TANANA BASIN AREA PLAN

PHASE I
RESOURCE INVENTORY
AUGUST, 1983

AGRICULTURE ELEMENT

STATE OF ALASKA
Department of Natural Resources
4420 Airport Way
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U.S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service

AGRICULTURE
EXECUTIVE SUMMARY

The Tanana Basin includes 21 million acres of land along the Tanana River stretching from the Canadian border on the east to the Yukon River on the northwest. As shown in Figure 1, it includes the most populated area of Alaska's Interior. Except in the areas which have had area plans completed, this study addresses all state selected, tentatively approved and patented land within the Tanana Basin.

Exclusive of lands already designated for agriculture, this analysis indicates that there are an estimated 1,214,000 acres of lands with agricultural potential in the Tanana Basin. About 582,000 acres of these lands lie within six miles of a road or navigable river and are therefore relatively accessible, although they may be located a considerable distance from potential markets.

As discussed in Chapter 5, if the state is to supply a reasonable share of the domestic market for agricultural products, approximately 485,000 acres of cropland would be needed. The current out of state demand for Alaskan barley is minimal, since thus far, Alaskan barley prices have not been competitive on the world market. This situation may change, however, as more Alaskan farms come on line and world prices change. In the meantime, however, the domestic market appears to be the most promising.

Within the Tanana Basin, the state has already designated 379,000 acres for agriculture, of which 115,000 have sold and the rest are expected to sell within the next few years. In addition, there are extensive areas of agricultural land in other areas of the state, particularly in the Mat-Su region. These areas should be adequate to both supply the projected domestic market and test the feasibility of exporting agricultural products.

Based on the information in this report, the Division of Agriculture recommends that lands with agriculture potential be designated for agriculture or resource management wherever conflicts with other resources can be minimized. Overall, the emphasis will be on small scale agricultural sales in the most accessible areas and protection of agricultural soils through resource management designation in the less accessible areas.

CONTENTS

Chapter 1

Introduction

This report summarizes the information gathered by the Tanana Basin Area Planning staff, the University of Alaska Agricultural Experiment Station and the DNR Division of Agriculture concerning the agricultural resources of the Tanana Basin. It is part of a resource inventory of seven resources including fish and game, agriculture, forestry, minerals, outdoor recreation, settlement and water.

The purpose of the paper is to present the information on agriculture in the Basin in a concise form for use during preparation of the Tanana Basin Area Plan. This plan will allocate state-owned land in the Basin to different uses and will stipulate management guidelines for each allocation. The Final Plan is due for completion in March, 1984.

Chapter 2

Issues and Local Preferences

I. INTRODUCTION

Issues and local preferences are important pieces of information which must be incorporated into the planning process. Issues concerning the use of a specific resource provide a focus and framework for the planning process; local preferences show how the public feels these issues should be resolved. In this section issues and local preferences are documented for incorporation in the planning process through the work of the Planning Team Members.

A. Issues

An issue is something which is debated. For example, the amount of land to be disposed of is an issue; some people favor more land and others would prefer less. Another issue is the effect of agriculture on fish and game; some feel that the effect is positive; others feel that it is negative or neutral. The purpose of this paper with any particular viewpoint. These issues are then to be addressed in the Tanana Basin Area Plan which will create policies to deal with them. The issues reported here are those which the plan can affect through classifications or management guidelines.

The issues identified in this chapter were collected and summarized from three sources. The public meetings that were held in the Tanana Basin during the spring of 1982 was the first source of issues used for this chapter. Planning team members, after reading the comments from the public meetings developed a series of issues concerning the resource they represent. The Tanana Basin Plan sketch elements were a second source used to identify issues. The sketch elements were developed in 1981 to provide a starting point for the Tanana Basin Area Plan. The issues identified in the sketch elements were based on conversations with agencies, resource experts and public interest groups. The third source was interviews with agency representatives.

B. Local Preferences

Local preferences about how these issues should be addressed were determined from two principal sources. One of the sources which will be used in the planning process for developing local preferences is a series of community originated land use plans. Several communities are currently working on proposed plans for state land in their area; others have already submitted proposals to DNR.

These local land use plans provide a clear indication of what a community prefers. This is particularly true when a proposal receives endorsement of village councils, city councils, native corporations, and other interest groups in the area.

The possibility of doing land use plans was mentioned at the public meetings and in a newsletter that was sent to all communities. Only a few of the communities, however, have decided to submit proposals. Most of these proposals will not be completed until February, but some have been on file with the State Department of Natural Resources and summaries are included in this report.

The Tanana Basin Public Meetings are the other source of information on local preferences. Public meetings were held in all communities in the Basin in the spring of 1982 to discuss the Tanana Basin Area Plan. The notes from these meetings were given to members of the planning team who then developed the summaries included here. The summaries represent the planning team members understanding of how residents want state land in their area managed for a specific resource.

The sources of local preferences are not as accurate as a public survey, but in most cases, they represent the only information available. They should not be considered to be representative of the entire community; they are simply indications of the opinions of some of the residents.

A survey now being conducted by the Alaska Department of Community and Regional Affairs will provide a better indication of local preferences in the Tok area. The results of this survey will be available to the planning team by March of 1983.

ISSUES CONCERNING AGRICULTURE

The following issues concerning agriculture were drawn from the public meetings, sketch elements and interviews with agency representatives:

ISSUE 1. The amount of state land classified and sold for agriculture.

ISSUE 2. The size of the farm parcels offered for sale by the state.

ISSUE 3. The impact of agriculture on the economy of Alaska.

ISSUE 4. The effect of land disposals on agriculture.

ISSUE 5. The effect of forestry on agriculture.

ISSUE 6. The effect of recreation on agriculture.

ISSUE 7. The effect of minerals on agriculture.

ISSUE 8. The effect of fish and wildlife on agriculture.

ISSUE 9 The effect of agriculture on recreation.

ISSUE 10. The effect of agriculture on land disposals.

ISSUE 11. The effect of agriculture on forestry.

ISSUE 12. The effect of agriculture on water quality and the environment.

ISSUE 13. The effect of agriculture on fish and wildlife.

ISSUE 14. The effect of agriculture on mineral development.

III. LOCAL PREFERENCES FOR AGRICULTURE

A. Community Originated Land Use Plans.

The following section lists the various community originated plans that have been completed, or are in progress for state lands in the Basin. For detailed information on each plan listed here, contact the Division of Research and Development.

1. Minto Flats

Minto Village Council passed a resolution in 1980 requesting that the state classify Minto Flats for Wildlife Habitat and Forestry. The village council sent the resolution with a "Summary Report" about Minto Flats to the Department of Natural Resources. The Summary Report discusses the fish and game resources, the village's utilization of these resources, and includes a map which identifies historic fishing spots and trails into the Minto Flats.

The Department of Natural Resources sent the Summary Report and classification request for interagency review, but in late 1980 the proposal was put on hold so that it can be addressed by the Tanana Area Basin Plan.

2. Tok River Basin

In 1979 the Department of Fish and Game, in response to public opinion in the Tok area, requested that land in the Tok River Basin be classified as Wildlife Habitat. DFLWM gave public notice of the proposed classification at which time the Tok Chamber of Commerce, Tetlin Village Council and Tok Fish and Game Advisory Board voiced their support of the classification. The Director of the Department of Land and Water and Forests concurred with the classification action and sent the request to the Commissioner, at which time it was decided that the classification should wait until the Tanana Basin Area Plan was under way.

The Department of Fish and Game wrote a report in support of the Tok River classification. The report addresses population, economic considerations, wildlife values, nonconsumptive recreation, timber harvesting, mining, management objectives and procedures, and it includes a legal description of the area proposed for wildlife habitat.

3. Lake Minchumina

In August 1979, the Lake Minchumina Homeowners Association sent the Department of Natural Resources a formal classification request based on a Land Use Plan for the Lake Minchumina Area. The community identified nearby lands for wildlife habitat, watershed, public recreation, forestry, greenbelts and dispersed open-to-entry disposal classification. The community wrote a narrative justifying their proposal.

The proposal went through in-house and interagency review and public notice. The DFLWM supported the classifications and felt that the proposal had generated "a general scheme for dealing with state lands that both the public and the district can support." The District sent the proposal to the Commissioner at which time the request was put on hold pending the Tanana Basin Area Plan.

4. Yanert-Revine Creek Area Community Land Use Plan

In December 1979, the communities in the Yanert-Revine Creek area submitted a land use plan for lands adjacent to their community to the Department of Natural Resources. The plan was "the result of efforts of the entire community" and was developed over a period of three months during which time the community conducted three public meetings. The plan designated specific areas for disposals, recreation, and wildlife habitat, and included management guidelines for buffers, density of settlement and public easements. The plan did not include any formal classification requests, so it was not processed by the Division of Land and Water. However, the cover letter from the community stated that "We, as a community, strongly urge the Division of Forests, Land and Water Management to consider this proposal and adopt it as its guidelines for land disposals in this area."

5. Lower Tanana-Manley Hot Springs Area

The Forestry Section of DFLWM in response to a proposal from Northland Wood, requested that certain lands along the major river drainages between Nenana and Manley Hot Springs be classified for forestry. The proposal included a land use plan that discussed the following topics: location, criteria for the recommendation, access, vegetation, timber resources, soils, wildlife and fish habitat, recreation, current use, reasons for state selection of the lands, adjacent land uses, benefit to the public, expected impact of forest classification, proposed management guidelines, and justification for requested classification.

The request was sent for interagency review at which time it was decided that the classification was premature since other resource potentials of the land had not been assessed fully.

6. Community Strategy Plans

Tanana Chiefs Conference has worked extensively over the past several years with most Village Councils in the Doyon Region to develop Community Strategy Plans. Strategy Plans identify goals and objectives for each community. Most goals and objectives address social services. However, there is a section in each strategy plan that identifies land use concerns and priorities for their area.

7. Interior Village Association Planning Project

Interior Village Association, an organization based in Fairbanks, which specializes in helping village corporations do corporate planning, is currently working with Manley Hot Springs and Tanana to develop corporate plans for the village's lands. These plans should be done by September. At that time, the village corporations will begin doing feasibility studies on the projects they identified in their plan. IVA is also encouraging other Village Corporations to do similar plans.

8. Bean Ridge Corporation Classification Request

Bean Ridge Native Corporation of Manley Hot Springs on October 15, 1982, requested the state to classify lands surrounding Manley Hot Springs as wildlife habitat. Bean Ridge feels it is critical to protect habitat lands in the Manley area, since the land is used for subsistence by residents of Manley, Minto, Tanana, Nenana and Rampart and sport hunters from residents of other areas.

9. Upper Tanana Land Use Plan

The Upper Tanana Development Corporation is currently working on a community and land use plan for the Upper Tanana region. The plan will be based on a coordinated effort of all local governments and interest groups in the area.

