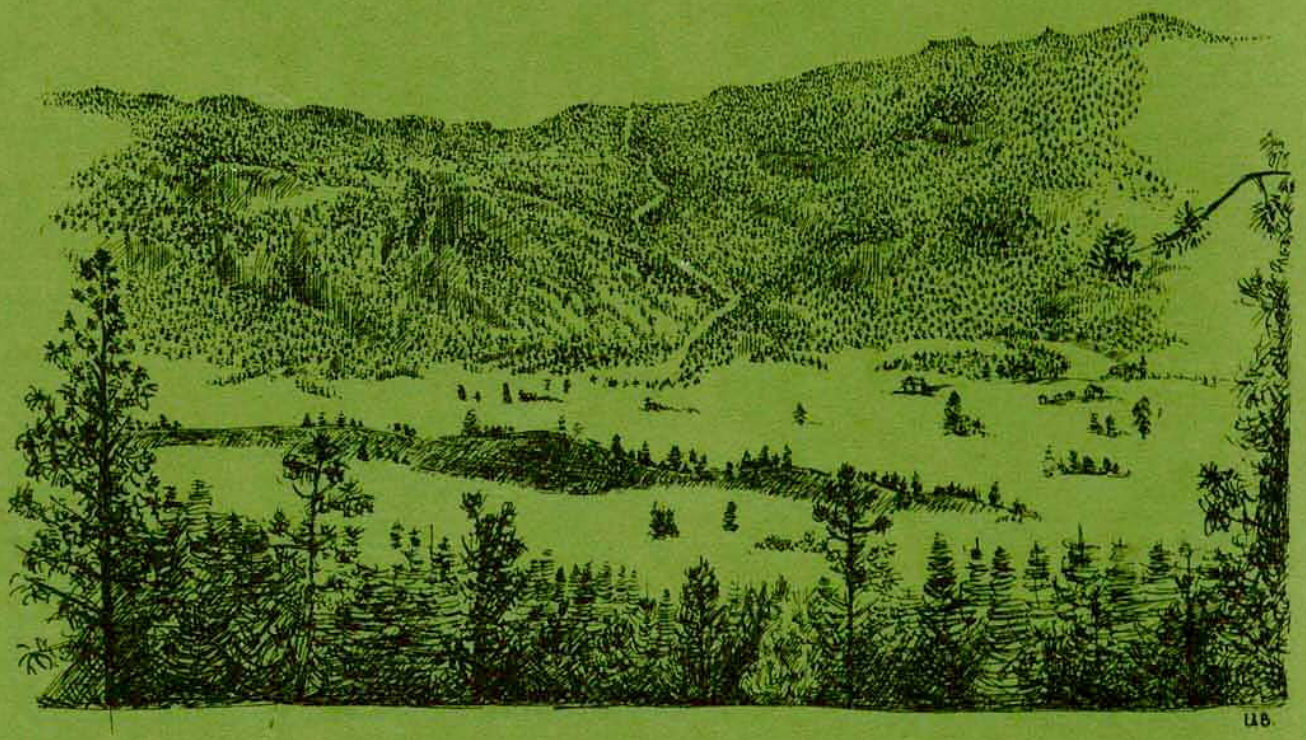
A Soil Resource and Land Use Survey of the

Nicola-Mameet Indian Reserve no.1

A.L. Bedwany and L. Farstad
Edited by: Dr. R.E. Carlyle



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Report No. 299

Research Station,
Agriculture Canada,
6660 N.W. Marine Dr.,
Vancouver 8, B.C.

A SOIL RESOURCE AND LAND USE SURVEY

OF THE

NICOLA-MAMEET INDIAN RESERVE NO. 1

A.L. Bedwany[1] and L. Farstad[2]

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Report No. 299,
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Contents

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Mr. J.C. Ryder, District Agriculturist, Kamloops, supplied information on fertilizer recommendations.

Mrs. N. Cukor prepared the maps and illustrations.

Ms. U. Bachinski prepared the hand-drawn cover picture from a photograph of part of the Reserve.

Soil and water analyses were done by Mr. K.S. Chan and the laboratory assistants, Soil Survey Section, Research Station, Agriculture Canada, Vancouver, B.C.

The final maps and legend were printed by the Cartography Section, Soil Research Institute, Ottawa.

Summary

The soils of Nicola-Mameet Indian Reserve No. 1 are surveyed and mapped. A total of 12 soil Series, Associations and Landtypes are identified, described and mapped (Fig. 4).

The soils are also grouped into six management areas (Fig. 5). Each management area is described and its practical use is discussed. Water requirements, fertilizer rates and irrigation practices are indicated.

The Reserve has a considerable potential for forage production. Maximum yields can be achieved by good management. The length of the growing season allows growing selected cereals, corn for silage and a wide range of vegetables. However, irrigation is required for these crops because precipitation is deficient.

A relatively short frost free season and low heat units during the growing season preclude the successful growth of stone fruits.

For the present, the best use of the Reserve's arable land is forage production. Alfalfa and timothy, planted together or separately, produce well if irrigated and fertilized. Also, a large capital investment in machinery is not required. The largest outlay is irrigation equipment. The present beef herd utilizes a large portion of the forage but with good management a considerable tonnage should be available for sale on the open market.

At the same time cereal production can be kept in mind and tried if prices are favorable. However, cereals require greater outlays

for machinery and more expertise to produce successfully.

The Reserve's rangeland is in a poor state of productivity at the present time. However, with improved management, range yield should increase and provide better grazing for the Reserve's livestock.

The forested parts of the Reserve can be utilized for summer grazing and selective logging.

A technical training program for selected local Indians in agriculture, forestry and rangeland management is suggested. At the same time full advantage can be taken of provincial services.

Introduction

This report is one of a group describing the soil resources of some of the Indian Reserves in British Columbia. These surveys are done by the Soil Survey Section, Research Station, Canada Department of Agriculture, Vancouver, at the request of the Department of Indian Affairs and Northern Development.

The objectives of this report are as follows:

(a) to assess the soil resources of the Reserve,

(b) to group the soils into management areas including practical management suggestions for each area,

(c) to outline irrigation and fertilizer requirements,

(d) to suggest improved management practices.

Economic assessments are not included in this survey but the economic soundness of all suggestions has been kept in mind.

The soils of the Nicola-Mameet Indian Reserve No. 1 were surveyed as part of the soil survey of the Merritt Map Sheet 92 I/SE. However, more detailed field work and soil sampling were carried out on the arable and irrigable areas of the Reserve.

The boundaries between soil units were established by the use of aerial photographs followed by field checks. The soils were classified according to the System of Soil Classification for Canada (8). The soils were systematically mapped and samples were collected for physical and chemical analyses. The soils also were grouped into management areas and their distribution was mapped.

Agriculture on the Reserve is mostly ranching. Cattle are raised by 20 - 25 band members, each controlling his own cattle and allotted land. In 1973 approximately 500 head of Hereford cattle were maintained on the Reserve.

Crops are confined largely to forage, this being alfalfa and timothy or a mixture of the two. Some vegetables are raised for home use. Early frosts limit the range of crops that can be matured.

The Reserve has a relatively low productivity rating for forestry (Classes 5 and 6) by Canada Land Inventory System (7). However, there is considerable timber but little use is made of it at the present time other than as a source of posts and firewood.

Discussions with the chief of the Band and some of the Reserve residents yielded important information on agricultural practices.

Location and Extent

The Nicola-Mameet Indian Reserve No. 1 (Fig. 1) is located between the town of Merritt and the community of Lower Nicola. The major portion lies north of the Nicola River with a small portion lying south of the river. The reserve is more or less rectangular, being about 8 miles by 2 miles. It covers approximately 16 square miles or 10,240 acres[1]. The arable part of the Reserve is approximately 2,620 acres. The balance is open rangeland or wooded slopes.

