BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HAT CREEK PROJECT

Canadian Bio-Resources Consultants Ltd. - Hat Creek Project - Detailed Environmental Studies - Agriculture - Volume I - Inventory - July 1978

ENVIRONMENTAL IMPACT STATEMENT REFERENCE NUMBER: 52a

B.C. HYDRO & POWER AUTHORITY

HAT CREEK PROJECT

DETAILED ENVIRONMENTAL STUDIES

AGRICULTURE

VOLUME I - INVENTORY

by

Canadian Bio Resources Consultants Ltd.

Surrey, B.C.

for

British Columbia Hydro & Power Authority

July 1978

CANADIAN BIO RESOURCES CONSULTANTS LTD.

PRIMARY RESOURCE SCIENCES, MANAGEMENT & ENGINEERING

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July 27, 1978

Letter of Transmittal

B.C. Hydro & Power Authority
555 West Hastings Street
Vancouver, B.C.
V6B 4T6

Attention: Mr. H.J. Goldie, Manager
Systems Engineering Division

Dear Sirs:

Hat Creek Detailed Environmental Studies
Agriculture
Final Draft Report

We are pleased to submit our final draft of the *Agriculture* report. It comprises two volumes, I - *Inventory* and II - *Impact Assessment*.

A summary of the study findings is provided as Section 1.0 in each volume.

We have appreciated the opportunity to undertake this study and hope that we may be of service in the future.

Yours truly,

G.F. Kennedy, P.Eng., P.Ag.
Study Manager

GFK/mh

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1.0 SUMMARY

1.1 INVENTORY

The *Agriculture* study is a Land Resources Subgroup component of the Hat Creek Detailed Environmental Studies conducted for British Columbia Hydro and Power Authority to assess the impact of their proposed 2000-MW thermal plant and associated coal mine in the Hat Creek valley of British Columbia.

The agricultural resource was described by three levels of information providing regional, local, and site specific perspectives for assessment. The broadest level of information was prepared for the Regional Study Area and mapped at the scale of 1:250,000. Intermediate level information was prepared for the Local Study Area and mapped at the scale of 1:50,000. The most detailed level of information was prepared for the Site Specific Study Area and mapped at the scale of 1:24,000. Besides the resource perspectives provided by the three study areas, resource use was also placed in the context of the Hat Creek basin because of the potential impacts that would relate to the valley-based agricultural industry of the area. Figure 2-1 and 2-2 show the location of the three study areas and of the Hat Creek basin.

(a) Regional Study Area

(i) Climate Capability for Agriculture

Climate, which varies widely from region to region in British Columbia, constrains agricultural use. Within the Regional Study Area there are areas that have some of the best agricultural

climate in the province and there are areas with poor climate for agriculture. The highest climate capability occurs at the lower elevations particularly along the benches of the Fraser and Thompson Rivers and the Nicola Lake and Kamloops Lake areas. These areas are limited by aridity and irrigation is required to produce most agricultural crops.

(ii) Land Capability for Agriculture

Land capability of the Regional Study Area was broken down on the following basis: land of high agricultural capability - 12 percent; land of grazing capability - 43 percent; land of limited or no agricultural value - 45 percent. The distribution of the high capability lands is largely a function of climate and occurs in the river valleys and on the plateaus of the northern part of the region. The Regional Study Area contains 30 percent of the provincial total of CLI agricultural capability class 1 land.

(iii) Agricultural Land Reserves

Within the Regional Study Area approximately 9190 km^2 (3547 mi^2) are included in the Agricultural Land Reserve (ALR) which represents 25 percent of the land area of the region and 20 percent of ALR land of the province. The majority of these lands are found adjacent to the major rivers and their tributaries and on the plateau areas north and west of Clinton.

(iv) Present Agricultural Use

The present agriculture of the Regional Study Area is primarily devoted to a cow/calf type of beef enterprise. The climate, soil and topography of the region provide the resources - productive river valleys that are well suited to forage production for winter

feed; and large tracts of grazing land that provide summer range pasture required for this type of enterprise. Beef cattle raised in the region are mainly sold as calves for finishing outside of the province.

On the basis of 1976 census statistics (Thompson-Nicola Census Division) present farmland in the area, 5476 km^2 (1,353,538 acres), represents 23 percent of the provincial total; beef cattle numbers, 135,119, represents 23 percent of provincial total; and area of forage production, 307 km^2 (75,971 acres) represents 11 percent of provincial total.

(b) Local Study Area

(i) Climate Capability for Agriculture

The Climate Capability for Agriculture Classification System was used to describe the varied climate of the Local Study Area. In general, the climate of most of the Local Study Area is restricted by aridity or lack of moisture during the growing season and irrigation is required for crop production.

Class 1 climates are found in the valleys and associated benches of the Thompson, Fraser and Bonaparte Rivers. There are also isolated pockets of class 1 climate found in the Hat Creek valley. This class, which is suitable for the production of corn, occurs in 30 percent of the Local Study Area. Within the class 1 climate areas are subregions designated with a special class 1b climate that indicates suitability for the production of heat-loving crops such as tomatoes and vine crops. Class 1b climate areas are located on the lower benches and valley bottoms of the Fraser, Thompson and Bonaparte Rivers and make up 17 percent of the Local Study Area.

The benches adjacent to the class 1 areas generally have class 2 or 3 climates which are suitable for cool-loving vegetables like cabbage, forage crops, and most cereal grains. These two climate classes, which also occur in the Hat Creek valley make up 26 percent of the Local Study Area.

The remainder of the Local Study Area, which includes the lower and upper regions of the mountain areas, has climate capability of class 4 through 7. This area is limited to some extent by aridity but the major limitations to agricultural production are the short length of the frost free period and the low number of accumulated growing degree days. Class 4 and 5 climate areas, which are limited to forage production or native rangeland, make up 26 percent of the Local Study Area. Class 6 and 7 climate areas, which have respectively limited or no agricultural potential, make up 16 percent of the Local Study Area.

(ii) Land Capability for Agriculture

Land within the Local Study Area with capability for irrigated agriculture (based on the Land Capability for Agriculture Classification System) is found principally in the valleys and benches of the Thompson, Bonaparte and Fraser Rivers, on the plateaus east of Pavilion and in the Hat Creek valley. This land occupies a total of 260 km^2 (100 mi^2) which represents 13.2 percent of the Local Study Area.

Land of class 1 agricultural capability,capable of producing the very widest range of vegetables, cereal grains, forages, berry fruits and numerous specialty crops,occupies 37 km^2 (14 mi^2) or 1.9 percent of the Local Study Area. Lands with agricultural capability class 2, capable of producing a wide range of crops, occupy 19 km^2 (7.3 mi^2) or 1 percent of the Local Study Area.

Lands with agricultural capability classes 3 and 4, capable of producing a fairly wide range (class 3) to a restricted range (class 4) of crops, occupy 156 km^2 (60 mi^2) or nearly 8 percent of the Local Study Area. Land with agricultural capability class 5, limited to perennial forages, occupies 48 km^2 (18.5 mi^2) which represents 2.4 percent of the Local Study Area.

Lands with capability for grazing were identified in terms of grazing capability classes 1 through 5. High capability grazing lands (grazing capability classes 1, 2, and 3), principally located on the secondary benches adjacent to the rivers and on the lower elevations of the mountains in the Hat Creek drainage basin, occupy 907 km^2 (350 mi^2) or 46.2 percent of the Local Study Area.

(iii) Agricultural Land Reserves

Within the Local Study Area 529 km^2 (204 mi^2) are included in the Agricultural Land Reserves (ALR) which represents 27 percent of the total land area. ALR within the Hat Creek basin account for approximately 145 km^2 (56 mi^2).

(iv) Present Agricultural Use

Twelve of the 13 major farms in the Local Study Area are cattle ranching operations; the other is a commercial hay operation. The farms are composed of private (deeded) and Crown lease lands; the cattle operations also use forested Crown land for spring and summer grazing.

Presently irrigated lands of the Local Study Area and Hat Creek basin total 42 km^2 (17 mi^2) and 10.8 km^2 (4.2 mi^2) respectively. The major crops grown are those for cattle feed and include

alfalfa, alsike clover, orchard grass, reed canary grass, crested wheatgrass, timothy, and corn.

The rangeland of the Local Study Area and Hat Creek basin totals 1880 km^2 (726 mi^2) and 630 km^2 (243 mi^2) respectively. The number of cattle presently stocked on the Crown permit ranges of the Local Study Area and Hat Creek basin was estimated to be 5100 and 2050 respectively.

The lower grassland ranges, with a present stocking capacity of something poorer than 2.4 ha-AUM^{-1} (6 acres-AUM^{-1}) and perhaps as poor as 5-ha AUM^{-1} (12.4 acres-AUM^{-1}) indicate a relatively poor condition of these grasslands compared to a potential carrying capacity of around 0.8 ha-AUM^{-1} (2 acres-AUM^{-1}) under excellent range conditions. The more productive areas of the mid-elevation ranges with present carrying capacities better than 2.0 ha-AUM^{-1} (5 acres-AUM^{-1}) are again in relatively poor condition when compared to the 0.4 ha-AUM^{-1} (1 acre-AUM^{-1}) maximum potential carrying capacity. The higher elevation ranges although of lower absolute productivity are in relatively better condition when compared to their maximum potential. On the average these lands in their current condition support roughly 65 percent of their maximum potential, 6 ha-AUM^{-1} (15 acres-AUM^{-1}) compared to 4 ha-AUM^{-1} (10 acres-AUM^{-1}).

Some conflict between agriculture and wildlife exists within Hat Creek basin. The principal wildlife species that are involved are deer, elk, to a limited degree, sheep on the upper ranges, and waterfowl. These conflicts have resulted mainly due to the overgrazing of portions of the range resource by domestic livestock.

(c) Site Specific Study Area

Inventory information for the Site Specific Study Area is predominantly in mapped form and composed largely of information presented for the Local Study Area. Additional information includes soil series survey and present irrigation water use.

Twenty-five soil series units of a total 82 mapped for the Site Specific Study Area were rated as being significant for arable agriculture or irrigated pasture use. Most of the remaining soil units were rated as being significant for grazing use.

The total annual quantity of irrigation water licenced for diversion within the upper Hat Creek valley is 859 ha-m (6964 acre-ft). Almost half of this quantity, 382 ha-m (3097 acre-ft), is for use outside upper Hat Creek valley; including 222 ha-m (1800 acre-ft) diverted for irrigation of the Thompson River lowlands within the Site Specific Study Area. The principal sources are Hat Creek, licenced for 294 ha-m (2383 acre-ft) and Medicine Creek licenced for 236 ha-m (1913 acre-ft). Within the Cornwall and Cheetsum drainages which approximate the eastern portion of the Site Specific Study Area, 125 ha-m (1013 acre-ft) are licenced for annual diversion.

2.0 INTRODUCTION

The *Agriculture* study is a Land Resource Subgroup component of the Hat Creek Detailed Environmental Studies conducted for British Columbia Hydro and Power Authority to assess the impact of their proposed 2000-MW thermal plant and associated coal mine in the Hat Creek valley of British Columbia. Canadian Bio Resources Consultants Ltd., an agricultural consulting firm of Surrey, British Columbia was commissioned in July 1976 to carry out the *Agriculture* study.

The results of the study work are presented in two volumes. Volume I - *Inventory* describes the agricultural resource of the area in terms of climate capability and land capability for agriculture, Agricultural Land Reserves, and present agricultural use. Volume II - *Impact Assessment* describes the impact of the project on the agricultural resource primarily by comparing the projection of probable future agricultural use with the project to the projection of probable use without the project.

2.1 TERMS OF REFERENCE

The purpose of the Detailed Environmental Studies as per the Terms of Reference dated June 1977 prepared by the client is:

> *"Identify and evaluate the effects of the design alternatives of the proposed Hat Creek coal mine, associated thermal generating station and offsite facilities on the natural and cultural resources of the area, both in the short and in the long term. Compare these with the evolution of the area and its resources without the project. Assist in the development of practical mitigation measures. In cooperation with the*

design consultants and B.C. Hydro, ensure a satisfactory compromise between environmental constraints and engineering requirements."

The terms of reference for the *Agriculture (Appendix A-4)* study as per the above June 1977 document are as follows:

"1. Map Agricultural Land Reserves.

2. In consultation with ranchers and range specialists, determine agricultural land use and capabilities. (Consider climate, soil type, acreage and crop suitability. Land use should include livestock inventory, crops, farm structures, etc.)

3. Describe relationships with other resource uses.

4. Provide input to Resource Evaluation for Environmental Account (Appendix C-3).

5. Assess feasibility of application of waste heat tc agricultural production. Estimate increase in average production for proposed crops or livestock through the addition of water.

6. Establish criteria (specifications) for water for irrigation.

7. List crop species which are inadvisable due to sensitivity to plume contents and concentrations. Consider greenhouse crops, ornamentals, house plants, cut flowers, etc. which may be grown under cover but utilize ambient air.

8. Assess impact of project on agricultural land use and capability."

In addition, the following terms of reference of the *Physical Habitat and Range Vegetation (Appendix A-1)* component were assigned to the *Agriculture* study.

> *"1. Assess forage productivity, present and potential carrying capacity and present conditions of range areas (include land capability for grazing);*
>
> *2. Study relative utilization of range by livestock and wildlife and relate to productivity;*
>
> *3. Identify sensitivity of range components to construction and operation activities. Where possible, include quantitative impacts. Note maximum exposure limits, regulatory requirements and sensitive species (liaison required with air programme to identify sensitive areas);*
>
> *3. Identify potentially irrigable lands which could serve as possible compensation measures and establish their feasibility, productivity, and costs. Identify specifications for water quality for irrigation water with view to using plant waste water."*

In fulfillment of these terms of reference, definition of the task work (emphasis, scope, and methodology) was made at the outset of the study by Canadian Bio Resources Consultants Ltd. and was revised as the study progressed in response to more refined definitions of project character as provided by British Columbia Hydro and Power Authority and to the needs of other consultants of the Detailed Environmental Studies.

The assessment of the sensitivity of agricultural crops and range vegetation to air emissions is contained within a separate report by Dr. V.C. Runeckles *Assessment of Airborne Emissions on Vegetation, Proposed Hat Creek Project, B.C. Hydro and Power Authority*[1]. This report was used in describing the impact of air emissions on the agriculture resource as reported herein.

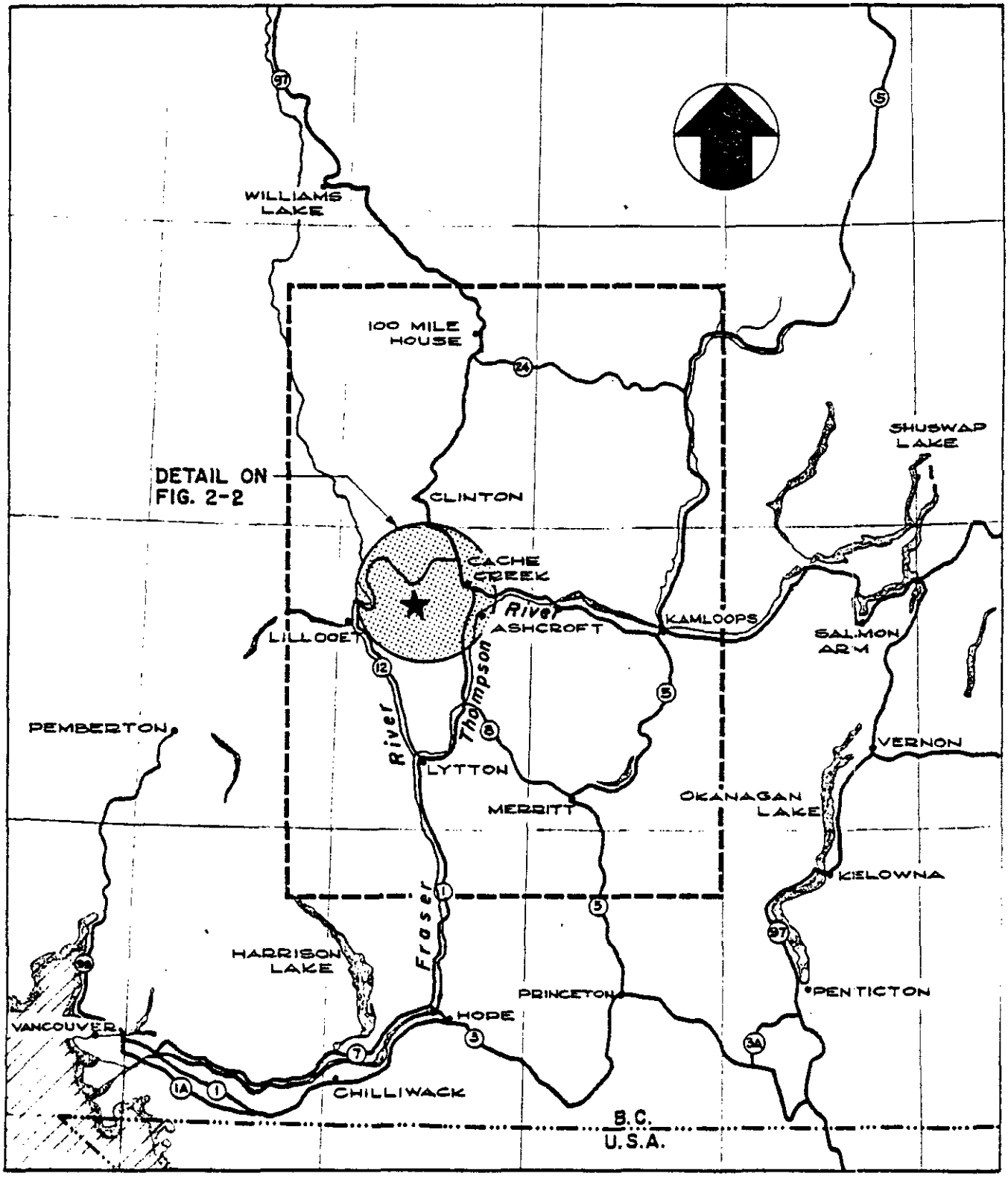
2.2 SCOPE

The agricultural resource was described by three levels of information providing regional, local, and site specific perspectives for assessment.

The broadest level of information was prepared for the Regional Study Area and mapped at the scale of 1:250,000. The Regional Study Area (see Figure 2-1) is defined by a western boundary Approximately 45 km (27.9 mi) west of Lytton, a northern boundary approximately 20 km (12.4 mi) north of 100 Mile House, an eastern boundary approximately 25 km (15.5 mi) east of Kamloops, and a southern boundary approximately 35 km (21.7 mi) south of Merritt. The total area for the regional study is 36,800 km^2 (14,208 mi^2). The boundaries of the Regional Study Area were based on preliminary projections of the project "zone of influence" as provided by B.C. Hydro to the consultants. Resource information was largely obtained from published sources that provided uniform coverage for the area. This included various province-wide maps and data from Statistics Canada.

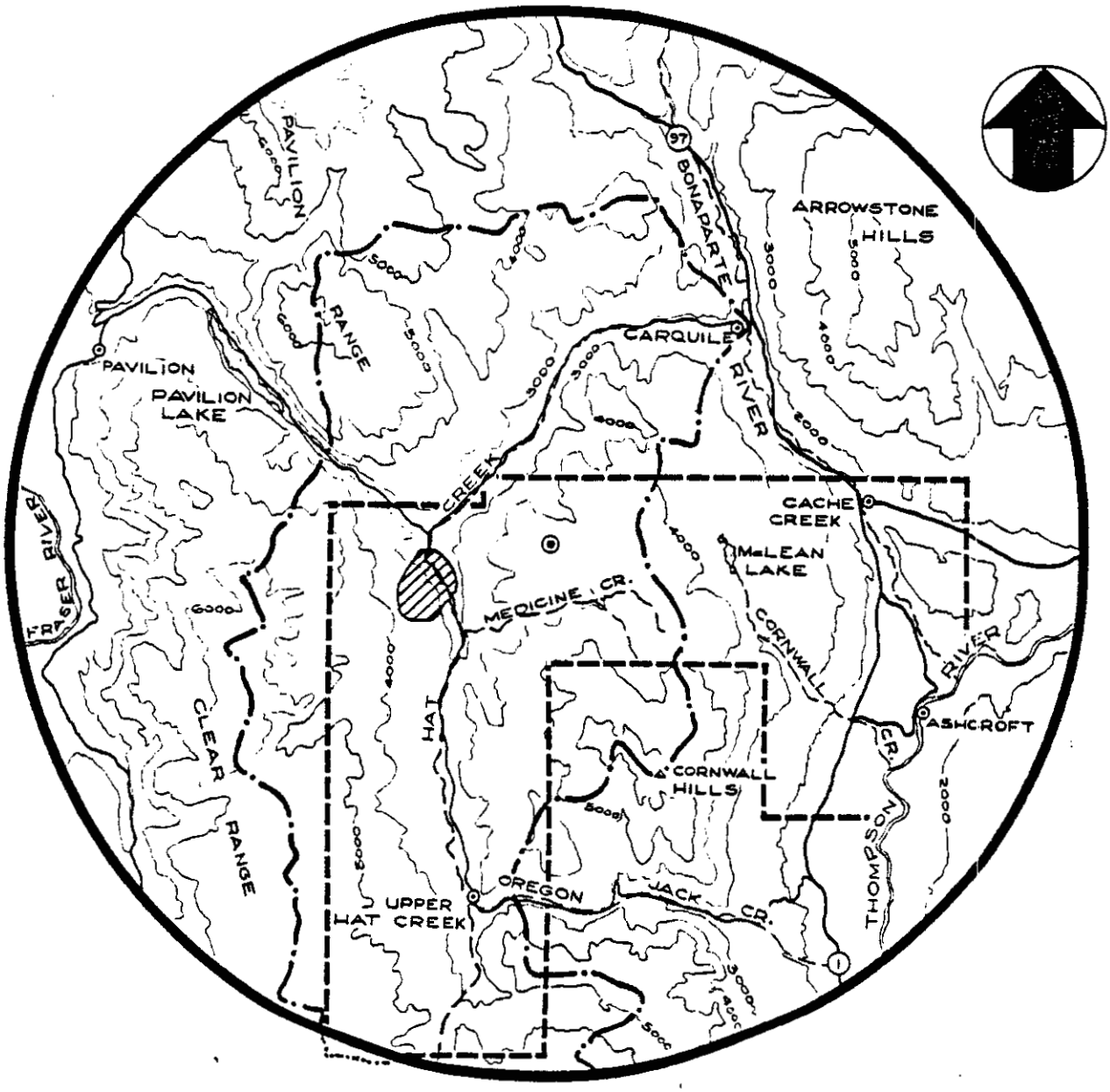
Intermediate level information was prepared for the Local Study Area and mapped at the scale of 1:50,000. The Local Study Area (see Figures 2-1 & 2-2) is defined by a 25 km (15.5 mi) radius circle with its center located at the proposed thermal plant near Harry Lake in Hat Creek valley. The total area of the Local Study Area is 1963 km^2 (738 mi^2). Resource information was obtained from published sources, government files, and extensive air photo and map analysis. Capability for agricultural use was based on Canada Land Inventory (CLI) maps of soil (association level), climate capability, and land capability.

