tugs and barges have been used (see Figure 9). These are augmented by larger shallow draft tugs and barges which position the cargo at Kiana, a transshipment point about 132 kilometers (82 miles) from Kotzebue. All this equipment remains at Kotzebue over the winter since the river del iveries must be made while Kotzebue Sound is still not free



Tug and barge carry cargo up the Kobuk River *Photo: Steve and Delores McC.*

FIGURE 9

EXAMPLE OF RIVER BASED TUG AND BARGE OPERATION

Source: Comprehensive Development Plan, Kotzebue, Alaska; Alaska State Housing Authority; March, 1971.

of ice. The general cargo and bulk petroleum being delivered during this period has either been brought into Kotzebue the season before or was airlifted in during the winter or spring.

Once the Sound becomes ice free, operations in Kotzebue shift to lighterage of linehaul common carrier vessels and tankers and deliveries to coastal villages from Shishmaref in the south to Point Barrow in the north. The river equipment is unsuitable for this work and larger shallow draft equipment with good seakeeping characteristics are required, Except for the riverine equipment, the lighteraging equipment maintained at Kotzebue is similar to that at Nome(see Page .36). Approximately eight to nine linehaul vessels are lightered each season. These include one government cargo ship, (North Star III), four common carrier dry cargo barges, two contract dry cargo, and one to two contract bulk petroleum barges. The frequency is two to three linehaul vessels per month July through September.

Throughput tonnage data for 1977 by origin and destination is shown in Table 12. Liquid bulk in 1977 accounted for approximately 71% of outbound traffic. Kotzebue is a regional distribution center for local communities and villages in northwestern Alaska. Kotzebue shipped approximately 16,063 ST of cargo outbound from its port in 1977 and approximately 98.5% was distributed to local communities and villages, while the remaining cargo was transshipped to Unalaska, Dutch Harbor, Nome and Anchorage.

TABLE 12

PORT OF KOTZEBUE
1977 COMMODITY TONNAGE BY ORIGIN AND DESTINATION

COMMODITY CLASSIFICATION			INBOUND COMMODITIES		THROUGHPUT	OUTBOUND COMMODITIES	
GROUP	CODE	TITLE	ORIGIN	TONNAGE	TONNAGE	TONNAGE	DESTINATION
	1442	Sand, Gravel, Crushed Rock	Nome	250	250	--	--
Food Products	2094	Groceries	Seattle	767			
			LWC[2]	268	1,124"	89	Local
	2099	Miscellaneous Food Products	Seattle	14	14	--	--
Lumber and Wood Furniture Products	2421	Lumber	Seattle	626			
			LWC	561	1,999	812	Local
	2431	Veneer, Plywood, Worked Wood	LWC	136	136	--	--
	2491	Wood Manufacturers, Nec.	Seattle	373			
			LWC	92	817	352	Local
	2511	Furniture and Fixtures	LWC	6	6	--	--
Petroleum Products	2911	Gasoline	Seattle	37			
			Iliuliuk	8,560	10,827	2,206	Local
						24	Iliuliuk
	2912	Jet Fuel	--	--	943	943	Local
	2914	[distillate Fuel Oil	Iliuliuk	1,681	2,736	1,055	Local
	2915	Residual Fuel Oil	--	--	7,032	7,032	Local
	2921	Liquefied Gases	--	--	235	235	Local
	2991	Petroleum and Coal Products. Nec .	Seattle	31tt			
			Bethel	53	2,565	2,194	Local
Building Products	3291	141st. Nonmetallic Mineral Products	Seattle	110	110	--	--
	3315	Iron, Steel Shapes, Except Sheet	LWC	6	6	--	--
	3411	Fabricated Metal Products	LWC	34	48	14	Local
	3511	Machinery, Except Electrical	Seattle	51			
			LWC	23			
			Nome	35	922	603	Local
						210	Nome
	3611	Electrical Machinery & Equipment	LWC	5	5	--	--
Transportation Equipment	3711	Motor Vehicles, Parts, & Equipment	Seattle	36			
			LWC	85	127	6	Anchorage
	3731	Shipsand this	bathe	7	7		--
	4112	Commodities, Nec.	Seattle	362			
			Seattle	24			
			LWC	56			
			Bethel	5	735	288	Local
TOTALS				14,581	30>644	16>063	

Notes: 1) Throughput tonnage is the sum of inbound and outbound commodities.

As in the Nome throughput tonnage data, the inbound-outbound relationship appears reversed in the Corps of Engineers data. This discrepancy cannot be immediately explained. A more typical situation is illustrated in Arctic Lighterage's projected 1980 tonnage, shown in Table 13. Outbound tonnage is approximately 28% of inbound tonnage and approximately 22% of throughput tonnage.

3,2.1,3 Port of Unalaska/Dutch Harbor

Facilities. Unalaska is located on Unalaska and Amaknak Islands in the Aleutian Chain across Iliuliuk Bay from the abandoned military community of Dutch Harbor on Amaknak Island. The two islands are separated by a narrow strait of approximately 800 feet. The natural harbor, which is centrally located at Alaska's Pacific and Bering Sea fishing grounds, is the only developed deep water port on the chain. There are three major moorages located in this area. They are Dutch Harbor, Iliuliuk Bay, and Captain's Bay. Figure 10 shows the general location of each harbor and bay.

The bay known as Dutch Harbor has two principal docks. One is an abandoned military dock on the northwest side of the Bay under Mt. Ballyhoo. To the south of the Ballyhoo dock site is a T-shaped dock owned and used by Standard Oil. The dock has a loading face 101.8 meters (334 feet) long with water depths ranging from 7.6 meters to 9.1 meters (25 to 30 feet) along the loading face. This facility is used primarily as a refueling base although small amounts of cargo are unloaded that have a destination of Unalaska.

TABLE 13

PORT OF KOTZEBUE
PROJECTED 1980 TONNAGE BY LINEHAUL HANDLING CATEGORIES

	INBOUND	THROUGHPUT 1/	OUTBOUND
Dry Cargo	5,000 ST	7,500 s-r	2,500 ST
Bulk Petroleum	22,377 2/	27,552 ST	5,175 s-f
	(160,000 bbl)	(197,000 bbl)	(37 ,000 bbl)
TOTALS	27,377	35,052	7,675 ST

NOTES: 1/ Throughput tonnage is the sum of inbound and outbound commodities.

2/ The relationship 1 Ton = 7.15 bbl is used to convert barrels to short tons. This factor averages the varying weights among different petroleum products.

SOURCE: Arctic Lighterage Company.

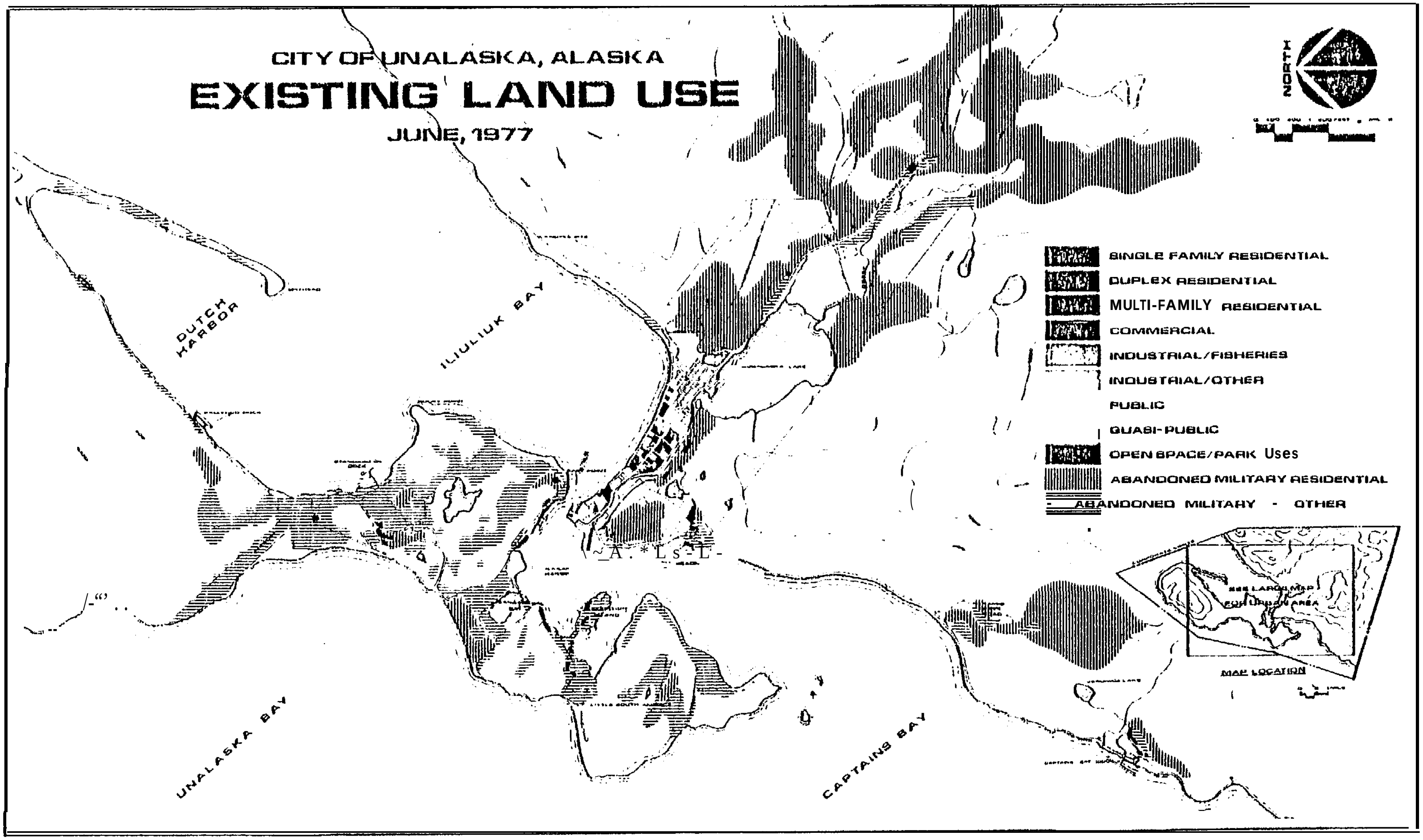


FIGURE 10

LOCATION MAP OF UNALASKA/DUTCH HARBOR PORT FACILITIES

SOURCE; Tryck, Nyman & Hayes, 1977

At the end of the spit of land where the City of Unalaska is situated is a two-faced dock. Each side is about 79.3 meters (260 feet) long with a depth of 9.1 meters (30 feet) alongside the western face, and 6.1 meters to 7.0 meters (20 feet 23 feet) alongside the northeastern face.

There are several docks on the northern and western side of Iliuliuk Harbor and on the southern side of Expedit on Island adjacent to Iliuliuk Harbor there is a long deep water quay with a slipway. This slipway was part of a now abandoned submar ne base and is designed to handle 300 tons. In addition to the Standard Oil Dock, the other major port facilities are located south of Unalaska at Captain's Bay Dock. This dock is T-shaped with a loading wharf of approximately 183 meters (600 feet) long, with depths of 11 meters to 14.6 meters (36 feet to 48 feet). Enclosed storage facilities are located near the dock alongside the docking facilities. The facilities are owned and operated by Crowley Maritime Corporation. This is a major facility for Sea Land container service into and out of Unalaska, including the export of seafood products.

As the fishing industry continues to expand and as oil and gas exploration begins in western Alaska, heavier demands may be placed on the harbor and port facilities located in this area. Unalaska is already on its way to becoming a major transshipment point for foreign ports, western and northern Alaska, and ports in the Lower 48 states.

Several improvements are planned for this area. A November 1977 study by Tryck, Nyman, and Hayes reported that a new boat harbor may be constructed in the protected lee of the spit at the northeast tip of Amaknak Island, in Dutch Harbor. The cost is estimated at $2,8 million. The proposal calls for a city cargo dock, with first phase construction of a 61 meter by 15 meter (200 by 48 feet) docking facility with depths alongside the dock of 12.8 meters to 15 meters (42 to 48 feet). The project is located on the old Ballyhoo Dock site, in Dutch Harbor. A preliminary design completed by Tryck, Nyman and Hayes calls for the excavation of the cliff face on the uphill side of the road at the facility site. The resulting area 'would be used as a marshaling yard for Sea Land service containers. The second phase of construction calls for an addition of 61 meters (200 feet) to the dock face built in phase one. The phase 1 construction was almost completed in July of 1979, but fire destroyed part of the partially completed dock. Sea Land Service Company made a new start, however, and the dock is now completed.

In addition to the two phase development of the city cargo dock project, American President Lines and the Dutch Harbor Development Corporation have prepared plans for a major dock facility. The plan calls for a 7 acre waterfront site located between Rocky Point and East Point. The project includes a 1.5 acre dock site and a bottomfish processing plant. The dock is under construction at this time. Completion of both docking facilities 'would provide a protected moorage which is not currently available at existing facilities.

Navigational Characteristics. The harbor entrance is approximately .8 kilometers (0.5 miles) wide and 29.3 meters to 32.9 meters (96 feet to 108 feet) deep. The harbor is subject to violent will iwaws during spring and fall gales making anchorage dangerous. Iliuliuk Harbor, at the head of Iliuliuk Bay, offers better protection than Dutch Harbor, but this area is congested due to the concentration of fish processing plants and associated heavy vessel traffic. Captain's Bay is the most exposed of the three areas, however, anchorage is available in water depths from 17 to 20 fathoms. This area is generally ice free because of the relatively warm waters of the Japan Current. The water is deep close to shore throughout the harbor, except off Rocky Point.

The diurnal tidal range is 1.1 meters (.3.7 feet) while the extreme range is 2.8 meters (9.1) feet. The tidal current is of minor significance with velocities seldom exceeding 1 knot and is not considered a factor in navigation.

Winds are variable and often strong. Southeasterlies are prevalent on the north side of Unalaska Island from November through February. Winds have climbed to 65 knots at Dutch Harbor. Precipitation occurs on from 200 to 300 days of the year in the Aleutians generally. At Unalaska, the average rainfall is 1.47 meters (58 inches) and when snowfall is included, reaches 2.06 meters (81 inches) (Denconsult, 1979). There are many days with snow, drizzle, and fog. The poorest risibilities in Alaska occur along the Aleutians. Visibility is best in the winter; however, even then it can be hampered by fog, snow, and rain, making navigation difficult.

<u>Facilities Usage</u>. In Unalaska/Dutch Harbor ships can reach the dock without trouble and no lightening is required. Table 14 illustrates the annual level of vessel activity in Iliuliuk Harbor for the period from 1972 through 1977. The numbers shown include all types of commercial vessels.

Throughput tonnage data for the period 1968 through i977 is illustrated in Table 15 and fear 1977 is presented by commodity origin and destination

TABLE 14

ILIULIUK HARBOR

VESSEL ACTIV ITY

1972- 1977

Year	Inbound			Outbound		
	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Tow or Tug
1972	709	58	50	712	59	53
1973	707	26	27	708	28	27
1974	928	20	52	929	21	52
1975	877	60	43	875	62	42
1976	89	64	238	85	66	36
1977	150	54	63	147	45	61

Source: Corp of Engineers., Waterborne Commerce Statistics

TABLE 25

ILIULIUK HARBOR
THROUGHPUT TONNAGE
1968 - 1977

Year	Tonnage
1968	120,980
1969	263,905
1970	251,973
1971	245,163
1972	190,109
1973	163,586
1974	157,477
19?'5	300,953
1976	349,760
1977	342,324

Source: Corp of Engineers, Waterborne Commerce Statistics in Table 16. Table 15 illustrates a rapid growth in throughput tonnage between 968 and 1977; approximately 183%. Most of this is due to increases n bulk petroleum products, which in 1977 accounted for 96% of inbound products and 90% of outbound products. The remaining 4% inbound consisted of building materials, groceries, and all other variety of commodities. The remaining 10% outbound consisted mostly of fresh fish or prepared fish, together with an assortment of other miscellaneous commodities. Table 17 illustrates the distribution of outbound tonnage from Iliuliuk to domestic ports. Approximately 96% of the outbound tonnage has a destination in western Alaska

3.2.2 MARINE CARRIERS

Marine freight carriers serving the study area can be divided into three general categories, as follows: (1) interstate ocean; (2) intrastate coastal shipping, and (3) lightening transportation. Table 18 identifies the carriers that serve Norton Sound. Most of these carriers also serve Kotzebue and Dutch Harbor. The carriers are regulated by either the Interstate Commerce Commission (ICC); Federal Maritime Commission (FMC) or both, with the exception of the North Star III. This vessel is owned and operated by the Bureau of Indian Affairs. In the discussion that follows, these carriers are presented in two groups. In the first group are the common and contract carriers engaged in interstate ocean shipping. The services provided are typically tug and barge except for the North Star III. In the second group are contract lighteraging services engaged in the intrastate coastal shipping and lighteraging.

TABLE 16

ILIULIUK HARBOR
1977 DOMESTIC COMMODITY TONNAGE BY ORIGIN AND DESTINATION

COMMODITY CLASSIFICATION			INBOUND COMMODITIES		THROUGHPUT	OUTBOUND COMMODITIES	
GROUP	CODE	TITLE	ORIGIN		TONNAGE	TONNAGE	DESTINATION
	0911	Fresh Fish, Except Shellfish	LWC[2]	172			
			Kodiak	375	568	21	Kodiak
	0912	Shellfish, Except Prepared	--	--	1,303	1,29?	LWC
						334	Kodiak
			..	--	..	272	Bellingham
	1491	Salt	LWC	91			
	2031	Fish and Shellfish Prepared	--	--	4,019	3,950	Kodiak
			--	--	--	69	SSAP[3]
Food Products	2081	Alcoholic Beverages	Seattle	13			
			LWC	110	123	..	--
	2094	Groceries	Seattle	22			
			LWC	501	523		
	2099	Miscellaneous Food Products	Kodiak	110	110	--	
	2414	Timber, Posts, Poles, Piling	Seattle	110	110	--	..
	2421	Lumber	Seattle	14			
Lumber and Wood Furniture Products			LWC	150			
			Kodiak	12	176	--	--
	2431	Veneer, Plywood, Worked Wood	LWC	3	3	--	--
	2491	Wood Manufacturers, Nec.	Seattle	14			
			LWC	73			
			Kodiak	150	237	..	--
	2691	Pulp and Paper Products, Nec.	LWC	43			
			Kodiak	337	380	--	--
	2911	Gasoline	Richmond, CA	21,115			
			SSAP	571			
			Bering Sea	24	46.141	228	Kodiak
						37	King Cove
						3	Aleutian Ports
						414	Pribilofs
						307	SSAP
						2,323	Naknek
						2,556	Dillingham
						8,409	Bethel
						585	Nome
						3,:.59	Bering Sea North
Petroleum Products	2912	Jet Fuel	Richmond, CA	53,540	56.120	205	Naknek
						1,407	Bethel
						568	Nome
	2914	Distillate Fuel Oil	Richmond, CA	50,976			
			Unalaska	31,353	189.243	491	Kodiak
						332	King Cove
						14,502	Aleutian Ports
						3,515	Pribilofs
						4,707	SSAP
						9,517	Naknek
						5,591	NSAP[4]
						5,783	Dillingham
						22,958	Bethel
						9,748	St. Michael
						3,223	Nome
						14,247	Bering Sea, North
	2991	Petroleum and Coal Products, Nec.	Seattle	23	23	--	--
	3241	Building Cement	LWC	383	383	--	--
	3291	Misc. Nonmetallic Mineral Products	Seattle	14	14	--	--
Building Products	3315	Iron, Steel Shapes, Except Sheet	LWC	1	1	--	--
	3411	Fabricated Metal Products	LWC	1,272	1,295	13	LWC
	3511	Machinery, Except Electrical	LWC	48			
			Kodiak	35	33	--	--
	3711	Motor Vehicles, Parts & Equipment	Seattle	2			
Transportation Equipment			LWC	11			
			Kodiak	25	39	--	--
	3791	Misc. Transportation Equipment	LWC	39	39	--	--
	4112	Commodities, Nec.	Seattle	37			
			LWC	200			
			Kodiak	1,216	2,473	32	LWC
						928	Kodiak
TOTALS				185,665	318,366	132,701	

Notes:
1. Throughput Tonnage is the sum of inbound and outbound commodities
2. "LWC" represents the Lake Washington Canal
3. "SSAP" represents the Southerly Side of the Alaska Peninsula
4. "NSAP" represents the Northerly Side of the Alaska Peninsula

Source: Corps of Engineers, Waterborne Commerce Statistics

TABLE 17

ILIULIUK HARBOR

PERCENTAGE DISTRIBUTION OF OUTBOUND COMMODITIES

DOMESTIC PORTS

1977

Destination	Tonnage	% of Total
Bethel	32,774	24.7
Bering Sea North	22,816	17.2
Dillingham	22,184	16.7
Aleutian Ports	14,505	10.9
St. Michael	9,747	7.4
Kodiak	5,952	4.5
Alaskan Peninsula	10,775	8.1
Seattle, Washington	4,402	3.3
Nome	4,376	3.3
Pribilofs	4,029	3.0
King Cove	869	0.7
Bellingham, Washington	272	0.2
	132,701	100.0

Source: Corp of Engineers, Waterborne Commerce Statistics

TABLE 18

MARINE CARRIERS SERVING NORTON SOUND

Carrier	Type of Service	Regulatory Agency
U.S. Government Bureau of Indian Affairs	North Star III, General Cargo Ship	None
Arctic Lighterage	Coastal & Inland River Tug & Barge	ICC & FMC
Arctic Lighterage	Lighterage	ICC & FMC
Alaska Cargo Lines, Inc.	Oceangoing Tug & Barge	FMC
Alaska Puget United Transportation Companies (APUTCO)	Oceangoing Tug & Barge, "COOL BARGE"	FMC
Black Navigation Co.	Coastal & Inland River Tug & Barge	ICC & FMC
Pacific Alaska Line - West[1]	Oceangoing Tug & Barge	FMC
Foss Alaska Line, Inc.	Oceangoing Tug & Barge	FMC

Notes: 1. Crowley Maritime Corporation subsidiary

2. Abbreviations used:

ICC - Interstate Commerce Commission
FMC - Federal Maritime Commission

Source: L. Berger & Associates, WAATS, 1979

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3.2.2.1 Common and Contract Carriers

Common carriers and linehaul contract tug-barge operations can be divided into two categories: (1) scheduled common-carriers, and (2) contract carriers.

Scheduled Common-Carriers. Typical examples of this type of marine service are Alaska Cargo Lines (formerly Northland Marine Lines); Pacific Alaska Line-West; and Foss Alaska Line. With respect to western Alaska operations, each line publishes scheduled routes and sailing dates and provides services from Seattle to major western Alaska ports, such as Nome, Kotzebue, and Unalaska/Dutch Harbor. Tables 19 and 20 identify the ports served by Alaska Cargo Lines and Pacific Alaska Line-West and the nature of the service: direct or via transshipment from another port. Alaska Cargo Lines generally make three trips per season stopping at Nome three times and Kotzebue twice.

Pacific Alaska Line-Nest travels a slightly different route than Alaska Cargo Lines making three stops at Nome and two at Kotzebue each season. The first trip usually begins just prior to breakup with a final destination of Nome in the latter part of May. PacificAlaska generally uses two 4200 hp tugs and two 122 meter by 23 meter (400 by 76 feet) container barges of 9100 DWT. In addition, the icebreaker barge "Arctic Challenger" is used to break ice encountered during this time of year. The "Arctic Challenger" is also used later in the season in the second run to Prudhoe Bay. Cargo is generally transferred to lighterage craft for delivery to shore, and when commercial lighterage craft are not available, helicopters are used to transfer cargo.

TABLE 19

PORTS OF CALL

ALASKA CARGO LINES[1]

(Formerly Northl and Marine Lines)

Dutch Harbor[2]

Dillingham

Bethel

Napakiak

St. Michael[3]

Unalakleet

Nome

Kotzebue[4]

Notes: 1. Alaska Cargo Lines makes 3 voyages annually.

2. To Dutch Harbor from Seattle direct and via Kodiak.

3. Delivery to Lower Yukon River points from St. Michael.

4. Only one call at Kotzebue

Source: L. Berger & Associates, WAATS, 1979.

TABLE 20

PORTS OF CALL

PACIFIC MASKA LINE - WEST -

(subsidiary of Crowley Maritime)

Dillingham

Bethel

Yukon River[1] ,

- Emmonak
- Alakanuk
- Kotlik
  Mountain Village
- St. Marys

Nome

St. Michael[2]

Unalakleet[2]

Kotzebue

Point Hope[3]

Point Lay

Wainwright

Barrow

Kaktovi k

Notes: 1 . Delivered by accompanying lighter from Black River.

2. Delivered from Nome by Arctic Lighterage Co.

3. Commercial cargo for the Arctic Coast Ports are delivered by "Cool Barge" (Point Hope to Kaktovik).

Source: L. Berger & Associates, WATTS, 1979

Contract Carriers. Contract or charter carriers are used by major shippers, such as petroleum companies, to move specialized and oversized cargo throughout Alaska as the need develops. An example of the use of this type of carrier is transshipment of supplies to Prudhoe Bay between 1968 and 1975 for the development of oil and gas on Alaska's North Slope. During this period, Arctic Marine Freighters shipped 594,000 tons to the North Slope. Their largest shipment was made in 1975 when they shipped 153,000 tons using 24 tugs and 48 barges. Crowley Maritime and Dillingham Maritime (Ocean Division) also provide contract tug and barge service in Alaska. Their principle place of operations to date have centered in the Gulf of Alaska. However, Crowley does maintain a major operation in western Alaska and could provide this service to Norton Sound (Crowley Maritime, 1980).

Alaska Puget-United Transportation Company (APUTCO) is a contract operator of the "COOL BARGE" which makes deliveries of dry cargo, reefer, and bulk petroleum to the Department of Defense and other federal agency coastal installations in western Alaska. Their barges call at Nome two times and Kotzebue two to three times each season. Table 21 provides a list of locations and agencies served by "COOL BARGE." In Nome, The National Guard and National Weather Service receive supplies via "COOL BARGE."

Puget Sound Tug and Barge Company is a contract operator that makes bulk petroleum deliveries on a scheduled basis to distribution centers in Western Alaska for Chevron USA, Inc. Their barges call at Nome two to three times and Kotzebue two times during the season. Their itinerary is Seattle, Nome, St. Michael, Seattle and Dutch Harbor, Nome, St. Michael, Dutch Harbor. Puget Sound Tug and Barge Company also moves a substantial amount of construction material and contractor equipment on a non-scheduled

TABLE 21

LOCATIONS AND AGENCIES SERVED BY
U.S. MILITARY SEA LIFT COMMAND "COOL BARGE"

Location	Agency	Location	Agency
Akhiok	PHS	Nome	AKARNG,NWS
Atka	PHS	N.E. Cape	ASL
Attu	USCG	Oliktuk Point	DEN
Barter Island	DEW,FWS,NWS	Perryville	PHS
Bethel	AKARNG BIA,PHS,NWS	Point Barrow	PHS,AKARNG NPRA,ARL,DEW
Cape Lisburne	AAc	Point Hope	PHS
Cape Newenham	AAC	Point Lay	DEW,AKARNG
Cape Romanzof	AAC	Port Clarence	USCG
Captains Bay	FWS	St. Elias	USCG
Chignik Lake	PHS	St. George	NMF
Cold Bay	AAC,FWS,NWS	St. Michael	AKARNG
Dillingham	PHS	Sarichef	FWS
English Bay	PHS	Sheldon Point	PHS
Fire Island	FAA	Shemya	AAC
Hinchinbrook	FAA,USCG	Tatalina	AAC
Karluk	FAA,USCG	Teller	AKARNG
King Salmon	AAC, NWS	Tin City	AAC
Kotzebue	AAC ,AKARNG	Togiak	AKARNG
Level Island	FAA	Unalakleet	AKARNG
Lonely	NPRA, DEW	Wainwright	DEW,AKARNG
McGrath	NWS	Wales	ASL
Middletown Island	FAA	Yagataga	FAA
Naknek	NPS,PHS		

Abbreviations used:

AAC	Alaska Air Command	FWS	Fish & Wildlife Service
AKARNG	Alaska Army National Guard	NMF	National Marine Fisheries
ARL	Arctic Research Laboratory	NPRA	National Petroleum Reserve
ASL	Arctic Submarine Laboratory	NPS	National Park Service
BIA	Bureau of Indian Affairs	NWS	National Weather Service
DEW	Distant Early 'Warning Station	USCG	U.S. Coast Guard
FAA	Federal Aviation Agency		

Source: L. Berger & Associates, WAATS, 1979 contract basis.

Other contract operators providing similar services are Foss Tug and Launch Company, Marine Leasing, Wick Construction Company, Dunlap Towing, and other smaller companies. Southbound freight from Nome and Kotzebue is minimal and consists chiefly of contractor's equipment and scrap material. Most is destined for Anchorage and other construction sites in Alaska in the case of contractor's equipment and Seattle in the case of scrap material .

At the present time the only cargo ship regularly serving the western and arctic coasts of Alaska is the Bureau of Indian Affairs ship, North Star III. The characteristics of this ship were presented earlier in Table 4 . The ship takes bulk cargo and petroleum products, as well as reefer cargo, to Alaska coastal villages from the Aleutians to the Arctic. Two voyages are made each year. The first voyage serves people living in the area from the Aleutian Islands to Cape Prince of Wales and the second voyage serves coastal villages north of Wales and Little Diomede Island. Table 22 identifies the communities served by the North Star 111 during the 1978 shipping season. About 17,000 revenue tons of cargo are delivered each year.

3.2.2.2 Contract Lighteraging Service

Two contract lighteraging firms provide services to Norton Sound Communities: Arctic Lighterage Company and Black Navigation Company. Both firms provide bulk petroleum, and neobulk, breakbulk, and container dry cargo delivery service to outlying coastal communities, Arctic Lighterage is locatedin Nome and also provides a similar service from Kotzebue. The

TABLE 22

PORTS "OF CALL

U.S.M.S. NORTH STAR III

(1 978 Season)

APRIL - AUGUST VOYAGE (miles travelled, 6,704)

Dutch Harbor[1]
Goodnews Bay
Platinum
Tununak
Newtok
Toksook Bay
Nightmute
Mekoryuk
Scammon Bay
Hooper Bay
Chevak
Golovin
Stebbins
St. Michael[2]
- Marshall
- Pilot Station
- Alakanuk
- Kotlik

White Mountain
Unakakleet
Scammon Bay
Dutch Harbor
Savoonga
Gambel 1
Shaktoolik
El im
Koyuk
Nome
Little Diomede
'dales
Tin City[3]

AUGUST - OCTOBER VOYAGE (miles travelled 7,228)

Dutch Harbor[4]
St. Michael
- Pilot Station
St. Marys
- Sheldon Point
- Alakanuk
- Kotlik
- Stebbins
Nome
Brevig Mission
Little Diomede
Kotzebue[5]
- Buckland
Barrow
Wainwright
Point Lay

Point Hope
Kivalina
Kotzebue
Deeri ng
Shishmaref
Little Diomede
Brevig Mission
Tin City
Deering
Little Diomede
Wal es
Port Clarence
Wal. es
Mekoryuk[6]

Notes: 1 . Serves Gulf of Alaska & Bristol Bay prior to Dutch Harbor.
7. Lower Yukon River points served by local lighter in St. Michael.
3. From Tin City return to Seattle.
4. Serves Aleutian ports prior to Dutch Harbor.
5. Kotzebue Sound and river ports served by local lighter.
6. Return to Seattle from Mekoryuk.

Source: L. Berger & Associates, WATTS, 1979 communities served from each location are identified in Table 23. These services were described in detail earlier (pages 34-38 and 63). In addition to these services, Arctic Lighterage has the operating authority and capability to load and unload contract aircraft. Black Navigation located in St. Michael receives dry cargo from Arctic Lighterage and bulk petroleum directly at St. Michael's and delivers to eastern and southern Norton Sound communities and communities along the Yukon River to St, Mary's. The communities served by Black Navigation are identified in Table 24.

3.2.3 CARRIER RATES

Marine shipping rates by carriers reflect the characteristics of traffic to a given community. Among these characteristics are totsl tonnage, length of haul, breakdown of tonnage by commodity and handling category, relationship between inbound and outbound cargo, and amount of competition. Table 25 illustrates commodity linehaul rates and lighterage tariffs for Pacific Alaska Lines and Arctic Lighterage for a variety of goods moved between Seattle and Nome or Kotzebue.

3.2.4 REGULATIONS

For marine freight operatiens, most regulatory functions are handled by federal agencies. The Corps of Engineers handles the permit process for channel and harbor improvements. The Corps, with the participation of local and State agencies, funds the construction of breakwaters and channel improvements. The U.S. Coast Guard has multiple sea-oriented missions, including the establishment and maintenance of navigational aids, carrying out of search and rescue missions, policing fishing treaties and the 200-mile limit, enforcing water pollution laws, and conducting marine inspections.

TABLE 23

PORTS OF CALL

ARCTIC LIGHTERAGE COMPANY

(Subsidiary of Crowley Maritime)

Points Served From Nome	Points Served From Kotzebue
Shishmaref[1]	Barrow
Wales	Wainwright
Brevig Mission	Point Lay
Teller	Point Hope
Nome	Kivalina
'Mbits Mountain	Noatak
Golovin	Kotzebue
Elim	Noorvik
Koyuk	Kiana
Shaktoolik	Selawik
Unalakleet	Ambler
St. Michael	Shungnak
Stebbins	Kotsuk
Gambell	Deering
Savoonga	Buckland
Moses Point	Kiwalik
Ungalik	Shishmaref[1]
Hooper Bay	
Cape Romanzof	

Notes: 1. Shishmaref is the only point served from both bases.

Source: L. Berger & Associates, WAATS, 1979.

TABLE 24

PORTS OF CALL.

BLACK NAVIGATION COMPANY[1]

Elim

Koyuk

Shaktoolik

Unalakleet

St. Michael[1]

Stebbins

Moses Point

Ungalik

Kotlik

Hamilton

Emmonak

Alakanuk

Scammon Bay

Hooper Bay

Chevak

Mountain Village

Pikas Point

St. Marys

Pilot Station

Marshall

Notes: 1) Provides services from St. Michael, Alaska.

TABLE 25

COMMODITY RATES AND LIGHTERAGE TARIFFS
BETWEEN SEATTLE AND NOME/KOTZEBUE
(in $ per 100 pounds)

Commodity	SEATTLE TO PORT NOME: Linehaul Rates Seattle to the Nome Anchorage	Lighterage Tariff Nome Anchorage to Port Nome[1,2]	Total Shipping Charge	SEATTLE TO PORT KOTZEBUE: Linehaul Rates Seattle to the Kotzebue Anchorage	Lighterage Tariff Kotzebue Anchorage to Port Kotzebue[1,3]	Total Shipping Charge
Household Appliances	21.11	4.80	25.91	22.16	5.00	27.16
Automobiles	25.51	9.20	34.71	26.78	10.00	36.78
Boats, Canoes and Skiffs	44.60-65.11	21.72	66.40-07.49	46.22-69.06	22.38	60.60-91.44
Bricks, Blocks	5.76-9.20	2.50-3.50	8.26-12.78	6.40-9.75	2.80-3.90	9.20-13.65
Buildings or Houses	11.10	2.50	13.60	11.10	2.60	13.70
Building Materials	25.93	2.50	28.43	29.63	2.60	32.23
Cement, Gravel, Lime	6.09-9.06	20.60	26.69-29.66	6.31-9.52	21.16	27.53-30.68
Conduit or Pipe	10.03	3.50	13.53	11.03	3.70	14.73
Freight Not Otherwise Specified		0.00	---	---	8.30	---
Iron/Steel	7.00	2.50	9.50	7.54	2.60	10.14
Furniture	14.87-47.84	6.50-11.50	21.37-59.34	16.44-50.24	6.70-11.80	23.14-62.04
Groceries		2.40	---		2.50	---
Liquor	10.82-17.63	5.20	16.10-22.91	13.55-19.04	5.44	18.99-24.48
Lumber-Rough or Surfaced		1.80		---	1.84	---
Lumber-Poles	8.68	2.16	10.84	9.02	2.24	11.26
Machinery	7.21-9.41	2.60	9.81-12.01	7.62-11.72	2.66	10.28-14.38
Oil-Liquid Bulk	7.16-9.72	2.20	9.36-11.92	7.40-10.25	2.30	9.70-12.55
Trailers/Mobile Homes	11.10	13.80	24.90	11.10	14.20	25.30
Snow & Ice Vehicles	20.57	10.80	39.37	30.00	11.10	41.10

Notes: 1. Arctic Lighterage Co. imposes a 25 percent surcharge on goods lighteraged from linehaul carriers after September 25.

2. Distance from Nome anchorage to Port Nome approximately 1.6 kilometers (1 mile).

3. Distance from Kotzebue anchorage to Port Kotzebue approximately 11.3 kilometers to 24.1 kilometers (7 miles to 15 miles) depending on the linehaul barge.

Sources: Linehaul Rates: Pacific Alaska Line, Inc.; Freight Tariff No. 1-A., effective December, 1979.

Lighterage Tariff: Artic Lighterage Co.; Freight Tariff No. 2-A., effective February, 1979.

Several federal agencies regulate interstate commerce and are pushing ahead with deregulation of freight rates in all modes. These actions will cause rates to reflect the distribution of costs rather than what the "traffic will bear" (Frederic Harris, 1978).

The Jones Act prevents foreign-built ships from carrying freight or passengers between U.S. ports. In authorizing construction of the Trans-Alaska pipeline, Congress mandated that none of the oil could be exported. At the present time this egislation only affects the operation of-tankers serving Valdez.

3.3 Air Mode

The air mode of transportation in western Alaska provides an important year-round interstate, intrastate and intraregional service. Aircraft landing facilities are found throughout the study area; many are privately owned. The scheduled type of service offered to the Nome and Kotzebue areas can best be described as "hub and spoke" in that linehaul service is available between these regional hub communities and Fairbanks and Anchorage, with feeder service provided between the hubs and smaller communities in each region. Contract services are also available. A multitude of aircraft types are employed in providing these services. For the small hub communities of Nome, Kotzebue and Unalakleet, and the large hub Anchorage International Airport, the following discussion identifies relevant terminal characteristics, including facilities and services available; as well as the carriers providing aviation services. Rates charged for services and applicable institutional factors are also discussed.

3.3.1 AIR TERMINALS

This description of existing airports will focus on the major terminal facilities and examine four categories of data as follows: (1) ground facilities which aircraft utilize, including runways, taxiways, and aprons for loading and unloading freight and passengers; (2) visual and instrument landing aids; (3) service-related activities such as control towers, fuel and maintenance, and weather reporting and (4) passenger and freight handling facilities, terminals, and the r utilization.

Two measures of capacity exist for airports--the size and type of aircraft that can be accommodated and the numbers of operations (take-offs and landings) that can take place. The first measure relates to ground facilities and the second to all four categories listed above. Once ground facilities are in place, introduction of additional landing aids and services can increase the number of possible operations. The governing constraint for each airport should be recognized. For a specified annual amount of freight/passenger tonnage, inadequate runway length may reduce aircraft payloads, thereby increasing the number of annual operations and adversely affecting airport capacity. In such cases, the runways may need to be lengthened. In some cases, the runway configuration will govern and new runways may be required to improve capacity. In other cases, the landing aids and facilities may limit operations and need to be upgraded. Finally, geographical constraints in the form of obstructions or lack of level land for development can be the ultimate constraint.

The State of Alaska has established for Alaska three major categories of airports. International airports provide the interface between combinations of international, interstate, and intrastate service. Truck airports, which are usually served by jet aircraft, distribute goods and passengers to outer ying secondary airports approximately 241 Km (150 miles) to 323 km (200 miles) away. The designation represents the highest use of the airport. Commuter airlines and air taxi operators co-exist with jet aircraft at trunk and international airports. Nome, Kotzebue, and Unalak eet are each designated as trunk term nals; Anchorage is designated as an international airport,

For each a rport, minimum visibility and ceiling guidelines are established for different types of aircraft based on available landing aids and nearby obstructions. These guidelines and local prevailing weather conditions affect the reliability of operations which, in turn, affect the capacity of the airports. Table 26 identifies the navigation aids and other aid facilities available at Nome, Kotzebue, and Unalakleet airports. All are designated air carrier service level airports by the Federal Aviation Administration (FAA). Table 27 identifies runway characteristics and ground facilities at these airports.

The existing route structure and passenger load factors are illustrated in Figure 11 and 1978 traffic between city pa rs for January and August are identified in Table 28. The passenger loa factors identified on both Figure 11 and Table 28 indicate an increase in summer travel and freight demands which is consistent with present economic patterns. The summer travel increase is due in large part to tourists and seasonal employment in fishing and construction trades.

3.3.1.1 Nome

Landing facilities at the Mome Airport consist of two asphalt runways; one is 183 meters (600 feet) long, by 46 meters (150 feet) wide and the other is 1,699 meters (5,575 feet) long, by 46 meters (150 feet wide. The

TABLE 26

AIRPORT AND RUNWAY CHARACTERISTICS AND AIDS
AT NOME, KOTZEBUE AND UNALAKLEET

	AIRPORT					
	NOME		KOTZEBUE		UNALAKLEET	
	Runway 09-27	Runway 02-20	Runway 08-26	Runway 17-35	Runway 14-32	Runway 08-25
Airport Role						
- Service Level	Air Carrier		Air Carrier		Air Carrier	
- Design Type	Air Carrier		Air Carrier		Air Carrier	
Runway Catagory	Precision	Non-Precision	Precision	Non-Precision	Non-Precision	Non-Precision
Lighting						
- Rotating Beacon	yes	yes	yes	yes	yes	yes
VASI	yes	yes	yes	no	yes	no
- Runway	yes	yes	yes	yes	yes	no
- Approach	yes	no	no	no	yes	no
Navigational Aids						
VOR	yes	yes	yes	no	yes	no
- NDB	yes	yes	yes	no	yes	no
- ILS	yes	no	yes	no	no	no

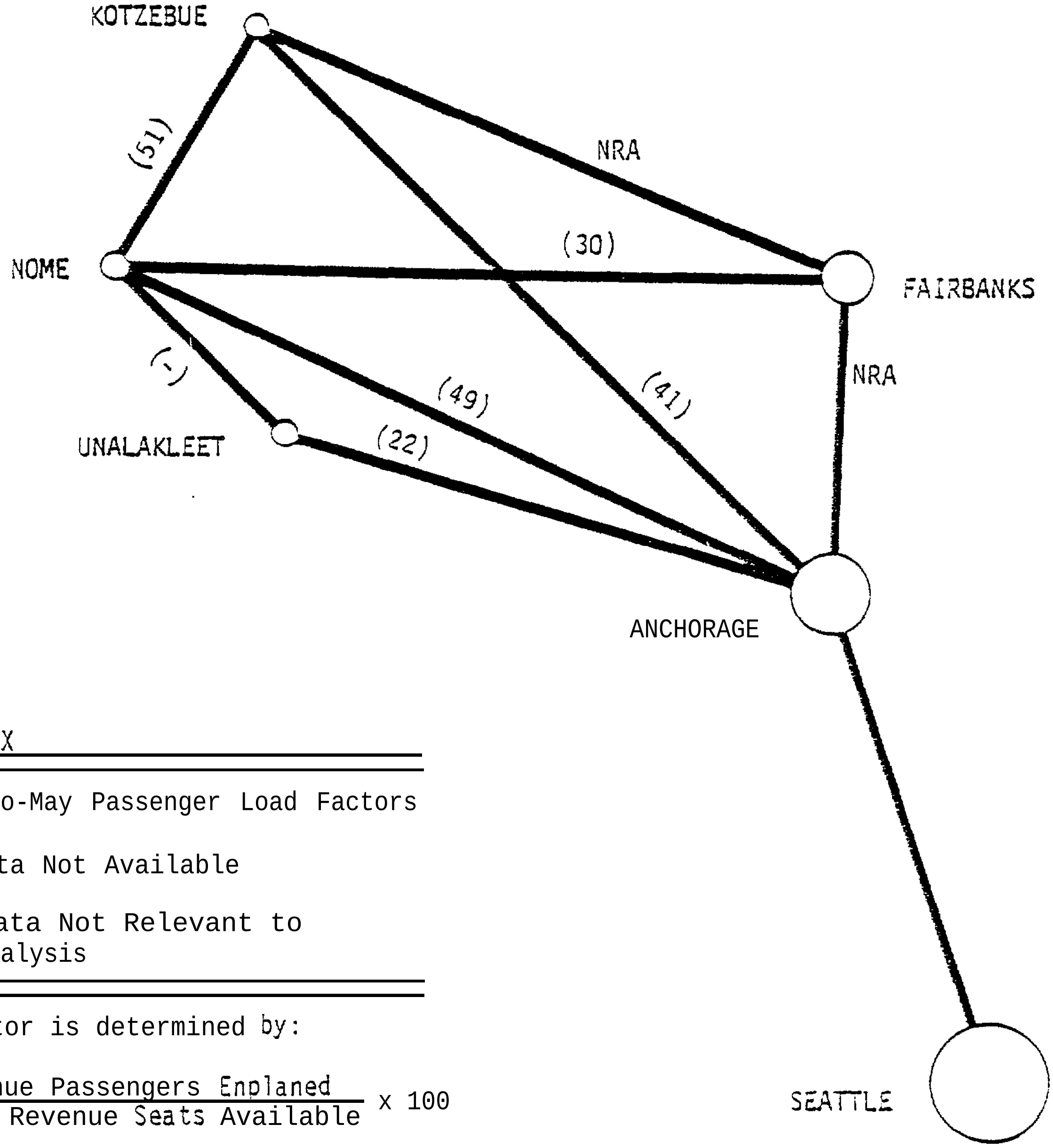
Sources: FAA and L. Berger & Assoc. WAATS, 1979.

TABLE 27

RUNWAY AND GROUND FACILITIES AT NOME, KOTZEBUE, AND UNALAKLEET

Community	Location	Owner	Runway Heading	Length Meters(ft)	Width Meters(ft)	Surface Type	Heliport	Terminal Building	Hangers	Fuel	Maintenance	Storage	Weather Information
Kotzebue	½ mile so. of town center	State of Alaska	17-35	4000	90	Gravel	No	Yes	5	Yes	Yes	Yes	Yes
			8-26	5899	150	Asphalt							
Nome	2 miles west of towncenter	State of Alaska	2-20	5575	150	Asphalt	No	Yes	3	Yes	Yes	Yes	Yes
			9-27	6006	150	Asphalt							
Unalakleet	½ mile north of town center	State of Alaska	0-26	2320	150	Gravel	No	Yes	No	Yes	No	No	Yes
			14-32	6004	110	Gravel							

Source: FAA, Ten Year Plan, July 1979.



