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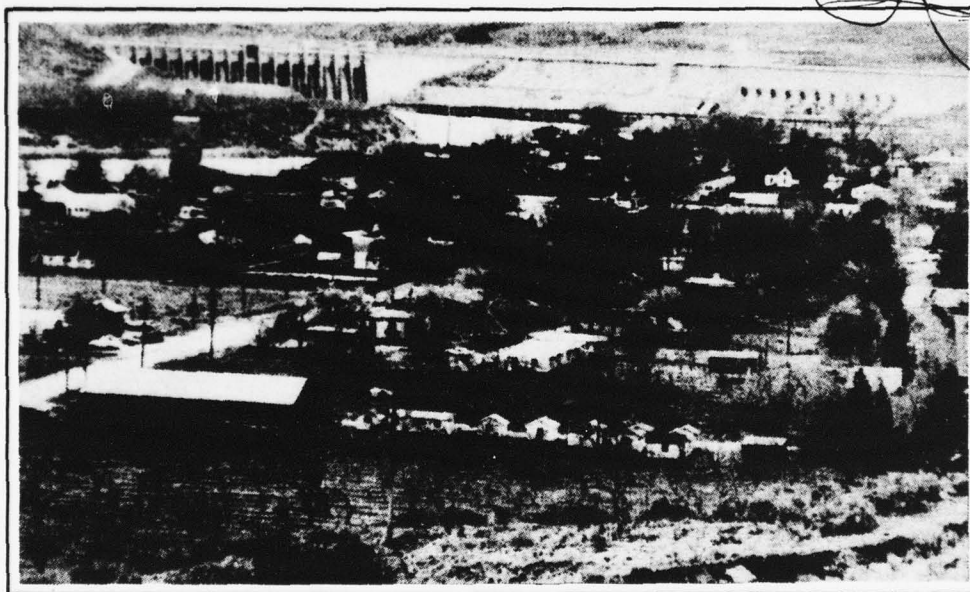
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**COLUMBIA RIVER, WASHINGTON**

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**COMMUNITY IMPACT REPORT**  
**UPDATE III**  
**CONDITIONS AT PEAK IMPACT**

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CHIEF JOSEPH DAM  
Columbia River, Washington

COMMUNITY IMPACT REPORT  
UPDATE III: CONDITIONS AT PEAK IMPACT

A Report Submitted To:

Institute for Water Resources  
U.S. Army Corps of Engineers  
Kingman Building  
Fort Belvoir, Virginia 22060

By

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## PREFACE

This report is one of a series prepared by Seattle District, U.S. Army Corps of Engineers, to document economic and social impacts on local communities as a result of major construction activities at Chief Joseph Dam, Washington. Chief Joseph Dam Community Impact Report (February 1974) and Community Impact Report, Update I (October 1974) were prepared prior to construction and discussed the anticipated impact. Community Impact Report, Update II (April 1978) was prepared at the request of the Institute for Water Resources (IWR), Corps of Engineers, Washington, D.C., and discussed the Federal response in meeting increased educational expenses of the affected communities. This report, also prepared for IWR, is the result of a study of economic and social conditions during the peak construction period in late 1977. A subsequent report (scheduled for 1981) will document community adjustment to postimpact conditions. A final report will analyze the entire community experience from preimpact to postimpact conditions, including Corps of Engineers' community relations, and provide guidelines for predicting economic and social impacts of future major construction projects. This report has been prepared under the directive of Mr. Arthur Harnisch of the Seattle District in consultation with Dr. Jerry Delli Priscali of the Institute for Water Resources, Corps of Engineers, Fort Belvoir, Virginia.

## SECTION 1 - INTRODUCTION

### Purpose

The purpose of this report is to provide a case history documentation of economic and social impacts on rural communities during peak construction activities of the U.S. Army Corps of Engineers at Chief Joseph Dam, Washington. Information provided in this report will be used to establish guidelines in planning for economic and social impacts of future projects in rural areas.

### Scope

Scope of the study includes data on public facilities, services, and other social and economic characteristics affected by a large influx of construction workers. Data on a profile of the construction work force was collected during period of peak construction.

### Authority

Section 122 of the River and Harbor and Flood Control Act of 1970 obligates the Corps of Engineers to identify and assess all significant project-caused effects, including economic and social effects. Similar requirements have been imposed on all Federal agencies by the National Environmental Protection Act of 1969.

### Project Description

Chief Joseph Dam is located on the Columbia River in north-central Washington State near the small communities of Bridgeport and Brewster (figure 1). The dam is one of the major projects in the comprehensive water resource development plan for the Columbia River basin in the United States and Canada. Construction of the dam and 16 hydroelectric power units was completed in 1958. Construction activities to add 11 additional hydropower units and raise the dam and pool by 10 feet commenced in 1973 with an estimated total cost of \$310 million. The additional units will increase installed capacity from 1,024,000 kW to 2,069,000 kW. The initial major influx of construction workers arrived during the 1975-1976 school year. A peak work force of almost 900 occurred during the summer of 1977. Project completion is scheduled for 1981.

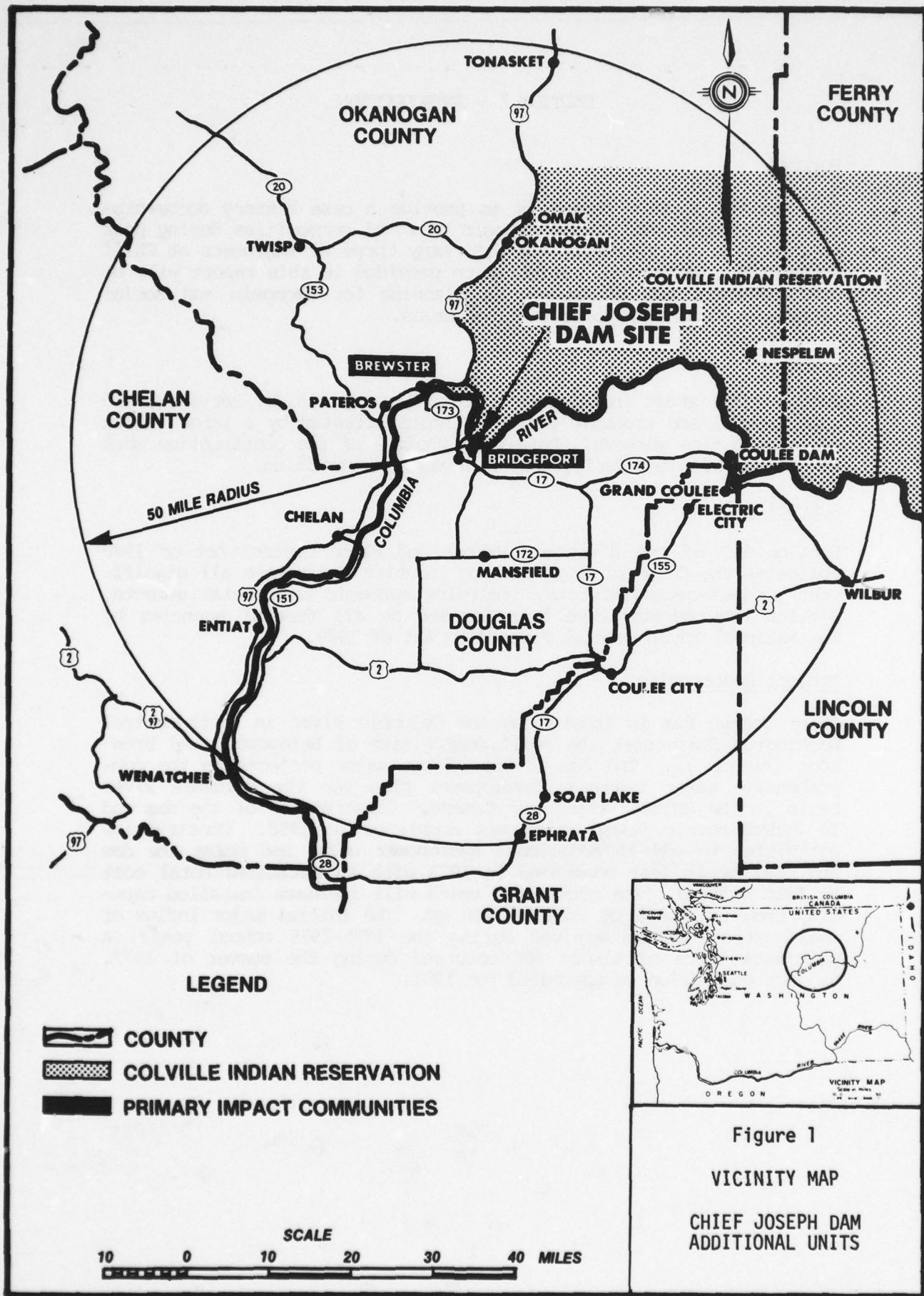


Figure 1  
VICINITY MAP  
CHIEF JOSEPH DAM  
ADDITIONAL UNITS

## SECTION 2 - PREVIOUS IMPACT REPORTS

The Seattle District, Corps of Engineers, initially discussed potential impact of construction worker influx in an environmental statement prepared in 1971. Bridgeport was identified as the primary impact community, and a brief statement was included as to the possible local effects of a sharp growth in population.

The first detailed report was Community Impact Report (CIR) published in February 1974. This report documented conditions as of 1973 and provided preliminary projections of the impact of the Chief Joseph Dam Additional Units Project. The report included impact population projections and an assessment of community facilities and services for all identifiable communities within a 50-mile radius of the dam. The CIR allocated project-related new population on a weighted town attractiveness basis. Availability of existing community facilities to accommodate additional population was considered an important factor. The town of Brewster was projected to receive the majority of the population influx, although significant numbers of people were also projected to select the communities of Bridgeport, Coulee Dam, Okanogan, and Pateros.

Community Impact Report, Update I, published in October 1974, presented revised population influx projections. Update I projections placed major weighting on commuting distance, and Bridgeport was identified as the primary impact community. Brewster, Coulee Dam, Bridgeport Bar, Pateros, Okanogan, and Mansfield were named as other communities likely to receive a significant impact population. The major impact on facilities and services was experienced by local school districts, resulting in two additional publications: Design Memorandum 51, Support to Local School Districts (May 1977) and Community Impact Report, Update II (April 1978). Both publications reported on assistance provided to local school districts by the Corps of Engineers.

In addition to the above studies, several unpublished employment and population reports were provided at the request of congressional representatives. These interim projections were the result of changed construction schedules.

### SECTION 3 - DESCRIPTION OF IMPACTED COMMUNITIES

#### General

The study area included all communities within a 50-mile radius of Chief Joseph Dam, Washington (figure 1). The area is predominantly agricultural, with scattered small rural towns. The climate exhibits seasonal characteristics of both maritime and continental air masses, with warm to hot summers and moderate to cold winters. Average yearly precipitation is meager, ranging from 12 to 15 inches in the northwestern part to less than 10 inches per year in the southeastern portion. High winds and blowing dust often occur in the more southerly portions. Topography is diverse, ranging from the Cascade foothills in the west to the Waterville plateau in the south. The study area lies in the drainage basin of the Columbia River which flows south and westward, eventually emptying into the Pacific Ocean.

Most land area in the region remains in forest or open range. Agriculture is an important component of the economy, with irrigated fruit crops, beef cattle, and wheat as primary products. Directly related to this economic activity are food processing and storage industries. Forested areas in the north and east supply raw materials for an active lumber and wood products industry. Wholesale and retail trade, personal services, tourist-related businesses, and local, state, and Federal Government employ a substantial portion of the work force.

Outdoor recreational opportunities predominate. Fishing, boating, and swimming are popular summer sports. During winter months, areas for skiing, ice skating, ice fishing, snow tobogganing, and snowmobile touring are within easy driving distance. Hunting for deer and waterfowl is good. Communities offer a limited variety of entertainment facilities.

Most of the incorporated communities in the study area (table 1) have a mayor-city council form of government. The majority of the communities also have planning commissions, zoning ordinances, and building codes. Unincorporated communities generally have no formal governing bodies and are under the jurisdiction of the county.

The land to the north and east of the project is part of the 1.4 million-acre Colville Indian Reservation. The Reservation is sparsely populated by approximately 2,500 members of the 11 bands comprising the Colville Confederated Tribes. Tribal administration is by an elected Tribal Business Council. The tribes have become increasingly active in recent years over controlling economic development and other activities on the Reservation.

