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SUSITNA HYDROELECTRIC PROJECT
SUBTASK 4.5: SOCIOECONOMIC STUDIES

Draft Final
PROJECTION ASSUMPTIONS, METHODOLOGY, AND OUTPUT FORMATS

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Draft Final

PROJECTION ASSUMPTIONS, METHODOLOGY AND OUTPUT FORMATS

For: HARZA–EBASCO and the

ALASKA POWER AUTHORITY

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ASSOCIATES, INC.

ARLIS
Alaska Resources
Library & Information Services
Anchorage, Alaska

July 1983

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I. INTRODUCTION

The main purpose of this paper is to present the assumptions and methods that have been used to project potential socioeconomic impacts of the proposed Susitna Hydroelectric Project. Another purpose is to describe the formats that will be used to report results of future analyses.

Many of the assumptions and methods described in later sections of this paper are the same as those used in the preparation of Chapter 5 of Exhibit E (February, 1983). Because of the current need to determine potential impacts that could result from alternative management and design scenarios, some methods were refined, and some new assumptions and methods were developed.

Most of the changes from earlier methods occurred in the portion of the economic-demographic module that involves origin and settlement of workers. A gravity allocation element was created in response to the need to model the effects of alternative camp/village sizes and other attributes, work force characteristics, transportation options for workers, access corridors, and scheduling. Other changes, which primarily increased the ease with which assumptions may be changed, occurred in most elements of all of the modules of the model.

This paper is organized in seven sections. Section II presents the Federal Energy Regulatory Commission's (FERC's) requirements and needs, while Section III describes the near- and long-term objectives of the socioeconomic studies. Section IV provides an overview of the impact projection methods, and the structure of the model used to project impacts. The paper concludes with detailed presentations of each of the three parts (modules) of the model.

II. FERC REQUIREMENTS AND NEEDS

The Report on Socioeconomic Impacts, a required section of the Susitna Hydroelectric Project license application Exhibit E, must identify and quantify the impacts of constructing and operating the Susitna Hydroelectric Project, including impacts on employment, population, housing, personal income, local government services and tax revenues, and socioeconomic conditions in the communities and other jurisdictions in the vicinity of the project.

The Report is to include, among other things:

1. An evaluation of the impact of any substantial project-induced in-migration of people on the impact area's governmental facilities and services, such as police, fire, health, and educational facilities and programs;

2. Estimation of the numbers of project construction personnel who:

   - currently reside within the impact area;

   - Would commute daily to the construction site from places situated outside the impact area; and

   - Would relocate on a temporary basis within the impact area.

3. A determination of whether the existing supply of available housing within the impact area is sufficient to meet the needs of the additional project-induced population; and

4. A fiscal impact analysis evaluating the incremental local government expenditures in relation to the incremental local government revenues that would result from the construction of the proposed project. (Federal Register, November 13, 1981).

FERC regulations do not explicitly define mitigation policy nor goals for socioeconomic impacts. However, mitigation measures for addressing significant and adverse potential effects of the project must be developed to satisfy the mitigation and other requirements of the National Environmental Policy Act. Hence, it is necessary for the Report to also address mitigation issues.

The Report on Socioeconomic Impacts, as part of the Susitna Project license application, was submitted to FERC in February, 1983. The Report was accepted by the FERC, although FERC requested supplemental information primarily concerning the methods utilized in analyzing impacts and the formulation of an impact mitigation plan. The Report presents alternative mitigation measures, and a definite mitigation plan will be prepared as project management and design plans evolve.

III. OBJECTIVES OF THE SOCIOECONOMIC STUDIES

The main objective of the socioeconomic studies is to satisfy FERC's requirements and needs. Secondary objectives include:

- Providing information that will help the Alaska Power Authority make decisions on measures to mitigate potential adverse socioeconomic impacts and on interdisciplinary issues, such as the selection of an access corridor or camp/village sizes and quality.

- Providing planning information to communities, the Mat-Su Borough and state agencies so that they can anticipate and cooperatively plan for avoiding and mitigating potential adverse project-induced socioeconomic impacts.

IV. OVERVIEW OF THE MODEL

To meet the above objectives, it was necessary to develop impact projections and assessments, and alternative mitigation measures, that would help in designing the project, assessing environmental impacts, and determining project feasibility. Additionally, it was desirable to develop impact projection methods and procedures that would allow projections to be easily and periodically revised before and during project construction.

A. Conceptual Foundation, Choice of Method and Techniques

1. Conceptual Foundation

Any of several alternative theoretical concepts can be used as the foundation of an impact projection and assessment model. These alternatives include location, central place, and economic base theories.

Location theory has limited usefulness for this socioeconomic assessment. It's strengths are in estimating the potential for the development of interrelated industries, and for assessing the growth potential of direct industries and industry sectors. This information was not required as part of this study.

Like location theory, central place theory has limited usefulness for this study. It's strength lies in providing a means to estimate the geographic distribution of impacts. Although it was not the main conceptual foundation for the projections, it provided part of the conceptual basis for predicting workers' settlement patterns. This is discussed further in Section V-B-2.

Economic base theory was relied upon heavily for this study because its strength lies in estimating how secondary industry sectors will change in reponse to a change in direct industry sectors. This is relevant for this project because one of the most significant sources of impacts will be employment and population growth that is stimulated by the project's direct employment. As a result, the quantifying approach is deterministic (causal)-- relationships between the variable(s) to be forecast and influencing variables/factors are identified and determined, and then incorporated into the forecasting process.

In economic base theory, there are two key concepts. First, it assumes that the economy may be split into two sectors: direct and secondary. Businesses and other economic entities that sell goods and services at places outside of the local economy comprise the direct sector, and those that sell goods and services within the local economy comprise the secondary sector. Second, it assumes that the amount of secondary activity is determined by the amount of direct activity. Thus, an increase in direct activity (e.g., employment) is accompanied by a corresponding, and roughly predictable, increase in secondary activity.

Aggregate employment multipliers are commonly used to estimate employment effects that are likely to result from changes in direct employment. Other multipliers may be used to estimate population effects that result from the increases in direct and secondary employment. Aggregate employment and other multipliers are discussed further in later sections of this paper.

2. Choice of Method

Methods that were considered for implementing an economic base model included aggregate employment multiplier, intersectoral flows, and input-output. Several criteria were developed to evaluate these methodological alternatives. There were also several constraints that influenced the choice of methodology. The criteria and constraints may be grouped as follows:

a. Criteria:

- Must quantify impacts at the local (community) level, and to a lesser extent, regional and statewide levels.

- Must use best possible techniques to estimate secondary employment impacts.

- Must have consistent methodology for "with project" and "without project" projections.

- Must be easy to update results.

- Must provide information that is useful to decision makers (FERC, APA, local jurisdictions).

b. Constraints:

- Must be able to develop and use the model within the budget and other resources available.

- Availability of data.

- Must be consistent with the Institute of Social and Economic Research's (ISER's) projections of employment and population at the statewide and regional (railbelt and subareas) levels.

Each of the three alternative methods differ substantially in their data requirements, cost and time for development, and the level of detail provided in the results. The input-output method can be the best method to use from a results perspective (e.g., it is capable of providing detailed projections of impacts on industry sectors). For this analysis, however, this method could not have provided detailed projections because the local economies (boroughs/census divisions) of Alaska are not large enough for an input-output method to be functional. Further, the cost of development and implementation of this method would have been prohibitive even if it were potentially functional. The intersectoral flows method would have also been preferred from a results perspective, but it too would have resulted in excessive development and implementation costs.

Part of the reason for the high costs associated with these methods is that large amount of primary data would have been required on a continuing basis. For the input-output method, it would have been necessary to collect primary data to support the development of technical coefficients (direct requirements coefficients or input-output table) at the borough/census division level. Besides the budget and time constraints, it is very doubtful that a meaningful input-output table could have been developed. This is because the Mat-Su Borough's economy is not yet well-developed, among other factors.

Similarly, the intersectoral flows method would have required a table showing requirements coefficients. Because it focuses solely on exports, data requirements are less than those reqired for the input-output method. Nevertheless, these data requirements would have been quite substantial, and it is doubtful that a meaningful table could have been developed due to the limited size and breadth of the Mat-Su Borough's export economy. Moreover, the level of detail of the regional economy produced by this type of method would exceed the requirements of this project.

The aggregate employment multiplier method was chosen because techniques were available to provide more detail to the impact projections, and it did not share the shortcomings of the methods discussed above. Further, ISER's MAP model, being an economic base-econometric model, fit well with this decision. Accordingly, it was decided that the ISER employment and population projections would serve as baseline projections for the statewide, railbelt region, and subarea (multi-borough/census division) levels, and that baseline projections for borough/census divisions and smaller areas would be derived by disaggregating the ISER projections. The techniques used to disaggregate these projections are discussed in Section V-B-2.

The method used to project impacts of the project follows economic base theory in that secondary (support sector) impacts of the project are estimated using employment multipliers. It is assumed that the level of secondary activity is uniquely determined by the level of direct (basic sector) activity, and that a given change in the level of direct activity will bring about a predictable change in secondary activity (Leistritz and Murdock, 1981). Thus, the creation of a given number of construction jobs will create a predictable number of secondary jobs in related industries and the service sector. The techniques used to estimate secondary employment effects are discussed further in Section V-C-1.

It would have been preferable to use income instead of employment as the indicator to measure economic change if adequate data had been available. Employment may not be an accurate indicator of economic activity in sectors that experience technological change, and if different direct industries have significantly different wage rates and/or input purchasing patterns). However, it was not possible to use income because adequate income data was not available.

3. Techniques

Several techniques were used in conjunction with the aggregate employment multiplier method to project impacts. Some of the more important techniques are:

- o Gravity allocation model (used to allocate inmigrating workers to communities)
- o Trend analysis (used to allocate ISER's MAP model's baseline employment and population projections to smaller geographic areas)
- o Person per household trend multipliers (used to project numbers of households)
- o Per capita planning standards (used to project demands for public facilities and services)
- o Per capita fiscal multipliers (used to project local jurisdictions' revenues and expenditures, with and without the project

Each of these techniques is discussed in Sections V - VII.

B. Model Structure

1. Overview

Having established aggregate employment multiplier as the method, the next step was to design a model that could use this method to produce appropriate projections. Several needs were considered during the design process. These were:

- Ability to meet the information requirements of FERC, NEPA, APA, and local officials (e.g., employment, population, housing, public facilities and services, and fiscal impacts).
- Ability to produce annual projections for up to 25 years.
- Ability to efficiently handle multiple scenarios.
- Amenable to sensitivity analysis.
- Ability to quantify potential impacts in detail, and for small geographic areas.
- Ability to efficiently interact with monitoring and mitigation activities.
- Ability to produce results that are useful: (1) in identifying potential problems, (2) to decisionmakers, and (3) to the mitigation activity.
- Capable of being updated quickly, efficiently, and at low cost.
- Capable of being manipulated at low cost.
- Relatively short processing (run) time.
- Ability to create many diverse reports (output formats).
- Ability to have results validated and the model calibrated.

With these considerations in mind, the structure for the model was developed. The general structure is shown in Figure 1. Here it can be seen that the model is composed of three main modules, each containing equations that compute baseline and "with-project" (construction and operations) projections. Comparisons of these projections yield impact projections.

This general structure mirrors economic base theory, as the source of impacts rests in the economic-demographic module (creation of direct jobs), and these impacts are reflected in the public facilities and services, and fiscal modules. New populations associated with construction workers, secondary workers, and dependents create demands on housing and public facilities and services. The budgets of local jurisdictions are impacted by these new demands.

Each of the modules are discussed further in Sections V, VI, and VII, and each of the considerations presented above are addressed at appropriate places in these sections. Before proceeding on to the detailed discussions, however, it is appropriate to discuss in more detail several key considerations, including the need for computerization. These are discussed below.

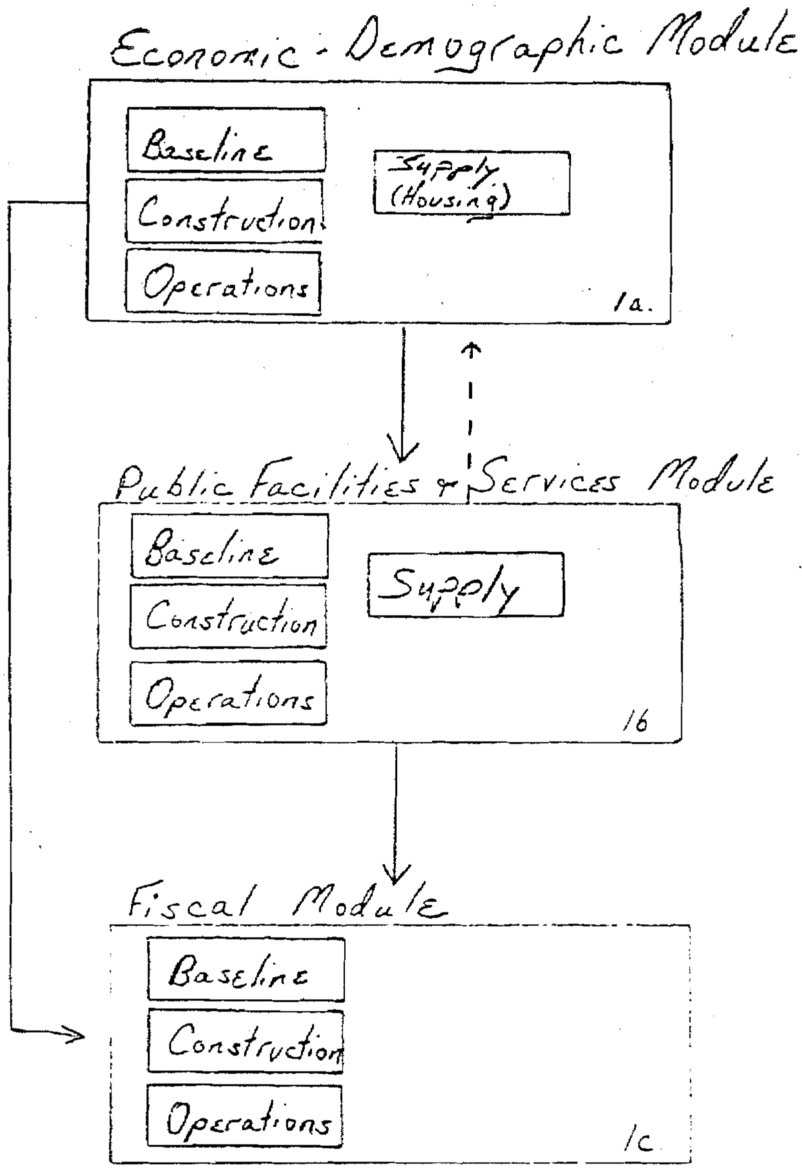
2. Key Considerations

a. Ability to Quantify Impacts in Detail, and for Small Geographic Areas

As the nearest communities to the construction sites are quite small, and any settlement by workers would create measurable impacts, it was necessary to consider developing the capability to quantify potential impacts for small geographic areas. Based upon a review of the attributes of these communities, it became apparent that some workers, under certain conditions, would probably be attracted to, and settle in these small communities. As a result, a rather large number of small impact areas were delineated. These are shown in Table 1. A map showing the impact Areas is shown in Figure 2.

Figure 1

STRUCTURE OF SUSITNA MODEL



The Module is composed of 3 main modules, each containing information/projections on the baseline and "with project" impacts.

Organized By functional Area.

Table 1
POTENTIAL IMPACT AREAS, AND/OR WORKER TRACKING POINTS

LOCAL

Work sites:

Work camp 1 (At Watana)
Village 1 (At Watana)
Work camp 2 (At Devil Canyon)
Village 2(?)