The Upper Tanana Development Corporation hopes to have some information from their planning effort available in time to be used in the Tanana Basin Area planning process.

10. Lower Tanana Land Use Plan

Tanana Chiefs Conference is currently working with the village councils, city councils and village corporations of Minto, Manley, Tanana and Nenana on a set of classification

requests for state land in the lower Tanana River basin. Classification requests are for forestry, minerals, and fish and wildlife habitat. Also included in the plan is a description of areas that should be off limits to disposals, and lands where some settlement might be acceptable. This effort should be completed in time to be used in the Tanana Basin Area planning process.

11. Land Bank Nominations

The states land disposal program allows the public to nominate lands that they would like to see sold to the public. During September 1982, DNR received 7 different nominations for land in the Tanana Basin that should be sold. The decision on these requests were deferred to the Tanana Basin Area Plan for planning team review.

B. Tanana Basin Public Meetings

Carlos Lozano, the Tanana Basin Planning Team member from the Alaska State Department of Natural Resources, Division of Agriculture is responsible for incorporating agricultural concerns into the planning process. After attending several of the public meetings and reading the meeting notes, he outlined the following local preferences for each community in the Basin. These statements represent the opinions of those who attended the meetings and are not necessarily those of the community at large.

ANDERSON

The people at this meeting would like to see more small farms and they prefer to have economics dictate the future of agriculture.

CANTWELL

There is support for grazing land and small farms.

DELTA

Very strong support for agriculture along with some expression to protect existing recreation trails and to have large and small agricultural tracts was expressed.

Specific conditions or qualifiers which this community has identified which affect the management of this resource are greenbelts.

DOT LAKE

An interest in subsistence farming was presented; no other interest in agriculture was presented.

HEALY

There was support for agriculture and farm size was felt to be important in that the farms must be large enough to be economically supportive.

LAKE MINCHUMINA

According to the comments from the public meeting held at this community there is very little, if any, support for agriculture.

MANLEY HOT SPRINGS

A strong interest in small scale agriculture was expressed.

MENTASTA LAKE -no specific concerns were identified.

MINTO -no specific concerns were identified.

NENANA

There was a positive interest in agriculture, however, they wanted a variety of sizes -- with the smaller tracts located near their community.

NORTHWAY no specific concerns were identified.

TANACROSS

There was one recorded comment concerning agriculture and it was a negative comment concerning its popularity in the area.

TANANA

The group definitely supported the sale of small agricultural tracts.

TETLIN -no specific concerns were identified.

TOK

There is support for agriculture in the area. There is also concern about the impact of agriculture on fish and game.

FAIRBANKS

A strong support for agriculture was expressed.

Specific conditions or qualifiers which this community has identified which affect the management of agriculture:

Greenbelts are important. The timber resources should be utilized and not wasted and farming should occur in an environmentally sound manner.

Chapter 3

Supply of Agricultural Soils

INTRODUCTION

This chapter discusses the supply of agriculture in the Basin. It estimates the amount of land of different quality which is available in the area.

The chapter is divided into two sections--the first is "Physical Capability" and the second is "Suitability". Physical capability concerns the supply of the resource without reference to ownership, access, or land use policies. It represents the ability of the land to "produce" a particular resource.

Suitability refines this capability by taking such things as land ownership, accessibility/economic feasibility, and minimum parcel size into account. Short-term and long-term estimates of the supply of the resource have been made based on current and expected production costs.

Acreage summaries have been made by planning unit. These units have no significance in themselves but are used strictly for convenience in inventorying the resources; it was felt that acreage summaries would be more useful if done by smaller units rather than for the Basin as a whole.

PART 1. PHYSICAL CAPABILITY OF THE TANANA BASIN FOR AGRICULTURE

This part of chapter 4 is divided into two sections: (1) criteria used to produce the maps of physical capability and (2) a discussion of the acreage and estimated supply of the resource by planning unit.

I. Criteria Used to Produce the Maps of Physical Capability

The maps showing areas in the Basin which are likely to have Class II, Class III, Class IV, greater than Class IV and unsuitable capability for agriculture were based on a soils map of the Tanana Basin. The soils map used was produced in 1982 by Ray Krieg and Associates under contract to the Division of Geological and Geophysical Surveys. This map is the best information available to date on the soils of the Basin. The different sources of information used to produce this soils map are as follows:

1. Reger, S., Schoephorster, D.B., and Furbush, C.E., 1979, Exploratory Soil Survey of Alaska. U.S. Dept. of Agriculture, 213 p., scale 1:1,000,000.
2. Soil surveys and reports.
3. Soil Conservation Service, 1975, Soil Taxonomy: U.S. Dept. of Agriculture, no. 436, 754 p.
4. U.S.G.S. 1:250,000 topographic quadrangle
5. Aerial photography

For a detailed discussion of the process used to integrate this information, refer to the Susitna River Basin Automated Geographic Information System; Land Capability and Suitability Analysis, published by Environmental Systems Research Institute in 1981. This document explains how soils maps were developed for the Susitna River Basin, which was the same process as that used to produce the vegetation map for the Tanana Basin.

The soil type map produced by Ray Krieg and Associates was then used to determine the capability of different areas for agriculture. To determine the capability of each soil type to support agriculture, each soil type was classified according to standard Soil Conservation Service (SCS) categories. This classification was done by Mark Kinney of the SCS in Fairbanks.

The capability classes rank each soil type according to its limitations in terms of the plants which can be grown and/or the conservation practices which must be used. Class II soils, for example, have relatively few limitations, while Class IV soils require more careful use. The classification definitions are presented in Appendix 4A.

limitations, while Class IV soils require more careful use. The classification definitions are presented in Appendix 4A.

The results of the classification process are shown in Appendix 4B. Many of the classifications can be found in the detailed soil surveys prepared by the SCS for this area. In areas not covered by detailed soil surveys but covered by the exploratory soil survey the likely capability of the exploratory soil type to support agriculture was estimated.

Based on these estimates and other information provided by SCS and ESRI (see appendix 4B) Class II, III, and IV soils were mapped. The map that was produced however has certain limitations.

In the Fairbanks, Tanana, Kantishna and Livengood areas, the map and the number of acres in each soil group is not entirely accurate. All areas with a slope of 12 to 15% that are mapped as Class II soils may include some Class III and IV soils. The Division of Agriculture decided that this inclusion of lower quality soils into a higher category was preferable to the alternative. The alternative not chosen by the Division would have excluded some Class II soils in areas with 12 to 15% slope from the Class II soils category. Also, some Class III soils in areas between 12 and 15% slope would have been eliminated from the Class III category.

The map of the Tanana Basin showing Class II, III and IV soils is not included in this report. The map can be seen at the Department of Natural Resources in Fairbanks. A summary of the mapped information, however, can be found in the next section on suitability.

PART 2. LAND IN THE TANANA BASIN SUITABLE FOR AGRICULTURE

This part of Chapter 4 refines the capability map explained in the previous part of this chapter by examining (1) the amount of agricultural land that is state owned and (2) the location of agricultural lands that are economically feasible to develop.

I. State Owned Agricultural Lands

The number of acres of state selected, tentatively approved and patented land with Class II, III and IV soils was calculated manually. The land ownership map used for these calculations was provided by the Bureau of Land Management. This ownership map was last updated December 15, 1982.

This information indicates that there are approximately 1,214,000 acres of Class II and III soils on tentatively approved and patented land and state selected land in the Tanana Basin. The actual number of acres of Class II and III soils available for agriculture however is slightly less than is indicated by these figures since the land that has already been disposed of in the state land disposal and agriculture program have not been subtracted.

II. Location of Agriculture Lands that are Economically Feasible to Develop

Specific areas economically feasible to develop for agriculture were not identified in this part of the analysis. Numerous assumptions had to be made regarding markets; transportation and road construction costs; and how the product is stored and packaged if areas were to be identified. Because of the complexity of making these assumptions and doing various scenarios, such an analysis was not attempted in this chapter. However, the planning team member, Carlos Lozano will document the assumptions he makes regarding these considerations in Chapter 7.

Chapter 4

Economic Feasibility

INTRODUCTION

Many crop and livestock products can be produced in Alaska. If a commercial agricultural industry is to emerge in the state, these products must be available to the consumer at a price which is competitive. For this to occur, individual farming and processing units must be sized to allow commercial production to take place in an economically viable manner. An efficient infrastructure must also be available to support agricultural producers. If commercial farms and the associated infrastructure are to be efficient, a sufficient volume of products must be produced and moved through the system.

The State of Alaska is moving toward a feed-grain based agriculture. Approximately 500,000 acres of farmland, producing feed grain as well as harvested forage and other crops such as oilseeds, vegetables and seed for feed grain, will provide the basis for an efficient, cost-effective agricultural industry. Over half (268,000 acres) would be used for production of feed grains. Most of this acreage is available in the Tanana Basin.

The model chosen for analysis for the Tanana Basin was a family farm, 3,000 acres in size producing barley on 2,600 acres. Although other crops and livestock are being and will continue to be produced in the basin, the greatest portion of agricultural lands in production are producing barley. This trend is likely to continue.

Important elements contributing to the cost effectiveness of barley production are clearing cost, land price, barley yield and barley price.

Clearing cost will vary by cover crop and clearing technique used. In the Tanana Basin, the cover crop is largely black spruce and moss. The most common clearing technique involves chaining and piling the cover crop and breaking the land. Cost estimates for clearing approximately 3,000 acres average $200 per acre in 1982. This cost was used in the model.

An important variable in economic evaluations is land price. Land price on the Delta I project in the Tanana Basin averaged $10 per acre after homestead credits were applied. The interest rate was six percent. Delta II farms, also in the Tanana Basin, sold for an average of price of $180 per acre with an interest rate of 12 percent. To determine the sensitivity of costs to land price, four prices were used: $10, $25, $50, and $100 per acre. An interest rate of 10 percent was applied in all cases.

It has been demonstrated that yields as high as 1.8 tons per acre can be reached on large acreages. On the other hand, as a result of poor management practices, yields as low as .70 tons per acre have been recorded. A yield of 1.5 tons per acre is a possible average. To determine sensitivity to yield, 1.00, 1.25 and 1.50 tons per acre were used.

In-state barley prices have been as high as $160 per ton and at present are $130 per ton f.o.b. Delta Junction. World barley prices are currently $120 per ton. To reflect both export and in-state price, $100, $125, and $150 per ton were used.

A development scenario beginning with the purchase of agricultural rights to uncleared land in the first year (1983) was used. Production and investment costs for equipment, buildings, grain drying and grain storage were obtained through personal interviews in the spring and fall of 1982 with farmers in the Delta I project. A typical equipment, building, drying, and storage complement is shown in Table 1.

Four financial analysis techniques were used to determine the economic feasibility of each combination of land price, barley yield and barley price. These were:

1) annual budgets for farms when full production is reached;
2) annual cash flows from year 1 (1983) through year 19 (2001);
3) net present value from 1983 through 2001 and from 1990 when full production was reached through 2001;
4) internal rate of return from 1983 through 2001.