TABLE 1

## IMPACT COMMUNITIES

## CHIEF JOSEPH DAM ADDITIONAL UNITS

Community	Road Miles From Chief Joseph Dam	Population <sup>3/</sup>		Difference	Number of Chief Joseph Dam Construction-Related Students <sup>4/</sup>	Estimated Number of Chief Joseph Dam Construction Workers at Peak Impact <sup>5/</sup>
		Preimpact 1975	Peak Impact 1977			
Bridgeport	4	1,050	1,623 <sup>1/</sup>	573	242	405
Brewster	14	1,120	1,471 <sup>1/</sup>	351	133	160
Mansfield	18	345	375	30	--	10
Pateros	21	545 <sup>1/</sup>	589 <sup>1/</sup>	44	20	25
Okanogan	31	2,225	2,250 <sup>1/</sup>	25	8	15
Omak	36	4,440	4,126 <sup>1/</sup>	-314	3	25
Grand Coulee	38	1,400	1,375	-25	896 <sup>6/</sup>	50
Electric City	39	864	855	-9	--	30
Coulee Dam	39	1,536	1,517 <sup>1/</sup>	-19	--	15
Chelan	41	2,980	3,000	20	--	25
Coulee City	41	568 <sup>1/</sup>	602 <sup>1/</sup>	34	11	2 <sup>2/</sup>
Twisp	50	750	818	68	--	2 <sup>2/</sup>
Nespelem	56	335	340	5	2	2 <sup>2/</sup>
Wilbur	57	1,140	1,100	-40	10	2 <sup>2/</sup>
Soap Lake	57	1,200	1,400	200	12	15
Tonasket	59	985	985	0	2	2 <sup>2/</sup>
Entiat	60	374 <sup>1/</sup>	406 <sup>1/</sup>	32	--	2 <sup>2/</sup>
Ephrata	62	5,140 <sup>1/</sup>	5,320 <sup>1/</sup>	180	6	2 <sup>2/</sup>

<sup>1/</sup>Actual census.

<sup>2/</sup>Estimated to be less than 10 workers.

<sup>3/</sup>Population Trends, 1977, Population Studies Division, Office of Fiscal Management, State of Washington. Noncensus years estimated by state with the assistance of local communities.

<sup>4/</sup>Public Law 81-874 census of students reporting parent(s) working on Chief Joseph Dam. Mansfield, Electric City, Chelan, Twisp, and Entiat had no applications under Public Law 81-874 during that school year. Students from the town of Coulee Dam attend Grand Coulee district schools.

<sup>5/</sup>Estimated from December 1977 Survey and Construction Manpower Reports.

<sup>6/</sup>Does not include Grand Coulee Dam-related students attending Grand Coulee schools.

### Selection of Primary Impact Communities

There are 31 incorporated towns within a 50-mile radius of the project. The two largest communities, Ephrata (1977 population 5,320), and Omak (4,126), are important regional trade and service communities for north-central Washington. The towns of Bridgeport (1,623) and Brewster (1,471) have been significantly affected by previous construction and operation of Chief Joseph Dam. Grand Coulee (1,375), Electric City (855), Coulee Dam (1,517), and Coulee City (602) owe much of their existence to activities at Grand Coulee Dam. Chelan (3,000) and Soap Lake (1,400) have local recreation attractions and have become popular retirement communities. Other communities in the impact area are small, with business districts of sufficient size to serve only the immediately surrounding rural area.

Analysis conducted during preparation of Community Impact Report and Update I narrowed to 17 the number of communities expected to experience some project-related impacts. Only two of the 17 actually received significant economic and social impacts. Table 1 lists criteria used to determine intensity of impact and primary impact communities. Changes in population from 1975 (preimpact) and 1977 (peak impact), numbers of school children whose parents were involved with the dam construction, and numbers of construction workers in each locality are presented. Bridgeport and Brewster (figures 2 and 3) received the major impact in all three categories and had the most severe demands placed upon facilities serving residents. These two communities are referred to as the primary impact communities and were examined in greater detail. The fact that impact was centered primarily in two towns, rather than the several predicted, intensified the impact experience. The substantial population growth at Soap Lake and Ephrata was unrelated to activities at Chief Joseph Dam. The relatively large number of Public Law 81-874 students at Grand Coulee, in combination with a slight population decline, indicates that many of these students lived in the Grand Coulee area prior to construction at Chief Joseph Dam.<sup>1/</sup> Grand Coulee experienced little impact on public facilities and services from Chief Joseph Dam construction.

The Colville Indian Reservation was only marginally affected by employment in construction activity. With the exception of a small Indian community near Omak, principal Reservation towns are all 50 or more road miles from the dam. Total number of Indians in the dam work force apparently never exceeded 10 to 15.

<sup>1/</sup>Public Law 81-874, administered by the U.S. Department of Health, Education, and Welfare (HEW), provides operation and maintenance assistance to schools impacted by Federal activities. Reporting requirements under the law include documentation of place of work by parents of recipient students.





FIGURE 2. BRIDGEPORT, WASHINGTON. MIDDAY VIEW OF MAIN BUSINESS STREET DURING PEAK IMPACT PERIOD (MAY 1977).



FIGURE 3. BREWSTER, WASHINGTON. MIDDAY VIEW OF MAIN STREET DURING PEAK IMPACT PERIOD (MAY 1977).

## SECTION 4 - SOCIAL AND ECONOMIC EFFECTS

### Population Growth

Bridgeport and Brewster have exhibited slow, steady growth rates except for boom years during construction of the original dam in the 1950's. Between 1960 and 1970, the two communities jointly gained only 195 residents. From 1970 to the spring of 1975, when the last preimpact population count was estimated, only 159 more residents were recorded. Within the following 2 years (1976-1977), 924 new residents were counted. Population growth closely followed the influx of construction workers (table 2 and figure 4). Although exact numbers are not available, numerous families and individuals also settled into unincorporated Bridgeport Bar between the two communities. Population influx into the areas easily exceeded 1,000 during the 2 years, about a 50 percent gain over the preimpact population. Population figures include only those individuals who claimed the towns as their permanent residence. In addition, the normal workday population also included: (1) weekly commuters, (2) short-term workers unaccompanied by families, and (3) workers accompanied by families who also maintained a permanent home elsewhere.

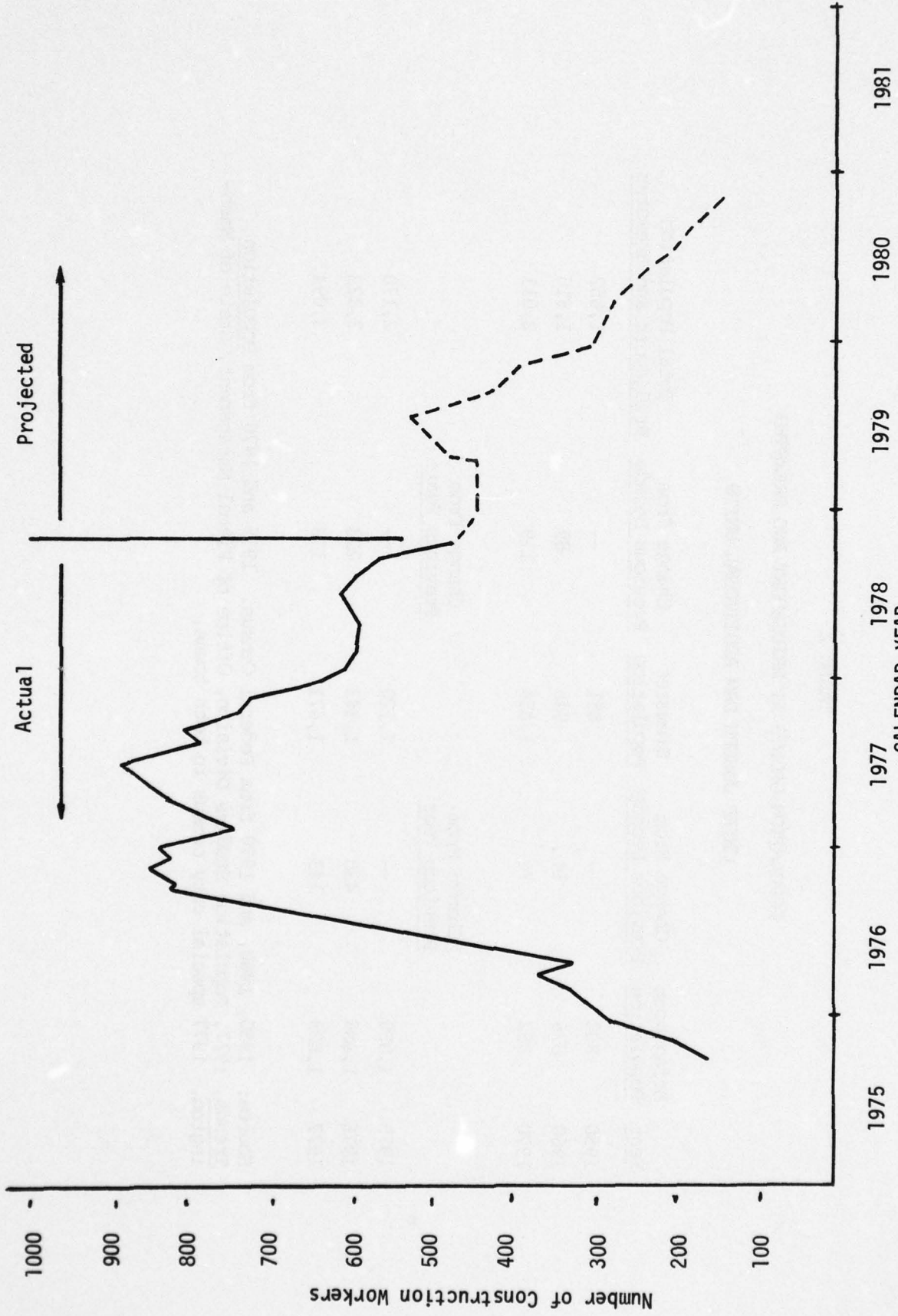
### Housing

Both Bridgeport and Brewster exhibit characteristics typical of housing in construction boomtowns (figures 5 through 8). During impact conditions in the spring of 1977, 39 percent of Bridgeport population was living in mobile homes and trailers, while Brewster reported 18 percent in the same category (table 3). Despite the influx of construction workers, over 120 housing units were reported as vacant in the two communities. While this situation may be partially explained by normal turnover and temporary vacancies at the time of the census, it also reflected the large number of sub-standard housing units in the communities. A special housing census conducted in Bridgeport in 1976 by the Douglas County Regional Planning Commission reported 28 percent of the housing structures were dilapidated or deteriorated. Many workers undoubtedly chose to buy or rent mobile home or trailer space rather than live in available poor housing. About two-thirds of the nonlocal workers were found to be living in mobile homes and trailers, versus one-third of the local workers. A more complete presentation of types of housing selected by construction workers is given in table 4.

TABLE 2  
 POPULATION GROWTH AT BRIDGEPORT AND BREWSTER  
 CHIEF JOSEPH DAM ADDITIONAL UNITS

<u>Year</u>	<u>Bridgeport Population</u>	<u>Change From Previous Decade</u>	<u>Brewster Population</u>	<u>Change From Previous Decade</u>	<u>Total Population Bridgeport and Brewster</u>
1950	802	—	851	—	1,653
1960	876	74	940	89	1,816
1970	952	76	1,059	119	2,011
		<u>Change From Previous Year</u>		<u>Change From Previous Year</u>	
1975	1,050	—	1,120	—	2,170
1976	1,480	430	1,343	223	2,823
1977	1,623	143	1,471	128	3,094

Source: 1950, 1960, and 1970 from Federal Census. 1975 and 1976 from Population Trends, 1977, Population Studies Division, Office of Fiscal Management, State of Washington. 1977 special city census in both towns.



ACTUAL AND PROJECTED NUMBER OF CONSTRUCTION WORKERS  
 CHIEF JOSEPH DAM ADDITIONAL UNITS  
 FIGURE 4  
 CALENDAR YEAR



FIGURE 5. ENTRANCE TO TOWN OF BRIDGEPORT, WASHINGTON. TRAILER COURT IN FOREGROUND (MAY 1977).



FIGURE 6. TYPICAL TRAILER COURT IN BRIDGEPORT, WASHINGTON.

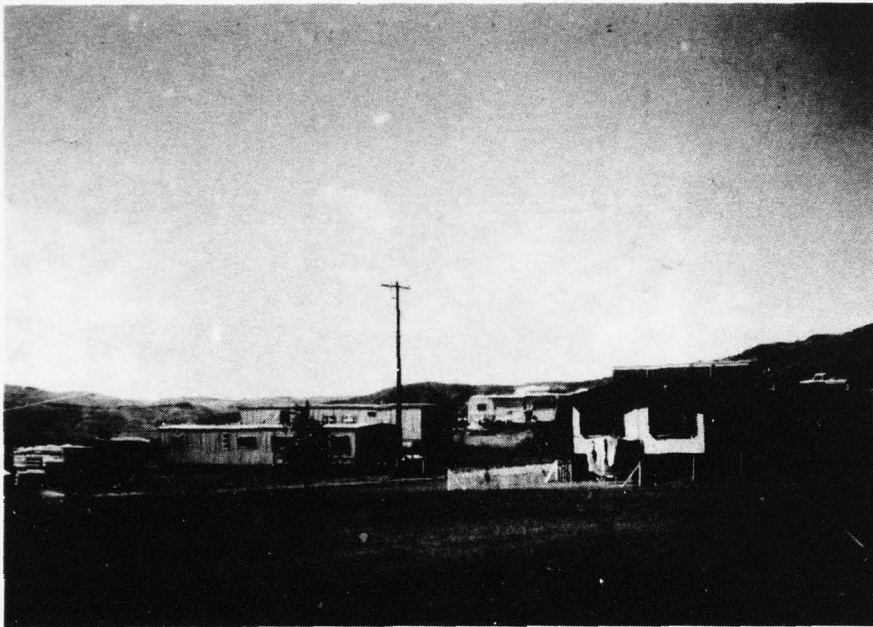


FIGURE 7. TRAILER COURT IN BRIDGEPORT BAR, WASHINGTON.