Cantwell

Cantwell railroad camp
Cantwell community

Cantwell area (Cantwell, Denali and other areas of Western Denali Highway)
(not to be used at this time due to lack of baseline data)

Healy area (not to be used at this time due to lack of baseline data)

McKinley (not to be used at this time due to lack of baseline data)

Nenana area (not to be used at this time due to lack of baseline data)

Paxson (not to be used at this time due to lack of baseline data)

Trapper Creek

Talkeetna

Gold Creek (not to be used at this time due to lack of baseline data)

Railroad communities: (not to be used at this time due to lack of baseline data)

Sherman
Curry
Chase
Chulitna
Canyon
Lane

Hurricane/Indian River subdivision
(not to be used at this time due to lack of baseline data)

Palmer

Wasilla

Houston

Other Mat-Su Borough

Surburban
Rural and Remote

Table 1
(continued)

REGIONAL (census divisions)

Anchorage

Fairbanks-North Star Borough

SE Fairbanks

Seward

Kenai-Cook Inlet

Yukon-Koyukuk

Mat-Su Borough	(Trapper Creek, Talkeetna, Palmer, Wasilla, Houston, Hurricane-Indian River, Gold Creek, Railroad commnities)

Valdez-Chitina-Whittier

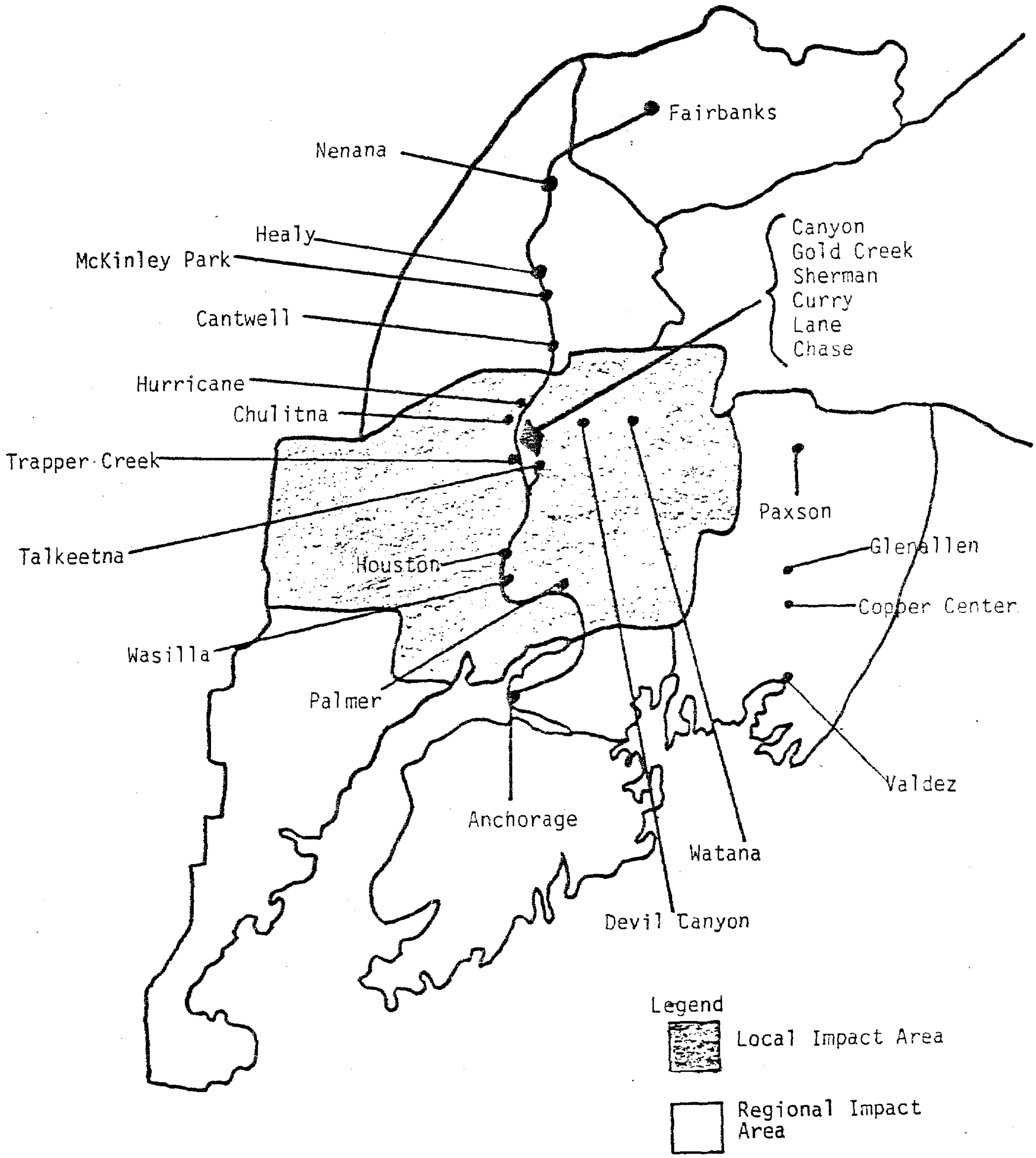
Glennallen
Valdez
Copper Center
Gulkana

Note: The model is structured to include these communities should it become necessary to conduct impact analyses for these communities. Baseline data would be required for these analyses.

Note: The region will be expanded from the original ISER Railbelt region to include a portion of the Yukon-Koyukuk census division as Cantwell and other potentially impacted communities are in this census division.

Figure 2

POTENTIAL IMPACT LOCATIONS IN THE LOCAL IMPACT AREA



b. Ability to Efficiently Handle Multiple Scenarios

There are several aspects of project design and management that will affect the level, distribution, and composition of socioeconomic effects that are currently uncertain. These include:

- o Choice of access corridor
- o Transportation mode(s) and frequency for workers
- o Size and quality of construction camp/village
- o Work schedules
- o Local hire and training programs

Additional project characteristics possibly subject to revision during detailed project design are:

- o Manpower requirements and timing of same
- o Timing of construction for Watana and Devil Canyon dams

Analysis of alternative scenarios will help decisionmakers select policies, with substantial knowledge of the range of possible impacts. The model is designed to project with-project socioeconomic variables using these scenarios, and to accommodate and produce different baseline projections. Hence, ranges of potential impacts can be provided.

c. Amenable to Sensitivity Analysis

The model must be able to accommodate alternative assumptions concerning various economic and demographic relationships in the impact areas, and to determine the sensitivity of projections to variations in these assumptions. Some examples of assumptions are:

- Percent of total work force that will relocate (settle) in communities

- Possible deviations from derived employment multipliers

- Local supply of skilled and unskilled labor

- Number of dependents per accompanied worker

- Number of school-age children per accompanied worker

- Attractiveness indicators for communities

Determining how sensitive the results are to changes in these and other assumptions helps decisionmakers and planners prepare for a possible range of impacts. As actual data for these assumptions are obtained from monitoring local community conditions prior to and after construction begins, the assumptions can be revised. This will result in more accurate projections, and permit formulation of responsive mitigation measures.

The model is designed to easily accommodate changes in assumptions in the pre-construction, construction, and post-construction phases.

d. Computer Software

It was appropriate to computerize the model in view of the following needs:

- Ability to efficiently handle multiple scenarios.

- Amenable to sensitivity analysis.

- Ability to efficiently utilize results from and provide input to the monitoring and mitigation activities.

- Ability to produce results that are useful: (1) in identifying problems, (2) to decisionmakers, and (3) to the mitigation activity.

- Capable of being updated quickly, efficiently, and at low cost.

- Capable of being manipulated at low cost.

- Relatively short processing (run) time.

- Ability to create many useful and diverse reports (output formats).

The model was computerized using the Data*Model economic and financial modeling software package. It is operated on a Wang Virtual Memory computer system. It takes between two and three hours to run the Susitna impact model and generate the 50 standardized reports that were developed for it (print-out of all the results takes considerably longer). The model has been structured so that assumptions and data are easily changed and the set of alternatives can be performed efficiently.

The planning of a computerized economic impact model needs to take into account both hardware and software considerations. The major criteria that were used to determine the way the model would be computerized included:

1. Ability of the computer system (hardware) to handle a very large model, in terms of both on-line computer memory and storage capacity;

2. Cost of development of the model;

3. Operation and storage cost;

4. Flexibility of reporting (a software consideration);

5. Operation speed (related to both hardware and software);

A modeling software package was chosen over the alternatives of custom programming of a model or using a timeshare statistical package for several reasons. Use of modeling software results in a lower set-up cost than the first alternative by avoiding the development time of programming, and has a lower operating cost than timeshare systems. The advanced report-writing capability of the system means that any combination of variables in the various parts of the model can be displayed in a report, and that the model and equations can be defined before all the report formats are developed. In addition, this software allows non-programmers to create and modify the model. Finally, use of in-house software and computer equipment will allow integration of the model with custom programming or statistical analysis software, as appropriate. Some speed in running the model was given up as result of the choice of using a minicomputer rather than timesharing options on a mainframe.

. Description of the Software

Data*Model is a computerized spreadsheet program in which the data, calculations and reports are independent modules. The model can handle up to 500 time periods and 30,000 rows. Data*Model is available for approximately 12 different mini- and micro-computer systems. The major components of a model using this software are:

1. A Row Definition, which defines all names of data inputs, parameters and variables that are used in the model.

2. Model definition files, which store data and equations. The interrelationships of data input, parameters, and variables are defined here.

3. A Spreadsheet, the data file in which the results of the model's calculations are stored.

4. Report formats, which store instructions for the presentation of any combination of projections (results)and assumptions. A variety of reports are generated from each spreadsheet model.

   - Vertical report formats store instructions for the variables that are to be displayed, and the order in which they will appear.

   - Horizontal report formats define the horizontal dimension of the reports: the time periods that are to be shown and the order in which they will appear.

As Figure 3 shows, the rowname file and model definition files combine to produce a spreadsheet of all data and calculations in the model. A report is generated by specifying the spreadsheet to be reported on and the vertical and horizontal definitions to be combined. This modular structure allows an efficient way of handling multi-scenario models, in that the data or assumptions can change without affecting the rest of the model or the structure of the reports.

Data*Model contains a number of built-in features that increase the efficiency and ease of model building and manipulation. These include (1) linking statements, which allow various modules to run automatically, in sequence, without further input from the user; (2) automatic percent change calculations over time; (3) goal-seeking routine (in which a result is requested and the model calculates a component of the equation); (4) lead and lag equations, (5) routines for inflation, sums and means, accumulation of values over time, and financial routines such as depreciation, amortization, present value, etc. The equations in the model are functionally linked.

A limitation of Data*Model is its lack of sophisticated matrix handling functions, which increases its set-up cost relative to other spreadsheet programs. An equation needs to be written out for each variable and each impact area. This facet of the software was accepted as a cost that is compensated for by the speed of operation (compared

Figure 3

DESIGN OVERVIEW OF DATA*MODEL

ECONOMIC MODELING SOFTWARE

```
                                           -------------------------
                                           |   MODEL DEFN.          |
                                           |------------------------|
                                           |        DATA            |
                                           |         &              |
                                           |   COMPUTATIONS         |
                                           -------------------------
                                                    |
                                                    V
 ------------------------    ---------------------------------------------
 |                      |    |                                            |
 |  ROW DEFINITIONS     |---->|            SPREADSHEET                     |
 |                      |    |           |                                |
 |                      |    |   ROWS    |           DATA                 |
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                                         |
                                         |    -----------------------------------
                                         |    | HORIZONTAL REPORT FORMAT        |
                                         |    -----------------------------------
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                                         V                    V
                     ----------      ---------------------------------------------
                     | V R D  |      |                                           |
                     | E E E  |      |                                           |
                     | R P F  |      |                                           |
                     | T O I  |----->|            R E P O R T                    |
                     | I R N  |      |                                           |
                     | C T I  |      |                                           |
                     | A   T  |      |                                           |
                     | L   I  |      |                                           |
                     |     O  |      |                                           |
                     |     N  |      |                                           |
                     ----------      ---------------------------------------------
```

to other modeling programs), the flexible reporting options, and the ability of the system to handle the large number of equations and impact areas. Its effects were mitigated by use of a custom program which facilitated the copying and editing of groups of row definitions and equations.

e. Ability to Create Many Useful and Diverse Reports (output formats)

As discussed above, the reporting flexibility of the model is substantial. The reports now being generated by the model are intended to meet most of the decisionmakers' needs. However, it is probable that additional reports will be required or desired. Because of the reporting flexibility, these reports will be available quickly and at low cost.

The model currently produces reports that compare conditions with the project during the projection period (1985-2005) to projected conditions without the project, rather than to current conditions. This is an important distinction for two reasons. First, the magnitude of population influx and other effects related to the project need to be evaluated in light of the size of population (and other variables) that would be in the impact area in the absence of the project. Second, because many of the impact areas are expected to grow and change rapidly over the next 20 years, whether the project occurs or not, comparison of the "with project" scenario to current conditions would be misleading.

In the areas of housing and public facilities and services, the model also compares total demands with the project to the capacity of the communities to fulfill these demands.

V. ECONOMIC-DEMOGRAPHIC MODEL

The economic-demographic (E-D) module calculates the impacts of the project on population, employment, and housing, by impact area and year, and provides detailed population influx and efflux information to the public facilities and services, and fiscal modules. This information is used in these modules to determine impacts on public facilities and services, and local jurisdictions' expenditures and revenues. Input information, and information concerning impacts, is provided by year and by impact area to help local jurisdictions with mitigation planning.

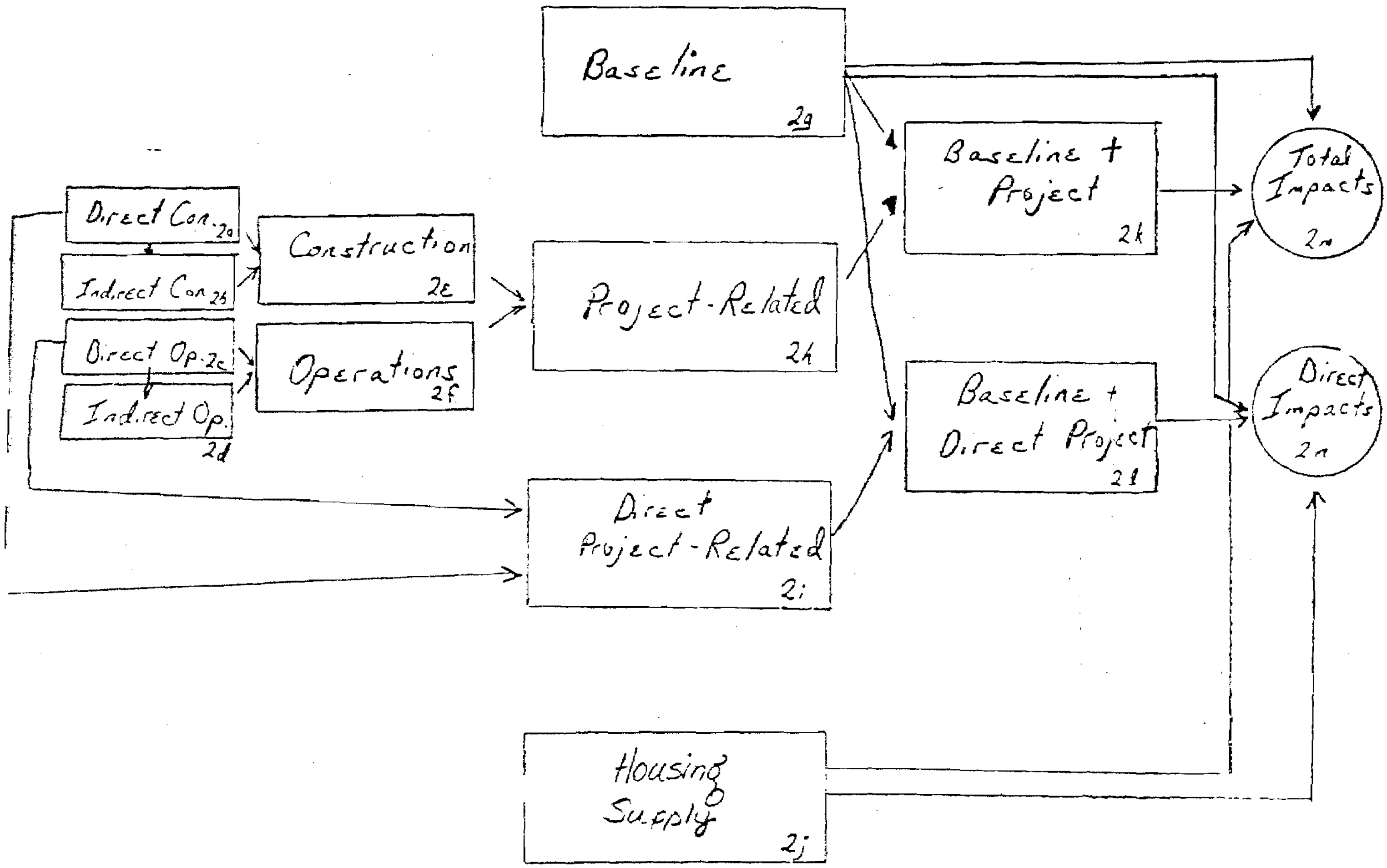
In response to FERC's requirements and needs, and the needs of the APA and local jurisdictions, the module also provides detailed information on employment, payroll, spending, and settlement patterns of the direct construction work force. For example, this information includes employment by residence and by year, payroll by labor category and year, spending patterns of construction workers by year for selected impact areas, and demand for housing, by impact area and by year.

