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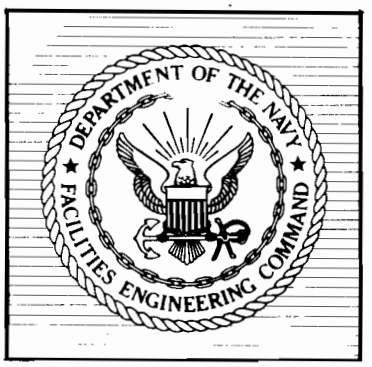
REGIONAL MASTER PLAN

BARROW REGION, ALASKA



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NAVAL FACILITIES ENGINEERING COMMAND

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BARROW REGIONAL MASTER PLAN

BARROW, ALASKA

May 1973

Prepared for: The Barrow Intergovernmental Coordinating Committee

Prepared by: John Graham and Company

Contract Administered by: Western Division, Naval Facilities Engineering Command

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MEMBERS OF THE BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE*

ARCTIC SLOPE NATIVE ASSOCIATION, LTD.

BUREAU OF INDIAN AFFAIRS

CITY OF BARROW

PUBLIC HEALTH SERVICE

STATE OF ALASKA

U. S. NAVY

The Barrow Intergovernmental Coordinating Committee was founded in 1971. Its purpose is to coordinate governmental activities and programs within the region. Its principal functions are

- To collect data regarding all projects related to the region
- To coordinate the information and maintain coordination
- To develop a regional master plan
- To make recommendations based on the plan
- To monitor progress of the implementation of the plan

* Although representatives of these organizations serve as members of the Committee, there are many other federal, state, and local agencies that have programs within the region.

FOREWORD

The primary objective of the regional master plan is to identify, study, and propose solutions to those physical problems which are of concern to the city of Barrow, and to the various government agencies in the region. It should eliminate the requirement for each activity or agency to attempt to solve regional problems in order to satisfy its own individual needs. It must also take into consideration the social, economic, and political characteristics of the Barrow region in order to propose development plans which are realistically capable of being implemented. The plan should provide a general guide for the future development of that area within a 10-mile radius of the city of Barrow.

The normal steps in preparing a plan consist of the inventory and analysis of physical, social, economic, and environmental factors; the identification of the goals of the region and its problems; the preparation of alternative means of meeting these objectives and solving the problems; and the means of implementing the recommendations contained within the plan.

The plan is more than just a map illustrating locations for various land uses, highways, and utilities. The most important element of the plan is the set of alternatives which describe how certain actions will affect the region.

The regional master plan for Barrow recognizes the culture of the people within the community and their immediate needs. It also recognizes the important role that government has played, not only in scientific research, education, medical treatment, military defense and aviation, but also in providing employment opportunity for residents of the community.

In 1970 the Alaska State Housing Authority (ASHA) prepared the *Comprehensive Development Plan* for the city of Barrow. In response to the need for considering problems on a larger scale, the Western Division of Naval Facilities Engineering Command prepared the *Preliminary Regional Master Plan* in 1971. Both documents contain valuable background data and serve as a framework for the preparation of this current planning project.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF PLATES

EXECUTIVE SUMMARY

I. EXECUTIVE SUMMARY

LOCATION

The Barrow region is the northernmost area of the United States and is bordered by the Arctic Ocean on the north and relatively level tundra which extends inland to the Brooks Range. The Barrow region is a part of that area of Alaska known as the North Slope. For purposes of this study, the Barrow region has been defined as that geographic area within a 10-mile radius of the center of the city of Barrow. This area includes the Naval Arctic Research Laboratory, located 4 miles northeast of the city.

AUTHORIZATION

This Barrow Regional Master Plan was prepared for the Barrow Intergovernmental Coordinating Committee by John Graham and Company. The contract was administered by the Western Division, Naval Facilities Engineering Command. Funding was provided by the Bureau of Indian Affairs, the City of Barrow, the U. S. Public Health Service, the State of Alaska, and the U. S. Navy.

EXISTING CONCERNS

A multitude of governmental agencies are located within the Barrow region, each with its respective area of concern. Considerable interagency coordination has occurred in the past, due primarily to the efforts of the Barrow Intergovernmental Coordinating Committee. The variety of services provided by these agencies include educational and medical care programs, street maintenance, operation of airports and an incinerator, and research programs dealing with the arctic biome. Social programs now underway are expected to be major steps in enhancing the life style of the region's populus. However, the intricate role of individual government agencies and the complexity of development programs will require close coordination among all agencies, including the North Slope Borough.

REGIONAL PROBLEMS

Constraints and influences to develop in the study area include (1) inherent ecologic sensitivity of the tundra as a land base; (2) hostile climatic conditions, including winter winds which can create chill factors of -95 F; and (3) increased construction and freight costs due to the remoteness of the area.

Existing problems within the region include a high rate of unemployment, lack of adequate water supply and distribution and sanitary sewage systems, and the absence of emergency power and gas backup in case of a system failure. The on-going transition from a subsistence life to a cash economy is posing serious social adjustment problems for the natives.

OBJECTIVE

The objective of this regional master plan is to provide a framework for the coordinated development of plans and policies of all governmental agencies as well as a guideline for solving existing problems. The needs and desires expressed by concerned individuals and agencies have been recognized in the formulation of this regional master plan.

SUMMARY OF RECOMMENDATIONS

The following is a summary of the major recommendations contained in the regional master plan. They represent a synthesis of all available information and the previously cited concerns.

Utilities

- The Arctic Environmental Research Laboratory should be requested to study the feasibility of developing water and sewage service in the city through the Alaska Village Demonstration Project.

- The cost for maintenance and operation of the incinerator should be agreed upon.

- Gas and electric intertie between the city and NARL should be constructed.

- The storm drainage study for the city should be implemented.

Transportation

- An all-weather road between the city and NARL should be constructed.

- The city airport expansion program should proceed.

- A cost/benefit study of relocating the NARL airport facility at the city airport should be conducted.

- A feasibility study of alternate modes of transportation should be conducted.

Land Use

- The city should remain in its present location.

- The Borough Planning Department should assume responsibility for a planning program within the region.

- Community expansion should take place in the area east of Browerville.

- Additional housing units should be constructed.

- The construction of a regional high school should be commenced.

- The weather service operation should be relocated south of the city airport.

- A new cemetery should be developed on Fresh Water Lake Road.

Historic, Cultural, and Natural Resources

- Tourist facilities should be developed.

- The beach erosion replenishment program should be investigated and subsequently implemented.

- The feasibility of dredging gravel from the ocean floor should be examined.

ADDITIONAL CONSIDERATIONS

The impact of on-going and proposed activities by various agencies will be instrumental in effecting future change in the Barrow region. The dynamic nature of this change necessitates the following additional considerations.

In developing any master plan in the North Slope region, it is necessary to be cognizant of the role the *North Slope Borough* will play in its subsequent implementation.

Population and employment needs may be substantially altered by the construction of the *regional high school* and its effect on future regional population and employment distribution.

Though the impact of the *Alaska Native Claims Settlement Act of 1971* cannot be completely identified, it will, in fact, affect growth and land use in the Barrow region.

SUMMARY

The preparation of this regional master plan was a cooperative effort of all members of the Barrow Intergovernmental Coordinating Committee. Engineering studies prepared by the Bureau of Indian Affairs, the Public Health Service, and the State of Alaska are incorporated in this plan. This master plan attempts to provide a solution which is both politically workable and economically feasible. Continued coordination will be the key to its successful implementation.

INTRODUCTION

II. INTRODUCTION

OBJECTIVES OF THE PLAN

1. To create a region where people can pursue a life style in accordance with their aspirations.

2. To use land wisely in order to protect the environment and to concentrate land uses and activities as compactly as possible in order to

   - Minimize the cost of construction of buildings, utilities, and other facilities

   - Protect people from the elements.

3. To solve region-wide problems so as to allow local, state, and federal agencies to function efficiently and successfully.

ASSUMPTIONS

Population

Population will increase as the economy improves.

Economy

1. The major employer within the region will be the Naval Arctic Research Laboratory and its camp contractor.

2. The Arctic Slope Regional Corporation will implement revenue-producing activities.

3. Tourism will increase.

4. Permanent native employment will be made available as part of the development and production of the North Slope oil reserves.

Housing

The existing residential areas of Browerville and Block A will be fully developed before other areas are utilized for housing.

Transportation

1. Use of the automobile by the people of Barrow will increase by 1980.

2. The prime method of transportation by the residents of Barrow will be by walking, snowmobile, and taxicab.

Government

1. The federal government or scientifically oriented organizations will continue to fund research in the region.

2. The U. S. Public Health Service will provide for the health and medical needs of the region.

3. The educational facilities will be operated by either the Bureau of Indian Affairs or the North Slope Borough.

ROLE OF GOVERNMENTAL AGENCIES

A variety of interests establishes the character of a community. In the Barrow region, numerous governmental structures will be affected by development. The following is a list of the principal organizations concerned with the region's future.

U. S. Department of Defense (DOD)

1. On July 1, 1972, the Naval Arctic Research Laboratory (NARL), which has operated for 25 years, was granted official status as a Navy Shore Activity and assigned to the Chief of Naval Research for command and support. The mission of NARL is to provide facilities and services for

accomplishing those programs of basic and applied research which contribute to successful naval operations in arctic regions. In addition, the laboratory accomplishes specific tasks as may be assigned by the Chief of Naval Research in support of other naval activities in the arctic region.

2. The Office of Naval Petroleum and Oil Shale Reserves has the responsibility for administering the naval petroleum reserves in the Barrow area.

3. The U. S. Coast Guard operates a radio station that provides service to ships in the arctic region.

4. The U. S. Army Corps of Engineers has made studies of beach erosion in the Barrow area.

5. Also involved in the Barrow region are the National Aeronautics and Space Administration, the Point Barrow Space Disturbance Monitoring Field Station, and the U. S. Air Force Air Defense Command.

Bureau of Indian Affairs (BIA)

The Bureau of Indian Affairs operates the school system, builds and maintains the roads, and owns and operates a water and sewer system which serves the hospital, school, and various Bureau and Public Health Service employee residential units. The Bureau also operates a power plant and sells electricity and natural gas to Barrow Utilities Inc., a co-operative, which in turn sells these utilities to the residents of Barrow.

U. S. Public Health Service (PHS)

The Public Health Service is responsible for village health. A field hospital is maintained with resident doctors and a dentist. Medical and dental service is provided to all natives on a reduced collection basis, and to non-natives at rates similar to those in the "lower 48." Preventive medicine programs and health education are also provided. The hospital cannot treat serious injuries or long-term illness; these cases are generally flown to Fairbanks.

Eastern portion of Barrow "downtown" area looking north. Bureau of Indian Affairs and Public Health Service facilities on the right.

Bureau of Indian Affairs educational facilities in foreground; Public Health Service facilities in background.

Economic Development Administration (EDA)

In 1972 the Economic Development Administration approved an application by the city for an airport terminal project. An agreement was never signed with an operator and EDA has since withdrawn funding.

U. S. Department of Agriculture

The Department of Agriculture, Farmers Home Administration, is involved in housing finance.

Federal Aviation Administration (FAA)

The Federal Aviation Administration is responsible for air navigation and has plans for expanded operations.

State of Alaska

1. The Division of State Planning and Research, Office of the Governor, has undertaken planning studies in the past.

2. The new Department of Community and Regional Affairs provides planning services, including those formerly administered under the Rural Cap program and the Office of Economic Opportunity.

3. The Local Boundary Commission has delineated the new Barrow city boundary and the North Slope Borough boundary.

4. The Department of Highways has long-range plans for a road connecting to Barrow, but probably not within the time frame of this plan.

5. The Department of Environmental Conservation has jurisdiction with respect to water supply, sewage disposal, solid waste disposal, pesticides, radiation exposure, and air quality.

6. The Department of Public Works constructed the Barrow Airport and has plans for its expansion.

7. The Alaska State Housing Authority prepared the *City of Barrow Comprehensive Development Plan*, dated July 1970.

8. The Department of Natural Resources has a primary interest in the submerged lands out to the 3-mile limit.

9. The Department of Health and Social Service has jurisdiction over environmental health problems.

North Slope Borough

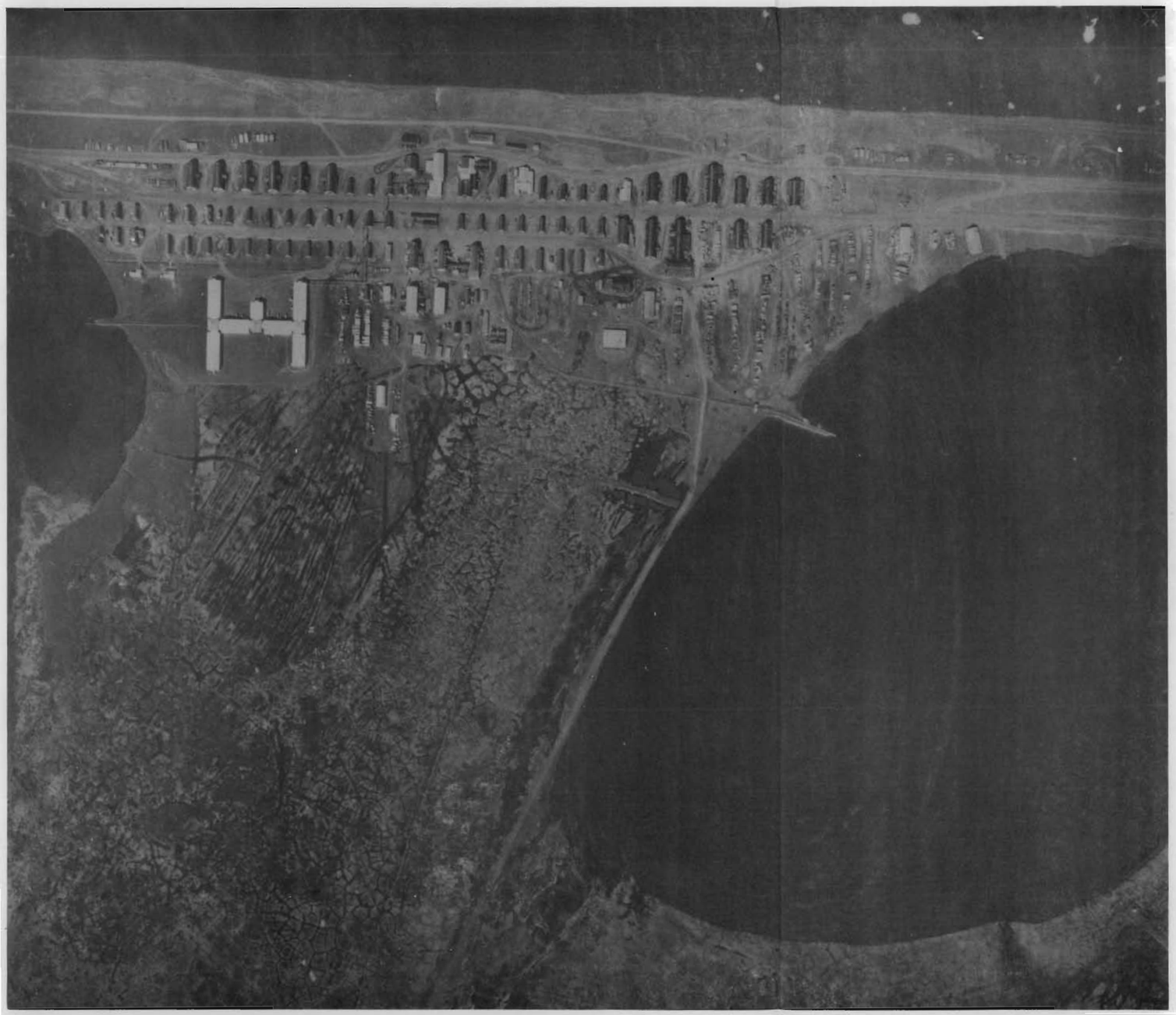
The North Slope Borough, assuming it becomes a reality, will have the mandatory powers of assessment and collection, education, and planning and zoning. The borough may also exercise any powers of a first-class city.

City of Barrow

The city is, of course, concerned with all aspects of a regional plan.

↗ north

City of Barrow, Alaska



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Naval Arctic Research Laboratory

AREA FACTORS

III. AREA FACTORS

REGIONAL GEOGRAPHIC RELATIONSHIPS

The major cities within the state of Alaska of concern because of their impact on the development of Barrow are Juneau, the state capital; Anchorage, the largest city and major commercial center of Alaska; and Fairbanks, the hub of the interior (Plate 1).

Barrow is the most northerly point in the state. Its economic, cultural, and political influence extend over the entire North Slope. The Arctic National Wildlife Range is bounded on the west by the Canning River and on the east by the Canadian boundary. The 23-million-acre Naval Petroleum Reserve No. 4, known as PET 4, was established in 1923. Point Barrow is the most northerly point of this area.

Prudhoe Bay is located 200 miles east of Barrow. Some of Barrow's major neighbors are Wainwright, on the coast to the west, and Kaktovik, to the east.

The city of Barrow and the Naval Arctic Research Laboratory are located near Point Barrow (Plate 2.) Particular nearby sites of interest are the Will Rogers/Wiley Post Monument, near the old Eskimo camp of Walakapa; Nunavak, an old Eskimo village; an Eskimo graveyard; and a national monument adjacent to Elson Lagoon.

The entire Barrow region falls within the boundaries of PET 4. Here the Office of Naval Petroleum and Oil Shale Reserves has been assigned mineral rights, including sand and gravel which are defined as minerals, and surface rights insofar as they affect the mineral rights beneath the surface. Within PET 4, the Navy maintains three land reserves upon which first priority for surface use is controlled by the Navy. The first is the primary real estate for the laboratory; the second is the gas well area; and the third, at Plover Point, is used for a tide gauge. The U. S. Air Force Reserve, established for the POW Main DEWLine site, is within the Navy's laboratory area.

To the southwest is the city of Barrow, which includes a subdivided development known as Browerville. The recently established new city boundary takes in portions of both the Navy and Air Force Reserves.

The following is a brief regional inventory and analysis in regard to the physical, social, economic, financial, and legal structure of the area.

TOPOGRAPHY

The topography of the Barrow region is typical of the arctic coastal plain, a region with very low relief. Most construction in the area has been on old beach ridges. The town itself is on a small plateau rising above the sea, 20 to 30 feet above mean sea level. For many miles elevations are no more than 60 to 70 feet above sea level.

Starting around the center of the city's waterfront, there are bluffs, some 30 feet high, and narrow beaches which run 40 miles southwest down the present coastline.

GEOLOGY

The North Slope region in the vicinity of Barrow is a sedimentary plain with the surface features consisting of scattered gravel deposits, drained lake basins, and small estuaries. The entire area, with the exception of the many scattered ponds and shallow lakes, is composed of tundra underlain by permafrost. The active layer (depth of thaw) is approximately 18 inches. Borings in the area have disclosed that the permafrost (soil perenially below 32 degrees F) varies in depth to a known maximum of 1300 feet below the surface.

Much of the permafrost area is extremely ice-rich soil with ice composing a large portion of the permafrost below the thin active surface layer of soil and tundra. Borings have disclosed that a "quick" permafrost condition exists in areas such as Isatkoak Lagoon, where high salt content in the soils will allow a liquid brine condition to exist at temperatures well below the normal permafrost temperature. This condition has been observed to penetrate to a depth of 100 feet below the surface.

Where granular materials exist in a natural state, the soils may be relatively stable, with little effect caused by superficial thawing. If well drained, such deposits will act to insulate materials below the gravels. Such areas, when available, offer superior construction sites.

If construction is necessary in ice-rich areas, particular attention must be given to foundation design in order that the frozen condition be maintained.

Foundations for structures in the Barrow area should be based on the application of sound engineering principles and must consider permafrost data, soils classifications and types, structure type and purpose, and projected effect of construction on the permafrost.

Structure design approach must be chosen from among the following alternatives:

- Maintain the bearing medium in a frozen state.
- Thaw the bearing medium when the building is in use.
- Thaw and improve the bearing medium prior to construction.
- Disregard the thermal state of the bearing medium and be willing to accept or provide for the action caused by thawing.

Choice among the alternatives will be based on the economics of construction and maintenance of the particular facility to be built.

While Barrow proper and the airport are built on high gravel permafrost left behind by an old river delta, it is estimated that much of the area available for the expansion of the city is ice-rich permafrost. Several studies have been made around the Naval Arctic Research Laboratory, and some investigation has been made in the vicinity of the city. More permafrost studies should be conducted in the city area.

METEOROLOGY

The arctic coastal plain is dry and cold. The U. S. Weather Service has maintained an observation station at Barrow for about 41 years. Were it not

for its arctic location, Barrow would be considered a semi-arid region because of its low average precipitation.

Average temperatures are

Mean annual temperature	+10.1 degrees F
Mean July (warmest month)	+39.7 degrees F
Mean February (coldest month)	-17.9 degrees F
High recorded (July 1927)	+78.0 degrees F
Lowest recorded (February 1924)	-56.0 degrees F

Average annual precipitation at Barrow is about 4.4 inches with peaks in July and August, when more than one-third of the total annual precipitation occurs.

Barrow summers last for about 90 days. During 13 weeks, there are 24 hours of sunlight each day. From the middle of November, the sun does not appear over the horizon for approximately 60 days.

Winds during the winter months usually come from the northeast, averaging about 10 miles per hour. The steady wind, coupled with fine powder-like snow, tends to create major snow-drifting problems if proper precautions are not taken. Instances of single-story buildings being entirely covered are common in Barrow.

Planning of facilities can and should minimize the problems of the climate. It is important to keep in mind that, unlike the temperate zone, the norm in the Arctic is subfreezing temperatures and snow, with a short period of disruption due to thawing and potential flooding of the coastal area during the brief summer.

HYDROGRAPHY

It is estimated that 50 to 75 percent of the coastal plain is covered either by lakes or by marshes that occupy low areas or form lake basins. The greater portion of the land area near Barrow is featured by drained lakes. The existing lakes vary relatively little in depth, but greatly in shape and areal dimension. A lake which is less than 6 feet in depth will normally freeze to the bottom during the winter months.

The normal daily tide is about 6 inches; an additional monthly variation of above 5 inches exists. Tides are not a very important factor at Barrow, except during times of storm. When ice is not present, the winds develop waves which tend to approach the Barrow beaches from the west or north. Without the protection of ice, these winds, in conjunction with high tides, can create waves of catastrophic proportions. In 1963 winds up to 55 miles per hour, with gusts 75 miles per hour, were able to blow over an open ocean. This combination of open water and high winds created the worst storm in the memory of the Eskimo people. The result of this storm was a rage of water about 10 feet above normal sea level, extending about three-quarters of a mile directly behind the Naval Arctic Research Laboratory. Buildings were washed off their foundations, the air strip was inundated, the camp water supply was contaminated, and extensive flood damage was done to other facilities.

Most of the fresh water in the area is high in organic and iron content. Precipitation in Barrow, as mentioned, is very light. Were it not for the underlying permafrost, which prevents deep water seepage, much of the North Slope might be a desert. The Barrow area has a high evaporation rate in summer and a great deal of sublimation in spring.

The many shallow lakes around Barrow disguise the fact that water supplies are limited. Poor surface drainage, and internal drainage blocked by permafrost, result in a great variety of permanent and intermittent bodies of water, varying from small pools to lakes several miles in length.

Waves and ice erode the bluffs southwest of Barrow. The sediment is transported both by wave wash and by long shore currents northeast to Point Barrow, where it is deposited on the west side of the Point.

Probably the most important factor in the shallow water environment at Barrow is the ice. It can stop the entire process of beach erosion, transportation, and deposition. It limits the size of waves, affects the pattern of currents, and may even affect sea level for a short time. Erosion threatens portions of the city and the beach road opposite Browerville. The past excavation of gravel from the beach interferes with the natural processes of replenishment.

NATURAL RESOURCES

Arctic resources potential must be included in northern development plans. These may be divided into renewable and non-renewable resources.

Renewable resources include fish, fur-bearing and other animals, grazing land, etc. Non-renewable resources consist generally of oil and mineral deposits.

There are no trees around Barrow except for a few stunted willows that may grow as high as 12 inches. There is little plant life available for human consumption. In the summer, flowers cover much of the tundra in a brief blaze of color. There are approximately 15 different species of flora and approximately 125 different plants in the vicinity of NARL. The plant life, in itself, is not important to the Eskimo but, as a food source to the animals of the arctic, it eventually provides him with basic nutrients. The smallest common animal in the vicinity is the lemming and the largest is the whale. Animals and birds kept at the laboratory for research are generally typical denizens of the area. It is important to realize that the purpose of NARL is to study the environment, including the flora and fauna, and that desecration of these will obviate the reasons for the laboratory's existence.

Probably the most important natural resources of the North Slope are gravel and the natural gas and oil reserves. Development of the latter two resources is, to a major degree, dependent upon finding ways of transporting them south to the population centers. Petroleum exploration on the North Slope has generally been confined to PET 4 and to the area east of the Colville River. An 800-mile pipeline will transport the oil from Prudhoe Bay to the ice-free city of Valdez. The Secretary of the Interior has authorized the issuance of a construction permit, but this has been delayed pending court cases brought by various conservation groups. The subject is expected to be resolved in 1973. The Navy and Navy contractors explored for oil throughout PET 4 during the period 1946–1953.

Coal and phosphate reserves are known to exist in the arctic slope region, but as yet no commercial development exists. Deposits of soft coal are found in the Meade River area, at Point Lay, and near Wainwright.

Certainly the inevitable development of the oil fields on the North Slope will have an impact on Barrow and has been an important consideration in this regional planning study.

ARCHITECTURE AND CIVIC ART

All native cultures have developed their own form of art, and the Eskimo culture is no exception. Baleen baskets and parkas are two of the more sophisticated art forms produced by the residents. Paintings and prints by Eskimo artists can be found in leading art galleries in the United States and Canada. Certainly the Eskimo can and should play a leading role in the development of civic art and architecture in this remote area.

CONSTRUCTION

With the construction of the new Naval Arctic Research Laboratory building, designed by the Navy, it is evident what a contribution architecture can make towards improving living conditions in such a hostile environment. The design that goes into a building such as this requires a great deal of research, study, and experience, since the problems are far different from those encountered in a more temperate climate.

The type of structure built here is governed by such factors as cost – approximately two and one-half times Seattle prices; lack of local building materials; problems of transporting materials; effect of environment on the materials used; lack of an experienced labor force in some construction trades; and climatic conditions.

Precut building components appear to offer the best solution to construction in the North. Wood is one of the best building materials. The type of architecture and construction which is suitable for this area is, therefore, another prime consideration in future plans for the region. Homes within the community are built generally on sills or piling.

TRANSPORTATION

Transportation facilities are very limited.

Air

The air system is now, and will continue to be, the principal means for extending transportation into arctic Alaska. Aviation plays a more important role in the economic, social, and political development of Alaska than in any other state. Virtually all passenger traffic moves by air on scheduled flights from Anchorage and Fairbanks to most outlying cities and towns. Light aircraft can be chartered at reasonable prices to fly people and/or cargo to remote locations. Wien Consolidated Airlines provides daily commercial services from Fairbanks and Anchorage.

The State of Alaska owns and operates a 6500-foot airport runway in the city. In addition, the Navy operates a second airstrip from which military and charter aircraft fly special missions, such as resupply of ice island research stations and shipment of produce to Barrow. Freight rates are high.

Roads

The state's highway system does not extend north of the Yukon River. A road is planned adjacent to the Alyeska pipeline from the interior to Prudhoe Bay. However, no plans exist for extending this road west to Barrow.

There is no land route connection between Barrow and surrounding communities. The only connector road in the Barrow region links the Naval Arctic Research Laboratory and the city of Barrow. There are approximately 100 vehicles in the city and ownership is increasing. NARL maintains heavy-duty vehicles having oversized tires and arctic block heaters, which are used for transportation over the gravel roads. Dog sleds are a thing of the past and have been replaced by snowmobiles. The use of the latter permits hunting over a greater area in a much shorter period of time.

Water

The only alternative transportation is by boat or barge. Normally, there is a short period in August and early September when the arctic ice pack breaks up and blows away from shore enough to allow sea-going vessels to approach Barrow. The *North Star III*, operated by the Bureau of Indian Affairs, carries supplies to Barrow each September. Most of these supplies are used in conjunction with local Bureau affairs, or to meet the need of other

government agencies. Annually, there is a resupply shipment for the Naval Arctic Research Laboratory, presently arriving by barge from Seattle, Washington, under government contract.

HEALTH

Barrow has many physical health problems, especially since it is one of the largest communities in Alaska without sewers or running water. It also has some quite serious mental health problems brought about by such factors as rapid cultural change, physical isolation, and the long months of winter darkness. There are no private physicians in Barrow, but the Public Health Service maintains a 12-bed hospital, a health clinic, and has two doctors and a dentist. A state public health nurse was permanently assigned to Barrow early in 1970. Through concerted remedial programs, the Public Health Service has been able to substantially reduce many of the more serious endemic diseases. Alcoholism is a serious problem. The majority of arrests made reflect alcohol-related incidents. Although remedial efforts are being undertaken to combat this problem, it is still one of the most serious health problems on the North Slope and, indeed, the entire Arctic.

SOCIAL CONSIDERATIONS

The Barrow region has a current population of approximately 2350, of which some 90 to 95 percent are Eskimo. Significant differences in living styles exist between the white and native populations. The white population has virtually no unemployment, is generally better housed, and has higher income levels. Poverty in Barrow, which is substantial, is limited to the native population. These inequities, together with the entire problem of acculturation and social change, will play a major role in determining how effective some of the proposed programs, such as new housing and utility systems, will be. Planners and governmental agencies must recognize that a major problem in Barrow is the stress caused by an increasing desire for white middle-class values and goods while there is still a major inability for legitimately achieving such goods or values. The creation of false expectations, provision of non-workable or inadequate programs, and the lack of proper on-going support, training, and/or funding programs can ultimately negate the best of intentions.

HOUSING

As in much of Alaska, adequate housing is a major problem in Barrow. Of the 400 houses, some 250 are in need of major repairs. At least 30 need replacement. None of the houses have flush toilets. Drinking water is hauled in from a fresh-water lake 4 miles from the town. Houses are generally small and overcrowded. However, a natural gas system has been installed and electricity is generally available.

EDUCATION

The Bureau of Indian Affairs now provides schooling from kindergarten through the 9th grade. Three buildings include the 29 classrooms, 30 teachers, and 3 supervisors. Apartments are provided for the staff. The Bureau of Indian Affairs is planning the construction of a high school and playfield in Block A. The school will serve the important function of permitting high-school-aged children to remain in the community instead of having to attend school elsewhere in the country. The facility will serve 500 students from the Barrow region and the North Slope.

RECREATION

Recreational facilities include two movie houses, two poolrooms, and the gymnasium in the Bureau of Indian Affairs school. Barrow has several soda fountains and coffee shops, but there is a lack of free recreation. No parks exist. The Youth Center is overburdened as a community hall. The theater, sauna bath, and small recreation building at NARL provide very limited facilities, and are available for Navy use only. The BIA plans to construct a swimming pool at part of the new high school in Block A, plus an outdoor playfield.

SOCIAL SERVICES

Barrow has three churches; the Youth Center (which also functions as a City Hall); an old fire hall which houses the police, magistrate's court, and jail; and the schools and hospital which have been mentioned.

Looking west toward the city of Barrow, with the Arctic Ocean on the right and Isatkoak Lagoon in the foreground.

Looking south, with the Barrow Indian Health Service Hospital and housing facilities in the foreground and the airport in the background.

MUNICIPAL AND REGIONAL SERVICES

Water

Water is supplied to the community by a private vendor, who truck-hauls it and sells cakes of fresh-water ice in the winter. The federal compounds have the only running water systems. Both the Bureau of Indian Affairs and the Public Health Service currently obtain their drinking and washing water by the distillation of water from Isatkoak Lagoon.

The primary source of water for NARL is Imikpuk Lake, located within the Naval Reserve and directly northeast of the main camp. The source of supply to this reservoir is runoff from the spring thaw. The raw water from this lake is then piped to a boiler plant located in the center of the camp, where it is first filtered and/or distilled by evaporation units. Piping systems are then run to the dining hall and the new laboratory. All other water for the camp is provided by daily hauling via tank truck from the boiler plant to storage tanks located within the various facilities. In 1963 the lake was flooded by the adjacent ocean and the water supply was contaminated.

The Navy plans to use Imikpuk Lake as a water source for the foreseeable future. A special project is now being compiled to request replacement of one of the two flash distillation units, with a reverse osmosis plant to treat water from the existing water source, Imikpuk Lake. This plant is being installed by the camp contractor and will be in operation by April 1973. The reverse osmosis system is rated at 30,000 gallons per day at an input water temperature of 35 degrees F. The project may require installation of a reservoir for fire protection purposes. In order to transform the special project system into a long-range solution to the Department of Defense water supply problem, it is presently believed that only a second reverse osmosis plant need be installed. At that time, the water treatment function would move to a site behind the new power plant, and a reservoir structure may be necessary. This could occur in fiscal year 1976 at the earliest.

Future studies are needed to resolve the long-range needs. One alternative is the construction of a dam at the inlet of Middle Salt Lagoon.

Sewage

With the exception of the Bureau of Indian Affairs, the Public Health Service compound, the Weather Service, and the laboratory building at NARL, all structures within the region handle their sewage with chemical toilets or honey buckets. Disposal is by 55-gallon drums which are hauled away and dumped. In the city, the Bureau of Indian Affairs operates a sewage treatment plant which handles waste from its facility and that of the Public Health Service.

At NARL, sewage from the laboratory building is run through a comminutor and then discharged into Middle Salt Lagoon. Kitchen waste water from the mess hall, and shower and wash waters, are dumped in the ocean. The Navy is currently constructing a sewage treatment facility which will treat sewage from all major planned facilities. Sewage will be transported through a utilidor. The treatment facility is scheduled for completion August 1974.

Natural Gas

The primary source of power for heat and electrical generation is five operating gas wells located in the South Barrow Gas Field, 4 miles inland from NARL. Above-ground gas lines extend from the gas field to the BIA plant in the city and to the new power plant at NARL. The 5-mile-long 6-inch pipe to the city is the best engineered line in Alaska. It contains 74 expansion loops at about 340-foot intervals. The line is carried on wood piles. The 4-inch line to NARL is in poor condition.

Within the city, the Bureau of Indian Affairs sells natural gas to the Barrow Utilities, Inc., a native-managed organization which, in turn, sells gas to the residents of the city. Gas lines within the city are installed on oil drums above ground and, consequently, are vulnerable to damage from snow machines and other vehicles. At several streets throughout the city, driveway arches have been installed to permit vehicles to pass under the pipe lines.

The lack of an intertie between the city and NARL is a very serious problem. (The Bureau of Indian Affairs plan for an intertie is discussed in a later section of this report.)

For the Barrow region, the Office of Naval Petroleum and Oil Shale Reserves maintains primary responsibility for all subsurface minerals in PET 4.

Activity is presently limited to the production of natural gas for the area from the single existing developed well field. No resident staff is maintained. Drilling crews are sent to the site whenever new wells must be developed.

In order to increase the deliverability of the present reservoir, a step-well will be started in March 1973. Approximately 20 men will be flown in for a month's duration. There will be employment for approximately 10 men from Barrow for a month to assist in constructing the rig. An exploratory well and another step-well are programmed for February and March 1974, respectively. Both will require construction assistance from the Barrow labor force.

More wells in the existing reservoir will add to the peak deliverability but will not necessarily increase the over-all amount of gas available. Therefore, exploratory wells will most likely be drilled in the area southeast of NARL.

The following table shows the estimated Barrow area gas demands through fiscal year 1977. The footnotes explain the sources of information on which these estimates are based. At the gas consumption rate indicated, it is estimated that approximately seven to eight years' gas supply remains within the known existing limits of the South Barrow Gas Field. The relatively short life remaining for this field, and the probability of increasing workover problems, has necessitated a search for new gas, hopefully within 10 miles of Barrow. The seismic information obtained by the Navy during the PET 4 program (1944 – 1953) has been updated via digitization and then computerized for incorporation with modern data. In May 1972, 72 miles of detailed seismic work was completed in the Barrow area and 32 more miles were completed by November 1972. Unbudgeted geophysical plans call for approximately 150 additional miles of seismic work to be completed in fiscal year 1974. Unbudgeted drilling plans include another South Barrow Gas Field development well (No. 11) in fiscal year 1974 and three exploratory gas wells, the first one scheduled to be started in fiscal year 1974.

A computer program study conducted in 1968 showed the total recoverable gas reserves in the South Barrow Gas Field to be 17.7 billion cubic feet. Through fiscal year 1972, about 6.1 billion cubic feet of gas have been produced, leaving approximately 11.6 billion cubic feet as remaining recoverable reserves. This results in a current reserve/annual gas demand ratio of 17.8.

FIVE-YEAR PRODUCTION FORECAST, BARROW GAS FIELD
(million cubic feet)

Fiscal Year	BIA[1]	BUI[2]	Military[3]	Totals
1972	179,413	130,955	343,093	653,461[4]
1973	197,413	144,050	459,400	800,804
1974	225,709	158,456	509,400	893,383
1975	264,262	174,301	492,820	931,383
1976	452,634	191,731	542,820	1,187,185
1977	497,899	210,904	605,820	1,314,623

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[1] Includes all government consumption in Barrow and Browerville. Projection based on fiscal years 1968 through 1972 average yearly increase of approximately 10 percent adjusted annually. Additional yearly increases include Figure VII-1 and Table VII-1 from *Water and Sewer Master Plan and Preliminary Engineering Report, City of Barrow, Alaska*, Linck-Thompson, July 1972. Fiscal year 1976 includes the new Barrow high school.

[2] Includes all non-government consumption in Barrow and Browerville. Projection based on fiscal years 1968 through 1972 average yearly increase of approximately 10 percent adjusted annually.

[3] Includes all Point Barrow Navy Research site consumption including POW Main. Five-year estimates are made by WDNAVFACENGCOM annually.

[4] Actual

Note: The above estimates in the BIA column may no longer be applicable as water and sewer plans for the city are no longer being considered by the Public Health Service.

ESTIMATED NATURAL GAS REQUIREMENTS FORECAST,
BARROW, ALASKA – FISCAL YEARS 1973 TO 1977

Fiscal Year	Date Gas Required	Project No.	Project Name	Estimated Requirement By Facility (mcf/year)[1]	Estimated Total Requirement (mcf/year)
1972			Fiscal year 1972 requirements, including Air Force facility in the camp		339,400
1973	Sept '72	P-010	Electric power plant	120,000	459,400
1974	Oct '73	P-025	Refuse disposal (incinerator)	50,000	509,400
1975	July '74		Increase in electric load	9,500	
	Aug '74	P-024	Sewage treatment facility	200	
	Oct '74	P-019	Utilidor	(26,280)[2]	
	Oct '74	P-009	Laboratory facility, 2nd increment	0	
				(16,580)	492,820
1976	July '75		Increase in electric load	50,000	
	Oct '75	P-028	Laboratory facility, 3rd increment	0	
	Oct '75	P-029	Laboratory facility, 4th increment	0	
					542,820

ESTIMATED NATURAL GAS REQUIREMENTS FORECAST,
BARROW, ALASKA –FISCAL YEARS 1973 TO 1977 (continued)

Fiscal Year	Date Gas Required	Project No.	Project Name	Estimated Requirement By Facility (mcf/year)[1]	Estimated Total Requirement (mcf/year)
1977	Aug '76	P-007	Equipment shop, maintenance building	0	
	Jun '78	P-004	Recreation building	0	
	Jun '78		Increase in electric load	63,000	
					605,820

[1] Million cubic feet (mcf) = 1,000 cubic feet @ 1,000 BTU per cubic foot

[2] Gas consumption is expected to decrease when the utilidor project is completed because waste heat from the gas turbine generators will be used to heat other buildings. Subsequent gas consumption increases will only result from increased electric load, which will require additional generators on-line.

The natural gas requirements for facilities at NARL through fiscal year 1977 are noted in the table on the previous pages.

