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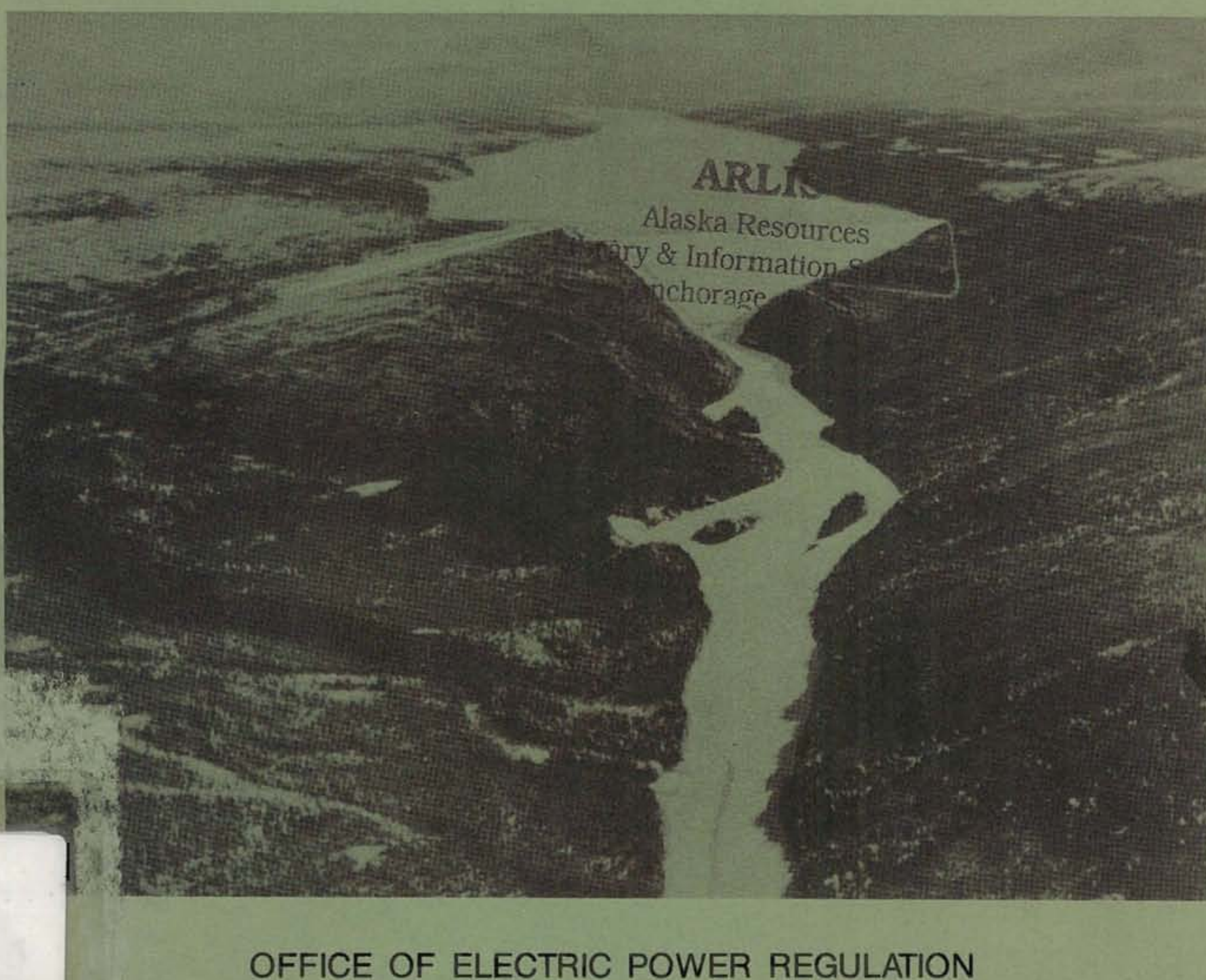
SUSITNA HYDROELECTRIC PROJECT

FERC No. 7114

ALASKA

Draft Environmental Impact Statement

Volume 7: Appendices N and O



OFFICE OF ELECTRIC POWER REGULATION
FEDERAL ENERGY REGULATORY COMMISSION

MAY 1984

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FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF ELECTRIC POWER REGULATION

DRAFT ENVIRONMENTAL IMPACT STATEMENT

SUSITNA HYDROELECTRIC PROJECT
FERC NO. 7114 - ALASKA

Volume 7.

Appendix N. Socioeconomics

Appendix O. Cultural Resources

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Additional copies of the Draft-EIS may be ordered from:

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Federal Energy Regulatory Commission
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May 1984

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APPENDIX N

SOCIOECONOMICS

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APPENDIX N. SOCIOECONOMICS

N.1 AFFECTED ENVIRONMENT

N.1.1 Proposed Project

N.1.1.1 Introduction

With the exception of the transmission line route, the proposed Susitna Hydroelectric Project would be located almost entirely within the Matanuska-Susitna (Mat-Su) Borough of Alaska (Fig. N-1). Only a few isolated residences exist within or near the proposed project boundaries, but the project might affect many communities within Mat-Su Borough, particularly along the "Railbelt"--the string of communities between Anchorage and Fairbanks that have access to transportation and livelihood via the Parks Highway and the Alaska Railroad line. Other communities outside the borough but still in the proximity of the project area include Cantwell in the Yukon-Koyukuk Borough and Paxson in the Valdez-Chitina-Whittier Borough. The proposed transmission line route would for the most part parallel the rail line (Fig. N-1), between Anchorage and Fairbanks. The line would pass communities along the Railbelt in Mat-Su Borough, and Cantwell, Healy and Nenana in the Yukon-Koyukuk Borough.

Most of the communities near the sites of proposed project facilities are small and have little economic development. Full-year residents of these communities, such as Talkeetna, Trapper Creek, Gold Creek, and Cantwell, rely on tourism (acting as guides, operating lodges, or providing recreational supplies) or construction projects for income. Talkeetna is a take-off point for many mountaineering expeditions to Mt. McKinley. Two very small community centers, Montana and Caswell, lie south of Talkeetna on the Parks Highway. Each of these communities consists mainly of a lodge that caters to recreational fishermen and hunters and a small rural, permanent population (DOWL Engineers, 1983). Cantwell was primarily a Native Alaskan community until workers associated with the Trans-Alaska Pipeline project settled in the community during the 1970s. Natives and non-Natives now reside generally in their own sections of the community. Healy and Nenana, like Cantwell, are primarily small Native communities, although the proportion of non-Native residents has increased in the past decade.

Most of the residents of Mat-Su Borough reside in the southern portion of the borough, just north of Anchorage. The relatively larger communities of Palmer, Wasilla, Willow, and Houston increasingly are becoming "bedroom" communities for Anchorage. Less-developed parts of Mat-Su Borough farther north along the Railbelt are becoming popular areas for second homes and for easy access to outdoor recreation resources for Anchorage residents, particularly since the completion of the Parks Highway. With the exception of scattered, isolated residences, the remainder of the borough is generally uninhabited.

Anchorage and Fairbanks are the largest cities and the major metropolitan, industrial, and commercial centers of the state.

The principal areas considered in this appendix include the Matanuska-Susitna Borough, Cantwell, Paxson, communities along the proposed transmission line in Yukon-Koyukuk Borough (Healy and Nenana), and the termini of the transmission line, Fairbanks and Anchorage. Emphasis is placed on Mat-Su Borough and Cantwell, the political units nearest to the proposed project facilities. Less emphasis is given other communities along the proposed transmission line route (Healy and Nenana) and farther from the site (Paxson, Anchorage, and Fairbanks. Because financing of the proposed project would be in large part from the State of Alaska, the entire state will be covered, but only to a limited extent. Communities and political units closest to the project area are discussed first, followed by discussion of more distant population centers.

N.1.1.2 Population

Numerous large-scale projects, most of them energy-related (e.g., the Trans-Alaska Pipeline), caused a 32% increase in population in Alaska between 1970 and 1980 (from 302,361 to 400,481) (State of Alaska, 1982) (see Table N-1). Rapid increases in population also occurred in much of the region around the proposed project area over this same period. In fact, the growth rate in Mat-Su Borough exceeded that of the state in the 1970s, increasing 174% from 6,509 to 17,816 people according to state figures (State of Alaska, 1982). Estimates by borough administrators are even higher of 1980 population, about 22,000. Annual borough growth rates have fluctuated from as low as about -4% (1981) to as high as about 27% (1975), reflecting the volatility of population patterns; to a large extent this volatility is attributable to changes in construction

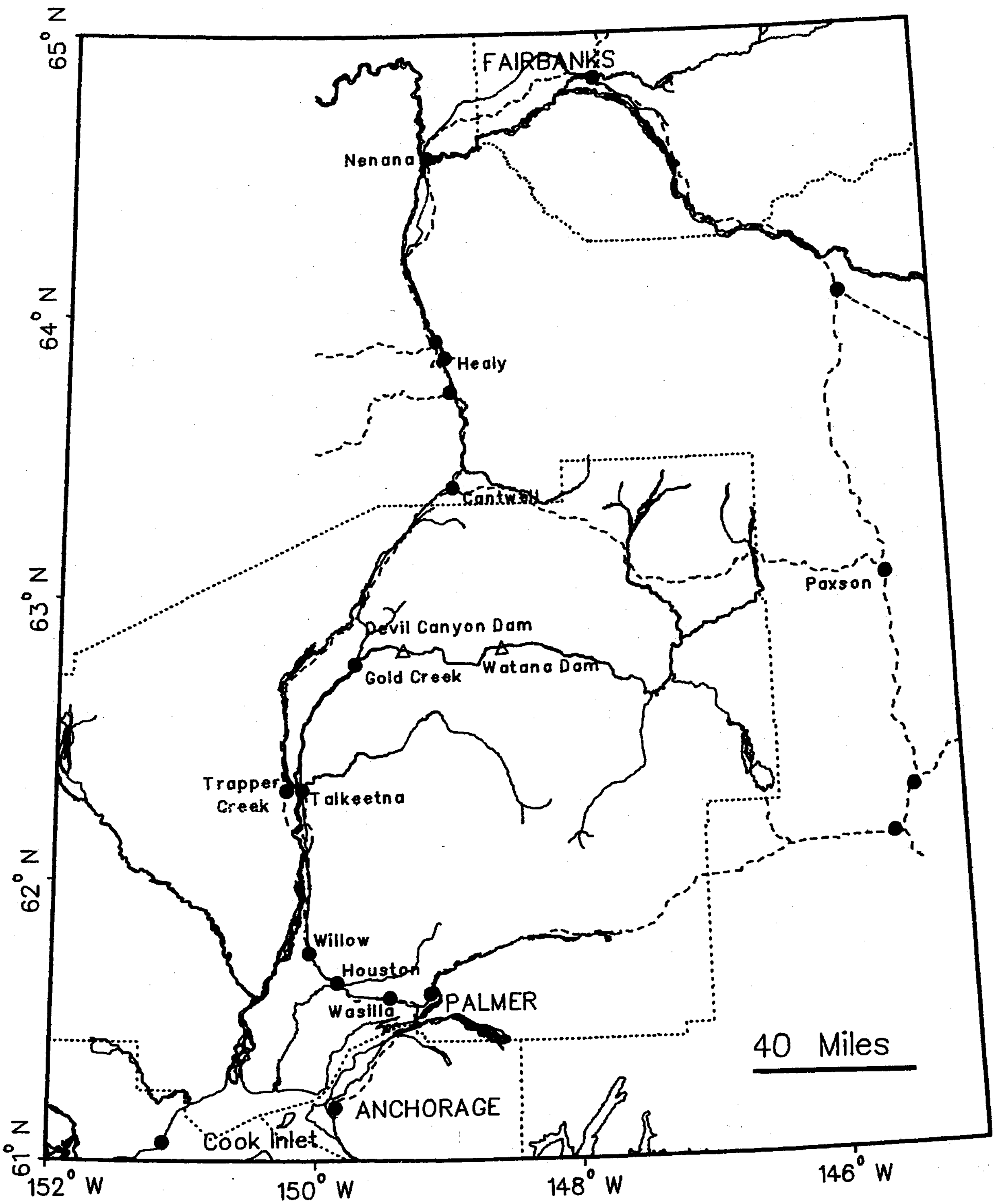


Figure N-1. Map Showing Locations of Communities and Political Units in the Vicinity of the Proposed Project Features.

Table N-1. Baseline Population Projections, 1970 - 2010

Political Subdivision	1970†[1]	1981	1985 ISER†[2]	1985 Applicant†[3]	1990 ISER†[2]	1990 Applicant†[3]	1995 ISER†[2]	1995 Applicant†[3]	2000 ISER†[2]	2000 Applicant†[3]	2005 ISER†[2]	2005 Applicant†[3]	2010 ISER†[2]	2010 Applicant†[3]
Matanuska-Susitna Borough														
Talkeetna	182	640†[3]	623	780	700	1000	726	1,281	741	1,642	779	2,106	834	NA
Trapper Creek	NA	225†[3]	215	263	241	320	250	390	255	474	269	577	288	NA
Willow	38	139†[4]	129	NA	145	NA	150	NA	153	NA	161	NA	173	NA
Houston	69	600†[3]	580	878	652	1,415	676	2,278	690	3,669	726	5,909	777	NA
Wasilla	300	2,168†[3]	2,082	2,895	2,342	4,157	2,428	5,967	2,479	8,474	2,607	12,053	2,791	NA
Palmer	1,140	2,567†[3]	2,469	3,302	2,776	4,525	2,878	5,374	2,938	6,383	3,091	7,581	3,309	NA
Big Lake	36	410†[4]	386	NA	434	NA	451	NA	460	NA	484	NA	518	NA
Other	4,818	16,085†[3]	15,498	23,084	17,430	31,547	18,072	39,317	18,449	48,692	19,405	59,843	20,777	NA
Total Borough	6,509	22,285†[4]	21,466	31,202	24,142	42,964	25,030	54,607	25,553	69,334	26,877	88,069	28,777	NA
Paxson	Unknown, very small			Projections not made										
Yukon-Koyukuk Borough														
Cantwell†[5]	62	89†[4] (1980)	97		107		117		128		143		158	
Healy†[5]	79	334†[4] (1980)	425		470		519		573		632		698	
Nenana†[6]	362	470†[4] (1980)	529		613		710		823		929		1,077	
Total Borough	4,752	7,691†[4] (1980)	NA		NA		NA		NA		NA		NA	
Municipality of Anchorage†[7]	126,385	187,761	200,918		NA		NA		NA		NA		NA	
Anchorage Census Division (includes Greater Anchorage Area Borough)	124,542	173,017†[5]	197,829	NA	218,123	NA	234,393	NA	246,390	NA	264,329	NA	287,865	NA
Fairbanks Census Division	45,864	57,366†[2]	63,561	NA	70,060	NA	74,043	NA	76,743	NA	81,536	NA	87,959	NA

NA: Not Available or not made because supporting information not available.

†[1] U.S. Bureau of the Census (1973), pp. 3-15, 3-16.

†[2] Projections of Institute of Social and Economic Research (ISER), University of Alaska, as in Reeder et al. (1983b) for Mat-Su Borough, Anchorage, and Fairbanks only. Projections made only at borough or census division level. Baseline population projections for the communities in the Mat-Su and Yukon-Koyukuk boroughs were made in the following way: Because of the lack of data, a general assumption was made that the distribution of borough population to the communities in 1981 would hold through 2005. This assumption is weak in that many factors affect where inmigrants settle, e.g., distance from project locations, commercial development, availability of housing and community services. Lacking this information, the assumption of constant distribution pattern was used. These distribution percentages were then applied to the ISER borough total projections for each year to generate projections by community. Totals are less than sum of allocation (by 0.024%) to communities because of rounding errors in calculating percentages.

†[3] Frank Orth & Associates (1982a) p. 4-7. Projections made for Mat-Su Borough only.

†[4] U.S. Bureau of the Census (1980).

†[5] Projections are made by Staff and assume 2% growth rates, the same rate assumed for Cantwell by Frank Orth & Associates (1983), p. 33.

†[6] Projections are made by Staff and assume 3% growth rate, slightly higher than the Cantwell rate because of Nenana's greater percentage growth between 1970 and 1980 (6%) and its proximity to Fairbanks.

†[7] Yarzebinski (1983), pp. 25, 27. Projections made only through 1988. Includes more census divisions than do ISER projections below.

†[8] U.S. Bureau of Land Management (1982).

activity in Alaska (DOWL Engineers, 1983: p. III-14). The population of Cantwell increased by about 44% between 1970 and 1980, although in absolute numbers, the community remains small, with a 1980 population of only 89 people (U.S. Bureau of Census, 1980).

Most of the growth in the Mat-Su Borough has occurred in unincorporated areas, chiefly in the southern part of the borough. Accessibility of recreation resources and proximity to Anchorage and the Railbelt, as well as job opportunities related to development of Alaska's natural resources and the large Trans-Alaska Pipeline project, have all contributed to the growth. Although still small relative to Fairbanks and Anchorage, the communities of Palmer, Wasilla, Houston, and Talkeetna by 1980 had expanded to as much as 10 times their 1970 population size (Table N-1).

Considerable variance exists among various population growth projections made for the project area and for the Mat-Su Borough without the Susitna project by many agencies at the state and local levels and by consultants for various projects proposed for this part of Alaska (DOWL Engineers, 1983). The variance between two major sources of population estimates for the Susitna project are shown in Table N-1 and Figure N-2. Projections made by the Institute of Social and Economic Research (ISER) at the University of Alaska (first column under each year after 1985 in Table N-1) are substantially lower than those made for the Susitna Applicant by Frank Orth & Associates, Inc. (second column for each year after 1985 in the table). Projections made by Frank Orth & Associates for the Mat-Su Borough for the year 2005 are more than three times greater than those made by ISER. ISER based its baseline projections on the assumption that there would be few new large-scale construction projects in the area. The model used by Frank Orth & Associates is a regression model based on historical population data from 1964 to 1980, including the steep growth curves of the 1970 to 1980 decade (attributable to large-scale inmigration). However, Frank Orth & Associates anticipate that except for the construction of a natural gas pipeline near the Alaska Highway, there would be no major projects to affect population and economic growth.

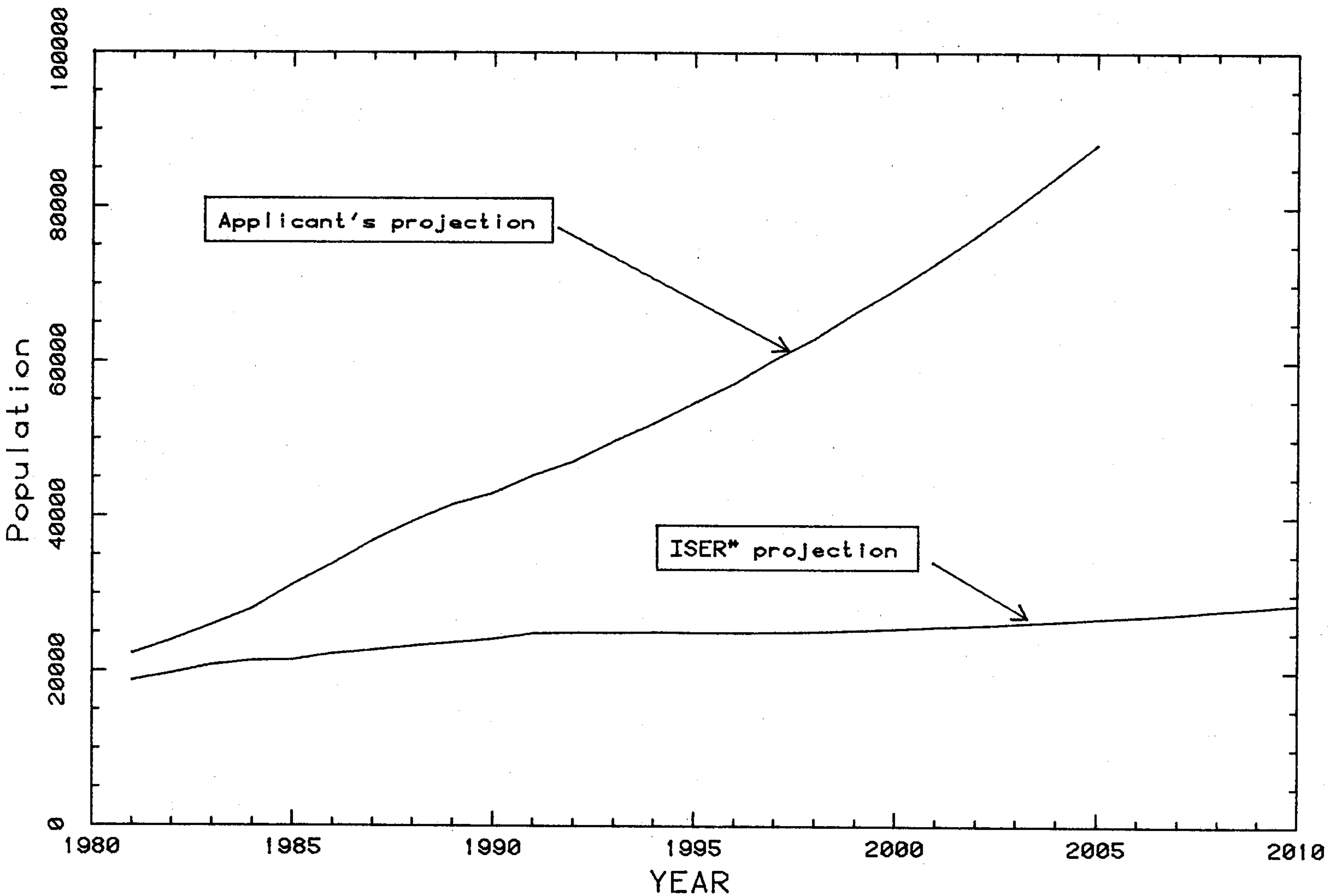
A third set of baseline population projections for Mat-Su Borough only was made by the Mat-Su Borough Planning Department, and is shown in Table N-2. These projections are made for Planning Districts, which include the identified community plus dispersed population in the area around the community (see Section N.2.1.1.2, "Comparison of Applicant and Borough Projections," for more explanation). Thus, the allocation of population is to similar, but not identical, units.

Frank Orth & Associates predict that without the Susitna project, total borough population will increase nearly 300% by the year 2005, the anticipated end of the Susitna project construction period. All population centers in the borough would grow rapidly (e.g., Wasilla by about 450% over the 1981 population), but the communities would still be fairly small in absolute numbers of people (see Table N-1). These high-growth projections clearly parallel the rapid growth in the area between 1970 and 1980 due in great part to the influx of workers on the Trans-Alaska Pipeline. Projections made by Mat-Su Borough Planners (Table N-2) show a smaller increase of about 210% in baseline growth by 2001 for almost all planning districts and the Borough as a whole. Only Wasilla and areas in the "Other" category are projected to grow by more (270% and 220%, respectively) and Palmer by less (only 100%).

The ISER model relies on assumptions about (1) workforce inmigration related to a limited number of projects likely to take place in the region and (2) state spending (Reeder et al., 1983a). Of particular influence in the projection of much lower growth in the borough was the assumption by ISER that state spending would decline after 1990, stabilizing again after 2000.

The methods used in arriving at these baseline population projections for the Mat-Su Borough illustrate different assumptions about the dynamics of demographic and economic development in Alaska. Because of their reliance on population changes over the past decade, the models of Frank Orth & Associates and the Borough may overestimate growth. First, the construction of the Trans-Alaska Pipeline was a massive undertaking, requiring large numbers of workers (Olshansky, 1983). These workers, their dependents, and the service workers who provided the support structure for the increased population, considerably expanded the population along the Railbelt. Given the drop in oil prices and the consequent lower state revenues and fewer new resource development projects, this kind of massive growth may not be repeated in the next two decades. Second, Frank Orth & Associates also assumed that the high annual rate of increase in the share of Anchorage metropolitan population that resided in Mat-Su Borough between 1970 and 1980 would continue through 2005. If growth in Anchorage slows, this assumption will not necessarily hold (Olshansky, 1983).

The ISER model, on the other hand, may underestimate the population growth through 2005. The model is based on the assumption that only a few small projects will be developed and thus little inmigration will occur. For example, unlike the assumption of Frank Orth & Associates, no natural gas pipeline construction is assumed in the ISER model (Reeder et al., 1983a; Frank Orth & Assoc., 1982a). However, the ISER model still projects that populations in the borough in 2005 will be almost 21% higher than in 1980.



* ISER = Institute of Social and Economic Research (Univ. of Alaska)

Figure N-2. Comparison of Baseline Population Forecasts for the Mat-Su Borough by the Applicant and by the Institute for Social and Economic Research, University of Alaska.

Table N-2. Mat-Su Borough Planning Department Baseline Population Projections

Political Subdivision	1983	1985	1987	1989	1990	1991	1993	1995	1997	1999	2001
Matanuska-Susitna Borough											
Talkeetna	1,027	1,209	1,463	1,723	1,861	2,010	2,280	2,538	2,746	2,970	3,213
Trapper Creek	146	172	208	245	265	286	324	360	389	421	456
Willow	911	1,073	1,298	1,528	1,650	1,782	2,021	2,249	2,433	2,631	2,845
Houston-Big Lake	3,291	3,874	4,687	5,518	5,959	6,436	7,300	8,125	8,788	9,506	10,281
Wasilla	11,397	13,709	16,942	20,363	22,217	24,237	28,041	31,824	35,085	38,667	42,600
Palmer	5,959	6,722	7,779	8,742	9,216	9,710	10,461	11,029	11,265	11,467	11,626
Other	2,168	2,580	3,190	3,846	4,178	4,487	5,047	5,582	6,011	6,476	6,981
Total Borough	24,899 (27,589)	29,339 (32,534)	35,567 (39,807)	41,965 (47,075)	45,346 (50,771)	48,948 (54,722)	55,474 (61,513)	61,707 (68,368)	66,717 (73,935)	72,138 (79,525)	78,002 (86,032)

†[1] Source: Calculated from Mat-Su Borough Planning Department (1983), pp. IV-18 - IV-19, IV-21 - IV-24. Numbers were calculated by subtracting the Planning Department's projections of "Susitna Hydro Impact Population Projections" (pp. IV-21 - IV-22) from total population projections. Total Borough figures in parentheses are updated projections from the Mat-Su Borough Planning Department (undated). Updated projections are not available for each planning district.

Frank Orth & Associates (1982b) also made baseline population projections for an environmental assessment of the proposed move of the Alaska Capital from Juneau to Willow (Table N-3). In that document, the projections for Mat-Su Borough are lower than the baseline projections shown in the Susitna application (see Table N-1). Taking these four varying projections (one by ISER, two by Frank Orth & Associates, and one by Mat-Su Borough Planners) and their bases into account, it appears that baseline population projections used in the Susitna application may be high. Because this issue is unresolved, the lower ISER and Mat-Su Borough baseline projections will be used for baseline projections for the purposes of this assessment.

Table N-3. Projecticns of 1985-1994 Baseline Population for Mat-Su Borough Made for Assessment of Proposed Move of Alaskan Capital to Willow

Political Subdivision	1985	1990	1994
Mat-Su Borough Total	27,717	36,473	45,465
Palmer	3,059	3,812	4,546
Wasilla	2,787	3,819	4,913
Houston	701	853	998
Willow-Big Lake	2,983	3,899	4,830
Suburban	15,494	20,735	26,177
Other	2,693	3,355	4,001

Source: Frank Orth & Associates (1982b), pp. 184, 190.

Consideration of the age, race, and ethnic distributions of existing communities is helpful in establishing a background with which to compare characteristics of construction project work forces and their families and to evaluate the kinds of services needed for different age groups. Median age in the Mat-Su Borough in 1980 was 27.1 years, up from 25.8 years in 1970. These values are higher than the state medians and lower than the U.S. medians for the same census years. The age group between 18 and 44 years old comprised 45% of the borough population (DOWL Engineers, 1983: pp. III-22-23). Reasons for these patterns in age distribution may be inferred from state statistics (Alaska Division of Budget and Management, 1982b: p. 3). Specifically, because of the large growth in population due to construction activity, the peak of the age distribution of the state in 1980 was between the ages 20 and 35. In 1970, the peak was between ages 20 and 25. In addition to aging of the young 1970 population, inmigration of people between 20 and 35 to work on construction projects has probably kept the age-distribution patterns of the two census years similar. The ISER model for statewide population projections indicates net inmigration would occur through about 1990, but at a decreasing rate beginning in about 1987. Net outmigration would dominate after 1990, reach a peak in about 1996, then continue at a slower rate through 2005. If these projections are accurate, the bulge of 20-to-35 year olds would be evident until net outmigration began. At that point, more usual population age distribution patterns would predominate. About 95% of the Mat-Su Borough population is white, another 2% is American Indian.

Currently the Gold Creek area, site of the head of the proposed rail spur and an access road to the Devil Canyon dam site, is a collection of land tracts, some with structures, and is sparsely populated. Homesteads established in the gold rush, many now abandoned, are owned privately by absentee owners who bought them as recreational property. Other land tracts have been privately acquired through Alaska's various land disposal programs. Current residents include a few employees of the railroad and a few miners (Braund and Lonner, 1982). No official population statistics or projections are available for the area; but it has been estimated that between 80 and 150 people are permanent residents in the area between Talkeetna and Gold Creek. (These would be included in the "other" category for the borough in Table N-1.) The part-time population in the summer may be twice or three times greater than the permanent population (Braund and Lonner, 1982: p. 16).

Cantwell is a small community (1980 population of 89) located at the intersection of the Denali and Parks highways in Yukon-Koyukuk Borough. Cantwell, as well as other communities in the borough, has a large component of Native Alaskans and some recent Trans-Alaska Pipeline inmigrants. No baseline projections are available. Since 1960, the community has had a population of less than 100 people (U.S. Bureau of Census, 1973). Cantwell would likely not grow rapidly over the next two decades unless new construction projects were implemented nearby. In Cantwell, the percentage of Natives is probably much higher, but exact figures are not available (DOWL Engineers, 1983: p. III-24).

The 1980 populations of Healy and Nenana were 334 and 470, respectively. Between 1970 and 1980, Healy more than quadrupled its size, while Nenana experienced substantial, but lesser, growth (Table N-1). Both communities have a large component of Native Alaskans. No official population projections for the next two decades are available for these two communities. Those shown in Table N-1 were calculated assuming a baseline annual growth rate of 3% for both Healy and Nenana (see footnote 5, Table N-1).

Anchorage and Fairbanks are the population, commercial, and transportation centers of Southcentral Alaska. As shown in Table N-1, Anchorage is about three times the size of Fairbanks; both are many times larger than any other community in the state. Both cities grew substantially between 1970 and 1980 and are expected to continue growing, although at a slower rate, through the year 2005. The Anchorage population has stabilized somewhat after increases in the 1960s and early 1970s followed by a decrease between 1978 and 1980 due to completion of the Trans-Alaska Pipeline. Municipality planners project an even 2% annual growth rate through 1988 (Yarzebinski, 1983: p. 23). The median age in Anchorage is 26.3 years. About 85% of Anchorage's population in 1980 was white, 5% Native, 5% Black, and 4% Asian and other races (Yarzebinski, 1983: pp. 23, 31).

N.1.1.3 Institutional Issues

The cities of Anchorage, Fairbanks, Palmer, Wasilla, Houston, and Nenana, and the Mat-Su Borough are the only incorporated government entities in the proposed project area. No formal regional or local forms of government exist in the Yukon-Koyukuk Borough (Commonwealth Assoc., 1982), although community organizations do exist (see below). Incorporated political units have powers to levy taxes and provide and maintain many community services (see Sec. N.1.1.6). Administration of school systems is separate from other administrative functions of the borough. Elected officials of the Mat-Su Borough are a mayor and five assembly members who, along with a full-time administrative manager, have responsibility for borough powers (Frank Orth & Assoc., 1982a).

Three communities within the Mat-Su Borough are incorporated: Palmer, Wasilla, and Houston. Each has a mayor, a city council, and a city manager (Palmer) or clerk (Wasilla and Houston). The only other incorporated units in the area are Nenana, Anchorage, and Fairbanks. Each have political powers to provide all community services. Both Anchorage and Fairbanks have a mayor-council form of government, with a city manager and other officers to administer the services (Frank Orth & Assoc., 1982a: pp. 4-191 - 4-195; Community Research Center, 1983). Nenana has a mayor and a clerk, as well as a Native Village Corporation, Toghotthele.

Paxson is unincorporated, but has a village council. Paxson's school is administered by the Copper River School District, headquartered in Copper Center (Alaska Dep. of Community and Regional Affairs, 1983). Valdez-Chitina-Whittier Borough, in which Paxson is located, is also unincorporated.

The Yukon-Koyukuk Borough is not incorporated and thus has none of the powers of the Mat-Su Borough. The school system for Cantwell and Healy is the Upper Railbelt School District. Nenana is in the Yukon-Koyukuk School District (Alaska Dep. of Community and Regional Affairs, 1983).

Cantwell is also an unincorporated community. Because its population has a large component of Native Alaskans, the Ahtna Corporation, a Native Alaskan organization, administers Native financial concerns in the community, e.g., development of Native Alaskan lands. Ahtna Corporation has no recognized political power (McClanahan, 1983). There are two councils in the community: a Native council and the recently formed Community of Cantwell, Inc. (CCI), representing primarily non-Native interests. Both the Ahtna Corporation and CCI were organized to receive state grants for the community. Conflict exists between the two groups as to which is the legal representative of Cantwell. The conflict is such that even the Alaska State Department of Community and Regional Affairs has separate representatives to deal with each group (Exhibit E, Vol. 7, Chap. 5, p. E-5-8).* The Copper River Native Association is a non-profit political organization that complements the for-profit Ahtna Corporation. Both these organizations are in the regional corporation Cook Inlet Native Association Inc.

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*Throughout this document, references to specific "Exhibits" are to the exhibits submitted to FERC as part of Alaska Power Authority's Susitna Hydroelectric Project License Application. References to specific "Appendices" (App.) are to the appendices provided in Volumes 2 through 7 of this Draft Environmental Impact Statement.

Thirteen regional Native corporations and 174 village corporations were established by the Federal Alaska Native Claims Settlement Act (ANCSA) enacted in 1971. When Congress wrote ANCSA it was with the intention of creating a way for the Natives themselves to decide on the land they would claim and the development of that land and its resources. The Act specifically established the Native corporations as profit-making. Each Alaskan who could claim one-quarter or more Native blood received 100 shares of stock in one of the corporations. To guarantee Native control of decisions, the stock cannot be sold until 1991 (Schuyten, 1975: pp. 158-159; U.S. General Accounting Office: 1983).

Ahtna, Inc. is one of several village and regional corporations with jurisdiction over the proposed project area. Doyon Limited is the for-profit organization and the Tenana Chiefs Conference the non-profit Native organization that include Paxson. Nenana's Natives are organized under the Toghotthele Native Corporation. Another Native corporation, the Tyonek Native Corporation has also claimed lands within proposed project boundaries and thus is involved in project discussions (Acres American, undated). These corporations administer funds received from the Federal government for the Alaska Area Native Health Service, Indian Child Welfare Contract and Comprehensive Employment and Training Act, and State funds for programs on alcohol, energy assistance, and rural health clinics, among others (Peat, Marwick, Mitchell, & Co., 1982). The Native corporations also invest funds in development projects and distribute income from the investments and from their assets to members of the corporations (U.S. General Accounting Office, 1983).

Recently, representatives of Native organizations and village councils met at a conference of the Alaska Federation of Natives to discuss whether Native villages should be organized as tribes and recognized as political entities by the U.S. Government. Conflicts with Alaska state political representatives on this issue continue (McClanahan, 1983).

A legal, economic, and cultural issue of importance in the study area is the participation of a portion of the population in subsistence activities. Subsistence activities include hunting, trapping, and fishing for rural custom and traditional uses. Subsistence activities are protected by law for a particular population of Alaskans:

> "rural Alaska residents ... [who have] ... a long-term, consistent pattern of use [.This use pattern recurs] ... in specific seasons of each year ... [, meets certain criteria of efficiency and accessibility, includes] means of handling, preparing, preserving and storing fish or game which have been traditionally used by past generations, but not excluding recent technological advances where appropriate ... [, and] ... provides substantial economic, cultural, social and nutritional elements of the subsistence user's life." Subsistence use patterns are also recognized in terms of communities which encompass "individuals, families, or groups who ... meet the criteria ... [for subsistence users]." (Alaska Board of Game, undated: p. 70).

Subsistence use includes using the products for nutrition, or for "customary trade, barter, sharing and gift-giving", including for small amounts of cash. Significant commercial enterprise use is specifically excluded from protection in the law. Also explicitly excluded are subsistence "uses which will jeopardize or interfere with the conservation and management of fish stocks or game populations on a sustained yield basis" (Alaska Board of Game, undated: p. 71).

Subsistence activities in rural Alaskan communities are often carried out in combination with a cash-based economy. The cash gained from some subsistence harvests, state and Federal government programs, Native association investment dividends, and employment pays for the materials and services of modern civilization, e.g., transportation, housing, and education (Darbyshire & Associates, undated: p. 7). Subsistence users may rely on subsistence activities for a majority of their sustenance needs or may use them to supplement their food and material supplies. In one study, researchers projected a possible increase in subsistence activities as a result of more efficiently run households, more cash to purchase equipment, and improvements in technology to make such activities easier (Darbyshire & Associates, undated: pp. 46-48; 1980: p. 84).

Insufficient information is available to quantify current use of and reliance on subsistence activities in the project area. A study of five Bethel-area Alaskan villages between 1951 and 1961 indicated that subsistence food harvests provided 37% to 45% of total calories and 67% to 86% of protein consumed (Darbyshire & Associates, 1980: p. 84). Comparable figures for subsistence use in the project area would probably be lower, because many of the communities in the area are located along or near major transportation routes, have some commercial development, and have mixtures of Native and non-Native residents. However, subsistence activities remain important to the economy of rural communities, such as Cantwell, and to individuals who reside in remote areas. For example, in Tyonek, a Native community southwest of Anchorage, 70 people hold subsistence permits for king salmon, equivalent to about one-third of the community population of 250, while only 27 residents have limited entry commercial fishing permits. Thus, in some Native areas, subsistence use of resources is far greater than commercial use. Each subsistence permit allows the holder to harvest 70 king salmon, which residents feel is sufficient to meet their needs (Alaska Department of Natural Resources, 1982, p. 23). Controversy continues among those who claim subsistence rights, others competing for the same harvests, and government agencies who must interpret and enforce Alaska's subsistence laws (Associated Press, 1983; U.S. Bureau of Land Management, 1982).

N.1.1.4 Quality of Life

A 1981 study (Braund and Lonner, 1982) of residents in the Talkeetna, Trapper Creek, and Cantwell areas, including smaller settlements and remote dwellings, documented the historical settlement pattern and the current attitudes of the residents toward the proposed Susitna project. In general, residents value the isolated, rural settings and the scenic wilderness. Because employment opportunities are limited and tourism is not well-developed, residents are often willing to accept a self-sufficient existence or live on low incomes in order to remain in the setting. Some who live in locations accessible only by foot from the rail line periodically leave the area for seasonal work, and further supplement their lifestyle with hunting and fishing and income from welfare sources. Others who build and maintain residences in the area intend them for seasonal use only, e.g., for the summer.

Braund and Lonner categorize the permanent population of the Talkeetna and Trapper Creek areas into two groups. One is made up of long-term residents, most of whom came to the area in the 1950s or early 1960s. This group in general has remained through many changes in the area. In particular, the 1965 completion of the Parks Highway made the area easily accessible from Anchorage and Fairbanks. Many younger people were attracted by the scenic wilderness, and established residences in the area in the late 1960s and 1970s. These people, who came after the road was built, make up the second group of residents.

Residents north of the proposed project site consist of both Natives and non-Natives. As the original inhabitants, the Natives lived subsistence lifestyles before the Parks Highway was built. With the construction of the highway and the development of Alaska's resources, non-Natives have moved into the communities. Development, increased access, and the economic opportunities opened by the Alaska Native Claims Settlement Act have contributed to a generally positive attitude by the Natives and Native corporations toward further development (Braund and Lonner, 1982).

N.1.1.5 Economy and Employment

In general, the economy of the Railbelt area between Anchorage and Fairbanks is limited to some commercial development, especially tourist-related activities along the Parks Highway. Little development of natural resources or of industry has occurred. Employment is provided primarily by government or is related to tourism and recreation. The labor force is extremely mobile, with many residents employed outside the area. Thus, employment by residence location is not consistent with employment opportunities offered in the area. Economies of Anchorage and Fairbanks are based on both commercial and industrial operations.

N.1.1.5.1 Economy

Economic activity in Mat-Su Borough is centered in the southern part of the borough in and around the communities of Palmer, Wasilla, Houston, Big Lake, and Willow. Of the nearly 1,000 business licenses held in Mat-Su Borough in 1980, almost 800 were in Palmer and Wasilla, with about 175 in the rest of the borough. More than over one-third of the licenses were in the services (transportation, public utilities, finance, insurance, real estate, and public administration) and another one-third were divided nearly evenly between trades (retail and wholesale) and construction (Ender, 1980; Commonwealth Assoc., 1982).

Business receipts for establishments in Mat-Su Borough show two Standard Industrial Classifications considerably overwhelming the others: construction and retail goods, at about $26 million and $32 million, respectively in 1977. These two classifications accounted for about 70% of total business receipts for that year. Third overall was services, at about $8 million (Overall Economic Development Program, 1980). Greater development in agriculture and in mining (especially gold) is being encouraged (e.g., through alternative plans for land use in the Borough Comprehensive Development Plan) to increase income from these currently very small economic sectors (Commonwealth Assoc., 1982; Alaska Dept. of Natural Resources, 1983).

In 1977, Cantwell businesses were oriented to tourism and transportation. They included gas stations, lodges, cafes, bars, and a laundromat (Univ. of Alaska, 1977). Healy is the site of the Usibelli Coal Mine, which produces about 700,000 tons [640,000 metric tons (MT)] of coal per year and employs about 100 workers (Usibelli Coal Mine, undated). Mine workers support other small commercial operations in the town. Nenana residents depend on fishing, highway work, and recreation-oriented activities for income.

Commercial and sport fishing and hunting are important industries in the Susitna Basin and in the Cook Inlet region south of the project area. A 1980 study found that "commercial fishermen received over $7 million from Susitna Basin fish". Processors and retailers of those fish received over $32 million. It was estimated that 69,000 recreational fishermen and 19,000 hunters spent 700,000 days in the Susitna Basin area in 1980, generating $44 million for industries and services, such as equipment suppliers, guides, lodging and food (Grogan, 1983: p. 4).