Annual budgets provide an indication of operating and average owner costs for one year. Cash flows indicate how cash would move through an enterprise over a period of years based on annual revenues and cash costs. From the cash flows it can be seen in which years, if any, cash returns would be negative and how many years would be required to make up this deficit. The net present value reflects the time value of money and is the difference between the net cash flow and total capital expenditures. If the net present value is greater than zero, the return from the project will more than cover the cost of capital (discount rate). The internal rate of return represents the rate of return on the capital expended.

Table 1. Equipment and Building Complements Required to Grow Barley on 2,600 Acres

Item	New Cost	Salvage Value	Life	Annual Depreciation	Interest per Acre
250 hp 4WD tractor	$105,000	$ 21,000	7	$12,000	$ 1.53
175 hp 4WD tractor	75,000	15,000	7	8,500	.10
30 ft tandem disc	30,000	6,000	7	3,400	.44
28 ft chisel	14,000	2,800	7	1,600	.20
45 ft fertilizer spreader	6,600	1,300	7	750	.10
36 ft grain drill	36,000	7,200	7	4,100	.53
16 ft swather	20,000	4,000	7	2,300	.29
24 ft combine (2)	200,000	40,000	7	22,800	2.92
45 ft tractor-mounted sprayer	3,500	700	7	400	.05
2-1/2 ton trucks (2)	50,000	10,000	7	5,700	.73
3/4 ton pickup	12,000	2,400	7	1,300	.18
6 ton grain wagons (2)	14,400	2,800	7	1,600	.21
Total	$566,500	$113,800		$64,450	$13.90
60 x 80 building	57,600	-0-	20	2,900	.66
Storage and drying	85,000	17,000	20	3,400	1.24

I. ANNUAL BUDGETS

An annual budget can be used as a planning tool. It includes all costs of production as well as cash and noncash ownership costs. Annual budgets are usually calculated for an average production years, but can also be used for development planning.

Costs for producing a barley crop are categorized as operating and ownership costs. Operating costs are those incurred only if a crop is produced. These include purchase of inputs, operation of equipment, labor, repair and maintenance, and interest on operating capital. Ownership costs are associated with purchase and ownership of equipment, buildings and land and will be incurred whether a crop is produced or not. These costs include insurance, depreciation and interest on investment.

A. Operating Costs

1. Fertilizer:

Years 1-5 of production	154 lb/acre of 46-0-0 (N source) 78 lb/acre of 11-51-0 (P source) 67 lb/acre of 0-0-60 (K source)
Year 6 and beyond	122 lb/acre of 46-0-0 (N source) 78 lb/acre of 11-51-0 (P source) 67 lb/acre of 0-0-60 (K source)

The average price for these fertilizers in Delta Junction in 1982 was $245/ton for 46-0-0, $325/ton for 11-51-0, and $270/ton for 0-0-60.

2. **Seed:** Seed prices for Lidal and Galt, the common varieties grown in the Tanana Basin, was $22/cwt in 1982. The average seeding rate was 65 lb/acre.

3. **Fuel:** Diesel fuel in 1982 averaged $1.15/gal, gasoline $1.33/gal. (An average of $1.23/gal was used for combine fuel). Where fuel consumption could be obtained from farmers for particular implements, these figures were used. Where it could not, standard consumption from Farm Machinery Costs as a Guide to Custom Rates, Alberta Agriculture, Farm Business Management Branch, Agdex 825-4, 1982, and Farm Power and Machinery Management, Iowa State University Press, Ames, 1977, were used.

4. **Hired Labor:** An average price of $7 per hour was used. Farmers in Delta Junction in 1982 paid $4/hour for laborers, $7/hour for general farm workers and $10/hour for specialty operators.

5. **Herbicide:** Control is necessary for broadleaf weeds. The herbicide commonly used is 2-4, D with an application rate of one pint per acre. The average price in 1982 was $12.20/gal.

6. **Repair and Maintenance:** A standard percentage of five percent of new cost was applied for equipment and two percent for buildings, shop and office equipment, and storage and drying facilities.

7. **Interest and Operating Capital:** An eight percent rate, that charged by the agricultural Revolving Loan Fund (ARLF), was used assuming that the loan was obtained on April 1 and repaid October 1.

B. Ownership Costs

1. **Insurance:** Insurance was assumed to be carried on equipment only. A rate of $3.30 per $1,000 new cost was used.

2. **Interest on Investment:** Interest on Investment (IOI) was calculated using a standard formula which averages the interest paid over the lifetime of the loan. An interest rate of eight percent was used for equipment and buildings. Land loan interest rate was 10 percent. Clearing loan interest was eight percent.

$$IOI = \frac{(\text{loan amount}) + (\text{salvage value})}{2} (\text{interest rate})$$

To obtain the cost per acre, IOI is divided by the number of acres farmed, in the case of equipment and buildings, and the number of acres purchased, in the case of land and clearing loans.

3. **Depreciation:** Calculations were made using the straight line method. It was assumed that equipment had a life time of seven years (the duration of ARLF loans on equipment) and a salvage value of 20 percent of new cost. Life time of building and drying and storage facilities was considered to be 20 years (ARLF loan duration). Buildings were given a zero salvage value, drying and storage facilities a slavage value of 20 percent of new cost.

4. **Loan Conditions:** Loans for equipment, buildings, drying and storage facilities were considered to be financed at the 75 percent level, that is, 25 percent equity is required from the borrower. Ninety-five percent of the land cost is financed and 100 percent of the land clearing cost is financed.

An annual budget for a farm producing 2,600 acres of barley on 3,000 acres with a yield of 1.5 tons per acre, land price of $25 per acre, facing a market price of $125 per ton is illustrated in Table 2. The farm is assumed to be in full production after year six and thus is using the reduced amount of fertilizer.

The annual budgets are useful for short-term planning. In the short term, the farmer is most concerned with annual operating cost rather than total cost. The annual decision to grow a crop is based on the operating cost. As long as crop receipts are above this cost, it is in the farmer's best interest to produce since he will at least minimize losses even though

all ownership costs are not covered. In the long term however, all costs must be covered in most years if the farmer expects to stay in business.

Table 3 illustrates the manner in which the amount remaining to cover ownership costs can be calculated from the annual budget in Table 2. A management return has been subtracted prior to calculating the amount which could be applied to ownership costs. This is an arbitrary figure and could be eliminated if another source of income is available. In the case shown, the $102.23 would totally cover ownership costs of $56.31.

Table 2. Annual Budget for 2,600 Acres in Production

ITEM	$/ACRE	ASSUMP:	AMOUNT
GROSS RECEIPTS FROM PRODUCTION	187.50	ACRES IN PRODUCTION	2600.00
		LAND PRICE- $/ACRE	25.00
CASH COSTS		BARLEY YIELD- T/ACRE	1.50
CASH OPERATING COSTS:		BARLEY PRICE- $/TON	125.00
FERTILIZER	46.57		
SEED	13.09		
HERBICIDE	1.53		
FUEL			
EQUIPMENT			
TILLAGE	1.36		
FERTILIZER	0.29		
SEED	0.29		
SWATH	0.20		
COMBINE	1.42		
MISCELLANEOUS	0.40		
TRUCKS			
FERTILIZER	0.17		
SEED	0.05		
COMBINE	0.80		
HIRED LABOR	15.19		
DRYING	8.25		
INTEREST ON OPERATING CAPITAL	3.68		
TOTAL CASH OPERATING COST	93.29		
CASH OVERHEAD COST:			
REPAIR AND MAINTENANCE			
EQUIPMENT	1.72		
TRUCKS	0.03		
BUILDINGS	0.02		
INSURANCE			
EQUIPMENT	0.69		
BUILDINGS	0.00		
TOTAL CASH OVERHEAD COST	2.46		
TOTAL CASH COSTS	95.75		
EARNINGS AFTER CASH COSTS	91.75		
NON-CASH COSTS:			
INTEREST ON INVESTMENT			
EQUIPMENT	8.28		
BUILDINGS	0.84		
STORAGE AND DRYING	1.24		
LAND CLEARING	16.00		
TOTAL INTEREST ON INVESTMENT	26.36		
EARNINGS AFTER INTEREST ON INVESTMENT	65.39		
DEPRECIATION			
EQUIPMENT	24.90		
BUILDINGS	0.89		
STORAGE AND DRYING	1.31		
TOTAL DEPRECIATION	27.10		
EARNINGS AFTER DEPRECIATION	64.65		
EARNINGS AFTER DEPRECIATION AND INTEREST ON INVESTMENT	38.29		
LAND CHARGE	2.85		
EARNINGS AFTER LAND CHARGE	88.90		
EARININGS AFTER LAND CHARGE AND DEPRECIATION	61.80		
EARININGS AFTER LAND CHARGE,DEPRECIATION AND INTEREST ON INVESTMENT	35.44		

*AFTER REACHING FULL PRODUCTION, CASH COSTS ARE REDUCED BY $16.04/ACRE DUE TO A REDUCTION IN FERTILIZER COST

Table 3. Amount Remaining After Operating Costs Have Been Paid

	TOTAL	PER/ACRE	CASE:	$
PRODUCTION RECEIPTS	487500.00	187.50	BARLEY PRICE-$/T	125.00
LESS: PRODUCTION COSTS	201695.00	77.58	BARLEY YIELD-T/ACRE	1.50
RETURN TO PRODUCTION COSTS	285805.00	109.92	LAND PRICE-$/ACRE	25.00
LESS: MANAGEMENT RETURN	20000.00	7.69	ACRES IN PRODUCTION	2600.00
REMANINING TO APPLY TO OWNER COSTS	265805.00	102.23		

II. CASH FLOW

Cash flows were developed from the annual budgets. In place of the average investment costs used in the annual budgets, the amortized yearly payment were applied. All loan conditions were the same as those used in the annual budgets.

To caluclate the cash flows, it was also necesssary to formulate a development and payment schedule, a schedule of purchases of equipment, buildings, and drying and storage facilities, and the rate at which maximum yields were reached and fertilizer applied.

A. Purchase and Payment Schedules

1. **Land:** Payments begin in 1984

2. **Clearing:** In 1983, 30 percent is completed. An additional 50 percent is completed in 1984. The final 20 percent in 1985. Payments begin in 1987 on the initial 30 percent ($60/acre). In 1988, they include the additional 50 percent ($160/acre) and in 1989 the full amount ($200/acre).

3. **Buildings** In 1985, 25 percent of the buildings are purchased with payments beginning in 1986. In 1986 and 1987, an additional 37.5 percent are purchased each year with payments beginning in 1987 and 1988.

4. **Equipment:** In 1985, 55 percent is purchased with payments beginning in 1986. In 1986 and 1987, an additional 22.5 percent is purchased each year with payments beginning in 1987 and 1988.