FIGURE 8. TRAILER COURT IN BREWSTER, WASHINGTON.

TABLE 3  
HOUSING CHARACTERISTICS AT PEAK IMPACT

BRIDGEPORT AND BREWSTER  
CHIEF JOSEPH DAM ADDITIONAL UNITS

Type of Housing Built	Bridgeport			Brewster		
	Total Housing Units	Vacant Housing Units	Occupied Housing Units	Total Housing Units	Vacant Housing Units	Occupied Housing Units
One-Unit Structure	360	38	322	367	16	351
Two-Unit Structure	6	1	5	21	0	21
Three- or More Unit Structure	116	12	104	112	14	98
Mobile Home <sup>1/</sup> Structure	204	13	191	107	7	100
Trailer <sup>1/</sup>	<u>66</u>	<u>12</u>	<u>54</u>	<u>24</u>	<u>10</u>	<u>14</u>
TOTAL	752	76	676	631	47	584
			1,623			21
						1,471

Source: Population and Economic Studies Division, State of Washington, situation as of 1 April 1977.

<sup>1/</sup>Mobile home has wheels or axles removed or is attached to foundation or permanent structure. Trailers have wheels and axles attached and have no foundation or other type of permanent structure attached.

TABLE 4  
HOUSING CHARACTERISTICS OF WORK FORCE 1/  
CHIEF JOSEPH DAM ADDITIONAL UNITS

<u>Type of Housing</u>	<u>Local Workers</u>	<u>Nonlocal Workers</u>
Single Family Dwelling	58%	18%
Apartment	5	10
Mobile Home	33	43
Travel Trailer or Camper	3	23
Sleeping Room	<u>1</u>	<u>6</u>
TOTAL	100%	100%

NOTE: Housing in both Bridgeport and Brewster included. Totals also included workers residing outside the primary impact area.

1/Construction Worker Survey, Chief Joseph Dam, December 1977.

Economy

Bridgeport. Before construction activities began, Bridgeport had a small business district with about 30 retail outlets. Representative stores included three service stations, three small grocery stores, two restaurants, two taverns, and a variety of other small shops. There was one dentist but no doctors, lawyers, accountants, or other professional people.

Retail sales increased from \$2.5 million in the 1974 preimpact year to \$3.8 million in 1977. While an estimated one-third of this increase was due to the effects of inflation, most of the remaining increase can be attributed to spending by construction-related firms and employees. Despite greater volume of sales, there was very little change in the number of businesses. The temporary nature of construction activities, in combination with the historical pattern of irregular growth, deterred prospective new business investors. Most residents and construction workers apparently bought staples locally and traveled to larger regional trade communities such as Wenatchee and Spokane for major purchases. The one bank in Bridgeport reported that deposits in 1977 were \$1.8 million over the 1974 total of \$2.9 million. The number of new accounts increased by 722 during the same period.



One observation about Bridgeport was the presence of abandoned commercial structures built during construction of the original dam in the 1950's. Even during peak employment at the additional units project, the business district of Bridgeport had numerous vacant and boarded-up buildings and lacked the appearance of a typical construction "boomtown."

Brewster. Due to the location of Brewster on a major highway and employment in several fruit packing establishments, local economic activity was much stronger and more diverse than in Bridgeport. Despite a similar population in 1974, there were about 100 retail establishments, triple the number of Bridgeport. Professional offices included doctors, dentists, attorneys, and accountants. Retail sales jumped from \$8.8 million in 1974 to \$13.4 million in 1977. As in Bridgeport, there was little change in the actual number of establishments.

Bank deposits increased by about \$4.7 million over preimpact deposits of \$6.3 million. Bank officials attributed only about one-fourth of this increase to the construction impact. The local fruit growing and packing industry, concentrated in the Brewster area, experienced an excellent year in 1977. Income from fruit sales resulted in a large inflow of funds into the Brewster bank. The bankers did report that major contractors on the dam were purchasing many supplies and services locally. These purchases injected money into the local economy, in addition to the direct spending of their employees.

#### Schools

The influx of children of construction workers into local school districts at Bridgeport and Brewster was the most severe impact felt by any local service or facility. Beginning with the 1975-1976 school year, the number of students grew rapidly with the increase in construction activity. Estimated number of impact students at the time of peak construction is presented in table 1. Maximum enrollment pressure on the schools occurred during the 1976-1977 and 1977-1978 school years.

Special congressional authority to provide school facilities for dependents of persons working on Chief Joseph Additional Units project was granted by virtue of Section 151, Public Law 94-587, 94th Congress, approved 22 October 1976. However, funds were not released under that law until Fiscal Year 1978. Bridgeport and Brewster school districts, working through congressional representatives, obtained a release of funding through passage of Section 305, Title III, Public Law 95-26, 95th Congress, approved 4 May 1977. Under this authority, the Corps of Engineers provided approximately \$2.6 million in school construction assistance. Funding assistance was based on cost of temporary facilities

needed to meet the impact. Both school districts supplemented Federal funds with local monies and constructed permanent facilities. The new permanent facilities, along with certain existing school buildings in poor condition, gave the school districts some flexibility in meeting peak impact conditions, as well as planning for the postimpact period. For example, old buildings in poor condition may be eliminated if not repaired when the construction work force leaves the area.

The Seattle District, Corps of Engineers, advised the school districts in assessing physical plant needs and providing necessary engineering and financial support. Design Memorandum 51 (May 1977) provided substantial detail on construction plans, cost estimates, and legal considerations. Building alterations to accommodate grade transfers were completed prior to start of the 1977-1978 school year. Permanent facilities were scheduled for beneficial occupancy during the 1977-1978 school year. In addition to funds for school buildings, the Corps of Engineers will provide approximately \$400,000 in school operation and maintenance (O&M) reimbursement funds under the same congressional authority during the impact period. Amount of funds was determined by a mutually agreeable formula and final audit. Reimbursement was based on O&M funds per student not covered by existing Federal or state sources. The per-student dollar amount was then multiplied times the number of impact students to arrive at the total reimbursement. Amounts reimbursed ranged from \$250 to \$450 per impact student per school year. Community Impact Report, Update II (April 1978) reported on the school impact in detail, including methodology and estimated funding assistance. Student O&M expense at 10 comparable schools determined maximum allowable expense for O&M at Bridgeport and Brewster.

Close liaison between staff of the Seattle District, Corps of Engineers, and the school districts was maintained throughout the impact period. After passage of authorizing legislation for school assistance, and particularly during preparation of final forecasts and school design, contacts occurred almost daily. Primary liaison during this latter stage was between Chief, Design Branch, Engineering Division, and each school superintendent. Seattle District staff also included economists and sociologists. Seattle District lawyers and fiscal specialists participated during the contract phase of the assistance. The Washington State Office of the Superintendent of Public Instruction and the Seattle Regional Office of the U.S. Department of Health, Education and Welfare were kept apprised of the assistance activity throughout the impact period and provided important information on school facility standards and funding sources.

## Health and Safety

Health Care Facilities. Of the 15 hospitals located in the six counties surrounding the dam, seven were located within the actual impact area (table 5 and figure 9). These seven hospitals contained a total of 212 set-up (ready for occupancy) beds. Two hospitals located in Wenatchee, just outside the 50-mile radius of the dam, offered an additional 186 set-up beds for patient care. In addition to the hospitals in the area, there are several clinics providing mental health, outpatient, alcoholism, and migrant worker and Indian health treatment.

A preliminary study completed in 1977 by the Central Washington Health Systems Agency (CWHSA) (whose jurisdiction includes the four counties most heavily impacted by the project - Chelan, Douglas, Okanogan, and Grant) indicated that most hospitals in this area were in generally good financial health. However, they were troubled by low rates of utilization and an excess number of beds. Overall occupancy remained close to 50 percent between 1973 and 1976. The ratio of beds per 1,000 population has stayed close to 3.8 since 1973. Interviews with officials of the CWHSA indicate that, with scheduling and planning, a hospital can adequately serve area population with only two to three beds per 1,000 people.

Excess bed and low utilization rates are probably due to the shortage of physicians (typical in rural communities) in the impact area. Many physicians with specialties are located in either Wenatchee (about 60 miles from the damsite) or Spokane (about 110 miles from the damsite). Data in the Annual Hospitalization Report (State of Washington) indicate that patients travel to these two cities to receive routine as well as specialized care. A person consulting a doctor in either city was more likely to stay in a hospital in that city than in a hospital closer to home. This was referred to as the "escaping patient" phenomenon by local health authorities.

Medical and dental services for the Bridgeport-Brewster area are centered in Brewster. The town supports the 50-bed Okanogan-Douglas County Hospital. There is also a 73-bed convalescent center in Brewster which operates an ambulance service with a capacity of four patients. In 1973, there were five physicians registered to practice in Brewster; in 1977, there were three. Medical services in Bridgeport consist of one dentist, several volunteer firemen trained as medics, and a two-patient ambulance service operated by the fire department.

The Mayor of Brewster, who also is Administrator of Okanogan-Douglas County Hospital, stated that no major impacts on the health care facilities of the area were due to the influx of construction-related population. Apparently, many individuals associated with dam construction traveled to Wenatchee or Spokane for medical purposes. A major concern had been the probability, based on data from