The general structure of this module is shown in Figure 4. Here it can be seen that the module produces both total and direct impacts. Another important feature, implicit in Figure 4, is that direct construction employment is separate from indirect construction-induced employment (i.e., secondary employment generated by direct construction activity and employment), and that contruction employment is separate from the operations employment. This allows for more detailed impact projections and assessments, and is methodologically superior to a more aggregated treatment of the work forces.

The general method for projecting total project-related employment, and total in-migrant workers and population, is shown in Figure 5. Here it can be seen that the number of direct and secondary jobs created is a function of (1) direct manpower requirements and (2) the number of secondary jobs created by the direct construction jobs. Employment multipliers were used to estimate these secondary jobs (see Section V-C-1).

Figure 4

STRUCTURE OF ECONOMIC/DEMOGRAPHIC MODULE



(Contents of 2a-2l)

Types of Information Contained

Population

Employment

Housing

Income

(Contents of 2m + 2n)

Quantitative Expression of Impacts

% Increase Over Baseline

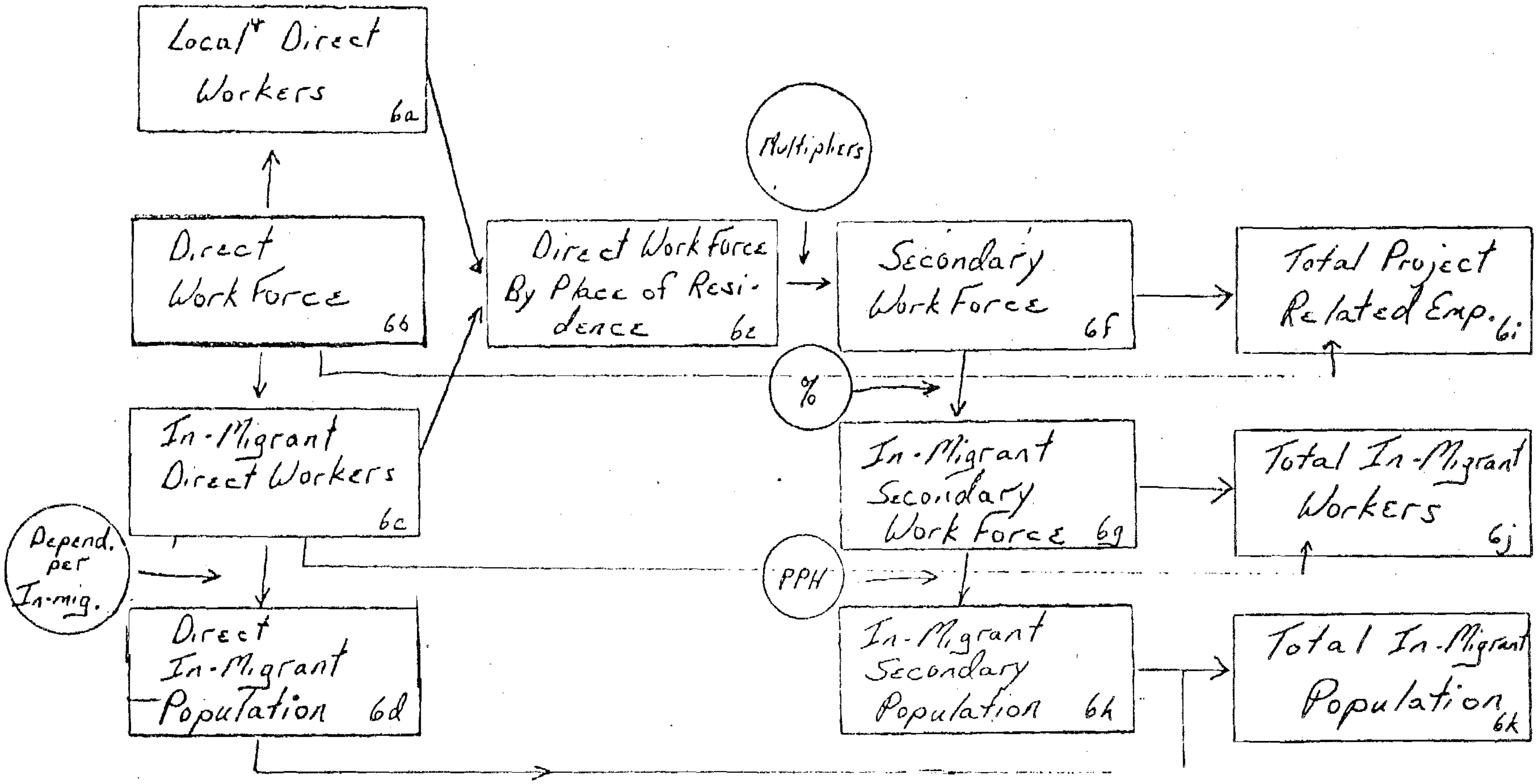
Increase Over Baseline in Nos.

Capacity Utilization

Distribution of Increase Over Geographic Areas

Figure 5

RESIDENT AND NON-RESIDENT PROJECT AND RELATED EMPLOYMENT AND POPULATION



The Logic in this diagram holds for each "impact area."
*Local = people who lived there previously.

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The total number of in-migrant workers is simply total direct manpower requirements less the number of jobs filled by local residents, plus the number of secondary jobs that are not filled by local residents. Total in-migrant population is calculated by applying a dependents per in-migrant worker value to the direct in-migrant workers, and adding this to the in-migrant secondary population. This population is calculated by applying a persons per household value to the in-migrant secondary work force.

Total in-migrant population is compared to baseline population projections to arrive at total impacts, as indicated in Figure 5. Similarly, direct project-related population is compared to baseline population projections to arrive at direct impacts of the project.

The techniques used to make baseline projections are discussed in the next section. This discussion is followed in subsequent sections by presentations of techniques used to make "with project" projections.

A. Baseline Projections

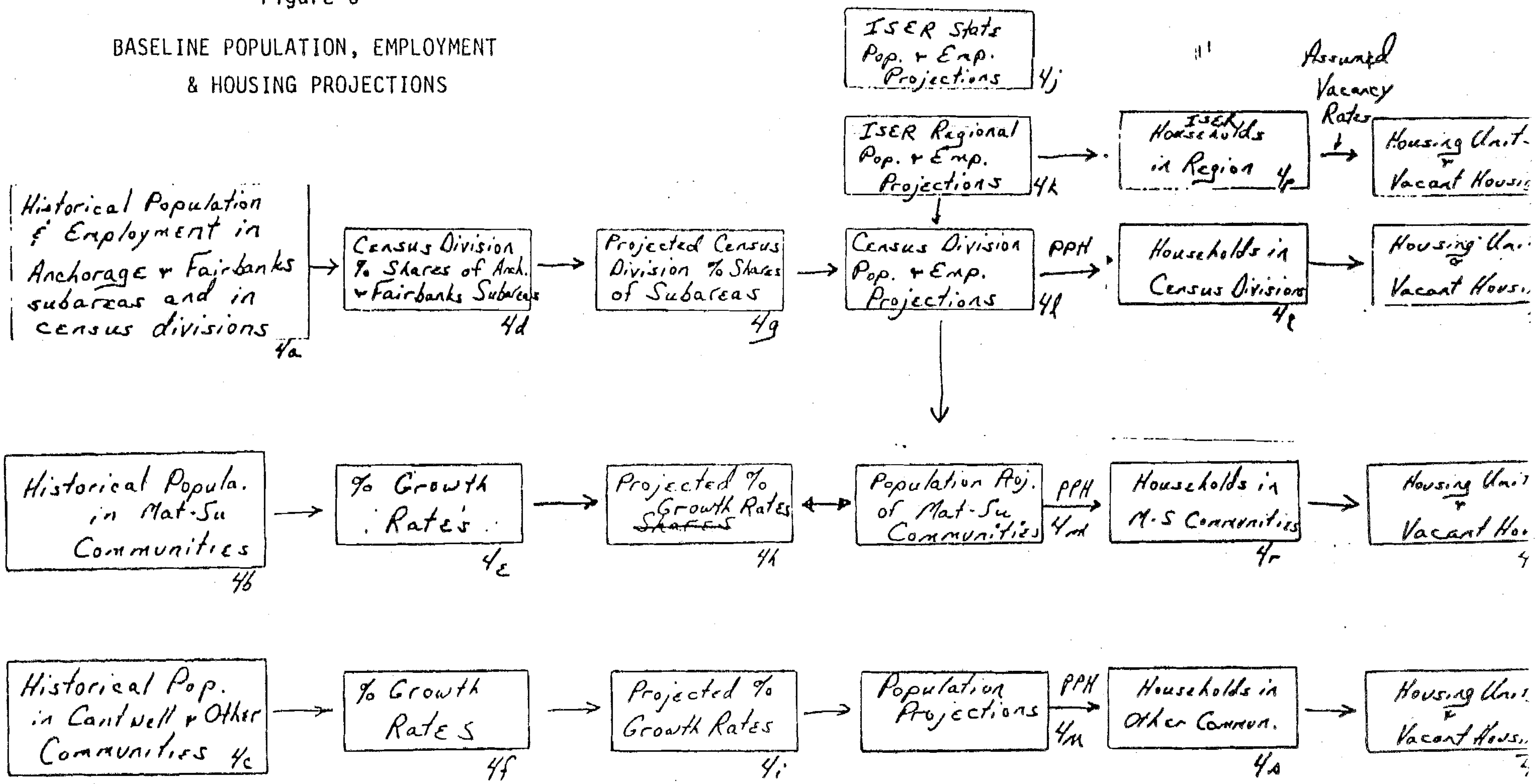
Figure 6 displays the structure of the baseline projection portion of the economic-demographic module. The approaches and projection techniques used are discussed below.

1. Employment

Baseline projections for employment in the Railbelt region and its three subareas, Anchorage, Fairbanks and the Valdez-Chitina-Whittier census division (see Figure 2), were generated by the Institute of Social and Economic Research's (ISER's) Man-in-the-Arctic-Program (MAP) econometric model (September 1981). This model was also used for the determination of the need for energy during the projection period. As additional data from the MAP model is made available, baseline projections can be updated.

Figure 6

BASELINE POPULATION, EMPLOYMENT
& HOUSING PROJECTIONS



Notes
1. Employment not projected at community level
2. Income not projected in baseline.

Frank Orth & Associates, Inc. used ISER's projections as the basis for the employment projections for the various census divisions that comprise the Anchorage and Fairbanks subareas (Anchorage/ Kenai-Cook Inlet/ Seward/ Mat-Su Borough, and Fairbanks-North Star/ Southeast Fairbanks, respectively). These were calculated from ISER's subarea employment projections using several steps:

1. A time series of employment in each census division was collected for 1964-1980). These data were derived from unemployment insurance records collected by the Alaska Department of Labor. They are considered to be the most consistent and accurate series of statistics on employment in Alaska. The major limitations of the series are that (1) employment is listed by place of work rather than place of residence; and (2) the figures do not include workers who are not covered by unemployment insurance.

2. The percentage that each census division in the Anchorage subarea and Fairbanks subarea represented of total employment in that subarea was calculated annually. In general, the trends in employment were relatively stable, with the Mat-Su and Kenai census divisions increasing their percent shares of the Anchorage subarea slightly during the 1970's.

   From these numbers, percent change in the percent shares was also calculated. For each census division, a trend analysis of the increase in percent share over time was performed, which yielded the average increase or decrease in percent share for that census division.

3. Based upon the assumption that these historical trends will continue, the average increase in percent share was applied to the 1980 figure to obtain a set of projections of percent share of employment for each census division for the years 1981 through 2005 (see Table 2).

Table 2

PROJECTED PERCENT SHARE THAT CENSUS DIVISIONS WILL REPRESENT OF EMPLOYMENT IN THE ANCHORAGE AND FAIRBANKS SUBAREAS*

	Percent of Employment In Anchorage Subarea				Percent of Employment In Fairbanks Subarea	
	Anchorage	Kenai-Cook Inlet	Seward	Mat-Su Borough	Fairbanks North Star	Southeast Fairbanks
1981	87.0	7.7	1.5	3.6	95.4	4.6
1982	86.8	7.8	1.5	3.7	95.4	4.6
1983	86.7	7.9	1.5	3.8	95.4	4.6
1984	86.5	7.9	1.5	3.9	95.4	4.6
1985	86.3	8.0	1.5	4.0	95.4	4.6
1986	86.2	8.1	1.5	4.1	95.4	4.6
1987	86.0	8.2	1.5	4.2	95.4	4.6
1988	85.8	8.3	1.5	4.3	95.4	4.6
1989	85.6	8.3	1.5	4.4	95.4	4.6
1990	85.5	8.4	1.5	4.4	95.4	4.6
1991	85.3	8.5	1.5	4.5	95.4	4.6
1992	85.1	8.6	1.5	4.6	95.4	4.6
1993	85.0	8.7	1.5	4.7	95.4	4.6
1994	84.8	8.7	1.5	4.8	95.4	4.6
1995	84.6	8.8	1.5	4.9	95.4	4.6
1996	84.5	8.9	1.5	5.0	95.4	4.6
1997	84.3	9.0	1.5	5.1	95.4	4.6
1998	84.1	9.1	1.5	5.2	95.4	4.6
1999	83.9	9.1	1.5	5.3	95.4	4.6
2000	83.8	9.2	1.5	5.3	95.4	4.6
2001	83.6	9.3	1.5	5.4	95.4	4.6
2002	83.4	9.4	1.5	5.5	95.4	4.6
2003	83.3	9.5	1.5	5.6	95.4	4.6
2004	83.1	9.5	1.5	5.7	95.4	4.6
2005	82.9	9.6	1.5	5.8	95.4	4.6

* As defined in the Institute of Social and Economic Research's Man-In-the-Arctic economic model.

4. These percent share projections were then multiplied by ISER's employment projections for the Anchorage and Fairbanks subareas to obtain projections of employment, by place of employment, for each census division.

Employment data for the communities of the Mat-Su Borough are not reliable, due to data collection and reporting problems. Thus, employment was not projected at the community level.

2. Population

The methodology used to project population in the various impact areas, without the project, is similar to the employment methodology listed above. Baseline population was projected independently of the employment projections as a result of the need to disaggregate the regional trends to smaller areas. In these census divisions and communities, population and employment trends differ significantly.

Baseline projections of population in the Railbelt region and the three subareas of Anchorage, Fairbanks and the Valdez-Chitina-Whittier census division were generated by the MAP model (September 1981). As additional data from the MAP model is made available, these projections can be updated.

Population projections for the various census divisions that comprise the Anchorage and Fairbanks subareas (Anchorage/ Kenai-Cook Inlet/ Seward/ Mat-Su Borough, and Fairbanks-North Star/ Southeast Fairbanks, respectively) were calculated from the population projections for the subareas using these steps:

1. A time series of population in each census division was collected for 1964-1980. These data are mostly derived from U.S. Bureau of the Census data. The Mat-Su Borough data included data collected in annual surveys conducted by the Mat-Su Borough Planning Department. As a result of the rural and rapidly increasing population in the Borough, it was believed that the Planning Department's surveys were more accurate than U.S. census data.

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2. The percentage that each census division in the Anchorage subarea and Fairbanks subarea represented of total population in that subarea was calculated annually. In the Anchorage subarea, the figures showed that the percent shares of population accounted for by Mat-Su Borough and the Kenai-Cook Inlet areas have increased rapidly, while the percent share of the Municipality of Anchorge has declined.