The Reserve lies within the National Topographical Sheet No. 92 I/SE.

Highway No. 8 and the Canadian Pacific Railway cross the extreme southern portion of the Reserve. The British Columbia Hydro and Power Authority and the Westcoast Transmission Lines both cross the Reserve lengthwise.

Nature of the Landscape

The major part of the Reserve is characterized by irregular topography. The main drainage outlet is Guichon Creek which runs from north to south inside the western boundary of the Reserve. It drains into the Nicola River just outside the southwest corner. The Steffens, Morgan and Jesse Creeks join Guichon Creek from the east and Stumbler Creek joins it from the west (Fig. 2).

The landscape slopes from both sides towards Guichon Creek. The southern portion of the Reserve occurs on flatter topography. Figure 3

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[1] Acreages were measured from aerial photographs.

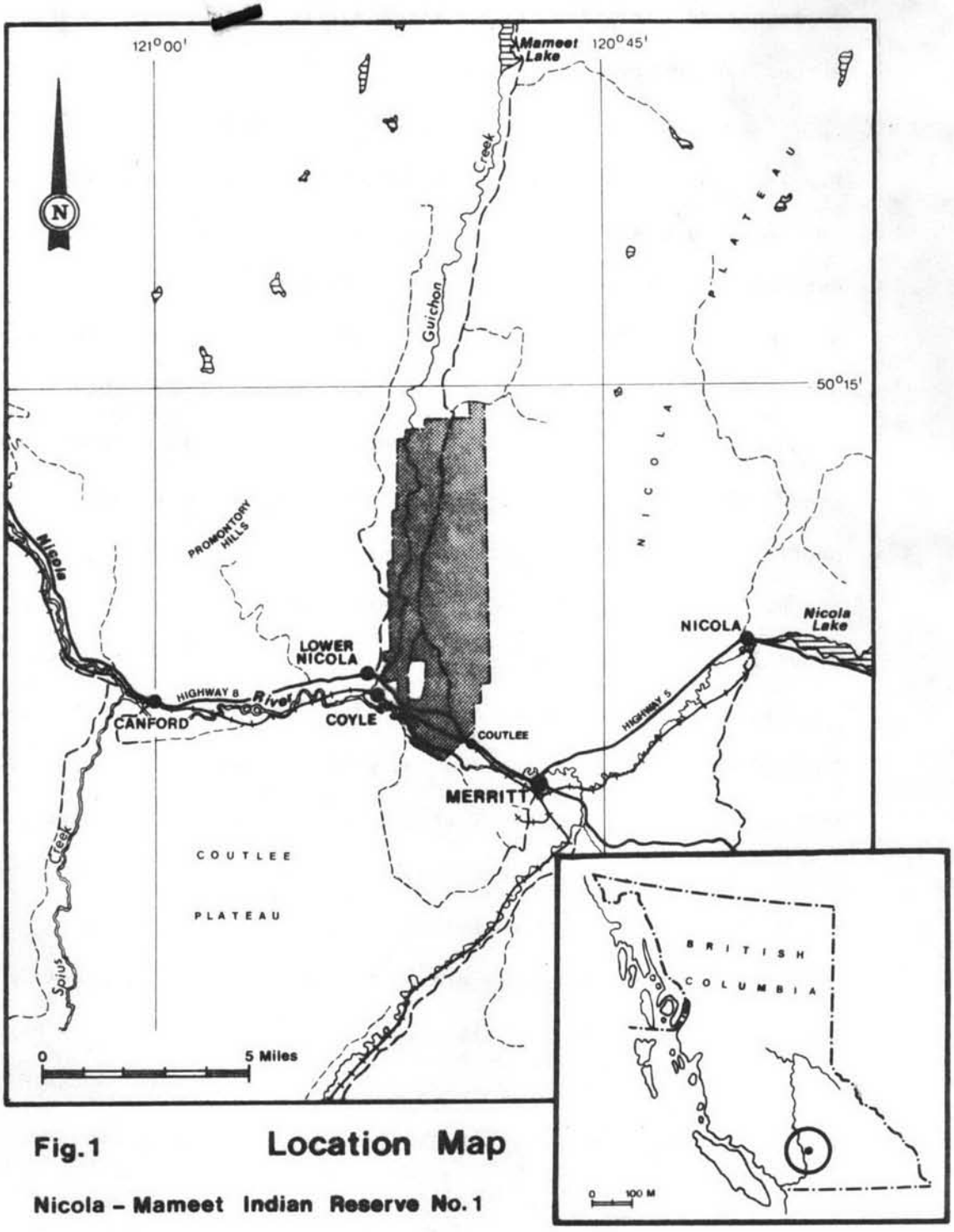

Fig.1 **Location Map**

Nicola – Mameet Indian Reserve No. 1

depicts a topographical cross section (from [redacted]heast to northwest) across the Reserve.

Elevations range from about 2000 feet in the south (near Nicola River) to 4000 feet near the middle of the eastern boundary.

Landforms are well developed mainly by glacial action (5). In the extreme southern part a flat tc very gently sloping flood plain borders the Nicola River. It is dissected at places by meanders and oxbows with the occurrence of a few wet depressions. Above the river flood plain is a large glacial-fluvial fan which is divided by Guichon Creek. Hummocky till deposits characterized by large kettles and scattered ponds occur on the east side of Guichon Creek just north of the big fan. This material is interspersed with some coarse glacial-fluvial deposits and small isolated pockets of lacustrine sediments.

To the east of the hummocky till deposits, and sloping towards Guichon Creek, is a strongly sloping wooded area made up of colluvium and till deposits. Morainal gravels characterized by irregular topography, hummocks and kettles, occupy most of the remainder of the Reserve with the exception of a few flatter terraces.

Arable areas generally are associated with the flood plain of the Nicola River, and the glacial-fluvial fan just north of Highway No. 8. A few scattered relatively level fields occur to the north and east of the fan. Most of the Reserve is non arable.