The most detailed level of information was prepared for the Site Specific Study Area and mapped at the scale of 1:24,000. Of



STUDY LOCATION PLAN

FIG. 2-1



Scale 1:300,000

Local Study Area Boundary

Site Specific Study Area Boundary

Hat Creek Basin Boundary

Proposed Thermal Generating Plant

Proposed Coal Mine

LOCATION PLAN
LOCAL & SITE SPECIFIC STUDY AREAS

FIG. 2--2

irregular shape (see Figure 2-2), the Site Specific Study Area includes most of the upper Hat Creek valley (including the Harry Lake vicinity) and a corridor which extends along Medicine and Cornwall Creeks to the Thompson River. The Site Specific Study Area was established so as to encompass those areas for which project facilities and activities are proposed. Capability for agricultural use was based on soil survey work (series level) done especially for this study.

Besides the resource perspectives provided by the three study areas, resource use was also placed in the context of the Hat Creek basin (see Figure 2-2) because of the potential impacts that would relate to the valley-based agricultural industry of the area. In describing the basin resource, the most detailed information was used, this being in some cases a combination of information developed for the Local and Site Specific Study Areas.

2.3 STUDY PERSONNEL

The *Agriculture* study was carried out by Canadian Bio Resources Consultants Ltd., a consulting firm composed of agricultural scientists, economists, and engineers. Key personnel for this study were:

G.F. Kennedy, P.Eng.,P.Ag. - study manager; project organization and technical supervision with emphasis on irrigable lands, irrigation water requirements, waste heat, land alienation and projection of probable agricultural use with and without the project; report writing (Vol.I & II).

J.T.R. Husdon, P.Ag. - back-up study manager; supervision of economic assessment and technical areas with emphasis on agricultural inventory, assessment of range potential,

development of agricultural scenario, and assessment of air emission and noise impacts; report writing (Vol.I & II).

J.T. Forster, P.Ag. - field survey; agricultural inventory; and assessment of agricultural potential.

C.J. Purpora, P.Eng. - administrative assistance; rancher interviews; coordination of report inputs; and report writing (Vol.I & II).

E.M. Thiessen, EIT - field data retrieval; assessment of irrigation water requirements and agricultural uses of project waste heat; map and data control; report writing (Vol. II).

R.D. James - assessment of beef production economics, air emission and noise impacts.

Professor L.M. Staley, P.Eng. - associate advisor on waste heat utilization.

Professor N.R. Bulley, P.Eng. - associate advisor on waste heat utilization.

2.4 ACKNOWLEDGEMENTS

Canadian Bio Resources Consultants Ltd. would like to acknowledge the assistance of the personnel of the following government agencies in providing information pertaining to this study:

- Range Division, B.C. Ministry of Forests, Kamloops,
- B.C. Ministry of Agriculture, Kamloops and Abbotsford.

- Resource Analysis Branch, B.C. Ministry of the Environment, Victoria, Kamloops and Kelowna.
- B.C. Land Commission, Burnaby.
- Water Rights Branch, B.C. Ministry of the Environment, Victoria and Kamloops.
- Water Investigations Branch, B.C. Ministry of the Environment, Victoria.
- Lands Management Branch, B.C. Ministry of the Environment, Kamloops.
- Canada Agriculture Research Station, Kamloops.

The author would also like to acknowledge the B.C. Cattlemen's Association, the B.C. Livestock Producers' Cooperative Association, and ranchers of the Hat Creek valley for their informative exchanges made to the credit of the study.

The author thanks B.C. Hydro and Power Authority, the client, and Ebasco Services of Canada Limited, the overall environmental study coordinator, for their valuable assistance and guidance.

3.0 METHODOLOGY

3.1 INVENTORY

(a) Regional Study Area

(i) Historical Perspective

A short history of the Regional Study Area emphasizing agricultural development was prepared from the Kamloops Bulletin[2].

(ii) Climate Capability for Agriculture

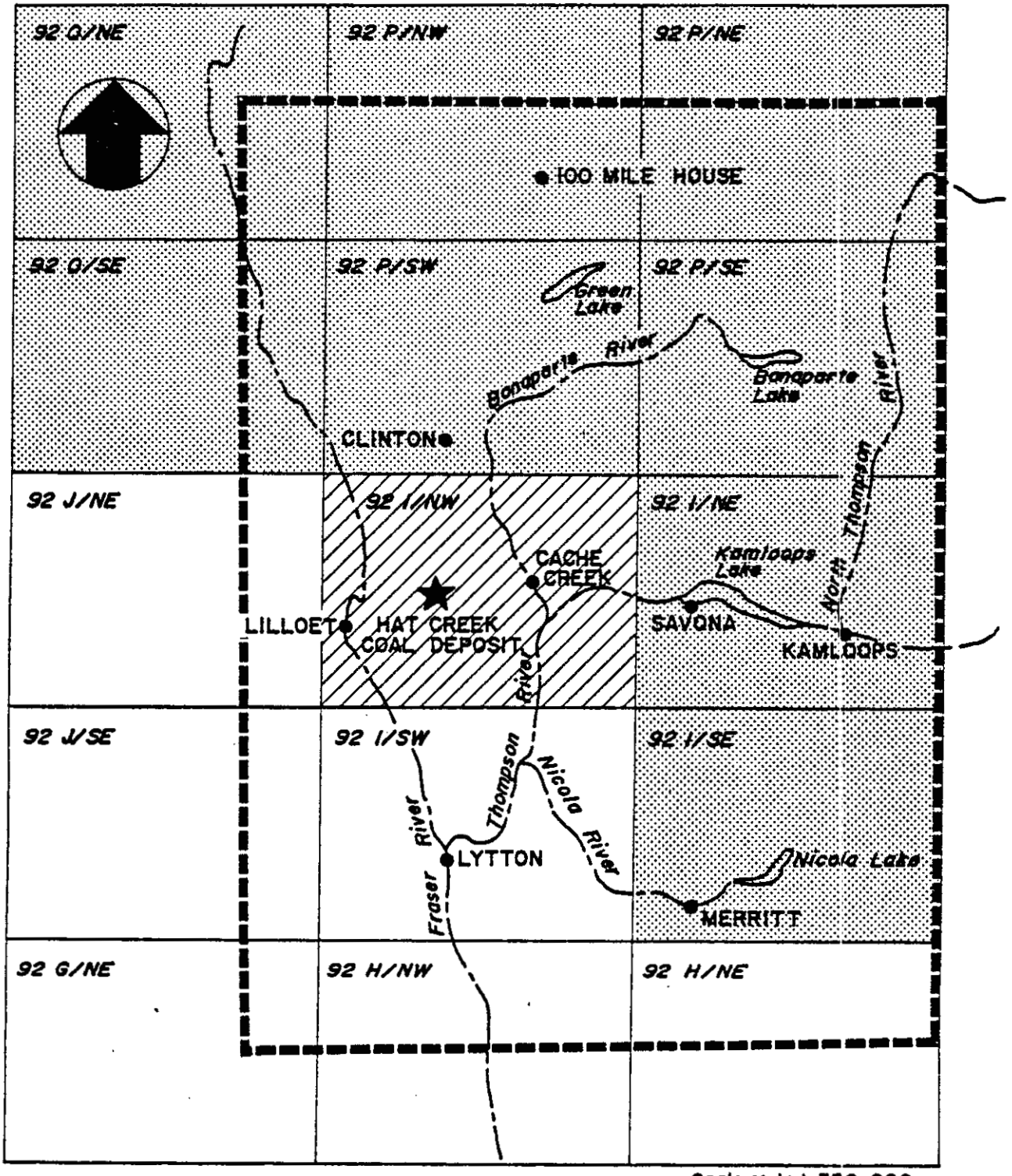
The Climate Capability Classification System for Agriculture[3] differentiates climate according to the constraints that the climate of an area places on agricultural use. This system was the basis for assessing climatic limitations and enhancements to the agricultural resource in this study. In this system, areas of similar climate are identified in terms of the range of agricultural crops that can be grown. The better the climate capability rating the wider the range of crops suitable for a particular area. The system contains seven capability classes (1 to 7) that are established on the basis of the following climate characteristics: frost free period, growing degree days greater than 5°C (≈42°F), annual precipitation, May to September precipitation, and moisture deficit during the growing season. In some situations, a climate capability class is designated for a land area on the basis of both dryland (nonirrigated) conditions and irrigated conditions. This dual class designation is used in areas where the dominant climatic limitation to agriculture is the

lack of precipitation during the growing season, a limitation which can be effectively overcome with irrigation.

British Columbia has the widest range of climates in Canada. This variety of climates cannot be satisfactorily classified under the national system which was developed primarily for application to the prairie regions of Canada where grain farming predominates. As a result, the system has been modified in British Columbia through the designation of four class 1 climate subclasses that denote the special climatic features of certain subregions. A detailed description of the class 1 subclasses and of the other seven basic climate classes is provided in Appendix A.

Climate capability is used by the government agencies in conjunction with soil and landform characteristics to determine agricultural land capability (described in Section 3.1(a)(iii)).

Climate Capability for Agriculture maps[4] have been published for approximately 60 percent of the Regional Study Area at a scale of 1:125,000 (see Figure 3-1). A map of the area which includes the Hat Creek valley and the Cache Creek-Ashcroft area is currently available in provisional form[5]. The information available from the published and provisional maps was used to describe the climate capability for agriculture for most of the Regional Study Area. For the area where no climate capability maps were available, 1:3,500,000 climate maps[6] of frost free days, growing degree days greater than 5°C (≈42°F), annual moisture deficit, May through September precipitation, and annual precipitation were consulted. These maps were compared to the available Climate Capability for Agriculture maps which allowed a qualitative assessment of the unmapped portion of the Regional Study Area. Note that the above climate parameters, except annual moisture deficit, are the same as those on which climate capability maps are based. The



Scale ≈ 1: 1,330,000

Regional Study Area Boundary

Map Sheet Boundary

Provisional Map (1:100,000)

Published Map (1:125,000)

Map Not Available

KEY OF CLIMATE CAPABILITY FOR AGRICULTURE MAPS — REGIONAL STUDY AREA

FIG. 3-1

relatively small-scale of this supplemental map information allowed only broad interpretations of climate capability for agriculture to be made.

(iii) Land Capability for Agriculture

The land capability for agriculture of the Regional Study Area was described on the basis of three general capability categories - land of high agricultural capability, land of grazing capability, and land of limited or no agricultural capability. This information was mapped for the Regional Study Area at the scale of 1:250,000.

A. Land of High Agricultural Capability

The principal sources of information on high capability agricultural lands were Canada Land Inventory (CLI) reports[8], data[9] and maps[10] that pertain to the Regional Study Area. The Land Capability for Agriculture classification system uses information on soils, landform and climate to identify the agricultural capability of different land areas. Under this system of classification, climate is the basic limitation to the production of agricultural crops. Government personnel utilize Climate Capability for Agriculture maps as the basis for establishing this limitation.

The CLI agricultural capability classification system places land into seven classes depending on its potential for agricultural use. A description of each class is provided below:

> *"Class 1 - land is capable of producing the very widest range of vegetables, cereal grain, forages, berry fruits and numerous specialty crops. Soil and climate combinations are optimum.*

Class 2 - land is capable of producing a wide range of regional crops as above with some differences in variety due to minor restrictions of soils or climate.

Class 3 - land is capable of producing a fairly wide range of regional crops under good management practices. Soil and/or climate limitations are somewhat restrictive.

Class 4 - land is capable of a restricted range of regional crops such as hardy cereal grains, hardy vegetables and forages. Soil and climate limitations demand special management considerations.

Class 5 - land is capable of production of perennial forage crops only. Soil and/or climate restrictions severely limit the land's capability.

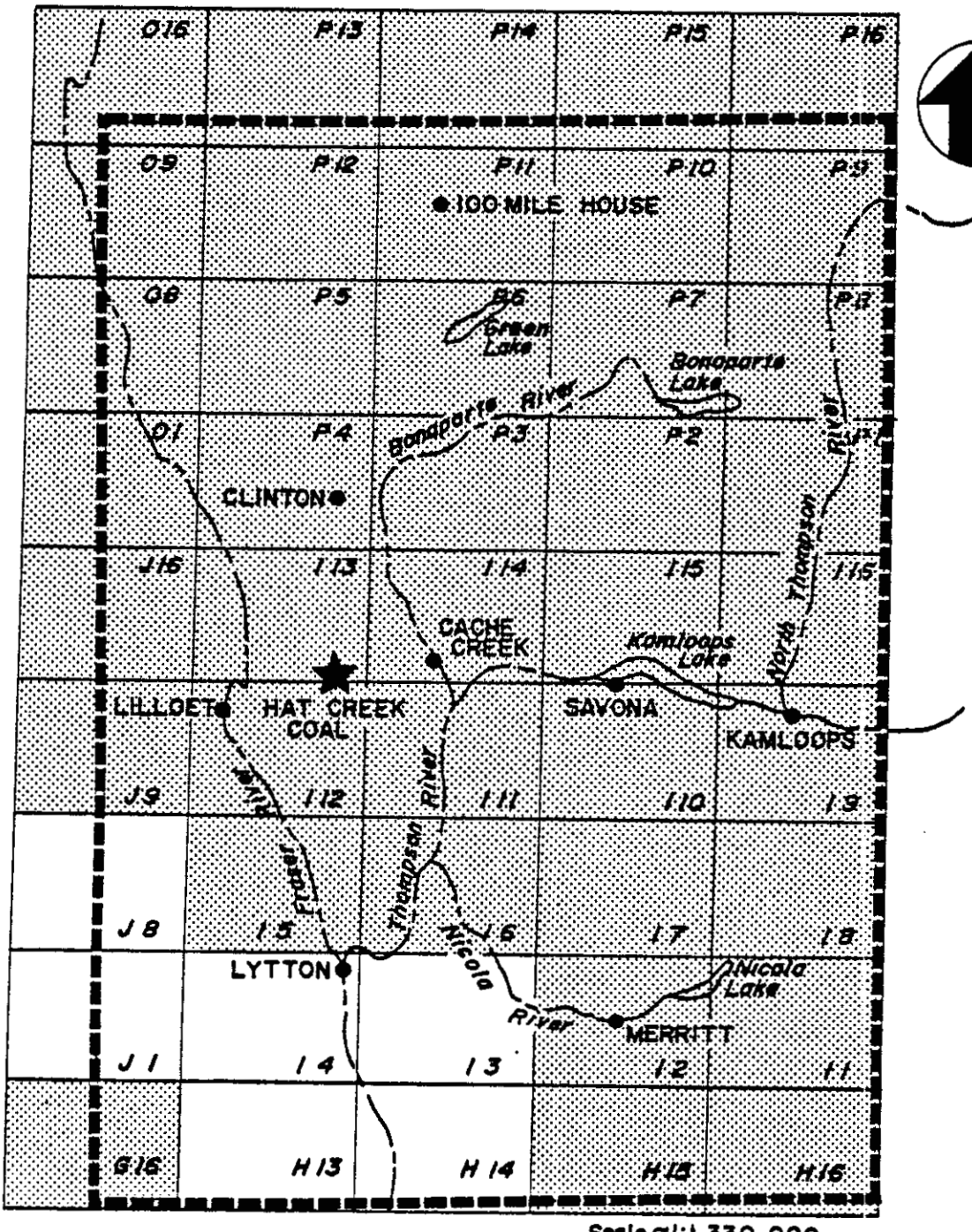
Class 6 - land is natural rangeland. Soil and/or climate limitations preclude cultivation but the land may be important in its natural state as grazing land.

Class 7 - land has no agricultural capability whatsoever."[7]

It is important to note that this CLI classification denotes the range of crops possible and not the productivity of any crop grown within these designated units[8].

A mapped capability unit sometimes is designated two CLI class ratings — an <u>improved</u> rating whereby the capability is determined assuming there is irrigation and/or drainage improvement, and an <u>unimproved</u> rating, whereby the capability assumes no such improvements.

The delineation of lands of high agricultural capability was based on provincial Agricultural Land Capability maps[10] at a scale of 1:50,000. Of the 45 map sheets required to cover the entire Regional Study Area, 39 are published or available in provisional form (see Figure 3-2). For areas where Climate Capability for



Scale ≈ 1:1,330,000

Regional Study Area Boundary

Map Sheet Boundary

Published Map (1:50,000)

Map Not Available

KEY OF AGRICULTURE LAND CAPABILITY MAPS — REGIONAL STUDY AREA

FIG. 3-2

Agriculture maps were not published (see Figure 3-1), the provisional Agricultural Land Capability maps reflect approximate information on climate and therefore provide a less detailed indication of agricultural capability. Land units designated with Canada Land Inventory (CLI) agricultural capability classes 1, 2, 3, and 4 (improved rating) are considered valuable agricultural lands for intensive crop production. The mapped land units of these classes were drawn as an aggregate unit on the 1:250,000 Regional Study Area map.

The amount of land of each of the CLI agricultural capability classes 1, 2, 3, and 4 (improved rating) as determined by ELUC[9] for each of the 39 completed agricultural capability map sheets was used to describe the makeup of lands of high agricultural capability within subareas of the Regional Study Area.

For the small area south of the town of Lytton for which neither published nor provisional Agricultural Land Capability maps were available, maps of the National Topographic System[11] were used in preparing qualitative statements regarding lands of high agricultural capability. Areas below 1219 m. (4000 ft.) in elevation and of moderate topography (slopes less than 15 percent) were identified as areas of possible high capability. However, soils information which would be needed to confirm this possibility was not considered.

The relative importance of the Regional Study Area in terms of agricultural capability was addressed by comparing the quantity of lands of high agricultural capability within it, as determined by totalling the amounts[10] of CLI agriculture capability classes 1, 2, 3, and 4 for the 39 map sheets, to the quantity reported[7] for the province as a whole. This comparison is meaningful since Reid[12] has estimated that approximately 99 percent of all CLI agricultural

capability classes 1, 2, 3, and 4 lands in the province have been mapped and quantified.

B. Land of Grazing Capability

Land of grazing capability was broadly identified on the basis of the description of Biogeoclimatic Zones for British Columbia[13,14]. Six biogeoclimatic zones occur within the Regional Study Area. Three have grazing capability for livestock based on the occurrence of common grass species in each. The three zones and the grass species important to grazing of each are: Ponderosa Pine - Bunchgrass Biogeoclimatic Zone (bluebunch wheatgrass *Agropyron spicatum*, Idaho fescue *Festuca idahoensis*, and needlegrass *Stipa coma*); Interior Douglas-fir Biogeoclimatic Zone (pinegrass *Calamagrostis rubescens*); and Cariboo Aspen - Lodgepole Pine - Douglas-fir Biogeoclimatic Zone (pinegrass *Calamagrostis rubescens*). These three biogeoclimatic zones which were mapped at the scale of 1:250,000[15] were grouped together as a single unit and the area, less that already designated as land of high agricultural capability, was measured.

C. Land of Limited or No Agricultural Capability

The portion of the Regional Study Area not designated as either land of high agricultural capability or land of grazing capability was designated as land of limited or no agricultural capability and this area was measured from the map.

(iv) Agricultural Land Reserves

The Province of British Columbia has established an Agricultural Land Reserve (ALR) to preserve those lands that have a potential for agriculture. The ALR was established following the proclamation

of the British Columbia Land Commission Act in 1973. The primary objective of this act is the preservation of farm lands to accommodate the food needs of future generations.

Agricultural Land Reserves were designated for each regional district within the province. Generally, lands with agricultural capabilities of class 1 through 4, and some class 5 and 6 lands in range areas, were placed in these reserves. Crown range lands that are administered by the B.C. Forest Service, however, are generally not included in the ALR even though they do contain class 5 and 6 lands with grazing capability.

The provisions within the Land Commission Act are administered by the B.C. Land Commission which is an appointed body within the British Columbia Ministry of the Environment. Land within these reserves cannot be used for nonagricultural purposes without permission of this commission.

The area of the Agricultural Land Reserves within a particular region provides an indication of the extent of agricultural land within that region. However, no direct inference can be made as to the value of agricultural land in the ALR since low-intensity use grazing lands are included as well as high-intensity use crop lands. In some instances land with limited or no agricultural capability are included in the reserve. This occurs where these areas are an integral part of a larger land unit and their development for a nonagricultural purpose could have a detrimental effect on surrounding agricultural lands.

Information on the location and extent of Agricultural Land Reserve areas within the Regional Study Area was obtained from published maps[16,17,18,19,20,21] at a scale of 1:2,000,000 and 1:500,000. This information was used to prepare an ALR map for the Regional

Study Area at a scale of 1:250,000 from which ALR lands were measured for area.

(v) Present Agricultural Use

Present agricultural use within the Regional Study Area was studied by analysis of census statistics, interpretation of satellite photographs, reference to published materials and discussion with personnel of agricultural agencies.

Census statistics for 1976[22] for the Thompson-Nicola Census Division were used to determine the agricultural status (farm size, livestock numbers, crop types, etc.) of the Regional Study Area. Although the Thompson-Nicola Census Division defines a different geographical area than the Regional Study Area, the area that is common to both contains most of the irrigated land (Figure 3-3). Within the Regional Study Area cultivation of arable land is only possible with irrigation because of the semi-arid climate; therefore, the census statistics provide a quantitative measure of present agricultural use for those parameters closely related to irrigated land (i.e., forage crops, field crops and vegetable crops). For parameters not necessarily related to irrigated land (i.e., total farmland*, farm value and number of farms**), the comparison is not as valid, but the statistics provide an order of magnitude that can be related to provincial totals.