   From these numbers, percent change in the percent shares was also calculated. For each census division, a linear regression of the increase in percent share over time was performed, which yielded the average increase or decrease in percent share for that census division.

3. Based upon the assumption that these historical trends will continue, the average increase in percent share was applied to the 1980 figure (or 1981 for the Mat-Su Borough) to obtain a set of projections of percent share of population for each census division for the years 1981 through 2005. These are displayed in Table 3.

4. These percent share projections were then multiplied by ISER's population projections for the Anchorage and Fairbanks subareas to obtain projections of population, by place of population, for each census division.

5. Population projections for several of the communities of the Mat-Su Borough were caculated separately. Annual growth rates were projected for the future based on historical growth rates and the changing population distribution patterns in the Borough. These growth rates are displayed in Table 4.

   As a result of this methodology, both (1) the population increase based on historical trends and (2) the population increase related to economic development are taken into account. ISER's regional and subarea projections explicitly

Table 3

PROJECTED PERCENT SHARE THAT CENSUS DIVISIONS WILL REPRESENT OF POPULATION IN THE ANCHORAGE AND FAIRBANKS SUBAREAS*

	Percent of Population In Anchorage Subarea				Percent of Population In Fairbanks Subarea	
	Anchorage	Kenai-Cook Inlet	Seward	Mat-Su Borough	Fairbanks North Star	Southeast Fairbanks
1981	78.4	10.3	1.3	10.0	91.2	8.8
1982	77.8	10.4	1.3	10.4	91.2	8.8
1983	77.2	10.6	1.3	10.9	91.2	8.8
1984	76.6	10.7	1.3	11.3	91.2	8.8
1985	76.0	10.8	1.3	11.8	91.2	8.8
1986	75.4	11.0	1.3	12.2	91.2	8.8
1987	74.8	11.1	1.3	12.7	91.2	8.8
1988	74.2	11.3	1.3	13.1	91.2	8.8
1989	73.6	11.4	1.3	13.5	91.2	8.8
1990	73.0	11.6	1.3	14.0	91.2	8.8
1991	72.4	11.7	1.3	14.4	91.2	8.8
1992	71.7	11.9	1.3	14.9	91.2	8.8
1993	71.1	12.0	1.3	15.3	91.2	8.8
1994	70.5	12.2	1.3	15.8	91.2	8.8
1995	69.9	12.3	1.3	16.2	91.2	8.8
1996	69.3	12.5	1.3	16.7	91.2	8.8
1997	68.7	12.6	1.3	17.1	91.2	8.8
1998	68.1	12.8	1.3	17.6	91.2	8.8
1999	67.5	12.9	1.3	18.0	91.2	8.8
2000	66.9	13.1	1.3	18.5	91.2	8.8
2001	66.3	13.2	1.3	18.9	91.2	8.8
2002	65.7	13.4	1.3	19.4	91.2	8.8
2003	65.1	13.5	1.3	19.8	91.2	8.8
2004	64.5	13.7	1.3	20.3	91.2	8.8
2005	63.9	13.8	1.3	20.7	91.2	8.8

* As defined in the Institute of Social and Economic Research's Man-In-the-Arctic economic model.

Table 4

ASSUMPTIONS FOR BASELINE POPULATION GROWTH RATES
FOR SELECTED COMMUNITIES LOCATED NEAR THE PROJECT SITE

Community	1981-1990	1991-2005
Palmer	6.5%	3.5%
Wasilla	7.5%	7.5%
Houston	10.0%	10.0%
Trapper Creek	4.0%	4.0%
Talkeetna	5.0%	5.0%
Cantwell	2.0%	2.0%

included assumptions on economic development scenarios and the percent share methodology reflects the trends in the distribution of growth within the region.

3. Housing

Projections of housing demand were calculated for each of the communities likely to be affected by the project and for the Railbelt region as a whole. Housing demand was calcuated by applying population-per-household projections (see Table 5) to the projected populations of each community and census division. The population-per-household measures were assumed to decline gradually over time to converge with the national and state averages. These measures were dervied from the ISER study of the need for power in the Railbelt (Goldsmith and Huskey, 1980). In the ISER model, average population per household is estimated to decline by 20 percent over the next twenty years, and is consistent with the projected decline in the national level.

Current housing supply estimates were obtained from the U.S. Census Bureau (1980) and community surveys where available. Housing stock was assumed to increase in direct proportion to the growth in the number of households. Baseline housing supply was projected by multiplying the number of households by an assumed average vacancy rate of five percent. The exception was the area of the Mat-Su Borough outside the incorporated communities, for which it was assumed that the vacancy rate (25 percent in 1981) would fall over time.

No differentiation among types of housing was made, and the timing of housing construction was not estimated. These simplifications were appropriate for the following reasons. The Mat-Su Borough is increasingly becoming a bedroom community in which single family dwellings on plots of an acre or more predominate. As a result of the large population increase expected in the Mat-Su Borough in the next twenty years, with or without the project, it is likely that there will be a continuous need for new housing, fueled by increasing demand. In many of the communities closest to the project, there is currently very

TABLE 5

POPULATION-PER-HOUSEHOLD ASSUMPTIONS

	State	Mat-Su Borough	Trapper Creek	Talkeetna	Cantwell	Palmer	Wasilla	Houston
1981[a]	3.073	3.270	3.300	3.300	2.750	3.153	3.127	2.900
1982	3.064	3.240	3.269	3.269	2.741	3.128	3.103	2.885
1983	3.053	3.210	3.238	3.238	2.733	3.103	3.079	2.871
1984	3.040	3.180	3.207	3.207	2.725	3.078	3.055	2.856
1985	3.041	3.150	3.176	3.176	2.717	3.053	3.027	2.842
1986	3.031	3.121	3.144	3.144	2.709	3.028	3.008	2.828
1987	2.998	3.091	3.113	3.113	2.701	3.003	2.984	2.813
1988	2.960	3.061	3.082	3.082	2.693	2.978	2.960	2.799
1989	2.932	3.031	3.051	3.051	2.685	2.953	2.936	2.785
1990	2.900	3.002	3.020	3.020	2.677	2.929	2.912	2.770
1991	2.876	2.972	2.989	2.989	2.669	2.904	2.889	2.756
1992	2.849	2.942	2.958	2.958	2.661	2.879	2.865	2.742
1993	2.824	2.912	2.927	2.927	2.652	2.854	2.841	2.727
1994	2.801	2.883	2.896	2.896	2.644	2.829	2.817	2.713
1995	2.777	2.853	2.865	2.865	2.636	2.804	2.793	2.699
1996	2.754	2.823	2.834	2.834	2.628	2.779	2.770	2.684
1997	2.731	2.793	2.803	2.803	2.620	2.754	2.746	2.670
1998	2.707	2.764	2.772	2.772	2.612	2.730	2.722	2.656
1999	2.682	2.734	2.741	2.741	2.604	2.705	2.698	2.641
2000	2.657	2.704	2.710	2.710	2.596	2.680	2.674	2.627
2001	2.637	2.674	2.679	2.679	2.588	2.655	2.651	2.613
2002	2.617	2.645	2.648	2.648	2.580	2.630	2.627	2.598
2003	2.597	2.615	2.617	2.617	2.572	2.605	2.603	2.584
2004	2.577	2.585	2.586	2.586	2.564	2.580	2.579	2.570
2005	2.556	2.556	2.556	2.556	2.556	2.556	2.556	2.556

a. Matanuska-Susitna Borough Planning Department, 1981.

little vacant housing available to support a sizable increase in population. Housing distribution within communities, the types of housing that will be constructed, and the speed with which the supply of housing will respond to or anticipate the demand can only be guessed at, and this was complicated by the long time frame for the project and the impact model.

Thus, it was felt that detailed projections of housing supply would be of limited usefulness due to the expected large changes in the housing market in the local impact area and the uncertainty surrounding any set of assumptions. In this model, the emphasis of the determination of project-related effects on housing is placed on the effects that the project will have on the demand for housing. Housing supply will be addressed by the community and household monitoring program.

B. Direct Work Force

1. Work Force Requirements

a. Annual Work Force.

Estimates of work force requirements for the project, by trade and by year, were obtained from the project engineers (Acres American, 1981). The estimates include all manpower required for the construction of the access road and camp/village; power facilities and transmission facilities; and all management, adminstrative, and operations personnel. Manpower for off-site activities such as procurement, manufacturing, shipping and a portion of the engineering staff are not included in these estimates. The different types of workers are added up into three labor categories - laborers, semi-skilled/skilled and administrative/engineering, and total work force by year is also calculated.

Construction of the first phase of the Watana dam will require a significantly greater number of workers than both the second phase of Watana and construction of the Devil Canyon dam. This difference can little vacant housing available to support a sizable increase in population. Housing distribution within communities, the types of housing that will be constructed, and the speed with which the supply of housing will respond to or anticipate the demand can only be guessed at, and this was complicated by the long time frame for the project and the impact model.

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Construction of the first phase of the Watana dam will require a significantly greater number of workers than both the second phase of Watana and construction of the Devil Canyon dam. This difference can be attributed to the additional labor requirements in the initial years for construction of the work camp and village, the access road and to the more labor-intensive nature of a gravel-fill dam (Watana) than a concrete arch dam (Devil Canyon).

b. Accommodation of Changes in Manpower Requirements and Construction Schedules.

In the model, the construction and operations work force requirements, by trade (such as carpenter, millwright, ironworker, plumber, etc.) for each dam, are entered separately. This will facilitate adjustment of the model if the size of the work force changes, if the trade mix is altered, or if the schedule for either or both of the dams is changed.

c. Seasonality.

The demand for construction manpower will vary during any given year. Monthly manpower requirements are calculated by the model using the following steps:

1. The percentages of the total yearly work force that will work in each month were projected. These percentages are displayed in Table 6. The model was designed to accommodate different seasonality assumptions for the major labor categories, if appropriate.

2. For each labor category, the number of workers in each year are multiplied by the percentages for each month to yield the numbers of workers in that labor category needed in each month.

3. For each month, the number of laborers, semi-skilled/skilled and adminstrative/engineering personnel are added to obtain the total construction work force needed per month.

Table 6

SEASONALITY OF PROJECT EMPLOYMENT:
PERCENTAGES OF PEAK ANNUAL CONSTRUCTION WORK FORCE
THAT WILL BE EMPLOYED IN EACH MONTH

January	30 %
February	31 %
March	43 %
April	66 %
May	72 %
June	87 %
July	99 %
August	100 %
September	90 %
October	69 %
November	51 %
December	35 %

2. Origin and Settlement Patterns

a. Overview

This portion of the module addresses four basic questions:

- From where do the direct workers originate?
- Which direct workers settle in the local communities?
- Where do the in-migrant direct workers settle?
- How many in-migrant workers leave when they are no longer employed on the project, and when do they leave?

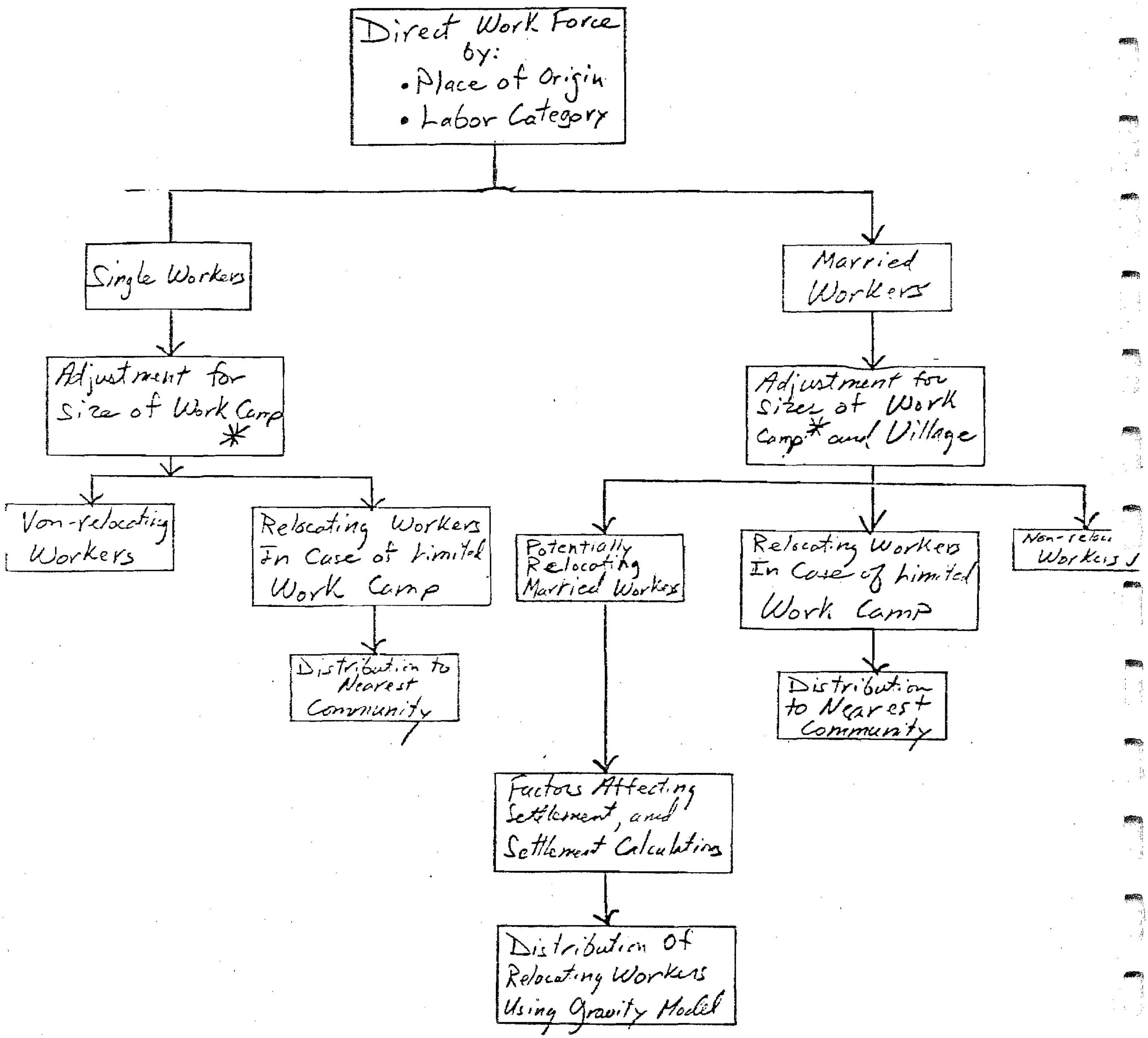
This portion of the module is a critical part of the model because it largely determines the magnitude and geographic distribution of the project's impacts. For this reason, special care has been taken to structure this portion to allow for quick and efficient analysis of multiple scenarios, and sensitivity analysis of key assumptions.

The methodology used to project settlement patterns for the work force is diagrammed in Figure 7. Here it can be seen that, in general, only married workers are expected to relocate their permanent residences (The model has been structured to also account for single workers who may relocate their residences). It can also be seen that the magnitude of in-migration by married workers is expected to be influenced by several major factors. These include:

- place of origin
- labor category
- attractiveness of the work camp
- leave schedules (days on and days off-work)
- access corridor/mode of transportation

Figure 7

METHODOLOGY USED TO PROJECT SETTLEMENT PATTERNS OF DIRECT WORK FORCE



* The work camps are currently planned to accommodate all workers. Single and married workers will have a strong incentive to relocate if the camps are not large enough to accommodate all workers.

Assumptions concerning the last three of these factors can be varied to provide socioeconomic input to the work force and project access analyses that will be conducted by the Power Authority.

Further, it can be seen in Figure 7 that the distribution of inmigrant workers to impact areas is projected using a gravity model. Travel time or cost of travel to the work sites, relative attractiveness of communities as places to live, and other factors are incorporated into this model. This model is designed to address several of the work force and project area access issues that will be considered by the Power Authority, including the transportation and access corridor/mode of transportation options.

In reviewing Figure 7, it should be noted that workers will relocate to local communities temporarily or permanently if the work camp is not large enough to accommodate all single and married workers. In this case, single as well as married workers that cannot be accommodated will relocate to the community located nearest to the work camp that can accommodate additional residents.