Salmon is the most important fish harvested commercially in Alaska. In 1980, 512 million pounds were caught--over 50% of the total domestic fisheries catch that year--producing $269 million in payments to fishermen (Alaska Div. of Budget and Management, 1982b: p. 35). Susitna Basin fish catch alone produced 1% of this value to Alaskan fishermen.

The Ahtna Development Corporation, a subsidiary of AHTNA, Inc. (which includes Cantwell Natives) was organized specifically to develop Native talents and experience in "catering support for industrial and tourism projects." The Corporation has provided services for 10 pump stations on the Trans-Alaska Pipeline and (in cooperation with the Knik Village Corporation) for the temporary construction camp at the proposed Watana Dam site, as well as on other energy development projects. Other profit-making subsidiaries of AHTNA, Inc. are involved in housing (especially in Native villages) and other small-scale construction road building and maintenance and mineral development. Other small-scale contracts on Ahtna lands have included building the community center at Cantwell and the Ahtna Lodge at the junction of the Richardson and Glenn Highways (AHTNA, Inc., undated; Exhibit E, Suppl. Information, June, 1983: p. 5-2-3). Doyon, Limited, another Native corporation, has been involved in similar economic development activities (Doyon Ltd., undated).

Per-capita personal income in Alaska in 1980 was $12,759, which was 134% of the national average. For the regions potentially affected by the Susitna project, 1980 per-capita personal incomes were: Mat-Su Borough, $10,846; Yukon-Koyukuk Borough, $12,429; Anchorage, $14,266; and Fairbanks, $13,308. Even the lowest of these values (Mat-Su Borough) is 114% of the national average (Alaska Dept. of Labor, 1983). Median household income (before taxes) as determined in the Mat-Su Borough survey in 1979 was $29,048 (Ender, 1980: p. 52). Although these values appear high, they must be considered in the context of the cost of living in Alaska relative to the rest of the country. For example, food costs as a percentage of a household budget in Anchorage and Fairbanks (the only project-related areas for which data are available) were 110% and 127% of the U.S. average, respectively, as of June 1982. Total budget expenditures for a family of four in Anchorage were 150% of the U.S. average--housing costs were 195% of the average U.S. household budget allocation, personal income taxes 183%, transportation 168%, and medical care 160% (Alaska Dept. of Labor, 1983). Thus, higher incomes are needed to pay the higher costs of living in Alaska. Adjusting for Alaska's cost of living relative to that for the U.S. as a whole, average 1979 per-capita income in the state was only 0.86 of average U.S. per-capita income (Argonne National Laboratory, 1982: p. 46).

Native households are generally among the poorest in the state. In Anchorage in 1979, one-sixth of a total of 12,000 families made less than $5,000; 73% of Native families were below the median income for Anchorage families, and 21% were below the poverty level, as compared with about 7% for Anchorage overall (Yarzebinski, 1983: pp. 44, 45, 49).

Employment and income in many regions of Alaska are highly dependent on state government sources. On an institutional level, the state provides funds to finance energy development and community infrastructure to support population increases related to that development (Alaska Dept. of Commerce and Economic Development, 1983: p. III-12). It provides funding to aid boroughs in need of services that cannot be provided with local tax income. Currently, the state pays for about 85% of the total Mat-Su Borough budget, when both shared revenue and grants are included (Campbell, 1983). Through the Alaska Housing Finance Corporation and the Division of Housing Assistance, the state buys mortgages made by private lending institutions. The low interest rates offered on single-family housing, and recently extended to owner-occupied triplexes and four-plexes, have made the state government practically the only mortgage lender in the state and have kept the number of housing starts increasing while this number has been declining in the rest of the United States (Longenbaugh, 1982: pp. 6-7). It has been estimated that state government spending has accounted for 84% of employment growth in the state since 1978 (Myers, undated).

On an individual level, the state government accounts for about 45% to 50% of personal wage-and-salary income in rural communities, and a statewide average of 31% (Hoffman, 1983; Irvin, 1983; Darbyshire & Associates, 1980, undated; Myers, undated). Last year, the state distributed $1,000 from oil royalties to each resident; this year, even with dropping oil prices each resident should receive about $300 (Hillkirk, 1983: p. 2). If dividend checks to citizens from the Alaska Permanent Fund and other transfer payments are considered, the level of income dependence on state sources is even greater. In rural areas where subsistence activities may be the primary source of livelihood, residents rely considerably on public funds for cash (Irvin, 1983; Darbyshire & Associates, undated). State law also allows property tax exemptions for "the permanent place of abode" for eligible residents 65 years of age or older and the State reimburses the municipality for revenue lost from such exemptions. In Fiscal Year 1982, 372 homes in Mat-Su Borough were approved for exemptions, resulting in state payment of $197,150 in lost taxes to the borough (Alaska Dept. of Community and Regional Affairs, 1983: pp. 74-75).

N.1.1.5.2 Employment

Although construction and retail sales have the largest receipts in Mat-Su Borough, they are not the major employers in the Borough. In 1979, non-agricultural Borough employment was concentrated in government (39%, or 1,198 workers), particularly at the state and local level (36%). The next largest group of borough-sited employers was retail sales establishments, with 23% of the total of 3,078 workers (indicating the reliance of the area's economy on tourism and recreation), followed by finance, insurance, and real estate operations with a combined total of 15% of the workers. Construction firms accounted for only 6% of the workers employed within borough boundaries (Alaska Dept. of Labor, 1980, as cited in Frank Orth & Assoc., 1982a: p. 4-138). The low construction employment is related in part to the fact that the industry is unionized, with strong collective bargaining agreements. Thus, union halls in Anchorage and Fairbanks are the principal sources of construction workers (Cooperative Extension Service, 1980: pp. 9-10).

A large portion of Mat-Su Borough residents are not employed in any of the businesses within the borough. In fact, in a survey sampling from about 90% of borough residents, 36% of employed adults in the sample worked outside the borough (in Anchorage or elsewhere, e.g., on remote construction projects) (Ender, 1980). Another comparison indicated that the number of employed people residing in the Mat-Su Borough was more than two times greater than the number of jobs available in the borough (Commonwealth Assoc., 1982). Thus, employment opportunities in the borough are few compared to the size of the population.

Because of the large component of "commuter" residents in the borough, the ranking of primary employing industries and occupations is not consistent with rankings based on either receipts or employment opportunities within the borough. As shown in Table N-4, a 1979 survey in Mat-Su Borough indicated that the largest group of employed adults surveyed (27.9%) worked in services, exclusive of government (combined professional and other services, and education). The construction industry was the next largest employer of borough residents at 16.6%, followed by government

Table N-4. Employment by Industry†[1] for Adult Residents of Matanuska-Susitna Borough

Industry	Percentage of Adults	Number†[2]
Agriculture-fishing	2.9	24
Mining	5.5	46
Construction	16.6	139
Manufacturing	2.5	21
Transportation, utilities, communications	10.5	88
Wholesale trade	2.8	23
Retail trade	11.4	95
Finance, insurance, real estate	4.5	38
Professional services	9.4	79
Other services	9.4	79
Education	9.1	76
Federal government	6.3	53
State government	5.4	45
Local government	3.6	30

†[1] Place of employment may be within or outside Mat-Su Borough.

†[2] Total sample size of 679 households. The population sampled included all households accessible by road in the Mat-Su Borough--approximately 90% of all borough households. The sample of 679 households actually surveyed was estimated to be about 12% of borough households. The purpose of the survey was to acquire information on housing style, costs, energy use, employment of household members, and attitudes toward economic development. Numbers in the table represent more than one worker per household in some cases.

Source: Ender (1980).

of all levels (15.3%), and wholesale and retail trade (14.2%). Thirty-four percent of the adults in the sample (Ender, 1980) were in professional, technical, managerial, or office occupations, and 16% were in clerical or sales (Ender, 1980), reflecting the character of the southern part of the borough as home for Anchorage workers. Smaller percentages of workers were in construction-related occupations: craftsmen (14.6%) and operatives (12.2%). A 1979 survey done by the Alaska Department of Labor Employment Center in Wasilla of occupational skills available supported the fact that construction workers of all types were not in abundance. The survey found a surplus of skilled applicants for jobs as heavy equipment operators and laborers, but a deficit for jobs requiring such skills as cable splicers, all types of engineering, and helicopter pilots (Commonwealth Assoc., 1982). In summary, although construction and retail sales rank as the largest sources in business receipts, government is the largest employer within Mat-Su Borough. However, many residents work outside the borough, and most of these commuters are employed in the services at professional, technical, or managerial occupations.

In 1981, average employment in the Mat-Su Borough was 8167 people out of a total labor force of 9,362 (Table N-5). This was equivalent to an unemployment rate of 12.8%, considerably higher than the state average of 9.4%, but down from the borough high of 18.9% in 1978. Unemployment in the borough in other years since 1976 has been 15% to 16% (Alaska Dept. of Labor, 1983). The volatile nature of these statistics reflects the dependence of much of the Alaskan work force on large-scale, energy-related projects for employment. These projects have temporary peak requirements for a large number of workers, but offer long-term permanent employment for very few. Thus, when project construction work forces decline (particularly on the Trans-Alaska Pipeline), unemployment rises dramatically. Additionally, in Mat-Su Borough between 1975 and 1978 the labor force increased more rapidly than employment opportunities (CH2M Hill, 1981). There are also seasonal variations in unemployment because construction projects often are active only in the summer. It has been estimated that employment in midsummer of 1980 in Mat-Su Borough was 20% higher than in midwinter (Commonwealth Assoc., 1982).

Data for the Yukon-Koyukuk Borough, which includes Cantwell, Healy, and Nenana, are sketchier than those available for Mat-Su and its communities. As shown in Table N-5, in 1981 the total labor force in the Yukon-Koyukuk Borough was 2,063 persons, with 1,768 of them employed--a 14.3% unemployment rate (Alaska Dep. of Labor, 1983). In September 1982, about 37% of the borough population was employed in government, about 18% each in trades and services, and less than 10% in construction and mining combined (Table N-4) (Alaska Dept. of Labor, 1983). Cantwell residents are employed primarily in tourist- or transportation-related businesses. Some employment (about 100 jobs in 1980) for residents of the Healy area is provided by the nearby Usibelli Coal Mine (Commonwealth Assoc., 1982). About 50 to 75 other jobs in Healy and Nenana are provided by highway work and recreation-oriented operations (Commonwealth Assoc., 1982). As with the Mat-Su Borough, however, in all job classifications the number of jobs existing in the Yukon-Koyukuk Borough was slightly smaller than the number of employed workers residing there, reflecting the fact that some of the employed workers are commuting to Fairbanks or elsewhere for work (Alaska Dept. of Labor, 1983).

Unemployment rates for Anchorage have been considerably lower than those for Mat-Su and Yukon-Koyukuk boroughs, ranging around 7% or 8% since 1976. Fairbanks has had higher unemployment rates than Anchorage (Table N-5), peaking at 17.6% in 1978, but closer to 12% since then. Employment in both Fairbanks and Anchorage has been primarily in government: in September 1982, 25.1% of employed workers in Anchorage and 35.8% in Fairbanks worked in government service. The Federal government is the major government employer in Anchorage, while the state dominates in Fairbanks. Both cities have about 20% of their employment in each of services and trade (wholesale and retail) and each has only 10% in construction. The total annual average labor force in Anchorage in 1981 was 86,064 persons; in Fairbanks it was 20,813 persons (Alaska Dept. of Labor, 1983; Yarzebinski, 1983).

Unemployment among Native Alaskans is in general higher than for other residents. Although Natives made up only 4% of the total labor force in Anchorage in 1980, 22% of all Natives in the labor force were unemployed, as compared with about 8% overall (Yarzebinski, 1983: p. 47).

N.1.1.6 Housing

Housing units in the Mat-Su Borough are a mixture of year-round residences, and recreational or part-year residences owned by people with permanent residences elsewhere. Nine cabins, of which only four are used (and these only on a temporary basis), are located on land within the boundaries of the proposed impoundments for the two Susitna dams (Exhibit E, Suppl. Information, June, p. 5-15-1). Cantwell, Healy, Nenana, Anchorage, and Fairbanks have fewer recreational units than Mat-Su Borough communities.

All the communities in the proposed project and transmission line areas have volatile housing markets that follow the boom-and-bust cycles of the economy. Thus, data on housing can be difficult to interpret in terms of establishing a baseline for an incoming project-related population. Several studies of housing in the area have been conducted since 1979, although many gaps remain in the data. The results of these studies are summarized in Table N-6. For

Table N-5. Total Labor Force and Unemployment Rates for Proposed Project Area and Transmission Line Route, 1976 through 1981

	Political Subdivision				
	Matanuska-Susitna Borough	Yukon-Koyukuk Borough	Anchorage	Fairbanks	State of Alaska
1976					
Total Labor Force	5,495	2,689	68,053	24,789	164,000
Employment	4,683	2,390	63,184	22,917	150,000
Unemployment Rate (%)	14.8	11.1	7.2	7.6	8.5
1977					
Total Labor Force	6,345	2,283	77,648	21,924	172,000
Employment	5,341	1,986	72,065	19,046	156,000
Unemployment Rate (%)	15.8	13.0	7.2	13.1	9.3
1978					
Total Labor Force	6,891	2,243	82,184	21,817	181,000
Employment	5,591	1,874	75,435	17,967	161,000
Unemployment Rate (%)	18.9	16.5	8.2	17.6	11.0
1979					
Total Labor Force	9,194	2,070	80,063	20,916	183,000
Employment	7,869	1,788	74,106	18,221	166,000
Unemployment Rate (%)	14.4	13.6	7.4	12.9	9.3
1980					
Total Labor Force	9,125	2,079	81,647	20,488	187,000
Employment	7,723	1,738	75,616	17,982	169,000
Unemployment Rate (%)	15.4	16.4	7.4	12.2	9.6
1981					
Total Labor Force	9,362	2,063	86,064	20,813	192,000
Employment	8,167	1,768	79,956	18,288	174,000
Unemployment Rate (%)	12.8	14.3	7.1	12.1	9.4

Source: Alaska Department of Labor (1983), pp. 23-24.

Table N-6. Number, Distribution, and Vacancy of Housing Units by Type

Community/ Planning District	Single-Family Units		Multi-Family Units		Mobile Homes		Lodges or Other Temporary Units		Totals	
	Number or %	Vacancy	Number or %	Vacancy	Number or %	Vacancy	Number or %	Vacancy	Number	Vacancy Rate
Palmer	Unknown	-					Unknown	-	872†[1]	10.2%†[1]
Houston	Unknown	-	343†[2]	Unknown	178†[2]	Unknown	4 facilities†[2]		1,979†[1]	9.6% - 49.9%†[1]
Wasilla	Unknown	-					Unknown	-		
Suburban Palmer to to Houston area	-	-	-	-					718†[1] 3,801†[1]	6.7%†[1] 6.8%†[1]
Willow†[3]	162	Unknown	0	-	2	Unknown	278	Unknown	Unknown	-
Talkeetna	92†[3]	Unknown	0†[3]	-	2†[3]	Unknown	36†[2]		196†[1]	1%†[1]
Trapper Creek	Unknown	-	Unknown	-	Unknown	-	32†[2]		69†[1]	Unknown
Cantwell	Unknown	-	Unknown	-	Unknown	-	24†[2] 9† facilities rooms	seasonal availability; often full in summers†[2]	96†[1]	30%†[1]
Healy	Unknown	-	Unknown	-	Unknown	-	80 units†[2]		Unknown	-
Nenana	Unknown	-	Unknown	-	Unknown	-	Unknown	-	Unknown	-
Between Paxson and Cantwell	Unknown	-	Unknown	-	Unknown	-	7 facilities†[2]	seasonal availability	7 facilities†[2]	Unknown
Municipality of Anchorage†[4]	32,010 (46%)	5.2% vacancy rate†[4]	28,950 (42%)	4.9-7.5 vacancy rate†[4]	8144 (3%)	5.1-7.2% vacancy	Unknown	-	70,104	5.7%
Fairbanks Census Division	37%†[5]	Unknown	57%†[6]	Unknown	5%†[6]	Unknown	21 hotels/motels†[6] (1,547 units)	Unknown	18,224†[7]	†[5]
Mat-Su Borough	80†[5]	Unknown	6%†[5]	Unknown	12%†[5]	Unknown	14%†[5] (of all units)	Unknown	8,582†[8]	5.1%†[5]

†[1] Exhibit E, Vol. 7, Chap. 5, p. E-5-9 and Table E.5.4. Information gathered in the October, 1981 Mat-Su Borough housing survey. The vacancy rate includes seasonal residences. Houston figures include the large Big Lake recreational housing area. Total housing units (8582) include 947 units, many seasonal (vacancy rate of 52.8%), not located in any of the communities.

†[2] May be rental houses, cabins, lodges or rooms. Unfortunately, precise data distinguishing all types and capacities are not available. Data for Palmer, Houston, and Wasilla were gathered in a 1981 housing study conducted by Mat-Su Borough Planners and reported in Exhibit E, Supplemental Responses (June, 1983), pp. 5-1-2 - 5-1-3, and 5-14-3 - 5-14-5.

†[3] Commonwealth Associates, Inc. (1982).

†[4] Yarzebinski (1983), pp. 71, 75, and 77. Data are for 1982. The range of vacancy rates represents the highest and lowest values for different-sized multi-family units and for mobile homes in parks and mobile homes in lots.

†[5] Ender (1980), pp. 8, 9 and 11. Data are for 1979.

†[6] Community Research Center (1983). Data are for 1982. The vacancy rate has been as high as 17.6% (April 1980) to as low as 2.2% (spring of 1982).

†[7] U.S. Bureau of the Census (1980).

†[8] The data were gathered in a 1981 housing study conducted by Mat-Su Borough Planners and reported in Frank Orth & Associates, Inc. (1982a).

example, a 1981 study by the Mat-Su Borough Planning Department indicated a total of 8,582 units and an overall borough vacancy rate of 20.6%. However, these figures included many recreational or part-year units that elevated the overall vacancy rate (DOWL Eng., 1983). In Big Lake, a recreational area near Houston, the vacancy rate was about 50%, while in Talkeetna it was only 1% (Frank Orth & Assoc., 1982a). The 1981 borough study also reported a total of only 62 duplexes, 343 multifamily complexes, and 178 mobile homes--all located in the Palmer, Wasilla, and Houston area (DOWL Eng., 1983: p. III-32). In the same study a total of 22 spaces were found in mobile home courts in Wasilla, 49 in Palmer, 48 in Houston, and 3 near Talkeetna - a total of 122 spaces (Exhibit E, Suppl. Information, June 1983: p. 5-14-6). Vacancy rates are not available for these units.

Another survey of housing in the borough (Ender, 1980) excluded units that were exclusively recreational (about 16% of all units). That study showed that about 80% of the residential housing stock was in single-family dwelling units. Only about 12% was in mobile homes and a little over 6% was in multi-family units. (Borough officials feel that more mobile homes exist, but were counted as single-family residences [DOWL Engineers, 1983].) The housing survey also found that only about 14% of the housing units sampled were rental units, including about 10% of the single-family units, 63% of multifamily, and 16% of the mobile homes. Almost 80% of all residence units were either wholly owned or were being purchased (Ender, 1980: pp. 8, 9, 11). About 14%, or about 1200, of the units in the borough are rental units (Exhibit E, Suppl. Information, June 1983: p. 5-1-1). However, the majority of these units are in the communities just north of Anchorage. Results of the Ender (1980) study indicated that the vacancy rate for the whole borough is 5.1%, with Palmer having the highest vacancy rate. This rate is considerably less than the 20.6% vacancy rate of the 1981 study by the borough, probably because the Ender study does not include recreational units.

Data on the availability of temporary living units are also shown in Table N-6. Because data are not routinely collected or updated on these units, they are inconsistent in coverage and in level of aggregation. A total of 35 facilities, mostly lodges and cabins between Wasilla and Healy, were counted in a survey by the Applicant (Exhibit E, Vol. 7, Chap. 5, pp. 5-14-3 - 5-14-5). Three of these facilities are identified as being in the project vicinity. Capacity of these facilities is not known. However, many lodges include a number of rooms, and rooms and cabins can often house more than one or two residents. Motels and hotels were not included in the Applicant's survey, but these would be located primarily in the vicinities of Anchorage and Fairbanks.

Many of the temporary lodging facilities in the project area are open only in the summer. Many are in great demand by tourists, hunters, and fishermen, are reserved in advance, and are at capacity, particularly on summer weekends.

The mobility of the borough population and recent large population increases are also reflected in the results of the housing study by Ender in 1980. Of the residents sampled, 43.1% had moved into the borough within the two years prior to the housing survey, another 26.7% within four years before, and only about 13% more than ten years before the survey. Of those sampled, 56% had lived in the Mat-Su area less than five years, and about 54% had moved one or more times in the past three years. The largest group (44.6%) had moved to Mat-Su from Anchorage (Ender, 1980).

Developers have estimated that between 1,300 and 1,500 new homes were built in Mat-Su Borough in 1982, primarily in the Wasilla area (Campbell, 1983; The Frontiersman, 1983: pp. 3-4). Continued growth in housing construction was expected in 1983 (Mitchell, 1983). Although housing is being constructed rapidly, a constraint on the number of new units possible is that most proposed subdivisions are not likely to be served by community sewer or water systems. Borough regulations demand a lot size of one acre when served by individual wells and septic tanks, thus limiting the number of houses that can be built on a given acreage. There is a shortage of small-lot housing, apartments, and condominiums and a very low vacancy rate in rental units (The Frontiersman, 1983: p. 4).

According to the Ender (1980) survey, the average household size in the borough in 1979 was 3.34 persons and the median was 3.18 persons; the 1980 Census found an average household size of 3.06 persons (U.S. Bureau of the Census, 1980).

Projections of the number of households in the proposed project and transmission line route area through 2010 are shown in Table N-7. As was done for population, projections from two sources are presented in the table. The first column under each year for 1985 and beyond contains projections made by applying 1980 Census household size (see table footnotes) to data from ISER or by calculating from ISER data to distribute to borough communities (see Table N-1 for explanation). Census projections are that household size will decrease on a national level. However, no particular projections for Alaska have been made; thus for the sake of consistency, 1980 average household sizes were assumed to hold throughout the projection period. The second column for each year for 1985 and beyond contains the projections made by Frank Orth & Associates (1982a) for the Applicant.

Table N-7. Baseline Projections of Number of Households, 1970-2010

Political Subdivision	1970†[1]	1980†[2]	1985 ISER†[2]	1985 Applicant†[3]	1990 ISER†[2]	1990 Applicant†[3]	1995 ISER†[2]	1995 Applicant†[3]	2000 ISER†[2]	2000 Applicant†[3]	2005 ISER†[2]	2005 Applicant†[3]	2010 ISER†[2]	2010 Applicant†[3]
Matanuska-Susitna Borough														
Talkeetna	54	209	201	246	226	334	235	453	240	618	252	792	270	NA
Trapper Creek	NA	74	71	83	80	107	83	138	84	178	89	217	95	NA
Willow	11	45	42	NA	47	NA	49	NA	50	NA	53	NA	57	NA
Houston	20	197	189	308	212	508	220	837	225	1,381	236	2,224	253	NA
Wasilla	88	708	683	930	768	1,404	796	2,124	812	3,189	855	4,536	915	NA
Palmer	335	839	808	1,083	909	1,551	942	1,928	962	2,402	1,012	2,853	1,083	NA
Big Lake	11	134	140	NA	158	NA	164	NA	167	NA	176	NA	188	NA
Other	1,417	5,257	5,063	7,277	5,695	10,514	5,904	13,891	6,027	18,326	6,340	22,523	6,788	NA
Total Borough	1,841	7,283	7,015	9,927	7,890	14,417	8,180	19,371	8,351	26,095	8,783	33,146	9,404	NA
Paxson	Unknown, very small number. Projections not made.													
Yukon-Koyukuk Borough														
Cantwell	16	20	31		34		37		40		45		50	
Healy	20	105	134		148		163		180		199		219	
Nenana	91	148	166		193		223		259		292		339	
Total Borough	1,015	2,280	NA		NA		NA		NA		NA		NA	
Anchorage Census Division (includes Greater Anchorage Area Borough)	34,988	60,470 (70,104)†[4]	70,653		77,901		86,922		87,996		94,403		102,809	NA
Fairbanks Census Division	11,590	18,224	21,918		26,946		28,478		29,517		31,360		33,830	NA

NA: Not Available

†[1] 1970 household data for the boroughs & census divisions are taken from the U.S. Bureau of the Census (1973), pp. 3-31, 3-52. Household data for communities are estimated by dividing the population estimates from Table N-1 by the estimated average household size for the borough in which the community is located (U.S. Bureau of the Census, 1973: p. 3-31).

†[2] Anchorage and Fairbanks data are from Bureau of the Census (1980). Assumes Mat-Su Borough household size of 3.06; Yukon-Koyukuk Borough household size of 3.18; Anchorage household size of 2.8; and Fairbanks household size of 2.6 (U.S. Bureau of the Census, 1980). Calculated from ISER model population projections (Reeder et al., 1983b) shown on Table N-1. See footnote 2 for explanation of distribution to communities. Mat-Su Borough estimates for 1981 are higher, giving a total of 7,701 housing units in the borough (DOWL Engineers, 1983).

†[3] Household projections by Frank Orth & Associates (1982a), Table 4.1-6, p. 4-14. Assumes household size of 3.07 for 1982, decreasing to Census Bureau's national average of 2.657 in year 2000.

†[4] 1982 figure from Yarzebinski (1983) for municipality of Anchorage, which includes more census divisions than do ISER's Anchorage projections.

Table N-9. Years When Community Service Needs Will Equal Existing or Planned Capacity in Project-Area Communities Using ISER Population Projections†[1]

Community	Water	Sewers	Solid Waste Disposal	Schools		Fire	Police	Hospital Facilities
				Elementary	Secondary (Jr/Sr)			
Talkeetna	Individual sources	Individual septic tanks	Rely on borough landfills	2010+	2010+	2010+	Covered by borough	None exist
Trapper Creek	Individual sources	Individual septic tanks	Rely on borough landfills	2010+	Attend in other communities	No facilities	Covered by borough	None exist
Houston	Individual sources	Individual septic tanks	Rely on borough landfills	2010+	2010+	2010+	Covered by borough	None exist
Wasilla	2010+	Individual septic tanks	Rely on borough landfills	2010+	2010+/2010+	1983	Covered by borough	None exist
Palmer	2010+	2010+	Rely on borough landfills	2010+	2010+/2010+	1983	2010+	2010+†[3]
Matanuska-Susitna Borough	NA	NA	2009+†[2]	2010+	2010+	NA	1982	Provided in Palmer
Anchorage	1992	2010+	NA	2010+	1983	1983	1983	NA
Fairbanks	1983	2004	NA	2010+	2001	1983	1983	NA
Cantwell	Individual sources	Individual septic tanks	Rely on private landfills	Unknown		2010+	Covered by state	None exist

NA = Not applicable

†[1] Calculated from Table N-1, ISER projections, and Table N-8.

†[2] See comparable entry in Table N-8.

†[3] The Mat-Su Borough estimated this at 1995.

Table N-10. Years When Community Service Needs Will Equal Existing or Planned Capacity Using Mat-Su Borough Population Projections†[1]

Community	Water	Sewers	Solid Waste Disposal	Schools: Elementary	Schools: Secondary (Jr/Sr)	Fire	Police	Hospital Facilities
Talkeetna	Individual sources	Individual septic tanks	Rely on borough landfills	1985	1989	2001+	Covered by borough	None exist
Trapper Creek	Individual sources	Individual septic tanks	Rely on borough landfills	2001+	Attend in other communities	No facilities	Covered by borough	None exist
Houston	Individual sources	Individual septic tanks	Rely on borough landfills	1983	1983	1983	Covered by borough	None exist
Wasilla	Serves community only	Individual septic tanks	Rely on borough landfills	1983	1983/1990	1983	Covered by borough	None exist
Palmer	2001+	1983	Rely on borough landfills	1989	1990/2001+	1983	1983	1985†[3]
Matanuska-Susitna Borough	NA	NA	1985†[2]	1987	1987	NA	1983	Provided in Palmer

NA = Not applicable

†[1] Calculated from Table N-1 and Table N-8. High population projections are those developed by the Mat-Su Borough Planning Department (DOWL Engineers, 1983).

†[2] See comparable entry in Table N-8.

†[3] The Mat-Su Borough Planning Department estimated this at 1995 in its 1983 Comprehensive Development Plan (DOWL Engineers, 1983).

Planning Districts that include residents outside community boundaries, Table N-10 gives a more pessimistic picture that might be considered a high-impact projection.

N.1.1.7.1 Community Services

WATER

Only Anchorage, Fairbanks, Palmer, and Wasilla have city water systems. Remaining residents in the proposed project area rely on small private water systems or individual wells (Commonwealth Assoc., 1982). The system in Palmer has a capacity to supply 1,368,000 gallons per day (gpd) [5,198,400 liters per day (L/D)] and to treat 864,000 gpd (3,283,200 L/d). Average per-capita daily use of water in Palmer has been 120 gpd (456 L/d) (Frank Orth & Assoc., 1982a). Palmer is expanding its system capacity by 216,000 gpd (820,800 L/d). If current water-use rate continues after the expansion, the Palmer system could support a population of 13,200. This means that based on Table N-1, the system will have sufficient capacity for the town's projected baseline population (ISER or Mat-Su Borough projections) beyond the year 2001 (see also Tables N-9 and N-10). The Wasilla water supply and treatment system extends to the concentrated downtown area only; it is estimated to be adequate to serve two times the current population (Frank Orth & Assoc., 1982a: p. 4-79).

Residents in the remaining Mat-Su Borough communities, in Cantwell, Healy, Nenana, and in isolated areas are served by individual wells or by small systems serving residential developments, schools, businesses, or multi-unit dwellings (Univ. of Alaska, 1977; Frank Orth & Assoc., 1982a: p. 4-79).

SEWERS

As is the case for water systems, few communities in the proposed project area have community sewer systems. In the Mat-Su Borough, only Palmer has a citywide sewage treatment facility. The capacity of the present system is 500,000 gpd (1,900,000 L/d), which is sufficient to serve a community of 5,000 people (Stenehjem and Metzger, 1980: p. 41). Based on ISER and Mat-Su Borough population projections, this system should be adequate to beyond the year 2001. Other communities in the region rely on individual septic tanks, although some subdivisions and trailer parks have public facilities (Univ. of Alaska, 1977; Exhibit E, Vol. 7, Chap. 5, p. E-5-13). Only the City of Houston is considering building a facility to service the discharge from private sceptic tanks in the borough (Frank Orth & Assoc., 1982a: p. 4-82).

SOLID WASTE DISPOSAL

The Mat-Su Borough handles solid waste disposal for all residents in the borough except those in Palmer, Wasilla, and Houston (incorporated communities with their own powers to provide this service). Anchorage and Fairbanks also provide solid waste disposal facilities and services. The Mat-Su Borough presently operates nine landfills, but plans to centralize disposal at one 80-acre (32-ha) site near Palmer. Currently, the incorporated communities contract with the borough for use of landfills. Based on a standard of 0.11 acre (0.04 ha) of landfill required per 1000 persons annually (Exhibit E, Vol. 7, Chap. 5, p. E-5-B-3), the new 80-acre (32-ha) landfill would suffice for the borough until 2009 under the ISER population projections, but only until 1985 under Mat-Su Borough projections. Projections by the Borough Planning Department indicate that the Talkeetna and Willow landfill sites will be filled within ten years and five years, respectively (DOWL Engineers, 1983: p. III-58).

Only Palmer provides pickup; other borough residents must transport their own waste to a landfill (Exhibit E, Vol. 7, Chap. 5, pp. E-5-13 - E-5-14). Once a community or region reaches a certain population density, it may become economically feasible and more practical to provide pickup of solid wastes. This would particularly be the case if the Mat-Su Borough follows through on its plan for a centralized landfill site. Standards for trucks for pickup are one truck per 1,800 housing units for low-density rural areas (Stenehjem and Metzger, 1980: p. 45). Application of these standards to the number of households projected using ISER population projections (Table N-7) indicated a projected need for four borough trucks in 1985, with another added by 1995. More would be needed under Borough projections. It is not clear whether the borough or any of the Mat-Su communities would choose to start solid-waste pickup, but particularly under the Applicant's projections, it may be a feasible and necessary plan.

Cantwell's landfill site is privately owned and residents transport their wastes to it (Exhibit E, Vol. 7, Chap. 5, p. E-5-14). Paxson, Healy and Nenana also rely on private landfill disposal sites.

EDUCATION

Schools in the proposed project region are administered at the borough level for Mat-Su communities. There are 17 schools in the Mat-Su Borough (DOWL Engineers, 1983: p. III-46). The smaller communities have their own elementary schools and share junior and senior high schools.

Correspondence courses are offered for children outside population centers. Most of the schools are not now filled to capacity, with the exceptions of elementary schools in Trapper Creek and Willow, where the number of pupils doubled between 1971 and 1981 (DOWL Engineers, 1983: p. III-46). Expansions or replacements are planned for the Trapper Creek and Willow elementary facilities and for an old elementary school in Wasilla. Capacities for students in these schools are shown in Table N-8.

For planning purposes, the Mat-Su Borough assumes that 22.8% of the borough population will consist of school-aged children, divided approximately evenly between elementary and secondary schools (Frank Orth & Assoc., 1982a). Using this borough standard and the ISER-based population projections of Table N-1, the total capacity of all schools in the borough will be exceeded by about the year 2010. Using Borough projections, schools in Talkeetna, Houston, and Wasilla need to be expanded now, and schools in other communities before 1990 (Table N-10).

Cantwell has an elementary school and Healy has a high school, both of which are administered by the Upper Railbelt School District and funded by the state (Univ. of Alaska, 1977). Nenana schooling is administered by the Yukon-Koyukuk Borough School District. Paxson children attend a small school administered by the Copper River School District (Alaska Dept. of Community and Regional Affairs, 1983).

The enrollment of the public school system of Fairbanks increased 10% between 1980 and 1982. However, enrollments were still 1% lower than the 1976 peak during the building of the Trans-Alaska Pipeline (Community Research Center, 1983). Anchorage secondary schools are in need of expansion now, based on the population level and the standards used in Table N-9.

Although vocational education is being encouraged in the Mat-Su Borough, only one community college exists in the borough to provide it: Matanuska-Susitna Community College. Campuses of the University of Alaska are located in Anchorage and Fairbanks.

FIRE PROTECTION

Mat-Su Borough has ten fire protection service areas, each with one fire station. The cities of Palmer and Houston have their own city fire departments (DOWL Engineers, 1983: p. III-50). Only Palmer and Wasilla (which has one of the borough fire stations) have any paid employees - two in Palmer and one in Wasilla. The rest of the service areas are staffed by volunteers. New equipment has recently been acquired and six new stations added to reach the present total of ten. Another six stations are called for in the borough's fire protection plan (Exhibit E, Vol. 7, Chap. 5, p. E-5-17; Frank Orth & Assoc., 1982a: pp. 4-98 - 4-102). The ten borough service areas and Palmer and Houston's fire departments together serve approximately 80% of the borough population. The remaining 20% who live outside of the service areas must rely on help from neighbors. Those residents are located in Willow, along the Parks Highway between Willow and Trapper Creek, and in the roadless areas of the borough (DOWL Engineers, 1983: p. III-55).

Standards of one station and two pumper trucks per 1,000 dwelling units in outlying rural areas, and one station and two pumper trucks per 300 to 420 dwelling units in small rural communities have been proposed (Stenejhem and Metzger, 1980: pp. 56-57). Applying these standards to baseline projections of the number of households from Table N-7, Houston has sufficient services through 2005, but Palmer and Wasilla need additional services now (Table N-9). Under Borough projections, Houston also needs additional fire services now. The remainder of Mat-Su Borough's residents are served adequately by organized fire protection forces according to these standards. However, should the number of isolated, dispersed, but road-accessible residents increase, some additions may be needed to cover the larger territory. Current capacities are shown in Table N-8. As more stations and equipment are added, it will be more likely that the service areas will begin to hire more full-time, paid firemen rather than relying completely on volunteers (Cortese and Jones, 1977; Stenejhem and Metzger, 1980).

Currently, Cantwell and Healy have local volunteer fire departments (Commonwealth Assoc., 1982). Cantwell is in the process of planning a community fire service area and fire protection facilities. One facility should be adequate to serve the projected baseline population of the town for some years.

Anchorage fire services employ 298 persons; Fairbanks services have 59 (Alaska Div. of Budget and Management, 1982a: pp. 7, 18). Based on application of standards of service-to-population ratios used in Table N-9, both cities need additional fire service facilities now.

POLICE

Only Anchorage, Fairbanks, and Palmer have city police departments. Anchorage employs 365 persons, Fairbanks 27 (Alaska Div. of Budget and Management, 1982a: pp. 7, 18). Based on service-to-population ratios applied to current populations, both cities need expanded police forces (see Table N-9).

Alaska State Troopers patrol Mat-Su Borough and Cantwell; 17 troopers are stationed in Palmer, 3 in Trapper Creek, and 1 in Cantwell--each trooper with a vehicle (Exhibit E, Vol. 7, Chap. 5, pp. E-5-16 - E-5-17; Frank Orth & Associates, 1982a: pp. 4-91 - 4-98). Healy also relies on state troopers for police protection. Additionally, Palmer has its own police force of eight officers. Application of standards of about 4.5 officers and 0.7 vehicle per 1,000 dwelling units in rural communities and 3.0 officers and 0.5 vehicle per 1,000 dwelling units for rural areas (Stenejhem and Metzger, 1980: p. 52) to projections shown in Table N-7 indicates that current police forces in Palmer will suffice beyond 2010, but that additional troopers are needed for the whole borough now. Using Borough projections, Palmer police forces also require expansion now. Also, any communities that incorporate to serve increasing populations and more concentrated housing development will need police forces of their own, as standards for adequate protection will rise (Stenejhem and Metzger, 1980: p. 52).

Three detention and correctional facilities exist in the borough, with another prison planned. The correctional facilities serve Anchorage as well (Exhibit E, Vol. 7, Chap. 5, pp. E-5-16 - E-5-17; Frank Orth & Assoc., 1982a: p. 4-94).

HEALTH CARE

Complete health care services are provided only in Anchorage, Fairbanks, and the southern portion of Mat-Su Borough. One hospital, Valley Hospital in Palmer, serves the Mat-Su Borough residents for acute health care. The hospital is increasing its capacity from 25 beds to 30 beds and adding equipment and facilities space. Its current staff of eight physicians will probably increase with the expansion. The hospital serves in- and out-patients. Additionally, there are three public health centers (general use ones in Palmer and in Wasilla and the Cook Inlet Native Association Health Care Center in Wasilla), a nursing home in Palmer, and two mental health facilities (Exhibit E, Vol. 7, Chap. 5, pp. E-5-17 - E-5-18; Frank Orth & Assoc., 1982a: pp. 4-102 4-108; DOWL Engineers, 1983: pp. III-47 - III-50). Ambulances and 120 trained volunteer emergency medical technicians also serve Palmer, Wasilla, Willow, Talkeetna, Houston, and Trapper Creek (DOWL Engineers, 1983: pp. III-49 - III-50).

Extensive health care facilities and physicians' services exist in both Anchorage and Fairbanks and serve the metropolitan populations in addition to out- and in-patients from the Mat-Su and Yukon-Koyukuk boroughs and from all over Alaska (see Table N-8). In 1981, Anchorage had 365 physicians and 158 dentists, Fairbanks had 101 physicians and 45 dentists (Div. of Management and Budget, 1982a: pp. 4, 15). Because these facilities and professionals serve a larger population than their own metropolitan area, their capacity and adequacy cannot be estimated. Facilities for the general public as well as for Native Alaskans are available in Anchorage (Frank Orth & Assoc., 1982a: pp. 4-103, 4-210 - 4-213).

Cantwell has a small medical clinic, an ambulance, and emergency medical technicians, although no physicians practice full-time in the community. Residents of Cantwell travel to Fairbanks or Anchorage for medical care. Healy and Nenana also each have a small medical clinic served by medical technicians, but no resident physicians.

Projections of health care needs are made primarily for hospital space or beds. Assuming a per-capita use rate in Mat-Su Borough of 0.45 days (Frank Orth & Assoc., 1982a: p. 4-107) and using ISER baseline population projections from Table N-1, the 30-bed hospital Valley Hospital in Palmer will be sufficient for the borough until 1995, assuming present use rates. By 2005, a total of 35 beds would be needed. Borough planners also assume Palmer's hospital's capacity will suffice through 1995 (DOWL Engineers, 1983), although using Borough projections (Table N-2) and assuming total reliance on this hospital and none on Anchorage facilities, additional beds would be needed after 1985. With the additional beds, new physicians may also be attracted to Valley Hospital. As these facilities and services increase, Mat-Su Borough residents may increase their use of this facility instead of going to Anchorage or Fairbanks. If so, expansion would be needed before 1995. Standards for outpatient clinics, emergency medical care facilities, and physician-to-patient ratios for rural areas are not available, and thus baseline projections cannot be made.

RECREATIONAL AND CULTURAL FACILITIES

Anchorage and Fairbanks provide a full range of cultural activities, as well as city parks. Mat-Su Borough has four libraries (Trapper Creek, Talkeetna, Willow, and Sutton) and Palmer and Wasilla each have city library systems. The Borough has three major museums, and one stage theater in Palmer (DOWL Engineers, 1983: pp. III-60 - III-62).

Many outdoor recreational activities (e.g., hunting, fishing, camping, and mountaineering) are available in the project region. (For an extensive discussion of the recreational resources, see Appendix L.) Except for single parks in both Palmer and Wasilla, there are few public community parks in the borough. However, plans call for development of playgrounds and neighborhood parks associated with schools (Exhibit E, Vol. 7, Chap. 5, p. E-5-19). The borough does provide and maintain a number of ball fields, two hockey rinks, community centers in Houston and Willow, picnic areas, and ski trails in its communities (DOWL Engineers, 1983: p. III-74).

As the populations of the borough communities and of Cantwell increase, so will the need for local parks, playgrounds, and recreation centers. Applying a standard of about 4 acres [2 hectares (ha)] per 1,000 housing units (Stenehjem and Metzger, 1980: p. 50) to Table N-7 figures, Wasilla and Palmer would need about 4 acres (about 2 ha) of playgrounds and neighborhood or community parks by the mid-1980s. More would be needed under Borough projections. Standards do not exist for low-population-density, rural communities and dispersed residential areas. If lot sizes remain large and population centers small in the rest of Mat-Su Borough and Cantwell, no community parks or open-space areas would be necessary.