INDEX

( ) - Two-May Passenger Load Factors

(-) - Data Not Available

NRA - Data Not Relevant to Analysis

Load factor is determined by:

$$\frac{\text{Revenue Passengers Enplaned}}{\text{Total Revenue Seats Available}} \times 100$$

FIGURE 11

PASSENGER LOAD FACTORS
ON SELECTED CITY PAIR AIR ROUTES

SOURCE : James D. Lindsay & Assoc.

TABLE 28

1978 TRAFFIC DATA FOR WEIN AIR ALASKA
ON SELECTED CITY PAIR AIR ROUTES

City Pairs	Passengers Enplaned	Passengers Transported	Number of Departures	Tons'	% Load Factors Passengers	% Load Factors Tons
Jan. 1978[2]						
ANC - OME	1223	1305	55	375	48.59	53.92
ANC - OTZ	878	1138	56	302	40.67	43.53
ANC - UNK	143	143	18	86	22.07	40.20
FAI - OME	292	292	26	100	30.29	30.87
OTZ - OME	561	931	30	137	50.76	39.77
OME - UNK	---	---	3	1	---	100.00
Aug. 1978						
ANC - OME	4725	4725	75	578	66.31	62.00
ANC - OTZ	4205	4205	63	530	66.85	72.76
ANC - UNK	608	616	19	107	66.24	60.98
FAI - OME	198	361	13	117	51.23	68.34
OTZ - OME	342'5	3883	52	422	61.99	6a.30
OME - UNK	---	---	1	---	---	100.00

Notes: [1] Torts includes passenger weight at 200 pounds,

[2] ANC · Anchorage
OME = Nome
OTZ = Kotzebue
UNK = Unalakleet
FAI = Fairbanks

Source: Civil Aeronautics Board

airport is located approximately 3.2 kilometers (2 miles) west of the town center and approximately 24.1 kilometers (15 miles) west of Cape Nome.

Figure 12 shows the Nome Airport layout plan. The airport is owned and operated by the State Alaska. There are five hangers adjacent to the runway. The largest hanger, "Birchwood Hangar", will be removed to make room for a future terminal. There is also a large maintenance area allowing for minor airframe and power plant repairs and a large complex of buildings for the FAA quarters.

Wien Air Alaska, Alaska Airlines, and Munz Northern Airlines are the only air carriers providing scheduled passenger service to Nome. Great Northern dropped their air passenger service in 1979 because of lack of revenue. Wien "Air Alaska provides jet service daily from Anchorage and three times weely from Fairbanks. During the 12 months ending December 31, 1978, Wien completed 80.9% of its scheduled flights. Alaska Airlines, which operated between Anchorage and Nome/Kotzebue up to 1975, again began jet service to Nome and Kotzebue on June 1, 1980. Munz Northern Airlines is a commuter airline serving Nome, Kotzebue, and Unalakleet, as well as 32 other communities and villages in the Norton Sound-Bering Strait area.

In addition to air carrier passenger service, Wien Alaska Airlines, and Great Northern provide air freight service to Nome. Wien and Alaska Airlines provide daily combination passenger/freight service from Anchorage and Great Northern provides daily freight-only service (except Sunday) from Anchorage.

Several air taxi operators and contract aviation services are available on the airport including Foster Aviation, Nome Flying Service, Munz Northern Airlines, and Seward Peninsula Flying Service.

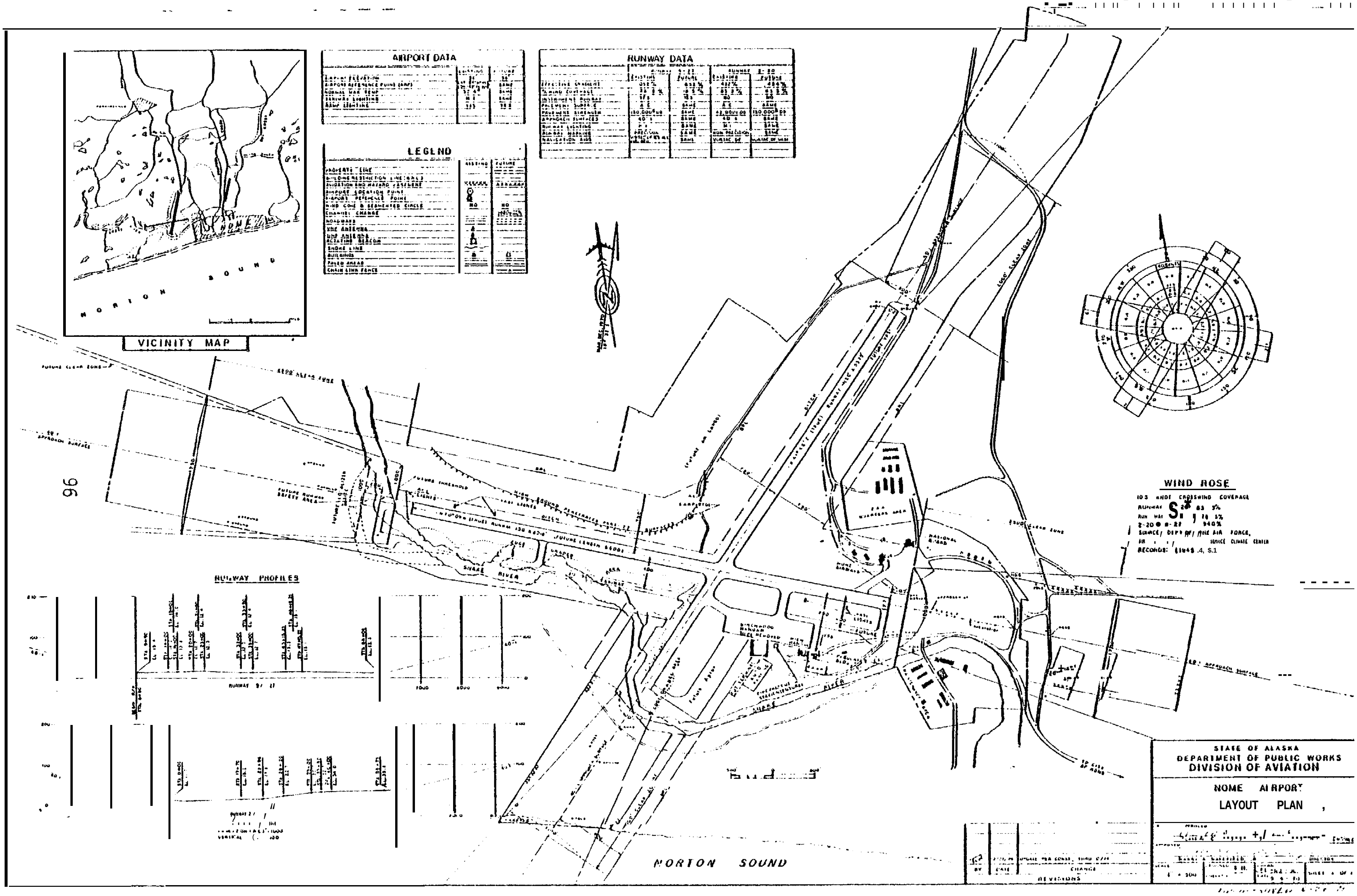


FIGURE 12 NOME AIRPORT LAYOUT PLAN

SOURCE: Alaska DOT/PF

Recent action by the CAB tentatively granting rights for a number of air-lines to initiate service into western Alaska, and their consideration of yet other requests for similar routes, may affect Nome service. While all of the approved routings were to communities other than Nome, a pending application by Western Yukon Air identified Nome as one of several communities it would serve. Western Yukon Air must undergo "fitness" hearings before being granted the rights it seeks. These hearings were scheduled to take place during May 1980 (Anchorage Daily News, April 17, 1980).

The breakdown of 59,000 operations for FY1978 for the Nome facility is as follows:

Air Carriers	14 percent
General Aviation	51 percent
Air Taxi	25 percent
Training (Touch and Go)	10 percent
	100 percent

The runway length is adequate to serve existing jet traffic. The longer runway has a FAA gross weight strength of 45,359 kilograms (100,000 pounds) for single wheel loading, and 148,778 kilograms (328,000 pounds) for dual tandem loading. There are no close-in obstructions with the exception of a hill 610 meters (2,000 feet) from the small runway on a westerly approach, although gold dredging equipment may begin to interfere with airport operations in the near future (FAA, personal communication). The Alaska Transportation Commission (ATC) has indicated that the north-south runway may be extended to 1,951 meters (6,400 feet); however, the date for this expansion has not been set. Tine practical annual capacity of the airfield based on runway configuration is crudely estimated at

175,000 operations (FAA), which means in 1978 the airport was operating at about 35 percent of capacity.

The FAA has forecast an increase of 16.6 percent in air carrier operations and 73.3 percent in air taxi operations between 1978 and 1990. The FAA Ten-Year Plan has recommended a number of airport improvements that are intended to be implemented by 1990. They include the rebuilding of the east-west runway, providing for new or improved approach aids on the north-south runway (VOR, DF, and VASI), construction and expansion of the terminal facilities, the provision of a new terminal access road, and fencing of the access road.

3.3.1.2 Kotzebue

Figure 13 illustrates the airport layout plan for Kotzebue. The airport is located at the south end of the community, within walking distance of hotels. The airport is owned by the State of Alaska and the terminal facilities are operated by Wien Air Alaska. The main runway, which lies east-west, measures 1,798 meters (5,899 feet) long by 46 meters (150 feet) wide and is of asphalt construction. The crosswind runway, which lies north-south, measures 122 meters (400 feet) long, by 47 meters (155 feet) wide and is gravel sufaced. A float plane facility lies adjacent to the gravel runway with a landing and take-off area of approximately 457 meters (1,500 feet) long by 30 meters (100 feet) wide.

Three scheduled air passenger carriers and two scheduled air freight carriers serve Kotzebue. The community has daily passenger service by Wien Air

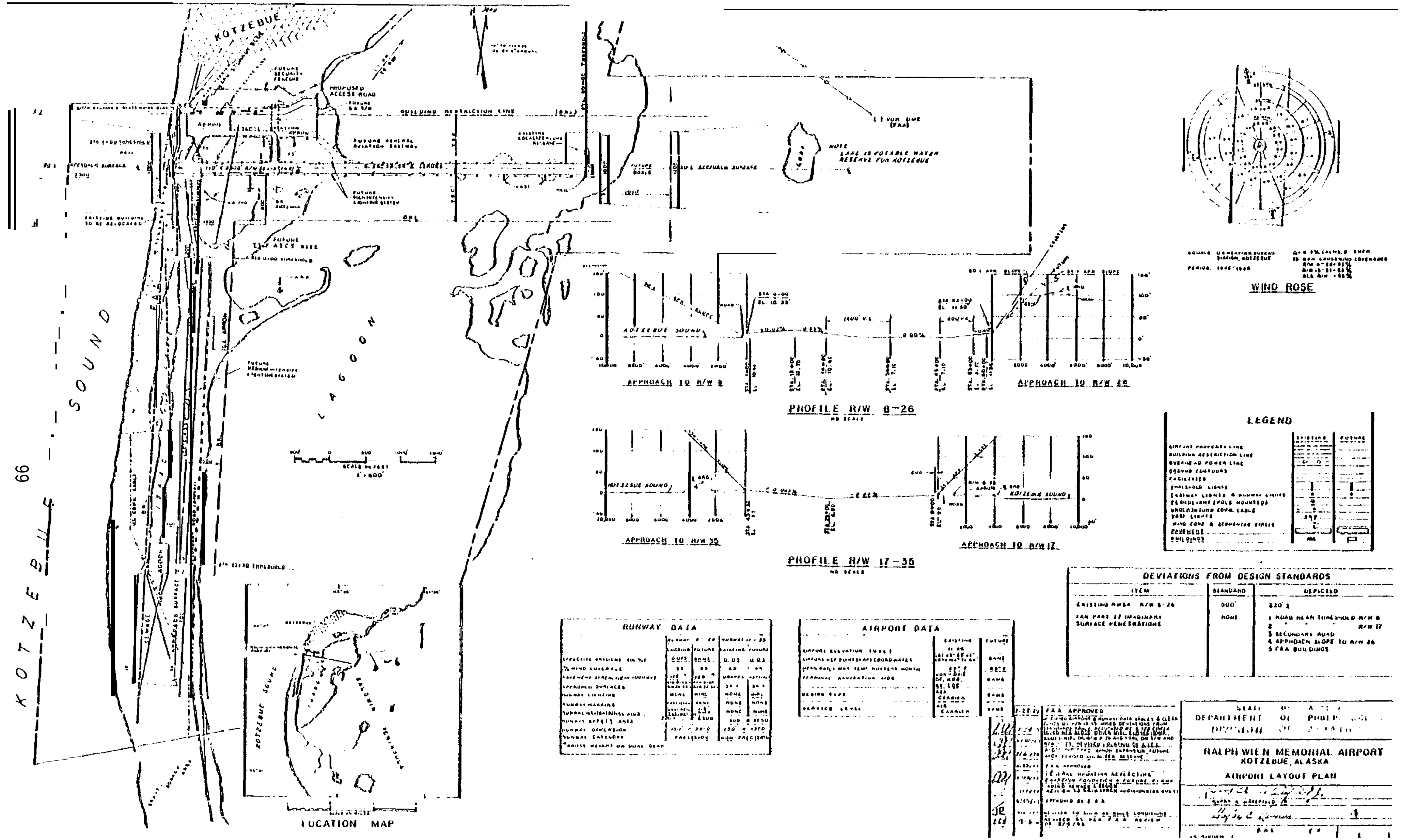


FIGURE 13 KOTZEBUE AIRPORT LAYOUT PLAN

SOURCE: Alaska DOT/PF

Alaska from Anchorage and service three times per week from Fairbanks. During the 12 months that ended December 31, 1978, Wien completed 92.8 percent of its scheduled departures. Munz Northern Airlines provides scheduled service from Nome. Alaska Airlines inaugurated service to Kotzebue and Nome on July 1, 1980, after a 5-year absence.

At present, Wien, Alaska Airlines and Great Northern Airlines provide scheduled air freight service to Kotzebue. Wien and Alaska Airlines provide a combination of freight/passenger service, and Wien also provides a freight charter service. Great Northern Airlines, which until early in 1979 provided passenger service in addition to freight service, has dropped their passenger service due to lack of revenue and rising fuel costs. They currently provide daily (except Sunday) freight service.

The airport is also served by a variety of air taxi operators: Baker Aviation, Kotzebue Flying Service, Maxson Aviation, Shellabarger Flying Service, and 'Walker Air Service.

The runway length is adequate to serve existing jet traffic. Topography and land uses present no problems for landings or take-offs. The FAA has forecast a 73.3 percent growth in air taxi operators and a 25 percent increae in air carrier operators over the next 12 years. In response to this increase in the number of operations anticipated to occur, the FAA has proposed several improvements to the airport facilities. The plan calls for the construction of a new terminal, improvement of paving and lighting on the runways, additional lighting aids, and an access road and fencing.

The FAA has also planned a number of navigational and landing aid improvements. They include upgrading the VOR (VHF Omni-Directional Radio Range), the addition of OME which make possible lower instrument flight minimums, and the establishment of NDB which is a navaid. In addition, FAA has commissioned "Visual Approach Slope Indicators" (VASI) which allow for visual vertical guidance; "Runway End Identifi cation Lights" (REIL) designed to provide early visual identification of the runway end; "Localizer (Marker) or Distance Measuring Equipment" (DME) which make possible lower instrument flight minimums and a "Glide Slope". A guide slope and middle marker will be added to upgrade the facility to provide precision instrument approach capability. Tine FAA has also recommended the funding of "OMNI Directional Approach Lights". These are used in cases, such as the Kotzebue Airport, where visibility or approach flight path problems cannot be overcome with one of the standard approach lighting systems.

3.3.1.3 Unalakleet

The Unalakleet airport is owned and operated by the State of Alaska. The airport plan is shown in Figure 14. Landing facilities at the Unalakleet Airport consist of a gravel runway (number 14-32) 1,829 meters (6,000 feet) long, by 46 meters (150 feet) wide and a secondary gravel runway referenced as 8-26, which is used for small planes and measures 707 meters (2,320 feet) long, by 46 meters (150 feet) wide. The airport is located north of Unalakleet within walking distance of the town center. The runway is parallel to the shoreline, allow ng over water approaches from both directions. here are no close- n obstructions to the runways.

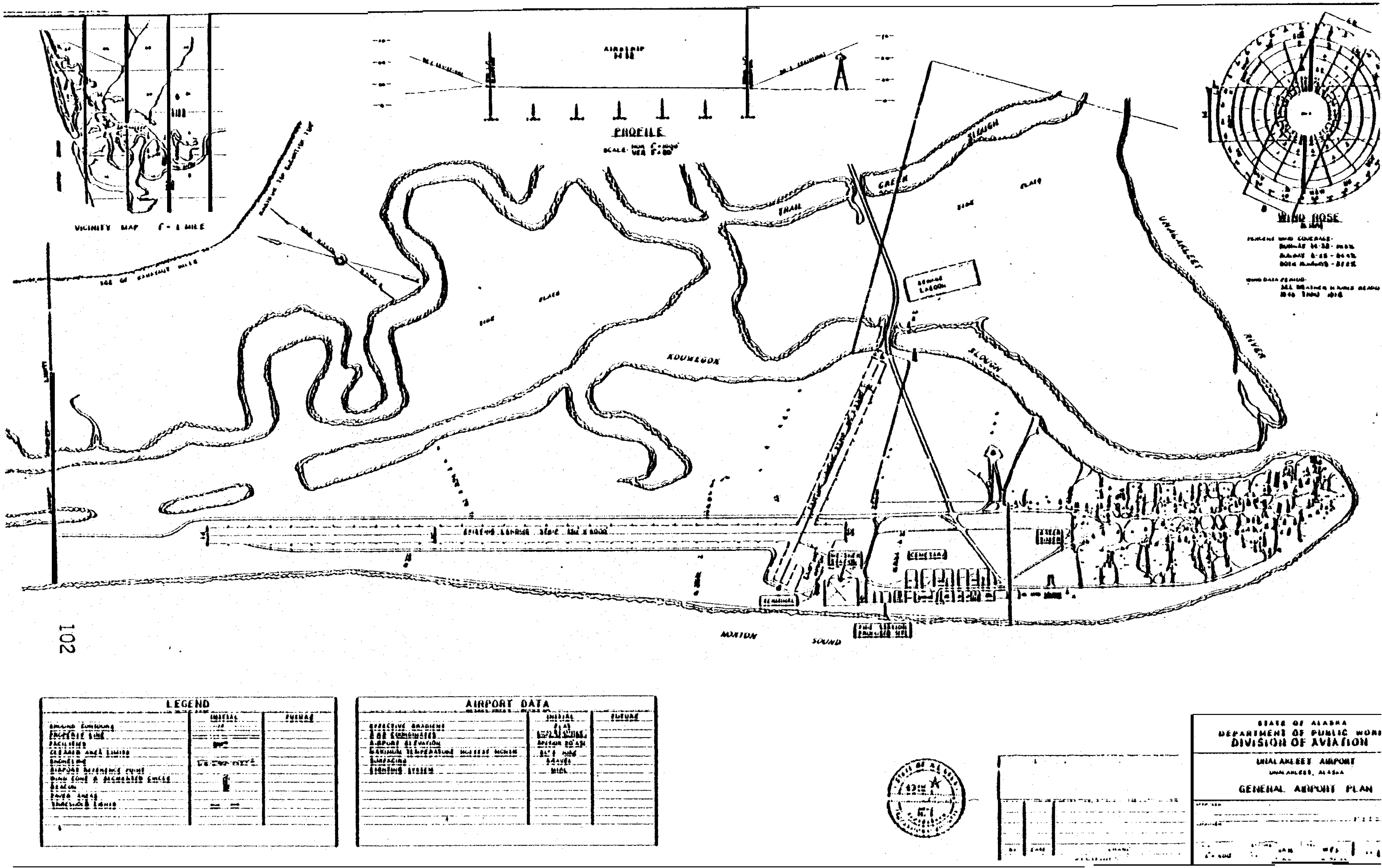


Figure 14

SOURCE: Alaska DOT/PF

UNALAKLEET AIRPORT PLAN

The Unalakleet Airport is designated as an Air Carrier airport by the FAA. One scheduled air carrier serves Unalakleet. The community is an intermediate stop for Wien Air Alaska 737 jet service between Nome and Anchorage. It receives three flights per week. During the 12-month period ending December 31, 1978, Wien completed only 76.9 percent of its scheduled flights, which represents a significant drop in the level of service from prior years when the percentage ranged from 94 to 99. The airport also serves the Unalakleet Air Taxi Service. There are no commercial hangars; however, Unalakleet Air Services has a private hangar that is used to service their air taxi operation. Wien Air Alaska maintains a small terminal at the south end of runway 14-32. There is also fuel available.

The breakdown of 16,000 operations for the FY1978 for the Unalakleet facility is as follows:

Air Carriers	12.5 percent
General Aviation	12.5 percent
Air Taxis	50.0 percent
Training (Touch and Go)	25.0 percent
	100.0 percent

Based upon runway configuration, the annual practical capacity of the Unalakleet Airport is estimated at 270,000 operations, which means that in 1978 the airport was operating at about 6 percent of capacity. The FAA has forecast a growth of 75.0 percent in air taxi operations between 1978 and 1990, while the number of air carrier operations for the same period is forecast to remain constant.

The FAA Ten Year Plan has recommended a number of airport improvements through FY1990. They include paving both runways, including apron paving and lighting; new approach aids; the expansion of the existing terminal; construction of a crash fire rescue building and provision of equipment; wind cone; and a segmented circle.

3.3.1.4 Anchorage International Airport

This facility handled 236,000 operations (landings and take-offs) in 1976 which is 77 percent of the capacity estimated in the 1971 Master Plan (Quinton-Budlong, 1971) . The primary purpose of the new north-south runway, which is presently under construction, is to provide a runway capable of accommodating larger jets in cross-wind conditions and to alleviate aircraft noise impact east of the airport by placing the majority of aircraft operations over water. The completed runway will also raise the airport operational capacity to 334,000 operations, a 9 percent increase. The runway will be used primarily for air carrier arrivals and one of the east-west runways will be used for air carrier departures. The three existing asphalt runways include two that are greater than 3,048 meters (10,000 feet) in length.

During 1976 (the base year in this study), enplaned (boarding) passengers totaled 944,467. Certified air carriers accounted for 86.4%, commuter services for 10.2%, and international carriers for the remaining 3.4% of the enplanements (Moore, 1978). In 1979, passenger enplanements exceeded 1 million persons as did the number of passengers passing through Anchorage. By 1996, the Alaska Department of Transportation & Public Facilities (ADOT/PF) is forecasting 3.6 million enplanements and 3.2 million through passengers.

The facility serves an important role in moving freight and passengers to, from, and within Alaska. In 1976, throughput tonnage of the airport amounted to 107,8 thousand metric tons (118.8 thousand tons), which was 11.1% of the Port of Anchorage's throughput for general cargo in that year. By 1979, cargo entering or leaving Anchorage reached one-quarter billion pounds (125 thousand tons) and is forecast by ADOT/PF to reach 1.1 billion pounds (550 thousand tons) by 1996. Transiting cargo, which in 1979 was about 1 billion pounds (500 thousand tons), is forecast to reach 6.2 billion pounds (3.1 mill ion tons) in 1996.

The Lake Hood complex adjacent to Anchorage International Airport has four water runways and caters to general aviation and air taxi operators. These groups also heavily use Merrill Field, located adjacent to downtown Anchorage. Present usage of Lake Hood runways is 75,000 operations compared to a theoretical capacity of 88,000 operations.

3.3.2 AIR CARRIERS

The Alaska Transportation Commission (ATC) regulates all common air carriers operating solely within the State of Alaska and jointly regulates with the Civil Aeronautics Board (CAB) those carriers that operate interstate routes. The CAB also regulates two intrastate carriers: Munz Northern and Kodiak Western Airlines. The ATC issues permits in three categories-- dir taxi operators, scheduled carriers, and contract carriers, Scheduled carriers currently operate only fixed wing aircraft, and fixed wing aircraft are available from contract and air taxi operators. 'able 29 shows a breakdown of air carr· ers operating within the study area.

TABLE 29

AIR CARRIERS SERVING NOME, KOTZEBUE AND UNALAKLEET

Location	Company	Certificate
Kotzebue	Baker Aviation, Inc.	Air Taxi
	Kotzebue Flying Service, Inc.	Air Taxi
	Maxson Aviation	Air Taxi
	Shellaborger Flying Service	Air Taxi
	Walker Air Service	Air Taxi
	Wien Air Alaska, Inc.	Sched., Charter
	Great Northern Airlines, Inc.	Sched., Charter
	Alaska Airlines, Inc. (July, 1980)	Sched., Charter
Nome	Foster Aviation, Inc.	Air Taxi, Postal
	Nome Flying Service	Air Taxi
	Seward Peninsula Flying Service, Inc.	Air Taxi
	Munz Northern Airlines, Inc.	Sched., Contract
	Wien Air Alaska, Inc.	Sched., Contract
	Great Northern Airlines, Inc.	Sched., Contract
	Alaska Airlines, Inc. (July, 1980)	Sched., Contract
Unalakleet	Unalakleet Air Taxi	Air Taxi
	Wien Air Alaska, Inc.	Sched., Contract

Source: L. Berger & Associates, WAATS, 1979.

A recent study of air service to rural Alaska, which focused on much of western Alaska including Nome and Kotzebue concluded that the present system is “at best inadequate and at worst dangerous” and that rural Alaskans are being shortchanged as compared to their urban neighbors in the quality of transportation services offered by private enterprise and by government (Parker Associates, 1979). The report went on to state that:

- The situation is not the fault of any one sector responsible for air service delivery, rather it is due to being ill prepared to deal with the explosion of passengers, mail, and freight generated in rural Alaska.

- Several local air carriers are as much the victims of the system as are the customers they serve. Even with high fares and rates many cannot afford the type of aircraft and ground support facilities required to do a good job.

- Because Wien operates in a larger area and under generally more difficult conditions it has been the major target for complaints.

  The evidence is overwhelming that Wien's move to direct its resources toward high-profit passenger routes between urban centers has wreaked havoc with freight and parcel post deliveries bound for the bush. Service to Nome and Kotzebue, among other regional centers, are specifically cited.

  Even more serious than the inability of Wien to handle the freight and parcel post load to the regional centers has been the intermittent breakdown of the system subsequent to the carrier's decision to subcontract to small local operators all routes from the regional centers to the villages. Before retreating from the bush Wien had a well-balanced fleet of aircraft to serve rural Alaska villages, including twin and single-engine Otters with Skyvans to carry outsize loads and peak cargo loads. Currently, however, not one Wien subcontractor operates a twin-Otter and only one has a single-Otter.

- In addition to subcontracting to ill-equipped operators, deteriorating service can also be traced to the failure of all concerned with aviation in rural Alaska to supply the most essential tools required for good service. These essential tools range from navigational aids, radios, and electronics equipment to maintenance facilities and services, all of which contribute to more efficient utilization of existing aircraft.

- The installation of improvements lacks overall planning or coordination. The effectiveness of past actions, both policy related and funding related, are not being monitored or audited. No performance standards have been established to guide actions.

3.3.2.1 Air Taxi Operators

Air taxi carriers operate from fixed bases of operation that are specified in their operating rights. Although most operate aircraft with certified gross take-off weights less than 5,670 kilograms (1 2,500 pounds) , the ATC has authority to grant air taxi certificates to operators having larger aircraft. Operators must provide "safe, adequate, efficient, and continuous service from and maintain bases of operation at listed locations (in their operating rights)" (Alaska Transportation Commission). Air taxi operators specialize in serving locations inaccessible by highway. Two examples of air taxi operators are Unalakleet Air Taxi and Foster Aviation, both based in Nome. Table 30 shows the number of passengers, pounds of freight, and mail carried by Unalakleet Air Taxi for the last six months in 1978. Table 31 illustrates similar information for Foster Aviation.

3.3.2.2 Contract Carriers

Contract carriers are private 'or-hire carriers who are not generally restricted by location in their operating authorities. They operate under one or more contracts of a continuing nature for a limited number of persons (charter) or perform a specialized service for specific individuals or concerns. Principal contract carriers in the study area include Munz and Foster, both of whom are based at Nome.

3.3.2.3 Scheduled Carriers

Scheduled carriers offer services to the public generally and operate aircraft between paired points. The primary source of revenue is individual passenger fares or per pound cargo rates. The Alaska Transportation

TABLE 30

UNALAKLEET AIR TAXI

PASSENGERS AND FREIGHT CARRIED

BETWEEN JULY AND DECEMBER, 1978

Month	Passengers	Lbs. Freight	Lbs. Mail
July	9	5,591	27,123
August	25	3,542	20,605
September	15	7,035	42,335
October	10	8,723	43,217
November	5	2,697	39,899
December	1	8,275	18,231

Source: Alaska Transportation Commission

TABLE 31

FOSTER AVIATION[1]

PASSENGERS AND FREIGHT CARRIED

BETWEEN JULY-AND DECEMBER, 1978

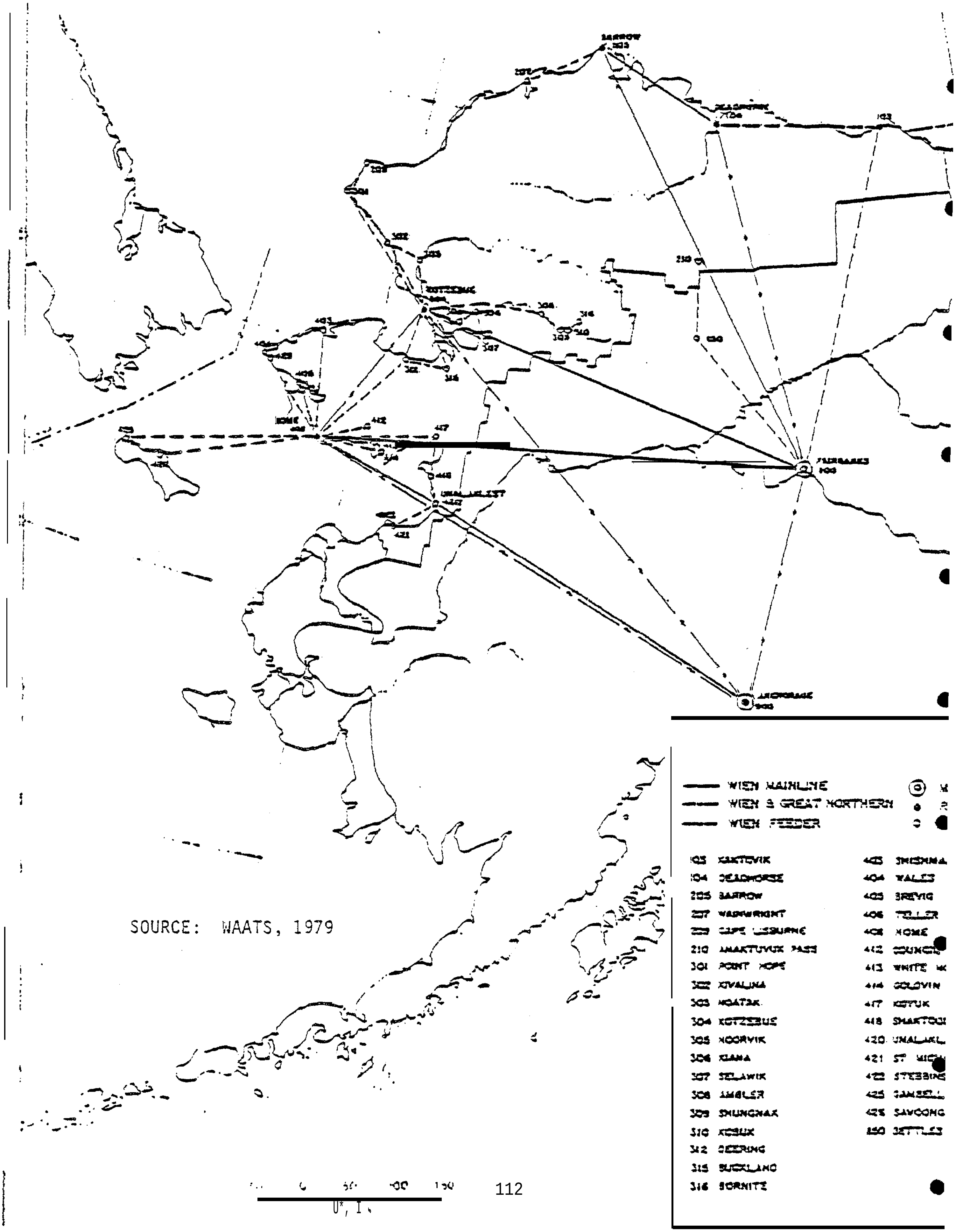
Month	Passengers	Lbs. Freight	Lbs. Mail
July	16	907	2386
August	23	4920	2569
September	25	569	1233
October	12	.-	2165
November	9	32	2018
December	data not filed with ATC		

[1] Scheduled Service to Pt. Clarence.

Source: ATC

Figure 15

WIEN AIR ALASKA SCHEDULED AIR ROUTES



SOURCE: WAATS, 1979

Commission has only one category of scheduled carriers, but the CAB makes a distinction between major trunk airlines and commuter services. Commuter services are considered to fly aircraft with gross weights less than 5,670 kilograms (12,500 pounds), and trunk airlines are those that offer flights greater than 805 kilometers (500 miles), usually with jet service.

Trunk Airlines Federal deregulation of interstate passenger and freight operations will be phased in over the next five years and has already had impacts in Alaska. Great Northern Airlines until recently operated scheduled passenger service to both Kotzebue and Nome. Both routes were phased out because of lack of revenue passengers and presently Great Northern operates only freight service to these cities. Wien presently operates a combination passenger/freight service to Kozebue and Nome from Anchorage and Fairbanks.

Figure 15 shows routes for Wien which operates principally jet service to western Alaska. Alaska Airlines offered service to Nome and Kotzebue up to 1975. At that time, the CAB ruled that the airline market would not support both Wien and Alaska Airlines, and Alaska Airlines Service was curtailed. Wien Airlines was awarded the sole market. This decision was to be reviewed after an eight year period; however, because of deregulation the decision is no longer valid. Alaska Airlines has recently obtained authority to once again provide service to Nome and Kotzebue and service began June 1, 1980.

Tables 32, 33, and 34 show traffic data for scheduled airlines from 1974 through 1978 for Nome, Kotzebue, and Unalakleet, respectively. When Alaska Airlines dropped their service in 1976, Great Northern Airlines began

TA=LE 32

TRAFF C DATA FOR NOME AIRPOR

Year	Enplaned Passengers	Freight (Revenue Tons)	Mail (Revenue Tons)	Airline	Scheduled Service	Non-scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	[illegible]11	360.52	726.06	--	2,571	12	2,583	2,202	2,001	90.87
				Alaska	552	1	553	541	528	97.59
				Wein	2,019	11	2,030	1,661	1,473	88.68
1975	25,474	509.22	955 9	--	2,754	2	2,756	2,382	2,063	86.61
				Alaska	46	--	46	47	46	97.87
				Wein	2,708	2	2,710	2,335	2,017	86.13
1976	26,154	484.04	1.089.58	--	2,876	744	3,621	2,871	2,330	81.16
				Wein	2,809	9	2,819	2,795	2,263	80.96
				Great Northern	67	735	802	76	67	88.15
977	22,[illegible] 9	426.42	1, 87.88	--	3,313	--	3,313	3.591	2,592	72.18
				Wein	3,150	--	3,150	3.436	2,442	71.07
				Great Northern	163	--	163	155	150	96.77
1978	25,788	445.95	1,106 29	--	2,874	7	2,881	3,657	2,080	56.88
				Wein	2,711	7	2,718	3,499	1,949	55.70
				Great Northern	163	--	163	158	131	82.91

Source: CAB Airport Activity Statistics.

TABLE 33

TRAFFIC DATA FOR KOTZEBUE AIRPORT

Year	Enplaned Passengers	Freight (Revenue Tons)	Mail (Revenue Tons)	Airline	Scheduled Service	Non-scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	29>674	1,809.21	1,148.86	--	2,323	101	2,424	1,771	1,700	95.99
				Alaska	530	18	548	532	522	98.12
				Wein	1,793	83	1,876	1,239	1,178	95.07
1975	22,208	835.82	1,433.84	--	2,647	12	2,659	1,834	1,761	96.01
				Alaska	46	--	46	47	46	97.87
				Wein	2,601	12	2,613	1,787	1,715	95.87
1976	27,379	906.46	1>488.65	--	2,857	13	2,870	2,209	2>047	92.66
				Wein	2,790	13	2>803	2,133	1,980	92.82
				Great Northern	67	--	67	76	67	88,15
1977	22,896	408.16	1,413.43	--	3,809	--	3,809	3,685	2,847	77,25
				Wein	3,539	--	3,539	3,530	2,698	76.43
				Great Northern	270	--	270	155	149	96,12
1978	23,551	294.37	1,268.57	--	3,938	3	3,941	4,398	2>793	63.5
				Wein	3,678	3	3,681	4,201	2>602	61.9
				Great Northern	260	--	260	197	191	96.95

Source: CAB Airport Activity Statistics.

TABLE 34

TRAFFIC DATA FOR UNALAKLEET AIRPORT

Year	Enplaned Passengers	Freight (Revenue Tons)	Mail (Revenue Tons)	Airline	Scheduled Service	Non-scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	1,684	384.21	257.79	--	1,016	12	1,028	467	462	98.92
				Alaska	235	--	235	208	205	98.55
				Wein	781	12	793	259	257	99.22
1975	1,978	121.17	320.19	--	1,070	3	1,073	488	480	98.36
				Alaska	17	1	18	17	17	100.00
				Wein	1,053	2	1,055	471	463	98.30
1976	2,237	148.69	266.52	--	1,084	--	1,084	521	489	93.85
				Wein	1,084	--	1>084	521	489	93.85
1977	1,606	157.31	259.03	--	959	--	959	458	436	94.98
				Wein	959	--	959	458	436	94.98
1978	1,779	356.15	255.57	--	831	--	831	415	319	76.86
				Wein	831	--	831	415	319	76.86

Source: CAB; Airport Activity Statistics.

providing the service until it was discontinued in early 1979. During the period 1974 through 1978, Wien has been the principal air carrier to each city and has dominated these routes.

The recent acquisition of Great Northern Airlines by Alaska International Air, Inc. has created a sizeable air cargo capability serving western Alaska. In addition to Nome, Kotzebue and Unalakleet, Great Northern serves Bethel, Fairbanks, and Prudhoe Bay with three prop-jet Electra aircraft. Alaska International operates a contract fleet of five Super Hercules. Together, the AIA/GNA merger offers eight all-cargo aircraft capable of handling general freight, building materials or outsized cargo to remote locations.

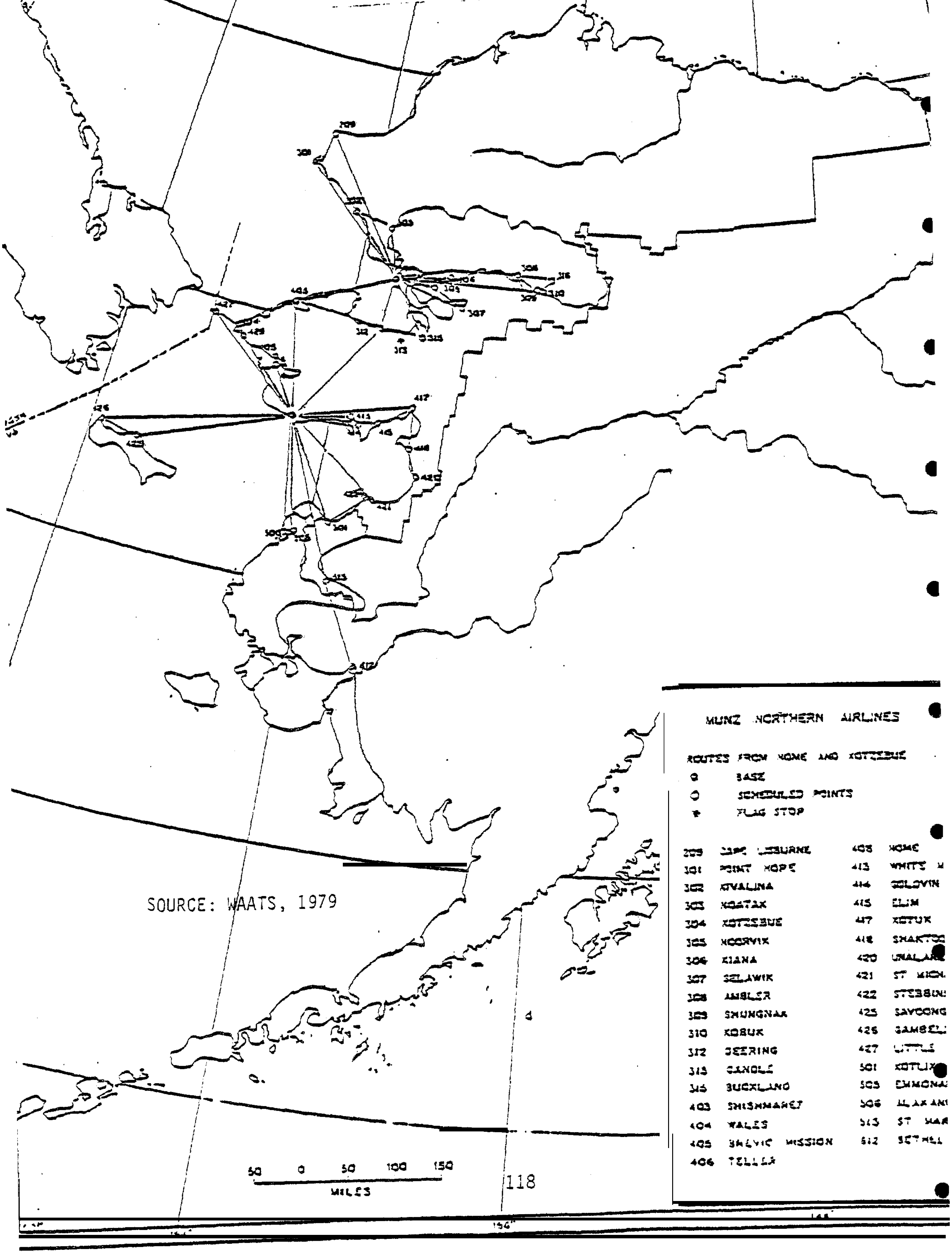
Commuter Airlines. Munz Northern Airlines is both a scheduled and contract carrier based in Nome. It serves the communities of Kotzebue and Unalakleet in addition to thirty-two other communities and villages as shown on Figure 16.

3.3.3 EQUIPMENT OPERATIONS

Both Wien and Great Northern operate a variety of aircraft equipment in providing various services to Nome, Kotzebue and Unalakleet. A listing of equipment utilized in 1978 is shown in Table 35.

Wien operates a series of 737-200 jet aircarft which are equipped to operate on both asphalt and gravel runways, and are capable of rapid conversion from all passenger to mixed passenger/cargo or all cargo. Maximum passenger capacity is 112 seats. Cargo containers configured specifically for this aircraft called “igloos” with a payload of 3402 kilograms

MUNZ NORTHERN AIRLINES AIR ROUTES



SOURCE: WAATS, 1979

Table 35

1978 TRAFFIC DATA BY TYPE OF AIRCRAFT, BY CARRIER, BY AIRPORT FOR KOTZEBUE, NOME, AND UNALAKLEET

Airport	Carrier	Type of Air Craft	Scheduled Service	Non-Scheduled Service	All Services
Kotzebue	WE	4-Type-PIS-2	58	--	5a
		F27 Series	15	2	17
		DHC-6	1,812	10	1,822
		B-737-200C	780	1	781
		U Type PIS-1	9	--	9
		SC-7	1	--	1
		3-737-200	?14	--	114
		FH-227	1	--	1
	XY	FW UNDR 300 HP	43	--	43
		BN-2/A	5	--	5
		BEECH D-37	19	--	19
Home	WE	U-Type PIS-1	1,750	--	1,750
		F-27 Series	139	7	146
		Cl-iC-b	3	--	3
		B-737-200C	795	2	797
		FH 227	1	--	1
		3-737-200	119	--	119
		U Type PIS 2	2	--	2
	XY	FW UNOR 300 HP	43	176	219
		BN-2/A	5	313	313
		AC 500 & 600 Series	--	31	31
		AC-680 FHL	--	109	109
		00-28	--	56	56
		BEECH D-35	19	--	19
Unalakleet	WE	U Type PIS-1	871	--	871
		F-27 Series	36	--	36
		DHC-6	1	--	1
		SC-7 Short	5	--	5
		B-737-200C	118	--	118
		U Type PIS-2	3	--	3

Note:

Model	Manufacturer
U Type ?1S 1	Unknown
u Type PIS 2	Unknown
F-27 Series	Fairchild
FH 227	Fairchild
FW Under 300 hp	Various
DHC-6	de Havilland
3-737-200	Boeing
BN-2/A	Brittin Norman
AC 500 & 600 Ser.	Air Commander
AC - 680 FHL	Air Commander
DO- 28	Dornier
Beech D-35	Beechcraft
SC-7	Short

WE = Wien Alaska Airlines
XY = Great Northern Airlines

Source: CAB; Airport Activity Statistics.

(7500 lbs.) each. The 737-200 cabin can accept between five and six igloos in the all cargo model. Daily flights between Anchorage and Nome/Kotzebue usually carry one igloo and approximately 93 seats.

Great, Northern, who previously operated a combination of passenger freight service from Anchorage, presently operates Lockhead L-188 Electra freight aircraft to Kotzebue and Nome with a payload of 14,515 kilograms (32,000 lbs.).

Feeder or local service lines using smaller aircraft than trunk carriers provide service from regional hubs to outlying locations. In 1978, Wien had two subcontractors supplementing their mainline service: Munz Northern Airlines in Nome and Unalakleet Air Taxi in Unalakleet. Munz, the largest operator, has an extensive network of flights in addition to the Wien contract flights using a fleet of light twin-engine aircraft.