5. **Drying and Storage:** In 1986, 50 percent is purchased with payments beginnings in 1986. In 1987, the remaining 50 percent is purchased with payments beginning in 1988.

B. Land Development Schedules: The land development schedules were prepared considering three levels of potential yields.

Year	Acres Produced	Potential Yields		
		1.0 Ton/Acre	1.25 Ton/Acre	1.50 Ton/Acre
1985	520	1.00	1.00	1.00
1986	1,040	1.00	1.25	1.25
1987	1,560	1.00	1.25	1.25
1988	2,080	1.00	1.25	1.50
1989	2,600	1.00	1.25	1.50

In the sixth year of production (1990), fertilizer requirements were reduced as stated previously.

Cash flows were developed from the schedules. An example for a farm producing 1.5 tons per acre, a barley price of $125 per ton and a land price of $25 per acre is shown in Table 4. As can be seen, annual cash flow becomes positive in 1992. The positive annual cash flows are indicative of a farm which is in full production with and equipment complement (Table 1) sized to 2,600 acres and fertilization rates lowered after several crop years have been completed.

Table 4. Cash Flow For 2,600 Acres In Production

ANNUAL PROJECTED REVENUES AND EXPENSES
DELTA BARLEY PRODUCTION:3000 ACRE FARM

YEAR:	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
CASH RECEIPTS:										
PRODUCTION RECEIPTS			65000	146250	227500	325000	422500	455000	455000	455000
LOAN RECEIPTS										
LAND	71250									
CLEARING	180000	300000	120000							
OPERATING			46982	94813	142644	191324	240003	199997	199997	199997
BUILDING			10800	16200	16200					
EQUIPMENT			233700	95605	95605					233700
DRYING & STORAGE				31875	31875					
SALVAGE										62320
TOTAL RECEIPTS	251250	300000	476482	384743	513823	516324	662503	654997	654997	951017
DISBURSEMENTS:										
CASH PRODUCTION COST			43586	87173	130759	174346	217932	176228	176228	176228
CASH DRYING COST			3396	7640	11885	16978	22071	23769	23769	23769
INVESTMENT										
LAND	75000									
CLEARING	180000	300000	120000							
BUILDING			14400	21600	21600					
EQUIPMENT			311600	127473	127473					311600
DRYING & STORAGE				42500	42500					
TOTAL INVESTMENT	255000	300000	446000	191573	191573	0	0	0	0	311600
DEBT SERVICE (PRINC+INT)										
LAND		8369	8369	8369	8369	8369	8369	8369	8369	8369
CLEARING					15362	40965	51206	51206	51206	51206
BUILDING				1100	2750	4400	4400	4400	4400	4400
EQUIPMENT				44887	63250	81613	81613	81613	81613	81613
DRYING & STORAGE					3247	6494	6494	6494	6494	6494
OPERATING			48861	98605	148350	198977	249604	207997	207997	207997
TOTAL DEBT SERVICE	0	8369	57230	152961	241328	340818	401686	360079	360079	360079
TOTAL DISBURSEMENTS	255000	308369	550213	439347	575544	532141	641689	560076	560076	871677
YEARLY CASH CHANGE	-3750	-8369	-73730	-54605	-61721	-15818	20814	94921	94921	79341
CUMMULATIVE CHANGE	-3750	-12119	-85849	-140454	-202175	-217992	-197178	-102257	-7336	72005

Table 4 (continued). Cash Flow for 2,600 Acres in Production

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
455000	455000	455000	455000	455000	455000	455000	455000	455000	406250
199997	199997	199997	199997	199997	199997	199997	199997	199997	199997
233700	95605	95605					233700	95605	95605
62320	25495	25495					62320	25495	25495
951017	776096	776096	654997	654997	654997	654997	951017	776096	776096
176228	176228	176228	176228	176228	176228	176228	176228	176228	176228
23769	23769	23769	23769	23769	23769	23769	23769	23769	21223
311600	127473	127473					311600	127473	127473
311600	127473	127473	0	0	0	0	311600	127473	127473
8369	8369	8369	8369	8369	8369	8369	8369	8369	8369
51206	51206	51206	51206	51206	51206	51206	51206	51206	51206
4400	4400	4400	4400	4400	4400	4400	4400	4400	4400
81613	81613	81613	81613	81613	81613	81613	81613	81613	81613
6494	6494	6494	6494	6494	6494	6494	6494	6494	6494
207997	207997	207997	207997	207997	207997	207997	207997	207997	207997
360079	360079	360079	360079	360079	360079	360079	360079	360079	360079
871677	687549	687549	560076	560076	560076	560076	871677	687549	687549
79341	88547	88547	94921	94921	94921	94921	79341	88547	88547
72005	160552	249099	344020	438941	533862	628783	708124	796671	885219

ASSUMP:

	AMOUNT
ACRES IN PRODUCTION	2600.00
LAND PRICE - $/ACRE	25.00
BARLEY YIELD - T/ACRE	1.50
BARLEY PRICE - $/TON	125.00
OPERATING - $/ACRE	83.82
DRYING - $/BUSH	0.15
BUILDING - $	57600.00
LARGE EQUIPMENT- $	544546.00
SMALL EQUIPMENT - $	22000.00
DRYING & STORAGE - $	85000.00
FARM SIZE - TOTAL ACRE	3000.00
CLEARING PRICE - $/ACR	200.00
LAND DEBT SERVICE:	
@$25/ACRE	8369.00
@$50/ACRE	16738.00
@$100/ACRE	33476.00
INTEREST ON LAND (%)	10.00

Table 5. Net Present Value for 2,600 Acres in Production

PRESENT VALUE CASH FLOW

YEAR	RECEIPTS	CASH-OUT	NET-CASH FLOW	PRESENT VALUE-8%	PV-CASH FLOW	INVEST-MENT	PV-(8%) INVESTMENT	RATE-OF RETURN	
1983	0	0	0	0.93	0	255000	237150	PV OF CASH FLOW =	1558158.73
1984	0	0	0	0.86	0	300000	258000	PV OF INVESTMENT =	1513981.34
1985	65000	48861	16139	0.79	12750	446000	352340		
1986	146250	98605	47645	0.74	35257	191573	141764	NET PRESENT VALUE =	44177.40
1987	227500	148350	79150	0.68	53822	191573	130270		
1988	325000	198977	126023	0.63	79395	0	0	RATE OF RETURN =	0.03
1989	422500	249604	172896	0.58	100280	0	0		
990	455000	207997	247003	0.54	133382	0	0		
991	471250	208880	262370	0.50	131185	0	0		
992	549820	209763	340057	0.46	156426	311600	143336		
993	512995	209763	303232	0.43	130390	127473	54813		
994	512995	209763	303232	0.40	121293	127473	50989		
995	487500	209763	277737	0.37	102763	0	0		
996	487500	209763	277737	0.34	94431	0	0		
997	487500	209763	277737	0.32	88876	0	0		
998	487500	209763	277737	0.29	80544	0	0		
999	549820	209763	340057	0.27	91815	311600	84132		
000	512995	209763	303232	0.25	75808	127473	31868		
001	512995	209763	303232	0.23	69743	127473	29319		
					1558159		1513981		
990	455000	207997	247003	0.93	229713	255000	237150	PV OF CASH FLOW =	2187602.71
991	471250	208880	262370	0.86	225638	300000	258000	PV OF INVESTMENT =	1368662.29
992	549820	209763	340057	0.79	268645	446000	352340		
993	512995	209763	303232	0.74	224392	191573	141764	NET PRESENT VALUE =	818940.43
994	512995	209763	303232	0.68	206198	191573	130270		
995	487500	209763	277737	0.63	174974	0	0	RATE OF RETURN =	0.60
996	487500	209763	277737	0.58	161088	0	0		
997	487500	209763	277737	0.54	149978	0	0		
998	487500	209763	277737	0.50	138869	0	0		
999	549820	209763	340057	0.46	156426	311600	143336		
000	512995	209763	303232	0.43	130390	127473	54813	ASSUMPTIONS:	
001	512995	209763	303232	0.40	121293	127473	50989	LAND PRICE $/A =	25.00
					2187603		1368662	BARLEY PRICE $/T =	125.00
								YIELD T/ACRE =	1.50

III. PRESENT VALUE AND INTERNAL RATE OF RETURN

The net present value considers the time value of money. To calculate net present value, an appropriate discount rate (cost of capital) must be determined. The prevailing loan interest rate from the ARLF is presently eight percent. Negative net present values and internal rates of return were not calculated. This occurred for the cases listed in Table 6.

Table 6. Scenarios Resulting in Negative Average Returns to Total Costs

Land Price	Yield Tons/Acres	Price Per Ton
$10	1.00	$100
		125
	1.25	100
25	1.00	100
		125
		150
	1.25	100
	1.50	100
50	1.00	100
		125
		150
	1.25	100
	1.50	100
100	1.00	100
		125
		150
	1.25	100
		125
		150
	1.50	100

Twenty of the scenarios would not pay back total costs. This occurred for yields of 1.00 and 1.24 tons per acre and barley prices of $100 per ton for all land prices. Also, for all but the $10 per acre land price and $125 and $150 per ton and a yield of 1.00 tons per acre resulted in negative returns to total costs.

When the average earnings were positive, net present values and internal rates of return were calculated. These results are given in Table 7 as are the per acre average returns.

Table 7. Average Returns, Net Present Values and Internal Rates of Return for Scenarios Resulting in Positive Average Returns to Total Cost

Land Price Per Acre	Yield Tons/Acre	Price Per Ton	Average Returns Per Acre	Net Present Value	Internal Rate of Return
$ 10	1.25	$125		-	4%
		150		+	11
	1.50	100		-	4
		125		+	9
		150		+	15
25	1.25	125	$ 4.19	-	4
		150	35.44	+	11
	1.50	125	35.44	+	22
		150	72.94	+	14
50	1.25	125	1.34	-	3
		150	32.59	+	9
	1.50	125	32.59	-	7
		150	70.09	+	13
100	1.25	150	26.89		8
	1.50	125	26.89	-	7
		150	64.39	+	12

Note that the net present value will always be negative when the internal rate of return is less than eight percent since the discount rate selected was eight percent.

For a constant yield and price per ton, changes in land price from $10 to $25 per acre had little or no effect on the internal rate of return. An increase from $25 to $50 caused the internal rate of return to drop one to two percent as did an increase from $50 to $100. Increasing yield from 1.25 to 1.50 tons per acre increased internal rate of return between three and five percent. Increasing price from $125 to $150 per ton resulted in increases in internal rate of return of five to seven percent.

Even though the change in rate of return due to shifts in land price is less sensitive than to the change in barley yields and barley prices, the affect is still significant. This is important because land price is under the control of the state. The price that the state charges for agricultural land can have a major role in providing economic feasibility.

The internal rate of return varied from a minimum of less than one percent to a maximum of 15 percent. For those cases which had a positive net present value, the minimum internal rate of return was eight percent.