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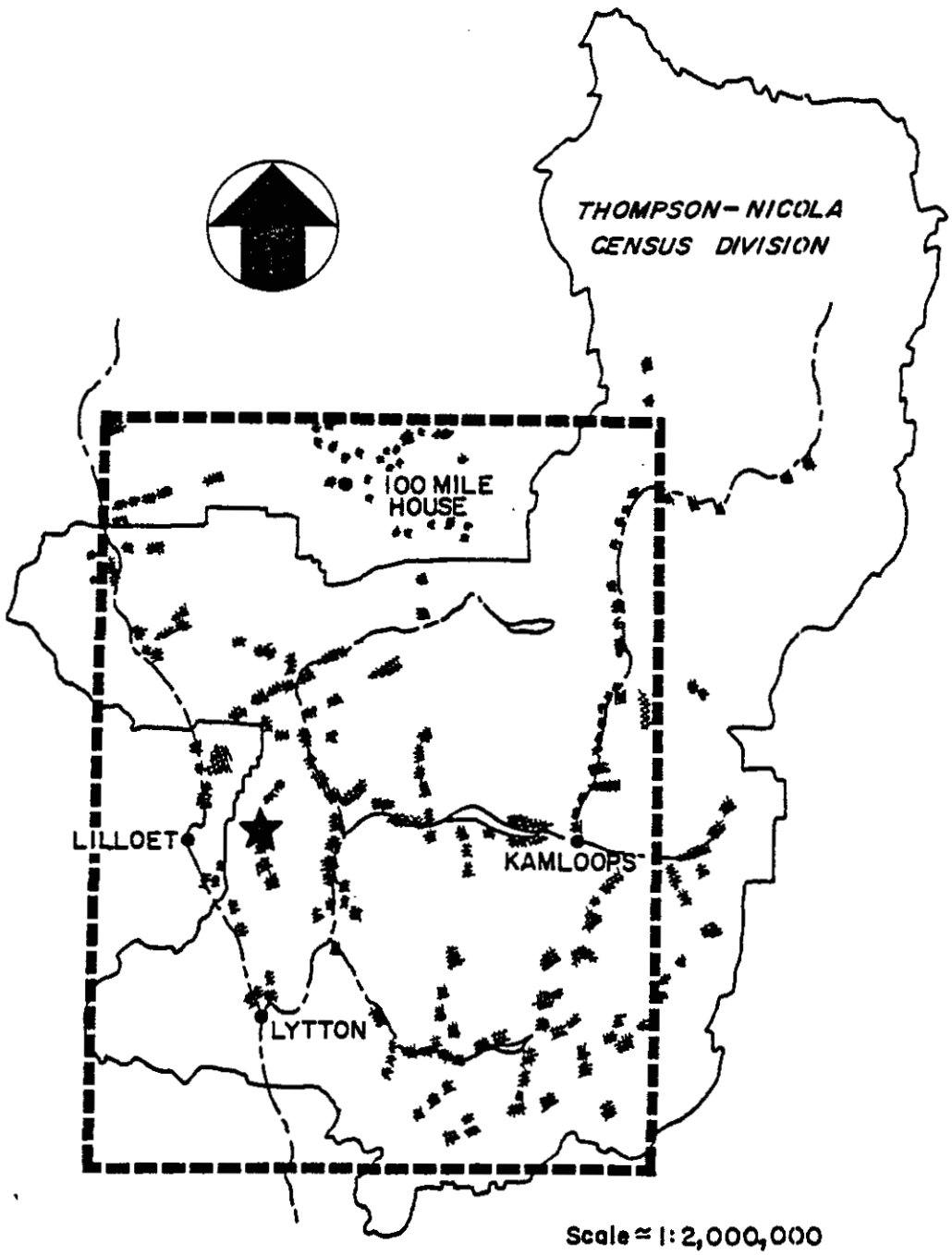
* farmland (as per Statistics Canada[22]) - is improved land (crop land and improved pasture) and unimproved land (woodland and unimproved pasture) whether owned or leased from the Crown. Farmland does not include Crown rangeland that is used under a per-head grazing fee.

** farm (as per Statistics Canada[22]) - is a farm, ranch or other agricultural holding of one acre or more with sales of agricultural products during the year 1975 of $1200 or more.



IRRIGATED LAND
THOMPSON-NICOLA CENSUS DIVISION & REGIONAL STUDY AREA

FIG. 3-3

Irrigated land of the Regional Study Area was identified from Earth Resources Technology Satellite (ERTS) band 8 composite photographs[23] at a scale of approximately 1:330,000. Irrigated land appears pink or bright red on these photographs taken during the growing season and is distinguishable from nonirrigated lands. The identified areas were drawn on a map of the Regional Study Area at a scale of 1:250,000 by using physiographic features as a guide.

The area used by cattle within the Regional Study Area was broadly defined on the basis of a map at a scale of 1:1,900,800 that indicates cattle distribution in British Columbia[24]. This is a qualitative map and does not provide information regarding the density of livestock use.

Normal crop yields for cultivated lands within the Regional Study Area were taken from information sheets[25] and publications[26,27] prepared by the B.C. Ministry of Agriculture.

The present livestock carrying capacity of the biogeoclimatic zones previously used to describe land of grazing capability within the Regional Study Area was documented from government publications[28,29].

Information about government crop and range research trials that have been carried out or are currently in progress within the Regional Study Area was compiled from discussions and correspondence with government personnel, including Dr. A. McLean and Dr. A. Van Ryswyk of the Agriculture Canada Research Station in Kamloops, and J. Ryder and A. Bawtree of the B.C. Ministry of Agriculture in Kamloops.

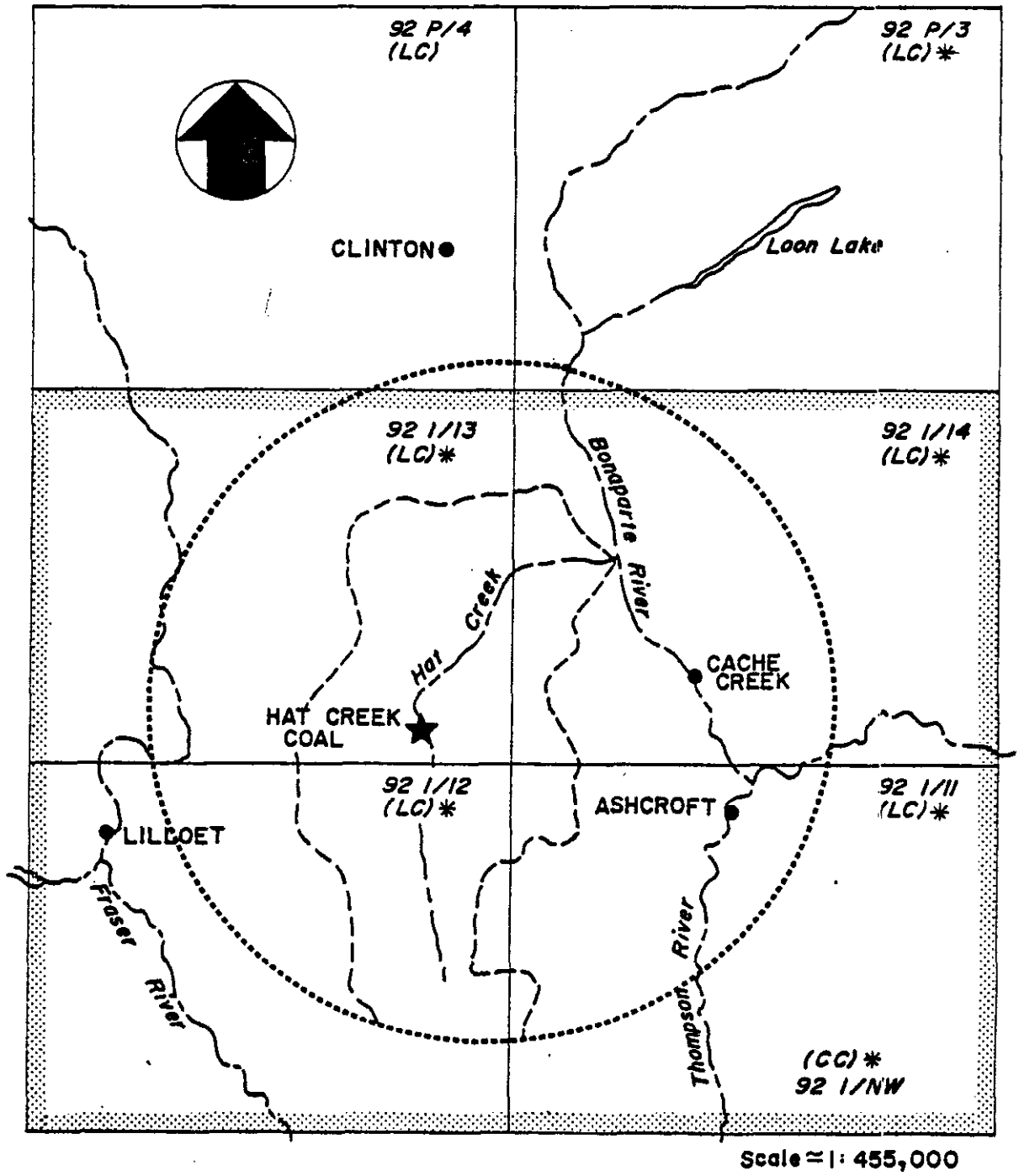
(b) Local Study Area

(i) Climate Capability for Agriculture

Information on climate capability of the Local Study Area was based on a provisional Climate Capability for Agriculture map (Resource Analysis Branch[5]), revisions (in progress) to the climate capability classification system[30], and consultation with R. Williams and R. Wilson of the Resource Analysis Branch who are involved in the preparation of climate capability maps. The areal coverage of the climate capability map sheet comprising the Local Study Area is depicted in Figure 3-4. On the Climate Capability for Agriculture map, land is subdivided into homogeneous units according to the climate capability for agriculture classification system. The importance of this classification system is discussed in Section 3.1(a)(ii) and a description of each climate class is given in Appendix A.

A study map (1:50,000) was prepared from the provisional climate capability map identifying land units within the Local Study Area in terms of eight climate capability classes, namely 1 to 7 plus 1b (a special class composed of climate capability classes $1b_1$ and $1b_2$ - see Appendix A). The irrigated class was used to describe climate capability rather than the dryland class because it is more useful for interpreting potential agricultural use for an area where arable agriculture is dependent on irrigation. The area of each capability class was measured and tabulated.

Two other provisional maps depicting the climate moisture deficit and/or surplus[31], and the May through September precipitation[32] of the Local Study Area were consulted to supplement the climate capability for agriculture information with respect to climate characteristics that constrain or limit agriculture in the Local Study Area.



Scale ≃ 1: 455,000

Local Study Area Boundary
Hat Creek Basin Boundary
Climate Capability For Agriculture Map (CC)
Agriculture Land Capability Map (LC)
* Provisional Status Map

KEY OF CLIMATE CAPABILITY FOR AGRICULTURE MAPS & AGRICULTURE LAND CAPABILITY MAPS LOCAL STUDY AREA

FIG. 3-4

(ii) Land Capability for Agriculture

The analysis of agricultural capability within the Local Study Area was based on two aspects — land capability for irrigated agriculture and land capability for grazing. Two classification systems were used to establish land capability — Canada Land Inventory (CLI) Land Capability for Agriculture[7], and Lard Capability for Grazing[8]. In general, these classificatien systems describe the potentials and limitations of land for agricultural use based on inherent soil, landform and climatic characteristics. A full description of the CLI Land Capability for Agriculture capability classes and of the significance of this classification system appears in Section 3.1(a)(iii). The Land Capability for Grazing classification system is discussed following (Section B). The primary sources of information were provisional Land Capability for Agriculture maps[10] (see Figure 3-4 for map sheet coverage), provincial publications which describe the rationale and methods of the classification systems[7,8] and provincial Soils and Landforms maps[33].

A. Land Capability for Irrigated Agriculture

Land units which are designated as having an improved CLI agricultural capability class* of 1, 2, 3, 4, or 5 are considered important for irrigated agricultural production. These lands of the Local Study Area were identified from the provisional Land Capability for Agriculture maps[10] (1:50,000) prepared by the B.C. Resource Analysis Branch. These maps were developed without Climate Capability for Agriculture maps, which were unavailable at the time, and therefore may include some land units with questionable classifications. In light of this possibility, the

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* improved CLI agricultural capability class is designated on the basis that there is irrigation and/or drainage improvements.

provisional Climate Capability for Agriculture map[5] which was issued subsequently, was consulted by CBRC staff to identify those capability units within the Local Study Area seemingly having an inappropriate class designation.

B. Land Capability for Grazing

The remaining portion of the Local Study Area, i.e., designated with provisional CLI agricultural capability classes 6 and 7 is considered to have no capability for production of cultivated crops and is an area where agricultural use is consequently restricted to grazing. This area was assigned grazing capability classes by CBRC staff according to the Land Capability for Grazing system developed by Runka[8]. The Runka approach is a tentative provincial classification system which subdivides the land according to its capability for the grazing of native forage plants by domestic livestock. Grazing capability classes are assigned to land units on the basis of soil, landform, climate, and forage plant species. This classification system attempts to quantify grazing capability which the CLI Land Capability for Agriculture classification system does not.

There are five classes in the Land Capability for Grazing system with class 1 denoting the best conditions for grazing and class 5 the worst. A description of each grazing capability class follows. Note that productivities are expressed in terms of gross pounds of palatable native forage produced per acre per year on lands under good range management.

Grazing Capability Classes

"Class 1 Lands having no important limitations to the growth of native forage plants.

.....Productivity is usually greater than 1000 lb./acre/year natural forage. This class is commonly found on black chernozem soils in the upper grassland, and organic soils and regosols found on floodplains.

Class 2 Lands having slight limitations to the growth of native forage plants.

.....Productivity is usually from 500-1000 lb./acre/year natural forage. This class is commonly found on dark brown chernozem soils in the middle grassland, and gray luvisol soils in the Interior Douglas-fir zone, and saline soils found on saline seepage areas.

Class 3 Lands having moderate limitations to the growth of native forage plants.

.....Productivity is usually from 250-500 lb./acre/year native forage. This class is commonly found in brown chernozems in the lower grassland, on Eutric Brunisols in the Ponderosa pine-bunchgrass zone and lower Interior Douglas-fir zone and on brunisolic gray brunisols in the long term lodgepole pine sere of the Engelmann spruce-subalpine fir zone.

Class 4 Lands having moderately severe limitations to the growth of native forage plants.

.....Production usually ranges from 125-250 lb./acre/year native forage. This class is commonly found on Eutric and

Dystric Brunisol soils in the Ponderosa-pine-bunchgrass, Interior Douglas-fir and Engelmann spruce-subalpine fir zones.

Class 5 Lands having severe limitations to the growth of native forages.

.....Soils in this class are considered unsuitable for grazing due to overriding climatic and environmental limitations. Productivity is usually from 0-125 lb./acre/year native forage and not necessarily on a sustained yield basis. This class is commonly found on Eutric, Dystric, Sombric, and alpine brunisols in the Ponderosa pine-bunchgrass, Interior Douglas-fir, Engelmann spruce-subalpine fir and alpine tundra zones."[8]

Grazing capability was not available in mapped form for the Local Study Area. However, grazing capability classes had been assigned by provincial personnel[34] to each soil and landform type of the provincial Soils and Landforms maps[33] (scale of 1:50,000) comprising the Local Study Area. Land units of agricultural capability (CLI 1 to 5) and grazing capability (1 to 5) were transferred to the same 1:50,000 study map, providing complete coverage of the Local Study Area for capability information. All units were measured for area and tabulated.

(iii) Agricultural Land Reserves

Information on the location of Agricultural Land Reserve (ALR) areas within the Local Study Area was obtained from published maps[35,36] at the scale of 1:50,000. This information was traced onto a study map of the same scale. The ALR lands were measured for area and tabulated. The Agricultural Land Reserve system and its usefulness in describing the agricultural resource are discussed in Section 3.1(a)(iv).

(iv) Present Agricultural Use

Present agricultural use within the Local Study Area was described using various sources of information. In some cases, two or more sources were consulted to provide information on a single aspect of present use. Consequently, as is noted in this section, information is not always of uniform detail throughout the Local Study Area.

A. Land Tenure

Land within the Local Study Area is either private, Crown, or Indian Reserve. For this study land was classified on the basis of the following land tenure categories: private (deeded) land; agricultural and grazing lease land (Crown); and Indian reserves. The remaining land area, other than these three categories is composed of Crown reserves, other classes of Crown lease land, and nonalienated Crown land* and was not differentiated for this study.

Agricultural leases are available from the Crown for a parcel of land that is at least half arable (capable of being brought under cultivation). These leases are issued for three years subject to renewal for another 17 years. An annual rent based on the appraised value of the property and property taxes are payable by the lessee. The lessee has the option to purchase the parcel of leased land provided that 80 percent of the arable land has been put into a cultivated condition.

Grazing leases are available for Crown land that is considered impractical to administer under grazing permit (see Section C - Rangeland). In general, the Crown does not encourage grazing leases because the use of forage on Crown range is considered

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* nonalienated Crown land - is Crown land that has no lease or reserve rights registered against it.

best administered by grazing permit. Grazing leases are issued for a maximum of five years; there is no option to purchase this leased land. These leases are periodically examined and are subject to cancellation if the lands are improperly managed. Crown leases, both agricultural and grazing, are administered by the B.C. Lands Management Branch.

The location of agricultural and grazing lease lands within the Local Study Area and the names of the lessees were taken from land status maps of the Lands Management Branch, Kamloops District[37]. The location of deeded lands within the Local Study Area was primarily determined from this same source; a B.C. map of the National Topographic System[38] provided informatior for the area that lies outside the Kamloops Lands Management District (small area around Pavilion near the Fraser River). The owners of private land in the upper Hat Creek valley were identified from a map prepared by B.C. Hydro[39]; owners of private land in the Cache Creek area were identified from the land status maps, although this latter information was not necessarily up to date.

Information on private lands and agricultural and grazing lease lands was transferred to a Local Study Area study map (1:50,000). The location of Indian reserves within the Local Study Area was already delineated on the study base map prepared by the client. The area of each land tenure category was measured and tabulated.

B. Cropland and Pasture Use

Both crop lands and pastures were identified from the fact that they are irrigated. Irrigation is required within the Local Study Area for the production of crops and forages because of the arid climate (see Section 4.2(a)). Presently irrigated land was identified from colour aerial photos (1:24,000)[40], published

present use maps (1:50,000)[41], and an unpublished government study[42]. The aerial photos, taken in September 1976, were considered the most up-to-date source of information with almost complete coverage of the Local Study Area; however, because of the greater time involved in identifying irrigated lands from the air photos and transferring this information to a Local Study Area study map (1:50,000), this source was used primarily to check and up-date irrigated lands identified by the other two sources. The irrigated land of the Hat Creek basin was differentiated by type of use, that is, cultivated cropland or pasture from the analysis of the colour aerial photos. The mapped irrigated land of the Local Study Area was measured for area and tabulated.

Crop types (species) were identified during site visits and from discussions with local farmers, particularly those of the Hat Creek valley. Present crop productivities were established from government information sheets[25] and reports[26,27], and the discussions with the farmers.

C. Rangeland Use

The use of natural ranges occurs, for the most part, on Crown lands administered under grazing lease (see Section A, Land Tenure) or grazing permit. Grazing permits, which are administered by the B.C. Forest Service, are issued on a five year basis for a specific range area and number of livestock (cattle, horses and sheep) and a specific grazing period. The charge to the rancher for using rangeland under permit was $0.53 per Animal Unit Month (AUM) in 1976. This is a nonnegotiable rate but is influenced, to some extent, by the current price of cattle.

Information on the grazing permits issued for 1977 for Crown land within the Local Study Area was obtained from the maps and files

of the Kamloops District office of the B.C. Forest Service. This information, which includes the location of permit range, name of permittee, number of Animal Unit Months* (AUM) permitted, and the period of use, was transferred to a study map (1:50,000) of the Local Study Area. Each permit range was measured for area from the map.

Information on the use of other rangelands within the Local Study Area, i.e., on private property and/or grazing lease lands, was less detailed than that for the permit lands and was obtained primarily from discussions with the farmers of the area regarding their operation (further discussion appears in Section D, Farm Units).

Rangeland use within the Local Study Area as defined by grazing permits and grazing leases, is quantified in terms of rather broad geographical areas which gives an idea of average use within the areas, but does not adequately define variability. In order to add to the range use information, land areas of relatively low grazing use were identified, this being done on the basis of topography and vegetation. A ground slope greater than 50 percent is generally regarded as a serious limitation for livestock grazing (even though livestock can be forced to graze steeper slopes). This criterion was used to identify land areas with a relatively low grazing use because of topography. B.C. topographic maps[43] were used for this analysis. Land mapped by TERA[44] with the following vegetation associations were also identified as low grazing use areas because of the generally low productive nature of the understory vegetation: Engelmann Spruce - Subalpine Fir - Grouseberry association; Englemann Spruce - Grouseberry - White Rhododendron association; Engelmann Spruce - Grouseberry - Lupines association; Douglas-fir - Spirea - Bearberry association; and Engelmann Spruce - Horsetail association.

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* Animal Unit Month - is a feed equivalent used to indicate the number of grazing animals a range area can support. One AUM is one cow and calf or one 454 kg (1000 lb) steer grazing for one month.

Vegetation information was not available for some peripheral portions of the Local Study Area. The low use grazing lands identified on the basis of the topographic and vegetation criteria were drawn onto a study map of the Local Study Area and measured for area. Other areas that might presently be considered as low use because of low productivity as a result of overgrazing were not identified.

Important cattle trails within the Local Study Area were identified during field visits and discussions with the local ranchers. These trails were drawn on to the study map by referring to Departmental Reference Maps[45] on which these trails are depicted.

Range plants in the Local Study Area which are important forage species for cattle were identified from a plant species checklist[44] on the basis of plant grazing value information contained in a government publication[46] and from consultation with government range specialists, including Dr. A. McLean of Agriculture Canada Research Station in Kamloops, A. Bawtree of B.C. Ministry of Agriculture in Kamloops and J. Kidder of the B.C. Select Standing Committee on Agriculture. Each species was rated on a relative scale (high, medium, low) as to its importance (palatability and feed value) to cattle.

Information on the present livestock stocking rate of rangelands in the Local Study Area was obtained from two sources. For each grazing permit area in the Local Study Area, an average stocking rate was calculated by simply dividing the area of the permit by the total Animal Unit Months permitted, giving stocking rate in terms of area per AUM. The stocking rate for various vegetation covers for rangelands located between Hat Creek and Thompson River were obtained from a grazing map prepared in 1969 by the B.C.

Forest Service[47]. The stocking rates so obtained were compared to values reported in the literature[28,29] to indicate the relative condition of the ranges for grazing.

D. Farm Units

A farm unit, for the purpose of this study, is defined as the aggregate land area, under single management control, that functions as a unit for the production of agricultural products. It may be composed of land of various land tenures (i.e., private, Crown lease and other Crown land) and of various land uses (e.g., farm residence and farm buildings, irrigated cropland, pasture and natural rangeland).

The information previously discussed in this section was reorganized on a farm unit basis. Because of incomplete or outdated information regarding the present owners of private land, this analysis could not be done for lands generally east of the Thompson and Bonaparte Rivers and those within the Fraser River basin. In addition, other information about each farm unit was obtained by interviewing ranchers of the area, especially those residing in the Hat Creek valley. Information included cattle herd numbers, location of herd wintering areas and details on the pattern of cattle movement throughout the year.

E. Agricultural/Wildlife Interface

The assessment of the agricultural/wildlife interface involved an examination of those areas within the Local Study Area where agriculture and wildlife compete for resources. The basic information for wildlife use came from discussions with the wildlife consultants associated with this project and from wildlife maps they have prepared. Identification of range plant

species within the Local Study Area for which cattle and wildlife compete was based on the plant species checklist[44].

F. Agricultural Research Plots

Information on government crop and range research trials within the Local Study area was compiled from discussion and correspondence with government personnel.