3.3.4 REGULATIONS

The Federal Aviation Administration within the U.S. Department of Transportation, through its flight standards program, "promotes safety of flight of civil aircraft in air commerce by assuring the airworthiness of aircraft, the competence of airmen, the accuracy of navigational aids and the adequacy of flight procedures for various air operations," (Federal Aviation Administration, 1977). To accomplish these goals, its personnel inspect, evaluate, review and certify, as appropriate, aircraft, air carriers, general aviation activities, and navigational aids. Also, FAA provides a large percentage of funds used in Alaska to upgrade runways and landing aids at airports. Grants can be provided to either the State of Alaska or local governments or other eligible political subdivisions. The State of Alaska Department of Transportation has jurisdiction over the Kotzebue, Nome and Unalakleet airports.

Fares and routes fal under the jurisdiction of the Civil Aeronautics Board for interstate carriers and of the Alaska Transportation Commission fur intrasta e carriers. In the spring of 1979, decisions were made in the West Coast Service Investigations and additional routes were authorized for all certificated carriers which were a party to the investigations. The Board's policy of deregulation is designed to increase service yet, at the same time, maintain acceptable profits for the carriers. Guidelines are being established which will guarantee essential service to small communities. Communities served by none or one certified air carrier would be eligible for subsidies. For planning purposes, the CAB recognized Anchorage, Fairbanks, and Juneau as the State's transportation hubs. The next level of importance are twelve regional centers, which include Nome, Kotzebue, and Unalakleet.

Interstate air freight transportation has been deregulated by the CAB; deregulation of interstate air passenger transportation is proceeding on a five-year timetable.

3.3.5 TECHNOLOGY

Table 36 shows the service characteristics of scheduled carriers serving the study area. The data shows the impact that technology has on the level of service as distance increases, For the Anchorage to Kotzebue link, Wien, flying Boeing 737 jets, charges passengers 20.4 cents per mile compared to 40.3 cents per mile on the Nome to Unalakleet link. Generally, as

Table 36

CHARACTERISTICS OF SCHEDULED SERVICE BY WIEN AIR ALASKA
IN THE BERING-NORTON STUDY AREA

Link	Carrier	Kilometers (Miles)	One Way Coach Fare	cost ¢/km (¢/mi.)	Elapsed (Hours-Minutes)	Average Speed km/hr (mph)
Anchorage-Kotzebue	Wien	882 (548)	$112.00	12.70 (20.44)	1 hr. 20 min.	(411)
Kotzebue-Nome	Wien	295 (183)	56.00	19.01 (30.60)	1 hr. 10 min.	(157)
Anchorage-Nome	Wien	866 (538)	112.00	12.94 (20.82)	1 hr. 20 min.	(404)
Nome-Unalakleet 1/	Wien	237 (147)	71.00	30.01 (48.30)	1 hr. 5 min.	--
Unalakleet-Anchorage 2/	Wien	631 (392)	99.00	15.69 (25.26)	2 hr.	--
Nome-Fairbanks	Wien	835 (519)	111.00	13.29 (21.39)	1 hr. 20 min.	(389)
Kotzebue-Fairbanks	Wien	708 (440)	111.00	15.68 (25.23)	1 hr. 10 min.	(377)

Notes: 1/ Makes 2 stops.

2/ Makes 1 stop.

Source: Airline Passenger Tariffs; 80, Oct. 1, 1979; IATA & Tariffs; CH-8058 Zurich, Switzerland.

distance increases, unit distance cost drops markedly for jet aircraft.

Northwest Orient's fare to Chicago from Anchorage represents a cost of 4.7¢/km (7.5¢/mi.), which is approximately one fourth of that for Wien Airline's Anchorage-Nome trip. Jumbo jet aircraft, with their large capacities and efficiency at high altitudes, provide fast and economical service for long distances. A rcraft used by commuter airlines are unable to compete economically at medium or long distances when adequate demands exist.

Major trunk air carriers, because of the long distances they serve, can benefit from new generations of aircraft that have increased performance and will purchase them as their financing capabilities permit.

Technology improvements are occurring in rotary wing as well as fixed wing aircraft. Boeing-Vertol is marketing the commercial version of its Chinook helicopter developed originally for the military. Fitted for passenger use, it has a capacity of 44 passengers and a range of 982 km (600 miles). Firm orders have already been received for use in transporting personnel to and from platforms in the North Sea. The cargo version has a shorter range, but a lifting capability of up to 12.7 metric tons (14 ST) (Boeing-Vertrol, 1979),

According to the WAATS study, major breakthroughs are not expected in aviation technology which could have a significant impact on aviation in western Alaska. However, modest improvements in short takeoff and landing (STOL) capabilities are expected to continue, along with a slow but steady improvement in aircraft operating characteristics and economy. It is probable that increased application of existing technologies in terms of ground-to-ground communications and weather reporting will have greater impact on increased aircraft utilization, economy and reliability of service in western Alaska than will new technologies.

4.0 BASE CASE

4.1 Introduction

Construction and analysis of the transportation base case is an important facet of the impact assessment process. As mentioned briefly in Chapter 2 and discussed in more detail in Appendix B, the general purpose of the base case is to provide a foundation upon which transportation demands and requirements of each of the Lease Sale 57 scenarios can be added and to which the resultant conditions can be compared. In this study, the base case portrays a transportation situation that might occur if Lease Sale 57 is not held and existing trends and conditions continue. The base case is not a non-OCS case, however, since at the regional and state-wide level certain economic and copulation forecasts include the direct effects of OCS activities associated with lease sales occurring prior to Lease Sale 57.

The base case follows a conservative perspective in that no particular response by the transportation industry, affected communities, or public regulatory agencies is presumed. Any addition to or improvement of existing conditions, including routes or services, is not considered in the development of the base case unless funds are already committed or the improvement is otherwise publicly recognized. Projects identified as being needed but which are not committed for implementation, are discussed in a presentation of issues at the end of each impact category.

The base case, as well as the OCS cases presented in later chapters, examine the marine transportation and aviation modes of travel at the state-wide, regional, or local level. The base case focuses its attention on the City of Nome and the immediate region it serves. Anchorage, which serves as the major entry port for interstate movement of air passengers and some air freight, is the principal focus of the state-wide systems analysis.

The organization of this chapter centers around four tasks necessary to develop impacts in each mode: (1) specification of identified improvements to transportation facilities or services and their effect on expected activities; (2) development of transportation demands (tonnage and/or person trips, as applicable); (3) development of transportation requirements (vehicles and new facilities) generated by these demands; and (4) an assessment of the change expected between existing conditions and forecast conditions (i.e.: impacts).

4.2 Significant Factors Affecting Growth

Changes in western Alaska transportation systems in the absence of OCS development in the Bering-Norton area are expected to result from two major influences: (1) the marginal increase in transportation demands brought about by increases in regional and local population due to economic growth over the period between now and 2000; and (2) physical improvement of facilities and changes in the operation and management of transportation systems in the Bering-Norton study area.

From a statewide perspective, growth in the Alaskan economy is based on changes in the national economy, changes in Alaskan industries that grow largely or entirely in response to forces external to the Alaskan economy, and actions of the State of Alaska in executing fiscal policy. For the Nome-Wade Hampton region, the SESP anticipates that state government fiscal policy will play a key role and will be a major determinant of future economic growth. Over the 20 year study period, state government is expected to receive revenues from oil development which far exceed current levels of expenditure. The rate at which the state government chooses to spend these revenues (or to offset existing revenue sources with them) will serve to determine not only direct employment in the government sector, but through the multiplier effects of such expenditures or tax reductions, will have impacts on all endogenous sectors affecting the growth of employment, income, prices, and migration into the state. Revenues have already overtaken expenditures as a consequence of the onset of production from Prudhoe Bay and will continue to increase as a consequence of both increased production and price increases. As in the past, increasing levels of economic activity have generated new demands for government services. As prices and population rise, increased expenditures are required to simply maintain services at a constant level. However, this level can be expected to rise over time, if historical trends continue. If past trends carry over into future fiscal responses to surplus petroleum revenues, future real per capita expenditures can be expected to rise within the bounds set by revenue quantities and statutory constraints. At a minimum, the state might choose to simply maintain real per capita expenditures at their current levels. At a maximum, it could choose to spend all but 25% of restricted petroleum revenues, as they are incurred. Since the range of possibilities within these brackets is very large, the. SESP has assumed a middle-range policy in generating statewide and regional forecasts (ISER, 1980).

In the Nome-Wade Hampton region, declining total employment is expected to lead to a decline in regional population which continues through 1982. It is assumed that a rise in government employment thereafter stabilizes support sector employment, thereby stimulating population growth through about 1985. After 1985, growing basic sector employment combines with the growth of government employment-to keep population growing throughout the period. By the year 2000, total regional population reaches 15,140, about 28% above its 1980 level, representing the average growth of about 1.2% annually. The expected changes in regional population are illustrated on Table 37 (ISER, 1980).

With respect to the City of Nome, Nome's role in the region is expected to remain at about 25% of the population and 28% of the employment throughout the study period. In 1979, the Nome economy included the following sectors: Mining; construction; manufacturing; transportation, utilities, and communication (TUC) ; trade; finance, insurance, and real estate (FIRE); services; federal government; state government; and local government. The SESP anticipates, on the basis of current trends, that Nome will remain the center for the Norton Sound-Bering Straits area and that the growth of Nome and its surrounding region is likely to be incremental rather than dramatic. It is assumed that Nome can expect its greatest gains in population and employment to occur in the 1980's with a slow-down

TABLE 37

BERING-NORTON BASE CASE POPULATION PROJECTIONS AND GROWTH FACTORS

Calendar Year	Year After Lease Sale (1)	City of Nome Population	City of Nome Growth Factor (2)	Nome-Wade Hampton Region Population	Nome-Wade Hampton Region Growth Factor	Region Without Nome City (3) Population	Region Without Nome City (3) Growth Factor	City of Anchorage Population	City of Anchorage Growth Factor
1977		2,885	1.00	11,800	1.00	8,915	1.00	183,606	1.00
1983	1	3,317	1.15	11,752	1.00	8,435	0.95	211,110	1.15
1984	2	3,383	1.17	12,406	1.05	9,023	1.01	209,796	1.14
1985	3	3,451	1.20	12,525	1.06	9,074	1.02	206,018	1.12
1986	4	3,520	1.22	12,517	1.06	8,99?	).01	206,522	1.12
1987	5	3,590	1.24	12,556	1.06	8,966	1.01	209,175	1.14
1988	6	3,662	1.27	12,690	1.08	9,028	1.01	213,839	1.16
1989	7	3,735	1.29	12,8136	1.09	9,151	1.03	219,035	1.19
1990	8	3,U10	1.32	13,108	1.11	9,298	1.04	223,847	1.22
1991	9	3,829	1.33	13,292	1.13	9,463	1.06	228,875	1.25
1992	10	3,848	1.33	13,494	1.14	9,646	1.08	234,256	1.20
1993	11	3,867	1.34	13,682	1.16	9,815	1.10	240,001	1.31
1994	12	3,886	1.35	13,909	1.18	10,023	1.12	245,597	1.34
1995	13	3,905	1.35	14,105	1.20	10,200	1.14	251,175	1.37
1996	14	3,925	1.36	14,291	1.21	10, 66	1.16	257,405	1.40
1997	15	3,945	1.37	14,491	1.23	10,546	1.18	264,412	1.44
1998	16	3,965	1.37	14,707	1.25	10,742	1.20	271,922	1.48
1999	17	3,985	1.38	14,949	1.27	10,964	1.23	279,323	1.52
2000	18	4,005	1.39	15,140	1.28	11,135	1.25	287,256	1.56

Notes: (1) Lease Sale No. 57 is currently scheduled for November 1982.
(2) Growth Factors are derived by dividing the forecast year population by the 1977 population.
(3) Derived by PMM&Co. by subtracting City of Nome forecast from Nome-Wade Hampton Region forecast.

Sources: Nome Population Projections, Policy Analysts, 1980.
Regional and Anchorage Population Projections, ISER, 1980.

in the 1990's It should be pointed out that this Nome forecast is made under the assumption that local and regional conditions are more important to growth than state effects. Whereas, the regional analysis described above is based on disaggregating state-wide growth to the Nome-Wade Hampton region. The opportunities for modest growth are sufficient in Nome to expect a pattern that is different from the state, particularly in the 1980's (,Policy Analysts, Limited, 1980).

While mining is expected to be stagnant in the future, the Nome forecast expects modest growth in the region, both at Nome and in other new areas of investment, primarily in the Kobuk. Services and government are expected to out-perform the average over the long run. Construction activities are expected to continue to have high variability, but being a strong economic component on a cyclical basis. FIRE, TUC, trade and mining employment are expected to increase slowly in the 1980's and stabilize thereafter. This growth rate would be below that of government and services, Manufacturing is expected to remain stagnant. Based on these characteristics of the economy, the population of Nome is expected to increase 21% over the period 1980-2000, as illustrated in Table 37 (Policy Analysts, Limited, 1980).

Also shown in Table 37, is the population forecast and growth factors for the City of Anchorage. Over the forecast period, Anchorage shows steady growth, increasing in population 56% over the base year (1977) by approximately 103,650 persons. It should be pointed out that these Anchorage projections, prepared as a part of the state-wide and regional projections by ISER, represent the cumulative effect of prior lease sales. OCS lease sales included in both the Anchorage and Nome-Wade Hampton regional forecasts are: Sale CI in Cook Inlet, the Joint Federal-State Beaufort Sea Sale, Northern Gulf of Alaska Sale 55, the Western Gulf of Alaska Sale 46 (since cancelled by BLM), and the second generation Lower Cook Inlet Sale 60.

Table 37 also shows the population and growth factors for that portion of the Nome-Wade Hampton region. The transportation demands of this group create the need for continuing transshipment of goods through the Port of Nome and generates movement of intraregional passengers to and through the Nome and Unalakleet airports.

4.3 Water Mode

4.3.1 DESCRIPTION OF MARINE ACTIVITIES

Historically, the water mode of transportation has provided seasonal movement of freight and fuel to Nome and to other communities in the Nome-Wade Hampton region via lighterage services. Typically, the demand for such services has grown in response to incremental changes in the economy, as well as population, and changes in personal income-. On the basis that the regional economy will continue to grow incrementally and that population will grow in a similar fashion over the twenty year study period, the demand for transportation services is expected to follow a similar trend in the future. The effective four month open water operating season is not expected to change. The character of the transportation service that presently exists wihin this weather window is expected to also remain the same: linehaul barge service from Seattle and lighterage activities into Nome and surrounding communities. The existing problems of harbor access and harbor maintenance, as well as the need to supply smaller communities over the beach, are expected to all continue. The size of the barges and size of lighterage craft are not likely to change in response to marginal increases in demands due to the navigat onal restrictions of the existing harbor. Instead, they will most likely be operated at capacity for longer periods of time potentially creating de ays for the linehaul carriers.

Although it is possible that the state, with its additional oil revenue monies, may construct a new dock facility in Nome, the analysis that follows assumes this does not occur. However, reference is made to the possibility of that occurrence and its effect in a later discussion of i ssues. In the absence of a new dock facility, increased emphasis will be placed on improving the various storage facilities. The existing and deteriorating warehousing space, located on leased city property, is expected to be replaced at some time during the study period. However, the precise data will depend, in a large part, upon increases in the tonnage demand and the pressure that those-increases place on the existing facilities versus their rate of deterioration.

4.3.2 FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

In the absence of OCS activities in Norton Sound, demands on marine transportation services will change in response to the changing economy, which is assumed in this study to be expressed through changes in population. Based upon an average throughput tonnage demand of about three tons per person per year, annual throughput tonnage over the 20 year study period is forecast as shown in Table 38. The relationship between dry bulk and liquid bulk, as well as the relationship between tonnage to Nome and tonnage to outport coastal areas, is assumed to remain constant as defined earlier in Figure 6.

From a transportation perspective, the assumption of such constant relationships probably understates the true demand to outport communities. There are at least two reasons for this. First, the recent construction of new schools in many villages and potential future construction or improvement of other public facilities creates a new long-term demand for fuel and freight as well as a one-time demand for the movement of construction materials. Secondly, the North Star 111 is currently operating at capacity and its ability to continue meeting the increasing fuel and cargo demands of coastal villages is limited. While there are several solutions to this situation, such as outfitting another ship like the North Star III or contracting for the service, the use of common carriers as a solution is likely to cause an increase in transshipped goods through Nome. Neither of these situations are represented in the historic data.

TABLE 38

BERING-NORTON BASE CASE POPULATION RELATED MARINE TRANSPORTATION DEMANDS

Year After Lease Sale	Year	Nome-Wade Hampton Regional Population	Throughput Tonnage Total (1)	Throughput Tonnage Dry Bulk (2)	Throughput Tonnage Liquid Bulk (3)	Nome Marine Tonnage Demands Dry Bulk (4)	Nome Marine Tonnage Demands Liquid Bulk (5)	Region Without Nome Tonnage Demands Dry Bulk (6)	Region Without Nome Tonnage Demands Liquid Bulk (7)	Total Inbound Tonnage (8) Dry Bulk	Total Inbound Tonnage (8) Liquid Bulk
1	1983	11,752	35,256	7,756	27,500	5,274	24,750	1.241	1,375	6,515	26,125
2	1984	12,406	37,218	8,188	29,030	5,568	26,127	1,310	1,452	6,878	27,579
3	1985	12,525	37,576	8,267	29,309	5,621	26,378	1,323	1,465	6,944	27,843
4	1986	12,517	37,551	8>261	29,290	5,618	26,361	1,322	1,464	6,939	27,825
5	1987	12,556	37,668	8,287	29,381	5,635	26,443	1,326	1,469	6.961	27,912
6	1988	12,690	38,070	8,375	29,695	5,695	26,725	1,340	1,485	?,035	28,210
7	1989	12,886	38,658	8,505	30,153	5,783	27,138	1,361	1,508	7,144	28.646
8	1990	13,108	39,324	8,651	30,673	5,883	27,605	1,384	1,534	7,267	29,139
9	1991	13,292	39,876	8,773	31.103	5,965	27,993	1,404	1,555	7,369	29,548
10	1992	13.494	40,486	8,906	31,576	6,056	28,418	1,425	1,579	7,481	29,997
11	1993	13,682	41,046	9,030	32,016	6,140	28,814	1,445	1,601	7,585	30,415
12	1994	13>909	41.127	9,180	32,547	6,242	29,292	1,469	1,627	7,711	30,920
13	1995	14,105	42,315	9,309	33,006	6.330	29,705	1,489	1,650	7,820	31,355
14	1996	14,291	42,873	9,432	33,441	6,414	30,097	1,509	1,672	7,923	31,769
15	1997	14,491	43,473	9,564	33,909	6,504	30,518	1,530	1,695	8,034	32,213
16	1998	14,707	44,121	9,707	34,414	6,601	30,973	1,553	1,721	8,154	32,694
17	1999	14,949	44,847	9,866	34.981	6,709	31,483	1,579	1,749	8,288	33,232
18	2000	15.140	45,420	9,992	35,428	6,795	31,885	1,599	1,771	8,394	33,656

Notes: (1) Total Throughput Tonnage = Regional Population x 3 tons per person per year.
(2) Total Throughput Dry Bulk is 22% of total throughput tonnage. See Figure 6, Part A.
(3) Total Throughput Liquid Bulk is 78x of total throughput tonnage. See Figure 6, Part A.
(4) Nome Dry Bulk is i4, 96% of total throughput tonnage. See Figure 6, Part E.
(5) Nome Liquid Bulk is 70.20% of total throughput tonnage. See Figure 6, Part E.
(6) Region Without Nome Dry Bulk is 3. 52% of total throughput tonnage. See Figure 6, Part F.
(7) Region Without Nome Liquid Bulk is 3.90% of total throughput tonnage. See Figure 6, Part F.
(8) Derived by adding Nome and Region without Nome Tonnage Demands.

Source: PMM&CO.

The increasing tonnage demands illustrated in Table 38 will require increased utilization of linehaul barges as well as lighters. The number of linehaul vessels calling on the" Port of Nome, is anticipated to increase from about 14 or 15 now to about 19 over the 20 year study period, as shown in Table 39. This projection does not take into account the use of larger linehaul barges nor a potential reduction in the number of linehaul barges due to possible increased use of direct shipments. Because of the navigational restraints in the entrance to Nome harbor, it is assumed that the existing literaging equipment will continue to be used, The number of round trips by- lighters serving these linehaul vessels is expected to increase from a total of 153 round trips at the beginning of the study period to 184 round trips at the end. When the lighters are performing coastal delivery service, the number of round trips are estimated to range from 16 in 1983 to 21 in 2000.

4.3.3 IDENTIFICATION OF MARINE TRANSPORTATION IMPACTS

The impacts of the incremental growth portrayed in the tonnage demands and transportation requirements, respectively Tables 38 and 39, is not expected to have a significant negative effect on the Port of Nome facilities. The tonnage demands illustrated in Table 38 indicate that at the beginning of the study period total throughput tonnage is utilizing approximately 50 percent of the capacity of available port equipment, and that over the study period throughput tonnage climbs to 56 percent of available equipment capacity in 1990 and 65 percent of available equipment capacity in 2000. These percentages are based on an estimated annual

Table 39

BERING--NORTON BASE CASE
MARINE TRANSPORTATION REQUIREMENTS

Year After Lease Sale	Year	Linehaul Vessel Arrivals: Dry Bulk (1)	Linehaul Vessel Arrivals: Liquid Bulk (2)	Linehaul Vessel Arrivals: Total	Lighter Trips Serving Linehaul Vessels: Dry Cargo (3)	Lighter Trips Serving Linehaul Vessels: Liquid Bulk (4)	Lighter Trips Serving Linehaul Vessels: Total	Coastal Delivery Trips (5)
1	1983	11	4	15	19	124	143	16
2	1984	11	4	15	20	131	151	17
3	1985	12	4	16	20	133	153	17
4	1986	12	4	16	20	133	153	17
5	1987	12	4	16	20	133	153	17
6	1988	12	4	16	20	134	154	17
7	1989	12	4	16	20	136	156	18
8	1990	12	4	16	21	139	160	18
9	1991	12	4	16	21	141	162	18
10	1992	12	4	16	21	143	164	18
11	1993	13	4	17	22	145	167	19
12	1994	13	4	17	22	147	169	19
13	1995	13	4	17	22	149	171	19
14	1996	13	5	18	23	151	174	19
15	1997	13	5	18	23	153	176	20
16	1998	14	5	19	23	156	179	20
17	1999	14	5	19	24	158	182	20
18	2000	14	5	19	24	160	184	21

Notes: (1) Assumes an average of 600 ST arrives on each linehaul dry cargo vessel.
(2) Assumes an average of 7,000 ST (50,050 bbl.) arrives on each linehaul tanker vessel.
(3) Assumes each lighter averages 350 ST of dry cargo per trip.
(4) Assumes each lighter averages 210 ST (1,500 bbl.) of liquid bulk per trip.
(5) Assumes each coastal delivery trip is made by a lighter averaging 216 ST per trip and cargo is composed of 40% (86 ST) "liquid bulk and 60% (130 ST) dry bulk or neobulk. Optimization of the number of trips is not considered.

throughput capacity of the available equipment of 70,000 ST as calculated in Chapter 3. If the dry bulk transfer and storage facilities are improved as planned, the likely limiting factor may be liquid bulk storage, particular y in certain categories of bulk petroleum (e.g. jet fuel).

The expected increases in transportation tonnage demands are not expected to have an adverse impact on the various marine carriers. In large part, this is due to the carriers' large inventory of tug and barge equipment and their ability to shift and utilize only that equipment necessary to handle anticipated demands. Since the anticipated growth in tonnage is expected to be incremental, the various carriers are anticipated to maintain their equipment and ability to respond in a similar fashion. The growth rate is such that annual evaluations by the carriers will allow sufficient time to respond, should the transportation demands fluctuate significantly from those forecast.

4.3.4 MARINE TRANSPORTATION ISSUES

The central marine transportation issue in Nome is the ability of the community to provide desired port improvements. In the 1976 study "Nome Barge Facility" by CH2MHill, the new facility was designed to improve the offloading of linehaul dry cargo vessels by allowing direct unloading, thus eliminating lighters for this task. However, because deep draft tanker ships rather than shallower draft tanker barges were used at the time of the study to linehaul petroleum products, no consideration was made in the design for handling bulk petroleum, which is almost 80 percent of the tonnage handled by the port. With the inclusion of bulk petroleum handling facilities in the design, the efficiency of the port to unload linehaul vessels and load lighters for coastal deliveries would appear to be greatly improved. The full capacity of lighters used for coastal deliveries would likely be available, reducing the number of such trips. If accomplished in conjunction with improvements to dry bulk and liquid petroleum storage facilities, the capacity of the port might be doubled. If accomplished in place of the storage facilities, the improvement may not be as beneficial.

Justification of the proposed improvement on the basis of coming OCS activities creates a highly speculative situation. If to avoid the speculative nature of constructing this facility, the community waits to see what happens during OCS exploration, construction costs of the facility will continue to rise with inflation and some perceived advantages of having a completed facility ready for the development stage will be lost. If the community acts now to save construction costs and builds the dock in anticipation of and reliance upon OCS development, but OCS exploration finds no oil, the community may be saddled with a facility it cannot afford to own or maintain. Unfortunately, the real key to dealing with the speculative nature of using OCS activities to support the dock construction rests not with the community, but with the oil industry. The industry's needs are temporary at best, if they do not find recoverable resources; but their needs may be very great, if they do find recoverable resources . Traditionally, the industry has required dedicated exclusive use of facilities because the level of investment in OCS field development cannot tolerate delays. Based on the 1976 design for the dock, and industry's requirement for dedicated facilities, it does not appear that the community could share the facility with OCS activities. In short, OCS poses as a greater disadvantage than an advantage in getting the dock constructed.

One action that could aid justification of a new facility and which is a second issue affecting the port is the possible use of commercial carriers to supplement or replace U.S. government supply activities, such as the "Cool Barge" or the North Star 111. It is unknown if the government has ever considered this option, is considering it now, or may ever consider it in the future. However, if such a move was made, the volume of tonnage through Port Nome might increase sufficiently enough to financially justify an improved facility. If the government moved in this direction, but the port was not improved, capacity problems and delays with higher transportation costs result.

All of this discussion leaves open the question as to whether or not construction of the dock can be justified without reliance on potential OCS development or some other panacea. A study by the Corps of Engineers in 1975 indicated that the benefit/cost ratio was far to low to justify federal expenditures. However, the design they evaluated was different than that proposed in 1976 and different than one that might be proposed now. From the community's perspective the anticipated cost of the facility seems to be too nigh for the community to finance itself.

Consequently, it appears that if the dock is to be constructed, the state will likely bear the lion's share of costs. The state could use income from federal and/or state OCS sales or other oil development to construct the dock, as well as other public facilities in western Alaska. However, that policy decision has not yet been made, even though the state has apparently set aside some limited funds for the facility. In the absence of the state's full commitment to construct a new dock in Nome, this study assumes in the remaining analysis of OCS impacts that the facility is not constructed during the study period.

4.4 Air Mode

4.4.1 DESCRIPTION OF AIR ACTIVITIES

Population growth in the Nome-Wade Hampton region, together with non-local seasonal employment and tourism, is expected to continue to create increasing demands on intrastate air carriers operating the Nome-Anchorage and Anchorage-Seattle air routes. The movement of freight, but particularly mail ; rising incomes in Bush communities which provide the means to travel to maintain family ties; and the movement of government services personnel and native regional corporation personnel to and from the villages all contribute to FAA's expectation of a 73.3 percent increase in regional air taxi operations between now and 1990.

The City of Anchorage is expected to continue to play a key role in air freight traffic, because it serves as a transshipment point for perishable and other goods traveling by air to Nome and Kotzebue, as well as other regional hub communities in western Alaska. If the governmental sector of the region's economy grows as forecast, Anchorage would also be expected to continue as an important location for state and federal government activities and a stopover point for government employees heading for Juneau, Seattle, or other Lower 48 cities.

Both the air carrier and air taxi operators are expected to make every attempt to increase aircraft load factors, reduce operating costs, and improve the over-all efficiency of their operations. The recent CAB action opening many western Alaska routes to interested and qualified operators is not expected to directly affect Nome to the same extent that it may affect western Alaska fishing communities. However, the entire regional air taxi system that currently exists might undergo a considerable shakeout resulting in a structural change to this sector of the aviation industry and indirectly affecting service to Nome. In the short run, the existing poor quality and level of service are likely to continue, but in the long run the system is expected to change and improve considerably,

Facility improvements are expected to be made in accordance with FAA's Ten Year Plan. At Nome this is expected to include rebuilding of the east-west runway (9-27), installation of new approach aids on the north-south runway (2-20), expansion of the terminal facilities, and a new terminal access road. Beyond 1990, this study assumes no additional improvements. "

4.4.2 FORECAST OF AVIATION DEMANDS AND REQUIREMENTS

Weekly demand for air passenger service is forecast for the Nome-Anchorage and Anchorage-Seattle links, as shown in Table 40. This fore-cast represents one-way travel during the average week of the" peak month, which is August. Passenger demands attributable to population growth, and those demands attributable to prior OCS activities, are identified separately. Travel demands over the Nome-Anchorage link, are unaffected by previous OCS activity.* Those increases in travel demand shown in Table 40 are solely attributable to population growth in Nome and the region. On the other hand, the City of Anchorage operates as a major hub with respect to air routes to the Lower 48, and as a result, is affected by prior OCS sales. As illustrated in Table 40, the effect of prior sales declines over time as activities in those sale areas move from exploration and development into the production stage when many OCS employees are expected to be Alaskan residents. The forecast for passengers other than OCS related, is derived from the Anchorage growth factors each year.

* This statement refers to lack of a direct effect. Indirectly, develop-ment in other OCS areas may induce statewide employment and population changes and some of this induced population may settle in Nome or else-where in the region, thus contributing to regional growth and causing an increase in air travel demand. However, this incremental indirect effect is sufficiently small enough in the Nome-Wade Hampton region to be ignored in this analysis. It is not ignored in the Anchorage region, nowever.

Table 40

BERING-NORTON BASE CASE
PEAK MONTH AVERAGE WEEK ONE-WAY AVIATION DEMANDS
AND FLIGHT REQUIREMENTS (1)

Year After Lease Sale	Year	Nome-Anchorage Passengers (2)	Nome-Anchorage Freight (3) (Tons)	Nome-Anchorage Mail (4) (Tons)	Anchorage-Seattle Prior OCS Sales Passengers	Anchorage-Seattle Other Than OCS Passengers (5)	Anchorage-Seattle Total Passengers	Required Flights Nome-Anchorage (6)	Required Flights Anchorage-Seattle (7)
1	1983	456	7	17	1,402	14,669	16,071	5	158
2	1984	479	8	18	1,315	14,542	15,857	5	156
3	1985	483	8	18	519	14,287	14,806	5	146
4	1986	483	8	18	659	14>207	14,946	5	147
5	1987	483	8	18	1,174	14,542	15,716	5	154
6	1988	492	8	19	1,314	14,797	16,111	6	158
7	1989	497	8	19	1,467	15,180	16,6117	6	164
8	1990	506	8	19	1,259	15,562	16,821	6	165
9	1991	515	8	20	1,049	15,945	16,994	6	16?
10	1992	520	8	20	735	16,328	17,063	6	168
11	1993	529	9	20	632	16,710	17,342	6	171
12	1994	53f3	9	20	51	17,093	17,144	6	169
13	1995	547	9	21	28	17,476	17,504	6	172
14	1996	551	9	21	12	17,858	17,870	6	176
15	1997	561	9	21	5	18,369	18,374	6	181
16	199tt	570	9	22	5	18,879	18,884	6	186
17	1999	579	9	22	3	19,389	19,392	7	191
18	2000	583	10	22	2	19,899	19,901	7	196

Notes: (1) Peak month is August.
(2) 1977 Peak Week average of 456 x Nome-Wade Hampton growth factors.
(3) 1977 weekly average of 7.43 tons x Nome-Wade Hampton growth factors.
(4) 1977 weekly average of 17.43 tons x Nome-Wade Hampton growth factors.
(5) 1977 weekly average of 12,756 x Anchorage growth factors.
(6) Derived by dividing Nome-Anchorage passengers by (110 seats x load factor of 80% = 88 seats).
(7) Derived by dividing total Anchorage-Seattle passengers by (128 seats x load factor of 80% = 102 seats).

Source: PMMCO.

The number of flights required to move the identified passenger demands are also shown on Table 40. The basis for these calculations assumes an 80 percent load factor and continued use of existing equipment by the air lines. Actual load factors during August lie in the range of 66 to 67 percent (see Table 28).

It should be noted that the forecasts presented in Table 40 deal with only those air routes likely to be significantly impacted by OCS activities. It is assumed that all Lower 48-bound OCS related trips go from Nome to Anchorage to Seattle and beyond. Alternatively, however, some of these trips could be routed Nome-Fairbanks-Seattle. The choice may depend solely on the schedule of actual flights. Thus, the distribution of trips among these two choices is subject to great speculation at this point in time. Also, due to tourism during summer months, tourist trip demands are routed Anchorage-Nome-Kotzebue-Anchorage or Anchorage-Kotzebue-Nome-Anchorage. The projections for the Nome-Anchorage link in Table 40 include consideration of such looped tourist travel, but only for the one link likely to be affected by OCS.

4.4.3 IDENTIFICATION OF AVIATION IMPACTS

The forecasts developed in Table 40 project an 11 percent change in passenger demands between now and 1990 and a 28 percent change between now and 2000. If these percentages are extrapolated to yield annual enplaned passengers on intrastate air carriers, 24,440 passengers are projected for 1990 and 28,180 passengers are projected for 2000.

The terminal facility is currently operating near capacity during summer peak periods when a jet aircraft arrives from and departs for Anchorage. An additional 28 percent increase in passengers coupled with higher load " factors means that the terminal will likely operate at capacity more frequently due to the additional number of aircraft flights. If the terminal is expanded as projected in FAA's Ten Year Plan the overcrowding during peak periods would be reduced.

FAA is currently forecasting a 16.6 percent increase in air carrier operations and 73.3 percent increase in air taxi operations by 1990. Extrapolating these increases against the 59,000 operations in 1978 produces a 1990 expected level of about 77,000 operations, which is approximately 44 percent of practical annual capacity. It does not appear that the increase in operations will have an adverse effect on runway capacity. If FAA reconstructs the main runway as planned, the increased number of operations should not damage the runway beyond expected deterioration.

Given the air carriers' desire to increase aircraft utilization and the present day load factors of about 67 percent, there appears to be sufficient capacity to handle 1990 passenger forecasts. The addition of Alaska Airlines to Nome routes will provide additional seats and, depending on the frequency of flights, should add sufficient seat capacity to handle the 2000 projections. A more significant impact may be the addition of too many seats, reducing load factors and possibly driving up the cost of a ticket.

4.4.4 AVIATION ISSUES

There are several issues which at present it is difficult to evaluate their total effect on the Nome-Wade Hampton region. Of particular interest is the regional air taxi problem and the potential for a structural change therein, together with the recent CAB action opening western Alaska routes to 'qualified" carriers. In the face of slow but steady growth in population for the region, as forecast in this study, the impacts certainly do not appear to fall on the carriers' ability to handle expected travel demands. The increased competitive situation can be expected to have a positive benefit on the level of service provided passengers and freight. However, if arrivals and departures are not properly scheduled, the potential turmoil in the terminal could prove to be a great negative impact, particularly if the terminal is not improved as planned.

The positive aspects of increased freight and mail capacity to Nome could also be an extremely negative impact if the distributional capacity of the air taxis is not improved. Major limiting factors for the regional air taxi operators is their inability to finance newer, larger, or more efficient aircraft and their inability to utilize existing aircraft to a greater extent. At present, passengers, mail, and freight deliveries to bush communities suffer considerable delay due to capacity constraints of existing aircraft. High interest rates restrain the ability of the carriers to purchase new equipment. In addition, increased aircraft utilization is constrained by VFR* flying requirements, which reflects

* VFR - Visual Flight Rules.

the lack of air navigation facilities in the smaller villages. FAA's Ten Year Plan is only one action likely to bring some improvement to the existing situation. Experts closer to the situation argue that what may be necessary is a major structural change and reorganization of the regional air taxi activities generally. Precisely how this would affect the Nome-Wade Hampton region is not known. OCS activities are not expected to have a great effect on the regional air carriers because, typically, relatively few local people are hired. In this report the regional carrier forecasts of OCS related trips are almost insignificant and are ignored except in passing comments. However, the few OCS employees that may depend on these services to reach their residence may find the services either greatly improved or a nightmare to experience.

4.5 Summary of the Base Case

The base case is founded on the continuation of present trends and conditions with some improvements to port storage capacity and the airport terminal. The forecast steady growth is not expected to create capacity constraints on either the port or the airport, if improvements are made as planned. Generally, both the marine and air carriers have sufficient flexibility and equipment to meet anticipated demands. The exceptions are the regional air carriers and their problems are not likely to be solved very quickly.

5.0 IMPACTS OF THE EXPLORATION ONLY SCENARIO

5.1 Introduction

In this chapter, the induced incremental economic and population changes of the exploration only scenario are added to the base case forecast presented in Chapter 4 and the combined effects on marine and air transportation are evaluated. The character of the exploration only scenario is based upon the assumption that no commercially recoverable oil or gas resources are discovered during exploration activities.

5.2 Significant Factors Affecting Growth

The principal difference in economic activities between the exploration only scenario and the base case is that OCS exploration commences the first year after the lease sale (1983), peaks during the second year, and terminates in the third year after discouraging results. All other characteristics of the base case pertaining to the economy are applicable in the exploration only scenario. This three-year exploration program (based on Dames & Moore, 1980) is principally centered in the central Norton Sound area. Because industry interest is low, the exploration program emphasizes drilling several wells in the larger geological structures. Because the waters of Norton Sound are too shallow to use semi-submersible rigs, exploration activities are conducted using jack-up drilling rigs augmented by drillships in the deeper water. Two wells located in shallow water (less than 18 meters or 60 feet) are drilled with conventional land based rigs from summer-constructed gravel islands. Drilling activities are conducted only during the four month summer open-water season.

It is anticipated that exploration support will be a problem in Norton Sound due to geographic isolation, climatic conditions, and lack of local infrastructure, including port facilities and potential port sites. Significant investments would be required to provide port facilities even for the supply boats due to the shallow water. Because of these problems, this scenario postulates that:

- Drilling materials, including mud, cement, casing, and related materials, are assumed to be stored on location in freighters or barges moored in Norton Sound.

- Gravel required for two exploration islands will be collected offshore by clamshell dredge and hauled to the is and sites by dump barges.

- Fuel and water required by the exploration rigs w 11 be provided under contract by the existing lighteraging service through the port of Nome.

- Consumable demands of OCS employees will be moved to the Bering-Norton area via contract linehaul barge together with the drilling materials.

- Supply/anchor boats needed to position the drill rigs and to haul drilling materials and consumables between the anchored barges and the drill rigs will be anchored offshore with the barges since their draft will not allow them to enter Nome harbor,

- Nome will be a forward support base for air-shipped light supplies and personnel equipment.

- A rear support base providing storage and shipment for heavy supplies is assumed to be located in the Aleutian Islands (no location specified).

Based on these additional economic activities, the population of Nome and the Nome-Wade Hampton regions are expected to change from the base case as shown in Table 41. At the height of the exploration activities in 1984, OCS induced population in the Nome-Wade Hampton region is only 2 percent that of the base case population. A similar effect is seen in the City of Nome. In Anchorage, which has a much larger base population, the induced changes identified in Table 41 amount to only one half of one percent in the peak year of exploration activities. In this scenario, it is assumed that 90 percent of all direct OCS employment will live in temporary housing located on the rigs, the islands, and on accommodation barges offshore. The remaining 10 percent will live onshore. The entire OCS work force is expected to be rotated on a regular schedule between place of work and place of residence. At the end of the exploration period in 1985, regional population is expected to dip slightly due to the loss of OCS induced population, while in the City of Nome, growth will slow from 3 percent a year to approximately 1 percent a year. Soon thereafter, growth trends return to those of the base case, so that in 2000, the difference in

TABLE 41

BERING-NORTON EXPLORATION CASE POPULATION PROJECTIONS AND GROWTH FACTORS

Calendar Year	Year After Lease Sale (1)	Nome-Wade Hampton Region: Base Case Population	Nome-Wade Hampton Region: OCS Induced Population	Nome-Wade Hampton Region: Total Population	Growth Factor (2)	City of Nome: Base Case Population	City of Nome: OCS Induced Population	City of Nome: Total Population	Growth Factor	Region Without Nome City (3): Base Case Population	Region Without Nome City (3): OCS Induced Population	Region Without Nome City (3): Total Population	Growth Factor	City of Anchorage: Base Case Population	City of Anchorage: Sale 57 Induced Population (4)	City of Anchorage: Total Population	Growth Factor	Year After Lease Sale (1)	Calendar Year
1977	--	11,800	--	11,800	1.00	2,885	--	2,885	1.00	8,915		8,915	1.00	103,606	-	101,606	1.00	-	1977
1983	1	11,752	94	11,846	1.00	3,317	27	3,344	1.16	8,435	61	8,502	.95	211,110	15	211,125	1.15	1	1983
1984	2	12,406	198	12,604	1.07	1.303	50	3,441	1.19	9,023	140	9,163	1.03	209,296	64	209,360	1.14	2	1984
1985	3	12.525	100	12,633	1.07	3,451	30	3,481	1.21	9,014	70	9,152	1.01	206.0131	95	206,113	1.12	3	1985
1986	4	12,517	6	12,523	1.06	1.520	..	1.520	1.22	8,997	6	9,2431	1.01	206.S22	73	206,595	1.13	4	1986
1987	5	12,556	3	12,559	106	3,590	..	1.5%	1.24	(3.966	3	8, 969	1.01	209,175	46	209,221	1.14	5	1987
1988	6	12,690	2	12,692	1.08	3,662		3,662	1.27	Y.020	2	9,030	1.01	213,839	36	213,815	1.16	b	1988
1989	7	12,886	2	12,888	1.09	3,135		3.735	1.29	9.151	2	9.153	1.03	219,015	30	219,065	1.19	J	1989
1990	8	13,108	3	13,111	1.11	3,010		3,810	1.32	9,298	3	9,301	1.04	223,847	27	223,874	1.22	8	1990
1991	9	11,29?	2	13,294	1.13	3,029		3.029	1.33	9,463	2	9,465	1.06	228,875	25	228,900	1.25	9	1991
1992	10	13,494	2	13,496	1.14	3,848		3,040	1.31	9,646	2	9,640	1.08	234.256	23	234,2?9	1.28	10	1992
1993	11	13, 602	2	13,604	1.16	3 ,867		4,867	1.14	9,815	2	9,817	1.10	240,001	21	240,022	1.31	11	1993
1994	12	13,909	2	13,911	1.18	3,886		3,886	1.35	10,023	2	10,025	1.12	245.591	20	245,61?	1.34	12	1994
1995	13	14,105	2	14,107	1.20	3,905		3,905	1.35	10,200	2	10.202	1.14	251.1)5	18	251,193	1.37	13	1995
1996	14	14,291	3	14,293	1.21	3,925		3,925	1.36	10,366	2	10,368	1.16	251.405	17	25 ,422	1.40	14	1996
1997	15	14,491	2	14.493	1 23	3,945	--	3,945	1.3?	10,546	2	10,548	1.18	264.412	16	264,420	1.44	15	1997
1998	16	14,707	2	14. /0,9	1.25	3,965		3,965	1.11	10,742	2	10,744	1.21	271,922	15	271,937	1.48	16	1998
1999	17	14,949	2	14,951	1.2?	3,985		3,985	1.38	10,964	2	10,966	1.23	219,321	14	2?9,337	1.52	17	1999
2000	18	15,140	2	15.142	1.20	4,005		4,005	1.39	11,135	2	11,137	1.25	20) . 256	14	287,270	1.56	18	2000

Notes:
(1) Lease Sale No. 57 is currently scheduled for November 1982.
(2) Growth Factors are derived by dividing the forecast year population by the 1977 population.
(3) Derived by PMNBCO by subtracting City of Nome forecast from Nome-Wade Hampton Region forecast.
(4) The Anchorage base case population includes induced population from OCS sales prior to Sale 57. These are not specifically identified herein but may be found in earlier SESP documents.

Sources: Nome Population Projections, Policy Analysts, 1980.
Nome-Wade Hampton Region and Anchorage Population Projections, ISER, 1980.
Region Without Nome City, PMNBCO.

population between the exploration only scenario and the base case is insignificant.

5.3 Water Mode

5.3.1 DESCRIPTION OF MARINE ACTIVITIES

The exploration only scenario will produce growth in addition to the base case largely due to seasonal employment resulting from OCS development. Because of this development, incremental but short-lived population changes are expected to occur. For the City of Nome and for the region as a whole, marine transportation demands will rise slightly in conjunction with the population changes. The marine transportation industry is expected to maintain the present character of its services: The use of linehaul barges to deliver products to Nome, the use of lighters to offload linehaul vessels, and use of lighters to deliver dry cargo and liquid bulk petroleum products to coastal villages.

Due to the physical limitations of Nome's harbor, oil industry supply boats will be restricted. Construction of permanent dock or harbor alternatives by the oil industry are cost y and unwarranted, if oil is not discovered, Typically, solutions to problems that arise are likely to be temporary. To the extent possible, the oil companies are anticipated to make maximum use of the available lighterage services on a contract basis. In particular, the lighterage service is expected to supply fuel and water to the rigs. A precedent for this action will be established in 1980 when the oil industry drills a COST* well in the Bering-Norton lease sale area. Because the City is currently constructing a special water supply line to the city dock to support COST well activities, it is anticipated that the city will also provide water during these exploration activities.

5.3.2 FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

The demand for transportation services are expected to arise from two sources: The local population and OCS related activities. It is assumed that local population demands will follow patterns established in the base case, generating throughput tonnage at an annual rate of three tons per capita. When this rate is extrapolated using the forecast population data of Table 41, population based marine transportation demands are as shown in Table 42. In 1984, at the height of exploration, the difference between the exploration only projections and those of the base case are less than two percent. When compared to the base case, the existing incremental growth has the effect of advancing transportation demands five years sooner in time.

Those OCS activities requiring transportation services are identified in Tables 43 through 45. Eight wells are proposed to be drilled during the three year period, as illustrated in Table 43. These eight wells are assumed to be drilled to an average depth of 11,500 feet. The annual quantities of drilling materials needed for these wells is identified in Table 44. The drill pipe and dry bulk materials are expected to be shipped to the lease

* COST - Continental Offshore Stratigraphic Test.