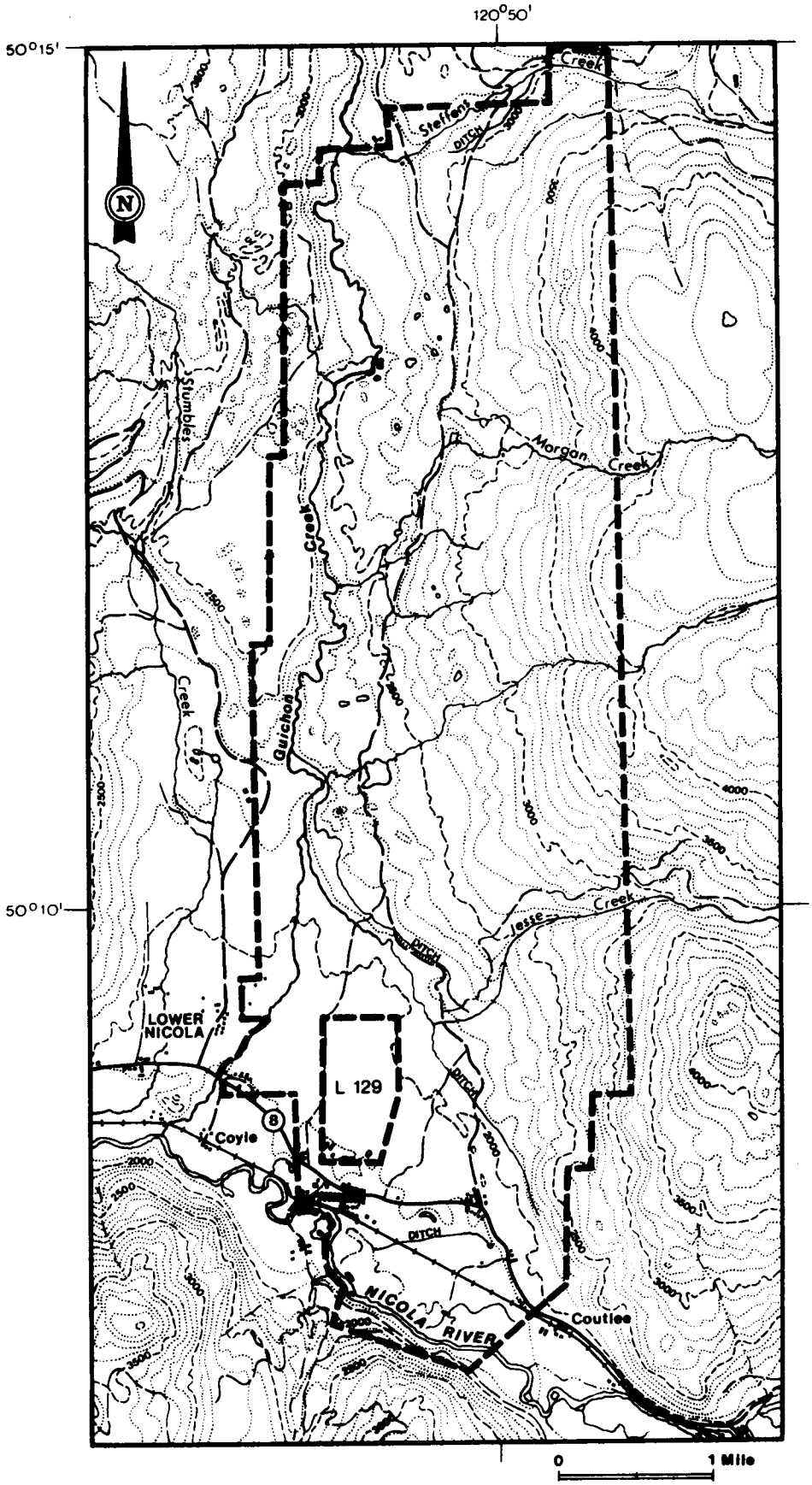

Fig. 2 **Topography and Drainage Map**

Nicola – Mameet Indian Reserve No. 1

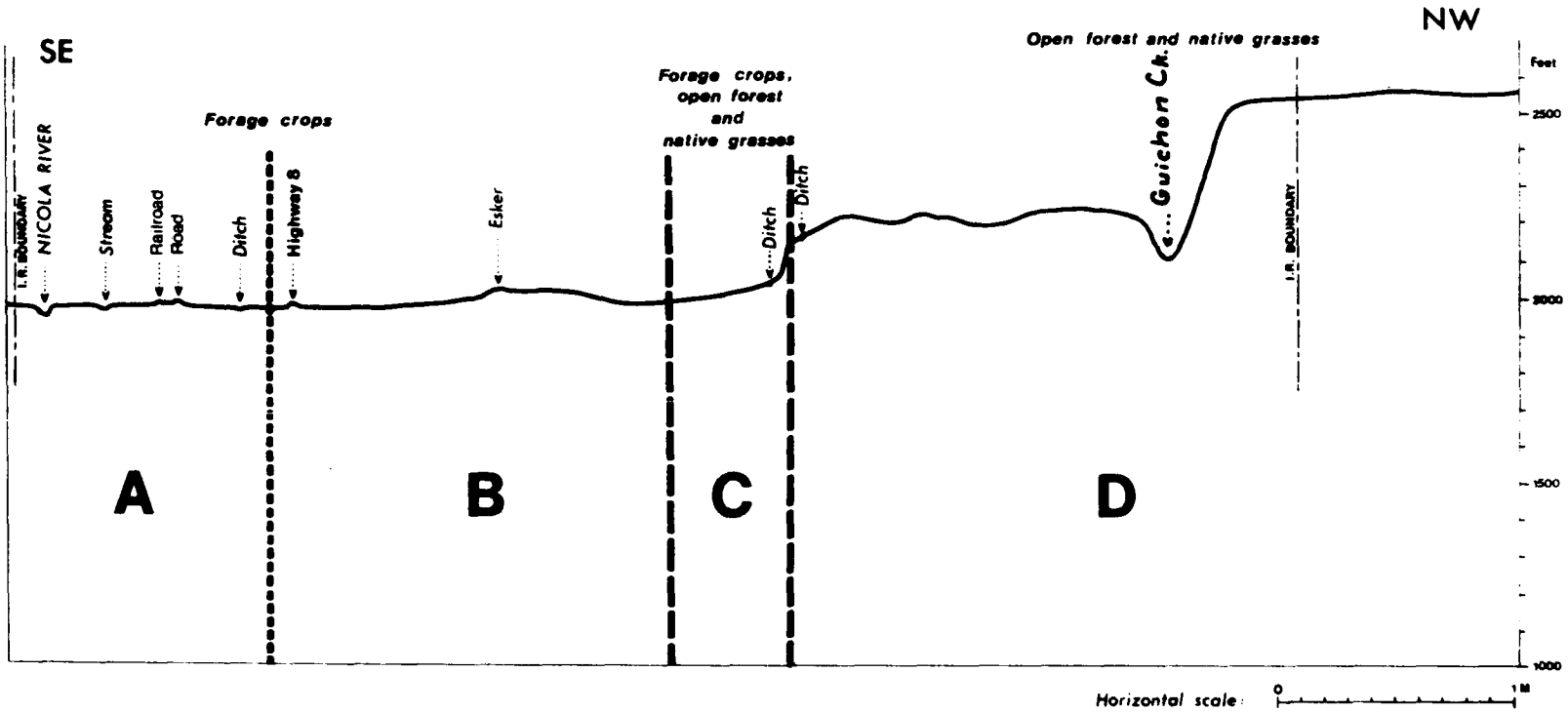

Fig.3 **A Topographical Cross Section**

Nicola - Mameet Indian Reserve No.1

(showing Lay of Land, Management Areas, and Vegetation)

Climate

The Reserve and the surrounding area has a moderate continental climate. Winters are cold with the minimum temperatures dropping below zero during the winter months. Local factors such as elevation, aspect, air drainage and exposure to mass invasions of cold air from the north affect the frost free period, growing season, growing degree days and precipitation.

Data from three nearby climatic stations, namely Mameet Lake, Merrit and Merritt Craigmont Mines are given in Table 1. December is the coldest month with mean temperatures of 21.3°, 23° and 24.1° F respectively, at these stations. Snow covers the ground from early November through part of March. Temperatures rise quickly in March and the spring is mild and dry. Summers are warm with hot days but cool and sometimes cold nights. July is the warmest month with mean temperatures of 58.8°, 65° and 63.5° for these same stations.

Precipitation is light, especially in the valleys and lowlands and more or less evenly distributed over the year. However, summer and winter receive slightly more precipitation than spring and autumn. The average total precipitation for the three weather stations is 14.6, 11.9 and 10.02 inches respectively. Moisture deficits are 6.7, 12 and 13.9 inches which means that growing season precipitation is insufficient for crop production. It also means that grazing stocking rates (the number of acres needed to graze a 1000-pound cow for one month, AUM) are relatively high.

Frost free periods are 81, 118 and 111 days respectively, in the Mameet Lake, Merritt and Merritt Craigmont Mines meteorological stations. The degree days in the same three stations are 1768, 2728 and 2638 respectively. The low figures for Mameet Lake are explained by its location in a narrow north-south valley subject to the pooling of cold air from adjacent uplands and the north. The other two stations are in localities where the valley widens and is subject to milder east-west influences.

Vegetation and Crops

A description of vegetation on the Reserve involves both cultivated and non-arable parts. The cultivated portions consist of the Nicola River flood plain and the fan above it. In addition, some cultivated fields are located on the east side of Mameet Lake Road near Springs village and on a gravelly terrace near Steffens Creek at the northern end of the Reserve. Regardless of locations, cultivated fields grow alfalfa or timothy but more often a combination of these two forages. Hay crops are the main product of the cultivated areas.