Electricity

The region has two power generating plants, one in the city and one at NARL. Power for the city is generated at the Bureau of Indian Affairs' utilities plant, which is equipped with two 750-kilowatt gas turbines plus 1150 kilowatts in standby diesel generators. Present capacity is apparently adequate for Barrow, but costs are excessively high. The Naval Arctic Research Laboratory has a new plant which contains four 750-kilowatt gas turbines. The BIA and NARL systems are not intertied. As a part of this regional master plan, the Bureau of Indian Affairs has prepared a study which would correct this deficiency. This plan is discussed in a later portion of this report.

The primary power generating plant for NARL was, until late 1972, the most deteriorated facility in the camp. A peak load of 1000 kW occurred in the winter months when heat loads had to be increased. The total capacity of the existing plant was less than 1400 kW if all generators were functioning. The plant had four 350-kW diesel generators, which had been converted to natural gas. A temporary installation of one 750-kW MUSE solar generator was made because of the existing poor condition of the camp power plant. A new power plant, having four gas turbines, was completed in the fall of 1972 and is now operational. There is one MUSE unit (750 kW) in standby at the present time.

Storm Sewers

All streets and roads in the region are built up on several feet of gravel laid over the tundra. While this is necessary to prevent the roadways from sinking, no system of storm sewer drainage is provided. Consequently, the raised streets, particularly in the city, serve as dams during the summer, causing water to remain in lakes around many houses. As a part of this regional master plan, the Bureau of Indian Affairs has prepared a storm water drainage plan for the city. This plan is discussed in a later section of the report.

Refuse Disposal

All trash and refuse within the region are hauled and dumped at South Salt Lagoon. The site is adjacent to where the Navy is constructing an incinerator, which will serve the region. This $2 million facility will be completed in October 1973. The operating costs have not been finalized yet among the various parties who will use it.

There are approximately 60,000 55-gallon barrels scattered throughout the Barrow region. Most are full of garbage, trash, and human waste. Although the contents of the barrels are frozen 80 to 90 percent of the time, they still remain sources of disease. They are also an eyesore. The major concentration of barrels is located southwest of the city, south of NARL, and at South Salt Lagoon.

The Department of the Interior, aided by the Department of Defense and the State of Alaska, is currently conducting a cleanup in the region. By the spring of 1972, the work crews had removed approximately 25,000 barrels from the tundra south of town. Another 1000 drums have been collected in both Browerville and Block A. The barrels are being hauled to a ravine southwest of town where they are being used in an erosion control project. The ravine is being filled and will be covered with earth so that drainage will flow in another direction during the spring thaw.

Part of the unsightliness of the town is due to the many barrels that stand outside all buildings. The development of a sewer and a trash collection system will help to make the community more attractive.

Fire Protection

Within the region fire protection and fighting capacity is virtually nil. In the city there is no piped system for water supply, and crash capability at the airport is especially poor. The city has one tractored fire vehicle which is operated by a volunteer fire department. The fire-fighting equipment at NARL is manned by the camp contractor. Nonetheless, whenever there is a fire, most buildings burn to the ground.

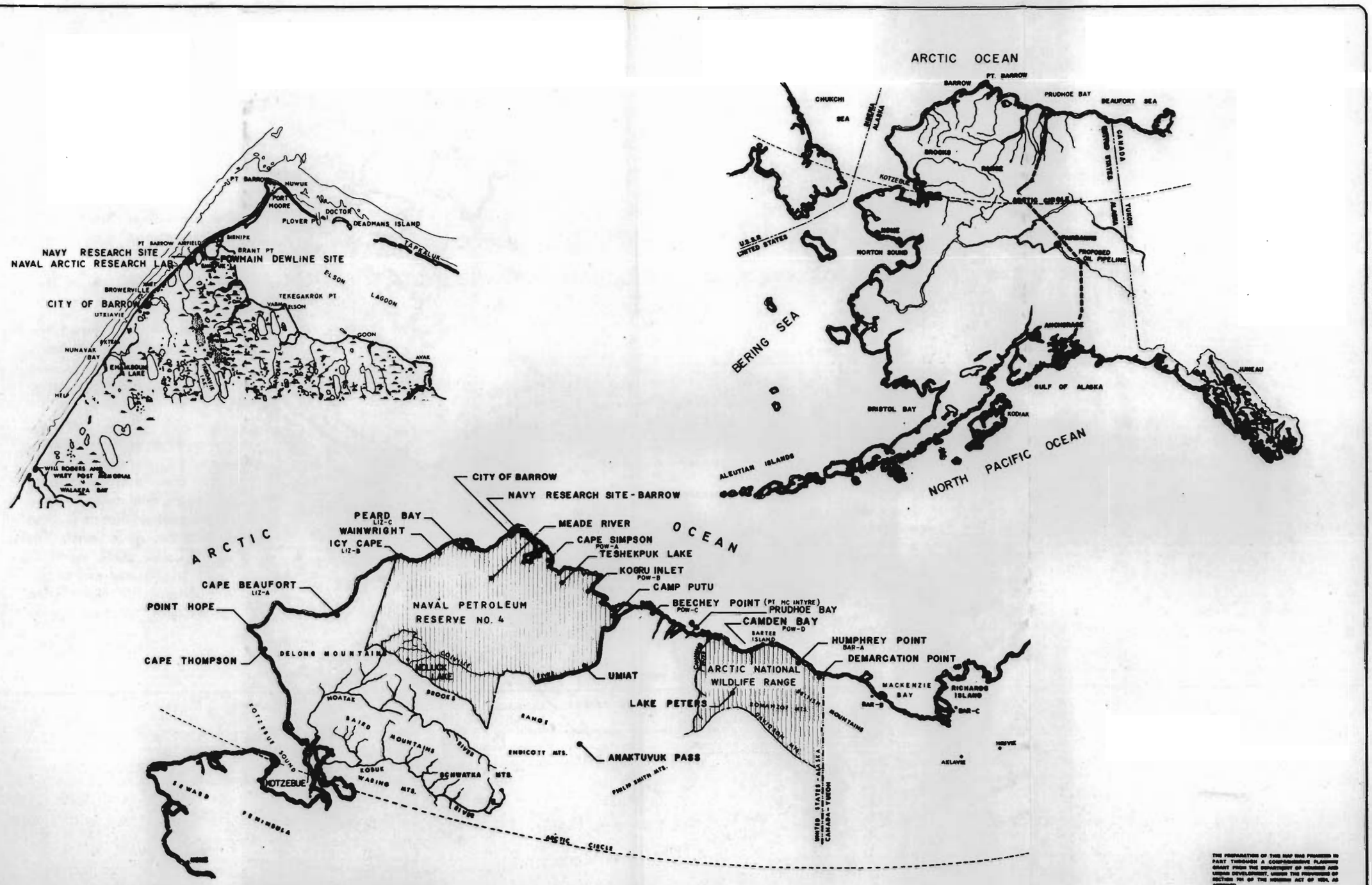
LAW ENFORCEMENT

Although serious crime is rarely a problem in Barrow, juvenile and/or alcohol-related offenses are a cause for concern. Barrow's full-time police force consists of a chief, two patrolmen, and several part-time guards. An Alaska state trooper resides in Barrow and has jurisdiction over the entire North Slope. The city is seriously deficient in office space and jail facilities.

ECONOMY

Barrow has no industry and commercial development is very limited. For hundreds of years the arctic slope provided a subsistence living for a widely scattered and nomadic people. Now the concentration of population at Barrow makes it physically impossible for people to live off the land as they did in the past.

Today, income to the community is provided by trade, service industries, government installations and their contractors, municipal services, transportation, communications, tourism, and petroleum exploration. However, it is estimated that only 30 percent of families in the community have adequate year-round employment. Average household income is about $9400 per year, but prices run up to twice what they are in Seattle. The local community cannot at present finance large-scale public works or construction programs. Under its existing legal status, Barrow cannot levy real estate property taxes. With the establishment of the North Slope Borough, a real estate tax base will be available for local capital improvements and municipal services.



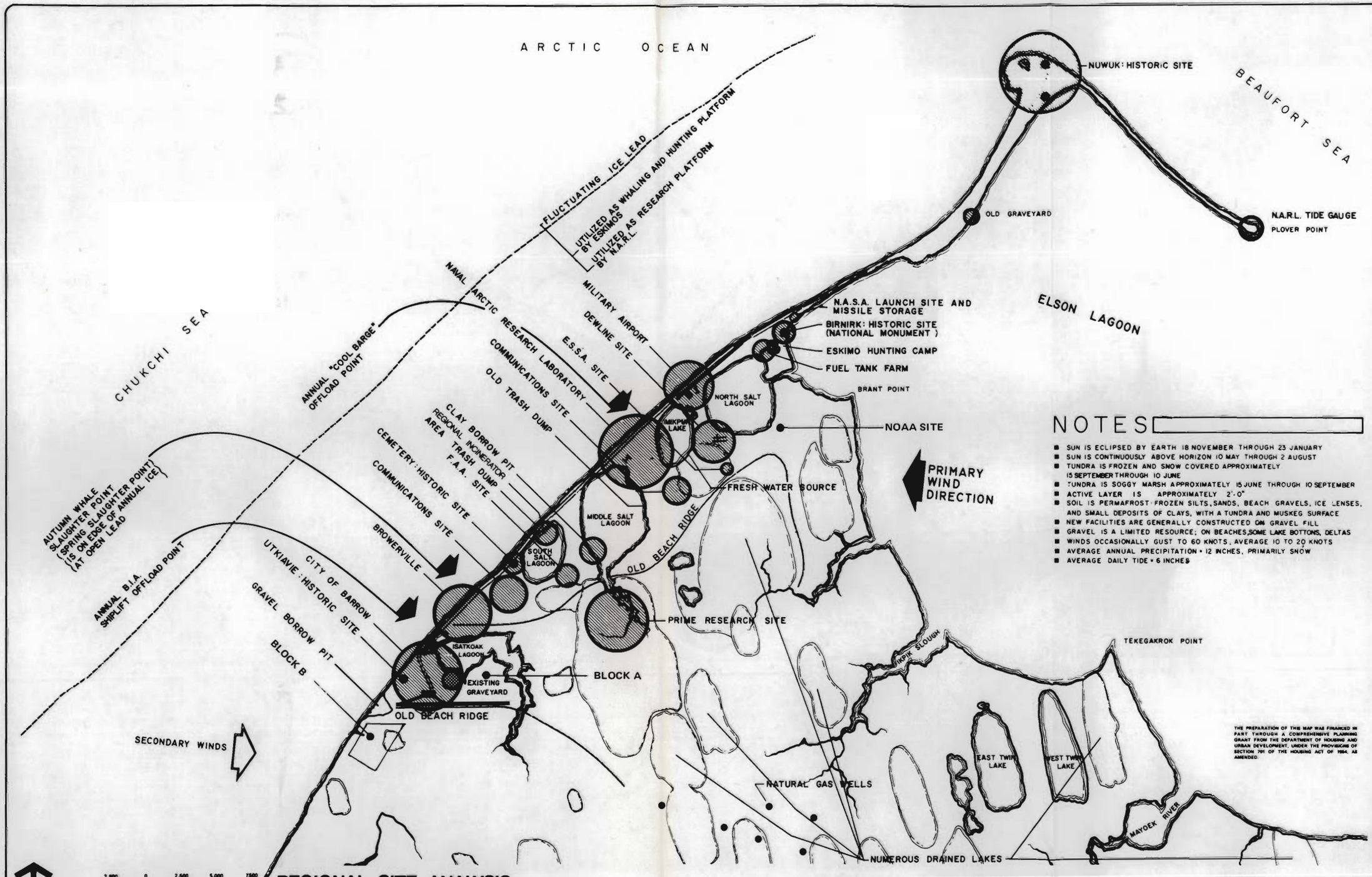
GEOGRAPHIC LOCATION MAP

THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

BARROW REGIONAL MASTER PLAN, BARROW, ALASKA
BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
contract: N 62474-72-C-0228



NOTES

- SUN IS ECLIPSED BY EARTH 18 NOVEMBER THROUGH 23 JANUARY
- SUN IS CONTINUOUSLY ABOVE HORIZON 10 MAY THROUGH 2 AUGUST
- TUNDRA IS FROZEN AND SNOW COVERED APPROXIMATELY 15 SEPTEMBER THROUGH 10 JUNE
- TUNDRA IS SOGGY MARSH APPROXIMATELY 15 JUNE THROUGH 10 SEPTEMBER
- ACTIVE LAYER IS APPROXIMATELY 2'-0"
- SOIL IS PERMAFROST: FROZEN SILTS, SANDS, BEACH GRAVELS, ICE LENSES, AND SMALL DEPOSITS OF CLAYS, WITH A TUNDRA AND MUSKEG SURFACE
- NEW FACILITIES ARE GENERALLY CONSTRUCTED ON GRAVEL FILL
- GRAVEL IS A LIMITED RESOURCE; ON BEACHES, SOME LAKE BOTTOMS, DELTAS
- WINDS OCCASIONALLY GUST TO 60 KNOTS, AVERAGE 10 TO 20 KNOTS
- AVERAGE ANNUAL PRECIPITATION = 12 INCHES, PRIMARILY SNOW
- AVERAGE DAILY TIDE = 6 INCHES

THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

north 2,500 0 2,500 5,000 7500

REGIONAL SITE ANALYSIS

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

BARROW REGIONAL MASTER PLAN, BARROW, ALASKA
BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
contract: N 62474-72-C-0228

AGENCIES AND ACTIVITIES IN THE REGION

IV. AGENCIES AND ACTIVITIES IN THE REGION

As discussed in the subsection entitled "Role of Governmental Agencies," there are many organizations that play an important role in the economy of the region. This section of the report discusses these organizations (Plate 3).

BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

This committee was founded in 1971 by the various city, state, and federal agencies having activities and programs in the Barrow region. It has met twice a year since its creation and has been instrumental in several major undertakings. These include the preparation of this regional master plan and the construction of an incinerator that will serve the region.

The incinerator was designed by the Navy and funded by the Bureau of Indian Affairs, the Public Health Service, and the Navy. Now under construction and scheduled for completion in October 1973, the incinerator is located on the north side of South Salt Lagoon, adjacent to the existing trash and refuse dump. The incinerator will have two systems and will contain equipment for processing and burning refuse and human waste. The first system is for general waste incineration, and the second for liquid waste incineration. Metal drums which are salvagable will go through a barrel baler system and be shipped out to the scrap metal markets. Drums which are not salvagable will be baled and disposed of.

The incinerator is designed to handle the honey-bucket wastes from the community, as well as trash and garbage from the region, until an adequate city sewage system can be constructed.

NAVAL ARCTIC RESEARCH LABORATORY

The Naval Arctic Research Laboratory (NARL) is a Navy-owned contractor-operated (University of Alaska) research facility and shares in the basic mission of accomplishing those programs of basic and applied research

which contribute to successful naval operations in arctic regions. NARL has the specific mission of providing expert guidance and coordination of field and laboratory research tasks assigned by the Chief of Naval Research and of providing the logistics support necessary to such research efforts.

The mission further includes indoctrination and training of administrative and scientific personnel for living and working in arctic areas; provision for welfare and safety of personnel; development of new techniques, methods, and procedures for exploitation of potential arctic research; guarding and maintenance of government property; liaison between the Office of Naval Research and scientists in the arctic; and advisory functions to the Office of Naval Research with respect to current programs and requirements.

*NARL's scientific program is oriented toward understanding of the ocean environment, its ice surface, and its overlaying atmosphere. While a diversity of basic and applied sciences are supported, physical/biological oceanography, geophysics, and underwater acoustics receive greatest attention.**

The main camp, consisting of 4541 acres, is situated along the beach and is comprised primarily of three parallel rows of predominately Quonset (86) buildings, a 5000-foot airstrip, and air terminal facilities (Plates 3 and 4). In addition, there are multifarious smaller facilities that have been constructed as a result of specific needs. Spaced throughout the camp are numerous open storage areas that are filled to overflowing shortly after the annual barge shipment in mid-August, and reduced to open space by mid-summer of the following year.

The only structures that can be considered permanent construction in good condition are the new laboratory building, the hangar, the transmitter facility, and the new power plant. All other structures were built as temporary facilities and should not be considered in any long-range plan for NARL; their replacement should be programmed as soon as possible.

The most economical way of constructing the camp as a temporary oil exploration camp in the 1940's was to build on the beach. This resulted in alignment of the main camp with the runway, and the creation of an aircraft

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* P-F7, Department of the Navy, *RDT&E Management Guide*, NAVSO P-2457

Looking south toward the NARL airport on the left, hangars in the foreground, and the DEWLine facility in the background. The bodies of water are North Salt Lagoon (left), Imikpuk Lake (right), and the Arctic Ocean (bottom).

Looking south toward the Naval Arctic Research Laboratory. The Arctic Ocean is in the foreground and Middle Salt Lagoon is on the right.

hazard that has heretofore been overlooked for economy reasons. With a predominant easterly wind, aircraft generally take off toward the northeast and land from the southwest. This places the NARL main camp within the last 3000 feet of the landing zone, endangering facilities, aircraft, and personnel every day.

For a major part of the year, during the winter months, two Cessna 180 ski plane airstrips are established on Imikpuk Lake. This is a strip of ice that is marked by painted barrels only, but the strip is an essential part of the small aircraft operation, since most outlying research sites must be approached on skis in the winter months. Aircraft landing here use the same fueling and terminal facilities as wheeled aircraft.

For summer operations, a Cessna 180 float plane strip is established roughly parallel to the main camp strip on North Salt Lagoon. The facilities for this operation consist of a fuel tank and a vehicular approach. Again, this operation is essential to the maintenance of outlying research sites. Most of the sites along the North Slope have no airstrip and must be reached by pontoon aircraft landing on small lagoons or lakes in the summer months.

In general, the facilities required for operation of the camp are more extensive than would normally be required at a station in the "lower 48." This is because of the isolated situation. Storage for one full year's supplies (covered and open) must be maintained, all utilities must be generated, the camp and vehicles must be maintained, personnel must be housed and fed, and support of scientific personnel must be provided from resources within the immediate confines of the camp. Additionally, the long cold winters create an extensive requirement for covered heated storage. For example, it takes approximately one full day to thaw out a Caterpillar tractor before mechanics can begin working on it. With the exception of the annual summer barge shipment, all contact with the outside world is via aircraft, which are limited in capacity and erratic in schedule. The implications of this isolation must be considered in planning for facilities at Barrow.

Roads and Circulation

In addition to the primary connector road running from the DEWLine, through NARL and to Barrow, there are a series of secondary connector roads to the National Aeronautics and Space Administration facilities and to within 3 miles of the gas wells. The main camp has four main access routes

between the parallel rows of facilities and the beach, but vehicular traffic is not confined to anything that can be called a road system. Essentially, wheeled vehicular traffic is permitted any place on the gravel fill that will support the vehicles, including the smaller access areas between buildings.

An extreme safety hazard due to conflict between vehicles and pedestrians is inherent in the existing camp plan. Camp speed limits are set at 15 mph for the camp and 5 mph for the family housing area, but this is essentially a useless regulation since speedometers are generally inoperative due to the rigors of arctic climate. Heavy equipment, such as D-8 tractors, weasels, and trucks, do not mix well with pedestrians at any speed.

Because of the constant drifting of fine snow for the major portion of the year, the existing primary vehicular access routes, although not aligned with the predominately easterly winter winds, are raised above the adjacent tundra to allow blowoff of the drifting snow. Substantial drifting occurs between buildings. Thousands of dollars are spent on snow removal each winter in the camp and at the airstrip.

Construction practice at Barrow for roads, pads, and open storage areas is to place 4 to 5 feet of gravel on the ground surface, to insulate the permafrost and prevent its later thaw and subsidence. Clay-like fines are placed in the upper 18 inches of the rounded beach gravel fill to serve as a binder. During the summer months, the primary camp roads are oiled to reduce the dust problem. In the arctic spring a tremendous thaw occurs, which softens compacted soil roads and walkways. The main connector road between NARL and Barrow is washed out occasionally by water runoff, causing considerable inconvenience and requiring extensive reconstruction.

Future Projects

Military construction items for the Naval Arctic Research Laboratory (Plate 5) are listed on the following page.

Employment

Project personnel loading at the Naval Arctic Research Laboratory are shown on the following table. Native employment at NARL ranged from 60 to 100 during the last fiscal year.

MILITARY CONSTRUCTION
NAVAL ARCTIC RESEARCH LABORATORY

Item No.	Item Name	Occupancy Date
P 025	Refuse Disposal (incinerator)	October '73
P 024	Sewage Treatment Facility	August '74
P 019	Utilidor System	October '73

Planned Items as of September 1972

		Size
P 009	Laboratory Facility (2nd increment)	22,600 sq. ft.
P 018	Bachelor Civilian Quarters	125 men
P 007	Equipment Maintenance/Storage Facilities	12,000 sq. ft.
P 028	Laboratory Facility (3rd increment)	18,385 sq. ft.
P 035	Outfitting Warehouse	5,000 sq. ft.
P 023/026	Water Collection and Treatment	
P 034	Laboratory Facility	5,300 sq. ft.
P 020	Road to Barrow	27,000 sq. yds.
P 004	Recreation Building	18,240 sq. ft.
P 014	Boat Storage	2,500 sq. ft.
P 005	Dry Provisions/Cold Storage	4,000 sq. ft.
P 032	Float Plane Terminal Facility	LS
P 016	Fire Alarm System	40 BX
P 031	Air Terminal Building	2,000 sq. ft.
P 013	Animal Laboratory	3,696 sq. ft.
P 021	Auto Vehicle Storage	4,000 sq. ft.
P 008	General Warehouse	8,000 sq. ft.
P 022	General Warehouse	8,000 sq. ft.
P 015	Fire Station	3,000 sq. ft.
P 017	Laundry/Dry Cleaning	2,500 sq. ft.
P 011	Electric Power Tieline	22,000 lin. ft.
P 033	Power Line to Gas Wells	24,000 lin. ft.
P 027	Road to Gas Wells	40,000 sq. yds.

	FY 1969		FY 1970		FY 1971		FY 1972		FY 1973		FY 1974		FY 1975		FY 1976		FY 1977	
	Peak	Low	Peak	Low	Peak	Low	Peak	Low	Peak	Low	Peak	Low	Peak	Low	Peak	Low	Peak	Low
O&M Contractor [1]	112	92	116	95	121	96	126	90	131	100	136	102	141	105	146	107	146	110
Construction Contractor [2]	38	10	35	8	40	10	25	10	35	10	45	15	45	12	40	10	40	10
Communications Detachment [3]	19	0	19	0	19	0	12	4	7	3	7	3	7	3	7	3	7	3
NARL Staff [4]	92	58	101	59	109	62	114	65	121	70	126	70	135	75	143	75	150	78
Research Personnel [5,6]	115	30	124	35	150	40	167	48	175	50	175	50	180	55	185	60	185	60
Totals	376	190	395	197	439	208	444	217	469	233	489	240	508	250	521	255	528	261

1 O&M contractor may include PET 4 cleanup support. O&M is union, with approximately 20 percent native employment.

2. Continued construction assumed. Approximately 10 to 15 percent native employment.
3. Communications are expected to continue under Coast Guard, with no native employment.
4. Native employees are included, at approximately 60 percent of the total.
5. High population usually occurs in summer from transient personnel. Usually there is no native employment.
6. NSF AIDJEX and Tundra Biome Projects impact is allowed for.

Aircraft Loading: Six Cessna 180, two R4D
Occasional Visits: P2V, C54, C119, C123S, C130, C124

AIR FORCE AIR DEFENSE COMMAND

The POW Main DEWLine facility is operated by RCA under contract to the Air Force. Staffing is composed of two military personnel and 18 civilians. The DEWLine site contains 267.87 acres (Plate 3).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA has a facility which is used for rocket reconnaissance of weather and other atmospheric phenomena. It has personnel at Barrow for periods of 2 to 3 weeks duration several times a year. The facility is located north of the NARL airstrip.

OFFICE OF NAVAL PETROLEUM AND OIL SHALE RESERVES

For the Barrow region, the Office of Naval Petroleum and Oil Shale Reserves maintains primary responsibility for all subsurface minerals in PET 4. Activity is presently limited to the production of natural gas for the area from the single existing developed well field. No resident staff is maintained. Drilling crews are sent to the site whenever new wells must be developed.

UNITED STATES COAST GUARD

Communications operations at NARL were transferred to the Coast Guard in 1972. They lease the entire communications facility at the laboratory and provide communications to ice breakers and commercial marine traffic in arctic waters. The Coast Guard also serves as a new link for scientific expeditions east and west of Barrow, ranging to Ice Station T-3, currently located north of Greenland. Four men are assigned to the station year-round, with an additional four during the summer.

FEDERAL AVIATION ADMINISTRATION (FAA)

The FAA provides communications for aircraft in the Barrow area, including polar flights. The agency has an office at the state-owned airstrip in Barrow,

and an antenna complex within the Naval Reserve. Residences for personnel are provided at the Naval Reserve. The FAA maintains a staff of nine.

An upgrading of navigational aid equipment is underway. A direction finder and a localizer were completed in 1972. A glide slope was also started in the summer of 1972, which provides the airport with a complete standard instrument landing system. The direction finder is located on the north side of the airport, adjacent to Block A. The localizer is located approximately 7500 feet from the eastern edge of the runway. The Very High Frequency Omnirange and Tactical Air Navigation (VORTAC) facility is planned on a 370-acre tract of land south of the airport. Access is by way of Fresh Water Lake Road. This facility is planned for 1973.

The FAA had originally planned to construct 14 units in Block A to house its employees. Budgetary limitations, however, have forced them to abandon this project. They now plan to rotate their staff from Anchorage on a two- to three-week basis.

BUREAU OF INDIAN AFFAIRS (BIA)

The Bureau of Indian Affairs is responsible for the school and educational system and for street and road maintenance. It owns and operates the water distillation system serving the school and hospital, the sewage treatment plant serving the above facilities, and the power generating plant (Plate 4).

The school system serves the educational needs of the community only through the ninth grade. Students attending high school must leave the community, either for southeast Alaska or the lower 48. The BIA is planning a high school on Block A which will not only serve Barrow but the other outlying communities on the North Slope. The school will have a capacity for 500 students. The students from other communities are expected to board with relatives or friends within the community. Such a program is not feasible at this time, due to the excessive overcrowding that already exists and to the lack of available new housing. There is adequate land area in Block A for the construction of a dormitory that would house the students, should housing not be made available.

The existing BIA facilities include an elementary, primary, and junior high school, the latter two connected by enclosed heated walkways which house

the utilidor system. There is also a multi-purpose building used for basketball and other recreational purposes, both during school hours by the pupils and at night by the community. The elementary school is located in the downtown area and is not connected to the water and sewer system. The Alaska State Housing Authority plan suggested that a more appropriate use for this building would be for commercial and office use.

The junior high school building contains an industrial arts shop, a home economics laboratory, a science laboratory, and a food preparation center. The development of a high school will permit an even greater variety of courses to be offered, both to children and to the adults of the community.

The teaching staff is composed almost entirely of whites who come to Barrow on two-year contracts. They are housed in apartments adjacent to the schools. There are 30 teachers and three supervisors.

The BIA is also involved in the maintenance of streets and roads in the community, including snowplowing during most of the year. It erected street signs throughout the community during the summer of 1972.

The Bureau of Indian Affairs contracts to Barrow Utilities, Inc., the operation of the water, sewage treatment, and power generating plants, together with the responsibility for the distribution of electricity and natural gas to all buildings in the community.

As part of the regional master plan, the Bureau of Indian Affairs prepared the studies on an electric power and gas intertie with NARL, the all-weather road to NARL, and the storm drainage plan for the city.

The BIA has a housing improvement program, administered out of the Fairbanks agency office. This agency serves the needs of approximately 8000 natives. In fiscal year 1973, 34 new units and 12 renovated housing units were programmed throughout the agency region. The budget for the year was $214,000. This program is designed strictly as an outright grant for disabled or handicapped persons, mothers with children, and the like. The budget is limited ($214,000 in fiscal year 1973). To date, no funds have been expended in Barrow because of (1) severe pressing needs in other more remote villages, such as Anaktuvuk Pass; (2) budget limitations; and (3) the possible availability of alternative programs, such as HUD, in Barrow.

The BIA also has an employment assistance program which is effective in Barrow. As of April 1, 1973, 26 single persons and two families from Barrow have received training in Fairbanks or Anchorage in mechanics, heavy equipment repair, welding, clerical work, and other related activities.

U. S. PUBLIC HEALTH SERVICE (PHS)

The Alaska Area Native Health Service operates the medical facilities in Barrow. It serves much of the North Slope, including Wainwright and Barter Island. The hospital and residential quarters are located immediately north of the BIA school plant and are served by its water and sewer system.

The hospital was constructed in 1964 and contains 14 beds. The total staff is composed of 26 natives and 17 whites. There are two doctors, one dentist, one pharmacist, and eight nurses.

The operation at the hospital is changing from in-patient to out-patient care, as increasing emphasis is placed on preventive medicine. It needs four more examining rooms, plus ten housing units, to meet the hospital staffing requirements.

As part of this regional master plan, the Public Health Service prepared the water and sewer plan for the city.

STATE OF ALASKA

The State of Alaska has several facilities and representatives in Barrow. It owns and operates the city airport. Expansion plans for this facility are contained elsewhere in this report.

Employment opportunities in the region are monitored by the Alaska Department of Labor. Unemployment is estimated at 70 percent during the winter season. There were few new jobs created in 1972, and most hiring activity is based mainly on turnover.

The State also maintains state troopers in Barrow whose responsibilities include the entire North Slope.

The Department of Environmental Conservation does not have a staff in Barrow, but its Commissioner is the former Director of the Naval Arctic Research Laboratory. This department has a continuing interest in the effects of new development on ecology and the environment.

U. S. WEATHER SERVICE

The Weather Service's mission in Barrow is upper atmosphere observation as part of a world-wide system, briefing service to pilots, and support to NASA on rocket firings. There are six persons employed at the facility, none of whom are natives. The installation of a computer will mean one less employee by 1973.

The operation is located on an 8-acre tract of land in the middle of town. When established in the early 1940's, it was situated on the edge of town. Now it is hemmed in by residential development. The Alaska State Housing Authority plan called for its relocation to the south side of the airport. An official of the Weather Service has stated that funds are not available for relocating and that, if forced to move, it would probably close down its operation.

ARCTIC SLOPE NATIVE ASSOCIATION

The Arctic Slope Native Association is a non-profit corporation organized under the laws of the state of Alaska. The area that it represents is one of the 12 regions within the state which has established a regional corporation to conduct business for profit. The Association was a major participant in the development and successful passage by Congress of the Alaska Native Claims Settlement Act of 1971.

CITY OF BARROW

Barrow was incorporated as a fourth-class city in 1958 and became a city of the second class in 1972. It has a seven-man council. It cannot have a property tax and must rely on sales tax for its major revenue. The City Council has projected a $170,000 budget for fiscal year 1973, an increase of

$50,000 over the 1972 fiscal year. The breakdown of revenues is estimated at

3 percent sales tax	$ 75,000
State revenue sharing	$ 55,000
City fines, miscellaneous	$ 40,000
	$170,000*

* Excludes revenues from the sale of liquor

In 1972 the city attempted to improve its economy by constructing an air terminal complex. It applied to the Economic Development Administration for a grant to develop this badly needed facility. The complex was to be located at the airport and contain 37,000 square feet of area, including the airport terminal, a restaurant, lounge, and a 41-room hotel. It would also have provided space for state government and FAA offices, a gift shop, and space for a local air taxi operator's office. The estimated development cost was $3.6 million.

The project would have enhanced the tourism segment of the economy and provided an estimated payroll of $425,000 a year. The gift shop would have provided an outlet for the sale of locally made arts and crafts. The restaurant and lounge portion of the complex were key elements of the financing package and it was required that the city agree to the use of liquor, an action that was approved in a community-wide vote in November 1972. Net revenues from the restaurant and lounge were expected to be $36,600 and $73,200, respectively. The hotel operation, on the other hand, was expected to have a $13,300 deficit.

The Economic Development Administration processed the application and approved it late in 1972. The city was to own the complex and Wien Consolidated Airlines had indicated its willingness to manage and operate the facility. At the present time, there is no operator, EDA funding has been withdrawn, and the project is considered terminated.

It is anticipated that city revenues from the sale of liquor will approximate $100,000 to $125,000. The city is considering the use of this money for several people-oriented programs, such as a park or summer youth program.

Another project that the city is considering is a juvenile building that will be located on four lots in Browerville. The building will contain approximately 3000 square feet and will have a capacity of 15 to 20 beds. The funding for this project or the priority for development is not determined at this time.

The city has nine employees: a city administrator, a city clerk, four policemen, and three clerks at the liquor store.

NORTH SLOPE BOROUGH

In June 1972 the citizens on the North Slope voted to create the borough form of government. The new borough extends from Point Hope on the west to the Canadian border on the east, and from the Brooks Range on the south to the Arctic Ocean. This area contains approximately 56.5 million acres, or the equivalent area of most New England states combined. The area also includes the potential oil-producing area at Prudhoe Bay which, when taxed, will provide revenue for the borough to operate. As of April 1973, the oil companies' court case against formation of the borough had not been decided.

The borough will have the mandatory functions of property tax assessment and collection, education, and planning and zoning. Once in operation, it could assume the functions of fire protection, health, police, sewer and water, and sales taxation, if approved by the voters.

Barrow will be the administrative headquarters for the borough and will benefit economically. The mayor and borough assembly members were elected in June 1972. The staff includes an administrative assistant and a secretary.

VILLAGE CORPORATION

The Alaska Native Claims Settlement Act of 1971 grants $962.5 million and 40 million acres of land in Alaska to native people in settlement of their long-standing aboriginal land claim. The law sets aside 40 million acres in fee title (22 million acres of village lands, 16 million acres of regional corporation lands, and 2 million acres of "hardship land bank" lands). The natives will also receive a cash settlement of $462.5 million from

congressional appropriation and $500 million from a 2 percent royalty on the leasable mineral revenues of all public land in Alaska. Regional and village corporations were authorized to administer the settlement.

The Barrow village will be entitled to select eight townships, or 161,280 acres, by 1975. It can select land within Petroleum Reserve No. 4, but it will not have subsurface rights.

A decision has not been reached as to whether the Barrow Village Corporation will be a profit or non-profit corporation.

ARCTIC SLOPE REGIONAL CORPORATION

The Native Claims Act provides for the organization of 12 regional corporations within the state that will conduct business for profit. The Arctic Slope Regional Corporation encompasses the geographic area of Alaska known as the North Slope, an area covered by the operations of the Arctic Slope Native Association. This corporation will be owned by all of those Inupiat Eskimos on the Arctic Slope who are enrolled in the region. All enrolled natives will receive 100 shares of stock and will be able to receive dividends from the corporation.

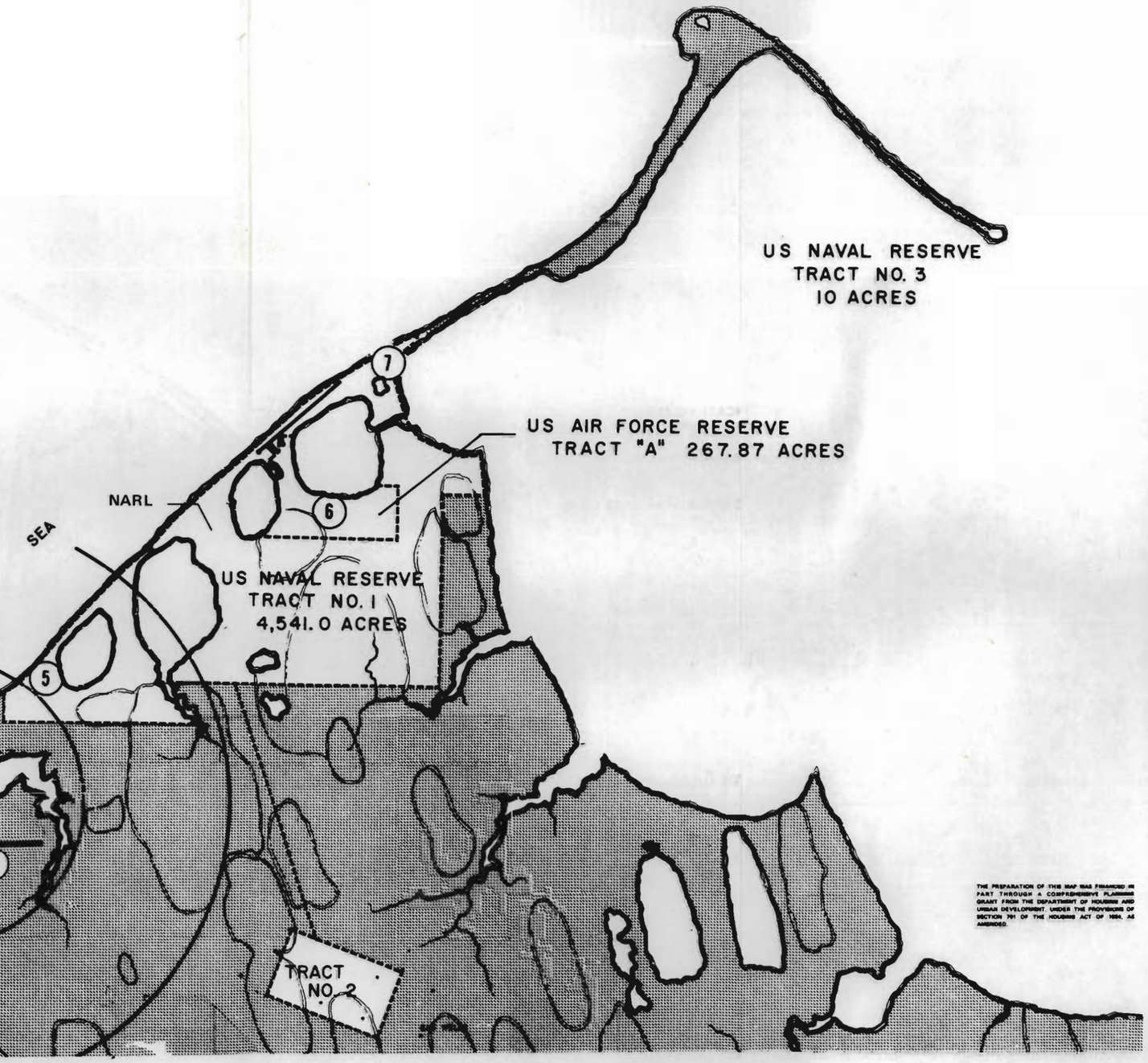
The corporation must distribute 70 percent of all revenues from timber resources and subsurface estate patented to it to the 12 regional corporations. If the Arctic Slope region has 7 percent of the total native population, it can receive 37 percent of the profits from its land. It also receives 7 percent of the revenues from other regions.

Assuming the Arctic Slope has 7 percent of the total native population, its monetary settlement over an 11-year period will be $32.375 million. In addition, it will receive a 2 percent royalty on mineral development in Alaska of a possible $35 million. However, this $35 million might not be forthcoming until at least 15 years and possibly as long as 30 to 40 years, all depending on the speed with which mineral development takes place.

The Arctic Slope Regional Corporation is required to distribute 50 percent of the above funds to the village corporations. The remaining 50 percent can be used for the carrying on of business for profit, investments, grants and loans to natives within the region, etc.

At the present time, the Arctic Slope Regional Corporation has nine members on its staff. The President/Chief Executive, Vice President – Planning, Special Assistant, and two secretaries are located in Barrow. The corporation plans to have a future staff of at least 17 persons, 13 of them located in Barrow and the remainder in Wainwright, Kaktovik, Anaktuvak Pass, and Point Hope.