TABLE 42

BERING-NORTON EXPLORATION ONLY SCENARIO
POPULATION RELATED MARINE TRANSPORTATION DEMANDS

Year After Lease Sale	Year	Nome-Wade Hampton Regional Population Exploration Only Scenario	Throughput Tonnage Total (1)	Throughput Tonnage Dry Bulk (2)	Throughput Tonnage Liquid Bulk (3)	Nome Marine Tonnage Demands Dry Bulk (4)	Nome Marine Tonnage Demands Liquid Bulk (5)	Region Without Nome Tonnage Demands Dry Bulk (6)	Region Without Nome Tonnage Demands Liquid Bulk (7)	Total Inbound Tonnage (8) Dry Bulk	Total Inbound Tonnage (8) Liquid Bulk
1	1983	11,846	35,538	7,818	27,720	5,316	24,948	1,251	1,386	6,56?	26,334
2	1984	12,604	37,812	8,319	29.493	5,657	26,544	1,331	1.475	6,988	20,019
3	1985	12,63.3	37,899	0,330	29,561	5,670	26,605	1,334	1,478	7,004	28,083
4	1986	12,523	37,569	8.265	29,304	5,620	26,373	1,322	1,465	6,943	27,839
5	1987	12,559	37,677	8,289	29,380	5,636	26,449	1,326	1,469	6,963	27,919
6	1988	12,692	30,076	8,377	29,699	5,696	26,729	1,340	1,485	7,036	28,214
?	1989	12,888	30,664	0,506	30,158	5,784	27,142	1,361	1,508	7,145	28,650
8	1990	13,111	39,333	0,653	30.680	5,884	27,612	1.385	1,534	7,269	29,146
9	1991	13,294	39,882	8,774	31,100	5,966	27,997	1,404	1,555	7,370	29,553
10	1992	13,496	40,488	0,907	31,581	6,057	28,423	1,425	1,579	7,482	30,002
11	1993	13,684	41,052	9,031	32,021	6,141	28,819	1,445	1,601	7,586	30,420
12	1994	13,911	41.733	9,181	32,552	6,243	29,297	1,469	1,628	7,712	30,924
13	1995	14,)07	42,321	9,311	33,010	6,331	29,709	1,490	1,651	7,821	31,360
14	1996	14,293	42,879	9,433	33,446	6,415	30,101	1,509	1,672	7,924	31,773
15	1997	14,493	43,479	9,565	33,914	6,504	30,522	1,530	1,696	0,035	32,210
16	1998	14,709	44,127	9,708	34,419	6,601	30,977	1,553	1,721	8,155	32,698
17	1999	14,951	44,853	9,868	34,905	6,710	31,487	1,579	1,749	8,289	33,236
18	2000	15,142	45,426	9,994	35,432	6,796	31,889	1,599	1,772	8,395	33,661

Notes:
(1) Total Throughput Tonnage = Regional Population x 3 tons per person per year.
(2) Total throughput dry bulk is 22% of total throughput tonnage. See Figure 6, Part A.
(3) Total throughput liquid bulk is 78% of total throughput tonnage. See Figure 6, Part A.
(4) Nome Dry Bulk is 14.96% of total throughput tonnage. See Figure 6, Part E.
(5) Nome Liquid Bulk is 70.20% of total throughput tonnage. See Figure 6, Part E.
(6) Region Without Nome Dry Bulk is 3.52% of total throughput tonnage. See Figure 6, Part F.
(7) Region Without Nome Liquid Bulk is 3.90% of total throughput tonnage. See Figure 6, Part F.
(8) Derived by adding Nome and Region Without Nome tonnage demands.

Source: PMM&CO.

TABLE 43

BERING-NORTON - EXPLORATION ONLY SCENARIO
TRANSPORTATION RELATED ACTIVITIES

Year After Lease Sale	Calendar Year	Exploration Rigs: Conventional (1)	Exploration Rigs: Gravel Island (2)	Wells Drilled (3)
1	1983	2	--	2
2	1984	3	1	4
3	1985	1	1	2

NOTES: (1) Includes Jack-ups or Drillships.

(2) Gravel Islands use shore based technology. Quantity of gravel for each exploration island estimated to be 114,690 cubic meters (150,000 cubic yards) based on an island diameter of 60 meters (198 feet) in 30 feet of water,

(3) Assumes average well completion rate of approximately 4 months and an average total well depth of 3,048 to 3,692 meters (10,000 to 13,000 feet)

Source: Dames & Moore, 1980

TABLE 44

GRAVEL AND DRILLING MATERIALS REQUIREMENTS

I3ER1NG-NOR1ON EXPLORATION ONLY SCENAR1O

Year After Lease Sale	Calendar Year	Exploration and Delineation Wells Drilled	ANNUAL TONNAGE[1] Drill Pipe	Dry Bulk	Total Dry Freight	Fuel	Drill Water[2]	Gravel 3
1	1983	2	910	2,218	3,128	3,942	6,160	243>000
2	1984	4	1,821	4,436	6,257	7>884	12,320	243,000
3	1985	2	910	2,218	3,128	3,942	6,160	---

NOTES: 1. Tonnage requirements per exploration well (see Appendix B)

Drill Pipe = 405.2 tons
Dry Bulk = 1,109.0 tons
Fuel · 1,971.0 tons
Drill Water = 3,080.0 tons

2. Drill water will be obtained locally.

3. Gravel islands are built the year prior to actual use. Each island requires 114,690 cubic meters (150,(100 cubic yards) of gravel at 2.12 ST/cubic meter (1.62 ST/cubic yard).

sale area on contract linehaul vessels. As mentioned earlier, the fuel and drill water are all expected to be obtained locally and transported to the rigs under contract to the local lighterage company using specially constructed barges brought in for this purpose.

Two exploration gravel islands will be constructed, one in 1983 for use the next year and one in 1984 for use in 1985. These gravel islands utilize shore based technology, but require at least 150,000 cubic yards of gravel in their construction. Although the gravel material for these islands exists onshore at Nome, the gravel would have to be transported to the dock by truck and to the island site by barge. Since barge capacity is limited due to the shallow water, this would not be an efficient operation. It is assumed that in place of this two step process, a clam-shell dredge will be utilized to mine offshore gravel resources. A 2,000 cubic yard bottom dump barge, accompanied by a supply barge and personnel accommodation barge, are expected to be involved in the island construction operation. Construction time is estimated to be 40 to 50 summer days.

Non-1ocal personnel employed by the oil companies during exploration will require food, shelter, and other temporary services. These services are defined for purposes of this study as OCS consumables with an estimated consumption level of approximately 300 pounds per person per month. An estimate of the annual OCS consumable tonnage demand is identified in Table 45. This demand represents four months of summer operations. It is anticipated that these consumable items will be transported with the drilling mud and other materials. Some of these consumables will be

TABLE 45

BERING-NORTON EXPLORATION ONLY SCENARIO
TRANSPORTATION DEMAND OF OCS CONSUMABLES

Year After Lease Sale	Year	OCS Related Non-Local Population (1)	Annual OCS Consumable (2) Demand (In Tons)
1	1983	186	112
2	1984	426	256
3	1985	399	239
4	1986		
5	1987		
6	1988		

Notes: (1) Equals Offshore-onsite non-local employment plus Onshore-onsite non-local employment,

(2) Assumes consumption level of 300 pounds per person per month over four months.

stored on the offshore barges, some will be stored on the rigs themselves, and replenished via supply boats. A portion of consumable demand associated with perishable goods are expected to be air freighted in and are discussed in a later section.

When all of these various demands are looked at collectively, the annual marine vessel requirements are anticipated to be as shown in Table 46. Included in the table are both the population related, as well as the OCS related demands. (luring the peak year of exploration, total linehaul vessels requiring lighteraging services increases from 15 in the base case to 18 under this scenario, a 20 percent Increase. For the same years, the number of lighter trips required to serve these vessels increases from 151 in the base case to 250 in this scenario, a 66 percent increase. At least two tanker barges for drill water and fuel) and a tug are added to the existing port barge equ pment in order to handle the increased demands. One reason for the large ncrease in lighter vessel movement is because fuel used for OCS activities must first be offloaded from the linehaul tanker barges, brought ashore for storage, and then as needed every ten or so days, delivered by special barge to the rigs. Water used for OCS activities is collected at the dock and is outbound only, With the additional port equipment (barges) use of available port equipment is about the same as the base case. supply boat and gravel barge operations will not affect the Nome harbor.

TABLE 46

BERING-NORTON EXPLORATION ONLY SCENARIO
ANNUAL MARINE VESSEL REQUIREMENTS

		Population Related					OCS Related				
		Linehaul		Linehaul Lighter		Coastal Delivery	Linehaul		Linehaul Lighter		
Year After Lease Sale	Year	Dry Cargo Arrivals (1)	Tanker Barge Arrivals (2)	Dry Cargo Round Trips (3)	Tanker Round Trips (4)	Lighter Round Trips (5)	Dry Cargo Arrivals (6)	Tanker Barge Arrivals (2)	Tanker Round Trips (4)	Supply Boat Round Trips (7)	Gravel Barge Round Trips (8)
1	1983	11	4	19	125	16	2	1	49	24	36
2	1984	12	4	20	133	17	3	2	97	48	36
3	1985	12	4	20	134	17	1	1	49	24	
4	1986	12	4	20	133	17					
5	1987	12	4	20	133	17					
6	1988	12	4	20	134	17					
7	1989	12	4	20	136	18					
8	1990	12	4	21	139	18					
9	1991	12	4	21	141	18					
10	1992	12	4	21	143	18					
11	1993	13	4	22	145	19					
12	1994	13	4	22	147	19					
13	1995	13	4	22	149	19					
14	1996	13	5	23	151	19					
15	1997	13	5	23	153	20					
16	1998	14	5	23	156	20					
17	1999	14	5	24	158	20					
18	2000	14	5	24	160	21					

Notes: (1) Assumes an average of 600 ST arrives on each linehaul dry cargo vessel.

(2) Assumes an average of 7,000 ST (50,050 bbl.) arrives on each linehaul tanker vessel.

(3) Assumes each lighter averages 350 ST of dry cargo per trip.

(4) Assumes each lighter averages 210 ST (1,500 bbl.) of liquid bulk per trip. OCS fuel goes inbound to storage and outbound to the rig. OCS water is outbound only. All trips are shown.

(5) Assumes each coastal delivery trip is made by a lighter averaging 215 ST per trip and cargo is composed of 40 percent (86 ST) liquid bulk and 60 percent (130 ST) dry bulk or neobulk. Optimization of the number of trips is not considered.

(6) Consumable dry cargo and drilling materials dry freight are included. These commodities are expected to arrive on 6,000 ST capacity contract vessels which are anchored offshore.

(7) Includes supply/anchor boats used in positioning and supplying platforms. See Appendix B for discussion of assumptions.

(8) Exploration gravel island construction is expected to take 43 days; 2,000 cubic yard work barge operates for two round trips per day over the period.

5.3.3 IDENTIFICATION OF MARINE TRANSPORTATION IMPACTS

Except for three years of slightly more intense activities, the marine demands of the exploration only case are similar to those of the base case. Consequently, the impacts expected in the exploration case are similar to those of the base case. The principal difference between the two cases is that exploration demands in 1984 are about equivalent to base case demands in 1988, which means the exploration only case advances throughput tonnage demands in time by about 4 to 5 years. However, this advance is short lived because activities return to near the levels of the base case following the end of exploration. Even the decline in tonnage demands in 1986, the year after exploration ends, is not significant. The decline in the base case in 1986 due largely to general economic slowdown is about 25 ST, whereas the decline following end of exploration is about 330 ST. The difference is equivalent to loss of about a year's growth when compared to annual changes in demands of the base case.

A more important negative impact might occur if gravel is obtained onshore versus offshore. In the earlier discussion of gravel island construction it was assumed the gravel would be obtained offshore via dredge and bottom dump barge. If this assumption proves incorrect, the operation would have to be conducted in a slightly different manner and impact on the port would be quite large. In place of the 2,000 cubic yard bottom dump barge, one or several 300 cubic yard barges would be employed. Like other equipment operating in the port, the capacity of these barges would likely be restricted to half of the rated capacity: 150 cubic yards or 243 ST.

At this capacity rating at least 1,000 trips are required to haul the needed gravel. If the construction time frame remains at 40 to 50 days, 20 to 25 barge trips a day must be made. The port must therefore be capable of loading a barge every 40 to 50 minutes. Loading facilities at the port are nonexistent. Currently, loaded trucks drive onto the barge, unload, and a bulldozer spreads the material. This is an effective approach for small amounts of gravel. If the same procedure were followed in loading the gravel island barges, 50 truck trips (slightly more than one per minute) by a 5 ton truck will be required for each barge. Larger trucks could be employed to reduce the number of trips. However, either the large number of smaller trucks or the smaller number of large trucks is likely to seriously deteriorate the roads used to haul the gravel. Regardless of how the gravel operation is set up through the port, it is likely to be much more inefficient than offshore dredging.

5.3.4 MARINE TWVISPORTATION ISSUES

Marine transportation issues in the exploration only case are similar to those of the base case and focus on the potential new dock facility. Comments made in the base case still apply. One additional consideration in looking at the feasibility of a new dock facility is its use during exploration activities, particularly if gravel resources were obtained onshore instead of offshore. If the dock included the capability to handledry bulk as well as liquid bulk and was completed prior to the beginning of OCS exploration, it could relieve the pressure on the existing port facilities by handling the day to day cargo-demands of the population and, when available, supplement the existing port facilities in loading gravel barges. This action, however, would not reduce the impact of the trucks on local streets. Furthermore, like the exploration activities, these benefits are short-lived.

5.4 Air Mode

'5.4.1 DESCRIPTION OF AVIATION ACTIVITIES

Because of the skills required, it is estimated that about 72 percent of the OCS work force will commute by air to and from residences outside the state. About 26 percent of the work force will commute to other regions of Alaska 'with most of these (75 percent) traveling by air to or through Anchorage. About one half of one percent will travel by air to residences in the region outside Nome and about 1.5 percent are expected to be residents of Nome who require no commuting. Based on this distribution of OCS employees, aviation impacts are most likely to occur on the Nome-Anchorage and Anchorage-Seattle air routes or in the Nome or Anchorage terminals. The air carriers serving these routes are expected to respond to these increased demands by increasing load factors, increasing the frequency of flights, and if necessary leasing additional aircraft on a short term basis. It is unlikely they 'will purchase new equipment unless justified on some other basis.

Since 90 percent of the work force will be offshore, the oil industry is expected to contract for helicopter services to move employees back and forth between the Nome Airport and offshore locations.

5.4.2 FORECASTOF AVIATION DEMANDS AND REQUIREMENTS

The anticipated aviation passenger demands for the exploration only scenario are detailed in Table 47. The peak period for OCS employee movements is expected to be 1984. During an average week of the peak month of that year, approximately 209 OCS employees require movement between offshore locations and the Nome airport. Only one or possibly two people use the intraregional aviation services. Along the Nome-Anchorage link, population related travel increases by the growth factors. It is estimated that about 75 percent of the OCS trips would be on the Nome-Anchorage link. Of that 75 percent, 20 percent are headed to Anchorage because they have residency in that region, while 80 percent are heading to Anchorage for connections to Seattle and other places in the Lower 48. As a result of Bering-Norton OCS development, the Nome-Anchorage link trip demands increase 16 percent over the base case in 1984, while the Anchorage-Seattle link trip demands increase 0.8 percent over the base case for the same year.

When these various demandsare translated into aircraft flight requirements, the forecast is as illustrated in Table 48. Contract helicopters serving the linkage between offshore rigs and Nome is estimated to be 15 trips per week during the peak months of 1984 and 1985. The increment of one or two additional passengers on the air taxi between Nome and regional points is estimated to require at least one additional flight, although this additional passenger would most likely be accommodated on existing flights. With respect to the air carriers serving the Nome-Anchorage and Anchorage-Seattle trips, the influence of the exploration only scenario adds approximately one

TABLE 47

BERING-NOR ON EXPLORA ION ONLY SCENARIO LOCAL POPULATION AND OCS EMPLOYMENT PEAK MONTH WEEKLY AVIATION PASSENGER DEMANDS

				Nome-Anchorage			Anchorage-Seattle			
Year After Lease Sa e	Year	Offshore-Nome OCS Relate 1)	Nome Regiona (1)	Population Related (2	OCS Related (1)	Total	Population Related (3)	Prior OCS Sales	Exploration Only Scenario (1)	Total
1	1983	101	1	456	75	531	14,669	1,402	60	16,131
2	1984	209	1	488	154	642	14,542	1,315	126	15,983
3	1985	201	2	488	148	636	14,287	519	121	14,927
4	1986	--	-	483	--	483	14,414	659	--	15,073
5	1987	--	-	483	--	483	14,542	1,174	--	15,716
6	1988	--	-	492	--	492	14,797	1,314	--	16,111
7	1989	--	-	497	--	497	15,180	1,467	--	16,647
8	1990	--	-	506	--	506	15,562	1,259	--	16,821
9	1991	--	-	515	--	515	15,945	1,049	--	16,994
10	1992	--	-	520	--	520	16,328	735	-	17,063
11	1993	--	-	529	--	529	16,710	632	--	17,342
12	1994	-	-	538	--	538	17,093	51	--	17,144
13	1995	--	-	547	--	547	17,476	28	--	17,504
14	1996			552	--	552	17,858	12	--	17,870
15	1997	--	-	561	--	561	18,369	5	--	18,374
16	1998			570	--	570	18,879	5	--	18,884
17	1999			579	--	579	19,389	3	--	19,392
18	2000			584	--	584	19,899	2	--	19,901

Notes: (1) Derived from Dames & Moore Scenario Employment data.
(2) Peak week average of 456 x Nome-Wade Hampton Region growth factors.
(3) Peak week average of 12,756 x Anchorage growth factors

Sources: Dames & Moore, 1980
PMM&CO.

TABLE 48

BERING-NORTON EXPLORATION ONLY SCENARIO
PEAK MONTH WEEKLY AIRCRAFT FLIGHT REQUIREMENTS

Year After Lease Sale	Year	Contract Helicopters Offshore-Nome (1)	Air Taxi Nome-Regional Points (2)	Air Carrier Nome-Anchorage (3)	Air Carrier Anchorage-Seattle (4)
1	1983	8	1	6	158
2	1984	15	1	7	157
3	1985	15	1	7	146
4	1986	--	-	5	148
5	1987	--		6	154
6	1988	--		6	158
7	1989	--		6	163
8	1990	--		6	165
9	1991	--		6	167
10 "	1992	--		6	167
11	1993	--		6	170
12	1994	--		6	168
13	1995	--		6	172
14	1996	--		6	175
15	1997	--		6	180
16	1998	--		6	185
17	1999	--		7	190
18	2000	--		7	195

Notes: (1) Derived by dividing Offshore-Nome OCS Related Passengers by 14 seats.

(2) Derived by dividing Nome-Regional Points Passengers by 4 seats.

(3) Derived by dividing Nome-Anchorage Passengers by (110 seats x load factor of 80% =) 88 seats.

(4) Derived by dividing Anchorage-Seattle Passengers by (128 seats x load factor of 80% =) 102 seats.

Source: PMM&Co.

to two flights per week to the Nome-Anchorage linkage and only one additional flight per week on the Anchorage-Seattle link.

5.4.3 IDENTIFICATION OF AVIATION IMPACTS

From many different" aspects including runway capacity or the carrier's ability to meet demands, the incremental difference between the base case and the exploration only scenario is insignificant. Perhaps a slightly greater effect will be felt in the Nome terminal building if it is not improved as planned, although two additional flights per week are not likely to have a major influence on the terminal unless they arrive simultaneously. From the perspective of the regional air taxi operators, the addition of one more passenger per week could only exacerbate the existing freight and mail problems. From the perspective of the passenger on the regional air taxi, the prospect of getting back to Nome for his next shift rotation may be a great inconvenience, if he has to begin the trip several days beforehand to ensure he can get on a flight. Being tardy when shifts are rotating could cost a person his/her job.

5.4.4 AVIATION ISSUES

The minor difference between the exploration only scenario and the base case surfaces no additional issues. Those described in the base case are equally applicable to this scenario.

5.5 Summary of Exploration Only Scenario

The exp' oration only scenario is based on the-assumption that no commerc ally recoverable oil or gas resources are found during a three year period of exploration. The oil industry does not wish to make permanent investments in marine infrastructure facilities and can be expected to set up their operations offshore so as to minimally disturb the community. The incremental demands of the exploration only case on the marine transportation system, as well as on the aviation system, have the effect of advancing demands 4 to 5 years sooner in time than might be expected in the base case. This incremental difference is expected to be easily absorbed by the facilities and by the various transportation services.

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6.0 IMPACTS OF THE MEDIUM FIND SCENARIO

6.1 Introduction

In this chapter, the induced economic and population changes of the medium find scenario are added to the base case forecast presented in Chapter 4 and the combined effects on marine and air transportation are evaluated. The medium find scenario assumes modest discoveries of oil and non-associated gas. The total reserves discovered and developed are 1,200 mmbbl of oil and 2,300 bcf of non-associated gas. The characteristics of this scenario become additional points of comparison in evaluating the low and high find scenarios in Chapters 7 and 8 respective.

6.2 Significant Factors Affecting Growth

The principal difference in economic activity between the medium find scenario and the base case is the discovery and development of the above referenced oil and gas resources. All other characteristics of the base case pertaining to the economy are applicable. It is assumed that five oil fields comprise the total reserves. They are located in twu groups of fields: one in inner Norton Sound consists of two fields; the second in the central sound southwest of Nome, consists of three fields, as shown in Figures 17-1 and 17-2. The gas reserves are contained in two fields close to each other, about 48 kilometers (30 miles) south of Nome. It is also assumed that all crude oil is brought to a single terminal to be located by the oil industry at or near Cape Nome. For the inner sound fields, this

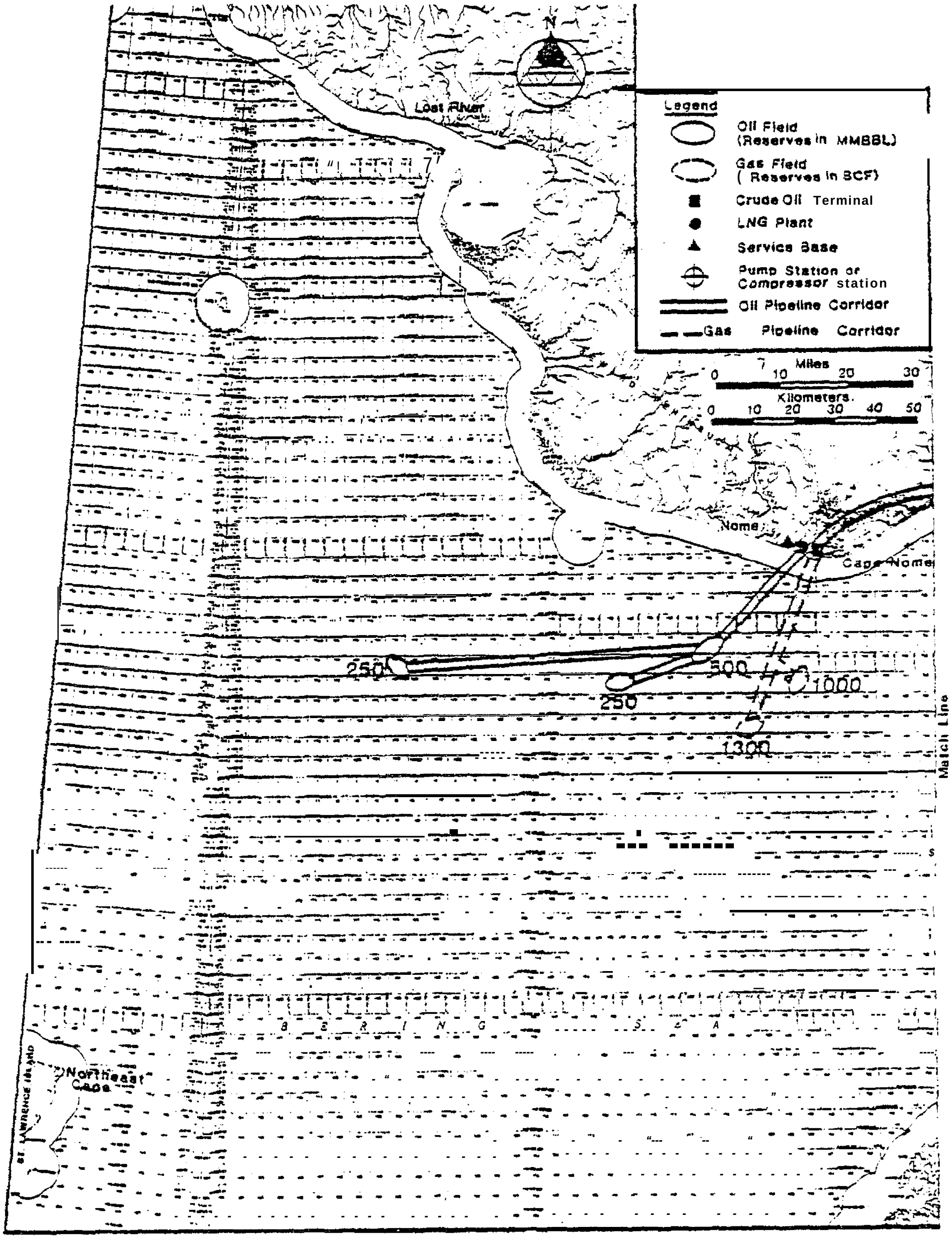

FIGURE 17-1

MEDIUM FIND SCENARIO
FIELD AND SHORE FACILITY LOCATIONS

Source: Dames & Moore, 1980

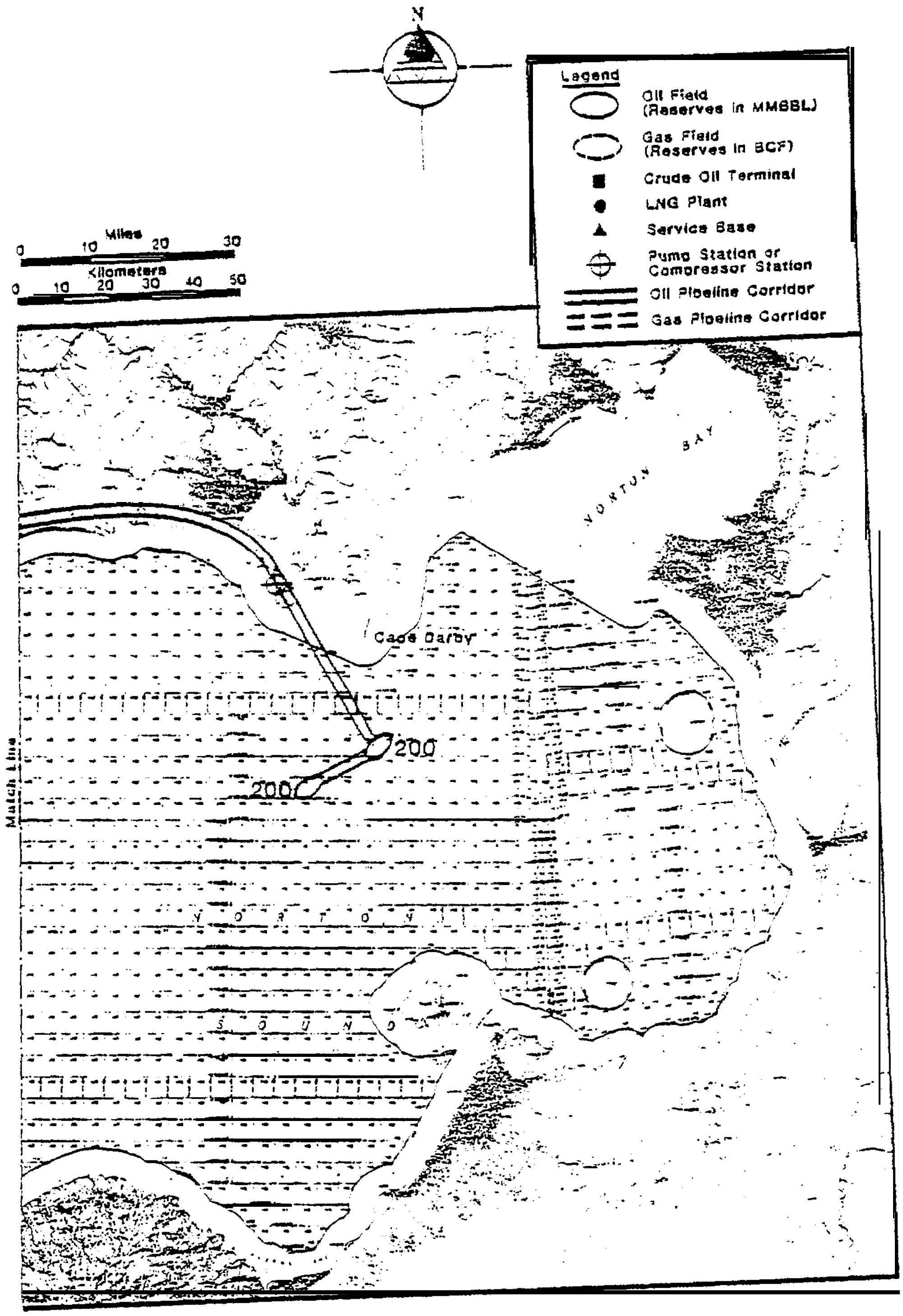

FIGURE 17-2

MEDIUM FIND SCENARIO
FIELD AND SHORE FACILITY LOCATIONS

Source: Dames & Moore, 1980

involves a 100 kilometer (62 mile) onshore pipeline segment from Cape Darby to Cape Nome. A trunk pipeline from the central and outer sound fields makes landfall close to the terminal site and therefore involves minimal onshore pipeline construction. The non-associated gas fields are assumed to share a single trunk pipeline to an LNG plant located adjacent to the crude oil terminal at Cape Nome.

The assumed schedule of OCS activities forecast that exploration commences in the first year after the lease sale (1983), peaks in year three with 16 wells drilled, and terminates in the seventh year with a total of 64 wells drilled. Seven commercial discoveries are made (5 oil, 2 non-associated gas) over a five-year period. The exploration activities are expected to involve jack-up rigs and drill ships (in the outer sound) and limited use of summer-constructed islands in shallow water 15 meters (50 feet) or less, where suitable barrow materials are either adjacent to the well site or within economic haul distance. Economics dictate extension of the drilling season from the four-to-six month open-water season to a maximum of eight months. This is accomplished by the use of ice-breaker support for supply boats and other vessels.

Field development commences in year four after the decision to develop the first discovery (a 500 mmbbl reserve oil field in central Norton Sound) and the first platform is installed in year five. Development drilling commences the following year and the first oil production is brought to shore in year seven (1989). Offshore construction activity peaks in year six when four platforms are installed. The favored development strategy is ice-reinforced steel platforms; two caisson-retained gravel production islands are, however, constructed in the inner sound to develop two 200 mmbbl oil fields. The last platform is installed in year eight.

Oil production commences in year eight after the lease sale (1990), peaks at 463,000 barrels per day in year 12 (1994), and ceases in year 29 (2011). Gas production commences in year seven (1989), peaks at 460.8 mmcfd in years 12-18 (1994-2000), and ceases in year 28 (2010).

Based on these levels of activity, primary employment rises to a peak of 3,550 by 1990 and moderates to 2,447 between 1996 and 2000. Between one-fifth and one-fourth of this total works onshore, while the balance are employed in offshore facilities. Except for a small increment which decides to take up local residence, much of the work force lives in a highly self-contained and self-sufficient environment offshore. A large portion of the onshore work force (86 to 89 percent) also resides in an enclave environment either at the Cape Nome service base or in coastal work camps whose location at present is not specified.

Secondary employment increases in direct relationship to the primary work force and phase of development. The real increase in secondary work force peaks at 266 though there is also in-migration to replace workers in the existing base case secondary employment sector who shift to primary sector jobs. Secondary employment is expected to be partially filled by existing unemployed residents available to the work force (estimated at 15 percent). The remainder of secondary employment would be filled primarily by Native regional residents drawn into the Nome employment area (estimated to be 33 percent) or primarily non-Native workers from outside the region who move to Nome (estimated to be 67 percent).

The resultant changes in population for the City of Nome and the Nome-'Jade Hampton region are illustrated in Table 49. The regional population is expected to increase approximately 60 percent between 1983 and 2000 with considerable growth taking place in the City of Nome, which undergoes an 81 percent increase in population over the same period. At the peak of OCS activities in 1991, the regional population associated with the medium find scenario is 40 percent above the same year population forecast for the base case. The Anchorage area population increases almost 60 percent between 1983 and 2000, largely because the city serves as a major source of employment, particularly during the development and production phases, In 1991, the Anchorage population of the medium find scenario is only two percent that of the base case.

6.3 Water Mode

6.3.1 DESCRIPTION OF MARINE ACTIVITIES

During the exploration phase it is anticipated that the oil industry will operate in a manner similar to that described in the exploration only scenario (.Chapter 5) In particular, the oil industry is expected to operate from barges anchored offshore using supply boats to shuttle materials between the barges and the various rigs and platforms. When the

Table 49

BERING-NORTON MEAN OCS CASE POPULATION PROJECTIONS AND GROWTH FACTORS

		Nome-Wade Hampton Region				City of Nome				Region Without Nome City (3)				City of Anchorage					
Calendar Year	Year After Lease Sale (1)	Base Case Population	OCS Induced Population	Total Population	Growth Factor (2)	Base Case Population	OCS Induced Population	Total Population	Growth Factor	Base Case Population	OCS Induced Population	Total Population	Growth Factor	Base Case Population	Sale 57 Induced Population (4)	Total Population	Growth Factor	Year After Lease Sale (1)	Calendar Year
1977		11,800		11,800	1.00	2,885	--	2,885	1.00	8,915	--	8,915	1.00	IO). 606		18J,606	1.00	--	1911
1983	1	11,752	289	12,041	1.02	3,317	41	3,330	1.15	8,435	2)6	4).711	0.98	211,110	50	211,160	1.15	1	1983
1984	2	12,406	673	13,079	1.11	3,383	32	3,415	1 10	9,02)	64 l	9.664	1.08	209,196	199	209.995	1 14	2	1984
1985	3	12,525	.048	13,573	1.15	3,451	14	3,485	1.21	9,074	014	10,088	1.13	206,010	1224	206. 346	I 12	3	1985
1986	4	12,517	942	13,459	1.14	3,520	609	4,209	1.46	0.991	253	9.250	1.04	206,522	657	207.1 79	1.12	4	1986
1987	5	12,556	998	1). 554	1.15	1.590	961	4.553	1.60	8.966	15	9.001	1.01	209,1?5	1,233	210,402	1.15	5	190?
1988	6	12,690	1,832	14,522	1.23	3,662	1,081	4,743	.64	9,028	751	9,779	1.10	213,839	1,541	215,380	1.17	6	1988
1989	7	12,886	1,534	14,420	1.22	3,735	1,046	4.101	.66	9,151	400	9.639	1.00	219,035	2.052	221,087	1.20	7	1909
1990	8	13,108	4,473	17,582	1.49	3.010	1,300	5,I10	77	9.290	3,173	12,471	1 40	22),041	2.902	226,039	1.24	8	1990
1991	9	13.292	5,309	18,601	I 50	3,029	1,335	5,104	80	9,463	3,974	13.43)	1.51	220,015	4.460	233.143	1.21	9	1991
1992	10	13,494	5,017	18,511	1 57	3,848	1,288	5.136	.78	9,646	3,)29	13,375	I 58	234.256	5.120	239,516	1.30	10	1992
1993	11	13,682	4,146	17,828	1 51	3,867	1,235	5,102	.77	9,815	2.911	12,726	1 43	24(4,001	5,505	245.5u6	1.34	11	1993
1994	12	13,909	3,729	17,638	1 49	3,886	1,202	5.000	.76	10,023	2,527	12.550	141	245.591	5,470	251,061	1.31	12	1994
1995	13	14.105	3,603	17.180	150	1,905	1.202	5,107	.77	10,200	2,401	12.601	1.42	251,115	s. 505	256, 760	1.40	13	1995
1996	14	14,291	3.756	10.047	1 51	3,925	I,202	5.12?	.78	10,166	2.554	12.920	1 45	257.405	5,866	261,2?1	1.43	14	1996
1997	15	14,491	3.704	18,275	I 55	3,945	I,202	5,147	.78	10.546	2,582	13,128	1.47	264,412	6,208	210,620	1.47	15	1997
1998	16	14,707	3,762	18,469	1 57	1,965	1 202	5,167	1 79	10,142	2,560	13,302	1.49	211,922	6,534	278,456	1.52	16	1998
1999	17	14.949	3,726	10.615	1 50	3,905	I,202	5.101	100	10.964	2.524	13,488	1 51	2)9, 123	6.025	286,148	1.56	17	1999
2000	In	15,140	1,600	18,828	1 60	4.005	I,202	5,212	1.01	11,135	2.406	13,621	1.53	287,256	7,087	294,343	1.60	18	2000

Notes:
(1) Lease Sale No. 57 is currently scheduled for November 1982.
(2) Growth Factors are derived by dividing the forecast year population by the 1977 population.
(3) Derived by PMH&CO by subtracting City of Nome forecast from Nome Wade Hampton region forecast.
(4) The Anchorage base case population includes induced population from OCS sales prior to Sale 57; these are not specifically identified herein but may be found in earlier SESP documents.

Sources: Nome Population Projections, Policy Analysts, 1980.
Nome Wade Hampton Region and Anchorage Population Projections, ISER, 1980.
Region Without Nome City, PMH&CO.

service base is completed in 1987, the oil industry will shift its operations from the anchored barges to the service base. Once oil is discovered and the decision to develop the fields is made, a large volume of construction materials for the service base, marine terminal, and LNG plant will be moved to the area. All of this material is expected to be moved through the Port of Nome. When the service base becomes operational, all incoming OCS materials are anticipated to be moved through the service base facilities. The local lighterage service is expected to be called upon to provide fuel and water to the rigs and platforms until the service base is operational, At that time, the lighterage service will no longer continue to provide fuel and water. When oil and gas production begins in 1989, oil and LNG tankers will begin round trip movements between the marine terminal and west coast ports.

The marine transportation industry is expected to maintain the present character of its service: use of linehaul barges to deliver products to Nome, use of lighters to offload linehaul vessels, and use of lighters to deliver dry cargo and liquid bulk petroleum products to coastal villages, The Port of Nome tself is riot expected to change significantly because, as discussed earl er in this report (Chapters 4 and 5), no new docking facilities are assumed to be constructed.

6.3.2 FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

As in the other scenarios, the demand for transportation services is expected to arise from two sources: The local copulation, and OCS related activities.

It is assumed that local population demands will follow patterns established in the base case, creating throughput tonnage demands at the rate of 3 tons per person per year. When this rate is extrapolated using the forecast population data of Table 49, population based marine transportation demands are shown in Table 50. In 1991, at the height of OCS development activities, throughput tonnage demands reach 55,800 ST, which is 40 percent above base case demands for the same year.

Those OCS activities requiring transportation services are identified in Tables 51 through 55. Based on the scenario estimates, 64 exploration and delineation wells are drilled during the first seven years of development and between 1988 (year 6 after the lease sale) and 1994 (year 12 after the lease sale) approximately 320 additional wells are drilled on a schedule as illustrated in Table 51. During exploration these wells are assumed to be dril 1 ed to an average of 3,505 meters (11 ,500 ft.) . However, development wells are anticipated to be drilled to only 2,286 meters (7,500 ft.). Based on the well drilling schedule identified in Table 51, the annual number of tons of materials required to drill these wells is identified in Table 52. Tine drill pipe and dry bulk materials are expected to be shipped to the lease sale area on contract linehaul vessels. The local lighteraging service is expected to provide the fuel and drill water over the period 1983 to 1987. After this period, supply boats operating from the service base will provide fuel and drill water.

As noted in Table 51, one exploration gravel island will be constructed every year for five successive years between 1984 and 1988. 'wo of these

TABLE 50

BERING-NORTON MEDIUM FIND SCENARIO
POPULATION RELATED MARINE TRANSPORTATION DEMANDS

Year After Lease Sale	Year	Nome-Wade Hampton Regional Population Medium Find Scenario	Throughput Tonnage Total (1)	Throughput Tonnage Dry Bulk (2)	Throughput Tonnage Liquid Bulk (3)	Nome Marine Tonnage Demands Dry Bulk (4)	Nome Marine Tonnage Demands Liquid Bulk (5)	Region Without Nome Tonnage Demands Dry Bulk (6)	Region Without Nome Tonnage Demands Liquid Bulk (7)	Total Inbound Tonnage (8) Dry Bulk	Total Inbound Tonnage (8) Liquid Bulk
1	1983	12,041	36,123	7,947	28,176	5,404	25,358	1,272	1,409	6,676	26,767
2	1984	13,079	39,237	8>632	30,605	5,870	27,544	1,381	1,530	7,251	29,075
3	1985	13,573	40,719	8,958	31,761	6,092	28,585	1,433	1.580	7,525	30>173
4	1986	13,459	40,377	8>883	31,494	6,040	28,345	1>421	1 *575	7,462	29,919
5	1987	13,554	40,662	8,946	31,716	6,083	28,545	1,431	1,586	7,514	30,131
6	1988	14,522	43,566	9,585	33,981	6,51?	30,583	1,534	1,699	8,051	32,282
7	1989	14,420	43,260	9,517	33,743	6,472	30>369	1,523	1,687	7,994	32,056
8	1990	17,582	52,746	11,604	41,142	7,891	3? ,028	1,857	2,057	9,747	39,085
9	1991	18,601	55,803	12,277	43,526	8,348	39,174	1,964	2,176	10,312	41,350
10	1992	18,511	55,533	12,217	43,316	8, 308	38,984	1,955	2,166	10,262	41,150
11	1993	17,828	53,484	11,766	41,718	8>001	37,546	1,883	2,086	9,884	39,632
12	1994	17,638	52,914	11,641	41,273	7,916	37,146	1,863	2,064	9,779	39,209
13	1995	17,788	53,364	11,740	41,624	7,983	37,462	1,878	2,081	9,862	39,543
14	1996	18,047	54,141	11,911	42,230	8,099	38,007	1,906	2,111	10,005	40,118
15	1997	18,275	54,825	12,062	42,764	8,202	38,487	1,930	2,138	10,132	40,625
16	1998	18,469	55,407	12,190	43,217	8,289	38, 896	1,950	2.161	10,239	41,057
17	1999	18,675	56,025	12,326	43,700	8,381	39,330	1,972	2,185	10,353	41,515
18	2000	18,828	56,4114	12,426	44,058	8,450	39,652	1,988	2,203	10,438	41,855

Notes: (1) Total Throughput "Tonnage = Regional Population x 3 tons per person per year.
(2) Total throughput Dry Bulk is 22% of total throughput tonnage. See Figure 6, Part A.
(3) Total Throughput Liquid Bulk is 78% of total throughput tonnage. See Figure 6. Part A.
(4) Nome Dry Bulk is 14.96% of total throughput tonnage. See Figure 6, Part E.
(5) Nome Liquid Bulk is 70.20% of total throughput tonnage. See Figure 6, Part E.
(6) Region Without Nome Dry Bulk is 3.52% of total throughput tonnage. See Figure 6, Part F.
(7) Region Without Nome Liquid Bulk is 3.90% of total throughput tonnage. See Figure 6, Part F.
(8) Derived by adding Nome and Region Without Nome tonnage demands.

Source: PMM&CO.

TABLE 51

TRANSPORTATION RELATED ACTIVITIES

BERING-NORTON MEDIUM FIND SCENARIO

YEAR AFTER LEASE SALE	CALENDAR YEAR	EXPLORATION AND DELINEATION RIGS	PLATFORMS INSTALLED STEEL	PLATFORMS INSTALLED EXPLORATION GRAVEL	PLATFORMS INSTALLED PRODUCTION GRAVEL	DEVELOPMENT RIGS JAN	DEVELOPMENT RIGS JULY	WELLS DRILLED EXPLORATION DELINEATION	WELLS DRILLED OIL DEVELOPMENT	WELLS DRILLED GAS DEVELOPMENT	WELLS DRILLED OTHER	PIPELINE CONSTRUCTED ONSHORE MILES	PIPELINE CONSTRUCTED OFFSHORE MILES	OIL PRODUCTION WELLS	GAS PRODUCTION WELLS	ONSHORE FACILITY CONSTRUCTION
1	1983	3						6								
2	1984	7		1 NOTE 1				14								
3	1985	8		1 NOTE 2				16								
4	1906	6		1 NOTE 2				12								NOTE 4
5	19N7	4	1	1 NOTE 2				8								NOTE 5
6	1988	2	3	1 NOTE 2	1 NOTE 3	0	2	4	10	0	2	4	64			NOTE 6
J	1989	2	1		1 NOTE 3	2	7	4	33	6	7			23	6	
8	1990		1			7	11		6 0	8	12	62	73	83	14	
9	1991					11	11		67	8	13			159	22	
10	1992					11	1		47	8	9			217	30	
11	1993					7	2		20	2	4			237	32	
12	1994					2	0		3	0	1			240	32	
13	1995													240	32	
14	1996													240	32	
15	1997													240	32	
16	1998													240	32	
17	1999													240	32	
18	2000													240	32	

NOTES:

1. Exploration Gravel Island in 7.5 meters (25 ft) of water. Requires 53,522 cu. meters (70,000 cu. yds) of gravel based on an island surface diameter of 60 meters (198 ft).

2. Exploration Gravel Island in 15 meters (50 ft) of water. Requires 110,102 (144,000 cu. yds) of gravel based on an island surface diameter of 60 meters (198 ft).

3. Production Island in 15 meters (50 ft) of water. Requires 1,376,280 cu. meters (1,000,000 cu. yds) of gravel based on an island surface diameter of 213 meters (7[10 ft). Arrows indicate Exploration Island expanded and modified for production. Net additional gravel required is 1,266.178 cu. meters (1,656,000 cu. yds).

4. Begin construction of Oil Terminal, LNG Plant, and Support Base.

5. Support Base completed.

6. Oil Terminal and LNG Plant completed.

SOURCE: Modified from Dames & Moore, 1980.

TABLE 52

GRAVEL AND DRILLING MATERIALS REQUIREMENTS

BERING-NORTON MEDIUM FIND SCENARIO

YEAR AFTER LEASE SALE	CALENDAR YEAR	EXPLORATION AND DELINEATION WELLS DRILLED[1]	DEVELOPMENT WELLS DRILLED[2]	ANNUAL TONNAGE[3]					GRAVEL (in 1,000 TONS
				DRILL PIPE	DRY BULK	TOTAL DRY FREIGHT	[illegible]	DRILL WATER[4]	
1	1983	6		2,431	6,653	9,084	11,828	18,482	
2	1984	14		5,673	15,525	21,198	27,600	43,124	243
3	1985	16		6,483	17,742	24,225	31,542	49,285	396
4	1986	12		4,862	13,306	18,168	23,656	36,964	396
5	1987	8		3,242	8,871	12,113	15,771	24,642	396
6	1988	4	12	5,757	11,375	17,132	20,225	36,433	1,557
7	1989	4	46	17,447	37,977	55,454	67,527	12 S,S61	2,321
8	1990		80	27,576	46,264	73,840	82,264	1 60,744	1,251
9	1991		88	30,333	50,890	81,223	30,490	176,818	
10	1992		64	22,061	37,011	59,072	65,811	128,595	
11	1993		26	8,962	15,036	23,998	26,736	55,242	
12	1994		4	1,379	2,313	3,692	4,113	3,037	

NOTES: 1. From Table 51.