The following sections provide more detailed descriptions of the methodology outlined in Figure 7. Assumptions and methods concerning outmigration of workers are provided at the end of Section V-B-2.

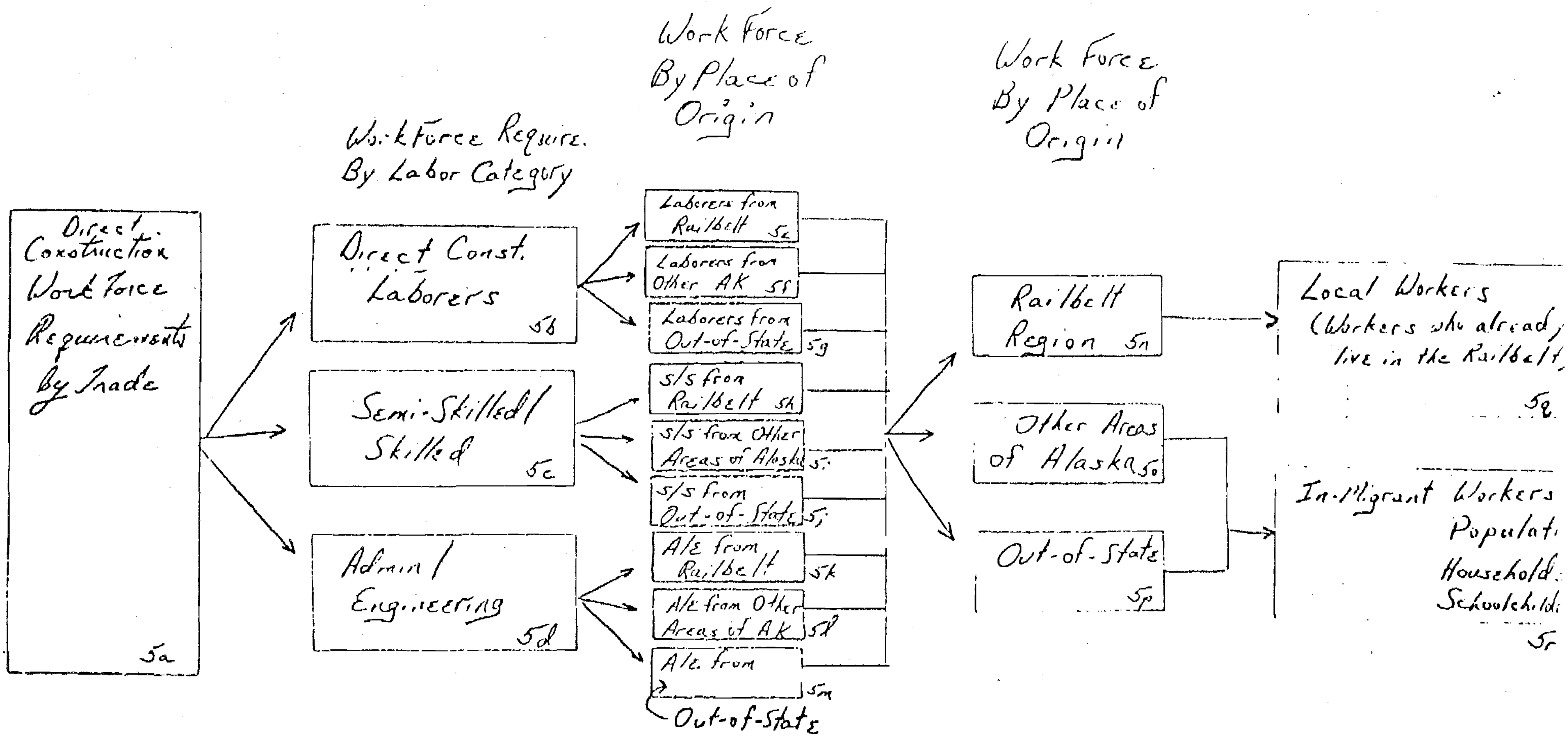
b. Origin of the Direct Workforce

The technique for estimating the origin of the direct work force is shown in Figure 8. Here it can be seen that the direct work force trades data was aggregated over trades into labor categories (Laborers, Semi-skilled/Skilled and Administrative/Engineering). Next, assumptions regarding the percentage of workers in each labor category that would originate from the Railbelt Region, other parts of Alaska excluding the Railbelt Region, or outside of Alaska were developed.

Assumptions for the proportion of workers that will originate from (a) the Railbelt Region, and (b) other parts of Alaska excluding the Railbelt Region, were based upon analysis of unemployment data for the

Figure 8

DIRECT CONSTRUCTION WORK FORCE



trades, and discussions with labor union business managers, Alaska Department of Labor economists, and construction contractors. Current and probable future availabilities for workers were approximated, and compared to direct work force requirements. Based upon these comparisons, the amount of labor, by labor category, that would be supplied from each of the three areas was estimated. These estimates (origin assumptions) are as follows:

Work Force Origin Assumptions

	Railbelt Region	Other AK	Outside AK
Laborers	85%	5%	10%
Semi-skilled/skilled	80	5	15
Administrative/Engineering	65	5	30

The model is structured to allow for sensitivity testing of these assumptions.

The amounts of labor that will originate from the census divisions of the Railbelt Region and selected communities/cities of the Mat-Su Borough and Cantwell were also estimated. These estimations were made by assuming that project employment will be distributed among census divisions based, in part, upon each census division's average share of total construction employment in the Railbelt Region during 1979 - 1981. These shares were adjusted to reflect the census division's proximity to the construction sites relative to other census divisions. The shares (origin assumptions) are as follows:

Assumptions on Work Force Origin Within the Railbelt:

Anchorage:	55.9%
Mat-Su	6.7
Kenai-Cook Inlet	11.1
Seward:	0.2
Fairbanks	23.8
S.E. Fairbanks	0.2
Valdez-Chitina-Whittier	2.1
Yukon-Koyukuk	(to be determined in coordination with the above shares)

Direct employment was estimated for residents of selected Mat-Su Borough cities/communities based upon each city/community's recent average share of total population in the Borough. Trends in population shares were also taken into account in making initial estimations of city/community shares of the Borough's direct project employment. Population data were used in lieu of employment data because employment data are not available for most cities/communities.

As with the census divisions, these shares were adjusted to reflect a city/community's proximity to the construction sites relative to other cities/communities. The shares (origin assumptions) that were used are as follows:

Assumptions on Work Force Origin Within the Mat-Su Borough:

Palmer	10%
Wasilla	8
Houston	5
Trapper Creek	1
Talkeetna	4
Other Mat-Su Borough	72
Suburban	
Rural and remote	

Both Mat-Su city/community share assumptions and census division share assumptions can be easily altered for sensitivity testing.

c. Residency and Movement of Direct Workers

The direct construction work force will be composed of single and married workers (the latter category includes cohabitants that are not married). It is assumed that none of the single workers will choose to relocate their permanent residence closer to the construction sites. Instead, the single workers will reside at the camp/village while at work, and maintain their original permanent residences. The only exception to this pattern will occur if the camp is not large enough to accommodate all single workers that need housing. In this case, it is assumed that some of the single workers will seek temporary housing, or establish permanent residence, in nearby communities. Because single workers will generally not relocate, they are handled separately in this part of the model.

In contrast, it is assumed that some of the married workers will choose to relocate their permanent residences closer to the construction sites (though they themselves will remain at the work camp during the week). Married workers will also have an additional incentive to relocate if the camp cannot accommodate all married workers.

i. <u>Relocation of Married Direct Workers</u>

<u>Numbers of Workers That Will Face the Relocation Decision</u>

The first step to estimating the number of married workers who will relocate to cities/communities is to determine the total number of married workers. This is done using single:married data from other projects (U.S. Army Corps of Engineers, 1981). Next, married workers are allocated to the three labor categories using the labor category multipliers discussed above. It should be noted that the single: married ratio, and the labor category multipliers can be adjusted to provide for sensitivity testing.

Workers who will be confronted with the relocation decision will be those for whom there is no room at the village. It was assumed that housing would be available at the village for the engineering/administrative (E/A) and semi-skilled/skilled (S-S/S) workers and their families. The available housing will be split unequally between these labor categories, with more of the housing available to the E/A workers. The model is structured to allow for adjustment of the shares of housing available at the village for each of these labor categories.

Once these E/A and S-S/S workers are subtracted from total married workers, the number of workers who are confronted with the decision to relocate to cities/communities, remains. The next step is to apply the origin multipliers discussed above to each labor category. This calculation provides the number of married workers, by place of origin (Railbelt Region, other parts of Alaska outside of the Railbelt Region, and outside of Alaska), that face the relocation decision.

Number of Workers That Will Relocate

The number of workers that will relocate is estimated according to workers' place of origin and labor category. It is assumed that both these factors will influence the relocation decision. Place of origin is important because it affects travelling time; labor category may also affect the magnitude of inmigration because the number of workers who have dependents and the average duration of employment may vary by labor category.

In addition, the attractiveness of the camp and village, leave schedules, and access corridor/mode of transportation may influence workers' incentives to relocate. As the attractiveness of the camp and village increases, the incentive to relocate should decrease. As leaves become more frequent, or the time/cost of travel increases, the incentive to relocate (or obtain temporary housing) will become greater.

Accordingly, unique relocation multipliers can be assigned to workers from each place of origin and labor category. The model is structured to allow for adjustments in camp and village attractiveness, and leave schedules.

The projected number of relocating workers, by place of origin and labor category, is calculated by applying the relocation multipliers to the number of workers who face the relocation decision. These workers have the option to relocate to the Railbelt Region, and census divisions and cities/communities therein.

Geographic Places of Relocation

It is difficult to accurately predict where workers will settle. They will consider a myriad of things when they make their decisions.

Recognizing that it is not possible nor appropriate to try to account for all factors that workers may consider, the approach is to focus upon the most likely factors. After reviewing the socioeconomic literature, and analyzing the situation in the Railbelt Region, the attractiveness indicators listed below were determined to be the most relevant for that segment of the Susitna work force that will consider relocating.

Community Attractiveness Indicators

Housing
Schools
Public Facilities and Services
Wholesale/Retail/Finance, Insurance, Real Estate/Services
(number of establishments or employment)
Land available for development

The previous version of the model considered the above indicators in an informal way. Workers were allocated to communities based upon judgement. With a growing need to take into account alternative assumptions, it was decided to allocate workers in a more systematic and explicit manner.

To systematically apply these indicators (decision criteria), incorporate other important factors, and to be able to perform sensitivity analysis, it was decided to create an equation whose parameters and variables could be easily manipulated. The attraction-constrained version of the gravity model was chosen over more complex formulations, such as capacity-constrained and linear programming (LP) models, for two reasons: (1) considerably more data would be required for the more complex formulations, particularly for the LP model (these data are not now available, and would only be available at substantial cost); and (2) the simpler formulation can predict quite well magnitudes and locations of demand that are important for planning.

The equation that incorporates the indicators is:

$T_{ij} = B_j D_j W_i d_{ij}^{-a}$ (Stenehjem and Metzger, 1980),
where:

T_{ij} = Number of workers that are predicted to settle in place i and commute to work site j (j = Watana or Devil Canyon).

B_j = A constant scaling factor that constrains the total number of workers commuting from alternative communities to the number of jobs that these workers fill at the work site ($\sum_i T_{ij} = D_j$). $B_j = (\sum_i W_i d_{ij}^{-a} D_j)^{-1}$.

D_j = Number of workers that are predicted to relocate.

W_i = Measure of the attractiveness of a community as a place to settle; this measure is, itself, the result of a calculation in which the community's rating on each attractiveness indicator is weighted and tallied. The following weights are used:

Community Atractiveness Indicator	Weight
Housing	3
Schools	2
Public facilities and Services	2
Wholesale/Retail/FIRE/Services	2
Land available for development	1

Each indicator is weighted according to its perceived importance relative to another indicator. These weights will remain constant in all applications of the model. An ordinal scale of 1 - 5 will be used to rate the attractiveness of an indicator in one place relative to that same indicator in another place.

d_{ij} = Mean transit time from community to work site (an average of the winter and summer transit times). Note: Mean transit time could be replaced by out-of-pocket travel expenses, where d_{ij} could become $e^{-aC_{ij}}$ (C = out-of-pocket travel expenses).

a = Weighting factor attached to the mean transit time measure. Note: "a" becomes larger as the worker gains more opportunities to leave the camp (e.g., more frequent leaves, or more liberal camp rules). Also, as cross-sectional data for T_{ij}, W_i, and d_{ij} become available, the parameter "a" can be more accurately calibrated through the use of regression analysis. It will also be possible to assess the statistical significance for alternative values for a.

The following assumptions will be used in the implementation of the model:

Travel time to the work site: workers will prefer to minimize travel time from their residence to the work site. Places with lower transit times to the work site will be preferred over those with higher transit times.

Cost of travel to the work site: workers will prefer to minimize the cost of travel from their residences to the work site. Places with lower costs of travel to the work site will be preferred over those with higher costs of travel.

Leave schedule: as leaves become more frequent, places located closer to the work site will be preferred over those located farther away.

As data on project-related population change in the various communities becomes available (through the monitoring program), the above equation may be modified with the intent of improving the accuracy of settlement projections.

The gravity model will be used to project settlement for:

- Workers who originate from other parts of Alaska, and outside of Alaska. These workers may relocate to Anchorage, Fairbanks, Mat-Su (and cities/communities therein), Yukon-Koyukuk (and cities/communities therein), and Valdez-Chitina-Whittier (and cities/communities therein) census divisions.

- Workers who originate from Anchorage, Kenai-Cook Inlet, and Fairbanks census divisions. These workers may relocate to the cities/communities of the Mat-Su and Yukon-Koyukuk census divisions.

ii. Relocation of Single and Married Workers (Special Case)

As discussed earlier, single and married workers may live in nearby communities if the camp does not have enough capacity to accommodate all workers. In this case, the single-to-married ratio is applied to the number of workers that cannot be accommodated at the camp, to obtain numbers of single and married workers that must find accommodations elsewhere. It is assumed that these workers seek housing in the nearest community.

The origin and labor category multipliers are applied to these temporarily or permanently relocating workers to obtain information that is necessary for worker tracking purposes. In addition, an estimate is made for the percent of married workers who will choose to have their dependents accompany them to their place of relocation. This information is used in the population influx calculations discussed in Section V-B-3.

The total number of married workers, used as the starting point for projections in the general case (discussed in section i. above), is diminished by the number of married workers that cannot be accommodated at the camp. This is done to avoid double-counting.

d. Outmigration of Workers

It is assumed that a percentage of the inmigrant workers that are no longer employed on the project will choose to move due to lack of employment opportunities or other factors. The model has the flexiblity to move these inmigrant workers from their places of relocation in any given year, and at any given rate.

Currently, it is assumed that 50% of the workers who in-migrated from outside of Alaska, or from other parts of Alaska outside of the Railbelt Region, and lose their employment on the project, will out-migrate. They will leave their places of relocation and return to their original place of residence or go elsewhere in search of employment.

On large projects in the lower 48 states, an average of about 30-40 percent of the workers who completed their employment on projects chose to remain at their places of relocation. The percentage is assumed to be higher for this project because it is expected that workers will stay in the area after construction on Watana ends, hoping to obtain employment on the Devil Canyon Dam during 1994-2002. After 2002, it is expected that a large number of these workers will choose to remain in the area because by that time they will know about job opportunities in the area and will have an attachment to the area.

It is assumed that workers who relocated from areas of the Railbelt Region to places closer to the work sites, do not outmigrate when their employment of the project ends. Instead, these workers remain at their places of relocation and search for new employment.

3. Population Calculations

The cumulative population influx into each impact area is calculated in the model as a function of : (1) the cumulative number of in-migrating direct workers; (2) the percentage of those workers that are assumed to be accompanied by dependents; and (3) the average number of dependents per accompanied worker.

It was assumed that 100 percent of the direct workers who relocate to the Railbelt region will be accompanied by dependents (The model is now structured to allow this percentage to vary). Since housing will be provided on-site, there will be little incentive for most single workers who come from outside the Railbelt region to establish residences in a nearby community. On the other hand, in-migrating direct workers with families who cannot obtain family housing on-site will be more likely to desire housing for their dependents in the region. It should also be noted that a large percentage of the work force for this project will be skilled tradesmen, and such workers are more likely to have families than unskilled construction laborers. This assumption can be easily changed in the computerized model, for sensitivity analysis purposes.