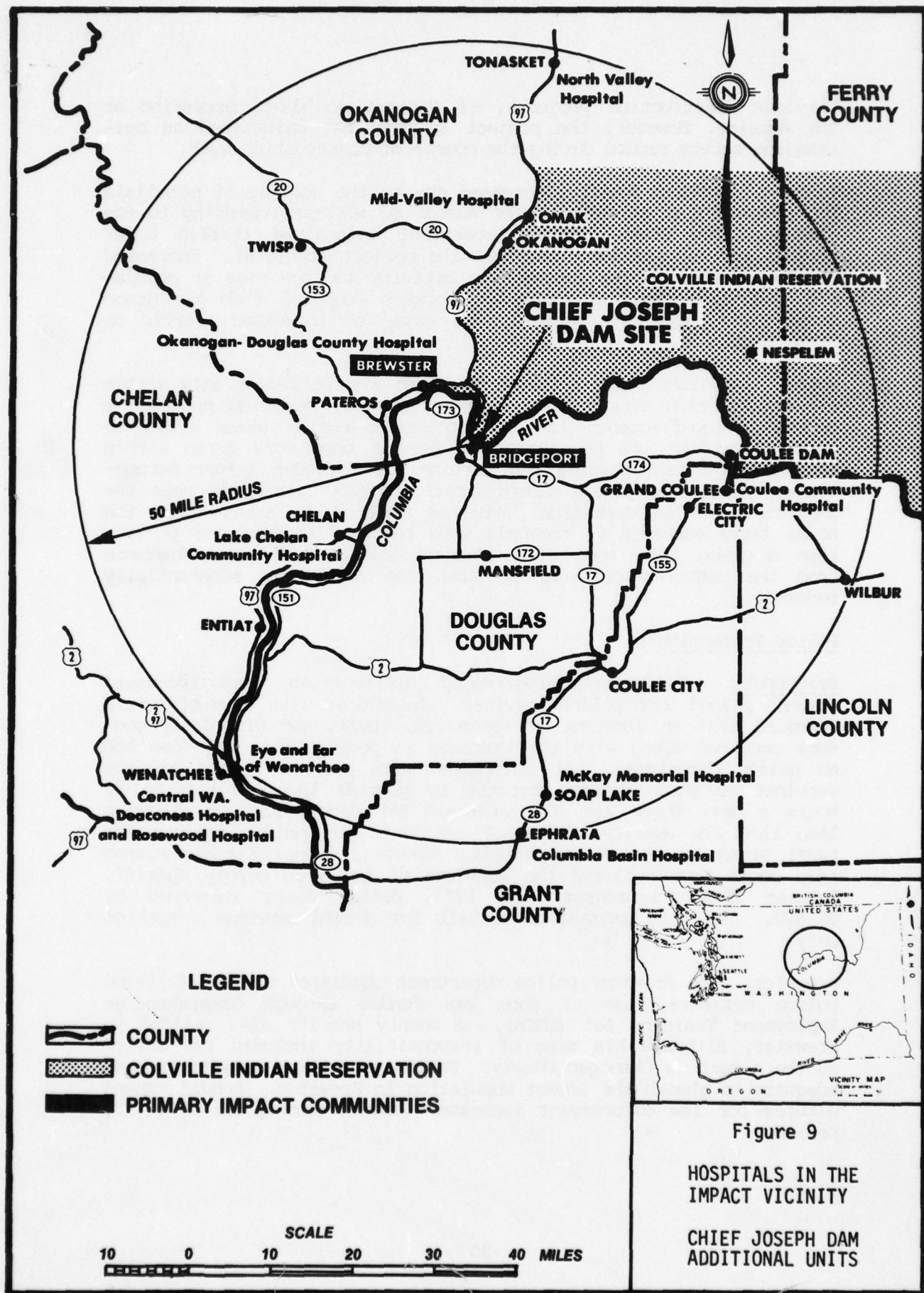
TABLE 5

HOSPITALS IN THE SIX COUNTIES SURROUNDING  
CHIEF JOSEPH DAM PROJECT AREA

## CHIEF JOSEPH DAM ADDITIONAL UNITS

<u>Hospital</u>	<u>Town</u>	<u>County</u>	<u>No. of Set-Up Beds</u>	<u>Located Within Actual Impact Area</u>
Cascade General Hospital	Leavenworth	Chelan	20	No
Central Washington Deaconess and Rosewood Hospitals (Consolidated)	Wenatchee	Chelan	162	On Edge
Columbia Basin Hospital	Ephrata	Grant	29	Yes
Coulee Community Hospital	Grand Coulee	Grant	27	Yes
Eye and Ear Hospital of Wenatchee	Wenatchee	Chelan	24	On Edge
Ferry County Memorial Hospital	Republic	Ferry	15	No
Lake Chelan Community Hospital	Chelan	Chelan	28	Yes
Lincoln Hospital	Davenport	Lincoln	24	No
McKay Memorial Hospital	Soap Lake	Grant	21	Yes
Memorial Hospital	Odessa	Lincoln	21	No
Mid-Valley Hospital	Omak	Okanogan	27	Yes
North Valley Hospital	Tonasket	Okanogan	30	Yes
Okanogan-Douglas County Hospital	Brewster	Okanogan	50	Yes
Quincy Valley Hospital	Quincy	Grant	16	No
Samaritan Hospital	Moses Lake	Grant	50	No
TOTAL			544	

Source: 1976 Annual Hospitalization Report, Department of Social and Health Services, State of Washington.



previous construction projects, of serious accidents occurring at the damsite. However, the project to date has maintained an outstanding safety record during the course of construction work.

Traffic. Traffic density increased due to the hauling of materials for construction as well as the number of workers commuting to the damsite. The State Highway Department maintained traffic count records for several locations near the project (table 6). Increased traffic paralleled the increase in activity and the rise in population near the dam. A number of workers commuted from the Grand Coulee area, and were probably the cause of increased traffic on State Route 174.

Noise. Increased noise appeared to be an adverse factor only within the construction site. Turbine and generator operation produced a constant, low-frequency hum and hydraulic rumble which could be heard throughout the powerhouse. Noise in some work areas within the generator air housing and turbine pit exceeded 8-hour Occupational Safety and Health Administration (OSHA) standards when the generator was in operation. Workmen located in areas where the noise level exceeded 85 decibels were required to wear ear protection devices. The town of Bridgeport was at sufficient distance from the construction site so that the noise was substantially reduced.

#### Police Protection

Bridgeport. Bridgeport experienced difficulties with increased demands placed upon police services. Interviews with town officials revealed that an increase in vandalism, theft, and disorderly conduct occurred along with the increase in population. The town had no police department, but contracted with Douglas County for the services of three deputy sheriffs to provide local protection 16 hours a day. There are 368 residents per deputy sheriff which is less than the average number of residents per police officer for rural areas in the United States. However, town officials stated they could have utilized the services of one more deputy sheriff. Between 1974 (preproject) and 1977, police costs increased by \$8,600. The city maintained a jail for 4-hour maximum detention only.

Brewster. The Brewster police department consisted of five fulltime police officers, one of whom was funded through Comprehensive Employment Training Act (CETA). A county sheriff also resided in Brewster, although his area of responsibility included the entire southern part of Okanogan County. Police protection services proved adequate to absorb the impact population in Brewster. Annual expenditures for law enforcement increased \$33,600 during the 1974-1977 period.

TABLE 6

COMPARISON OF AVERAGE DAILY TRAFFIC VOLUMES IN IMPACT AREA  
1974-1977

## CHIEF JOSEPH DAM ADDITIONAL UNITS

## Average Daily Traffic Volume\*

<u>Segment of Highway</u>	<u>Leg of Inter-section</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>Percent Increase From 1974 to 1977</u>
Junction of State Route 17 with State Route 173 (between Bridgeport & project site)	S	1,120	1,140	1,200	1,370	22.3
	N	1,060	1,420	1,500	1,550	46.2
Junction of State Route 173 with Pine Avenue (about halfway between Bridgeport and Brewster)	E	1,220	1,310	1,750	1,850	51.6
	W	1,240	1,320	1,800	1,900	53.2
Junction of State Route 174 with State Route 17 (about halfway between Grand Coulee area & project area)	—	610	510	680	710	16.4

Source: Annual Traffic Report, 1976, Washington State Highway Commission, Department of Highways (1977 figures obtained in telephone conversation with same).

\*Volumes shown represent an estimate of one average day of the year.

## Fire Protection

Bridgeport. Bridgeport had a crew of 21 volunteer firemen with two pumper trucks. Several of the volunteers, including the fire chief, were Corps of Engineers' employees. A potentially serious fire hazard existed where mobile homes utilized for temporary housing were placed too close together. The main fire concern was an inadequate water supply to meet the needs of an increased population. Lack of water for fire protection to the homes on higher elevations behind town and on the Bridgeport Bar was a major concern of fire officials. Fortunately, no large fires occurred during the peak construction period.

Brewster. Brewster had a 25-member volunteer firefighting crew equipped with two pumper trucks and three auxiliary trucks. Water pressure and storage capacity were satisfactory for adequate fire protection, according to standards set by the National Board of Fire Underwriters. Brewster fire department had the staff and equipment to protect a town three and one-half times present size including impact population. No major fires occurred during the peak construction period.

## Utilities

### Sewer.

Bridgeport. The existing sewage treatment plant is owned and operated by the town of Bridgeport, and was placed in operation in 1969. The plant was designed to handle an average flow of 200,000 gallons per day (g.p.d.). Assuming an average daily flow of 100 gallons per capita daily, the system was designed to handle a population of 2,000. (Census in 1977 was 1,623.) Average inflow during the peak impact, coupled with required sludge recirculation, substantially exceeded design capabilities of the existing clarifier. Cause of the excess flow was uncertain, but may have been due both to high per capita flow and a workday population which exceeded the permanent (census) population. Inflow and recirculation measured in August 1977 was approximately two times the design hydraulic loading. The effect of this overloading was visually apparent as a rolling, muddy appearance as sludge spilled over the weir. To alleviate the sludge overflow, the town hauled activated sludge and dumped it on open land near the town. Such dumping technically violated U.S. Environmental Protection Agency (EPA) standards.

In March 1975, prior to the construction impact, Bridgeport applied for funds to expand its sewer system under a Washington State funding program. In August 1977, the state offered a \$30,000 loan to conduct engineering design studies and to fund subsequent financing applications. In March 1977, a step one facility plan, application for study, was submitted to the Washington State Department of Ecology and the EPA. An offer of \$11,000 was made by these agencies in July 1977.



A step two application for final design plans and specifications was scheduled for December 1977. The timing of step three has yet to be determined. The 1977 estimated cost to upgrade and expand the Bridgeport sewer system was \$242,000.<sup>1/</sup>

Brewster. The existing sewage treatment plant, owned and operated by the town of Brewster, was placed in operation in 1967. The plant was designed to handle an average daily flow of 250,000 g.p.d. Assuming an average per capita daily flow of 100 gallons, the system was designed for a population of approximately 2,500, well above normal plus impact population. Estimated average flow during the peak, however, was about twice the earlier estimate. Fruit-packing operations were estimated to contribute a peak of 90,000 g.p.d. to the system. Two of the four fruit packing operations in the town are connected to the sewer system, and are major contributors to the total flow. About two-thirds of the average flow is domestic sewage. Several large roof drains connected to the system, plus system infiltration during runoff periods, can contribute up to 200,000 g.p.d. of additional inflow to the system.

The capacity of the present system was exceeded during peak impact. Although influx of construction workers was not the primary factor that caused the strain on the Brewster sewer system, the added population did worsen the situation. Much of the overload was due to a new fruit processing technique used by the packing houses which uses more water than the old process. Because of this new process, and the possibility that other packers may hook into the system, the town is conducting engineering studies necessary for expansion of the sewer system. The design capacity of the new system is projected to be up to 750,000 g.p.d. Because of the uncertainty as to the capacity that will be needed to serve the packing houses, consulting engineers considered three alternative expansion programs. Each is designed to accommodate a population of 2,000 with the balance of system capacity varying with the service needed to service packing houses.

Brewster applied for EPA funding in December 1975. An initial \$22,000 of funding was received in June 1977. Construction is planned for the summer of 1979. The city is exploring various ways of financing the contemplated system expansion.

<sup>1/</sup>Estimate based on discussions with consulting engineer for the town.

## Water.

Bridgeport. Water usage records were not sufficient to measure consumption accurately. The 1977 physical condition of much of the water distribution system was unknown. Two of the three wells were unmetered, and total usage could only be estimated. Consumption by unmetered users was unknown, and may have been substantial. A 1975 study estimated average water usage at 700 gallons per capita daily (g.p.c.d.) and peak usage at 2,000 g.p.c.d. This contrasted sharply with reported national rates of 200 g.p.c.d. average use and 400 g.p.c.d. peak use<sup>1/</sup> for cities the size of Bridgeport. During peak usage (2.9 m.g.d.), the estimated pumping capacity of the three wells (2.3 m.g.d.) was exceeded, and the system suffered from low water pressure and a falling reservoir level.<sup>2/</sup> This lack of capacity constituted a considerable inconvenience for customers and a greatly increased fire risk. High usage rates appeared to be due to use of domestic water for large lawns and gardens, irrigation of some orchards, and for an extensive municipal park system. Although the water system had deficiencies prior to the influx of construction workers, the rapid population increase at the peak of the impact was a factor in the inadequacy of the system during the 1976-1978 period.

In March 1975, Bridgeport applied for state funds to upgrade its water system, and the state offered to fund 40 percent of construction costs (\$134,799). In October 1976, Bridgeport submitted an application for \$529,850 to the Economic Development Administration (EDA) to supplement funds offered by the state and to fund the construction of a city maintenance shop (an additional \$188,160). Because unemployment was not sufficiently high in the area, the EDA did not make a grant award to Bridgeport (May 1977). In June 1977, the state withdrew its grant offer because the project had not commenced. The town also made a grant application to upgrade the water system in January 1977 to the Department of Housing and Urban Development (HUD). The following month, Bridgeport was notified no grant would be forthcoming because unemployment was not a problem in the area. As of May 1978, the city had not resolved the problem of obtaining funding. Although total water usage will taper off as the construction work force is phased out, the deteriorated condition of the system will require a long-term solution.

Brewster. The municipal water system is completely metered. According to studies conducted by engineers for the town, average demand was 0.75 million gallons per day (m.g.d.) with a peak demand of 1.25 m.g.d. These figures contrast with the supply capacity of 1.75 m.g.d. Major nonresidential users included the school system,

<sup>1/</sup>Evaluation Study of Impact Upon Utility Systems of Bridgeport, Washington, January 1975, prepared by Lee Johnson Associates.

<sup>2/</sup>Letter from Lt. Col. John Terpstra to Mayor Dennis Hardie, dated 30 August 1977.

hospital, rest home, four apple packers/processors, a motel, two supermarkets, a laundromat, and a trailer court. The engineers estimated 4 percent of the meters account for about 20 percent of the average daily summer demand.

On the average, 0.75 m.g.d. was pumped into the system, and 0.65 m.g.d. was recorded on service meters and sold. The difference between production and sales was attributable to fire flow, leaks, pipe flushing, flow through inoperative meters, and municipal uses (unmetered) such as irrigation, the town hall, and sewage plant. The ratio of water produced to water sold during the winter indicated the water system was efficient and in good condition. No orchards or other agricultural crops within the confines of the distribution system were irrigated with the municipal supply. The population growth associated with project construction was not sufficient to create water supply problems.