The lower part of the Reserve potentially can grow corn for silage. It is also suitable for a range of forage crops such as alfalfa, red clover, alsike clover, orchard grass, brome grass and timothy. A wide range of vegetables and fruits can be grown such as asparagus, beans, beets, broccoli, Brussels sprouts, cabbage, carrots,

cauliflower, celery, kohlrabi, leeks, lettuce, parsnips, peas, potatoes, radishes, rhubarb, turnips, spinach, Swiss chard, strawberries and raspberries.

Cereal grains such as wheat, oats and barley (2) can be grown.

Irrigation has to be provided to counteract the climatic moisture deficit during the growing season.

Grassland in the Reserve is mainly confined to the large hummocky area in the middle of the Reserve east of Guichon Creek. The vegetation is sage brush, sparse bluebunch wheatgrass plus cacti. Other grass species such as cheat grass occur in scanty amounts. At a higher elevation immediately east of the hummocky area is a small tract of steeply sloping till where bluebunch wheatgrass and rough fescue are dominant. The grass ranges have been severely overgrazed and are in a poor state of productivity.

The remainder of the Reserve is dominated by forest vegetation. An open stand of ponderosa pine, kinnikinnick and bluebunch wheatgrass dominates the elevations up to approximately 2900 feet. At higher elevations the species rapidly change to an open to medium dense stand of Douglas fir with a ground cover of pine grass.

Aspen, willows and other deciduous species tend to dominate the terrain along stream beds where moisture is more available.

Range Resources[1]

The Nicola-Mameet Indian Reserve has considerable potential for valuable grazing lands providing management practices are drastically improved. Overgrazing, particularly of the open grassland, has caused a lessening of palatable grasses and increased the prevalence of sagebrush, cacti and other undesirable species. An increase in the stocking rate is required along with fertilizer applications. The areas that are highly depleted of palatable species should be rested for a reasonable period of time; other less affected areas would benefit from a partial seasonal rest. Expert advice should be sought regarding proper and reasonable stocking rates. Thus a long range grazing plan is required to halt range deterioration and effect improvement.

The low elevation coniferous and deciduous forest with abundant grass species in the understory, can provide spring grazing as well as the grassland. Summer grazing is found in the higher Douglas fir forest where pine grass forms an important part of the understory. In addition, the Reserve has a permit to graze 11,000 acres on the wooded upland adjacent to the east side of the Reserve.

Drinking water for cattle is available in scattered ponds and small lakes in addition to the creeks in the Reserve.

A few relatively small open grassy areas can be used for irrigated pasture. Properly managed, these areas can supplement the late fall feeding of some of the cattle.

The forage from the cultivated fields provides the main winter feed.

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[1] The publication "Grassland Ranges in the Southern Interior of British Columbia" by Dr. A. McLean and Leonard Marchand was most helpful in assessing the value of the grasslands of the Reserve.

Irrigation

Guichon Creek (Fig. 2) is the main source of irrigation water. Two ditches named "Skookum Billy" and "Lower" transport water to the cultivated fields on the fan above the Nicola River flood plain. A third unnamed ditch can divert water to Lot 129 which is privately owned, inside the Reserve, partially cleared and partly cultivated. The cultivated fields at the north end of the Reserve are irrigated from Steffens Creek. Finally, a ditch from a spring located just south of Highway No. 8 irrigates part of the flood plain. The spring also supplies drinking water for the village.

Most of the cultivated area is flood irrigated. A few individuals operate sprinkler systems. Three operators are hooked up to pump houses and two others use portable units. One gravity fed sprinkler system is used to irrigate a hay field near the north end of the Reserve.

It is a well established fact that flood irrigation tends to waste water and plant nutrients as well as hasten the appearance of salinity problems under some conditions. Thus, plans should be made for conversion to sprinkler irrigation with implementation taking place as soon as finances permit. It must be remembered that sprinkler irrigation is more technical and requires trained personnel for successful operation and maintenance.

In this report water in the soil (see Management Areas) is expressed as inches of water per one foot depth of soil. The total

amount of water available to plants is known as the Available Water Storage Capacity (A.W.S.C.) (1). Technically, it is the difference in soil moisture content between Field Capacity and the Permanent Wilting Point.

Water is not uniformly available to plants over the entire range of the A.W.S.C. For example, the first 35 percent of the range may be readily available to a given crop and then becomes increasingly difficult to take from the soil over the remaining 65 percent of the range. In this report it is assumed that 50 percent of the A.W.S.C. is readily available to plants.

When the A.W.S.C. has not been determined for a certain soil, it is possible to estimate it from soil textures and the depths of the layers making up the plant root zone.

The irrigation requirement for the region is considered to be approximately 30 inches of water based on alfalfa growth and a 150 day growing season. An evapo-transpiration rate of 0.20 inches per day is assumed (1).

Analyses of the irrigation water (Table 2) indicate that all the sources of irrigation water would be rated good (4). The flow of water is adequate for the irrigable land of the Reserve.

Soils of the Reserve

Fig. 4 is a soil map delineating the various soils of the Reserve and showing the landforms, topography, classification and textures. Table 3 lists the analyses of the cultivable soils and Table 4 summarizes their practical aspects.

A brief description of the soils of the Reserve follows.

The Arable Soils

Jesse Series (Je) - Carbonated Rego Dark Brown (Chernozem) soils.

Jesse soils are the dominant soils on the major cultivated part of the glacial-fluvial fan above Highway No. 8. Topography is gently sloping. The soils generally have a sandy loam texture with an average depth of about 3 feet overlying sands and gravels. Going north past the middle point of the unit the depth to the sands and gravels gradually decreases. These soils are well drained. They are cultivated and produce alfalfa and timothy grass.

A description of a profile of these soils is as follows:

Horizon	Depth inches	
Apk	0-6	Dark grayish brown to brown (10YR 4/2 -3d), very dark grayish brown (10YR 3/2 m); sandy loam; weak, medium to coarse, subangular blocky and coarse granular; friable; about 5 percent stones; abundant roots; weakly calcareous; gradual, smooth boundary; pH 7.7.

Horizon	Depth inches	
Ck	6-27	Brown (10YR 5/3 d), dark brown (10YR 3/3 m); sandy loam, weak, medium to coarse, subangular blocky structure; friable; about 5 percent gravel; plentiful fine roots in the upper part of layer; weakly calcareous; gradual, smooth boundary; pH 7.8.
Cca	27-35	Yellowish brown (10YR 5/4 d), dark grayish brown (10YR 4-5/2-3 m); sandy loam; moderate, medium to coarse subangular blocky structure; friable to firm; about 10 to 15 percent gravel; moderately calcareous; few roots; abrupt smooth boundary; pH 7.9.
II Ck	35-46+	Olive brown to light olive brown (2.5Y 4-5/4 m); coarse sand; about 10 to 15 percent gravel; loose, single grain; few roots; weakly to moderately calcareous; grades into more gravel at 46 inches up to about 85-90 percent; pH 7.9.

Merritt Association[1] (Me) - Orthic Dark Brown (Chernozem) and Solonetzic Dark Brown soils.

These soils occur in three small areas close to Highway No. 8, with the Orthic Dark Browns being dominant. They have developed on remnants

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[1] A sequence of soils of about the same age, derived from similar parent materials, and occurring under similar climatic conditions, but having unlike characteristics because of variation in relief and drainage.

of lacustrine sediments which could have been more extensive in the past. This parent material is stratified, moderately calcareous, and initially weakly saline. The texture ranges from silts to silty clays, however silts and silt loams are prevalent. Topography is generally undulating to gently rolling. However, as a result of erosion and possibly slumping, a few steep banks and some rough topography has been created at scattered locations.