2. Combines oil and gas development wells and other wells drilled, from Table 51.

3. Tonnage requirements per well (see Appendix B):

	EXPLORATION	DEVELOPMENT
Drill Pipe	405.2 ST	344.7 ST
Dry Bulk	1,109.0 ST	578.0 ST
Fuel	?,971.0 ST	1,028.0 ST
Drill Water	3,080.0 ST	2,009.0 ST

4. Drill water will be obtained locally.

.. Exploration gravel islands are constructed the year prior to use. Production gravel islands require two years to construct. Gravel is estimated to weigh 2.12 ST per cubic meter (1.62 ST per cubic yard).

TABLE 53

BERING-NORTON MEDIUM FIND SCENARIO PIPELINE CONSTRUCTION TONNAGE DEMANDS

Year After Lease Sale	Year	Kilometers (Miles) of Pipeline (1) Offshore 12"	14"	16"	18"	20"	Onshore 14"	18"	20"	Uncoated Pipe Tonnage (2) (3) Offshore 12"	14"	16"	18"	20"	Onshore 14"	18"	20"	Total	Offshore Pipeline Coating Materials Tonnage (3) (4)	Total Dry Cargo Tonnage (3)	Coated Pipe Tonnage (5) 12"	14"	16"	18"	20"	Total	Year	Year After Lease Sale
1	1983																										1983	1
2	1984																										1984	2
3	1985																										1985	3
4	1986																										1906	4
5	1987									, 161			2,322	4,176		244	278	8,181	12,977	21,150							1901	5
6	1988	24 (15)			31 (19)	411 (30)		3 (2)	3 (2)												J,204			8,533	14,901	26,638	1988	6
7	1989									3,560	1,787	584			5,276			11,207	8,061	19,268							1909	7
8	1990	74 (46)	34 (21)	10 (6)			100 (62)														9.026	5,212	2,171			11.2119	1990	8
9	1991																										1991	9
10	1 W?																										1992	10
11	1993																										1993	11
12	1994																										1994	12

Notes: (1) From Dames & Moore

(2) Based on:

	Tons/Kilometer	(Tons/Mile)
12"	48.1	77.4
14"	52.9	85.1
16"	60.5	97.4
18"	75.9	122.2
20"	216.5	139
24"	t04 O	167.4

(3) If pipe is coated in the study area, pipe and coating materials must be transported one year before needed

(4) Based on:

	Corrosion Protection		Cement		Sand Aggregate		Iron Ore Aggregate		Wire Mesh		Total	
	Tons/Kilometer	(Tons/Mile)	Tons/Kilometer	(Tons/Mile)	Tons/Kilometer	(Tons/Mile)	Tons/Kilometer	(Tons/Mile)	Tons/Kilometer	(Tons/Mile)	Tons/Kilometer	(Tons/Mile)
12"	10,2	48 6	7.6	12.2	22 7	36.6)	- - -		0.6	(1.0)	61.1	(98.4)
14"	35.3	56.8	92	14.8	216	444	-		0.9	(1.5)	73.0	(117.5)
16"	403	649	17.3	27.8	51.8	014	--	.	1.1	(1.8)	110.5	(177.9)
18"	45.3	129	22.0	35.	65 9	106.1)		.	14	(2.2)	134.6	(216.6)
20"	62 5	100 6	222	15	66	7 107.3	-"	--	1.6	(2.5)	153.0	(246.2)
24"	74 6	200	40.3	64.	-		283 u	(455 0)	2 2	(3.5)	399.8	(643.4)

(5) Based on:

	Tons/Kilometer	(Tons/Mile)
12"	132 8	(213.6)
14"	154 2	(248,2)
16"	224.9	(361.8)
18"	279.1	(449.1)
20"	308.6	(496.7)
24"	460,1	(753.6)

TABLE 54

BERING-NORTON MEDIUM FIND SCENARIO
TRANSPORTION DEMAND OF OCS CONSUMABLES

Year After Lease Sale	Year	OCS Related Non-Local Population (1)	Annual OCS Consumable (2) Demand (In Tons)
1	1983	332	398
2	1984	994	1,133
3	1985	1,037	1,244
4	1986	1,087	1,304
5	1987	1,475	1,770
6	1988	2,334	2,801
7	1989	1,217	1,460
8	1990	1,729	3,275
9	1991	1,735	2,082
10	1992	1,616	1,939
11	1993	1,354	1,625
12	1994	1,292	1,550
13	1995	1,322	1,586
14	1996	1,322	1,586
15	1997	1,367	1,640
16	1998	1,367	1,640
17	1999	1,367	1,640
18	2000	1,367	1,.640

Notes: (1) Equals offshore-onsite non-local employment plus onshore-onsite non-local employment.

(2) Assumes consumption level of 300 pounds per person per month over 8 months.

Source: PMM&CO.

TABLE 55

BERING-NORTON MEDIUM FIND SCENARIO
RESOURCE PRODUCTION TRANSPORTATION DEMANDS"

Year After Lease Sale	Year	Oil Production MMBBL (1)	Oil Production MMTons (2)	Gas Production BCM (3)	Gas Production BCF (4)
1	1983				
2	1984				
3	1985				
4	1986				
5	1987				
6	1988				
7	1989	7.008	0.905	0.744	26.280
8	1990	31.536	4.074	1.786	63.072
9	1991	77.088	9.960	2.977	105.120
10	1992	122.640	15.845	3.572	126.144
11	1993	147.168	19.014	4.168	147.168
12	1994	159.125	20.559	4.763	168.192
13	1995	157.450	20.342	4.763	168.192
14	1996	140.937	18.209	4 .763	168.192
15	1997	117.554	15.188	4.753	168.192
16	1998	95.932	12.394	4.763	168.192
17	1999	77.620	10.028	4.763	168.192
18	2000	64.593	8.345	4.763	168.192

Notes: (1) Million barrels of oil, from Dames & Moore, 1980.

(2) Million tons of oil = MMBBL ÷ 7.74 bbl./ton.

(3) Billion cubic meters = BCF x 0.02832 cubic meters per cubic foot.

(4) Billion cubic feet of gas from Dames & Moore, 1980.

islands will be converted to production platforms following the discovery of oil. Initially, each gravel island will require approximately 150,000 cubic yards of gravel during construction. The two production islands require 1,800,000 cubic yards of material. Gravel fill is expected to be obtained by suction dredges mining offshore gravel resources. The gravel island construction barge spread for the exploration islands will be the same as for the exploration only scenario. The construction barge spread for the production islands could potentially include several suction dredges, several large bottom dump work barges, a supply barge, and several accomoda-tion barges, all operating offshore.

Pipeline construction may commence in 1987 or 1988, depending on whether or not the oil industry establishes a pipe coating yard in the lease sale area. As shown in Table 53, if the yard is established in the area, pipe and coating materials must be transported in 1987, so that the coated pipe can be delivered offshore in 1988. If the oil industry chooses not to establish the coating yard in the area, which appears more likely, the coated pipe is expected to be shipped directly from a Lower 48 pipe coating yard to the lay barge. Uncoated pipe is expected to be shipped to the service base.

The demand for OCS consumables, which includes food, shelter, and other temporary serv ces for non-local personnel employed by the oil companies, is estimated at approximately 300 pounds per person per month. Using anticipated non-local OCS employment as a base, annual OCS related consumable tonnage is projected as in Table 54. This level of demand represents eight months of operations. It is anticipated that these consumable items will be transported with the drilling mud and other materials as part of the linehaul services contracted to the oil industry. During the exploration phase (up to 1987) these consumable materials as well as the drilling materials will be stored at the service base.

When resource production begins in 1989, oil production is expected to gradually rise to a peak of about 159 MMBBL per year in 1994, and decline thereafter, while gas production gradually rises to a level of about 4.8 bcm per year, also in 1994, and remains steady at that level for the remaining years of the study period. The annual changes expected in resource production are identified in Table 55. Tankers employed for crude oil transportation are expected to range in size from 70,000 DWT to 120,000 DWT, while LNG tankers are expected to be 130,000 cubic meters.

When these various transportation demands are viewed collectively, the annual marine vessel requirements are anticipated to be as shown in Table 56. Included in the table are both population related and OCS related demands. The peak year for transportation activity is anticipated in 1989. A total of 37 dry cargo and tanker barge arrivals for both population and OCS related activities are anticipated, In conjunction with OCS activities that year, monthly supply boat-trips are expected to peak at 264 trips and barge movements associated with gravel island construction peaks at 778 trips. All of these movements coincide with the startup of production and the beginning of resource tanker operations.

IADL E 56

BERING NORTON MEDIUM F IND SCE NARIO
ANNUAL MAR I NE VESSEL REQU IREMENT S

Year After Lease Sale	Year	Population Related: Linehaul Dry Cargo Arrivals (1)	Population Related: Linehaul Tanker Barge Arrivals (2)	Population Related: Linehaul Lighter Dry Cargo Trips (3)	Population Related: Linehaul Lighter Tanker Trips (4)	Population Related: Coastal Delivery Lighter Trips (5)	OCS Related: Linehaul Dry Cargo Arrivals (6)	OCS Related: Linehaul Tanker Barge Arrivals (2)	OCS Related: Module Barge Arrivals (7)	OCS Related: k.Inehaul Lighter Tanker Trips (4)	OCS Related: Monthly supply that Trips (8)	OCS Related: Gravel Barge Trips (9)	OCS Related: Pipeline Lay & Bury Barges (10)	OCS Related: Resources Tanker Departures (11) Oil	OCS Related: Resources Tanker Departures (11) Gas
1	1903	11	4	19	127	16	2	2		201	36				
2	1904	12	4	21	138	18	4	4		460	84	75			
3	1905	13	4	22	144	18	4	5		535	96	122			
4	1906	12	4	2t	142	18	3	3	33	401	72	122			
5	1901	13	4	21	143	10	2	2	21	268	72	122			
6	1908	13	5	21	154	20	3	3	u		216	511	5		
7	1989	13	5	23	153	20	9	10			264	778	1	16	10
8	I 990	16	6	2a	106	24	13				236	389	5	68	23
9	1991	17	6	29	197	25	14				252		1	166	38
10	1992	17	6	29	196	25	10				212			265	46
11	1993	16	6	2tk	t ft9	24	4				122			317	53
12	199'4	16	6	2t3	187	24	1				52			343	61
13	1995	16	6	20	180	24	1				32			340	61
14	1996	17	6	29	191	25	1				32			304	61
15	1997	17	6	29	193	25	1				32			253	61
16	I 998	17	6	29	196	25	1				32			201	61
17	1999	17	6	30	198	25	1				32			168	61
16	2000	17	6	30	199	26	1				32			140	61

Hutes :

(1) Assumes an average of 600 ST arrives on each linehaul dry cargo vessel.

(2) Assumes an average of 7,000 ST (50,050 bbl.) arrives on each linehaul tanker vessel

(3) Assumes each lighter averages 350 ST of dry cargo per trip.

(4) Assumes each lighter averages 210 ST (1.500 bbl.) of liquid bulk per trip. OCS fuel goes inbound to storage and outbound to rig. OCS water is outbound only. All trips are shown.

(5) Assumes each coastal delivery trip is made by a lighter averaging 216 SI per trip and cargo is composed of 40 percent (86 ST) liquid bulk and 60 percent (130 ST) dry bulk or neobulk. Optimization of the number of trips is not considered.

(6) Consumable dry cargo and drilling materials dry freight are included. These commodities are expected to arrive on 6,000 ST capacity contract vessels which are anchored offshore.

(?) Module barges include an estimate of barges required for construction equipment and materials used in support base, marine terminal, and LNG plant construction.

(8) Includes supply/anchor boats used in positioning and supplying platforms and pipeline construction barges. See Appendix B for discussion of assumptions.

(9) Based on 2,000 cubic yards (3,240 ST) capacity bottom dump barges.

(10) One lay or bury barge each year plus 6,000 ST capacity pipe supply barge.

(11) 70,000 to 120,000 DWT oil tankers are employed for crude oil transportation while three 130,000 cubic meter LNG tankers are employed for LNG transportation.

The demand for linehaul lighters reaches a peak in 1985, when the local lighteraging service is still providing fuel and drill water to exploration rigs. Including coastal delivery trips during 1985, the total number of expected lighterage trips is 719, which is more than a fourfold increase over the base case during the same year. In order to meet the demand for additional lighter trips, the local lighteraging service is expected to increase the number of lighters located in Nome, particularly those supporting the fuel and drill water operations.

With respect to the supply boat trips, it should be noted in Table 56 that the numbers shown are not annual trips, but monthly trips. When extrapolated over eight months, these trips amount to a considerable level of supply boat activity, Included in these supply boat figures are the icebreaker support vessels which provide assistance to tankers operating between Norton Sound and the Lower 48. The icebreakers are expected to be specially constructed 'or arctic conditions and would likely operate in the area only during the winter months. The size of these vessels precludes their access to Nome Harbor,

Because of the extended annual operational period (8 months), it is anticipated that at the beginning of each construction season, the oil industry would prepare a flotilla of barges similar to the sea lift operations in the Beaufort Sea. The purpose of this early sea lift is to bring as much materials and equipment as possible to the Norton Sound area, as soon as possible each year. It would be anticipated that this flotilla would be supported by icebreaking equipment. Alternatively, the industry might ship the supplies at the end of the prior year open water season and store the materials in the area over the winter.

6.3.3 IDENTIFICATION OF MARINE TRANSPORTATION IMPACTS

Under the medium find scenario, the level of marine transportation activity in Norton Sound is expected to increase significantly over that forecast for the base case. The magnitude of the increase is such that even if Nome's harbor had no navigational restrictions, the existing harbor facilities (berths, cargo handling equipment, storage space, etc.) could not handle anticipated demands. But the harbor does have navigation restrictions and so to improve the efficiency of the OCS operations, it is anticipated that the oil industry will operate temporarily from offshore facilities. Later, after the decision to develop the various fields is made, more permanent onshore facilities will be constructed.

Possible impacts may arise in Nome Harbor during the exploration stage prior to development of a permanent service base. The large volume of fuel and water needed on the rigs, if supplied through Nome, exceeds the existing equipment's capacity when all demands are taken into account. As a result, the lighteraging company will need to provide additional lighters to serve OCS needs. One fuel and one water barge, each specially built to service rigs, will be used and evaluated in support of a COST well being drilled during the summer of 1980. At least one and most likely two more of each type barge will probably be required to meet anticipated OCS demands. Based on the potential utilization of these barges, construction of the additional barges would not seem to be a problem for the lighteraging company.

Assuming that additional lighters will be brought in to service OCS fuel and water needs, existing lighters will be called upon to service the expanded population related demand, which includes an increased number of linehaul vessels and increasing need for coastal village deliveries. Demands for these services reach a level in 2000 that is 24 percent above that of the base case. Based on available equipment, throughput tonnage demands in 2000 are expected to use approximately 81 percent of available equipment capacity, as compared to 65 percent in the same year in the base case. The addition of other new barges may potentially reduce this impact, if employed to help lighter the bulk petroleum linehaul tanker barges.

The addition of six new barges to the harbor may have a serious effect on crowding, particularly in the entrance channel. This could be handled by improved scheduling, and may be reduced by the increased utilization of the new equipment. Sufficient capacity exists to store the vessels in the inner harbor turning basin along the southwest side of the channel. Overwintering also does not appear to create a problem, since the barges are hauled on the beach.

With respect to the need for supply boat berths, oil and LNG tanker berths, and barge berths, the oil industry is expected to provide an optimum number of berths at the various onshore facilities (supply base, marine terminal, and LNG plant).

The variety of other activities associated with the OCS sale would not affect the Nome harbor. The draft of the supply boats is too great to be able to navigate the harbor channel so that during exploration, all supply boat trips would be between the offshore-anchored barges and the rigs and when the supply base became operational, the trips would be between the supply base and the rigs. Similar comments can be made about the gravel barge and pipeline construction activities. For example, in 1989 the high number of gravel barge trips (770 trips) is between the dredges and the different island locations.

Because of the offshore anchored barges, artificial islands, rigs, platforms, and vessel traffic, the number of vessel accidents is likely to increase. The extent of change is impossible to measure at this time. However, the level of change may bring about establishment of formal traffic lanes.

6.3.4 MARINE TRANSPORTATION ISSUES

Marine transportation issues in the medium find case are similar to those discussed in the exploration only case and in the base case, The OCS activities anticipated in this scenario assumed no new dock facilities. It is unlikely that a new dock facility would add considerably to the ability of the oil industry to service its operation. Industry's penchant for dedicated facilities and priority use on those facilities would appear to not warrant their use of a city-owned dock faci ity. Certainly, if a dock facility was available and was capable of handl ng dry bulk as well as liquid bulk cargo, it could very much reduce the total number of fuel and water supply trips proposed for the lighters as well as the number of those lighter trips serving to offload linehaul carriers and to make coastal village deliveries.

It would appear that both the private and contract carriers of bulk have sufficient capacity or can develop sufficient capacity to support the oil industry operations, particularly because the service is a contractual one.

If the available dry cargo and bu" k petroleum storage capacity is not improved, it is unlikely that the flow of additional supplies, especially fuel, will have a major impact. Initially, improved scheduling of line-haul tankers could offset rapid fuel drawdowns by OCS activities. Another way that might offset the problems of temporary high capacity storage is to anchor a large compartmentized storage barge offshore and use that to empty the linehaul tankers and to refuel the work barges. Another approach may be to utilize the special lighters to make deliveries directly from the linehaul tankers to the rigs without ever entering the harbor, although this action could cause delays for the linehaul tankers. Consequently, it would appear that the potential short-run storage impacts could be reduced without significant major investment in onshore facilities.

6.4 Air Mode

6.4.1 DESCRIPTION OF AVIATION ACTIVITES

Based on the assumed distribution of OCS employees, aviation impacts of OCS activities are most likely to occur on the Nome-Anchorage and Anchorage-Seattle air routes or in the Nome or Anchorage terminals. An increasing demand for regional air taxi services is also expected, ones field develop-

e

ment begins and more regional workers are employed. It is anticipated that oil industry aviation support activities will be centered in Nome. A few airports are scattered throughout the Norton Sound area but all, with the possible exception of Nome, would require extensive work to become suitable for continual use by large, heavily-laden aircraft. The oil industry is expected to contract for helicopter service to move employees back and forth between the Nome airport and offshore locations. It is assumed this service also operates from Nome airport.

6.4.2 FORECAST OF AVIATION DEMANDS AND REQUIREMENTS

Aviation passenger demands anticipated in the medium find scenario are detailed in Table 57. The peak periods for OCS employee movements is expected to be 1988 and 1990, when major pipeline linkages are under construction. During an average week of the peak month of 1990, approximately 1,143 employees require movement between offshore locations and the Nome airport. That year, approximately 64 trips per week are expected on intraregional aviation services. Along the Nome-Anchorage link, population related travel demand is expected to increase in accordance with the growth factors, which in 1990 is expected to be approximately 679 trips. OCS related trips over the same link during 1990 amount to 910 trips, which is 57 percent of the total traffic volume of 1,589 passengers. Of the 910 OCS employees, approximately 686 or about 75 percent of them will continue through Anchorage to Seattle. Compared to the base case in 1990, the Nome-Anchorage link in the medium find scenario carries more than three times (3.14) the passenger load while the Anchorage-Seattle link increases only 6 percent. Once the

TABLE 57

BERING-NORTON MEDIUM FIND SCENARIO
LOCAL POPULATION AND OCS EMPLOYMENT
PEAK MONTH WEEKLY AVIATION PASSENGER DEMANDS

Year After Lease Sale	Year	Offshore - Nome OCS Related (1)	Regional Points (1)	Nome-Anchorage Population Related (2)	Nome-Anchorage OCS Related (1)	Nome-Anchorage Total	Anchorage-Seattle Population Related (3)	Anchorage-Seattle Prior Sales	Anchorage-Seattle OCS Medium Scenario (1)	Find Total
1	1983	168	2	465	125	590	14,669	1,402	101	16,172
2	1904	411	5	506	354	860	14,542	1,315	287	16,144
3	1985	528	5	524	391	915	14,287	519	317	15,123
4	1986	436	10	520	360	090	14,287	659	288	15,234
5	1987	374	28	524	378	902	14,669	,174	293	16.136
6	1988	1,168	42	561	867	,428	14,925	,314	133	16,972
7	1989	572	27	556	455	,001	15,307	,467	357	17,131
8	1990	1,143	64	679	910	,589	15,817	,259	686	17,762
9	1991	900	46	720	653	,373	16.200	,049	455	17,704
10	1992	815	55	716	606	,322	16,503	735	325	17,643
11	1993	644	49	689	473	,162	17,093	632	180	17,905
12	1994	605	56	679	4fJ4	,003	17,416	51	--	17s521
13	1995	625	57	684	415	,099	11,058	2a	--	17,886
14	1996	645	59	698	425	,123	10,241	12	--	10,253
15	1997	655	59	707	430	.137	18,751	5	--	10,756
16	1998	655	59	716	410	1,146	19,389	5	--	19,394
17	19'39	655	59	720	430	1,150	19,099	3	--	19,902
18	2000	655	59	730	430	1,160	20,410	2	--	20,412

Notes : (1) Derived from Dames & Moore Scenario Employment data.
(2) Peak week average of 456 x Nome-Wade Hampton Region growth factors.
(3) Peak week average of 12,/56 x Anchorage growth factors.

Sources : Dames & Moore, 1980.
PMM&CO

oil field is in full production, anticipated passenger demand for the Anchorage-Seattle linkage drops off sharply, since most personnel involved during this stage of development would likely be Alaska residents.

When these various demands are translated into aircraft flight requirements, the forecast is as illustrated in Table 58. Contract helicopters serving the linkage between offshore rigs and Nome peaks at 83 trips in 1988, and again in 1990. At about this same time, the demand for regional air taxis increases sharply. In 1986, regional, air taxi demands are estimated to be only three flights per week, but by 1990 the demand for flights is expected to peak at 16 flights per week. In a span of no more than four years the demand for intraregional travel increases in excess of five-fold. Scheduled air carrier flight requirements for the Nome-Anchorage linkage also peak in 1990 with a demand of 18 flights per week. This is a three-fold increase over those demands forecast for the base case. Over the Anchorage-Seattle link, the increase is only about five percent.

6.4.3 IDENTIFICATION OF AVIATION IMPACTS

The increase in passenger movements through terminals and increased levels of aircraft operations, including helicopters, are sources of potential impact, particularly during the field development period. Passenger movements through the Nome airport peak in 1990 at 3,178 passengers per week, almost a three-fold increase over the base case. Such increases in passenger demands will provide additional justification for constructing new terminal facilities. Passenger demands are such that facilities e

TABLE 58

BERING-NORTON MEDIUM FIND SCENARIO
PEAK MONTH WEEKLY AIRCRAFT FLIGHT REQUIREMENTS

Year After Lease Sale	Year	Contract Helicopters Offshore-Nome 1	Air Taxi Nome-Regional Points (2)	Air Carrier Nome-Anchorage (3)	Air Carrier Anchorage-Seattle (4)
1	1983	12	1	7	159
2	1984	34	2	10	158
3	1985	38	2	10	148
4	1986	31	3	10	149
5	1987	27	7	10	158
6	1988	83	11	16	166
7	1989	41	7	11	168
8	1990	82	16	18	174
9	1991	64	12	16	174
10	1992	58	14	15	173
11	1993	56	13	13	176
12	1994	43	14	12	172
13	1995	45	15	12	176
14	1996	46	15	13	179
15	1997	47	15	13	184
16	1998	47	15	13	191
17	1999	47	15	13	196
18	2000	47	15	13	201

Notes : (1) Derived by dividing Offshore-Nome OCS Related Passengers by 14 seats.

(2) Derived by dividing Nome-Regional Points Passengers by 4 seats.

(3) Derived by dividing Nome-Anchorage passengers by (110 seats x load factor of 80% =) 88 seats.

(4) Derived by dividing Anchorage-Seattle Passengers by (128 seats x load factor of 80% =) 102 seats.

Source: PMM&Co.

could be designed for the late 1980's and not be underutilized throughout the remainder of the study period. The willingness or ability of public agencies to provide new terminal facilities in conjunction with the air-lines would alleviate forecast overcrowding. The incremental increase in passenger movements at the Anchorage terminal are not expected to create overcrowding there.

Carriers serving the Nome-Anchorage link. and the Anchorage-Seattle link are expected to respond to the increased demands with increased service, initially by increasing load factors and frequency of operations to maximize utilization. Additional carriers will try to seize the opportunity to enter these markets. As compared to the exploration only case, knowledge of the size of the find should allow both regulatory agencies and carriers to make permanent longer-term decisions rather than seeking temporary short-term arrangements. This knowledge may be particularly significant to decision making regarding improvements to freight handling facilities.

The critical impacts are most likely to be felt on the intraregion air taxi routes, where the situation is already a problem. As in the other routes, increased competition will bring in new operators and may lead to potential restructuring of this part of the aviation industry. Until something happens, however, potential economic impacts, reduced travel Opportunities, and continued slow delivery of freight are a likely result of medium find scenario aviation demands.

The increased level of aircraft operations should not affect either the Nome or Anchorage airports. The adequacy of runway capacity and bearing capacity is expected to exist throughout the study period. Improvements in navigational and control facilities, aprons, and taxiways, that were identified for the base case, should provide for improved efficiency in operations at these two airports.

6.4.4 AVIATION ISSUES

The major aviation issue in western Alaska is the quality of aviation services provided small bush communities. For virtually all of these communities, the aviation system plays a major role in their economic system. In its present condition, the system is considered a barrier to social and economic ties between these communities and the rest of the state and nation. While present conditions, which are termed worse than 20 years age, are not the fault of any one section responsible for service delivery, none-the-less the onus for improvement of the service falls on all groups equally: The air carriers and air taxi operators, the federal and state governments. The situation is complicated on both sides of the issue.

On one side, the intrastate carriers are accused of shifting their resources toward the high-profit interurban routes allowing the bush service to deteriorate. If this is true, OCS development may exacerbate the situation due to the high number of OCS passengers traveling the interurban routes. On the other side, the governmental agencies are accused of failure to set appropriate priorities and to coordinate air system development efforts. If this is true, OCS development is 1 ikely to redirect short-term priorities at the expense of longer term development plans.

In the short-term it is unclear 'whether present conditions will improve; in the long-term it is mandatory that they do.

7.0 IMPACTS OF THE LOW FIND SCENARIO

7.1 Introduction

In this chapter, the induced economic and population changes of the low find scenario are added to the base case forecasts presented in Chapter 4 and the combined effects on marine and air transportation are evaluated. The low find scenario assumes small commercial discoveries of oil and nonassociated gas. The total reserves discovered and developed are 380 MMBBL of oil and 1,200 BCF of nonassociated gas.

7.2 Significant Factors Affecting Growth

The principal difference in economic activity between the low find scenario and the base case is the discovery and development of the above referenced oil and gas resources. All other characteristics of the base case pertaining to the economy are applicable. This low find scenario is characterized by the assumption that the reserves identified above, especially the gas, are barely economic to develop. As illustrated in Figures 18-1 and 18-2, the oil reserves are thought to comprise two fields located between 34 and 58 kilometers (21 and 36 miles) southwest of Nome, while the nonassociated gas reserves occur in a single field located about 34 kilometers (21 miles) south of Nome. Two pipelines transport oil and gas production directly to a crude oil terminal and LNG plant, respectively, located at Cape Nome. Minimal onshore pipeline construction is involved in the development of these fields.

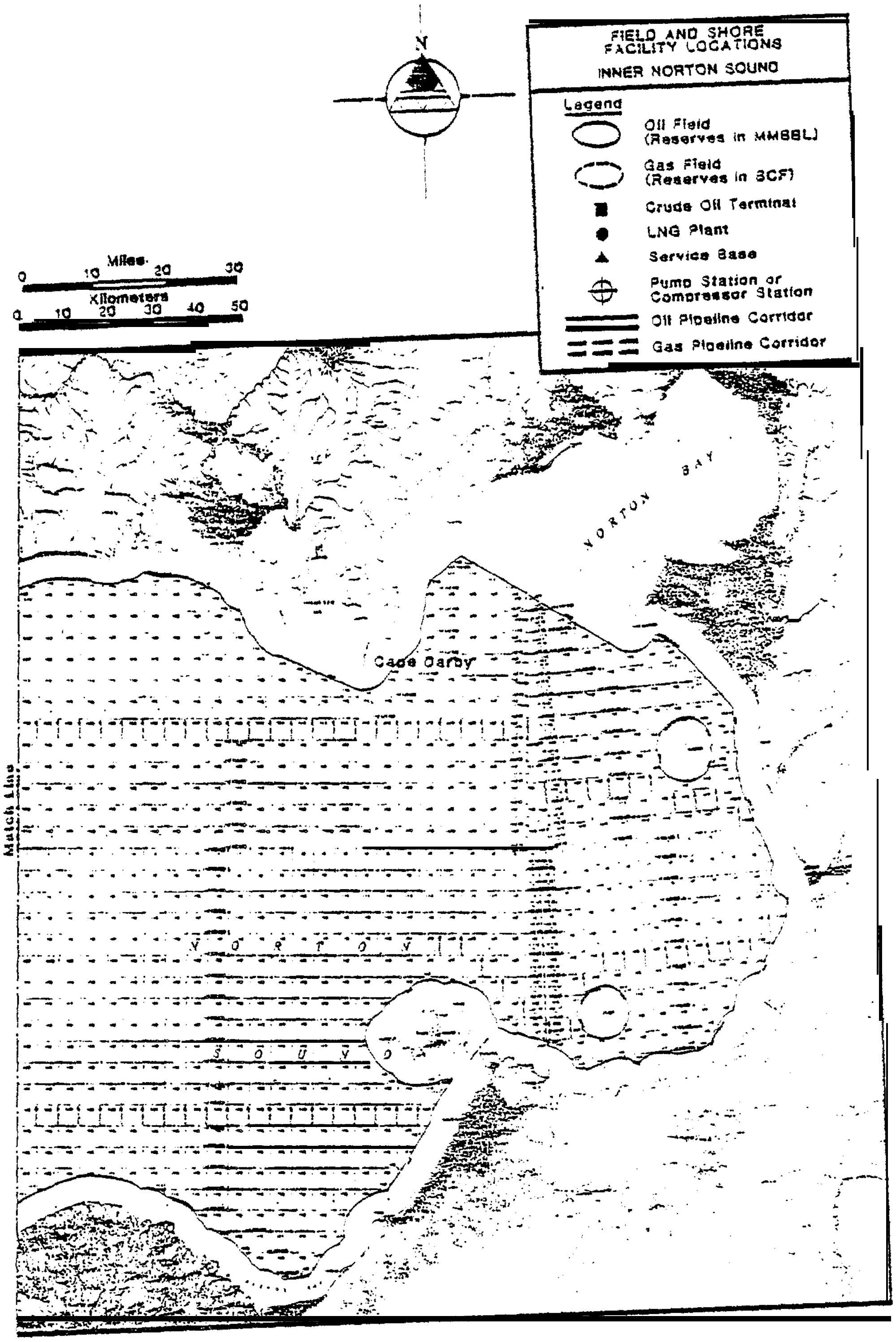

FIGURE 18-1

LOW FIND SCENARIO
FIELD AND SHORE FACILITY LOCATIONS

Source: Dames & Moore, 1980

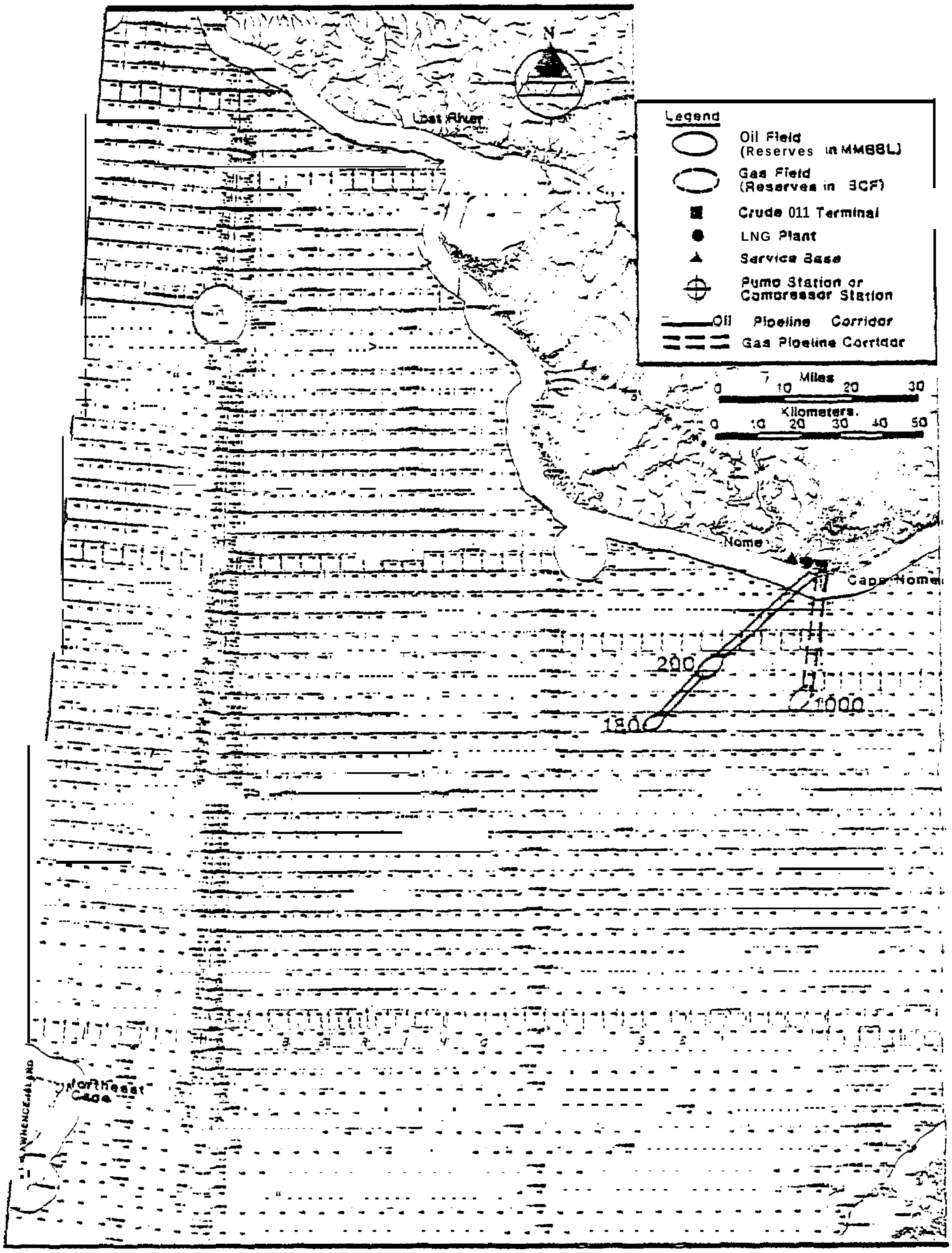

FIGURE 18-2

LOW FIND SCENARIO
FIELD AND SHORE FACILITY LOCATIONS

Source: Dames & Moore, 1980

The schedule of OCS activities assumes that exploration commences the first year after the lease sale (1983), peaks in year 4 with 12 wells drilled, and terminates in year 6 with a total of 36 wells drilled. No discoveries are made until the second year of exploration when two small oil fields southwest of Nome are discovered. The only commercial gas discovery is made in year 3 (1985), after which no further commercial hydrocarbon finds are made. The exploration program involves jack-up rigs and drillships in the outer sound and limited use of summer-constructed gravel islands i n shallow water, 15" meters (50 feet) or less, where suitable barrow materials are either adjacent to the well site or within economic haul distance. Economics dictate extension of the drilling season from the 4 to 6 month open water season to a maximum of 8 months; this is accomplished by the use of icebreaker support.

The decision to develop the two small oil fields is made concurrently in year 4. Single ice-reinforced steel platforms for each field are installed 24 months later. Development drilling commences in year 7 and crude production is brought on line in year 8 (1990). Field construction to develop the gas field starts with the installation of a single steel platform in year 7 (1989) and gas production commences the following year.

Oil and gas production from Norton Sound both start in year 8 (1990). Oil production peaks at 153,000 b/d in year 11 (1993) and ceases in year 27 (2009). Gas production peaks at 230.4 MMCF/D in years 11 through 19 (1993 through 2001)7 and ceases in year 32 (2014).

In response to this level of development, population changes" in the Nome-Wade Hampton region and in Nome are estimated to be as shown in Table 59. At the regional level, OCS induced population peaks in 1990 at 2,265 persons then declines to 1,341 persons in 2000. As a result of OCS induced population growth to 1990, the regional population increases 17 percent over the base case, but represents a 13 percent decline from the medium find scenario. The rise and fall in population is due to the fact that expected employment associated with the low find scenario peaks in 1990 at less than 42 percent of the level of the medium find scenario.

In Nome, primary employment rises to a peak of 1,376 in 1990, and moderates to 846 in 2000. Onshore primary employment rises to 387 in 1989 during development (about 28 percent of the total employment) and stabilizes at about 26 percent of the total work force during the late development and production phases. The balance of the employees (approximately 72 percent) work on offshore facilities. The effects on OCS induced and total population are illustrated in Table 59. The induced population increases to 345 persons in 1990 and declines to a stable level of 553 persons in 2000. The peak increase represents a change of 22 percent over the base case and 65 percent of the medium find forecast for the same year,

Low find scenario population changes in the City of Anchorage are also identified in Table 59. The induced population due to Sale 57 increases from 30 in 1983 to 2,624 in 2000. The 2000 population represents a 58 percent increase over 1977 population and is approximately 37 percent of the medium find scenario. When compared to 5ase case population, the difference in the year 2000 is less than 1 percent.

TABLE 59

DURING 1981 OO L UO OCS CASE POPULATION PROJECTIONS AND GROWTH FACTORS

Calendar Year	Year After Lease Sale (1)	Nome-Wade Hampton Region: Base Case Population	Nome-Wade Hampton Region: OCS Induced Population	Nome-Wade Hampton Region: Total Population	Growth Factor (2)	City of Nome: Base Case Population	City of Nome: OCS Induced Population	City of Nome: Total Population	City of Nome: Growth Factor
1977	--	11,800		11,800	1. W	2,885	--	2,885	1.00
1983	1	11,752	189	11,941	1.01	3,317	u	3,325	1.15
1904	2	12,406	294	12,700	1.08	2,303	0	$,196	1.18
1905	3	12.525	524	13,049	1.11	3,451	13	3,494	1.21
1986	4	12,517	750	13,277	1.23	3,520	17	3,537	1.23
1987	5	12.556	308	12,864	1.09	3,590	252	3.042	1.33
1988	6	12,690	699	11, 389	13	3,662	526	4,188	1.45
1989	7	12,0416	926	13,612	17	3,735	816	4,551	1.58
1990	8	13,108	2.265	15,373	30	3,810	845	4,655	1.61
1991	9	13,292	2,210	15.502	31	3,829	790	4,619	1.60
1992	10	13,494	1,717	15,211	29	3,048	639	4,487	1.56
1993	11	13,602	I ,111	15,019	27	3,867	518	4,385	1.52
1994	12	13,909	1.262	15,171	29	3,886	500	4,386	1.52
1995	13	14,105	1,402	15,507	31	3,905	553	4,458	1.55
1996	14	14,291	1.192	15.603	33	3,925	553	4,478	1.55
1997	15	14,491	1,382	15,873	15	3,945	553	4,498	1.56
1998	16	14,707	1,372	16,079	1.36	3,96$	553	4,518	1.57
1999	17	14.949	1,156	16,305	1.38	3,985	553	4.530	1.57
2000	18	15,140	1,341	16,481	1.40	4.005	553	4.550	1.58

Region Without Nome City: Base Case Population	Region Without Nome City: OCS Induced Population	Region Without Nome City: Total Population	Growth Factor	City of Anchorage: Base Case Population	City of Anchorage: Sale 57 Induced Population (4)	City of Anchorage: Total Population	Growth Factor	Year After Lease Sale (1)	Calendar Year
8,915	..	8,915	1.00	183,606	--	183,606	1.00	--	1977
8,435	181	8,616	u 97	211,110	30	211,140	1.15	1	1983
9,023	206	9.309	1.04	209.796	108	209,904	1.14	2	1904
9,014	511	9,505	1.08	206,018	177	206,195	I 12	3	1905
8,997	743	9,140	1.09	204,522	284	206,004	1.13	4	1906
0.966	66	9,022	1.01	209,175	413	209.5043	1.14	5	1987
9,028	173	9,201	1.03	213,839	477	214,116	17	6	1988
9.151	110	9,261	1.04	219.035	856	219.091	20	7	1909
9.290	1,420	10,718	1 20	223,134?	1,513	225.360	.23	8	1990
9,461	1.420	10,883	1.22	220,01s	2,079	230,954	.26	9	1991
9.646	1,628	10,724	1.20	234.256	2,159	236.413	.29	10	1992
9.uL5	819	10,634	1.19	240,001	2,055	242,056	.32	11	1993
10.023	Jb2	10, 785	1.21	24$,591	1,991	247,588	.35	12	1994
10.200	849	11,049	1 24	251.115	2,073	253,240	.38	13	1995
10. 36b	019	11,205	1.26	25).40S	2,213	259.610	.41	14	1996
10.546	029	11,375	1.28	264,412	2,331	266,743	.45	15	1997
10,742	819	11,561	1.30	271,922	2,438	2J4 . 36U	1.49	16	1998
10,964	003	11,767	1.32	2?9.323	2.535	201,050	1.54	17	1999
11,135	788	11,923	1.34	201.256	2,624	289,800	1.58	18	2000

Notes:
(1) Lease Sale No. 57 is currently scheduled for November 1982.
(2) Growth Factors are derived by dividing the forecast year population by the 1977 population.
(3) Derived by PMM&Co. by subtracting City of Nome forecast from Nome-Wade Hampton Region forecast
(4) The Anchorage base case population includes induced population from OCS sales prior to Sale 57. These are not specifically identified herein but may be found in earlier SESP documents.

Sources: Nome Population Project loots, Policy Analysts, 1980.
Nome Wade Hampton Region and Anchorage Ibid.it ion Projections, ISER, 1980
Region Without Nome City, PMM&CO

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7.3 Water Mode

7.3.1 DESCRIPTION OF MARINE ACTIVITIES

During the exploration period following the lease sale, it is anticipated that the oil industry will utilize the existing lighteraging service in a manner similar to that described in the exploration only scenario (Chapter 5). That type of operation will also be maintained during the development phase, since the number of wells requiring servicing is such that the lighteraging service appears to have adequate capacity to provide this service. The oil industry is also anticipated to maintain an offshore supply operation working from barges anchored in the sale area. When the support base is completed in 1987, certain of the offshore supply operations, particularly the dry freight drilling materials, will shift to the service base. When oil and gas production starts in 1990, both oil and LNG tankers are expected to begin round trip movements between the marine terminal and west coast ports.

The marine transportation industry is expected to maintain its present character of services: use of 1 inehaul barges to del iver products to Nome, use of lighters to offload linehaul vessels, and use of lighters to deliver dry cargo and liquid bulk petroleum products to coastal villages.

7.3.2 FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

It is assumed that local population demands will follow patterns established in the base case, generating throughput tonnage at an annual rate of three tons per capita. Based on the forecast population data illustrated in Table 59, the projected population based marine transportation demands are as shown in Table 60. At the peak of OCS activities in 1991, throughput tonnage demands approach 46,500 ST, which is approximately 17 percent greater than that anticipated in the base case and represents approximately 83 percent of the level of throughput tonnage anticipated in the medium find scenario. When compared to the base case, the existing incremental growth has the effect of advancing population related transportation demands nine years sooner in time.

OCS activities requiring transportation services are identified in Tables 61 through 65. It is anticipated that 37 wells will be drilled during the exploration and delineation stage of development and that an additional 112 'wells for oil and gas development and other purposes will be drilled during the development stage between 1989 (year seven after the lease sale) and 1992 (year ten after the lease sale). The annual number of tons of materials required to drill these wells is identified in Table 62. The drill pipe and dry bulk materials are expected to be shipped to the lease sale area on contract linehaul vessels. As mentioned earlier, the oil industry will initially store these materials offshore, but will shift to the service base in 1987. Also mentioned earlier, fuel and drill water are all expected to be obtained locally and transported to the rigs under

TABLE 60

BERING-NORTON LOW FIND SCENARIO
POPULATION RELATED MARINE TRANSPORTATION DEMANDS

Year After Lease Sale	Year	Nome-Wade Hampton Regional Population Low Find Scenario	Throughput Tonnage Total (1)	Throughput Tonnage Dry Bulk (2)	Throughput Tonnage Liquid Bulk (3)	Nome Marine Tonnage Demands Dry Bulk (4)	Nome Marine Tonnage Demands Liquid Bulk (5)	Region Without Nome Tonnage Demands Dry Bulk (6)	Region Without Nome Tonnage Demands Liquid Bulk (7)	Total Inbound Tonnage (8) Dry Bulk	Total Inbound Tonnage (8) Liquid Bulk
1	1983	11,941	35,823	7,881	27,942	5,359	25,148	1,126	1,397	6,620	26,545
2	1984	12,700	38,100	8,382	29,718	5,700	26,746	1,341	1,486	7,041	28,232
3	1985	13,049	39,147	8,612	30,535	5,856	27,481	1,378	1,527	7,234	29,008
4	1986	13,277	39,831	8,763	31,068	5,959	27,961	1,402	1,553	7,361	29,515
5	1987	12,864	38,592	8,490	30,102	5,773	27,092	1,358	1,505	7,132	28,597
6	1988	13,389	40,167	8,837	31,330	6,009	28,197	1,414	1,567	7,423	29,764
7	1989	13,812	41,436	9,116	32,320	6,199	29,088	1,459	1,616	7,657	30,704
8	1990	15,373	46,119	10,146	35,973	6,899	32,376	1,623	1,799	8,523	34,174
9	1991	15,502	46,506	10,231	36,275	6,957	32,647	1,637	1,814	8,594	34,461
10	1992	15,211	45,633	10,039	35,594	6,827	32,034	1,606	1,780	8,433	33,814
11	1993	15,019	45,057	9,913	35,144	6,741	31,630	1,586	1,757	8,327	33,387
12	1994	15,171	45,513	10,013	35,500	6,809	31,950	1,602	1,775	8,411	33,725
13	1995	15,507	46,521	10,235	36,286	6,960	32,658	1,638	1,814	8,597	34,472
14	1996	15,683	47,049	10,351	36,698	7,039	33,028	1,656	1,835	8,695	34,863
15	1997	15,873	47,619	10,476	37,143	7,124	33,429	1,676	1,857	8,800	35,286
16	1998	16,079	48,237	10,612	37,625	7,216	33,862	1,698	1,881	8,914	35,744
17	1999	16,305	48,915	10,761	38,154	7,318	34,338	1,722	1,908	9,039	36,246
18	2000	16,481	49,443	10,877	38,566	7,397	34,709	1,740	1,928	9,137	36,637

Notes: (1) Total Throughput Tonnage = Regional Population x 3 tons per person per year.
(2) Total Throughput Dry Bulk is 22% of total throughput tonnage. See Figure 6, Part A.
(3) Total Throughput Liquid Bulk is 78% of total throughput tonnage. See Figure 6, Part A.
(4) Nome Dry Bulk is 14.96% of total throughput tonnage. See Figure 6, Part E.
(5) Nome Liquid Bulk is 70.20% of total throughput tonnage. See Figure 6, Part E.
(6) Region Without Nome Dry Bulk is 3.52% of total throughput tonnage. See Figure 6, Part F.
(7) Region Without Nome Liquid Bulk is 3.90% of total throughput tonnage. See Figure 6, Part F.
(8) Derived by adding Nome and Region Without Nome tonnage demands.