ELECTRIC POWER

Electric power is supplied to residents of the Mat-Su Borough by the Matanuska Electric Association. Residents of Cantwell presently rely on individual generators, but are looking for a commercial power provider (Exhibit E, Vol. 7, Chap. 5, pp. E-5-22 - E-5-23) and may tie into the Intertie transmission line now under construction between Anchorage and Fairbanks (Ahtnakans, 1983).

Electric power is provided to Fairbanks by Fairbanks Municipal Utilities System and Golden Valley Electric Association (Community Research Center, 1983). The latter association also serves Healy (Commonwealth Assoc., 1982). Chugach Electric Association supplies Anchorage (Community Research Center, 1983).

N.1.1.7.2 Fiscal Status

REVENUES

Mat-Su Borough is incorporated and thus has taxation powers; of the individual communities in the project area, only Palmer, Wasilla, and Houston are incorporated. Major sources of revenue for the Mat-Su Borough and its communities are property taxes [mill rate of 4.9 on the full assessed value in 1982 (Campbell, 1983)], municipal assistance funds, and state and Federally shared funds. Total assessed value of all land, businesses, and homes rose 19.2% between 1982 and 1983 assessments (Campbell, 1983). Because of the lack of an industrial base in the borough, nearly all property taxes are from residential properties.

Revenues are organized into four funds. The general fund is composed mostly of property revenues, plus smaller amounts from the other sources. The service areas fund is made up of property taxes (30% in 1981-1982 budget) and of state-shared and municipal assistance funds (70%). The land management fund is a very small portion of borough revenues (3%) and is from state grants and land management fees. The education operating fund is the largest portion of the borough revenue (58% in 1981-1982), as is true of most small communities (Burchell and Listokin, 1978). The state is the major source of funds (approximately 70%). The state also reimburses 90% of school bonded indebtedness, but there is a lag in reimbursements (Exhibit E, Vol. 7, Chap. 5, pp. E-5-19 - E-5-21; Frank Orth & Assoc., 1982a). Per-capita revenue for the general, service area, and land management funds in 1981 was about $1,000; for the school district budget it was about $1,100. If residential building and the population continue to increase at a fairly even rate, the borough may be able to continue to rely on only property taxes only from residences. However, the Borough Planning Department is also attempting to attract industry. The mill rate in the borough will also probably rise from 4.9 to 6.0 or 7.0 on the full assessed value (R. Schulling, Mat-Su Borough Planning Department, personal communication to B.A. Payne, Argonne National Laboratory, June 21, 1983).

Palmer levies a sales tax of 2% on gross retail sales and a property tax of 4 mills on the assessed valuation to add to its revenues from borough and state funds. Wasilla and Houston revenues are based primarily on borough and state funds (Frank Orth & Assoc., 1982a; City of Palmer, 1983; City of Houston, 1983). Actual or projected budgets of revenues and expenditures between fiscal years 1982 and 1983 changed less than 1% in both Palmer and Houston (City of Palmer, 1983; City of Houston, 1983).

Talkeetna administers borough revenue from local taxes and from state revenues to provide road, fire, and flood control services. Trapper Creek levies no taxes and has no administrative responsibilities (Exhibit E, Vol. 7, Chap. 5, p. E-5-21).

Neither Cantwell nor Healy can levy taxes and both rely primarily on state grants and on annual state-shared revenues. Some additional funding for community services in Cantwell comes from per-capita grants via the Native village council (Exhibit E, Vol. 7, Chap. 5, pp. E-5-21 - E-5-22).

Anchorage and Fairbanks both levy property taxes at rates that vary depending on service areas within the metropolitan areas. Neither city imposes a sales tax (Alaska Div. of Budget and Management, 1982a: pp. 7, 18).

EXPENDITURES

As is the case in most rural areas, the Mat-Su Borough School District was the largest borough budget item in 1981, averaging $5,650 per pupil. Road maintenance absorbed the next largest portion of the budget, at $33 per capita. Total expenditures from the general fund (including ambulance, sanitary landfill, library, road maintenance, and administration), service area fund (fire and police protection), and land management fund were about $22 million, or about $1,000 per capita (calculated from Frank Orth & Assoc., 1982a). When shortfalls have occurred in borough budgets in the past, the state has contributed to the budget to prevent deficits (Exhibit E Vol. 7, Chap. 5, pp. E-5-20 - E-5-21; Frank Orth & Assoc., 1982a).

Expenditures for the Mat-Su Borough School District were about $1,100 per capita. The school district currently has a capital improvements plan calling for completion of numerous improvements or additions to school facilities. The total budget requirements for these items have been projected through fiscal year 1987. The requirements peak in 1986 at about $19 million, dropping to $8.5 million in 1987. Mat-Su Borough will pay for about 80% of these capital improvement expenses, and the state is expected to finance the remainder (Exhibit E, Vol. 7, Chap. 5, pp. E-5-20 - E-5-21; Frank Orth & Assoc., 1982a: pp. 4-45 - 4-51).

All of the communities in Mat-Su Borough rely on the borough for their education systems. Palmer's major expenditures in 1981 were for public works, administration, and police (Frank Orth & Assoc., 1982a). Wasilla and Houston made their major expenditures in administration and road maintenance (Frank Orth & Assoc., 1982a: pp. 4-61 and 4-70). Talkeetna's expenditures in road maintenance were about two-thirds of its total expenditures in 1981 (Frank Orth & Assoc., 1982a: p. 4-72).

Cantwell will pay to maintain its fire protection facilities when they are acquired. Its school is supported almost entirely by state (87%) and federal government (8%) revenues (Exhibit E, Vol. 7, Chap. 5, p. E-5-22).

Expenditures by Anchorage and Fairbanks in fiscal 1981/1982 are shown in Table N-11.

N.1.1.8 Transportation

Besides having their own networks of roadways, Fairbanks and Anchorage are junctions of major transportation routes. Both have airports for major carriers, terminals for major rail lines, and are intersections for primary trans-Alaska roadways. Anchorage additionally has a ship port. Both cities are major commercial and transportation centers for the state. Transportation facilities in areas closer to the proposed project site are discussed below.

Table N-11. Fiscal Year 1981-82 Per Capita Expenditures by Anchorage and Fairbanks Governments for Community Services

Service	Municipality of Anchorage	City of Fairbanks
Police	$153	$135
Fire	100	142
Ambulance	19	NA
Parks and recreation	56	35
Library	21	NA
Health care	25	NA
Transportation	84	NA
Sewage	254	110
Solid waste disposal	59	NA
Water	348	83
Public works	NA	102
Electricity	NA	360
Road repair	$28,550 per mile	NA
Education	$7,730 per pupil	$5,400 per pupil

NA: Not available

Source: Frank Orth & Associates (1982a), pp. 4-192 - 4-193 and 4-195 - 4-196.

N.1.1.8.1 Road and Highway

Few roadways traverse the region around the proposed Susitna project site. The major north-south highway is the Parks Highway, which is the primary route between Anchorage and Fairbanks, a distance of about 350 miles [560 kilometers (km)] (see Fig. N-1). The Parks Highway is a paved road which parallels the rail line for most of its length and connects the communities along the Railbelt between the metropolitan areas of the two large cities. A spur from the highway goes to Talkeetna. The highway was built to meet projected needs through the year 2000, and for the majority of its length (except around Wasilla) is currently used at only about 10% of capacity. An expansion is now being built in the Wasilla area. Traffic is a mixture of personal and recreational vehicles and commercial trucks (Exhibit E, Vol. 7, Chap. 5, pp. E-5-14 - E-5-15).

A second north-south highway, the Richardson Highway, extends east of the proposed project area, connecting Valdez and Fairbanks. It is the oldest road in the state and was used heavily during construction of the Trans-Alaska Pipeline. As a result of this heavy use, sections of the road are in poor condition. The paved highway is two lanes wide most of its length (Frank Orth & Assoc., 1982a: p. 4-206).

The Denali Highway connects Cantwell on the Parks Highway with Paxson on the Richardson Highway; it is about 130 mi (200 km) long. Open only in the summer months, the Denali Highway is a gravel road used mainly by tourists and hunters in passenger vehicles. Average daily traffic volume along the highway ranges from 50 to 120 vehicles (Exhibit E, Vol. 7, Chap. 5, p. E-5-15).

Maintenance of local roads in the Mat-Su Borough is by the borough and its individual communities. Yukon-Koyukuk Borough is not incorporated and so its communities (Cantwell, Healy, and Nenana) often have unmaintained roads (Exhibit E, Vol. 7, Chap. 5, p. E-5-15).

N.1.1.8.2 Rail

The Alaska Railroad connects Anchorage and Fairbanks and for the most part parallels the Parks Highway through the region of the proposed project area. It also serves some communities and residences without road access. The line carries freight (at an estimated 20% of capacity) and passengers (daily in the summer, twice per week in the winter). On specified trips, the train will stop when flagged at any point along its route to pick up or drop passengers, thus providing an important link for isolated residents to large population and commercial centers (Exhibit E, Vol. 7, Chap. 5, p. E-5-16).

N.1.1.8.3 Air

In addition to large commercial airports in Anchorage and Fairbanks, most of the communities in the project area have airstrips for small aircraft (Exhibit E, Vol. 7, Chap. 5, Table E.5.5). These strips are often used by tourists for access to the area or for take-off to more remote wilderness areas, e.g., isolated lakes or base camps for mountaineering trips. Air travel by small plane and float plane is a relatively common travel mode because of the inaccessibility of many areas of the state, especially in winter.

N.1.2 Susitna Development Alternatives

N.1.2.1 Alternative Dam Locations and Designs

All the alternative dam locations and designs in the Susitna Basin would be located in the same existing environment as the proposed Susitna development. This setting includes all of the Matanuska-Susitna Borough; the towns of Cantwell, Healy, Nenana, and Paxson; and the metropolitan areas of Anchorage and Fairbanks. For a description of all aspects of that socioeconomic environment, refer to Section N.1.1.

N.1.2.2 Alternative Access Routes

The existing socioeconomic environment of all the access route alternatives would be the same as that described in Section N.1.1.

Native concerns are particularly important in the existing environment of the access routes, as Native groups control or will eventually acquire control of much of the land in the Susitna Basin area. All Native organizations, including local corporations and the Cook Inlet Region, Inc. (CIRI) regional group are interested in developing Susitna Basin land for hunting, guiding, trapping, etc., and to develop Native businesses based on these uses. Project roads would provide access to this land for these recreational and business pursuits. However, Native organizations are divided in their preferences for access routes. The organizations each prefer the route that would bring the greatest access to their individual lands. CIRI holds lands around and to the south of the proposed impoundments; Ahtna Native Corporation holds lands along the Denali Highway. Thus, CIRI and the Tyonek Native Corporation prefer the southern access route; and Ahtna, supported by the Cantwell Village Council, supports the proposed Denali-North route. No Native groups support the northern route (Federal Energy Regulatory Commission, 1983; Exhibit E, Vol. 9, Chap. 10: p. E-10-48).

N.1.2.3 Alternative Power Transmission Routes

All the alternative power transmission routes share the socioeconomic environment described in Section N.1.1. From the site south to Anchorage, all routes are in the Mat-Su Borough; north of the site, all begin in the Mat-Su Borough, then either traverse the Yukon-Koyukuk Borough via areas covered in Section N.1.1, or cross sparsely populated land to enter Fairbanks directly from the south. Most of the territory crossed by the alternative routes is sparsely populated, e.g., near the Railbelt or in recreation areas, or is unpopulated. However, the southern segment alternatives around Palmer and Anchorage and those entering Fairbanks from the south would cross more densely settled land. These population centers are described in Section N.1.1.

N.1.2.4 Alternative Borrow Sites

All alternative borrow sites are located in unpopulated areas and are of commercial interest only in the context of the hunting, trapping, fishing, and other dispersed recreational and tourist uses of these areas. These interests are described in Section N.1.1.

N.1.3 <u>Non-Susitna Generation Alternatives</u>

Locations of the communities and Boroughs described below are shown in Fig. N-3.

N.1.3.1 Natural-Gas-Fired Generation Scenario

The socioeconomic environments of the potential sites of the eight 200-MW combined-cycle units are the Tyonek area southwest of Anchorage, the northern Kenai Peninsula, and the Anchorage metropolitan area. The potential sites of the two 70-MW combustion turbines using gas would be near Anchorage. The socioeconomic environment of Anchorage is described in Section N.1.1. Descriptions of the socioeconomic environments of northern Kenai Peninsula and of the Tyonek area are given below.

N.1.3.1.1 <u>Northern Kenai Peninsula</u>

Two of the 200 MW combined-cycle units would be located south of Anchorage and north of Kenai on the Kenai Peninsula. Soldotna, another of the peninsula's large communities, lies a few miles southeast of Kenai. Both of these communities and some small, unincorporated settlements north of Kenai (e.g., Salamatof and Nikishka) are located in what is called the Central Peninsula area of the Kenai Peninsula Borough. The economy and way of life of the area are reliant on fishing and timber industries, oil and gas development, tourism, and on subsistence activities.

The Kenai Peninsula Borough provides planning and zoning, education, and solid waste disposal services and assesses and collects taxes. It also administers two hospital service areas, two fire service areas, and one recreation service area for residents of the peninsula. Six borough communities have organized governments: Kenai, Soldotna, Homer, Seldovia, Seward, and Kachemak. All except Kachemak are empowered to collect taxes, provide community services, and have comprehensive development plans, although they may also cooperate with the borough on services (e.g., for hospitals - see below) (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 3, 98-177).

Citizens in the area have expressed concern that resource development "be consistent with their present lifestyles and values", and are thus active in evaluating development plans (U.S. Army Corps of Engineers, 1982: p. 78).

The population of the borough is concentrated (almost 90%) on the west side of the Kenai Peninsula in the communities of Kenai, Soldotna, Homer, and Seldovia (see Fig. N-3). The 1982 populations of Kenai and Soldotna were 5,231 and 3,008 persons, respectively. North and northeast of the Kenai-Soldotna area, the 1982 population totaled 4,120, including 2,014 in Nikishka 1,143 in Salamatof, and the remainder scattered outside communities (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 25 and 28).

The borough population increased by 28% between 1978 and 1982; the city of Kenai increased by 20% and Soldotna by 27% during that same period. As with other areas in Alaska, the population of the area has been through "boom and bust" periods in response to phases of development of natural resources. Stability in the population varies by community. A 1977 borough survey showed that over 35% of Kenai's population and 50% of Soldotna's had moved there during the previous two years. Around 35% of each these community populations had lived in the community at least since 1970. The same survey showed that almost 40% of the residents of the Homer and Seldovia areas had lived there over 11 years and expected to remain for the next 5 years. The median age in the Borough in 1980 was 27 years. Population in Kenai and Soldotna is over 90% white; the remainder is primarily Native Alaskan (Kenai Peninsula Bor. Resour. Dev. Office, 1983).

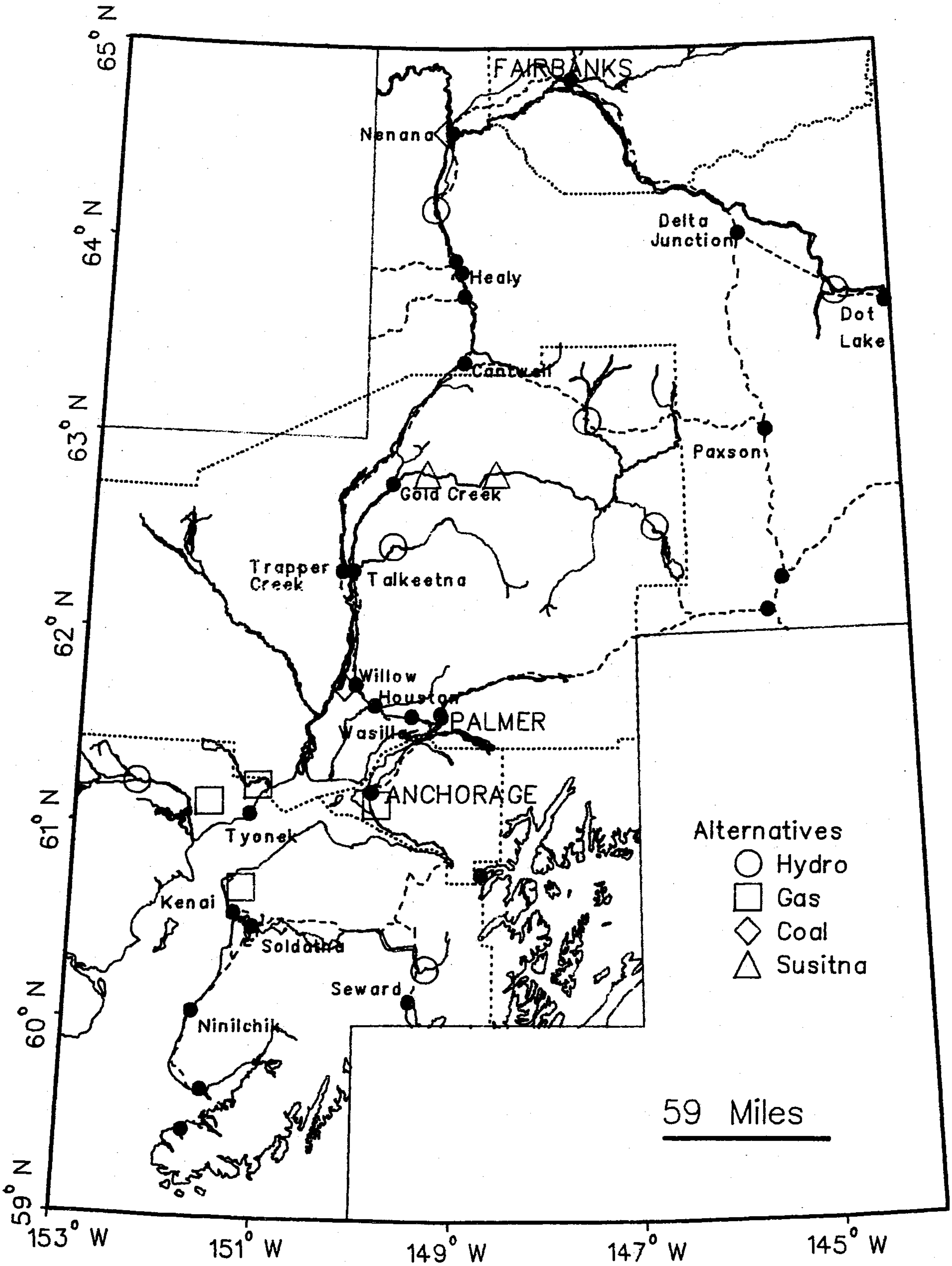

Figure N-3. Map Showing Locations of Communities and Political Units in the Vicinity of All Alternative Sites.

If industrial development--especially in fishing--in the Kenai area continues, and if proposed development of Beluga coal, offshore oil, and a liquified natural gas facility take place--as planned, rapid growth would continue on the Kenai Peninsula (U.S. Army Corps of Engineers, 1982: p. 78; Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 118). A Borough Planning Office study uses three widely ranging growth scenarios. The high scenario, based on the assumption that all the above developments occur, projects 106% population growth, to a total of 55,055 persons, between 1978 and 1992. Under the medium case, more moderate growth at a slower pace in the same areas a growth of 48%, to 39,305 persons, is projected between 1978 and 1992. The assumptions of the low case are declining oil production, no Beluga coal development, and little change in other industrial and resource development, giving a population growth of only 3.3%, to 26,748 persons, between 1978 and 1992 (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 118-119). The actual 1982 population exceeded the growth projections for 1982 under the low and medium cases, 7,000 and 4,000 persons, respectively, although the actual figures were 4,000 persons below the high case 1982 projection.

The oil and gas industry forms the economic base of central and northern Kenai Peninsula (Kenai, Soldotna, and borough residents to the north). The southern peninsula is reliant on commercial fishing and processing, and on tourism. Employment statistics are available only by census division, combining the southern Kenai Peninsula area with the northern Kenai-Soldotna area. Employment is concentrated in government (1,410 in 1980), manufacturing (1,295), services (994), and wholesale and retail trades (264 and 951, respectively). In 1982, the average unemployment rate was 15.3%, up from about 13% in 1981, when the total labor force was 11,350 (Alaska Dept. of Labor, 1983). As with other areas in Alaska, the unemployment rate is high, varies considerably seasonally, and has ranged widely over the past decade--from a low of 8.7% in 1975 to a high of 16% in 1973 (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 53 and 55).

Per capita income in the borough in 1980 was $10,158, which ranked 18th among Alaska's 29 census divisions (Office of Management and Budget, 1983: p. 73). This value is higher than the U.S. per-capita income level; however, when this value is adjusted for the high cost of living in the area, it is less than the similarly adjusted U.S. value (Kenai Peninsula Bor. Resour. Dev. Office, 1983).

Total assessed property value, excluding state-assessed oil-related properties, in the Borough has increased dramatically--by almost 600% (not adjusted for inflation)--since 1972, most of the change occurring between 1975 and 1979. Unlike many rural areas that rely heavily on property taxes for revenues, however, personal and property taxes make up only slightly more than a third (39%) of total borough revenues; intergovernmental sources (e.g., from the state) contribute 45% of total revenues. The percentage of total revenue that is from this source is expected to be even larger (over 50%) in the Fiscal year budget. In contrast, the cities of Kenai and Soldotna rely on personal property taxes for over 50% of their revenues. Schools are the greatest expense (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 66-70, P. 75; U.S. Bureau Land Management, 1981: pp. 17-24).

Kenai and Soldotna dropped their property tax rates dramatically during the last decade. Kenai's rate went from a high of 16.75 mills in 1975-1976, to a low of 4.21 mills in 1981-1982. Soldotna's rate dropped from 15.0 mills in 1974-1975 to 6.35 in 1981-1982. Borough rates also have dropped steadily, from 5.0 mills between 1972 and 1978, to 1.75 mills in Fiscal Year 1981-1982. In 1982, Kenai had a sales tax of 3%; Soldotna had 2%; and the borough had an additional sales tax of 2% (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 71-72).

In 1977, Kenai and Soldotna had about 1,300 and 700 households, respectively (calculated from Kenai Peninsula Bor. Resour. Dev. Office, 1983: Tables 5 and 11). Since 1978, Kenai has authorized the building of about 400 additional housing units, and Soldotna an additional 277. Most of these were authorized during 1979 or 1982, with a lull in building between these years. The distribution of housing by type is presented in Table N-12. Single-family units are the most common housing type in all communities. In 1980, about 60% of Kenai residents and 70% of Soldotna's owned their homes. Rental was more common in Kenai - just under 40% units were rented - than in Soldotna, where around 30% were rented. Vacancy rates for apartments vary seasonally, as high as about 31% in Kenai in February of 1981 to as low as no vacancies in Soldotna in June 1981 (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 30, 34, 37, 38). The Borough Development Office states that "[e]xpanded motel/hotel and public campground accommodations" are needed to satisfy the growing tourist industry (Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 13).

Total 1982 school district enrollment in the Central Peninsula area, including Kenai and Soldotna, was 4,666, up 22% from 1978. Both communities have a full range of elementary and secondary schools. One elementary school (Nikiski Elementary) is located north of Kenai. It has had an enrollment of about 400 students since 1978. There is also a community college in Kenai and a state vocational technical school in Seward (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 51-52).

Table N-12. Residency Distribution by Housing Type in Communities of the Kenai Peninsula Borough (1982)

	Residency Distribution (%)†[1]			
Community	Single Family	Apartment	Mobile Home	Other
Kenai	54.9	32.5	12.5	0.1
Soldotna	61.0	23.7	15.3	0
Homer	55.7	21.8	22.4	0.1
Seldovia	82.0	4.6	12.9	0.5
Seward	67.3	31.5	0.4	0.8

†[1] Percentage of population residing in each housing type.

Source: Kenai Peninsula Borough Resource Development Office (1983), p. 38.

Most households in the two communities rely on city water and sewer systems: water - about 61% of the households in Kenai, and 57% in Soldotna; sewers - about 61% in Kenai, and 68% in Soldotna. Others in the communities and outside the boundaries rely on well water and septic tanks. Homer Electric Service provides power for Kenai and Soldotna. Gas is the prime heating fuel for about three-quarters of the households in Kenai and Soldotna (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 16, 39, 106).

Kenai and Soldotna each have their own city police departments. Fire service is provided by each city and by borough-administered service area departments. The latter are supported by property taxes in the service areas. More fire service areas (at least three) and equipment additions are being considered. There are three general hospitals with in- and out-patient care in the borough, and a nursing home in Seward. The central Peninsula General Hospital is in Soldotna. The hospitals do not have a wide range of specialty care facilities, so residents must travel to Anchorage for these services. There are also three district mental health care centers, one of which is in Kenai (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 17, 46-49, 116-117).

The Kenai Peninsula is accessible by highway from Anchorage. Sterling Highway (Highway 1) is a major roadway on the Peninsula and passes through Kenai and Soldotna. The highway extends to the Homer area, and Seward Highway (Highway 9) branches off it to Seward. Smaller roads, most unpaved, extend north of Kenai to Salamatof and the area around Nikishka. Average annual daily traffic on Highway 1 in Soldotna rose by about 12% between 1981 and 1982, and by 115% between 1972 and 1982, to a 1982 level of 3,089 vehicles. Average annual daily traffic fluctuates seasonally from a high in July of about 1-2/3 times the annual average, to only about 60% of the annual average in January. About 50% of the traffic is passenger vehicles, 45% pickup and campers, and about 8% trucks or buses (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 86, 88).

Between June 1 and September 1, regular service is provided by state ferries between Anchorage and Homer, Seldovia, and on to Kodiak Island, and between Kodiak Island and Seward. Fishing boats, personal boats, commercial ships, and barges also serve the coastal areas of the peninsula. Water routes are relied on to bring equipment and workers to remote energy developments. Rail service on the peninsula is available only between Anchorage and Seward, via Portage (Rand-McNally, 1983). The city of Kenai has a municipal airport that has recently been renovated (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 45, 107). Homer also has a strip which can handle jet traffic. Use of both the Kenai and Homer airports is below capacity. Other airstrips for small planes are scattered around the peninsula, primarily near communities and resource development operations (U.S. Bureau of Land Management, 1981: p. 47).

N.1.3.1.2 Tyonek Area

Tyonek is located between the Chuitna and Beluga rivers on the western shore of Cook Inlet (see Fig. N-3). Two of the combined-cycle units would be on the lower Beluga River, three others on the Chuitna. Tyonek is the only population concentration in the area. Tyonek is located in what is called the Western Peninsula area of the Kenai Peninsula Borough. This area, combined with the Central and Southern Peninsula Areas (including the larger borough communities of Kenai, Soldotna, Homer, and Seldovia, and many smaller communities along the west coast and southern tip of the Peninsula), make up the Cook Inlet Census Division. Because of the sparse population in Tyonek and the Western Peninsula, data is often not available for the village or the Tyonek-Beluga-area independent of the census division.

Tyonek is a Native Alaskan village which had a population of 239 in 1980--only 7 persons more than in 1970. The only non-Natives in the village are teachers who remain as residents for periods of a year or so. The median age is 16.6 years for males and 18.6 years for females (1980), about 10 years younger than for the rest of the borough or the state (Bechtel, 1983: pp. 6-85, 6-104).

The for-profit Tyonek Native Corporation represents the Natives in the village. The corporation is a member of the Cook Inlet Region, Inc. The Tyonek Native Corporation has the right to determine the development and use of its lands [more than 115,000 acres (47,000 ha)], and to lease parcels for development by others. The policy of the corporation in the past has been not to allow easements and rights-of-way across their land, thus limiting the development of natural resources in the Tyonek area (Bechtel, 1983: pp. 6-87 - 6-89).

Tyonek is a Federally chartered Native village, but is not an incorporated city under Alaska law. The Village Council is currently considering incorporation in order to assume more responsibility and control of Village land, growth, and improvement (Bechtel, 1983: pp. 6-90 - 6-91).

Employment opportunities in the Tyonek area are limited to a few service jobs in the Village and to jobs in the development of natural resources, e.g., commercial fishing, timber harvesting and processing, and exploration for petroleum. Most of these opportunities are seasonal, and thus unemployment is high, particularly in winter. Personal income is low; a 1980 survey found that 70% of the 40 households sampled (about 35% of the total households in the community) had household incomes of less than $10,000 per year (Kenai Peninsula Bor. Resour. Dev. Office, 1983). This figure is only slightly above the 1978 per capita income of $9,408 for the Kenai/Cook Inlet Census Division. It is considerably lower than the $28,864 annual "family budget required for a moderate standard of living" in 1979, according to the Alaska Department of Commerce and Economic Development (Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 60). All the households surveyed relied on Native/Public Health benefits or some other form of aid (e.g., food stamps, Social Security) to supplement their incomes (Bechtel, 1983: pp. 6-104 - 6-107).

Because of strong ties to the historical Native Alaskan culture, the lack of employment opportunities, and the low incomes in the Western Peninsula, there is heavy reliance on subsistence activities. Traditional modes of hunting, fishing, and gathering provide food and contribute to social and cultural cohesion. Subsistence activities, like employment opportunities, are more productive and accessible during the summer months (Bechtel, 1983: pp. 6-99, 6-107 - 6-108).

The Tyonek Village is in the Central Hospital Service Area, to which residents pay property taxes. The service area supports the hospital (located in Soldotna on the Kenai Peninsula), fire services, and public recreation facilities. The mill rate in 1982 was 4.37, down about 0.5 from that charged in 1979 through 1981 (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 70-71).

Nearly all of the 90 or so homes in Tyonek are single-family residences owned by the Tyonek Village Council. There are only six trailers (two are temporary residences for school teachers) and no multifamily units. Worker camps are provided for permanent and temporary work forces on the nearby lumber mill, gas-fired generation facilities, and crude oil processing plants and pipeline (Cook Inlet Region, Inc. and Placer Amex Inc., 1983: pp. 10-1, 10-2). One temporary lodging facility, the Shirleyville Lodge, has capacity for 24 persons (Bechtel, 1983: pp. 6-110 - 6-111). Vacancy rates are not available, but because so much of the housing is in single-family units, the rate is probably very low. It may also vary seasonally, as is characteristic of Alaskan communities dependent on seasonal industries for employment. Information on the availability of rental units, aside from the lodge, is also not available.

The village has its own water system, which depends on a lake as it source. All houses are on this system. Well water is used for all public buildings and services, and by the timber and petroleum exploration industries. Large septic tanks provide the village with wastewater disposal. These tanks are in need of improvements and maintenance (Bechtel, 1983: pp. 6-114 - 6-115).

Police service is provided by a resident constable who is employed by the Alaska State Troopers. Industrial construction camps provide their own security forces. The U.S. Bureau of Land Management provides fire protection services in Tyonek (Bechtel, 1983: p. 6-113).

A medical center in Tyonek has medical and dental care facilities, but no doctors or dentists are in permanent residence in the community. Emergency health care can be provided by a resident licensed practical nurse, a community health aide, the police constable, or the U.S. Air Force. Natives receive health care without charge from the community health aide, whose services are provided by the U.S. Public Health Service. For more extensive care, residents must go to Anchorage or to the Kenai Borough's Central Hospital in Soldotna (Bechtel, 1983: p. 6-114).

There is one school in Tyonek that serves elementary through high school students. In October 1982, 89 students were enrolled. Enrollment has fluctuated between 86 and 107 over the four previous years (Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 51). Capacity of the school facilities is 240 students (Bechtel, 1983: p. 6-111).

Tyonek and the Chuitna and Beluga River areas are accessible by unpaved roads, some built by a local logging company. Most roads do not penetrate far inland from the coast. The roads are in relatively good condition. However, no road between Tyonek, the Beluga area, and Anchorage is open year-round, except when the Susitna River freezes to provide a winter crossing. A year-round road has been proposed and planned, but will not be constructed unless resource and other development occurs in the Beluga area, e.g., development of the Beluga coal field (Bechtel, 1983: pp. 6-116 - 6-118).

Air access is primarily via an airport operated by the village. The village has retained responsibility for this airfield, despite large expenses, in order to control permission to land. There are also several other privately owned, smaller, and less well-maintained strips in the area (Bechtel, 1983: pp. 6-91 - 6-92, 6-119).

Tyonek and industrial operations along the coast also are served by barge (Bechtel, 1983: p. 6-119).

N.1.3.2 Coal-Fired Generation Scenario

The coal mine that would supply the five 200-MW coal units and ten 70-MW combustion turbines would be the Usibelli Mine near the community of Healy in the Yukon-Koyukuk Borough. Two of the coal units would be in Willow in the southern Railbelt, and three more in Nenana, north of Healy and also in the Yukon Koyukuk Borough. The socioeconomic environments of all of these communities are described in Section N.1.1. The ten 70 MW combustion turbines would be located around Cook Inlet, including the Tyonek area, metropolitan Anchorage, and the northern Kenai Peninsula. Anchorage is described in Section N.1.1; the northern Kenai Peninsula and the Tyonek area in Section N.1.3.1.

N.1.3.3 Combined Hydro-Thermal Generation Scenario

Locations of the five potential hydropower facilities are shown in Figure N-3. The socioeconomic environment of Johnson includes the communities of Tok, Delta Junction, and metropolitan Fairbanks. The Keetna hydropower alternative would be located near Talkeetna in the Mat-Su Borough. This alternative could affect other communities along the Railbelt, and the metropolitan areas of Anchorage and Fairbanks. Snow would be sited near the southeastern coastline of the Kenai Peninsula. Its socioeconomic environment would include the city of Seward and the Eastern Peninsula section of the Kenai Peninsula Borough. The Browne hydropower alternative includes in its socioeconomic environment the communities of Healy and Nenana in the Yukon-Koyukuk Borough, metropolitan Fairbanks, and the Railbelt communities in northern Mat-Su Borough. The Chakachamna site would be in the Tyonek area.

The thermal units in this scenario would be a subset of those described in Sections N.1.3.1 and N.1.3.2. Their socioeconomic environments would include Nenana, Healy, metropolitan Fairbanks, the northern Railbelt, the Tyonek area, and metropolitan Anchorage.

Most of the socioeconomic settings for the components of this scenario have been described previously. Healy, Nenana, Paxson, the entire Railbelt, Talkeetna, Anchorage, and Fairbanks are described in Section N.1.1. The Tyonek area and the northern Kenai Peninsula are described in Section N.1.3.1. Thus, only Seward, the Eastern Peninsula section of the Kenai Peninsula, Tok, Delta Junction, and the area between Tok and Delta Junction are described in this section.

N.1.3.3.1 Seward Area and the Eastern Kenai Peninsula

The Snow hydropower alternative would be located near the southeastern coastline of the Kenai Peninsula. The nearest population center is Seward, which is the largest population center on the eastern half of the Kenai Peninsula (called the Eastern Peninsula), with a 1982 population of 1,828. The population has declined in the last three years, but is still about 3% greater than in 1978. The Seward Census Division, which includes Seward and the eastern coastal areas of the Kenai Peninsula, has increased by 31% since 1970, to a 1982 total of 3,500. These figures, although high, are lower than those for the rest of the Kenai Peninsula Borough. In a 1977 survey, almost 50% of Seward residents questioned said they had lived there 11 or more years (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 27-28, 31).

Seward's population in 1980 had the highest median age in the borough: 28.7 years, and the lowest percentage of its population under age 18: only 24%. Fifteen percent of the city's residents were non-white (1980) (Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 30).

Projections of population have been made by the borough through 1992. (See discussion of the projection assumptions in Sec. N.1.3.1.1.) The low-case projection for the Seward Census Division is an increase to 3,507 persons in 1992 (1.1% annual growth between 1978 and 1992); the high case is 4,946 persons (4.6% annual growth rate). Peak growth of 10% annually under the high case is expected between 1982 and 1987 (Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 121).

Seward is a home-rule city and thus has power to tax its citizens, to provide education and other community services, and to plan and zone. A "Growth Management Strategy" was developed in 1979 for the Seward area. This report contains needs assessments and strategies for coping with projected growth, and evaluation of possible stimuli to growth, such as expanded development of natural resources on the outer continental shelf (Kenai Peninsula Bor. Resour. Dev. Office, 1983).

Seward is the southern terminus of the Alaska Railroad and is thus a transportation center for the state. However, freight only is transported by rail between Portage and Seward, except by special charter arrangement. Primary industrial bases for Seward are fishing, and processing of fish and timber. It is also a cargo port, since Resurrection Bay on which it is located is free of ice all year. Seward is the site of the University of Alaska Institute for Marine Sciences. The Eastern Peninsula is a popular tourist attraction, and tourism provides a big part of the economic base of the whole area (Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 3; The Milepost, 1983).

Employment statistics are available only on the census division level, which combines Seward and the Eastern Kenai Peninsula. Additionally, for many industries, data are suppressed to protect the privacy of individual firms which, in a small community like Seward, often dominate the economic environment. Generalizations must be made taking these qualifications into account. Federal, state, and local government employ about 20% of the working population in the Seward Census Division. The total labor force in 1982 was 1,622, with an unemployment rate of 14.7%. As with the rest of Alaska, unemployment rates have ranged widely in Seward over the past decade: from 9.2% in 1975 to 16.5% in 1972 and 1973. Unemployment is usually higher in the Seward Census Division than in the rest of the borough or in the state as a whole (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 53, 55).

Wages from government employment made up over 40% of the total wage payments in 1980. The 1980 per capita income was $11,967, slightly higher than the rest of the borough (Office Management and Budget, 1983: pp. 127, 130). However, the cost of living is also slightly higher in Seward compared to the rest of the borough (Kenai Peninsula Bor. Resour. Dev. Office, 1983: p. 60).

Assessed land value in Seward has remained about $50 million since 1980, when it was at a peak of $51.7 million. The total property tax rate dropped from 16 mills to 8.75 mills between 1979 and 1982. The city's property tax is 7 mills of the total 8.75 (1982 - down from 20 mills in 1976); the remaining 1.75 mills is for the borough. The Seward Service Area (fire protection and health services) has a tax rate of 6.25 mills (1982). Seward recently instituted a 1% sales tax (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 68-69: 71-72).

Household size in Seward averaged 2.8 persons in 1977, smaller on the average than for the rest of the borough. In 1978, there were about 600 households in Seward. In 1982, just under 70% of housing in the city of Seward was in single family units, with almost all the remaining 30% in apartment units. Less than 1% was in mobile homes. Unlike Homer and Seldovia, about 75% of all housing authorized for construction in Seward between 1978 and 1982 was in multiple-family units, and only about 30% in single-family units (see Table N-12). Vacancy rates are not available for Seward (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 30, 34, and 38).

Nearly all Seward households are on city water and sewer systems. Electricity is supplied by City of Seward Electric; oil is used as a heating fuel in over 90% of the residences. Seward has one hospital and one mental health clinic. The city has its own fire and police departments, and areas around it are served by departments funded through service area taxes (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 39, 43, 49, 69).

The Eastern Peninsula has four elementary schools and one high school; one of the elementary schools and the high school are in Seward. Total elementary school enrollment in the Eastern Peninsula area in 1982 was 401 students (311 in Seward); total for the high school was 161. These figures are about 17% above enrollment five years ago. In the intervening years (1979-1981), enrollment declined and remained constant at about 520 students. The Alaska Vocational Technical Center and the University of Alaska Institute for Marine Sciences are both located in Seward (Kenai Peninsula Bor. Resour. Dev. Office, 1983: pp. 31, 51-52).

Seward is the terminus both of Highway 9 and the rail line from Anchorage. Highway 9 branches off Highway 1, which is the road access to the Peninsula. In the summer of 1981, on Highway 9 just south of the Highway 1 intersection, average daily traffic volume was 1,186 vehicles; in the winter of 1981, average daily traffic volume was 774 vehicles. About 43% of the vehicles were passenger vehicles, about 9% trucks or buses, the remainder pickups, panel trucks, and camper vehicles (Kenai Penin. Bor. Resour. Dev. Office, 1983: p. 88). State-run ferries also connect Seward with Homer, Seldovia, Valdez, and Kodiak Island. Seward Airport has scheduled service to Anchorage and serves private planes (The Milepost, 1983).

N.1.3.3.2 Tok and Delta Junction Area

The Johnson hydropower alternative site is just north of the Alaska Highway about 140 miles [220 kilometers (km)] southwest of Fairbanks. The nearest major communities are Tok to the southwest and Delta Junction to the northeast of the site.

Tok is a small community at the intersection of the Trans-Alaska Highway and the Tok cut-off of the Glenn Highway. The town serves as a point of entry to Alaska. It is about 70 miles (110 km) southeast of the Johnson site. Tok's 1980 population was 750, up 250% since 1970 (The Milepost, 1983: p. 104; U.S. Bureau of the Census, 1970). The town is primarily a service center for tourists and other highway travelers. Thus, employment is seasonal for many residents. Many residents are also involved in raising dogs for sledding and breeding (The Milepost, 1983: p. 105).

The town is unincorporated. Services are provided through state planning and funding. The elementary and high school in Tok are administered by the Alaska Gateway School District. There are several motels and three commercial campgrounds in the town (The Milepost, 1983: p. 101; Alaska Dept. of Community and Regional Affairs, 1983). Tok has a public health clinic, a fire department, a State Trooper station, and small airfield that serves private and chartered planes (The Milepost, 1983: p. 101). In 1982, a monthly average of 11,620 vehicle passengers entered Alaska at the Tok station, an average increase of 6%. In June alone, almost 33,000 passengers entered (Kenai Penin. Bor. Resour. Dev. Office, 1983: p. 89). Assuming an average of three passengers per vehicle, this figure means at peak times, 11,000 vehicles may pass through Tok and this section of the Alaska Highway each month.

Two small native communities, Tanacross and Dot Lake, are located along the Alaska Highway between Tok and the Johnson site. Tanacross had a population of 117 in 1982. The population of Dot Lake was 67 people (The Milepost, 1983: p. 110). The 1970 populations were 84 and 42, respectively (U.S. Bureau of the Census, 1970). Tanacross has an airstrip and is the site of a fireguard station for the area. Dot Lake has a few lodging units and a few tourist-related services, e.g., gas station, restaurant (The Milepost, 1983: p. 110). The community is about 25 miles (40 km) southeast of the Johnson site.

One lodge with a restaurant and a lounge is located about 30 miles (50 km) northwest of the Johnson site on the Alaska Highway. The next community is Delta Junction, about 10 miles (16 km) farther northwest on the highway. Delta Junction is an incorporated community located at the junction of the Alaska and Richardson highways. In 1982 the population of Delta Junction was 1,044 (Alaska Dept. of Community and Regional Affairs, 1983), about one-third higher than its 1970 population of 703 (U.S. Bureau of the Census, 1970). Delta Junction has full community services, including a fire station and a health clinic, staffed by a physician's associate. Schools are administered by the Delta/Greenly School District. The town's commercial operations are tourist-oriented and are stretched along the Alaska-Richardson Highway. Delta also has an airport for private planes (The Milepost, 1983: pp. 111-113).