These small areas of Merritt soils have been under cultivation. Some parts have been abandoned and a few locations have been used for housing. Using these silty and stratified materials for housing sites along their steep edges is hazardous, since they are subject to slumping. Septic tank disposal systems would accelerate this process as a result of seepage.

A description of a typical profile of the Orthic Dark Brown soil is as follows:

Horizon	Depth inches	
Ah	0-3	Dark brown to Brown (10YR 4-5/3 d) very dark grayish brown (10YR 3/2 m); silt loam; moderate, medium to coarse, platy structure; soft, plentiful fine roots; gradual, smooth boundary; pH 7.
Bm	3-11	Pale brown (10YR 6/3 d), very dark grayish brown to dark brown (10YR 3/2-3 m); silt loam; weak, coarse, columnar breaking into subangular blocky structure; slightly hard; plentiful fine roots; abrupt smooth boundary; pH 6.9.

Horizon	Depth inches	
Cca	11-27	Light brownish gray (10YR 6/2 d), brown (10YR 5/3 m); silt loam; massive, breaking into coarse platy (varved) and subangular blocky; slightly hard, few roots; evidence of weak salinity; moderately calcareous, lime accumulates in soft nodules; pH 8.3.
Ck	27+	Pale brown (10YR 6/3 d), dark grayish brown (10YR 4/2 m); silt; slightly hard; massive breaking into coarse platy (varved) and subangular blocky; few roots; lime is evenly distributed; pH 8.3.

The associated soils form a small portion of the total acreage. They are classified as Solonetzic Dark Browns (Chernozems). They have developed on the heavier textured part of the lacustrine sediments.

The Merritt soils are suitable for cultivation, except for some rough topography areas where irrigation is difficult.

Nicola Association (Ni) - Carbonated Rego Dark Brown (Chernozem) and Saline Gleysol soils.

These two soils occur in an association in the southern part of the Reserve on the Nicola River floodplain. Topography is usually nearly level to gently undulating with a few interspersed depressional sites. These soils usually have a sandy loam to silty clay loam texture in the upper 2 feet overlying sands and gravels. The Nicola soils are cultivated, producing mainly alfalfa and timothy grass, forage.

The Carbonated Rego Dark Brown (Chernozem) is dominant (60-80 percent) occurring in the higher better drained locations. A description of a typical profile of this soil is as follows:

Horizon	Depth inches	
Apk	0 - 6	Dark grayish brown (10YR 4/2 d), very dark grayish brown (10YR 3/2 m); loam; massive breaking into moderate, medium subangular blocky and platy structure; friable; abundant fine roots; gradual, smooth boundary; weakly to moderately calcareous; pH 8.2.
Ck_1	6-18	Dark brown (10YR 3-4/3 m); loam; massive breaking into moderate, medium to coarse subangular blocky structure; friable; plentiful roots; gradual, smooth boundary; weakly to moderately calcareous; pH 8.00.
Ck_2	18-22	Dark grayish brown to olive brown (2.5YR 4/3 m); loam; massive breaking into moderate, medium, subangular blocky structure; friable; few roots; weakly to moderately calcareous; abrupt smooth boundary; pH 7.1.
II Ck	22 +	Variegated colors; coarse sand; about 80 to 90 percent rounded gravels 1 to 4 inches in diameter; loose; single grain; weakly calcareous; pH 7.6.

Profiles of this type become slightly mottled in the lower layers getting closer to depressional poorly drained sites.

The associated soil, the Saline Gleysol, occurs in the depressional locations on the flood plain. It is usually poorly to very poorly drained. The water table is 2 to 3 feet below the surface. During the summer, evaporation of brackish ground water rising to the surface by capillarity has caused salt deposition in certain locations. These saline areas are characterized by cinquefoil and short salt-tolerant sedges and grasses. A description of a profile of this type is as follows:

Horizon	Depth inches	
LHsk	5-3	Very dark brown to black semi-decomposed and decomposed plant remains; patches of thin salt crusts accumulated on the surface.
Hsk	3-0	Black (7.5YR 2/0 m); humus layer (60+ percent organic matter), the remaining mineral portion is silty clay loam in texture; abundant fine roots; weakly calcareous and moderately saline; pH 7.2.
Bgk	0-7	Very dark gray to dark gray (10YR 3-4/1 m); few, fine to medium, distinct reddish brown mottles; sandy loam; slightly sticky; massive, wet; plentiful roots; weakly calcareous; gradual smooth boundary; pH 7.9.
Ckg_1	7-20	Dark grayish brown (10YR 4/2 m); many, medium to coarse, prominent reddish brown mottles; sandy loam; slightly sticky; massive; wet; few roots; weakly calcareous; gradual, smooth boundary; pH 7.8.

Horizon	Depth inches	
Ckg_2	20-40	Dark greenish gray (5GY 4/1 m); sandy loam; slightly sticky; massive; wet; weakly calcareous; ground water started seeping into the hole at about 36 inches; pH 7.1.

Shulus Association (Sh) - Orthic Dark Gray (Chernozem) and Degraded Eutric Brunisol soils.

The Shulus Association consists of two soils which have many common characteristics. Parts of these soil areas have been cleared and cultivated. They occur on glacial-fluvial deposits of fan and deltaic landforms. They are found mainly on the western side of the Reserve. Topography is usually gently sloping to almost level. A relatively small area of the deltaic landform has an irregular hummocky topography because of kettle holes. These soils have developed under a fairly open and dry Ponderosa pine forest associated with bluebunch wheatgrass and kinnikinnick in the understory. Exceptional to this is the relatively small terraced area near Steffens Creek. This has a ponderosa pine - Douglas fir tree cover associated with the same type of ground cover including the addition of pine grass.

Soils of the Shulus Association are usually characterized by sandy loam to loamy sand upper layer(s), ranging in thickness from 10 to 18 inches. Underlying this are usually sands and gravels which are generally rapidly drained. The surfaces tend to be moderately stoney. The stones range from 4 to 10 inches in diameter and have to be removed if the soil is cultivated.

The Orthic Dark Gray (Chernozem) is dominant (about 60 to 80 percent) occuring under the more open parts of the forest cover with more grass in the understory. A description of a typical profile of this soil is as follows:

Horizon	Depth inches	
Ahe	0-6	Dark grayish brown to grayish brown (10YR 4-5/2 d), very dark grayish brown (10YR 3/2 m); loamy sand; weak, medium, subangular blocky and fine platy structure; loose; abundant fine roots; bleached sand grains; about 40 to 50 percent gravel; gradual, smooth boundary.
Bm	6-36	Dark brown to brown (10YR 4/3 m), a medium and coarse sand; loose; single grain; plentiful fine roots in the upper part decreasing to few at bottom of layer; about 70 percent gravel and cobble; gradual, smooth boundary.
Ck	36+	Variegated color due to heterogeneity of gravels; average color is brown (10YR 5/3 m); coarse sand; single grain; loose; about 75 to 85 percent gravel and cobble.

The Degraded Eutric Brunisol occurs under relatively denser tree stands and less grass ground cover.

A description of a typical profile of this soil is as follows:

Horizon	Depth inches	
Ae	0-2	Grayish brown to light brownish gray (10YR 5-6/2d); sandy loam; weak, medium, subangular blocky structure; soft; abundant fine roots; about 15 to 20 percent gravel; abrupt, smooth boundary; pH 5.9.
Bm	2-13	Brown (7.5YR 4-5/4 m); sandy loam; weak, medium, subangular blocky structure; soft; plentiful roots; about 15 to 20 percent gravel and cobbles; abrupt, smooth boundary; pH 6.1.
II C	13-36	Variegated colors dominated by reddish brown and dark gray; coarse sand; loose; single grain; about 80 percent gravels and cobbles; few roots.
II Ck	36 +	Variegated colors as above; coarse sand; loose; single grain; about 80 percent or more gravel and cobble; lime accumulates on underside of stones; few roots.