1. WEATHER SERVICE
2. BUREAU OF INDIAN AFFAIRS
3. PUBLIC HEALTH SERVICE
4. STATE OF ALASKA (AIRPORT)
5. U. S. COAST GUARD (COMMUNICATIONS SITE)
6. AIR FORCE AIR DEFENSE COMMAND (DEWLINE SITE)
7. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



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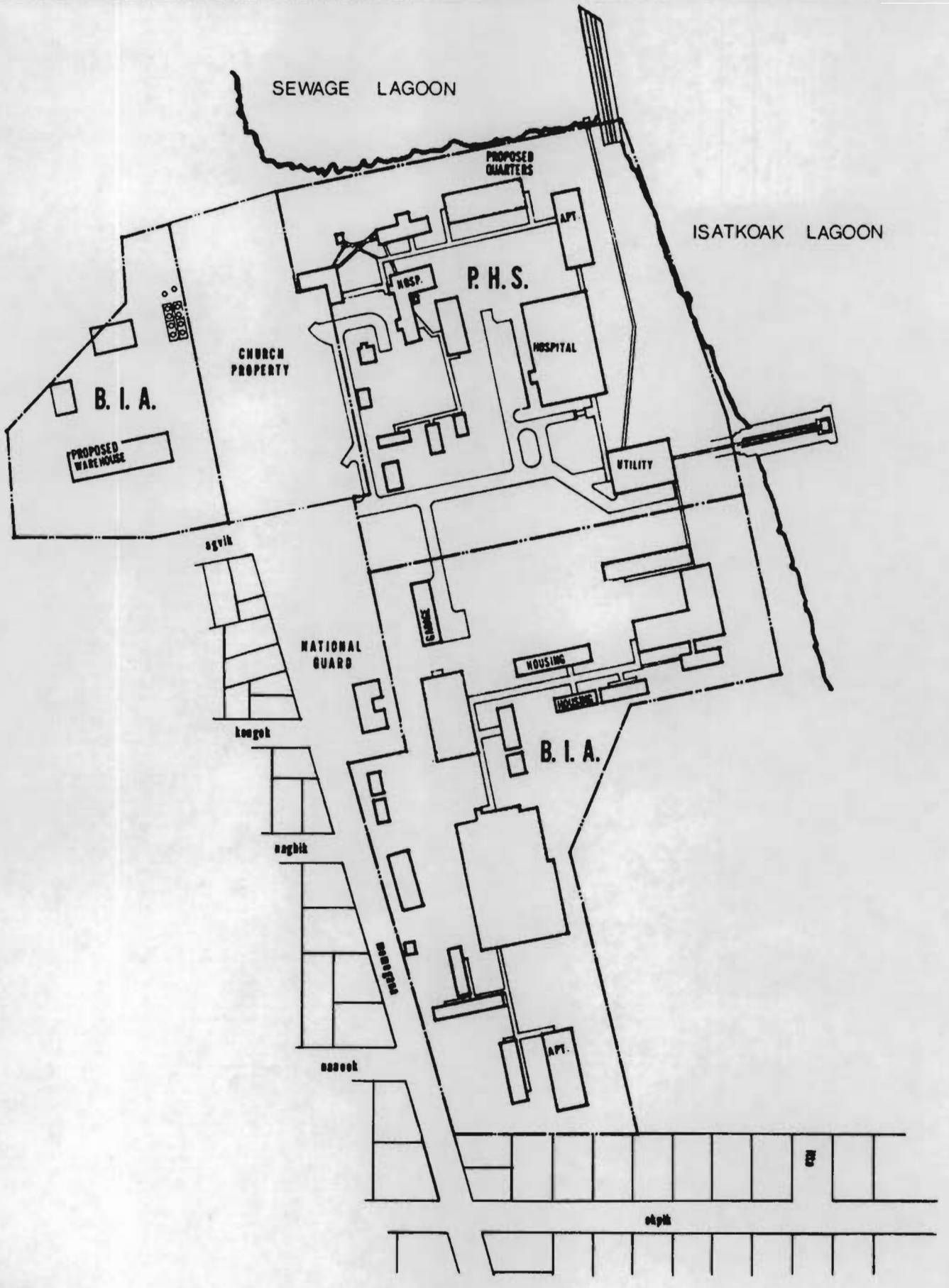
BARROW REGIONAL MASTER PLAN, BARROW, ALASKA
BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
contract: N 62474-72-C-0228



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BIA MASTER PLAN

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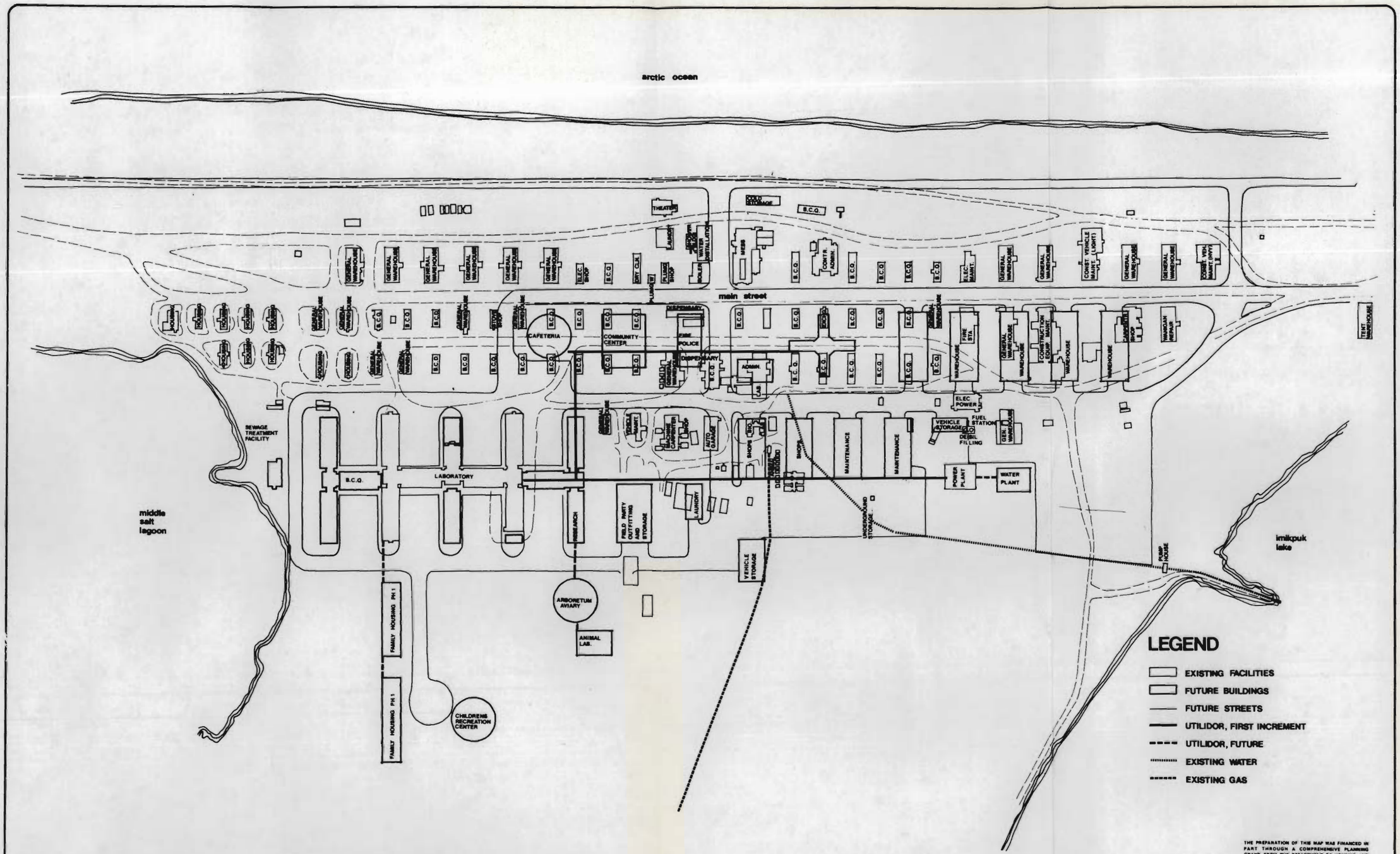
BARROW REGIONAL MASTER PLAN, BARROW, ALASKA
BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND



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PROPOSED DEVELOPMENT PLAN · NARL

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BARROW REGIONAL MASTER PLAN, BARROW, ALASKA

BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
contract: N 62474-72-C-0228

ECONOMIC AND SOCIAL CONSIDERATIONS

V. ECONOMIC AND SOCIAL CHARACTERISTICS

The regional master plan is intended to assist the Barrow area residents in planning for the future of the region. An important part of this planning process is to have a specific estimate of how many people will live in the area over the next 5, 10, 15, and 20 years. These types of projections must be made in order to determine the need for additional jobs, new houses, new school classrooms, expanded commercial and retail facilities, and the other activities that are part of any healthy community.

POPULATION

In order to prepare projections of the future population, it is first necessary to understand the existing characteristics of the local population and to understand what changes have occurred in the recent past.

Area of Influence

While the regional master plan concentrates on the area within a 10-mile radius of Barrow, the social and economic influence of Barrow extends far beyond this area and basically includes the entire North Slope. The reasons for this are

- Family and personal ties of Barrow residents extend to other communities such as Wainwright, Point Hope, Anaktuvuk Pass, and Kaktovik. A portion of the population growth of Barrow during the last decade resulted from an in-migration from these smaller villages.

- The establishment of the North Slope Borough, if it is upheld in the courts, will extend the political jurisdiction and, consequently, the economic influence of Barrow throughout the entire region.

- The development of the North Slope oil reserves around Prudhoe Bay, 200 miles to the east, can create employment opportunities for Barrow residents on a commuting basis.

- A decision by the federal government to permit oil exploration or development of PET 4 could have a very important impact in creating jobs for local residents, as well as bringing a large number of people into the region.

- Governmental agencies in Barrow, specifically the U. S. Public Health Service and the Bureau of Indian Affairs, provide their services elsewhere in the state and thus can be affected by the activities of the total North Slope. This in turn can affect the economic and social structure of the Barrow region itself.

Historic Population Trends

The Barrow region is part of a much larger geographical region established by the United States Bureau of the Census called the Barrow Census Division. This area includes Barrow, the Naval Arctic Research Laboratory, and the DEWLine station, as well as Anaktuvuk Pass, Wainwright, and Cape Lisburne. The Barrow Census Division thus includes all of the Arctic Slope north of the Brooks Range from Cape Lisburne east to, but not including, Prudhoe Bay. Prudhoe Bay, Deadhorse, and Kaktovik (Barter Island) are located in the Upper Yukon Census Division, which extends further east to the Canadian border and south into the Yukon River basin. While the southern portion of the Upper Yukon Census Division is beyond the immediate zone of influence of Barrow, the three communities of Prudhoe Bay, Deadhorse, and Kaktovik are part of the Barrow sphere of influence, and will be more so in the future. Point Hope, in the Kobuk Census Division, is also part of the North Slope Borough.

Past Population Trends

Every ten years, the Census Bureau collects detailed statistics for cities, census divisions, and other geographical areas. As shown in the following table, the population of Barrow increased by 1741 persons between 1939 and 1970. Comparable data for other North Slope villages is also shown.

The most notable element of this table is the increasing importance of Barrow as the population center of the North Slope. In 1939, Barrow, Wainwright, and Point Hope were all relatively equal in population. Today, Wainwright is slightly smaller than it was in 1939, while Point Hope has increased. Point Lay was abandoned during this same time period. There has

HISTORICAL POPULATION TRENDS

	1939	1950	1960	1970
Barrow	363	951	1314	2104
Wainwright	341	227	253	315
Point Hope	257	264	324	386
Anaktuvuk Pass	NK	66	NK	99
Kaktovik	NK	46	NK	123
Prudhoe Bay*	—	—	—	49
Deadhorse*	—	—	—	163
Point Lay	117	75	NK	—
Tikikluk	NK	49	NK	—

NK – Not Known

* Prudhoe Bay and Deadhorse are new, essentially non-native communities related to oil exploration and development.

Source: U. S. Bureau of Census

been a definite trend in population movement from the smaller villages to Barrow. However, the villages are still a strong and viable component of the North Slope Borough. The extent to which they will remain so will be influenced, to a significant extent, by decisions of the borough, state, and federal governments with respect to school facilities and programs, health services, employment, and other related activities.

Even though there has been a movement of population from the smaller villages of the Barrow Census Division to the city of Barrow, there was also a movement out of the North Slope as a whole. Between 1960 and 1970, there were 1012 births recorded in the Barrow Census Division, while there were only 150 deaths. If 150 is subtracted from 1012, the increase would thus be 862 persons. In reality, the population increase of the Census Division was only 530, which means that at least 332 people moved out of the region in the last decade. The following table summarizes these shifts in population.

COMPONENTS OF POPULATION CHANGE,
BARROW CENSUS DIVISION

1960 Population	Births 1960–1970	Deaths 1960–1970	Net Out-Migration 1960–1970	1970 Population
2133	1012	(150)	(332)	2663

It is not known exactly who left the Barrow region or why they left. It is believed, however, that a substantial number of women have departed from the region. This was observed in 1964 in the *Barrow Community Development Study* prepared for the Bureau of Indian Affairs by the University of Alaska. Figures in the 1970 census confirm this finding. Of the 1970 population of the Census Division, there were 1433 males, but only 1230 females. The difference is especially noted in the adult age groups, as indicated in the following table.

The number of males and females in the age groups below 20 years or over 40 years is about equal. It is only in the young adult age groups that a serious difference is observed. While precise reasons are not known, it is possible to speculate that many women leave the region because of the ease

with which they can find employment in the cities and/or marry whites, as compared to the difficulties faced by men in the same situation.

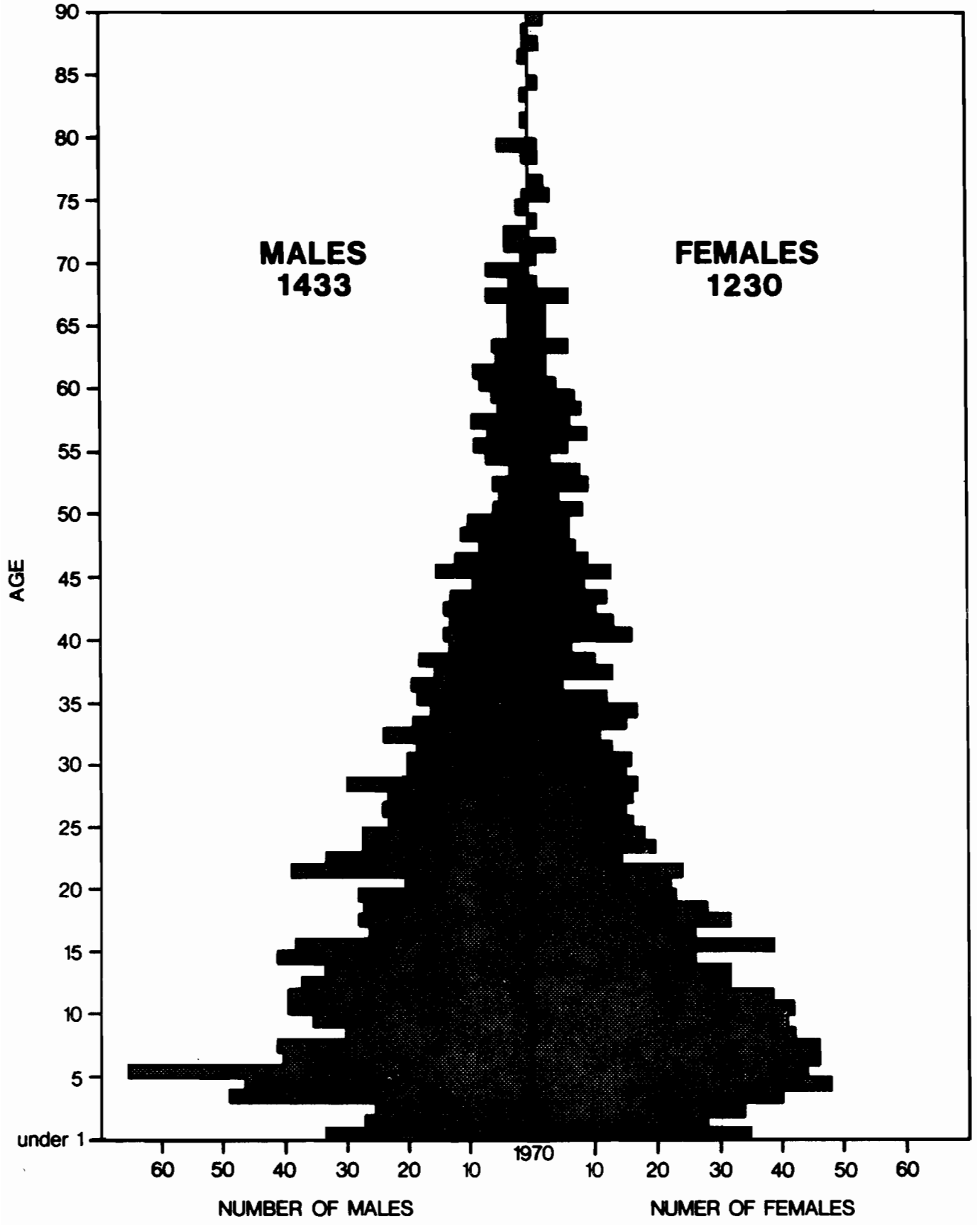
NUMBER OF MALES AND FEMALES IN THE BARROW CENSUS DIVISION IN 1970

Age Group	Males	Females
20 to 24 years	146	98
25 to 29 years	120	79
30 to 34 years	97	72
35 to 39 years	83	46
	446	295

Within the 1970 Barrow Census Division population of 2663, only 330, or 12 percent of the total, were white. The balance were virtually all Eskimos. The city of Barrow itself had 191 whites, leaving 139 in the other communities, plus the permanent population of the Naval Arctic Research Laboratory facility. It is difficult to accurately assess the degree to which the laboratory's population can be considered "permanent." Many of the persons living there can be considered transient in that they maintain residences in other Alaskan cities, or in the lower 48 states. According to the 1970 census, a maximum of 62 persons could be classified as permanent residents of the laboratory. The number of professional staff who stay at the laboratory on a limited time basis, plus the support staff who rotate from homes in Fairbanks, etc., create a unique problem in that it is difficult to determine the extent to which the laboratory's population is truly a part of the local community. Even though NARL children may use the schools, and the parents or adults may use town facilities such as basketball courts, etc., the transient character of many persons at the laboratory, plus the physical separation of the laboratory from the village, is such that two separate entities exist. This started as purposeful separation on the part of the Navy during the early petroleum exploration when the camp was viewed as a temporary facility that would soon be abandoned.

The median age of Alaska in 1970 was 22.9 years. The Barrow Census Division has a much younger population, with a median age level of 18 years. Of the total population of 2663, 1450 persons are under 20 years of age.

1970 AGE AND SEX CHARACTERISTICS
BARROW CENSUS DIVISION



SOURCE: U.S. BUREAU OF THE CENSUS -
"General Population Characteristics - Alaska, 1970"

The graph illustrates a population "pyramid," which shows the number of persons by age from birth to 90 years of age. While one can always expect to have more children than adults, simply because of the death rate for the older population, the number of persons on the lower portion of the pyramid indicates a substantially higher birth rate than the state average. For example, there are 44 children in Alaska for every 100 women between 15 and 49 years of age. In the Barrow Census Division, there are 67 children for every 100 women.

There are clear indications that the birth rate in Barrow is declining. If one studies the population pyramid, it can be seen that there are fewer children under five than in the five- to nine-year-old category (under five – 365; five to nine – 430). The Public Health Service is providing extensive family planning services throughout the region, and it is apparent that many parents or potential parents are involved in some type of family planning program. It has been recognized, however, that a substantial reduction of the birth rate will clash with traditional cultural values regarding children and the size of families. Accordingly, it is still too early to accurately predict the long-term effects of improved family planning on the over-all birth rate in the future.

Despite whatever efforts are undertaken today to engage in family planning, future population growth will occur when the population now in the under-20 age group have children. As will be discussed subsequently, obtaining meaningful employment in the region is a serious problem. With most of the population under 20, it can be seen that, as the children grow up, more jobs will be required. If more jobs do not materialize, then unemployment will increase or a larger number of the youth will have to leave the region in order to find jobs.

To illustrate this point, the following table has been prepared to project the working age population between the ages of 20 and 60 over the next 20 years. This projection only considers the existing population already residing in the Barrow Census Division. It does not take into account any continued out-migration or possible in-migration. Also, even though the death rate in Barrow is dropping, there will still be some deaths of children now under 20 years of age over the next 20 years. The amount of such deaths, however, should be minimal and will not seriously affect this illustration.

This table was calculated by simply assuming that, for each five-year period, those children who are now living that reach the age of 20 will become of

working age, while those persons now considered of working age who reach the age of 60 become retired. It was also assumed that all of the men and half of the women would be potentially in search of jobs. On this basis, 825 additional jobs will be needed by 1990 just to take care of the population already born, even without taking into account the current problem of finding employment to take care of those adults who need jobs today.

BARROW CENSUS DIVISION,
POTENTIAL WORKING AGE POPULATION
(20 to 59 years old)

	1970	1975	1980	1985	1990
Working age population	1091	1314	1615	1948	2191
Net increase each period		223	301	333	243
Cumulative increase		223	524	857	1100
Potential job seekers at 100 percent of male and 50 percent of female increase		167	393	643	825

Population Projections

Population projections for the Barrow Census Division and for the Barrow region have been made by five-year increments, beginning with the base year of 1972 and extending on to 1990. In using these projections, it should be emphasized that the economy of Barrow and the population characteristics of its citizens are such that precise projections are impossible to make for any given or specific year. The most meaningful approach is to prepare a range of probabilities and to indicate what basic factors could change in the economy or the population structure that would either quicken or hinder the projections made herein. The changing political structure of the local area, the impact of oil exploration and development on the North Slope, a changing birth rate, an extremely youthful population, the development of a high school, increased tourism, the land claims settlement, the new housing

program (if it materializes), out-migration, and many other factors will have a bearing on future growth.

Population projections for the Barrow Census Division were made for three different growth rates:

- Low Rate of Growth

  The birth rate in the Barrow area is exceedingly high, but it has been decreasing. In the low range, it has been assumed that a substantially continued reduction will occur in the birth rate, and that no major new economic activities will move into the area. The low rate would also occur if Barrow experiences a relatively minimal impact on its economy from the Native Land Claims Settlement and oil slope production. If this occurs, there will be continued out-migration of Barrow residents to Fairbanks or other communities. While this low range is a pessimistic outlook, and one which does not take recognition of the current efforts on the part of many local citizens to improve the region's economic and social conditions, it is a possible, though not probable, growth rate and can thus be used as a base for planning the minimum needs of the region.

- Moderate Growth Rate

  This is a mid-range projection which, for the purposes of this analysis, is believed to be the most realistic projection for use in the planning program. The mid-range projections assume that the birth rate will decline, but will still remain relatively higher than the state average. It also assumes that the Eskimo community will benefit economically by virture of the money coming in from the Native Land Claims Settlement for the regional development corporations. Also, it assumes that the development of a high school in Barrow will keep some of the population within the area that would otherwise leave the North Slope for schooling and possibly future employment. In order for this assumption to be realized, additional employment on the North Slope oil fields will be necessary. The moderate growth rate also assumes that the North Slope Borough will be upheld in the courts and that the local communities will gain the much-needed tax base to provide services to the community.

- High Growth Rate

  A high growth rate would reflect substantially greater economic impact on the North Slope in terms of native employment opportunities, very substantial benefits from the land claims settlement, and, perhaps most important, no further reduction in the birth rate. It is not believed to be a realistic assumption, as there simply does not appear to be the amount of jobs forthcoming to support such a population, nor is it expected that subsistence hunting could support such a large population base. It has been included in this study, however, to indicate an upper range of what could happen in certain circumstances and to indicate what such a population growth would mean in terms of the demand for additional houses, schools, and services.

The population projections prepared for the Barrow Census Division under each of these ranges are listed in the following table.

POPULATION PROJECTIONS, BARROW CENSUS DIVISION

	Low Growth Rate	Moderate Growth Rate	High Growth Rate
1970	2663	2663	2663
1972	2875	2875	2875
1975	3160	3300	3330
1980	3690	3940	4160
1985	4220	4810	5280
1990	4750	5680	6600

The future distribution of population within the Barrow Census Division is a matter of considerable importance. The population of the small villages, as noted previously, is generally increasing. The extent to which this population will continue to grow in the future is partially controllable from an economic and social standpoint and still, at the same time, beyond the control of local planners. The four most important aspects, with regard to the past movement of population from the villages to Barrow, were

- The introduction of a cash economy through construction work and employment opportunities at the various private and public facilities in or near the city of Barrow
- The expanded educational facilities at the Barrow school
- The availability of natural gas for heating
- The central location of the Public Health Service hospital

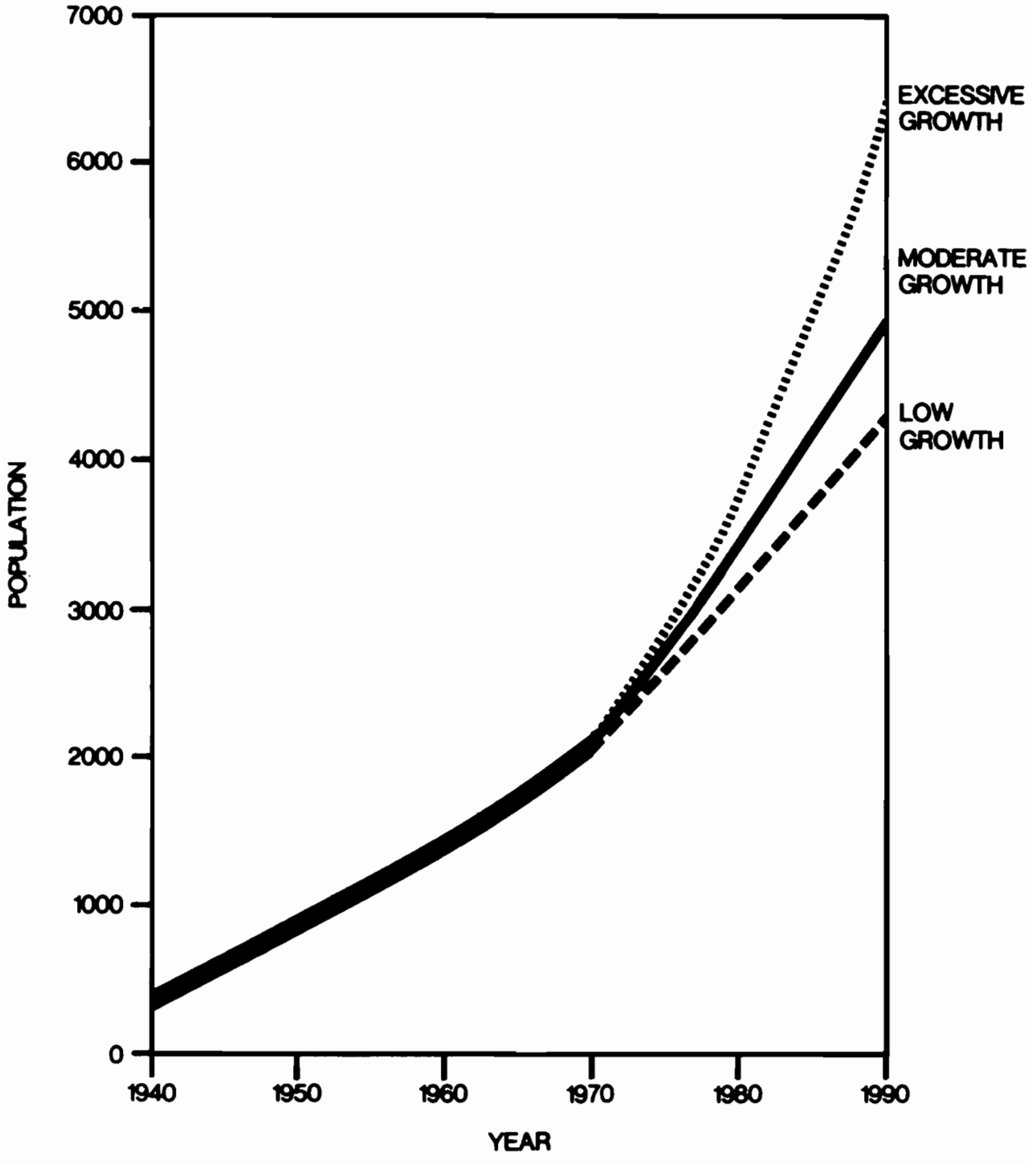
With the establishment of the regional corporation as part of the land claims settlement, and due to the influence and impact of the borough government, a definite program to further encourage the vitality of the villages can be undertaken, if so desired on the part of the borough population. The projections of Barrow's population can thus be made on the basis that the growth will stabilize (which is most likely to occur if no concerted action programs are undertaken to reverse the trend), or that the villages will continue to grow. This could occur if programs are undertaken to provide employment and economic opportunities in the communities. The third possibility, that the villages will grow at an increasing rate, will take substantial money and effort on the part of the borough and the regional corporation.

POPULATION PROJECTIONS, BARROW REGION

	Low Growth Rate	Moderate Growth Rate	High Growth Rate
1970	2164	2164	2164
1972	2350	2350	2350
1975	2700	2750	2900
1980	3200	3350	3800
1985	3800	4150	5000
1990	4300	5000	6500

In the table above, projections for the Barrow region have been made for low, moderate, and high growth rates. The middle column assumes that there will be a continued increase in the population of the villages, but that the

BARROW REGION
POPULATION GROWTH
TRENDS AND PROJECTIONS



rate of increase will be less than has occurred in the past. This is a reflection of the impact that the new high school could have in consolidating additional population into Barrow, the introduction of new employment opportunities within Barrow proper, and the continued economic and political concentration that could be expected as Barrow consolidates its position as the headquarters community for the native population of the entire North Slope area.

It is important to recognize that the population figures include not only the city of Barrow proper but the region for which this plan is being outlined. More specifically, the laboratory's permanent population is included in these projections. It can be expected that the total laboratory population will increase. The personnel loading program indicates a low-level population at the base of 261 by fiscal year 1977, a 20 percent increase over the fiscal 1972 low level of 217.

The projections of population are used in this plan to indicate the level of housing and services the community will need to provide over the next 20 years to accommodate its citizens.

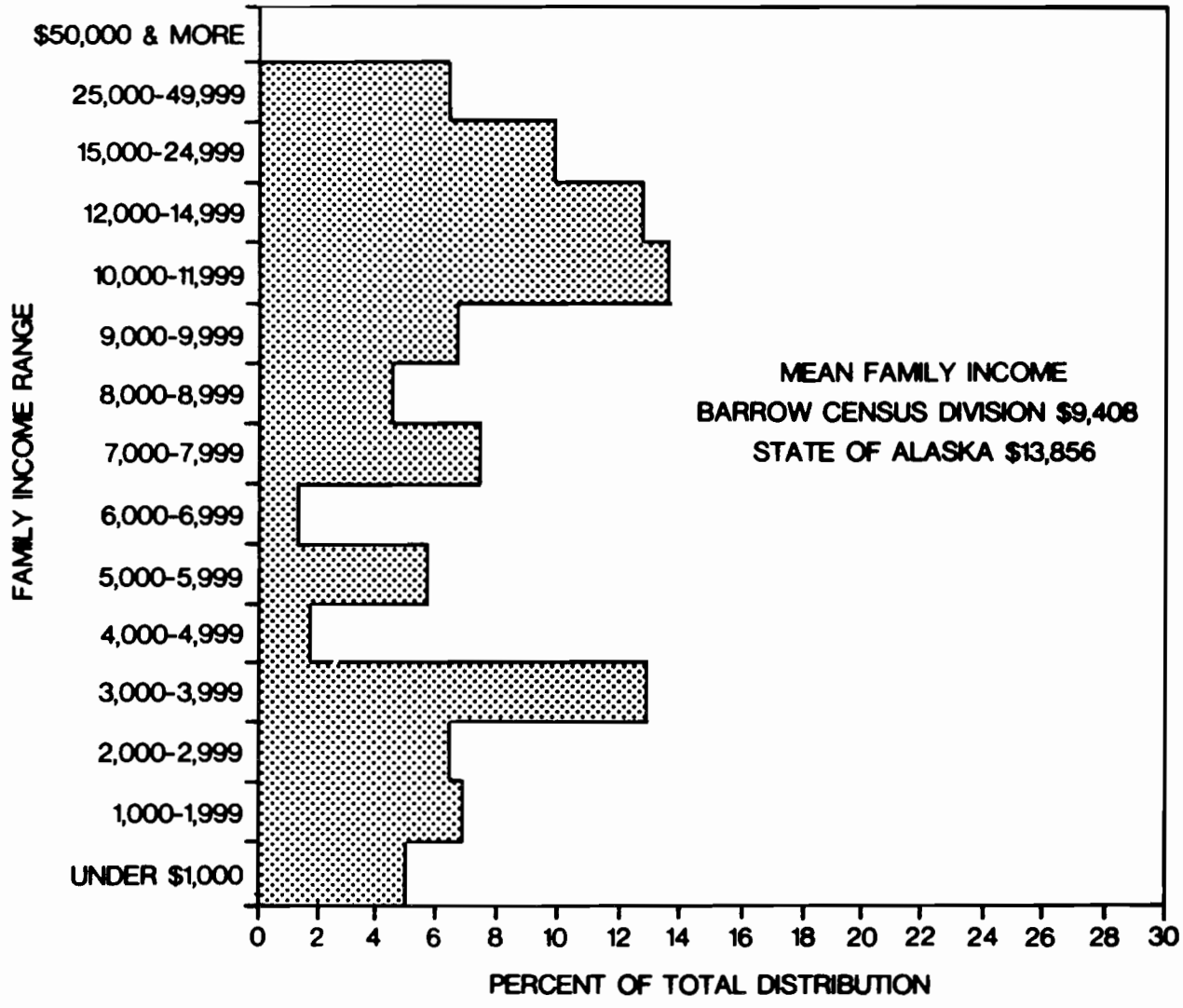
INCOME

The 1970 Alaska State Housing Authority plan estimated, on the basis of a 70 percent survey, that the average household income in Barrow was $8500 per year. The 1970 Census of Population data, published in 1972, indicate that incomes within the census division were actually in excess of this amount by $900. Figures for the city of Barrow alone are not available.

The family income distribution graph indicates the distribution of incomes in 1969, the last year for which data were available. (Discussions with local employment officials indicate no particular reason to assume any change in total levels or distribution between 1969 and 1972.) This graph clearly indicates that there are two groups of families, in terms of income – one earning over $7000 annually, and the other earning less than $4000 annually. There is a surprising "gap" in the middle area.

Unfortunately, the census figures do not indicate the racial breakdown of incomes. Because the unemployment problem of Barrow is concentrated primarily, if not almost entirely, among the native population, it can be

BARROW CENSUS DIVISION
FAMILY INCOME DISTRIBUTION
1969



SOURCE: 1970 Census of Population, General Social & Economic Characteristics

easily surmised that most of the white families are in the upper or "affluent" group, while the lower group is composed of the native families. There are, however, a noticeable number of native families whose incomes are in the upper income group as well.

The average of $9408 is quite high compared to other rural census divisions (Angoon – $2519, Bethel – $6431, Kuskokwim – $6268), but it is still below the state average of $13,856 by a very significant amount (32 percent). The 1970 Census indicated that 120 families in the census division, or 28 percent of the total, had incomes that could be classified as being in the poverty level. The mean family income of the poverty families was only $2578, as compared to the over-all average of $9408.

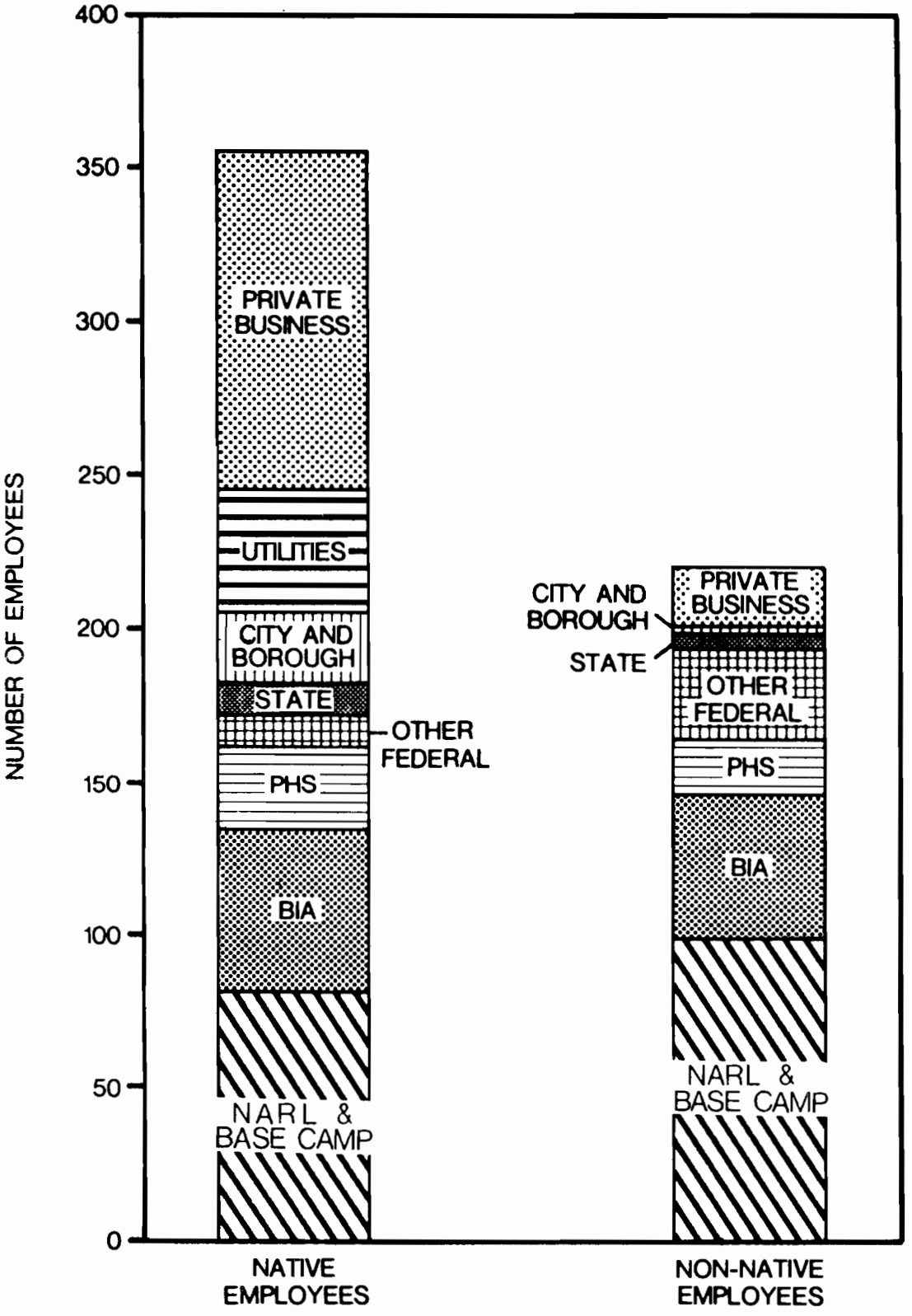
This income differential is critical when the cost of living differential between Barrow and the urban centers of the state is taken into consideration. Although precise figures are not available, costs for new housing appear to be approximately 100 to 125 percent greater than in Seattle. Food costs, especially for air-freighted fresh items, have approximately the same general relationship. Despite the cost of living and the existence of substantial poverty, the level of welfare in Barrow is not particularly high, nor has there been much of an increase in total benefits since the Alaska State Housing Authority's report of 1970.

One generally accepted measure of a community's wealth or lack thereof is bank deposits. In Barrow, checking account deposits have increased from some $550,000 to approximately $1,000,000 in the last few years. Savings account levels have remained generally steady ($250,000) except for normal seasonal variations.

EMPLOYMENT

Employment remains one of the most crucial problems of the Barrow region. The community is very dependent upon federal expenditures of the Naval Arctic Research Laboratory, the Bureau of Indian Affairs, and the Public Health Service for employment. Despite the efforts of these agencies, however, the State of Alaska Manpower Center indicates that unemployment levels at the present time could be as high as 250 persons, or approximately half of the native labor force. These figures can be misleading in that the real unemployment may be even higher than reported. For example, many

EXISTING EMPLOYMENT PATTERNS
BARROW REGION 1972



persons are employed on a part-time basis or on a seasonal basis. The question of who is permanently employed versus who is temporarily or part-time employed in Barrow is far less capable of clear definition than it would be in a more mature economy such as Anchorage. The 1964 *Barrow Plan* and the 1970 *Comprehensive Development Plan* prepared by the Alaska State Housing Authority both noted the difficulty of the Barrow economy and discussed some of the reasons that this exists.