Although the supply of water at the source was deemed adequate by engineers for the town, improvements were being sought in the distribution system. An application was made in January 1974 under State Referendum 27 for funds to upgrade the distribution system. Approval was received in May 1977 for an \$80,000 grant covering 40 percent of construction costs (\$200,000). Brewster paid for the balance through a bond issue. In November 1976, the Economic Development Administration (EDA) rejected an application by the city for funds to upgrade the water distribution system. The city is presently working through its consulting engineers to find other sources of financing.

Other. Other utilities such as electrical and telephone service expanded to meet the impact population without difficulty.

#### City Finances

Bridgeport. Revenues and expenditures were balanced at \$71,600 in 1974 (preimpact) and \$90,200 in 1977 during peak impact (table 7). Revenue categories such as retail sales taxes, licenses, permits, and miscellaneous fees and fines all increased substantially over preimpact figures. Unfortunately, the need for additional services also rose rapidly, and the necessity to balance the budget limited expenditures. In addition, due to the high rate of inflation during the 1974-1977 period, about one-half of the added revenues were lost in terms of real purchasing power. The mayor of Bridgeport felt that the quality of services such as police protection had suffered due to lack of additional operating revenues.

Brewster. Revenues and expenditures in Brewster were \$94,300 in 1974 and \$129,600 in 1977 (table 7). With a smaller influx of workers, larger tax base, and more diversified economy, Brewster was better able to maintain sufficient community services. The mayor of Brewster felt that his community had financially absorbed the worker impact with little effect on the quality of services provided.

TABLE 7

CURRENT EXPENSES AND REVENUES  
BRIDGEPORT AND BREWSTER  
1974 and 1977

CHIEF JOSEPH DAM ADDITIONAL UNITS

	Bridgeport		Brewster	
	1974	1977	1974	1977
1. <u>Revenues.</u>				
Cash on Hand	\$7,000	\$6,000	\$30,000	\$15,000
Taxes <sup>1/</sup>	13,500	27,100	33,000	65,100
Licenses, Permits, Fines	3,800	7,800	10,100	10,800
Intergovernmental Revenues <sup>2/</sup>	30,800	20,300	18,800	38,200
Miscellaneous <sup>3/</sup>	<u>16,600</u>	<u>29,000</u>	<u>2,400</u>	<u>500</u>
TOTAL	\$71,700	\$90,200	\$94,300	\$129,600
2. <u>Expenditures.</u>				
Current Expenditures <sup>4/</sup>	\$56,700	\$65,600	\$44,000	\$45,700
Police	12,000	20,600	41,000	74,100
Fire	<u>3,000</u>	<u>4,000</u>	<u>9,300</u>	<u>9,800</u>
TOTAL	\$71,700	\$90,200	\$94,300	\$129,600

Source: Town fiscal records.

<sup>1/</sup>Sales and use, property, utility district, and amusement.

<sup>2/</sup>Revenue sharing, Federal and state (including grants).

<sup>3/</sup>Bridgeport includes garbage service; Brewster does not.

<sup>4/</sup>Wages and salaries (other than police and fire), supplies, and other operating costs.

## Esthetic Values

Visual Landscape and Patterns of Land Use. The project area still shows scars from construction of Chief Joseph Dam original units 20 years ago. Remains of a short-lived commercial boom can be seen in the vacant buildings, substandard housing, and scattered lots in the Bridgeport and Bridgeport Bar area. Present construction has further impacted the appearance and land-use patterns of the area.

Results from the construction worker survey discussed in section 5 showed that about 1,000 new residents moved into the impact area. Bridgeport and Brewster received the bulk of this new population. Many construction-related families lived in mobile homes and trailers. Residential development primarily in the form of trailer parks occurred on the outskirts of both towns. Mobile homes were scattered on previously vacant lots throughout the towns. Since most trailers were quite new, the overall impression was not unpleasant. Some attempts were made to landscape many of the trailer sites. The influx of school-age population was great enough to require the construction of attractive new school facilities in both towns, with major financial assistance from the Corps of Engineers. Aerial photographs of both towns, taken before impact and during peak impact, are included as figures 10 through 13.

Bridgeport did not experience an economic boom similar to that of the 1950's during original construction, so random and unplanned location of short-lived businesses was not a problem in the 1970's.

The impact area should experience a reduction in residential land use as the construction workers move away. Substantial amounts of landscaping are planned around the dam after construction is completed. These combined activities should help create a more pleasant landscape.

Recreational Facilities. The impact area contained a variety of recreational facilities. The communities of Bridgeport and Brewster maintain a bowling alley, libraries, parks, swimming pools, and picnic areas. The outdoor facilities were heavily used during the hot summer months by tourists and local residents. The increase in impact population at peak added to this use. Adverse effects upon recreational facilities of the communities consisted of some overcrowding at the municipal pool, and some acts of vandalism at the pool and public toilets at Bridgeport.



FIGURE 10. AERIAL PHOTOGRAPH OF BRIDGEPORT, WASHINGTON, PRIOR TO IMPACT. MAY 1974.  
SCALE: 1" = 900' ±



FIGURE 11. AERIAL PHOTOGRAPH OF BRIDGEPORT, WASHINGTON, DURING PEAK IMPACT. ARROWS POINT TO AREAS OF INCREASED DEVELOPMENT. SEPT 1977. SCALE: 1" = 900' ±



FIGURE 12. AERIAL PHOTOGRAPH OF BREWSTER, WASHINGTON, PRIOR TO  
IMPACT. MAY 1974.  
SCALE: 1" = 888' ±





FIGURE 13. AERIAL PHOTOGRAPH OF BREWSTER, WASHINGTON, DURING PEAK IMPACT. ARROWS POINT TO AREAS OF INCREASED DEVELOPMENT. SEPT 1977. SCALE: 1" = 900' ±

Archeological Resources. Several cultural resource reconnaissance and survey investigations have taken place in north-central Washington since 1945. Corps of Engineers-sponsored reconnaissance at the Chief Joseph project has identified 272 prehistoric and historic cultural resource sites. In 1977, test evaluation of sites that may be affected by the project was undertaken by the Corps of Engineers to identify properties eligible for the National Register of Historic Places, and to determine the need for salvage/preservation of significant cultural data. On the basis of existing information, the Colville Confederated Tribes and the Washington State Historic Preservation Officer maintain that many sites presently endangered are crucial to the full understanding of the cultural and environmental history of the area and people, and have taken steps to nominate the Rufus Woods Lake area to the National Register as an Archeological District. The Corps of Engineers began salvage operations in early summer of 1978. About 30 persons moved temporarily into the project area, locating near Nespelam and drawing upon the community facilities of that town. An additional 25 persons may be hired from the local labor force. About half of the salvage crew were seasonal transient workers living in trailers in a base camp onsite during the summer field season and leaving the area during the winter. Fewer than 10 persons were projected to move into the area for the duration of the salvage operation. Current estimates indicate that up to 20 Colville Confederated Tribal members may be employed. The complete salvage and preservation program is estimated to cost up to \$2.4 million, and may continue through 1983.

#### Civic Organizations and Community Growth, Cohesion, and Response

Civic Organizations. A few service, fraternal, and business-related organizations, representative of those found nationwide, are also found in the primary impact area. Examples include the American Legion and the Chamber of Commerce. Recently organized youth activities include the Boy Scouts and Girl Scouts of America.

Involvement of contractor employees and their families tended toward organizations of personal interest and benefit such as the school board and Scouts. Corps of Engineers' employees were more active in community service and local government such as the Chamber of Commerce and the volunteer fire department.

Interviews with officials indicate that workers were welcome to participate in any activity of their choosing. Officials said workers appeared to support community organizations, but were not active to any large extent. Their participation did not significantly affect the leadership or goals of these organizations.

Community Growth. The development of social, economic, and political systems within a given community comprises community growth. Such growth was only temporarily affected in Bridgeport and Brewster due to the short term nature of construction activities and population increase. Although numerous employees and their families became active in civic organizations, their relatively short-lived stay in the community prevented their participation from affecting any permanent changes in the existing social structures.

An economic boom atmosphere with substantial business expansion occurred during the original dam construction in the 1950's. Many businesses started at that time closed soon after construction ceased, as it became apparent that the postconstruction economy could not support the new businesses. Potential investors were wary of repeating that experience in the 1970's. In spite of substantial gains in bank deposits and retail sales over preimpact conditions, very few new businesses were established. The postimpact financial composition of both towns will probably be much as it was before construction.

Any project-related, long-term growth may be associated with increases in tourism and use of proposed nearby recreational facilities and the related increased need for support services. Community representatives appear to favor such long-term growth.

The basic political structure of both towns appeared to be unchanged by the construction impact. Both mayors were long-time residents. The majority of the construction workers appeared to have little interest in local politics.

The nearby Colville Indian Reservation was little affected by construction. Indian employment on the construction project never exceeded 10 to 15 people. All major Indian communities were at a substantial distance from the dam. Negotiations between the Colville Confederated Tribes and the Federal Government over electrical power revenues, land acquisition, and archeological preservation are in progress. The outcome of these negotiations may have a major impact on future growth on the Reservation. An Indian culture theme, which may be featured in the public use facilities at the dam, would likely draw visitor attention to the Reservation.

Community Cohesion. Community cohesion is the unifying force which allows a group to establish patterns of interrelationships, common institutions, commonly agreed-upon ways of behaving, and a common identity. The essential elements of community cohesion are physical proximity, social similarities, and group activities. The introduction of several hundred construction personnel and their families into the towns near the project was the greatest

project-related threat to the community cohesion of these towns. With such a large concentration of impact population, Bridgeport and Brewster were the towns most likely to experience changes in community cohesion. (The project was not expected to adversely affect the cohesion of the Colville Confederated Tribes.)

Interviews with officials indicated that no significant changes in the cohesiveness of either town was experienced. In spite of their relative residential isolation, construction workers and their families were active to some extent in community affairs. Officials noticed no tension or conflict of interest between local groups and new residents. Construction workers and their families participated in activities in which they were likely to work with long-time residents toward similar goals. Although some demographic differences existed between long-time residents and new residents (for instance, new residents were older, more likely to be married, and had slightly smaller families than long-time residents), these differences did not appear to prevent these groups from working together. Contributing toward the cohesiveness of both towns was the fact that almost 60 percent of the work force was made up of local residents who were already established members of the communities.

Community Response. The reaction of community leaders in Bridgeport and Brewster to the influx of construction workers was mixed. Increased retail sales and the prestige and publicity associated with expansion of one of the largest hydropower dams in the world were widely appreciated. Overcrowded schools and the strain on local utilities and services, however, caused considerable feelings of resentment. Anger and frustration were primarily directed at the Federal Government and not the construction workers. Congressional authority to assist local schools was widely praised, but the lack of funding for utility improvements remained a major source of tension. The general reaction of many local officials was that, since the Federal Government brought in the workers, the Federal Government should pay for any impact created by the increased population. The presence of economists and sociologists from the Corps of Engineers who were investigating potential community impacts before construction led some people to believe that Federal financed assistance was in process. The communities did not appear to have the expertise necessary to deal effectively with the complicated Federal and state bureaucratic and regulatory structures from which funds might have been obtained. The lack of authority for the Corps of Engineers to mitigate local social and economic impacts was not widely understood or appreciated by the community.

## SECTION 5 - CONSTRUCTION WORKER PROFILE

### Introduction

Demographic characteristics of the expected work force are an essential component of any community impact planning process. The Chief Joseph Project provided an opportunity to obtain such data from a large number of workers at a major construction site. Statistics gathered from the survey can be compared with studies by other Federal or state agencies to develop a construction worker profile. This profile provides basic data which can be utilized to project worker characteristics for future community impact studies.

Three brief construction worker surveys at the Chief Joseph project were conducted at the request of congressional representatives between late 1975 and early 1977. These surveys only determined numbers of workers and residency patterns during the preliminary construction phases. Additional information was needed for a more complete community impact study. Recognizing this need, major contractors on the project agreed to assist in conducting a survey of their workers in December 1977. Substantial construction activities were in progress on that date, with over 600 workers employed onsite.

### Methodology

A survey form, the size of a computer card, was distributed by contractor administrative staff to each worker with his weekly paycheck at the end of the first week in December 1977. Workers were requested to return the completed form by the following payday. Over 80 percent of the cards were returned in usable form. Basic information was requested on residency, occupation, housing, previous employment, and family characteristics. A sample form and details on editing and processing are included as appendix A.

### Source of Work Force

Workers were classified as local or nonlocal according to where they had lived prior to employment on the project. A local worker was one who still lived in the same town he had lived in before employment on the project. A nonlocal worker was one who had lived in a different town prior to starting work on the project.