Source: PMM&CO.

TABLE 61

TRANSPORTATION RELATED ACTIVITIES

BERING-NORTON LOW FIND SCENARIO

YEAR AFTER LEASE SALE	CALENDAR YEAR	EXPLORATION AND DELINEATION RIGS	PLATFORMS INSTALLED: STEEL	PLATFORMS INSTALLED: EXPLORATION GRAVEL	PLATFORMS INSTALLED: PRODUCTION GRAVEL	DEVELOPMENT RIGS: JAN	DEVELOPMENT RIGS: JULY	WELLS DRILLED: EXPLORATION DELINEATION	WELLS DRILLED: OIL DEVELOPMENT	WELLS DRILLED: GAS DEVELOPMENT	WELLS DRILLED: OTHER	PIPELINE CONSTRUCTED: ONSHORE MILES	PIPELINE CONSTRUCTED: OFFSHORE MILES	OIL PRODUCTION WELLS	GAS PRODUCTION WELLS	ONSHORE FACILITY CONSTRUCTION
1	1983	2						4								
2	1984	4		1 NOTE 1				6								
3	1985	5		1 NOTE 2				9								
4	1986	6		1 NOTE 2				11								
5	1987	3		1 NOTE 2				5								NOTE 3
6	1988	1	2					2								
7	1989		1			0	4		20		4	4	53			NOTE 4
8	1990					4	5		27	6	5			47	6	
9	1991					5	5		26	8	6			73	14	
10	1992					5	0		7	2	1			80	16	
11	1993													80	16	
12	1994													80	16	
13	1995													80	16	
14	1996													80	16	
15	1997													80	16	
16	1998													80	16	
17	1999													80	16	
18	2000													80	16	

NOTES:

1. Exploration Gravel Island in 7.5 meters (25 ft) of water. Requires 53,522 cu. meters (70,000 cu.yds) of gravel based on an island surface diameter of 60 meters (198 ft).

2. Exploration Gravel Island in 15 meters (50 ft) of water. Requires 110,102 (144,000 cu.yds) of gravel based on an island surface diameter of 60 meters (198 ft).

3. Begin and complete construction of Support Base, begin construction of Oil Terminal and LNG Plant.

4. Oil Terminal and LNG Plant completed.

SOURCE: Modified from Dames & Moore, 1980.

TABLE 62

GRAVEL AND DRILLING MATERIALS ?. EQUIREMENTS

BERING-NORTON LOW FIND SCENARIO

YEAR AFTER LEASE SALE	CALENDAR YEAR	EXPLORATION AND DELINEATION WELLS DRILLED[1]	DEVELOPMENT WELLS DRILLED[2]	ANNUAL TONNAGE[3] DRILL PIPE	DRY BULK	TOTAL DRY FREIGHT	FUEL	DRILL WATER[4]	GRAVEL (in 1,000 TONS)[5]
1	1983	4		1,621	4,436	6,057	7,884	12,320	
2	1984	6		2,431	6,654	9,085	11,826	18,480	243
3	1985	9		3,647	9,981	13,628	17,739	27,720	396
4	1986	11		4,457	12,199	16,656	21,681	33,880	396
5	1987	5		2,026	5,545	7,571	9,355	15,400	396
6	1988	2		810	2,218	3,028	3,942	5,160	
7	1989		24	3,273	13,872	22.145	24,672	48,216	
8	1990		38	1,309	21,964	35,063	39,064	76,342	
9	1991		40	13,788	23,120	36,908	41,120	80,360	
10	1992		10	3,447	5,780	9,227	10,290	20,090	
11	? 993								
12	1994								

NOTES: 1. From Table 61.

2. Combines Oil and Gas development wells and other wells drilled from Table 61.

3. Tonnage requirements per well (see Appendix B):

	EXPLORATION	DEVELOPMENT
Drill Pipe	405.2 ST	344.7 ST
Dry Bulk	1,109.0 ST	378.0 ST
Fuel	1,971.2 ST	1,028.0 ST
Drill Water	3,080.0 ST	2,009.0 ST

4. Drill water will be obtained locally.

5. Exploration gravel islands are constructed the year prior to use. Production gravel islands require two years to construct. Gravel is estimated to weigh 2.12 ST per cubic meter (1.62 ST per cubic yard).

TABLE 63

BERING-NORTON LOW FIND SCENARIO
PIPELINE CONSTRUCTION TONNAGE DEMANDS

Year After Lease Sale	Year	Kilometers (Miles) of Pipeline (1) Offshore 12"	Offshore [illegible]	Onshore [illegible]	Uncoated Pipe Tonnage (2)(3) Offshore 12"	Offshore 14"	Onshore 14"	Total	Offshore Pipeline Coating Materials Tonnage (3) (4)	Total Dry Cargo Tonnage (3)	Coated Pipe Tonnage (5) 12"	14"	Total
1	1983												
2	1984												
3	1985												
4	1986												
5	1987												
6	1988				1,161	3,234	340	4,735	5,941	10,676			
7	1989	24 (15)	62 (38)	6 (4)							3,204	9,432	12,636
8	1990												
9	1991												
10	1992												
11	1993												
12	1994												

Notes: (1) From O&M, 1980.

(2) Based on:

	Tons/Kilometer	(Tons/Mile)
12"	48.1	(77.4)
14"	52.9	(85.1)
16"	60.5	(97.4)
18"	75.9	(122.2)
20"	86.5	(139.2)
24"	104.0	(167.4)

(3) If pipe is coated in the study area, pipe and coating materials must be transported one year before needed.

(4) Based on: Tons/Kilometer (Tons/Mile)

	Corrosion Protection	Cement	Sand Aggregate	Iron Ore Aggregate	Wire Mesh	Total
12"	30.2 (48.6)	7.6 (12.2)	22.7 (36.6)	-- --	0.6 (1.0)	61.1 (98.4)
14"	35.3 (56.8)	9.2 (14.8)	27.6 (44.4)	-- --	0.9 (1.5)	73.0 (117.5)
16"	40.3 (64.9)	17.3 (27.8)	51.8 (83.4)	-- --	1.1 (1.8)	110.5 (177.9)
18"	45.3 (72.9)	22.0 (35.4)	65.9 (106.1)	-- --	1.4 (2.2)	134.6 (216.6)
20"	62.5 (100.6)	22.2 (35.8)	66.7 (107.3)	-- --	1.6 (2.6)	153.0 (246.2)
24"	74.6 (120.0)	40.3 (64.9)	-- --	283.0 (455.0)	2.2 (3.5)	399.3 (643.4)

(5) Based on:

	Tons/Kilometer (Tons/Mile)
12"	132.3 (213.6)
14"	154.2 (248.2)
16"	224.9 (361.3)
18"	279.1 (449.1)
20"	308.6 (496.7)
24"	468.3 (753.6)

TABLE 64

BERING-NORTON LOW FIND SCENARIO
TRANSPORTATION DEMAND OF OCS CONSUMABLES

Year After Lease Sale	Year	OCS Related Non-Local Population (1)	Annual OCS Consumable (2) Demand (In Tans)
1	1983	213	256
2	1984	522	626
3	1985	644	773
4	1986	834	1,001
5	1987	559	671
6	1988	810	972
7	1989	1,162	1,394
8	1990	666	799
9	1991	666	799
10	1992	666	799
11	1993	404	485
12	1994	404	485
13	1995	404	485
14	1996	404	485
15	1997	404	485
16	1998	404	485
17	1999	404	485
18	2000	404	485

Notes: (1) Equals offshore-onsite non-local employment plus onshore-onsite non-local employment.

(2) Assumes consumption level of 300 pounds per person per month over 8 months.

Source: PMM&CO.

TABLE 65

BERING-NORTON LOW FIND SCENARIO
RESOURCE PRODUCTION TRANSPORTATION DEMANDS

Year After Lease Sale	Year	Oil Production MMBBL (1)	Oil Production MMTons (2)	Gas production BCM (3)	Gas production BCF (4)
1	1983				
2	1984				
3	1985				
4	1986				
5	1987				
6	1988				
7	1989				
8	1990	14.016	1.811	0.595	21.024
9	1991	28.032	3.622	5.433	42.048
10	1992	42.048	5.433	8.149	63.072
11	1993	56.064	7.243	10.865	84.096
12	1994	54.012	6.978	10.865	84.096
13	1995	43.189	5.580	10.865	84.096
14	1996	33.460	4.323	10.865	84.096
15	1997	26.254	3.392	10.865	84.096
16	1998	20.527	2.652	10.865	84.096
17	1999	16.232	2.097	10.865	84.096
18	2000	12.498	1.615	10.865	84.096

Notes: (1) Million barrels of oil, from Dames & Moore, 1980.

(2) Million tons of oil = MMBBL ÷ 7.74 barrels/ton.

(3) Billion cubic meters = BCF x 0.02832 cubic meters per cubic foot.

(4) Billion cubic feet of gas from Dames & Moore, 1980.

TABLE 66

BERING-NORTON LOW FIND SCENARIO
ANNUAL MARINE VESSEL REQUIREMENTS

Year After Lease Sale	Year	Population Related: Linehaul Dry Cargo Arrivals (1)	Population Related: Linehaul Tanker Barge Arrivals (2)	Population Related: Linehaul Dry Cargo Trips (3)	Population Related: Lighter Tanker Trips (4)	Population Related: Coastal Delivery Lighter Trips (5)	OCS Related: Dry Cargo Arrivals (6)	OCS Related: Linehaul Tanker Barge Arrivals (2)	OCS Related: Module Barge Arrivals (7)	OCS Related: Linehaul Lighter Tanker Trips (4)	OCS Related: Supply Boat Trips (8)	OCS Related: Gravel Barge Trips (9)	Pipeline Lay & Bury Barges (10)	Resource Tanker Departures (11) Oil	Resource Tanker Departures (11) Gas
1	1983	11	4	19	126	16	1	1		134	24				
2	1984	12	4	20	134	17	2	2		201	48	15			
3	1905	12	4	21	1 Jo	18	2	3		301	60	122			
4	1906	12		21	141	10	3	3		360	72	122			
5	1987	12	:	20	136	10	I	1	17	'6?	36	122			
6	1988	12	4	21	142	18	1	1	12		60				
7	1909	13	4	22	146	19	4	4	3		138		3		
8	1990	14	5	24	163	21	6	6			102		1	31	8
9	1991	14	5	25	164	21	6	6			112			61	16
10	1992	14	5	24	161	21	2	1			162			91	23
II	1993	14	5	24	159	20	1				12			121	31
12	1994	14	6	24	161	21	1				12			117	31
13	J995	14	5	25	164	21	1				12			93	31
14	1996	14	5	25	166	21	1				12			13	1'
15	1997	15	5	25	160	22	I				12			57	31
16	1998	15	5	25	170	22	I				12			45	31
17	1999	15	5	26	173	22	1				12			35	31
10	2000	15	5	26	174	22	1				12			21	31

Notes: (1) Assumes an average of 600 ST arrives on each linehaul dry cargo vessel.

(2) Assumes an average of 7,000 ST (50,050 bbl) arrives on each linehaul tanker vessel.

(3) Assumes each lighter averages 350 ST of dry cargo per trip.

(4) Assumes each lighter averages 210 ST (1,500 bbl) of liquid bulk per trip. OCS fuel goes inbound to storage and outbound to rig. OCS water is outbound only. All trips are shown.

(5) Assumes each coastal delivery trip is made by a lighter averaging 216 ST per trip and cargo is composed of 40 percent (86 ST) liquid bulk and 60 percent (130 ST) dry bulk or neobulk. Optimization of the number of trips is not considered.

(6) Consumable dry cargo and drilling materials dry freight are included. These cuwiw411 ies are expected to arrive on 6,000 ST capacity contract vessels which are anchored offshore.

(7) Module barges include an estimate of barges required for construction equipment and materials used in support base, marine terminal, and LNG plant construction.

(8) Includes supply/anchor boats used in positioning and supplying platforms and pipeline construction barges. See Appendix o for discussion of assumptions.

(9) Based on 2,000 cubic yards (3,240 ST) capacity bottom dump barge.

(10) One lay or bury barge each year plus 6,000 ST capacity pipe supply barges.

(11) 70,000 to 120,000 DWT oil tankers are employed for crude oil transportation while three 130,000 cubic meter LNG tankers are employed for LNG transportation.

contract to the local lighterage company. Specially constructed barges brought in for this purpose will be utilized.

Four exploration gravel islands are anticipated to be constructed, one each year over the period 1984 to 1987. Each island is assumed to require approximately 150,000 cubic yards of gravel during its construction. The gravel island construction activity will be performed using a clamshell dredge to mine offshore gravel resources. A 2,000 cubic yard bottom dump barge, accompanied by a supp y barge and personnel accomodation barge, are expected to be involved n the island construction operation. Construction time for each island is estimated to be 40 to 50 summer days.

Approximately 57 miles of pipeline, most of it offshore, are expected to be constructed under the low find scenario. The various pipe sizes, tonnage demands and schedule are illustrated in Table 63. Depending on actions by the oil industry in locating a pipe coating yard in the lease sale area, linehaul transportation demands in 1988 and 1989 could be quite different. If the yard is established, the uncoated pipe and coating materials must be transported in 1988, the year before the finished pipe is needed offshore, In 1989, the coated pipe must be delivered to the lay barge. If the yard is not established, the coated pipe must be shipped from a Lower 48 coating yard and held offshore for use by the lay barge. It is assumed that the oil industry will do the latter. Onshore pipeline, which is not coated, is expected to be shipped directly to the service base.

OCS consumable supplies, which include canned food, paper, and other supplies, are estimated to be consumed at a rate of approximately 300 pounds per person per month. Eased on the estimated number of non-local personnel as identified in Table 64, annual OCS consumable tonnage demand peaks in 1986 during exploration and construction activities and again in 1989 when pipeline and terminal construction is at its highest level. This estimate of demand represents approximately 8 months of summer operations. It is anticipated that these consumable items will be transported with drilling mud and other materials. A portion of the consumable demand associated with perishable goods are expected to be air freighted.

Once resource production begins in 1990, oil production is expected to gradually rise to a peak of about 56 MMBBL in 1993, while gas production gradually rises to a level of about 11 BCM per year and remains steady at that level for the remaining years of the study period. Changes in resource production are illustrated in Table 65. Respectively, peak evel oil production in the low find scenario is 35 percent of the medium f nd scenario, while gas production is 44 percent of the medium find scenario.

When these various transportation demands are viewed collectively, the annual marine vessel requirements for the low find scenario are ant cpated to be as shown in Table 66. Included in the table are both populat on related and OCS related demands. The peak year for transportation activity is anticipated in 1985. A total of 22 dry cargo and tanker barge arrivals for both population and OCS related activities are anticipated. This is only 59 percent of the arrivals forecast for the medium find scenario. In conjunction with OCS activities that year, monthly supply boat activities are expected to require 72 trips and barge movements associated with gravel island construction peaks at 122 trips. Respectively, these projections represent 27 percent and 16 percent of the level of activities in the medium find scenario.

The demand for linehaul lighters reaches a peak in 1986 when the local lighteraging service is still providing fuel and drill water to exploration rigs. Including coastal delivery trips during 1986, the total number of expected lighterage trips is 548, which is more than a three-fold increase over the base case during the same year and constitutes 76 percent of the medium find scenario. In order to meet the demand for additional lighter trips, the local lighteraging service is expected to increase the number of lighters located in Nome, particularly those supporting the fuel and drill water operations.

With respect to the supply boat trips, it should be noted in Table 66 that the numbers shown are not annual trips, but monthly trips. When extrapolated over eight months, these trips amount to a moderate level of supply boat activity. Included in these supply boat figures are the icebreaker support vessels which provide assistance to tankers operating between Norton Sound and the Lower 48. The icebreakers are expected to be specially constructed for arctic conditions and would likely operate in the area only during the 'winter months. The size of these vessels precludes their access to Nome Harbor.

Because of the extended annual operational period (8 months), it is anticipated that at the beginning of each construction season, the oil industry would prepare a flotilla of barges similar to the sea lift operations in the Beaufort Sea. The purpose of this early sea lift is to bring as much materials and equipment as possible to the Norton Sound area, as soon as possible each year. It would be anticipated that this flotilla would be supported by icebreaking equipment.

7.3.3 IDENTIFICATION OF MARINE TRANSPORTATION IMPACTS

Under the low find scenario, the level of marine transportation activity in Norton Sound is expected to increase moderately over that forecast for the base case and to decrease significantly from that forecast for the medium find scenario. The magnitude of the increase, although not as great as the medium or high find scenarios, is such that even if Nome's harbor had no navigational restrictions, the existing facilities (berths, cargo handling equipment, etc.) could not handle anticipated demands. To reduce the impacts and improve the efficiency of the OCS operations, it is anticipated that the oil industry will operate temporarily from offshore facilities. Later, after the decision is made to develop the various fields, more permanent onshore facilities will be constructed.

Possible impacts may arise in Nome Harbor during the exploration stage prior to development of a permanent service base. The large volume of fuel and water needed on the rigs, if supplied through Nome, exceeds the existing equipment's capacity when all demands are taken into account. As a result, the lighteraging company will need to provide additional lighters to serve OCS needs. At least one fuel barge and one water barge in addition to the two special barges used in the 1980 COST well will probably be required to meet anticipated OCS demands. Based on the potential utilization of these barges, construction of the additional barges does not appear to be a problem for the lighteraging company.

Assuming that additional lighters will be brought in to service OCS fuel and water needs, existing lighters will be called upon to service the expanded population related demand, which includes an increased number of linehaul vessels and increasing need for coastal village deliveries. Demands for these services reach a level in 2000 that is only 9 percent above that of the base case. Eased on available equipment, throughput tonnage demands in 2000 are expected to use approximately 71 percent of available equipment capacity, as compared to 65 percent in the same year in the base case and 81 percent in the medium find scenario. The addition of other new barges may potentially reduce this impact, if also employed to help lighter the bulk petroleum linehaul tanker barges.

Tine addition of four new barges may have an effect on crowding in the harbor, particularly in the entrance channel. This could be handled by improving scheduling, and may be reduced by the increased utilization of the new equipment. Sufficient capacity exists in the harbor turning basin to store the vessels. Over'wintering does not appear to create a problem, since the barges are hauled onto the beach.

With respect to the need for supply boat berths, oil and LNG tanker berths, and barge berths, the oil industry is expected to provide an optimum number of berths at the various onshore facilities (supply base, marine terminal, and LNG plant).

The variety of other activities associated with the OCS sale would not affect the Nome harbor. The draft of the supply boats is too great to be able to navigate the harbor channel so that during exploration, all supply boat trips would be between the offshore-anchored barges and the rigs.

When the supply base becomes operational, the trips would be between the supply base and the rigs. Similar comments can be made about the gravel barge and pipeline construction activities. For example, over the period 1985-1987, the high number of gravel barge trips (122 trips) is between the dredges and the different island locations.

Because of the offshore anchored barges, artificial islands, rigs, platforms, and vessel traffic, the number of vessel accidents is likely to increase. The extent of impact is impossible to measure at this time. However, the level of change may bring about establishment of formal traffic lanes.

7.3.4 MARINE TRANSPORTATION ISSUES

Marine transportation issues in the low find case are similar to those discussed in the exploration only case and in the base case. The OCS activities anticipated in this scenario assumed no new dock facilities, It is unlikely that a new dock facility would add considerably to the ability of the oil industry to service its operation. Industry desires for dedicated facilities would appear to preclude their use of a city-owned dock facility. Certainly, if a dock facility was available and was capable of handling dry bulk as well as liquid bulk cargo, it could very much reduce the total number of fuel and water supply trips proposed for the lighters as well as the number of those lighter trips to offload linehaul carriers and to make coastal village deliveries.

It would appear that both the private and contract carriers have sufficient capacity or can develop sufficient capacity to support the oil industry operations, particularly because the serv ce is a contractual one.

If the available dry cargo and bulk petro eum storage capacity is not improved, it is unlikely that the flow of additional supplies, especially fuel, will have a major impact. Initially, improved scheduling of line-haul tankers could offset rapid fuel drawdowns by OCS activities. Another way that might offset the problems of temporary high capacity storage is to anchora large compartmentized storage barge offshore and use that to empty the linehaul tankers and to refuel the work barges. Another approach may be to utilize the special lighters to make deliveries directly from the linehaul tankers to the rigs without ever entering the harbor, although this action could cause delays for the linehaul tankers. Consequently, it would appear that the potential short-term storage impacts would be reduced without significant major investment in onshore facilities.

7.4 Air Mode

7.4.1 DESCRIPTION OF AVIATION ACTIVITIES

Based on the assumed distribution of OCS employees, aviation impacts of OCS activities are most likely to occur on the Nome-Anchorage and Anchorage-Seattle air routes or in the Nome or Anchorage terminals. A moderate increase in demand for regional air taxi services is also expected, once field development begins and more regional workers are employed. It is anticipated that oil industry aviation support activities will be centered in Nome. Of the various airports scattered throughout the Norton Sound area, only Nome would not require extensive work to become suitable for continual use by large, heavily-laden aircraft. The oil industry is expected to contract for helicopter service to move employees back and forth between the Nome airport and offshore locations. It is assumed this service also operates from Nome airport.

7.4.2 FORECAST OF AVIATION DEMANDS AND REQUIREMENTS

Aviation passenger demands anticipated in the low find scenario are detailed in Table 67. The peak periods for OCS employee movements is expected to be in 1986 during exploration and 1989 during pipeline and marine terminal construction periods. During an average week of the peak month of 1989, approximately 465 OCS employees require movement between offshore locations and the Nome airport. That year, approximately six trips per week are expected on intraregional aviation services. Along the Nome-Anchorage link,

TABLE 6?

BERING-NORTON LOW FIND SCENARIO
LOCAL POPULATION AND OCS EMPLOYMENT
PEAK MONTH WEEKLY AVIATION PASSENGER DEMANDS

Year After Lease Sale	Year	Offshore-Nome OCS Related (1)	Nome-Regional Points (1)	Nome-Anchorage Population Related (2)	Nome-Anchorage OCS Related (1)	Nome-Anchorage Total	Anchorage-Seattle Population Related (3)	Anchorage-Seattle Prior OCS Sales	Anchorage-Seattle Low Find Scenario (1)	Anchorage-Seattle Total
1	1983	109	1	461	81	542	14,669	1,402	66	16,137
2	1984	260	1	492	180	680	14,542	1,315	156	16,013
3	1985	218	1	506	230	736	14.287	519	191	14,997
4	1986	419	1	515	302	817	14,414	659	251	15,324
5	1987	209	1	497	153	650	14,542	1,174	126	15,842
6	1988	363	4	515	157	672	14,952	1,314	105	16,371
7	1989	465	6	534	384	918	15,307	1,467	316.	17,090
8	1990	349	5	5'33	257	850	15,690	1,259	178	17,127
9	1991	349	5	597	245	842	16,073	1,049	134	17,256
10	1992	215	4	588	153	741	16,455	735	58	17,248
11	1993	178	4	597	116	695	16,830	632	--	17,470
12	1994	178	4	588	116	704	17,221	51	--	17,272
13	1995	208	5	597	132	729	17,603	28	--	17,631
14	1996	208	5	606	132	738	17,986	12	--	17,998
15	1997	208	5	616	132	748	18,496	5	--	18,501
16	1998	208	5	620	132	?52	19.006	5	--	19,011
17	1999	208	5	629	132	761	19,644	3	--	19,647
18	2000	208	5	638	132	770	20,154	2	--	20,156

Notes: (1) Derived from Dames & Moore Scenario Employment data.
(2) Peak week average of 456 x Nome-Wade Hampton Region growth factors.
(3) Peak week average of 12,756 x Anchorage growth factors.

Sources: Dames & Moore, 1980
PMM&CO.

population related travel demand is expected to increase in accordance with the growth factors, which in 1989 is expected to be approximately 534 trips (79 percent of the medium find scenario). OCS related trips over the same link during 1989 amount to 384 trips, which is 42 percent of the total traffic volume of 918 passengers. Of the 384 OCS employees, approximately 316 or about 82 percent of them will continue through Anchorage to Seattle as compared to about 75 percent in the medium find scenario. When compared to the base case in 1989, the Nome-Anchorage link in the low find scenario carries only twice the passenger load, while the Anchorage-Seattle link increases only three percent. These should be compared to the medium find scenario for the same year when the Nome-Anchorage link also carries two times the passenger load and the Anchorage-Seattle link increases only three percent. Once the oil field is in full production (1992) anticipated passenger demand for the Anchorage-Seattle linkage drops off sharply, since most personnel involved during this stage of development would likely be Alaska residents.

When these various demands are translated into aircraft flight requirements, the forecast is as illustrated in Table 68. Contract helicopters serving the linkage between offshore rigs and Nome peaks at 33 trips in 1989, and declines to a steady demand of about 15 trips per week by 1995. At about this same time, the demand for regional air taxis increases slightly from one to two trips per week. Scheduled air carrier flight requirements for the Nome-Anchorage linkage peak in 1990 with a demand of 10 flights per week. This is a 67 percent increase over those demands forecast for the base case. Over the Anchorage-Seattle link, the increase is only about two percent.

TABLE 68

BERING-NORTON LOW FIND SCENARIO
PEAK MONTH WEEKLY AIRCRAFT FLIGHT REQUIREMENTS

Year After Lease Sale	Year	Contract Helicopters Offshore Nome (1)	Air Taxi Nome-Regional Points (2)	Air Carrier Nome Anchorage (3)	Air Carrier Anchorage-Seattle (4)
1	1983	8	1	6	158
2	1984	19	1	8	157
3	1985	16	1	8	147
4	1986	30	1	9	150
5	1987	15	1	7	155
6	1988	26	1	8	161
7	1989	33	2	10	168
8	1990	25	2	10	168
9	1991	25	2	10	169
10	1992	15	1	8	169
11	1993	13	1	8	172
12	1994	13	1	8	170
13	1995	15	2	8	173
14	1996	15	2	8	177
15	1997	15	1	9	182
16	1998	15	2	3	187
17	1999	15	2	9	193
18	2000	15	2	9	198

Notes: (1) Derived by dividing Offshore-Nome OCS Related Passengers by 14 seats.

(2) Derived by dividing Nome-Regional Points Passengers by 4 seats.

(3) Derived by dividing Nome-Anchorage Passengers by (110 seats x load factor of 80% =) 88 seats.

(4) Derived by dividing Anchorage-Seattle Passengers by (128 seats x load factor of 80% =) 102 seats.

Source: PMM&CO.

7.4.3 IDENTIFICATION OF AVIATION IMPACTS

" The increase in passenger movements through terminals and increased levels of aircraft operations, including helicopters, are sources of potential impact, particularly during the field development period. Passenger movements through the Nome airport peak in 1990 at 1,700 passengers per week, about a 68 percent ncrease over the base case and about 53 percent of the level of the medium find scenario. Such increases in passenger demands will provide additional justification for constructing new terminal facilities. Passenger demands are such that facilities could be designed for the mid-1980's and not be underutilized throughout the remainder of the study period. The willingness or ability of public agencies to provide new terminal facilities in conjunction with the airlines would alleviate forecast overcrowding. The incremental increase in passenger movements at the Anchorage terminal are not expected to create overcrowding there.

Carriers serving the Nome-Anchorage link and the Anchorage-Seattle link are expected to respond to the increased demands with increased service, initially by increasing load factors and frequency of operations to maximize utilization. Additional carriers will try to seize the opportunity to enter these markets. As compared to the exploration only case, knowledge of the size of the find would allow both regulatory agencies and carriers to make permanent longer-term decisions rather than seeking temporary short-term arrangements. This knowledge may be particularly significant to decision making regarding improvements to freight handling facilities.

The impacts on the intraregional air taxi routes, where the situation is already a problem, is mild compared to the medium find scenario. If air taxi travel demands increase as forecast by the FAA (see Chapter 3), the increased competition may bring in new operators and may lead to potential restructuring of this part of the aviation industry. OCS in the low find scenario is not anticipated to contribute significantly to the forecast growth.

The increased level of aircraft operations should not affect either the Nome or Anchorage airports. The adequacy of runway capacity and bearing capacity is expected to exist throughout the study period, particularly if the runway improvements are made. Improvements in navigational and control facilities, aprons, and taxiways, that were identified for the base case, should provide for improved efficiency in operations at these two airports.

7.4.4 AVIATION ISSUES

The aviation issues of this scenario are identical to those of the Medium Find Scenario, section 6.4.4, page 199.

8.0 iMPACTS OF THE HIGH FIND SCENARIO

8.1 Introduction

In this chapter, the induced economic and population changes of the high find scenario are added to the base case forecast presented in Chapter 4 and the combined effects on marine and air transportation are evaluated. The high find scenario assumes significant commercial discoveries of oil and non-associated gas. The total reserves discovered and developed are 2,600 mmbbl of oil and 3,200 bcf of non-associated gas.

8.2 Significant Factors Affecting Growth

The principal difference in economic activity between the high find scenario and the base case is the discovery and development of the above referenced oil and gas resources. All other characteristics of the base case pertaining to the economy are applicable. It is assumed that the resources identified above are distributed in three "clusters" of fields located respectively in inner Norton Sound, south of Cape Darby; central Norton Sound, south of Nome; and outer Norton Sound, southwest of Cape Rodney. These are illustrated in Figures 19-1 and 19.2. All oil and gas production is brought to shore by pipeline to a large crude oil terminal and LNG plant located at Cape Nome. Production from the central Norton Sound fields involves direct offshore pipeline to Cape Nome, while production from the outer and inner Norton Sound fields involves significant onshore pipeline segments.

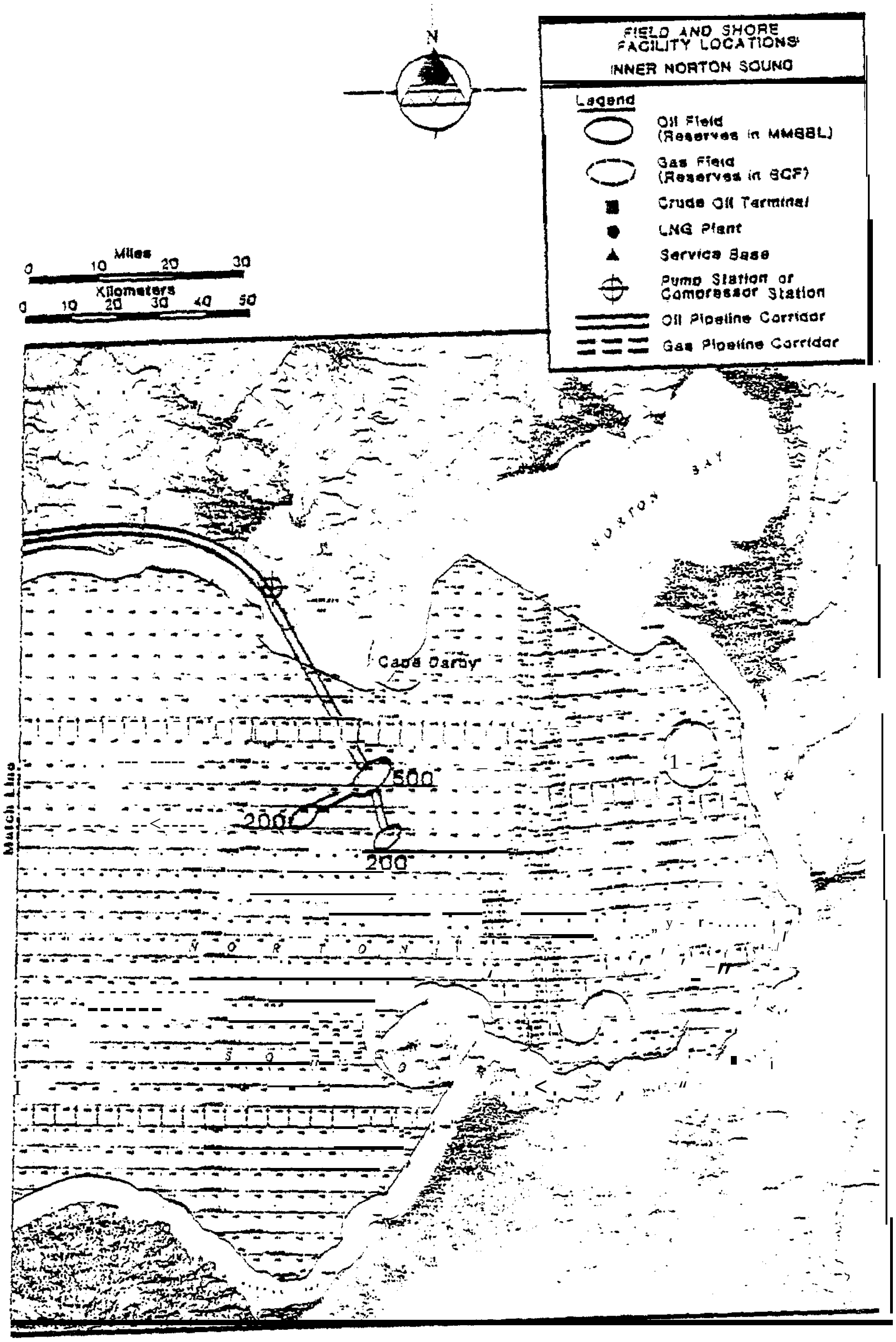


FIGURE 19-1

HIGH FIND SCENARIO
FIELD AND SHORE FACILITY LOCATIONS

Source: Dames&Moore, 1980.

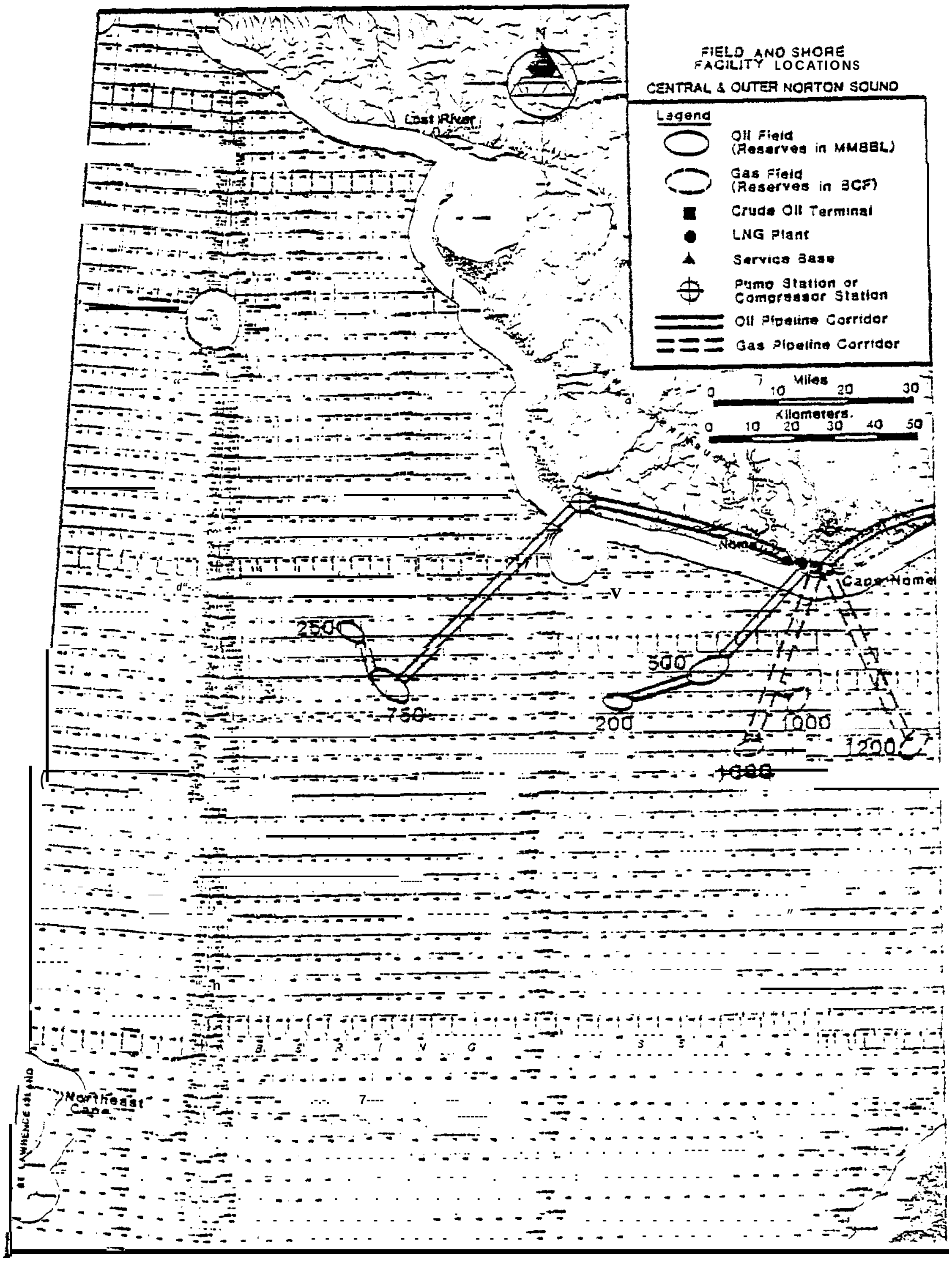


FIGURE 19-2

HIGH FIND SCENARIO
FIELD AND SHORE FACILITY LOCATIONS

Source: Dames & Moore, 1980.

The assumed schedule of OCS activities forecasts that exploration commences in the first year after the lease sale (1983), peaks in year 4 with 20 wells drilled, and terminates in the seventh year with a total of 90 wells drilled. Over a six year period, ten commercial discoveries are made; seven oil discoveries and three nonassociated gas discoveries. The exploration program involves jack-up rigs and drill ships in the outer sound, with limited use of summer-constructed gravel islands in shallow water, 15 meter (50 feet) or less, where suitable barrow materials are either adjacent to the well site or within economic haul distance. Economics dictate extension of the drilling season from the four to six months open water season to a maximum of eight months; this is accomplished by the use of icebreaker support.

Field construction commences in year 4 after the decision to develop the first discovery and the first platform is installed in the summer of year 5. Development drilling commences the following year and the first oil production is brought to shore in year 7 (1989). The last platforms (a gravel island in inner Norton Sound and a steel gas platform in central Norton Sound) are installed in year 9.

Oil production from Norton Sound commences in year 7 (1989) after the lease sale, peaks at 764,000 barrels per day in year 13 (1995), and ceases in year 34 (2016). Gas production also commences in year 7 (1389), peaks at 691,200 mmcfd in years 13 through 16 (1995 through 1999) and ceases in year 34 (2016).

In response to this level of development, population changes in the Nome-Wade Hampton region and in Nome are estimated to be as shown in Table 69. At the regional level, OCS induced population peaks in 1992 at 8,874 persons then declines to 6,747 persons in 2000. As a result of OCS induced population growth to 1992, the regional population increases 66 percent over the base case, and represents a 21 percent increase over the medium find scenario. The rise and fall in population is due to the fact that expected employment associated with the high find scenario peaks in 1992 at more than 66 percent over the level of the medium find scenario.

In Nome, primary employment rises to a peak of 5,276 in 1991, and moderates to 3,930 in 2000. Onshore primary employment rises to 1,544 in 1987 during development (about 58 percent of the total employment) and stabilizes at about 21 percent of the total work force during the late development and production phases. The balance of the employees (approximately 42 percent) work on offshore facilities. The effects on OCS induced and total population are illustrated in Table 69. The induced population increases to 8,874 persons in 1992 and declines to a level of 6,747 persons in 2000. The peak increase represents a change of 43 percent over the base case and 7 percent over the medium find forecast for the same year.

High find scenario population changes in the City of Anchorage are also identified in Table 69. The induced population due to Sale 57 increases from 49 in 1983 to 12,263 in 2000. The 2000 population represents a 63 percent increase over 1977 population and is approximately 2 percent larger than the medium find scenario. When compared to base case population, the difference in the year 2000 is about 4 percent.

TABLE 69

BERING-NORTON HIGH OCS CASE POPULATION PROJECTIONS AND GROWTH FACTORS

Calendar Year	Year After Lease Sale (1)	Nome-Wade Hampton Region: Base Case Population	OCS Induced Population	Total Population	Growth Factor (2)	City of Nome: Base Case Population	OCS Induced Population	Total Population	Growth Factor
1977		J1,800	--	J 1,800	J .00	2,885	--	2,885	1.00
1983	1	11,752	283	12,035	1.02	3,317	13	3,330	1.15
1984	2	12,406	578	12,984	1.10	3,303	28	3,411	1.18
1985	3	12,525	1,206	13,731	1.16	3,451	45	3.496	1.21
1986	4	12,517	1,536	14,053	1.19	3,520	1,043	4,563	1.58
1987	5	12,556	2,001	14,555	J.23	3.590	1,344	4,934	1.71
1988	6	12,690	2,708	15,398	1.30	3,662	1,363	5,025	1.74
1989	?	12,886	3,504	16,390	1.39	3,735	1,467	5,202	1.00
1990	0	13,1(JU	7,015	20,123	1.71	3.010	1,512	5,322	1.84
1991	9	13.292	8,597	21,000	1.85	3,829	1,600	6,509	1.91
1992	10	13,494	8,074	22,367	1.90	3,848	1,649	5,491	1.91
1993	11	13,682	7,916	21,598	1.83	3,867	J,557	5,424	1.88
1994	12	13,909	7,139	21,048	1.78	3,886	1.516	5.402	1.87
1995	13	14.105	6.961	21.066	1.?9	3,905	1,500	5,403	1.0)
1996	14	14,291	6>04)	21,139	1.?9	3.925	1,498	5,423	1.88
1997	15	14,'391	6,857	21,340	1.81	3.945	1,500	5,445	1.09
1998	16	14,707	6,816	21,524	1.82	3,965	1,500	5,465	1.89
1999	i?	14,949	6,811	21,760	1.84	3, 9N5	1,502	5,407	1.90
2000	10	15,140	6,747	21. (NJ)	1.85	4,005	1,502	5.50>	1.91

Calendar Year	Region Without Nome City (3): Base Case Population	OCS Induced Population	Total Population	Growth Factor	City of Anchorage: Base Case Population	Sale 57 Induced Population (4)	Total Population	Growth Factor	Year After Lease Sale (1)	Calendar Year
1977	8,915		8,915	1.00	183,606	--	183,606	1.00		1977
1983	8,435	270	8,1(J5	0.98	211,110	49	211,159	1.15	1	1983
1984	9.023	550	9.573	1.07	209, ?96	184	209,900	1.14	2	1904
1985	9,074	1,161	10.23s	1.15	206,018	347	206,365	1.12	3	1905
1986	8,997	493	9,490	1.06	206,522	0?3	201,395	1.13	4	1986
1987	0,966	657	9,623	1.08	209,115	1,951	211,126	1.15	5	1987
1988	9,028	1,345	10,373	1.16	213.039	2,866	216,705	1.18	6	1988
1989	9,151	2,037	11,188	1.25	219,035	3,598	222,633	1.21	1	1909
1990	9,298	5,503	14,801	1.66	223,847	5,117	220,964	1.25	0	1990
1991	9,463	6,917	16,380	1.84	226,075	7,213	236.000	1.29	9	1991
1992	9,646	7,225	16,871	1.09	234,256	a, 709	242,965	1.32	10	1992
1993	9,815	6,359	16,174	1.81	240,001	9,433	249,434	1.36	11	1993
1994	10.023	5.623	15,646	1.76	245.591	9,591	255.100	1.39	12	1994
1995	10.200	5,461	15,661	1.76	251,135	9,827	261,002	1.42	13	1995
1996	10, 366	5,349	15,715	1.76	257,405	10,245	26?,650	1.46	14	1996
1997	10,546	5, 357	15,903	1.10	264,412	10,747	275,159	1.50	15	1997
1998	10,742	5,316	16,058	1.80	271,922	11,270	283,192	J.54	16	J990
1999	10.964	5.309	16,273	1.83	279,323	11.784	291.107	1.59	17	1999
2000	11,135	5,245	16.3130	1.84	207,256	12,263	299.519	t.63	18	2000

Notes:
(1) Lease Sale No. 57 is currently scheduled for November 1982.
(2) Growth Factors are derived by dividing the forecast year population by the 1977 population.
(3) Derived by PMMACO by subtracting City of Nome forecast from Nome - Wade Hampton Region forecast.
(4) The Anchorage base case population includes induced population from OCS sales prior to Sale 57. These are not specifically identified herein but may be found in earlier SESP documents.