An assumption of 2.11 dependents per accompanied construction worker was used to calculate the population influx associated with the direct work force. This figure is an average derived from a survey of construction projects throughout the United States that was performed for the U.S. Corps of Engineers (U.S. Army Corps of Engineers, June 1981). Comparable data on Alaskan projects are not available. The resultant population per household figures differ from the household size projected for the state. The specific construction worker measure was used because construction workers have been observed to have characteristics slightly different from the population as a whole.

4. Payroll

Payroll is calculated by multiplying the number of workers of a given trade by the number of hours worked in an average month by the hourly pay rate. The payroll figures are projected in constant 1981 dollars.

Numbers of Hours. The assumptions on numbers of hours varied by type of worker:

Laborers -	232 hours	(54 hours per week, 4.3 weeks per month)
Semi-skilled/skilled -	232 hours	(54 hours per week, 4.3 weeks per month)
Administrative/Engineering -	208 hours	(48 hours per week, 4.3 weeks per month)
Operations Work Force -	208 hours	(48 hours per week, 4.3 weeks per month)

Wage Rates. Wage rates for laborers and semi-skilled/skilled workers were obtained from the Alaska Department of Labor (ADOL) and are displayed in Table 7. These wage rates are routinely collected by ADOL through industry surveys, and are the workers' base rate of pay exclusive of any fringe benefits and prior to standard deductions. Wage rates for engineering/adminstrative and operations/maintenance personnel were obtained from Acres American, Inc. and are the workers' Alaskan base rate of pay exclusive of any fringe benfits and prior to standard deductions. These wage rates do not include travel allowances, housing allowances, or other other highly variable types of compensation.

Table 7

1981 HOURLY WAGE RATES USED TO CALCULATE PAYROLL

TRADE	HOURLY WAGE	TRADE	HOURLY WAGE
LABORERS			
Drilling	$18.30	Blasting	$11.36
Cement	17.13	Laborers	16.62
Pumping	16.16	Excavating	18.30
Material Handling	15.66	Moving Storage	7.17
Security	6.10	Fire	7.55
Police	10.10	Janitor	10.00
Waste Disposal	14.43		
SEMI-SKILLED/SKILLED			
Stationary Engineer	$15.00	Electric Powere Gen.	$14.37
Machanic - Machine	13.21	Mechanic - Auto	14.81
Mechanic - Engine	17.48	Truck Driver (Heavy)	15.80
Truck Driver (Light)	15.80	Air	9.50
Bus Driver	6.00	Nurses	9.14
Radio/T.V.	5.75	Telephone Operator	6.09
Medical Assistant	7.63	Purchasing Agent	12.45
Structural Steel	16.93	Sheetmetal	20.93
Boilermakers	20.97	Welders	17.46
Electronics	17.57	Electricians	21.31
Rail Transport	9.50	Painters	18.65
Carpenters	18.51	Bricklayers	18.93
Roofers	18.82	Pipefitters	20.73
Plumbers	20.73	Bartenders	8.25
Chefs	13.13	Cooks	8.12
Kitchen Workers	5.71	Laundering	5.94
Electrical Transmission	19.45	Recreation	6.46
Photography	10.24	Nursery	4.61
Airplane Pilots	18.29	Secretarial	7.24
Bookkeeping	7.21	Data Processing	7.63
Accommodation	6.41	Teachers	7.87
Writers	4.67	Commercial Artists	7.45
Office Managers	9.49	Landscapers	9.25
ADMINISTRATIVE/ENGINEERING			
Electrical Engineer	14.37	Electrical Eng. Draft	11.10
Civil Engineer	14.17	Civil Engineer Draft	9.21
Mechanical Engineer	11.38	Mechanical Eng. Draft	9.21
Mining Engineer	22.00	Surveyers	12.92
Geologist	12.92	Geotech	10.10
Hydrology	12.00	Environment	8.92
Managers	9.49	Misc. Professionals	10.00

C. Secondary Work Force

1. Multipliers

Secondary employment was estimated by applying location and time-specific secondary employment multipliers to the on-site construction work force and any operations workers that maintain permanent residences in the region outside of the villages and construction camps. These work forces include both the single and married workers discussed in the previous section. The following multipliers were applied to these work forces:

Census Division	Multiplier (Time Period)
Anchorage	1.1 (1983-84); 1.2 (1985-87); 1.3 (1988-96); 1.4 (1997-2005)
Mat-Su	0.8 (1983-87); 0.9 (1988-2005)
Kenai-Cook Inlet	0.4 (1983-89); 0.5 (1990-99); 0.6 (2000-2005)
Seward	0.3 (1983-99); 0.4 (2000-2005)
Fairbanks	0.5 (1983-89); 0.6 (1990-99); 0.7 (2000-2005)
SE Fairbanks	0.2 (1983-99); 0.3 (2000-2005)
Valdez-Chitina-Whittier	0.3 (1983-99); 0.4 (2000-2005)

The value of each location-specific multiplier was assumed to increase with time due to import substitution and other factors that reflect a maturing and growing economy.

It is implicitly assumed that the secondary employment multiplier associated with workers housed on-site is zero. This multiplier is expected to be very low or insignificant in all areas except, perhaps, Cantwell and the Mat-Su Borough. Accordingly, the multipliers for these areas have been raised slightly.

The secondary employment multiplier for Anchorage was developed as part of an in-depth theoretical and empirical analysis of the Anchorage economy (Tuck, 1980), and the multiplier for Fairbanks was taken from an industrial development projects impact assessment model developed by Dr. Bradford Tuck and Environmental Services Ltd. for the Fairbanks Northstar Borough.

The secondary employment multiplier for the Mat-Su Borough is based upon research conducted jointly by Dr. Tuck and Frank Orth & Associates, Inc. The multiplier was initially estimated to be 0.76, and was raised to 0.80 to account for the expected effect of expenditures made by workers who reside at the camp or village and take occasional excursions in the Railbelt Region and/or travel to their residences outside of the Railbelt Region.

Multipliers for the remaining census divisions are based upon work conducted by Dr. David Reaume (Reaume, 1980). Dr. Reaume estimated regional multipliers as follows:

Gulf (Cordova-McCarthy, Kenai-Cook Inlet, Kodiak, Seward, and Valdez-Chitina-Whittier census divisions): 0.2

Interior (Fairbanks, S.E. Fairbanks, Upper Yukon, and Yukon-Koyukuk census divisions): 0.4

The multipliers used for the Kenai-Cook Inlet, Seward, and Valdez-Chitina-Whittier census divisions are slightly higher than Dr. Reaume's estimate for the Gulf Region. This is because it was assumed that the secondary sectors of these census divisions' economies would grow relative to the basic (direct) sectors of their economies during 1980 - 1983.

The multiplier used for the S.E. Fairbanks census division is lower than that for the Interior Region because it was known that the multiplier for the Fairbanks census division was about 1.5. Given that the economy of S.E. Fairbanks is far less developed than that of Fairbanks, a multiplier of 0.2 was assumed for S.E. Fairbanks.

The model is structured to allow for adjustment of these multipliers. This flexibility is especially appropriate because several of these multipliers may change more or less quickly than the rates of change assumed above.

Flexibility is also important because it may be appropriate to lower the multipliers associated with the direct construction work force. Recent research (Denver Research Institute, 1982) has shown that these multipliers are frequently over stated. Accordingly, the model will be run using several values for the multipliers.

2. Origin and In-migration

Since the employment multipliers were applied to the on-site construction workers according to their places of residence, the distribution of secondary sector jobs within the region was simultaneously determined. Thus, it was assumed that secondary sector jobs will be created where construction workers maintain their permanent residences.

Some of these jobs will be filled by local residents while the remainder will be filled by in-migrant workers from other areas. The number of in-migrating secondary workers was determined by estimating the percent of total secondary jobs, created in each census division and community, that is likely to be filled by in-migrants. The following percentages were used:

Anchorage:	25%
Kenai-Cook Inlet:	15
Seward: 0	
Fairbanks:	15
S.E. Fairbanks:	20
Valdez-Chitina-Whittier:	30
Yukon-Koyukuk:	90

Mat-Su Borough:

Palmer:	10%
Wasilla:	10
Houston:	10
Trapper Creek:	70
Talkeetna:	25
Other Areas:	10

These percentages resulted from an analysis of the amount of labor potentially available at each location. Unemployment data, labor force participation rates, and underemployment information were utilized in this analysis. These percentages were then applied to the total secondary employment estimates, by location, to obtain the number of in-migrating secondary workers in each location.

It should be noted that this represented an extension of the economic base method, as this method usually ignores underemployment of labor and often results in overestimation of the in-migration of secondary workers and related population. This extension serves to provide for a more realistic (lower) estimate of in-migrant secondary workers. It should also be noted that the percentages discussed above will be estimated for other locations (impact areas) at a future time.

3. Population Calculations

Cumulative population influx associated with the secondary work force is calculated for each impact area by multiplying the population-per-household measures that were projected for the state under the Base Case by the estimated number of in-migrating secondary workers. It was assumed that these workers would have the same general demographic characteristics as present residents.

D. Housing Impacts

The impacts of the project on housing are quantified using the following steps:

1. The number of cumulative project-related in-migrant households is calculated as equalling the number of direct and secondary workers that in-migrate into a community or area by a given year.

2. The percent increase that this number of households represents of the total projected number of households in the impact area is calculated.

3. The projected project-related influx is compared to the number of vacant houses that is expected under "without project" conditions.

VI. PUBLIC FACILITIES AND SERVICES

A. Overview of Methodology

The general approach to forecasting public facility and service requirements during 1985-2005 was:

1. to develop appropriate standards, for each service category and for each relevant community, that relate service and facility requirements to the size of population;

2. to assess the adequacy of existing facilities and services and to quantify any over- or under-capacity using these standards;

3. to estimate future needs based on the application of these standards to the population growth forecasts with and without the Susitna project;

4. to indicate the significance of the impact on local jurisdictions; and

5. to provide indicators of need for project-impact mitigation measures.

B. Geographic Scope

Projections of impacts of the project on public facilities and services are calculated only for communities and other jurisdictions in the Local Impact Area. The flexibility to project facility and service requirements of other communities and jurisdictions in the Railbelt region has been built into the computerized model. At this time, however, no further work has been done to develop appropriate per capita service standards for these jurisdictions.

C. The Computerized Module

The public facility and service model utilizes three types of data input. First, the module reads in the population and household projections from a data file that is created as an output of the economic-demographic module. Second, assumptions on service standards and data on capacity are accepted. Third, information on present and planned capacity is entered.

A schematic of the structure of the facilities and services module is presented in Figure 9. Per capita service standards are multiplied by the projected population of each community, under the "with project" and "without project" scenarios, and the results are stored as service requirements for that community. The effects of the direct population influx and the total project-related population influx are calculated independently, so that direct and total impacts can be separated for mitigation planning purposes.

Impacts of the project are displayed quantitatively in various ways. Project-related requirements are compared to the requirements without the project as a percent increase, and to 1981 capacity in both absolute and percent capacity utilization terms.

The results of the model are presented for each community or impact area, by variable, on a yearly basis. Table 8 is an example of the report format that is produced by this module.

D. Types of Service Standards

Service standards can be divided into two categories--average and prescriptive. Average standards are based on recent data on existing service levels on a per capita basis for a given area. Average standards may be based on national, regional, state or local averages, or on averages for a given type or size of community; their distinguishing feature is that they are based on an average of what currently exists. As such, they reflect the realities of funding and staff limitations that local governments face.

FSER/POLICEV/POLICWAH/FSERRPT
Alternate 02 of 02
06/12/83 AT 02:52:21

Table 8

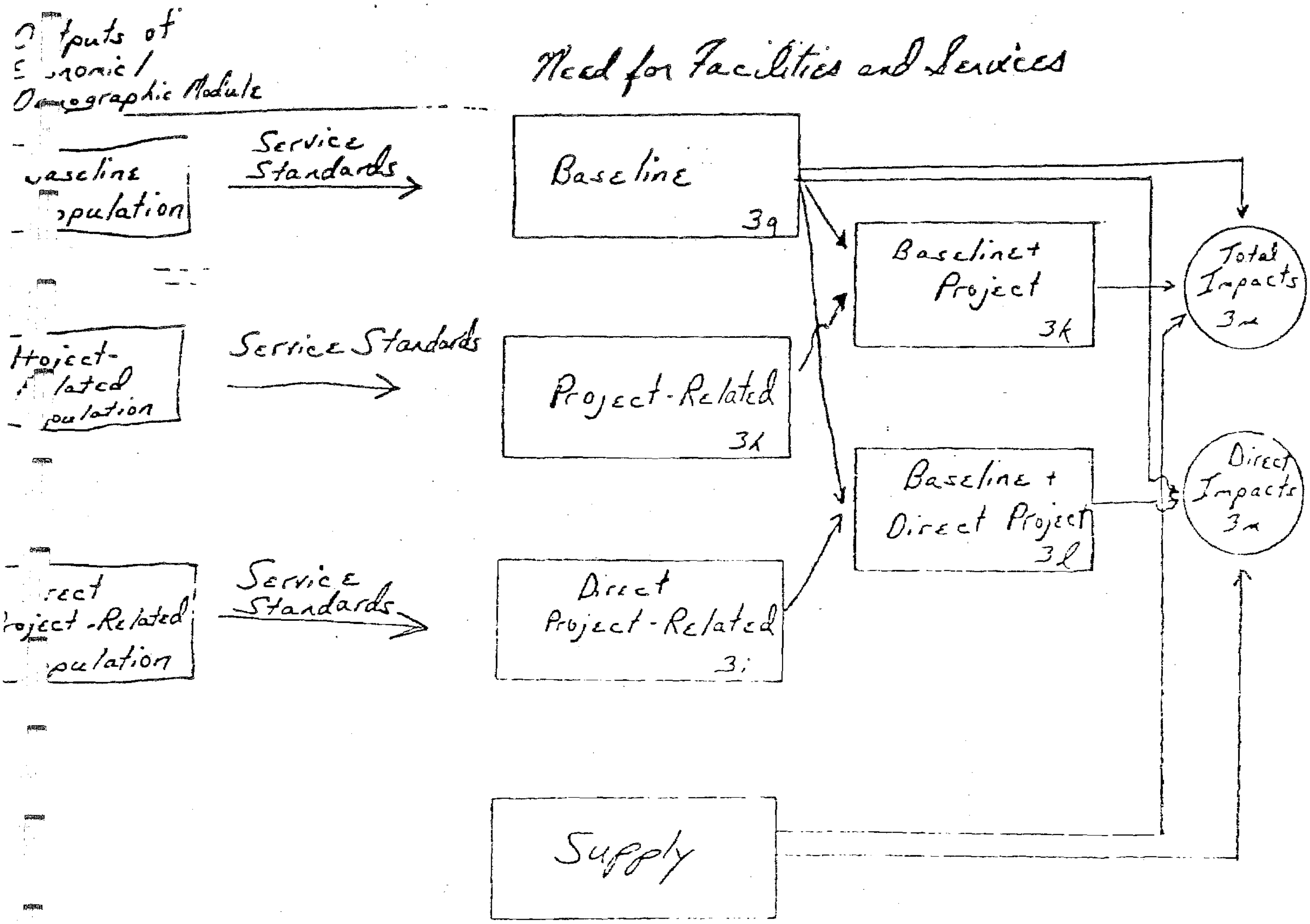
USER = RLH

IMPACT OF THE PROJECT ON POLICE PROTECTION
IN THE MATANUSKA-SUSITNA BOROUGH
(NUMBERS OF OFFICERS)

YEARS	1985	1986	1987	1988	1989	1990	1991	1992	1993
PROJECT-RELATED REQUIREMENTS									
Direct Project	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Project	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BASELINE (Cum.)	28.0	31.0	33.0	35.0	37.0	39.0	41.0	42.0	45.0
TOTAL REQUIREMENTS	28.0	31.0	33.0	35.0	37.0	39.0	41.0	42.0	45.0
Direct Require. As % Increase Over Basel.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Require. As % Increase Over Basel.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981 Capacity	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Excess (Under) Cap.	(8.0)	(11.0)	(13.0)	(15.0)	(17.0)	(19.0)	(21.0)	(22.0)	(25.0)
% Capacity Utiliz.	140.0	155.0	165.0	175.0	185.0	195.0	205.0	210.0	225.0

Figure 9

STRUCTURE OF PUBLIC FACILITIES AND SERVICE MODULE



(Contents of 3g - 3l)

<u>Types of Information Contained</u>

Water } gallons per day

Sewage - gallons per day

Solid Waste - acres per year

Police - number of police

Hospitals - Bed Need, Doctors

Schools - classrooms, teachers

Not quantified: Fire · Transportation

Playgrounds
Neighborhood Pks
Community Parks

(3m & 3n)

<u>Quantitative Expression of Impacts</u>

% Increase Over Baseline

Increase Over Baseline in Nos.