The higher rates of return correspond to the highest yield and barley prices. It is not considered unreasonable for yields of 1.5 tons per acre to be attained. The price of barley in Alaska will depend on demand and supply conditions in the state and demand and supply conditions of world feed grains. Past experience suggests that a price of $125 per ton is reasonable and, in fact, may be conservative.

If yield should drop to 1.25 tons per acre, the internal rate of return will be four percent for $10 and $25 per acre and three percent for $50 per acre. At $100 per acre, returns to total cost are negative.

Yields between 1.25 and 1.5 tons per acre at a barley price of $125 per ton will result in returns between four and nine percent at a land price of $10 and will bring negative to seven percent returns at a land price of $100 per acre. Thus the farmers' management ability and the price paid for the land wil play an important role in the decision to invest in a farming enterprise of the type discussed.

It is theoretically irrational for an individual to farm if the total benefit received is less than that received from an alternative investment. It is rational, however, for an individual to receive benefits from amenity values which are not monetary. The farmer may receive additional benefits from the farming operation because it is enjoyable, it is a desirable atmosphere in which to raise a family, or it is desirable to be one's own boss. Historically, farmers have been willing to accept an annual farm income lower than some other alternatives because of these and perhaps other similar reasons.

V. AGRICULTURAL LABOR

The importance of agricultural development can be illustrated using the Delta area as an example. Changes in employment associated with 50,000 and 100,000 acres of agricultural land were projected in 1976. It was assumed that the farms would be largely involved in small-grain production. Some livestock would be produced, but animal numbers would be insufficient to affect the number of jobs generated. Subsequent estimates of actual employment on large grain farms indicate a reasonable agreement with the 1976 projections. Using this data base, Table 8 indicates the impact on jobs that would occur if 500,000 acres were developed as family-type grain farms producing 2,500 acres of barley. The number of jobs created using a small-grain scenario only, both on and off the farms, by 1992 will be 2,250.

Table 8. Employment Associated with the Development of Grain Farms Totaling 500,000 Acres by 1992[a]

	1980	1984	1988	1992
On-farm employment (4.5 persons per farm - seasonal)	51	170	510	850
Off-farm employment (7 persons per farm)	84	280	840	1,400
TOTAL	135	450	1,350	2,250

[a] If livestock and other farming enterprises were included in these projections, employment both on and off the farm would be substantially increased.

Of all agricultural enterprises, small-grain farms are the least labor intensive. Employment is seasonal with peaks occurring during planting and harvest. If enterprises are diversified to include livestock, employment would increase and become less seasonal.

The development of new farms will encourage other agricultural enterprises. A nucleus for the expansion of poultry and vegetable production already exists in Alaska. Commercial greenhouses will benefit from the general expansion of agriculture. Grain production and the availability of by-products from meat and fish processing will provide a feed base for the expansion of fur farming. Historically, Alaskan furs have maintained a top position in the market place.

In summary, the implication is that a self-sustaining agricultural industry, which includes not only grain production but value-added products such as livestock and dairy products as well, will add jobs where they were not previously available. Additionally, these jobs will be year-round and should provide community stability, a factor inherent in agricultural development.

Chapter 5

Agricultural Land Demand

I. EXISTING PRODUCTION

Table 9 illustrates recent trends in cropland[1] planted and harvested in Alaska. Data for these 15 years indicate that production statewide has increased rather rapidly primarily as the result of the Delta I Agricultural Project. Table 10 shows the distribution of crops on harvested land.

Table 9. Cropland Statistics, 1981[a]

Year	Cropland Planted	Cropland Harvested
1967	17,425	16,970
1968	17,020	16,590
1969	16,895	16,230
1970	17,430	16,210
1971	19,310	17,825
1972	19,905	18,720
1973	20,005	18,865
1974	19,345	18,825
1975	20,335	19,815
1976	19,017	18,485
1977	19,005	18,382
1978	20,181	19,828
1979	20,432	19,988
1980	30,484	29,162
1981	36,881	25,173
Average	20,911	19,405

[a] Source: Alaska Crop and Livestock Reporting Service

[1] Includes land in oats, barley, grain mixtures, grass, potatoes, lettuce, cabbage, carrots, and miscellaneous vegetables.

Table 10. Acres Harvested, 1981[a]

Crop	Acres Harvested
Potatoes	500
Other vegetables	
Lettuce	100
Cabbage	41
Carrot	27
Miscellaneous	105
	273
Grains	
Oats	4,200
Barley	6,700
Grain mixtures	700
	11,600
Grass hay	12,800
TOTAL	25,173

[a] Source: Alaska Crop and Livestock Reporting Service

Like crop production, outputs of other agricultural commodities in the state are relatively minor at present when compared to production from any of the "lower 48" states. The production of these other commodities is shown in Table 11.

Table 11. Production of Selected Agricultural Commodities, 1981

Commodity	Unit of Measurement	Total
Beef and Veal	lbs dressed weight	749,000
Lamb and Mutton	lbs dressed weight	18,000
Pork	lbs dressed weight	293,000
Poultry	lbs dressed weight	231,000
Milk	lbs	13,400,000
Eggs	dozen	558,000

II. EXISTING CONSUMPTION/DEMAND

For some resource elements addressed in this report, a distinct difference exists between actual consumption or available supply and demand. For example, demand for remote recreation cabin sites currently exceeds land being made available for this purpose, and is, therefore, presently unfulfilled. Similarly, existing demand for particular minerals also appears to exceed currently mined supplies.

For agricultural commodities, however, no such gap exists between supplies available for consumption and supplies demanded even though at present Alaska is the most dependent state in the United States in terms of agricultural products (Table 12). People within and close to the study area, for the most part, can readily obtain food products comparable in quality and quantity to those available in the remainder of the United States, and far better than available in most countries throughout the world. For all intents and purposes, the population has sufficient supplies to consume what it demands.

The concern, however, in terms of resource issues and objectives considered in this report, is that many Alaskans have a strong desire to develop the state's renewable resources and become more self-sufficient. The term "self-sufficient" has strong implications when used in conjunction with the concept of demand. The fact that Alaska's demand for agricultural commodities is currently being met has little effect on Alaska's demand for both agricultural commodities and self-sufficiency.

A statewide goal or desire for self-sufficiency may result in negative economic impacts unless meeting this goal is subject to economic feasibility constraints. While most of Alaska's citizens favor the concept of self-sufficiency, there are many who do so only if sufficiency results in lower consumer prices than presently exist. Alaska prices tend to approximate Seattle, Washington prices plus transportation. This price differential suggests that in-state producers have an advantage over outside suppliers. While this is true at present, it is true in terms of transportation cost savings only. Other in-state costs such as labor and equipment often offset this transportation cost advantage.

Table 12. Existing Supply and Demand of Selected Agricultural Commodities[a]

Commodity	Per Capita Demand (lbs)[b]	Total Alaska Demand (1,000 lbs)	1981 Alaska Supply (1,000 lbs)	Imports to Alaska	
				Quantity (1,000 lbs)	Percent
Potatoes	74.8	31,580	9,500	22,080	69.9
Vegetables	158.3	66,832	2,320[c]	64,512	96.5
Beef & Veal	124.3[d]	52,478	749	51,729	98.6
Lamb & Mutton	20.3[d]	844	18	826	97.6
Pork	56.1[d]	23,685	293	23,392	98.8
Poultry	49.3[d]	20,814	231	20,583	98.6
Milk	546.0[e]	230,514	13,400	217,114	94.2
Eggs	35.4[f]	14,945	874	14,071	94.2

[a] Based on 1981 Alaska population of 422,187. Source: Alaska Population Overview - 1981, Alaska Department of Labor.
[b] USDA Agricultural Statistics and USDA Food Consumption, Prices and Expenditures (nationwide averages).
[c] Represents 1981 supply.
[d] Dressed weight - For poultry, dressed wt. and retail wt. are assumed to be equal.
[e] Represents milk equivalent of per capita demand for all dairy products.
[f] One case = 30 dozen eggs = 47 lbs (7.66 eggs = 1 lb).

III. ACREAGE REQUIRED TO SATISFY DEMAND

Since one of the objectives of this planning process is allocating lands for various uses, the figures in Table 11 must be translated into acres. However, because of differences in land quality and operator managerial ability, this translation relies heavily on yield projections. Table 13 has been prepared showing variability of barley yields in selected areas for the past three years for which data are available.

Table 13. Barley Yield[a] (Bushels/Acre)

Location	1978	1979	1980	Average
Alaska	37.5	49.5	29.5	38.8
U.S.	49.2	50.9	49.6	49.9
Canada	45.4	42.2	44.8	44.1
European Commonwealth	69.7	75.3	79.2	74.7
Finland	47.8	48.5	62.1	52.8
Norway	67.3	57.8	64.7	63.3
Sweden	67.1	61.9	70.3	66.4
Australia	26.8	27.9	20.3	25.0
South America	23.8	23.8	22.5	23.4
Asia	23.1	23.4	22.9	23.1
Africa	14.9	15.1	16.6	15.5
World Average	39.4	33.8	37.6	36.9

[a] Source: Derived from Agricultural Statistics, USDA, 1981.

The vast differences in yields among selected areas of the world reflect the availability (or lack) of three basic kinds of resources: physical resources (including environmental), technological, and human (management) resources. Lower yields in developing countries are primarily a function of limited technology and management skills, while higher yields

in developed nations indicate all three kinds of resources are available in substantial quantities. Several questions have arisen concerning the reasons for only mediocre yields for the U.S. as a whole. The most important reason is that, although the U.S. possesses all of the three basic resources, economics dictate that higher-value crops be grown on the best soils. As a result, much of the U.S. barley crop is grown on poorer soils, accounting for lower yield.

Currently, Alaska has a three year average barley yield of 38.8 bu/acre, which is approximately equal to the world average (36.9 bu/acre). One of the most overlooked explanations for Alaska's lower yields to date relates to management--lack of farmer experience in Alaska. Alaska has access to the best technology, adequate soils, and adequate growing season.

Because yields vary greatly in Alaska, the amount of land needed to satisfy demand for 100 percent self-suficiency in various agricultural products has been calculated using several alternative yield assumptions. Obviously, the higher the assumed yield, the less land is required to produce a particular quantity of product. Tables 14, 15, and 16 illustrate land required per capita to satisfy demand for particular items assuming various yields/acre. In other words, acreage figures shown in these tables indicate the amount of land required to produce the average person's annual intake of each commodity listed in the "item demanded" column. All "items demanded" shown are for human consumption with the exception of horses which are primarily for recreational use.