(c) Site Specific Study Area

(i) Soils

Information on soils within the Site Specific Study Area was obtained from the *Physical Habitat & Range Vegetation* report[44] of the Hat Creek Detailed Environmental Studies. This information consisted of a soil map (1:24,000) at a soil series level and attendant soil descriptions, the origin of which was two-fold — a provincial soil survey map and report[48] covering the small portion of the Site Specific Study Area within the lowlands of the Thompson and Bonaparte River valleys, and a soil survey[44] covering the lower elevation lands of the Hat Creek valley and all other lands between Hat Creek and the Thompson River in which physical disturbance might occur due to the development of Hat Creek coal mine and thermal generating plant.

Soil series level of mapping identifies physiographic units in terms of parent material, vegetation, soil development, depth of topsoil, soil texture, topography, and drainage characteristics. This level of mapping is based on relatively large-scale aerial photographs (1:15,840) and extensive field checking resulting in the subdivision of land into units which are more accurate than

the level of soil mapping which is used to prepare the CLI Land Capability for Agriculture maps discussed in Section 3.1(b)(ii) for the Local Study Area. The soil series level of information, as opposed to the CLI information, allows a more detailed assessment of agricultural potential to be made including the amount of water required for irrigation, the susceptibility of soil to erosion, the type of land management practices required for agricultural production, and the expected crop yields. This detail in turn allows economic projections to be made of potential agricultural production.

A qualitative ranking of the agricultural significance of the soil series mapped for the Site Specific Study Area was based on the soil summary table contained in the *Physical Habitat and Range Vegetation* report[44].

(ii) Agricultural Land Reserves

The location of Agricultural Land Reserves (ALR) within the Site Specific Study Area was obtained from published maps[17] and was drawn on to a study map at a scale of 1:24,000. Information on the Agricultural Land Reserve system and its usefulness in describing the agricultural resource are discussed in Section 3.1(a)(iv).

(iii) Present Agricultural Use

Present agricultural use within the Site Specific Study Area was developed primarily from sources discussed for the Local Study Area (Section 3.1(b)(iv)) and portrayed at the larger study map scale (1:24,000). The information that was transferred included land tenure classification, agricultural land use (irrigated land and rangeland) and farm unit composition.

The expected productivities of present hay lands within the Hat Creek portion of the Site Specific Study Area were assigned on the basis of series level soils information (Appendix B), climatic constraints as previously documented, and, to some extent, existing farming practices.

Information on the use of water for irrigation within the Hat Creek basin was obtained from the *Hydrology, Drainage, Water Quality and Use*[49] component of the Hat Creek Detailed Environmental Studies and from provincial water licence data obtained from the B.C. Water Rights Branch[50]. The water licence data pertain to the use or storage of surface waters and give details on the source of water, the point of diversion, the quantity of water allowed to be diverted or stored, and the specific parcel of land on which the water is to be used. For each water licence within the Hat Creek basin, the location of the water source and land irrigated, as well as the licenced water quantity was drawn on to the present use study map (1:24,000).

4.0 INVENTORY

4.1 REGIONAL STUDY AREA

(a) Historical Perspective

The first reported agricultural use of the area occurred in the 1820's and involved the grazing of as many as 500 - 600 horses along the Thompson River at the Hudson's Bay Company farm at Fort Kamloops. A small dairy herd was also kept at this farm.

The discovery of gold in the interior of British Columbia and the subsequent gold rush that began in 1858 brought many changes to the area. By 1864 a regular 4-horse stage line was carrying passengers and freight from Yale to Soda Creek. The demand for supplies, accommodation and transportation from the mining activity produced tremendous economic stimulation. Cattle ranches were established along the Thompson and Nicola valleys and a variety of economic activities including truck gardens and grist mills were established at Lytton, Spences Bridge and Cache Creek. Ranches in the Ashcroft-Cache Creek area used the Hat Creek valley and the surrounding hills as range land for their cattle.

Following the entry of British Columbia into confederation and the establishment of the Canadian Pacific Railway, Ashcroft became the main cattle shipping point for the extensive beef-ranching country of the Cariboo.

In 1910 the first major irrigation project for the area was developed at Walhachin on the Thompson River east of Cache Creek. Approximately 1200 ha (3000 acres) were to be irrigated using water

from a dam constructed eighteen miles upstream on Deadman River. The project was abandoned following the First World War but the remains of the flume system can still be seen from Highway 1 between Cache Creek and Savona.

During the late 1940's and 1950's the area produced potatoes and tomatoes on a commercial scale. However, due to the difficulty in obtaining the extensive labour needed for these crops, commercial vegetable production almost disappeared and alfalfa hay, a low labour crop, became predominant. Alfalfa hay was needed to support beef cattle ranching, which became the main agricultural activity of the area.

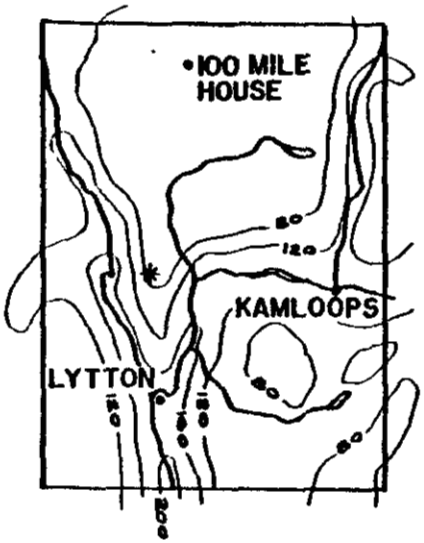
(b) Climate Capability for Agriculture

The climate of British Columbia varies widely from region to region reflecting physiography and proximity to the Pacific Ocean and to the interior of the continent. Within a particular region there can be considerable climatic variation as a result of differences in elevation and/or other climatic influencing characteristics. These climatic variations have a major effect on the type of agricultural crops that can be grown and form the basis for climate capability differentiation. In the Climate Capability for Agriculture classification system, outlined in Section 3.1(2)(ii), land is divided into areas of similar climate which are rated on the basis of the range of crops that can be grown. These ratings range from class 1 to class 7 with class 1 representing the highest agricultural capability and class 7 having no significant agricultural capability.

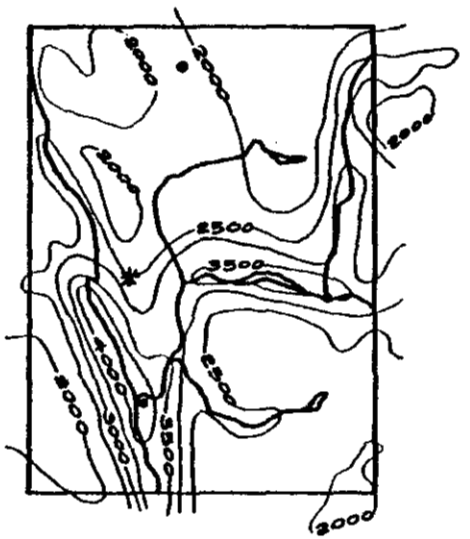
Climate Capability for Agriculture maps are available for approximately three-quarters of the Regional Study Area; limited climate information is available for the remaining portion. The

capability maps are available for the following land areas: Merritt-Nicola Valley, Kamloops-Kamloops Lake, Bonaparte Lake, Clinton-Green Lake, 100 Mile House, and Lillooet-Cache Creek[4,5]. An examination of these maps indicated that the highest climate capability classes occur at lower elevations particularly along the benches of the Fraser and Thompson Rivers and the Nicola Lake and the Kamloops Lake areas. These areas have been designated climate capability classes 1, 2 and 3 under dryland farming conditions with the subclass limitation of drought or aridity causing a soil moisture deficit which severely limits plant growth. This climate would limit the type of crops that could be grown to drought resistant forage crops or cereal crops. Under irrigation, this limitation is overcome and the climate capability for these areas is improved to class 1, indicating that a wide range of crops could be raised including sweet corn. Within class 1 climate areas are subregions with special class 1 designations indicating climatic conditions conducive for special heat-loving crops such as tomatoes and vine crops as well as hardy varieties of apples. Areas of special class 1 climate exist on the eastern benches of the Fraser River between Lillooet and Lytton and on the benches of the Thompson River between Ashcroft and Savona. Lands that are higher in elevation than the benches have lower capability climates due primarily to a more limited frost free period. These areas have considerable agricultural value, however, due to their forage production capability which is enhanced by the high number of growing degree days associated with the region.

To assess the agricultural climate capability of the area for which published information was not available, small scale climate maps[6] of the five principal climate parameters used by government agencies for the assessment of agricultural climate capability were consulted (Figure 4-1). An examination of these maps indicates that the remaining benches and lowlands of the Thompson and Fraser



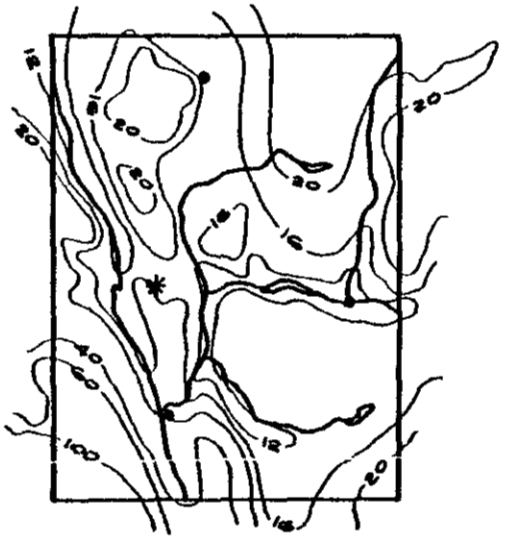
FROST FREE DAYS



GROWING DEGREE DAYS >42°F

ANNUAL MOISTURE DEFICIT (IN.)

MAY–SEPT. PRECIPITATION (IN.)



ANNUAL PRECIPITATION (IN.)

✱ HAT CREEK COAL DEPOSIT

SOURCE:
DEPT. OF GEOGRAPHY,
U.B.C., 1965–66 [6]

SCALE 1:3,500,000

SMALL SCALE CLIMATE MAPS
REGIONAL STUDY AREA

FIG. 4-1

Rivers and the Lower Nicola River would have climate capability classes similar to the higher classes (1 - 3) found in the mapped portion of the Regional Study Area because of the similarity in frost free period, growing degree days and precipitation.

(c) Land Capability for Agriculture

Within the Regional Study Area, land of high agricultural capability (CLI agricultural capability classes 1 through 4) totals 4430 km^2 (1710 mi^2), land of grazing capability totals 16,000 km^2 (6176 mi^2), and land of limited or no agricultural capability makes up the remainder, 16,400 km^2 (6332 mi^2) (Table 4-1).

The areal distribution of the three land capability categories is shown in Figure 4-2 (foldout). Table 4-2 provides the areal breakdown of land by capability classes 1 through 4 for each of the published Agriculture Land Capability maps within the Regional Study Area (see Figure 3-2).

An examination of Figure 4-2 and Table 4-2 shows that high capability agricultural land occurs mainly in the river valleys and on the plateaus in the northern part of the region. This distribution is largely a function of climate (see Section 4.1(b)). Even though there are larger total amounts of high capability agricultural land in the northeastern and northwestern part of the Regional Study Area, the areas with CLI agricultural capability classes 1 and 2 occur mainly along the North Thompson River, Merritt-Nicola Lake area, Kamloops Lake area, the Fraser River valley from Lillooet to Lytton, and the Thompson River valley in the vicinity of the Ashcroft-Cache Creek-Savona area. Because of these high capability ratings these areas are regarded as a valuable agricultural resource. Only a small amount of high capability agricultural land is likely to lie in the portion of the Regional Study Area for

TABLE 4-1

LAND CAPABILITY FOR AGRICULTURE

REGIONAL STUDY AREA AND PROVINCE

Agricultural Land Capability	B.C. Capability Area (10^2 km^2)	Regional Study Area Capability Area (10^2 km^2)	Percent of RSA	Percent of B.C. Cap.
Land of High Agricultural Capability*				
CLI Class 1	7.0	2.1***	0.6	30
CLI Class 2	39.8	3.5	1.0	9
CLI Class 3	100.0	11.0	3.0	11
CLI Class 4	213.2	27.7	7.5	13
Sub Total	360.0	44.3	12.1	12.3
Land of Grazing Capability**	9223	160.0	43	NA
Land of Limited or No Agricultural Value		164.0	45	NA
Total	9583	368	100	NA

* Improved class rating.

** Includes biogeoclimatic zones: Ponderosa Pine - Bunchgrass, Interior Douglas-fir, & Cariboo Aspen - Lodgepole Pine-Douglas-fir.

*** Adjusted totals as per Table 4-2; Primary source ref. 9.

NA Information not available.

RSA Regional Study Area

TABLE 4-2

HIGH CAPABILITY AGRICULTURAL LAND (acres)
REGIONAL STUDY AREA

N.T.S. Map No. (refer to Figure 3-2 (foldout))				Canada Land Inventory Agriculture Land[8] Capability Class (Improved Ratings)				Totals (1-4)
				1	2	3	4	
92	G	16	*	-	-	796	1,912	2,708
	H	13	*	NA	NA	NA	NA	NA
		14	*	NA	NA	NA	NA	NA
		15	*	-	1,161	2,961	9,423	13,545
		16	*	-	-	457	1,073	1,530
	I	1		-	609	14,090	15,861	30,560
		2		-	7,003	11,528	8,941	27,472
		3		NA	NA	NA	NA	NA
		4		NA	NA	NA	NA	NA
		5		1,111	3,551	904	1,634	7,200
		6		227	2,498	2,841	361	5,927
		7		-	-	748	1,064	1,812
		8		-	-	2,550	11,046	13,596
		9		472	15,687	25,490	28,698	70,347
		10		458	1,706	4,725	30,122	37,011
		11		6,932	1,790	999	13,009	22,730
		12		2,138	3,296	3,124	6,440	14,998
		13		1,926	4,815	11,223	6,282	24,246
		14		6,921	1,370	3,625	10,903	22,819
		15		1,735	2,837	2,629	1,943	9,144
		16		50	4,849	13,181	16,745	34,825
	J	1	*	NA	NA	NA	NA	NA
		8	*	NA	NA	NA	NA	NA
		9	*	-	-	-	656	656
		16	*	-	292	-	178	470
	O	1	*	2,872	-	436	3,685	6,993
		8	*	6,447	2,329	5,565	33,321	47,662
		9	*	11,256	10,639	33,933	46,577	102,405
		16	Δ	5,945	41,259	82,795	26,667	156,666
	P	1		4,109	2,415	1,156	10,241	17,921
		2		-	-	18,453	3,757	22,210
		3		-	-	15,383	25,216	40,599
		4		-	-	4,941	6,564	11,505
		5		-	-	7,075	88,880	95,955
		6		-	-	17,561	84,085	101,646
		7		-	-	5,395	22,729	28,124
		8		3,418	878	2,285	4,244	10,825
		9		1,275	971	1,924	4,108	8,278

Continued on next page

TABLE 4-2

.....continued

HIGH CAPABILITY AGRICULTURAL LAND (acres)
REGIONAL STUDY AREA

N.T.S. Map No. (refer to Figure 3-2 (foldout))	Canada Land Inventory Agriculture Land[8] Capability Class (Improved Ratings) 1	2	3	4	Totals (1-4)
92 P 10	-	-	4,301	31,968	36,269
11	-	2,910	9,703	95,533	108,146
12	-	-	2,171	18,250	20,421
13 Δ	17,781	32,751	53,112	105,813	209,457
14 Δ	1,423	4,351	47,491	78,897	132,162
15 Δ	-	-	15,092	35,197	50,289
16 Δ	-	-	-	2,514	2,514
Totals	76,496	149,967	430,643	894,537	1,551,643
Adjusted*** Totals:					
Acres	52,500	87,600	271,000	683,000	1,094,100
Km^2	212	354	1,097	2,764	4,427

* 75% used for adjusted total

Δ 25% used for adjusted total

NA - map sheet not published

*** *The adjusted totals, prepared by the author,* eliminate a portion of the high capability lands for those N.T.S. map sheets that in part lie outside the Regional Study Area (refer to Figure 3-2), and are approximate numbers only. Note that these adjusted totals do not contain estimates of a small amount of high capability land that is likely to exist within the area not covered by Agricultural Land Capability maps, i.e., map sheets 92H/13&14; 92I/3&4; 92J/1&8.

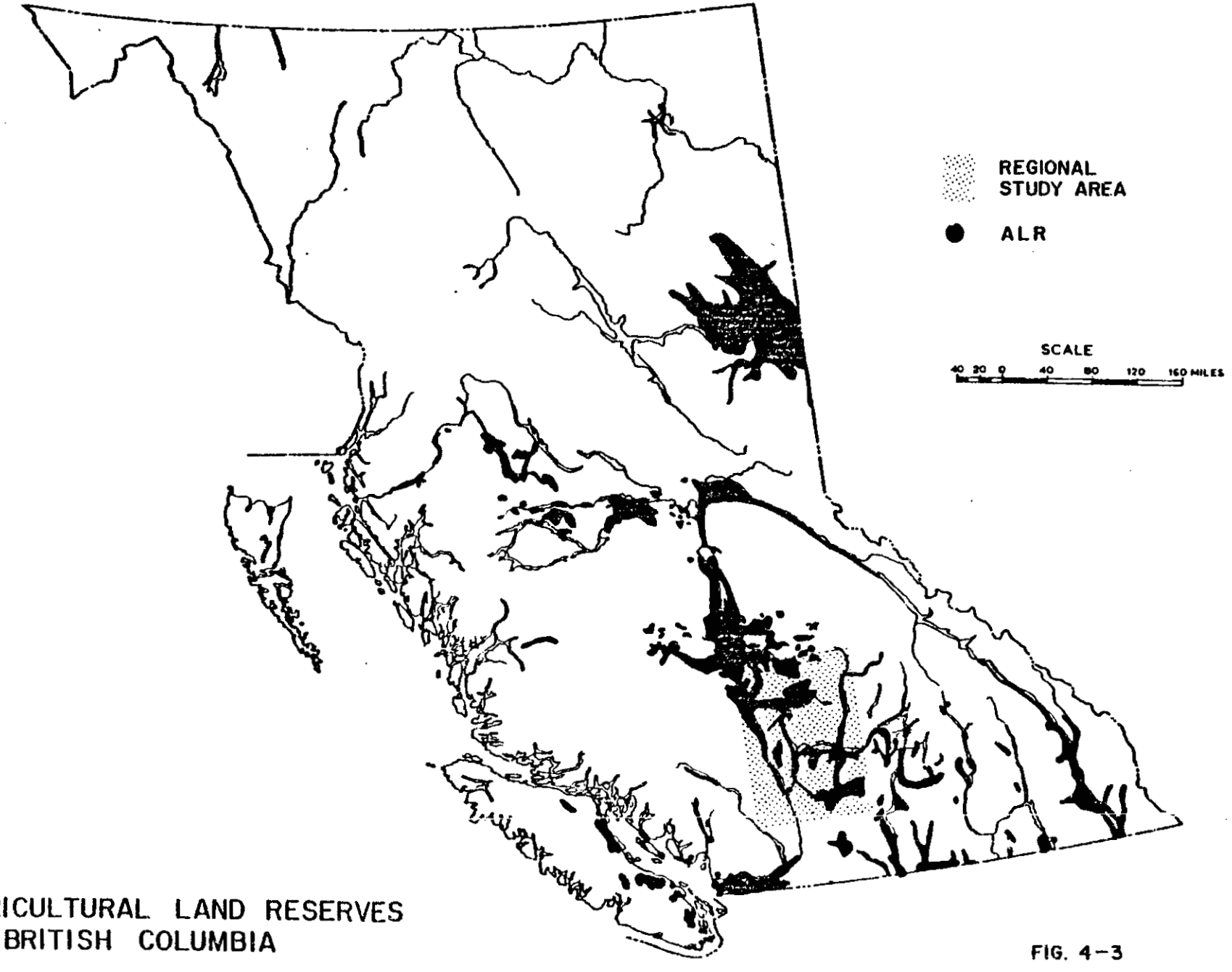
which Agricultural Land Capability mappings are not published (see Figure 3-2). On the whole, this area (unmapped) is very mountainous, and except for a portion of the narrow Nicola River valley, would be unsuitable for arable agriculture.

The amount of agricultural land of British Columbia is also shown in Table 4-1. The 210 km^2 (81 mi^2) of class 1 land in the Regional Study Area represents 30 percent of the provincial total of class 1 land. Because of the large quantity of land of grazing capability, 16,000 km^2 (6176 mi^2), which lies in close proximity to this high capability land, this region is ideally suited for beef cattle production.

(d) Agricultural Land Reserves

There is presently a total of 47,000 km^2 (18,147 mi^2) in the Agricultural Land Reserve of British Columbia and this comprises 4.9 percent of the total land area of the province. The areal extent of the Agricultural Land Reserves in the province is shown in Figure 4-3; a more detailed map of ALR in the Regional Study Area is shown in Figure 4-4 (foldout).

Within the Regional Study Area approximately 9190 km^2 (3547 mi^2) are included in the ALR which represents 25 percent of the land area of the region and 20 percent of ALR land of the province. The majority of the Agricultural Land Reserves within the Regional Study Area are found adjacent to the major rivers and their tributaries (with the exception of the Fraser River south of Lytton) and on the plateau areas north and west of Clinton.



AGRICULTURAL LAND RESERVES
BRITISH COLUMBIA

FIG. 4-3

(e) Present Agricultural Use

A large portion of the Regional Study Area is presently used for agriculture, the predominant use in an areal sense being that of livestock grazing.

Several aspects of present agricultural use of the Regional Study Area are mapped on Figure 4-5 (foldout). The distribution of irrigated land as interpreted from the ERTS satellite photographs[23] provides an indication of where intensive agriculture occurs in the study area. It is evident that the principal areas of irrigated land occur in the Merritt-Nicola Lake area, the North Thompson River valley, the Ashcroft-Cache Creek-Savona area and the Fraser River valley upstream of Lytton.

Based on the cattle distribution map[24] and the identification of irrigated lands from the ERTS photos, it was estimated that agricultural use presently occurs within about 85 percent of the Regional Study Area. Based on the biogeoclimatic information presented in Section 4.1(c), the use of some of this area by cattle would be relatively limited.

A. Regional and Provincial Perspective

British Columbia contains approximately 930,000 km^2 (230 million acres) of land with 23,518 km^2 (5.81 million acres) or 2.5 percent designated as farmland[22] (as defined in Section 3.1(a)(v)). In addition there are approximately 93,000 km^2 (23 million acres) in Crown range reserve[51].