The area around Delta Junction is used for agriculture, primarily in growing barley. The state's Delta Barley Project I encouraged development of the area for barley production in 1978 with a lottery of 65,000 acres (26,000 ha) of land. By 1981, 15,000 acres (6,100 ha) were cleared and in production, including 13,000 acres (5,300 ha) barley (The Milepost, 1983: p. 113).

Between Delta Junction and Fairbanks are a number of lodges, motels, and other tourist facilities. One community, North Pole (1980 population of 928), is located just south of Fairbanks. North Pole's commercial operations are primarily tourist-oriented. The town is the home of many people who commute to Fairbanks for employment and most services (The Milepost, 1983: pp. 115-116).

N.2 ENVIRONMENTAL IMPACTS

N.2.1 Proposed Project

N.2.1.1 Watana Development

N.2.1.1.1 Introduction

Impacts related to the proposed Susitna project would be the same kinds that have occurred as a result of many other large-scale energy projects. Commonly called "boomtown" phenomena, they are a result of sudden, rapid growth in population in a rural area. Population growth is caused by an influx of project construction workers (direct workers), workers to staff the support services created by the new population (support workers), and the household members who accompany direct and support workers. After a few years, however, when the peak in construction work force is passed and the work force size begins to decline, many of these new residents leave the area, causing a "bust" period. The decline continues until the project is in operation. The operations staff is generally far smaller than the peak size of the construction work force.

One measure of boom-bust impacts to the project area communities is the ratio of the size or peak work force to the size of the operation work force (Denver Research Institute et al., 1982: p. III-4). For Watana Dam and Devil Canyon dams combined, this ratio is 21:1, indicating a potentially great difference between peak and long-term, post-project demands for housing and other community resources. In some of the following sections, descriptions of impacts include those from both Watana and Devil Canyon, as cumulative impacts of the two should not be separated Impacts specific to Devil Canyon development are in Section N.2.1.2.

N.2.1.1.2 Population

GENERAL DESCRIPTION OF PROJECTIONS

Potential socioeconomic impacts of the proposed Susitna project (including both Watana and Devil Canyon dams) would occur primarily as a result of project-related population increases. As described in Section N.1.1.2, population projections for the project area vary greatly. Those made during the early 1980s reflected the massive growth in population associated with the Trans-Alaska Pipeline project and other natural resource development projects in the state. They also reflect an assumption of continued resource development and increasing state revenues from existing and new development. Based on these estimates, growth in general is expected to continue at a rate only slightly less than over the previous decade. More recent projections, however, reflect other conditions. The drop in oil prices has reduced state revenues and slowed development of new supplies of energy resources in Alaska. Inmigration, a major source of the earlier population growth, has slowed due to fewer employment opportunities in the more sluggish economy. Thus, projections made in 1983 by ISER, for example, reflect far lower growth rates.

Mat-Su Borough planners, however, in a special survey of their population in 1982, found earlier projections made by their consultants for that year low for their borough. Their compromise was to calculate the percentage lower the actual 1982 population was from the previous year's projections and add that percentage (approximately 10%) to each year in the projections to 2010 (Mat-Su Borough Planning Dep., undated). Mat-Su Borough planners have found ISER projections of the past few years to be low, and thus have used sample surveys and projections made by other consultants specifically for the Borough in their planning. In this analysis, the lower ISER baseline projections will be used as a base for the low-boundary of project impacts (see below). Borough projections will be used as an indication of potentially greater population impacts.

It is a complex task to allocate the project work force, accompanying persons, workers for support jobs created by increased demand from direct workers, and household members accompanying both groups to population centers in the project area. Assumptions must be made about how many current residents will fill direct and support jobs, how many inmigrants will be temporary residents for their term of employment on the project, how many people will accompany inmigrant direct workers, how many support workers are needed per inmigrant direct worker and household member, and so on. The assumptions made are based on literature reviews, historical data on the project area, and judgments of local authorities. The numbers projected are then added to baseline population projections to generate "with-project" population estimates for the region.

Other factors besides the accuracy of baseline data and of the many assumptions about the inmigrating population affect the quality of the projections. A recent study compared projections of impacts with what actually occurred for a number of large-scale construction projects of energy-producing facilities. Results showed that "the actual timing and magnitude of construction employment differed substantially from the estimates made prior to commencement of the project" (Denver Research Institute et al., 1982: p. S-1). Generally the estimates were low because of unexpected delays in construction schedules caused by such things as work stoppages or delays in receiving equipment or materials. The preproject estimates of peak work force size made in the 12 cases studied were low by less than 1% to as much as almost 195%; the estimates of when the peak would occur were early in 7 of the 12 cases by 2 to 36 months (Denver Research Institute et al., 1982: p. III-4). However, the same study found that total population growth (baseline plus project-induced) has generally been overestimated. The projections made here should be considered in light of these findings.

The same study also found that because specific skills in construction were needed for short periods of time relative to the total length of the construction period, turnover of workers was higher than expected. So while the number of workers was higher than estimated and the construction period longer, more workers than expected worked for shorter periods on the project, i.e., turnover was more rapid than the work force estimates would indicate (Denver Research Institute et al., 1982). It would seem then that demands for temporary or onsite housing rather than permanent housing would be higher - especially given the 21:1 construction-to-operation workforce ratio.

REVISING THE APPLICANT'S PROJECTIONS

The Applicant's model incorporates all the assumptions and data necessary to make population projections for the project. Numbers of direct or project workers, support workers, and househol members have been generated and allocated to many of the region's population centers. Construction and operation workforce requirements are shown in Table 2-1. Based on evaluation of the documentation of this work, the assumptions and data on project-related population will be used by the staff as part of this analysis. However, these project-related population figures will be added to the 1983 ISER baseline population projections. These baseline projections are considerably lower then the Applicant's baseline, as discussed in Section N.1.1.2, and shown in Table N-1. Thus, overall with-project estimates of population growth would be lower than those in Exhibit E (Vol. 7, Chap. 5). Additionally, other qualifications must be placed on these projections. These qualifications are discussed below, as are the modifications made by the staff to the Applicant's estimates.

The Applicant has used literature reviews of similar large-scale project situations and evaluations of the availability of local, regional, and state residents for the work force to predict the number of project workers who would be temporary or permanent inmigrants to the project area.

Projections of impacts could vary widely, depending on the transportation plans available (Metz, 1983). For example, if the Applicant were to arrange air commutes from Anchorage and Fairbanks and a work schedule of two weeks onsite followed by one week off, many workers might choose to use onsite facilities during the onsite periods and have permanent residences in Anchorage or Fairbanks. If the same work/leave schedule existed and commuting service were offered only by road to the Denali or Parks Highways, some workers might be more likely to make onsite housing their permanent residence. Others may set up permanent residences in the small communities along the Parks Highway. The first scenario would mean greater impacts to the two large metropolitan areas than to the local project area; the second would mean greater impacts to the small communities near the site and negligible impacts on Anchorage and Fairbanks. The projections made in this document are based on assumptions like those of the second scenario, i.e., transportation would be offered offsite by commuting services or private vehicles only to the Denali or Parks Highways. These assumptions are more consistent with the Applicant's current project proposal. However, because of the possibility of impacts to Anchorage and Fairbanks, the potential for the first scenario will be discussed. As worker transportation plans and work-leave schedules develop, assumptions made by the Applicant and in this document as to numbers and characteristics of the inmigrating population may change.

The Applicant has made several assumptions which lead to conservative projections of project-related (basic, support, and households) inmigration. These will be discussed in the following paragraphs. It has been assumed in the Applicant's projections that no single workers would choose to relocate their permanent residences to population centers near the site, i.e., all inmigrating single workers would live at the construction camps or in temporary housing in these population centers. Since many construction workers on this remote and seasonal project may be single, this is a fairly strong assumption which reduces projected population impacts considerably. However, if work/leave schedules, transportation plans for workers, and onsite lodging and food are attractive, the assumption may be a good one. Unfortunately, transportation plans, features of the construction camps, access routes, and work schedules have not yet been determined. Without this information, it is difficult to evaluate the appeal of onsite housing and the incentives for workers to maintain permanent residences outside the area.

The Applicant's model also allocates inmigrating workers who are expected to reside (temporarily or permanently) offsite according to commuting time from the community to the site. Although transportation time is a crucial factor, two qualifications need to be made that may change this allocation. First, until transportation plans for workers are developed (e.g., whether opportunities will be provided to fly weekly from the site to Fairbanks, Anchorage, or other areas) and access routes are determined, it is not clear which communities would be the closest in travel time. This assessment will be based on the plan as proposed, i.e., that most workers would live onsite. Secondly, studies of workers on other transmission line and powerplant construction projects have indicated that the availability and supply of housing, shopping facilities, and community services may be as important in determining where workers, especially those with families, would settle, regardless of distance from the site (Denver Research Institute et al., 1982; Gale, 1982). Additionally, acceptable commuting distances in sparsely populated rural areas are generally greater than in densely populated areas (Murdock and Leistritz, 1979).

The Applicant assumes that only 7% of the work force would come from Mat-Su Borough. Yet, only 10% of project workers who are hired from the rest of the Railbelt, Fairbanks, or Cook-Inlet regions, are expected to move nearer to the site, e.g., to Talkeetna, Trapper Creek, or Cantwell (Exhibit E, Vol. 7, Chap. 5, pp. E-5-59 - E.5-60). This assumption is counter to the increasing trend in Alaska and in the lower 48 states of population migration from metropolitan to non-metropolitan areas. Evidence of this trend in the project region is the rapid growth of the Palmer-Wasilla-Houston area north of Anchorage, as discussed in Section N.1.1.2. Based on this assumption, projections by the Applicant are that of a peak 1990 work force of about 3,500 workers (Exhibit E, Vol. 7, Chap. 5, Table E-5-28), only 345 will inmigrate to Mat-Su Borough, most of these to Talkeetna, Trapper Creek, and nearby small, unincorporated communities. Very few are projected to locate in the Anchorage area and fewer still in the Fairbanks area.

Over the five year period of 1988 to 1992, when project employment for six months of each year would be 2,000 or more, the Applicant projects that only a cumulative 334 workers would become permanent residents. Because project employment numbers serve as a basis for the multipliers used to predict numbers of in-migrant support workers and accompanying persons, the Applicant will also have lower projections for overall in-migration. Second, it has also been stated by the Applicant that only 7% of the work force would come from Mat-Su Borough. More than 55% would be from Anchorage and another 24% from Fairbanks (Frank Orth & Assoc., 1983: pp. 43-44). With over 93% of the work force expected to come from outside the borough and most of that from 200 mi (320 km) away, it seems likely that the projection used by the Applicant of 10% inmigration to communities nearer the site is a low-bound estimate.

The Applicant also assumes that onsite housing would be used to maximum capacity. Given the results of the study discussed earlier that many more workers than initially projected work for shorter periods on construction projects, this may be a good assumption. A counter argument, however, is that in the case of the Trans-Alaska Pipeline project, many workers came to Alaska or from other parts of Alaska using employment on the pipeline as an opportunity to establish residence in the area. Additionally characteristic of population influxes related to large-scale Alaskan construction projects is the fact that a large number of unemployed workers come to the project area looking for employment (McAnerney, 1982; Lewis, 1983: p. 2). Some of these are hired as project workers or in support jobs stimulated by the project; others take up residenc in the area, although unemployed, in the hopes of finding positions later. Although it is very difficult to project the number of people who would be attracted by, but not employed by, the Susitna project, the fact that this phenomenon occurs makes conservative any projections based only on project employment.

The Applicant's projections of inmigrating direct project workers, support workers, and household members and a staff-revised version are shown in Table N-13. Distribution of population to communities is made in two ways. One is according to the Applicant's model, and the other is a staff-modified version that includes Healy, Nenana, and Paxson in the allocations. The staff modified the projection to include these additional communities for two reasons. The communities are as easily accessible from the project site as many of the communities in the Mat-Su Borough. Healy and Nenana are on the Parks Highway, the major route to Fairbanks; Paxson is at the intersection of the Denali and Richardson highways, which are also access routes to Fairbanks and Anchorage. The second reason is that Healy and Nenana are also established communities of greater size and development than Mat-Su communities near the project site, and there is some evidence that construction workers will sacrifice some commuting convenience to have access to established community settings and services (Denver Research Institute et al., 1982; Gale, 1982). The redistribution of some of the population to Healy, Nenana, and Paxson was done in a simplistic way and is intended to present more of a qualitative idea of impacts to these communities rather than quantitative results.

To accomplish the revised distribution, four assumptions were made by the staff. First, fewer people would inmigrate to Healy and Nenana than to northern Mat-Su Borough communities. This is because Healy and Nenana are farther from the project site. Second, the population to be redistributed is taken from Houston, Wasilla, and Palmer because of their greater distance from the project site. Third, the percentage of population taken from distributions to Houston, Wasilla, and Palmer should be less than half because of the historical attraction of these population centers and their greater size. They also are closer to Anchorage, which is a larger service and transportation center than Fairbanks. An arbitrary choice of one-third of the population allocated to the three Mat-Su towns is reallocated to Healy, Nenana, and Paxson. Fourth, because Healy and Nenana are larger than Paxson and are located on the more well-used Parks Highway, they are each allocated 40% of the redistributed population, and Paxson is allocated 20%. Unadjusted and adjusted distributions and projections are shown in Table N-13.

The projections used for Cantwell are those of the Applicant's high case, which was made based on the assumption that AHTNA, Inc. would decide to allow development of their land in the Cantwell area for residences (Exhibit E, Vol. 7, Chap. 5, pp. E-5-43 - E-5-44). Additionally, a temporary construction camp is proposed for Cantwell with capacity to house the approximately 200 workers constructing the railhead facility. These workers are included in the projections. If AHTNA, Inc., did not allow development of its land for housing, the projections for Cantwell would be far lower (see Exhibit E, Vol. 7, Chap. 5, Table E.5.24). Projections for other nearby communities would also be higher, as workers who want to have their households near the site choose the next closest alternatives.

MAT-SU BOROUGH PROJECTIONS

Mat-Su Borough planners have also made projections of population that include Susitna project effects. In making these projections, borough planners evaluated a number of widely ranging projections made by various demographers in public and private agencies. Historical growth

Table N-13. Cumulative Distribution (applicant's and revised) of Projected Project Population to Impact-Area Communities, Alternate Years Plus 1990 (Peak Year) and 2002 (End of Construction)†[1]

Community/ Planning District	1985	1987	1989	1990	1991	1993	1995	1997	1999	2001	2002
Talkeetna											
Applicant	25	174	267	335	323	250	222	240	257	230	209
Revised	25	174	267	335	323	250	222	240	257	230	209
Trapper Creek											
Applicant	32	241	378	475	451	288	227	278	314	256	212
Revised	32	241	378	475	451	288	227	278	314	256	212
Houston											
Applicant	4	23	35	44	42	37	35	36	37	35	33
Revised	3	15	23	29	28	25	23	24	23	23	22
Wasilla											
Applicant	5	31	47	59	57	48	44	46	48	44	42
Revised	3	21	31	39	38	32	29	31	32	29	28
Palmer											
Applicant	5	26	39	49	48	39	35	37	39	36	33
Revised	3	17	26	33	32	26	23	25	26	24	22
Other											
Applicant	40	226	341	427	415	351	327	338	352	328	308
Revised	40	226	341	427	415	351	327	338	352	328	308
Mat-Su Borough Total											
Applicant	110	721	1,107	1,389	1,337	1,013	891	975	1,047	930	837
Revised†[4]	105	694	966	1,338	1,288	972	852	936	1,006	891	801
Cantwell											
Applicant	430	638	843	999	984	920	785	785	796	767	744
Revised	430	638	843	999	984	920	785	785	796	767	744
Healy											
Applicant	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revised	2	11	16	20	20	16	16	16	16	16	14
Nenana											
Applicant	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revised	2	11	16	20	20	16	16	16	16	16	14
Paxson											
Applicant	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revised	1	5	9	11	9	9	7	7	9	7	8
Anchorage Census Division											
Applicant	435	325	537	663	556	-219	-523	-219	-36	-333	-532
Revised	435	325	537	663	556	-219	-523	-219	-36	-333	-532
Fairbanks Census Division											
Applicant	82	-89	-136	-173	-171	-280	-323	-295	-271	-309	-341
Revised	82	-89	-136	-173	-171	-280	-323	-295	-271	-309	-341

†[1] "Applicant" values are from Exhibit E, Vol. 7, Chap. 5, Table E.5.35. "Revised" values have been adjusted by the FERC Staff to include Healy, Nenana, and Paxson in the distribution. To accomplish this, one-third of the population allocated to each of Houston, Wasilla, and Palmer were subtracted, and then reallocated: 40% each to Healy and Nenana, 20% to Paxson.

NA = Not available.

patterns over the past two decades showed dramatic growth rates: 25% in the 1960s and 200% in the 1970s. However, Alaska's history shows several periods of population booms followed by busts. Some demographers felt that recent growth rates would continue; others that they would taper off. Different projections included different assumptions regarding construction projects and thus growth was based on varying labor force expectations. The borough rejected many of these projections (including ISER's) as too low because the borough planners felt that the projections were not confirmed by recent growth patterns. Thus, a great deal of uncertainty exists about Mat-Su Borough growth patterns (DOWL Engineers, 1983). In their official projections, borough planners assumed a more stabilized but still growing population, particularly in the area north of Anchorage, and inmigration of people for construction of the proposed Susitna project.

COMPARISON OF APPLICANT AND BOROUGH PROJECTIONS

Projections and distribution of project-induced population changes, excluding baseline population, made by the Applicant and Mat-Su Borough planners are shown in Table N-14. Population was distributed by the borough to borough planning districts, not particular communities, as discussed in Section N.1.1.2. Planning districts may include one or more communities and a large amount of relatively unpopulated land. The Applicant allocated project-related populations specifically to communities. Thus, the geographical areas used for distribution comparison are not identical. However, an examination of a map of borough planning districts shows that with the exception of the "Other" and "Willow" categories, the districts include the communities in the Applicant's projections. Comparison of the two projections should thus be based on relative estimates and distribution rather than absolute numbers. The "Other" category for Mat-Su Borough covers the interior of the borough in which the Susitna project, but no population centers, are located. Thus, it includes the population in onsite housing, a population (3,300 or more at peak) considerably higher than the current population (<200) in this geographical area. The "Other" category for the Applicant includes any part of the borough not specifically listed separately, including any population centers. However, it excludes the population housed onsite. (See footnote 3 in Table N-14.)

It is clear that both the distribution schemes and the size of the project-related inmigration differ depending on the source of the projections, particularly between 1988 and 1992. The borough's projections are much higher and concentrated more in communities and land areas very near the site--Talkeetna and Trapper Creek--rather than distributed over the Railbelt. They indicate considerably greater population impacts to these communities. The Applicant's projections are lower for all communities and the total borough, and are distributed more widely. Even if a peak onsite population of 3,300 (Exhibit E, Volume 1, p. A-1-25) is added to the Applicant's "Other" category and to borough totals during peak construction years, the numbers are substantially lower. Besides being higher, Mat-Su Borough projections show project-induced population growth concentrated in communities closest to the project site. The earlier discussion on the importance of assumptions on worker transportation and work-leave schedules should be kept in mind in evaluating these impact projections.

Numerous assumptions, uncertainties, and complexities are inherent in projecting socioeconomic impacts of any large-scale energy project. Recent research comparing projections with what actually occurred during construction and operation periods revealed problems of, for example, underestimation of project schedules and work force size and turnover, and overestimation of incoming support population (Denver Research Institute et al., 1982). In light of these points, a compromise position is taken on the population projections used in the remainder of this section on socioeconomic impacts. Specifically, two sets of projections are used to provide a range for Mat-Su Borough. They are shown in Table N-15. The lower set [Applicant (Revised)] is that made from combining ISER baseline projections with the Applicant's project-induced (direct and support workers and their accompanying household members) population projections distributed according to the revised plan (i.e., including Healy, Nenana, and Paxson). This set also includes projections for Anchorage, Fairbanks, Cantwell, Healy, Nenana, and Paxson. The higher set of projections (borough) is that made by the Mat-Su Borough planners. These represent higher borough impacts, impact areas closer to the project, and are the basis for any borough preparations in process or anticipated. For communities not in Mat-Su Borough, only the one set of projections is used. Both sets, however, when compared with ISER baseline figures in Table N-1, indicate substantial population growth in the small communities near the project site.

The values in Table N-15 show that very large discrepancies exist between borough population projections and the Applicant's revised projections. Because estimates of other impacts are calculated on the basis of population projections (e.g., housing, community services), they too will have the same wide range. Thus, precise or even narrowly-bounded estimates cannot be made with confidence.

Despite the fact that these two widely different sets of population projections do not help to make precise impact projections, they are used for several important reasons. First, as discussed earlier, projections of baseline population growth made for Mat-Su Borough have varied widely over the last few years. The ISER baseline used by the Applicant was for higher than the

Table N-14. Cumulative Distribution of Annual Project-Induced Population to Mat-Su Borough Communities as Projected by Applicant (Unrevised) and Mat-Su Borough Planning Department

Community/ Planning District†[1]	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Talkeetna																		
Applicant	25	33	174	237	267	335	323	294	250	233	222	229	240	253	257	251	230	209
Borough	NA	NA	NA	882†[2]	854	826	796	551	302	265	295	385	405	244	90	60	65	NA
Trapper Creek																		
Applicant	32	43	241	337	378	475	451	387	288	250	227	247	278	306	314	302	256	212
Borough	NA	NA	NA	588†[2]	570	550	530	368	202	177	196	256	270	162	60	40	42	NA
Houston																		
Applicant	4	5	23	31	35	44	42	40	37	36	35	35	36	37	37	36	35	33
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wasilla																		
Applicant	5	7	31	42	47	59	57	54	48	46	44	45	46	48	48	47	44	42
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Palmer																		
Applicant	5	6	26	35	39	49	48	44	39	37	35	36	37	39	39	39	36	33
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other																		
Applicant†[3]	40	52	226	303	341	427	415	390	351	336	327	331	338	349	352	346	328	308
Borough	393	1,542	4,296	5,013	5,059	5,107	5,157	3,519	2,600	2,649	2,652	2,920	2,884	1,840	1,107	1,025	1,066	NA
Mat-Su Borough Total																		
Applicant†[3]	110	146	721	985	1,107	1,389	1,337	1,210	1,013	937	891	924	975	1,032	1,047	1,021	930	837
Borough†[4]	393	1,542	4,296	6,483	6,483	6,483	6,483	4,438	3,104	3,091	3,143	3,561	3,559	2,246	1,257	1,125	1,173	NA

†[1] The applicant allocated projected population specifically to the communities listed. The borough planning department allocated projected population to planning districts that include the community and some surrounding land. The units are similar, although not identical, geographical areas.

†[2] It is not clear from the source if all these persons would move in only during 1988 or over several of the previous years.

†[3] Excludes workers, household members, and staff housed in onsite housing. If these workers were added, peak years of 1990 and 1999 would increase in the "Other" category to 3,727 and 2,552, respectively, and to 4,689 and 2,847 in the Total Borough, respectively.

†[4] It is not explicitly stated that projections for this planning district include persons housed in onsite facilities, but the large numbers during peak Watana employment years imply that these persons are included.

NA = Not available. Borough projections not made for these areas/years.

Sources: Applicant's projections are from Application Exhibit E, Vol. 7, Chap. 5, Table E.5.35; Mat-Su Borough projections are from: DOWL Engineers (1983), pp. IV-21 - IV-22.

Table N-15. Cumulative Projections of Total Population including Susitna Project as Made by Applicant (Revised)†[1] and Mat-Su Borough†[2] for Alternate Years and 1990 (peak year) and 2002 (end of construction)

Community/ Planning District	1985	1987	1989	1990	1991	1993	1995	1997	1999	2001	2002
Talkeetna											
Appl. Rev.	648	833	955	1,035	1,046	975	948	967	1,092	977	913
Borough	1,209	1,463	2,577	2,687	2,806	2,582	2,833	3,151	3,060	3,149	3,278
Trapper Creek											
Appl. Rev.	247	468	615	716	700	538	477	528	567	514	472
Borough	172	208	815	815	816	526	556	659	481	478	498
Willow											
Appl. Rev.†[3]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Borough	1,073	1,298	1,528	1,650	1,782	2,021	2,249	2,433	2,631	2,736	2,845
Houston											
Appl. Rev.	583	628	664	681	701	700	699	700	709	719	724
Borough†[4]	3,874	4,687	5,518	5,959	6,436	7,300	8,125	8,788	9,506	9,886	10,281
Wasilla											
Appl. Rev.	2,085	2,225	2,334	2,381	2,456	2,457	2,457	2,462	2,491	2,529	2,551
Borough	13,709	16,942	20,363	22,217	24,237	28,041	31,824	35,085	38,667	40,960	42,600
Palmer											
Appl. Rev.	2,472	2,630	2,756	2,809	2,898	2,901	2,901	2,907	2,941	2,988	3,013
Borough	6,722	7,779	8,742	9,216	9,710	10,461	11,029	11,265	11,467	11,551	11,626
Other											
Appl. Rev.	16,555 (15,538)†[5]	18,600 (16,629)	20,465 (17,483)	21,824 (17,857)	21,883 (18,411)	20,126 (18,402)	19,454 (18,399)	20,195 (18,430)	20,838 (18,655)	20,122 (18,937)	19,475 (19,089)
Borough	542	4,476	5,271	5,336	5,404	2,880	2,964	3,221	1,471	1,404	1,460
Mat-Su Borough Total											
Appl. Rev.	22,588 (21,571)	25,384 (23,413)	27,690 (24,708)	29,447 (25,480)	29,685 (26,213)	27,698 (25,974)	26,937 (25,882)	27,759 (25,994)	28,540 (26,357)	27,850 (26,665)	27,199 (26,813)
Borough	32,927	44,103	53,558	57,254	61,205	64,617	71,511	77,494	80,782	84,175	87,205
Cantwell											
Appl. Rev.	527	739	948	1,106	1,093	1,033	902	906	921	898	878
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Healy											
Appl. Rev.	427	454	477	490	499	515	535	556	578	600	610
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nenana											
Appl. Rev.	531	572	611	633	651	685	726	769	815	864	887
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Paxson											
Appl. Rev.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anchorage Census Division											
Appl. Rev.	198,264	208,271	215,139	218,786	224,114	230,079	233,860	238,793	243,142	249,203	252,380
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fairbanks Census Division											
Appl. Rev.	63,643	66,659	68,836	69,887	71,510	72,841	73,720	74,559	75,734	77,281	78,165
Borough	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

†[1] Projections were made using ISER baseline projections as shown in Table N-6 and Revised applicant's project-related population projection from Table N-11.

†[2] DOWL Engineers (1983), pp. IV-18 - IV-19, except for Mat-Su Borough totals. Totals are updated, higher projections made in light of more recent censuses. However, these new figures were not distributed to Planning Districts. Thus, total population in any year exceeds the sum of the Planning Districts above.

†[3] Applicant did not make projections specifically for Willow, but instead included the Willow area in the "Other" category.

†[4] Borough's projection for Houston Planning District includes Big Lake.

†[5] Number outside parentheses includes residents of onsite villages and construction camps; number inside parentheses excludes those residents.

NA = Not Available.

more recent (1983) ISER baseline used in the revised Applicant's projections. Since the 1983 ISER projections were made, Mat-Su Borough officials have found that growth since 1982 has exceeded Borough projections. Because of the wide variance, it is best to use a range of projected population changes. The Applicant's revised projections will serve as the lower bound, and the much higher borough projections as the higher bound.

Another reason for using both these widely discrepant projections is to take into account both of the primary actions in institutional negotiations and planning that would take place should the proposed Susitna project be built. Borough officials are making plans for construction and expansion of community facilities and services based on their official projections. The Applicant, in a similar manner, is developing mitigation plans based on its projections of impacts. Thus, for political and fiscal reasons, impacts calculated based on these projections need to be identified and evaluated.

Finally, both borough planners and the Applicant are updating and revising their population projections. It is likely that the range of projections shown here will include revised projections made by both groups.

Comparing the two sets of projections raises another important point. The stability of the population and the percentage of the peak which remains in the area determines the severity of "boom-bust" impacts. The borough projects far more volatility in the population than does the Applicant. For example, the number of project-related residents in Talkeetna in 2001 as projected by the borough is only 7% of the number at the peak in 1988. According to the Applicant's projections, the comparable statistic is 69% in 2001, and a far larger number remain permanently. The difference in situations projected in other borough communities is similar.

The percentage of a community/planning district's population estimated to be project-related is shown in Table N-16. The values in this table emphasize the differences discussed here, i.e., the degree of localized impact, and of boom-bust phenomena. "Boom-bust" phenomena are more difficult to plan for than gradual growth. Many assumptions must be made about how much of the boom population inmigrating will remain and how far existing community services and facilities can be expanded or stretched to handle the peak, yet not be left with unused capacity during the bust period which follows. Such phenomena have been well-documented (for example, Cortese and Jones, 1977; Payne and Welch, 1982). Thus, borough planners have greater expectations that the borough will experience these problems than the Applicant's projections of a more gradual and less volatile growth pattern. Such problems are discussed in greater detail in the sections that follow.

N.2.1.1.3 <u>Institutional Issues</u>

None of the small communities near the site (Talkeetna, Trapper Creek, Cantwell, Paxson) is incorporated. Either an incorporated borough (Mat-Su) or the state provides planning and community services. Because of greatly increased population, desire for greater local control, and potential need for larger tax revenues, Talkeetna and Cantwell may find it practical to incorporate. A vote was taken a few years ago by the residents of Talkeetna on incorporation, but it was defeated (Braund and Lonner, 1982). Other communities (e.g., Nenana and Houston) have incorporated at population levels of as low as 500 persons, a level that both these communities would rapidly exceed soon after project construction began.

Faced with increasing demands to provide planning and services, Mat-Su Borough would have to expand its administrative operations before property tax revenue was available to pay for it. Based on a ratio of about six borough staff employees in the Palmer office per 1,000 borough residents, the office would have to nearly double in size by the end of the project. New buildings would be needed to provide offices for the increased staff. Additionally, because much of the growth would occur in the northern portion of the borough nearly 200 mi (320 km) from Palmer, Borough planners are considering decentralizing Borough facilities and establishing local offices (DOWL Engineers, 1983: pp. IV-27-IV-28).

The Mat-Su Borough School District currently favors a plan by the Applicant to incorporate the proposed onsite school into the district when it is built. Thus, additional administrative duties would be taken on by the District as a result of the project (Exhibit E, September 1983, Suppl. Responses, pp. 5-4-1 - 5-4-2).

Goals of Native corporations in Cantwell and elsewhere are in general oriented to developing Native commercial and employment opportunities. The corporations favor the project because increased population and increased access to Native lands would make development easier and enhance tourism (Federal Energy Regulatory Commission, 1983; AHTNA, undated). However, the Watana project construction period would overlap with the adjustment of the Native corporations to the opening of sale of their stocks to non-Natives in 1991, as stated in ANCSA. This situation could spread their institutional capacities thinly and thus hamper their ability to develop project-related economic opportunities.

Table N-16. Percentage over Baseline ISER Projections of Population Growth Projected with Susitna Project†[1]

Community/ Planning District	1985	1990	1995	1999	2001/2002
Talkeetna					
Appl. Rev.	4	48	31	35	28
Borough	0	44	11	3	2
Trapper Creek					
Appl. Rev.	15	197	91	124	82
Borough	0	208	54	14	9
Houston					
Appl. Rev.	<1	4	3	4	3
Borough	0	0	0	0	0
Wasilla					
Appl. Rev.	<1	2	1	1	1
Borough	0	0	0	0	0
Palmer					
Appl. Rev.	<1	1	1	1	1
Borough	0	0	0	0	0
Other†[2]					
Appl. Rev.	7 (<1)	25 (2)	8 (2)	14 (2)	4 (2)
Borough	263	2,230	850	304	271
Mat-Su Borough Total†[2]					
Appl. Rev.	5 (<1)	22 (6)	8 (3)	13 (4)	5 (3)
Borough	1	11	4	2	1
Cantwell					
Appl. Rev.	443	934	671	637	555
Healy					
Appl. Rev.	<1	4	3	3	2
Nenana					
Appl. Rev.	<1	3	2	2	2
Paxson					
Appl. Rev.	NA	NA	NA	NA	NA
Anchorage Census Division					
Appl. Rev.	<1	<1	<1	<1	<1
Fairbanks Census Division					
Appl. Rev.	<1	<1	<1	<1	<1

†[1] The bases for selection of the years included in the table are: 1985 is the beginning of Watana construction; 1990 is the peak employment year for Watana construction; 1995 is the year Watana is operational and the lowest employment year; 1999 is the peak employment year for Devil Canyon; 2001/2002 is the last year of Devil Canyon construction or the year in which projections were made (see Exhibit E, Vol. 7, Chap. 5, Table E.5.28). No projections were made by the applicant after 2002; none were made by the borough after 2001.

†[2] Number outside parentheses includes residents of onsite villages and construction camps; number inside parentheses excludes those residents.

NA = Not Available.

Sources: Calculated from Tables N-1, N-13, and N-14.

Increased growth and development could interfere with subsistence activities particularly in Native Alaskan communities. Subsistence activities are protected by law for "rural Alaska residents" (Alaska Board of Game, undated: p. 70), as described in Section N.1.1.3. Project activity, population growth and improved access to hunting, fishing, and trapping areas could increase competition for subsistence harvests and drive fish and animals to new areas. Although the activities are protected by law, the availability of resources in traditionally used areas is not. Subsistence activities are usually carried on by Natives. Because of lack of training and because they are not members of construction workers unions, Natives are not expected to be hired for the project in great numbers. Thus, they will remain dependent on subsistence activities to supplement their food and other resource supplies. In addition to filling resource needs, subsistence activities are a part of a cultural heritage for Native Alaskans and for others who chose to live at least partially "cff the land" in remote areas of Alaska. With increased population and access to the area of the proposed project, those residents who preserve that culture may become more involved in the cash economy growth would bring (Justus and Simonetta, 1983).

N.2.1.1.4 Quality of Life

Attitudes of citizens and organizations in the project area toward the Susitna project are varied. In Section N.1.1.3, the population of the Talkeetna and Trapper Creek areas was categorized into two groups: long-term residents who had lived in the area prior to the opening of the Parks Highway in 1965, and generally younger, more recent residents who had settled in the area after 1965. The first group, the pre-road residents who have witnessed many changes in the area already, is less resistant to the Susitna project than is the second group of post-road, more recent residents. The second group feels that the project would bring increased population, industrialization, and commercialism, all undesirable changes from their point of view. Many members of both groups for the most part share an appreciation of the beauty and undeveloped nature of the area. They value the isolated and small-town nature of their communities (Acres American, undated).

Residents in both groups, but primarily in the post-road group, are concerned about the effect increased access would have on their quality of life. They have expressed fears that growth related to the project would interfere with their rural way of life. Those who live full- or part-year in residences accessible only by foot from the rail line are particularly concerned that they would no longer be able to carry on their way of life removed from and partially independent of other people (Federal Energy Regulatory Commission, 1983). Some have formed local citizens' organizations to oppose the project because of the changes they feel it would cause in the lifestyle of residents (Braund and Lonner, 1982).

The citizens' fears are supported by experience in other rapid growth areas. Greater formalization of activities and larger numbers of residents have changed the nature of small-town cultures reliant on personal trust, community social control mechanisms, and face-to-face contact. Crime, alcoholism, and other social problems increase. Shortages of housing and services also cause local inflation. Large numbers of newcomers bring new expectations for what is a good quality of life. As their numbers increase in proportion to the number of pre-project residents, they are able to change the nature of community decisions and operations. For example, those pre-project residents who qualify may pursue jobs on the high-paying construction work force. Positions they vacate in the community would be taken over by women drawn into the work force or by men or women newcomers. With such changes, formal childcare facilities would replace babysitting or family childcare. Examples of such changes in boomtown situations have been documented in many cases (Gilmore and Duff, 1975; Cortese and Jones, 1977; Freudenburg, 1976; 1979a,b; 1980; 1981; Finsterbusch, 1980; Gilmore and Stenehjem, 1980; Colorado Div. of Criminal Justice, 1981; Payne and Welch, 1982). [However, controversy exists as to the validity of some of this research (Wilkinson et al., 1982)]. These changes in quality of life would also occur in the project area.

Those long-term residents who have already seen many changes in the area are not so opposed to the project. Although they value the isolated and scenic setting and the rural, independent lifestyle, they have remained through other growth periods and adapted. They feel the Susitna project may bring a needed economic boost to the area. The conclusion of the Braund and Lonner study of the residents in the Talkeetna-Trapper Creek area is that one faction is strongly opposed, while another is neither opposed nor strongly supportive (Braund and Lonner, 1982).

Residents living north of Talkeetna and Trapper Creek are also divided in their opinions about the project. Cantwell area residents in general favor it because of the economic and employment opportunities they believe will accompany it. Their area offers few jobs for current residents and unemployment, especially in the winter months, is high. Residents of the area along the Parks Highway around the entrance to Denali National Park hold a different view on the project. They are dependent for their livelihood on park visitors and other tourists. Their concern is that project structures and access roads and the accompanying population growth will detract from the visual quality of the area and cause overuse of the wilderness. Because little land is available, they also fear that increased property values will cause commercial development of a strip along the Highway, increasing their competition and further detracting from the wilderness nature of the area (Braund and Lonner, 1982).

N.2.1.1.5 Economy and Employment

Boom-bust phenomena would also affect the economy of the project area. During construction and before the 1990 peak is reached, local commercial operations would benefit from increased sales to the larger population and from subcontracting for the project. Some operations might expand to serve the increased demand. New businesses might come in as the population grows to a level to support services previously offered only in Anchorage or Fairbanks. Local governments would experience a rise in revenue from sales taxes. However, shortages of housing, services, and supplies would raise prices and rents, causing local inflation. One effect of the Susitna project as a whole would be to increase accessibility to remote wilderness areas for tourists and for recreational and commercial hunters, trappers, and fishermen. This could have a positive economic impact in that communities would profit from visitors' expenditures. Project expenditures and subcontractors [estimated at $4.5 billion (Exhibit E, Suppl. Information, September 1983, p. 5-17-1)] would benefit some local businesses, although most work would probably be contracted in Anchorage or Fairbanks. Workers onsite would also buy goods and services in offsite communities.

As with many of the negative impacts, these positive effects are difficult to quantify. Many issues that have yet to be resolved - e.g., work/leave schedules and worker transportation plans - would affect the level of these impacts. However, it can be said that without a transportation plan to the larger metropolitan areas, communities nearest the site (northern Mat-Su, Cantwell) would experience the greatest commercial development and increased sales. If the transportation plan made it possible for workers to commute from Anchorage or Fairbanks, then these cities would receive these impacts. Relative to their present commercial development, the impacts would be small.

After the construction peak in 1990, demand for goods and services would drop as construction efforts were completed and workers left the area. Businesses might be left with large inventories and too many workers. Some might have to close, unable to continue on the reduced demand or until Devil Canyon construction brought in more inmigrants. Additionally, rapid growth boom periods, such as would occur in communities near the site, are often accompanied by inflation and difficulty in getting financing and supplies (Scrimgeour, undated; Gilmore and Stenejhem, 1980), creating difficulties for buyers and sellers alike. Residents with lower or fixed incomes would have their buying capabilities reduced (Clemente, 1973, 1975; Cortese and Jones, 1977).

Because of competition for jobs on actual construction of the project and the special skills needed for many of them, the Applicant does not expect many Natives to be hired in this capacity (Exhibit E, June 1983, Suppl. Responses, p. 5-2-2). However, construction of the proposed project could provide an opportunity for AHTNA, Inc., subsidiaries to expand their experience and business, in the form of catering, housekeeping, and maintenance for the railhead and onsite construction camps and for the onsite village. The increased population and improved access might also increase tourism to the area allowing AHTNA, Inc., to pursue its goal of developing more Native-owned and operated tourist-related businesses, e.g., catering or building and operating tourist lodging facilities. Increased access and population would also create a demand for development of Native lands held by several village corporations, (Ahtna, Chickaloon, Knik and Tyonek) for residences, recreation, and mineral extraction (Exhibit E, June, 1983, Suppl. Responses, p. 5-2-3).

Some guiding businesses might be displaced by the Watana dam construction and operation. Guides are registered by the state to operate in specific geographic areas, i.e., particular Game Management Units (GMU). Although guides may register in up to three units, seven registered for GMU 13 (which includes the dam site) operate only in that unit. These guides would lose their source of livelihood or have to reestablish themselves in another area. If reestablishment involves creation of new campsites or lodging facilities either in GMU 13 or located nearby for convenient accesses, financial losses could be substantial for these guides (Federal Energy Regulatory Commission, 1983; Rivers, 1983).

As described in Section N.1.1.5.1, the economy of rural communities and the employment and income of its citizens is highly dependent on state sources. The state's ability to continue its programs rests primarily on income from taxes on development of oil and natural gas resources on its land. The future of this source of income is in turn dependent on the price of oil (Alaska Dep. of Commerce and Economic Development, 1983). Both because of the declining prices of oil and natural gas and because future development may be more likely to occur on Federal land or outside the state's 3-mi (4.8-km) offshore limit, this financial resource may decrease in the future. Any decrease in the state budget increases competition among demands for state funds. Thus, financing for the proposed Susitna project could diminish the proportion of its funds the state could provide for local governments, private industrial developing, housing mortgages, and income for its citizens.

A recent report issued by the state's Office of Management and Budget presented an analysis of state revenues projecting future decreases. Suggestions to curb state spending in light of the decreases included stopping dividend distributions from the Alaska Permanent Fund and reinstituting a state income tax (Cony, 1983). A Federal study of the state's debt capacity and debt management found that in light of probable decreases in revenue, the state should consider setting up controls to limit the bonding capacity of borough governments and "[a]void any attempt to erode the Alaska Permanent Fund or weaken its position" (Seplocha, 1983). Financing a large proportion of the Susitna project would add to the problems of decreasing revenues, putting the state in the position of following some or all of these expenditure cuts. Rural residents and boroughs with little industrial base--such as Mat-Su--or unincorporated boroughs which the state manages--such as Yukon-Koyukuk--would feel the reduction in expenditures disproportionately to more developed and populated parts of Alaska.

Only a small work force would be required for project operation, and the Applicant has projected that many would live in the permanent village onsite, a projection with which Staff agrees. Because of these facts, impacts to the economy and employment would be minimal, once the area recovered from the decline in population between 1990 and 1995.