Unfortunately, economic conditions of the Barrow region have not improved over the past two years; in fact, they may actually be worse. Barrow has had an exposure to a cash economy since the whaling of the late 1880's. Development of the Navy laboratory in 1946, where local natives were employed, furthered the change from a subsistence to a cash economy. The expansions over the subsequent quarter century by the laboratory, Public Health Service, and Bureau of Indian Affairs complexes, and the other state and federal agencies, have further shifted the emphasis to a cash economy.

The difficult situation is that Barrow is not readily suited to a cash economy *under current economic and development conditions.* Air distances and the resulting high freight rates place the community at a competitive disadvantage vis-a-vis the larger cities of Anchorage and Fairbanks. (The same problem plagues Alaska, which has a competitive cost disadvantage with the lower 48 states.)

The existing employment patterns chart indicates the current level of employment for the Barrow region. It can easily be seen from this chart how the three major federal employers (the Naval Arctic Research Laboratory and its base camp contractor, the Bureau of Indian Affairs, and the Public Health Service) dominate the employment market. This is especially noticeable in the non-native employment category.

The large amount of capital improvement programs on the part of the various federal and, increasingly, the state agencies has had a built-in "boom and bust" implication. Unfortunately, capital expenditures on the part of governmental agencies reflect current needs and/or current budgetary concerns on the part of the appropriate legislating bodies. Consequently, it is not always possible to maintain a steady source of employment, especially in construction. The result has been a greater fluctuation of employment demand and, accordingly, income level than would be expected in a more stable private market place. The current year is a case in point, where

construction has been quite limited compared to previous years. Future employment increase in the public sector is definitely expected to take place. The new high school, for example, will require additional faculty members. While most of the new faculty members can be expected to be non-native, increased education on the part of the native Barrow population, with an ever-increasing number going to college, can result in a reservoir of locally trained talent that can be employed in the schools in future years. The construction of new schools will involve a substantial amount of local employment over a two-year period. There will also be a requirement for additional maintenance and service personnel that can come from the local community.

The Naval Arctic Research Laboratory anticipates increased future employment at the laboratory. From fiscal year 1972 to fiscal year 1977, it is anticipated that the operations and maintenance contractor will increase employment from a peak and low level of 126 and 90 persons, respectively, to 146 and 110 persons. The NARL contractor is non-union and has a high (approximately 60 percent) native employment, versus the maintenance and operations contractor, which is union and has approximately 20 percent native employment. Any changes in the relative roles of the two contractors will provide an unusually heavy impact on village employment.

The Public Health Service also anticipates expanding its medical facilities to accommodate an increased demand for its services. This demand is being generated both by continued population growth and by increased knowledge and sophistication on the part of the local population with respect to both preventive and traumatic medicine. The establishment of the regional high school, and the fact that existing facilities are overcrowded and equipment is not adequate at the present time, will also affect required expansion. The projected programs in all areas indicate a requirement for 13 additional staff members by fiscal year 1974. Some of these staff additions will, by necessity, be outside-trained, non-native personnel. Others can definitely be recruited from the local community.

A review of these figures for the local agencies against the magnitude of population entering the labor force over the next 10 to 20 years clearly indicates that there still is a major crisis emerging. Regardless of the expansion of the federal facilities, *the demand for additional jobs will be substantially greater than can be provided on a basis of increased employment by federal, state, or local government agencies.*

Accordingly, attention has been directed to two areas – tourism and petroleum production – which have great promise for employment in the arctic, where substantial activities can take place if properly programmed.

Tourism

Of all parts of the Barrow economy, tourism is the one area which can provide the most jobs with the widest spectrum of educational and age levels. Tourism requires a substantial number of personnel for each dollar of investment. This is completely opposite from the other major industry of the arctic – oil production – where relatively few employees are involved even though far greater amounts of money are involved than could ever go to tourism.

Many aspects of the tourist industry have no specialized educational or employment backgrounds. It is thus ideally suited for students, part-time workers, housewives, and others who are not available full-time in the job market. This is an important consideration, as the weather conditions of the arctic are such that it is inconceivable that tourism will become a year-round event on the North Slope.

The importance of tourism to Alaska is clearly evidenced by the fact that, in 1964, approximately 59,000 tourists visited Alaska. In 1970, this level had increased to 120,000 tourists, or an increase of over 100 percent in a period of only six years. The State of Alaska Travel Division estimated that 22 percent, or 26,000 tourists, visited the arctic and western Alaska, especially Nome and Kotzebue. Last year, Barrow attracted approximately 5000 tourists, or approximately 4 percent of the state total. Obviously, it would only take an increase of one or two percentage points to have a very substantial and profound impact on Barrow's tourist economy.

Barrow has suffered from the lack of tourist accommodations and organized facilities. Various tour operators and airline companies have indicated a potential demand for increased tours to Barrow, providing more modern hotel accommodations become available.

The Alaska Travel Division estimates that the number of visitors to the state in 1975 will increase to 186,000 and, by 1980, 300,000. This means that, even if Barrow's percentage of total tourism remains constant at 4 percent, by 1980 some 12,000 tourists could be visiting Barrow annually, as

compared to the 5000 current level. If Barrow can increase its share of state tourists to 6 percent, approximately 50,000 tourists could come to Barrow by 1980.

While this is a very substantial figure, it is not at all impossible given the increase that is taking place in tourism throughout the state, the increasing awareness on an international basis of the arctic through the discovery of oil, and the desire of many persons to search out unique and different vacation or tourist spots. This, combined with the increasing proliferation of tour packages on the part of major airline companies and travel organizations, indicates that 12,000 persons visiting Barrow annually by 1980 could be a conservative estimate if adequate air transportation and accommodations could be provided.

The economic impact of this increase in Barrow cannot be underestimated. If one-half of the 12,000 projected visitors to Barrow by 1980 stay overnight, modern accommodations for approximately 70 persons would be required. This is a level that would be quite feasible if a new hotel facility is developed.

At an average rate of $20 per night per person, 6000 annual overnight visitors to Barrow would add $120,000 to the local economy. With an average expenditure of $20 per tourist for food and drink, tour guides, taxis, gifts, and curios, the 12,000 tourists would contribute an additional $240,000 to the economy. Thus combined, the 12,000 tourists would have an annual impact of approximately $360,000 annually on the local economy. Not only would this create substantial revenues for the community in terms of sales tax, but it also would support jobs in the hotel and tourist industry for cooks, waiters, housekeepers, gift-shop operatórs, taxi drivers, and all the other related activities.

Accordingly, as part of the regional master plan, it is strongly recommended that continuing efforts be made to develop expanded hotel and tourist facilities in the community and for the community to work directly with Wien Consolidated Airlines to provide entertainment (such as native dancers) and other coordinated activities. Suggested means of providing for increased tourism are discussed in more depth in the section entitled "Problems and Discussion," under "Lack of Adequate Tourist Facilities."

Petroleum Production

The experience of the North Slope relating to the production of oil has been the same as that of the state -- frustration. Since the discovery of oil and the sale of leases in 1969, legal battles with respect to the environmental impact of the Trans-Alaska pipeline have delayed construction of the pipeline and the beginning of production of the oilfield.

In 1972, the Secretary of the Interior announced that the Department of the Interior would grant the issuance of the pipeline permit. This, of course, has led to more court cases. The timing or shape of the final outcome is not known, and it would be presumptous in a study of this type to predict the findings of the court or subsequent legislative action.

However, *if* the courts and/or Congress approve issuance of the pipeline permit and production begins, the impact on the Barrow region can be important.

The major and vital concern is employment. It is estimated that the construction of that portion of the Prudhoe Bay/Valdez pipeline north of Fairbanks will take three years and have a maximum monthly employment of 5800 to 6000. If only 1 or 2 percent of the employment force is recruited from the North Slope, between 60 and 120 of the construction workers could be Eskimo. The impact of this on the local economy during the period of construction would be very substantial.*

After completion of the pipeline, the state of Alaska can expect substantial unemployment and resultant depression, even though the state is collecting royalties from the oil flowing through the pipe. This simply recognizes the fact that, while upwards of 10,000 men and women can be employed during construction, the actual number of persons engaged in operation of the pipeline and the oilfield itself will only number in the hundreds.

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* It should be noted that Mr. E. L. Patton, president of the Aleyeska Pipeline Company, testified before the Legislative Pipeline Impact Committee on April 3, 1972, that *total* native employment during the three-year construction period could range from 1380 to 1710, with a 15 to 20 percent margin of accuracy (this for all natives, not just natives from the North Slope).

After completion of the system, it is estimated that 400 to 500 persons maximum will be required on the North Slope. While many of these workers will be specialists who live in Fairbanks or Anchorage, there will also be available employment opportunities compatible with the skills or educational levels of Barrow residents. It thus becomes imperative that Barrow exert any available political and economic strength to ensure that a maximum number of natives are hired for the oilfields. (This also implies that the school and the Manpower Training Center work together with the oil companies to develop the necessary skills and aptitudes for oilfield employment.)

If an adequately trained reservoir of manpower is made available in Barrow, it would be in the best interests of the oil companies to use local help. The commuting distance between Barrow and Prudhoe Bay (200 miles) makes for less expensive flights than from Prudhoe Bay to Fairbanks (500 miles) or Anchorage (750 miles).

A one-week-on/one-week-off schedule can have a minimum disruptive impact on Barrow, especially for the married men, as compared to more standard two-on/one-off and two-on/two-off schedules. These are important considerations that need to be worked out with the oil companies. The main concern now, and one that influences this regional master plan, is the necessity of simply getting the jobs in the first place. Unfortunately, only about 20 Barrow residents are employed in the oil industry at this time. This is a figure that has not varied substantially for several years. If and when major activity takes place in the oilfields, then it will be necessary to move forward with concerted programs to ensure maximum local employment. The importance of this is summed up in a quotation in the 1970 Alaska State Housing Authority plan:

> *Although in the long run it may be cheaper for the industry to recruit from a population which is at home in an area whose conditions of life most Americans find intolerable, there is little indication that the industry will on its own take the initiative in this direction.**

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* "A Subregional Economic Analysis of Alaska," p. 339, as quoted in the *Barrow Plan, July 1970*

The second major future possibility for employment in the petroleum industry would occur if the federal government decides to open the Naval Petroleum Reserve No. 4 (PET 4) for oil exploration and production. While the possibility or timing of such a program is impossible to predict at this time, it is safe to say that full employment of Barrow's citizens should be virtually assured from that point on.

Other Manufacturing Employment Opportunities

High construction costs, the lack of extensive local markets, and high utility costs virtually eliminate the possibility of other types of non-service-oriented jobs, such as manufacturing for export markets. One possibility that can create new jobs is in cottage crafts – Eskimo art and sculpture, parkas, and other related products. These items would be unique and would find a ready market. Tourists would purchase such items locally, and an export business could be established with products being shipped to retail outlets throughout North America.

Land Claims Settlement and Employment

The Alaska Native Claims Settlement Act of 1971 established regional and village corporations to manage the cash and land settlements to the local natives. The initial native role and the subsequent selection of land are still in the planning and implementation stages. It is still too early to determine the results of some of the legal uncertainties of the Act, nor is it yet possible to determine how the settlement and future income from the subsurface rights will flow to the betterment of the community. In this master plan study, however, it was determined through conversations with local native leaders that the Land Claims Settlement will be used first for education (as "seed" money), second for community betterment, and third for industrial enterprises in the various villages and communities. In terms of the regional master plan, land must be made available for non-residential uses such as warehousing, industrial activities, and the like.

Block B was initially set aside for residential purposes. Its separation from the existing residential area, schools, and service establishments makes it undesirable for this type of use. It is recommended, as an alternative, that Block B be set aside to accommodate future industrial land requirements that will be an outgrowth of the Land Claims Settlement or other employment-generating programs.

RESIDENTIAL HOUSING REQUIREMENTS

New housing units will be required in Barrow to serve two markets. The first and most significant demand for housing will be generated by the new population growth that is expected. A secondary source of demand for new housing will result from the replacement of existing units that are dilapidated or are in a deteriorating condition.

In 1960, the average family size in the census division was 6.10 persons. By 1970, this had decreased to 5.70 persons, or a drop of 0.4 person in one decade. This reduction was caused by two factors. First, as more housing has become available, older children who are married now have housing available of their own and can leave their parents' homes. Second, the birth rate in the community is dropping. There are fewer children in the zero- to five-year-old age group in the city of Barrow than there are in the five- to ten-year-old group.

This is a phenomenon that has been observed in the entire total native population of the state of Alaska, where the birth rate is decreasing, even though it is still significantly higher than the non-native birth rate. (A distinction must be made between family size and household sizes. The average household size in Barrow is only 5.3 persons per dwelling unit. This takes into account the fact that there are 194 unrelated individuals in Barrow – either younger persons on their own who are not yet married, or older persons who are living alone.)

As new housing becomes available, as family sizes decrease, and as the community becomes increasingly dependent on a cash economy, it is expected that the number of persons per dwelling unit will decrease. In calculating the demand for additional dwelling units, it is also likely that, if birth rates do not decrease as anticipated and the family sizes remain at a higher level, the total population itself will increase proportionately. Thus, the total number of housing units actually required would still remain relatively the same, at least for the next 20 years. This is a reflection of the fact that the parents or potential parents of the population for the next 15 years are already born and it is only between 1985 and 1990 that a significant variation in total housing units could be expected.

The following table indicates the projections of the housing units required for the Barrow region from 1970 to 1990. As indicated, approximately 700

units in total will be required to accommodate the additional population growth expected. With the exception of approximately 40 units for the Naval Arctic Research Laboratory, all of these units would be in the city of Barrow, Tract A, and in Browerville.

HOUSING REQUIREMENTS, BARROW REGION

	Population Increase	Persons Per Unit	New Units (Incremental)	New Units (Cumulative)
1972–1975	400	5.15	80	80
1975–1980	700	4.85	140	220
1980–1985	900	4.55	200	420
1985–1990	1000	4.25	240	660

Specific housing requirements have been identified for certain governmental agencies:

Navy	39 units
Public Health Service	10 units
Federal Aviation Administration	14 units
Bureau of Indian Affairs*	15 units

The location of the governmental units will be important in terms of the relationship of the federal government to the community. At the present time, federal "compounds" exist at the laboratory, the Bureau of Indian Affairs, and the Public Health Service facilities. This type of housing emphasizes the difference between the native and non-native income levels, life styles, and social position. It has been emphasized by native and non-native alike that it would be highly desirable to place all new federal employee housing into the community rather than continue the existing patterns. With the introduction of the sewer and water systems being planned by the Public Health Service, it will be possible to place attractive and desirable new federal employee housing throughout the city.

* The Bureau of Indian Affairs estimates are based upon the anticipated staffing requirements of the new high school. These figures are still unofficial and may be revised as the high school plan is finished.

The Navy housing could also be located within the community, but the distance between the laboratory and the city is such that commuting problems could arise. The varied working hours of laboratory administrative and research staff further suggest that the development of additional laboratory housing units in the city could create some commutation problems.

This could be offset by the social benefits that could accrue to families living in town. Proximity to schools and recreation facilities would be valuable for the children. Community facilities such as stores, restaurants, and recreation would also be available to Navy residents in town, as would proximity to the airport terminal complex.

Budgeting limitations may prohibit the Navy from building housing at NARL. An alternative to be explored would be to have local development groups build housing for lease to the Navy concurrent with the new HUD housing program. This housing can be integrated with the new native housing to avoid creating additional federal compounds.

Housing Location

The Barrow region contains two distinct physical and social entities -- the city of Barrow and the Naval Arctic Research Laboratory. The former is an Eskimo community where whites are the outsiders, while NARL is a self-contained white compound. The communication between the two is poor, partially because of the 5-mile separation and partially due to different cultural backgrounds and life styles.

The Eskimo is justifiably proud of his heritage, but is having difficulty in adjusting to the white man's world. He sees examples every day of how whites live, but he becomes frustrated by his inability to achieve his aspirations. He has been hampered by low income, lack of education, and non-acceptance by a society dominated by whites.

Within the city, there is also a contingent of whites. Many are employees of either the Bureau of Indian Affairs or the Public Health Service. These agencies provide housing for the white employees adjacent to the schools and hospitals. There is much resentment among Eskimos because these people spend their entire time either at work or in their apartments, and

seldom socialize with the people of the community. The whites at NARL are also prone to live their separate lives.

Several whites within the community have married natives and have become leaders in civic affairs and business. But for most, living in Barrow is only a temporary situation. The life for whites in the Barrow region, however, is not necessarily pleasant. Although he or she may be fulfilling an altruistic objective, they are also subject to some of the harshest weather conditions in the world. This has resulted in the whites associating with people who have the same backgrounds, aspirations, life styles, etc. Unfortunately, this action has not created a region where everyone lives in harmony. Perhaps, like the proverbial cliche, this will take several generations to overcome. It is evident, however, that for as long as white compounds exist there will be animosity on the part of the native.

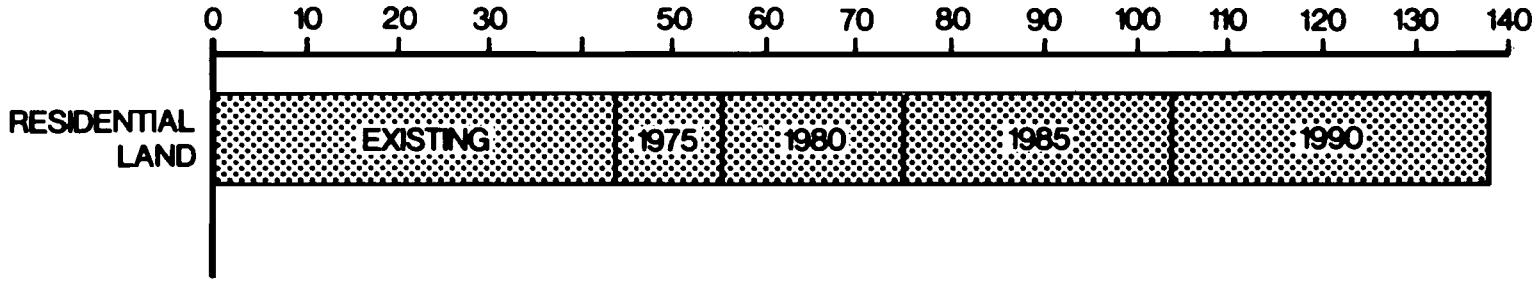
This plan recommends that federal agencies located in the city construct or lease housing accommodations throughout the entire community. This action, at least, would be a start to integrating the two cultures. Because of the research nature of NARL and the problem of transportation to and from work, it is probably unlikely that it would be feasible to incorporate any appreciable NARL housing in the city.

The new housing lots in Barrow are 125 x 50 feet, for a total lot size of 6250 square feet. If future housing maintains this average lot size, then approximately seven houses can be built per acre (excluding streets). The projected residential land area graph indicates that, by 1990, 138 acres of residential land will be required in Barrow to accommodate the future growth. Today, approximately 44 acres of residential land are in use. The development of 94 acres of additional residential land over the next 18 years will constitute one of the major social concerns of this master plan.

The question of housing density has not been totally resolved in Barrow. As part of the planning process for the proposed new housing units and utility system, native leaders and community citizens have clearly stated a preference for unattached single-family housing units. In the arctic environment, privacy is an important aspect of successful community living. Accordingly, many local residents believe that apartment houses will find little public acceptance. Single-family houses require more land than in a temperate climate. The combination of wood construction, low temperatures, insufficient water supply, and high winds can result in severe

BARROW REGION

PROJECTED RESIDENTIAL LAND AREA IN ACRES



fire danger. Despite the fact that the city has a new and modern fire engine manned by a trained volunteer fire department, it is a fact of life that most homes will burn to the ground in a matter of minutes. From a safety standpoint, it is imperative that the lots be large enough to minimize the danger of fires spreading from house to house in a high wind.

The possibility of apartments supplying part of Barrow's future housing needs cannot, however, be dismissed. The costs of multiple family units can be cheaper, through the use of common interior walls, foundations, and utility cores. Maintenance and heating costs for each unit would be reduced. With careful attention to design, a significant level of privacy can be obtained. It may thus be possible to provide adequate housing for persons who otherwise may not be able, for either financial or supply availability reasons, to live in single-family houses.

Replacement Housing Needs

The determination of the units that should be replaced is a much more difficult and subjective issue. In 1969, the Alaska State Housing Authority (ASHA) undertook a survey of approximately 65 percent of the dwelling units of Barrow. In this survey, they indicated that some 20 percent of the units were dilapidated, 60 percent were essentially deteriorated, and 20 percent were sound. It is believed that the same percentage figures can be applied to the total housing stock of the community. Thus, with a housing level of approximately 400 units, 80 (20 percent of the total) can be considered as dilapidated. Dilapidated houses are, by definition, virtually impossible to meaningfully or economically rehabilitate and thus are the prime units for replacement. In this instance, it can be calculated that there are a minimum of 80 units that should be replaced immediately.

Of the remaining 60 percent of the units that are deteriorated, rehabilitation can certainly be considered a possibility. There are no hard and fast rules for predicting when a deteriorated unit can or should be taken off the market. With the severe climatic problems of Barrow and the fact that new housing is going to be made available in sufficient degree to replace much of the older homes, it can be calculated that 10 percent of the deteriorated units could be replaced on an annual basis. Thus, of the 240 deteriorated units, an estimated 24 units per year could be replaced, thus phasing out all of the deteriorated units on a ten-year basis.

The deteriorated unit replacement program, of course, would need to be in addition to the new housing units indicated in the above table, which are oriented towards the new population growth.

The federal housing program currently in process for Barrow envisions 100 new units to be constructed within the next year in Block A. The reasons for such houses are apparent. The social problems associated with poor housing have been extensively documented by the Alaska State Housing Authority, Public Health Service, Bureau of Indian Affairs, and others. Diseases such as gastroenteritis, otitis media, acute respiratory disease, and tuberculosis would be decreased if good housing, waste disposal, and water supply are provided.

COMMERCIAL AND INDUSTRIAL LAND AREA REQUIREMENTS

At the present time, there are approximately 3.2 acres of commercial activities in Barrow. Transportation, warehousing, and utilities occupy an additional 3.6 acres. As the community continues to grow, additional commercial services will be required to serve the retailing, business, and personal service needs of the local population. In addition, further land will need to be set aside for areas of employment, for transportation facilities, for light industry, utility facilities, and the like.

Projections of the future land area required for these types of activities have been prepared on the basis of 65 square feet of land per capita for commercial activities and 75 square feet of land for industrial, transportation, utilities, and the like. The results of these calculations, when applied to the projected population of the city of Barrow, are indicated in the following table.

These figures do not include non-residential land required by the Navy, the Bureau of Indian Affairs, or the Public Health Service. Geographically, and for ease of transportation and utilities, all retail facilities should be grouped in one central area.

ADDITIONAL NON-RESIDENTIAL LAND REQUIRED

	Commercial (acres)		Industrial/Warehousing/ Utilities (acres)	
	Incremental	Cumulative	Incremental	Cumulative
1972–1975	0.4	0.4	0.5	0.5
1975–1980	1.0	1.4	1.2	1.7
1980–1985	1.3	2.7	1.5	3.2
1985–1990	1.5	4.2	1.7	4.9

The requirements for other governmental office space, in addition to the two larger agencies, is difficult to predict, as such decisions are often made on the basis of policy rather than actual stated demand levels. For planning purposes, however, the community will need to provide for an expanded city government, the offices of the North Slope Borough, and possibly some quasi-public agencies such as the Arctic Slope Native Association, the Regional Development Corporation office, and the like. A planning level for a governmental building that would have as its first phase space level 25,000 square feet with expansion possibilities to 50,000 square feet is recommended. At a 50 percent land coverage, this would mean setting aside 1 acre for the Phase I development and an additional acre for the Phase II development, for a total governmental complex of 2 acres.

EDUCATIONAL REQUIREMENTS

The current and future educational requirements of the Barrow region can be analyzed in terms of

- The total number of students to be educated, based on present and expected future population levels

- The type of educational programs to be offered that best serve the needs and aspirations of the regional population, taking into account its unique and economic structure

In 1972, enrollment in the Barrow school was approximately 709 in grades kindergarten through 10. This covered a population which is generally 5 through 16 years of age. The estimated Barrow regional population in 1972, between the ages of 5 through 16, was 768, indicating that approximately 92 percent of the community's children are currently in school.

There are, however, an additional 100 or so youth in the Barrow region, plus the outlying villages, that are between the ages of 17 and 19. These youth would be possible 11th- or 12th-grade students if high school facilities were available today. In addition, some 80 students are boarding outside of the Barrow region (or the total North Slope area) at Mount Edgecombe, Chemawa, or Fairbanks. When these figures are added, it can be seen that there would be approximately 950 potential students for the Barrow school system. This figure assumes that younger children would be educated in their local communities, while students from grades 9 through 12 would be educated in Barrow. The existing schools at Anaktuvuk Pass and Wainwright would continue to serve as the kindergarten through 8th- or 9th-grade local educational facilities.

The Arctic Slope Native Association has indicated that the improvement of educational facilities will be a major objective of the Native Land Claims Settlement. As part of the new North Slope Borough planning program, the development of junior high schools at Point Hope, Anaktuvuk Pass, Wainwright, and Kaktovik will become an important objective. The borough and the Arctic Slope Native Association are also anticipating that a community college will ultimately be developed on the North Slope. Presumably, because of its concentration of people and housing, Barrow would be the logical place for such a facility. The regional master plan has taken cognizance of these aspirations and makes recommendations for setting aside land within the Barrow region so that adequate space is available for developing new school buildings as conditions warrant.

Throughout this entire planning process, it has been recognized that there is a "pull" between Barrow, with its schools, jobs, and service activities, and the villages. Perhaps nowhere is this pull greater than in the area of education. Thus, in preparing the master plan for the Barrow region, the stated aspirations with respect to the improvement of village educational facilities have been recognized. Fortunately, the existing facilities, plus the planned high school, will suffice to serve the children of the Barrow region, plus the high school age students throughout the North Slope. Thus, even

though it is necessary to make long-range provisions for additional school facilities in Barrow, a "breathing space" has been provided.

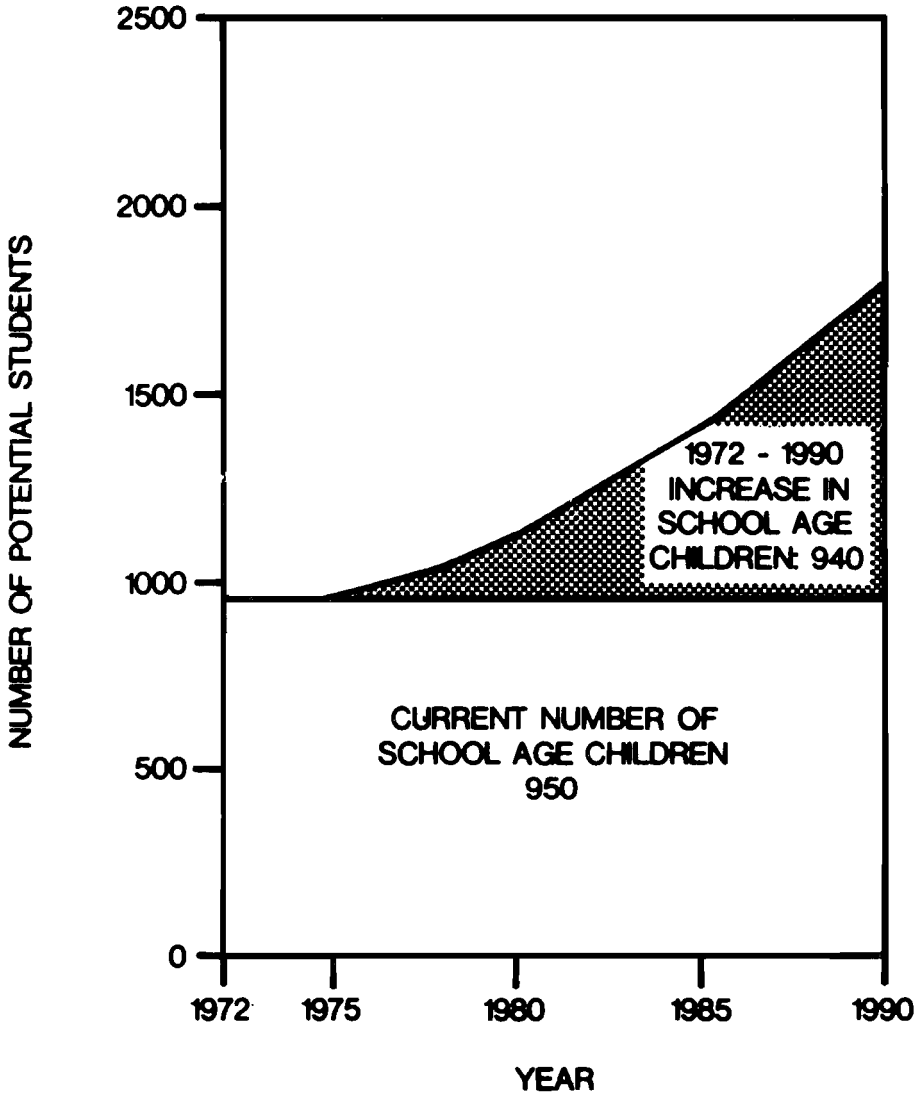
To determine when additional school facilities will be needed in the future, a projection of the increase in school-age children that can be expected to take place over the next 18 years was made. Because of the large number of teenagers currently in the area, it is expected that an increasing number of children will be born in the region when these teenagers become adults. This will take place even though the over-all birth rate will decline as a result of greater local acceptance of family planning procedures. The projected increase in school-age children graph indicates that, by 1990, there could be an increase of approximately 940 students over the 1972 levels. This includes all of the children within the city of Barrow and its immediate surrounding region in the age group 5 through 15, plus those students in the outlying villages who would be coming to Barrow to attend high school.

The present school enrollment of 710 includes approximately 200 students who are using the old unit in the village. When the new high school is opened, the old unit will not be used for educational purposes. The remaining or current school facility has an assumed student capacity of 500. With a new high school designed for 500 students, the expanded Barrow school system, without the old village building, will have a capacity of educating 1000 students. Based on a level of 90 percent of the school-age population actually being in school, these figures indicate that, with a design capacity of 1100 students, the school system now envisioned for Barrow will suffice until the population between the ages of 5 and 19 reaches this maximum enrollment level. It is expected that this level will be reached in 1980, at which point in time additional facilities could be required. Of course, if expanded junior high school facilities are provided in the villages, then the "breathing space" for Barrow could be extended to 1985 or thereabouts. At some future point in time, however, the Barrow community will need to provide additional school facilities beyond the high school now in the planning process.

These future facilities will consist of both a new elementary school function and an expansion of the high school. Accordingly, as part of the regional master plan, it is recommended that provision be made for a second elementary school site in the Browerville area, which will be accommodating much of the new residential growth of the community. Similarly, in designing and laying out the location for the new high school in Block A, it

PROJECTED INCREASE IN SCHOOL AGE CHILDREN

BARROW REGION *



* ASSUMES STUDENTS WILL COME FROM THE VILLAGES TO BARROW FOR GRADES 9-12 AFTER THE HIGH SCHOOL IS BUILT.

is important that the site plan and site boundary be set in such a way that future expansion can take place. It would be unfortunate if the high school were to be built against the present configuration of 500 students, which should be adequate for the next 8 to 10 years, only to find that subsequent expansion cannot take place because residential or commercial development was allowed to encroach upon a logical expansion area for the high school.

If a community college is built in Barrow in the future, the logical location for it would be near or as part of the high school. This, too, should be incorporated into the regional master plan.

Educational Objectives

The people of Barrow have expressed a desire for the drawing area for the regional high school to be from Barter Island, Anaktuvuk Pass, Wainwright, and Point Lay. They have also requested that the program be an enriched curricular rather than basic or minimal. Some of the students will be preparing for college and professional careers, while others will work toward acquiring vocational and technical skills.

The Barrow School Board and members of the community have been actively involved in helping prepare the educational specifications for both the existing facilities and the new high school. It has been recognized that the Barrow junior/senior high school program will need to be flexible enough to meet the changes that are occurring in Barrow on both an individual basis and for the society as a whole.

The high school curriculum currently being considered for the 7th- to 12th-grade levels will be

- The Language Arts Program

  To include reading, writing, listening to, and speaking in English. It will also include the use of the Eskimo language (spoken and written) as well as the study of at least one language such as French or Spanish.

- The Science Program

  To include discovery of concepts and an attitude of inquiry and critical thinking. Courses in the biological and physical sciences will be offered.

- The Mathematics Program

  To include computational skills, concepts, ideas, and problem-solving techniques. It will also include advanced mathematics and its uses in today's technological society.

- The Social Studies Program

  To include knowledge, skills, attitudes, and behavior of people of other cultures and countries, governmental systems, and problems facing all people in the modern world.

- The Fine Arts Program

  To include creativity, expression, and appreciation in music, art, drama, and dance – especially as they relate to Eskimo culture.

- The Business Education Program

  To include secretarial and clerical skills, business machines, and an orientation to the world of work.

- The Practical Arts

  To include home and vocational skills, appreciation and understanding of tools and materials, and advanced work in the industrial arts and homemaking areas.

- The Health and Physical Education Program

  To include development of motor skills, physical fitness, knowledge of individual sports, and personal, community, and mental health and safety.

Preparation of students for meaningful employment is a major concern on the North Slope. As much of the future employment will be oriented to the oil industry, an industrial arts program has been designed to provide students with some understanding of the industrial world, as well as an opportunity to explore some of the industrial occupations. The student will be able to develop an insight and understanding of industry and its place in culture. It

is also oriented to developing basic skills in the proper and safe use of common industrial tools, machines, processes, and their safe care and maintenance.

The business education program will also be directed toward acquiring skills, knowledge, abilities, and attitudes important in securing beginning jobs in business.

Through these enriched and expanded programs, it is anticipated that the youth of the region will become increasingly equipped to participate in a changing society, both in terms of being able to cope with the stresses of change and also in terms of being trained for today's employment market.

Arctic Seminars

The Barrow region contains two human resources which have never been fully exploited: the native is an expert in arctic survival, and the scientists at NARL have expertise in the arctic environment. The Barrow school system and the University of Alaska should consider offering seminars on the arctic environment. These seminars could be conducted during the winter, when hotel accommodations are vacant.

PROBLEMS AND DISCUSSION

VI. PROBLEMS AND DISCUSSION

Before preparing this master plan, it was necessary to determine major problems confronting the Barrow region. Most of these problems, however, were identified in the *Preliminary Regional Plan, Barrow, Alaska*, dated September 1971.

TRASH REMOVAL AND DISPOSAL

Problem

All refuse from the region is hauled and dumped at South Salt Lagoon. There is no organized method of collection and disposal within the city.

Solution

An incinerator is now under construction at South Salt Lagoon. However, no agreement has been formalized among the various parties for the operation and maintenance costs of the facility, which is estimated at $118,000 a year. The estimated usage and approximate prorated costs are

	Usage	Approximate Cost
City of Barrow	67%	$79,000
Navy	18%	$21,000
Bureau of Indian Affairs	10%	$12,000
Public Health Service	3%	$ 3,500
Other	2%	$ 2,400

Neither the Bureau of Indian Affairs nor the Public Health Service has plans at this time to collect or transport trash to the incinerator once it is in operation. The Public Health Service has indicated that they would probably go in on any BIA plan for pickup. No plans for including the city in the pickup have been considered as yet.

All governmental facilities presently have a truck pickup system in operation. The Navy will continue to collect trash and waste, as is now being done, with the incinerator being the disposal destination. Truck pickup at NARL is about twice a week, and is being done by the camp contractor.

A community program for trash collection was tried several years ago, but had to be abandoned when people could not pay their monthly bill. The financial capability of the community is no better now, and may improve in the future as the economy grows.

The only apparent means of ensuring continuous trash collection is through action by the Public Health Service, the Bureau of Indian Affairs, and the city. The city's share could be derived from the increased revenues it receives from the sale of liquor.

SEWAGE DISPOSAL

Problem

The only facilities within the region having adequate means of sewage disposal are the Bureau of Indian Affairs, Public Health Service, Weather Service, and the new laboratory building at NARL.

Solution

The Navy is currently constructing a package sewage treatment plant at NARL, and the Public Health Service has prepared a sewer plan for the city. This plan and alternatives are reviewed in greater detail under the subsection of the report entitled "Engineering Studies."

GAS FIELD SUPPLY

Problem

The field is estimated to have only seven to eight years of useful life.

In early 1973, the Office of Naval Petroleum and Oil Shale Reserves had plans to drill additional step wells within the Gas Field as well as to seek a new source elsewhere. These plans were discussed in the "Area Factors" section under "Municipal and Regional Services."

NATURAL GAS AND ELECTRIC POWER

Problem

Both the BIA and NARL have their own power plants. However, if one system fails, the other system cannot serve as a backup.

Solution

In the "Engineering Studies" subsection, plans by the Bureau of Indian Affairs are discussed which provide gas and electrical interties between the two systems.

WATER SUPPLY

Problem

Within the region, only the Bureau of Indian Affairs and Public Health Service complexes and the laboratory building at NARL have running water.

Solution

The water system for NARL was discussed in the "Area Factors" section. The water plan prepared by the Public Health Service for the city is discussed in greater detail in the "Engineering Studies" subsection.

BEACH EROSION

Problem

The portion of the city adjacent to the ocean is being eroded at the rate of 10.1 feet per year. The Corps of Engineers has made a reconnaissance report on the erosion problem but cannot justify a solution on economic grounds.

Solution

The extraction of gravel from the beach adjacent to the community has been ordered stopped. Alternative actions that can be taken are discussed in the "Special Studies" subsection.

TRANSPORTATION

Problem

An all-weather road is needed between the Barrow airport and the main camp at NARL.

Solution

The all-weather road is discussed in the "Engineering Studies" subsection.

HOUSING

Problem

With the exception of the Bureau of Indian Affairs and Public Health Service quarters and the housing in the new laboratory building at NARL, the condition of housing within the region is poor.

Solution

The number of new housing units needed is discussed in the section entitled "Area Factors" under "Economic and Social Characteristics."

SOIL CONDITIONS

Problem

The underlying composition of the permafrost is unknown in areas where development could occur.

Solution

Soils studies must be conducted in areas where construction is planned.

GRAVEL SUPPLY

Problem

An adequate supply of gravel is not readily available for the many projects that are envisioned. For example, the Point Barrow spit is no longer an acceptable source of fill material.

Solution

The feasibility of dredging from the ocean must be studied. The Bureau of Indian Affairs is already studying potential sources and the Navy has requested permits to explore six areas within 20 miles of NARL. The new haul distance is expected to be a minimum of 6 miles and as much as 20 miles, a factor that will greatly increase the cost per cubic yard.

CITY LOCATION

The Problem

Beach erosion threatens portions of the community. There is limited land area for community expansion.

Background

The above problems are considered so serious that some consideration must be given to the merits of relocating the village. There are environmental, sociological, and economic factors to consider in such a move. For one, the people have lived here for many years and have established roots which are extremely deep. They have always lived adjacent to the sea and have depended on it for food.

In spite of the fact that their livelihoods are gradually changing to reliance on other forms of employment, their culture must still be recognized. For many, particularly the older generation, the habits of tradition cannot and should not be changed.

The concept of moving villages is extremely costly. It has been done before, not only in Alaska but throughout the Arctic, the most notable example being Inuvik, Northwest Territory. The merits of relocating to a new site offer the challenging opportunity of creating a completely new town. The new town could be designed and developed to incorporate the latest planning technology, based on American, Russian, and Canadian experience. More important, the design can reflect the values of the people who will live there.

The negative experience of Inuvik and other cities with respect to planned changes should not be ignored, however. Inuvik has become a city that apparently has intensified rather than reduced the problems of native versus non-native living. Immediate problems of income and employment differences between groups can become substantially worsened by well-intentioned programs that do not assess the impact on the historical and cultural background and structure of the native population. It has been

specifically recommended that not only the Public Health Service and Bureau of Indian Affairs, but all social service people, become involved in carefully designed seminars, with outside help as necessary, to relate the social pathology factors to other elements of present life.