The data for the Thompson-Nicola Census Division are used to characterize the Regional Study Area and are shown in Tables 4-3, 4-4, and 4-5. Although this census division does not exactly cover the same area as that defined by the Regional Study Area

TABLE 4-3

FARM SIZE, LAND AREA AND VALUE, 1976[22]
THOMPSON-NICOLA CENSUS DIVISION AND PROVINCE

Statistic Category	Thompson-Nicola Census Division	Province	Census Division as Percent of Province
Number of Farms by Size:			
Less than 69 acres	114	6,487	2
70 to 129 acres	66	1,248	5
130 to 399 acres	167	2,558	7
400 to 1119 acres	151	1,792	8
Over 1119 acres	128	948	14
Total Number of Farms	626	13,033	5
Farmland Area:			
Improved land (acres)	142,521	1,819,281	8
Unimproved land (acres)	1,211,017	3,992,150	30
Total Farmland (acres)	1,353,538	5,811,431	23
Farm Capital Value:			
Land & Buildings	$168 million	$2,504 million	7
Mach. & Equip.	$ 19 million	$ 307 million	6
Livestock	$ 33 million	$ 186 million	17
Total Capital Value	$220 million	$2,996 million	7

TABLE 4-4

LIVESTOCK NUMBERS AND VALUE, 1976[22]
THOMPSON-NICOLA CENSUS DIVISION AND PROVINCE

	Thompson-Nicola Census Division		Province		Census Division as Percent of Province	
	Number	Value	Number	Value	Number	Value
Beef Cattle	135,119		587,606		23.0	
		$32,027,775		$163,594,620		19.6
Milk Cows	803		79,714		1.0	
Pigs	1,873	133,021	53,014	4,005,598	3.5	3.3
Sheep	3,910	149,000	37,938	1,441,278	10.3	10.3
Hens & Chickens	51,325	130,996	9,628,929	12,573,134	0.5	1.0

TABLE 4-5

CROP PRODUCTION LAND AREA, 1976[22]
THOMPSON-NICOLA CENSUS DIVISION AND PROVINCE

Crop Type	Thompson-Nicola Census Division	Province	Census Division as Percent of Province
Cereal Grains (acres)	2,832	367,969	0.8
Total Forage Crops (acres)	75,971	703,122	10.8
Hay (acres)	70,055	620,816	11.3
Seed Crops (acres)	3	28,482	0.0
Potatoes (acres)	56	10,653	0.5
Vegetables (acres)	251	18,012	1.4
Tree Fruits (acres)	145	26,624	0.5
Small Fruits (acres)	14	9,219	0.2
Other Field Crops (acres)	109	3,928	2.8
Total Land Area Used For Crop Production (acres)	79,381	1,168,009	6.8
(km^2)	321	4,727	

boundaries (see Figure 3-3), the data used are considered representative of the conditions within the study area.

Data from Table 4-3 show that the Thompson-Nicola Census Division contains 5476 km^2 (1,353,538 acres) of farmland which represents 23 percent of the provincial total. The extensive type of agricultural use predominant in the region is evident from the fact that this large percentage of the provincial farmland supports only 626 farms or 5 percent of the province's total. This extensive use is also shown by the fact that more than 70 percent of the farms are greater than 53 ha (130 acres) in size.

The importance of the livestock industry in the Regional Study Area is evident from the fact that the farm capital value of the livestock sector in the census division is $33 million which is 17 percent of the provincial total. Table 4-4 shows that there are over 135,000 head of cattle in the census division which represents 23 percent of the provincial total. Of the 626 farms in the census division, 540 or 87 percent reported cattle on inventory at the time of the 1975 census[22]. There is little other livestock production in the area with the exception of sheep, of which the Thompson-Nicola Census Division accounts for 10 percent of the sheep numbers in the province.

Crop production in the Thompson-Nicola Census Division is devoted almost entirely to forage crops (Table 4-5). Hay is the principal crop and accounts for 88 percent of the total land area used for crop production in the census division. This also represents 11 percent of the total land area used for hay production in the province. However, on the basis of yield the area would have a larger percentage of the provincial hay production since the highly productive Thompson, North Thompson and Nicola valley areas produce on the average 11.2 to 13.5 $Mg\text{-}ha^{-1}$ (5 to 6 $tons\text{-}acre^{-1}$) of

hay (see Table 4-6). This compares with regions like the Peace River that has a much larger hay producing area but with average yields of 2.2 to 4.5 Mg-ha^{-1} (1 to 2 tons-acre^{-1})[25].

B. Beef Cattle Industry Profile

The agriculture of the Regional Study Area is primarily devoted to a cow/calf type of beef enterprise. The climate, soil and topography of the region provide the resources — productive river valleys that are well suited to forage production for winter feed; and large tracts of grazing land that provide summer range pasture — required for this type of enterprise.

The typical ranch operation utilizes range lands to provide low cost feed for the cattle during the grazing season (May to September) and the valley lowlands for hay production for winter feed. For the most part the rancher uses Crown lease or Crown permit land for grazing and deeded land for hay production. The normal cattle movement patterns begin with spring grazing at the lower elevations followed by summer grazing at the higher elevations. In the fall, grazing again occurs at the lower elevations and, to a large extent, on harvested haylands. The cattle are wintered in areas adjacent to the hay production areas. Spring and fall grazing lands are important economic factors since they reduce the amount of winter feed required.

Beef cattle raised in the region are mainly sold as calves for finishing* outside of the province. At the present time the finishing of cattle in the Regional Study Area is relatively insignificant with a small number of small feedlots operating in the area. The majority of the cattle are marketed through the B.C. Livestock Producers' Cooperative Association which operates saleyards, within the Regional Study Area, at Kamloops and Merritt

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* Finishing - refers to growing and fattening beef animals to the weight suitable for slaughtering and marketing.

TABLE 4-6

REPORTED CROP YIELDS
REGIONAL STUDY AREA

Location	Crop	Annual Yield* $Mg\text{-}ha^{-1}$	($Tons\text{-}acre^{-1}$)
Kamloops	Alfalfa hay	9 (2 cuts)	(4)[25]
Kamloops	Alfalfa hay	11 (3 cuts)	(5)[25]
Kamloops	Corn silage	45	(20)[26]
Cache Creek	Alfalfa hay	11-16 (3-4 cuts)	(5-7)[27]

* reported yields represent a range of the applicable information. Crop yields for Hat Creek valley were not available from these references.

and outside the study region at Williams Lake and Okanagan Falls. In 1973 approximately 50 percent of the cattle raised in the central interior* were sold through the Kamloops and Merritt facilities[52].

In most instances the production of forage crops is integrated into the same farming operation as the beef production. However, there are some farming operations, principally in the Ashcroft-Cache Creek-Savona area, that are devoted almost exclusively to forage production. This forage is principally alfalfa hay which is sold to beef production operations located both within and outside the Regional Study Area and to dairy operations located outside the region[53].

Present range carrying capacities typical of the three biogeoclimatic zones previously used to describe grazing capability are provided in Table 4-7. The present conditon of the range, with respect to previous grazing activity, dictates the expected carrying capacity on a range specific basis. This is quite variable in the case of the Ponderosa Pine - Bunchgrass Biogeoclimatic Zone where a range in excellent condition may have a carrying capacity of 1.2 acres-AUM^{-1} and one in poor condition a carrying capacity of 12.0 acres-AUM^{-1}.

The generally very productive grazing resource afforded by the many open grasslands in the region, together with a relatively short wintering season and highly productive haylands provides this region with the basic inputs required for the successful beef industry.

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* The central interior - refers to an area roughly bounded by the coast mountain range to the west, the watershed division between the Peace and Fraser Rivers to the north, the Rocky Mountain Trench to the Columbia River and then Revelstoke to the east, and by the towns of Lytton and Merritt to the south.

TABLE 4-7

REPORTED RANGELAND CARRYING CAPACITIES
REGIONAL STUDY AREA

Biogeoclimatic Zone	Annual Carrying Capacity $ha\text{-}AUM^{-1}$	($acres\text{-}AUM^{-1}$)	Range Condition
Ponderosa Pine - Bunchgrass	0.5	(1.2)[24]	Excellent
	4.9	(12.0)[24]	Poor
Interior Douglas-fir	2.0	(5.0)[24]	Average
Cariboo Aspen - Lodgepole Pine - Douglas-fir	1.8 - 2.0	(4.5 - 5.0)[25]	Average

C. Regional Agricultural Services

The agricultural services for the Regional Study Area are nearly all located in Kamloops (Figure 4-5). These services include:

Government

- B.C. Ministry of Agriculture which provides extension (range, crop and animal) and regulatory (brand and veterinary inspection) services.
- Agriculture Canada Research Station.
- B.C. Ministry of Forests, Range Division which administers grazing permits.
- B.C. Land Branch which administers Crown leases.
- B.C. Water Rights Branch which administers water licenses.

Commercial

- Feed and fertilizer suppliers.
- Veterinary services.
- Farm equipment suppliers.
- Livestock saleyard.

These commercial services operate at a near marginal capacity. The extensive nature of agriculture of the region means that there are fewer producers in the area compared to areas where intensive agriculture is practiced and as a result the demand for commercial farm services is not as high. The existing agricultural services, therefore, do not operate at as high a capacity or efficiency as comparable services in intensive agricultural areas.

Also displayed on Figure 4-5 are the experimental agricultural plots or test areas currently (or recently) under study. These plots are sponsored and managed by either the B.C. Ministry of Agriculture through their Kamloops office or Agriculture Canada through their Research Station at Kamloops. A summary of the studies or the respective plots is shown in Table 4-8.

TABLE 4-8

AGRICULTURAL RESEARCH PLOTS
REGIONAL STUDY AREA

Map Number*	Location Name	Description	Sponsor
		Range Use	
1	Tranquille	intensive grazing	Ag Canada
2	Pass Lake	intensive grazing	Ag Canada
3	Tranquille Lake	intensive grazing	Ag Canada
4**	Bonaparte Ranch	seeding & grazing trials	Ag Canada
5	Beaver Dam Lake	exclosure grassland	BCMA
6	Copper Creek	integrated use	Ag Canada
7	Lac de Roches	exclosure forest	BCMA
8**	Jackson Ranch	weed trial & range forage demonstration	BCMA & Ag Canada
9	Lac le Jeune	sedge meadows	Ag Canada
10	Community Lake	BCFS Study	Ag Canada
11**	Semlin Ranch	crested wheatgrass range plot	BCMA
12**	Bonaparte Ranch	fertilizer plot on range	BCMA & Ag Canada
		Crop Use	
13**	Fountain Ranch	alfalfa	BCMA
14**	Ashcroft Estates	forage corn	BCMA & Ag Canada
15	Walhachin	potatoes	BCMA
16	Spences Bridge	forage corn	BCMA
17	Barnhartvale	forage corn	Ag Canada
18	Darfield	forage corn	Ag Canada
19	Tranquille	forage corn	Ag Canada
20	Sidray Ranch	alfalfa	BCMA

* refer to Figure 4-5 (foldout).

** located within 25 km of Harry Lake.

4.2 LOCAL STUDY AREA

(a) Climate Capability for Agriculture

The climate capability for agriculture varies markedly throughout the Local Study Area as depicted on Figure 4-6 (foldout). The climate classes were identified on the basis of the irrigated class rating since the climate of most of the Local Study Area is restricted by aridity or lack of moisture during the growing season. The degree of aridity in terms of average moisture deficit during the growing season (May to September) ranges from 200 to 450 mm (7.9 to 17.7 in) in areas with class 1 climate capability. For the remainder of the Local Study Area, the net moisture ranges from a deficit of 200 mm (7.9 in) to a surplus of 50 mm (2.0 in) with the surplus occurring in only isolated areas of high elevation. The associated average amount of precipitation during the growing season varies between 100 and 150 mm (3.9 to 5.9 in) in the class 1 climate capability areas. The precipitation during the growing season in the Hat Creek valley lowlands is somewhat higher, ranging from 150 to 200 mm (5.9 to 7.9 in). The maximum average precipitation in the Local Study Area (May to September) occurs at the higher elevations and ranges up to about 250 mm (9.8 in).

Class 1 climates are found in the valleys and associated benches of the Thompson, Fraser and Bonaparte Rivers (Figure 4-6). There are also isolated pockets of class 1 climate found in the Hat Creek valley.

Within the broad class 1 climatic areas are subregions with a special class 1b designation (see Appendix A, description of classes $1b_1$ and $1b_2$) that indicates climatic characteristics that are conducive for the production of special heat-loving crops such

as tomatoes and vine crops. The important climatic characteristics of class 1b are the relatively long frost free period, being greater than 150 days; the high number of growing degree days greater than 5.5°C (42°F), being between 1667 and 2111 (3000 and 3800); and the fact that a large thermal accumulation occurs above 13°C (55°F). Another important feature of this climate class is that winter extreme minimums are relatively severe which is limiting to the production of tree fruits, even that of hardy apples. These special class 1 climate areas are located on the lower benches and valley bottoms of the Fraser, Thompson and Bonaparte Rivers and are shown on Figure 4-6.

The remainder of the class 1 climate capability area (Figure 4-6), identified by a class 1 rating, has a shorter frost free period, of 90 to 120 days and a smaller number of growing degree days greater than 5.5°C (42°F), this being 1194 to 1444 (2150 to 2600). Corn is the key crop designated for this cliamte capability class, although class 1 is suitable for a wide range of vegetables and small fruits, forage crops and cereal grains. Without irrigation (dryland conditions) the class 1 climate areas (1b and 1) have climatic capability ratings that range from class 3 through to class 7.

The benches adjacent to the class 1 areas (Figure 4-6) generally have climatic capability ratings of class 2 or 3. These classes also occur in the Hat Creek valley where they are largely associated with the lower grasslands and have the capability for intensive agriculture where soils are not limiting. The climate characteristics that limit agricultural production are primarily the frost free period which ranges from 60 to 90 days and the range of growing degree days greater than 5.5°C (42°F) of 917 to 1194 (1650 to 2150). These two climate classes are suitable for cool-loving vegetables like cabbage, forage crops, and most cereal grains.

The remainder of the Local Study Area (Figure 4-6), which includes the lower and upper regions of the mountain areas, has climatic capabilities that range from class 4 through class 7. This area is limited to some extent by aridity but the major limitations to agricultural productivity are the short length of the frost free period, this being less than 60 days, and the low number of growing degree days greater than 5.5°C (42°F), this being less than 1056 (1900). The lower mountain regions have generally class 4 and 5 climates which limit their value for cultivated agriculture to the production of forage crops (class 4) but allows considerable grazing potential. Areas with class 6 and class 7 climate capabilities have respectively limited or no agricultural potential and are largely associated with the higher elevation mountains in the western portion of the study area.

The area of each climate capability class in the Local Study Area is shown in Table 4-9. The areas of class 1 climate encompass 598 km^2 (231 mi^2) which represents 30 percent of the study area. Within this class, 336 km^2 (130 mi^2) are designated as class 1b which represents about 56 percent of the class 1 area and 17 percent of the Local Study Area. Climate classes 2 and 3 represent over 510 km^2 (197 mi^2) or 26 percent of the Local Study Area. The areas of class 4 and 5 climate capability lands account for 500 km^2 (193 mi^2) or 26 percent of the Local Study Area. The areas of classes 6 and 7 climatic capability comprise 318 km^2 (123 mi^2) which is 16 percent of the study area.

(b) Land Capability for Agriculture

(i) Land Capability for Irrigated Agriculture

The capability of lands within the Local Study Area for irrigated agriculture is shown in Figure 4-7 (foldout). These lands are

TABLE 4-9

CLIMATE CAPABILITY FOR AGRICULTURE
LOCAL STUDY AREA

Climate Capability Class *	Area (km^2)	Percent of Local Study Area
1b	336	17
1	262	13
2	266	14
3	244	12
4	155	8
5	345	18
6	181	9
7	137	7
Unclassified **	37	2
Total	1963	100

* Irrigated rating.

** Reliable information not available.

found principally in the valleys and benches of the Thompson, Bonaparte and Fraser Rivers, on the plateaus east of Pavilion and in the Hat Creek valley. The area of land with capability for irrigated agriculture in the Local Study Area and Hat Creek basin is given in Table 4-10.

Land with capability for irrigated agriculture occupies a total of 260 km^2 (100 mi^2) which represents 13.2 percent of the Local Study Area. An important component of this land is the 37 km^2 (14 mi^2) with class 1 agricultural capability which represents 1.9 percent of the Local Study Area. This also represents approximately 18 percent of the CLI class 1 land (210 km^2) in the Regional Study Area (note that the Local Study Area is 5 percent of the area of the Regional Study Area). Land with CLI agricultural capability class 1 rating is capable of producing the very widest range of vegetables, cereal grains, forages, berry fruits and numerous specialty crops. Soil and climate combinations are optimum.

Lands with agricultural capability class 2 occupy 19 km^2 (7.3 mi^2) or 1 percent of the Local Study Area. This land is capable of producing a wide range of crops; however, there are minor restrictions of soils or climate that limit production to some extent.

Lands with agricultural capability classes 3 and 4 occupy 156 km^2 (60 mi^2) or nearly 8 percent of the Local Study Area. These lands are capable of producing a fairly wide range (class 3) to a restricted range (class 4) of crops because of soil and/or climate limitations.

Land with agricultural capability class 5 occupies 48 km^2 (18.5 mi^2) which represents 2.4 percent of the Local Study Area. Crop production is limited to perennial forages.

TABLE 4-10

LAND CAPABILITY FOR AGRICULTURE
LOCAL STUDY AREA AND HAT CREEK BASIN

Capability Class	Local Study Area Area (km^2)	Local Study Area Percent	Hat Creek Basin Area (km^2)	Hat Creek Basin Percent
Capability for Irrigated Agriculture:				
CLI Ag. Capability 1*	37	1.9	0	0
CLI Ag. Capability 2*	19	1.0	0	0
CLI Ag. Capability 3*	71	3.6	14	2.2
CLI Ag. Capability 4*	85	4.3	36	5.6
CLI Ag. Capability 5*	48	2.4	18	2.8
Sub Total	260	13.2	68	10.6
Capability for Grazing:				
Grazing Capability 1	12	0.6	4	0.6
Grazing Capability 2	593	30.2	232	36.2
Grazing Capability 3	302	15.4	85	13.3
Grazing Capability 4	465	23.7	124	19.3
Grazing Capability 5	331**	16.9	128**	20.0
Sub Total	1703	86.8	573	89.4
Total Area	1963	100.0	641	100.0

* Improved class rating.

** Includes area of water bodies, estimated to be 10 km^2 for the Local Study Area and 1 km^2 for Hat Creek basin.

Within the Hat Creek basin there is no land with class 1 or 2 agricultural capability because where class 1 climate capability occurs in the basin, the attendant soils have limitations that reduce the agricultural capability. Within the basin, lands with classes 3, 4 and 5 agricultural capability occupy 68 km^2 (26 mi^2) which represents approximately one-quarter of all lands with capability for irrigated agriculture in the Local Study Area.

Lands with capability for irrigated agriculture were based on the capability for agriculture maps available as outlined in Section 3.1(b)(ii). The maps for some of the areas in the Local Study Area were provisional in nature since they were prepared without precise information on climate and only preliminary information on soils. The recently available provisional Climate Capability for Agriculture map[5] provides the type of information required to prepare final agricultural capability maps. Although it is beyond the terms of reference of this study to revise the provisional land capability for agriculture class ratings, an examination was made of the provisional land capability maps in conjunction with the recently available climate map to determine if possible erroneous classifications exist in this inventory. This examination showed that there are six land units with capability for irrigated agriculture which appear to have inappropriately high agricultural capability classifications. These units are noted on Figure 4-7; the majority are located in the Hat Creek basin. The areas involved are approximately 18 km^2 (7 mi^2) of class 3 land that would more appropriately be class 4 and 6 km^2 (2.3 mi^2) of class 4 that would be limited to class 5.

(ii) Land Capability for Grazing

The lands with capability for grazing were identified in terms of grazing capability classes 1 through 5 with class 1 denoting the

highest capability for grazing and class 5 the lowest. The lands with high capability for grazing (grazing capability classes 1, 2, and 3) are principally located on the secondary benches adjacent to the rivers of the Local Study Area and on the lower elevations of the mountains in the Hat Creek drainage basin (Figure 4-7, foldout).

As evident from Table 4-10, lands with class 1 grazing capability are extremely limited and represent less than 1 percent of the Local Study Area. However, lands with class 2 grazing capability represent an important resource and occupy 593 km^2 (229 mi^2) of area which is 30.2 percent of the study area. Within the Hat Creek basin class 2 grazing capability land occupies approximately 232 km^2 (90 mi^2) which is 36.2 percent of the total land in the basin. Class 3 grazing capability land occupies approximately 302 km^2 (117 mi^2) or 15.4 percent of the Local Study Area. Within the Local Study Area the land area with the higher capability for grazing (1, 2, and 3) covers 907 km^2 (350 mi^2) which represents 46.2 percent of the total area. Grazing class 4 and 5 land which occupies 796 km^2 (307 mi^2) or about 40.6 percent of the Local Study Area represents a relatively low grazing resource.

(c) Agricultural Land Reserves

Agricultural Land Reserves (ALR) provide a measure of the importance of agriculture in an area. The location of ALR in the Local Study Area is shown in Figure 4-8 (foldout). The areas of ALR in the Local Study Area and Hat Creek basin are given in Table 4-11.

Within the Local Study Area 529 km^2 (204 mi^2) are included in the ALR which represents 27 percent of the total land area. The largest areas are located in the vicinity of the Thompson River

TABLE 4-11

AGRICULTURAL LAND RESERVES
LOCAL STUDY AREA AND HAT CREEK BASIN

	Local Study Area		Hat Creek Basin	
	Area (km^2)	Percent	Area (km^2)	Percent
ALR	529	27	145	23
Non-ALR	1434	73	496	77
Total	1963	100	641	100

(Figure 4-8) and include over 270 km² (104 mi²) which is over 50 percent of the total ALR within the Local Study Area. ALR within the Hat Creek basin account for approximately 145 km² (56 mi²) or 27 percent of the total ALR of the Local Study Area.

Although 73 percent of the land area in the Local Study Area is not included in the Agricultural Land Reserves there is widespread agricultural use of these non-ALR lands. This situation occurs because forested Crown land which is administered by the B.C. Forest Service is usually not included in the ALR even though these lands are an important livestock grazing resource.

(d) Present Agricultural Use

(i) Land Tenure

Land within the Local Study Area is either private, Crown or Indian Reserves. Some of the Crown land is held under agricultural and grazing leases. The area of land held under various tenure categories is shown in Table 4-12 and the areal distribution of these lands is mapped in Figure 4-9 (foldout). An examination of these two items shows that private (deeded) land occupies 243 km² (94 mi²) or 12.4 percent of the Local Study Area. Within the Hat Creek basin private land occupies 31 km² (12 mi²) or 4.9 percent of the drainage basin. Private land is located generally in the valley bottoms of the Local Study Area with the largest amount found adjacent to the Thompson River.

Agricultural and grazing leases occupy 392 km² (151 mi²) or 20.0 percent of the Local Study Area. Within the Hat Creek basin the relationship between leased land and total area is quite similar with 22.9 percent of the land area or 147 km² (57 mi²) being held

TABLE 4-12

LAND TENURE
LOCAL STUDY AREA AND HAT CREEK BASIN

	Local Study Area		Hat Creek Basin	
	Area (km^2)	Percent	Area (km^2)	Percent
Private Land	243	12.4	31	4.9
Agricultural & Grazing Lease Land (Crown)	392	20.0	147	22.9
Indian Reserves	79	4.0	29	4.5
Other Crown Land	1249	63.6	434	67.7
Total	1963	100.0	641	100.0

under lease tenure. The majority of the Local Study Area under lease tenure is grazing land.