Sources: Nome Population Projections, Policy Analysts, 1980.
Nome-Wade Hampton Region and Anchorage Population Projections, ISER, 1980.
Region Without Nome City, PMMACO

8.3 Water Mode

8.3.1 DESCRIPTION OF MARINE ACTIVITIES

During the exploration phase it is anticipated that the oil industry will operate in a manner similar to that described in the exploration only scenario (Chapter 5). In particular, the oil industry is expected to operate from barges anchored offshore using supply boats to shuttle materials between the barges and the various rigs and platforms. When the service base is completed in 1989, the oil industry will shift its operations from the anchored barges to the service base. Once oil is discovered and the decision to develop the fields is made, a large volume of construction materials for the service base, marine terminal, and LNG plant will be moved to the area. All of this material is expected to be moved through the port of Nome. When the service base becomes operational, all incoming OCS materials are anticipated to be moved through the service base facilities. The local lighterage service is expected to be called upon to provide fuel and water to the rigs and platforms until the service base is operational. At that time, the lighterage service will no longer continue to provide fuel and water. When oil and gas production begins in 1989, oil and LNG tankers will begin round trip movements between the marine terminal and west coast ports.

The marine transportation industry is expected to maintain the present character of its service: Use of linehaul barges to deliver products to Nome, use of lighters to offload linehaul vessels, and use of lighters to deliver dry cargo and liquid bulk petroleum products to coastal villages. The port of Nome itself is not expected to change significantly. In par-titular, as discussed earlier in this report (Chapters 4 and 5), no new docking facilities are assumed to be constructed.

8.3.2 FORECAST OF MARINE TRANSPORTATION DEMANDS ANO REQUIREMENTS

As in the other scenarios, the demand for transportation services is expected to arise from two sources: The local population, and OCS related activities. It is assumed that local population demands will follow patterns established in the base case, creating throughput tonnage demands at the rate of 3 tons per person per year. When this rate is extrapolated using the forecast population data of Table 69, population based marine transportation demands are shown in Table 70. In 1992, at the height of OCS development activities, throughput tonnage demands reach 67,101 ST, which is 66 percent above base case demands and 21 percent above the medium find scenario for the same year.

Those OCS activities requiring transportation services are identified in Tables 71 through 75. Based on the scenario estimates, 100 exploration and delineation wells are drilled during the first seven years of develop-ment and between 1988 (year 6 after the lease sale) and 1996 (year 14 after the lease sale) approximately 590 additional wells are drilled on a schedule as illustrated in Table 71. During exploration these wells are assumed to be drilled to an average of 3,505 meters (11,500 ft.). However, development wells are anticipated to be drilled to only 2,286 meters -

BERING-NORTON HIGH FIND SCENARIO
POPULATION RELATED MARINE TRANSPORTATION DEMANDS

Year After Lease Sale	Year	Nome - Wade Hampton Regional Population High Find Scenario	Throughput Tonnage Total (1)	Throughput Tonnage Dry Bulk (2)	Throughput Tonnage Liquid Bulk (3)	Nome Marine Tonnage Demands Dry Bulk (4)	Nome Marine Tonnage Demands Liquid Bulk (5)	Region Without Nome Tonnage Demands Dry Bulk (6)	Region Without Nome Tonnage Demands Liquid Bulk (7)	Total Inbound Tonnage (8) Dry Bulk	Total Inbound Tonnage (8) Liquid Bulk
1	1983	12,035	36,105	7,943	28,162	5,401	25,346	1,271	1,408	6,672	26,754
2	1984	12,9s34	38,952	8,569	30,303	5,827	27,344	1,371	1,519	7,198	28,863
3	1985	13,731	41,193	9,062	32,131	6.162	28,917	1,450	1,607	1,612	313,524
4	1986	14,053	42,159	9,275	32>884	6,307	29,596	I,484	1,644	7,791	31,240
5	1987	14,555	43,665	9,606	34,059	6,532	30>653	1,53?	1,703	8,069	32,356
6	1988	15,398	46,194	10,163	36,031	6,911	32,428	J,626	1,002	0,537	34,230
7	1989	16,390	49,170	10,817	38,353	7,356	34,517	1,731	1,918	9,007	36,435
8	1990	20,123	60,369	13,281	41>000	9,031	42,379	2,125	2,354	11,156	44,733
9	1991	21,888	65,664	14,446	51,218	9,1323	46,096	2,311	2,561	12.135	48,657
10	1992	22,367	67,101	14.762	52,339	10,038	47,105	2,362	2,617	12,400	49,722
11	1993	21,598	64,794	14,255	50,539	9,693	45,485	2,281	2.527	11,974	40,012
12	1994	21,048	63.144	13,892	49,252	9>446	44,32)	2,223	2,463	11,669	46,790
13	1995	21,066	63,198	13,904	49,294	9,454	44,365	2,225	2,465	11,679	46,830
14	1996	21,139	63,417	13,952	49,465	9,487	44,519	2,232	2,473	11,719	46,992
15	1997	21,348	64>044	14,090	49,954	9,501	44.959	2,254	2,498	11,835	47,457
16	1998	21,524	64,572	14.206	50,.366	9,660	45,310	2,273	2,518	11,933	47,848
17	1999	21,760	65,200	14,362	50,9)8	9,766	45,827	2,298	2,546	12,064	48,372
18	2000	21,887	65,661	14.445	51,216	9,823	46,094	2,311	2,561	12,134	48,655

Notes:
1) Total Throughput Tonnage = Regional Population x 3 tons per person per year.
2) Total Throughput Dry Bulk Is 22% of total throughput tonnage. See Figure 6, Part A.
3) Total Throughput Liquid Bulk is 78% of total throughput tonnage. See Figure 6. Part A.
4) Nome Dry Bulk Is 14.96% of total throughput tonnage. See Figure 6, Part E.
5) Nome Liquid Bulk Is 70.20% of total throughput tonnage. See Figure 6, Part E.
6) Region Without Nome Dry Bulk is 3.52% of total throughput tonnage. See Figure 6, Part F.
7) Region Without Nome Liquid Bulk is 3.90% of total throughput tonnage. See Figure 6, Part F
8) Derived by adding Nome and Region Without Nome tonnage demands.

Source: PMM&CO

TABLE /1

TRANSPORTATION RELATED ACTIVITIES

BERING-NORTON HIGH FIND SCENARIO

YEAR AFTER LEASE SALE	YEAR	EXPLORATION AND DELINEATION RIGS	PLATFORMS INSTALLED: STEEL	PLATFORMS INSTALLED: EXPLORATION GRAVEL	PLATFORMS INSTALLED: PRODUCTION GRAVEL	DEVELOPMENT RIGS: JAN	DEVELOPMENT RIGS: JULY	WELLS DRILLED: EXPLORATION DELINEATION	WELLS DRILLED: OIL DEVELOPMENT	WELLS DRILLED: GAS DEVELOPMENT	WELLS DRILLED: OTHER	PIPELINE CONSTRUCTED: ONSHORE MILES	PIPELINE CONSTRUCTED: OFFSHORE MILES	OIL PRODUCTION MMB	GAS PRODUCTION WELLS	ONSHORE FACILITY CONSTRUCTION
1	1983	3						6								
2	1984	u		1 Note I				12								
3	1935	11		1 Note I				18								
4	1986	12		1 Note 2				30								
5	1987	9	1	I Note 2				14								
6	1988	8	4	I Note 2	I Note 3	0	2	12	10		2	4	49			NOTE 4
7	1989	6	4	I Note 2	2 Note 3	2	9	8	43	6	9	40	61	23	6	NOTE 5
8	1990		1			9	17		83	20	17	62	28	107	26	NOTE 6
9	1991		1		I Note 3	17	20		112	18	22	2	30	220	44	
10	1992					20	13		90	10	18			340	54	
11	1993					13	9		60	8	12		10	390	62	
12	1994					9	2		23	2	5			423	64	
13	1995					2	2		13		3			436	64	
14	1996					2	0		4		o			440	64	
15	1997													440	64	
16	1998													440	64	
17	1999													440	64	
18	2000													440	64	

NOIES: 1. Exploration Gravel Island in 7.5 meters (25 ft) of water. Requires 53,522 cu. meters (70,000 cu. yds) of gravel based on an island surface diameter of 60 meters (198 ft).

2. Exploration Gravel Island in 15 meters (50 ft) of water. Requires 110, I(32 (144,01)0 cu. yds) of gravel based on an island surface diameter of 60 meters (198 ft).

3. Production Island in 15 meters (50 ft) of water. Requires 1,376,280 cu. meters (1,800,000 cu yds) of gravel based on an island surface diameter of 213 meters (700 ft). Arrows indicate Exploration Island expanded and modified for production. Net additional gravel required is 1,266, 178 cu. meters (1,1.%X,000 cu. yds).

4. Begin construction of Oil Terminal, LNG Plant, and Support Base.

5. Support Base completed.

6. Oil Terminal and LNG Plant completed.

SOURCE: Mud i 1 ied f rom Dames & Moore, 1980

TABLE 72

GRAVEL AND OR ILLING MATERIALS REQUIREMENTS

B ERING-NORTON HIGH FIND SCENARIO

YEAR AFTER LEASE SALE	CALENDAR YEAR	EXPLORATION AND DELINEATION WELLS DRILLED [1]	DEVELOPMENT WELLS DRILLED [3]	ANNUAL TONNAGE [3] DRILL PIPE	DRY BULK	TOTAL DRY FREIGHT	FUEL	DRILL WATER [4]	GRAVEL (in 1,000 TONS) [5]
1	1983	6		2,431	6,654	9,085	11,826	18,480	
2	1984	12		4,367	13,308	18,170	23,652	36,960	243
3	1985	18		7,293	19,962	27,255	35,478	55,440	243
4	1986	20		8,104	22,180	30,294	39,420	61,600	396
5	1987	14		5,673	15,526	21,199	27,594	43,120	396
6	1988	12	12	8,999	17,444	26,443	35,988	61,068	1,854
7	1989	3	58	23,234	42,396	65,630	59,624	141,162	1,573
8	1990		120	41,364	59,360	110,724	123,360	241,080	2,719
9	1991		152	52,394	87,356	140,2.50	156,256	305,368	1,251
10	1992		118	64,804	68,204	133,008	121,304	237,062	1,251
11	1993		30	27,576	46,240	73,816	82,240	160,720	
12	1994		30	10,341	17,340	27,681	30,340	60,270	
13	1995		16	5,515	3,248	14,793	16,448	32,144	
14	1996		4	1,379	2,312	3,691	4,112	3,036	

NOTES: 1. From Table 71.

2. Combines oil and gas development wells and other wells drilled, from Table 71.

3. Tonnage requirements per well (see Appendix 3):

	Exploration	Development
Drill Pipe	405.2 ST	344.7 ST
Dry Bulk	1,109.0 ST	578.0 ST
Fuel	1,971.0 ST	1,028.0 ST
Drill Water	3,080.0 ST	2,009.0 ST

4. Drill water will be obtained locally.

5. Exploration gravel islands are constructed the year prior to use. Production gravel islands require two years to construct. Gravel is estimated to weigh 2.12 ST per cubic meter (1.62 per cubic yard).

TABLE 73

BERING-NORTON HIGH FIND SCENARIO
PIPELINE CONSTRUCTION TONNAGE DEMANDS

		Kilometers (Miles) of Pipeline (1)							Uncoated Pipe Tonnage (2) (3)								Offshore Pipeline	Total	Coated Pipe Tonnage (5)						
		Offshore				Onshore			Offshore				Onshore												
Year After Lease Sale	Year	12"	16"	18"	24"	16"	18"	24"	12"	16"	18"	24"	16"	18"	24"	Total	Coating Materials Tonnage (3) (4)	Dry Cargo Tonnage	12"	16"	18"	24"	Total	Year	Year After Lease Sale
1	1983																							1983	
2	1984																							1904	:
3	1985																							1905	3
4	1986																							1986	4
5	1987									1,851		5,022	195		335	7,403	22,682	30,085						1987	5
6	1988 -		30 (19)			3 (2)		(2)	1,161	584	4 ,888			4,888		11,521	11,207	22,728		6.014		22,608	29,482	1988	6
7	1989	24 (15)	10 (6)	64 (40)			64 (40)		542		2.566			?, 5?6		10.604	5,238	15,9?2	3,204	2,171	17,964		21.319	1989	7
8	1990	11 (7)		34 (21)	"‘ ‘J"’		100 (62)	‘	619			5,022			335	5,916	20.009	26. 065	1,495		9,431		10.926	1990	8
9	1991	13(80)			40 (30)			J (2 I											I. 109			22.24)0	24,317	1991	9
to	1902								774							774	984	1,758						1992	10
11	1993	1 6 (10)																	2,136				2.116	1993	11
12	1994																							1994	12

Notes : (1) From Dames & Moore, 1980.

(2) Based on: Tons/Kilometer (Tons/Mile)

	Tons/Kilometer	(Tons/Mile)
12"	40.1	77.4
14"	52.9	85.7
16"	60.5	97
18"	75.9	122.
20"	86 5	139.
24"	104.0	167

(3) If pipe is coated in the study area, pipe and coating materials must be transported one year before needed

(4) Based on: Tons/Kilometer (Tons/Mile)

	Corrosion Protection	Cement	Sand Aggregate	Iron Ore Aggregate	Wire Mesh	Total
12-	2f.2 (48,6)	7.6 (12.)	22.7 (36.6)	-- --	0.6 (1.0)	61.1 (98.4)
14"	35.3 (556.8)	9.2 (1)	21.6 (44)	--	0.9 (1.5)	73.0 (117.5)
16	40.3 (64.9)	17.3 (21.)	54.0 (83.4)		1.1 (1.8)	110.5 (177.9)
18"	45.1 (72.9)	22.0 (15.)	55.9 (106)	-	1.4 (2.2)	134.6 (216.6)
20"	62 5 (100.6)	22. 2 (5)	66.7 (107)	-- --	1.6 (2.5)	153.0 (246.)
24"	14 6 (1200)	40.3 (4.)		283.0 (455.0)	2.2 (3.5)	399.8 (643.)

(5) Based on: Tons/Kilometer (Tons/Mile)

	Tons/Kilometer	(Tons/Mile)
12"	132.8	(213.6)
14-	154 2	(248.2)
16"	224 9	(361.8)
18"	279 1	(449.1)
20	100 6	(496.7)
24"	468 3	(753.6)

TABLE 74

BERING-NORTON HIGH FIND SCENARIO
TRANSPORTATION DEMAND OF OCS CONSUMABLES

Year After Lease Sale	Year	OCS Related Non-Local Population (1)	Annual OCS Consumable (2) Demand (In Tons)
1	1983	306	367
2	1984	825	990
3	1985	34A	1,133
4	1986	1,696	2,035
5	1987	2,589	3,107
6	1988	3,337	4, 004
7	1989	4,235	5,082
8	1990	3,451	4,141
9	1991	3,256	3,907
10	1992	2,674	3,209
11	1993	2,266	2,719
12	1994	2,017	2,420
13	1995	2,092	2,510
14	1996	2,044	2,453
15	1997	2,089	2,507
16	1998	2,089	2,507
17	1999	2,104	2,525
18	2000	2,104	2,525

Notes : (1) Equals offshore-onsite non-local employment plus onshore-onsite non-local employment.

(2) Assumes consumption level of 300 pounds per person per month over 8 months.

Source: PMM&CO.

TABLE 75

BERING-NORTON HIGH FIND SCENARIO
RESOURCE PRODUCTION TRANSPORTATION DEMANDS

Year After Lease Sale	Year	Oil Production		Gas Production	
		MMBBL (1)	MMTons (2)	BCM (3)	BDF (4)
1	1983				
2	1984				
3	1985				
4	1986				
5	1987				
6	1988				
7	1989	7.008	0.905	0.595	21.024
8	1990	38.544	4.980	2.382	84.096
9	1991	98.088	12.673	4.168	147.168
10	1992	178.704	23. 088	6.549	231.264
11	1993	245.280	31.690	8.336	294.336
12	1994	277.279	35.824	8.931	315.360
13	1995	278.995	36.046	9.526	336.384
14	1996	262s799	33.953	9.526	336.384
15	1997	230.211	29.743	9.526	336.384
16	1998	192.860	24,917	9.526	336.384
17	1999	157.757	20.382	9.526	336.384
18	2000	128.936	16.658	7.996	282.339

Notes: (1) Million barrels of oil, from Dames & Moore, 1980.

(2) Million tons of oil = MMBBL ÷ 7.74 bbl./ton.

(3) Billion cubic meters = BCF x 0,02832 cubic meters per cubic foot.

(4) Billion cubic feet of gas from Dames & Moore, 1980.

(7,500 ft.). Based on the well drilling schedule identified in Table 71, the annual number of tons of materials required to drill these wells is identified in Table 72. The drill pipe and dry bulk materials are expected to be shipped to the lease sale area on contract linehaul vessels. The local lighteraging service is expected to provide the fuel and drill water over the period 1983 to 1988. After this period, supply boats operating from the service base will provide fuel and drill water.

As noted in Table 71, one exploration gravel island will be constructed every year for six successive years between 1984 and 1989. Two of these islands will be converted to production platforms following the discovery of oil. Initially, each gravel island will require approximately 150,000 cubic yards of gravel during-construction. The four production islands each require 1,800,000 cubic yards of material. Gravel fill is expected to be obtained by suction dredges mining offshore gravel resources. The gravel island construction barge spread for the exploration islands will be the same as for the exploration only scenario. The construction barge spread for the production islands could potentially include several suction dredges, several large bottom dump work barges, a supply barge, and several accomoda-tion barges, all operating offshore.

Pipeline construction may commence in 1987 or 1988, depending on 'whether or not the oil industry establishes a pipe coating yard in the lease sale area. As shown in Table 73, if the yard is established in the area, pipe and coating materials must begin to be transported in 1987, so that the coated pipe can be delivered offshore beginning in 1988. If the oil industry chooses not to establish the coating yard in the area, which appears more likely, the coated pipe is expected to be shipped directly from a Lower 48 pipe coating yard to the lay barge. Uncoated pipe is expected to be shipped to the service base.

The demand for OCS consumables, which includes food, shelter, and other temporary services for non-local personnel employed by the oil companies, is estimated at approximately 300 pounds per person per month. When forecast using anticipated non-local OCS employment as a base, annual OCS related consumable tonnage is projected as in Table 74. This level of demand represents eight months of operations. It is anticipated that these consumable items will be transported with the drilling mud and other materials as part of the linehaul services contracted to the oil industry. During the exploration phase (up to 1989) these consumable materials, as well as the drilling materials will be stored on offshore barges. After that time these materials will be stored at the service base.

Once resource production begins in 1989, oil production is expected to gradually rise to a peak of about 279 MMBBL in 1995, while gas production gradually rises to a level of about 9.5 BCM per year and remains steady at that level for the remaining years of the study period. Changes in resource production are illustrated in Table 75. Respectively, peak level oil production in the high find scenario is 75 percent above the medium find scenario, while gas production is twice that of the medium find scenario. Tankers employed for crude oil transportation are expected to range in size from 70,000 DWT to 120,000 DWT, while LNG tankers are expected to have a capacity of 130,000 cubic meters.

When these various transportation demands are viewed collectively, the annual marine vessel requirements are anticipated to be as shown in Table 76. Included in the table are both population related and OCS related demands. The peak year for transportation activity is anticipated in 1989. A total of 41 dry cargo and tanker barge arrivals for both population and OCS related activities are anticipated. In conjunction with OCS activities that year, monthly supply boat trips are expected to reach 416 trips per month and barge movements associated with gravel island construction peaks at 1,411 trips. All of these movements coincide with the startup of production and the beginning of resource tanker operations.

The demand for linehaul lighters reaches a peak in 1986 when the local lighteraging service is still providing fuel and drill water to exploration rigs. Including coastal delivery trips during 1986, the total number of expected lighterage trips is 859, which is almost a fivefold increase over the base case and a 21 percent increase over the medium find case for the same year. In order to meet the demand for additional lighter trips, the local lighteraging service is expected to increase the number of lighters located in Nome, particularly those supporting the fuel and drill water operations.

With respect to the supply boat trips, it should be noted in Table 76 that the numbers shown are not annual trips, but monthly trips. When extrapolated over eight months, these trips amount to a considerable level of supply boat activity. Included in these supply boat figures are the icebreaker support vessels which provide assistance to tankers operating between Norton Sound

TABLE)6

BERING-NORTON HIGH FIND SCENARIO
ANNUAL MARINE VESSEL REQUIREMENTS

Year After Lease Sale	Year	Population Related: Linehaul Dry Cargo Arrivals (1)	Population Related: Linehaul Barge Arrivals (2)	Population Related: Linehaul Lighter Dry Cargo Trips (3)	Population Related: Linehaul Lighter Tanker Trips (4)	Population Related: Coastal Delivery Lighter Trips (5)	OCS Related: Dry Cargo Arrivals (6)	OCS Related: Linehaul Tanker Barge Arrivals (2)	OCS Related: Module Barge Arrivals (7)	OCS Related: Linehaul Lighter Tanker Trips (4)	OCS Related: Monthly Supply Boat Trips (8)	OCS Related: Gravel Barge Trips (9)	Pipeline Lay & Bury Barges (10)	Resource Departures (11)	Linker "i&--
1	1983	11	4	19	127	16	2	2		201	36				
2	1984	12	4	21	137	18	3	3		401	96	75			
3	1985	13	4	22	145	19	5	5		602	132	15			
4	1986	13	4	22	149	19	5	6	54	669	144	122			
5	1987	13	5	23	154	20	4	4	30	460	132	122			
6	1988	14	5	24	163	21	5	5	14	634	267	512	6		
7	1989	15	5	26	174	22	12	9			416	1,411	7	16	0
n	1990	19	6	32	213	27	19	18			679	039	5	83	31
9	1991	20	7	35	232	30	24	22			509	309	6	212	53
10	1992	21	1	35	2)?	10	23	17			433	309	1	305	83
11	1993	20	)	34	229	29	13	12			280		1	529	106
12	1994	19	7	33	223	29	5	4			110		I	590	113
13	1995	19	7	33	223	29	3	2			100			601	121
14	1996	20	7	33	224	29	1	1			80			566	121
15	1997	20	1	3'4	226	29	1				60			496	121
16	1998	20	7	34	228	29	1				60			416	121
17	1999	20	7	34	210	30	1				60			140	121
18	2000	20	7	35	232	30	1				60			270	101

Notes: (1) Assumes an aver age of 600 ST arrives on each linehaul dry cargo vessel

(2) As sumes an average " f 7,000 ST (50,050 bbl.) arrives on each linehaul tanker vessel.

(3) Assumes each lighter averages 350 ST of dry cargo per trip.

(4) Assumes each lighter averages 210 ST (1, 500 bbl .) of liquid bulk per trip. OCS fuel goes inbound to storage and outbound to rig. OCS water is outbound only. All trips are shown.

(5) Assumes each coastal delivery trip is made by a lighter averaging 216 ST per trip and cargo is composed of 40 per cent (tf6 ST) liquid bulk and 60 percen t (130 S1) dry bulk (), neobulk. Optimiza tion of the number of trips is not considered.

(6) Consumable dry cargo and drilling mater ials dry freight are included. These commodities are expected to arrive on 6,000 ST capacity contr act vessels which are anchored o ffs hor e.

(7) Module ba rge s include an estimate of bar ges required for const ruction equipment and mater ials used In support base, marine terminal, and LNG plant con str uct ion.

(8) Includes supply/anchor boats used in pos itioning and supplying platfor ms and pipeline construction ba rges. See Appendix B for discussi on of assumpt ions

(9) Ba sed on 2,000 cubic yards (3,240 ST) capacity bot tom dump bar ges.

(10) One lay or bury bar ge each year plus 6,000 ST capacity pi pe supply barge.

(11) 70, 000 to 120 ,000 DWT oil tan ker s are employed for crude oil trans porta tion while three 130,000 cubic meter LNG tankers are employed for LNG tr anspor ta tion.

and the Lower 48. The icebreakers are expected to be specially constructed for arctic conditions and would likely operate in the area only during the winter months. The size of these vessels precludes their access to Nome Harbor.

Because of the extended annual operational period (8 months), it is anticipated that at the beginning of each construction season, the oil industry would prepare a flotilla of barges similar to the sea lift operations in the Beaufort Sea. The purpose of this early sea lift is to bring as much materials and equipment as possible to the Norton Sound area, as soon as possible each year. It is anticipated that this flotilla would be supported by icebreaking equipment.

8.3.3 IDENTIFICATION OF MARINE TRANSPORTATION IMPACTS

Under the high find scenario, the level of marine transportation activity in Norton Sound is expected to increase significantly over that forecast for the base case and moderately over that forecast for the medium find scenario. The magnitude of the increase over the base case is such that even f Nome's harbor had no navigational restrictions, the existing facil ties (berths and cargo handling equipment) could not meet anticipated demands. To reduce the impacts and improve the efficiency of the OCS operations, it is anticipated that the oil industry will operate temporarily from offshore facilities. Later, after the decision to develop the various fields is made, more permanent onshore facilities will be constructed.

Possible impacts may arise in Nome Harbor during the exploration stage prior to development of a permanent service base.. The large volume of fuel and water needed on the rigs, if supplied through Nome, exceeds the existing equipment's capacity when all demands are taken into account. As a result, the lighteraging company will need to provide additional lighters to serve OCS needs. At least one, and most likely two, more of each of the special fuel and water barges used in support of the 1980 COST well will probably be required to meet anticipated OCS demands. Based on the potential utilization of these barges, construction of the additional barges would not seem to be a problem for the lighteraging company.

Assuming that additional lighters will be brought in to service OCS fuel and water needs, existing lighters will be called upon to service the expanded population related demand, which includes an increased number of linehaul vessels and increasing need for coastal village deliveries. Demands for these services reach a level in 2000 that is 45 percent above that of the base case and 17 percent above that for the medium find scenario. Based on available equipment, throughput tonnage demands in 2000 are expected to use approximately 94 percent of available equipment capacity, as compared to 65 percent in the same year in the base case and 81 percent in the medium find scenario. The addition of other new barges may potentially reduce this impact, if employed to help lighter the bulk petroleum linehaul tanker barges.

The addition of six new barges to the harbor may have a serious effect on crowding, particularly in the entrance channel. This could be handled by improving scheduling, and may be reduced by the increased utilization of the new equipment. Sufficient capacity exists to store the vessels in the inner harbor turning basin along the southwest side of the channel. Over-wintering also does not appear to create a problem, since the barges are hauled on the beach.

With respect to the need for supply boat berths, oil and LNG tanker berths, and barge berths, the oil industry is expected to provide an optimum number of berths at the various onshore facilities (supply base, marine terminal, and LNG p" ant).

The variety of other activities associated with the OCS sale would not affect the Nome harbor. The draft of the supply boats is too great to be able to navigate the harbor channel so that during exploration, all supply boat trips would be between the offshore-anchored barges and the rigs and when the supply base became operational, the trips would be between the supply base and the rigs. Similar comments can be made about the gravel barge and pipeline construction activities. For example, in 1989 the high number of gravel barge trips (1,411 trips) is between the dredges and the different island locations.

Because of the offshore anchored barges, artificial islands, rigs, platforms, and vessel traffic, the number of vessel accidents is likely to increase. This increase is impossible to measure at this time. However, the level of change may bring about establishment of formal traffic lanes.

8.3.4 MARINE TRANSPORTATION ISSUES

Marine transportation issues in the high find case are similar to those discussed in the medium find case. The OCS activities anticipated in this scenario assumed no new dock facilities. It is unlikely that a new dock facility would add considerably to the ability of the oil industry to service its operation. Industry's desire for dedicated facilities would appear to not warrant their use of a city-owned dock facility. Certainly, if a dock facility was available and was capable of handling liquid bulk as well as dry bulk cargo, it could very much reduce. the total number of fuel and water supply trips proposed for the lighters, as well as the number of those lighter trips serving to offload linehaul carriers and to make coastal village deliveries.

Both private and contract bulk carriers appear to have sufficient capacity or can develop sufficient capacity to support the oil industry operations, particularly because the service is a contractual one.

If the available dry cargo and bulk petroleum storage capacity is improved, it is unlikely that the flow of additional supplies, especially fuel, will have a major impact, except as to pumping equipment. On the other hand, if these facilities are not improved a significant problem could develop. One way that the lighteraging service may attempt to offset the problems of temporary high capacity storage is to anchor a large compartmentalized storage barge offshore and use that to empty the linehaul tankers and to refuel the work barges. Another approach may be to utilize the special lighters by making deliveries directly from the linehaul tankers to the rigs without ever entering the harbor, although this action could cause delays for the linehaul tankers. Consequently, it would appear that the potential storage impacts could be reduced without significant major investment in onshore facilities.

8.4 Air Mode

8.4.1 DESCRIPTION OF AVIATION ACTIVITIES

Based on the assumed distribution of OCS employees, aviation impacts of OCS activities are most likely to occur on the Nome-Anchorage and Anchorage-Seattle air routes or in the Nome or Anchorage terminals. An increasing demand for regional air taxi services is also expected, once field development begins and more regional workers are employed. It is anticipated that oil industry aviation support activities will be centered in Nome. Of the few airports scattered throughout the Norton Sound area, only Nome is suitable for continual use by large, heavily-laden aircraft. The oil industry is expected to contract for helicopter service to move employees back and forth between the Nome airport and offshore locations. It is assumed this service also operates from the Nome airport.

8.4.2 FORECAST OF AVIATION DEMANDS AND REQUIREMENTS

Aviation passenger demands anticipated in the medium find scenario are detailed in Table 77. The peak periods for OCS employee movements is

TABLE 77

BERING-NORTON HIGH FIND SCENARIO
LOCAL POPULATION AND OCS EMPLOYMENT
PEAK MONTH WEEKLY AVIATION PASSENGER DEMANDS

Year After Lease Sale	Year	Offshore Nome OCS Related (1)	Nome-Regional Points (1	Nome-Anchorage: Population Related (2)	Nome-Anchorage: OCS Related (2)	Nome-Anchorage: Total	Population Related (3)	Anchorage-Seattle: Prior OCS Sales	Anchorage-Seattle: High Find Scenario (1)	Total
1	1983	159	1	465	119	594	14,669	1,402	96	16,167
2	1984	419	1	502	310	812	14,542	1,315	251	16,108
3	1985	487	1	529	362	891	14,287	519	292	15,098
4	1986	637	4	543	537	1,080	14,414	659	423	15,496
5	1987	634	13	561	651	1,212	14,669	1,174	483	16,326
6	1988	1,378	13	593	621	1,214	15,052	1,314	424	16,790
7	1989	1,847	21	634	1,437	2,071	15,435	1,467	1,100	18,002
8	1990	1,529	22	780	1,120	1,900	15,945	1,259	632	17,836
9	1991	1,713	22	844	1,173	2,017	16,455	1,049	656	18,160
10	1992	1,379	18	866	959	1,825	16,838	735	534	18,107
11	1993	1,146	16	834	789	1,623	·7,348	632	374	18,354
12	1994	980	16	812	670	1,482	17,731	51	259	18,041
13	1995	1,030	17	816	661	1,477	18,114	28	136	18,278
14	1996	1,000	18	816	626	1,442	18,624	12	66	18,702
15	1997	1,030	19	825	623	1,448	19,134	5	--	18,702
16	1998	1,030	19	830	623	1,453	19,644	5	--	19,649
17	1999	1,040	19	839	623	1,462	20,282	3	--	20,285
18	2000	1,040	19	844	623	1,467	20,792	2	--	20,794

Notes (1) Derived from Dames & Moore Scenario Employment Data.
(2) Peak week average of 456 x Nome-Wade Hampton Region growth factors.
(3) Peak week average of 12,756 x Anchorage growth factors.

Sources: Dames & Moore, 1980.
PMM&Co.

expected to be the period between 1989 and 1991, when major pipeline linkages and other facilities are under construction. During an average week of the peak month of 1989, approximately 1,847 employees require movement between offshore locations and the Nome airport. That year, approximately 21 trips per week are expected on intraregional aviation routes. Along the Nome-Anchorage route, population related travel demand is expected to increase in accordance with the growth factors, which in 1989 is expected to be approximately 634 trips. This change represents a growth of 28 percent over the base case and 14 percent over the medium find. scenario. OCS related trips over the same link during 1989 amount to 1,437 trips, which is 69 percent of the total traffic volume of 2,071 passengers. Of the 1,437 OCS employees, approximately 1,100 or about 77 percent of them will continue through Anchorage to Seattle. Compared to the base case in 1989, the Nome-Anchorage link in the high find scenario carries more than four times the passenger load while the Anchorage-Seattle link increases only 8 percent, compared to about three times the passenger load and six percent increase for the medium find scenario. Once the oil field is in full production (about 1994), anticipated passenger demand for the Anchorage-Seattle linkage drops off sharply, since most personnel involved during this stage of development would likely be Alaska residents.

When these various demands are translated into aircraft flight requirements, the forecast is as illustrated in Table 78. Contract helicopters serving the linkage between offshore rigs and Nome peaks at 132 round trips in 1989, and again in 1991. At about this same time (1987), the demand for regional air taxis increases sharply. In 1986, regional air taxi demands are esti-

TABLE 78

BERING-NORTON HIGH FIND SCENARIO
PEAK MONTH WEEKLY AIRCRAFT FLIGHT REQUIREMENTS

Year After Lease Sale	Year	Contract Helicopters Offshore-Nome (1)	Air Taxi Nome-Regional Points (2)	Air Carrier Nome-Anchorage (3)	Air Carrier Anchorage-Seattle (4)
1	1983	11	1	7	159
2	1984	30	1	9	158
3	1985	35	1	10	148
4	1986	45	1	12	152
5	1987	45	4	14	160
6	1988	98	4	14	165
7	1989	132	6	24	176
8	1990	109	6	22	176
9	1991	122	6	23	178
10	1992	99	5	21	178
11	1993	82	5	18	180
12	1994	70	4	17	177
13	1995	74	5	17	179
14	1996	71	5	16	183
15	1997	74	5	16	188
16	1998	74	5	17	193
17	1999	74	5	17	199
18	2000	74	5	17	204

Notes: (1) Derived by dividing Offshore-Nome OCS Related " Passengers by 14 seats.

(2) Derived by dividing Nome-Regional Points Passengers by 4 seats.

(3) Derived by dividing Nome-Anchorage Passengers by (110 seats x load factor of 80% =) 88 seats.

(4) Derived by dividing Anchorage-Seattle Passengers by (128 seats x load factor of 80% =) 102 seats.

Source: PMM&CO.

mated to be only one flight per week, but by 1989 the demand for flights is expected to peak at six flights per week. Scheduled air carrier flight requirements for the Nome-Anchorage linkage also peak in 1989 with a demand of 24 flights per week. This is a four-fold increase over demands forecast for the base case. Over the Anchorage-Seattle link, the increase is only about five percent.

8.4.3 IDENTIFICATION OF AVIATION IMPACTS

The increase in passenger movements through terminals and ncreased levels of aircraft operations, including helicopters, are sources of potential impact, particularly during the field development period. Passenger movements through the Nome airport peak in 1989 at 4,142 passengers per week, almost a four-fold increase over the base case. Such increases in passenger demands will provide additional justification for constructing new terminal facilities. Passenger demands are such that facilities could be designed for the late 1980's and not be underutilized throughout the remainder of the study period. The willingness or ability of public agencies to provide new terminal facilities in conjunction with the airlines would alleviate forecast overcrowding. The incremental increase in passenger movements at the Anchorage terminal are not expected to create overcrowding there

Carriers serving the Nome-Anchorage link and the Anchorage-Seattle link are expected to respond to the increased demands with increased service, initially by increasing load factors and frequency of operations to maximize utilization. Additional carriers will try to seize the opportunity to enter these markets.

As compared to the exploration only case, knowledge of the size of the find could allow both regulatory agencies and carriers to make permanent longer-term decisions rather than seeking temporary short-term arrangements.

The critical impacts are most likely to be felt on the intraregional air taxi routes, where the situation is already a problem. As in the other routes, increased competition will bring in new operators and may lead to potential restructuring of this part of the aviation industry. Until something happens, however, the potentially severe economic impacts and reduced travel opportunities are a likely result of high find scenario aviation demands.

The increased level of aircraft operations should not affect either the Nome or Anchorage airports. The adequacy of runway capacity and bearing capacity is expected to exist throughout the study period. Improvements in navigational and control facilities, aprons, and taxiways, that were identified for the base case, should provide for improved efficiency in operations at these two airports.

8.4.4 AVIATION ISSUES

The aviation issues of this scenario are identical to those of the Medium Find Scenario, section 6,4.4, page 199.

REFERENCES

Alaska Consultants, Inc., 1976. Marine service bases for offshore oil development. Prepared for Alaska Department of Community and Regional Affairs, Division of Community Planning. 87 pp.

Arctic Lighterage Company, 1979. Freight Tariff No. 2.A, Vessel Operating Common Carrier Tariff Naming Commodity Rates Between Alaska Ports Named Herein and Alaska ports and Points.

CH2M-Hill, 1976. Nome Barge Facility, City of Nome, Nome Alaska.

Corps of Engineers, Department of the Army, 1979. Waterborne Commerce of the United States. Part 4. Waterways and Harbors -- Pacific Coast, Alaska, and Hawaii. Vicksburg, Miss. 120 pp. Published annually, Reports from previous years also used.

Corps of Engineers, Department of the Army, 1978. Navigation and Flood Control, 1978 Project and Index, Rivers and Harbors, with Notice to Users, dated February 27, 1979. Anchorage, Alaska. 110 pp.

Dames & Moore, 1980. Bering-Norton Petroleum Development Scenarios (Sale 57), Technical Report No. 49. Prepared for Peat, Marwick, Mitchell & Co. as part of the Alaska OCS Socioeconomic Studies Program, Bureau of Land Management, Alaska OCS Office. Anchorage, Alaska. 199 pp and appendices.

Dennis Dooley and Associates, 1978. Beaufort Sea Petroleum Development Scenarios: Transportation Impacts, Technical Report No. 20, Prepared for Peat, Marwick, Mitchell & Co. as part of the Alaska OCS Socioeconomic Studies Program, Bureau of Land Management, Alaska OCS Office. Anchorage, Alaska. 163 pp.

Energy Resources Co., Inc. and E. G. Frankel, Inc., 1978. Study to Assess the Impact of Alaskan Petroleum Development on the Coast Guard through the Year 2000. Task 2, Marine Vessel Activity. Draft report. Prepared for U.S. Coast Guard. 158 pp and appendices.

Engelman, P., B. Tuck, J. O. Kreitner, and O. M. Dooley, 1978. Transportation and Development of Alaska Natural Resources. Federal-State Land Use Planning Commission for Alaska. Study 32. Anchorage, Alaska. 83 pp.

Engineering Computer Optecnomics, Inc., 1977. Final Report to the Federal-State Land Use Planning Commission for Alaska on Potential Port Site Assessment. 37 pp and appendices.

Federal Aviation Administration and Civil Aeronautics Board, 1977. Airport Activity Statistics of Certified. Route Air Carriers. 12 months ended June 30, 1977. Washington, D.C. 308 pp.

Federal Aviation Administration, 1979. Ten Year Plan - Alaska Region, 1981-1990.

Grundig, G., 1980. Problems and Prospects of the Small Alaska Air Carrier. Paper presented to Alaska Air Carriers Association Annual Convention, Anchorage, Alaska, February 21, 1980. 21 pp.

Horonjeff, R., 1975. Planning and Design of Airports. McGraw-Hill. 461 pp.

Institute of Social and Economic Research, University of Alaska, 1980. Bering-Norton Statewide and Regional Economic and Demographic Systems Impact Analysis. (Technical Report 50), Prepared for Peat, Marwick, Mitchell & Co. as part of the Alaska OCS Socioeconomic Studies Program, Bureau of Land Management, Alaska OCS Office. Anchorage, Alaska. 168 pp.

Kramer, L. S., V. C. Clark, and G. J. Cannelos, 1978. Planning for Offshore Oil Development. Gulf of Alaska OCS Handbook. Division of Community Planning, Alaska Department of Community and Regional Affairs. Juneau, Alaska. 257 pp.

Louis Berger and Associates, Inc., in association with Phillio Engineering and Architectural Service, Inc., 1979. Western and Arctic Alaska Transportation Study. Phase I Draft Report, Volume II, Aviation. Alaska Department of Transportation and Public Facilities. Fairbanks, Alaska.

______, 1979. Western and Arctic Alaska Transportation Study. Phase I Draft Report, Volume III, Marine. Alaska Department of Transportation and Public Facilities. Fairbanks, Alaska.

New England River Basin Commission, 1976. Factbook: Onshore Facilities Related to Offshore Oil and Gas Development. NERBC-RALY Project. The Commission. Boston, Massachusetts.

Parker Associates, 1979. Air Service to Rural Alaska: A Study in Inadequacy. Prepared under contract with The Division of Legislative Finance for the Alaska House Finance Committee. Juneau, Alaska. 219 pp.

Pacific Alaska Line, Inc., 1979. Freight Tariff No. 1-A; Vessel Operating Common Carrier Tariff, Naming Class and Commodity Rates between Seattle, Washington and Points in Alaska.

Peter Eakland and Associates, 1979a. Northern Gulf of Alaska (Sale No. 55) Petroleum Development Scenarios, Transportation Systems Impacts, Technical Report No. 31. Prepared for Peat, Marwick, Mitchell & Co. as part of the Alaska OCS Socioeconomic Studies Program, Bureau of Land Management, Alaska OCS Office. Anchorage, Alaska. 167 pp.

______, 1979b. Western Gulf of Alaska (Sale No. 46). Petroleum Development Scenarios, Transportation Systems Impacts, Technical Report No. 37. Prepared for Peat, Marwick, Mitchell & Co. as part of the Alaska OCS Socioeconomic Studies Program, Bureau of Land Management, Alaska OCS Office. Anchorage, Alaska. 263 pp and appendix.

______, 1979c. Lower Cook Inlet (Sale No. 60). Petroleum Development Scenarios, Transportation Systems Impacts, Technical Report No. 45. Prepared for Peat, Marwick, Mitchell & Co. as part of the Alaska OCS Socioeconomic Studies Program, Bureau of Land Management, Alaska OCS Office. Anchorage, Alaska. 284 pp with appendix.

Policy Analysts, Limited, 1980. Bering-Norton Petroleum Development Scenarios, Local Socioeconomic Systems Analysis. Technical Report 53. Prepared for Peat, Marwick, Mitchell & Co. as part of the Alaska OCS Socioeconomic Studies Program, Bureau of Land Management, Alaska OCS Office. Anchorage, Alaska. 585 pp.

Tryck, Nyman & Hayes, 1977. Recommended Community Development Plan. Prepared for the City of Unalaska. Anchorage, Alaska.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1979. United States Coast Pilot, Pacific and Arctic Coasts Alaska, Cape Spencer to Beaufort Sea. Ninth Edition.

*

APPENDIX A

GLOSSARY

Breakbulk: Loose freight which requires manual manipulation.

Bulkhead: A retaining wall along a waterfront.

a

Clamshell : A bucket or grapple having two hinged jaws used for excavating; or an excavating machine having a clamshell.

Containerized: Used to refer to cargo that can be stored and shipped in a standard size container or van-type trailer,

Crawler Crane: A crane that travels on endless chain belts like those of a caterpillar tractor.

Diurnal: Used in reference to tides having a daily cycle.

Drayage: A dray is a vehicle used to haul goods; specifically a strong, low cart or wagon without sides. Drayage refers to the work or cost of hauling by dray.

Dry Bulk: Refers to bulk commodities that can be moved by various types of conveyer systems.

Embayment: A small bay within a bay.

Jetty: A structure extended into the sea to protect a harbor.

Lighter: A large flat bottomed barge used for loading or unloading ships.

Linehaul: The transporting of cargo between major distribution terminals.

Liquid Bulk: Cargo that can be offloaded or loaded by pipeline.

Littoral: In a coastal region, the shore zone between high and low water marks,

Neobulk: Cargo which has been pre-loaded into boxes, crates, slings, pallets, or strapped to allow unloading by machinery.

Shoal : A sand bank or sand bar that makes the water become shallow.

Steel Sheet Piles: Typical' y, prefabricated interlocking vertical piles made of sheet steel.

Williwaw: A sudden violent wind.

APPENDIX B

TECHNICAL METHODOLOGY

8.1 Introduction

The purpose of this discussion is to present in detail the various technical aspects of the methodology employed in this study. The material included here n follows logically the overview discuss ion resented in Chapter 2.

The task of assessing the impact of oil and gas development in the Bering-Norton lease sale area on regional and statewide transportation systems requires an integrated methodology that can forecast transportation demands and requirements 'within the context of the Socioeconomic Studies Program (SESP). Of equal importance is the ability to assess the effects of these demands and requirements on available or anticipated facilities and services. The multi-disciplinary aspect of the SESP is enhanced to the extent that the forecasts are based on population and employment figures generated by concurrent studies in the SESP. In accordance with SESP policy, this assessment of impacts attempts to delimit the range of the more significant impacts of OCS development.

The value of impact assessments in the federal decision making process is the ability to pinpoint the cause of impacts and to relate causes to effects. The desirability of establishing causal relationships between demands and impacts requires that the methodology: (1) establish a set of base condi-ions to which incremental growth and developmental activities could be added; and (2) transportation demands and requirements be disaggregated as much as possible so that details of the impact can be examined. The material that follows begins with an explanation of the kinds of demands OCS places on the existing transportation system, together with a discussion of the ability of the oil industry to in part provide its own transportation services. Following that discussion is a detailed explanation of the methodologies and assumptions employed in forecasting the population related and OCS related transportation demands and in assessing marine and aviation facilities and services impacts.