Table 14. Barley and Hay Land (Acres per Capita)

Item Demanded	Assumed Yield per Acre			
	40 bu. barley 1.0 tons hay	50 bu. barley 1.5 tons hay	60 bu. barley 2.0 tons hay	70 bu. barley 2.5 tons hay
Meat	2.154	1.681	1.385	1.178
Poultry	0.126	0.101	0.084	0.072
Eggs	0.092	0.074	0.061	0.053
Dairy	0.415	0.322	0.264	0.224
Horses	0.066	0.048	0.038	0.032
TOTAL	2.853	2.226	1.832	1.559

Table 15. Vegetable Land (Acres per Capita)

Item Demanded	Assumed Yield per Acre			
	70 Cwt	80 Cwt	90 Cwt	100 Cwt
All vegetables currently produced in Alaska	0.023	0.020	0.018	0.016

Table 16. Potato Land (Acres per Capita)

Item Demanded	Assumed Yield per Acre				
	9 tons (180 cwt)	10 tons (200 cwt)	11 tons (220 cwt)	12 tons (240 cwt)	13 tons (260 cwt)
Potatoes	.0042	.0038	.0034	.0031	.0029

When per capita land requirements are multiplied by population figures, the total demand for land for agricultural uses can be calculated.

IV. A LAND BASE MODEL

It is highley unlikely that Alaska will become totally self-sufficient in agricultural production at any time in the foreseeable future. However, a reasonable model based on a feed grain production system can be developed.

Adequate supplies of grain in the state would eliminate the cost of freight from the Pacific Northwest as a component of the feed-grain price in Alaska. The surplus not used by the in-state livestock industry would be available for export. The only way to encourage production of surplus feed grain is to provided an efficient system for accessing available export markets.

An efficient system for exporting feed grain required a critical volume of grain. A small export terminal at tidewater can be operated efficiently when 150,000 tons of grain are moved through the system. This volume would also lower transportation costs to in-state users.

With increases in grain supplies in Alaska, livestock producers could supply significantly more than the two percent of the red meat marketed in the state. Alaskan milk production could also be increased substantially above the current 15 percent. Slaughter facilities could efficiently process 100,000 hogs and 20,000 slaughter cattle annually in Alaska. These would supply approximately 43 percent of the pork market and 25 percent of the beef market in the state. As dairies at Point MacKenzie and other areas in the state expand milk production, raw milk supplied to Alaskan processors will increase. By the end of the decade, 75 percent of the

Alaskan market could be supplied by Alaskan producers. Expansion of the livestock industry will occur in areas of the state other than the Tanana Basin. This expansion is important to the basin, however, since it will provide markets for feed grains and other products produced.

Expansion of Alaska's livestock industry will not occur unless competitively priced feed grains are available. With competitively priced feed grains, consumers also can expect food products from Alaskan poultry, sheep, and goats to increase. Expanding infrastructures for grain production would benefit farmers producing vegetable crops, oilseed crops, and seed for feed grains and grasses.

The major components of a model for Alaskan agriculture are:

- Competitively priced feed grain
- Expansion of the livestock and dairy industry
- Encouragement of production of other agricultural products.

The model must, by necessity, be land based. Sufficient cropland is needed to produce feed grain for the in-state market and provide sufficient volume for an efficient and cost-effective export system. This will provide feed grain in Alaska at a competitive price. Additionally, grazing lands and harvested forage will be required if cattle and sheep production are to be expanded. Projections of animal numbers are based on the volume needed for the efficient operation of facilities for meat and milk processing.

Parameters for animal production and the percentage of in-state markets supplied by Alaskan animal products are shown in Table 18. The acreage which will be needed to produce feed grains and harvest forage for

the livestock industry as well as feed grains for export is shown in Table 19. Much of this acreage is located in the Tanana Basin. Rangeland needs and acreage for other crops such as seed, oilseed, and vegetables are also listed, although those used for range will largely be located outside the basin.

Table 17. Production Parameters for a Model of Alaskan Agriculture

Product	Number of Animals[a]	Requirements Per Animal		Percentage of State Market Satisfied
		Type	Amount	
Beef Cattle	66,000	forage	2.00 acres[b]	---
Slaughter Cattle[c]	20,000	feed grain	1.45 acres[d]	25
Market Hogs	100,000	feed grain	.40 tons[e]	43
Dairy Cattle	6,000	feed grain forage	2.90 tons 4.00 acres	75

[a] Number of other animals such as poultry, sheep and goats were not estimated; rather acreage required for feed production was estimated.
[b] Based on an average of 1.6 ton/acre harvested.
[c] Only slaughter cattle are processed for the consumer market.
[d] Forage and range requirement included in Beef Cattle.
[e] Includes requirement for boars and sows.

Table 18. Crops and Acreage Required to Support the Agricultural Model

Crop	Amount Required (tons)	Acres Required
Feed Grain		
Slaughter Cattle	29,000[a]	
Market Hogs	40,000[b]	
Dairy	17,400[c]	
Other Livestock	10,000	
Total In-state	96,400	105,000[d]
Export	150,000	163,000[d]
Total Feed Grain	246,400	268,000[d]
Harvested Forage		
Beef Cattle	211,200	132,000[e,f]
Dairy	38,400	24,000[g]
Other Livestock		24,000
Total Harvested		180,000
Other Crops		
Feed Grain Seed		12,000
Other Seed, Oilseed, Vegetables & others		25,000
Total Other Crops		37,000
TOTAL CROPLAND		485,000
Grazing Land		
Beef Cattle		690,000[h]
TOTAL GRAZING		690,000

[a] 1.45 ton x 20,000 slaughter cattle = 29,000 tons
[b] .40 ton x 100,000 hogs = 40,000 tons
[c] 2.90 ton x 6,000 dairy cattle = 17,400 tons
[d] Assumes a yield of 1.15 ton per acres and that 1/4 of the land is fallow.
[e] 1.6 ton/acre x 66,000 beef cattle x 2 acres = 211,200 tons.
[f] Includes the harvested forage requirement for slaughter cattle.
[g] 1.6 ton/acre x 6,000 dairy cattle x 4 acres = 38,400 tons.
[h] 15 acres x 46,000 beef cattle (does not include 20,000 slaughter cattle) = 69,000 acres.

Chapter 6

Demand vs. Supply

SUPPLY AND DEMAND FOR AGRICULTURE

DEMAND

The gross area needed to meet current Alaskan demand for potatoes, vegetables, beef, lamb, pork, poultry, milk, and eggs is dependent on assumptions concerning both the percentage of the total demand that will be supplied from the Tanana Basin, and the crop yields of Alaskan soils.

Assuming that it would be economically feasible for the Tanana Basin to meet 100% of Alaska's demand for agricultural products, and that barley yields are in the 40 bushels per acre range, there will be a demand for approximately 485,000 acres.

The demand for Alaskan agricultural products from outside the state is dependent on the competitiveness of Alaskan prices on the world market. If Alaskan barley prices become competitive, there could be a large demand for land in the Basin for agriculture. (See Chapter 4 concerning the competitiveness of Alaskan barley on the world market).

SUPPLY COMPARED TO DEMAND

The total supply of lands with Class II and III soils in the Basin is approximately 1,214,000 acres. Already in the Tanana Basin approximately 115,000 acres of state land have been sold in large and small tracts for agriculture. The state has identified another 264,000 acres for small agriculture and the proposed Nenana-Totchaket large tract agriculture project. If these projects go, there will be a total of over 379,000 acres of agricultural land in the Basin. This is approximately 106,000 acres short of the 485,000 acres needed for the Tanana Basin to meet the likely statewide demand for agricultural products.

The demand for this number of acres could be met from the total supply of Class II and III soils in the Basin. However, only a small percentage of these acres are accessible by the existing transportation network, and the accessible areas are most likely to be economically feasible.

Chapter 7

Recommendations

I. STATEWIDE GOALS AND THEIR IMPLICATIONS FOR AGRICULTURE MANAGEMENT IN THE TANANA BASIN

A. Introduction

The preceding chapters describe existing and expected demand for agricultural products, the availability of agriculture lands to supply those products, and the economic feasibility of agricultural development. These analyses, together with the goals for agriculture laid out in the FY83 Statewide Natural Resources Plan, form the foundation for the management recommendations that follow.

B. Relationship of Statewide Agriculture Goals to the Tanana Basin

The Statewide Natural Resources Plan is the broadest of the plans developed by the Department of Natural Resources. It provides the context for the area plans, such as the Tanana Basin Area Plan, by setting forth goals and objectives for each resource. The Statewide Plan is used in formulating ADNR's budget and setting inventory and planning priorities.

The following goals and objectives were developed by the Division of Agriculture as part of their statewide framework to define the purposes and goals of agriculture in the state.

> **1. Economic Development and Quality of Life.** Develop an agricultural industry that contributes to state and local economies, without long-term subsidy, by providing increased employment, increased per-capita income, and opportunities for Alaskans to pursue an agrarian lifestyle.

Although it may not be economically feasible to bring all agricultural lands into production by 1990, potential agricultural lands should be preserved and managed so they will be available for future agricultural use. Should the state pursue a self-sufficient agricultural industry, the agricultural resources in the Tanana Basin would be essential in meeting a portion of the land base requirements for in-state production.

Sufficient agricultural soils (Class II and III) have been identified in the Tanana Basin to meet the projections for agricultural production to 1990. In addition to 115,000 acres of agricultural land already sold in the Tanana Basin, an additional 264,000 acres are proposed for sale by 1985. Assuming 65%[a] of this land comes into production by 1990, there will be a sufficient amount of land

[a]. Agriculture Element Paper, Susitna Area Plan, 1983

on which to test large scale agriculture. Although the long term feasibility of agriculture exports is uncertain under current market conditions, it is important to have enough land dedicated to agriculture to test its feasibility over a number of years. In the long term, exportation of agricultural products may be feasible and it would be wise to set aside sufficient land for this possibility and thus not to preclude the option.

Therefore some agricultural lands should be designated for agriculture but not scheduled for sale at this point. As more land comes into agriculture production and if and when market conditions make sale of more agriculture land desirable, then these acres should be added to those scheduled for sale.

2. Providing Agricultural Products. Ensure the availability of nutritious and low cost agricultural food products produced in Alaska and lower the State's dependence on imported food.

If 100% of the vegetables and potatoes consumed within Alaska were grown in the state, 13-18,000 acres would be required to support the projected population by the year 1990. In the Tanana Basin, 115,000 acres have already been sold for agricultural development and 264,000 additional acres are scheduled for sale by 1985. This is enough land to amply meet in-state demand for vegetables and potatoes.

A self-sufficient livestock industry could require a land base for grain production of approximately 460,000 acres statewide by 1990. The 379,000 acres already allocated for agriculture in the Tanana Basin would contribute substantially to this industry. Including both past and currently planned agriculture sales statewide, this acreage could meet the entire statewide demand to the year 1990.

Current constraints to providing agriculture products are not related to the available land base but to efficient development of the land already allocated. In-state agricultural production would be furthered if existing farms produced higher yields more economically so there would be sufficient economic incentive to buy locally grown food products. Research and development of better methods and crops varieties better suited to the Interior would aid in lowering prices of locally grown crops.