The Non-Arable Soils

Coutlee Series (Ct) - Lithic Degraded Eutric Brunisol soils.

The Coutlee Series occurs in a small area in the southeast corner of the Reserve.

These soils developed on shallow till and colluvial materials overlying bedrock. Topography is steep to very steep. The soils are well to rapidly drained.

The vegetation is dominated by ponderosa pine and bunchgrass, with

minor stands of Douglas fir and pine grass.

These soils are considered non-arable because of their shallowness and adverse topography, but they have some use for early spring grazing.

Craigmont Association (Cr) - Orthic Dark Gray (Chernozem) and Degraded Eutric Brunisol soils.

This association occurs in three locations on wooded slopes on the east side of Mameet Lake Road. The parent material is undifferentiated colluvial and till deposits. Topography is steep to very steep. These soils are well to rapidly drained.

The vegetation is fairly open ponderosa pine forest with a surface cover of bluebunch wheatgrass. At elevations of about 3000 feet Douglas fir becomes part of the plant community with pine grass as ground cover.

The Orthic Dark Gray (Chernozem) is the dominant (60 to 80 percent) soil in this association. It is found under the more open tree stands and heavier grass cover. The associated soils, Degraded Eutric Brunisols are found under denser tree stands and a limited grass cover.

These soils are not suitable for cultivation because of the steepness of their topography. They are suitable for early spring grazing, if properly managed, and selective logging.

Guichon Association (Gu) - Degraded Eutric Brunisol and Orthic Gray Luvisol soils.

This association occurs mainly on the wooded slopes in the north-eastern section of the Reserve adjacent to the eastern boundary. A small unit is located near the central eastern boundary and another at the extreme south boundary. The parent materials are undifferentiated colluvium and till deposits between 3500 and 4000 feet elevation on the west-facing aspect. Topography is steep to very steep. These soils are well to rapidly drained.

The vegetation is dominated by a Douglas fir and pine grass community. The lower fringes have some ponderosa pine.

The dominant Degraded Eutric Brunisol soils (60 to 80 percent) occur on the steeper less stable parts of slopes and under more open forest stands. The associated Orthic Gray Luvisol soils occur on more stable less steep slopes and under denser tree cover.

These soils are not suited for cultivation, because of their very steep slopes. They could be managed for summer grazing and selective logging.

Morgan Association (Mo) - Solonetzic Dark Brown (Chernozem) and Orthic Dark Brown (Chernozem) soils.

This association occurs in the central part of the Reserve on the east side of Guichon Creek.

These soils have developed essentially on hummocky-till deposits characterized by large kettles and scattered ponds. These deposits are interspersed with some coarse glacial-fluvial materials and small

isolated pockets of stratified lacustrine sediments.

The dominant Solonetzic Dark Brown (Chernozem) soils (about 60 to 80 percent) occur mainly on the till deposits which are medium to fine textured. The Orthic Dark Brown (Chernozem) soils occur mainly on the coarse to medium textured associated deposits. The topography is quite irregular with short, steep and repetitive slopes being common.

Vegetation consists of big sagebrush, sparse bluebunch wheatgrass plus cacti and a few scattered ponderosa pine. This range is severely overgrazed at the present time and undesirable species like sagebrush and cacti are prevalent.

These soils are not suitable for cultivation mainly because of rough topography. Under good management, they are suitable for early spring grazing.

Steffens Association (Sf) - Orthic Black (Chernozem) and Saline Orthic Black (Chernozem) soils.

This association occurs in the central part of the Reserve near the eastern boundary just east of the Morgan Association. These soils have developed on medium to heavy textured, weakly saline till.

The dominant soil (60 to 80 percent) is Orthic Black (Chernozem) occurring on relatively higher well drained sites. The other member of this association, the Saline Black (Chernozem), occurs in relatively lower seepage receiving sites.

Topography is generally steep to very steep with a westerly aspect. Some gully erosion is taking place. The soils are well to rapidly drained.

The vegetation consists of bluebunch wheatgrass and rough fescue. At the present time this range is overgrazed resulting in accelerated erosion.

These soils are not suitable for cultivation, being limited primarily by steep slopes. Under good management, they are suitable for early spring grazing.

Stumbler Association (St) - Orthic Dark Gray (Chernozem), Solonetzic Dark Brown (Chernozem) and Degraded Eutric Brunisol soils.

The Stumbler Association occurs in two locations, one on the north side of the Morgan Association (central part of the Reserve) and the other south of it. These soils have developed on deposits similar to the soils of the Morgan Association.

The Orthic Dark Gray (Chernozem) soils dominate the association (60 to 80 percent) and occur mainly on the till with minor proportions of the Solonetzic Dark Brown (Chernozem) in open grass-covered patches. The third member of the group, the Degraded Eutric Brunisol soils, occurs on the associated coarser materials under tree vegetation. The topography also is quite similar to the topography of the Morgan Association.

Vegetation consists of a fairly open stand of ponderosa pine and bluebunch wheatgrass and some pine grass. Scattered saskatoon berry and rabbit bush are present.

These soils are not suitable for cultivation because of the complex topography. However, with good management they can be useful for early spring grazing and selective logging.

Miscellaneous Land Types

There are two units in this miscellaneous group of landforms.

E - Denotes an Esker formation in the southeastern section of the Reserve. This is a fairly long, narrow and steep sided essentially stratified gravel and sand deposit. It is cut up at points and has a sparse ponderosa pine and bunchgrass vegetative cover.

G - Denotes the steep sided valleys of Guichon, Jesse, Morgan, Steffens and Stumbler Creeks. They are all steep and subject to erosion. The valley sides have fairly open tree stands of ponderosa pine, and some Douglas fir in the northern parts. Considerable amounts of grasses are part of the understory.

The valley bottoms have coarse alluvial materials and a fairly dense deciduous tree and shrub community plus grasses.

Management Areas

A soil management area is a portion of soil surveyed land having approximately similar soil conditions, topography and climate that can be managed as a unit. It emphasizes soil utilization and problems rather than classification. It has been developed to assist the land manager to understand the surveyed area. Management areas are derived from soil survey maps.

In this report management areas are shown on a map (Fig. 5) and designated by capital letters. Table 5 summarizes the management area descriptions.

Management Area A (591 acres)

This Area is made up of the soils of the Nicola Association which occupy the flood plain of Nicola River. It lies at the lowest elevation of the Reserve and receives soluble salt-charged seepage from the surrounding uplands, and higher irrigated fields. Thus, seepage and proximity to the river, helps to maintain a fairly high water table. Continuous evaporation from the water table via capillary action results in accumulation of salts in surface layers and as surface crust. Table 3 lists a conductivity of 8.56 mmhos/cm^2 at 25°C in the surface layer of a sampled profile. Thus, parts of this management area will sustain only medium salt tolerant crops such as barley, reed canary grass and alfalfa.

A drainage network is required to lower the water table and intercept seepage from the adjacent higher grounds. Leaching of salts, initially by the flooding method, is also required to return the soils to normal, and raise productivity of the Area. The Nicola River is an accessible natural outlet for drainage, probably with little or no pumping.

The topography is nearly level to gently undulating with interspersed depressional and saline areas.

The soils are calcareous, deep and moderately fertile. The average profile is 3 feet of sandy loam materials overlying sands and gravels. The available water storage capacity is 1.5 inches per foot (1), or 4.5 inches per 3 feet. About 2.25 inches of this water is readily available to plants. Based on an alfalfa crop and an estimated

average evapotranspiration of 0.20 inches per day, the available water would be exhausted in about 11 days. Therefore, irrigation of the well drained, non saline soil requires 2.25 inches of water every 11 days. Water losses caused by the variable efficiency of irrigation systems should be calculated and added to the irrigation requirements.

Fertilizer requirements for alfalfa or alfalfa-grass are 160 lbs. of 11-48-0 plus 45 lbs. of Borax (11.38 percent Boron) per acre. This mixed fertilizer should be applied at seeding time and every second year thereafter. After the initial application the fertilizer can be applied in early apring or in the fall.