EMPLOYMENT

The Applicant assumes in its population model that 85% of laborers on both the Watana and Devil Canyon work forces would come from the Railbelt Region, 80% of the semi-skilled and skilled workers, and 65% of the administrative and engineering workers. No local hire program is planned beyond conforming to Alaska law which requires that "95[%] of all nonsupervisory employees be Alaska residents" (Exhibit E, Suppl. Information, September 1983, p. 5-11-1). Any person whose primary residence is in the state qualifies as a resident. The Applicant assumes that over half of the workers would come from the Anchorage area, about a quarter from Fairbanks, and only about 7% from the Mat-Su Borough. This is primarily because in Alaska, the construction industry is highly unionized and union hiring halls are located in the large metropolitan areas. No specific percentage was assumed to come from the Yukon-Koyukuk communities, but it would likely be a small number. The remainder of workers would come from other parts of Alaska and a few from out of state (Frank Orth & Associates, 1983: pp. 43-44).

Annual unemployment is high on the average, with large seasonal variations. The proposed project would provide many job opportunities, although these too would be seasonal. They may also be short-term, as different skill needs in construction pass quickly (Denver Research Institute et al., 1982). Thus, workers for the project would be available from the Railbelt area. Unemployment problems for current residents would be reduced. Because hiring would be through union halls in Anchorage and Fairbanks, Mat-Su Borough residents who are not union members or skilled workers would not be as likely to obtain project work. Additionally, the particular skill needed on a project may be available only from large labor pools found in metropolitan areas. Thus, direct project work opportunities may help to reduce the already fairly low unemployment rates in Anchorage and Fairbanks, but may do little to reduce the much larger unemployment in Mat-Su Borough.

Opportunities in support jobs generated by the increased demand for services would be more likely to employ local project area persons and help to reduce unemployment in Mat-Su communities near the site. However, current Mat-Su residents would have to compete with household members of inmigrating workers for these positions (McAnerney, 1982). Traditionally, construction work on large-scale projects pays higher wages than do support positions. Attracted by higher salaries, some skilled workers now in the borough would likely move to positions on the project, leaving their former positions open for new workers. However, given the occupational distribution described Section N.1.1.5.2, few residents would be eligible for such a move. Thus, Mat-Su residents would be competing for lower-paying support jobs induced by the project. More women would also be drawn into the labor force to fill lower-paying support jobs traditionally held by women.

Counter-balancing the expansion of job opportunities would be competition between older residents and inmigrants for business and jobs. Long-time operators of established businesses may not have the ability to change with the new and greater demands. Locals may not have the skills needed for the greater variety of more formalized and specialized jobs created.

Finally, as discussed in Section N.2.1.2, large-scale construction projects in Alaska (particularly the Trans-Alaska Pipeline) have historically attracted a larger group of job-seekers than could be hired (McAnerney, 1982). If this is the case for the proposed project, then unemployment figures may not change or may even increase in some communities.

Labor demand would start in 1985 at 1,100 workers, build to a peak of 3,498 workers on Watana construction, and then drop to a low of 649 workers in 1995. This boom-bust employment phenomenon would contribute to the volatile unemployment record of the past discussed in Section N.1.1.5.2.

Table N-17. Cumulative Projected Number of Households in Impact Area Communities, Alternate Years Plus 1990 (Peak Year) and 2002 (End of Construction)†[1]

Community/ Planning District	1980†[2]	1985	1987	1989	1990	1991	1993	1995	1997	1999	2001	2002
Talkeetna	209											
Appl. Rev.		212	272	312	338	342	319	310	316	357	319	298
Borough		395	478	842	878	917	844	926	1,030	1,000	1,029	1,071
Trapper Creek	74											
Appl. Rev.		81	153	201	234	229	176	156	173	185	168	154
Borough		56	68	226	266	266	172	182	215	157	156	163
Houston	197											
Appl. Rev.		191	205	217	223	229	229	229	229	232	235	237
Borough		1,266	1,532	1,803	1,947	2,103	2,386	2,655	2,874	3,107	3,231	3,360
Wasilla	708											
Appl. Rev.		681	727	763	778	803	803	803	805	814	826	834
Borough		4,480	5,537	6,655	7,260	7,921	9,164	10,400	11,466	12,636	13,386	13,922
Palmer	839											
Appl. Rev.		808	859	901	918	947	948	948	950	961	976	985
Borough		2,197	2,542	2,857	3,012	3,173	3,419	3,604	3,681	3,747	3,775	3,799
Other†[3]	5,436											
Appl. Rev.		5,410 (5,078)	6,078 (5,434)	6,688 (5,713)	7,132 (5,836)	7,151 (6,017)	6,577 (6,014)	6,358 (6,013)	6,600 (6,023)	6,810 (6,096)	6,576 (6,189)	6,364 (6,238)
Borough		528	1,897	2,222	2,283	2,348	1,602	1,704	1,848	1,351	1,353	1,407
Mat-Su Borough Total†[3]	7,283											
Appl. Rev.		7,382 (7,049)	8,295 (7,651)	9,049 (8,075)	9,623 (8,327)	9,701 (8,566)	9,052 (8,488)	8.803 (8,458)	9.072 (8,495)	9,327 (8,613)	9,101 (8,714)	8,889 (8,762)
Borough		10,760	14,413	17,503	18,710	20,002	21,117	23,389	25,325	26,399	27,508	28,498
Cantwell	20											
Appl. Rev.		166	232	298	348	344	325	284	285	290	282	276
Healy	105											
Appl. Rev.		134	143	150	154	157	162	168	175	182	189	192
Nenana	148											
Appl. Rev.		167	180	192	199	205	215	228	242	256	272	279
Paxson	NA											
Appl. Rev.		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anchorage Census Division	61,791											
Appl. Rev.		70,809	74,383	76,835	78,138	80,041	82,171	83,521	85,283	86,836	89,001	90,136
Fairbanks Census Division	20,763											
Appl. Rev.		24,478	25,638	24,584	24,960	27,504	26,015	28,354	26,628	29,128	27,600	27,916

†[1] Based on the household sizes used in Table N-7 (see footnote 2) and Table N-16.

†[2] From Table N-7. Values are for communities only, not for planning districts so they are more comparable to the Revised Applicant's projections. Willow and Big Lake are included in "Other" category.

†[3] See footnotes 2 and 5 in Table N-15.

be most likely to live in mobile homes, motels or other temporary units, and even for short periods in recreational vehicles (Gale, 1982; Denver Research Institute et al., 1982). Combined with the findings discussed earlier in Section N.2.1.1.3 that more workers than projected often are employed on projects for short periods of time, it would be expected that demand for motel rooms and mobile homes would be high. As discussed in Section N.1.1.6, there are very few units of this type north of the Anchorage area.

It is not possible to quantify precisely the kinds of housing needed. However, if the findings of the earlier studies are used as a guide, approximately 50% of the housing demand could be for temporary units rather than for permanent single-family units. Shortages of all kinds of housing in the project area could create severe impacts, particularly on small communities like Talkeetna, Trapper Creek, and Cantwell. Considerable planning, development, financing, and construction would have to occur before and in the early years of Watana construction to avoid a housing shortage, even under the more conservative revised Applicant's growth projections.

To complicate these problems, demand for housing and particularly for temporary housing would be highest in summer and fall off in winter. Workers would also be competing with tourists in the summer for the limited facilities in temporary units, reducing the flow of tourists and the units available for workers. Seasonal variations in demand would depend on how many workers chose to take permanent residences or to remain in temporary residences in the project area over the winter months. Demand would also fall after the Watana construction peak, would increase again until the Devil Canyon construction peak in 1999, and then decline. Overbuilding is difficult to manage, especially in light of the many uncertainties about housing and location preferences of workers. Housing markets in boomtowns generally enjoy an increase in demand at first, and then fall into a recession as construction work forces level off and decline in size (Denver Research Institute et al., 1982).

A characteristic of boom-town or rapid growth situations is that construction of housing is difficult to begin before demand exists. This is due to lack of financing, sufficient numbers of housing construction workers, and water, sewer and power hook-ups not yet developed by local governments. Developers would also have to compete with the project for construction workers. Since the project could pay higher wages, housing construction may suffer in lower quality and high worker turnover (Denver Research Institute et al., 1982; see also Payne and Welch, 1982 for a review of the literature on these phenomena). The increased demand for housing and developable land would also cause prices to rise. Onsite housing proposed by the Applicant, if attractive to workers, would help to avoid some of these pressures, as would a worker camp at Cantwell, but, as shown in Table N-15, substantial numbers of workers and support workers relative to current population are projected to choose to live in the established communities.

Most, if not all, the small operations work force would live in the permanent village constructed onsite. Thus, additional impacts from the operation period beyond the boom-bust cycles described above would be negligible.

N.2.1.1.7 Community Services and Fiscal Status

COMMUNITY SERVICES

Community services in the project area are provided both on an individual and centralized level. Where centralized facilities exist, they are, in general, provided and administered by Mat-Su Borough, or by the state for unincorporated Yukon-Koyukuk Borough. Large numbers of incoming population would change the way some of these services are provided and stress current capacities. Additional service needs from project-induced population alone have been estimated by the Staff and are shown in Table N-18. The years when existing capacities would be equalled or exceeded by incoming population are shown in Table N-19. It is important to keep in mind the facts that the revised Applicant projections are very conservative, and the Borough's projections are that project-related inmigration will be concentrated near the site.

Because project-induced population increases projected for Fairbanks and Anchorage are so slight, service and fiscal impacts are expected to be negligible. However, should transportation plans provide commuting to these cities, impacts could be greater, as discussed in Section N.2.1.1.2. Concern has been raised in Anchorage that the city will be accessible as a place of residence for project workers (Yarzebinski, 1983). The Applicant has already allocated about 650 people to Anchorage in the peak Watana construction year of 1990 (Table N-13). Impacts to Fairbanks and Anchorage metropolitan areas are discussed qualitatively. The discussion is based on the assumption that if a transportation plan provided commuting to the cities, each would receive a percentage of the work force and their households as residents. In order to narrow the impact range for the purposes of discussion that percentage is assumed to be 10% except where the Applicant has already made a projection for Anchorage. This would mean an offsite population of about 200 people to Fairbanks and 650 to Anchorage under the revised Applicant's projections and about 650 to each city under borough projections in the peak Watana construction year of 1990 [calculated from Table N-13 (10% × [1,338 total Mat-Su Borough + 663 Anchorage Census Division] ∿ 200) and Table N-14 (10% × 6,483 Mat-Su Borough Total)].

Table N-18. Years When Existing or Planned Community Services Capacity of Project Area Communities Will Be Exceeded (includes service requirements for project-related population)

Community/ Planning District	Water	Sewers	Solid Waste Disposal	Schools†[1] Elementary	Schools†[1] Secondary (Jr/Sr)	Fire	Police	Hospital Facilities
Talkeetna								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	1990	2002+	2002+	Covered by borough	None exist
Borough				1985	1986	2002+		
Trapper Creek								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	2002+	(80 students)†[2]	May need to acquire own facilities	Covered by borough	None exist
Borough				2002+	(90 students)†[2]			
Houston								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	2002+	2002+	2002+	Covered by borough	None exist
Borough				1983	1983	1983		
Wasilla								
Appl. Rev.	2002+	Individual septic tanks may not be adequate	Rely on borough landfills	2002+	2002+/2002+	1985	Covered by borough	None exist
Borough	1983			1983	1983/1990	1983		
Palmer								
Appl. Rev.	2002+	2002+	Rely on borough landfills	2002+	2002+	1985	2002+	2002+
Borough	2002+	1983		1989	1990/2002+	1983	1983	1985
Other								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	Correspondence courses or attend in communities		Covered by borough fires districts	Covered by borough	None exist
Borough								
Mat-Su Borough Total†[3]								
Appl. Rev.	NA	NA	2002+	2002+	2002+	NA	1985	Provided in Palmer
Borough	NA	NA	1985	1985	1985	NA	1985	

Table N-18. (Continued)

Community/ Planning District	Water	Sewers	Solid Waste Disposal	Schools†[1] Elementary	Schools†[1] Secondary (Jr/Sr)	Fire	Police	Hospital Facilities
Cantwell								
Appl. Rev. Borough	Individual sources may not be adequate	Individual septic tanks may not be adequate	Private landfill services may not be adequate	1985	1985	2002+	Covered by state	None exist
Healy								
Appl. Rev. Borough	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on private landfill	Unknown	Unknown	Unknown	Covered by state	None exist
Nenana								
Appl. Rev. Borough	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on private landfill	Unknown	Unknown	Unknown	Covered by state	None exist
Paxson								
Appl. Rev. Borough	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on private landfill	Unknown	Unknown	Unknown	Covered by state	None exist

†[1] Projection for Mat-Su Borough is based on the borough's planning value of 22.8% of population in school-aged children; for Cantwell 18% school-aged children assumed (Frank Orth & Associates, 1983: p. 69).

†[2] Could attend in other communities.

†[3] All entries for Mat-Su Borough services are based on assumption that the borough would not provide services for onsite population. The borough would have to administer and may contribute to financing of some of these services, particularly the school located onsite.

NA = Not Applicable.

Sources: Calculated from Tables N-8 and N-15 and standards from Stenehjem and Metzger (1980). Anchorage and Fairbanks do not appear on the table because the adequacy of their services cannot be estimated until worker transportation plans and work schedules are developed. However, see text discussion on estimates of service impacts in these cities under specified assumptions about transportation plans.

Table N-19. Additional Community Services Requirements over Baseline for Project-Induced Population in 1990 (peak Watana construction work force)†[1]

Community/ Planning District	Water	Sewers	Solid Waste Disposal	Schools†[2] Elementary	Schools†[2] Secondary (Jr/Sr)	Fire	Police	Hospital Facilities
Talkeetna								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	1 class	1 class	Would need additional staff and full-time employees	1 officer	Would need full-time health care professionals
Borough				3 classes	3 classes		2 officers	
Trapper Creek								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	2 classes	2 classes	Would need community based facilities	2 officers	Would need full-time health care professionals
Borough				2 classes	2 classes		2 officers	
Houston								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	No additional needs	No additional needs	No additional needs	No additional needs	No additional needs
Borough								
Wasilla								
Appl. Rev.	No additional needs	Individual septic tanks may not be adequate	Rely on borough landfills	No additional needs	No additional needs	No additional needs	No additional needs	No additional needs
Borough								
Palmer								
Appl. Rev.	No additional needs	No additional needs	Rely on borough landfills	No additional needs	No additional needs	No additional needs	No additional needs	About 25% additional facilities and staff
Borough								

Table N-19. (Continued)

Community/ Planning District	Water	Sewers	Solid Waste Disposal	Schools†[2] Elementary	Schools†[2] Secondary (Jr/Sr)	Fire	Police	Hospital Facilities
Other								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Rely on borough landfills	2 classes	2 classes	Would need additional staff and full-time employees	1 officer	Rely on Palmer
Borough				18 classes or 1 school	18 classes or 1 school		7 officers	
Mat-Su Borough Total†[3]								
Appl. Rev.	NA	NA	Landfill/area needed several years earlier than currently planned	5 classes	5 classes	Would need additional staff; and full-time employees	3 officers	see Palmer entry
Borough	NA	NA		5 classes + 1 school	5 classes + 1 school		11 officers	
Cantwell								
Appl. Rev.	Individual sources may not be adequate	Individual septic tanks may not be adequate	Private landfill may not be adequate	4 classes	4 classes	No additional need	2 officers	Would need full-time health care professionals
Healy								
Appl. Rev.	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need
Nenana								
Appl. Rev.	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need
Paxson								
Appl. Rev.	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need	No additional need

†[1] Calculated using Tables N-8, N-9, and N-14 and standards from Stenehjem and Metzger (1980).

†[2] Each new class or school would require a teacher and other staff (principal, clerical, janitorial, librarian, etc.).

In situations of rapid growth, greater centralization and formalization of community services usually occurs (Payne and Welch, 1982; Cortese and Jones, 1977; also see Sec. N.2.1.1.3). These effects occur because of greater needs for coordinated planning, higher and more consistent quality, greater efficiency in resource use, and more cost-effective construction or provision of services. Individual provision of services (e.g., individual wells) on an as-needed basis may no longer suffice when housing is built in anticipation of needs or hurriedly as demand grows suddenly. Because many inmigrants would be from less rural areas which had centralized services, expectations for services would also be different from those in the existing community. During construction of the Trans-Alaska Pipeline, community services were greatly strained by the large inmigrating population (McAnerney, 1982; Lewis, 1983).

With expanding population and needs for services go the need for a larger staff to plan and manage those services. Based on projected project-related increases of 1,000 and 6,500 persons (depending on the source used in Table N-14), between one and eight additional staff members would be needed in Mat-Su Borough general administration over personnel needs related to baseline growth (calculated from Table N-14 and standard from Stenehjem and Metzger, 1980: p. 59). Mat-Su Borough planners use a ratio of about six general and school district administrators per 1000 population (DOWL Engineers, 1983: p. IV-28). This would mean project-related increase of about 6 to 40 new staff members.

As long as communities remain small and lot sizes an acre or more, individual wells and septic tanks might be adequate to provide water and sewer service. However, such standards would not necessarily hold in Trapper Creek, Talkeetna, and Cantwell. As rapid growth occurs, it is accompanied by a residential development boom in residential building, both in single-family and multi-family units, both on lots smaller than the existing rural community tradition. Pressure is placed by developers anticipating growth and by inmigrants for centralized water and sewer services. Thus, communities like Talkeetna, Trapper Creek, and Cantwell, which would all experience rapid growth beyond baseline projections, are likely to be faced with expectations of and demands for centralized water supplies and sewage treatment. Trapper Creek also has a limited supply of suitable ground water sources, limiting the number of individual wells that could be used (Exhibit E, Vol. 7, Chap. 5, p. E-5-38). Because these communities are currently unincorporated and, therefore, cannot collect taxes or plan and provide such services, Mat-Su Borough would be responsible for these tasks for Talkeetna and Trapper Creek and the state for Cantwell.

The larger communities of Palmer and Wasilla are now facing shortages in water and sewer service, respectively, according to Borough growth projections. Based on the distribution of project-induced population to these communities, the project would not accelerate the needs.

Anchorage's water and sewer system needs would be only slightly accelerated by the incoming population of about 650. Fairbanks is already in need of expanded water facilities, although sewer facilities are expected to suffice until after 2000. Using 10% of borough project-induced projections, 650 persons, the city would need expanded sewer facilities a year or two earlier and would have to expand capacities for its new water systems. Little accommodation would have to be made under 10% of revised Applicant's projections, 200 persons.

Solid waste disposal is the responsibility of the borough in Mat-Su Borough. According to borough projections, existing landfills would suffice only until 1985. Plans are underway to develop new centralized landfills near Palmer and Houston that would have sufficient capacity to last 100 years. The problem remains, however, of transporting the wastes from Talkeetna and Trapper Creek - whose local borough landfill sites would be filled more rapidly due to project-related population growth. Development of transfer stations to ease this transport problem is already called for in borough plans (DOWL Engineers, 1983: p. 14-39) based on their population projections anticipating the Susitna project. Purchasing extra trucks and development of transfer stations in the northern part of the borough would add to borough expenses. The construction of the Susitna project would only exacerbate these problems.

Impacts to the school system are once again found in Mat-Su Borough for the most part only using the borough's growth projections. The Skwentna Elementary School in Susitna Valley is currently near capacity (DOWL Engineers, 1983: p. IV-29). Talkeetna schools would reach capacity soonest from inmigrating project-related populations--in 1985 (borough) or 1990 (Applicant revised) and 1986 for elementary and secondary schools, respectively--as much as 20 years sooner than without Susitna under ISER baseline projections (see Tables N-8, N-9, N-14, and N-18). Trapper Creek children would be served adequately by existing facilities according to both sets of projections. Because of the Susitna project, schools serving residents outside communities would require 18 additional classes, the equivalent of a new school, in their elementary and in their secondary schools - a total of 36 additional classes. Houston and Wasilla schools would need to be expanded very soon, as would other area schools or new ones added in rural areas eventually according to Mat-Su Borough planners. But again, this situation would be true with or without the Susitna project, as borough projections have no project-related population distributed to these planning districts (DOWL Engineers, 1983: pp. IV-29 - IV-31). Construction of the project would add only about 10 to 12 children to the school population in each of the towns of Palmer, Houston, and Wasilla, under revised Applicant's projections.

Under the assumption that 10% of the peak Watana work force living offsite could commute to Fairbanks and Anchorage to live, about 150 and 45 children, respectively, would be added to the elementary and secondary school populations by 1990, under the revised Applicant's projections. This additional number would be the equivalent of approximately two extra classes, along with the staff to teach and administer them. However, these children would probably be dispersed across schools, so that the primary problem created would be overcrowding. Under borough projections, about 150 children would be added to each of the city school systems. This is the equivalent of about five classes. This number of children would create greater difficulties for school systems to expand, without advance planning, particularly in the smaller system in Fairbanks.

Because the onsite school is in Mat-Su Borough, the borough school district would prefer to have responsibility for its operation. It is not clear now whether the borough or Applicant would recruit and pay for school staff. This information will not be available until 1985 (Exhibit E, September 1983, Suppl. Responses). If the borough were held responsible, this would add to existing needs.

Police services are provided by the state for most of the project impact area. According to borough projections, expanded police services are needed immediately (Table N-7), with or without the Susitna project. Expanded population related to the project would only exacerbate this problem, especially in the northern part of the Borough, where as many as 11 new officers would be needed in Talkeetna, Trapper Creek, and dispersed residential areas (other) (Table N-18). Palmer, Wasilla, and Houston, which have their own police forces, would have to expand regardless of the Susitna project schedule. Cantwell's rapid growth would call for expanded police services. Anchorage and Fairbanks would need one to three additional officers, depending on the projection used, and under the "10% inmigrating work force" assumption.

Boomtown growth patterns are often accompanied by increases in crime, and by the appearance of new kinds of crimes, as the face-to-face social controls and trust of small towns is replaced with a more urban-like setting. This trend has been documented in several boomtown situations in the lower-48 (Kassover and McKeown, 1979; Finsterbusch, 1980; Freudenburg, 1981; Colorado Division of Criminal Justice, 1981; Payne and Welch, 1982). Whether or not the trend occurs here, additional state police and patrol cars would be needed, in addition to expanded social service (e.g., counseling agencies) and detention facilities. If the trend does occur, more services would be needed as the standard ratio of police staff to population moves from a rural to a more urbanized basis. The Borough, assuming the project is constructed, is considering establishing police service areas to correspond with Borough fire service districts (DOWL Engineers 1983: p. IV-51).

Fire protection equipment also is the responsibility of the borough and the State in communities near the site. However, staff is for the most part volunteer, except in the southern part of Mat-Su Borough. Besides expanded or new facilities in Talkeetna, Trapper Creek, Houston, and Cantwell, there would be a need to hire full-time paid professionals, rather than continuing to rely on volunteers (Payne and Welch, 1982). The number of many full-time workers that would be needed would depend on the number and distribution of fire stations and trucks. Expenses for the new staff would be incurred by the borough, adding to increased burdens from project-related growth.

Hospital facilities in Mat-Su Borough would need to be expanded soon to meet the demands of growth. The Susitna project would accelerate this need considerably, as it would increase total borough population by between 11% and 20% above baseline (Table N-16). Besides hospitals, full-time health professionals would be needed beyond the physician's assistants and paramedics now in small clinics in many of the communities. Standards for the number needed are estimated at 1.5 full-time physicians for each 1,000 population (Olsen et al., 1981: p. 61). Applying this standard would mean that Talkeetna, Trapper Creek, and Cantwell would require full-time resident health professionals before 1989. Emergency helicopter transport services to cities where more serious health needs can be met would not be adequate for the growing population in the project area. It is often difficult to attract such professionals to private practice in rural areas; thus some sort of subsidized salary program may be necessary (Payne and Welch, 1982). Mat-Su Borough currently has a Health Systems Plan which calls for the establishment of small health clinics in more of its rural communities (DOWL Engineers, 1983: p. IV-32).

It has been documented in other boomtown situations that the caseloads of mental health agencies rises dramatically (Gilmore and Duff, 1977). Other studies of experience during construction of the Trans-Alaska Pipeline indicate that social and psychological problems from rapid growth related to large-scale construction projects also increased considerably (Kassover and McKeown, 1979: p. 54; McAnerney, 1982). The elderly - particularly long-time residents of the impact areas studied, wives of inmigrating project workers who set up households in the local communities, and children were found to be particularly susceptible to the stresses and changes of the rapid growth, relocation, and changes in lifestyle and the local social structure (Cortese and Jones, 1977; Freudenburg, 1979b, 1980, 1981; Kassover and McKeown, 1979). To meet these needs, new forms of services for which there is no precedent in communities like Trapper Creek, Talkeetna, and Cantwell would be needed (and in Paxson and others, should the population distribution shift from problems in housing). Counseling and mental health agencies and/or personnel would be needed in these local communities--even if only on a temporary basis during the period of greatest growth. No standards have been set to estimate the number required. It is unclear if such services could be provided by the borough, the state, or through encouragement of private agencies.

The increment in population in Anchorage and Fairbanks, assuming commuting plans to these cities, would probably not stress further existing health care facilities and professionals.

A hospital and medical professionals provided by the Applicant onsite would serve the onsite population (Exhibit E, September 1983, Suppl. Responses) so that this population would not add to responsibilities of offsite agencies.

Community recreational and cultural facilities are not established in Talkeetna, Trapper Creek, and Cantwell. Project-related inmigrants would not only increase the population density of these communities, making community facilities desirable, but would also be composed of people from less rural areas who have expectations that these services exist. Based on projections assuming project-construction, Mat-Su Borough and its communities have already recognized needs for libraries, parks, and other community facilities and programs (DOWL Engineers, 1983: pp. IV-47 - IV-49). Providing these services would add to local and borough planning and cost loads.

A serious problem in rapid growth situations is that community services are needed by the time the population arrives. Thus, they must be planned and constructed in advance, causing a number of difficulties. Before a project is underway, many uncertainties exist as to its scale, schedules, timing of approval by licensing agencies, size and nature of work force, and where inmigrants would settle. The borough may not have adequate staff to adjust and implement plans quickly, let alone the financial resources to expand the services in advance of tax revenues from the new population. As discussed earlier, government agencies may lose their most skilled workers to the construction projects which pay higher wages. Although these impacts cannot be quantified, they could be serious for Mat-Su Borough planners and state planners for Yukon-Koyukuk Borough.

If community services were expanded in Talkeetna, Trapper Creek, and Cantwell to support peak population growth, they would suffice beyond their needs after the peak had passed, based on the revised Applicant's projections. Borough projections show continued growth for Talkeetna which, if it occurs, would mean that the excess capacity would soon be used. Trapper Creek and Cantwell, however, show little, if any, growth above or approaching the level of the 1990 peak; thus these communities could be left with unused capacity. The unused services would be costly to maintain or close, potentially causing financial problems for Mat-Su Borough (in the case of Trapper Creek) and the state (in the case of Cantwell). Careful planning would be needed to supply for peak demand in 1990 and 1999 and yet not overbuild.

FISCAL STATUS

As discussed in Section N.1.1.7.2, Mat-Su and Yukon-Koyukuk boroughs are highly dependent on property taxes and state and federal funding. Expenditures for services needed because of project-related inmigration would put a burden on both sources of funds. The Applicant, based on assumptions of greater non-project baseline growth than assumed here, has projected slight shortfalls of borough funds in 1990 (Exhibit E, Vol. 7, Chap. 5, p. E-5-87). This projection is based on the assumption that tax revenues are available to the borough as soon as the new population arrives. However, a lag in revenues is usually the case. Even if borough revenues per capita are eventually sufficient to equal costs, in boomtown situations the revenues are collected only after expenditures for the new population are required [see Denver Research Institute et al., (1979) and Lee (1980) for discussions and projections of revenue lags in the case of oil shale development in rural Colorado]. Because of the lag and because of the updated ISER baseline which projects a smaller baseline tax population relative to inmigrants, borough revenue shortfalls are likely to be higher than estimated by the Applicant. Additionally, deficits accrued during the first two years or so of project construction have not been estimated in other energy-development-related boomtown situations (Stinson and Voelker, 1982). This is particularly true when the construction schedule is long, and the construction work force very large relative to the operations work force (Stinson and Voelker, 1982).

If per capita revenues remained comparable to the existing levels, increases would be in the range of the percentages of population growth over baseline estimates, shown in Table N-15. However, it is difficult to incorporate the lag period into such quantifications. Revenue shortfalls would be higher in the earlier years of growth, i.e., before 1990, as increased revenues are not realized until later years. It is in these earlier years, e.g., 1985 to 1987, when the need for new and expanded services would be greatest. If Mat-Su Borough wished to anticipate demand and expand services prior to expected growth, the shortfalls would occur before 1985.

Without a strong industrial base, Mat-Su Borough and the larger communities in the southern part of the borough must either wait until property taxes are collected from inmigrants before financing new services, raise taxes of existing residents to build in anticipation, rely on state financing, or borrow money (by selling bonds or by some other means). All of these means have their disadvantages, and all but the first are complicated by the uncertainties in the project's schedule, permitting, and work force size and characteristics.

If the borough chose to increase services in anticipation of inmigration, it would be responsible for building possibly a school and fire and police stations in the Talkeetna/Trapper Creek area, expanding landfills, and then hiring the staff to operate the facilities. Borough planners could also go further in their planning and build sewer and water systems to encourage residential developers, establish a library and community recreation facilities, set up a clinic and hire full-time resident health professionals. To finance these items would severely strain Borough resources that are already strained meeting to meeting demands of continued gradual growth.

The state would not only be responsible for planning and financing expansion of service in Yukon-Koyukuk communities, but would also bear some of the burden of Mat-Su Borough expenses. For example, the state provides most of the funds for education and thus would be a primary financer of new school facilities and staff. Additionally, historically the state has always come to the aid of boroughs in need of money (Frank Orth & Associates, 1983). Given shortfalls in Mat-Su Borough revenues in advance of the inmigrating population, aid would likely be requested. The state, already facing declining revenues (see Sec. N.1.1.3), would be further strained by such needs.

Because the Applicant's plans for who would manage community services onsite during operation are not yet available, the potential impact of these additional services cannot be estimated. However, the Applicant would bear the cost of construction of these services, reducing this initial impact. Maintenance and operation costs would probably not be large for the borough, but would be an additional load.

Decline in demand for services would occur after the construction work force and population peak in 1990. The borough and state would have to take this decline into account in their planning so as not to overbuild and be left with maintenance costs for unused capacities. Trapper Creek and Cantwell, projected to suffer the most severe boom-and-bust cycle, would be particularly susceptible to this situation.

N.2.1.1.8 Transportation

All transportation modes and routes would be used more heavily during project construction. Highway use, particularly on the Denali and Parks Highways, would increase the most. Because the Parks Highway is currently used at only about 10% capacity, few difficulties are anticipated along most of this highway. Some congestion could occur during peak tourist seasons when project commuters increase the already greater volumes. The Denali Highway would be paved and cleared in winter between Cantwell and the project access road, increasing use by recreation and tourist vehicles. This highway is also the only route connected to the project access road. Thus, traffic volume on this highway could increase substantially from use by commuters to the project.

The Applicant estimates that for the peak construction year of 1990, the Denali Highway would be used by approximately 90 light and heavy trucks per day. Commuter vehicle volume could be as high as 800 passenger vehicles per day, depending on what transportation and work-leave options are available for onsite workers. This would be a considerable increase over the current average daily volume of 50 to 120 vehicles and twice projected volume without the project (Exhibit E, Vol. 7, Chap. 5, p. E-5-36). The State Department of Transportation has recommended that the Denali Highway be upgraded and widened even without the project. The start of the project would mean that the road would have to be paved as well as upgraded and widened, and the action would take place sooner than planned without the project (Exhibit E, September 1983 Suppl. Information, pp. 5-9-1 - 5-9-2). The additional volume, the improvements, and the need to keep Denali Highway clear in winter would mean additional maintenance expenses for the State Department of Transportation. Additionally, according to the Applicant, the state would also be responsible for maintaining the access road after it is built and during and after construction of both dams, compounding project-induced expenses.

Increased population in communities, particularly in Talkeetna, Trapper Creek, and Cantwell, would necessitate improvement and expansion of local road systems. The responsibility for planning and financing construction and maintenance of these roads would be with private developers or with Mat-Su Borough (for Talkeetna and Trapper Creek) and the state (for Cantwell). These roads would ideally be built prior to most housing construction, adding to pre-project financing problems and administrative burdens to private developers and to the Borough described in Section N.2.1.1.7.

The Applicant states that most equipment would be shipped to the project area by rail, using the railhead to be built at Cantwell. Because the rail line operates at only 20% of capacity (Sec. N.1.1.8), there would be little impact on railroad operations. However, locating the railhead at Cantwell would increase traffic on local roads which are now often unmaintained. It would also create traffic control problems at intersections between railhead access roads and the Parks and Denali Highways. Congestion and traffic control problems would interfere with local and in-transit traffic and tourist traffic, on which the community economic system is based.

Because air and float plane travel are common in Alaska, increased population in the area would likely increase use of local air fields. Air strips onsite may also increase air travel to this formerly less accessible area.

As construction populations decline between 1991 and 1994 and again after 1999, project-related traffic volume on all modes of transportation would decrease. However, although usage drops, the need to maintain new or improved roads remains. If a decision is made to retain all the roads and allow public use of the project access road, then Mat-Su Borough and the State Department of Transportation would have responsibility for maintenance.

N.2.1.2 Devil Canyon

N.2.1.2.1 Population

Population projections covering both the Watana and Devil Canyon dam construction periods are shown in Table N-15. Discussion of population impact, boomtown phenomena, and issues in making projections appears in Section N.2.1.1.2. The Devil Canyon construction period would create a second, more moderate boom-and-bust cycle. Additionally, an influx of job-seekers beyond the number that can be hired may recur. Impacts on the area would not be as severe as during the Watana dam period because adjustments to rapid growth would have been made before. The population projections are the basis for all other socioeconomic impact projections.

Smaller communities like Talkeetna, Trapper Creek, and Cantwell, still in the process of recovering from the population growth and decline, would experience the greatest increases again.

Additionally, the rail extension constructed from Gold Creek to the Devil Canyon camp for transport of materials and supplies (Exhibit E, Vol. 1, p. A-7-18) may cause population inmigration to Gold Creek. Only a very small number of people currently live in the area around this community (see Sec. N.1.1.2). Even a very small influx of population would mean a substantial increase.

N.2.1.2.2 Institutional

Institutional issues for the Devil Canyon dam construction and operation periods would be similar to those described for Watana Dam construction in Section N.2.1.1.3, although at lower magnitudes. Demands for the growth to the second peak in 1999 would be placed on local and Borough governments for services. However, because much of the greatest growth spurt would have passed, adequate adjustments may already have taken place so that these demands can be coped with adequately. Native corporation interests and local lifestyles may have adapted and, if still not resolved, would be able to use past experience on Watana to adjust to the new, but less severe growth.

N.2.1.2.3 Economics and Employment

Major impacts of the boom and bust cycles in the local economy and employment situation were described in Section N.2.1.1.5. The Devil Canyon construction period would prolong some of these effects, but would also maintain for a few more years a higher level of demand. Businesses and workers alike could perhaps profit from this period to adjust and stabilize their operations and to plan for the bust period after the year 2000. However, the decline in demands between work force peaks (1990 until 1995) and smaller increase to the 1999 peak may lead to the failure of some businesses. Unemployment would also increase in this period, and after the peak placing more financial and administrative burdens on the social service systems of local and state governments.

The Applicant has estimated that labor demand on Devil Canyon would begin about 1994, reach a peak of about 1700 in 1999, and then drop to an operations work force of 157 by 2002 (Exhibit E, Vol. 7, Chap. 5, Table E.5.28). It cannot be predicted how many of the workers from the Watana phase would remain in the area on the hopes of being rehired on the Devil Canyon phase. However, the 1999 peak year for Devil Canyon would employ only a little over half the number of workers of the peak employment year on the Watana phase (Exhibit E, Vol. 7, Chap. 5, Table E.5.28). Thus, even if the same skills and workers could be used on both, over half would not be needed after 1995. The operations work force on Watana would be less than 5% of the peak work force. The Applicant expects that 50% of the inmigrants would remain to work on new projects and perhaps later be employed on Devil Canyon. This expectation is based on the assumption that they can find interim employment. If these inmigrants remain in Anchorage or Fairbanks, more job opportunities may exist. However, unless plans for new large-scale construction projects in Mat-Su Borough develop in the next decade, workers remaining there during the interim and after completion of Devil Canyon may raise unemployment statistics. Thus, the Applicant's estimate of 50% overlap in project work forces is probably high.

Little if any impacts to the economy and employment would be caused by the operation period, beyond those of adjustment to the declines after peak employment, as discussed above and in Section N.2.1.1.5.

N.2.1.2.4 Housing

A general discussion of housing impacts was included in Section N.2.1.1.6. These impacts would carry through the Devil Canyon construction period, when a more moderate growth and decline period would occur. Temporary housing (apartments, mobile homes, motels) built during the Watana dam period, if retained, would serve for the Devil Canyon period. If, after working over the long schedule of both projects, some workers decide to remain in the area permanently, sufficient lead time would exist to construct additional permanent housing to meet the demand.

Three cabins, only one of which is used and maintained, would be inundated by the Devil Canyon dam and impoundment. Other impacts to housing were discussed in Section N.2.1.1.6. As discussed, the Devil Canyon dam construction period would exacerbate the boom-bust cycle problems in housing availability, construction, and markets by causing a second boom period. As with Watana Dam, the operations work force necessary for Devil Canyon dam would be so small relative to earlier construction work forces that additional impacts would be negligible.

N.2.1.2.5 Community Services and Fiscal Status

Community services expanded to meet demand during the Watana dam construction period would suffice for the Devil Canyon dam construction period. Revenues would also have caught up with expenditures so that new or temporary services could be maintained. Thus, negligible additional impacts would be expected. The operation period would add no new impacts and would be the end of the decline in increased demand for community services.

N.2.1.2.6 Transportation

Overall proposed project-related transportation impacts are discussed in Section N.2.1.1.8. Devil Canyon dam construction and operation period would only prolong some of the impacts (e.g., increased traffic volume and need for road maintenance), but would probably not necessitate construction of more transportation facilities. The one place where some disruption of normal rail activities might occur is at the intersection of the main rail line and the spur at Gold Creek. Unless deliveries and transfers of materials were scheduled around routine rail traffic, some delays might occur.

N.2.1.3 Access Routes

The construction and use of access routes would have only a few minor socioeconomic impacts. As discussed in Section N.2.1.1.8, existence of the access road would mean increased use of Denali Highway by commuters, by heavy duty equipment, and by trucks delivering supplies to the site. The State Department of Transportation would have the responsibility for maintaining Denali Highway and, according to the Applicant, the access road once it was constructed. Maintenance activities for the access road would add slightly to state expenses.

Both the rail corridor and line (especially if left in operation after project completion) and the road would also increase the accessibility of the project site area for tourists and recreational and commercial hunting, fishing, and trapping. Native Alaskans would have increased access to their land for subsistence uses or for development of commercial recreation facilities. Increased accessibility would be seen by some as an opportunity for expanded residential and commercial development; others would feel increased access would detract from the value of the area as a remote, relatively undeveloped wilderness (Federal Energy Regulatory Commission, 1983).

Because of its location at the head of the proposed rail spur to the Devil Canyon site, and at the head of an access road, Gold Creek and the surrounding area would be affected by the construction of the dam. Construction of the access road bridge crossing the Susitna River would begin three years prior to dam construction, in about 1992 or 1993. Rail construction and work on other portions of the access road would begin a year later. Construction workers may choose to establish residences, even temporarily, in Gold Creek, using the Alaska Railroad to gain access to services in other Railbelt communities. If workers on construction of the dam were allowed to commute to the site on the road or by rail, many of them may also choose Gold Creek for permanent or long-term temporary residence. Besides proximity, the Gold Creek area would be attractive for the availability of private land for purchase and development (see Sec. N.1.1).

Because Gold Creek is not incorporated and data on it are not gathered independent of the borough or the Applicant's "Other" category, quantitative baseline and with-project impacts cannot be made.

Although the current population of Gold Creek is not known precisely, the community is very small. Until worker transportation plans are developed, even qualitative statements about project-induced growth are very tentative. Even a slight increase would affect greatly the nature of the settlement for those miners and recreational property owners who now live there. The quality of life for these people who value their isolation and the wilderness would change--be reduced, in the eyes of most, should expansion occur there. Growth directly related to project construction could begin in 1992 and continue to the peak of Devil Canyon construction period in 1999. However, because of the access provided to the area by the project structures, growth indirectly related to the project could continue to change the nature of the settlement. Conflicts could also be expected between pre-project residents and those who came later. Because of the small size of the community, even with growth, current service facilities would suffice and residents would rely on other Railbelt communities for many needs.

N.2.1.4 Power Transmission Facilities

Construction of the transmission lines and power houses would have relatively few socioeconomic impacts separate from those of the construction of the two dams, discussed in Sections N.2.1.1 and N.2.1.2. A few construction workers may choose to move between temporary lodging facilities following the progress of construction of the line, but this is not characteristic of most transmission line workers in the lower 48 states. They are more likely to settle for the entire construction period in an established community and commute to the site (Gale, 1982). Occasional traffic congestion may occur during construction as equipment is delivered along the route.

The line may go through existing residential areas or areas planned for development (Exhibit E, Vol. 1). Controversies over reductions in property values of lots near the right-of-way would be expected. Temporary losses in property values and permanent changes in development due to transmission line rights-of-way have been documented in some cases (U.S. Dept. of Energy, 1983), but without more specific information about the location of the right-of-way, these cannot now be quantified. Once land value and development issues are resolved, no additional socioeconomic impacts are expected after transmission facilities are completed.

N.2.1.5 Alternative Borrow Sites

No socioeconomic impacts would occur at any of the alternative borrow sites, as they are far from population centers and residences. Temporary increases at all sites in noise, fugitive dust, heavy-duty vehicle traffic would reduce the use of the area for such activities as commercial and recreational hunting and trapping.

N.2.2 <u>Susitna Development Alternatives</u>

N.2.2.1 Alternative Dam Locations and Designs

Three alternative hydropower plants have been proposed for the Susitna Basin, each including the construction and operation of two large hydropower facilities. Because the facilities under each alternative would be located in the same socioeconomic environment as the proposed project would be, the impact area would be the same. The alternatives each combine two facilities which are slightly smaller than the proposed Watana and Devil Canyon dams. The construction work forces would be smaller and the construction period shorter. The level of socioeconomic impacts of a project is, in general, proportional to the size of the peak construction work force and the duration of the construction period. Thus, impacts of the alternatives would be slightly lower than, of the same kind, and located in the same areas and communities as impacts of the proposed project, described in Section N.2.1.