3. Revenue for Farmers. Develop an agriculture industry that increases the value of farm production to farmers.

The preceding goals and policies address various issues which will help support the profitability of farm production. In addition to developing a more profitable agricultural industry, certain non-monetary values can also increase the value of farm production to individual farmers. Many potential farmers are interested in making a "living off the land" as opposed to large scale farming. The acres of small scattered parcels of Class II and III soils, too small for agricultural projects, could be used to provide homestead acreage on which farmers could pursue a lifestyle as well as agricultural production to contribute

to the local economy.

Improved production through better crop strains, improved management techniques and improved infrastructure will also increase benefits to farmers. Research can provide better crops strains and management techniques and education can assist individual farmers in using the most up-to-date technology. Continued sales of agricultural lands will encourage production to help support infrastructure necessary to economically process and market crops and commodities.

4. Conservation. Design and conduct all development programs to maintain the productive capability of Class II and III soils, and rangeland.

In order to protect resource values, Farm Conservation Plans should be required on all lands sold for agriculture production. These plans will incorporate appropriate ecologically sound agriculture practices developed by the Soil Conservation Service and other agencies with relevant expertise. In addition, agriculture parcel recipients should be encouraged to participate in SCS conservation programs.

Grazing potential is not identified for lands in the Tanana Basin and lands for this purpose will not be designated in the plan. However, guidelines for management of grazing lands will be developed. In order to allow flexibility and tailoring of requirements to local conditions, range management plans will be developed instead of standard guidelines for all areas. These plans will address stocking densities, water quality protection and other habitat and environmental concerns.

C. CONCLUSIONS

In conclusion, most of the statewide goals for agriculture are best pursued in the Tanana Basin by pursuing the proposed agriculture disposals and allocating those agriculture areas identified in the subregions.

The Tanana Basin can contribute to the state's goals for agriculture through the sale of lands already allocated for primary use agriculture. Based on current demand studies, there is sufficient land for agriculture to the year 1990 uf we assume that the Basin will meet up to 50% of the state's demand, based on the acreage already proposed for sale.

Class II and III soils should be designated for either agriculture or resource management wherever there is no conflict or where conflicts can be minimized through management guidelines. Where conflicts do exist and where lands are essential for other resources, the feasibility of designating land for agriculture will have to be evaluated. The designation of agricultural soils for resource management will protect the potential for agricultural use of those lands in the future if changing circumstances warrant such use. World needs and markets are continually changing. Agricultural needs of the state or changes in economic feasibility may someday make more land for agriculture necessary or desireable.

Meantime the way to meet statewide goals seems to be to increase productivity and improve the feasibility of development of existing agricultural lands. Ways to do this include emphasizing research and education, both for the industry in the Interior and for individual farmers.

II. MANAGEMENT RECOMMENDATIONS

A. Recommendations for Designations

The following goals and objectives were developed by the Division of Agriculture for management of agriculture lands in the Tanana Basin.

1. Lands to be Managed Primarily for Agriculture

There is presently enough land allocated to agriculture in the Tanana Basin to meet near term demand. Combined with acreage recommended in the Susitna Basin Plan, there is sufficient acreage to meet anticipated statewide demand to 1990. Some accessible agriculture lands will be designated for agricultural sale over the next 20 years for small agriculture and agricultural homesteads.

Land designated for agriculture but not scheduled for near term sale will be managed for other resource uses which do not preclude eventual use for agriculture.

2. Lands Where Agriculture Potential Needs to Be Protected

Although the state may not need additional agricultural land for production at present, changing needs and technology may produce different requirements and possibilities at some point in the future. The potential for export markets suggests that the bulk of prime state agricultural lands should be reserved for agricultural use in the event that long-term markets prove favorable. In order not to preclude opportunities for resource development in response to changing needs, capable soils should be designated for protection of agriculture values wherever this is practicable.

To accomplish this, the bulk of inaccessible areas of class II and III soils should be classified resource management with agriculture identified as a primary value. These lands should be managed for multiple use in ways that will not preclude the development of agriculture in the future and should be reevaluated when the plan is revised or whenever market conditions warrant.

B. Management Guidelines

1. Grazing

Natural grasslands in the Tanana Basin are scarce, but if the vegetation is altered many areas can support grazing. Grazing leases will be limited to consideration on marginal agriculture soils or good agriculture soils of limited extent. Other departments or divisions will be consulted prior to approval when improved pasture is proposed in a grazing lease. Although grazing lands benefit the agricultural industry, grazing activities often conflict with other land uses. Many of these problems can be mitigated by grazing policies and guidelines. These policies and guidelines will be addressed in the Statewide Natural Resources Plan.

2. Timber Salvage

It is generally agreed that the public should be compensated for the value of the timber on lands to be cleared for agriculture. Policies and guidelines for timber salvage will be addressed in the Statewide Natural Resources Plan.

3. Farm Conservation Plans

Farm conservation plans should incorporate appropriate ecologically sound agricultural practices developed by the Soil Conservation Service and other agencies with relevant expertise. It is the responsibility of the Soil Conservation Districts to act as liaisons between local farmers and agencies or institutions with agricultural expertise.

4. Water Quality

In the design and management of agricultural land uses, ensure that water quality is not degraded below standards designated by the Department of Environmental Conservation.

The following items shall be included in the development and approval of Farm Conservation Plans.

a. Width of undisturbed buffer strips along streams that are not excluded in the disposal plan;

b. Method of vegetative waste disposal produced during land clearing.

c. Identification of personal use wood lot sites, to be managed by the owner according to the Forest Resources Practices Act

5. Research and Educational Needs

In addition to periodic evaluations necessary in determining future sales, continuing research and improved educational services may significantly contribute to successful agricultural development.

A. Research needs

(1) Plant materials: As indicated by recent economic feasibility studies, on-farm economic success is most sensitive to plant yields, management and commodity prices. Continuing research of plant strains best suited to Alaska's climate and appropriate crop and soil management may improve yields which could offset Alaska's relatively high production costs.

(2) Range inventories: More detailed evaluation and inventory of potential grazing areas will expedite leasing of publicly owned lands for domestic livestock grazing, which may help keep feed costs down.

(3) Economics of on-farm feasibility:

a) Diversified farming may provide better returns than single crop production to the agricultural industry. The Division of Agriculture is currently evaluating the success of diversified operations on small and medium size farms. Continued study may provide information on optimum crop rotations and investment scheduling which may help improve farm management.

b) Farm surveys: Little historical data exists regarding costs of production, crop management and yields. Surveys could provide necessary information which would be useful in determining crop budgets, expected yields and improved management techniques.

c) Forecasting: Projecting future price trends, production costs and demand are necessary in planning sales far enough in advance to allow land to be available and in production to benefit from expected market conditions.

B. Educational services

Educational services are needed on a regular basis for all farmers to be kept abreast of plant and soil research findings; management techniques including conservation, optimum crop rotations and farm financing and accounting; and future investments based on forecast information.

6. Water Quality

Protect and maintain water quantity and quality both for and from agricultural development.

Appendices

SOIL CLASS DESCRIPTIONS

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIc.—Soils for which the choice of crops is limited only by climatic factors.

Management group 1 (IIc–1): Deep, medium- to coarse-textured, well-drained, alluvial soils; permafrost deep or absent.

Management group 2 (IIc–2): Deep, medium-textured, well-drained, nearly level soils of uplands; not susceptible to thermokarst pitting after clearing.

Management group 3 (IIc–3): Deep, medium-textured, moderately well drained, nearly level soils of uplands; susceptible to thermokarst pitting after clearing.

Subclass IIe.—Soils subject to moderate erosion if not protected.

Management group 4 (IIe–1): Deep and moderately deep, medium-textured, well-drained, gently sloping soils; not susceptible to thermokarst pitting after clearing.

Management group 5 (IIe–2): Deep, medium-textured, moderately well drained, gently sloping soils of uplands; susceptible to thermokarst pitting after clearing.

Subclass IIs.—Soils that have moderate limitations because of shallowness to excessively permeable substrata.

Management group 6 (IIs–1): Moderately deep, well-drained, medium- to coarse-textured, alluvial soils; permafrost deep or absent.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Subclass IIIe.—Soils subject to severe erosion if they are cultivated and not protected.

Management group 7 (IIIe–1): Deep and moderately deep, medium-textured, well-drained, moderately sloping soils; normally not susceptible to thermokarst pitting after clearing.

Management group 8 (IIIe–2): Deep, medium-textured, moderately well drained, moderately sloping soils; susceptible to thermokarst pitting after clearing.

Subclass IIIs.—Soils that have severe limitations caused by shallowness to excessively permeable substrata or bedrock.

Management group 9 (IIIs–1): Shallow, medium- to coarse-textured, well-drained, alluvial soils; permafrost deep or absent.

Management group 10 (IIIs–2): Shallow, medium-textured, well-drained, gently sloping soils.

Subclass IIIw.—Soils that have severe limitations because of excess water.

Management group 11 (IIIw–1): Deep, medium-textured soils of the alluvial plain; imperfectly drained because of permafrost within 30 inches of soil surface.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe.—Soils subject to very severe erosion if they are cultivated and not protected.

Management group 12 (IVe–1): Deep and moderately deep, medium-textured, well-drained, moderately steep soils.

Subclass IVs.—Soils that have very severe limitations caused by shallowness to excessively permeable substrata or to bedrock.

Management group 13 (IVs–1): Shallow to very shallow, medium to coarse-textured, well-drained to excessively drained, level to moderately sloping soils.

Subclass IVw.—Soils that have very severe limitations for cultivation because of excess water.

Management group 14 (IVw–1): Deep, medium-textured, poorly drained, level to sloping, alluvial soils that are underlain by permafrost.

Management group 15 (IVw–2): Deep, medium-textured, gently sloping to moderately sloping soils in upland drainageways and on north-facing hillsides; poorly drained because of high permafrost table.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range.

Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protection is not maintained.

Management group 16 (VIe–1): Deep and moderately deep, medium-textured, well-drained, steep soils.

Subclass VIs.—Soils generally unsuitable for cultivation and severely limited for other uses by shallowness to bedrock.

Management group 17 (VIs–1): Shallow to very shallow, medium-textured, well-drained, moderately sloping to moderately steep soils.

Subclass VIw.—Soils severely limited by excess water and unsuitable for cultivation.

Management group 18 (VIw–1): Deep, medium-textured, moderately steep soils on north-facing hillsides; poorly drained because of high permafrost table.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation and restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.—Soils unsuited to cultivation and severely limited by risk of erosion if cover is not maintained.

Management group 19 (VIIe–1): Medium-textured, well-drained, steep to very steep soils.

Subclass VIIw.—Soils unsuited to cultivation and very severely limited by excess water.

Management group 20 (VIIw–1): Shallow, medium-textured, moderately steep to very steep soils on north-facing slopes; poorly drained because of a high permafrost table.