There are eighteen Indian Reserves in the Local Study Area and in total they occupy 79 km^2 (31 mi^2) which is 4.0 percent of the total area. These Indian Reserves are located throughout the study area.

Other Crown lands occupy 1249 km^2 (482 mi^2) and 434 km^2 (168 mi^2) of the Local Study Area and Hat Creek basin respectively. This represents 63.6 and 67.7 percent of the total land of these two respective areas. Other Crown lands include Crown reserves, Crown lease land (other than agricultural and grazing), and nonalienated Crown land. The majority of land in this category is still important to agriculture since it is used for grazing under grazing permits administered by the Crown (discussed in Section (iii)).

(ii) Cultivated Cropland and Pasture Use

Cultivated cropland and pasture are identified on the basis of land that is irrigated. This method was selected because irrigation is required for the production of crops and forages due to the arid climate of the region. Consequently, land that is developed for pasture but is not irrigated is classified as natural rangeland. On Photo 4-1, the contrast between irrigated lands and dry rangeland is well shown.

Agricultural land use, including irrigated and nonirrigated land by land tenure category for the Local Study Area and the Hat Creek basin, is tabulated in Table 4-13. The areas of irrigated land are identified on Figure 4-9. An examination of this table shows that 42 km^2 (17 mi^2) or 2.3 percent of the land within the Local Study Area is irrigated. Of the 10.8 km^2 (4.2 mi^2) of land irrigated in the Hat Creek basin, 8.8 km^2 (3.4 mi^2) is hay land and 2.1 km^2 (0.8 mi^2) is irrigated pasture.

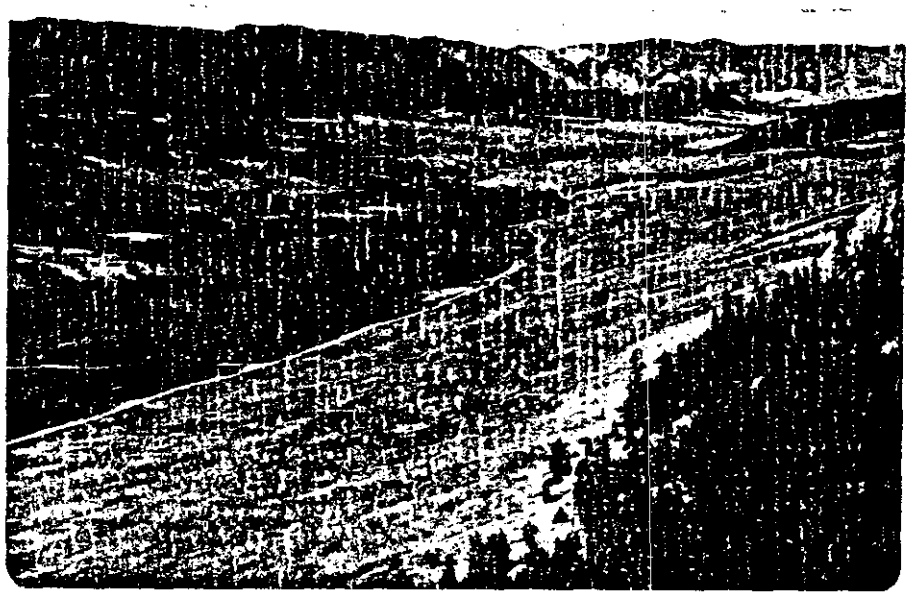

PHOTO 4-1
Contrast between irrigated lands and semi-arid spring grazing lands, upper Hat Creek valley.

TABLE 4-13

PRESENT AGRICULTURE LAND USE
LOCAL STUDY AREA AND HAT CREEK BASIN

	Local Study Area		Hat Creek Basin	
	Area (km)	Percent	Area (km)	Percent
Cultivated Cropland & Irrigated Pasture:				
Private & Leased	43	2.2	9.5	1.5
Indian Reserve	2	0.1	1.3	0.2
Sub Total	45	2.3	10.8	1.7
Rangeland:				
Private & Leased	592	30.2	168	26.2
Indian Reserve	77	3.9	28	4.4
Grazing Permits	1211	61.7	434	67.7
Nonagricultural	38	1.9	-	-
Sub Total	1918	97.7	630	98.3
Total	1963	100.0	641	100.0
Low Use Grazing Land (included in Rangeland categories)	415	21.1	127	19.8

The crop types found in the Local Study Area with their productivities and relative agricultural importance are given in Table 4-14. The productivity ranges reflect differences that occur as the result of management and climate.

Alfalfa is a valuable plant species to agriculture of the area and is grown by itself or in conjunction with a grass as a hay crop. The upper range of productivities, 1569 $Mg\text{-}km^{-2}$ (7 $tons\text{-}acre^{-1}$), would occur on the better managed land in the class 1b climate areas (refer to Figure 4-6, foldout). In these areas the high number of heat units are very favourable for alfalfa production and the long frost free period allows up to four harvests annually.

Alsike clover is of moderate agricultural importance in the Local Study Area and is used as part of a legume-grass hay mixture where soil factors limit the growth of alfalfa. White clover is of relatively low importance in the study area but is used as part of a legume-grass mixture for hay and pasture production on wetland meadows. This type of meadow is found in the Hat Creek valley and a large portion of the Bonaparte River valley.

Of the grasses found in the Local Study Area, orchardgrass is regarded as the most important and is used as part of a grass-legume hay mixture. Reed canary grass is used for hay production in wetland areas where other species of grasses or legumes would be less productive. Timothy is usually grown as a monoculture for hay production and is an important feed for horses. Timothy is also sometimes used in dryland range mixes for areas where spring seepage occurs. Crested wheatgrass is used for range reseeding and is particularly useful for early spring and late fall pasture.

Corn is gaining in popularity as an annual crop for silage production and is used as feed for cattle. The other annual crop

TABLE 4-14

PRESENT FORAGE & FIELD CROPS
LOCAL STUDY AREA

Crop Type	Agricultural* Importance	Productivity[25,26,27]
Perennials		
Legumes		
Alfalfa *(Medicago sativa)* - varieties Rambler, Vernal	High	3-7 tons-acre^{-1} (hay)
Alsike Clover *(Trifolium hybridum)* - varieties Aurora, Tetra	Medium	2-5 tons-acre^{-1} (grass hay mix)
White Clover *(Trifolium repens)* - variety White Dutch	Low	3-4 tons-acre^{-1} (hay-meadow grass mix)
Grasses		
Bromegrass *(Bromus arvensis, Bromus inermis)* - varieties Carlton, Magna	Low	2-4 tons-acre^{-1} (hay-legume mix)
Crested Wheatgrass *(Agropyron cristatum)* - varieties Summit, Nordan	Medium	0.5-1.0 acre-AUM^{-1} (pasture)
Orchardgrass *(Dactylis glomerata L.)* - variety Sterling	High	3-5 tons-acre^{-1} (hay-legume mix)
Perennial Ryegrass *(lolium)* - varieties Norlea and Tetraploid types	Low	1.0 acre-AUM^{-1} (wetland pasture)
Reed Canary Grass *(Phlaris arundinacea L.)* - varieties Frontier, Castor	Medium	3-5 tons-acre^{-1} (hay)
Timothy *(Phleum pratensis L.)* - varieties Climax, Champ	Medium	3 tons-acre^{-1} (hay)
Annuals		
Corn *(Zea mays L.)* - hybrid variety	Medium	20 tons-acre^{-1} (silage)
Potatoes *(Solanum tuberosum)*	Low	12 tons-acre^{-1}

* Refers to the relative agricultural importance of the crop in the Local Study Area.

grown in the area is potatoes which is currently of only limited importance.

(iii) Rangeland Use

The grazing of cattle on natural ranges in the Local Study Area occurs, for the most part, on Crown lands that are administered under grazing leases or grazing permits (Figure 4-9). The amounts of rangeland within the Local Study Area and the Hat Creek basin are summarized in Table 4-13. There are approximately 669 km^2 (258 mi^2) of rangeland within the Local Study Area on private, lease, or Indian Reserve land and approximately 1211 km^2 (468 mi^2) of rangeland under Crown grazing permit. The leased lands are generally located on the lower grassland ranges and some intermediate elevation grassland ranges adjacent to private land; the grazing permit areas are generally at the higher elevations encompassing forested lands.

On Figure 4-9 is the name of each grazing permit unit, the time of year in which the permit may be used, and the total number of Animal Unit Months that are allowed during the specified period. Permit information, tabulated in Table 4-15, shows an estimate of 18,000 AUMs presently being stocked on the grazing permit lands of the Local Study Area. The stocking rates (Table 4-15) of each grazing permit unit were calculated simply by dividing the area of the permit by the total number of AUMs permitted. These stocking rates range from 0.4 to 54.1 ha-AUM^{-1} (1.0 to 134 acres-AUM^{-1}) with the average for all the grazing permit land in the Local Study Area being 6.7 ha-AUM^{-1} (16.6 acres-AUM^{-1}). For the Hat Creek basin, 7500 AUMs are presently stocked on Crown permit lands with an average stocking rate of 5.8 ha-AUM^{-1} (14.3 acres-AUM^{-1}). The number of cattle presently stocked on the permit ranges of the Local Study Area and Hat Creek basin was calculated from permit

TABLE 4-15

GRAZING PERMITS
LOCAL STUDY AREA & HAT CREEK BASIN

Grazing Permit Unit	Permitted AUMs	Permit Area (km^2) Total	Within LSA**	Within HCB***	Calculated Stocking Rate ($ha\text{-}AUM^{-1}$)
Barnes Lake	150	22	22	-	14.8
Bedard Lake - A/C	523	24	24	-	4.5
Bedard Lake - B	2192	37	37	37	1.7
Bedard Lake - D/E	380	44	44	4	11.5
Blackhill Creek*	?	?	15	-	?
Blue Earth*	500	66	38	38	13.3
Cache Creek*	818	? }	152	-	?
Scottie Creek*	770	? }			?
Cairn-Blustery	450	30	30	30	6.6
Chipuln Creek	533	41	41	20	7.7
Cinquefoil*	540	36	34	-	6.7
Fountain Creek	148	20	20	-	7.1
Frantzen Creek	40	5	5	-	13.3
Gibbs Creek	111	8	8	-	6.9
Hat Creek Lowlands	150	1	1	1	0.4
Lower Colley	125	6	6	6	4.7
Langley Lake	293	20	20	5	5.7
Maiden Creek - A	1250	181	181	78	14.5
Maiden Creek - B	255	77	77	65	30.1
McCormick Creek	360	22	22	22	6.2
McKenna Creek	130	18	18	-	14.1
McLean Lake - A	2399	78	78	60	3.2
McLean Lake - B	476	7	7	-	1.5
McLean Lake - C	1230	46	46	23	3.7
Nine Mile Creek	138	13	13	-	9.8
Parke Lake	188	11	11	11	5.7
Pavillion Mountain*	2288	85	69	-	3.7
Rusty Creek	167	12	12	-	12.5
Sallus Creek	621	89	89	20	14.3
Tom Cole Mountain	825	34	34	-	4.2
Tremont Creek*	450	53	9	-	11.7
Twall*	2910	280	27	-	9.6
Upper Rough Creek	509	37	7	-	7.2
Yet Creek*	40	22	14	14	54.1
Totals	21,959 +	1425+	-	-	6.7 avg. (est)
LSA Totals	18,000	-	1211	-	6.7 avg.
HCB Totals	7,500			434	5.8 avg.

* Portion of unit lies outside Local Study Area
** LSA - Local Study Area
*** HCB - Hat Creek Basin

information to be 5100 and 2050 respectively. Further, the average period spent on these permit ranges comes to about 3½ months.

The present average stocking capacity of the 669 km^2 (258 mi^2) of private land (including Indian Reserves) and leased rangeland within the Local Study Area, as derived from the values given on the range map prepared by the B.C. Forest Service in 1969[47], was estimated to be 2.4 ha-AUM^{-1} (6.0 acres-AUM^{-1}). On the basis of this average stocking capacity, the total cattle grazing capacity afforded by the lower grasslands within the Local Study Area would be approximately 27,875 AUMs. This value appears to be high in comparison with the 5100 cattle on permit in view of the fact that the 27,875 AUM would be capable of supporting approximately 9300 cattle over a three month grazing period. Explanation of this high value is probably a combination of the following reasons: (1) the lower rangelands may be in poorer condition than they were ten years ago when the range map[47] was prepared; (2) the portion of the Local Study Area covered by the range map from which the average stocking capacity was derived may have better lower grassland ranges than the rest of the study area; (3) the 669 km^2 (258 mi^2) estimate of the area of the lower grassland areas within private and leased land may actually be an overestimate of the effective available grassland area.

The more productive ranges, those with a stocking capacity of 4 ha-AUM^{-1} (10 acres-AUM^{-1}) or better, are the lower grassland areas of the leased land and the mid-elevation grasslands of leased land and of permit areas near Pavilion (Pavilion Mountain and Tom Cole Mountain permit units) and the mideastern portion of the Hat Creek basin (McLean Lake and Bedard Lake permit units). The better areas of these latter regions have present stocking rates better than 2 ha-AUM^{-1} (5 acres-AUM^{-1}).

Comparing the values derived for the present stocking capacities of rangelands in the Local Study Area with the potential carrying

capacities under excellent range conditions (see Section 5.1 (b)(i)B,Vol.II) provides a rough idea of the present condition of the ranges. The lower grasslands, with a present stocking capacity of something poorer than 2.4 ha-AUM^{-1} (6 acres-AUM^{-1}) and perhaps as poor as 5 ha-AUM^{-1} (12.4 acres-AUM^{-1}) indicate a relatively poor condition of these grasslands compared to a potential carrying capacity of around 0.8 ha-AUM^{-1} (2 acres-AUM^{-1}) under excellent range conditions. These lands, then, in their present condition support between 15 and 30 percent of their maximum potential. The more productive areas of the mid-elevation ranges with present carrying capacities better than 2.0 ha-AUM^{-1} (5 acres-AUM^{-1}) are again in relatively poor condition when compared to the 0.4 ha-AUM^{-1} (1 acre-AUM^{-1}) maximum potential carrying capacity. These ranges in their present condition support about 25 percent of their maximum potential. The higher elevation ranges although of lower absolute productivity are in relatively better condition when compared to their maximum potential. On the average these lands in their current condition support roughly 65 percent of their maximum potential, 6 ha-AUM^{-1} (15 acres-AUM^{-1}) compared to 4 ha-AUM^{-1} (10 acres-AUM^{-1}). The poor condition of a lower grassland spring range and the good condition of a higher elevation summer range are shown in Photos 4-2 and 4-3.

The rangeland areas identified as of relatively low grazing use due to restrictive topography or vegetation are shown on Figure 4-9. These areas account for approximately 415 km^2 (160 mi^2) or 21.1 percent of the Local Study Area and 127 km^2 (49 mi^2) or 19.8 percent of the Hat Creek basin (Table 4-13). These areas are located primarily in the mountains between the Hat Creek valley and the Fraser River.

The location of important cattle trails, shown on Figure 4-9, provides an insight into cattle movements and the relationship between agricultural land use areas.

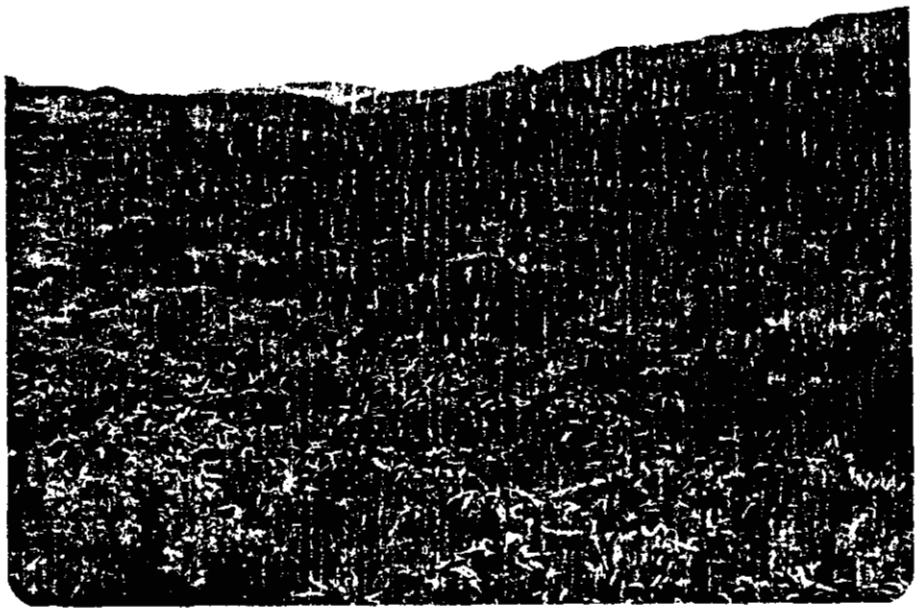

PHOTO 4-2

Overgrazed spring range.

PHOTO 4-3

Productive open summer range before grazing.

The range plant species found in the Local Study Area are listed in Table 4-16 together with a high, medium or low ranking on the relative value of the particular plant as range forage for livestock. The main criteria used in determining the relative value of a plant was its palatability and feed value to grazing livestock and does not account for relative abundance of the species in the Local Study Area.

(iv) Farm Units

The land within the Local Study Area was categorized into farm units, a farm unit being the aggregate land area, under single management control, that functions as a unit for the production of agricultural products. The analysis of the agricultural resource on a farm unit basis is important as it is the fundamental base unit for agricultural production.

The information presented previously pertaining to land tenure, cultivated cropland and pasture use, and rangeland use was reorganized on a farm unit basis. Because of the importance of the Hat Creek valley to the study, information on cattle herd numbers, the location of herd wintering areas, and details on cattle movement patterns were included for farm units in that area. The present use information for each of the thirteen farm units identified in the Local Study Area is shown in Table 4-17. The location and areal composition of these farm units is shown in Figure 4-9.

Twelve of the farm units are involved in cattle ranching operations; the other is a commercial hay operation. All of the cattle ranching operations with the exception of Farm Unit 12 have their headquarters inside the Local Study Area. Five of the farm units have their headquarters and all of their ranching operations within

TABLE 4-16

PRINCIPAL SPECIES OF RANGE PLANTS
LOCAL STUDY AREA

	Value as Range Forage for Livestock			Comments
	High	Med	Low	
Trees				
Pinus ponderosa			x	- causes abortion under special circumstances
Populus tremuloides	x			- use of new shoots
Shrubs				
Amelanchier alnifolia		x		
Artemisia frigida			x	
Cornus stolonifera		x		
Rosa gymnocarpa		x		
Salix cascadensis		x		
Salix nivalis		x		
Salix sp.		x		
Grasses				
Agropyron caninum	x	x		
Agropyron cristatum	x			
Agropyron repens			x	
Agropyron smithii	x			
Agropyron spicatum	x			
Agrostis alba	x			
Agrostis scabra		x		
Bromus ciliatus		x		
Bromus erectus		x		
Bromus inermis		x		
Bromus tectorum			x	- mechanical injury to mouth and throat
Calamagrostis canadensis			x	
Calamagrostis purpurascens		x		
Calamagrostis rubescens		x		
Carex albo-nigrum		x	x	
Carex aquatilis			x	
Carex petasata			x	
Carex rostrata	x			
Carex praticola			x	
Carex pyrenacia			x	
Carex sp.			x	
Danthonia intermedia		x		
Distichlis stricta			x	

continued on next page

TABLE 4-16

PRINCIPAL SPECIES OF RANGE PLANTS
LOCAL STUDY AREA

	Value as Range Forage for Livestock			Comments
	High	Med	Low	
Grasses (continued)				
Elymus cinereus		x		
Eriophorum riridiarinatum			x	
Festuca occidentalis		x		
Festuca ovina var. rydbergii		x	x	
Festuca rubra		x		
Festuca scabrella		x		
Hordeum jubatum	x			
Juncus balticus			x	
Juncus filifolius			x	
Juncus tenius			x	
Koeleria cristata		x		
Muhlenbergia sylvatica		x		
Oryzopsis hymenoides	x			
Phleum alpinum		x		
Phleum pratense	x			
Poa alpina	x			
Poa cusickii			x	
Poa gracillima			x	
Poa grayana			x	
Poa interior			x	
Poa juncifolia			x	
Poa pratensis		x		
Poa sandbergii			x	
Poa scabrella			x	
Spartina gracilis		x		
Sporobolus cryptandrus		x		
Stipa comata		x		- mechanical injury to mouth and throat
Stipa occidentalis			x	
Stipa richarsonii			x	
Trisetum spicatum			x	
Herbs				
Arnica cordifolia			x	
Astragalus miser		x		- toxic in spring
Astragulus purshii		x		- toxic in spring
Astragulus sp.		x		- toxic

continued on next page

TABLE 4-16

PRINCIPAL SPECIES OF RANGE PLANTS
LOCAL STUDY AREA

	Value as Range Forage for Livestock			Comments
	High	Med	Low	
Herbs (continued)				
Balsamorhiza sagittata			x	
Castilleja miniata			x	
Epilobium angustifolium			x	
Erigeron speciosus		x		
Fragaria glauca			x	
Geranium viscosissium		x		
Lathyrus ochrolecus	x			
Medicago lupulina		x		
Opuntia fragilis			x	- mechanical injury
Senecio triangularis		x		
Trifolium repens	x			
Valeriana sitchensis			x	

TABLE 4-17

FARM UNIT PRESENT USE - LOCAL STUDY AREA

	Farm Unit Number*													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
I Land Tenure														
Private (ha)	389	259	65	631	4973	2037	267	1165	820	-	2300(IR)	-	340	227
Lease (ha)	356	356	583	3610	9267	4955	826	4695	2672	732	-	3196	-	-
Total	745	615	648	4241	14240	6992	1093	5860	3492	732	2300(IR)	3196	340	227
% of Local Study Area	0.4	0.3	0.3	2.2	7.3	3.6	0.6	3.0	1.8	0.4	1.2	1.6	0.2	0.1
II Land Use														
Private & Lease Land														
- irrigated 1976 (ha)	130	61	40	232(2)	623(10)	385	104(19)	109(6)	282	-	180(IR)	-	180	53
- rangeland 1976 (ha)	615	554	608	4009	13617	6607	989	5751	3210	732	2120(IR)	3196	160	174
Other Crown Land														
- grazing permit land-1977 (ha)	5274	4381	c	4049	12658	25915	4121	14180	15236[d]	2751	e	f	-	-
- permit use-1977 (AUM-yr^{-1})	540[b]	610	95	638	3360	2780	533	2477	1639[b]	2910[b]	293	525	-	-
III Cattle Numbers														
From Permit Information														
- cattle on permit land-1977	145[b]	161	61	150	980	590	160	545	416[b]	582[b]	40	175	-	-
From Discussions with Ranchers-1978 (yearly average)														
- breeding herd size	125	225	75	300	NA	800	125	NA	NA	NA	NA	NA	-	-
- calves	10	0	10	250	NA	NA	100	NA	NA	NA	NA	NA	-	-
- yearlings	20	5	0	250	NA	NA	0	NA	NA	NA	NA	NA	-	-

* refer to Figure 4-9 (foldout) for location.

a Includes only permit land within Local Study Area; some Farm Units share permit areas (see c, d, e, & f below).

b Permit use is on permit land which is partially outside Local Study Area.

c Shares permit area included in Farm Unit 5 permit land.

d Shares permit area included in Farm Unit 6 permit land.

e Shares permit area included in Farm Unit 9 permit land.

f Shares permit area included in Farm Unit 9 permit land.

note 1 - bracketed numbers in table are irrigated areas (ha) of leased land.

note 2 - the private and lease land of Farm Units 1, 2, 3, 4, 7, 13, & 14 are located within the Site Specific Study Area.

note 3 - the majority of private and lease land of Farm Unit 5 is located within the Site Specific Study Area.