The expected yield under good management conditions is 5-6 tons per acre.

Management Area B (898 acres)

Management Area B consists essentially of the Jesse soils, with minor inclusions of Merritt soils and a gently undulating to gently rolling topography. It occurs mainly on the north side of Highway No. 8 and the Indian Village (Shulus) occupies the southwest corner. Lot 129, Fig. 4 and 5, is privately owned and occupies a little over one third of this unit.

The majority of the soils are sandy loam in texture with an average depth of 3 feet overlying sands and gravels. Going north past the middle point of the Area the depth to the sands and gravels gradually decreases. These soils are well drained and slightly calcareous up to the surface.

The available water storage capacity is 1.5 inches per foot or

4.5 inches per 3 feet depth. Thus, 2.25 inches of irrigation water should be applied every 11 days. Irrigation system losses must be added to water requirement.

The fertilizer recommendation for alfalfa or alfalfa-grass is similar to that in Management Area A.

The expected yield of alfalfa, with proper management, is 5 to 6 tons per acre.

Management Area C (1,130 acres)

Management Area C occurs mainly immediately north and west of unit B. In addition, 4 relatively small areas occur at the north end of the Reserve. Only a relatively small portion of the Area has been cleared and is presently cultivated.

This unit consists of Shulus soils. These have formed on the upper part of the glacial-fluvial fan in addition to the glacial-fluvial terraces on the east and west side of Guichon Creek. Topography ranges from very gently sloping to gently rolling.

The soils are usually coarse sands and gravels capped with a relatively finer, loamy sand to sandy loam material ranging in thickness from 6 to 13 inches. The virgin surface is usually covered with a fairly high amount of stones ranging in size from 3 to 10 inches in diameter. These stones require removal before cultivating the land. A good example of this stoniness was in the northwestern corner of Lot 129 where logs and stones were piled up after clearing. These soils are rapidly permeable and have a low water holding capacity. The estimated available water storage

capacity is 2 inches per 3 feet of soil. Therefore, 1 inch of irrigation water should be applied every 5 days. Irrigation system losses should be added to the water requirement.

Chemical fertilizers are required for alfalfa or alfalfa-grass crop. Amounts and timing are similar to those for Management Area A.

With good management a yield of 4 to 5 tons per acre can be expected.

Management Area D (6,220 acres)

Management unit D occupies over two thirds of the total area of the Reserve. This unit consists of the non-arable soils of the Coutlee, Craigmont, Morgan and Steffens Associations and also part of Shulus Association not suitable for agriculture. In addition the steep sided, eroded valleys of Guichon, Steffen, Morgan and Jesse Creeks are also included. Topography is generally steep to very steep and irregular. Less than one third of the unit is open grassland and the rest is dominantly dry open ponderosa pine forest with some grass species. Deciduous species concentrate along streams. Drinking water for the animals is available in small scattered ponds and the main creeks.

This Area is recommended for early spring grazing (from May 1 to June 15). A reseeding program should be set up to improve the plant association, particularly of the lower part of the grassland. Overgrazing should be strictly avoided to protect the quality and productivity of the grazing resource. Overgrazing or clear-cut logging also should be avoided to decrease soil erosion caused by the

direct impact of rainfall and overland water flow on relatively bare soil surfaces.

Management Area E (1,030 acres)

Management Area E is located along the upper half of the east boundary of the Reserve at a higher elevation than Management Area D. It consists of the non-arable soils of the Guichon Association. Topography is strongly to very steeply sloping. The vegetation is a Douglas fir - pine grass community.

This unit is recommended for summer grazing (from June 15 to August 31) and selected logging. Clear-cut logging should be avoided, particularly on steep slopes to prevent soil erosion. This Area, in addition to the 11,000 acre grazing permit, would be the main summer grazing resource of the Reserve.

Management Area F (370 acres)

This non-arable unit is essentially a long, narrow and steep sided gravel and sand formation.

It can be used as a source of granular materials such as sands and gravels, for road building and structures.

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Table 1. Nicola-Mameet Indian Reserve No. 1: Summary of Temperature and Precipitation Data, 1941-1970, at Mameet Lake, Merritt and Merritt Craigmont Mines

ELEMENT and STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	YEAR
MAMEET LAKE	LATITUDE 50 23 N					LONGITUDE 120 48 W						ELEVATION 3300 FT ASL	
Mean daily temperature (Deg F)	16.8	24.8	29.9	39.0	47.8	53.5	58.8	57.3	50.3	40.8	28.8	21.3	39.1
Mean daily maximum temperature	26.5	35.5	41.2	50.2	60.7	66.4	73.3	72.0	64.3	51.1	37.4	29.8	50.7
Mean daily minimum temperature	7.1	14.0	18.6	27.8	34.9	40.6	44.3	42.5	36.2	30.4	20.2	12.8	27.5
Extreme maximum temperature	52	58	64	76	86	94	94	93	87	75	61	51	94
No. of years of record	15	15	15	13	14	14	15	16	13	14	15	14	
Extreme minimum temperature	-45	-34	-37	6	12	28	30	29	20	2	-24	-35	-45
No. of years of record	15	15	15	13	14	14	15	15	13	14	15	14	
No. of days with frost	30	27	29	24	12	3		1	10	21	26	30	213
Mean rainfall (inches)	0.16	0.34	0.58	0.54	1.11	1.60	1.37	1.29	1.19	0.96	0.59	0.45	10.18
Mean snowfall	11.6	7.3	3.0	0.6	0.5	T	0.0	0.0	0.2	0.6	7.0	13.0	43.6
Mean total precipitation	1.32	1.07	0.88	0.60	1.16	1.60	1.37	1.29	1.21	1.02	1.29	1.75	14.56
Greatest rainfall in 24 hrs	1.02	0.86	0.48	1.30	0.92	1.23	1.54	1.26	1.87	1.16	2.75	1.21	2.75
No. of years of record	39	38	39	37	35	38	38	39	37	36	38	37	
Greatest snowfall in 24 hrs	10.0	8.0	13.0	8.0	4.5	0.9	0.0	0.0	3.0	6.3	8.0	13.0	13.0
No. of years of record	39	37	38	37	37	38	39	40	37	36	38	36	
Greatest precipitation in 24 hrs	1.22	1.47	1.30	1.30	0.92	1.23	1.54	1.26	1.87	1.16	2.75	1.30	2.75
No. of years of record	39	37	38	37	35	38	38	39	37	36	38	36	
No. of days with measurable rain	1	1	1	2	7	9	5	7	6	5	3	1	48
No. of days with measurable snow	8	5	4	2	1		0	0		1	5	8	34
No. of days with m. precipitation	8	6	5	4	7	9	5	7	7	6	8	9	81
MERRITT	LATITUDE 50 07 N					LONGITUDE 120 48 W						ELEVATION 1920 FT ASL	
Mean daily temperature (Deg F)	18.2	28.3	35 .4	44.7	52.8	58.4	63.5	61.7	54.8	44.7	33.4	24.1	43.3
Mean daily maximum temperature	27.1	37.8	46.4	57.3	66.1	71.1	77.6	75.8	69.1	55.9	41.6	32.0	54.8
Mean daily minimum temperature	9.2	18.6	24.5	32.1	39.4	45.6	49.3	47.5	40.4	33.4	25.2	16.1	31.8

(continued)

Table 1 (continued)