Management group 21 (VIIw–2): Peat soils with a high permafrost table.

Class VIII. Soils and land types that have limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife, or esthetic purposes.

Subclass VIIIs.—Land types that are too stony to support commercial plants.

Management group 22 (VIIIs–1): Nonsoil areas.

Subclass VIIIw.—Land types that are too wet to support commercial plants.

Management group 23 (VIIIw–1): Annually flooded areas.

Appendix 3B
Criteria Physical Capability Map for Agriculture

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
Eft-m	Typic Cryofluents - Loamy - Nearly level to rolling MLRA's 174,175, 176	X (Good)				
	MLRA 173			X (Poor)		
Eft-g	Typic Cryofluents - Very gravelly		X (Fair)			
Sc (Salchaket)	Coarse loamy mixed Non-acid Typic Cryofluents	II-c				
Tt (Tokotna)	Coarse loamy Non-acid Typic Cryofluents		III-w			
Ja (Jarvis)	Coarse loamy over sandy or sandy skeletal mixed, non-acid Typic Cryofluents	II-s				
Eot-m	Typic Cryorthents - Loamy Nearly level to rolling MLRA's 174,175, 176	X (Good)				
	MLRA 173		X (Fair)			

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
Eot-m (cont.)	- Loamy Hilly to steep			X (Poor)		
Kd (Kandik)	Coarse silty mixed calcareous Typic Cryorthents			IV-s		
Ch (Chena)	Sandy skeletal mixed Typic Cryorthents			IV-s		
On (Olnes)	Loamy skeletal mixed non-acid Typic Cryorthents			IV-s		
FA (Fairplay)	Loamy mixed Non-acid Pergelic Cryorthents				VI-e	
EOq-g	Aquic Cryorthents - Very gravelly - Hilly to steep					X
Eol-g	Lithic Cryorthents - Very gravelly - Hilly to steep					X
Eog-g	Pergelic Cryorthents - Very gravelly-nearly level to rolling					X
	- Very gravelly - Hilly to steep					X

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
Mk (McKinley)	Loamy skeletal mixed non-acid Pergelic Cryorthents				VII-e	
Est-c	Typic Cryopsamments - Sandy - Nearly level to rolling			X (Poor)		
	- Sandy - Hilly to steep					X
Tk (Teklanika)	Mixed Typic Cryposamments				VI-e	
HIi	Hydric-Borofibrists					X
Kp (Kantishna)	Dysic Hydric Borofibrists				VIII-w	
Hyp	Pergelic Cryofibrists					X
Lp (Lameta)	Dysic Pergelic Cryofibrists				VII-w	
Hm-p	Pergelic Cryohemists					X
Bo (Bolic)	Dysic Pergelic Cryohemists				VI-w	
IQw-m	Aeric Cryaquepts - Loamy - Nearly level to rolling	X (Good)				

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
Mn	Coarse silty mixed non-acid Aeric Cryochrepts	II-e				
	- Nearly level 0-3% slopes					
	- gently sloping 3-7% slopes	II-e				
	- moderately sloping 7-12% slopes		III-e			
	- strongly sloping 12-20% slopes			IV-e		
IQuw-m	Aerichumic Cryaquepts		X (Fair)			
	- Loamy nearly level to rolling					
Pn (Pincher)	Aeric-humic Cryaquepts			IV-w		
IQph-m	Histic pergelic Cryaquepts			X (Poor)		
	- Loamy nearly level to rolling					
	- Loamy - Hilly to steep					X
Gt (Goldstream)	Loamy mixed acid Histic, Pergelic Crya			IV-w		
Ks (Kuskokwim)	Loamy mixed acid Histic, Pergelic Cryaquepts				VII-w	

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
Kl (Kuslina)	Loamy mixed, non-acid Histic, Pergelic Cryaquepts				VII-w	
Su (Saulich)	Loamy mixed, non-acid Histic, Pergelic Cryaquepts			IV-w		
	- Nearly level 0-3% slopes					
	- Gently sloping 3-7%			IV-w		
	- Moderately sloping 7-12%			IV-w		
	- Strongly sloping 12-20%				VI-w	
	- Moderately steep 20-30%				VII-w	
	- Steep 30-45%				VII-w	
Ea (Easley)	Loamy, mixed, calcareous Histic-pergelic Cryaquepts			IV-w		
Yu (Yukon)	Coarse loamy mixed calcareous Histic-pergelic Cryaquepts				VII-w	
Gu (Goodpaster)	Loamy over sandy or sandy skeletal-mixed non-acid Histic Pergelic Cryaquepts			IV-w		

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
IQph-g	Histic pergelic Cryaquepts - Very gravelly nearly level					X
	- Very gravelly hilly to steep					X
Es (Ester)	Loamy, skeletal mixed acid Histic Pergelic Cryaquepts				VII-w	
Na (Nabesna)	Loamy, skeletal mixed acid Histic Pergelic Cryaquepts				VII-w	
IQp-m	Pergelic Cryaquepts - Nearly level to rolling MLRA's 174,175,176		X (Fair)			
	MLRA 173					X
	- Loamy - Hilly to steep					X
BA (Batza)	Loamy mixed non-acid Pergelic Cryaquepts			IV-w		
BR (Bradway)	Loamy mixed non-acid Pergelic Cryaquepts			IV-w		
Dt (Dot Lake)	Loamy mixed non-acid Pergelic Cryaquepts		III-w			

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
TA (Tanana)	Loamy mixed non-acid Pergelic Cryaquepts		III-w			
IQp-g	Pergelic Cryaquepts - Very gravelly - Nearly level to rolling					X
	- Very gravelly - Hilly to steep					X
In (Innesvale)	Loamy skeletal mixed, acid Pergelic Cryaquepts				VII-w	
KA (Karshner)	Loamy skeletal mixed, acid Pergelic Cryaquepts				VII-w	
IRt-m	Typic Cryochrepts - Loamy - Nearly level to rolling MLRA 173			X (Fair)		
	MLRA's 174,175, 176	X (Good)				
	- Loamy - Hilly to steep			X (Poor)		
Ky (Koyukuk)	Coarse silty mixed Typic Cryochrepts		III-e			
RA (Rampart)	Coarse silty mixed Typic Cryochrepts		III-e			

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
Mc (McCloud)	Coarse silty mixed Typic Cryochrepts				VI-e	
IRt-c	Typic Cryochrepts - Sandy - Nearly level to rolling		X (Fair)			
	- Sandy - Hilly to steep			X (Poor)		
BE (Beales)	Sandy mixed Typic Cryochrepts				IV-s	
IRt-g	Typic Cryochrepts - Very gravelly - Nearly level to rolling MLRA 173		X (Fair)			
	MLRA's 174,176		X (Fair)			
	- Very gravelly - Hilly to steep			X (Poor)		
Ne (Nenana)	Coarse silty over sandy or skeletal mixed Typic Cryochrepts - Moderately deep - Nearly level	II-c				
	- Moderately deep - Undulating	II-e				
	- Moderately deep - Rolling		III-e			
	- Shallow - Nearly level		III-s			

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
	- Shallow - Undulating		III-e			
	- Shallow - Rolling		III-e			
	- Shallow - Hilly			IV-e		
Lv (Livengood)	Coarse silty over fragmental mixed Typic Cryochrepts 0-3% Slopes	II-c				
	3-7% Slopes		III-e			
	7-12% Slopes		III-e			
	12-20% Slopes			IV-e		
	20-30% Slopes				VI-e	
	30-45% Slopes				VII-e	
FA (Fairbanks)	Coarse silty-mixed Alfic Cryochrepts - Nearly level 0-3% Slopes	II-c				
	- Gently Sloping 3-7%	II-e				
	- Moderately sloping 7-12%		III-e			
	- Strongly sloping 12-20%			IV-e		
	- Moderately steep 20-30%				VI-e	
	- Steep 30-45%				VII-e	
St (Sv) (Steese)	Coarse silty mixed Typic Cryochrepts - Moderately sloping 7-12%		III-e			

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
	- strongly sloping 12-20%			IV-e		
	- moderately steep 20-30%				VI-e	
	- steep 30-45%				VII-e	
IRF-g	Alfic Cryochrepts - very gravelly - hilly to steep			X (poor)		
Gm (Gilmore)	Loamy skeletal mixed, Alfic Cryochrepts - gently sloping 3-7% slopes		III-e			
	- moderately sloping 7-12%			IV-e		
	- strongly sloping 12-20%			IV-e		
	- moderately steep 20-30%				VI-e	
	- steep 30-45%				VII-e	
	- very shallow - gently sloping 3-7%			IV-e		
	- very shallow - moderately sloping 7-20%				VI-e	
	- very shallow - moderately steep 20-30%				VII-e	
	- very shallow - steep 30-45%				VII-e	

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
IRq-m	Aquic Cryumbrepts - loamy	X (Good)				
Rc (Richardson)	Coarse silty mixed Aquic Cryochrepts	II-c				
IRq-g	Aquic Cryochrepts -very gravelly	X (Good)				
Vk (Volkmar)	Coarse silty over sandy skeletal mixed Aquic Cryochrepts	II-c				
IRd-g	Dysteric Cryochrepts - very gravelly - hilly to steep			X (Poor)		
Hu (Hughes)	Loamy skeletal mixed Typic Cryochrepts - strongly sloping 12-20%			IV-e		
	- moderately steep 20-30%				VI-e	
	- steep 30-45%				VII-e	
Icl-g	Lithic Cryochrepts - very gravelly					X
Ch (Cheshnina)	Loamy skeletal mixed Lithic Cryochrepts - moderately sloping 7-12%				VI-e	
	- strongly sloping 12-20%				VI-e	

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
	- moderately steep 20-30%				VI-e	
Ip-g	Pergelic Cryochrepts - very gravelly					X
IUp-g	Pergelic Cryumbrepts - very gravelly nearly level to rolling					X
	- hilly to steep					X
Ut (Utopia)	Loamy skeletal mixed Pergelic Cryumbrepts				VII-e	
IUp-m	Pergelic Cryumbrepts - loamy					X
Sot-m	Typic Cryorthents - loamy - nearly level to rolling	X (Good)				
	- hilly to steep			X (Poor)		
To (Toklat)	Coarse loamy mixed orstein Typic Cryorthods		III-s			
Sot-c	Typic Cryorthods - sandy - nearly level to rolling		X (Fair)			
	- hilly to steep			X (Poor)		

Appendix 3B (cont.)

AGRICULTURAL RANKING

Map Symbol	Soil Type	Class II (Red)	Class III (Green)	Class IV (Blue)	Greater Than Class IV (Yellow)	Unsuitable (Blank)
Sol-g	Lithic Cryorthods - very gravelly - hilly to steep					X
SOp-g	Pergelic Cryorthods - very gravelly - nearly level to rolling					
	- hilly to steep					X