NA - information not available.

tne Hat Creek basin. The remaining seven cattle operations use the Hat Creek basin for some of their activities, principally summer grazing of livestock.

All of the cattle operations use leased land to some extent and in most instances this land is used for cattle grazing. Each of the cattle operations also has grazing permits which supply approximately three months of the annual grazing requirements. The private land in most ranching operations is used for building sites, cattle wintering grounds and for the production of hay for winter feed (see Photos 4-4 and 4-5). The normal operation pattern consists of grazing the cattle on the leased land in early spring (April - May) and late fall (September - October) with permit land being used for summer grazing. Grazing of stubble on harvested hay fields supplements fall feed (Photo 4-6). Cattle are wintered in the valley bottom lands close to the hay production areas. The cattle production patterns can vary from year to year but in the majority of cases calves born in the spring are sold in the fall or in the following spring.

(v) Agricultural/Wildlife Interface

There exists within the valley some conflicts between agriculture and wildlife. The principal wildlife species that are invclved in these conflicts are deer, elk to a limited degree, sheep on the upper ranges, and waterfowl. These conflicts have resulted mainly due to the overgrazing of portions of the range resource by domestic livestock. In the *Physical Habitat and Range Vegetation* report[44] that was prepared as part of these overall studies, the relative importance and use of plant species found in the Local Study Area for wildlife, livestock and man are given. The principal plant species that are important for both wildlife and livestock include:

PHOTO 4-4

Ranch house in upper Hat Creek valley.

PHOTO 4-5

Cattle wintering area in upper Hat Creek valley.

PHOTO 4-6

Fall grazing on hay fields after harvest.

Amelanchier alnifolia - important wildlife forage species with competition between livestock and wildlife in late summer and fall,

Artemisia frigida - important winter browse species for sheep with livestock competition occurring in late summer/ fall,

Gramineae - extensively used by wildlife throughout the year and presents a serious conflict with livestock,

Agropyron spp. (particularly *spicatum* species) - all of these represent livestock/wildlife competition throughout the grazing season,

Bromus spp. - all species represent livestock/wildlife competition,

Carex spp. - all species represent livestock/wildlife particularly as a winter feed source,

Koeleria cristata - livestock/wildlife competition particularly as winter/spring feed source for deer,

Poa spp. - all species are used by both livestock and wildlife.

There has been some reduction in these conflicts due to the exercising of better range management practices in the area. Generally, these improved practices include lower stocking rates, better cattle distribution patterns and physical improvements such as reseeding. The lower grasslands have, for the most part, been badly overgrazed and require careful management.

The main ungulate wildlife that use the detailed study area are deer. The conflict between this species and agriculture occurs as a result of the overgrazing by cattle of lands that the deer use for their range. The main range for the deer is located at the north end of Hat Creek valley, and the area is classified by

the wildlife consultants as being of moderate value from a regional perspective but it is important within the Local Study Area. The deer herd varies in size and averages approximately 25 to 50 head. However, during winters with high snowfall the upper Hat Creek valley is an important wintering area for the surrounding areas. The negative effect of livestock overgrazing is somewhat offset by the availability of winter forages to deer in the cattle wintering areas.

The other area of wildlife/agriculture conflict occurs with waterfowl as a result of cattle tramping down the vegetation surrounding ponds. These ponds are used as water sources by the cattle. The fencing off of a portion of these areas would benefit the waterfowl. However, the areas fenced would need to be extensive to ensure that the users of such areas do not become easy prey to predators such as coyotes.

The solution to the agriculture/wildlife conflicts would seem to be in the development of a coordinated resource management program that would take into account the objectives and desires of the various resource users of the area.

(vi) Agricultural Research Plots

The agricultural research plots that are located within the Local Study Area are shown on Figure 4-9; a listing is given in Table 4-18.

The Bonaparte Ranch research plot (map number 4, Figure 4-9) was established in 1975 to compare two varieties of grasses under dry range conditions with respect to cattle stocking rates and relative weight gains.

TABLE 4-18

AGRICULTURE RESEARCH PLOTS
LOCAL STUDY AREA

Map Number*	Plot Name	Use	Sponsor
4	Bonaparte Ranch	Grazing	Agriculture Canada
8	Jackson Ranch	Range Weed Control	BCMA & Agriculture Canada
11	Semlin Ranch	Range Reseeding	BCMA
12	Bonaparte Ranch	Range Fertilization	BCMA & Agriculture Canada
13	Fountain Ranch	Alfalfa	BCMA
14	Ashcroft Estates	Forage Corn	BCMA & Agriculture Canada
20	Bonaparte Ranch	Range Fertilization	BCMA & Agriculture Canada

Agriculture Canada - Agriculture Canada
Research Station
Kamloops, B.C.

BCMA - B.C. Ministry of Agriculture
Kamloops, B.C.

* Refer to Figure 4-9 (foldout).

The Jackson Ranch research plot (map number 8) was established in 1969 and involved the treating of native range with herbicides to control knapweed followed by reseeding with crested wheatgrass. These plots have been monitored to determine the effect of herbicide rate, fertilizer rate, and reseeding with crested wheatgrass, on the control of knapweed and on range productivity. This plot has demonstrated that knapweed can be controlled by herbicide treatment. Treated plots seeded to crested wheatgrass produced dry matter of 382 kg-ha^{-1} (340 lbs-acre^{-1}) compared to control areas that produced 248 kg-ha^{-1} (221 lbs-acre^{-1}).

The Semlin Ranch research plot (map number 11) was established in 1970 to study the effect of fertilizer application and grazing on productivity after seeding range areas with crested wheatgrass.

The Bonaparte Ranch research plot (map number 12) was established in 1971 to determine the effect of fertilization of crested wheatgrass under dry range conditions. The research has shown that relatively low rates of fertilizer application are effective on dry sites. Yields of up to 549 kg-ha^{-1} (489 lbs-acre^{-1}) were recorded during the trial.

The Fountain Ranch research plot (map number 13) was established in 1975 to demonstrate the production of various varieties of alfalfa.

The Ashcroft Estates research plot (map number 14) has been established annually to demonstrate the production of various varieties of forage corn. Yields of up to 6515 Mg-km^{-2} (29 tons-acre^{-1}) have been recorded in recent trials.

The Bonaparte Ranch research plot (map number 4) was established in the early 1960's to demonstrate yield comparisons between a number of grasses and legumes grown under range conditions.

4.3 SITE SPECIFIC STUDY AREA

(a) Soils

Soils of the Site Specific Study Area were characterized by the soil series level information reported in the *Physical Habitat and Range Vegetation* report[44]. Because of the basic importance of soils to agricultural resource assessment, the study map (1:24,000) and summary table prepared for the above report are included as Appendix B to this report.

The agricultural significance of the 82 soil series mapped for the Site Specific Study Area is provided in Table 4-19 where each soil unit has been rated according to a relative scale. Twenty-five soil units were rated as being significant for arable agriculture or irrigated pasture use (H, MH, M, & ML). Most of the remaining soil units were rated as being significant for grazing use (L).

(b) Agricultural Land Reserves

The Agricultural Land Reserves (ALR) in the Site Specific Study Area are shown on Figure 4-10 (foldout). The reserves encompass the bottom lands of the Hat Creek valley, the benches and bottom lands associated with the Thompson River and the high capability rangeland in the vicinity of McLean Lake. An exact areal measurement of the ALR in the Site Specific Study Area was not required; however, a visual comparison with the ALR of the Local Study Area (Figure 4-8) indicates that approximately two-fifths of the ALR of the Local Study Area is located within the Site Specific Study Area.

TABLE 4-19

AGRICULTURAL SIGNIFICANCE OF SOILS
SITE SPECIFIC STUDY AREA

	Agricultural Significance					
	H	MH	M	ML	L	NIL*
	(nil)	(17.16)	(5.34)	(8.08)	(169.50)	(2.07)
Ashcroft Soils		BN CR MA NE VS	SE WA		AY BS BE CC CT JS SV TL TN	
Soil Units 1 - 10		1 2 5 6A 7	3 4	10	6B 8 9	
Soil Units 11 - 20		13 18	16	12 17	11 14 15 19 20C 20D 20E	20A 20B
Soil Units 21 - 30		27 30	28	21 23	22 24 25 26 29	
Soil Units 31 - 64					All Others	42

H High agricultural significance; soils with no limitations for agricultural use.
MH Moderate-High agricultural significance; arable soils.
M Moderate agricultural significance; partially arable soils.
ML Moderate-Low agricultural significance; pasture.
L Low agricultural significance; grazing.
NIL no agricultural value.
* Bluffs (B), Rock Outcrop (RO), and Swamp (SW) which are indicated on Figure B-1 are not included in this table.
( ) Bracketed numbers are total mapped area (km^2) of each category.

(c) Present Agricultural Use

Information on present agricultural use in the Site Specific Study Area is mapped on Figure 4-11 (foldout) and was developed primarily from the data of present agricultural use within the Local Study Area. Included on this figure is information on land tenure, agricultural land use (irrigated land and rangeland), farm units, water licences and agricultural research plots.

Although a detailed areal measurement of the various components of present use was not required visual comparisons were made with the corresponding component in the Local Study Area. The majority of the private and leased land within the Local Study Area is located in the Site Specific Study Area. There are five areas of Indian Reserve in the Site Specific Study Area including one of the largest single reserves of the Local Study Area.

The Site Specific Study Area contains nearly all of the irrigated lands in the Hat Creek basin and roughly half of the benches and valley bottom lands of the Thompson River that were included in the Local Study Area. There are an estimated 880 ha (2175 acres) of irrigated land in the Hat Creek basin portion of the Site Specific Study Area (i.e., upper Hat Creek valley) and 870 ha (2150 acres) within the lowlands of the Thompson River.

The Site Specific Study Area contains all of Parke Lake and Lower Colley permit units and portions of many of the grazing permit units that were described for the Local Study Area. It also contains a large portion of the highly productive McLean Lake permit units.

The farm units shown in Table 4-17 in the present use section of the Local Study Area are present to some extent in the Site Specific Study Area except for Farm Units 10 and 12. Of the

eleven farm units in the study area, ten are cattle ranching operations and the other a commercial hay farm.

The Site Specific Study Area includes two major cattle trails. One of these trails traverses the study area from the Hat Creek basin through to the Trans Canada Highway (Highway 1) via Medicine and Cornwall Creeks. The second trail runs north from McLean Lake. These cattle trails are used to transport or herd cattle into the area and also to move cattle within the area.

Based on the soil series information, climatic constraints, and the farming practices of Hat Creek valley, the productivity levels of present hay land within the Hat Creek portion of the Site Specific Study Area were estimated as follows:

1) wetland hay mix produced on floodplain soils (soil units 2, 3, and 4, see Appendix B) having an expected productivity of 6.8 $Mg\text{-}ha^{-1}$ (3.0 $tons\text{-}acre^{-1}$);
2) alfalfa-grass mix produced on deep well drained soils (soil units 1, 5, 6A, and 7) having an expected productivity of 9.0 $Mg\text{-}ha^{-1}$ (4.0 $tons\text{-}acre^{-1}$); and
3) alfalfa-grass mix produced on upland tills (soil units 10, 13, 14, 15, and 16) having an expected productivity of 5.6 $Mg\text{-}ha^{-1}$ (2.5 $tons\text{-}acre^{-1}$).

Present water use in the Site Specific Study Area is illustrated on Figure 4-11. Shown are the location of the points of diversion of water licences, the quantity of water diverted, in $ha\text{-}m\text{-}season^{-1}$, and the lands irrigated with these waters. The *Hydrology, Drainage, Water Quality and Use* report[49] provides a detailed analysis of present water use. Some of that information as pertains to the Site Specific Study Area is summarized in the following paragraphs.

The total annual quantity of water licenced for diversion within the upper Hat Creek valley is 859 ha-m (6964 acre-ft) which does not include an additional 117 ha-m (949 acre-ft) under supplemental licences*. Almost half of this quantity, 382 ha-m (3097 acre-ft), is for use outside upper Hat Creek valley; including 222 ha-m (1800 acre-ft) diverted for irrigation of the Thompson River lowlands within the Site Specific Study Area. The principal sources (not including supplemental licences) are Hat Creek, licenced for 294 ha-m (2383 acre-ft) and Medicine Creek licenced for 236 ha-m (1913 acre-ft).

Within the Cornwall and Cheetsum drainages which approximate the eastern portion of the Site Specific Study Area, 125 ha-m (1013 acre-ft) are licenced for annual diversion. As well, 45 ha-m (365 acre-ft) are under supplemental licences.

The annual irrigation water use within the upper Hat Creek basin portion of the Site Specific Study Area was also estimated on the basis of theoretical water requirements[49]. This estimate is 536 ha-m (4345 acre-ft). The theoretical seasonal distribution of this is given as: May, 75 ha-m (608 acre-ft); June, 101 ha-m (819 acre-ft); July, 167 ha-m (1354 acre-ft); August, 131 ha-m (1062 acre-ft); and September, 62 ha-m (503 acre-ft).

Irrigation in the Site Specific Study Area is by two principal methods — the diversion of creeks via ditches for surface irrigation of the land,which is the predominant method in the Hat Creek valley, and sprinkler irrigation, which is the predominant method on the Thompson River lowlands and used to some extent in the Hat Creek valley. Sprinkler irrigation requires higher capital costs but results in more efficient use of water than surface irrigation.

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* supplemental licence - is an irrigation licence used only if another licenced source is inadequate to supply its full licenced quantity.

Photo 4-7 is an aerial view showing lands of the Hat Creek valley that are irrigated by both the above methods.

Two of the agricultural research plots that are discussed in Section 4.2(d)(vi) are located in the Site Specific Study Area. These are the Bonaparte Ranch plot (map number 4, Figure 4-11) used for grazing research by Agriculture Canada and another Bonaparte Ranch plot (map number 12) used for range fertilization research by the B.C. Ministry of Agriculture and Agriculture Canada.

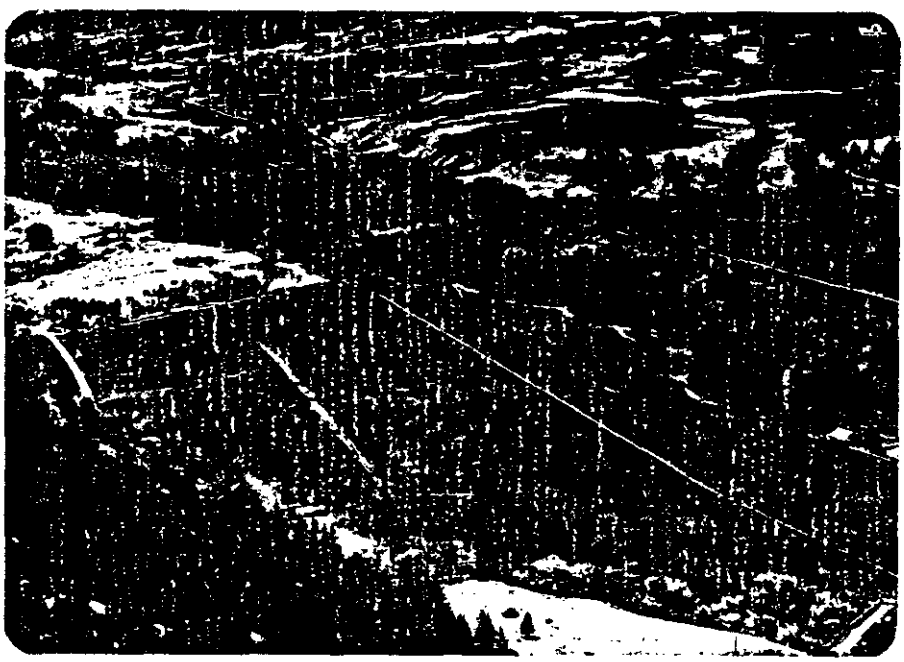

PHOTO 4-7

Irregularly shaped fields showing contrast between sprinkler irrigation (foreground) and ditch irrigation (backgrounc).

8.0 GLOSSARY

Agricultural Land Reserve (ALR) - land preserved for agricultural use as designated by the Province of British Columbia under the British Columbia Land Commission Act.

Animal Unit Month (AUM) - a feed equivalent used to indicate the number of grazing animals a range area can support. One AUM is one cow and calf or one 454 kg (1000 lb) steer grazing for one month.

arable land - land that is capable of being cultivated for crop production.

backgrounding - the feeding of weaned calves or yearlings in a manner to prepare them for finishing.

Biogeoclimatic Zone - a geographic area characterized by a certain combination of macro-climates, zonal soils and zonal (climax) vegetation.

carrying capacity - capability of a range to support livestock over a long period of time. Expressed as area per AUM.

clear-cut - forested land where all trees are cut down.

climax vegetation - the stable vegetation form resulting from the progressive natural replacement of earlier vegetation.

cool-loving vegetables - those which thrive in moderate temperatures, including cabbage, cauliflower, and broccoli.

farm unit - in this report, the total deeded and leased land holdings associated with an independent farm operation. Most operations in the study areas are cattle operations which also have Crown grazing permit areas associated with them.

field crops - include all plants that are grown for their seed.

finishing - feeding cattle on grass or in a feedlot to an age and weight suitable for slaughter.

forage crops - includes all crops which have their vegetative or seed components eaten by livestock.

frost free period - length of time in days between the last day in the spring and the first day in the fall when the temperature is at or below 0°C (32°F).

growing degree days - the accumulated temperature based on the daily mean above 5°C (≈42°) per season.

heat-loving vegetables - those which thrive in high temperatures, including tomatoes and vine crops.

irrigable land - in this report, includes presently irrigated land and other areas with suitable soil, climate and topographic characteristics for crop production (thus requiring irrigation in the semi-arid climate of this study area).

potential agricultural use - refers to the full (maximum) agricultural use of the land resource, based entirely on land and climate capability information.

potential evapotranspiration - is the maximum quantity of water capable of being lost as water vapor, in a given climate, by a continuous stretch of vegetation covering the whole ground and well supplied with water. It is dependent on meteorological conditions, since there are no soil or crop limitations.

probable agricultural use - is derived from potential agricultural use by considering additional constraints, i.e., water availability, economic, social and certain physical factors.

stocking rate - number of cattle that a range actually supports. Expressed as area per AUM.

well-stocked forest - with reference to B.C. Forest Service classification system, indicates a fully-stocked high yield stand containing deciduous and coniferous trees (excepting lodgepole pine).

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APPENDIX A

CLIMATE CAPABILITY CLASSES

APPENDIX A

CLIMATE CAPABILITY CLASSES[3]

Climatic Class 1d

Identifying Area

Oliver, Osoyoos, Cawston, Keremeos.

Characteristics

The frost free period is greater than 150 days.
Growing degree days accumulated above 42°F are greater than 3800.
A large thermal accumulation occurs above 55°F.
Full capacity can only be achieved if supplemental water is supplied.

Winter Climate

The probability of having -15°F or lower for more than five days is nil.
Snow cover is discontinuous.

Range of Crops

(a) Key crops - apricots, peaches, zucca melon, cantelope, Winesap apples and a wide variety of grapes.

(b) General - apples (early), asparagus, white and green beans, sugar beets, cherries, sweet corn, cucumbers, melons, peppers, early potatoes, pears, plums, raspberries, prunes, tobacco, tomatoes and cereal grains (including winter wheat).

(c) Cool Season Vegetables* - cabbage (early season), lettuce, peas, spinach and strawberries.

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* This period occurs early in the season between the beginning of the frost free period and the start of the thermal period. The thermal period occurs when mean daily temperatures are greater than 55°F.

Climatic Class 1c

Identifying Area

Summerland, Penticton, Naramata, Kaleden, Okanagan Falls, Peachland, Westbank and Kelowna in the areas near Okanagan Lake.

Characteristics

The frost free period is greater than 150 days.
The range of growing degree days accumulated above 42°F is 3500 to 3800.
Some thermal accumulation occurs above 55°F.
Full capacity can only be achieved if supplemental water is supplied.

Winter Climate

There is a 10% chance of having winter minimums less than -15°F.
Snow cover is continuous.

Range of Crops

(a) Key crops - peaches, apricots and grapes.

(b) General - apples, asparagus, white and green beans, sugar beets, cherries, sweet corn, cucumbers, melons, peppers, potatoes, pears, prunes, raspberries, tobacco, tomatoes.

(c) Cereal grains.

Climatic Class $1b_1$*

Identifying Area

Kelowna and Westbank in higher areas away from Okanagan Lake, Vernon, Oyama, Salmon Arm and Lillooet.

Characteristics

The frost free period is greater than 150 days.
The range of growing degree days greater than 42°F is 3000 to 3500.
Full capacity can only be achieved if supplemental water is supplied.

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* There are three examples of Climatic Class 1b because the range of crops in this category is relatively the same even though there are regional differences in individual climate parameters.

Winter Climate

There is a high probability of winter minimums less than -15°F for long periods.
Snow cover is continuous, except at Lillooet where alternate freezing and thawing is a limitation.
A combination of wind and extreme minimum temperatures can be limiting.

Range of Crops

(a) Key crops - hardy apples.

(b) General - asparagus, white and green beans, sugar beets, sweet corn, cucumbers, melons, peppers, potatoes, tomatoes, no soft fruits.

(c) Cool Season Vegetables - cabbage, lettuce, peas, spinach, strawberries.

(d) Cereal grains.

Climatic Class $1b_2$

Identifying Area

Kamloops to Barriere on the North Thompson River.

Characteristics

The frost free period is greater than 150 days.
The range of growing degree days greater than 42°F is 3000 - 3800.
A large thermal accumulation occurs above 55°F.
Full capacity can only be achieved when supplemental water is supplied.

Winter Climate

There is a high probability of freezing of even hardy varieties of apples.
Winter extreme minimums are relatively severe.
Snow cover is continuous.