In the case of two of the alternative in-basin projects (Watana I-Devil Canyon and Watana I-Modified High Devil Canyon) the scale of the projects would be particularly close to that of the proposed project. For the purposes of this discussion, it is assumed that 10% fewer construction workers would be required each year, and that the construction period would be shortened by 10%. For the third alternative (Watana I-Reregulating dam), the Watana I portion is assumed to be 10% lower in work force and time period than the proposed Watana Dam. The Reregulating dam would be of much smaller scale than the proposed Devil Canyon. The work force and time period on this dam is assumed to be 25% less than that of the proposed Devil Canyon. Further, it is assumed for all three alternatives that construction of Watana I would be nearly completed before substantial work on the second facility began, as is the phasing of the proposed project.

Impacts of the proposed project are described in detail in Section N.2.1. All the general discussion of impacts in that section would apply here: boom-and-bust phenomena, rapid population growth, difficulties in financing and providing adequate services in time for the growth, changes in the quality of life, and so on. The same communities, cities, and boroughs would experience project impacts under each of the three in-basin alternatives.

A 10% reduction in work force would not significantly reduce impacts, especially in the small communities, e.g., Talkeetna, Trapper Creek, and Cantwell. As shown in Table N-16, a 10% reduction in population growth by the peak year of 1990 would still leave projections of substantial growth: in 1990, by about 40%, 175%, and 800% for Talkeetna, Trapper Creek, and Cantwell, respectively. A 10% reduction in 1999, the Devil Canyon Dam construction peak, would vary by projection source. In the case of Mat-Su Borough projections, project-induced population growth would drop from 300% above baseline to about 270% above baseline. Growth of this scale, although slightly reduced from those of the proposed project, would result in nearly comparable impacts to all communities and boroughs in the project area.

As discussed in Section N.2.1.2, communities which prepared for and experienced rapid growth during the first construction period for the Watana structures, would probably have fewer problems during the second growth period associated with Devil Canyon construction. Because the growth can be planned for over a longer period, because tax revenues have accrued from the first boom, and because the area has gained experience, communities would have more resources to use in response. However, the same caveat raised in evaluating impacts of the proposed project holds true here: overbuilding during the first boom may help to accommodate the second, but would mean costly maintenance of unused facilities during the decline between booms and after construction is completed. This is a problem which would be greater in the alternative of Watana I plus the Reregulating dam, where the second phase is considerably smaller in scale than the first. This could be avoided by careful community planning.

Comparing the three alternatives and the proposed project by level of socioeconomic impacts results in the conclusion that for the first phase (Watana or Watana I), impacts are comparable. For the second phase, impacts in the Watana I plus Reregulating dam alternative would be less than for all other second phases, providing overbuilding does not occur during the first phase.

N.2.2.2 Alternative Access Routes

As with the proposed access route, both alternative routes would increase accessibility of the project site area for tourists and recreational and commercial hunting, fishing, and trapping. Native Alaskans could develop commercial operations on their land in the project area more easily than presently using either the alternative or the proposed access routes. Other residents would view increased accessibility as reducing the rural, isolated nature of the area that they value. Differences in impacts by route are discussed below.

N.2.2.2.1 Plan 13 "North"

This route would cause growth in Hurricane, the tiny unincorporated community where the access route would intersect with the Parks Highway. Construction workers might choose to reside in Hurricane, because of the easy commute to the dam sites. No population figures or projections are available specifically for Hurricane. Even a few new households in the community would change the nature of the setting and invite commercial and residential development. Service facilities would have to be built to accommodate new residents, funded by the borough.

N.2.2.2.2 Plan 16 "South"

This access route would begin at the railhead in Gold Creek. Gold Creek could become attractive to construction workers and to commercial and residential developers as the construction population grew. Impacts to Gold Creek would thus be increased levels of those described in Section N.2.1.3.

N.2.2.3 Alternative Power Transmission Routes

Impacts of the alternatives would be the same as those described in Section I.2.1.4. Alternatives whose right-of-ways passed near the more densely populated areas of Mat-Su Borough north of Anchorage could particularly affect property values, quality of life, and property tax revenues in those areas, as described in Section N.2.1.4.

N.2.2.4 Alternative Borrow Sites

All alternative borrow sites are located in unpopulated areas. Therefore, no socioeconomic impacts would occur as a result of any of them.

N.2.3 Non-Susitna Generation Alternatives

A number of assumptions are used in the following sections to assess impacts. To estimate population growth, one-half the construction work force and one-quarter of the operations workforce are assumed to be unaccompanied by household members. Construction workers not in construction camps are assumed to have household sizes of 3.0 persons, approximately the average household size of the nation (2.8 persons) and the project area (3.06 to 3.84 persons) in 1980 (see Table N-17). Support workers are assumed to be needed at a ratio of 0.8 support workers per construction worker, the multiplier estimated by the Applicant for Mat-Su Borough projections (Frank Orth & Associates, 1983: p. 56). Mat-Su Borough encompasses rural and suburban areas, and thus is representative of most of the impact areas of the alternatives. Household size of the total population is assumed, for simplicity, also to be 3.0 persons, slightly higher than the national average in 1980. Estimates of construction and operation work forces are taken from sources relying on industry, or the experiences of State of Alaska or U.S. Department of Energy agencies, as precise plans for construction and operation of the alternative facilities are not available.

N.2.3.1 Natural-Gas-Fired Generation Scenarios

N.2.3.1.1 Tyonek Area

Three of the combined-cycle units would be located on the lower Beluga River and two on the Chuitna River. The nearest community to both of these locations is Tyonek. In general, construction of one of these units requires a small work force of about 45 persons over a period of two to five years (Battelle Pacific Northwest Laboratories, 1982: p. 5.19). Operation would require about 6 persons per unit. The schedule for completion of the units could be staggered such that the most that would be built concurrently in the Tyonek area at any one time is two. This would mean a total maximum construction work force of 90 persons. If the two were built after three others were already on-line, a total operations work force of 18 would be added to the 90, making a total of 108 new workers in the area.

Tyonek is an extremely small and stable town of only 239 persons in 1980 (see Sec. N.1.3.1.2). An inmigrating work force of 45 or more for construction of one unit to 100 or more for two would greatly enlarge the town. If only half of these workers brought their families, the population increment would range between 88 and 200 (22 to 50 single workers, plus 22 to 50 workers with households of 3 persons).

No vacant housing is available, with the exception of 24 rooms in the Shirleyville Lodge (Sec. N.1.3.1.2). Thus, housing would have to be built or lots for trailers developed. The school building would have enough capacity for many inmigrating children, as it is used at less than half-capacity now. However, another teacher may be needed, as potentially about 20 to 40 school-age children may accompany the work force (22% of 88-200 inmigrants--see Sec. N.2.1.1.7, Education). As Tyonek is an unincorporated community in the Western Peninsula of the Kenai Peninsula Borough, the borough would bear the planning and funding responsibilities for expanded services. If Tyonek incorporates, as is being considered, its citizens would bear the costs. In either possibility, funding prior to the need would be difficult to acquire.

Tyonek is a Native Alaskan community whose residents rely a great deal on subsistence activities for their livelihood. Because the residents are very young and untrained in construction (Sec. N.1.3.1.2), few of them would be employed on the construction projects. Inmigrants would thus earn the high salaries of construction work. If commercial interests were developed in Tyonek in response to the expanded population, these interests would profit as workers spent their wages. However, this beneficial impact would be outweighed by the negative ones of conflicts between the cultures of the Natives and of construction workers, and by potential interference of the new population with traditional subsistence activities. Low incomes and heavy reliance on public aid programs on the part of the Tyonek Natives would contrast sharply with the income of the construction workers. Increased use of subsistence fish and wildlife resources by newcomers could reduce the supplies available to the Natives.

Roads would have to be built to the sites of the combined-cycle units, further increasing access to the area. Better road connections with Anchorage would be beneficial, but increased access would allow more non-Natives to come to the area. A construction camp to house workers near the site would reduce these impacts considerably. This strategy has been used for work-forces near Tyonek on a gas-fired generation facility (Cook Inlet Region, et al., 1981: pp. 10-1 - 10-2). However, problems of increased accessibility would remain, as would conflicts between worker and Native cultures.

Currently, the Tyonek Native Corporation will not allow easements, rights-of-way, roads, or rail lines to be built on their land. Permission to build some access roads may be difficult to obtain (Cook Inlet Region et al., 1981: p. 10-13).

N.2.3.1.2 Kenai Area

The two combined-cycle units proposed for the area would be within commuting distance of Kenai and Soldotna. These communities are more substantial than Tyonek, but still not large (Sec. N.1.3.1.1). The two units could be built in succession rather than concurrently, so a maximum of approximately 100 inmigrants might be expected at one time (45 construction workers, half with households of 3 persons, plus 6 operations workers). Additionally, some Kenai residents could probably be hired, reducing this number slightly.

Inmigration of 100 persons to the Kenai area would represent approximately a 2% increase over the 1982 population. The area accommodated increases of over 25% in the previous four years. Thus, only very minor negative impacts from the two combined-cycle units would be expected. Sufficient housing and services would be available. Impacts would be mainly in the form of increased access to the area north of Kenai and slight disruption of the rural lifestyle of those who live nearby.

N.2.3.1.3 Anchorage Area

One combined-cycle unit and two 70-MW combustion turbines would be built near Anchorage. The work force needed for construction of a combustion turbine would be approximately 30 persons; the operations work force 12. It is likely that most workers on the combined-cycle and combustion units would be hired in Anchorage and would commute to the sites. Thus, impacts would be minor and limited to slight increases in road traffic and increased access to the site areas.

N.2.3.2 Coal-Fired Generation Scenario

N.2.3.2.1 Healy Area

It is assumed that all the coal for the coal-fired generation scenario would be mined from the Usibelli Mine across the Nenana River from Healy. The mine currently produces about 700,000 tons (630,000 MT) of coal per year, most of which is shipped to Fairbanks and some to South Korea (Usibelli Coal Mine, undated; Argonne National Laboratory, 1982). To supply the fuel for the five 200-MW coal-burning power units proposed in this scenario and maintain supplies to existing markets, annual production would have to increase by over 5 times, to about 3.8 million (3.4 million MT) tons per year.

Estimates of the work force necessary to mine this amount of coal vary. The Usibelli Mine now employs about 90 persons in the summer and 70 in the winter (Usibelli Coal Mine, undated). A quintupling of production could imply a quintupling of the work force, to 350 in winter and 450 in summer. However, a generic estimate of workers needed in a Western surface coal mine is about 400 workers per 6 million tons (5.6 million MT) of coal mined in a year, or about 250 workers per 3.8 million tons (3.4 million MT). A conservative estimate between these two figures is appropriate, that is, a total of 300 workers would be needed to meet the new production levels. This would mean about 210 new workers, above the current summer employment of 90 workers.

As mining operations would require a permanent work force, most of these 210 workers would probably settle in the area, adding a total of about 600 people (assuming three-person households) to the existing population. Additionally, up to 170 support workers would be needed (0.8×210), who would also be permanent residents accompanied by household members. With household size of three persons, the total support-related inmigrants would be about 500 persons. Added to the mine work force, population in the Healy area could be increased by 1,100 people.

Current population in Healy is only 334 persons, many of whom are Native Alaskans (Sec. N.1.1). An additional 100 reside across the Nenana River, nearer the mine site. An influx of 1,100 persons would create severe difficulties for the community, in planning for, financing, and serving growth of this scale, even if it could be stretched over a period of a decade. Cultural difficulties between Native residents and non-Native inmigrants, interference with subsistence activities, and dramatic changes in lifestyle for current residents accustomed to the small-town setting would occur. Economic opportunities may expand, but these would be of benefit to new developers and inmigrating support workers and their households, rather than to current residents who could not adequately provide the services and skills. High unemployment rates may be reduced, but the youthful and inexperienced resident work force often found in rural Alaska (Argonne National Laboratory, 1982: p. 81) may lead employers to recruit experienced workers from elsewhere.

To accommodate the new population, many services would be required: new and perhaps centralized water and sewer services; schools for as many as 240 school-aged children; and fire, police, and health facilities for four times current capacity. New and upgraded local roads between communities and the mine site would also be necessary. With the expanded Healy population [and expanded Nenana population from the two coal-fired power units also in this scenario (Sec. N.2.3.2.3)], the town and the Yukon-Koyukuk Borough may choose to incorporate and thus gain powers to tax and plan for services. Until this occurred, the state would be responsible for planning, financing, and administering the new services.

Until a few years ago, housing for almost all the mine workers was provided by the company. Recently, the company developed a subdivision near the site where workers can build their own houses (Argonne National Laboratory, 1982: p. 81). This subdivision would have to be expanded considerably - perhaps to the scale of a new independent community, in addition to development of new single-family housing development in Healy.

N.2.3.2.2 Coal Transportation Routes

Currently, coal is shipped from the Usibelli Mine site to Fairbanks by rail on 75-ton cars (Usibelli Coal Mine, undated). Monthly shipments range between about 26,000 tons (23,400 MT) in summer to about 82,000 tons (73,800 MT) in winter (Argonne National Laboratory, 1982: p. 83). Thus, about 350 cars or 3.5 unit trains (of 100 cars) per month (26,000 tons ÷ 75 tons/car) are needed in the summer, and about 1,100 cars per month or about 5 unit trains every two weeks (82,000 tons ÷ 75 tons/car) in winter (one train every three days). The average for the year would be about 1.8 trains per week [(700,000 tons/year ÷ 75 tons/car) ÷ 100 cars ÷ 52 weeks].

Three-fifths of the additional 3.1 million tons (2.8 million MT) of annual coal production, or approximately 2.3 million (2.1 million MT) tons per year would be shipped to three 200-MW coal units in Nenana. This would require an average of about one unit train per day. Added to current demand in Fairbanks and assuming 75-ton cars, an average of about nine unit trains (18 trips) every week (1.8 trains/week currently + 7 trains/ week additional) would be required. In general, coal is transported in 100-ton cars on 100-car unit trains. The Alaska Railroad can carry weights of 100-ton cars (National Railway Publication Co., 1983: p. 9). If it is assumed that this is the most efficient and economical transport option, this would reduce the number of unit trains needed by a quarter, to about three trains (six trips) every four days. About twice as many trains would be needed in the winter than in the summer, but because of the greatly increased average number of trains needed to Fairbanks, the three to one difference may be reduced. This represents an increase of about three times current volume.

An unknown amount of coal is currently shipped south from the Usibelli Mine for export to South Korea. Under the coal-fired generation scenario, using unit trains of 100 75-ton cars would require about seven trains (14 trips) every two weeks to Willow. Using 100 100-ton cars would reduce this number to about five trains (ten trips) every week above current volume.

Currently, the Alaska Railroad is only used at 20% of freight capacity (Sec, N.1.1.8.2). A maximum average increment of about 14 trips per week between the mine and Nenana (higher in winter and lower in summer) may not strain the current rail line. However, this increment represents volume due to transporting coal only. Other trips would be needed for equipment for mining and for operation of the power plants. Additionally, greatly expanded populations in Healy and Nenana would increase the need for other rail-delivered commodities in these communities, and may increase demand for passenger service. Maintenance of the line, particularly in winter, would be required far more frequently. Because of unpredictable weather conditions in winter, and thus unreliability of deliveries, equipment and supplies for repairs at the Usibelli Mine must now be stockpiled in heated storage areas (Argonne National Laboratory, 1982). This precautionary effort would have to be expanded at increased cost, possibly causing slightly increased use of the rails during quiet winter weather.

N.2.3.2.3 Nenana Area

Three 200-MW coal-fired units would be located in Nenana under this alternative power generation scenario. Each unit would require about 600 workers two to five years to construct. Because work may be possible only six months of the year, the longer time frame may be more likely. A work force of about 100 persons would be needed to operate the completed plant (Battelle Pacific Northwest Laboratories, 1982). If the plants were built in succession, a peak work force of 600 would be needed for construction of the first plant, followed by a drop to 100 for its operation. At peak construction of the second plant, the work force required would be about 700 persons, including the permanent operations work force on the first plant. During construction of the third plant, the peak work force would reach 800 persons, and drop back to 300 operations workers for all three plants.

It is possible that many construction workers would commute from residences in Fairbanks, about 50 miles (80 km) away. The operations work force would be more likely to establish permanent residences in or near Nenana. In the worst case, all construction workers would choose to live in Nenana for the two to five years needed to complete each of the plants. If only one-half the construction workers and all support workers (0.8 × peak construction work force) were accompanied by household members, population inmigration could reach one peak of about 2,600, drop off to as low as about 500, then increase to a peak of about 3,100 (2,600 + 500) for the second plant and drop back to a level of about 1,000. Peak construction of the third plant combined with operations-workforce-induced population for the first two could lead to total inmigration of 3,600 persons. When all three plants were in operation, the total new permanent population could be 1,500 persons. The low points (500, 1,000, and 1,500 persons) represent the permanent operations work force of 100 for each plant and their households [three-quarters (75) in households of three persons, one-quarter single workers] plus a support work force (0.8 × 100 operations workers = 80 support workers), all in households of three persons. It is likely that anticipation of employment in construction of the second plant would cause some construction workers to remain in the area through this period; if so, this number would be higher. The number left (1,500) represents permanent residents related to both operation work forces.

The population of Nenana is currently only slightly less than 500 persons. A population influx of about 2,600 persons in the worst case over only two or three years during construction of the first plant would cause severe impacts to the community. Even if all unemployed local residents were employed on the project, they would fill only a small portion of the 600 workers necessary for plant construction. In the case that most construction workers resided in and commuted from Fairbanks, population increases related to the operations work force would still almost triple the size of the town.

Although unemployment may be reduced, the community would experience severe shortfalls in housing and community and commercial services, whether under the worst case or the more moderate one. Existing water and sewer services would have to be expanded dramatically, and in advance of residential and commercial construction. Fire, police, and health services, now provided at a small scale by a few professionals and volunteers, would have to hire full-time paid staff and acquire more equipment. The classic planning and financing problems encountered by a rural area in preparing for a boom followed by a bust, discussed in Section N.2.1, would occur in Nenana. Cultural differences between Native Alaskans, who presently comprise a substantial proportion of the community's population, and other residents would be magnified. Native Alaskan cultural and subsistence activities in Nenana would be overwhelmed by non-Native activities. Until Nenana and/or the Yukon-Koyukuk Borough incorporated, the state would be responsible for the costs of planning and constructing new services.

Most of the construction workers drawn from Fairbanks would be part of the existing work force. Some temporary inmigration may occur, but it would be of such a small scale relative to the size of the city that impacts would be insignificant.

N.2.3.2.4 Willow Area

Construction of three coal-fired units in the Willow area, beginning in the year 2000 and to be completed by 2020, could have substantial impacts, although not as severe as those in Nenana. Willow itself is a very small community (1981 population of only 139 persons), but larger communities, such as Houston, Wasilla, and Palmer, as well as unincorporated residential developments (such as Big Lake), are located within reasonable commuting distance. The combined population of these areas in 1981 was about 6,000 persons (Table N-1). Some construction workers could be drawn from the existing work force in this area. However, inmigration in large numbers may still be possible. If it is assumed that half the construction work force and all the operations work force moved to the area, and that the plants were built in succession, peak population increase would be about 2,600 persons for the first plant (Sec. N.2.3.2.3), and 3,100 for the second (2,600 construction + 500 operation).

Population in the Willow area is expected to grow more rapidly before the year 2000 than in other areas of the Mat-Su Borough. However, an increment of this many persons on top of baseline growth would only exacerbate planning, financing, and construction problems. Cultural conflicts would be milder than for Nenana, as these communities have a small proportion of Native Alaskans and little subsistence activity. If a large proportion of the inmigrants chose to reside in Willow, boom-and-bust impacts would be similar to those described in Sections N.2.1 and N.2.3.2.3.

No population projections for Willow are available, but it is assumed that the community would remain small to 2000, the year construction would begin. A population influx into the area of between 2,600 and 3,100 residents would require substantial development of services in Willow, and additions to those in the other three communities. To accommodate one-half of the influx, Willow would need a school, police and fire stations and staff, health care facilities (although specialty care could be provided at the existing hospital in Palmer), improved roads, and between 800 and 1,000 housing units to meet demands during peak construction periods. Once the peak in construction of the first unit was reached and accommodated, planning and adjusting to later growth would be easier. Operations work forces for the three units would likely be permanent residents, eventually using any excess capacity of housing and services provided to meet peak demand. Households of operations work forces and support households would number about 1,000 when all units were in operation. A large proportion of these people would settle permanently in or very near Willow.

With such substantial population growth over a period of about 15 years, it is likely that Willow would become an incorporated community, and thus acquire power to plan, collect taxes, and provide its own services. Until incorporation occurs, Mat-Su Borough would be responsible for these activities. Extra tax revenue would be available to the Borough from this growth, but only after construction to prepare for the growth had taken place. Thus, for the period of this lag, Mat-Su Borough may have financial difficulties in adapting.

Palmer and Wasilla are considerably larger than Willow and are projected to grow fairly rapidly by the year 2000 when construction on these coal-fired units would begin. Houston, the nearest community to Willow, had 600 residents in 1981, over four times Willow's population, but a small community. All three communities are incorporated presently. All would have to expand their service facilities, particularly Houston, to accommodate the proportions of construction and operation work forces that chose to settle within their boundaries. However, the scale of growth impacts would be less than those in Willow.

N.2.3.2.5 Cook Inlet Area

Ten 70-MW combustion turbines would be constructed around Cook Inlet as part of the coal-fired generation scenario. These would probably be located in the Tyonek area, north of Kenai, and near Anchorage. Because of the greater access to natural gas near Tyonek, a larger proportion of the units would be located in the Tyonek area. A construction work force of 30 persons for nine months, possibly spread over two summers, and an operations work force of 12 persons would be needed for each unit.

Accommodations of work forces for even two or three units built in succession would be minimal in the Anchorage and Kenai areas. The new populations could be drawn from or easily incorporated into existing facilities and growth projections.

As described in Sections N.1 and N.2.3.1.1, the Tyonek area has only one community, Tyonek, which is comprised almost completely of Native Alaskans. Little housing is available. For the short construction period, it is likely that a construction camp could be built to house workers, limiting impacts to those of workers using Tyonek's limited commercial operations. Currently, local commercial operations have onsite housing for workers to reduce impacts on Tyonek (Cook Inlet Region et al., 1981).

Operations work forces for two to four units would total between 24 and 48. If these workers chose to reside permanently near the plant, population inmigration could range between 75 and 150 (based on average household size of three persons). Impacts to Tyonek would be the same as those experienced under the gas-fired generation scenario and described in Section N.2.3.1.1, although on a slightly reduced scale.

N.2.3.3 Combined Hydro-Thermal Generation Scenario

The hydropower facilities proposed for this scenario range in production capacity between 65 and 370 MW. Generic estimates of work force needs are often given relative to peak power production capacity. However, the number of workers needed to construct a facility varies considerably, depending on the size of the dam and the reservoir, the difficulty of the design, the configuration of the river valley, accessibility of the site, and other factors. Additional workers may be required to rebuild structures displaced by the dam or reservoir, such as highways, rail lines, or transmission lines. Thus, it is difficult to project the size of the construction work force based on peak production. For example, it has been estimated that between 200 and 400 persons would be needed for 5 to 10 years to construct a 100-MW dam. The same source gives an estimate of 250 to 1,000 persons to construct plants of 100 to 1,000 MW (Battelle Pacific Northwest Laboratories, 1982: p. 5.38). Yet another source estimates 255 workers for construction of a 200 MW plant (U.S. Dept. of Energy, 1980: p. 215).

In this discussion, it will be assumed that a minimum of 200 workers and four years are needed to construct a hydroelectric plant even of a small commercial scale. Larger construction work forces will be assumed for the two larger dams in the scenario, Johnson and Chakachamna. The operations work force will be assumed to be 10 persons for the smaller plants (U.S. Dept. of Energy, 1980, p. 215; Battelle Pacific Northwest Laboratories, 1982: p. 5.38), larger for Johnson and Chakachamna.

N.2.3.3.1 Johnson

The Johnson hydropower facility would be the first to be built under this scenario, with a projected online date of 1993. Its peak capacity would be about 200 MW. The construction work force for this facility is assumed to be 300 workers; the operations work force, 25 workers. Construction is assumed to require seven years.

In the extreme case that no construction camp or onsite housing was provided, the sparsely populated area between Tok and Delta Junction, described in Section N.1.3.3.2, would experience severe impacts during construction. The most serious impact would be the possibility that the Native American community of Dot Lake would be inundated by the Johnson impoundment. This would displace at least 67 people (1980 Census), their homes and livelihood, and the cultural community established here by Native Alaskans. A lodge nearer the site might also be inundated.

A population influx of as many as 1,300 persons during the peak period [150 single workers, 150 with three-person households, plus 240 (0.8 x 300) support workers with three-person households] would almost double the current population of the area [750 in Tok, 117 in Tanacross, 67 in Dot Lake, and 1,044 in Delta Junction (Sec. N.1.3.3.2)]. Most construction workers would probably be recruited through union halls in Fairbanks and Anchorage, although some support jobs may be filled by local residents. As many as 400 new households would require temporary or permanent housing. Because construction workers tend to settle in established population centers, it is likely that Tok and Delta Junction would be faced with the majority of the inmigrants. Community services would have to be expanded considerably, at the cost of the state for Tok, and the community for Delta Junction. Boomtown impacts described generally in Section N.1.1 would occur in both communities.

With increased service needs, existing commercial operations might be expanded and new ones opened. Expanded operations may encourage more tourists to spend time in the area, especially if recreational facilities were developed at the impoundment, further enhancing commercial growth. However, these benefits may be offset by the decrease in the rural, undeveloped nature of the area and the change in the quality of the setting for current residents.

If construction camps or onsite housing were provided for the construction period, allowing workers to maintain permanent residences elsewhere [e.g., 140 mi (230 km) away in Fairbanks], impacts would be far less severe. However, commercial operations in the nearby communities would still experience greater demand from workers at the camps. The Native Alaskan communities of Tanacross and Dot Lake may experience cultural conflicts with the inmigrants. Subsistence activities may be interfered with, as a result of increased competition for fish and game.

The operations work force would be permanent residents near the site. The 25 workers with average household sizes of 3 persons, if dispersed over the area, would be a relatively minor increase in the local population. If many chose to establish a new community very near the site, impacts would be limited to increased business at existing commercial operations.

The impoundment created by the Johnson dam would inundate portions of the Alaska Highway and a pipeline. It is assumed that construction of a new segment of the highway and the pipeline around the impoundment would occur concurrently with plant construction, so as not to interfere with use of this well-used road to the state and the flow of gas in the pipeline. If the State of Alaska had to bear totally or partially the cost of this construction, this could be a substantial addition to expenditures. The state is currently suffering financial difficulties, and these are projected to continue if gas prices remain low (Sec. N.1.1). Additionally, these projects would expand the work force associated with construction of Johnson, creating greater "boom-bust" impacts in the Tok-to-Delta Junction area.

N.2.3.3.2 Chakachamna

Chakachamna would be the second hydroelectric plant to come on line in this scenario, five years after Johnson. The plant would be located in the sparsely populated, Native Alaskan, Tyonek area. At 370 MW, it would be the largest of the plants under this scenario. Construction is assumed to require a peak work force of 400 people and a period of five years, and operation to require a work force of 50 people. Using the general assumptions applied to all the alternatives of no construction camp, this work force size would mean a peak population increment of about 2,000 persons within three years [200 singles plus (200 × 3) workers with household members plus (0.8 × 400) × 3 support workers with household members], dropping back to about 250 persons for the operation period.

As discussed in Sections N.1.3.1.2 and N.2.3.1.1, Tyonek would experience significant impacts from inmigrating population associated with construction of even small power plants. The community is stable and small, with little or no vacant housing, either permanent single-family or temporary units. Sewer and water systems, fire and police protection personnel, and local medical facilities would have to be added to existing services and the school expanded by 50%, at least for the period of construction. Construction and planning of the services would be funded by the Kenai Peninsula Borough. Native Alaskan culture and subsistence activities would be interfered with, if not dominated by, the lifestyle of the inmigrants. Commercial operations would also expand and diversify. If project developers chose to establish a temporary community near the site and distant from Tyonek, impacts to Tyonek would be reduced to expansion of commercial operations and interference with Native Alaskan culture and subsistence activities. Whether or not a new community was established, increased access and competition for plant, fish, and wildlife resources would reduce supplies in traditional subsistence areas.

Camps for construction and permanent work forces have been built for other projects and commercial operations in the Tyonek area. One of these has capacity for 200 persons (Bechtel, 1983: p. 6-111). A construction camp for the Chakachamna project has been proposed in a feasibility study (Bechtel, 1983) and would be a likely alternative for accommodating the work force, and reducing impacts on the local area. However, construction and operation of a camp would add to project expenses.

The permanent operations work force of 50 persons could result in inmigration of up to 250 persons (12 singles + 38 with three-person households + 40 support workers and their households), a substantial decrease from the peak construction influx. Boom-bust impacts discussed in Section N.2.1 would be significant. Workers themselves could perhaps be housed in a camp near the site, and rotated every few months. However, this may raise turnover, increasing operation costs. If a permanent community were established near the site, disruptions in Tyonek would be reduced. However, if any of the workers chose to establish permanent residence in Tyonek, they would create a need for expanded services and housing supplies, and could cause conflicts with Native Alaskans, as have been documented in other cases (Bechtel, 1983).

The Tyonek Native Corporation has a policy of refusing easements and rights-of-way on their land. Thus, permits to construct roads to the site may be difficult to acquire.

N.2.3.3.3 Snow

Construction and operation of the Snow hydropower plant would affect the Eastern Kenai Peninsula and the City of Seward. Under the with-Chakachamna scenario, Snow would come online in 2003; without Chakachamna, the online year would be 1998. Construction is assumed to require 200 persons over a period of four years, and operation ten persons. These work force requirements would result in inmigration at the construction peak of about 900 persons. Some Seward residents may be hired to work on the project, possibly commuting from their residences in Seward, and reducing the high unemployment (Sec. N.1.3.3.1). However, as with other projects, most hiring would probably be done through union halls in Anchorage.

Although the population in Seward and the Eastern Peninsula area increased by 31% over the 1970's, Seward's population has remained fairly stable (Sec. N.1.3.3.1). If this trend continues, its population would follow the low-growth scenario of Kenai Peninsula Borough projections (Sec. N.1.3.3.1) and increase only slightly by 1998 or 2003. Inmigration of 900 persons would be a 25% increase over the 1982 population of the Eastern Peninsula. Seward, unlike many other small communities in Alaska, has a number of rental apartment units that could be used by project workers, providing commuting to the site was feasible. However, a 25% increment in housing needs in the Eastern Peninsula area, combined with the fact that workers may choose to live nearer the site, would mean that up to 300 new permanent or temporary units would have to be provided. Accompanying housing needs would be needs for sewer, water, and other community services. School structures in Seward have accommodated 17% more students than are now enrolled. It is likely they could absorb the students accompanying project- and support-related households. Additional staff would have to be hired. The City of Seward would be responsible for planning, financing, constructing, and maintaining services.

If workers chose to live near the site, housing and all services would be needed. If the population were dispersed, individual wells and septic tanks may suffice for water and sewer services, but schools, fire and police protection, and health facilities would have to be added. These would be at the expense of the Kenai Peninsula Borough. Traffic volume on transportation routes in the Eastern Peninsula would increase with project-related travel and deliveries. The small operations work force necessary would have negligible impacts on the area, generating only an estimated maximum of 10 households and 30 persons.

N.2.3.3.4 Browne

Browne, like Snow, would be a small hydroelectric facility, with peak capacity of 100 MW. It would be completed by 2008. Construction work force required is assumed to be 200 workers for a period of four years; operations work force, ten persons. Because Browne would be located between Healy and Nenana, its construction and operations work forces would create impacts primarily in these towns. The site is about 60 to 70 mi (100-120 km) from Fairbanks, a distance which is a long daily commute, but workers could maintain permanent residences in Fairbanks to which they could commute on weekends. Thus, it is assumed in this discussion that, in the worst case, only 75% of the construction work force (150 people) would inmigrate to the Healy-Nenana area.

Including household members and support workers, total peak inmigration could reach 660 persons [75 singles plus 75 x 3 construction workers and household members plus (0.8 × 150) × 3 support workers and household members]. This number would be about 65% higher than the 1981 population and about 35% higher than the projected population in 2005 (Table N-1). An increase of this magnitude would strain housing supplies and all community services. Currently, very little vacant temporary or permanent housing exists. Considerable development would be needed to accommodate the over 300 new households which may inmigrate. Commercial operations locally and in Fairbanks may have increased business. Schools, water and sewer facilities - perhaps centralized ones, police and fire equipment, health care facilities, and full-time personnel to staff the services would have to be added to the communities. Nenana, as an incorporated town, would be responsible for the planning, financing, construction, and administration of these additional services. The state would be responsible for additions in Healy. In either case, financing construction in anticipation of growth, planning so as not to overbuild, and avoiding accruing large deficits before increased tax revenues are collected would be difficult problems.

Healy and Nenana each have populations with large proportions of Native Alaskans. Many of these people (and other residents) rely on traditional subsistence activities for food and as an integral part of their culture. Increased population may interfere with these activities, reduce subsistence resources, and cause cultural conflicts.

If construction camps were built, impacts would be reduced. Commercial operations would still receive more business, and subsistence activities would still be interfered with. The Browne impoundment would inundate about 10 mi (16 km) of both the Parks Highway, the Alaska Railroad line, and the Intertie Transmission Line right-of-way. It is assumed that construction of new routes for all three would take place concurrently with construction of Browne structures. If this is the case, interference with the use of the three would be kept to a minimum. However, construction work forces on these projects could add substantially to inmigration, whether temporary or permanent. This situation would further compound the impacts from construction of Browne alone.

The Browne construction period would also be concurrent with the construction period of Keetna in the with-Chakachamna scenario. Because the sites would be about 200 mi (320 km) apart and in rural areas, population inmigration impacts may be increased. Shortages of supplies may be exacerbated; highways and the railroad may experience difficulties in carrying capacities necessary for both projects (and for the new highway, rail, and transmission line routes); and whatever local work force could be used would be split between the two projects, increasing the likelihood of the "worst-case" inmigration levels.

N.2.3.3.5 Keetna

The Keetna hydropower facility would be about the same size as the proposed Snow facility, and would be completed by 2008 (with Chakachamna) or 1998 (without Chakachamna). The nearest communities to the proposed site would be Talkeetna and Trapper Creek. Construction work force is assumed to be 200 workers at peak; operation work force, 10 workers. Because no large communities are within commuting distance, it is assumed for the worst-case that all workers would inmigrate for some or all of the four-year construction period.

Inmigration to the small communities of Talkeetna and Trapper Creek could be as high as 880 people [100 singles plus (100 x 3) workers with household members plus (0.8 x 200) x 3 support workers and household members]. Currently, total population in the two communities is a little less than 900 persons. The communities are projected to grow to about 1,000 persons by the year 2000 (ISER projections, Table N-1). Inmigration related to the Keetna project would almost double this population (or increase it by over a third, using the Applicant's baseline projections in Table N-1).

Impacts to the Talkeetna-Trapper Creek area from such large inmigration would be significant. Although the number of inmigrants would be only about a third of those who would come with the proposed Susitna project, difficulties in planning for the rapid and high growth, and for financing and administering new housing and services would be substantially the same. Boomtown phenomena, as described in Section N.2.1, would change residents' quality of life and the rural nature of the area. On the other hand, increased access would provide opportunities for commercial development of recreational and tourist facilities by Native Alaskan corporations and by private entrepreneurs. Improvements would be at the expense of Mat-Su Borough, unless either community incorporated before construction began.

Problems related to concurrence of the Keetna and Browne construction schedules were discussed in the previous section on Browne.

N.2.4 Comparison of Alternatives

Alternative Susitna Basin hydropower developments would have construction and operation impacts similar and of comparable magnitude to those of the proposed project. The sites are located in relatively sparsely populated areas with only a few small communities. The communities of Trapper Creek, Talkeetna, and Cantwell would be the locations affected most by construction and operation of the Susitna development alternatives. These hydropower alternatives also would have greater socioeconomic impacts than the non-Susitna Basin alternatives because the former would require larger construction work forces for longer periods than would the other alternatives. Thus, boom-and-bust phenomena would be greater for the communities near the proposed sites of the Susitna Basin alternatives.

Each alternative access route would increase accessibility to a different section of the project area, thus increasing possibilities for recreational, tourist, and commercial uses of the area. Additionally, the northern access route alternative would cause growth in Hurricane, and the southern alternative would cause growth in Gold Creek. Both settlements are currently very small and would experience boomtown types of impacts. Thus, the alternative access routes are comparable in terms of socioeconomic impacts.

Each alternative power transmission route would have essentially comparable socioeconomic impacts. The alternative borrow sites would have negligible socioeconomic impacts.

The coal-fired and natural-gas-fired generation scenarios each would have socioeconomic impacts on the small Native community of Tyonek. Each of these alternative facilities would require inmigration of project workers to the area. Separate construction work force communities could reduce impacts, as would successive construction periods for the ten combustion-turbine units (requiring a total of about ten years) under the coal-fired generation alternative (see Sec. N.2.3.2). About 1.5 times as many construction workers (45 workers) would be needed for about ten years for the natural-gas-fired generation alternative than for the coal-fired generation alternative. Construction camps and successive construction periods would reduce impacts. However, even if construction worker communities were developed, inmigration of project workers and their households could result in as much as a 100% increase in the present population of Tyonek (Sec. N.2.3.1). With or without these camps, impacts to Tyonek and its citizens would be significantly greater under the natural-gas-fired generation than the coal-fired alternative.

Except for impacts to Tyonek, the natural-gas-fired generation scenario would create fewer impacts to other communities than would the coal-fired generation scenario. Under the natural-gas scenario, other combined-cycle and combustion-turbine units would be located near Anchorage and the Kenai-Soldotna area. Both of these sites are within commuting distance of existing communities large enough to provide a source of the workers needed for construction and operation of the units.

Under the coal-fired generation scenario, however, other small communities besides Tyonek would experience significant population inmigration. Healy and Nenana, in particular, would grow considerably (by 300% and 700% at peak, respectively), due to inmigration of workers and their household members for the coal mine operation and for construction and operation of the 200-MW units. This new population would significantly affect supplies of services and the lifestyle and subsistence activities of the largely Native populations of these communities. The area around Willow is better equipped to accommodate a workforce influx for construction of the two 200-MW coal units under this scenario. However, some boomtown effects would be experienced here also. Thus, with the exception of significant impacts to Tyonek, the natural-gas-fired generation scenario would have fewer overall socioeconomic impacts than would the Susitna Basin or coal-fired generation scenarios.

The hydro-thermal generation scenario with Chakachamna would have more severe impacts than the scenario without Chakachamna because of the significant socioeconomic impacts to Tyonek from construction and operation of the Chakachamna facility. As many as 2,000 persons could move to the area during peak construction--almost ten times the current population (Sec. N.2.3.3). Additionally, under the scenario with Chakachamna, concurrent construction of the Keetna and Browne facilities might exacerbate independent effects of the two projects on nearby Nenana, Healy, Cantwell, Trapper Creek, and Talkeetna. Either with or without Chakachamna, thermal units would be constructed near Nenana and Tyonek, causing additional substantial growth impacts in these areas.

Other small communities would experience socioeconomic impacts from construction of the non-Susitna hydropower facilities. The sparsely settled area along the Alaska Highway between Tok and Delta Junction would be affected significantly by inmigration of as many as 1,300 people during peak construction. Two small Native Alaskan communities near the site (Dot Lake and Tanacross) would be particularly stressed by even minor population increases (Sec. N.2.3.3).

Development of the Snow facility could cause increase in the population of the Seward area by as much as 25%. Development of the Browne hydropower facilities would affect Healy, Nenana and Cantwell; the Keetna facility would affect the Trapper Creek and Talkeetna areas. The impacts that would be experienced in all cases would be shortages of services and changes in lifestyle and subsistence activities. However, the impacts would not be of the magnitude of those created under other scenarios.

Based on the assumption that construction camps would be built for projects in the Tyonek area, the natural-gas-fired generation scenario would appear to the Staff to have fewer overall socioeconomic impacts than any of the other scenarios (including the proposed project). Substantial population growth from project-induced inmigration in presently small communities would occur to some degree under all scenarios. This growth would cause shortages in all community services, changes in lifestyles, and disruption of subsistence activities. The combined hydro-thermal scenario with Chakachamna and all the Susitna Basin developments (including the proposed project) would have the greatest socioeconomic impacts. The coal-fired generation scenario would have more substantial impacts than the natural-gas-fired scenario, but less than the other alternatives.

N.3 MITIGATION

The Staff and Alaska State agencies concur on the need to develop the following additional mitigation strategies:

- Development of concrete transportation plans, including provision of low-cost transportion options from the site area to the Fairbanks and Anchorage areas, to discourage inmigration to local communities and to preclude or limit mobility by private vehicles [Department of Community and Regional Affairs (McAnerney, 1982); Staff].
- Development of concrete shift and leave schedules that encourage construction workers to establish or maintain permanent residences outside the project area, e.g., extended periods of work followed by extended leaves (Staff).
- Training and hiring of local subcontractors, the local labor force, and unemployed residents and inmigrants seeking employment, to reduce local unemployment and welfare needs [Department of Community and Regional Affairs (McAnerney, 1982;) Staff].
- Development of incentives (e.g., low rents, low-interest mortgages) to encourage workers (and their households) to live in onsite housing to reduce inmigration to small communities in the project area and when project activities were near Native communities [Department of Community and Regional Affairs (McAnerney, 1982); Staff].
- Clear definition of responsibilities by the Applicant, state, borough, or local authorities for administration and funding of facilities and services in the project (e.g., power and telephones, roads, the onsite school) developed in cooperation with these agencies to reduce uncertainties in planning [Department of Community and Regional Affairs (Yould, 1983); Staff].
- Definition of legal responsibilities for access to the site during construction and operation to clarify funding and work force needs and sources [Department of Community and Regional Affairs (Yould, 1983); Staff].
- Active and project-funded participation by state, Federal, and local agency representatives in developing mitigation strategies and monitoring impacts. These representatives should have legal authority to approve mitigation plans and to recommend changes in implementation of plans in light of monitoring studies and information on effectiveness of the plans to ensure mutually satisfactory efforts and reduce future conflicts [Fish and Wildlife Service (Bayh, 1983); Staff].
- Reimbursement of guides displaced by project structures and activities for losses of investments, losses from transfers to another area, and costs of reestablishing their businesses.
- Controls to limit fishing, hunting, and trapping by onsite personnel, particularly in areas used for subsistence activities, based on studies of effects of restricted and open access and of permitting [Fish and Wildlife Service (Bayh, 1983); Staff].
- Coordination with state, Federal, and local agencies on specific plans for the construction camp/village, administration of the camp/village, and access options [Fish and Wildlife Service (Bayh, 1983); Staff].
- Financing the development of community and borough land use plans to adapt to project-induced growth in an orderly fashion, in line with community goals (Staff).
- Provision of funding by the Applicant to the state, borough, and local communities to finance construction of community services (e.g., water and sewer systems, counseling services, local roads) in advance of population inmigration. Amount and nature of funding (e.g., grants, loans, payments-in-lieu-of-taxes) would be determined in consultation with the government agencies, and adjusted as ongoing impact monitoring revealed effectiveness (Staff).
- Quarterly or on-demand, communication to local, borough, and state agencies of project schedules, delays and changes in schedule, work force sizes and projected needs, and of work force shift and leave schedules to aid these agencies in their planning (Staff).
- Financing of residential construction through loans and other incentives to local developers, recruiting developers when local ones are not available, and buying land for temporary or permanent housing, so that construction can begin prior to inmigration and to reduce the difficulties of acquiring backing (Staff). Such financing could be provided as investments by the Applicant.