TABLE 8  
 LOCAL/NONLOCAL COMPOSITION OF WORK FORCE <sup>1/</sup>  
 CHIEF JOSEPH DAM ADDITIONAL UNITS

	<u>Number</u>	<u>Percent</u>
Local	234	57.5
Nonlocal	<u>173</u>	<u>42.5</u>
TOTAL	407	100.0

<sup>1/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

The CIR and Update I both assumed the majority of workers would be new to the area. A recent analysis of construction work force at 26 small construction projects in the western states also reported that most workers were from outside the local area.<sup>1/</sup> The unexpected high percentage of local workers indicated that a substantial pool of available labor existed locally. A number of the local workers were from towns near Grand Coulee Dam, about 40 miles east of the project. Many workers from the Third Powerplant project at Grand Coulee apparently remained in the area, and were able to find work at Chief Joseph. The percentage of local workers may be slightly inflated in that a few workers who moved into the area in anticipation of project work, but without an actual job, would have been reported by the survey as local workers.

Residency

Worker residential patterns at the time of the survey are presented in table 9. Predictions of residency were made in the original CIR and in Update I. The CIR predicted that 50 percent of the impact population would live in Brewster and 15 percent in Bridgeport. That report assumed that the majority of the workers would be non-local, and most would want to live in a community with better community services, facilities, and housing, even if a few miles farther away from work. Update I revised residency projections, giving more emphasis on commuting distance to the project site.

<sup>1/</sup>Construction Worker Profile, Final Report, prepared by Mountain West Research, Inc., for the Old West Regional Commission, Washington, D.C. (December 1975). Construction Worker Survey, Final Report, prepared by Mountain West Research, Inc., for the U.S. Bureau of Reclamation, Denver, Colorado (October 1977).

Update I predicted that 27 percent of the work force would locate in Bridgeport, 23 percent in Brewster, and 10 percent in the Bridgeport Bar area. Actual data from the survey was 43 percent at Bridgeport, 17 percent at Brewster, and 3 percent at Bridgeport Bar. This indicates that workers preferred to live close to the project rather than in a community a short distance away with more amenities. About 30 percent of the work force commuted from towns up to 50 miles away. A small number gave their address as communities over 50 miles away.

TABLE 9

RESIDENTIAL DISTRIBUTION OF WORK FORCE <sup>1/</sup>

CHIEF JOSEPH DAM ADDITIONAL UNITS

<u>Town</u>	<u>Local</u>		<u>Nonlocal</u>		<u>Total</u>	
	No.	%	No.	%	No.	%
Bridgeport	55	23.5	115	66.5	177 <sup>3/</sup>	42.7
Brewster	40	17.1	32	18.5	72	17.3
Bridgeport Bar	7	3.0	4	2.3	11	2.7
Grand Coulee Area <sup>2/</sup>	40	17.1	6	3.5	47 <sup>4/</sup>	11.3
Other Communities within 50-Mile Radius of Dam	68	29.1	13	7.5	81	19.5
Outside 50-Mile Radius of Dam	<u>24</u>	<u>10.3</u>	<u>3</u>	<u>1.7</u>	<u>27</u>	<u>6.5</u>
TOTALS	234	100.1	173	100.0	415	100.0

<sup>1/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

<sup>2/</sup>Grand Coulee area includes towns of Coulee Dam, Coulee City, Electric City, and Grand Coulee.

<sup>3/</sup>Includes seven workers who did not respond to question of local/nonlocal residency.

<sup>4/</sup>Includes one worker who did not respond to question of local/nonlocal residency.

Nonlocal workers were questioned as to their residency prior to project employment. As shown in table 10, most workers came from other areas in the state. Many out-of-state workers came from Montana or Idaho, where other Corps of Engineers projects were recently completed. These findings support the thesis that many workers migrate between major construction projects.

#### Prior Employment Status

Prior employment status of the surveyed workers is presented in table 11. A significant finding is that almost 60 percent of all workers had some period of unemployment in the 6 weeks prior to working on the project. Over one-fourth of all workers had been out of work for 31 or more days in the 6 weeks prior to project employment. The impact on local unemployment rates cannot be quantified from available data. Unemployment statistics are only gathered by the state to the county level. Bridgeport and Brewster each lie in different counties, thus scattering the work force between two reporting areas. The peak construction work force of nearly 900 amounted to less than 4 percent of the two-county total work force at that time. The large number of local workers who had been unemployed prior to starting work on the project would indicate that a significant reduction in unemployment must have occurred in the primary impact communities.

#### Occupational Distribution

Occupational distribution of the work force is presented in table 12. The local labor market provided substantially more craftsmen and laborers than did the nonlocal work force. Only in professional/technical, operatives, and clerical categories did the nonlocal worker predominate. The cause for nonlocal clerical workers apparently is that administrative, supervisory, design, and clerical staff were more likely to be employees of the Corps of Engineers and to have come into the area from other projects.

The substantial number of local craftsmen was unexpected. Apparently, many skills acquired by the local work force in agricultural and local construction jobs were available and transferable to project needs.

#### Age Distribution

Median age of the work force was 42.8 years. There was little difference in age distribution between local and nonlocal workers (table 13). The bulk of the work force was between the ages of 20 and 59. More workers were found in the ages between 30 and 64 than are found in the general male population in the State of Washington.



TABLE 10  
 RESIDENCY OF NONLOCAL WORKERS  
 PRIOR TO EMPLOYMENT AT  
 CHIEF JOSEPH DAM ADDITIONAL UNITS<sup>1/</sup>

Prior Residence	Number of Nonlocal Workers
<u>Washington:</u>	
Towns within 50-mile radius of dam	23
Seattle-Tacoma-Everett	16
Spokane	14
Tri-Cities	10
Other towns outside 50-mile radius, but in Washington	<u>38</u>
Total Washington	101
 <u>Other States:</u>	
Montana	21
Idaho	18
Oregon	11
Other	<u>20</u>
Total Other States	70
 <u>Other Countries:</u>	
	<u>2</u>
GRAND TOTAL	173

<sup>1/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

TABLE 11

EMPLOYMENT STATUS OF WORK FORCE  
PRIOR TO EMPLOYMENT AT  
CHIEF JOSEPH DAM ADDITIONAL UNITS<sup>1/</sup>

	Local Workers (N=234) <sup>3/</sup>	Nonlocal Workers (N=173)	Total Work Force <sup>2/</sup> (N=415)
Percent experiencing no unemployment in the 6 weeks prior to working on this project.	35.9	47.4	40.5
Percent experiencing some unemployment in the 6 weeks prior to being employed on this project.	62.0	52.0	57.8
No response as to prior employment.	<u>2.1</u>	<u>0.6</u>	<u>1.7</u>
TOTAL	100.0	100.0	100.0
Of those experiencing some unemployment, percent unemployed by duration:			
Unemployed 1-10 days of prior 6 weeks.	15.2	16.7	15.8
Unemployed 11-15 days of prior 6 weeks.	4.8	8.9	6.3
Unemployed 16-20 days of prior 6 weeks.	6.2	11.1	7.9
Unemployed 21-25 days of prior 6 weeks.	8.3	8.9	8.3
Unemployed 26-30 days of prior 6 weeks.	30.3	25.6	28.3
Unemployed 31 and more days of prior 6 weeks.	27.6	24.4	27.1
Unemployed, but no response as to how long.	<u>7.6</u>	<u>4.4</u>	<u>6.3</u>
TOTAL	100.0	100.0	100.0

<sup>1/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

<sup>2/</sup>Total includes eight workers who did not respond to question of local/nonlocal residency.

<sup>3/</sup>N = number of respondents.

TABLE 12

## OCCUPATIONAL DISTRIBUTION OF WORK FORCE

## CHIEF JOSEPH DAM ADDITIONAL UNITS

	<u>Total Work Force<sup>2/</sup></u>	<u>Local Workers as Percentage of Total Workers</u>	<u>Nonlocal Workers as Percentage of Total Workers</u>
Professional/Technical	50	42.0%	58.0%
Craftsmen	208	62.5	35.6
Ironworker (35)			
Cement Mason (8)			
Millwright (10)			
Pipefitter (11)			
Carpenter (71)			
Mechanic (11)			
Welder (2)			
Driller (3)			
Electrician (23)			
Oiler (12)			
Teamster (13)			
Warehouseman (2)			
Heavy Equipment (5)			
Plumbers (2)			
Laborers	74	79.7	18.9
Helpers	11	63.6	36.4
Operatives	22	40.9	59.1
Clerical & Others	48	16.7	79.2
No Responses	<u>2</u>	<u>--</u>	<u>50.0</u>
	415	57.5%	42.5%

<sup>1/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

<sup>2/</sup>Includes eight workers who responded to question of occupation but not to question of local/nonlocal residency.

TABLE 13

AGE DISTRIBUTION OF WORK FORCE<sup>1/</sup>  
 CHIEF JOSEPH DAM ADDITIONAL UNITS

Age	Local Workers		Nonlocal Workers		Total Work Force <sup>2/</sup>		Males in State of Washington, Ages 15-69 <sup>3/</sup>	
	#	%	#	%	#	%	#	%
15-19	2	0.9	2	1.2	4	1.0	169,153	15.1
20-29	45	19.2	38	22.0	83	20.0	269,889	24.3
30-39	55	23.5	37	21.3	95	22.9	188,172	16.8
40-49	52	22.2	38	22.0	90	21.7	195,688	17.5
50-59	58	24.7	42	24.2	102	24.5	176,967	15.8
60-64	18	7.7	13	7.5	32	7.7	67,484	6.0
65-69	2	0.9	2	1.2	4	1.0	50,197	4.5
No Response	2	0.9	1	0.6	5	1.2	--	--
	234	100.0	173	100.0	415	100.0	1,117,490	100.0

<sup>1/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

<sup>2/</sup>Total includes eight workers who did not respond to question of local/nonlocal residency.

<sup>3/</sup>Population Trends, Population Studies Division, Office of Fiscal Management, State of Washington, 1977.

### Marital Status and Family Size

Marital status of the work force was disproportionate to that found among males over 14 years old in the State of Washington. Table 14 indicates that 83 percent were married, 6 percent were single, and 7 percent were separated, widowed, or divorced. In 1970, 64 percent of Washington State males were married, 28 percent were single, and 8 percent were separated, widowed, or divorced. Data for rural areas (such as the project area) are similar. Marital status varied by few percentage points between locals and nonlocals. Nonlocal married workers were more likely to have no children or one child, while local married workers were more likely to have two, three, or four children. Local workers were more likely to be single. Average family sizes are given in table 15 for those married workers who had their families with them in the project area. Local workers appeared to have slightly larger families than nonlocal workers. About 40 percent of nonlocal married workers were not accompanied by their families to project area.

### School Age Children

The CIR projected numbers of construction-related students based on a population-to-student ratio from the 1970 census. Update I revised these predictions, using student-to-employee ratios. Student-to-employee ratios were recalculated in brief surveys during October 1976 and April 1977. Ratios estimated in these surveys were based upon a sampling of workers' residency. The December 1977 worker survey provided the first verification of the preliminary ratios. Results were surprisingly close to the earlier estimates (table 16).

### Population Influx

One of the most significant results of the Construction Worker Survey was the calculation of population influx per 100 construction workers (table 17). Approximately 229 people per 100 nonlocal construction workers moved to the impact area. Two hundred and eighty-two persons were associated with every 100 local construction workers. For all construction workers together, 260 persons were associated with every 100 workers. These ratios, if proven to be typical, will be useful for planning purposes. Once the expected work force for a project is determined, and proportion of local-to-nonlocal workers estimated, the approximate influx of new population can be calculated. Community planning and any mitigation of impacts can then proceed based upon the expected population gain.

TABLE 14

MARITAL STATUS AND NUMBER OF CHILDREN<sup>1/</sup>  
18 YEARS OR UNDER OF WORK FORCE<sup>2/</sup>

## CHIEF JOSEPH DAM ADDITIONAL UNITS

Marital Status	Local Workers		Nonlocal Workers		Total Work Force <sup>3/</sup>	
	#	%	#	%	#	%
Single	18	7.7	8	4.6	26	6.3
Divorced, Widowed, or Separated	13	5.6	13	7.5	27	6.5
Married, No Children	45	19.2	47	27.2	93	22.4
Married, One Child	35	15.0	36	20.8	74	17.8
Married, Two Children	55	23.5	26	15.0	83	20.0
Married, Three Children	23	9.8	14	8.1	38	9.2
Married, Four Children	11	4.7	5	2.9	16	3.8
Married, More Than Four Children	4	1.7	5	2.9	9	2.2
Married, No Response as to Number of Children	17	7.3	16	9.3	33	8.0
No Response as to Marital Status	<u>13</u>	<u>5.6</u>	<u>3</u>	<u>1.7</u>	<u>16</u>	<u>3.8</u>
TOTALS	234	100.1	173	100.0	415	100.0

<sup>1/</sup>Includes children living with worker and away from worker.

<sup>2/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

<sup>3/</sup>Total includes eight workers who did not respond to question of local/nonlocal residency.