Range of Crops

(a) Key crops - (heat loving crops) - asparagus, peppers, melons, tomatoes, watermelons and cucumbers.

(b) Early season fast maturing, cool loving vegetables - cabbage, lettuce, peas, spinach, strawberries.

(c) Cereal grains.

Climatic Class $1b_3$

Identifying Area

Lower Fraser Valley, Saanich Peninsula and East Coast of of Vancouver Island.

Characteristics

The frost free period is greater than 150 days
The range of growing degree days greater than 42°F is 3000 - 3500.
Full capability can only be achieved if supplemental water is supplied.
There are cool winter temperatures suitable for wintering cabbage and lettuce.
A 30-inch maximum annual precipitation limit occurs for tree fruits.

Winter Climate

The probability of extreme winter temperatures exceeding -10°F is nil.
Snow cover is discontinuous.

Range of Crops

(a) Key crops - Wide range of cool season crops such as: canning peas, cole crops, potatoes, raspberries, small fruits, sugar beet seed, lettuce and bulbs.

(b) A limited range of heat loving crops such as: beans, corn, cucurbits, narrow range of grapes, tomatoes, hardy tree fruits, onions and pumpkin.

(c) Cereal grains.

Climatic Class $1a_1$*

Identifying Area

Barriere north, Slocan, Columbia Gardens, Castlegar, Gang Ranch, and Grand Forks.

Characteristics

The frost free period is 120 to 150 days.
The range of growing degree days above 42° is 2500 to 3000.
Full capability can only be achieved when supplemental water is supplied.

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* There are two examples of Climatic Class 1a for the same reason as footnoted on page 2.

Winter Climate

There are low minimum temperatures, occasionally below -35°F.
Snow cover is continuous

Range of Crops

(a) Key crops - corn, and hardy apples in select microclimates.

(b) General - small fruits, asparagus, beans, beets, broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, kohlrabi, leeks, lettuce, parsnips, peas, potatoes, radishes, raspberries, rhubarb, spinach, swiss chard, strawberries and turnips.

(c) Cereal grains.

Climatic Class $1a_2$

Identifying Area

Creston and front benches adjacent to large lakes.

Characteristics

The frost free period is 120 to 150 days.
The range of growing degree days above 42°F is 2500 to 3000.
Full capability can only be achieved when supplemental water is supplied.

Winter Climate

Winter minimums do not exceed -30°F.
Snow cover is continuous.

Range of Crops

(a) Key crops - corn and McIntosh apples.

(b) General - small fruits, asparagus, beans, beets, broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, kohlrabi, leeks, lettuce, parsnips, peas, potatoes, radishes, raspberries, rhubarb, spinach, swiss chard, strawberries, and turnips.

(c) Cereal grains.

Climatic Class 1

Characteristics

The frost free period is 90 - 120 days.
The range of growing degree days greater than 42°F is 2150 to 2600.
Annual precipitation is more than 15 inches and the May-September precipitation is greater than 9 inches.
There is no significant heat deficiency and no serious moisture deficiency.
There is a climatic moisture deficit of 0 to 1.5 inches during the growing season in dryland areas.

Range of Crops

(a) Key crops - corn

(b) General - (wide range of vegetables and fruits), asparagus, beans, beets, broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, kohlrabi, leeks, lettuce, parsnips, peas, potatoes, radishes, rhubarb, turnips, spinach, swiss chard, strawberries, raspberries.

(c) Forage Crops - alfalfa, red clover, alsike clover, orchard grass, and brome grass.

(d) Cereal Grains - wheat, oats and barley.

Application to Agriculture

(a) Within Climatic Class 1, production of the full range of the above crops is possible in areas with Agriculture Capability Classes 1 to 3.

(b) Within areas of Agriculture Capability Class 4, it is possible to have production of forage, cereal grains, and specialty crops depending on annual climatic variation and specific soil estimations.

(c) Areas with Agriculture Capability Class 5 in a Climatic Class 1 are only useful for the production of forage crops.

Climatic Class 2

Characteristics

The frost free period is 75 to 90 days.
The range of growing degree days greater than 42°F is 1900 to 2150.
Annual precipitation is less than 15 inches.
The May-September precipitation is less than 8 to 10 inches.
There is a climatic moisture deficit of 1.5 to 4.5 inches during the growing season in dryland areas.

Range of Crops

(a) General - asparagus, beets, broccoli, brussel sprouts, cabbage, carrots, kohlrabi, leeks, lettuce, parsnips, radishes, rhubarb, turnips, spinach, swiss chard, strawberries and only very hardy varieties of broad beans, cauliflower, celery, peas, raspberries and potatoes. (Production of these latter crops is marginal.)

(b) Forage Crops - alfalfa, red alsike, sweet clover, brome grass and timothy.

(c) Cereal Grains - wheat, oats, and barley (harvesting problems may occur because of poor weather).

Application to Agriculture

(a) Within Climatic Class 2, production of the full range of the above crops is possible in areas with Agriculture Capability Class 2 or 3.

(b) Within areas of Agriculture Capability Class 4, it is possible to have production of forage crops and cereal grains depending upon annual climatic variation.

(c) Only forage crops can be produced in areas of Agriculture Capability Class 5.

Climatic Class 3

Characteristics

The frost free period is 60 - 75 days.
The range of growing degree days greater than 42°F is 1650 to 1900.
Annual precipitation is less than 13 inches.
The May-September precipitation is less than 8.5 inches.
A climatic moisture deficit of 4.5 to 7.5 inches occurs during the growing season in dryland areas.

Range of Crops

(a) General - Cool loving vegetables and small fruits in favoured local sites, cabbage, cauliflower and potatoes.

(b) Forage Crops - alfalfa, red alsike, brome grass, sweet clover, and timothy (more emphasis on clovers and timothy than in Climatic Class 2).

(c) Cereal Crops - oats, barley.

Application to Agriculture

(a) Within Climatic Class 3, production of the full range of the above crops is possible in areas of Agriculture Capability Class 3.

(b) Areas with Agriculture Capability Class 4, are useful for the production of forage crops with barley and oats capable of being grown periodically.

(c) Only forage crops can be produced in areas of Agriculture Capability Class 5.

Climatic Class 4

Characteristics

The frost free period is 50 to 60 days.
The range of growing degree days greater than 42°F is 1650 to 1900.
A climatic moisture deficit of 7.5 to 10.5 inches occurs during the growing season in dryland areas.

Range of Crops

(a) General - No potatoes, hardy varieties of cool-loving vegetables.

(b) Cereal Crops - Barley and oats are capable of being grown periodically.

(c) Areas with Agricultural Capability Class 4 are capable of producing forage crops.

Climatic Class 5

Characteristics

The frost free period is 30 to 50 days.
The range of growing degree days greater than 42°F is 1200 to 1650.
A climatic moisture deficit of 10.5 to 13.5 inches occurs during the growing season in dryland areas.

Range of Crops

Only forage crops are produced and these occur in areas with Agriculture Capability Class 5.
Agriculture Capability Class 5M or 5X is given the capability rating of 5CM or 5CX in areas where climate is a limitation as well as drought (M) or a combination of limitations (X)* although a range of forage crops can still be grown.

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* See: The Canada Land Inventory, "Soil Capability Classification for Agriculture", Report No. 2, Queen's Printer, Ottawa, 1965.

Climatic Class 6

Characteristics

The frost free period is less than 30 days.
The range of growing degree days greater than 42°F is 800 to 1200.
A climatic moisture deficit of 13.5 to 16.0 inches occurs during the growing season in dryland areas.

Range of Crops

The area is limited to native browse (grazing) species of plants. It is not suitable for cultivating of agricultural crops but it has some potential.

Climatic Class 7

Characteristics

The frost free period is highly variable but it is usually less than 30 days.
The number of growing degree days greater than 42°F is less than 800.

Range of Crops

There is no potential for agriculture, intensive or extensive because the area is largely rock and ice (climatically determined).

APPENDIX B

SOILS
SITE SPECIFIC STUDY AREA

APPENDIX B**

THOMPSON-BONAPARTE VALLEY SOILS - SITE-SPECIFIC STUDY AREA*

Map Name	No. of Separate Areas	Total Area	Parent Material	Ashcroft Soils Soil Development	Relative Depth of Soil Solum	Surface Texture	Drainage	Topography Slopes in %	Agricultural Significance
Anglesey	33	5.43 km^2	Glacial Fluvial	Rego Brown Chernozem	76 cm	gsl	well drained	< 5	partial grazing, partial pasture
Barnes	2	0.08 km^2	Alluvial-Colluvial Fan	Mull Regosol	28 cm	gls	excessive	5-40	partial pasture, partial grazing
Basque	8	1.13 km^2	Glacial Till	Orthic Brown Soil Chernozem	41 cm	sil	well drained	5-30	partial pasture, partial grazing
Bonaparte	8	1.60 km^2	Alluvial Fan	Rego Brown Chernozem	46-91 cm	fsl-sicl	moderate-well drained	< 5	arable
Cache Creek	2	0.33 km^2	Alluvial-Colluvial Fan	Saline Rego Brown	61 cm	sl-sil	moderately well drained	2-15	partial grazing, partial pasture
Carquille	3	0.14 km^2	River Alluvial	Gleyed Mull Regosol	30-122 cm	fsl	imperfectly drained	< 5	arable
Cheetsum	22	11.39 km^2	Glacial Till	Rego Brown Chernozem	30-46 cm	gsil-gfsl	well drained	> 15	grazing
Joeross	8	1.16 km^2	Aeolian	Rego Brown Chernozem	51 cm	s-fsl	rapidly drained	2-15	partial grazing, partial pasture
Mcabee	4	0.47 km^2	Lacustrine	Orthic Brown Chernozem	66 cm	sil	well drained	2-15	arable
Nepa	3	0.54 km^2	Alluvial River Deposits	Orthic Brown Chernozem	20-61 cm	sl	rapidly drained	2-9	arable
Savona	6	0.33 km^2	Aeolian	Mull Regosol	20 cm	s-ls	rapidly drained	5-50	grazing

* Soil Survey of the Ashcroft-Savona Area Thompson River Valley, British Columbia, B.C. Department of Agriculture, Kelowna, B.C. March, 1963.

** appears as Table 4-3 in *Physical Habitat and Range Vegetation* report[44]
refer to Figure B-1, Soils, Site Specific Study Area for accompanying map.

APPENDIX B (Continued)

Map Name	No. of Separate Areas	Total Area	Parent Material	Ashcroft Soils Soil Development	Relative Depth of Soil Solum	Surface Texture	Drainage	Topography Slopes in %	Agricultural Significance
Semlin	2	0.48 km^2	Alluvial-Colluvial Fan	Orthic Brown Chernozem	30-41 cm	gl	rapidly drained	3-15	partially arable
Taweel	38	9.53 km^2	Alluvial-Colluvial Fan	Rego Brown Chernozem	30-61 cm	fsl-gl	well drained	3-30	partial pasture, partial grazing
Thompson	5	0.58 km^2	Alluvial River Deposits	Orthic Regosol	-	g	excessive	< 5	grazing
Walhachin	2	0.14 km^2	Glacial Out-wash	Orthic Brown Chernozem	25-46 cm	sl	rapidly drained	0-9	partially arable
Venables	1	0.14 km^2	Alluvial-Colluvial Fan	Calcareous Meadow Soil	50-60 cm	sil	poorly drained	5-30	arable

APPENDIX B*

SUMMARY OF THE SOILS FOUND IN THE SITE-SPECIFIC STUDY AREA

Map Symbol	No. of Separate Areas	Total Area	Parent Material	Soil Development	Relative Depth of Soil Solum	Surface Texture	Drainage	Topography Slopes in %	Agricultural Significance
1	3	0.91 km^2	Alluvial fan deposits	Carbonated Cumulic Regosol	76 cm	l-sil	excessively-poorly	0-5	arable
2	3	1.11 km^2	Alluvial stream deposits	Carbonated Humic Gleysol	102 cm	organic-sicl	poorly	<5	arable
3	2	1.96 km^2	Alluvial stream deposits	Carbonated Gleysol	15 cm	l	poorly	<5	partially arable
4	3	1.37 km^2	Alluvial stream deposits	Orthic Regosol	15-76 cm	l-sil	moderately-poorly	<5	partially arable
5	2	0.14 km^2	Glacial outwash	Degraded Eutric Brunisol	61-91 cm	l-sil	excessively	5-10	arable
6_A	12	2.69 km^2	Glacial outwash	Degraded Eutric Brunisol-Orthic Dark Brown Chernozem	36-46 cm	sil-sicl	well drained	2-10	arable
6_B	3	0.86 km^2	Glacial outwash	Degraded Eutric Brunisol-Orthic Dark Brown Chernozem	<25 cm	sil-sicl	excessive	>20	grazing
7	1	0.54 km^2	Glacial outwash	Orthic Dark Brown Chernozem	76 cm	sil	well drained	<5	arable
8	2	1.25 km^2	Glacial till/ Lithic contact	Calcareous Dark Grey Chernozem	<25 cm	sl-l	excessively	15-20	grazing
9	1	0.17 km^2	Glacial till	Calcareous Dark Grey Chernozem	<38 cm	l-sil	moderately	5-15	grazing
10	2	2.34 km^2	Glacial till	Degraded Eutric Brunisol	46 cm	l-sil	moderately-imperfectly	<5	pasture
11	1	1.62 km^2	Glacil till/ Lithic contact	Lithic Black Chernozem-Degraded Eutric Brunisol	20-51 cm	l-sl	excessive	2-12	grazing
12	2	1.74 km^2	Glacial till	Degraded Eutric Brunisol	20-30 cm	l-sl	excessive	3-9	pasture

* appears as Table 4-4 in *Physical Habitat and Range Vegetation* report[44].

APPENDIX B (Continued)

Map Symbol	No. of Separate Areas	Total Area	Parent Material	Soil Development	Relative Depth of Soil Solum	Surface Texture	Drainage	Topography Slopes in %	Agricultural Significance
13	5	5.25 km^2	Glacial till	Calcareous Black Chernozem	61-76 cm	l	well drained	5-10	arable
14	10	8.22 km^2	Glacial till	Orthic Dark Brown Chernozem	20-46 cm	l-sl	excessive-imperfectly	5-15	partially pasture
15	11	4.22 km^2	Glacial till	Orthic Dark Brown Chernozem	46 cm	l-sil	excessive	5-10	partially grazing
16	12	0.48 km^2	Glacial till	Carbonated Black Chernozem	46-64 cm	l-sl	imperfectly	< 5	partially arable
17	1	3.23 km^2	Glacial till	Orthic Dark Brown Chernozem-Degraded Eutric Brunisol	0-46 cm	sil-sicl	excessive-poorly	5-10	pasture
18	2	2.25 km^2	Glacial till	Degraded Eutric Brunisol	15-20 cm	l-sl	moderately well	2-5	arable
19	9	5.24 km^2	Glacial till	Degraded Eutric Brunisol-Orthic Dark Brown Chernozem	30 cm	sil	excessive	7-15	partial grazing, partial pasture
20_A	1	0.18 km^2	Glacial lacustrine	Regosolic	-	c	well	5-9	nil
20_B	1	0.07 km^2	Glacial lacustrine	Regosolic	-	c	imperfectly	< 5	nil
20_C	1	0.18 km^2	Glacial lacustrine	Orthic Eutric Brunisol	36-46 cm	sicl-cl	excessive	< 15	grazing
20_D	1	1.30 km^2	Glacial lacustrine	Orthic Eutric Brunisol	10-30 cm	sil	well	7-10	grazing
20_E	1	0.21 km^2	Glacial lacustrine	Regosolic-Orthic Eutric Brunisol	20-41 cm	sil	well	7-10	grazing
21	1	0.58 km^2	Glacial till	Orthic Dark Brown Chernozem	25 cm	sil	moderately well	5-9	pasture
22	1	0.95 km^2	Glacial till	Degraded Eutric Brunisol	30 cm	sil	moderately well	5-15	grazing
23	1	0.19 km^2	Glacial till	Orthic Dark Brown Chernozem	38 cm	l-sil	moderately well	5-9	pasture
24	10	1.52 km^2	Glacial till	Rego Brown Chernozem	10 cm	gl-gsl	well-excessive	15-30	grazing
25	8	7.10 km^2	Glacial till	Orthic Brown Chernozem-Rego Brown Chernozem	15-46 cm	fsl-sil	excessive	5-20	partial grazing, partial pasture

APPENDIX B (Continued)

Map Symbol	No. of Separate Areas	Total Area	Parent Material	Soil Development	Relative Depth of Soil Solum	Surface Texture	Drainage	Topography Slopes in %	Agricultural Significance
26	3	1.22 km^2	Glacial till	Orthic Brown Chernozem	25 cm	fsl-sil	excessive	5-10	partial arable, partial grazing
27	3	1.15 km^2	Glacial till	Carbonate Black Chernozem	40-58 cm	l-sil	imperfectly	-	arable
28	9	0.91 km^2	Alluvial fan	Rego Brown Chernozem	20-25 cm	l-gsl	excessive	5-20	partial arable
29	5	3.04 km^2	Glacial till	Rego Brown Chernozem	15 cm	l-gsil	excessive	15-30	grazing
30	2	0.22 km^2	Alluvial fan	Saline Gleysol	15-30 cm	organic or sil-sicl	poor	<2	arable
31	8	1.68 km^2	Glacial till	Degraded Eutric Brunisol-Rego Brown Chernozem	10 cm	l-sil	excessive	30-50	grazing
32	10	1.11 km^2	Lithic contact	Lithic Brown Chernozem	8-10 cm	fsl-sil	excessive	25-40	grazing
33	1	0.61 km^2	Colluvial over Glacial till	Orthic Grey Luvisol	45-50 cm	l-sil	excessive	>30	grazing
34	15	7.15 km^2	Colluvial over Lithic Contact	Lithic Eutric Brunisol	10-15 cm	gsl-gl	-	10-40	grazing
35	4	2.85 km^2	Glacial till	Degraded Eutric Brunisol	15-20 cm	fsl-sil	moderately well	5-20	grazing
36	9	4.97 km^2	Glacial till	Rego Dark Grey Chernozem	5-20 cm	gsil-sil	well	5-10	grazing
37	6	15.90 km^2	Glacial till	Orthic Grey Luvisol-Degraded Eutric Brunisol	15-46 cm	fsl-sil	well-imperfectly	15-30	grazing
38	18	19.05 km^2	Glacial till	Orthic Grey Luvisol	23-35 cm	sil-gsil	moderately well	5-20	grazing
39	1	0.27 km^2	Glacial outwash	Degraded Eutric Brunisol	30-36 cm	sil-gsil	well	-	grazing
40	1	0.33 km^2	Glacial till	Orthic Grey Luvisol	46-61 cm	gl-gsil	moderately well	>5	grazing

APPENDIX B (Continued)

Map Symbol	No. of Separate Areas	Total Area	Parent Material	Soil Development	Relative Depth of Soil Solum	Surface Texture	Drainage	Topography Slopes in %	Agricultural Significance
41	3	3.30 km^2	Glacial till	Orthic Grey Luvisol	46-51 cm	gsil	excessive	20-40	grazing
42	6	1.82 km^2	Glacial till	Orthic Grey Luvisol -Orthic Regosol	15-25 cm	sil-gsl	excessive	>40	nil
43	2	1.04 km^2	Glacial till	Degraded Eutric Brunisol	15-46 cm	gsil-gl	moderately well	15-40	grazing
44	2	0.65 km^2	Glacial till	Degraded Eutric Brunisol	15-46 cm	gsil-gl	moderately well	15-40	grazing
45	3	0.73 km^2	Glacial fluvial	Degraded Eutric Brunisol	13-20 cm	sil	excessive	0-20	grazing
46	1	0.70 km^2	Glacial fluvial	Degraded Eutric Brunisol	13-20 cm	sil	excessive	0-20	grazing
47	6	3.33 km^2	Glacial till	Gleyed Orthic Grey Luvisol	15 cm	sil-sicl	imperfectly	>30	grazing
48	1	0.43 km^2	Glacial till	Gleyed Orthic Grey Luvisol	15 cm	sil-sicl	imperfectly	>30	grazing
49	3	0.91 km^2	Glacial till	Orthic Dark Grey Chernozem-Orthic Grey Luvisol	5-25 cm	sil-sicl	moderately well	15-20	grazing
50	8	6.87 km^2	Glacial till over Lithic Contact	Lithic Grey Luvisol	15-30 cm	sil-gsil	-	20-30	grazing
51	19	4.67 km^2	Glacial till-Glacial outwash	Calcareous Black Chernozem	5-10 cm	l-sil	well	5-20	grazing
52	3	4.46 km^2	Glacial till	Orthic Grey Luvisol -Gleyed Grey Luvisol	25-30 cm	sil-sicl	moderate-poorly	-	grazing
53	12	0.70 km^2	Alluvial fan	Calcareous Black Chernozem	45 cm	sil-l	moderately-imperfectly	2-25	grazing
54	5	7.09 km^2	Glacial till over Lithic contact	Orthic Grey Luvisol-Lithic Grey Luvisol	8-25 cm	sil-gcl	-	>15	grazing
55	9	0.59 km^2	Alluvial fan and stream deposits	Carbonated Black Chernozem	25-30 cm	l-sil	poorly	<5	grazing

APPENDIX B (Continued)

Map Symbol	No. of Separate Areas	Total Area	Parent Material	Soil Development	Relative Depth of Soil Solum	Surface Texture	Drainage	Topography Slopes in %	Agricultural Significance
56	4	0.95 km^2	Glacial fluvial	Orthic Dark Brown-Calcareous Black Chernozem	25 cm	l-sil	well	5-20	grazing
57	6	5.44 km^2	Colluvial fan	Orthic Dark Brown Chernozem-Degraded Eutric Brunisol	15-20 cm	sil-gsil	well	5-20	grazing
58	3	2.46 km^2	Glacial till over Lithic contact	Lithic Dark Grey Chernozem	3-5 cm	sil-sicl	-	5-15	grazing
59	3	0.51 km^2	Glacial till	Calcareous Black Chernozem	10-15 cm	l-gl	moderately well	5-15	grazing
60	5	0.65 km^2	Glacial till	Gleyed Orthic Grey Luvisol	25 cm	sil-gcl	poorly	-	grazing
61	1	0.05 km^2	Glacial fluvial	Orthic Dark Brown Chernozem-Degraded Eutric Brunisol	10-15 cm	l-gsil	well	10-15	grazing
62	1	0.96 km^2	Glacial till	Orthic Grey Luvisol-Degraded Eutric Brunisol	15-30 cm	sil	well-imperfectly	5-15	grazing
63	1	0.93 km^2	Glacial till	Orthic Brown Chernozem-Degraded Eutric Brunisol	45 cm	sicl	well-imperfectly	5-15	grazing
64	2	1.10 km^2	Colluvial over Glacial till	Degraded Eutric Brunisol	30-38 cm	sil-sicl	moderately well	5-12	grazing