A new site must be in an area containing adequate deposits of gravel which can be laid over the tundra. Assuming a town site of 500 acres, to meet both existing and future community needs, the amount of gravel needed based on a 4-foot fill would be 3,240,000 cubic yards. Based on a cost of $10 a yard, the estimated cost to excavate the gravel and to provide the pad for streets, residences, schools, hospitals, etc., is over $30 million. To this, of course, must be added the cost of

- Relocating homes from the existing town, assuming that they can be moved
- Building new residences, schools, stores, etc.
- Providing a water supply, sewage disposal system, gas, power, and other utilities
- Developing an all-weather road from the new site to the existing airport.

Dr. Max Brewer, former director of the Naval Arctic Research Laboratory and now Commissioner of the state's Department of Environmental Conservation, has estimated that the cost of relocating the village would approximate $100 million. The financial resources to fund such a move are not known at this time. Among the federal agencies active in the community, the only apparent resources appear to be the Bureau of Indian Affairs and the Department of Housing and Urban Development.

If the North Slope Borough is successful in its pending court case with the oil companies, the borough will be able to obtain revenues from the Prudhoe Bay area that can benefit all residents of the North Slope. Barrow is the largest city on the Slope and will receive the major share of revenues. However, these funds will no doubt be allocated to providing municipal services, which are already inadequate, and to a capital improvement program to develop and maintain badly needed public facilities. It is doubtful if Barrow can utilize enough of its share of the funds to finance,

over a period of years, the construction of a new town, while still maintaining adequate services to the people in the existing town.

The Bureau of Indian Affairs and the Department of Housing and Urban Development have participated in village relocation, but not to the extent contemplated here. The other native organizations being formed under the Land Claims Act are in the formative years and would probably not be able to handle such a tremendous undertaking in the immediate future.

The disadvantages of relocating the village are also economic, sociological, and environmental. The residents of Barrow are very heavily reliant on employment at the Naval Arctic Research Laboratory. Any relocation to the southwest would increase the distance and travel time for residents who work at the laboratory. During the dark days of winter, traffic would be hazardous because of poor visibility caused by the darkness and drifting snow.

The main disadvantage of relocating to the south is that it removes the native from his traditional location adjacent to the sea. This would appear to be an unacceptable action. In addition, the extraction of over 3 million yards of gravel from the tundra is a most questionable environmental action.

One advantage of relocating the village to an area south of town is the close proximity to gas and water resources. Less lineal feet of utility lines would have to be maintained. Such a site would have to be so located that the water source could not become contaminated. Relocating to the south would require the construction and maintenance of an all-weather road to the airport and to the laboratory.

The village could be relocated eastward, somewhere in the area between Browerville and NARL. However, the presence of several lakes in the intervening space does not provide an adequate site. More important, much of the land near the laboratory is used for research and usurping any of this land would negate the reason for even having such a research facility at Barrow, which would subsequently eliminate the major employment source.

For purposes of this analysis, possible general sites were designated to the west, east, and south. More definitive site selection studies would have to be performed in order to determine the availability of adequate gravel and fresh water, and the comparative costs for utilities.

Possible Alternative Solutions

Advantages and disadvantages are offered for the following general sites:

1. West – Will Rogers/Wiley Post Monument area
2. South – Ikroavik Lake area
3. East – Between Browerville and NARL

In general, all three sites have the common advantage of providing a completely new town with integrated utilities and facilities. All three would cost basically the same, except for utilities and transportation, which would depend on a particular site's relationship to water, gas, the airport, etc.

1. West – Will Rogers/Wiley Post Monument Area

Advantages

- The Bureau of Land Management believes that gravel is available at a site farther south along the shore.
- The community could be sited in close proximity to the sea.
- The site would offer unlimited possibilities for expansion.

Disadvantages

- Travel and driving time to the major source of employment, the Naval Arctic Research Laboratory, is increased by 10 miles and 20 minutes.
- The site would be further removed from the airport.
- A 10-mile all-weather road must be developed and maintained.
- Utility lines would have to be extended an additional 10 miles, unless water and gas resources are developed in the immediate area.

2. South – Ikroavik Lake Area

Advantages

- The site is close to a potential water source.
- Gas is relatively accessible.

Disadvantages

- The site is remote from the sea.
- The area has only limited possibilities for expansion.
- Gravel, if available, would have to be extracted from the tundra.

3. East – Between Browerville and NAVARCLAB

Advantage

The city and Naval Arctic Research Laboratory are dependent on one another and the distance and travel time between the two would be decreased.

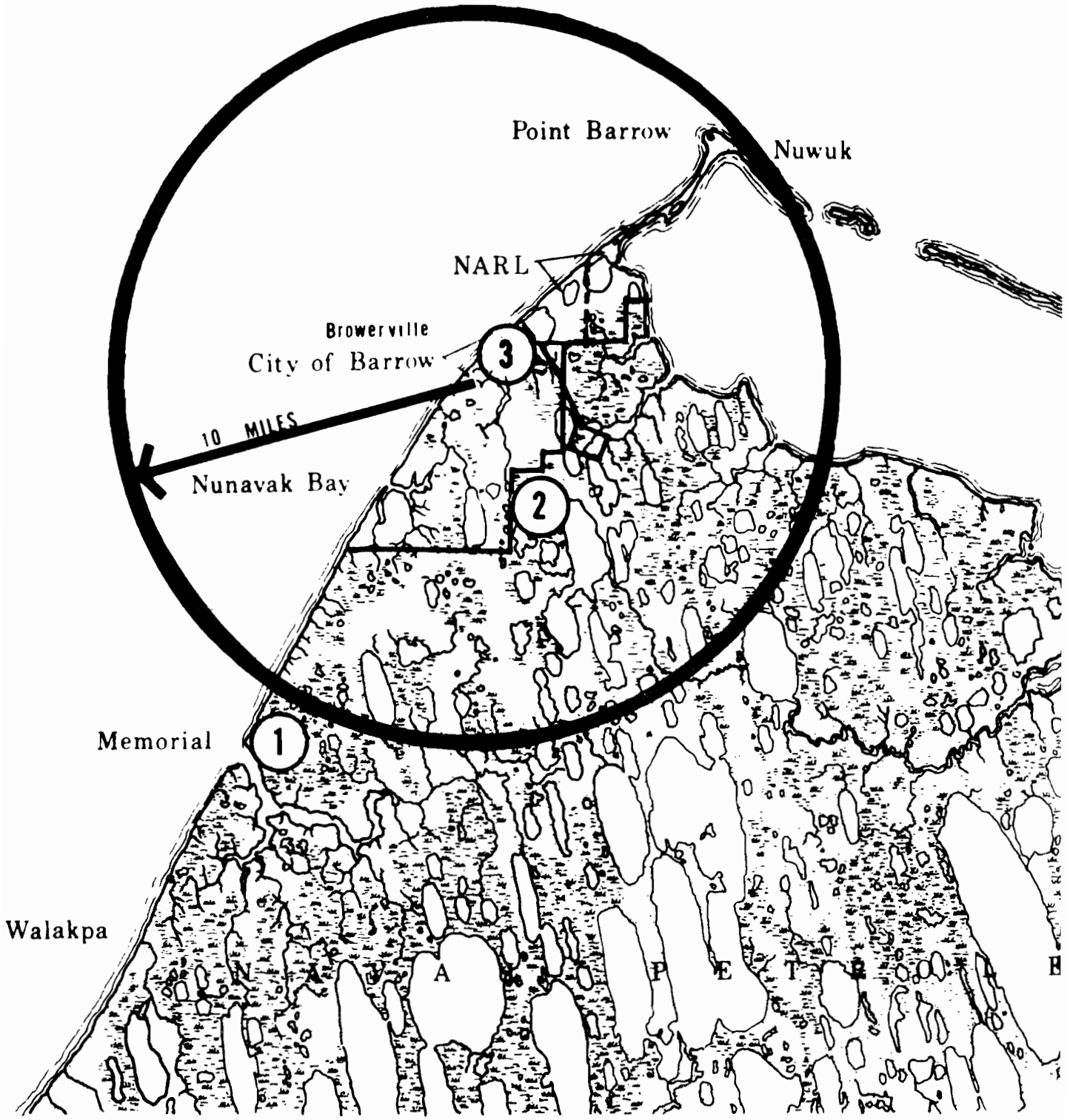
Disadvantages

- Lack of adequate area to construct a new city.

- Land in this area is either occupied by bodies of water or is used for research purposes.

Recommended Alternative

Because these alternatives are apparently not capable of implementation, the city should remain in its present location.



CITY LOCATION

BEACH EROSION

The Problem

Beach erosion threatens the town, NARL and adjacent military facilities, and the beach road that connects them.

Background

The normal cycle of beach erosion and littoral drift in the Barrow area has been of a slow collapse of the bluffs south of Barrow village with the fine sediments being transported to the northeast, causing an annual deposition of an estimated 10,000 cubic yards in the Point Barrow, Eluitkak Spit area.

This drift is composed of the suspended finer materials from the in-place materials. Therefore, the total erosive effect on the bluff areas exceeds this amount to a considerable extent, with the larger materials remaining fairly close to the point of origin and replacing those finer materials subject to littoral drift.

Over 400,000 cubic yards of beach sands and gravel have been borrowed from the beaches immediately seaward of the town site and the bluffs just south of town, plus an undetermined amount from the Naval Arctic Research Laboratory and beach road areas. Prior to the borrow operations, the beach contour and profile along the area from Barrow to the Point Barrow spit had been fairly stable, with the collapse and erosion of the bluffs more or less dependent upon the volume of the littoral drift to the northeast. Removal of large quantities of beach borrow has caused a rapid increase in the erosion of the bluffs and beaches from which material has been borrowed.

The beach underwater profile will tend to stabilize to conform to the cumulative erosive effect of ice and wave action. Removal of a portion of the beach as borrow causes a rapid erosion immediately shoreward while the new profile moves inward. The heavier materials will remain in the area to replace material borrowed, while the suspended fines may be moved for long distances by wave action and swash.

It may reasonably be expected that in a borrow area the beach will move shoreward to the extent necessary to provide sufficient material to maintain

the preborrow underwater profile. If the eroded materials are of sufficient size and gradation to replace borrowed materials, with little loss from off-site transport of suspended fine material, the erosive effect will be much less than if the beach materials have a high percentage of silts and fines which are subject to littoral drift. The Barrow bluffs are predominately silt and hence subject to extreme erosion.

The amount of material borrowed from the beaches, if replaced by natural erosive processes, most probably will come from the bluffs in the Barrow area and the erosion will extend some distance southwest of the city. Estimates of bluff erosion range from a minimum of 30 feet to a maximum of 130 feet of horizontal shoreward erosion of the shoreline near the city. This erosion is in addition to the natural long-term processes of erosion which occurred prior to any beach borrow and would be expected to continue even if the borrow could be replaced.

The short-term effect of major storms, such as the storm of October 3, 1963 (classified as a 50-year storm by the Navy), may be far in excess of the normal erosion over a span of several years. Such storms cannot be predicted; however, storms of lesser magnitude may be expected to occur at regular intervals, and the impact on the shoreline at Barrow must be considered.

The total effect of normal erosive processes, plus the acceleration of erosion due to material being borrowed from the beaches, indicates that the shoreline is eroding quite rapidly in the Barrow area and will continue to erode at an accelerated rate until the natural process strikes a balance and the effects of beach borrow have been cancelled out. Under normal conditions, this accelerated erosion would continue for many years, but could conceivably occur in a few hours if a storm of the magnitude of the 1963 storm should recur.

Possible Alternative Solutions

1. Relocate village.

   This alternative has already been discussed and rejected.

2. Provide beach stabilization program.

The Corps of Engineers is charged with the protection and preservation of shore areas under the River and Harbor Act of 1962. On October 22, 1968, the city of Barrow applied for assistance in a beach stabilization program under Section 103 of this act. A subsequent report by the Corps of Engineers – *Point Barrow Beach Erosion Reconnaissance Report, Section 103 of River and Harbor Act of 1962, Point Barrow, Alaska,* dated December 12, 1969 – concludes that there is not sufficient economic justification for federal participation in beach erosion protection at Barrow. Briefly, the report finds that conventional methods of erosion control are not practical, due to the absence of construction materials; that the imbalance of littoral drift would probably cause the undermining of a bulkhead or sea wall; and that the small amount of this drift would not replenish borrowed materials in the foreseeable future.

The cost of constructing conventional methods of shoreline erosion control, plus the unknown effect of ice and littoral drift on such structures, is the prime reason for the Corps of Engineers to conclude that such a program is not feasible.

Possibly other unconventional methods of control should be studied to determine feasibility and effects upon erosion. Possible erosion control might be effected by one or more of the following methods:

- Construct small "islands" of heavy barged-in rock which would be placed near the shore. These could deflect currents and/or slow down currents to limit the littoral drift. These islands would have to be capable of resisting the shoreward ice pressures.

- Construct an artificial offshore bar to force pack ice to ground well out from the beaches. The bar could be constructed from barged-in rock or by dredging from the seaward side of a bar.

- Utilize material at hand, such as old drums filled with a lean sand and concrete mix, and construct a gabion type of structure to act as a sea wall or jetty.

3. Replenish beaches with material to replace borrow.

   No available inland borrow areas are known that contain sufficient materials that could be utilized to replace materials borrowed from the beaches. The quantity of material required precludes barging in replenishment materials for beach nourishment, and the cost of such a replenishment program would be staggering in proportion to the economic returns.

   No investigation has been made of the quantity and quality of underwater deposits at some distance off shore. Should sufficient materials be found off-shore, it may be possible to dredge material from the ocean bed for use as a beach nourishment material and as a source of future borrow material. Such a material source, if available, could possibly provide material with a lesser impact upon the ecology of the area and probably at lowest cost per unit.

4. Replenish beaches by accelerating slump of bluffs southwest of city.

   It has been suggested that the tundra could be stripped from an area of the bluffs south of the airport and that the resultant increase in thawing and slumping would accelerate the rate of beach nourishment and thus stabilize the beaches in a shorter period of time.

   This concept merits further consideration. However, prior to implementation, a detailed investigation must be made to determine if the soils in the bluff area contain materials of sufficient gradation to replenish the coarser materials borrowed. The ecological effects of forcing an erosion of 100 or more horizontal feet in one area must be determined and it must also be ensured that, by the forcing of erosion in one portion of the bluffs, a chain reaction is *not* started which could result in a similar erosion in the entire bluff area, and especially northward to the Barrow area.

5. Do nothing to the beaches and adjust the physical improvements on land to allow for the expected erosion.

   The cost of providing some type of beach stabilization is out of proportion to the economic advantages gained. If a portion of the cost of a program of this magnitude were to be allocated to relocating

homes and other physical structures threatened by erosion, the region could divert additional funds to construction of streets, utilities, and other features to minimize damage from erosion.

A prime consideration would be to develop a program so that erosion would be limited to that which can be expected to occur due to the present imbalance of beach material. In order to accomplish this, the city and all agencies should jointly accomplish the following:

- Enact an ordinance which would prohibit the removal of materials from bluff and beach areas which are subject to erosion or will cause erosion to improved areas.

- Survey the area to determine which structures are now located near threatened areas and institute a program of relocation of these structures to areas safe from erosion.

- Design new utilities to occupy areas safe from future erosion and relocate any existing utilities to safe positions.

- Relocate streets and roads threatened by erosion to a safe location and study the possibility of realignment of waterfront streets to terminate in a cul-de-sac or other feature to limit loss if extensive erosion does occur.

- Institute a program of exploration of the ocean floor and the surrounding upland area to determine if construction materials (gravels and sand) are available in the area and to determine the economic and ecological effects of use of such materials.

- Encourage a definitive and systematic exploration of historical sites at Barrow village and Point Barrow now in danger of loss through erosion.

Recommended Solution

This report recommends that studies be conducted to determine the feasibility and the effects of forcing erosion of the bluffs southwest of the city. Additional studies should be made to determine if an "unconventional" type of physical structure could be installed which would control erosion.

COMMUNITY EXPANSION

The Problem

Physical barriers – the ocean on the north and the airport on the south and west – prevent the community from expanding.

Background

The lack of comprehensive planning in the past has resulted in a situation where the community has no place to grow. In addition, one portion of the community is threatened by beach erosion.

The possibility of relocating the village was discussed in a previous section of this report and rejected. There are several alternatives available to the community for providing additional land area for expansion. These include

1. Extension of Browerville eastward
2. Development of Block B
3. Increase of residential densities
4. The filling in of Isatkoak Lagoon

Possible Alternative Solutions

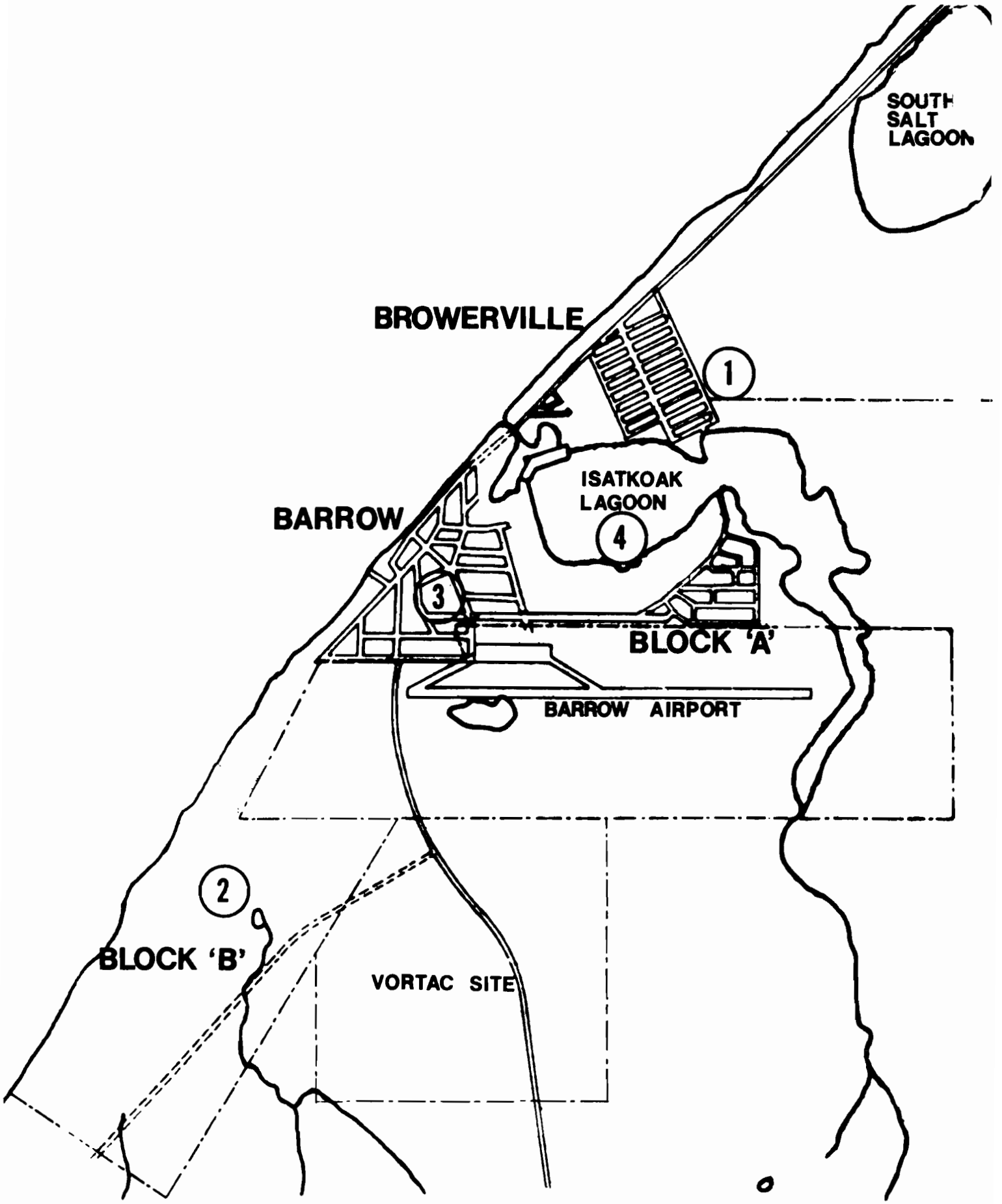
The planning considerations for the above alternatives are as follows:

1. Extension of Browerville Eastward

   This area is federally owned and occupied by an NARL facility, but there is land south of the existing structure that could be used for residential development. Part of the area apparently is underlain by ice lenses, but there is an old beach ridge which could offer firmer foundations.

   Advantages

   - The Browerville street system can be extended eastward into this area so that the street system is continuous.



COMMUNITY EXPANSION ALTERNATIVES

- This is the only "vacant" area that is contiguous to the community.

- The residents who would live in this area would be located closer to employment at NARL.

- The NARL facility could remain at its present location.

Disadvantages

- The residents in this area would be further removed from the downtown area.

- The high school in Block A would be accessible during the school year by students crossing the frozen lagoon. However, children would have to take a circuitous route through town during the summer months to reach the proposed athletic field, unless a road is constructed between Browerville and Block A.

2. Development of Block B

Advantage

Portions of the block have been platted by the Bureau of Land Management.

Disadvantage

The distance across the airport property is 3000 feet, and any residential development would be further removed from downtown, schools, the hospital, and the Naval Arctic Research Laboratory.

3. Increase of Residential Densities

Advantages

- By providing apartments instead of single-family homes, the amount of land area required for future growth would be reduced.

- An increase in densities would also decrease the amount of utilities.

- The travel distance to major points would not be substantially altered.

Disadvantage

An Alaska Federation of Natives (AFN) attitude survey in 1970 revealed that the people of Barrow were not willing to accept multiple-family housing. One of the major considerations in arctic living is the availability of privacy.

4. Filling in of Isatkoak Lagoon

This action would be accomplished by hydraulically dredging from the ocean. Approximately 4 million yards of fill material is needed. The resulting 145 acres would provide sufficient area to accommodate 400 homes or 2200 to 2600 persons. This amount of land area will not be needed until after 1980 and until Block A and Browerville have been totally developed.

There are many environmental considerations that must be resolved prior to the dredging of materials from the ocean. Will the beach erosion process be increased because of dredging? Is there sufficient and adequate material on the ocean floor? What affect will fill material have on the lagoon floor? What is the estimated cost for dredging versus other alternatives for community expansion? How will spring runoffs be accommodated?

The consultant has obtained a "guesstimate" from a Pacific Northwest contractor. He has indicated that the cost of dredging 4 million yards would be approximately $10 million, or $2.50 a yard. This estimate is based on use of a 30-inch dredge for two summer months over a two-year period. If the pack ice did not move out either year, the cost would, of course, increase.

Advantages

- The development would link Browerville to Block A.

- A re-evaluation of population needs in subsequent years might reveal that the total lagoon area is not needed. In this case, a portion of the lagoon could be filled.

- The Bureau of Indian Affairs and the Public Health Service could utilize a portion of the filled area by expanding their existing facilities eastwardly.

Disadvantages

- The high cost
- The lack of knowledge about adequate fill material in the ocean
- Environmental considerations

Recommended Alternatives

This plan recommends that a study be made of the merits of dredging from the ocean. This plan also recommends that population projections be analyzed every two years to ascertain if economic growth has surpassed or lagged behind the projections contained in this plan. These population studies can be performed by the North Slope Borough Planning Department.

Development should not be permitted in any area until Browerville, Block A, and the city itself are fully developed. At least three years before the need for community expansion is indicated, the borough should advise the Intergovernmental Coordinating Committee that additional residential land will be needed. By that time, in-depth studies may indicate that fill can be obtained from the ocean. If so, appropriations should be sought from the pertinent agencies. If filling of the lagoon is economically or environmentally unfeasible, Browerville should be extended eastwardly.

AIRPORT LOCATION

The Problem

The airport withdrawal area prevents community expansion to the south. The airport operation contributes noise pollution to the community.

Background

The airport is owned and operated by the State of Alaska. Wien Consolidated Airlines provides daily service to and from Anchorage and Fairbanks. The facility was planned and built in the early 1960's, before the community expanded to its current population of over 2000.

Its location was determined by an existing underlying ground gravel bar. The airport has a 6500-foot paved runway and is oriented perfectly to prevailing winds. The Federal Aviation Administration is currently planning extensive improvements to upgrade navigational equipment.

Within the planning content of this study, it is also necessary to review the second airport that exists within the region. This is the Navy-operated airport that exists adjacent to the beach, immediately east of NARL. The strip is 5000 feet long and has a steel-planked surface. The facility contains a terminal building, warehouse, and two hangars, one built in 1970. The runway is used by federal agencies and military passenger and cargo planes. The Naval Arctic Research Laboratory uses its planes to provide supplies to its camps elsewhere in the Arctic. During the 1963 storm, approximately 70 percent of the airstrip was demolished.

For a region that contains less than 3000 people, it appears to be inefficient to have two airports. Because both airports are owned by public agencies, the public is taxed twice to support them – through federal income taxes to pay for the NARL runway and state taxes to pay for the city runway. This is an inefficient use of tax dollars. Consideration should be given by the Navy to consolidating its operation with the state-operated facility in Barrow. Although the 1963 storm has been classified as a 50-year storm, it is conceivable that another storm of lesser intensity could occur any year. Repairing the NARL airstrip again would be a major expense item that could possibly be more costly than if the operations were transferred to the Barrow airport.

Another consideration is the state's role and priority in relocating the Barrow airport when there are many airports elsewhere in the state that are in dire need of basic improvements.

The following sites are offered for consideration:

1. Wiley Post/Will Rogers Monument area

2. South of town – Ikroavik Lake area

3. Barrow airport operation transferred to the Naval Arctic Research Laboratory airport facility

4. NARL airport operation transferred to Barrow airport

5. Existing Barrow airport operation moved to south side of runway

Possible Alternative Solutions

1. Wiley Post/Will Rogers Monument Area

   Advantages

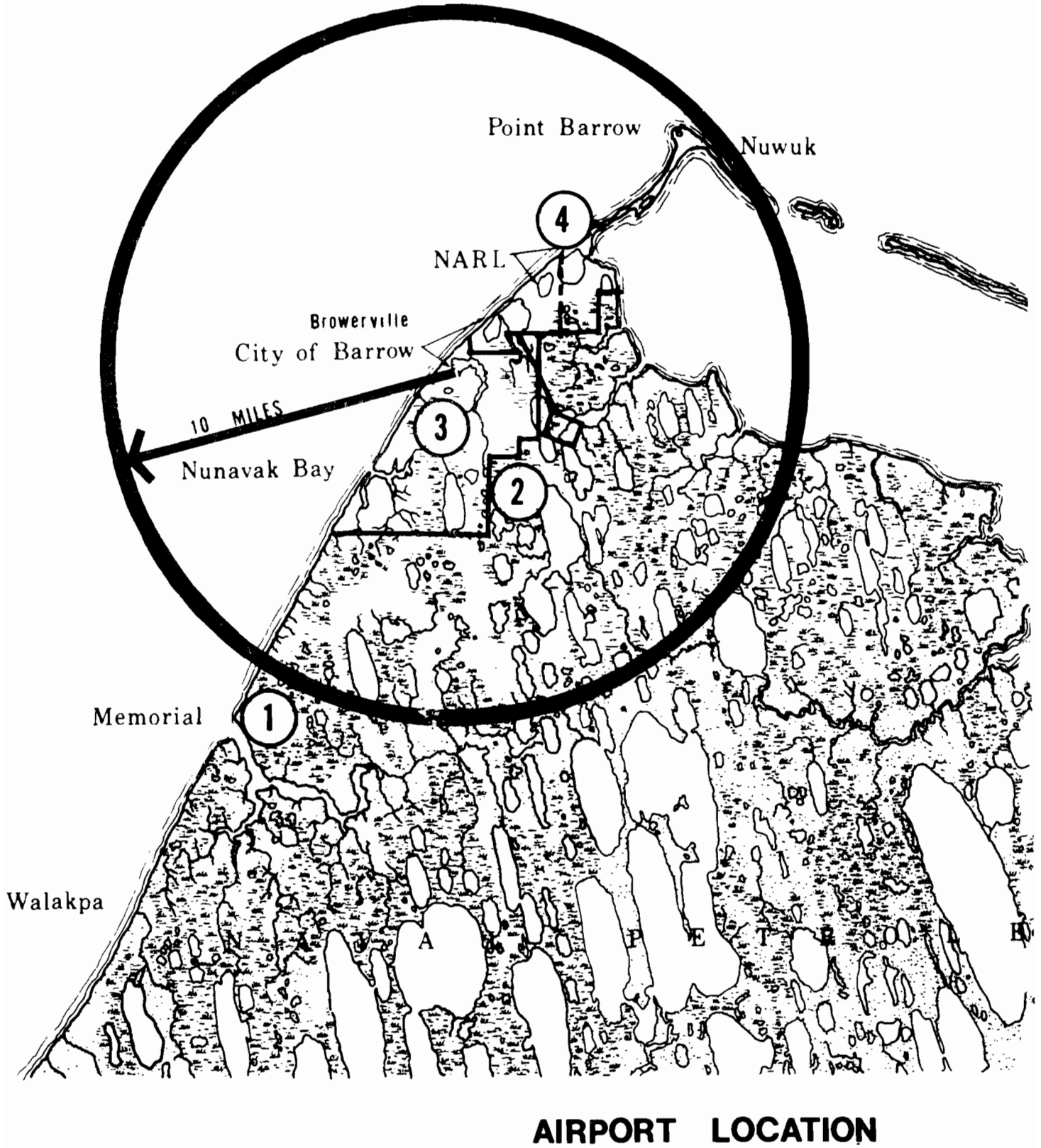
   - Noise pollution removed from town
   - Fire and explosive hazards reduced
   - Site is close to gravel deposits

   Disadvantages

   - Cost of constructing new facility, including a 6500-foot runway, terminal facility, water supply, sanitary facilities, power supply, 10 miles of all-weather road, and new Federal Aviation Administration navigational equipment

   - Increased distance and travel time to NARL and the city

   - Cost of maintaining road



AIRPORT LOCATION

2. South of Town – Ikroavik Lake Area

Advantages

- Noise pollution removed from town
- Fire hazards reduced
- Water supply close
- Gas supply close
- Laboratory-bound vehicles would not have to pass through town

Disadvantages

- Cost of constructing new facility, including 6500-foot runway, terminal facility, water supply, sanitary facilities, power supply, and new Federal Aviation Administration navigational equipment

- Cost of upgrading Gas Well Road and Ikroavik Lake Road to all-weather facilities and cost of maintenance

3. Barrow Airport Operation Transferred to the Naval Arctic Research Laboratory Airport Facility

Advantages

- Barrow airport and withdrawal area could be utilized for community expansion

- Eliminates air pollution and fire hazard at Barrow

- Permits community to grow as a compact unit instead of in remote areas such as Block B

Disadvantages

- Distance and travel time to city is increased.

- Airport-bound vehicles could disrupt the operation of the Naval Arctic Research Laboratory.

- Laboratory airport is not as well oriented to prevailing winds and is subject to storm damage.
- Economic asset to community is reduced.
- Laboratory airport facility would have to be upgraded.
- New terminal would have to be constructed.
- Barrow airport terminal is a social gathering point for many residents.
- Federal Aviation Administration navigational equipment would have to be relocated.

4. NARL Airport Operation Transferred to Barrow Airport

Advantages

- Cost of maintaining existing laboratory strip is eliminated.
- One consolidated operation is cheaper to maintain than two.
- Barrow airport has stable base and is not subject to beach erosion or storm damage.
- Existing airport has instrument landing facilities, either planned or under construction.

Disadvantages

- Hangars and support facilities at NARL would be obsolete for aviation purposes; could be used for storage and other supporting activities, or dismantled and reconstructed at Barrow airport.
- Air and noise pollution at Barrow increased.
- Operational cost to NARL increased.

- Laboratory traffic through community increased, especially heavy trucks.

5. Existing Barrow Airport Operation Moved to South Side of Runway

This alternative considers "flipping" the existing apron strip to the opposite side of the runway.

Advantages

- Fueling, fire fighting and additional maintenance facilities, and a hanger could be developed at a place more removed from residential areas.

- The Weather Service would have reason to move from the existing site in the city, thus adding more flexibility to that operation and providing an opportunity for better flight briefings.

- The Weather Service and FAA Flight Service could be in the same building, providing for better coordination and service to pilots.

- Noise pollution from aircraft operations would be reduced to some extent.

- Danger to children, who now use the present ramp as a playground, would be reduced.

- The hotel/bar/restaurant, formerly proposed to be located at the airport, could be developed in the center of town where the interest of tourists lies.

- The incentive for the Navy to utilize the airport would be increased.

Disadvantages

- The terminal would be further removed from the residents of the community. The existing terminal, whether intended or not, has evolved into an activity center for the residents of the city. To relocate the terminal on the south side of the strip would increase

the walking distance considerably. To prevent people, particularly children, from walking directly across the runway, security fences would have to be installed on the north side and west end of the runway.

- The State Department of Public Works is planning for the future construction of an airport fire station. This station will be of benefit to both the airport and city. Should the apron be flipped and a security fence installed, the fire station benefit to the city would be materially reduced.

- As city utilities may become available, cost of construction and maintenance would increase if extended to the south side of the runway.

- Most or all terminal, hangar, and fueling facilities will be constructed by private industry. Location to the south side will probably decrease the likelihood of such facilities being constructed in the near future.

- Flipping the apron would not free much land for city expansion, as the present FAA regulations for an ILS runway prohibits structures within 750 feet of the centerline.

Recommended Alternative

The present apron and facilities should be retained for civilian use and a study be conducted by NARL to determine the feasibility of transferring all operations to the Barrow Airport and constructing a separate apron for government operations on the south side of the strip.

Provision of a separate apron, offices, and hanager facilities for government operations would eliminate many of the objections to a combined operation at the airport, such as security, fueling and maintenance, and storage of government aircraft, yet would allow the advantages of a single operation to be realized. Such advantages would include combined fire protection, weather and FAA services, and the ILS capability of the airport.

Airport Location	Community Impact								Airport Design and Cost Factors								Utilities				Area Impact					Totals
	Local Access	Traffic Congestion	Noise	Fire Hazard	Expansion Area	Ecology of Immediate Area	Open New Areas	Dollar Value to Barrow	Site Topography	Orientation	Runway Costs	Lighting	Navigation Aids	Terminal	Hangar	Weather Station	Water	Gas	Electricity	Sewer	Area Access	Area Environment	Expansion Potential	Material Availability	Additional Tourism	
Barrow	4	2	2	2	1	4	1	4	4	4	4	4	4	4	3	4	3	4	3	3	4	4	2	1	2	77
NARL	3	1	1	1	2	3	2	2	1	2	3	3	3	3	4	3	4	3	4	4	2	3	1	3	3	64
Wiley Post	1	4	4	4	4	1	4	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	55
South of Town	2	3	3	3	3	2	3	1	2	1	2	2	2	2	2	2	2	2	2	2	3	2	3	2	1	54

All items graded from 1 to 4. Perfect score = 100

No. 1 is least desirable or largest estimated cost.

No. 4 is most desirable or smallest estimated cost.

LACK OF ADEQUATE TOURIST FACILITIES

The Problem

The financial straits of the community are partially based on its inability to capitalize on undeveloped tourist attractions.

Background

Tourism can be one of the strongest elements of a community's economy. The Barrow region is well aware of this factor and has for several years been attempting to develop a terminal at the airport which would contain hotel accommodations. Application was made to the Economic Development Administration and approved in late 1972. However, contractual agreements with an operator were never consummated.

This facility will offer first-class accommodations to visitors, whether they are destined for the city or the many governmental facilities or to view the various sights within the community. The hotel, however, is not a complete answer to providing a diversity of interests or activities for the visitor.

In order for a community's economy to be enhanced, the tourist must spend his money within the community. This occurs to a limited degree now, but it can occur even more in the future after the hotel is completed and other attractions developed.

The recommended alternatives described below are possible means of enhancing the regional economy.

Possible Alternative Solutions

Some of these attractions include

1. The Wiley Post/Will Rogers Monument
2. The history of the Eskimo in the United States
3. The research activities of the Naval Arctic Research Laboratory

The opportunity of developing the above tourist attractions could have a profound effect on the community's economy.

1. The Wiley Post/Will Rogers Monument

These men were internationally known years before their 1935 plane crash. Residents of Barrow were the first to find and report the disaster, and remnants of the plane are now displayed at the Naval Arctic Research Laboratory. The main constraint that prevents people from visiting the site, some 10 miles west of town, is the lack of a road. Travel is possible only by boat or by vehicle in the winter across the frozen tundra.

The Bureau of Indian Affairs is currently considering the excavation of gravel about a mile from the monument. The gravel would be used for the filling of Block A. In transporting the gravel to town, vehicles would use a new road which would have to be developed for this purpose. The road could also be used for transporting people to the monument. It is not economically feasible to construct the road to serve tourists only. The road will have to be maintained in future years, after gravel is exhausted.

2. The History of the Eskimo in the United States

There is universal interest in the culture of Eskimos. This interest has been accentuated in recent years by settlement of the native land claims and the discovery of oil on the North Slope. The Smithsonian Institute is currently circulating an exhibit on Greenland which contains many illustrations on the Thule culture. Of interest within the region is the Birnik National Historic Monument, an area located northeast of NARL.

This study is not aware of any museum or cultural center which contains a definitive history of the Eskimo in the United States. The development of one in Barrow is intended to meet that need.

The Eskimo cultural center could contain the following facilities and/or activities:

- A museum could house artifacts which have been uncovered in abandoned villages on the North Slope. The interpretive center portion of the museum could contain exhibits illustrating the migration route to North America; the location of early

settlements; the culture, history, and traditions of the people; and early photographs of the community.

- The museum could also contain a replica of an old-style house and a model of an early village.

- The facility could also include space for an arts program where residents of the community could create works of art, not only to continue a tradition, but to sell the products to tourists. This program could be in the form of a living demonstration where tourists could observe the actual work. The handicrafts could also be air-freighted to the "lower 48."

The museum would be located within the community and open to the general public, hopefully on a year-round basis, but more probably during the summer months only. The funding for such a cultural center would depend on obtaining monies from several possible sources. The most logical source is the National Park Service, which has the authority to create national monuments. Such a monument would serve the purpose of illustrating events that have historic significance to this country. Barrow has some of the characteristics of Sitka, Alaska, which has a national monument. Both cities are small, both have historic significance to the country, and both are located in areas that are not on the main transportation routes.

It is anticipated that visitors to the center would approximate 6,000 to 10,000 persons a year. Other possible sources of funding include the Regional Corporation and the Bureau of Indian Affairs. However, in the case of the Corporation, it is doubtful if admission charges could offset any of the cost of construction, financing, and operation.

In order for the cultural center to be successful, it must be of quality construction. The museum must rely on obtaining artifacts from individuals and museums. The Smithsonian, for example, will not lend articles unless the structure is completely fireproof, displays are housed behind locked glass, and there is a 24-hour guard. Other institutions, such as the University of Alaska, may have other restrictions. A possible location for the center is the Weather Service site.

3. The Research Activities of the Naval Arctic Research Laboratory

The function of the Naval Arctic Research Laboratory is to provide support for scientific research of the arctic biome. This mandate is carried out under direction of the Office of Naval Research and its contractor, the University of Alaska. Its operation and the papers which have been prepared by researchers have been publicized internationally. Many visitors to Barrow, however, are on airline package tours and cannot visit the laboratory because this facility is not open to the general public. It may be in the best interests of the region for the Office of Naval Research to publicize its work, in the form of exhibits which could be housed either in the Eskimo Cultural Center or in a visitors' center in the city.

The purpose of these exhibits would be twofold:

- To explain to the public the importance of arctic research and how it has contributed to the betterment of mankind
- To provide an attraction within the region that will help the tourism segment of the economy

Some of the research projects that should be publicized include

- Experiments studying the reasons why arctic animals do not suffer from snow blindness and the physiology of animal hibernation
- Magnetic, seismic, and gravity studies concerning the structure of the arctic basin
- Oceanograhic and meterological studies
- Biological sea studies, geophysics, and geology
- Sea-ice studies and under-ice submarine operations
- Communications, surveillance systems, and underwater acoustics
- Human survival techniques in the arctic

ENGINEERING STUDIES

In preparing this regional master plan, several governmental agencies were responsible for engineering studies.