Capacity Utilization

Distribution of Increase Over Geographic Areas

For some service types, prescriptive standards are set by relevant agencies or associations. For instance, a state government may require certain standards for health care and education; standards for fire protection based on insurance tables may be used widely. These standards often vary by size, type and community, and may be voluntary or mandatory.

A mix of average and prescriptive standards have been used in this analysis. The objective has been to provide detailed measures of adequate service levels, for those services which the local governments now provide, while keeping under consideration the resource constraints that communities face. Local preferences, based upon conversations with local, state and borough officials, have been taken into account.

For some facilities and services, the required level of service varies among communities, depending on factors such as the size of the community and the type of community (urban, suburban or rural).

In some cases, relevant standards may be based on variables other than population per se -- for example, the number of dwellings or the number of school-age children. These variables are related to population levels, but the actual ratios may change over time. Service categories such as education and health care are especially sensitive to demographic changes. Where possible, predictors of demographic changes have been incorporated into the model.

Due to the many factors that influence the needs for public facilities and services, the uniqueness of each community, and the subjectivity in deciding adequate service levels, the standards used in the model should not be considered absolutes, but rather as general indicators of changing requirements with and without the Susitna project. A summary of the standards used is displayed in Table 9. In the sections below, specific considerations relating to the choice of standards are discussed.

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Table 9

SUMMARY OF PUBLIC FACILITY AND SERVICE STANDARDS FOR SELECTED COMMUNITIES IN THE LOCAL IMPACT AREA

	Palmer	Wasilla	Houston	Trapper Creek	Talkeetna	Mat-Su Borough	Cantwell
Water Supply							
Average Water Supply (gpd per capita)	120-150[a]	120-150[a]	-	-	-	-	-
Sewage Treatment							
Sewage Treatment (average gpd per capita)	150	-	-	-	-	-	-
Solid Waste Disposal							
Landfill Requirements (acres per 1,000 population)	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]
Education							
Average Primary School-Age Children To Teacher Ratio	25	25	-	25	25	25	15
Average Secondary School-Age Children To Teacher Ratio	21	21	-	-	-	21	15
Teacher to Support Staff Ratio	8:1	8:1	8:1	8:1	8:1	-	-
Health Care							
Desired Hospital Bed Occupancy Rate	-	-	-	-	-	55%	-
Law Enforcement							
Police Officers (officers per thousand population)	1.5	-	-	-	-	1.0-1.5	1.0
Parks and Recreation							
Playgrounds (acres per 1000 dwelling units)	3.9	3.9	3.9	-	-	-	-
Neighborhood Parks (acres per thousand dwelling units)	3.3	3.3	3.3	-	-	-	-
Community Park (acres per thousand dwelling units)	-	-	-	-	-	4.8	-

[a] Assumed to increase from 120 gallons per day per capita in 1981 to 150 gallons per day in 2000.

[b] Assumed to increase from .11 acres per year per thousand population in 1981 to .21 acres per year in 2000.

E. Assumptions and Service Standard Used

1. Water Supply

Water systems are comprised of three components -- the supply source, the treatment facility and the distribution system. The most widely used standards for water service are the average and peak water consumption per capita, in terms of gallons per day (gpd). Facility standards sometimes include pipe length per thousand dwellings, and treatment capacity.

The standards are relevant only for communities that have or are expected to develop water systems. Only two communities in the Local Impact Area, Palmer and Wasilla, have city-wide water supply systems. Other residents, including inhabitants of the communities that will be most affected by the project, rely on individual wells or "community" systems that serve a particular subdivision, trailer park or other small area.

An average per capita water consumption standard of 120 gallons per day in 1981 rising to 150 gpd by the year 2000 was used. The city of Palmer currently has an average per capita water use rate of 120 gpd, and this relatively low usage may be attributed to the relatively small amount of industry in the area. It is expected that future growth will include an increase in business activity and hence a rise in per capita water consumption.

2. Sewage Treatment

The amount of sewage generated is a function of the amount of water that is used daily. In the literature on national standards, it has been estimated that an average of 65 percent of total water supplied becomes sewage, or 100 gpd per capita, with the remainder used for miscellaneous purposes such as watering lawns and gardens, firefighting and generating steam (Stenehjem & Metzger, 1980). This standard is not appropriate for application to many Alaska communities. In the winter in parts of Alaska, more water than required for use flows through the distribution system, in order to keep the water from freezing within the pipes. This water is then returned as sewage, resulting in sewage flows representing close to 100 percent of water use. This is the case in Palmer, where sewage requirements equal 100 percent of average water usage, or 120 gallons per day per capita. For the purposes of projections of impacts, a constant standard of 120 gpd has been used for Palmer, the only community with a sewage treatment system in the Mat-Su Borough, and for Wasilla, which is planning a sewage system at this time.

3. Solid Waste Disposal

Solid waste can be disposed through incineration or sanitary landfill disposal; sanitary landfill has become the prevalent mode. Facility requirements for solid waste disposal can be measured in terms of the amount of land needed per capita on an annual basis. Published standards range from 0.2 to 0.3 acres per thousand people, depending on assumptions of pounds of waste per capita, depth of the site and the rate of compression of the waste.

A lower standard of .11 acres per thousand population has been assumed initially for communities in the Mat-Su Borough and other communities in the Local Impact Area, based on the premises that waste production per capita is much lower and the fill depth of the central landfills is twice as high as national averages. This standard is calculated to rise to 0.21 acres by 2000 and held constant at this level between 2001 and 2005.

4. Education

The major determinant of the requirement for educational facil- ities and services is the ratio of school-age children to population, modified to take into account private school attendance. Two different methodologies were used to estimate the number of school-age children associated with the (1) Base Case population and (2) in-migrant population associated with the Susitna project.

Under the Base Case, for the Mat-Su Borough, the standards that the school district uses for planning were used in this study as well. Short-term planning through 1987 uses an estimate of 22.8 percent (school-age children : total population). For long-range planning purposes, an estimate of 25 percent is used. For the purposes of this study, the ratio is assumed to rise gradually from 22.8 percent in 1987 to 25 percent in 2000 and then held constant at that level through 2005. In Cantwell, the present 18 percent level was assumed to remain constant over time in the Base Case.

The number of school-age children accompanying workers on the project has been estimated using a ratio that was calculated, through surveys of other large projects, of .89 schoolchildren per in-migrant worker accompanied by dependents (U.S. Army Corps of Engineers, 1981). The number of school-age children associated with the in-migrant secondary population was calculated on the same basis as Base Case school-age children.

A major service standard for education relates the number of school-age children to the number of classes and teachers. Local preferences have been used as standards in this case. In the Mat-Su Borough school district, planning standards include an optimum of 25 students per class for primary schools and 20-22 for secondary schools. In addition, Mat-Su Borough statistics show that teachers comprise about 50 percent of total school district personnel requirements. In Cantwell, the Railbelt School District's planning standard teacher-student ratio of 15:1 was used.

Requirements for classroom space can be measured in terms of number of classrooms or alternatively, the number of square feet per pupil (90 square feet for primary school students and 150 square feet for secondary school students). The square feet calculations are useful to the estimation of the cost of constructing new facilities. The model is able to provide both sets of calculations.

It is assumed that the present ratios of primary school students (54 percent of total) and secondary school students (46 percent of total) will remain constant. It is beyond the scope of this analysis to forecast changes in distribution by school and by grade.

5. Health Care

Standards for acute public health care focus on the capability of hospital facilities and staff to accommodate the expected number of patients without building overcapacity that will then add to hospital costs. While rule-of-thumb bed multipliers of between 2.1 and 5.8 beds per 1000 population are often used, it has become customary to base the number of beds required on a measure of the long-term daily average daily census of patients using the hospital divided by the desirable occupancy rate. In Alaska, the recommended occupancy rates are 80 percent for urban hospitals and 55 percent for rural hospitals. The formulas used are:

Acute Care Patient Days at Valley Hospital plus Days at Alaska and Providence Hospitals for Borough Residents / Borough Population = Hospital Use Rate for Borough Residents

Hospital Use Rate for Borough Residents X Estimated Borough Population / 365 days in year = Projected Average Daily Census (PADC)

Projected Average Daily Census X Proportion of Bed Need Met at Valley Hospital / Minimum Occupancy for Rural Hospital (55%) = Valley Hospital Acute Care Bed Need

A significant aspect of the hospital system in Alaska deserves note. The Municipality of Anchorage has developed a comprehensive acute and long-term health care system that provides the main medical care for the residents of Southcentral Alaska, as well as other areas of the state. A large percentage of people living in areas such as the Mat-Su Borough, as well as Cantwell, presently elect to use hospitals in Anchorage over the local hospital due to the larger number of doctors (especially specialists) and the more modern facilities. However, the percentage of patients that use the Valley Hospital in Palmer has been rising rapidly in recent years, and this trend is expected to be accelerated by the planned addition to and renovation of this hospital, as well as the possible addition of certain medical specialists to the staff. It is assumed that the usage of Valley Hospital as a percentage of total Alaskan hospital use by Mat-Su Borough residents will rise from 38 percent in 1980 to 75 percent in 2000 and remain constant at that level through 2005.

Age and sex distributions of the population are important determinants of hospital use. Due to data limitations, these and other demographic factors have been assumed to remain constant. As data become available from communities and workers through the monitoring program, the model may be restructured to project age and sex distributions.

6. Law Enforcement

Police service standards range from one officer per thousand population in unincorporated rural areas to 1.5 officers per thousand population in small communities and 2 officers per thousand in moderately large cities. For rural parts of the Local Impact Area, a standard of 1.0 officers per thousand was applied to the population projections. For the southern part of the Mat-Su Borough (outside Palmer, which has its own police force), a standard of 1.5 officers per thousand population was used; it is anticipated that the growing suburbanization of the borough will soon justify use of the increased standard.

Alaska State Troopers judge the relative adequacy of their staffs in terms of the average case load (i.e. number of crimes) that each officer is charged with investigating. Six cases per Trooper is considered average, and eight is considered the level at which additional staff is needed. In the Mat-Su Borough, in 1981, there was approximately one Trooper per thousand population, and the average case load was about six per officer. This indicated that the rural standard discussed above was appropriate for this area.

7. Recreation

Projected requirements for recreation facilities, in terms of acreage for playgrounds, neighborhood parks and community parks, were calculated by applying national standards for rural areas. Standards for playgrounds and neighborhood parks are most applicable to the cities of Palmer, Wasilla, and Houston, whereas community parks are planned for larger areas, and the standard pertaining to this category is most relevant to Mat-Su Borough as a whole.

8. Other Facilities and Services

Some categories of public services did not lend themselves to this type of quantitative approach. The method of analysis used for these categories are discussed below.

9. Fire Protection

The major criteria that can used to evaluate the adequacy of fire protection are (1) the available water flow rate (gallons per minute), (2) response time, and (3) manpower availability. There are several standards that relate these variables to population size in the socioeconomic impact literature. Water flow, response time or service radii, and the equipment capacity are commonly used. It is common in communities of less than 7,000 to rely on volunteer firefighters; as this is not a cost item, requirements for manpower have not been projected for communities of the local impact area.

However, fire protection planning in Alaska, as in many other states, often takes the form of trying to achieve a certain fire rating as measured by the Insurance Service Organization (ISO). The ISO is a national organization that rates fire protection on a scale from one (best) to ten (worst); fire insurance rates closely reflect these ratings.

Communities without a community water system can at best achieve an ISO rating of 8 (which is the objective that the Mat-Su Borough presently hopes to achieve for its most populous fire districts). Requirements to achieve a rating of 8 are: that dwelling class property be within five road miles of a fire station (on roads that are in good condition) and that the fire department has demonstrated its ability to deliver 200 gallons per minute (gpm) for a period of twenty minutes without interruption. The latter requirement implies a need for a capacity of 4,000 gallons of water "on wheels." The ISO rating does not relate service availability to the size of population.

10. Transportation

The impacts of the project on transportation were analyzed with the consultation of public officials who have responsibility for transportation infrastructure in the region.

The capacity of the Parks Highway, the main highway in the project area, was discussed with the Alaska Department of Transportation and Public Facilities, and specific areas which could be transportation bottlenecks were determined. Officials at the Alaska Railroad confirmed that the rail line is underutilized, and could easily handle the additional freight that the project would generate.

The Mat-Su Borough has a skeletal road framework which will need to be expanded significantly to handle the population growth that is expected in the next twenty years. Discussions with Mat-Su Borough officials yielded estimates of the threshold borough population sizes that are expected to trigger the need for additional roads. For instance, as the population of the borough exceeds 30,000, there will be a need to build a collector road ring with a radius of four or five miles from Wasilla. Using these threshold levels, it was possible to estimate by how much the population influx related to the Susitna project would accelerate the need for these infrastructure additions.

Possible future enhancements to the impact model would entail (1) projecting the increase in traffic counts on major roads in the impact area related to the project and (2) relating the project-related population influx to the demand for airport facilities.

VII. FISCAL MODULE

A. Overview of the Fiscal Impacts Module

1. Purpose

The purpose of fiscal impact analysis of resource development projects, such as the Susitna Hydroelectric Project, is three-fold:

- To identify the types and magnitude of project-induced changes in the expenditures and revenues of local governments;
- To identify or estimate the timing of project-related expenditures and revenues; and
- To make the above information available to the mitigation planning process.

2. General Approach

The general approach taken in the analysis of the fiscal impacts of the Susitna Hydroelectric project was to consider two futures. First, baseline conditions were analyzed and projected, for each local jurisdiction, to provide a basis for comparison. Second, conditions with the project were projected, using data inputs from the economic-demographic and the public facilities and services modules.

In the analysis of baseline conditions, emphasis was placed on identifying the most important sources of revenue and expenditure items. Past and current trends in both revenues and expenditures were examined and analyzed, and these trends were used as the basis for the projections of future fiscal conditions in the project area.

In the projection of fiscal impacts related to the project, the effects of the direct population influx and the total project-related population influx are calculated independently, so that direct and total impacts can be separated for mitigation planning purposes.

B. Impact Areas and Local Jurisdictions

Within the project impact area, there are a number of jurisdictions that hold a variety of powers to collect taxes or otherwise receive revenues and to provide certain public services. The fiscal powers vested in these jurisdictions, to a large extent, determine likely sources of future revenue and future needs for expenditures for public facilities and services. The distribution of fiscal responsibilities among jurisdictions also will affect the extent to which any given jurisdiction is impacted by the project. In the following section a brief description of the government organization and fiscal responsibilities of jurisdictions in the project area is given. For additional information on government organization in the project area, refer to Frank Orth & Associates, Inc., 1982.

1. The Municipality of Anchorage and the City of Fairbanks

These centers comprise by far the largest population centers in the project area. The Municipality of Anchorage is a first class home rule municipality while Fairbanks is a first class city. This first class status provides both population centers powers to levy taxes on real and personal property as needed in order to provide services to their residents. Each one of these centers provides a wide range of public facilities and services.

2. Mat-Su Borough.

The powers and responsibilities of the Borough are comprised of four general functions: general fund administration, provision of fire protection and road services to service areas, land management functions, and responsibilities for the school district. General fund administration and responsibility for the school district are part of the Borough's area-wide duties to serve all areas in the Borough; provision of fire protection and road maintenance to service areas are non area-wide functions whereby only selected areas are served.