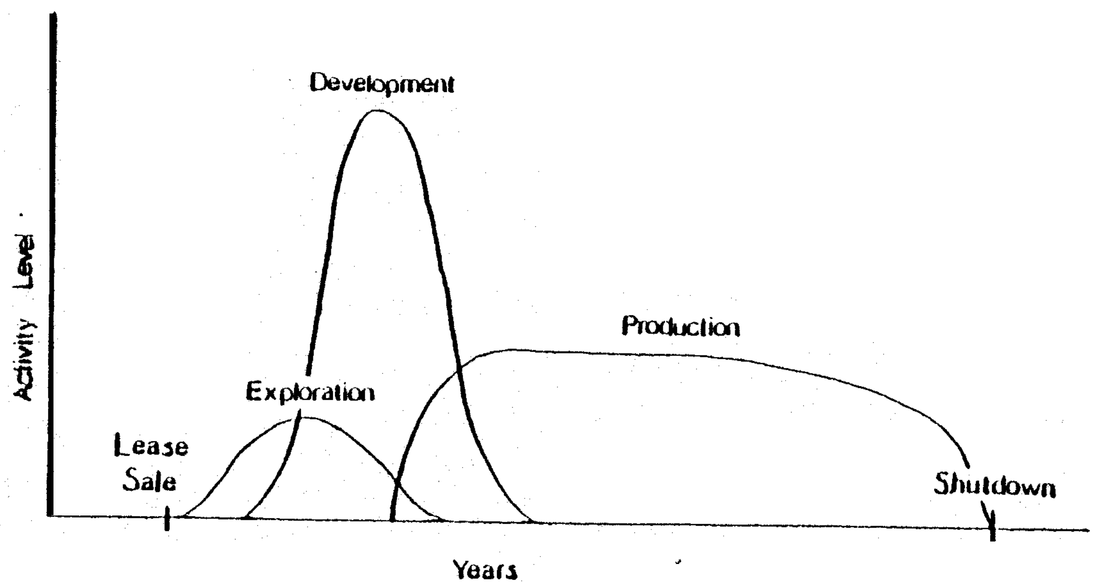
B.2 OCS Demands on Transportation Generally

The development of offshore oil and gas resources takes place in four overlapping stages as illustrated in Figure B-1: Exploration, development, production, and phase-out or shut down. From a transportation perspective, the type of activities occuring in each stage generally follow the pattern discussed below:

- Exploration. The exploration stage includes pre- and post-lease sale activities to discover and assess the location, quantity, and recoverability of oil and gas reserves. These include among other things the systematic drilling of tracts within the lease sale area. The major onshore requirement during exploration is for supply bases in harbors where drilling rigs and service vessels can receive drilling equipment, pipe, drilling mud, and other chemicals, as well

FIGURE B-1

Phases of Offshore Development



SOURCE: "Anticipating and Planning for the Impacts of OCS Oil and Gas Development" pamphlet presented at "Onshore Impacts of Outer Continental Shelf Oil and Gas Development," an ASPO training project, sponsored by U.S. Department of Interior and Environmental Protection Agency.

as consumable provisions. During this state of development when the prospect for new resources is unknown, oil companies and drilling contractors seek to minimize the investment in permanent facilities or equipment. In Nome, the service vessels cannot use the port due to the shallow water thus industry must provide alternatives such as anchoring supply and accommodation barges offshore.

From a transportation perspective, there is a need to employ tugs and anchor boats to bring the drilling rigs into the lease sale area and to position them over the planned tract. During this period, survey crews are making sure the rig is positioned properly. Once in place, drilling can begin. In support of the drilling activities, the supply boats bring fuel, drill pipe, and various drilling muds and chemicals to the rig on a regularly scheduled basis. In addition, food and other consumable items for the work crews on the rig are also brought on board. When crews rotate, there is generally a need for helicopter transportation to move one crew from the local airport to the rig and the other crew off the rig to a nearby airfield for deployment to their place of residence.

It is important to note in this stage, as well as in each of the subsequent stages of development, that movement of the rigs and various other pieces of equipment or other materials associated with OCS development requires specialized transportation services.

Offshore oil and gas activities, which occurred first in the Gulf of Mexico and later in the North Sea as well as other parts of the world, have produced specialized technologies and equipment together with companies to operate them. Oil and gas companies contract with these companies when the need arises rather than develop such capabilities in-house. Carriers now serving Alaska, it is assumed, would not compete for business where specialized vessels or expertise are required for such activities as moving goods from supply bases to offshore work sites, laying underwater pipelines, or in moving and positioning a rig. This degree of specialization has a significant effect on the range of impacts likely to occur in a particular lease sale area.

- Development. If sufficient recoverable resources are discovered through exploration, the industry may decide to proceed 'with development of the field. During development, production wells are drilled and offshore and onshore facilities are completed. Depending on the size of the find, the level of activity could be quite intense (witness the North Sea oil fields), Extremely large expenditures are required before production can begin after a discovery has been made. Once the decision to develop is reached, a field is put into production as soon as practicable and the oil recovered in as short a period as possible to maximize productivity of costly capital intensive activities. Consequently, oil companies to an extent will sacrifice costs to assure that established schedules are met.

In addition to servicing the drilling and other activities, which are an extension of the exploration phase, transportation services are needed to bring in construction materials for development of onshore facilities such as an expanded service base; a marine terminal for the storage and transshipment of oil; and/or an LNG terminal serving a similar function, if gas is associated with the oil field. The construction activity may also involve the expansion of existing marine facilities to provide the necessary berths and servicing facilities for supply boats and various linehaul carriers bringing in materials. Oil companies working adjacent leases normally agree to jointly operate supply bases, and this practice will be assumed. Unit agreements are also assumed in the development of oil terminals and LNG plants.

Pipeline construction, onshore and offshore, also begins during the development phase. Offshore pipes require a heavy cement coating in order to overcome buoyancy. Depending on the location, the pipe could be coated either at a yard outside the lease sale area or at a construction base in the lease area. If the coating is done in the lease sale area, then the raw pipe materials as well as cement, aggregate, and associated products must be brought into the area in advance of construction so that the coating can begin. Once coated, these pipes are then delivered to a lay barge which actually constructs the pipeline and lays it on the ocean floor. Later a bury barge will bury the pipe. The lay and bury barges are serviced by supply boats and anchor boats which position the barge in the correct location for the pipe and which keep the pipe laying/burying process supplied with necessary men and materials.

The development phase as illustrated in Figure 8-1 is characterized by its extreme peaking characteristics, largely due to the need to begin production as soon as possible. The construction and field development employment associated with this stage impose significant transportation demands on regional and interstate aviation transportation. The demand for workers typically can not be met locally either because a large number of workers are needed or because special skills are required. For example, the majority of OCS rig workers are highly qualified personnel not generally found in Alaska. They commute from their home of residence somewhere outside the state, work on the rigs for a specified period and rotate back home.

- Production. The production stage may continue for 20 or more years and involves the continuous production and transportation of oil and/or gas. Items of special concern during this stage include the maintenance of sufficient pressure to bring oil and gas to the surface; the prevention of blow-outs, spills and leakages; waste disposal problems; and the monitoring of all production functions. This stage requires long term storage facilities to support off-shore activities as well as support services for workers and, their families.

Production is characterized by a fairly constant level of demand over a relatively long period of time. OCS employees who operate and maintain the pumps and related equipment associated with production tend to be Alaska-based personnel due to the duration of this phase of work, and a considerable travel demand is placed on the intrastate aviation system because many of these employees are expected to locate in or near Anchorage and commute to work. In addition to employee transportation, other transportation demands during this stage are related to the use of oil tanker or LNG tanker support in moving the recovered resources from the oil field to refineries, typically along parts of the U.S. west coast. A fleet of tankers services each type resource on a regularly scheduled basis.

- Phase-out. When the petroleum resources cease to be economically or technically recoverable, industry closes down its production operations and plugs and abandons the wells. Many of the support facilities used by the oil companies during the exploration, development, or production phases may also be abandoned. Transportation demands during this phase of development are associated with the movement of recoverable pieces of equipment and machinery that have sufficient salvage value to warrant removal. Once these pieces of equipment are removed, the need for transportation services ceases.

3.3 General Assumptions Concerning Baseline Data

There are several general assumptions concerning the availability of information and use of available data in this study. First, it is assumed that there exists a strong set of historical information and data which can form the base for projections and analysis. Although portions of the available data set need to be verified or added to, without a good base or the assumption of a good base, the ability to carry the analysis into the future becomes more tenuous than the process has already made it. The second assumption is that the data that are available possess some predictable pattern or trend, or set of trends which can be utilized in forecasting. If the historical record has been fairly dynamic, or if unpredictable activities have created random patterns, or if such actions are anticipated in the future, there is little that can be done to develop an accurate future perspective. A third assumption is that there are reasonable methods or assumptions available to describe expected changes and to substitute for information that is not available.

3.4 General Assumptions Concerning Forecast Data

There are several general assumptions associated with the forecast data that govern the use of the data in this study. The first of these is the assumption of scope, which refers to the identification of analysis areas and the extent or level of detail of the analysis. It is important to remember that the analysis being conducted in this study is based on a set of extremely hypothetical and highly speculative scenarios of OCS oil and gas development. Those scenarios have an accuracy variation of plus or minus 100 percent. When those scenarios are extended through the SESP process and forecasts of population and economic changes are made, further assumptions and further extensions from the original set of values come about and the hypothetical character of the events becomes more acute. When that data s stretched still further with additional assumptions in this study, the credibility of the results is stretched considerably thin. That statement s not intended as an apology for the approach, rather a qualification that should be borne in mind when using the results. Tine objective of the study is to delimit the range of the most significant impacts and the methodology achieves that.

Because of the extended approach, an overly detailed analysis of the transportation system is unwarranted. How far to extend the analysis or how superficially to treat certain aspects of the evaluation are judgments made as the study progresses. To the extent possible these decisions are documented throughout this report. The lack of reliable and detailed information not only in the transportation sector, but in those activities on which the transportation analysis depends clearly precludes sophisticated approaches to the analysis,

The methodological model employed by the SESP is based on the assumption that OCS activities influence economic change, which in turn stimulates employment and population growth. Using comparative analysis techniques the study seeks to look at the effects of change.

Transportation demands resulting from OCS activities can be broken down into two basic types -- direct demands that can be derived from the schedule and nature of activities, and indirect, or induced demands that result from overall increases in population or disposable income. In the following discussion and throughout this report the direct demands are referred to as OCS demands and the indirect demands are referred to as population based or population related demands. Within this framework there are six categories of transportation demands, four of which are direct and two that are indirect. These are identified below and discussed in detail in the next two sections of this appendix: .

- INDIRECT
  - Population Based Dry Freight and Liquid Bulk
  - Population Based Air Passengers
- DIRECT
  - OCS Industrial Freight
  - OCS Consumables
  - OCS Resource Production
  - OCS Air Passengers

B.5 Population Based (Indirect) Transportation Demands

Population related transportation demands are forecast for dry freight and liquid bulk arriving by the marine mode and for air passengers on scheduled airlines. Forecasts covering the years 1983-2000 are made for the base case and for each of the OCS scenarios. The relationship that exists between population and demand 'in the base year is assumed to remain constant in future years. The forecasting process involves establishment of base year demands, computation of growth factors, and finally extrapolation of demand using the growth factors and base year demands. The resultant forecast demands are compared against capacities or threshold values, as appropriate. A detailed description of the process, first for the marine mode and next for the air mode, is described below.

B.5.1 POPULATION BASED DRY FREIGHT AND LIQUID BULK

The forecasting process for population based marine related dry freight and liquid bulk consists of three steps:

(1) Base Year Throughput Tonnage. The most recent such data available from secondary sources is for 1977, and this was chosen as the base year. After investigating the historic data it was found that substantial annual fluctuations have accursed. In Nome, 1977 (the selected base year) and 1972 data were examples of such fluctuations (see Table 6 in text). The use of regression analysis to correlate throughout tonnage to population changes produced unacceptable r-square values and the approach was discarded. Because the fluctuation occurred in the selected base year an attempt was made to adjust the base year data to better reflect an average condition. Annual per capita consumption was evaluated and an average base year rate of 3 tons per person per year 'was established.

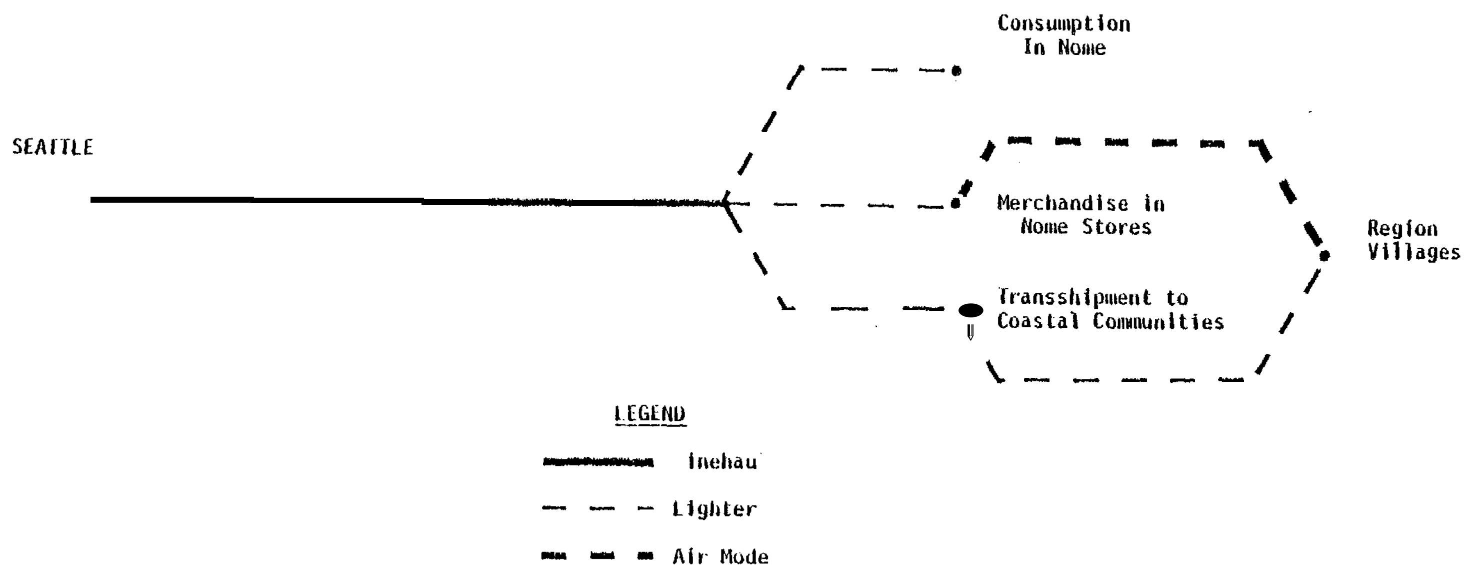
(2) Dry Cargo and Liquid Bulk Distribution Factors. The operation of the port at Nome is quite different than the operation of ports previously analyzed by the SESP. The difference is that the Port of Nome operates via a lighteraging service so that linehaul vessels do not have direct access to the port. Although that factor in and of itself required a different approach in dealing with capacity questions, more important was that the port performs a transshipment function, delivering dry cargo and liquid bulk to coastal communities in the region. Because of this additional activity, the distribution of throughput tonnage to Nome versus that transshipped to outport coastal communities needed to be assessed.

Two problems compounded this assessment. First, because of the way goods are distributed in the Bering-Norton region, and second because of a lack of transportation data, the assessment could not develop population based consumption data separately for the region outside of Nome and for Nome proper, Typical goods movements are illustrated in Figure B-2. Both dry freight and liquid bulk inbound to Nome (typically from Seattle) are distributed in one of three ways: To households in Nome as consumable goods, to stores in Nome as salable merchandise, and to coastal villages as transshipped goods. Some goods that become merchandise are later purchased and transshipped to regional villages via the air mode, typically as mail. Data on the quantities of goods moved along each of these paths is not available. The necessary population data is also of questionable value and is incomplete. These problems coupled with the fact that the population

FIGURE B-2

ILLUSTRATION OF TYPICAL GOODS MOVEMENT

BERING-NORTON REGION



projections being prepared for the Bering-Norton region and for Nome proper were based on differing methodologies, and thus incompatible, lead to abandonment of this approach to find distributional factors.

Instead, it was assumed that the distribution of goods to the region and to Nome proper will continue to be in the same proportion of total throughput tonnage as in the base year. However, since such data was unavailable for the base year, a set of average base year relationships was developed using 1980 forecast data assembled by Arctic Lighterage Company. See the discussion in Chapter 3, Section 2.1.1.

(3) Development of Growth Factors. Regional and local population forecasts developed by other subcontractors in the SESP are converted into annual growth factors by dividing the forecast for each horizon year by the base year population. This is accomplished for the base case as 'well as for each of the OCS scenario cases, for each year of the study period. This data is presented in various tables in the text.

B.5.2 POPULATION BASED AIR PASSENGERS

The process of forecasting passenger movements on scheduled airlines uses the same growth factors and general approach as with the marine mode. However, the forecasting occurs for each of the major air routes or links rather than terminal points. The process is as follows:

(1) Development of Links to be Analyzed. Since the majority of OCS employees in the Bering-Norton region will reside both outside that region as well as outside the state, linkages between Nome and Anchorage and Name and Fairbanks together with interstate linkages between Anchorage and Seattle were initially evaluated. On the assumption that Anchorage will continue to serve as the major interstate terminal, the analysis concluded that air passenger movements would be primarily concentrated on the Nome-Anchorage and Anchorage-Seattle linkages.

Intraregional travel was also evaluated. The existing system has many problems and data are limited and incomplete. Furthermore, the number of assumptions necessary to distribute OCS employment throughout the region and to evaluate it was deemed to be beyond the credibility of this evaluation and it was decided to treat intraregional travel demands as a complete system rather than as individual travel links.

(2) Development of Base Year, Peak Week Traffic Values. Data were collected for scheduled passenger service by carrier and route from the Civil Aeronautics Board and the Alaska Transportation Commission, as appropriate. August, 1978, was used as the base period to determine the percentage of annual enplaned passengers traveling in the peak month. That percentage was then used on the 1977 enplaned passenger data to identify peak month demand in 1977. The resultant base year figure was multiplied by 7/31 (0.226) to produce an estimate of base year peak month average weekly trips.

(3) Development of Forecast Year Air Passenger Demands. Two basic assumptions were made in the conduct of this step of the analysis. First, growth in air passenger service is assumed to be wholly related to population growth of the smaller community for each city pair link. Second, the ratio between population and traffic between city pairs is expected to remain constant in the future. The same growth factors used in developing the marine transportation forecasts were used in extrapolating the aviation demands. It should be noted that in the scenario cases the population base includes local OCS employees, but excludes non-local OCS employees. Their movements are forecast separately as a direct transportation demand. Peak month average weekly passenger forecasts were prepared for the Nome-Anchorage and Anchorage-Seattle links and are displayed in various tables in the text.

3.6 OCS Based (Direct) Transportation Demands

OCS activities have no historic reference in most of the areas of Alaska being studied. Use of the growth factor characteristic would be inappropriate in projecting OCS activities, because those activities are related more to the magnitude of the discovered and recoverable resource rather than to any function of the local economy. As a result, the forecast of OCS activities are more specialized, dealing with each of the major activity areas. The following sections discuss the individual assumptions and aspects of each of these areas of analysis.

B.6.1 OCS INDUSTRIAL FREIGHT

Industrial freight for OCS oil and gas activities supports two general activities -- drilling and construction. Quantities for the two activities are not considered to be additive, since different facilities would be used except in rare circumstances. These are discussed below.

B.6.1.1 Inbound Drilling Supplies

Table B-1 summarizes the estimated material requirements for individual exploration and development wells at depths outlined in the Lease Sale No. 57 scenarios. Development wells are assumed to require 80 percent of the materials per foot needed for exploration 'wells, except for water which will retain the same per foot requirements. At the exploratory stage, it is uncertain what drilling conditions will be encountered, and wells must be designed for a wide range of conditions. At the development stage, conditions are better known, and an optimum design can be made except for drill pipe. Tonnages for a 4,627 meter (14,000 ft.) well developed for the Alaska Department of Community and Regional Affairs (Alaska Consultants, 1976) are scaled down for the development well depth of 3,505 meters (11,500 ft.). Drill pipe tonnages are based on data prepared for the Beaufort Sea Environmental Impact Statement (Bureau of Land Management, 1979). 11

All materials are assumed to go to supply bases or offshore storage areas by barge or in the case of fuel, by small tanker or tanker barge. Supply

TABLE B-1

MATERIALS REQUIRED FOR DRILLING ACTIVITIES

Material	Quantity	Tons	Barge Loads (4,6)	Supply Boat Trips (5,7)
	Oil and Gas Exploration (2) Depth 11,500 feet			
Drill Pipe: (1)				
36 in.	100 ft.	7.7		
20 in.	1,000 ft.	66.5		
?3-3/8 in.	3,500 ft.	119.0		
9-5/8 in.	8,000 ft.	212.0		
		402.2	0.07	0.94
Dry Bulk:				
Bentonite		575		
Cement		246		
Barite		288		
		1,109	0.18	7.08
Fuel :		1,971	0.39	5.33
Drill Mater		3,080	N/A	6.25

Notes: (1) Drill pipe sizes, quantities, and unit weights obtained from Bureau of Land Management Beaufort Sea OCS Draft EIS, 1979.

(2) Quantities for bulk materials, fuel, and water are scaled down from material requirements for 14,000-foot well as shown on ?age 81 of "Marine Services Bases for Offshore Development," Alaska Consultants, 1976.

(3) Development wells are assumed to require 80% of materials/foot as needed for exploration wells except of water. See Page 57 of reference cited in Note (2) above.

(4) Barge loads are cumulative by type of commodity.

(5) Supply boat loads are not cumulative as commodity spaces are not interchangeable. The largest number dominates.

(5) Barge loads are based on average barge capacities of 6,000 short tons.

(7) Minimum supply boat trips are based on commodity capacities contained on Page 82 of reference cited in Note (2) above.

boats move all goods from the bases to the drill rigs and platforms. Table B-1 shows the approximate number of barges and supply boats needed to move the required tonnage of a given commodity to drill one well. The barge requirements *are* cumulative, because each commodity would likely arrive on a separate barge. Assure ng an average barge load of 5,443 metric tons (6,000 tons), each exp oratory well will require 0.40 barge loads of fuel and each development well 0.23. Drilling will occur year-round on the gravel islands, but only about eight months on the rigs. This will require a steady flow of barge traffic. Greater productivity during the summer months will result in corresponding increases in logistics requirements during this period.

Supply boats have a draft of 4.9 meters (16 ft.) and are designed to carry a variety of commod ties. They have enclosed areas for carrying fue , drill water, and dry bulk and have deck storage areas that are used for carrying pipe. The estimate of required supply boat trips for each type of commodity is based on capacities for a typical 61.0 meter (200 ft.) supply boat (Alaska Consultants, 1976). Unlike for barges, the resulting figures are not additive. The largest figure pinpoints the controlling commodity, which for exploratory wells is dry bulk followed closely by drill water. Drill water, fuel, and dry bulk all are in the same range, while drill pipe has a much smaller value. On a tonnage basis, drill water is the critical commodity. For each exploratory well, it represents 47 percent of the required tonnage. For Bering-Norton offshore activities, it is assumed that fuel will be supplied from storage in Nome, which in turn is supplied from storage areas in Unalaska/Dutch Harbor or Seattle.

Data in Table B-1 can be used to forecast the 'number of barges and supply boats minimally required to meet the logistics requirement *for* well drilling. The estimate for supply boats will significantly underestimate the actual number of round trips carried out. The minimum number of trips will not occur for a variety of reasons, including weather, the need to reduce turnaround time because of competition for berthing spaces, and the location of drilling operations. Also, supply boats are called upon during development to serve functions other than making deliveries to platforms. Supply boat movements, thus, are forecast separately,

The potential for conflicts between normal shipping operations to a community and logistics for OCS drilling varies from community to community, and individual circumstances must be recognized. The proposed existence of a service base facility at Cape Nome is not expected to affect normal operations into Port Nome.

B.6.1.2 Construction Materials

Construction activ ties can be separated into offshore pipelaying, platform installation, and onshore facilities including support bases, LNG plants, oil terminals, and onshore pipelines.

Platform installation, although it requires six support vessels, does not produce measurable impacts on the transportation systems, because the platforms are moved directly to where they will be installed from construction sites outside of Alaska.

Careful planning for construction of onshore facilities will be required because of the oversized shipments that will be involved and the need to move a large amount of tonnage during relatively short periods. For the most part, shipments will be delivered directly to work sites, and construction docks will be built. Initially, however, some construction equipment is anticipated to be moved through Nome Harbor.

Transportation impacts related to offshore pipelines may occur only at Cape Nome if a concrete-coating plant is established in the lease sale area. If this happens, the inbound uncoated pipe is assumed to arrive by barge the year before laying occurs. Pipe is coated to a sufficient thickness that it will sink if filled with air. Thus, the weight of the coated pipe must be significantly greater than the uncoated pipe, particularly for the larger diameters. The relatively short season for pipe-laying barges, May-October, and the large weight of the coated pipe produces significant outbound tonnages. The short season for pipelaying barges will create a potential for congestion greater than the tonnages would indicate. Tugs and barges can be expected to deliver coated pipe to offshore work sites. The barge would lay alongside until its supply of pipe was depleted and would then be replaced by another barge. Supply boats would be used to carry some of the pipe, but to use them exclusively for this purpose would unnecessarily divert them from other activities which would better use their capabilities. Onshore pipeline supplies will be delivered directly to work sites.

If the pipe coating plant is not established in the lease sale area, coated pipe is expected to be shipped from a Lower 48 pipe coating yard directly to the pipelaying barge in the year of construction. These supply barges would be used in the fashion as described above. In the text, forecasts for either eventuality are presented.

B.6.1.3 Outbound Logistics

Supply boats serve a variety of functions from anchor handling for pipe-laying barges to resupply missions. For some offshore activities, supply boats move offshore employees to and from offshore work sites, but it is assumed that this task will be performed exclusively by helicopters, Typical values of required boat trips per month have been established for each offshore activity (Alaska Consultants, 1976). This information is summarized *in* Table B-2. The peak summer period is used for computing the number of monthly supply boat round trips that will use each supply base.

B.6.2 OCS PASSENGER MOVEMENTS

S.6.2.1 Description of Terms

The generation of OCS employment-related transportation demands, which "includes passenger movements, requires information from the scenarios and both the regional and local socioeconomic studies. The information needed is summarized in Table B-3. The rotation factor and job duration are derived directly from the scenarios, which provide onsite average monthly

TABLE B-2

SUPPLY BOAT MOVEMENTS BY ACTIVITY

Phase	Activity	Trips/Month	Time of Year	Berth Requirements[1]
A. Exploration	1 Well Drilling	12/rig	Year-round	3.33 rigs/berth
B. Development	1. Well Drilling	20/rig[2]	Year-round	2 platforms/berth (1 rig) 1 platform/berth (2 rigs)
	2. Platform Installation	24/platform (6 vessels, 4 resupplies/month)	May-October	1.67 platforms/berth
	3. Offshore Pipeline Construction	43/80.5 km (50 mi.) of pipeline/year	May-October	0.93 pipelines per year maximum of 80.5 km (50 mi.)/berth
	• Pipe-laying	15/barge (all goods except pipe)[3] 16/barge for anchor handling		
	• Pipe-burying	12/barge		
C. Production	1. Resupply	4/platform	Year-round	10 platforms/berth

Notes: (1) Based on one berth accommodating a maximum of 40 trips/month.
(2) Berth requirements for development drilling based on comparison of well depth and number of wells drilled per year for exploration and development wells.
(3) Assumes that all pipe will be delivered directly from barges to pipe-laying barges and will not

TABLE B-3

CHARACTERISTICS OF OCS EMPLOYMENT TRIP-MAKING BY TASK

Employment Sectors for Petroleum Operations	Development	Rotation Factor(1)	Duration(2)	Residency(3)(4)	Round-Trips per Month(5)	Estimated Share of Employment to Alaskan Residents, Year: 1979-84	1985-89	1990
ONSHORE								
1. Service Base	Exploration	1	P	L	NA	1.0	1.0	1.0
	Development	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1.0	1.0	1.0
	Production	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1.0	1.0	1.0
2. Helicopter Service	Exploration	2	P	0.5L/0.5NL	0.717	0.75	0.75	0.75
	Development	1.5	P	L	NA	1.0	1.0	1.0
	Production	1	P	L	NA	1.0	1.0	1.0
3. Service Base Const.	Development	(1.11)	T	(0.1L/0.9NL)	(0.430)	.5	.525	.578
4. Pipe Coating	Development	1.11	T	NL	0.430	.2	.21	.231
5. Onshore Pipeline Const.	Development	(1.11)	T	(0.1L/0.9NL)	(0.430)	.2	.21	.231
6. Oil Terminal Const.	Development	(1.11)	T	(0.05L/0.95NL)	(0.430)	.5	.525	.578
7. LNG Plant Const.	Development	(1.11)	T	(0.05L/0.95NL)	(0.430)	.5	.525	.578
8. Concrete Plat. Const.	Development	-	-		-			
9. Oil Terminal Operations	Production	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1.0	1.0	1.0
10. LNG Plant Operations	Production	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1.0	1.0	1.0
OFFSHORE								
11. Surveys	Exploration	1	T	NL	0.717	.2	.21	.231
12. Rigs	Exploration	2	T	0.1L/0.9NL	0.717	.2	.21	.231
13. Platforms	Development	2	P	0.3L/0.7NL	0.717	.1	.3	.33
	Production	1	P	0.7L/0.3NL	0.717	1.0	1.0	1.0
14. Platform Installation	Development	2	T	0.1L/0.9NL	0.717	.1	.105	.116
15. Offshore Pipeline Cons.	Development	2	T	0.1L/0.9NL	0.717	.1	.105	.116
16. Supply-Anchor-Tugboats	Exploration	.5	T	0.2L/0.8NL	0.717	.4	.42	.462
	Development	.5	T	0.3L/0.7NL	0.717	.8	.88	.968
	Production	.5	P	0.8L/0.2NL	0.717	.8	.88	.968

Notes: (See following page.)

TABLE B-3

CHARACTERISTICS OF OCS EMPLOYMENT TRIP-MAKING BY TASK

Notes: (.1) Rotation factor is defined as follows:

$$1 + \frac{\text{number of weeks offsite}}{\text{number of weeks onsite}}$$

Multiplying the onsite employment by the rotation factor produces total employment for a given task.

(2) T = temporary; P = permanent.

(3) L = local; NL = non-local (Alaskan or non-Alaskan). For offshore activities and onshore activities, local is considered to be Nome and surrounding area.

(4) Material in parentheses refers to onshore activities at Afognak Island. Onshore activities without parentheses refer to Homer and/or Kenai.

(5) Computation of round trips per month for each rotation factor was as follows:

(4,3 weeks/month) / (weeks onsite + weeks offsite).

Rotation Factor	Weeks Onsite	Weeks Offsite	Round Trips per Month
1.1	9	1	0.430
1.5	4	2	0.717
2.0	3	3	0.717

(6) No concrete platforms.

Source: Rotation factors - Dames & Moore, 1979;
SEAR factors - ISER, 1979;
Residency - Alaska Consultants, 1979;
otherwise, Peter Eakland and Associates, 1979.

employment for the sale area by task. Total average monthly employment, which includes those employees that are onsite (on duty) and offsite (off duty) is obtained by multiplying the onsite employment by the rotation factor.

The residency and SEAR Share of Employment to Alaska Residents) factors enable the employment f·gures *for* the entire lease sale area to be dis-aggregated by community into local, non-local Alaskan, and non-Alaskan employees. The latter breaks down employment into Alaskan and non-Alaskan segments, and the former breaks down employment into local and non-local segments.

"Local resident" has different meanings depending upon the location of the work site, **however,** in this study, local means the community in which the activity occurs (Nome and surroundings).

Passenger movements can be computed using round trip per month factors computed for each task, This factor is the ratio of the weeks in a month (4.3) to an employee's rotation cycle (onsite weeks and offsite weeks).

5.6.2.2 Helicopter Operations

To obtain peak weekly helicopter operations, total offshore employment is first obtained for each service base. Employees for supply, anchor, and tug boats are not included since rotation for these tasks *occurs* when the boats are in port. Employment is then converted to round trips using a factor of 0.717, which is applicable for employees having rotation factors of either 1.5 or 2.0. The likelihood that all employees would be allowed offsite time prompted the use of a single factor for offshore employment despite the use of 1.0 rotation factors for survey and platform production work. Final conversion to helicopter trips is based on an average load of 14 employees per trip, which is the equivalent of one-half a drilling crew, and a peaking factor of 2.0. Twin-engine helicopters, which are expected to provide most of the personnel movements to and from shore bases, have a capacity of 20-22 persons but the helicopters do not usually operate full. The excess capacity provides allowance for light cargo shipments and trips by transient persons, such as company or government officials. The 2.0 peak factor was decided upon after comparing monthly average employment for each year to the estimated employment in July of the same year.

Helicopter operations are assumed to be based out of Nome.

B.6.2.3 OCS Air Carrier Passenger Movements

This category of transportation demand includes trips between service bases and residences. intrastate trips accommodate employees that are non-local Alaskans. They live in Alaska but do not reside in the community in which the helicopters are based. Local trips involve persons residing in the Nome area who are transported from work sites offshore to Nome by helicopter. The movement of non-Alaskans from the service base to and from points outside of the state constitute interstate trips. Both interstate and intrastate trips will use links within the state. The distinction between the two types of trips is based upon the final destination. Both categories are assumed to use existing scheduled carriers rather than chartered aircraft. Non-local Alaskans are expected to live primarily in Anchorage. For non-Alaskans, Seattle is assumed to be the final destination, although many may continue their trips to the south or east.

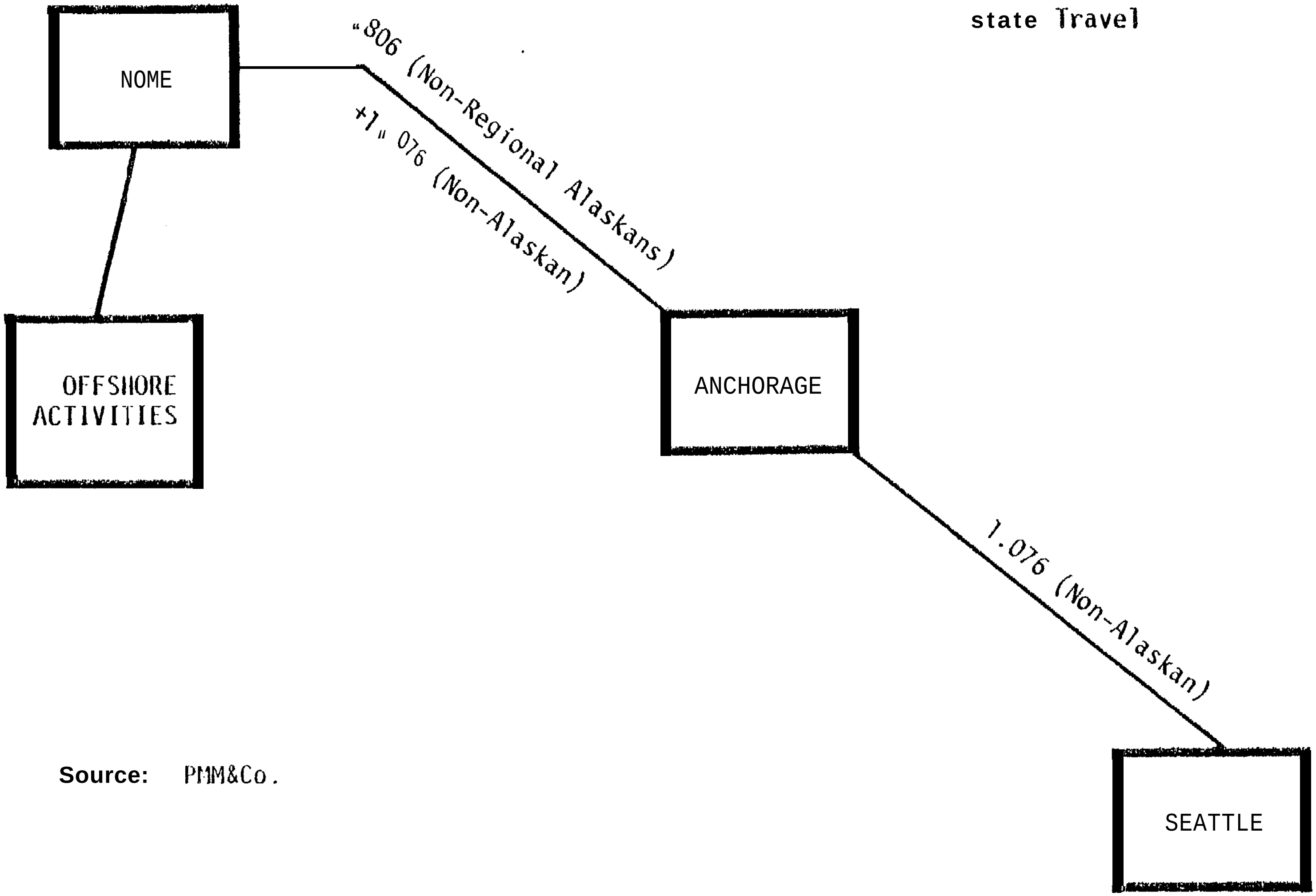
The final step of the analysis for the service base for each scenario is to assign weekly trips to the air travel links shown in Figure B-3. The analysis is limited to outbound trips from the service bases, since return trips are the same in number and are assumed to travel over the same links but in reverse.

Figure B-4 is a flow chart showing the factors and intermediate results needed to develop the link volumes. 30X No. 11 is the final result, peak weekly outbound trip link volumes for each scenario. Number 1 through 9 require three iterations, based on three scenarios (low, medium, and high). The Roman numerals represent factors and data required for the step-by-step transformations eventually leading to link volumes.

Separate processes are shown for the transformation of onshore ant! offshore employment data although the processes involve the same steps. Both are provided to emphasize that conversion factors differ significantly for the two types of employment. Also, several of the onshore and offshore interim products are used in estimating other transportation demands, which would be obscured by showing a single process. Interim product 2A, for example,

Figure B-3

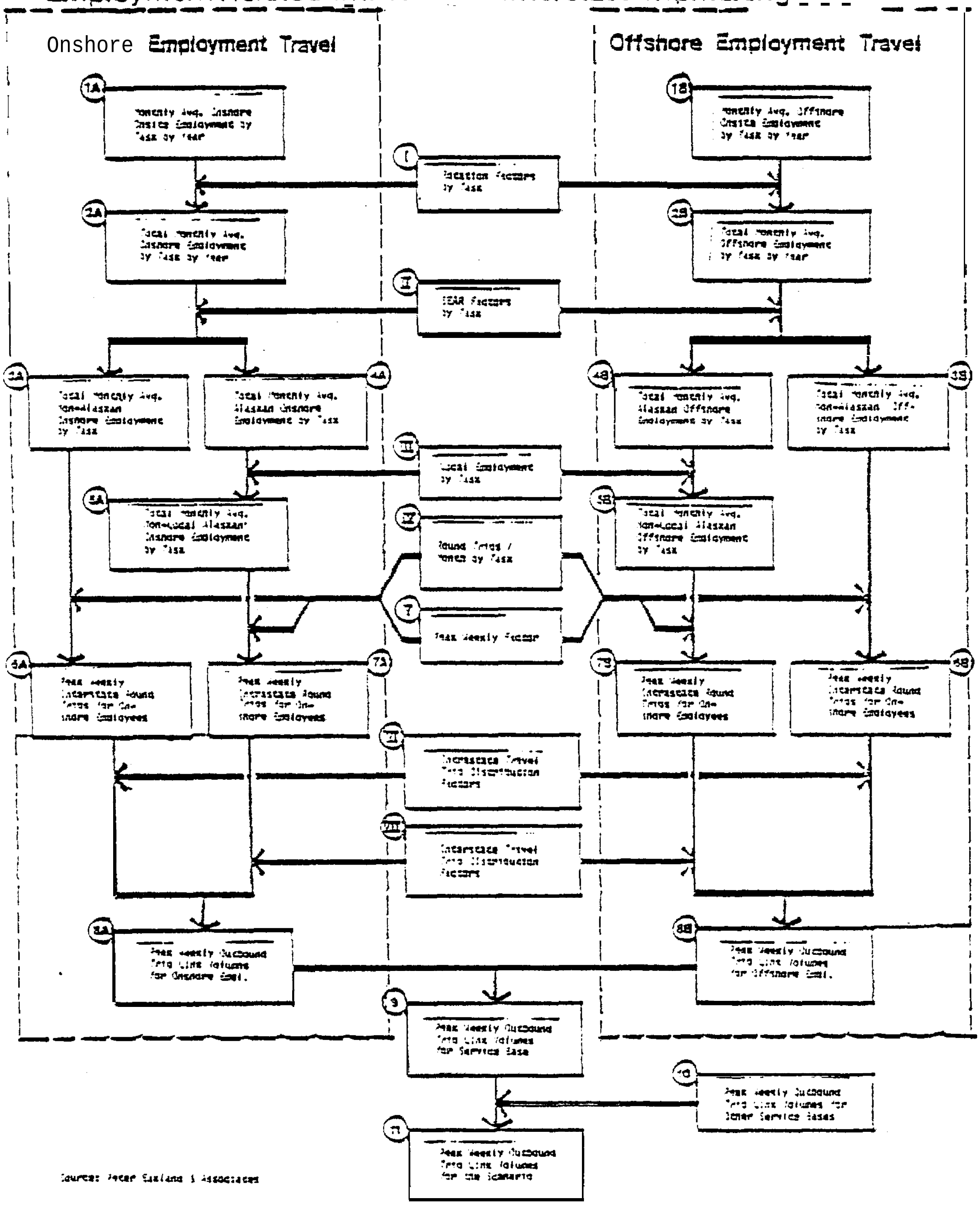
Bering-Norton Lease Sale 57 Assignment to Air Links of **Outbound Intrastate and Interstate Travel**



Source: PMM&Co.

FIGURE B-4

Employment Related Intrastate & Interstate Tripmaking



is the input for computing helicopter operations. The breakdown between onshore. and offshore employment is provided *in* the scenarios, continued in the local studies, and for continuity purposes, is carried forward into the assessment of transportation impacts.

The process begins with monthly average onsite employment by task by year. These figures are derived as part of local studies using scenario information as basic input. Because tasks can have different values for each factor, employment by task is maintained until step 6. Total employment (Box 2) is computed by multiplying onsi te employment (Box 1) by the . appropriate rotation factors (Box I). SEAR factors (Box II) then are used . to allocate employment into Alaskan (Box 4) and non-Alaskan (Box 3) categories, Subtracting local employment (Box III) from the Alaskan employment for each task produces non-local Alaskan employment (Box 5).

Once average monthly employment has been broken down into non-Alaskan and non-local Alaskan figures, they are then converted into peak weekly intrastate (Box 7.) and interstate (Box 6) trips. The combined factor used is as follows: (round trips/month by task) (1.5) / (4.3 weeks/month).

The peak factor, 1.5, was determined by comparing average monthly employment with July employment for the same year. A week is used as the *time* unit for traffic demand to facilitate comparison with existing services which publish weekly schedules.

Distribution factors (Boxes VI and VII), which have already been described, are used to assign the trips to specific links (Box 8). The final step is to combine offshore and onshore link volumes for offshore and onshore employment generated by the service base.

B.6.3 OCS CONSUMABLES

This category represents freight, primarily foodstuffs, needed to sustain the work force that does *not* live and work in the same area. Workers in this situation are all offshore workers and non-local, onshore employees. Those in the latter category are primarily involved in construction. Tine employment figure used to compute consumable requirements is the sum of three intermediate results shown in Figure B-4 -- 2A, 38, and 5B. It is multiplied by an assumed daily consumption of 4.54 kilograms (10 pounds) per person (Peter Eakland and Associates, 1979b). Consumables most likely will travel by established marine services in containers,

B.6.4 OCS OIL AND GAS PRODUCTION

When oil and gas production begin, there is a need to begin transporting the crude oil and LNG products to refineries and markets. The scenarios established that crude oil will be transported in 70,000 DWT to 120,000 DWT tankers while LNG will be transported in 130,000 cubic meter LNG tankers. The number of trips required per year for each type tanker is obtained by dividing annual production by tanker capacity.

B.7 Threshold and Impact Methodology

Methods must be developed to assess the impact of the changes in the various categories of transportation demand caused directly and indirectly by OCS activities. For several categories, thresholds can be computed based on the service or equipment capacity of a given link or terminal. In other cases, accepted standards can be used directly. Finally, in some cases, qualitative analyses will represent the only means of assessing impacts. In the following sections, the impact methodologies are discussed by mode.

B.7.1 WATER MODE

8.7.1.1 Port Capacity

Nome harbor is unique when compared to ports previously analyzed as part of the OCS program because it restricts direct access by linehaul vessels and requires a lighteraging operation. The concept of berth occupancy which was used previously to determine port capacity is not applicable in Nome. Instead, an alternative approach looked at existing equipment capacity based on daily discharge capacity, as well as practical capacity limitations due to navigation restrictions, the later being qualitatively determined from conversations with the lighteraging company. Details of the analysis are included in the text, Chapter 3.

6.7.1.2 Vessel Routes

Criteria do not exist regarding the level of vessel traffic that is required to justify the establishment of formal traffic lanes. Factors used in determining whether to set up such lanes include the following: Numbers of vessels by size and cargo; navigational conditions; nature and location of obstructions; and potential interference with fishing operations. A recommended width for traffic lanes in the Gulf of Alaska, should they be established, is 4.0 kilometers (2.5 miles)(ERCO, 1978). This distance is recommended whether or not separation zones are provided. This width would enable a two-way safety fairway to be upgraded to a traffic separation system at a later date.

No recommendations or analysis of the need for fairways or other control systems in the Bering Sea were made as part of this study. However, it is likely that further OCS exploration and development in the southern Bering Sea area may require such control systems as the number of tankers, cargo ships, and barges passing through the Aleutian islands increases.

B.7.2 AIR MODE

Thresholds for the air mode are of three types -- physical characteristics of runways and terminals; weather minimums; and available passenger and freight space offered by carriers over specified links.

6.7.2.1 Air Passenger Thresholds

Forecasting is independently performed for induced and direct OCS air transportation demands on each non-stop link. These figures, in the form of peak monthly weekly ridership, are then combined since it is assumed that all interstate travel related to movements of OCS employees will be on scheduled carriers. The passenger totals are converted into aircraft flights based on three variables, as follows, for each non-stop link: (1) Distribution of passengers by aircraft type; (2) threshold load factors; and (3) Seats per plane. The aircraft types are expected to remain similar to those used at present. A load factor of 0.3 is used on all intrastate air carrier flights, which are assumed to utilize jet aircraft. On the Nome-Anchorage 1 ink these aircraft were assumed to have 110 seats, but for the Anchorage-Seattle link a weighted average of 128 seats per flight was used .

No thresholds have been established for passenger terminal facilities, Qualitative assessments of impacts wil l be made based *on* the forecasts of passenger loadings and unloading.

5.7.2.2 Airport Facilities

For runways, a length of 1,524 meters (.5,000 feet) is adequate to serve both jets and Hercules C-130 freight aircraft. Weather minimums are based on local geography, navigational aids present at an airport, type of aircraft, and whether instrument approaches are possible.

The Federal Aviation Administration has set criteria for establishing and discontinuing facilities and services. For an airport to be considered for installment of an airport traffic control tower, the sum of three ratios, which are computed as follows, must be one or greater: (1) Air carrier operations/15,000; (2) Air taxi operations/25,000; and (3) General aviation and military operations (local plus itinerant)/200,000 (FAA, 1974).

Practical annual capacities based on runway configuration only have been computed for airports at Nome and Kotzebue by the FAA. These "guesstimates" as FAA referred to them, were used to evaluate peak aviation operations. It is assumed that air taxi and general aviation operations, which make up approximately 80 percent of total operations, are directly related to the areawide population.