- Feasibility study for construction of a permanent all-weather road between NARL and the city of Barrow – Bureau of Indian Affairs (Plate 6)

- Development of a water supply and distribution system for the city of Barrow – Public Health Service (Plate 7)

- Development of sewage and treatment system for the city of Barrow – Public Health Service (Plate 8)

- An electrical power intertie between NARL and the city of Barrow to allow emergency power backup to both – Bureau of Indian Affairs (Plate 9)

- A natural gas pipeline between NARL and the city of Barrow to allow emergency backup to both – Bureau of Indian Affairs (Plates 10 and 11)

- The composite location for utilities is incorporated in the existing and proposed regional utilities (Plate 12)

- A storm water drainage plan for the city of Barrow – Bureau of Indian Affairs

- A plan for upgrading of the Barrow city airstrip to airport status, with the necessary support facilities – State of Alaska, with the Federal Aviation Administration (Plates 13 and 14)

The findings of the studies (with maps) are included, along with an analysis of the studies based on social and economic considerations.

ALL-WEATHER ROAD – CITY TO NAVAL ARCTIC RESEARCH LABORATORY

The Problem

In spring the annual thaw and runoff makes portions of the road bed impassable. Beach erosion threatens the entire beach road, particularly that portion between town and Browerville.

Background

The beach road is the only means of travel between the city and the Naval Arctic Research Laboratory (Plate 6). It is approximately 4 miles long. Erosion of the beach is taking place all along the coast in the vicinity of Barrow. In recent years gravel has been removed from this beach, causing the beach to recede at an increased rate. Because of this it was necessary in 1969 to move the road between Barrow and Browerville back towards the lagoon.

In the past, the main source of gravel for construction purposes at Barrow has been the beach. The removal of this gravel has caused the beach to recede and some houses have had to be moved to prevent destruction by the waves. All borrowing of gravel from the beach in the vicinity of Barrow has now been prohibited. Until last year, gravel could be hauled from 4 or 5 miles northeast of NARL toward Point Barrow; however, the Bureau of Land Management has now terminated borrowing from this source. It now appears that gravel can only be taken from the beach to the southwest of Barrow and beyond Nunavak Bay. The deposits are scattered in this area and, within a few years, it may be necessary to go as far as 10 to 15 miles.

Another possible source of gravel is the bottom of the sea, either off shore in the vicinity of Barrow or in Elson Lagoon. The possibility of dredging has recently been discussed, but it would have to be by barge and not dragline from shore. Gravel borrowed using a dragline is normally replaced by wave action from the beach, causing almost the same erosion as would have occurred had the borrow been obtained from the beach directly.

Gravel in the vicinity of Barrow is limited and the need will continue on for years into the future. Dr. Max Brewer, State Commissioner of Environmental Conservation, and formerly director of the Naval Arctic Research

Laboratory at Barrow, strongly recommends that priorities be established for the use of the existing limited deposits within economic distance.

The Public Health Service of the U. S. Department of Health, Education, and Welfare is planning a sewer and water system in Barrow. Serious consideration is being given to building a dam across Isatkoak Lagoon between Block A and Browerville. This dam would impound a sufficient quantity of water to supply the city for one year.

If this concept is feasible, the Public Health Service is considering increasing the width of the dam crest from 20 to 40 feet in order that it may provide a street connection between Browerville and Block A. This connection alone would provide a bypass of the major area of potential storm damage on the existing beach road, would not necessitate any major added expense for construction, would reduce maintenance costs in winter or summer, and would not greatly deplete the already very limited supply of gravel located within an economic distance of Barrow.

It is important to both the city and the Naval Arctic Research Laboratory that an all-weather road be maintained. The people of Barrow need it in order to reach their major source of employment, and NARL needs it because it is the only route to town and to the airport.

Possible Alternative Solutions

The following routes are offered for consideration (see plate 6):

1. Existing route along beach
2. Route across existing dam and through Browerville
3. Block A – Browerville connection to beach road
4. Block A – Gas Well Road connection to beach road
5. Block A to Gas Well Road to south of NARL

Alternative 1 is primarily a reconstruction and maintenance program of the existing roadway. Alternative 2 provides for a new roadway along the north side of the Public Health Service compound, a crossing of the existing dam, through the southern portion of Browerville, and north to the existing beach road.

Alternative 3 requires the development of a road through Block A and a connection across the lagoon to Browerville. It would use most of the beach road. Alternatives 4 and 5 require the development of a road through Block A and the construction of new roads across the tundra. Alternative 5 is a completely inland route and does not use any portion of the existing beach road.

1. Existing Route through Town and along Beach Road

   Advantages

   - This route has been in operation for many years and is located on a gravel base. The subgrade is not subject to settlement due to the melting of permafrost, or heaving due to frost action.

   - The straight alignment makes maintenance and snowplowing more economical than the other alternatives.

   - The route offers a superb panorama of the frozen ice pack, including the pressure ridges.

   - This is the shortest route of any of the alternatives.

   Disadvantages

   - Beach erosion has forced relocation of a portion of this road and will probably require future relocation, especially in the section adjacent to Browerville.

   - The portion of this route from town to Browerville is subject to damage from storms and spring runoffs.

   - All vehicles that utilize this route are funneled through the center of the community. This creates a conflict between vehicles and pedestrians.

2. Route Across Existing Dam and Through Browerville

   This route bypasses the most serious beach erosion area. It requires partial filling of the sewage lagoon and dam in order to provide

adequate room for a new roadway. The existing sewage outfall line from the Bureau of Indian Affairs plant would have to be crossed over as would the utilidor planned by the Public Health Service. The route would cross the spillway and connect with the existing street system in Browerville. The route could either cross the tundra and connect with the NARL access road or make a 90-degree turn and continue north to the existing beach road.

Advantages

- Bypasses portion of road adjacent to Browerville most subject to storm damage.
- Least cost if dam between Block A and Browerville is not constructed.
- Shortest of other alternatives.
- Provides direct downtown route from Browerville.

Disadvantages

- Vehicles funneled through center of community.
- No direct route to new school site and Block A from Browerville.
- At least one house requires relocation.

3. Block A – Browerville Connection to Beach Road

Advantages

- The Block A – Browerville connection was recommended in the Alaska State Housing Authority's plan. It would provide access from one part of the community to another without requiring people to take a circuitous route through the downtown area.
- Traffic is removed from the center of the community.
- The streets in both Block A and Browerville are platted. The connection across the lagoon could be a causeway and a bridge or a road constructed on top of a dam.

- This route would bypass the portion of the present route most susceptible to wave erosion.

- There would be little difference in the total route distance between Barrow and NARL.

- The route, assuming the abandonment of the existing road between town and Browerville, would not adversely affect the businesses in Browerville as would a completely inland route.

Disadvantages

- The route would continue to use that portion of the road east of Browerville which is subject to spring thaw.

- The fill across the lagoon would be heavy and would have to be constructed from the sandy beach gravel found in the vicinity of Barrow. This material erodes easily and might require some form of protection from wave action in the lagoon. The problem of wave erosion on the road between Browerville and NARL would, of course, still be present.

4. Block A – Gas Well Road Connection to Beach Road

This route would pass through Block A in an east/west direction and would be extended eastwardly along the airport boundary, across the creek, to a connection with the Gas Well Road. It would then continue northwardly along the Gas Well Road to the beach road, thence east to the Naval Arctic Research Laboratory.

Advantages

- This route uses only that portion of the beach road between Gas Well Road and NARL. However, that portion east of Browerville would have to be maintained in order to provide access to the Bureau of Standards and the transmitter facilities.

- It provides an inland route that would not be subject to beach erosion.

- It uses Gas Well Road, which is already gravel-surfaced.

- The beach road between town and Browerville could be abandoned, if the Browerville – Block A connection is made.

Disadvantages

- It requires a bridge across the creek north of the airport.

- It requires a new road across the tundra from Block A to Gas Well Road. This route would be subject to settlement and heaving.

- The route would not provide a connection between Browerville and Block A.

- Access to the incinerator from the city would not be as convenient as it would via the existing beach road.

- Businesses in Browerville would be bypassed.

- A severe storm could leave Browerville cut off from the city, unless the Browerville – Block A connection is made.

- The route passes through one of the prime research areas in the region.

5. Block A to Gas Well Road to South of NARL

This route has the same alignment from town to Gas Well Road as in Alternative 4. From Gas Well Road the route crosses a bridge over the creek, which flows into Middle Salt Lagoon. It continues to the northeast to a point adjacent to the existing gas line which runs from the gas field to NARL. The route follows this gas line north to the laboratory.

For several years the Navy has been studying the possibility of utilizing the Middle Salt Lagoon watershed as a water source. This would be accomplished by damming the stream leading into the lagoon. Water would be piped from the dam, through Middle Salt Lagoon, to the Naval Arctic Research Laboratory. Until further studies are performed

by the Navy, it is not possible to determine the feasibility of this proposal. If it is feasible, the road could cross on top of the dam instead of on a bridge.

Advantages

- It provides a completely inland route that would not be subject to beach erosion.
- It provides a more direct connection between the Naval Arctic Research Laboratory and the airport.
- The portion of the beach road from town to Browerville could be abandoned, but only if the Browerville – Block A connection is made.
- The road could utilize the top of the Middle Salt Lagoon dam.

Disadvantages

- The beach road between the Naval Arctic Research Laboratory and the NARL facility east of Browerville would have to be maintained.
- The alignment from the Gas Well Road to a southern entrance to NARL would cross the tundra in an area used for scientific research.
- The 4.8-mile route requires 4 miles of new roadway.
- The route requires the construction of two bridges.
- All other factors quoted under Alternative 4.

Costs

Because of the uncertainty of the source of gravel, it is difficult to estimate costs of road construction at Barrow. For estimating purposes, a figure of $10 per cubic yard was used and this would include hauling and placing gravel and binder. Should the haul distance be greater than 4 miles, the cost

would increase. The following chart shows a cost estimate for the alternatives discussed. No consideration has been given to combining road and dam construction.

Route	Estimated Gravel Requirements (cubic yards)	Estimated Cost of Gravel ($10/cubic yard)	Total Estimated Costs
1	NA	NA	NA
2	24,000	$ 240,000	$ 440,000
3	40,000	$ 400,000	$ 800,000
4	125,000	$1,250,000	$1,375,000
5	160,000	$1,600,000	$1,725,000

There are little data available on which to base maintenance costs for gravel roads constructed of relatively heavy fill in the vicinity of Barrow. It is estimated that major reconstruction of the driving surface may be required every 10 to 15 years. The greater length in Alternatives 4 and 5 would cause an increase in maintenance costs of the driving surface on these routes as compared to the existing route.

On the other hand, the existing route is subject to wave erosion. There is not only cost to be considered, but also inconvenience while repairs are being made. It must also be kept in mind that the portion of existing road which could be abandoned after construction of Alternative 4 or 5 would only be a short distance. However, it is believed that the road probably would be abandoned only during periods of heavy storms in the September/early October period of the year. Severe storms which damage the present road for the full length are not too frequent. A special set of circumstances must occur for wave action to pound the beach. The wind must be from the west and the ice must be a distance greater that 50 miles off shore. Ice close to shore will take the brunt of the wave action and protect the beach.

Storm records showing wind direction in combination with the location of ice have been kept for such a limited number of years at Barrow that it is not possible to estimate the frequency of storms which will do major damage. The big storm of October 1963, which washed out the entire road, did considerable damage all along the coast of northern Alaska. Several houses

were damaged in Barrow and waves came over the area occupied by the Naval Arctic Research Laboratory and the adjacent camp. The airstrip to the northeast of the laboratory was also severely damaged. This storm was the worst on record or within the memory of the native people. A prior one, in October 1954, also washed out the road.

Alternate Transportation Systems

Wheeled or tracked ground transportation vehicles have been the only means of transportation in the past and planning has been oriented towards this method of transportation.

Recent studies in urban mass transportation systems and methods may well be applied to providing a system adaptable to the requirements of the Barrow region. Specific systems which are worthy of detailed study include a monorail system, cableway system, and the use of a ground-effect air-curtain type vehicle.

1. Monorail System

   A monorail or other track-type system could be installed to serve the area from the city airport to NARL. Such a system could incorporate a utiliduct system for utilities, either as the base of a surface system or hung from the supporting structure of an elevated system.

   Advantages

   - Less damage to the environment
   - Not dependent upon maintaining a roadbed
   - Would use very little gravel as compared to a roadway
   - Prefabrication would permit rapid construction on site
   - Able to operate independent of weather conditions
   - Not confined to land areas only

   Disadvantages

   - High initial cost
   - High maintenance and operational cost
   - Would require truck transportation for local service

2. Cableway System

A large cab-type cableway system is fully capable of meeting the needs of both personnel and freight transportation. For use in a limited area such as between Barrow and NARL, such a system could prove adaptable.

Advantages

- Lower first cost than a monorail system
- Ability to span long distances between supports, enabling a direct route regardless of obstructions
- Minimum damage to the environment

Disadvantages

- Unknown reliability under storm conditions
- Public acceptance unknown
- High operational and maintenance costs

3. Ground-Effect Surface Vehicles

The increasing use and reliability of air-curtain type vehicles for both passenger and freight service throughout the world indicates that such vehicles could be a means of transportation in the arctic. Objections to these vehicles due to grade limitations are not valid when considered for use in an area such as Barrow with its extremely flat terrain.

Advantages

- Not dependent upon roadways
- Able to travel over water, ice, snow, or unfrozen ground with little or no impact
- Ability to serve all areas of both the city and NARL
- Easily adaptable to both passenger and freight service

Disadvantages

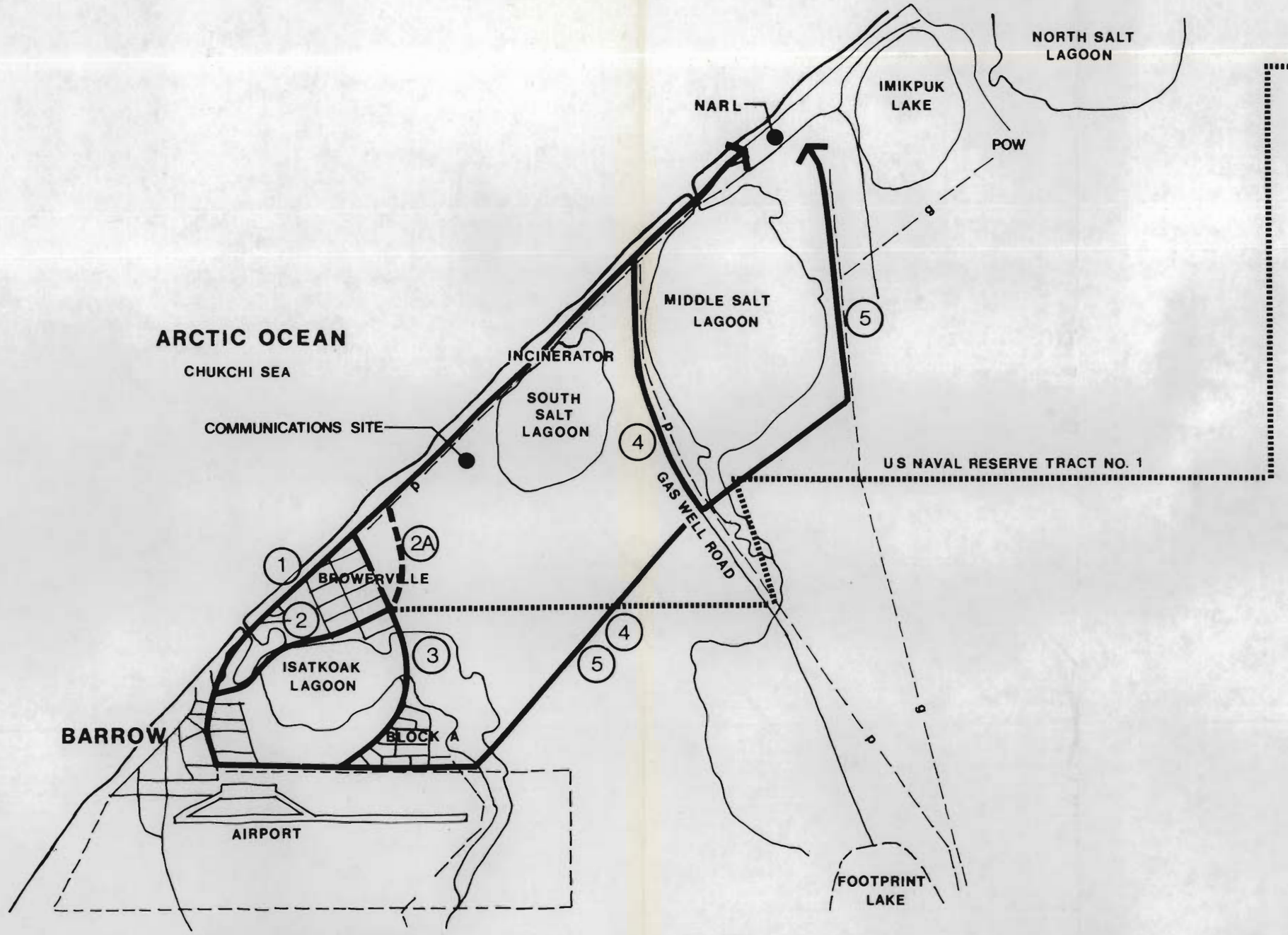
- High initial cost as compared to conventional motor vehicles
- Fairly high operation and maintenance costs

Recommended Alternative

It is recommended that Alternative 3 (the Browerville – Block A connection) be constructed. This would greatly benefit the city of Barrow by providing easy access between Browerville and Block A and would eliminate the isolation of a portion of the city during severe storms. If this could be combined with the construction of a dam, the savings over constructing two separate projects would be considerable. The savings would include both money and the limited supply of gravel available at Barrow.

Construction of Alternatives 4 and 5 are not justified at this time. Inconvenience, caused by washouts of the present road, is infrequent; cost of constructing either of the above mentioned alternatives would be high; and a considerable amount of the limited gravel available at Barrow would be required.

It is further recommended that a study of the feasibility of alternate modes of transportation be initiated. If such a study indicates the desirability of an alternate transportation system, the roadway programs should at that time be reviewed and the emphasis should shift to the preferred method of transportation.



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BARROW REGIONAL MASTER PLAN, BARROW, ALASKA

BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION. NAVAL FACILITIES ENGINEERING COMMAND
contract N 62474-72-C-0228

WATER SUPPLY AND DISTRIBUTION SYSTEM / SEWAGE COLLECTION AND TREATMENT SYSTEM

The above studies were undertaken by the Public Health Service and the conclusions are contained in the report entitled *Water and Sewer Master Plan and Preliminary Engineering Report*, prepared by Linck-Thompson, dated July 1972. This report is made a part of the regional master plan by reference. The general statement, and the conclusions and recommendations from this report, are contained herein. Maps depicting the layout and construction phasing of the water and sewage lines are shown in Plates 7 and 8. And finally, an independent analysis of the studies, based on social and economic considerations, is offered.

General Statement

The basic purpose of this report is to evaluate the alternatives and to recommend those facilities which could be most reliable under arctic conditions and would be economically feasible for the city to operate and maintain. Important conclusions and recommendations are summarized below.

Conclusions

1. The people of Barrow desire and expect running water in each home and a water-borne waste disposal system.

2. Federal agencies will provide funds for engineering and construction of a complete modern water and sewerage system to serve the city of Barrow.

3. The city must pay its share of the operating and maintenance costs.

4. A very reliable utility system that operates with lowest possible operation and maintenance costs is the major design objective.

5. The land use plan presented in the *Barrow Plan – July 1970* for the city of Barrow by the Alaska State Housing Authority established the land use pattern. A *Regional Master Plan for Barrow* is being completed under a Navy contract. Concepts of the Navy plan were considered and

can be accommodated by the water and sewerage plans proposed herein.

6. The design population is 5000 for the year 1985.

7. The studies indicate an over-all average daily demand of 50 gallons per capita per day.

8. Fire flows of up to 1000 gpm at critical locations can be provided by fire pumps at the central utility building.

9. Alternative water supply sources studies included sea water, surface water, and ground water.

10. The most feasible source appears to be the upper basin of Isatkoak Lagoon, which should be deepened by constructing a dam across the bar from Block A to Browerville and must be freshened by pumping out existing supply and replenishing with runoff water supplemented by water pumped from Emaiksoun Lake.

11. The raw water must be filtered, disinfected, and fluoridated and may require treatment for color, odor, and organic material removal.

12. Water treatment plant capacity of 0.25 million gallons per day is required, with provisions for storing 0.5 million gallons.

13. Because of permafrost characteristics at Barrow, buried piping is not feasible. Above-ground utilidors should be utilized with relocation, as required, of houses.

14. The location of the first stage of water and sewer construction is established to meet the needs of the native housing program scheduling 100 homes for development in Block A by fall 1973.

15. The priority of areas for service is (1) Block A, (2) Browerville, and (3) downtown Barrow.

16. Provisions for future water and sewer service to Block B are included.

17. Provisions for water service to the Department of Defense installations are included, with a minimum takeoff pressure of 30 psi at the northeast corner of Browerville.

18. Pumps must maintain up to 70 psi pressure in the distribution systems and provide continuous circulating flow in the water distribution mains. One set of pumps and heat exchangers for each area distribution system is required.

19. The distribution system studies have been based on a maximum hourly flow plus circulation flow necessary to provide a minimum velocity of 2.5 feet per second in the mains.

20. Special orifices and looped service lines are required to maintain constant flow in house services. Individual circulating pumps should be used on house services where distances from house to main exceed 75 feet.

21. Sewers should be gravity flow with lift stations and force mains provided where necessary.

22. Sewage requires secondary treatment and then pumping to Tasigarook Lagoon. Sewage from Department of Defense installations is not to be handled by sewerage facilities discussed herein.

23. An extended aeration waste treatment process is proposed, with final disposal of sludge at the new incinerator.

24. Water treatment plant; water storage, pumping, and heating facilities; and sewage treatment plant should be included in a new utility building designed for the Barrow environment.

25. Subsurface soil investigations were conducted to provide data for dam site studies and for potential aggregate sources evaluation.

26. The total estimated cost of providing the proposed water and sewerage facilities is $17,554,000.

Alternative

Subsequent to the completion of this regional master plan, it became increasingly apparent that the construction, operation, and maintenance of the proposed water supply and distribution system were economically unfeasible. It appears unrealistic to assume that the initial costs to serve the 100 HUD houses, plus the costs of subsequent expansion to the balance of the community, could be funded, due to the high cost per unit. Also, the system proposed would require a substantial annual operational subsidy, which is beyond the financial resources of the city or its individual citizens.

Therefore, it is a recommendation that further planning efforts be undertaken to

- Develop a system more compatible to arctic conditions.

- Develop a system that is less sophisticated and costly. While such a system may not meet the previously expressed desires of the local population for running water and sewage, it would still be a substantial improvement over present conditions.

- Explore the feasibility of interim delivery/collection measures pending either the development of a new alternative or the possible (though unlikely) funding of the proposed system.

An alternative which currently appears to offer the most promise is the Alaska Village Demonstration Project (AVDP).

Background

The Alaska Village Demonstration Project was established by Section 20, Public Law 91-224. The Water Quality Improvement Act is administered by the Federal Water Quality Administration (FWQA). This legislation was sponsored by Senators Ted Stevens of Alaska and Ted Kennedy of Massachusetts. In part the law states, "The Secretary is authorized to enter into agreements with the State of Alaska to carry out one or more projects to demonstrate methods to provide for central community facilities for safe water and the elimination or control of water pollution in those native villages of Alaska without such facilities." It is further stated that "in carrying out this section the Secretary shall cooperate with the Secretary of

Health, Education and Welfare for the purpose of utilizing such personnel and facilities of that department as may be appropriate."

Goals for A VDP Projects

- Demonstrate that unit processes for water treatment and waste treatment appropriate for use in Alaskan native villages are available.

- Demonstrate that the processes and related equipment can be operated and maintained by personnel from the village.

- Investigate and demonstrate new methods of arranging equipment or processes which will result in greater efficiency or reduction in costs.

- Investigate and demonstrate new or non-conventional concepts and systems, including new materials or methods of construction, which will provide either more reliability or substantial reduction in maintenance or installation costs.

- Investigate and demonstrate non-conventional concepts of basic living which will enhance the quality of life.

- Investigate and demonstrate innovative institutional arrangements or functions which will provide continuing and reliable installation, operation, and maintenance of facilities in remote villages which satisfy the needs for basic amenities of family and community living.

A VDP Design Objectives

The original design objective was to demonstrate full-scale viable alternatives to standard municipal utility systems for application in those parts of rural Alaska where village layout, ground conditions, or limited amounts of available water make the construction and maintenance of pipe systems unusually difficult and expensive.

The large Alaska rural housing project and the attendant mandate to provide these homes with utility service make such a demonstration especially timely. The results of broad consultations with native leaders and villagers, and positive feedback from communities with unconventional water and waste services in Canada, support the approach of refining a concept based

on delivery of limited quantities of water by vehicle to homes, pickup of honey-bucket waste or effluent from monomatic-type chemical toilets by vehicle, and provisions of complete and attractive bathing, sauna, and laundering facilities at a central location.

The advantages of such a setup are numerous. Entire communities, in their present and locally preferred layout, can be served. There are few villages in which utilidors or buried pipes can provide service to all homes where they are now. Usually, this is feasible only after houses have been realigned and consolidated in the fashion of our high-density subdivision. Rural communities may have good reasons for trying to steer clear of this.

The system described above is not as susceptible to major failures as a network of pipes in the event they freeze up. It obviates individual investment in expensive washers and dryers and reduces competition of machinery for precious living space in crowded homes. Under arctic and subarctic conditions, where good water in liquid form is usually very expensive, it is less conducive to wasteful water consumption and offers the possibility of recycling waste water for laundry use. It generates a significant number of jobs, and last, but not least, it far reduces the capital investment required to bring it into operation.

Accordingly, contracts were equalized with research and technology corporations to "provide facilities for safe water supply, waste disposal, and personal sanitation facilities in a central building" for the village of Emmonak, Alaska.

A unique feature of the installed system is the use of a proprietary item called a "catalytic combustor" for incineration of human wastes as well as refuse and garbage. The combustor is a bath of one or more molten salts, typically a nitrate-nitrite combination, that catalyzes oxidation so that any organic material introduced into the bath is oxidized completely. This equipment is constructed in such a way that odors and noxious products of combustion are retained within the system and prevented from polluting the atmosphere. This system is simple and easy to operate and is designed to considerably reduce fuel requirements from that of conventional incinerators. Heat losses from the molten bath are minimal, so that fuel costs are projected to be about one-fourth that of conventional incineration. Manufacturers of this equipment say that, with similar equipment to that proposed for Emmonak, the need for external fuel has been reduced to zero

when input to the system is approximately 15 percent organic solids. Heat-saving devices have been designed for inclusion in the molten bath to take advantage of excess heat for other uses in the facility.

Following the Emmonak contract, a second facility was contracted for the village of Wainwright. Due to freezing of the water source, it was necessary to provide storage facilities for a minimum of 8 months water usage.

Salient features of the Wainwright design are as follows:

- The central facility is a self-contained structure and works on a closed-circuit system with an outside 1,000,000-gallon storage tank, the latter constructed by the Public Health Service. Potable water from the storage tank is used for showers, lavatories, sinks, hose bibs, and for home delivery in tank trucks.

- The water system is insulated and heated to protect it from freezing. Waste water from potable uses is collected in gray water storage tanks and recycled by filtering, clarifying, recarbonization, and treatment. Reclaimed gray water is used to serve water closets and laundry machines. It is possible that gray water could also be used for showers. Water is lost from the system through toilet wastes and inadequate storage of reclaimed water. Losses could be lowered by using reclaimed water for showers.

- Sanitary wastes are processed in a macerator and burned in the incinerator. A hot oil system utilizing waste heat from the incinerator, with auxiliary heaters, is used to heat the water and the building.

Advantages

- One complex may be used to serve a small community or a neighborhood area of 50 or more homes.

- Heat losses are lower.

- Heating costs are reduced by utilizing waste heat.

- Total system cost is lower than for a conventional sewer system serving each home.

- Maintenance costs would be lower than a conventional system.

- Less water is required by reusing some of the water. Water is lost from water closets and by lack of storage for reclaimed water. Basically, losses are from showers.

- The system disposes of sanitary wastes.

- The modular construction reduces labor costs.

Disadvantages

- Inconvenience of not having facilities in your own home.
- High initial cost ($600,000 plus water supply and storage facilities).
- Requires a heating system to heat buildings and water.
- Fairly complex system, requiring trained maintenance people.
- Requires a home delivery system – tank trucks.

The Alaska Village Demonstration Project could be adapted for Barrow through the utilization of a master center near the existing power plant with satellite centers in Browerville and Block A. Such satellites could be connected to the master center by a vacuum system for waste collection and a small water duct for makeup water.

Recommendation

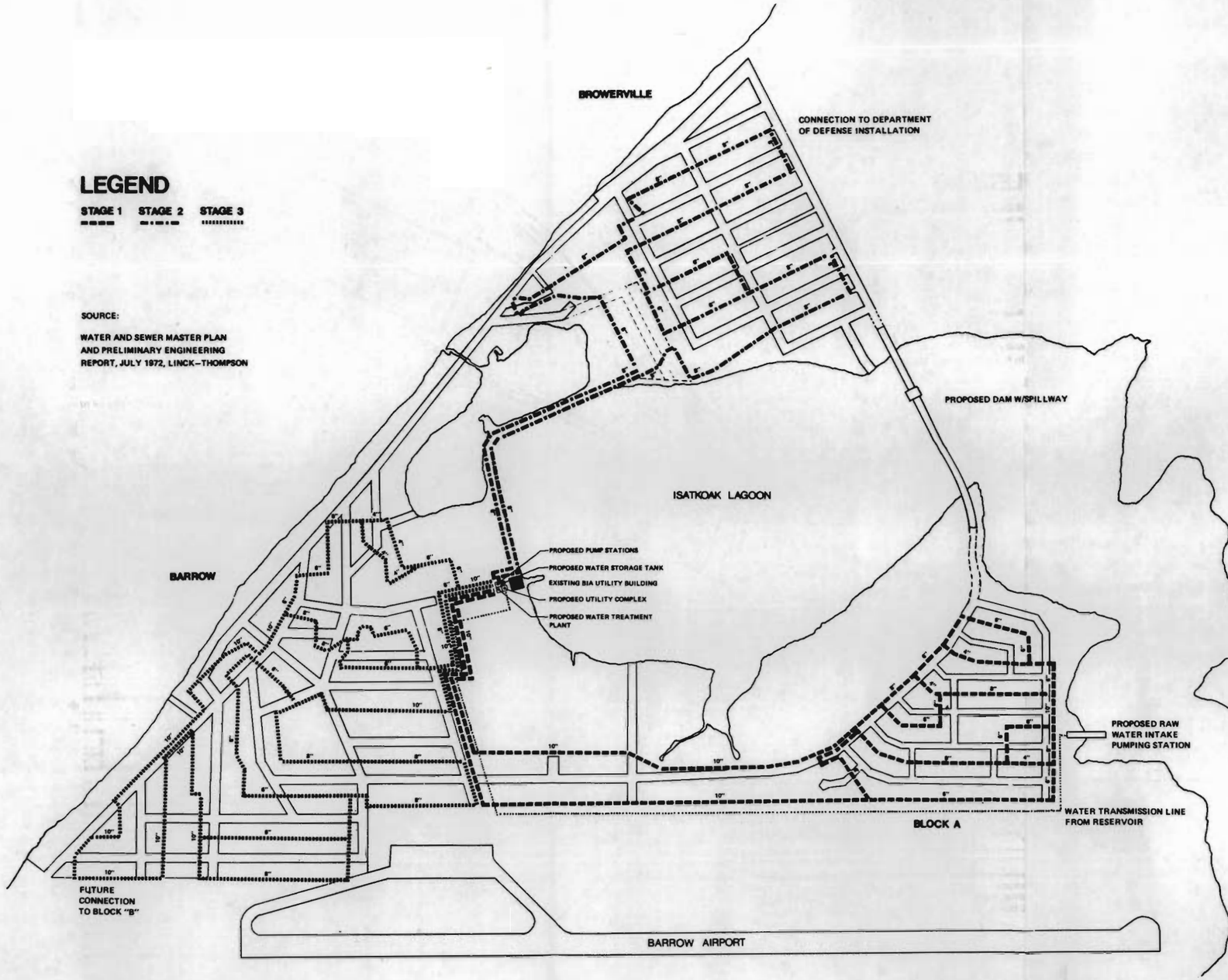
The city of Barrow should request of the Arctic Environmental Research Laboratory that it study the feasibility of developing the above-described system in Barrow.

LEGEND

STAGE 1 STAGE 2 STAGE 3

SOURCE:

WATER AND SEWER MASTER PLAN
AND PRELIMINARY ENGINEERING
REPORT, JULY 1972, LINCK–THOMPSON



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north 400 200 0 400 800

PROPOSED WATER SYSTEM

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

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BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
contract: N 62474-72-C-0228

LEGEND

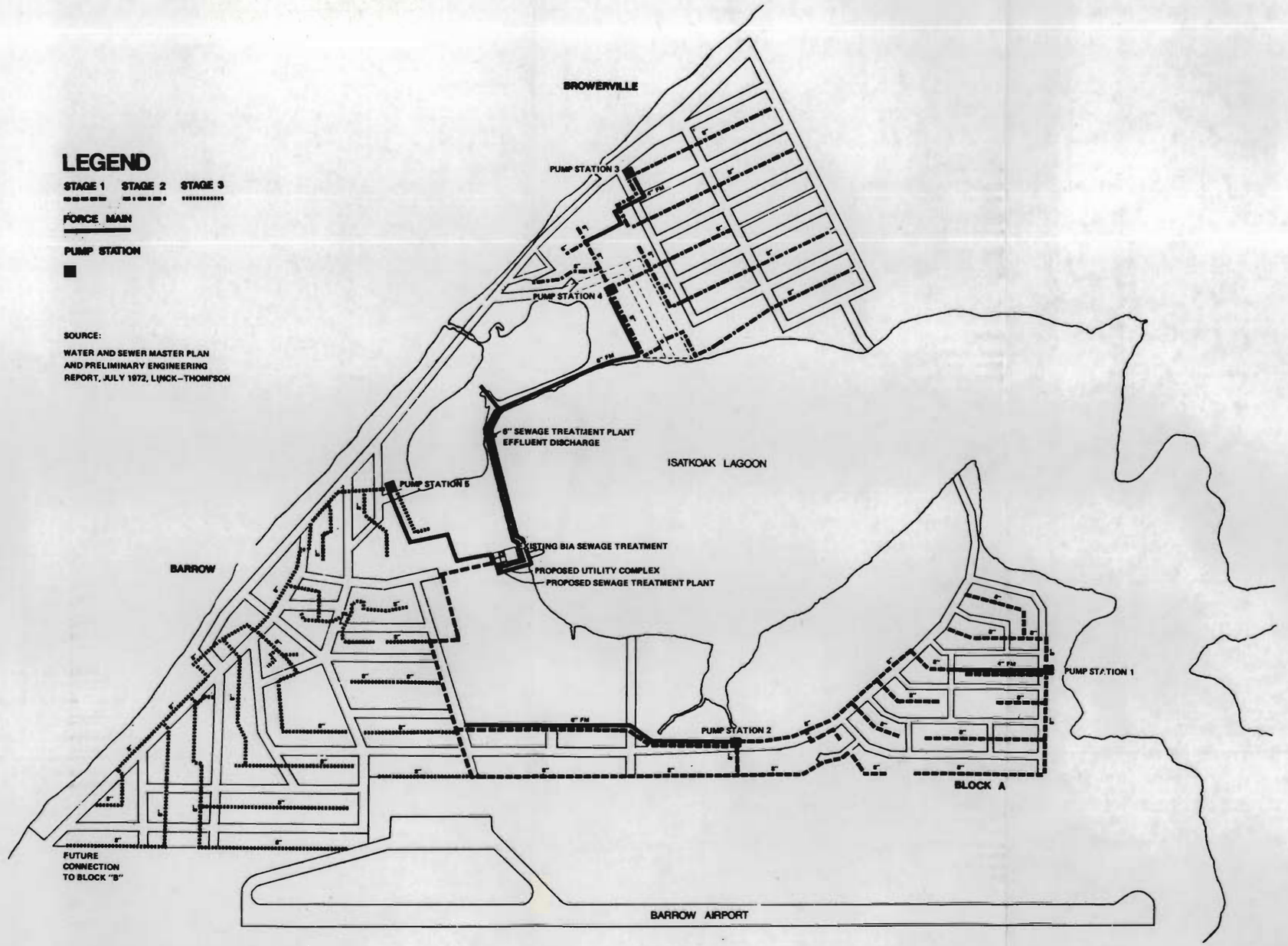
STAGE 1 STAGE 2 STAGE 3

FORCE MAIN

PUMP STATION

SOURCE:

WATER AND SEWER MASTER PLAN AND PRELIMINARY ENGINEERING REPORT, JULY 1972, LINCK–THOMPSON



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PROPOSED SEWER SYSTEM

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WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
contract: N 62474-72-C-0228

ELECTRIC POWER INTERTIE

The existing electrical distribution facilities at the Naval Arctic Research Laboratory consist of a recently constructed generating plant operated by NARL personnel and a 2400-volt 3-phase aerial pole line distribution system which serves the adjacent facilities and is extended southwestwardly down the coast to serve the NARL facility east of Browerville (Plate 9).

The NARL plant has a generating capacity of 3000 kW, consisting of four 750-kW gas turbine units. The power demand on the plant is unknown, but analysis of the distribution system, especially the new 2400-volt 3-phase feeder extended down the coast to serve the new incinerator building, indicated that the facilities are designed for the needs of NARL only, with possibly very limited excess capacity that could be made available for use of others without curtailing NARL needs or jeopardizing their operation.

The existing electrical generating and distribution facilities within the city consist of a government-owned Bureau of Indian Affairs generating plant located on the school site. The facilities are operated by the Barrow Utilities, Inc. (BUI), a village-formulated cooperative. The distribution system is comprised of a 5-kW 3-conductor armoured cable loop system on the BIA site, serving the school and hospital facilities, and a 2400-volt 3-phase pole line, which serves the Barrow and Browerville communities.

The existing generating plant was constructed in 1965 and has a generating capacity of 2650 kW if all units are operated in parallel. The plant consists of two 750-kW solar gas turbine units and one 450-kW gas engine unit located in the new generating building. Also, one 450-kW diesel engine unit and one 250-kW diesel engine are located in a remote warehouse that was the original generator building. These latter units are considered to be standby equipment, but may be intertied to the new plant's generating buss. All of the Bureau's generating equipment is at least seven years old, and it is questionable how much longer the older units will continue to be economically operational.

Since it is the Bureau's policy to consider only 50 percent of the available equipment for use at one time in isolated Alaska locations, the generating capacity is reduced to 1200 kW (one 750 kW and one 450 kW). The 250-kW unit is approximately 20 years old and it is felt that 100 percent of the demand capacity should be available for standby.

The present power demand on the Bureau's plant is 750 to 800 kW. The anticipated increase with the construction of the new Barrow High School is estimated at 500 kW. There will undoubtedly be an increased demand from the Barrow and Browerville communities as economic development continues.

Exclusive of the limited generating capacities of the existing power plant to serve their respective system demands, consideration has been requested in the long-range development of Barrow for an electrical power tie-line between the NARL and BIA plants.

The need for an intertie has been prompted by the possibility of an extreme emergency developing at the BIA site. The Bureau of Indian Affairs considers that they do not have 100 percent standby generating equipment. They limit themselves to 50 percent operating equipment at any one time, generally operating only one unit at a time without parallel operation. In addition, in the concept of economic development, Barrow Utilities, Inc., and others foresee the gainful possibility of providing commercial power to NARL. This would require NARL approval and mandatory reliability and stability, as well as being economically justifiable. Setting aside the fact that limited power is available to transmit either to the NARL plant or the BIA plant, a tie-line could be constructed.