TABLE 15  
 AVERAGE FAMILY SIZE OF MARRIED  
 CONSTRUCTION WORKERS WITH FAMILY PRESENT 1/  
 CHIEF JOSEPH DAM ADDITIONAL UNITS

	<u>Local Workers</u>	<u>Nonlocal Workers</u>	<u>State</u> <u>3/</u>
Average Family Size of Married Respondents with Family Present <u>2/</u>	3.64	3.25	3.58

1/Construction Worker Survey, Chief Joseph Dam, December 1977.

2/Children and spouse are living with worker in impact area.

3/1970 Federal Census.

TABLE 16  
 COMPARISON OF STUDENT-TO-EMPLOYEE RATIOS  
 BRIDGEPORT AND BREWSTER

CHIEF JOSEPH DAM ADDITIONAL UNITS

	CIR	Update I	Oct 76 Survey	Apr 77 Survey	Dec 77 Survey
Bridgeport	}	}	0.80 to 1.00	0.82 to 1.00	0.81 to 1.00
			3.26 <u>1/</u> to 1.00	0.73 to 1.00	
Brewster			0.91 to 1.00	1.01 to 1.00	0.97 to 1.00

1/Ratio of total population to children between the ages of 6 and 18 years in the state.

TABLE 17

AVERAGE POPULATION INFUX PER 100 CONSTRUCTION WORKERS<sup>1/</sup>

CHIEF JOSEPH DAM ADDITIONAL UNITS

	Worker Did Not Respond as to Marital Status	Worker Single, Widowed, Divorced, Separated	Worker Married But No Response as to Presence of Family	Worker Married But Family Absent	Worker Married and Family Present	Worker Spouse Children	Total Population "Influx" <sup>2/</sup>
Local Workers (N=234) <sup>3/</sup>	13	31	24	5	161	264	659
Nonlocal Workers (N=173)	3	21	9	41	99	124	396
Total Work Force <sup>4/</sup> (N=415)	16	53	33	47	266	397	1,078

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Average Population "Influx" per 100 Local Workers = 281.6. 282 people per 100 workers.  
 Average Population "Influx" per 100 Nonlocal Workers = 228.9. 229 people per 100 workers.  
 Average Population "Influx" per 100 Workers = 259.7. 260 people per 100 workers.

<sup>1/</sup>Construction Worker Survey, Chief Joseph Dam, December 1977.

<sup>2/</sup>The term "influx" is used loosely here for all but the nonlocal workers, since local workers and their families were already living in the impact area prior to start of construction. A calculation such as the above, however, is useful for determining the number of people in a community related to construction workers.

<sup>3/</sup>N = number of respondents.

<sup>4/</sup>Total includes eight workers who did not respond to question of local/nonlocal residency.



### Profile of a "Typical" Worker

The Construction Worker Survey was designed to measure certain demographic characteristics of the Chief Joseph Dam work force. The survey revealed that a worker was more likely to originate from within, rather than outside, 50 miles of the project. He preferred to live close to his place of work, rather than living in a town with more social and economic amenities further away. Travel time to the job was an important consideration in selecting a place to live. Chances were good that, if he was new to the project area, he had moved from some other part of Washington State. If he was from another state, he was likely to be from a neighboring state in which other Corps of Engineers' projects were located. He was likely to have experienced several weeks of unemployment prior to employment on the additional units project. If he was from out of the area, he was likely to face competition from local workers for the skilled labor jobs. A worker was likely to be older than the nonconstruction-related male population of the area. Few workers were unmarried. A nonlocal worker was not as likely as a local worker to have his family with him at the project area. If he did, it was a slightly smaller family than those of local workers and the state average. For every 100 workers, there were about 260 people in the community associated with them. This number was smaller (229) if the worker was nonlocal and larger (282) if the worker was local. The kinds of worker patterns established by these data are valuable in predicting worker profiles on future projects.

## SECTION 6 - SUMMARY AND MAJOR FINDINGS

Construction of additional hydroelectric units at Chief Joseph Dam, Washington, resulted in an influx of about 1,000 new residents into the small communities of Bridgeport and Brewster. This influx was equivalent to a 50 percent population increase during a 2-year period. Severe strains were placed on many local facilities and services. Quality and availability of housing were insufficient. Much of the construction-related population lived in mobile homes or trailers, apparently preferring that to substandard housing. Local schools received the major impact, and enrollments rapidly exceeded capacity. The Corps of Engineers received congressional authorization to provide funds for temporary school facilities and operational expenses to alleviate the crowded situation. Despite efforts to coordinate the availability of services with the needs of the communities, the provision of expanded school facilities occurred approximately 2 years late. Local school authorities added funds to contract new facilities. Sewer and water utilities also operated at or in excess of capacity. The local communities only met with limited success in applying for financial assistance from Federal and state agencies with funding authority for utility expansion. Although local health facilities were minimal, they appeared adequate during the peak impact period.

The town of Bridgeport received the bulk of the population impact. Of the two communities, Bridgeport was less able to provide local funds for alleviation of project impacts. Since the Corps of Engineers only had authority to assist the community for school impacts, relations between the community and the Corps of Engineers became significantly strained over responsibility for alleviating other impacts, such as water and sewer. In the eyes of the local small communities, the Corps of Engineers was the Federal Government and any delay or lack of mitigating local impacts (regardless of Corps of Engineers-voiced limits of authority) were considered to be due to ineffective planning or apathy on the part of the Corps.

The town of Brewster absorbed the impact with much less difficulty due to a smaller impact population, larger tax base, and more diversified economy.

Aside from new school facilities and crowded trailer courts, the local communities exhibited little physical change from preimpact conditions. Indications are that the towns will rapidly revert to preimpact population levels as dam construction is completed.

Major findings from the study include the following:

- Construction workers preferred to live close to the project rather than in a community a short distance away which had more social and economic amenities.

- Construction workers preferred to live in mobile homes and travel trailers rather than substandard housing.

- A high percentage of the work force consisted of local workers, indicating that a substantial pool of unemployed labor existed locally.

- Despite major increases in retail sales and bank deposits, new businesses were not attracted to the impact area.

- The new population impact was much more concentrated than had been predicted from the earlier community impact reports.

- Workers as a group were older than would be expected for construction industry, with median age being around 43 years.

- City revenues in the primary impact communities did not expand sufficiently to meet increased need for services.

- Local schools received the major impact and need for financial assistance.

- Community reaction concerning overcrowded schools and deteriorating services was primarily directed at the Corps of Engineers, not the construction workers.

- Small rural communities need funds and technical assistance in applying for Federal or state financial aid with such support provided on a timely basis.

- There appeared to be no permanent social or political changes taking place in the towns.

- Other than new schools and temporary residential development in the form of mobile home and trailer courts, there was little change in the permanent physical appearance of the towns.

- Nonlocal family size was slightly smaller than state average. Construction Worker Survey produced calculations of population influx that are useful for planning future projects and impact mitigation.

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Arthur A. Harnisch, Chief, Economic and Social Evaluation Section	Regional Economist
William R. Burton	Regional Economist
Margaret A. Hadaway	Sociologist
David R. Orcutt	Economist

APPENDIX A  
CONSTRUCTION WORKER DATA

## APPENDIX A - CONSTRUCTION WORKER DATA

### Introduction

This appendix provides data on the methodology, distribution, and return rates of data cards, and keypunch coding, variable names, and value labels used in the survey conducted at Chief Joseph Dam, Washington.

### Methodology

A brief survey data card (figure A-1) similar to one successfully used by another Federal agency was distributed with paychecks by contractors to their employees on 2 and 3 December 1977. The survey was designed to measure basic characteristics of construction workers, including the extent to which nonlocal workers (those who had not lived within the project area prior to employment on the project) were accompanied by their families.

Distribution of the work force between local and nonlocal workers, housing type and residential location, occupation, age, marital status, family size, and previous employment status of the work force were also examined. Workers were informed of the importance and future use of the data to be collected. Participation, however, was voluntary. The overall response rate of 82 percent was very good compared to most voluntary surveys. Cards were collected by the contractors and mailed to the Seattle District Office for coding and keypunching. Tabulations were carried out using the Statistical Package for the Social Sciences (SPSS). Data on survey distribution and return, as well as a list of keypunch codes, variable names, and value labels are presented in tables A-1 and A-2.

### Comparison with Other Construction Worker Surveys

Recent research on construction worker populations carried out by Mountain West Research, Inc. (Tempe, Arizona), provides an interesting comparison with results achieved in the survey of Chief Joseph Dam construction workers. In December 1975, Mountain West published results of a comprehensive study carried out on 14 energy projects in seven western states. <sup>1/</sup> The study was made for the Old West Regional Commission. Total sample size was 3,168 workers. A survey similar to that carried out at Chief Joseph Dam was also conducted by Mountain West on 12 Bureau of Reclamation water resource

<sup>1/</sup>Construction Worker Profile, Final Report, prepared by Mountain West Research, Inc., for the Old West Regional Commission, Washington, D.C. (December 1975).

TABLE A-1

CONSTRUCTION WORKER SURVEY DATA CARD DISTRIBUTION AND RETURN

CHIEF JOSEPH DAM ADDITIONAL UNITS

<u>Worker Group</u>	<u>Cards Distributed</u>	<u>Cards Returned</u>	<u>Response Rate</u>
Corps of Engineers	69	61	88.4%
Contractor Personnel			
Contractor A	244	224	91.8
Contractor B	170	106	62.4
Contractor C	<u>24</u>	<u>24</u>	<u>100.0</u>
TOTAL CONTRACTOR	<u>438</u>	<u>354</u>	<u>80.8</u>
GRAND TOTAL	507	415	81.9%

1. WHAT IS YOUR OCCUPATION (job title)? \_\_\_\_\_
  2. WHAT IS YOUR LOCAL PLACE OF RESIDENCE? \_\_\_\_\_  
town or place
  - (NOTE: Your local place of residence is the place from which you commute daily to your job and may not be your permanent address or the address at which your family is located).
  3. IN WHAT KIND OF HOUSING UNIT DO YOU LIVE AT YOUR LOCAL PLACE OF RESIDENCE? (Circle One)  
single family house      apartment or townhouse      mobile home      travel trailer or camper      sleeping room
  4. a. IS THIS WHERE YOU LIVED BEFORE YOU STARTED WORKING ON THIS PROJECT? (Circle One) YES NO  
 b. IF NO, WHERE DID YOU LIVE PREVIOUSLY? \_\_\_\_\_  
town      state
  6. WHEN DID YOU FIRST START WORKING ON THIS PROJECT? \_\_\_\_\_  
month      year
  6. a. DURING THE SIX WEEKS PRIOR TO THE TIME YOU BEGAN WORK ON THIS PROJECT, WERE YOU UNEMPLOYED AT ANY TIME? (Circle One) YES NO  
 b. IF YES, FOR ABOUT HOW MANY WORK DAYS WERE YOU UNEMPLOYED DURING THE SIX WEEK PERIOD? \_\_\_\_\_  
days
  7. WHAT IS YOUR AGE? \_\_\_\_\_ years
  8. WHAT IS YOUR MARITAL STATUS? (Circle One) MARRIED SINGLE WIDOWED SEPARATED DIVORCED  
**IF YOU DO NOT HAVE A WIFE OR CHILDREN, PLEASE DO NOT ANSWER ANY FURTHER QUESTIONS. THANK YOU.**
  9. a. IF YOU DO HAVE A WIFE AND/OR CHILDREN, DO THEY LIVE WITH YOU AT THE LOCAL PLACE OF RESIDENCE INDICATED IN QUESTION 2 ABOVE? (Circle One) YES NO  
 b. IF NO, WHERE DO YOUR WIFE AND/OR CHILDREN LIVE? \_\_\_\_\_  
town      state
  10. HOW MANY CHILDREN AGE 18 OR UNDER DO YOU HAVE? \_\_\_\_\_ children
- THANK YOU VERY MUCH FOR YOUR COOPERATION    P    1    2    3    4    5    6    7    8    9    10

FIGURE A-1. CONSTRUCTION WORKER SURVEY DATA CARD, CHIEF JOSEPH DAM ADDITIONAL UNITS.