- Provision of salaries and equipment for community and service area fire and police personnel (Staff).

- Cooperation with local, borough, and state transportation planners to plan and construct new intersections and other traffic congested places in the transportation network (e.g., intersection of the Parks and Denali Highways) (Staff).

- Provision of incentives (e.g., salary increases, transportation costs) for workers laid-off over the winter but who would be needed later in the project to return the following summer and for those employed on Watana to work on Devil Canyon in order to reduce the total number of inmigrants and the rate of population turnover (Staff).

- Provision of information about the local area, especially about Native Alaskan communities, culture, and subsistence activities, to inmigrating workers to reduce cultural and other conflicts with long-time residents (Staff).

- Development of a recruitment program to attract physicians and health care professionals to project-area communities.

Agencies have also suggested:

- Analysis of areas which would be flooded should one of the dams fail and development of land use restrictions in these areas [Department of Community and Regional Affairs (McAnerney, 1982)].

N.4 RECOMMENDED AND ONGOING STUDIES

The Applicant states that studies are being conducted to:

- Update baseline and project-induced population projections, incorporating new information that on other impact studies of large-scale construction projects, the ratios of support to project workers have been high (Yould, 1983; Exhibit E, September, 1983, Suppl. Responses);

- Develop and update a mitigation plan (Exhibit E, Vol. 7, Chapter 5, pp. E-5-127 - E-5-135; Yould, 1983);

- Plan the location of the proposed townsite and provision of services and facilities (Yould, 1983); and

- Revise all socioeconomic impact analyses (Yould, 1983).

Studies recommended in addition to those ongoing are:

- Analysis of the impacts of the location, type, and administration of the onsite camp and village on fish and wildlife resources [Fish and Wildlife Service (Bayh, 1983); Staff];

- Analysis of the impacts of the proposed project on commercial fishing, including changes in the number of jobs, in dollar values of catch, in life style of fishing families, and in subsistence catches [Fish and Wildlife Service (Bayh, 1983); Staff];

- Evaluation of subsistence, recreational, and commercial hunting, fishing, and trapping in the project area and monitoring of these activities (Staff);

- Monitoring of the availability of labor and skills in the local area, both in current resident population and in inmigrant population attracted by the prospect of employment on the project, in order to reduce local unemployment and welfare programs [Fish and Wildlife Service (Bayh, 1983), Staff];

- Surveying of workers to communicate to government agencies and local interests on where they have their permanent residences; the number of school children; fishing, hunting, and trapping activities; and use of local community facilities so that mitigation and planning can be updated (Staff); and

- In cooperation with Native Corporations and Councils, surveying of subsistence activities in Cantwell, near, and on the project site, so as to know if and when project activities interfere and need to be adjusted (Staff).

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DRAFT ENVIRONMENTAL IMPACT STATEMENT

SUSITNA HYDROELECTRIC PROJECT, FERC NO. 7114

APPENDIX O

CULTURAL RESOURCES

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APPENDIX O. CULTURAL RESOURCES

O.1 AFFECTED ENVIRONMENT

O.1.1 Proposed Project

O.1.1.1 Introduction

The cultural resource study areas for the proposed Susitna project are rich in prehistoric and historic remains. Both the quantity and the quality of these resources are significant. Currently, 423 archeological and historic sites are known in the area, and it is anticipated that further survey will produce additional sites (Exhibit E,* Vol. 7, Chap. 4, p. E-4-1; Dixon et al., 1984). Most of the known sites are concentrated in the middle and upper Susitna River Basin, chiefly along the river itself and its tributaries. More than half of the sites contain subsurface remains, and many of these appear to possess a datable stratigraphic context. This is particularly evident in the middle and upper Susitna Basin, where middle and upper Holocene time is represented by a dated sequence of volcanic tephras that permit widespread correlation of sites with an established chronological-stratigraphic scheme. This unusual geologic context, although subject to disturbance at some localities, presents considerable potential for contributing to the development of the regional culture-historic framework.

In addition to containing prehistoric and historic artifacts, many sites also contain features and faunal remains, and collectively provide a rich source of new information on past lifeways. Although in-depth evaluation of site significance has been completed at only a small portion of sites, it is apparent that many are highly significant and potentially eligible for inclusion in the National Register of Historic Places (Exhibit E, Vol. 7, Chap. 4, p. E-4-125).

O.1.1.2 Geoarcheology

O.1.1.2.1 Introduction

It is the unusual geologic context of the archeological sites in the study areas--a stratigraphic sequence of volcanic tephras--that underlies their significance and potential contribution to knowledge of Alaskan prehistory. For this reason, a thorough understanding of the local geoarcheology is of prime importance. The tephra sequence permits the relative and absolute dating of a large number of sites of post-glacial age (especially the middle and late Holocene), providing a rare opportunity for the development of a detailed cultural chronology for this portion of the Alaskan interior. The general lack of adequate stratigraphic contexts in Alaskan archeology, particularly in the Interior, has been recognized by many researchers (West, 1967; Anderson, 1968; and others). The value of the tephra stratigraphy may be limited to some degree, however, by post-depositional disturbance, another common problem in Alaskan archeology.

O.1.1.2.2 Glacial History

The initial controlling factor in the prehistoric settlement of most of the project area was the retreat of the Late Wisconsinan glaciers at the close of the Pleistocene. Although the existence of pre-Late Wisconsinan sites (i.e., sites pre-dating the advance of the Late Wisconsinan glaciers, approximately 25,000 years ago) in the area is theoretically possible, no incontrovertible evidence for such sites is presently available in Alaska. It is important, therefore, to date the retreat of the Late Wisconsinan ice in order to establish the earliest possible time of human habitation. An exception to this is the Healy-to-Fairbanks transmission corridor segment, which remained ice free throughout the Upper Pleistocene (Wahrhaftig, 1958).

The entire Southcentral Region of Alaska was inundated by Late Wisconsinan ice, including all project areas south of the Alaska Range (Pewe, 1975). Global climatic amelioration began after about 14,000 years before present (B.P.), and various dated deposits from this part of Alaska (Denton, 1974; Ten Brink and Ritter, 1980) suggest that glacier recession (periodically interrupted by brief readvances) had begun by 13,500 years B.P. Upland areas like the middle and

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*Throughout this document, references to specific "Exhibits" are to the exhibits submitted to FERC as part of Alaska Power Authority's Susitna Hydroelectric Project License Application. References to specific "Appendices" (App.) are to the appendices provided in Volumes 2 through 7 of this Draft Environmental Impact Statement.

upper Susitna Basin should have been blocked by ice until relatively late in this sequence of events, but a radiocarbon date of 11,535 ± 140 years B.P. (BETA-1821)* from post-glacial sediments near the Tyone-Susitna confluence suggests that most of the valley was ice-free by the end of the Pleistocene (Dixon et al., 1982: p. 5-6, Table 5). Large masses of stagnant ice and small readvances would have continued to influence local climate and topography at this time (Dixon et al., 1982: pp. 5-17 - 5-18). Although large glaciers were no longer present in the Susitna Valley by the early Holocene, local readvances in the mountains surrounding the basin, reflecting global climatic oscillations, occurred repeatedly during the middle and late Holocene (Denton and Karlen, 1973; Pewe, 1975). Brief episodes of renewed glacier expansion are recorded at approximately 6,000-5,000 years B.P., 3,500-2,500 years B.P., and again, after 1500 A.D. ("Little Ice Age"). The climatic fluctuations represented by these readvances undoubtedly influenced human settlement in the project area and constitute an important factor in the prehistory of the region.

O.1.1.2.3 Volcanic Tephra Deposits

Much of the middle and upper Susitna Basin has been blanketed with a series of volcanic tephra layers, which typically overlie the Late Wisconsinan glacial sediments (see Fig. O-1). This tephra sequence provides the most important basis for dating and correlating archeological sites in the project area. At least three, possibly four, tephras have been identified, three of which have been shown to be petrographically distinguishable (Dixon et al., 1983).

The tephras are relatively fine-textured, with silt and clay fractions predominating, and consist of volcanic glass and various mineral constituents. On the whole, they appear to represent volcanic ash falls of limited duration, subsequently compacted, eroded, and presumably mixed to some degree with non-volcanic sediments. The following sequence, with estimated minimum-maximum bracketing dates, comprises the project area "tephrochronology" (Dixon et al., 1982: p. 5-19, Fig. 152).

Devil Tephra (1,800-2,300 years B.P.)

Upper Watana Tephra [2,300-2,700(?) years B.P.]

Lower Watana Tephra [2,700(?)-3,200 years B.P.]

Oshetna Tephra (4,700-? years B.P.)

The age estimates are based on a series of radiocarbon dates obtained from organic-bearing non-volcanic units between and above the tephras. The recognition of individual tephras at various locations in the middle and upper Susitna Basin permits correlation and dating of numerous archeological sites over a wide area, despite the overall lack of depth of the deposits.

O.1.1.2.4 Other Deposits

Aeolian sand and silt units are often present below, between, and above the tephra layers in the middle and upper Susitna valley. These horizons apparently represent prolonged periods of deposition, weathering, and erosion, which alternately preceded and followed the brief episodes of tephra accumulation (Dixon et al., 1982: pp. 5-22 - 5-29). They are frequently enriched with organics derived from various sources, including soil formation. Many subsurface archeological horizons are found in this sedimentary context, and, considering the lengthy time periods that often appear to be represented, substantial units of occupation history may be compressed into these relatively thin layers. The organics, whether related to human activity or not, provide a productive source of radiocarbon-datable material.

Outside the middle and upper Susitna Basin, volcanic tephras are less common, and in those areas of the proposed transmission corridors examined to date, aeolian sand and silt comprise the sedimentary context for known subsurface sites (Dixon et al., 1982, 1983). Where these deposits are of adequate thickness and associated organics of sufficient quantity, this context permits relative and/or absolute dating of archeological horizons.

On the low terraces of the Susitna River and its tributaries, bedded sand and silt layers of alluvial origin provide an alternative context for subsurface sites (Dixon et al., 1982, 1983). These deposits tend to be thicker than the aeolian sequences in the project area, and also provide an acceptable and potentially independently datable stratigraphic context.

O.1.1.2.5 Post-Depositional Disturbance

Various geologic processes can modify a subsurface archeological site during or after burial, with significant effects on the condition and the horizontal and vertical position of the

*BETA-1821 is the laboratory number of the radiocarbon date.

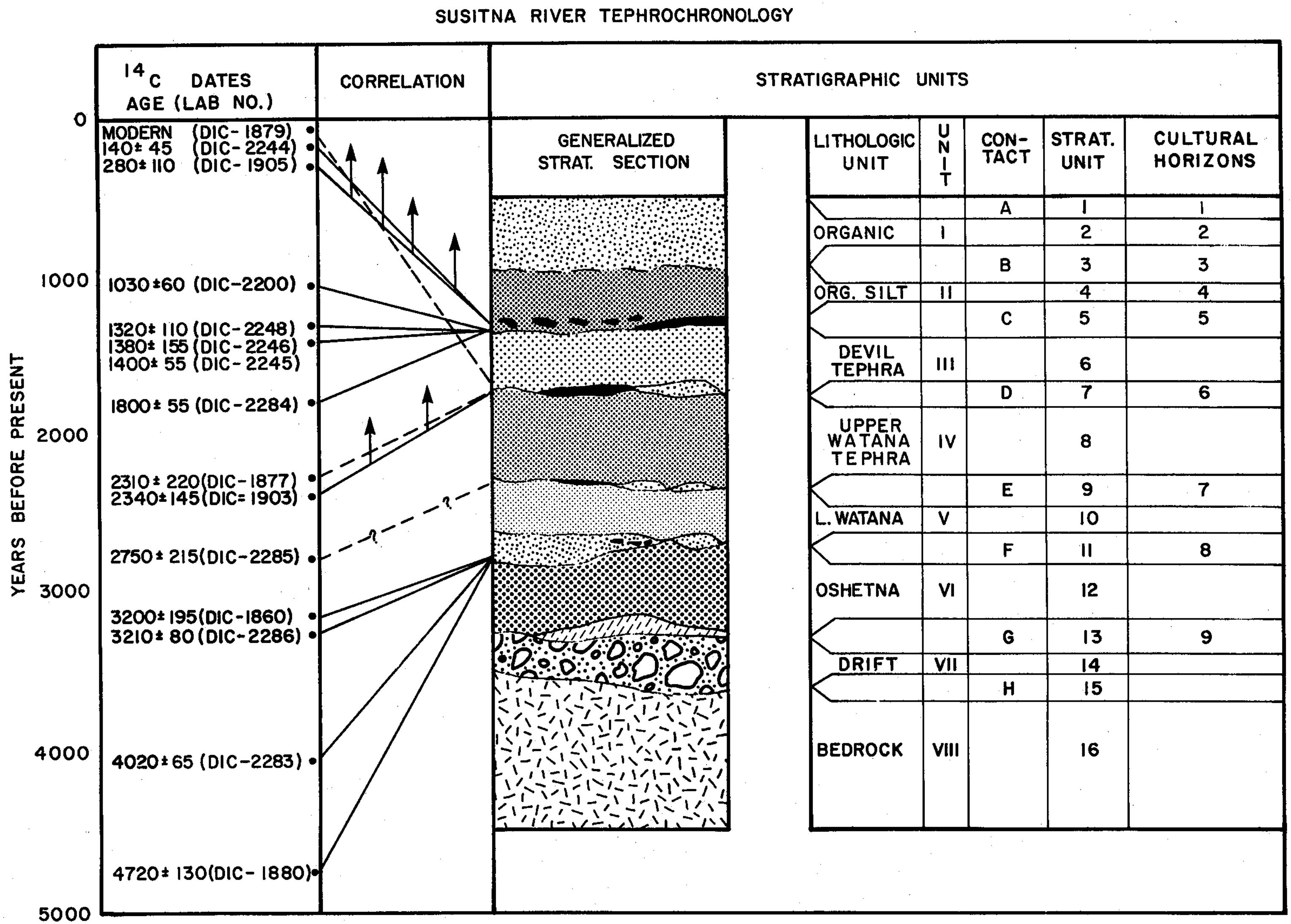

Figure 0-1. Stratigraphic Units and Tephrochronology of the Susitna Basin.
[Source: Dixon et al., 1982: p. 5-19, Fig. 152]

remains. Although virtually all of the known sites in the project area appear to be essentially in situ, a large number have been subject to some post-depositional disturbance processes, including cryoturbation, frost-driving, and solifluction (Dixon et al., 1982, 1983, 1984). The most serious consequences of these types of disturbance occur when substantial vertical displacement of remains damages or destroys the stratigraphic integrity of a site. This greatly reduces the potential of the site for contributing to knowledge of the local prehistory and history. Less severe effects include the horizontal displacement of remains (distorting spatial relationships and features), damage to artifact surfaces, and fragmentation of faunal remains.

O.1.1.3 Regional History and Prehistory

O.1.1.3.1 Introduction

Alaskan prehistory and history span at least 12,000 years (see Fig. O-2), and sites from all time periods are known in the regions containing the project study areas. An understanding of this prehistoric-historic culture framework is necessary for an evaluation of the cultural resource sites in these areas, and, as the following review indicates, it is a framework that retains many uncertainties and unresolved questions. The geologic context found in many parts of the proposed project areas makes it likely that their cultural resources will contribute significantly to the further development of the regional framework. In addition, the distribution of sites, their artifacts, and associated features and faunal remains are likely to reveal much about prehistoric adaptations and lifeways; some knowledge of the historic period is also likely to be gained.

O.1.1.3.2 Pre-Terminal Pleistocene (?40,000-12,000 years B.P.)

Since Alaska was almost certainly the entry point to the New World for the earliest Native American populations, it presumably contains the oldest archeological sites in this hemisphere. Many researchers believe that these sites should date to as much as 25,000-40,000 years B.P. or earlier. However, evidence of sites in this time range, not only in the American Arctic and Subarctic, but throughout the New World, is controversial, and at present sites pre-dating 12,000-13,000 years B.P. are questioned by some researchers (e.g., Haynes, 1982).

In the Far North, the most widely known evidence for pre-Terminal Pleistocene man consists of a large quantity of modified bones from Old Crow Basin in the Yukon, purported to be human artifacts, which appear to span the entire Wisconsinan (Irving, 1978; Morlan, 1980). Stone tools and habitation sites have not been discovered. Although the interpretation of these finds continues to be debated (Guthrie, 1980; Bonnichsen, 1981), it is apparent that many, though perhaps not all, of the modifications to these bones can be accounted for by natural processes (Haynes, 1983).

As the Susitna Basin appears to have been open prior to the onset of the Late Wisconsinan (ca. 25,000 years B.P.), and the Healy-to-Fairbanks transmission corridor segment was ice-free throughout the Upper Pleistocene, these areas may contribute evidence (positive or negative) to this hypothetical phase in Alaskan prehistory. Any sites dating to this time period would be highly significant with respect to their potential for yielding important information in prehistoric archeology.

O.1.1.3.3 Terminal Pleistocene (12,000-10,000 years B.P.)

The oldest uncontested sites in Alaska (including Southcentral Alaska), as elsewhere in the New World, date to the Terminal Pleistocene. In Alaska, the sites in this time range are assigned to the American Paleoarctic Tradition, specifically to the Denali Complex (West, 1967). The latter is characterized by wedge-shaped microblade cores, microblades, burins, and other diagnostic types, and bears close resemblances to many Upper Paleolithic sites in Northeast Asia.

Denali Complex sites in Southcentral Alaska include Donnelly Ridge in the Delta Valley (West, 1967), Dry Creek near Healy (Powers and Hamilton, 1978), and several sites in the Tangle Lakes area (West, 1981). Faunal remains from Dry Creek indicate that the makers of this technology hunted large, presently extinct Pleistocene mammals, including steppe bison (Bison priscus), and may have clustered in the cooler upland areas of the region, which apparently saw a delayed deterioration of periglacial tundra/steppe environments and their rich faunal resources (Ager, 1975).

It is possible that a second technology is also present in Interior Alaska, contemporaneous with or slightly earlier than the Denali Complex. The only clearly identified diagnostic artifacts of this technology are bifacial lanceolate or triangular points, now known from Terminal Pleistocene stratigraphic contexts at several sites, including Dry Creek (Powers and Hamilton, 1978) and Healy Lake (Cook, 1969). The existence of a separate bifacial point complex remains an unresolved issue.

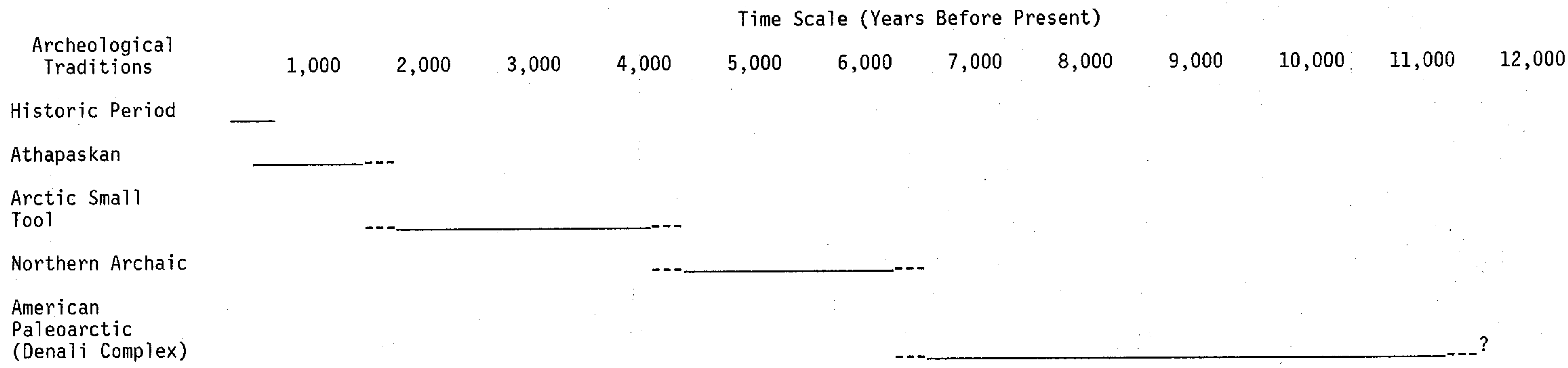

Figure 0-2. Chronology of Archeological Traditions in Southcentral Alaska. [Source: Based on Dumond, 1977; Anderson 1979; Dixon et al., 1982]

0.1.1.3.4 Early Holocene (10,000-6,500 years B.P.)

Few early Holocene sites are presently known in the Alaskan interior. Here, as in other parts of the world, post-Pleistocene environmental changes may have had a significant impact on human populations. On the other hand, there do not appear to have been major changes in tool technology, which continues to be characterized by the production and use of microblades. In northwestern Alaska, it is known locally as the Kobuk Complex (American Paleoarctic Tradition) (Anderson, 1968). The best known early Holocene site in the Southcentral Region of the state is Carlo Creek, in the Nenana Valley (Bowers, 1980). This site dates to ca. 8,500 years B.P., but lacks diagnostic artifact forms. The associated fauna includes caribou (Rangifer tarandus).

0.1.1.3.5 Middle Holocene (6,500-4,000 years B.P.)

Middle Holocene sites appear to be comparatively well represented in Interior Alaska, and they reflect an abrupt, significant change in the archeological record. Sites dating to this period are typically assigned to the Northern Archaic Tradition (Anderson, 1968), and are characterized by side-notched points, various bifacial tools, notched pebbles, and other forms. In Southcentral Alaska, Northern Archaic components have been found at Dry Creek (Powers and Hamilton, 1978), the Tangle Lakes sites (West, 1973), and elsewhere.

It is widely believed that the Northern Archaic technology represents an intrusion from more southerly latitudes, and is related to a warming peak (the Hypsithermal) and maximum expansion of the boreal forest (Dumond, 1977).

0.1.1.3.6 Late Holocene (4,000 years B.P. - 1741 A.D.)

During the later Holocene, the Alaskan interior witnesses at least two more abrupt changes in the prehistoric record. The first of these is the appearance of the Arctic Small Tool Tradition, which includes a series of coastal complexes (Denbigh, Choris, and Norton), not all of which may be represented in the Interior Region. As a whole, the Arctic Small Tool Tradition is characterized by a return to microblade and burin technology, but also contains various bifacial point forms, and eventually some pottery. In Southcentral Alaska, the Arctic Small Tool Tradition is known from a number of sites, including Lake Minchumina (Holmes, 1978), Yardang Flint Station in the Delta Valley (Reger et al., 1964), and in the Nenana Valley. The makers of these artifacts are thought to have possessed a diverse forest economy, exploiting lake and river resources, as well as woodland fauna (Dumond, 1977).

Some microblade sites from the later Holocene (ca. 1,000-2,000 years B.P.) have been regarded by some researchers as a Late Denali phase. Alternatively, these may represent additional Arctic Small Tool assemblages (West, 1975). This question remains unresolved.

Approximately 1,500-1,000 years B.P., prehistoric Athapaskan Tradition sites appear in the Interior, characterized by retouched boulder chips, scrapers, various bone implements, house depressions, and other artifacts and features. Towards the end of the 18th Century A.D., evidence of contact with European settlers, in the form of glass beads, metal implements, and other items, is present. Pre-contact and post-contact Athapaskan sites have been known in the middle and upper Susitna Basin for many years (Irving, 1957), and are not uncommon throughout the Interior. At the time of contact, most of the Southcentral Region was occupied by the Tanaina and Ahtna Athapaskans. Organized into a number of small local bands, these groups continued to follow a seasonal round of hunting, fishing, trapping, and gathering well into the historic period (Bacon et al., 1983).

0.1.1.3.7 Historic Period (1741 A.D. - present)

The earliest Europeans to explore the region were Russians, who came to the shores of Southcentral Alaska for fur trading following Bering's first expedition to the mainland in 1741. From a base established on Kodiak Island in 1784, they hunted in the waters of Prince William Sound and Cook Inlet, near the mouth of the Susitna River. Early contacts with the native population were often violent, as the Europeans repeatedly exploited native labor through superior military technology (Hulley, 1970).

Russian efforts to explore the interior of Alaska were limited, and not until 1834 did an expedition travel up the Susitna Valley, under the command of Malakoff (Bacon, 1975). By 1867, with fur resources declining, hostilities with the native population continuing, and the colony strategically vulnerable, the Russians decided to sell Alaska to the United States for $7.2 million (Hunt, 1976).

The first major influx of non-Native American settlers to the region came after the 1895 discovery of gold in Cook Inlet. In the following year, prospectors began to explore the Susitna River, although the difficult Devil Canyon passage limited penetration of the upper valley. A major gold strike on Valdez Creek in 1903 brought a large group of prospectors into the Susitna area, through the Copper River route (Bacon, 1975). Claims were worked there until the 1930s, after which the upper valley was used chiefly for hunting and trapping (Dixon et al., 1982).

0.1.1.4 Middle and Upper Susitna Basin

0.1.1.4.1 History of Research

The first archeological investigations in the middle and upper Susitna Basin were undertaken in 1953 (Irving, 1957); they involved surveying of the Devil Canyon dam site. All sites reported at that time, however, lay outside the current study area. Research did not resume until the 1970s, when a survey for the proposed Denali State Park (West, 1971) and an areawide aerial reconnaissance and ground survey at the proposed Devil Canyon and Watana dam sites (Bacon, 1975, 1978a,b) produced four prehistoric sites in the vicinity of the latter and five sites near Stephan Lake. In 1980-1983, the University of Alaska Museum initiated large-scale survey and preliminary excavation for the Alaska Power Authority (Dixon et al., 1981, 1982, 1983, 1984). Field work accomplished to date includes reconnaissance survey of the proposed Watana and Devil Canyon dam sites and impoundment areas, all borrow sites, geotechnical testing areas, and the Watana airstrip, sensitivity mapping* of the proposed access roads, railroad, Phase I recreation sites, and transmission lines, and systematic testing (i.e., significance assessment) of 26 subsurface sites (Dixon et al., 1984). During the 1984 field season, both the cultural resources inventory and significance assessment will be completed (Exhibit E, Vol. 7, Chap. 4, p. E-4-134).

The survey research design employed by the Alaska Power Authority was developed to focus on areas of high potential for cultural resource sites, which invariably exhibit a non-random spatial distribution (Dixon et al., 1980). Areas of very limited site potential (e.g., steep slopes) were eliminated altogether, while existing knowledge of site distributional patterns was used to select promising sampling locales on the basis of topographic characteristics and other important landscape features (e.g., a mineral lick) (Dixon et al., 1982: p. 2-11). Accordingly, 164 survey locales were designated, both within and adjacent to areas that would be directly affected by the proposed project. These locales (typically occupying several thousand square meters) were subject to a pedestrian surface reconnaissance and, where surficial sediments were present, a series of random test pits and smaller shovel tests. As the survey proceeded, new locational data were applied to refine the research design, leading to a significant increase in the number of sampled locales yielding sites [from 25% in 1980-1981 to 53% in 1984 (Dixon et al., 1984: p. 2-3)]. The methods employed in the survey appear to the Staff to be adequate for a relatively thorough inventory of cultural resources.

Among the sites discovered to date, a small number have been subject to systematic testing (exploratory excavation) in order to determine their eligibility for nomination to the National Register of Historic Places. Systematically tested sites were examined with a sequence of one-meter test squares, and in many cases substantial quantities of artifacts, faunal material, and information on stratigraphy and features were collected (Dixon et al., 1982, 1983, 1984). These data were fully adequate, and in some instances more than adequate, for assessment of site significance and National Register eligibility, given the relatively limited available knowledge of Interior Alaskan prehistory.

0.1.1.4.2 Prehistoric and Historic Sites

The middle and upper Susitna Basin contains 209 presently known archeological and historic sites [Dixon et al., 1982, 1983, 1984]. About 70% of these sites have produced subsurface remains, many of them possessing recognizable segments of the volcanic tephra sequence. The widespread occurrence of a datable stratigraphic context and diversity of represented archeological traditions make this an important group of sites for Alaskan prehistory. Geographically, the sites may be divided into five relatively concentrated groups, the remaining few occurring in isolated contexts (see Fig. 0-3). The largest and most important group is situated along the Susitna River and its tributaries, from the Tsusena Creek area to the Jay Creek area. This group covers an approximately 35-mile (mi) [60-kilometer (km)] section of the river and contains 116 sites, five of them historic (56% of the total for this project area). They occur near the proposed Watana dam site, and both within and adjacent to the impoundment area. Topographically, they tend to be clustered at stream confluences, along ridge-tops, and on knolls and terraces. The second group is found upriver, in the vicinity of the Oshetna-Susitna confluence, and includes 13 archeological sites (7% of the total). These sites are located adjacent to the uppermost portion of the Watana impoundment area, in topographic situations similar to the first group.

North of the river, along the proposed Denali Highway access road, a third group of sites occurs in the Deadman Lake-Big Lake area, comprising 14 archeological sites (7% of the total), chiefly situated on exposed knoll tops. These sites are located along the proposed access road and in nearby areas. Approximately 10 mi (17 km) to the southwest of this group, in the vicinity and north of Tsusena Butte in the upper Tsusena Creek valley, a fourth group, containing 29 sites (14% of the total), reported. This group includes one historic site. These sites are clustered in two proposed borrow areas; they generally occur along ridge-tops overlooking the stream

*This involves an evaluation of the site potential of a given area through aerial and limited on-ground reconnaissance.

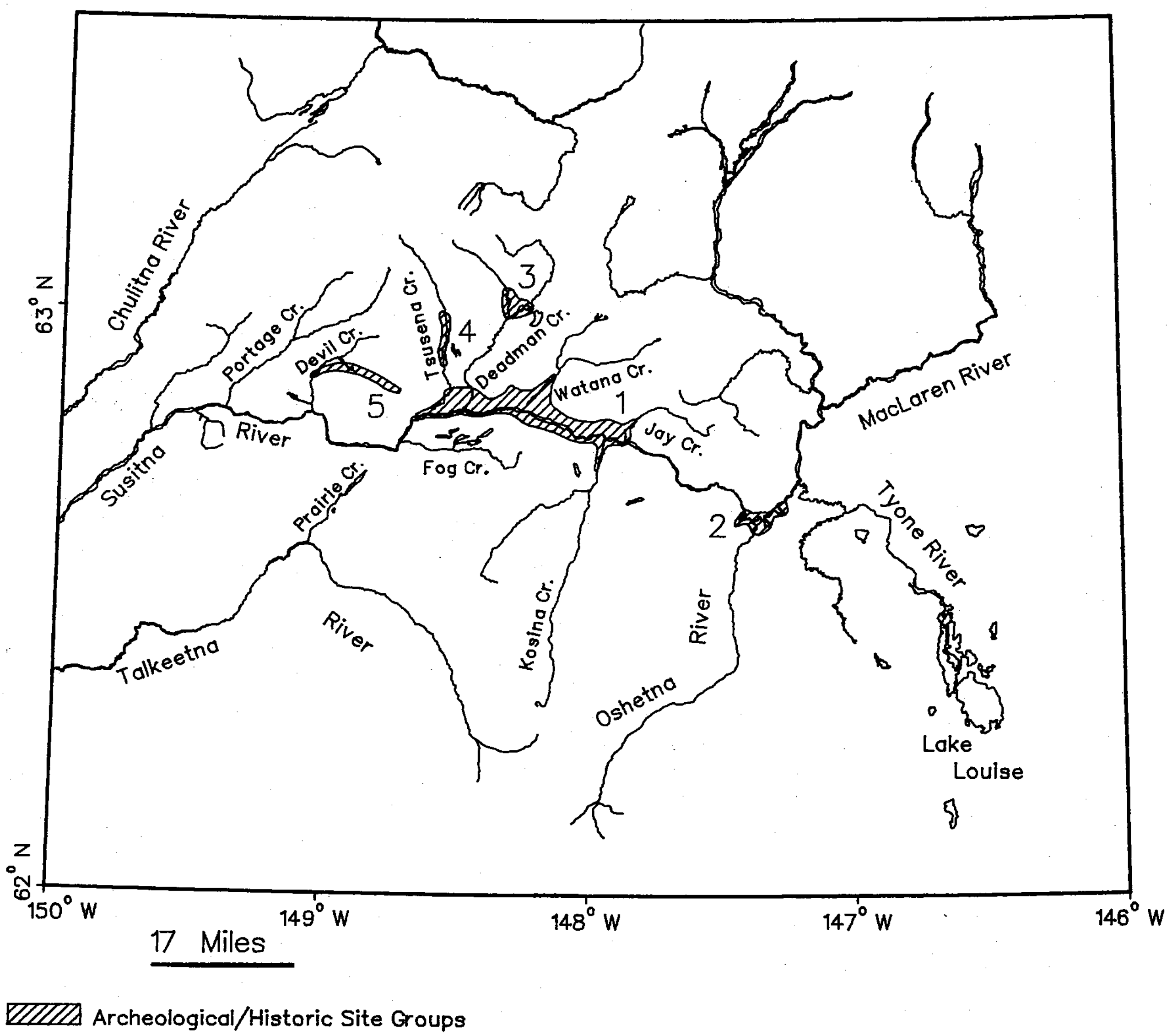

Figure 0-3. Major Cultural Resource Site Groups in the Middle and Upper Susitna Basin. [Source: Based on Data from Dixon et al., 1982, 1983, 1984]

valley. The fifth group comprises 11 archeological sites (5% of the total) distributed along a 12-mi (20-km) section of the proposed Devil Canyon-to-Watana dam site access road (Milepost 23 to Milepost 11). The remaining 24 sites (10% of the total), are isolated occurrences of varying significance; three historic sites are included. At least nine of the sites are situated in areas that would be affected by the proposed project: four within or adjacent to the Devil Canyon impoundment, three within or adjacent to the Watana impoundment, and two along the north-south access road north of the Watana dam site.

Of the 209 sites known in this study area, 142 (68%) have produced subsurface material, an unusually high percentage. These are the sites, especially those in a datable stratigraphic context, that are generally the most important. Most possess recognizable portions of the volcanic tephra sequence, which permits ready correlation and dating with the tephrochronological scheme. Among the subsurface sites, 30 or more may contain multiple buried components, some of which appear to represent different periods in the prehistoric-historic culture framework. Such sites (e.g., TLM 027, 048)* are uncommon in the Alaskan interior.

Of the 116 archeological sites known in the Tsusena-Jay Creek group, 74 contain subsurface remains. Among these, a surprising number (66) have not produced any surficial remains. Fully 66 of these subsurface sites contain recognizable portions of the tephra sequence and 33 have yielded faunal remains in association with artifacts and/or features. All of the defined regional archeological traditions appear to be represented among these sites: American Paleoarctic (TLM 027, 040, 048), Northern Archaic (TLM 027, 128, 143), Arctic Small Tool (TLM 018, 033, 053, 069), and Athapaskan (TLM 022, 038, 043, 045, 050, 059, 062, 065, 130). The five historical sites consist of wood cabins dating to the Trapping Period (1920-1945), all but one of them associated with artifacts from that period.

The Oshetna-Susitna confluence group contains ten subsurface and three surficial sites; two of the subsurface sites lack surficial remains. Recognizable portions of the tephra sequence are present at seven of the subsurface sites. Faunal remains were recovered from four sites. No regional archeological traditions have yet been identified at these sites, but in view of the high proportion of localities containing remains in stratigraphic (specifically tephra sequence) context, it seems likely that this will be accomplished in the course of future research.

The Deadman Lake-Big Lake group is largely composed of surficial sites of limited importance. Only three subsurface sites have been reported to date two of which contain portions of the tephra sequence. All of the subsurface sites possess surficial remains. No faunal remains have been recovered from these sites, and no regional archeological traditions have been identified.

The Upper Tsusena Creek group contains a high proportion of important sites. Of the 28 archeological sites, 23 possess subsurface material, and 14 of these lack surficial remains. Portions of the tephra sequence have been recognized at 20 of these sites; faunal remains have been recovered from only 3 of them. All regional archeological traditions except the American Paleoarctic have been identified at TLM 027, and it seems likely that future research will permit the identification of various traditions at other sites. One historic site, a wood cabin with associated artifacts and debris, has been located in this group.

The sites discovered to date along the proposed route of the Devil Canyon-to-Watana damsite access road are, like the Deadman Lake-Big Lake group, mostly surficial and of limited importance. Out of a total of 11 archeological sites, only one contains subsurface material. This site (TLM 110) also possesses surficial material and part of the tephra sequence. No faunal remains have been recovered from these sites, and no regional archeological traditions have been identified.

Sites located outside the five major geographic groups include 9 surficial and 12 subsurface archeological localities. Six of the subsurface sites possess portions of the tephra sequence; nine of them also possess surficial remains. Faunal material was recovered from only one site, a surface locality. Regional archeological traditions identified to date include Northern Archaic (TLM 030) and Arctic Small Tool (TLM 030, 034). Three historic sites, including two cabins and a rock inscription dating to the late Nineteenth Century, are presently known among the isolated sites.

0.1.1.4.3 Paleontologic Localities

The middle and upper Susitna Basin also contains several important paleontologic localities. Plant macro-fossils were recovered from 13 Tertiary bedrock outcrops along Watana Creek; they are thought to be of Oligocene age and provide information on plant communities during that period (Dixon et al., 1982: pp. 6-1 to 6-5). Pleistocene mammalian remains include a proboscidean femur fragment collected from Wisconsinan gravels at Tyone Bluff (near the Tyone-Susitna confluence), radiocarbon-dated at 29,450 ± 610 years B.P. (BETA-1819), (Dixon et al., 1982: pp. 5-33 to 5-34), and mandibular fragments and a molar representing a giant moose from TLM 196 (Dixon et al., 1984: p. 3-123).

0.1.1.4.4 Significance of Cultural Resources

Currently, 26 sites in the middle and upper Susitna Basin have been systematically tested by the Alaska Power Authority for significance assessment (Exhibit E, Vol. 7, Chap. 4, p. E-4-125; Dixon et al., 1984). With one exception (TLM 033), all were found to be significant and potentially eligible for inclusion in the National Register of Historic Places. The significance of these sites lies in their potentially important information on Alaska prehistory, both in terms

*These designations refer to the Alaska Historical Resources Survey number assigned to a given site in the Talkeetna Mountains (TLM) U.S.G.S. quadrangle. Each quadrangle is accorded a separate sequence of site numbers.

of (1) understanding the prehistoric-historic culture sequence and past lifeways, and (2) in their embodiment of distinctive characteristics of various prehistoric periods, as specified in 36 CFR 60.4, which lists the necessary criteria for National Register eligibility. All of these sites possess a datable stratigraphic context (typically containing portions of the tephra sequence), and many contain diagnostic artifacts, features, and faunal remains, all of which are pertinent to the first criterion, and most of which are pertinent to the second criterion. Three historic sites (cabins) have also been determined (without systematic testing) to be significant on the basis of their possession of distinctive characteristics of a historic period.

Given the high proportion of remaining stratified, datable archeological sites, many of which contain large quantities of artifactual and faunal remains, it is likely that many additional sites in areas potentially affected by the proposed project will be assessed as significant. A moderating factor in this evaluation is post-depositional disturbance, which has been observed at 10% to 15% of the sites. Where the vertical displacement of remains appears to have been substantial, site significance may be reduced. The surficial archeological sites generally lack an adequate stratigraphic context, and are of limited importance. Possible exceptions would include situations where surface material overlies the whole tephra sequence, and consequently rests in a better-defined chronological (and by inference, cultural) unit. These sites could provide some useful information on late prehistoric (specifically Athapaskan) settlement patterns. However, many surface sites occur on exposed till and lack diagnostic artifacts; these remains are very difficult to relate to specific periods within the 12,000-year record of regional habitation, and are therefore of little significance.

0.1.1.5 Transmission Corridors

0.1.1.5.1 History of Research

At present, only sensitivity mapping, including limited on-ground reconnaissance, has been completed along the proposed Dams-to-Gold Creek segment of the proposed transmission corridor, the Healy-to-Willow segment (which parallels the Intertie), and the Willow-to-Anchorage segment (Dixon et al., 1984). However, previous research and some ground reconnaissance have produced a number of sites in the Healy-to-Fairbanks segment and along the Intertie. Preliminary surveys in the Healy area were undertaken in 1973 and 1975 (Holmes, 1975) and 1976 (Plaskett, 1976), the first yielding the well-known stratified Dry Creek site (Powers and Hamilton, 1978). The Dry Creek site contains two Denali Complex (i.e., American Paleoarctic) components with associated faunal remains and a Northern Archaic component. Several new Healy area sites have been reported from recent survey work (Hoffecker, 1980), including reconnaissance testing for the Alaska Power Authority in 1982 (Dixon et al., 1983). Much information is available about cultural resources along the Intertie route, both as a result of surveys conducted by the Alaska Power Authority in 1981-1982 (Bacon et al., 1982, 1983) and earlier discoveries (Reger, 1978). Additional field work will be necessary to complete the cultural resources inventory and significance assessment of this study area.

Reconnaissance survey of the remainder of the transmission corridors is planned for 1984, with systematic testing where appropriate for evaluation of significance. The existing plans appear to be adequate for environmental impact assessment.