Because the power line would not at present, nor possibly in the future, be used to make commercial power available to NARL from the BUI-operated Bureau of Indian Affairs system, an intertie line is not economically justifiable. Disregarding economics, a 15-kV 3-phase conventional vertical pole tie-line, approximately 3-3/4 miles long, could be located along the routing and parallel to the existing pole lines. An originally considered alternate route away from the beach area would traverse and impose restrictions on future construction and development of the land set aside for the Naval Arctic Research Laboratory, without enhancing the visual ecology along the coast line due to the existing construction.

The intertie line would basically consist of No. 2/0 copper conductor strung on 15-kV insulators mounted in a conventional vertical arrangement on 45-foot Class I fully treated poles. The pole spacing would be approximately 130 feet. Two transformer banks, each consisting of three 833-kVA 15,000/240-volt askeral-filled transformers, would step up and step down the 2400-volt plant voltage to the 15,000-volt transmission voltage for the

most economical transmission of the ampere load requirements. This would reduce voltage losses and system fluctuations due to the distance.

At each terminal end, a switching structure would be provided in conjunction with the transformer banks, with the required air-break switches and fused cutouts, to facilitate the manual interconnection of the two systems. This would be operated by experienced and qualified personnel following a procedure as agreed upon by the Naval Arctic Research Laboratory.

Each terminal structure installation would be installed in a suitable metal building, approximately 20 x 30 feet. The enclosed transformers and switches, in lieu of an open-switch yard system, would provide better maintenance and operation during adverse weather conditions. The structures are a recommendation of NARL personnel. The estimated cost of the intertie line and related structures for manual interconnection would be approximately $375,000.

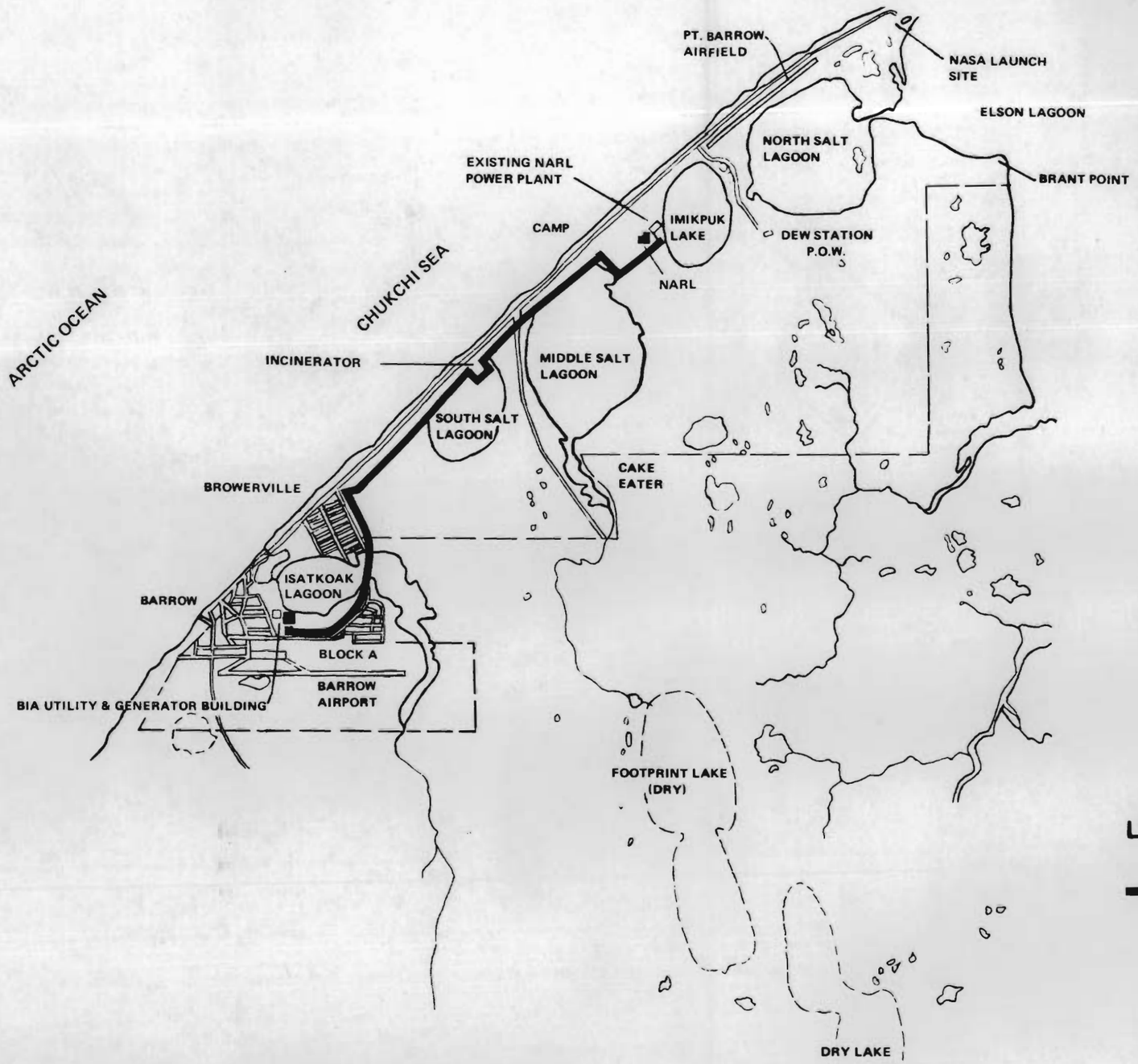
Consideration for remotely controlling, intertieing, and providing two-way metering, coupled with a separate communications system, reveals that it would be extremely difficult and especially costly, since the availability of systems to accomplish these functions is limited to the large complex systems presently available for use by large major utility companies on their systems. An estimated cost figure obtained from one of the major high voltage distribution apparatus manufacturers for a system and equipment to provide remote control is $250,000.

The limited demand for these specialty systems makes it uneconomical for manufacturers to develop and provide systems for the limited scope and use on distribution systems of the minute size operated by the NARL and BIA plants.

Since the Naval Arctic Research Laboratory has expressed an unconditional desire to retain control of the intertieing of the two systems, a procedure developed and executed under their direction, using non-remote sequenced startup and energization of the 15-kV intertie line from either the NARL or BIA system during an emergency situation warranting the intertieing of the two systems, would not necessitate the expenditure for a costly remote-control metering and communication system.

Recommendation

It is recommended that an intertie be constructed along the following alignment: From the BIA facility eastwardly through Block A, thence across the proposed Isatkoak Lagoon bridge, thence along the east side of Browerville to the beach road and eastwardly to the intertie at the incinerator. The line paralleling the beach road should be as far landward as practical for protection from possible future erosion. The portion of the line through Block A can function as the primary distribution for Block A; the extension through Browerville should be considered primary distribution to replace the present endangered beach line.



LEGEND

- PROPOSED SWITCH/TRANSFORMER STATION (244/12,470 VOLT)
- PROPOSED ELECTRIC LINE

north 2000 0 2000 4000

PROPOSED 15 KV. ELECTRICAL INTERTIE LINE

SOURCE: BUREAU OF INDIAN AFFAIRS
DIVISION OF PLANT DESIGN AND CONSTRUCTION

JOHN GRAHAM AND COMPANY
architects, planners, engineers
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BARROW REGIONAL MASTER PLAN, BARROW, ALASKA
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NATURAL GAS INTERTIE

The Naval Arctic Research Laboratory is supplied gas by a 4-inch 250-psi line from the gas field PRV station to the cantonment area and new power station. In the gas gatehouse at the power plant, beyond the takeoff for the power plant, the pressure is reduced to medium pressure to supply the incinerator (although the system is designed for 250-psi operating pressure), and the line continues through the cantonment area to the beach road, then along the road to the incinerator building located at South Salt Lagoon (Plate 10).

The city of Barrow is supplied by a recently installed 6-inch 250-psi line on piling from the gas field PRV station to the Bureau of Indian Affairs utility building PRV station. The pressure is then reduced to medium pressure (although designed for 250 psi) and the line size reduced to 4 inches; the line continues along the shore of Isatkoak Lagoon, across the dam spillway, to the boundary of Browerville. This line branches off to a PRV and metering station serving Browerville residents and the NARL facility immediately to the east. Prior to reaching the BIA utility building PRV and metering station, the 6-inch gas line branches in the vicinity of the Bureau's school complex and cemetery to supply a PRV and metering station that services Barrow residential and commercial facilities, as well as various government agencies located within the city of Barrow. The utility building PRV and metering station serves the Bureau of Indian Affairs power plant and school complex and the Alaska Native Service hospital.

The two PRV and metering stations serving Barrow and Browerville, and the gas distribution piping within the villages from these stations, are owned and operated by Barrow Utilities, Inc. All power plant and gas distribution facilities for the Bureau of Indian Affairs are operated and maintained by Barrow Utilities, Inc., under contract with the Bureau.

The residents of the city of Barrow depend entirely upon the gas served by the BIA transmission line from the gas field for their electricity and source of fuel for heat. In case of transmission line outage, there would be some emergency electrical power for the village through the use of diesel-powered generators, but there would not be any fuel for heating residences or businesses. All of the government facilities have fuel oil standby for their restrictive use. Any extended outage would create an extreme hardship upon the village residents. Although the Naval Arctic Research Laboratory may be

able to cope with a transmission line outage with their standby facilities, any extended outage would create hardships upon their personnel also.

It is possible to provide a parallel transmission line, approximately 5 miles long, from the gas control station to each of the two areas. However, what appears to be the most feasible emergency standby source of supply would be for one of the existing transmission lines to supply both areas during an outage of the other line. This may be accomplished by installing a connecting transmission line between Barrow and NARL, and would consist of a 2-mile-long 6-inch-diameter line between the 6-inch line in the Block A vicinity and the 4-inch valve at the incinerator (Plate 11).

It is proposed to connect to the existing 6-inch line at the easterly limit of Block A, thence northerly along Block A across the proposed Isatkoak Lagoon bridge, thence along the present easterly boundary of Browerville to the beach road, thence along the beach road parallel with the existing power line to a connection with the 4-inch gas valve at the incinerator. The gas line is to be elevated not less than 8 feet in the vicinity of Browerville and Block A, with additional height at street crossings. Then the gas line is to be lowered to a 4-foot elevation along the beach road, with additional elevation at necessary traffic crossings, except the line will be buried in the vicinity of the incinerator building.

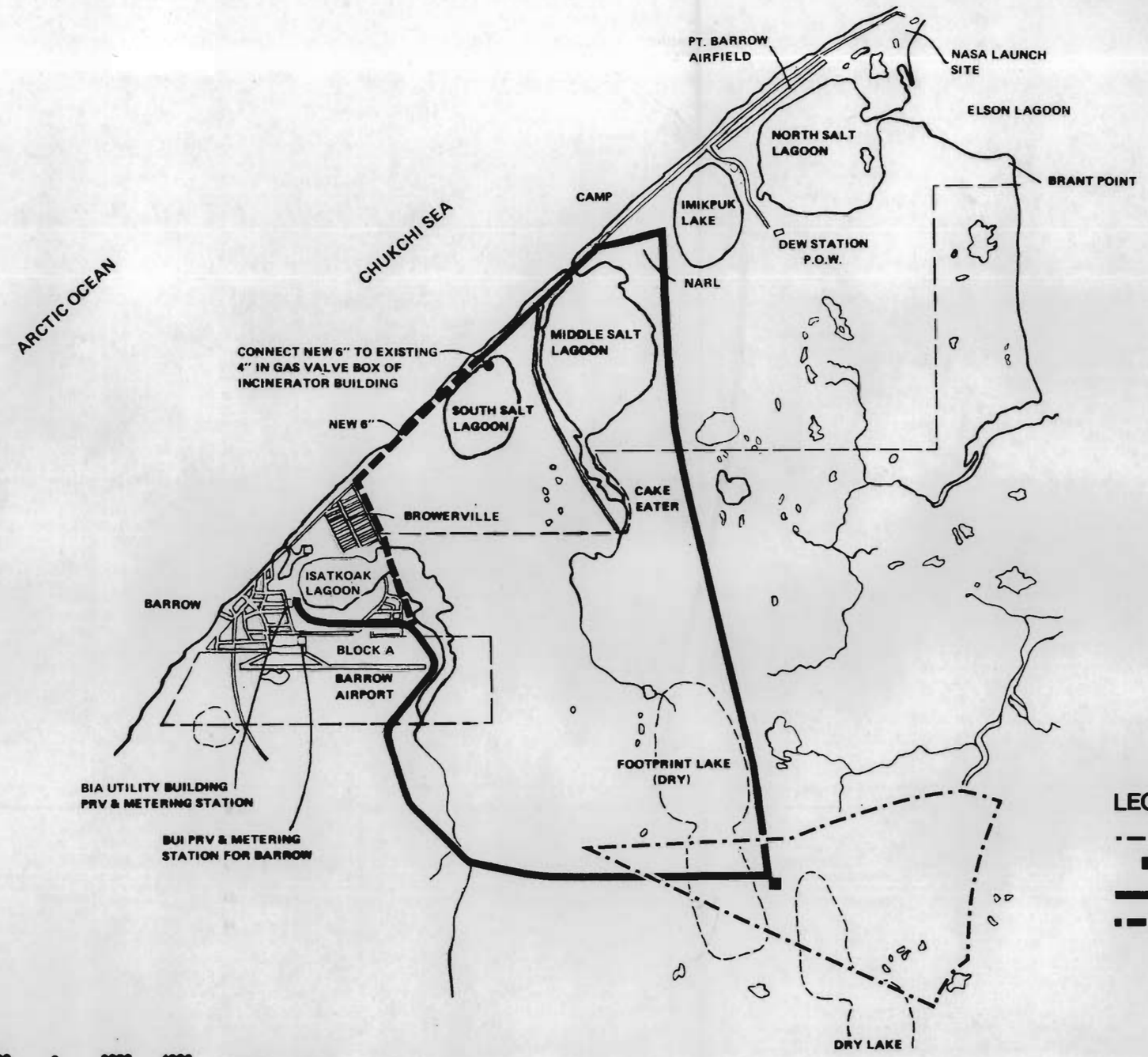
A pressure reducing station should be installed in the Block A area to supply domestic services and a pressure reducing station installed in Browerville for a future cross-tie to the existing Browerville supply. This will reduce dependence on the existing 4-inch line crossing the existing sewage lagoon dam, as well as provide additional capacity for Browerville expansion. This proposed intertie will permit the BIA facility in town to be bypassed and would allow full line pressure to be used in the intertie. This arrangement would also permit a second point of supply to Barrow from the Browerville PRV station. It also would closely approximate the advantages to be gained by having a separate parallel supply line independent of the distribution system.

The gas line should be designed for 250 psig, all welded steel, and conform to ASME publication *Guide for Gas Transmission and Distribution Piping Systems*, dated December 15, 1970. Anchors and expansion loops would be installed as required. It is not proposed to install meters for the flow in this line. Meters should be installed at the pressure reducing stations to meter

domestic use. The control of the supply through this gas line is to be maintained jointly, and each agency should have control of their respective valves. Various other detail problems can be resolved during design.

Although the proposed intertie line is connecting to a 4-inch line at the incinerator, it is proposed to install a 6-inch line in order to maintain sufficient pressure to operate the power generators. The estimated cost for this gas line is $350,000.

The recommended alignment for this intertie is shown on Plate 12.



SOURCE: BUREAU OF INDIAN AFFAIRS DIVISION OF PLANT DESIGN AND CONSTRUCTION

PROPOSED GAS INTERTIE PIPELINE

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

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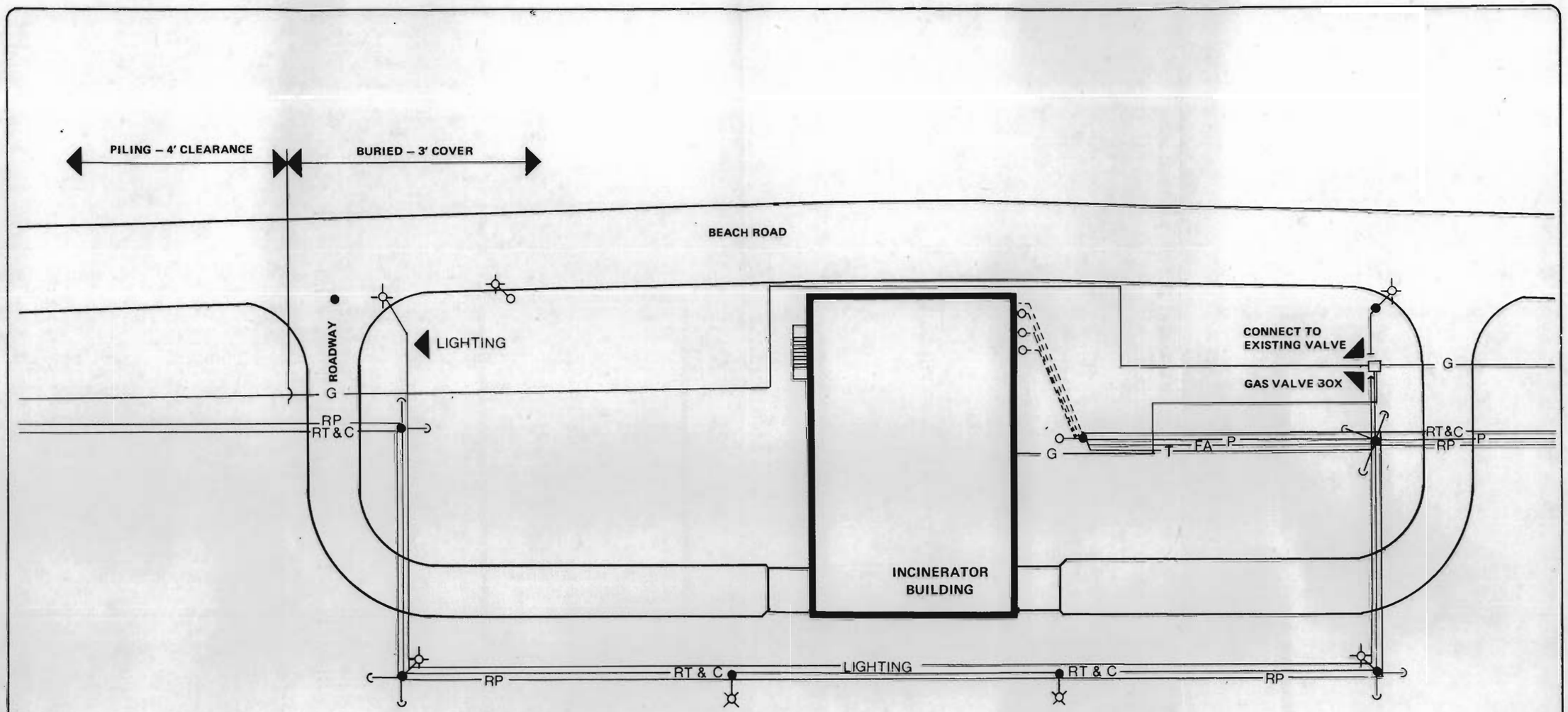

SOURCE: BUREAU OF INDIAN AFFAIRS
DIVISION OF PLANT DESIGN
AND CONSTRUCTION

north scale: 1" = 40'

INCINERATOR BUILDING: PROPOSED GAS INTERTIE PIPELINE

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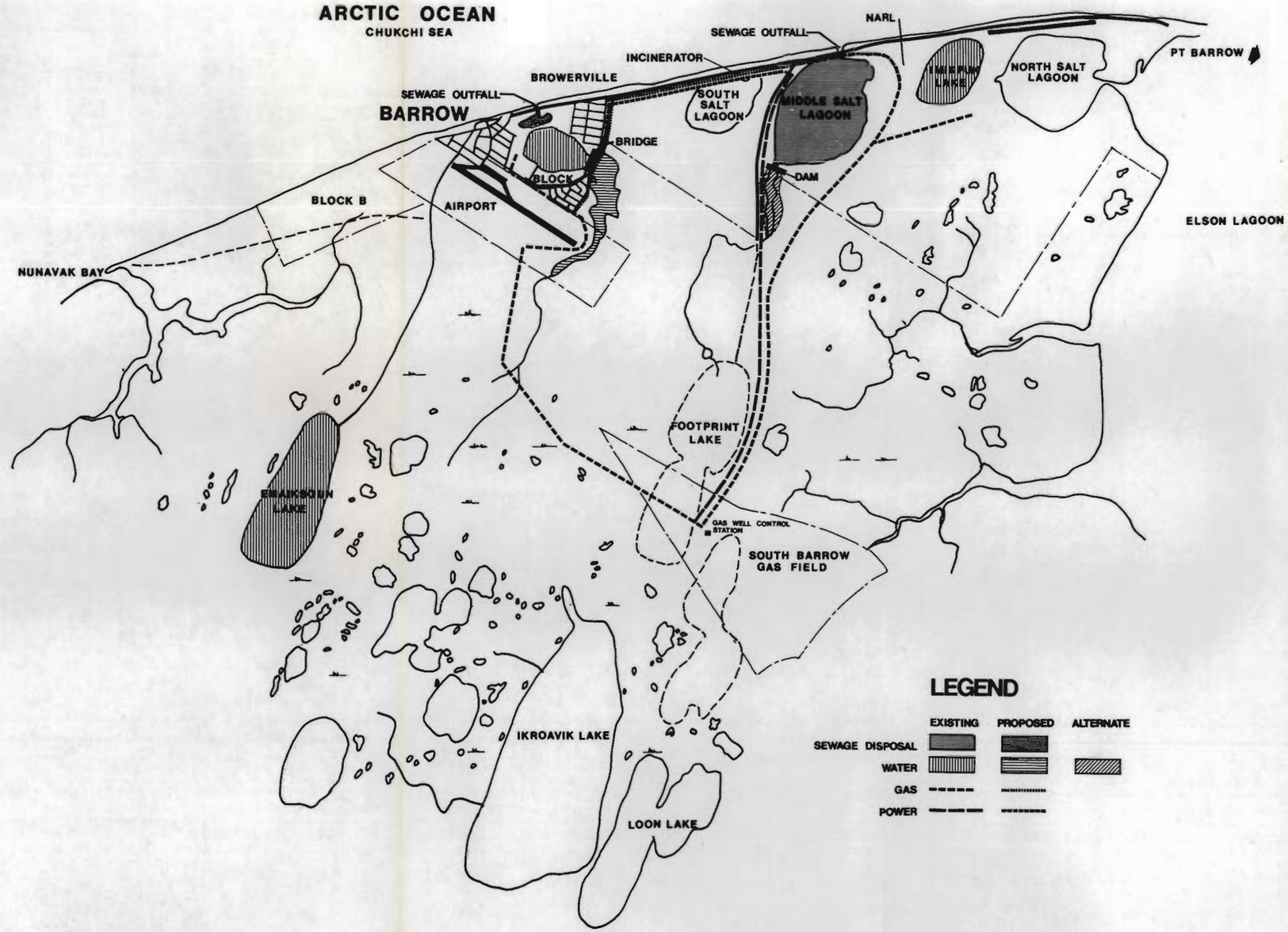

north 0 2000 4000 6000 8000 10,000

EXISTING AND PROPOSED REGIONAL UTILITIES

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

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BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

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12

STORM WATER DRAINAGE

The city of Barrow contains several defined drainage channels which carry a small amount of seepage during the summer months and occasionally a heavier runoff caused by melting snow and/or precipitation. A maximum annual precipitation of 8.3 inches has been recorded and a maximum annual snow accumulation of 30 inches is a matter of record. Due to the presence of subsurface permafrost, which prevents percolation of surface water into the subsoil, small ponds are formed and remain throughout the year. Isolated ponds such as these do not flow into the natural drainage channels because of the flat terrain found in most of the city.

Because of the erosion susceptibility of the surface soils, there has been reluctance to excavate drainage ditches to carry runoff of surface water to natural drainage channels. To overcome this condition, and to minimize frost upheaval action and subsidence caused by melting permafrost, all roads and streets are constructed with an overlay of granular material which is a minimum of 3 feet in depth. This practice has helped to divert surface water into culverts by directing it toward the natural drainage channels. This has helped to reduce ponding in some areas. Additional cross drains will be required as streets are constructed, especially in Block A, but their exact location will not be determined until a definite drainage pattern develops after filling in the streets and housing areas.

Many of the older homes in Barrow were constructed close to the ground, with inadequate foundations, thus contributing to dampness inside and subsequent deterioration. Most of the newer homes have been constructed on piling, which places the floors above the surrounding terrain. Also, in most of the commercial sites, granular material has been hauled in to fill in the ponds and potholes prior to constructing buildings. In some cases, this practice has improved drainage conditions by channeling surface water toward natural drainage channels. In other instances, the fill has obstructed drainage and created additional ponds and potholes.

Alternate No. 1 – Underground Storm Drainage System

Underground storm drainage systems are used successfully at Fairbanks and at Nome on the sections that have curbs, gutters, and paving. The Fairbanks streets, for the most part, have a subsurface consisting of fine sand and gravel. At Nome, the streets that are paved were excavated to a depth of 3 to

4 feet and backfilled with gravel to stabilize the grade and prevent heaving and settlement. At both locations, the storm drains are placed on stabilized drained material.

The town site of Barrow, which includes Browerville and Block A, is located in an area where the subgrade consists of silt and ice lenses to varying depths.

Ice cellars constructed by the BIA to depths of as much as 12 feet below the surface were in frozen silt that had a high percentage of ice crystals and in some cases there were lenses of ice 2 to 3 feet thick.

Removal of the insulating moss and grasses causes deeper thawing during the short summer and results in uneven subsidence due to the varying amounts of water in the subgrade. An underground storm drain would need to be completely insulated to prevent thawing of the surrounding area.

Catch basins for the drains would be difficult to maintain on a gravel surface street system. Due to the unstable ground conditions, it does not seem to be practical to start a street paving program in Barrow at present.

An underground street drainage system would not solve the problem of standing water in the lots unless additional drains were connected to all the ponded areas. These areas are too numerous and scattered to allow this method to be practical.

Alternate No. 2 – Surface Drainage System

The ground elevation in Barrow ranges from zero at sea level to a high of 30 feet within the residential area. This difference in elevation would be an aid in establishing a surface drainage system that would be satisfactory for the few months the surface is thawed. Filling in the ponds and potholes and raising the elevation of the streets where required would cause surface water to flow to the natural drainage channels. These channels will have standard culvert type drains under the streets.

In the business district and other areas such as a large school yard or playground, where gravel has been imported to cover the entire area and is continuous from the road shoulders, the drainage is satisfactory.

Due to the small amount of precipitation, the surface drains would normally have a small amount or no water running in them. Grading of the lots by filling with gravel would eliminate the low ponded areas.

Borrow Source

Due to a continuing demand for desirable fill material for street and road construction, as well as building construction in the region, borrow sources have become appreciably depleted within the immediate vicinity of Barrow. There are numerous deposits of beach gravel located several miles southwest of the city which have been investigated and could be made available. A costly all-weather road would have to be constructed across the tundra to gain access to these deposits, but the cost could be shared by all agencies working in the area who have a need for fill material. The absence of rock or stone deposits in the area, from which granular fill material could be manufactured, eliminates a possible alternative for a source of suitable borrow material.

Recommendations

To alleviate the ponds and potholes which now exist within the city of Barrow, it is recommended that consideration be given to providing a surface drainage system. This can be accomplished by grading off the minor high areas which are prevalent in the residential area, and covering the entire area with granular fill material averaging 2 feet in thickness. Also, all existing streets which traverse the residential area should be raised as required, probably averaging 1 foot of fill. In most locations, existing culvert pipe would be adequate to carry the surface drainage, but could be increased in size or moved if the drainage pattern changes. After this work has been accomplished in Barrow, similar improvements should be undertaken in Browerville. In areas of new street and housing construction, such as Block A, all streets and residential areas should be filled in prior to housing construction, if possible.

A few of the existing houses would have to be raised as they are now lower than the surrounding area. This would not be difficult as there are no basements and the houses are small.

Estimated Costs

1. Hauling and placing granular fill at $10.00 per cubic yard

Barrow	$2,580,000
Browerville	$1,360,000
Block A*	$ 925,000
Total	$4,865,000

2. Installing culvert pipe

Barrow	$ 9,900
Browerville	$ 3,350
Total	$ 13,250

3. Engineering and contingencies

10% of totals	$ 487,825

4. Indeterminate share of cost to construct borrow haul road.

* Filling in housing area only

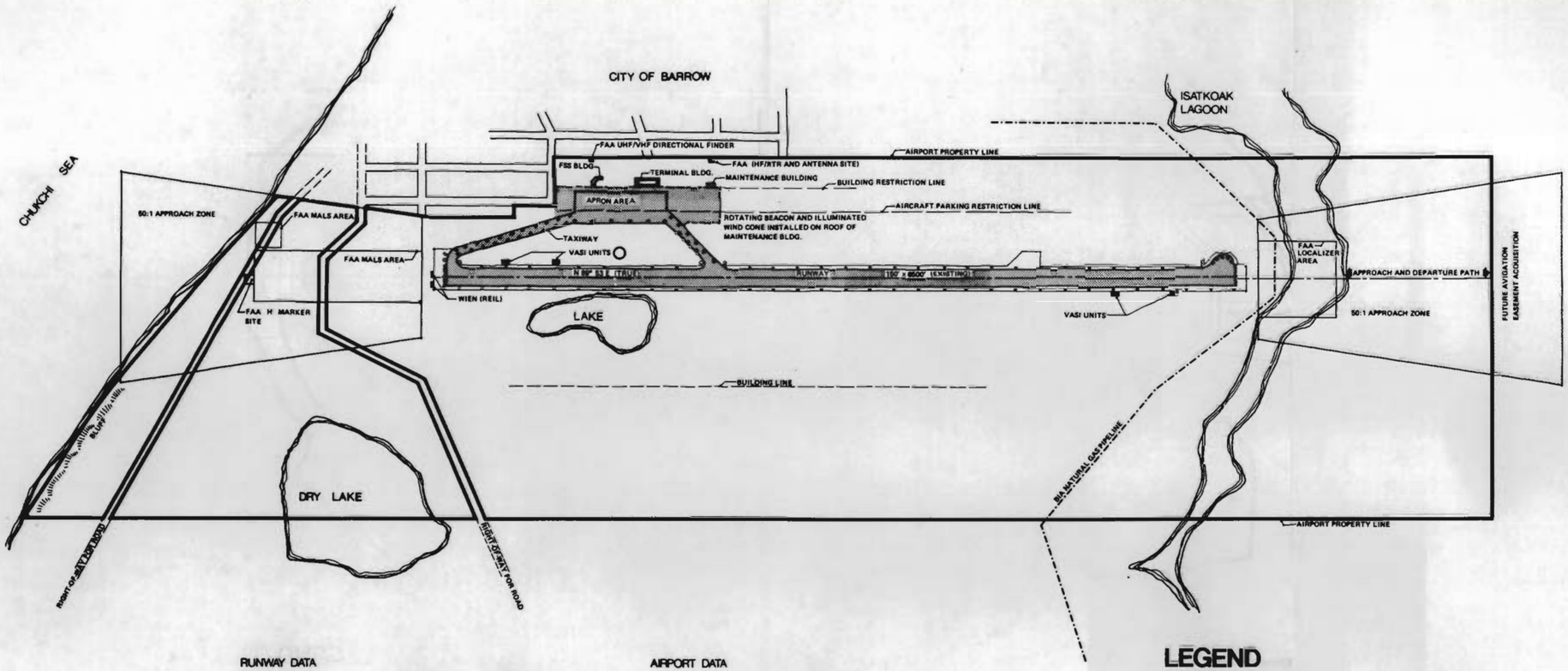
CITY AIRPORT PLANS

The general and commercial aviation needs of the Barrow region are presently served by the Wiley Post/Will Rogers Memorial Airport (Plate 13). This facility, located on 732 acres of land south of the Barrow townsite, has a 6500-foot asphalt-paved instrument runway, high-intensity runway lighting, approach lights, and a visual approach slope indicator. The Federal Aviation Administration is presently planning for the installation of a Very High Frequency Omnirange and Tactical Air Navigation (VORTAC) facility at the airport (Plate 14).

The combination of soil bearing conditions, permafrost, shortage of gravel resources, severe climate, and difficulties of transporation makes airport construction in the arctic a very expensive undertaking. The multi-million-dollar investment of the state and federal governments in the airport makes it highly unlikely that there will be any relocation of this facility in the foreseeable future.

In addition to the improvement of the instrument landing system by the Federal Aviation Administration, several airport improvements are contemplated by the State Division of Aviation. A $500,000 apron construction project is currently in the preliminary design stage. This project will add over 210,000 square feet of apron with a partial surfacing, as the size of the existing apron does not adequately provide for current operation, including the need to safely separate light aircraft parking areas from large commercial jet loading positions. In addition to the apron construction, there will be related alterations to the lighting system. This project is scheduled to be completed during the 1973 building season. Attention must also be paid to the settlement problem occurring on the east end of the runway.

Other improvements contemplated include the erection of an addition to the maintenance building, establishment of an emergency vehicle at Barrow, and possible erection of security fencing. Inasmuch as the latter two projects are dependent upon FAA input with respect to certification priorities and availability of funding, no definitive timetable has been established as yet.



RUNWAY DATA

	EXISTING	FUTURE
EFFECTIVE GRADIENT	0.218%	SAME
PERCENT WIND COVERAGE	91.0%	SAME
INSTRUMENT RUNWAY	YES	YES
PAVEMENT SURFACE	BITUMINOUS	SAME
PAVEMENT STRENGTH	100,000 LBS DUAL GEAR	SAME
APPROACH SURFACES	50:1	SAME
RUNWAY LIGHTING	M. I.	SAME
RUNWAY MARKING	ALL WEATHER	SAME
NAVIGATION AIDS	MALS, VASI, UHF, VHF, HMS, REIL, TLS	SALS, VORTAC
RUNWAY SAFETY AREA	200' x 6700'	SAME
RUNWAY LENGTH	6500'	SAME

AIRPORT DATA

	EXISTING	FUTURE
AIRPORT ELEVATION	46.1'	SAME
AIRPORT REFERENCE POINT (ARP)	LAT. 71° 17' 10" N	SAME
	LONG. 156° 45' 50" W	SAME
NORMAL MAXIMUM TEMPERATURE	42.7° F	SAME
TAXIWAY LIGHTING	M. I.	SAME
RAMP LIGHTING	NONE	SAME

SOURCE: STATE OF ALASKA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF AVIATION

LEGEND

- AIRPORT PROPERTY LINE
- GAS PIPELINE
- WIND CONE AND SEGMENTED CIRCLE
- NAVIGATIONAL AIDS
- RUNWAY LIGHT
- TAXIWAY LIGHT
- PAVEMENT

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north

CITY OF BARROW AIRPORT

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

BARROW REGIONAL MASTER PLAN, BARROW, ALASKA
BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
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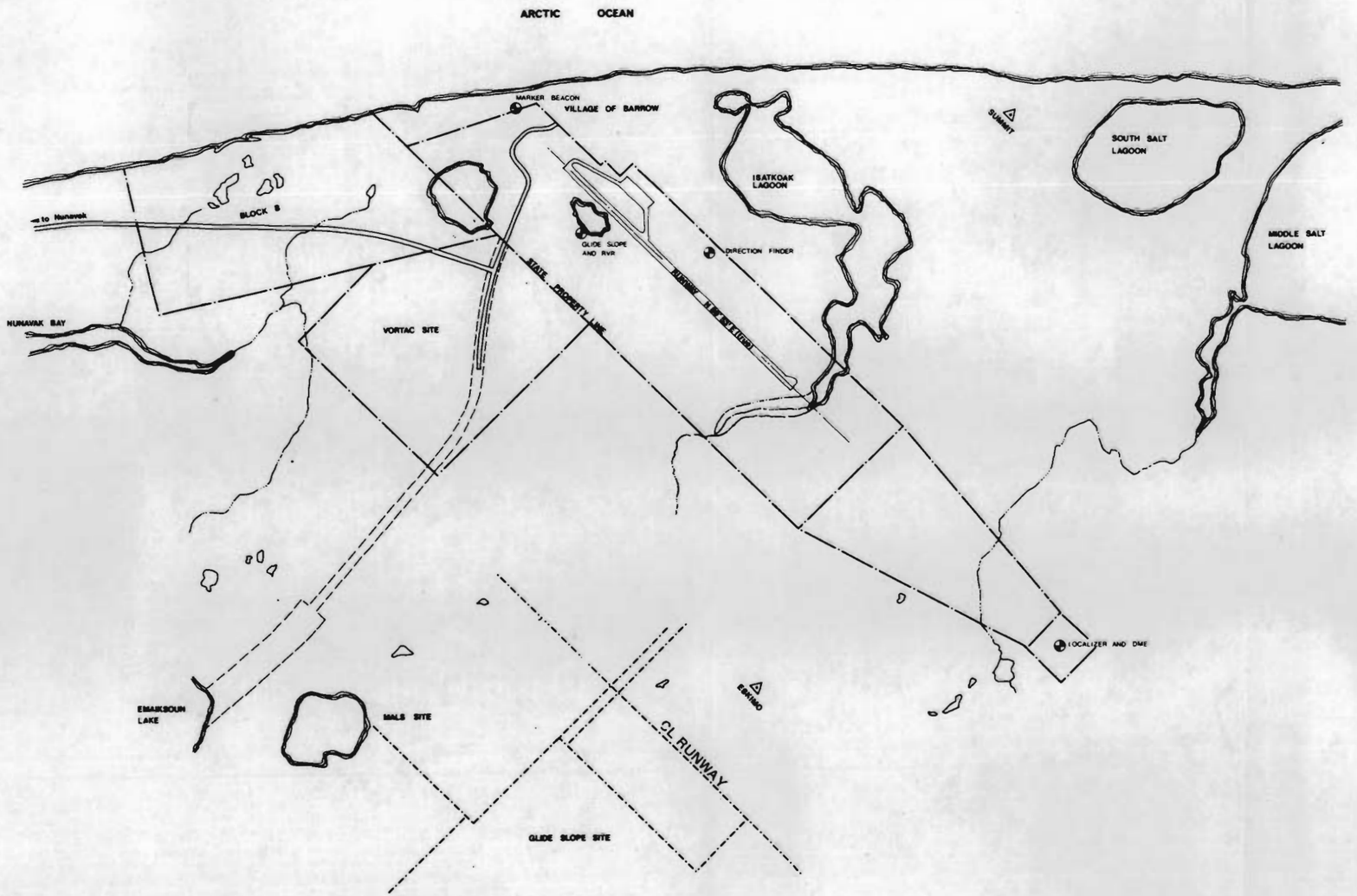

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AIRPORT NAVIGATIONAL AID IMPROVEMENTS

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SOCIAL AND ECONOMIC CONSIDERATIONS

Water and Sewer Plan

There is no question that the availability of running water and a water-borne sanitary sewer system will be of social benefit to the residents of the city. Personal hygiene can be improved, health hazards reduced, and the appearance of the community improved by the elimination of the many barrels that serve as receptacles for trash and human waste.

Alaska Village Demonstration Project

The Alaska Village Demonstration Project (AVDP) system would appear to be the most economically feasible program, both in initial cost and durability of facilities and equipment, and continued maintenance. In addition, the program has proven environmentally sound in its conservation of the water resource (both in usage and subsequent recycling). For the individual, the savings is felt through the availability of laundry facilities without the personal expenditure for high-cost equipment. The creation of local jobs to maintain the system is of value to the citizen and the area as a whole.

Unlike the proposed utilidor system, this system would not significantly alter the landscape through the establishment of barriers or the realignment of existing homes. The system could, in fact, utilize existing facilities as the basis for water heating and home units. The facility center would prove a gathering place as well as provide a supplementary source of portable water. The over-all flexibility of the system would allow for utilization by all persons in the area, a factor not met by the utilidor system.

Utilidor System

The utilidor system that the Public Health Service proposes appears to be the only water-borne system that has proven effective in the arctic. The so-called Swedish pressure system has never been used for more than 20 housing units, and may not be adaptable to a community of 2000.

The main adverse effect that the utilidor system will have on the community is the physical and visual barriers that it will create. The utilidors, in most cases, are located at the rear property lines. People will no longer be able to

walk through their back yards to their neighbor's. In effect, fences will be created throughout the community.