TABLE A-2

CONSTRUCTION WORKER SURVEY KEYPUNCH CODE, VARIABLE AND VALUE  
IDENTIFICATION LIST

## CHIEF JOSEPH DAM ADDITIONAL UNITS

<u>Variable Number</u>	<u>Column Numbers</u>	<u>Question Number</u>	<u>Variable Description and Code</u>
P	1-2		<p>NAME OF EMPLOYER:</p> <p>51 = Resident Engineer's Office</p> <p>52 = Kiewit Standard</p> <p>53 = Groves-Granite</p> <p>54 = General Electric</p> <p>55 = Other</p>
1	4-5	1	<p>RESPONDENT'S OCCUPATION:</p> <p>1 = Supervisor, Superintendent</p> <p>2 = Foreman</p> <p>3 = Engineer</p> <p>4 = Surveyor</p> <p>5 = Ironworker, Rod Bender, Rod Buster</p> <p>6 = Cement Mason, Cement Finisher</p> <p>7 = Millwright</p> <p>8 = Boilermaker</p> <p>9 = Pipefitter, Steamfitter</p> <p>10 = Electrician</p> <p>11 = Painter</p> <p>12 = Carpenter</p> <p>13 = Plumber</p> <p>14 = Mechanic</p> <p>15 = Sheet Metal Worker</p> <p>16 = Bricklayer</p> <p>17 = Welder, Mechanic-Welder</p> <p>18 = Laborer, Rigger</p> <p>19 = Helper</p> <p>20 = Winterization</p> <p>21 = Operative, Operating Engineer</p> <p>22 = Oiler</p> <p>23 = Teamster, Truckdriver</p> <p>24 = Warehouseman, Teamster-Warehouseman</p> <p>25 = Safety, First Aid</p> <p>26 = Office Personnel - Assistant to Resident Engineer, Administrative Officer, Clerk, Typist, Secretary, Stenographer, Dictating Machine Transcriber</p>



TABLE A-2 (con.)

<u>Variable Number</u>	<u>Column Numbers</u>	<u>Question Number</u>	<u>Variable Description and Code</u>
			27 = Other - Refrigeration Operator, Vibrator, Sawman, Construction Inspection (including Construction Representative), Engineering Technician (including Engineering Aid), Metals Technicians, Army Personnel, Geologist. 28 = Heavy Equipment 29 = Driller 30 = Miner 98 = No Response
2	7-9	2	<b>RESPONDENT'S LOCAL ADDRESS, ALL PROJECTS:</b> 750 = Brewster 751 = Bridgeport 752 = Bridgeport Bar 753 = Chelan 754 = City of Coulee Dam 755 = Coulee City 756 = Electric City 757 = Entiat 758 = Ephrata 759 = Grand Coulee 760 = Mansfield 761 = Okanogan 762 = Omak 763 = Pateros 764 = Soap Lake 765 = Tonasket 766 = Twisp 767 = Wilbur 768 = Inside 50 Miles 769 = Outside 50 Miles But Within Washington State 998 = No Response
3	11	3	<b>RESPONDENT'S HOUSING:</b> 1 = Single Family House 2 = Apartment or Townhouse 3 = Mobile Home 4 = Travel Trailer or Camper 5 = Sleeping Room 9 = No Response

TABLE A-2 (con.)

<u>Variable Number</u>	<u>Column Numbers</u>	<u>Question Number</u>	<u>Variable Description and Code</u>
4	13-15	4	<p>RESPONDENT'S PREVIOUS ADDRESS:</p> <p>998 = No Response</p> <p>999 = Same as local address; i.e., local resident. Previous address coded same as variable No. 2. See list for variable No. 2, then continue with:</p> <p>770 = Seattle-Tacoma-Everett Area</p> <p>771 = Spokane Area</p> <p>772 = Wenatchee</p> <p>773 = Tri-Cities</p> <p>774 = Walla Walla</p> <p>775 = Montana</p> <p>776 = Idaho</p> <p>777 = Oregon</p> <p>778 = California</p> <p>779 = Alaska</p> <p>780 = Wyoming</p> <p>781 = Other State</p> <p>782 = Other Country</p>
5	17-19	5	<p>NUMBER OF MONTHS RESPONDENT HAS BEEN ON JOB (Codes are actual number of months on job; i.e.,:)</p> <p>1 = December 1977</p> <p>2 = November 1977</p> <p>3 = October 1977</p> <p>4 = September 1977</p> <p>5 = August 1977</p> <p>6 = July 1977</p> <p>7 = June 1977</p> <p>8 = May 1977</p> <p>9 = April 1977</p> <p>10 = March 1977</p> <p>11 = February 1977</p> <p>12 = January 1977</p> <p>13 = December 1976</p> <p>14 = November 1976</p> <p>15 = October 1976</p> <p>16 = September 1976</p> <p>17 = August 1976</p> <p>18 = July 1976</p> <p>19 = June 1976</p> <p>20 = May 1976</p> <p>21 = April 1976</p>

TABLE A-2 (con.)

<u>Variable Number</u>	<u>Column Numbers</u>	<u>Question Number</u>	<u>Variable Description and Code</u>
5	17-19	5	NUMBER OF MONTHS RESPONDENT HAS BEEN ON JOB (con.): 22 = March 1976 23 = February 1976 24 = January 1976 25 = December 1975 26 = November 1975 27 = October 1975 28 = September 1975 29 = August 1975 30 = July 1975 31 = June 1975 32 = May 1975 33 = April 1975 34 = March 1975 35 = February 1975 36 = January 1975 37 = December 1974 38 = November 1974 39 = October 1974 40 = September 1974 41 = August 1974 42 = July 1974 43 = June 1974 44 = May 1974 45 = April 1974 46 = March 1974 47 = February 1974 48 = January 1974 49 = December 1973 50 = November 1973 51 = October 1973 52 = September 1973 53 = August 1973 54 = July 1973 55 = June 1973 56 = May 1973 57 = April 1973 58 = March 1973 59 = February 1973 60 = January 1973 998 = No Response

TABLE A-2 (con.)

<u>Variable Number</u>	<u>Column Numbers</u>	<u>Question Number</u>	<u>Variable Description and Code</u>
6	21	6A	RESPONDENT'S EMPLOYMENT STATUS JUST PRIOR TO STARTING PRESENT JOB: 1 = Unemployed 0 = Employed 9 = No Response
7	22-23	6B	NUMBER OF DAYS UNEMPLOYED IN THE 6-WEEK PERIOD PRIOR TO STARTING PRESENT JOB (maximum = 36 days) (codes are actual number of days): 98 = No Response
8	25-26	7	RESPONDENT'S AGE (codes are actual age): 98 = No Response
9	28	8	RESPONDENT'S MARITAL STATUS: 1 = Married 2 = Single 3 = Widowed 4 = Separated 5 = Divorced 9 = No Response
10	30-32	9	RESPONDENT'S FAMILY'S ADDRESS: 998 = No Response 999 = Lives With Respondent (If family does not live with respondent, coded same as questions Nos. 2 and 4.)
11	34-35	10	NUMBER OF CHILDREN AGE 18 OR UNDER IN RESPONDENT'S FAMILY (codes are actual number of children): 98 = No Response
12	50-51-52		CARD IDENTIFICATION (codes are 1 through N): N = Number of Respondents per Employer

TABLE A-3  
COMPARISON OF CONSTRUCTION WORKER SURVEY RESULTS  
CHIEF JOSEPH DAM ADDITIONAL UNITS

	Chief Joseph Dam 1/ Additional Units Project CWS - Dec 77		Mountain West Research, Inc. 2/ Study of 12 Water Resource Projects for Bureau of Reclamation - Oct 77		Mountain West Research, Inc. 3/ Study of 14 Energy Projects for Old West Regional Commission - Dec 75	
<u>Response Rate</u>	82%		52%		50%	
<u>Number of Cards Distributed</u>	507 survey cards distributed at 1 project		1,331 survey cards distributed among 12 projects		6,310 survey cards distributed among 14 projects	
<u>Composition of Workforce</u>						
Local	57.5%		47.2%		39.9%	
Nonlocal	42.5%		52.8%		60.1%	
<u>Occupational Dist. of Workforce</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>
Supervisory	} 42%	} 58%	31.7%	68.3%	32.9%	67.1%
Pro/Tech			10.7	89.3	17.7	82.3
Craftsmen	62.5	35.6	52.3	47.7	38.9	61.1
Laborers	79.7	18.9	61.7	38.3	56.9	43.1
Helpers	63.6	36.4	-	-	-	-
Operatives	40.9	59.1	37.7	62.3	40.4	59.6
Clerical and Other	16.7	79.2	19.6	80.4	38.3	61.7
<u>Marital Status and Number of Children 18 Years Old or Under</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>
Single	7.7%	4.6%	18.3%	17.8%	23.3%	18.5%
Divorced, Widowed, or Separated	5.6	7.5	7.5	9.0	5.9	6.1
Married, no children	19.2	27.2	21.6	24.0	16.7	21.5
Married, one child	15.0	20.8	14.1	14.4	13.6	15.0
Married, two children	23.5	15.0	17.0	18.6	17.3	16.7
Married, three children	9.8	8.1	8.8	8.8	10.7	10.0
Married, four children	4.7	2.9	5.9	3.4	6.9	7.4
Married, more than four children	1.7	2.9	6.9	4.0	5.5	4.6
No response	12.9	10.9	-	-	-	-
<u>Average Family Size of Married Workers</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>
	3.64 people	3.25 people	3.87 people	3.51 people	3.97 people	3.78 people
<u>Percentage of Married Nonlocal Workers with Family Present</u>	59.5%		64.9%		63.1%	
<u>Average Population Influx per 100 Nonlocal Workers</u>	228.9 people		213.9 people		227.8 people	
<u>Type of Housing Unit at Worker's Local Place of Residence</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Newcomer Construction Workers 4/</u>	
Single Family Dwelling	58%	18%	71.4%	30.3%	19%	
Apartment	5	10	6.4	20.1	2	
Mobile Home	33	43	19.6	26.1	10	
Travel Trailer or Camper	3	23	1.9	17.6	53	
Sleeping Room	1	6	0.6	5.9	16	
<u>Prior Employment Status of Workforce in Six Weeks Prior to Employment on Project</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>	Information Not Available in Comparable Form	
Percent experiencing no unemployment	35.9%	47.4%	45.4%	53.3%		
Percent experiencing some unemployment	62.0	52.0	54.6	46.7		
No response as to prior employment	2.1	0.6				
<u>Of Those Experiencing Some Unemploy- ment - Percent Unemployed by Duration</u>	<u>Local</u>	<u>Nonlocal</u>	<u>Local</u>	<u>Nonlocal</u>		
Unemployed 1-10 days	15.2%	16.7%	23.6%	15.2%		
Unemployed 11-15 days	4.8	8.9	8.7	12.7		
Unemployed 16-20 days	6.2	11.1	5.0	3.8		
Unemployed 21-25 days	8.3	8.9	5.0	7.0		
Unemployed 26-30 days	30.3	25.6	19.9	22.8		
Unemployed 31 or more days	27.6	24.4	37.9	38.6		
Unemployed but no response as to how long	7.6	4.4	-	-		

1/Construction Worker Survey, Chief Joseph Dam Additional Units, December 1977.

2/Construction Worker Survey, Final Report, prepared by Mountain West Research, Inc., for the U.S. Bureau of Reclamation, Denver, Colorado, (October 1977).

3/Construction Worker Profile, Final Report, prepared by Mountain West Research, Inc., for the Old West Regional Commission, Washington, D.C., (December 1975).

4/Results not available for local construction workers. Results for newcomer construction workers taken from Chapter III, "Household Survey," Construction Worker Profile, Final Report.

projects in October 1977.<sup>1/</sup> Total sample size was 692 workers. Results of these studies are compared with Chief Joseph Dam survey results in table A-3. Three significant differences in the results were readily apparent.

The first is the high response rate achieved in the Chief Joseph survey, about 30 percent greater than either Mountain West survey. This is probably due to the fact that the Chief Joseph survey covered only one project with few contractors while the Mountain West surveys covered several projects with many contractors in different states. A large survey area and large number of contractors make data more difficult to collect.

The second difference is that since the Chief Joseph survey covered one sizeable project, trends obtained were probably more reliable than if the sample size had been as small as many of the projects surveyed by Mountain West. Only five of those projects surveyed were larger than or equal to the Chief Joseph project in number of cards distributed. The highest response rate obtained among those five was 64 percent.

The third significant difference is in the larger percentage of local labor found at Chief Joseph. The project apparently utilized the sizeable pool of skilled labor already in the project area, much of which was surplus from completed work on Grand Coulee Dam. The majority of the work forces surveyed by Mountain West were made up of nonlocal labor. Analysis of the determinants of local/nonlocal composition of the work force was carried out by Mountain West, but the data did not support any meaningful conclusions.

In general, however, the results of the three surveys are strikingly similar. With a few exceptions, the data obtained on occupational distribution, marital status, average family size, numbers of nonlocal married workers with family present, population influx per 100 nonlocal workers, housing distribution, and prior employment status all exhibit trends important to the development of a construction worker profile.

<sup>1/</sup>Construction Worker Survey, Final Report, prepared by Mountain West Research, Inc., for the U.S. Bureau of Reclamation, Denver, Colorado (October 1977).

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Appendix (p. A1-A9): Construction worker data.

1. Dams - Social aspects - Washington (State).  
2. Community development. 3. Chief Joseph Dam.  
I. United States. Army. Corps of Engineers. Seattle  
District. II. Title. III. Series: United States.  
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