0.1.1.5.2 Prehistoric and Historic Sites

HEALY-TO-FAIRBANKS SEGMENT

A total of 69 archeological and historic sites is currently known from this portion of the proposed corridor (Dixon et al., 1984). No paleontological sites have been reported, although many Pleistocene mammal fossils have been recovered from the area around Ester (west of Fairbanks) (Pewe, 1975). The largest concentration of sites (46) occurs in the Nenana Valley between Healy and Browne. These are chiefly archeological and include a number of small surface sites (e.g., FAI 141, HEA 026, HEA 038) and several subsurface localities (e.g., FAI 214, HEA 035). Some of the latter contain multiple components (FAI 206, HEA 005, HEA 129, and others), but faunal remains are rare. All regional prehistoric traditions appear to be represented in this area. Some historic sites are present, including the Alaska Railroad station at Healy (HEA 080) (Holmes, 1975; Plaskett, 1976; Hoffecker, 1980; Dixon et al., 1983, 1984). The remaining 23 sites are mostly located within the town of Nenana and in Goldstream Valley, along the Alaska Railroad (Dixon et al., 1984). Detailed information about these sites currently is not available.

HEALY-TO-WILLOW SEGMENT

A total of 40 archeological and 76 historic sites has been recorded along the Intertie, which parallels the Healy-to-Willow segment of the proposed corridor (Bacon et al., 1982, 1983). Sites are distributed throughout the proposed project area, although the heaviest concentration occurs at the northern end, between Healy and Cantwell. The archeological localities are chiefly surficial (e.g., HEA 019, HEA 096, HEA 200), but several subsurface sites (e.g., HEA 201, HEA 203) are also known. These subsurface sites include the multi-component Carlo Creek site (HEA 031) (Bowers, 1980), and the late prehistoric Nenana River Gorge site (HEA 062) (Plaskett, 1977) both of which contain faunal remains. It seems likely that most, if not all, regional traditions are represented in this area. Half (43) of the historic sites are bridges, tunnels, stations, and camps associated with the Alaska Railroad. The remainder include historic cabins (e.g., TAL 019, HEA 206), houses (e.g., TAL 023, TAL 028), and cemeteries (e.g., CI 165, CI 169).

WILLOW-TO-ANCHORAGE SEGMENT

Thirty archeological and historic sites are currently known along this southern segment of the proposed transmission corridor (Dixon et al., 1984). Detailed information on these sites is presently limited. A number of them are historic localities, including sites associated with the Alaska Railroad (e.g., ANC 079, ANC 099).

O.1.1.5.3 Significance of Cultural Resources

Although no systematic testing for site significance assessment has been conducted by the Alaska Power Authority in the transmission corridor study area (Dixon et al., 1984), it is clear from existing data that at least several of the sites are likely to be judged significant and potentially eligible for the National Register of Historic Places. While the dated tephra sequence that occurs in the middle and upper Susitna Basin is absent in the transmission-corridor areas examined to date, the aeolian deposits in the Healy area constitute a stratigraphic context for several sites (e.g., Dry Creek) that already have provided important information on Alaskan prehistory. The Carlo Creek site (near Cantwell) represents another important archeological site. It is possible, therefore, that this portion of the study area will contain additional significant sites.

O.1.2 Susitna Development Alternatives

O.1.2.1 Alternative Dam Locations and Designs

O.1.2.1.1 Watana I-Devil Canyon

The reduction of the proposed Watana reservoir level by 100 feet (ft) [30 meters (m)] would not alter the affected environment, but would exclude a number of sites from the impoundment area or its potentially unstable margins. The largest concentration of these sites is located on the southern side of the Susitna River, opposite the mouth of Watana Creek, where 13 archeological sites (TLM 064, 120 through 125, 127, and 129 through 133) occur at elevations of 2,200 to 2,300 ft (670-700 m) (Dixon et al., 1983). Slopes in this area are currently stable, although subject to some potential beaching and flows (Exhibit E, Vol. 7, Chap. 6, Fig. E-6-35). Most of these sites would occupy higher slopes rather than reservoir margins under the Watana I scheme. One site (TLM 064) would occupy an impoundment margin area, rather than an inundated zone. A smaller group of five archeological sites (TLM 026, 042, 073, 196, 207) that occur at elevations of 2,200 ft (670 m) or slightly higher in the Oshetna-Susitna confluence area (Dixon et al., 1982, 1984), would be located on a reservoir margin and, possibly in some cases, higher slopes, rather than inundated zones. Only one of these sites (TLM 196) is in an area of current slope instability (Exhibit E, Vol. 7, Chap. 6, Fig. E-6-45). Five other archeological sites are likely to be affected, including TLM 177 near Deadman Creek, TLM 038 and 218 in upper Watana Creek, TLM 119 approximately 6 mi (10 km) above Watana Creek mouth, and TLM 145 on Jay Creek (Dixon et al., 1982, 1983, 1984). Three of these sites (TLM 119, 177 218) would occupy reservoir margins rather than inundated zones, while the remaining pair would probably be on higher slopes rather than in marginal zones. All other sites described in the Watana impoundment area for the proposed project (see Sec. K.1.1.1) would be inundated by the proposed Watana I alternative.

Only three of the sites discussed above (TLM 038, 042, 130) have been systematically tested for significance assessment, and all were found to be significant (Dixon et al., 1982, 1983). Among the other sites, only five (TLM 122, 124, 131, 132, 133) appear to be lacking in subsurface remains, and seem unlikely to be significant. Three sites (TLM 026, 123, 196) contain subsurface material that may or may not be related to human occupation. At least six localities (TLM 064, 073, 121, 177, 207, 218) contain archeological remains in a tephra sequence stratigraphic context and are likely to be significant. It is not clear how many of the remaining nine sites are likely to be significant.

Cultural resources within or near the Devil Canyon impoundment area, which would not be altered under this proposed alternative, are described in Section O.1.1.1.

O.1.2.1.2 Watana I-Modified High Devil Canyon

The existing environment for the proposed Watana I alternative is described in Section O.1.2.1.1.

The location of the Modified High Devil Canyon alternative dam site, approximately 5 mi (8 km) upstream from the proposed Devil Canyon site, and the elevation of the proposed Devil Canyon reservoir level by 20 ft (6 m), would not alter the affected environment with respect to cultural resources for this proposed project area as described in Section 0.1.1.1.

0.1.2.1.3 Watana I-Reregulating Dam

The affected environment for the proposed Watana I alternative is described in Section 0.1.2.1.1.

The location of the Reregulating dam alternative, approximately 13 mi (22 km) upstream from the proposed Devil Canyon dam site and the creation of a 1,500-ft (460-m) reservoir would alter the affected environment by excluding one archeological (TLM 118) and one historic (TLM 020) site from the area which would be impacted by the proposed Devil Canyon development as described in Section 0.1.1.1.

0.1.2.2 Alternative Access Routes

0.1.2.2.1 Corridor 1 (North)

This alternative has been subject to preliminary survey (chiefly aerial reconnaissance) (Exhibit E, Vol. 7, Chap. 4, p. E-4-4). Twelve archeological sites have been reported; these are discussed in Section 0.1.1.4.2. These sites are typically lacking in stratigraphic context and are of limited importance. It seems unlikely that this access corridor would contain many, if any, significant sites.

0.1.2.2.2 Corridor 2 (South)

Only limited portions of this alternative access corridor (along the Susitna River between Tsusena and Fog creeks) have been surveyed. Generally, the terrain covered by the route is thought to have less potential for significant sites than the other corridors (Exhibit E, Vol. 9, Chap. 10, p. E-10-46).

0.1.2.2.3 Corridor 3 (Denali-North)

Although this alternative access corridor has only been subject to preliminary (chiefly aerial) reconnaissance survey (Exhibit E, Vol. 7, Chap. 4, p. E-4-4), a group of sites has been discovered in the Deadman Lake-Big Lake area. These sites include 14 archeological localities; they are mostly surface sites of limited importance. Two other sites (TLM 116, 153) are reported near MP 36. TLM 116 is a surface site (rock cairn); no information is available on TLM 153. It seems likely that additional sites will be located in the course of future surveys; a small proportion of these sites may be significant.

0.1.2.3 Alternative Power Transmission Routes

Available information on existing cultural resources in the transmission corridors is presented in Section 0.1.1.5.

0.1.2.4 Alternative Borrow Sites

All proposed quarry/borrow sites have either been surveyed or eliminated from survey for cultural resources (Dixon et al., 1984). Only borrow sites C, E, and F contain archeological/ historic sites. Borrow site H is adjacent to the Fog Creek site (TLM 030), which has been assessed as significant.

Borrow site C is located in the Upper Tsusena Creek area, where 29 archeological sites have been discovered (see discussion in Sec. 0.1.1.4.2). Fifteen of the Tsusena Creek sites reportedly occur within this borrow pit, and the majority of these possess subsurface remains within volcanic tephra stratigraphy (Dixon et al., 1982, 1984). One site (TLM 097) has already been assessed as significant (Dixon et al., 1984), and it is likely that more of these sites will be termed significant.

Borrow site E, which is located at the mouth of Tsusena Creek, contains two archeological sites, one of which (TLM 022) has been systematically tested and termed significant, and a historic cabin. This area is also included within the Devil Canyon impoundment. A fourth site (TLM 035) is adjacent to this borrow pit but outside the impoundment; this site may be significant.

Borrow site F is located on Tsusena Creek, immediately downstream from borrow site C. It contains nine archeological and one historic site. All but two of the archeological sites have produced artifacts in a tephra stratigraphic context (Dixon et al., 1984), and although none has been systematically tested to date, it seems likely that some will be assessed as significant.

0.1.3 Non-Susitna Power Generation Alternatives

0.1.3.1 Natural Gas-Fired Generation Scenario

0.1.3.1.1 Beluga-Chuitna Area

No cultural resources are presently reported [i.e., listed in Alaska Historic Resources Survey (AHRS) files] from the two designated siting areas for this alternative location, and no local surveys have been conducted. However, a regional literature search has been completed (Bacon, 1982). Four historic and ethnohistoric sites are known in the Tyonek area (two in Tyonek, one in Ladd, and one at Granite Point) (Smith, 1984), but it has been suggested that prehistoric and historic native sites along the shoreline would have been largely destroyed by tidal action (Exhibit E, Vol. 9, Chap. 10, p. E-10-119). Site-specific surveys would be necessary to adequately assess cultural resources. Since both areas are near the coast, and contain portions of river systems, it seems likely that some cultural resource sites will be present, particularly on the higher ground. (See Sec. 0.1.3.2.3 for discussion of Cook Inlet regional prehistory and history.)

0.1.3.1.2 Kenai

The alternative siting area contains at least four archeological sites, apparently of late prehistoric and historic age (Kent et al., 1964). Several kilometers to the south, in the vicinity of the Kenai River, there are over twenty sites, consisting chiefly of ancient house depressions and pits. These sites contain a small number of Athapaskan (?) artifacts and Russian trade items, and are of comparable age. A site-specific survey would be necessary to fully assess existing cultural resources, and seems likely to produce additional sites, especially in association with Bishop Creek and the numerous small lakes in the area.

0.1.3.1.3 Anchorage

No cultural resource sites are currently reported (i.e., listed in AHRS files) in this alternative siting area (Dixon et al., 1984), and no local surveys have been conducted (Smith, 1984). A site-specific survey would be necessary to properly assess existing cultural resources. The north shore of Turnagain Arm has produced at least one highly significant archeological site (Beluga Point) which contains remains of the American Paleoarctic (?), Northern Archaic, and more recent Kachemak Tradition (Reger, 1977).

0.1.3.2 Coal-Fired Generation Scenario

0.1.3.2.1 Willow

Portions of the Willow area have been surveyed by Reger (1978), as well as by the Alaska Power Authority for the Anchorage-Fairbanks Transmission Intertie (Bacon et al., 1982, 1983), revealing three historic sites associated with the Alaska Railroad, and one prehistoric site containing a house pit. A site-specific survey would be necessary to fully assess existing cultural resources. The area seems unlikely to possess many significant sites.

0.1.3.2.2 Nenana

The Nenana area may be included in the regional history and prehistory discussion in Section 0.1.1.3. Seven sites are reported in the immediate vicinity of the town (Dixon et al., 1984), but no sites or surveys are reported for the designated siting area (Smith, 1984). A site-specific survey would be necessary for adequate assessment of existing cultural resources. It seems possible, given the geographic position (at the Nenana-Tanana confluence) and historic importance of Nenana, that significant prehistoric and historic sites would occur here.

0.1.3.2.3 Cook Inlet

The Cook Inlet area is part of a region (the southcentral coast) characterized by a prehistory and history distinct from that of the middle and upper Susitna Valley and adjoining areas of the Alaskan Interior. Various portions of it have been subject to surveys and excavations over the last half century, including Prince William Sound (deLaguna, 1956), the northern side of Knik Arm (Dumond and Mace, 1968), and the northwestern Kenai (Kent et al., 1964). The earliest inhabitants known to date manufactured a microblade technology, possibly associated with the American Paleoarctic Tradition (Denali Complex), discovered at the Beluga Point site (ANC 054) on the north shore of Turnagain Arm, which may also contain a Northern Archaic component (Reger, 1977). However, most of the sites in this region can be assigned to the Kachemak Tradition, representing the remains of a coastal-adapted late prehistoric people (3500-1000 B.P.) (Dumond, 1977). Important sites include Fish Creek (ANC 037) and Cottonwood Creek (ANC 035) on the north side of Knik Arm, and Palugvik on the east side of Prince William Sound. They have yielded pottery, stone lambs, labrets, polished slate implements, and other artifacts, and contain house depressions, pits, and middens. In historic times, the region (excluding Prince William Sound) was occupied by the Tanaina, an Athapaskan group, whose technology was largely manufactured on wood and bone, usually not preserved (Osgood, 1937; Kent et al., 1964). Prince William Sound, including the Whittier area, was inhabited by the Pacific Eskimo.

Site-specific surveys would be necessary in all siting locations selected for this alternative in order to properly assess existing cultural resources.

0.1.3.3 Combined Hydro-Thermal Generation Scenario

0.1.3.3.1 Johnson

No sites are reported (listed in AHRS files) from the designated dam site or upstream (Smith, 1984). Although no specific surveys of this alternative have been conducted to date, the Upper Tanana region in general has been subject to some study, and several significant sites have been discovered (Finn-Yarborough, 1975). One of the most important regional sites is Dixthada (Mansfield village area) which contains historic and prehistoric Athapaskan levels, as well as an earlier prehistoric component (probably Arctic Small Tool Tradition) (Rainey, 1940, 1953). There are several sites at Healy Lake about 20 mi (30 km) north of the alternative dam site, including the stratified Village site, which contains numerous prehistoric components (Cook, 1969). Two prehistoric (?) and three ethnohistoric sites occur on the northern shore of Lake George (Smith, 1984). Additional survey work is needed to assess existing cultural resources, and it seems likely that this additional work would produce new significant sites.

0.1.3.3.2 Keetna

No sites are presently recorded on the AHRS map, and no surveys have been conducted in this area (Exhibit E, Vol. 9, Chap. 10, p. E-10-12; Smith, 1984). A survey would be necessary to assess existing cultural resources. Since it occurs in the same region as the proposed project, this area may be as rich in prehistoric and historic sites as the middle Susitna Basin. The topography is similar, the valley being canyon-like, and it is conceivable that the Susitna volcanic tephra stratigraphy is present as well.

0.1.3.3.3 Snow River

No sites are recorded on the AHRS map, and no surveys have been undertaken at the designated dam site or nearby (Exhibit E, Vol. 9, Chap. 10, p. E-10-12; Smith, 1984). However, at least ten historic sites (including several ARR stations, cabins, cemetery, and trails) are known in the area. A survey would be necessary to evaluate cultural resources. Given the proximity of the coast and the natural resources of the area, sites along the river course (largely on the high surfaces of this canyon-like valley) and on the lakeshore seem likely. It should be noted, however, that surveys in the nearby Bradley Lake area have been unproductive despite these factors (Steele, 1981).

0.1.3.3.4 Browne

More than 50 sites are known in this area. Limited surveys have been conducted in the past (Holmes, 1975; Plaskett, 1976; Hoffecker, 1980), some as part of the northern transmission corridor study (Dixon et al., 1983a,b). Many of the known sites possess adequate stratigraphy (aeolian silt and sand) of varying depth, and represent several prehistoric traditions, including Athapaskan (FAI 205?), Arctic Small Tool (HEA 129), and American Paleoarctic (FAI 206). No historic sites are reported. However, no general survey has been conducted, especially in the valley bottom areas and lower terraces between Browne and Ferry, which are most likely to be affected by the proposed alternative. Both terrace-top aeolian deposits and side-valley alluvial fan sediments may contain new sites in this portion of the valley. Additional survey work is necessary, therefore.

0.1.3.3.5 Lake Chakachamna

No sites are presently recorded on the AHRS map in this area, and no cultural resources surveys have been conducted to date (Exhibit E, Vol. 9, Chap. 10, p. E-10-11; Smith, 1984). A survey would be necessary, therefore, to properly assess the existing environment. The proximity of the area to the coast and its available resources suggest that sites are likely to be present. On the other hand, the relative lack of suitable lakeshore margin terrain in this steep-walled basin is a negative factor. Small hunting camps in the upland areas seem more likely, although an adequate stratigraphic context may be absent.

0.1.3.3.6 Beluga River, Nenana, and Anchorage

Cultural resources in the Beluga River, Nenana, and Anchorage areas are described in Sections 0.1.3.1.1, 0.1.3.2.2, and 0.1.3.1.4, respectively.

0.2 ENVIRONMENTAL IMPACT

0.2.1 Proposed Project

0.2.1.1 Watana Development

0.2.1.1.1 Construction

Direct and indirect impacts to archeological, historic, and paleontological sites would occur during the construction of the dam and associated facilities, and during the inundation of the impoundment area. Indirect impacts to sites along the impoundment margins would occur during the later phases of reservoir-filling, and other sites near the impoundment limit would be subject to potential impacts. Direct impacts are defined as effects that "occur at the same time and place" as the proposed project, while indirect impacts include secondary adverse effects which are "later in time or farther removed in distance, but are still reasonably forseeable" (36 CFR 800.3a). "Potential impacts" are produced by less predictable ancillary developments and are distinguishable from those described above (McGimsey and Davis, 1977); for legal purposes, they may be considered as indirect impacts. Although some loss of significant cultural resources (i.e., those eligible for inclusion in the National Register of Historic Places) is inevitable, most impacts would be mitigated by investigation. Investigation involves problem-oriented study of sites through excavation and analysis of recovered material; it is usually preferred over avoidance and/or protection only when the latter are insufficient (McGimsey and Davis, 1977). Given the established importance of many of these sites (see Sec. 0.1.1.4.4), the mitigation process would be likely to make a substantial positive contribution to Alaskan prehistoric and historic knowledge. The latter is likely to lie in the realm of prehistoric cultural chronology, which still retains many gaps, because of the unusual quality of stratigraphic and temporal control exhibited by these sites.

As indicated in Table 0-1, eight archeological sites would be directly impacted, and six archeological sites would be indirectly impacted during construction of the proposed Watana dam and associated facilities. All sites are located in close proximity to the proposed dam site. Three sites have been systematically tested to date, and all have been assessed as significant; other sites seem likely to be significant as well.

Thirty-seven archeological and three historic sites would be directly impacted by inundation of the impoundment area. Eighteen archeological and one historic site would be indirectly impacted by effects on the reservoir margins, chiefly increased slope instability. Sites are generally concentrated along the river between the unnamed creek below Watana and Jay Creek (see Fig. 0-3, site group 1), and in the Oshetna-Susitna confluence area (see Fig. 0-3, site group 2). Nineteen of these sites have been systematically tested, and all but one have been assessed as significant; undoubtedly, additional significant sites will be identified, judging by the high proportion of subsurface localities with rich inventories (Dixon et al., 1982, 1983).

Approximately ten paleontological sites along Watana Creek would be directly impacted by inundation of the reservoir area. These localities, which have produced fossil plant assemblages, are of late Oligocene age, and therefore cannot contain archeological remains (Dixon et al., 1982). Fossil flora assemblages of this age are common in Alaska (Wolfe, 1977). For these reasons, the sites seem unlikely to be significant.

0.2.1.1.2 Operation

Adverse effects to cultural resources during this phase of the proposed project would seem likely to be confined to the category of potential impacts. These impacts would be the result of increased access to and use of the project area, and would vary according to the nature and extent of the latter. Although some damage due to vandalism to significant sites seems possible, preservation through avoidance and protection (a monitoring program involving periodic site inspections by the appropriate land-managing agency) appears to be an adequate mitigative measure.

Since precise assessment of potential impacts is impossible, the number of sites placed in this category is relatively subjective. Fifty-three archeological sites are currently included in the potential impacts list for this portion of the project area (see Fig. 0-3, site group 1). Three of these sites have been systematically tested and determined to be significant (e.g., TLM 139).

0.2.1.2 Devil Canyon Development

0.2.1.2.1 Construction

Archeological and historic sites within the impoundment limit would be subject to direct and impacts. No sites are known in the area of the proposed dam and associated facilities. Although some loss of significant cultural resources would be inevitable, investigation would mitigate

Table 0-1. Expected Impacts and Recommended Mitigation: Watana Development

AHRS†[1] No.	Type	Significance	Impact	Recommended Mitigation
TLM 015	Archeological		Indirect	
TLM 016	Archeological	Significant	Direct	Investigation
TLM 017	Archeological		Direct	
TLM 018	Archeological	Significant	Direct	Investigation
TLM 021	Archeological		Potential	Avoidance
TLM 025	Archeological		Potential	Avoidance
TLM 026	Archeological		Indirect	
TLM 028	Archeological		Potential	Avoidance
TLM 031	Archeological		Potential	Avoidance
TLM 032	Archeological		Potential	Avoidance
TLM 033	Archeological	Not Significant	Direct	None
TLM 036	Archeological		Potential	Avoidance
TLM 037	Archeological		Potential	Avoidance
TLM 038	Archeological	Significant	Indirect	Investigation
TLM 039	Archeological	Significant	Direct	Investigation
TLM 040	Archeological	Significant	Direct	Investigation
TLM 042	Archeological	Significant	Indirect	Investigation
TLM 043	Archeological	Significant	Direct	Investigation
TLM 044	Archeological		Potential	Avoidance
TLM 045	Archeological		Potential	Avoidance
TLM 046	Archeological	Significant	Potential	Avoidance
TLM 047	Archeological		Potential	Avoidance
TLM 048	Archeological	Significant	Direct	Investigation
TLM 049	Archeological		Potential	Avoidance
TLM 050	Archeological	Significant	Direct	Investigation
TLM 051	Archeological		Indirect	Avoidance
TLM 052	Archeological		Potential	Avoidance
TLM 053	Archeological		Potential	Avoidance
TLM 058	Archeological		Direct	
TLM 059	Archeological	Significant	Direct	Investigation
TLM 060	Archeological		Direct	
TLM 061	Archeological		Direct	
TLM 062	Archeological	Significant	Direct	Investigation
TLM 063	Archeological		Direct	
TLM 064	Archeological		Indirect	
TLM 065	Archeological	Significant	Direct	Investigation
TLM 066	Archeological		Potential	Avoidance
TLM 069	Archeological	Significant	Potential	Avoidance
TLM 071	Historic	Significant	Indirect	Preservation
TLM 072	Archeological		Direct	

Table 0-1. (Continued)

AHRS†[1] No.	Type	Significance	Impact	Recommended Mitigation
TLM 073	Archeological		Indirect	
TLM 074	Archeological		Potential	Avoidance
TLM 075	Archeological		Direct	
TLM 076	Archeological		Potential	Avoidance
TLM 077	Archeological		Direct	
TLM 079	Historic	Significant	Direct	Investigation
TLM 080	Historic	Significant	Direct	Investigation
TLM 102	Archeological		Direct	
TLM 104	Archeological		Direct	
TLM 115	Archeological		Direct	
TLM 119	Archeological		Direct	
TLM 120	Archeological		Indirect	
TLM 121	Archeological		Indirect	
TLM 122	Archeological		Indirect	
TLM 123	Archeological		Indirect	
TLM 124	Archeological		Indirect	
TLM 125	Archeological		Indirect	
TLM 126	Archeological		Direct	
TLM 127	Archeological		Indirect	
TLM 128	Archeological	Significant	Potential	Avoidance
TLM 129	Archeological		Potential	Avoidance
TLM 130	Archeological	Significant	Direct	Investigation
TLM 131	Archeological		Indirect	
TLM 132	Archeological		Indirect	
TLM 133	Archeological		Indirect	
TLM 134	Archeological		Potential	
TLM 135	Archeological		Potential	Avoidance
TLM 136	Archeological		Potential	Avoidance
TLM 137	Archeological		Direct	
TLM 138	Archeological		Potential	Avoidance
TLM 139	Archeological		Potential	Avoidance
TLM 140	Archeological		Potential	Avoidance
TLM 141	Archeological		Potential	Avoidance
TLM 142	Archeological		Potential	Avoidance
TLM 143	Archeological	Significant	Indirect	Investigation
TLM 144	Archeological		Potential	Avoidance
TLM 145	Archeological		Indirect	
TLM 146	Archeological		Potential	Avoidance
TLM 147	Archeological		Potential	Avoidance
TLM 148	Archeological		Potential	Avoidance
TLM 149	Archeological		Potential	Avoidance
TLM 150	Archeological		Potential	Avoidance
TLM 151	Archeological		Potential	Avoidance

Table O-1. (Continued)

AHRS†[1] No.	Type	Significance	Impact	Recommended Mitigation
TLM 152	Archeological		Potential	Avoidance
TLM 154	Archeological		Potential	Avoidance
TLM 159	Archeological		Potential	Avoidance
TLM 160	Archeological		Indirect	
TLM 164	Archeological		Indirect	
TLM 165	Archeological		Direct	
TLM 166	Archeological		Direct	
TLM 167	Archeological		Direct	
TLM 169	Archeological		Direct	
TLM 170	Archeological		Potential	Avoidance
TLM 171	Archeological		Direct	
TLM 172	Archeological		Direct	
TLM 173	Archeological		Direct	
TLM 174	Archeological		Direct	
TOM 175	Archeological		Direct	
TLM 177	Archeological		Direct	
TLM 180	Archeological	Significant	Indirect	Investigation
TLM 181	Archeological		Potential	Avoidance
TLM 182	Archeological		Direct	
TLM 183	Archeological		Potential	Avoidance
TLM 184	Archeological	Significant	Direct	Investigation
TLM 185	Archeological		Potential	Avoidance
TLM 186	Archeological		Potential	Avoidance
TLM 187	Archeological		Potential	Avoidance
TLM 188	Archeological		Potential	Avoidance
TLM 189	Archeological		Potential	Avoidance
TLM 190	Archeological		Potential	Avoidance
TLM 191	Archeological		Potential	Avoidance
TLM 192	Archeological		Indirect	
TLM 193	Archeological		Potential	Avoidance
TLM 194	Archeological		Direct	
TLM 195	Archeological		Potential	Avoidance
TLM 196	Paleontological/ Archeological[?]		Direct	
TLM 197	Archeological		Potential	Avoidance
TLM 198	Archeological		Potential	Avoidance
TLM 199	Archeological		Direct	
TLM 200	Archeological		Direct	
TLM 204	Historic		Direct	
TLM 206	Archeological		Direct	
TLM 207	Archeological		Indirect	
TLM 215	Archeological	Significant	Direct	Investigation
TLM 218	Archeological		Direct	
TLM 219	Archeological		Potential	Avoidance

†[1] AHRS = Alaska Historic Resources Survey.

most adverse effects and would probably make a contribution to the study of Alaskan prehistory and history.

Five archeological and two historic sites in the reservoir area would be subject to direct impacts (Table O-2). One archeological site would be exposed to indirect impact. These sites occur in the area between the mouths of Fog and Tsusena Creeks (they are not assigned to a specific site group). Three of them have been systematically tested, and all were identified as significant (Dixon et al., 1982, 1983).

Table O-2. Expected Impacts and Recommended Mitigation: Devil Canyon Development

AHRS†[1] No.	Type	Significance	Impact	Recommended Mitigation
TLM 020	Historic		Potential	Avoidance
TLM 022	Archeological	Significant	Direct	Investigation
TLM 023	Historic		Direct	
TLM 024	Archeological		Direct	
TLM 027	Archeological	Significant	Direct	Investigation
TLM 029	Archeological		Direct	
TLM 030	Archeological	Significant	Indirect	Investigation
TLM 034	Archeological		Direct	
TLM 041	Archeological		Potential	Avoidance
TLM 118	Archeological		Potential	Avoidance
TLM 178	Historic		Direct	

†[1] AHRS = Alaska Historic Resources Survey.

O.2.1.2.2 <u>Operation</u>

Two archeological and one historic site would be subject to potential impact during the operation phase. Preservation through avoidance and protection (monitoring) would seem adequate to mitigate damage to the archeological site (located on Devil Creek), but probably not to the historic site, a 19th century rock inscription near the proposed substation. It is not yet clear, however, whether these sites are significant.

O.2.1.3 Access Routes

O.2.1.3.1 <u>Denali Highway to Watana</u>

CONSTRUCTION

Archeological sites on or near this proposed route would be subject to direct impacts due to borrow pit excavation, and to indirect impacts due to greatly increased access to the area during construction. No historic or paleontological sites are known in this portion of the project area. A combination of preservation through avoidance and, where necessary, investigation, would probably mitigate most adverse effects. One or more sites may prove to be significant, although as a whole this group would be less likely to make an important contribution to Alaskan prehistory.

Four sites would be exposed to direct impacts, and four sites to indirect impacts during the construction phase (Table O-3). The former are located along or near the proposed route at MP 25-27 and MP 35; the latter are concentrated around MP 28, within 0.25 mi (0.4 km) of the centerline. All sites with the exception of TLM 153 are part of the Deadman-Big Lake site group (see Fig. O-3, site group 3). None of these sites has been systematically tested to date; it appears unlikely that many, if any, of these sites will be assessed as significant, due to their largely surficial character (see Sec. O.1.1.4.2).

Eight archeological sites would be subject to potential impact due to increased access to this area. (Their distance from the proposed access route would make impacts during construction less likely.) Preservation by avoidance, combined with a monitoring program, would mitigate

Table O-3. Expected Impacts and Recommended Mitigation: Access Routes

AHRS†[1] No.	Type	Significance	Impact†[2]	Recommended Mitigation
Denali Highway to Watana				
TLM 098	Archeological		Potential	Avoidance
TLM 099	Archeological		Potential	Avoidance
TLM 116	Archeological		Potential	Avoidance
TLM 117	Archeological		Indirect	
TLM 153	Archeological		Direct*	
TLM 155	Archeological		Indirect	
TLM 168	Archeological		Indirect	
HEA 174	Archeological		Potential	Avoidance
HEA 176	Archeological		Potential	Avoidance
HEA 180	Archeological		Indirect	
HEA 181	Archeological		Direct*	
HEA 182	Archeological		Direct*	
HEA 183	Archeological		Potential	Avoidance
HEA 184	Archeological		Potential	Avoidance
HEA 185	Archeological		Potential	Avoidance
HEA 211	Archeological		Direct*	
Watana to Devil Canyon				
TLM 101	Archeological		Potential	Avoidance
TLM 103	Archeological		Direct*	
TLM 106	Archeological		Direct*	
TLM 107	Archeological		Direct*	
TLM 108	Archeological		Direct*	
TLM 109	Archeological		Direct*	
TLM 110	Archeological		Direct*	
TLM 111	Archeological		Direct*	
TLM 112	Archeological		Potential	Avoidance
TLM 113	Archeological		Direct*	
Watana to Devil Canyon (continued)				
TLM 114	Archeological		Direct*	
TLM 214	Archeological		Potential	Avoidance
Rail Access to Devil Canyon				
TLM 005	Historic		Potential	Avoidance
TLM 006	Historic		Potential	Avoidance

†[1] AHRS = Alaska Historic Resources Survey.

†[2] "*" identifies a site that is located in a proposed access route borrow site.

most adverse effects to any significant sites. Five of these sites occur within 2 mi (3.3 km) of the proposed route, between MP 24-27, while two are located on the east shore of Deadman Lake, and one within 3,000 ft (900 m) of the route near MP 37 (see Fig. O-3, site group 3). None of these sites has been systematically tested; it appears unlikely that many, if any, will prove to be significant, due to their largely surficial character (see Sec. 0.1.1.4.2).

OPERATION

Any of the 16 sites described above not investigated during construction phase mitigation would be exposed to potential impacts, due to increased access to the area, during the operation phase. Preservation through avoidance (coupled with a monitoring program) would mitigate most impacts to any significant sites.

0.2.1.3.2 Watana-to-Devil Canyon Route

CONSTRUCTION

Nine archeological sites along this proposed route would be exposed to direct impact due to excavation of access road borrow pits. One archeological site [located within 0.25 mi (0.4 km) of the centerline] would be subject to indirect impact because of greatly increased access to the area. Another two archeological sites [located within 1 mi (1.7 km) of the centerline] would be exposed to potential impact, due to increased access. Preservation through avoidance, coupled with a monitoring program, and investigation, where necessary, would mitigate most adverse effects. These sites are situated at various points along the proposed route, between Portage and Tsusena creeks (see Fig. O-3, site group 5). None of them has been systematically tested to date, and only one site (TLM 110) presently appears to be potentially significant.

OPERATION

Any sites (of the 12 discussed above) not thoroughly excavated as part of the construction phase mitigation process would be exposed to potential impacts due to increased access to the area. Preservation through avoidance and monitoring would be sufficient to limit any further adverse effects.

0.2.1.3.3 Rail Access to Devil Canyon

This area has been subject to sensitivity mapping, yielding two historic sites (TLM 005 and TLM 006, an ARR station and bridge respectively) (Bacon et al., 1982; Dixon et al., 1984). These sites would be exposed to potential impacts. Preservation through avoidance is recommended.

0.2.1.4 Power Transmission Facilities

0.2.1.4.1 Dams-to-Gold Creek Segment

CONSTRUCTION

Two archeological and two historic sites located along this proposed transmission line [i.e., within 0.25 mi (0.4 km) of the centerline] would be potentially impacted by increased access to the area (Table O-4). Preservation through avoidance, combined with a monitoring program, would mitigate most adverse effects to significant cultural resources. The two archeological sites are located east of Devil Creek, near MP 19 on the proposed Watana-Devil Canyon access road. The two historic sites are Alaska Railroad structures, situated at Gold Creek. A third archeological site (TLM 018), located within a direct impact area at the proposed Watana Camp would be directly impacted by construction activity. Only TLM 018 has been assessed for significance (with positive results), although another archeological site (TLM 110) may also be found significant.

OPERATION

Any sites not thoroughly excavated as part of the construction phase mitigation process would continue to be exposed to potential impacts due to increased access. It is possible that it would be necessary to continue a cultural resources monitoring program, should any significant sites fall into this category.

0.2.1.4.2 Gold Creek-to-Fairbanks Segment

CONSTRUCTION

Three cultural resource sites along the proposed Gold Creek-to-Fairbanks transmission route would be exposed to potential impact due to increased access (Table O-4); they are concentrated in the northern foothills of the Alaska Range near Healy and are located within 0.25 mi (0.4 km)

Table 0-4. Expected Impacts and Recommended Mitigation: Power Transmission Facilities

AHRS†[1] No.	Type	Significance	Impact	Recommended Mitigation
Dams-to-Gold Creek Segment				
TLM 005	Historic		Potential	Avoidance
TLM 006	Historic		Potential	Avoidance
TLM 018	Archeological	Significant	Direct	Avoidance
TLM 110	Archeological		Potential	Avoidance
TLM 112	Archeological		Potential	Avoidance
Gold Creek-to-Fairbanks Segment				
HEA 012	Archeological		Potential	Avoidance
HEA 038	Archeological		Potential	Avoidance
Gold Creek-to-Anchorage Segment				
TYO 014	Archeological		Potential	Avoidance

†[1] AHRS = Alaska Historic Resources Survey.

of the centerline (Dixon et al., 1984). Although no sites have been systematically tested yet, several seem likely to be judged significant (due to their relatively good stratigraphic context). Additional survey is necessary. Preservation through avoidance and monitoring, with investigation where necessary, would limit adverse effects, although some loss of significant cultural resources would be quite possible, given the importance of a number of sites in the area. Mitigative investigation could make a modest contribution to knowledge of Alaskan prehistory.

OPERATION

Any sites not thoroughly excavated during the construction phase mitigation process would continue to be subject to potential impacts due to increased access. It is possible that it would be necessary to continue protective measures through avoidance and monitoring for any significant sites in this category.

0.2.1.4.3 Gold Creek-to-Anchorage Segment

CONSTRUCTION

Archeological and historic sites along the proposed Gold Creek-Anchorage transmission corridor would be subject at least to potential impact, due to increased access; additional design details are needed to assess further possible impacts (Exhibit E, Vol. 7, Chap. 4, p. E-4-127). Eleven archeological and two historic sites have been located along the Intertie Route (Table 0-4), all concentrated in the southern foothills on the Alaska Range (Bacon et al., 1982). None of these sites has been systematically tested; some may be judged significant. Sensitivity mapping indicates that at least one archeological site occurs along the proposed Willow-Anchorage segment [within 0.25 mi (0.4 km) of the centerline]; further details are not available at this time (Dixon et al., 1983). Preservation through avoidance, with a monitoring program, and investigation where necessary, would probably mitigate most adverse effects. At the present time, there appear to be few potentially significant sites in this portion of the project area.

OPERATION

Any sites not thoroughly excavated during the construction phase mitigation process would continue to be subject to potential impact due to increased access. It is possible that it would be necessary to maintain protective measures through avoidance and monitoring for any significant sites in this category.

0.2.2 Susitna Development Alternatives

0.2.2.1 Alternative Dam Locations and Designs

0.2.2.1.1 Watana I-Devil Canyon

Impacts (during the construction phase) to a number of archeological (but not historic) sites would be altered by the reduction of the proposed Watana reservoir level. On the southern side of the Susitna River, opposite the mouth of Watana Creek, 11 sites (TLM 064, 120, 121, 122, 123, 124, 125, 127, 131, 132, and 133) which would occupy indirect impact areas under the proposed project, would instead be subject only to potential impact. One site (TLM 130) would occur in an indirect or potential impact zone, rather than a direct impact area.

In the Oshetna-Susitna confluence area, four sites (TLM 026, 042, 073, and 207) would occupy potential rather than indirect impact zones, while one site (TLM 196) would be subject to indirect or potential impact, rather than direct impact. Five other sites in scattered locations (see Sec. 0.1.2.1.1) would acquire altered impact status. Three of them (TLM 119, 177, and 218) would occur in indirect or potential (rather than direct) impact areas, while two (TLM 038 and 145) would be shifted from indirect to potential impact zones.

Three of the 22 affected sites described above have been systematically tested and assessed as significant. At least six other sites appear likely to be significant (see discussion in Sec. 0.1.2.1.1).

All other archeological and historic sites would be subject to the same impacts under this proposed alternative as those described for the proposed project in Section 0.2.1.1 (Watana development) and 0.2.1.2 (Devil Canyon development).

0.2.2.1.2 Watana I-Modified High Devil Canyon

Changes in the impact status of cultural resources in the Watana I alternative are discussed in Section 0.2.2.1.1. Impacts to the alternative Modified High Devil Canyon dam and impoundment area would be the same as those described for this area under the proposed project (see Sec. 0.2.1.2).

0.2.2.1.3 Watana I-Reregulating Dam

Changes in the impact status of cultural resources in the Watana I alternative are discussed in Section 0.2.2.1.1. Impacts from the Reregulating dam alternative would be the same as those described for the Devil Canyon development under the proposed project (see Sec. 0.2.1.2).

0.2.2.2 Alternative Access Routes

0.2.2.2.1 Corridor 1 (North)

Cultural resource sites along the proposed north corridor would be subject to direct, indirect, and potential impacts due to road construction, borrow site excavation, and increased access to the area. Most impacts would probably be mitigated by preservation through avoidance. Few, if any, of the sites found to date in this proposed corridor (chiefly surficial archeological localities) appear likely to be assessed as significant (see Sec. 0.1.1.4.2).

0.2.2.2.2 Corridor 2 (South)

No cultural resources are presently known along this proposed corridor, and the area appears to have limited potential for significant sites. Preservation through avoidance would probably mitigate most impacts to any significant sites discovered along the proposed route or its associated borrow sites.

0.2.2.2.3 Corridor 3 (Denali-North)

Cultural resources along the proposed Denali-north corridor would be exposed to direct, indirect, and potential impacts due to road construction, borrow site excavation, and increased access to the area. Most impacts would probably be mitigated by preservation through avoidance. The sites known to date along this proposed corridor (chiefly surficial archeological sites) contain few, if any, significant localities (see Sec. 0.1.1.4.2).

0.2.2.3 Alternative Power Transmission Routes

Impacts to cultural resources on the alternative transmission line routes would probably not vary significantly from those of the proposed project. Archeological and historic sites within 0.25 mi (0.4 km) of the centerline would be at least potentially impacted during the construction phase by increased access to the area. Preservation through avoidance, combined with a monitoring program would mitigate most impacts to significant sites.

Along the Gold Creek-to-Fairbanks segment, several alternative routes would potentially impact a number of archeological sites in the Healy area. Alternative No. 3 would impact six sites [HEA 128, 139, 141, 142, FAI 141, 142], while No. 4 would impact three sites [FAI 143, 144, 145]. These sites appear to be largely surficial, and seem unlikely to be significant. Alternative No. 10 would impact one site (FAI 214), which contains subsurface remains and may be significant. Additional survey would almost certainly produce more sites in impact areas.

Along the Gold Creek-to-Anchorage segment, there are also several alternative routes which would potentially impact some cultural resource sites (chiefly historic) in the Anchorage area. Alternatives No. 4, 7, and 16 would impact one site each (ANC 245, 052, and 118 respectively). Alternative No. 15 would impact two sites (ANC 082, 096), and No. 17 would impact three sites (ANC 077, 079, 099). Many of these sites are probably significant. Additional survey would undoubtedly produce more sites in impact areas.

O.2.2.4 Alternative Borrow Sites

Archeological and historic sites would be subject to direct and indirect impacts in borrow sites C, E, and F. There would be no impacts to cultural resources in the remaining borrow areas. Most impacts to significant sites would probably be mitigated by investigation.

Borrow site C contains 15 archeological sites, all of which would be subject to direct impact due to excavation of the proposed pit area. An additional five archeological sites are located along its margins (including one site located in proposed borrow site F), and seem likely to be exposed to indirect impact due to destabilized slopes and increased erosion. At least one site is significant, and others are likely to be assessed as significant also.

Borrow site E contains two archeological sites and one historical site that would be subject to direct impact due to excavation. (These sites also occur within the proposed Devil Canyon impoundment area, which constitutes a direct impact zone as well.) At least one site has already been termed significant.

Borrow site F contains eight archeological and one historic site. All sites would be exposed to direct impact due to excavation. Two additional archeological sites are located along its margins (including one in proposed borrow site C), and seem likely to be subject to indirect impact due to destabilized slopes and increased erosion. None of these sites has been assessed for significance to date, but it is likely that several will be termed significant.

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