It is difficult to accurately assess the economic effect of the utilidor system when a large percentage of the residents are unemployed. In spite of this, many families are now paying $40 per month to have water or ice hauled to their homes. The residents of Barrow have repeatedly voiced their approval of the water and sewer plan, and they are aware that it will cost them at least $33 a month for each home. A public improvement of this type, unlike in the lower 48, will not be a catalyst for bringing more commerce or industry to town. It is not a revenue-producing enterprise. In fact, the system will probably always be subsidized.

This economic problem cannot be minimized. The Alaska Native Health Service subsidizes the system during a training period (usually one year). From this experience, the community can adjust the charges to fit the need. The total annual operation and maintenance cost of the system is estimated at $241,000, and the prorated share to city residents is estimated at $161,364. If the city government bears all this cost, the amount is almost equal to the total city budget at this time. Money simply is not available in the budget.

If the costs are allocated to home owners or renters, then the question of non-payment must be faced. For every resident who defaults on the monthly bill, the charges will need to be increased accordingly to the other users. This can create a vicious spiral of escalating costs which could ultimately lead to the collapse of the system unless public subsidy is introduced. (It should be remembered that 28 percent of Barrow's families are in a poverty bracket, with annual incomes averaging only $2578. A minimum sewer and water charge of $33 a month represents $396 annually, or 12 percent of this total income. These figures need to be reviewed further in relation to possible garbage and refuse costs associated with the new incinerator, and the mortgage costs of the new housing to which the sewer/water system will be connected.)

In light of these financial concerns, as well as questions that have been raised about the initial costs, it will be imperative that a detailed and thorough financial and operational understanding be reached between the Public Health Service and the city before actual construction of the system takes place.

The social implications of the proposed system are being identified as the plan becomes further refined. They are critical to the future harmony of the community and must be addressed at this time.

- There is no commitment to possible water and sewage disposal to all citizens of Barrow. Therefore, if the system is restricted to the 100 HUD units, a situation can emerge wherein lower-income families are provided with desirable amenities, whereas more moderate-income families may not be eligible. This can be destructive to creating desirable attitudes towards work performance in an emerging cash economy.

- The system will require the raising of houses to facilitate gravity flow. Although these costs are included in the Public Health Service report, there is no allowance for the realignment of residences so that the utilidor lines could be placed in a more logical and efficient manner.

- If the system is built and then collapses due to inadequate funds or a poorly trained staff, the social impact in terms of frustration, discouragement, and anger can create a condition that actually is worse than today's.

This consultant cannot offer a solution at this time to the problem of regional water supply, particularly for NARL. The Public Health Service engineering report states that Isatkoak Lagoon has adequate capacity to serve NARL. The Navy should determine the cost benefits of constructing an insulated water line to NARL versus the cost of developing a new water source.

All-Weather Road – City to Naval Arctic Research Laboratory

The need for this facility is based primarily on economic considerations. The residents of Barrow must depend on the federal agencies at NARL for much of their employment. The Naval Arctic Research Laboratory needs the road because it requires access to the community and to the city airport. The social benefits are derived from the employment which provides the financial means for people to improve their standards of living.

Electric and Gas Interties

It is probably a moot question whether the interties have a greater sociological or economic impact on the region. From the economic standpoint, a power outage could prevent planes from landing at the Barrow airport. If these planes were carrying tourists, the community would suffer economic losses, assuming that the planes returned to Fairbanks. A gas outage would have a similar effect, particularly if the tourists were already in town.

Although the Bureau of Indian Affairs has indicated that an electric intertie is not economically feasible, it is this consultant's belief that other planning considerations override economics, particularly the need to safeguard human resources in time of an emergency.

Storm Water Drainage

The Bureau of Indian Affairs' plan for storm water drainage would help to eliminate ponding around residences, thus reducing the possibility of health hazards.

City Airport Plans

The upgrading from an airstrip to a facility having navigational aids is important to the region on both sociological and economic grounds. It will mean that fewer flights will be cancelled, thus enhancing the tourism potential, plus providing additional assurance that air transportation will be available during emergency situations. The upgrading should also allow larger planes to use the facility, which will ultimately result in a reduction of freight costs through larger tonnages and greater flight reliability.

LAND USE PLAN

VII. LAND USE PLAN

REGIONAL

The plan is a composite of existing and proposed uses and facilities (Plates 15 and 16) and is based on analyses contained in the subsections of the report entitled "Special Studies" and "Engineering Studies," and on the section entitled "Recommendations."

This plan does not consider one factor which will have an effect on the region. The Regional and Village Corporations created by the Native Land Claims Settlement Act will be selecting certain lands adjacent to Barrow within the near future. Their plans for the use of these properties are not presently determined. This land use plan will have to be revised at such time as this action occurs.

Because of the need to show more detail for proposals within the city of Barrow, a separate land use plan is discussed in the following section of this report. (See Plates 17 and 18.)

The items which are of prime importance to the region include the following:

- Community Expansion

  The expansion of Browerville eastwardly into the Naval Reserve property would provide space for community expansion.

- Transportation

  The upgrading of the Barrow airport and the use of adjacent properties by the Federal Aviation Administration for a VORTAC site and a localizer will increase the reliability of aircraft landings and will minimize the expenditure of future funds for the military airstrip at NARL.

- Industrial

  A tract in Block B is provided for industrial or warehousing purposes.

- Bureau of Indian Affairs and Public Health Service

  The Bureau of Indian Affairs and the Public Health Service will remain in their present location within the city, with BIA expanding into a portion of Block A for the regional high school complex.

- Naval Arctic Research Laboratory

  NARL is expected to continue its scientific mission for arctic research. Its prime research site, south of Middle Salt Lagoon, is relatively free from encroachment. Future studies by the Navy for creating a reservoir in this area must be considered at a later date.

- Major Trafficway

  The major trafficway between the city and NARL continues to be the beach road, with the exception of a new section which is proposed through Browerville and Block A, with a vehicular crossing of Isatkoak Lagoon on either the top of a dam or on a bridge.

- Gas Intertie

  A gas intertié is proposed which would bypass the existing BIA facility in the city. It would use the right-of-way of the Block A – Browerville connection and continue eastwardly to a connection with the incinerator.

- Electric Intertie

  The electric intertie would use the beach road and the southern portion of Browerville. Both the gas and electric interties would bypass the portion of the beach road adjacent to Browerville which is most subject to storm damage.

- South Barrow Gas Field

  The South Barrow Gas Field is expected to have a producing life of seven to eight years. Explorations are planned in the area.

- Cemetery

  A new cemetery is proposed on Fresh Water Lake Road near the VORTAC site.

- Birnirk Historic Monument

  The boundaries of the monument should be marked and a plaque placed in a suitable location. This ancient Eskimo village site must be protected from encroachment. Gravel extraction and stockpiling, and vehicular truck-haul routes, must be routed around this area.

CITY

Two alternatives are offered for consideration (Plates 17 and 18). The basic differences between the two concepts are in the physical areas in which community growth takes place. Alternative One provides for the expansion of Browerville eastwardly. Alternative Two provides for the filling in of Isatkoak Lagoon. Otherwise, the two plans are similar, except for minor details.

Recommendations – Both Alternatives

- Replatting

  If funds are obtained for the Public Health Service water and sewer program, the downtown portion of the city should be replatted (Plate 19). This will require coordination among the Bureau of Land Management, the Public Health Service, the Borough Planning Department, the Bureau of Indian Affairs, and the city of Barrow.

- Weather Service

  The Weather Service should be relocated to the south side of the airport. This will permit the 8-acre tract in the center of the community to be used partially for a governmental center, a park, and for housing. The governmental center would contain office space for the city, the borough, the Arctic Slope Regional Corporation, and the Village Corporation. In order for these agencies to obtain this property, it is first necessary for the Weather Service to relocate. Years ago, the Weather Service acquired the land in an area that was on the outskirts of the community. At that time, no one suspected that the community would witness the growth that it has. The Weather Service tract of land now contains housing, offices, storage sheds, and the balloon launch building. It also has its own sewage facilities.

  In recent years, however, the community has encroached upon the facility. Weather Service officials have stated that they have difficulty in launching weather balloons because nearby buildings are in the way. This problem will become even more acute in the future as adjacent vacant lots are developed.

  The community is in need of a governmental center where all local agencies can be located in close proximity. It is difficult to assemble a large tract for such use because of the existence of many small lots under different ownership. The 1970 Alaska State Housing Authority plan for Barrow also recommended that the Weather Service relocate to the south side of the airstrips. The housing would be removed to vacant lots elsewhere in the downtown portion of the community.

- Browerville – Block A Connection

  A street connection should be developed between Browerville and Block A.

- Governmental Center

  A governmental center should be developed on the north half of the property now used by the Weather Service.

- Education

  The regional high school should be so located within the Block A parcel that land is left for outdoor recreational purposes and for the expansion of educational facilities beyond the year 1990.

  The school system should have programs catering to all age groups.

  An elementary school should be developed in Browerville and, when feasible, a community college should be located on Block A.

- Recreation

  Playgrounds should be developed in Browerville, Block A, and a portion of the property now occupied by the Weather Service.

  The swimming pool in the high school should be open to all people in the region.

- Zoning

  The borough should adopt zoning which is based on the land use plan.

- Business

  A retail district should be developed in Block A to serve the immediate needs of this area, and the existing downtown area should continue to be the main retail center of the entire community.

As indicated in the table on the following page, the city has sufficient lots to accommodate between 2880 and 3455 persons, based on either five or six persons per household. This is adequate land area until the years 1978–1980. Either Alternative One or Two will then be needed to handle the growth that will subsequently occur.

Alternative One (Plate 17)

This alternative provides for the extension of Browerville eastwardly. A residential neighborhood of approximately 65 acres would be created. The lot sizes are 60 x 120 feet and streets are 60 feet wide. Approximately 170

CITY OF BARROW HOLDING CAPACITY*

Section of City	Total Lots	Non-Residential	Residential	Persons Per Household @ 5	Persons Per Household @ 6
Downtown	379	128	251	1255	1505
Browerville	211	24	187	935	1120
Block A	155	17	138	690	830
	745	169	576	2880	3455
With Alternative One					
Browerville Extension	187	18	170	850	1020
	932	187	746	3730	4476
With Alternative Two					
Isatkoak Lagoon	472	32	440	2200	2640
	1217	201	1016	5080	6096

* Excludes Bureau of Indian Affairs and Public Health Service housing

lots would be devoted to residential usage, 12 lots for a playfield, and 6 lots for a retail area. Based on six persons per household, the area would support between 850 and 1000 persons.

A small business district should be developed in the Browerville extension to provide for the local needs of this portion of the community.

Alternative Two (Plate 18)

Before this alternative can be adopted, a study must be undertaken to determine if fill material can be dredged from the ocean without endangering the environment by increasing the rate of beach erosion.

If it is possible, and all parties are in agreement that it should be done, approximately four million yards of fill would be needed to create 145 acres of buildable land. An in-order-of-magnitude cost estimate by a Pacific Northwest contractor has indicated that the cost of gravel might be in the range of $2.50 a cubic yard. This very preliminary estimate is based on a two-month summer operation for two years using a 30-inch dredge. A canal would be developed from the dam spillway on the east to the sewage lagoon on the west. The width of the canal would be based on spring runoff and other engineering considerations.

The lot sizes are 60 x 100 feet and streets are 40 feet wide. Approximately 424 lots would be devoted to residential usage, 24 lots for a school and playfield, and 8 lots for a retail area. Based on five persons per household, the area would support 2100 persons.

A small retail district should be developed to provide for the local needs of this portion of the community, and tracts of land should be set aside for an elementary school and a playground.

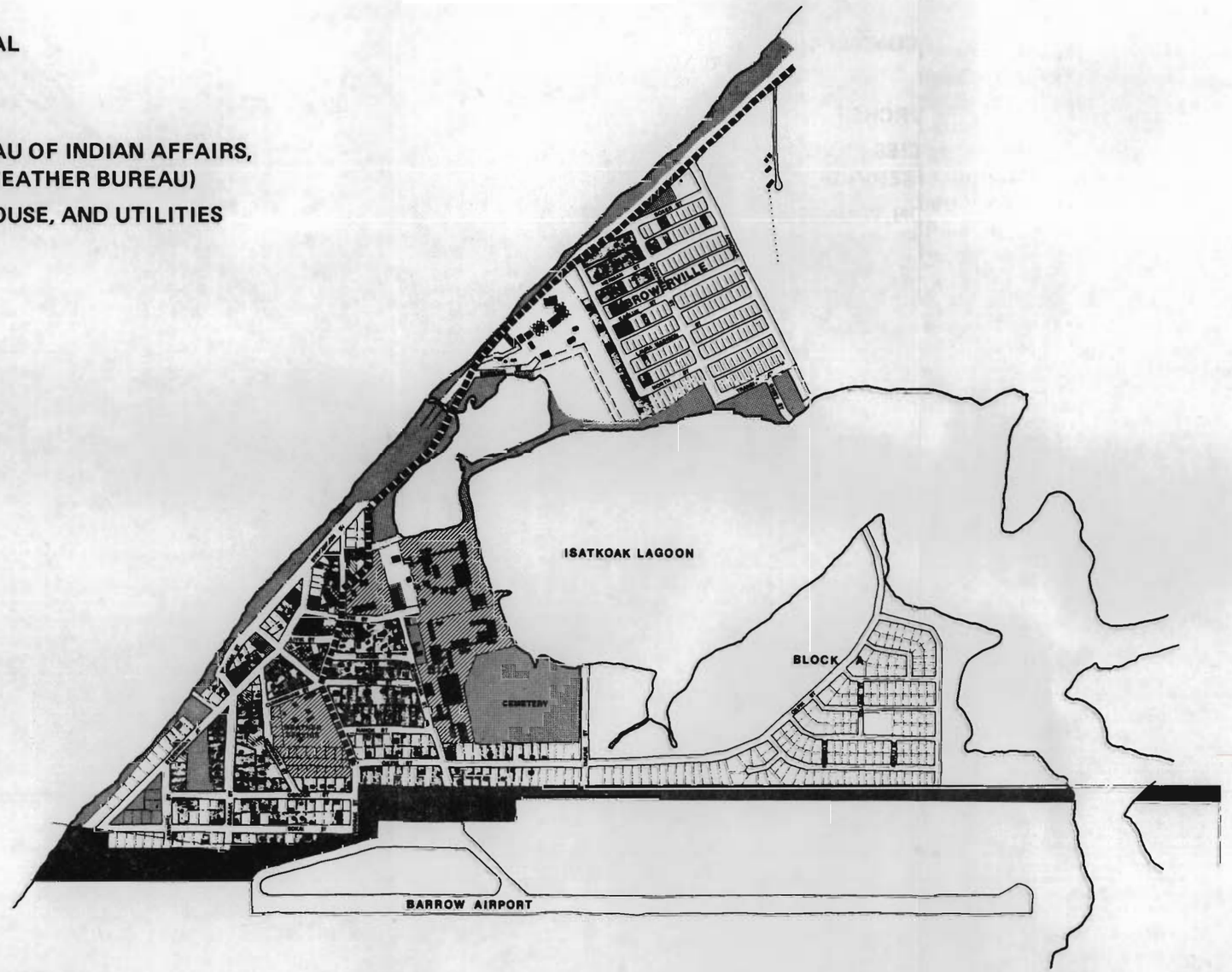
Street Improvements – Alternative (Plate 19)

This alternative represents a method of replatting streets in the downtown area in order to create a more efficient utilidor alignment. The replatting would require the moving of homes in some areas. Nanok and Opek Streets would be extended westwardly through the Weather Service site. Kongosak and Egasak Streets would be vacated. This would permit the utilidor lines to be extended and would eliminate several street crossings of the utilidor.

On the east side of the downtown area, Nachik Street would be vacated and a new street created approximately 60 feet to the south. This would reduce the overcrowding of homes in one block. Aivik Street could be vacated without hampering vehicular or pedestrian circulation.

A review of this alternative reveals that approximately 4000 lineal feet of new street would be needed. An in-order-of-magnitude cost comparison between this plan and the Public Health Service plan indicates that the proposed revisions would cost approximately $250,000 more.

- RESIDENTIAL
- RESIDENTIAL – COMMERCIAL
- COMMERCIAL
- PUBLIC AND CHURCHES
- FEDERAL AGENCIES (BUREAU OF INDIAN AFFAIRS, PUBLIC HEALTH SERVICE, WEATHER BUREAU)
- TRANSPORTATION, WAREHOUSE, AND UTILITIES
- MAJOR STREET



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EXISTING LAND USE · CITY

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architects, planners, engineers
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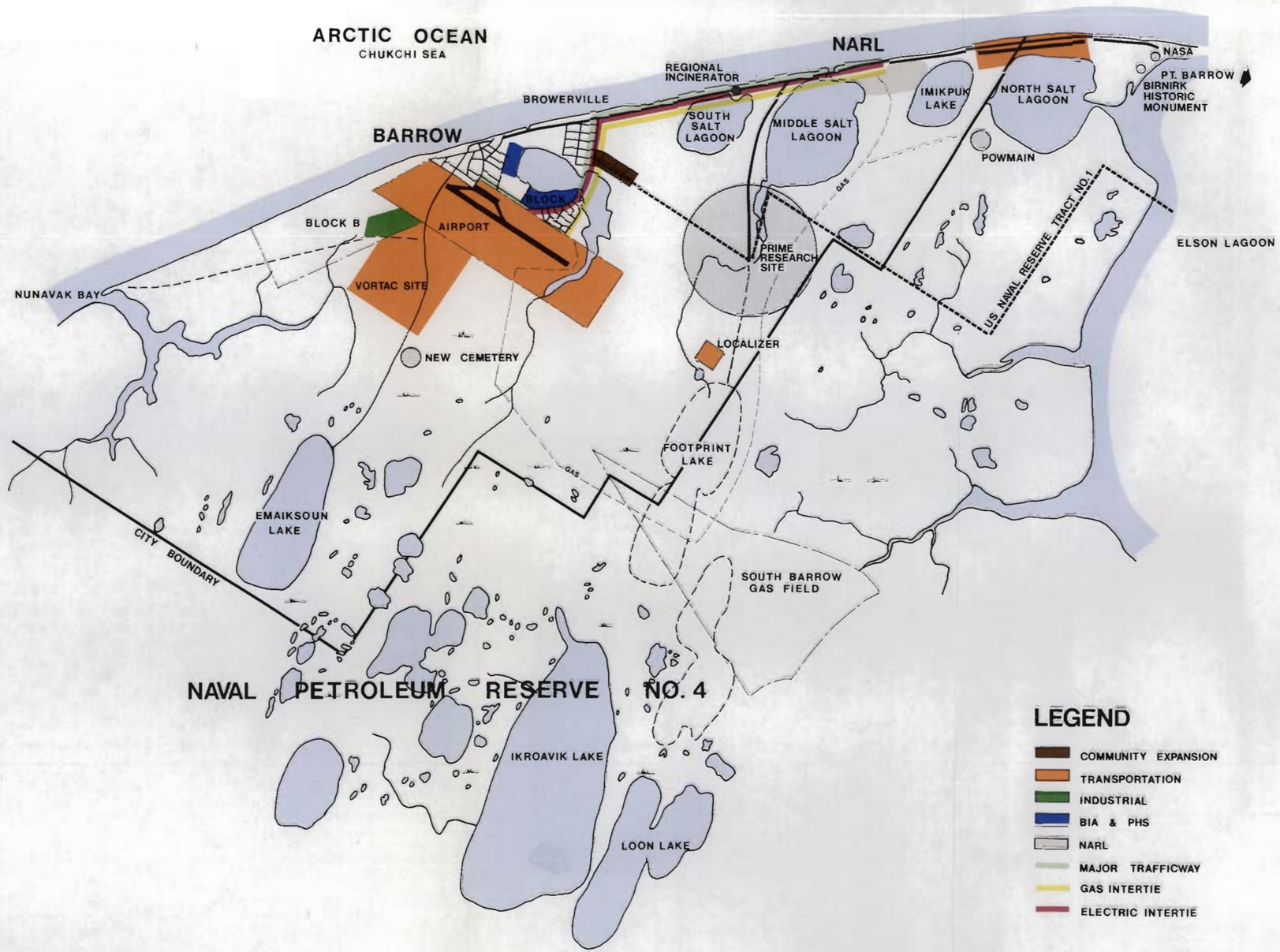

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LAND USE PLAN · REGION

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seattle, anchorage, fairbanks, new york

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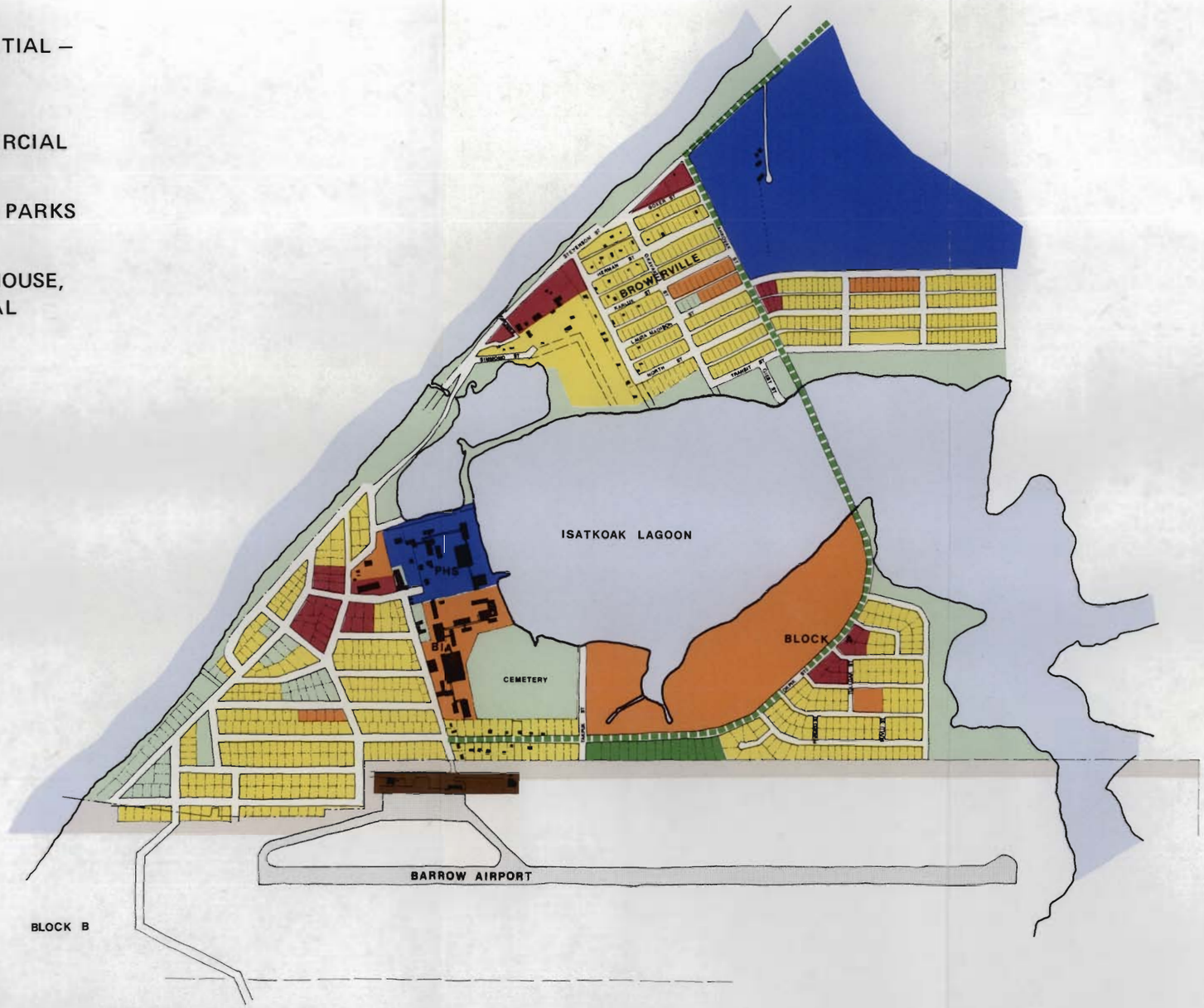
- RESIDENTIAL
- MEDIUM-DENSITY RESIDENTIAL – COMMERCIAL
- COMMERCIAL
- AIRPORT-RELATED COMMERCIAL
- PUBLIC AND CHURCHES
- SCHOOLS AND DEVELOPED PARKS
- FEDERAL AGENCIES
- TRANSPORTATION, WAREHOUSE, UTILITIES, AND INDUSTRIAL
- MAJOR STREETS



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LAND USE PLAN - ALTERNATIVE ONE

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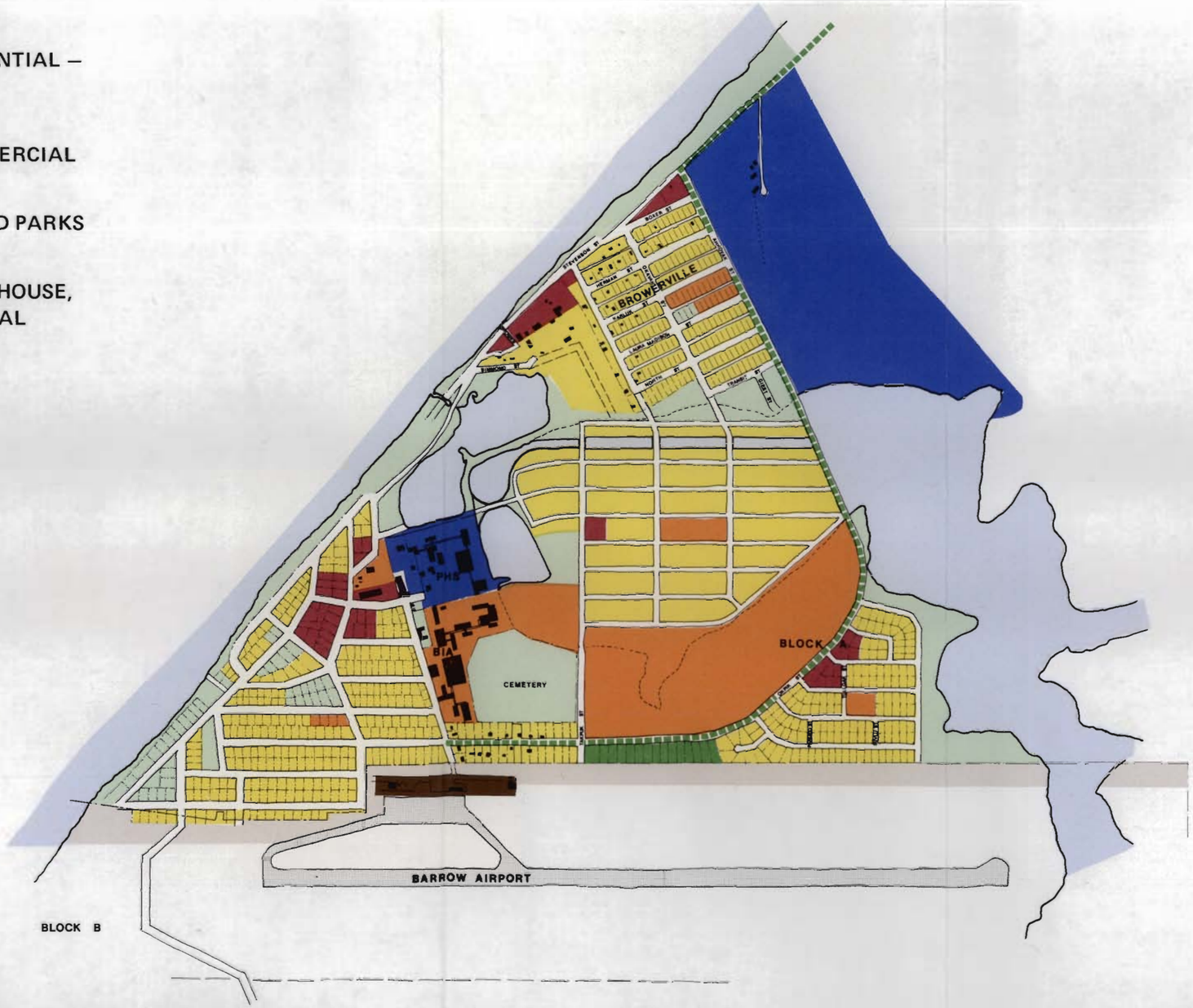
17

- RESIDENTIAL
- MEDIUM-DENSITY RESIDENTIAL – COMMERCIAL
- COMMERCIAL
- AIRPORT-RELATED COMMERCIAL
- PUBLIC AND CHURCHES
- SCHOOLS AND DEVELOPED PARKS
- FEDERAL AGENCIES
- TRANSPORTATION, WAREHOUSE, UTILITIES, AND INDUSTRIAL
- MAJOR STREETS



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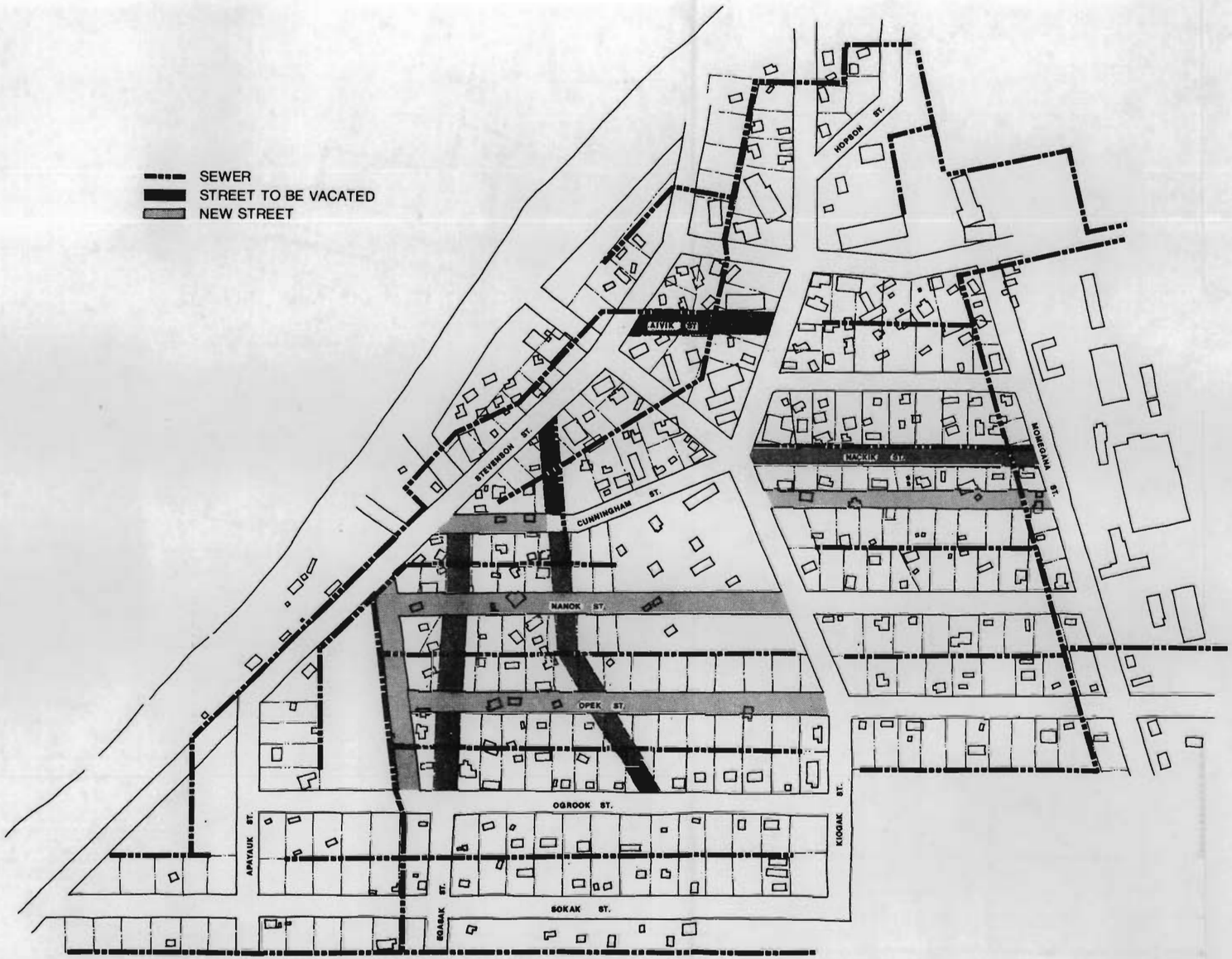
LAND USE PLAN - ALTERNATIVE TWO

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

BARROW REGIONAL MASTER PLAN, BARROW, ALASKA
BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
contract: N 62474-72-C-0228



THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A COMPREHENSIVE PLANNING GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

north 0 100 200 300 400 500

STREET IMPROVEMENTS · ALTERNATIVE

JOHN GRAHAM AND COMPANY
architects, planners, engineers
seattle, anchorage, fairbanks, new york

BARROW REGIONAL MASTER PLAN, BARROW, ALASKA

BARROW INTERGOVERNMENTAL COORDINATING COMMITTEE

WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
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RECOMMENDATIONS

VIII. RECOMMENDATIONS

CITY LOCATION

The city should remain in its present location.

BEACH EROSION

All new construction in the city and at NARL should be constructed as far inland as possible.

COMMUNITY EXPANSION

Community expansion should take place in the area east of Browerville.

AIRPORT LOCATION

The Barrow airport should remain in its present location. A feasibility study should be undertaken to determine the cost/benefit of relocating the NARL airport operations to Barrow.

LACK OF ADEQUATE TOURIST FACILITIES

The following tourist facilities should be developed:

- A modern hotel
- A visitors' center, including an Eskimo cultural center and NARL exhibits

WATER SUPPLY AND DISTRIBUTION / SEWAGE COLLECTION AND TREATMENT

Prior to the implementation of the Public Health Service water and sewage system plan, the Arctic Environmental Research Laboratory should study the feasibility of developing a water and sewage service through the Alaska Village Demonstration Project.

A comprehensive water supply and sewage system plan should be undertaken at NARL.

ALL-WEATHER ROAD

The all-weather road between the city and NARL should be constructed through Block A, with a connection across the lagoon to Browerville and to the existing beach road.

ELECTRIC POWER INTERTIE

The electrical intertie between the Bureau of Indian Affairs and NARL power plants should be constructed along the beach road.

NATURAL GAS INTERTIE

The natural gas intertie between BIA and NARL facilities should be constructed along the beach road from Browerville to the incinerator. From the east side of Browerville, the line should be run in a southerly direction to a connection with the gas line at the northeast corner of the airport.

STORM WATER DRAINAGE

The Bureau of Indian Affairs surface drainage system for the city should be undertaken.

CITY AIRPORT PLANS

The State of Alaska and the Federal Aviation Administration should proceed with their expansion plans for paving and navigational aid equipment, respectively. The feasibility study to determine the merits of relocating the NARL aviation operation to the city should be coordinated with both the State and FAA.

TRASH DISPOSAL

The various agencies who will use the incinerator should formalize an agreement for the cost of its operation and maintenance. The city or the agency who will collect trash within the city should formalize an agreement for the method of reimbursement.

EDUCATION

The Bureau of Indian Affairs should proceed with construction of the regional high school in Block A. They should also prepare detailed plans for housing non-local students, either in boarding houses or in dormitory facilities.

GRAVEL SUPPLY

The Bureau of Indian Affairs and the Navy should undertake a feasibility study of dredging fill material from the ocean.

HOUSING

The Arctic Slope Native Association housing program and the various agencies developing new housing should do so within the community instead of in compounds.

WEATHER SERVICE

The weather service operation should be relocated to the south side of the airport.

NATURAL GAS SUPPLY

The Office of Naval Petroleum and Oil Shale Reserves should seek a new source within the next five years.

PLANNING

The borough should hire a professional planning department and adequately fund it so that regional and local planning can be continued.

REPLATTING

If funding is obtained for the Public Health Service water and sewer program, the Bureau of Land Management should undertake a replatting program to create lots which will better conform to a utilidor system.

COORDINATION

The Barrow Intergovernmental Coordinating Committee should continue to meet twice a year to monitor and coordinate activities.

SUPPLIES

The Bureau of Indian Affairs and the Air Force should consider shipping to Barrow via one commercial tug and barge.

IMPLEMENTATION

IX. IMPLEMENTATION

PROJECTED CONSTRUCTION AND COST ESTIMATES

The following table identifies the projected construction for various projects and their estimated costs. The updating of this schedule in subsequent years should be the responsibility of the North Slope Borough Planning Commission. Federal and state agencies should submit their programs to the borough on an annual basis. The programs should be expressed in terms of priority of need, the projected cost for each improvement and the proposed method of financing, and the estimated annual cost of operating the improvements or facilities to be constructed.

A program of this type assures that the construction of projects can be coordinated between the various agencies and that they will become realities in the year that they are needed. The program must be updated yearly because of changes in priorities or the economy.

COORDINATION

The Barrow Intergovernmental Coordinating Committee has played an important role in preparing this plan. The implementation of the plan, however, will not be realized unless coordination is continuous. The one agency that can be most effective in providing over-all coordination is the Borough Planning Commission. This agency will be responsible for planning and zoning within the entire borough. It will need a staff of professional planners to prepare a zoning ordinance, capital improvement program, and population and employment studies. In addition, the staff will advise the Borough Assembly of the effects that proposed projects will have on the community and the region.

One of its more important functions will be to coordinate the many governmental agencies having jurisdiction within the community. It can play a role in formulating a building code for the community. Personnel at NARL and the Western Division of Naval Facilities Engineering Command have

considerable expertise in arctic construction, and they should be requested to offer their assistance.

ZONING

The purpose of zoning is to control the use of land so that the public welfare is protected. This is done by designating various districts of the city for either residential, commercial, industrial, or public uses. Within these districts, certain land uses are permitted and certain ones prohibited. For example, an industrial operation would not be permitted in a residential district because the traffic, noise, or air pollution generated from the operation might have a harmful effect upon the people living in the adjacent homes. Most cities in the United States have zoning ordinances and Barrow needs one too. It does not need one, however, just because other cities have one.

A zoning ordinance provides for the placement of residences on every lot. The homes cannot be located, for example, within 20 feet of the front-lot line or 15 feet from a side-lot line. This provision, or one similar to it, is needed in Barrow for fire protection and snow drift reasons.

Zoning can be used as a tool for channeling desirable development and for controlling undesirable land uses. For example, if the community desires to create areas where apartments could be developed, it could zone certain areas for multiple-family use. There is considerable merit in having apartments in Barrow. It would reduce the amount of future land area requirements and it would be an incentive for federal agencies to develop housing in the community, where all utilities are available.

If, on the other hand, the community desires to limit the location or number of "undesirable" uses, such as taverns, it can do so through zoning.

This regional master plan does not include a zoning ordinance or map. If the concept of zoning is acceptable to the community, the Borough Planning Department should prepare a zoning ordinance. The zoning should be based on the land use plan that is adopted after the acceptance of this report.

PROJECTED CONSTRUCTION AND COST ESTIMATES*

Project	Funding or Financing Agency	Cost Estimate ($000)
Short Range		
Gas wells	ONPOSR	NA
Incinerator	Joint funding	$ 2,000
Navigational aids	FAA	$ 500
Sewage treatment plant	Navy	$ 2,000
Airport apron	State	$ 500
All-weather road	Joint funding	$ 5,000
Browerville-Block A connection		
Construction, maintenance, repairs	PHS	$ 132
Block A fill	BIA	NA
Regional high school	BIA	$20,000
Natural gas intertie	BIA	$ 350
Electric power intertie	Joint funding	$ 375
Remote control		$ 250
Water and sewer facility (city)**	Undetermined	NA
BIA housing	BIA	NA
Housing in city	Undetermined	NA
Intermediate Range		
Ocean dredging study	Joint funding	NA
Hotel	Undetermined	NA
Hospital expansion	PHS	NA
Housing units	PHS	NA
Eskimo cultural center	Undetermined	NA
Housing in city	Undetermined	NA
Long Range* **		

* There is a need for construction at NARL in the order of magnitude of at least $21,486,000. These improvements, discussed in the section entitled "Agencies and Activities in the Region," will enable NARL to meet Navy criteria.

** If funds are appropriated for a modified version of the water and sewer utilidor plan, these costs would be allocated by phases. In addition, the downtown would have to be replatted by BLM and street improvements made.

*** The projects of the North Slope Borough and the Arctic Regional Corporation will have to be added in a subsequent revision of this schedule.

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