3. Incorporated cities

The incorporated cities in the Mat-Su Borough are Palmer, Wasilla, and Houston. Palmer is a first class home rule city, while both Wasilla and Houston are second class cities.

4. Palmer

As a home-rule city, Palmer has certain certain powers of taxation. Home rule and general law municipalities may levy tax on all real and personal property located in the municipality to support services provided throughout the municipality. The maximum rate of taxation is three percent (thirty mills) of the full and true value of taxable property.

5. Wasilla and Houston

As second class cities, Wasilla and Houston require a majority vote to exercise the power of taxation. In addition, there is a tax ceiling of five mills. For additional discussion of the tax powers of local authorities in the State of Alaska, refer to Frank Orth & Associates, Inc., 1982.

C. Projection of Revenues and Expenditures

1. Revenues

Sources of revenue are, in the main, determined by the taxation powers of a given jurisdiction together with its eligibility for intergovernment transfers. For each jurisdiction, the major traditional sources of revenue were determined and its tax powers were examined.

The next step was to determine appropriate methods of projecting future revenues. The discussion that follows presents a list of alternative methods including the ones chosen for this analysis.

a. "Own Source" Revenues

"Own source" revenues include all source of revenue that the local jursidiction raises for itself, such as property, sales and income taxes. These are a function of the size of the tax base and the tax rates used.

Property values are influenced by many factors, including the level of demand as population increases. To estimate changes in the property tax base, a real rate of growth of four percent was assumed for the Mat-Su Borough baseline assessed value. This rate is based on recent observed growth rates in the Borough's total assessed value. For the "with project" scenario, baseline per capita assessed valuation was applied to the population influx to estimate additional growth in the property tax base. Certain tax rates were assumed for the analysis period.

Sales tax revenues were assumed to grow in direct proportion to population. The sales tax rates were assumed to be constant.

b. Intergovernmental Transfers

In estimating intergovernment revenues, it is important to understand the criteria used by the state and federal government in allocating transfer funds to local jurisdictions. Allocations are usually made on the basis of local population size. Therefore, per capita based projections are good approximations of this form of revenue and were used in this analysis. In some cases, both population size and geographic location are considered when allocating transfer funds. Whenever appropriate, the per capita based projections in the model were adjusted to account for location specific factors.

c. Bonding

The Borough has in the past utilized school revenue bonds primarily for school capital projects. The authority to do this is always sought from the local taxpayers, as, in principal, they are responsible for repaying this form of obligation. However, the state legislature has in the past provided varying levels of reimbursement to the borough. Current law allows up to 90 percent reimbursement of both principal and interest payments. In this analysis, maximum bonded indeptedness is projected as a ratio of assessed valuation.

d. Political Factors

It is important to note that political factors, such as the form of government of a jurisdiction and changes in state statutes, can heavily influence the amount of revenue that may be available to a local jurisdiction. For example, a local decision to incorporate or upgrade the level of incorporation from a second class to a first class city, can lead to increased taxation powers and potential revenues. Similarly, a decision at the state level to change the criteria for providing revenue sharing assistance to local jurisdictions can have far reaching effects.

2. Expenditures

A first step to projection of expenditures is to identify the types of public facilities and services provided by a jurisdiction. This initial step provides a listing of the expenditure items for which projections must be made. Suitable methods can then be identified for making the projections. In the following section, alternative methods are discussed as is the rationale for selecting the method which was used in this study.

Generally, there are two groups of methodologies for projecting public expenditures: (1) the average cost approaches and (2) the marginal cost approaches. Methodologies in both groups were examined for advantages and disadvantages and for applicability to the project area. The following is a brief review of these methods.

a. Average Cost Methodologies

Average cost methodologies include the per capita cost, service standards, and cross-sectional regression analysis approaches. The per capita cost method is based upon the assumption that, in real terms, present per capita costs are reasonable estimates of future cost. It is a relatively inexpensive methodology to apply, as it readily utilizes available historic data. Its major weakness lies in its lack of direct accounting for threshold effects (i.e. predicting the large amount of new investment that is needed when a community reaches a certain "size threshold"), existence of excess capacity in public facilities, and economies of scale in providing new services.

The service standards method would multiply the results of the service requirements calculated in the facilities and services module by unit costs to project total facilities costs. The cross-sectional regression analysis approach estimates average service requirements based on data from several communities in the region. Both the service standards and regression methods require considerably more data than the per capita method. Additionally, because the regression method must draw on regional data to have enough data points, it is sometimes regarded as being too regionally based to constitute an appropriate local impact projection method.

b. Marginal Cost Methods

These include the case study approach, the comparable city method, and the economic engineering method. An important advantage of these methods is that they are able to explicitly account for the threshold effects, excess capacity and economies of scale. However, marginal cost approaches require great amounts of data, may not be accurate if there is uncertainty surrounding assessment of excess capacity in public facilities and services, and in addition require great amounts of effort to update the estimates. In general, these methods are more expensive to apply.

c. <u>Criteria for Methodology Selection</u>

The following criteria were used to make a selection of expenditure projections methodology:

- o Simplicity of application while providing reasonably accurate results;
- o Availability of data;
- o Ease of update and therefore usefulness in mitigation planning and mitigation measure revisions; and
- o Applicability to impact area fiscal conditions.

The first criterion demands a method that, although simple, would meet current standards of acceptability. The per capita cost method meets these requirements and is the most commonly applied fiscal impact methodology.

With the exception of the cross-section regression method, the average cost methods tend to require historical data that is readily available. The marginal cost methods require great amounts of data that may not be available and can be complex in application.

Cost projections for this project will need to be revised repeatedly to reflect the most current information on the project and its schedule. It is, therefore, necessary to have a method of projection that can be updated easily. Although the marginal cost methods (and in particular the case study method) can have a great deal of accuracy, their application demands a correspondingly higher data collection effort. As a result, marginal cost methods are more suited to a one-time application.

Using the above criteria, the per capita cost method was selected for use in this study. It was recognized, however, that the method's weaknesses could be minimized by incorporating some features of the Case Study approach. Thus, interviews with local officials were conducted in order to gain perspectives on trends in public facilities usage. Furthermore, public facilities thresholds and public preferences concerning the extent of public facilities and services will be monitored during the project period so that adjustments can be made during a dynamic mitigation planning process. During that process, the per capita multipliers used and assumptions that underlie them will be compared to actual costs to better facilitate mitigation. If revised cost estimates are required, they can be made easily and quickly. This is one advantage of the per capita method - it facilitates a continuous mitigation process.

D. Link of the Fiscal Module to other Modules

1. Input Data

As discussed above, many of the revenue items and most of the cost items are projected applying per capita multipliers to the projections of population and school-age children. Per capita multipliers were obtained or computed from current and historic budgets. Interviews with local officials supplemented this information. These multipliers are contained within the fiscal module. The rest of the data are derived from the other modules of the model.

2. Link to the Economic-Demographic Module

The fiscal module obtains population data from the Economic-Demographic module. The data extracted corresponds to the type of cost projections to be made (baseline projections, impact of the direct project-related population influx, and impact of the total project-related population influx) and the appropriate phase of the project. Accordingly, changes in the economic and demographic scenarios affect the revenue and cost estimates in the fiscal calculations.

3. Link to the Public Facilities Module

A significant portion of the Mat-Su Borough budget goes to education. In fact, the school district budget constitutes about 58 percent of the borough revenues. Consequently, one of the important variables in projecting fiscal conditions is the number of children in the borough. These estimates are provided by the public facilities module.

A possible future enhancement of the fiscal calculations will introduce a link to the public facilities module to specifically extract indicators of threshold effects. This linkage would then be used together with monitoring information to adjust cost estimates, as more data become available regarding supply shortfalls.

E. Baseline Projections

This section discusses the estimation of baseline projections. A detailed analysis is given regarding component revenue and cost items, some of the assumptions made, and specific methods of estimation for each jurisdiction. The jurisdictions covered are Mat-Su Borough, the cities of Palmer, Wasilla, and Houston within the borough, the Municipality of Anchorage and the City of Fairbanks. Within the Mat-Su Borough, special attention is given to the general fund, the school operating fund, the service area fund, and the land management fund.

For jurisdictions in the local impact area including Mat-Su Borough and Palmer, Wasilla, and Houston, considerable effort was devoted to projection of both the revenues and expenditures. Major sources of revenue and important expenditure items were identified. The Municipality of Anchorage and the City of Fairbanks are outside of the local impact area. Consequently, only expenditure projections were made. Major expenditure items were emphasized. The following is a discussion of the module structure for calculations.

1. Mat-Su Borough

Revenues: Two types of revenues are projected. They are "own source" revenues and intergovernmental revenues. The only source of own revenues is the property tax. Intergovernmental transfers received by the borough include such categories as state shared revenues, municipal assistance revenues, and federal revenue sharing. All intergovernment revenues were estimated using per capita multipliers. Property taxes were projected based on an assumed real growth in the tax base of four percent. The applicable tax rates are of two kinds: (1) the area-wide tax rate and (2) the non area-wide rate. The first is applied to the total Borough assessed valuation while the second is applied to the non area-wide assessed value. Residents of those selected areas where the Borough provides fire protection and road services pay a non area-wide tax in addition to the area-wide tax that is paid by all residents of the Borough. The general equations used for the two types of revenues are given below:

$$IGR_{it} = IGH_{it}*POP_t$$

$$PT_t = AV_t*MR_t$$

IGR_{it} = the ith item intergovernment revenue in the year (t)
IGH_{it} = the ith item per capita revenue ,,
POP_t = population in the Mat-Su Borough ,,
PT_t = property tax ,,
AV_t = assessed valuation ,,
MR_t = the mill rate (tax rate) ,,

Expenditure items for the borough, such as area-wide general fund administration, service area cost items, and land management fund, are projected based on per capita expenditure estimates using the following general equation:

$$COST_{it} = PCC_{it}*POP_{it}$$

PPC = the per capita cost multiplier
POP = the population size
Subscripts: (i) identifies the ith cost item, and
(t) identifies the year.

2. The School District Budget

Revenues: The school district revenues come primarily from the state government, area-wide local taxes, and the federal government. All government contributions, with the exception of those from the state's foundation program, are based on school-age population. Foundation program monies are granted on a per instruction unit basis and take into account area specific cost adjustment factors. This revenue item, however, can also be said to be based on population since instructional units are determined by the number of students. Estimation of property taxes was discussed above; the state and federal government contributions are projected using per capita school child revenues and the total school-age children. The general form of the equation used is as follows:

$$SR_{it} = PR_{it} * TSC_{it}$$

SR_{it} = nonlocal school revenue from the ith source in year (t)

PR_{it} = revenue from the ith source per school child in year (t)

TSC_t = total school age children in year (t)

3. The City of Palmer Budget

Revenues: The City of Palmer derives revenues from own sources, intergovernment transfers, and miscellaneous sources. Own sources include the local property taxes, sales taxes, and service charges. Own sources constitute close to 60 percent of all revenues while intergovernment sources contribute some 25 percent. Miscellaneous sources are responsible for the balance. Own source revenues are projected using per capita multipliers; intergovernment revenues are projected based on historic percentage contributions.

Other revenue sources are the special fund charges for water and sewer services. The projections in this category were based on per capita charges.

Expenditures: The city of Palmer provides a number of standard services. Cost projections for all the various services listed below were based on per capita cost multipliers.

Services provided include:

- o General administration
- o Police
- o Fire service
- o Ambulance
- o Parks and recreation
- o Health services
- o Library
- o Public works
- o Water supply
- o Sewer

Thus, the general formula for projecting the total outlay for each item is as follows:

$$COST_{it} = PCC_{it}*POP_{t}$$

The various terms in the equation are explained above.

4. City Of Wasilla

Revenues: There are two categories of revenues that the city of Wasilla receives. They include intergovernment transfers, and own-sources. Unlike the City of Palmer, Wasilla receives by far the greatest amount of its revenue from intergovernment funds, which include state-shared taxes, state and federal revenue sharing, state grants for capital projects, various transfers from Mat-Su Borough and elsewhere for the library, and other miscellaneous intergovernment transfers. All the revenue items were projected using per capita revenue multipliers.

Expenditures: Expenditure items for the City of Wasilla include:

- General administration;
- Parks and recreation;
- Library;
- Fire service;
- Capital projects.

All these were projected based on per capita expenditure multipliers with a general formula of the form:

$$COST_{it} = PCC_{it} * POP_{t}$$

5. City of Houston

Revenues: Although the composition of revenue items and purposes is quite varied, there are only two important sources of revenue for the City of Houston. These are the state and Mat-Su Borough. To project baseline revenues for Houston, per capita revenues estimates were obtained for each important revenue item and applied to the projected population of the city.

Expenditures: To project expenditures, per capita expenditure multipliers for the various cost items were obtained and used with the projected population of the city. The applicable expenditure items include:

- Local government administration;
- Fire service;
- Parks and recreation;
- Road maintenence;
- Solid waste.

6. Municipality of Anchorage

For the Municipality of Anchorage, expenditure projections were made using the per capita cost method. Per capita expenditures for major expenditure items were applied to the population projections; the total expenditure was then obtained by summing over the individual items. The most important components of expenditures are as listed below:

- Police;
- Fire service;
- Ambulance;
- Parks and recreation;
- Library;
- Health services;
- Transportation;
- Sewage service;
- Solid waste disposal;
- Water supply.

7. City of Fairbanks

As with the Municipality of Anchorage, only the expenditures were projected for the City of Fairbanks. The per capita cost approach was used. The items included in the expenditure projections are:

- Police;
- Fire sevice;
- Ambulance;
- Parks and recreation;
- Library;
- Health services;
- Transportation;
- Sewage service;
- Solid waste disposal;
- Water supply.

F. Impact Projections

Project impacts were projected using the same formulas as were used in the baseline projections. One difference in methodology concerns estimation of property tax revenues associated with the population influx. The approach was to use the baseline derived per capita assessed valuation together with the total population (including population influx) to estimate total assessed valuation. Tax revenues are then derived, as in the baseline projections, using the same mill rate multipliers.

Incremental revenues and costs were projected for various aspects of the project. The aspects considered in the fiscal calculations include the direct increment associated with the direct project populations, and the increment associated with the total population influx. Project scenario total revenues and expenditures (Baseline+Project - direct and secondary) are also projected.

G. Reports

Reports are organized by jurisdiction. The revenues and expenditures are reported as well as indications of deficits. The revenue projections reported include baseline revenues, incremental revenues due to direct population influx, increments due to total project-related population influx, and overall revenues in the "with project" scenario. Similar information is reported for expenditures. The reports display total revenues and total expenditures for each jurisdiction, rather than individual revenue/cost items. However, back-up tables that report on the detailed computations can be designed and produced to facilitate local plannning.

For the jurisdictions where both revenues and expenditures are projected, baseline deficits and "with project" scenario deficits are reported. In addition, the percent increase (decrease) in the jursidiction's deficit as a result of the project is reported. Two sample reports are included as Table 10 and 11. These two reports are similar, but differ in the time period of reporting. Table 10 covers the period from 1985 to 1993 while Table 11 reports on the remainder of the project development and beyond to the year 2005.

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Table 10

FISCAL MODULE REPORTS
REVENUES AND EXPENDITURES
IMPACTS ON BUDGETS
(Thousands)

Mat-Su Borough General Fund

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993
REVENUES									
PROJECT RELATED									
Direct Portion									
Project Total									
BASELINE PROJECTION									
TOTAL REVENUES									
EXPENDITURES									
PROJECT RELATED									
Direct Portion									
Project Total									
BASELINE PROJECTION									
TOTAL EXPENDITURES									
Baseline Deficits									
Total Deficts									
% [illegible]									

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Table 11

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FISCAL MODULE REPORTS
REVENUES AND EXPENDITURES
IMPACTS ON BUDGETS
(Thousands)

Mat-Su Borough General Fund

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	20(
REVENUES												
PROJECT RELATED												
Direct Portion												
Project Total												
BASELINE PROJECTION												
TOTAL REVENUES												
EXPENDITURES												
PROJECT RELATED												
Direct Portion												
Project Total												
BASELINE PROJECTION												
TOTAL EXPENDITURES												
Baseline Deficits												
Total Deficts												
% Increase in deficit												

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