ELEMENT and STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	YEAR
MERRITT (cont)													
Extreme maximum temperature	59	60	72	84	92	96	102	97	89	80	75	62	102
No. of years of record	38	38	38	38	39	39	38	38	38	38	39	39	
Extreme minimum temperature	-46	-31	-17	10	22	29	34	33	19	- 3	-11	-35	-46
No. of years of record	38	38	38	38	38	39	38	38	38	38	39	39	
No. of days with frost	30	26	26	16	5		0	0	4	15	25	28	175
Mean rainfall (inches)	0.29	0.07	0.32	0.56	0.71	0.85	0.61	0.73	0.64	0.79	0.46	0.54	6.57
Mean snowfall	12.0	5.6	3.0	0.6	0.3	0.0	0.0	0.0	0.0	0.2	4.1	8.7	34.5
Mean total precipitation	1.49	0.63	0.62	0.62	0.74	0.85	0.61	0.73	0.64	0.81	0.87	1.41	10.02
Greatest rainfall in 24 hrs	0.72	1.50	0.50	1.07	0.93	2.24	0.82	1.05	2.09	1.29	0.98	0.77	2.24
No. of years of record	38	38	38	38	39	39	38	38	38	38	39	39	
Greatest snowfall in 24 hrs	12.0	14.5	12.0	5.0	2.5	0.0	0.0	0.0	5.0	4.5	13.0	13.0	14.5
No. of years of record	38	38	38	38	39	39	38	38	38	38	39	38	
Greatest precipitation in 24 hrs	1.20	1.50	1.20	1.07	1.18	2.24	0.82	1.05	2.09	1.49	1.30	1.30	2.24
No. of years of record	38	38	38	38	39	39	38	38	38	38	39	38	
No. of days with measurable rain	2	2	3	6	6	8	6	7	6	7	6	3	62
No. of days with measurable snow	7	3	2			0	0	0	0		3	7	22
No. of days with m. precipitation	8	5	5	6	6	8	6	7	6	7	9	9	82
MERRITT CRAIGMONT MINES													
Mean daily temperature	23	31	33	44	49	58	65	63	52	49	32	23	44
Mean total precipitation	2.08	0.63	0.03	1.49	0.44	0.20	0.53	2.17	0.42	0.13	1.28	2.55	11.95

Table 2. Nicola-Mameet Indian Reserve No. 1:
Irrigation and Groundwater Analyses

Water Sample Source	Date Sampled	Conductivity mmhos/cm @ 25 C	pH ($CaCl_2$)	milliequivalents per liter							
				Ca	Mg	K	Na	CO_3	HCO_3	Cl	SO_4
Guichon Ck.	May 31, 73	0.358	8.45	2.50	0.96	0.06	0.36	0	3.14	0.06	0.15
Steffens Ck.	June 1, 73	0.430	8.50	2.89	1.14	0.07	0.40	0	3.58	0.03	0.46
Groundwater (Spring) South of Highway 8	June 2, 73	0.523	8.00	2.96	1.95	0.07	0.68	0	4.28	0.13	0.62

Table 3. Nicola-Mameet Indian Reserve No. 1:
Analyses of Some of the Arable Soils

Horizon	Depth inches	Mechanical Composition (Percentage of total weight) Sand	Silt	Clay	Fine Clay	Texture	Some Chemical Analyses pH ($CaCl_2$)	Conductivity mmhos/cm @ 25°C	Organic Matter %	Nitrogen %
					Jesse Soil Series					
Apk	0-6	55.69	32.42	11.89	4.32	Sl	7.68	0.53	3.81	0.184
Ck	6-27	60.90	31.20	7.90	2.30	Sl	7.78	0.33	1.38	0.089
Cca	27-35	61.45	29.71	8.84	0.88	Sl	7.88	0.26	0.46	0.035
					Nicola Association					
Ni 1:										
Apk	0-6	35.01	46.28	18.71	5.13	L	8.23	1.72	6.67	0.309
Ck_1	6-18	42.17	43.62	14.21	3.95	L	7.95	0.54	1.51	0.078
Ck_2	18-22	44.70	44.76	10.54	2.59	L	7.05	0.28	0.98	0.060
II Ck	22+	91.05	7.71	1.24	0	S	7.60	0.44	0.68	0.021
Ni 2:										
LHsk	2-0[1]						7.82	8.56	66.14	2.86
Hsk	0-3	15.67	53.95	30.38	3.58	Sicl	7.19	4.12	61.31	2.54
Bgk	3-10	65.06	26.42	8.52	1.88	Sl	7.89	0.87	1.39	0.057
CKg1	10-23	54.03	35.36	10.61	1.88	Sl	7.79	0.66	0.74	0.031
CKg2	23-40+[2]	67.26	24.87	7.87	2.86	Sl	7.09	1.27	0.73	0.026
					Shulus Association					
Ae	0-2	64.49	28.12	7.39	2.29	Sl	5.88	0.16	5.21	0.158
Bm	2-13	70.09	22.09	7.82	2.50	Sl	6.13	0.12	0.85	0.030
II C	13+	Coarse sand with about 80 percent gravel. Lime accumulation on the underside of stones at about 36 to 40 inches from the surface								

[1] Semi-decomposed and decomposed plant remains.

[2] Groundwater started seeping into the hole at about 36 inches.

Table 4. Nicola-Mameet Indian Reserve No. 1: Summary of the Practical Data for the Arable Soils of the Reserve

Soil Series & Associations	Texture	Drainage	Reaction (see table 3)	Topography
Jesse Series	sandy loam	well drained	mildly to moderately alkaline	gently sloping
Merritt Association	silt loam to silt	well drained	neutral to moderately alkaline	undulating to gently rolling. A few steep banks and some rough topography
Nicola Association	loam to sandy loam	well to moderately well drained; poorly drained in depressional locations	mildly to strongly alkaline	nearly level to gently undulating with a few interspersed depressional sites
Shulus Association	loamy sand to sandy loam (sand and gravel 6-13 inches below the surface)	rapidly drained to well drained	medium acid to neutral; mildly alkaline at deeper layers	gently sloping to almost level

Table 5. Nicola-Mameet Indian Reserve No. 1:
Summary of the Soil Management Area Descriptions

Soils Series & Associations Names and Textures	Fertility Status	Cultivation Suitability	Erosion Susceptibility
		Management Area A	
Nicola Association loams and sandy loams	moderate	very good - saline areas should be reclaimed	none to very slight, subject to periodical flooding and bank slumping along Nicola River
		Management Area B	
Jesse, sandy loams and Merritt Association, silt loams	moderate to high	very good except on rough topography sites of Merritt soils	none to very slight on Jesse soils. Moderate to severe on Merritt soils, slumping along the edges of steep banks
		Management Area C	
Shulus Association loamy sands and sandy loam, gravels and sands, 6 to 13 inches below surface	very low to low	moderate; surface stones should be removed, regular fertilizer application and well timed irrigation recommended for good results	very slight except for possibility of slumping along steep valley sides (e.g. Guichon Creek)

(continued)

Table 5 (continued)

Soils Series & Associations Names and Textures	Fertility Status	Cultivation Suitability	Erosion Susceptibility
		Management Area D	
Coutlee, Craigmont, Morgan, Shulus and Steffens Associations, sandy loams and loams	moderate to low	unsuitable because of adverse topography. Recommended for early spring grazing and selective logging	severe upon overgrazing and/or clear-cut logging
		Management Area E	
Guichon Association sandy loams and loams	moderate	unsuitable because of adverse topography. Recommended for summer grazing and selective logging	severe upon clear-cut logging
		Management Area F	
E. Esker, steep sided, long and narrow gravel and sand formation		unsuitable; recommended for use as a source of granular material, i.e. gravel and sand for road building, structures etc.	

Glossary

alkaline soil - Any soil that has a pH greater than 7.4. See also - reaction, soil.

alluvial fan - A fan-shaped deposit of alluvium laid down by a stream where it emerges from an upland into a less steeply sloping terrain.

alluvium - Material such as clay, silt, sand, and gravel deposited by modern rivers and streams.

available water storage capacity - The range in soil water between field capacity and permanent wilting point. Units: percentage of oven dry weight of soil, inches of water per foot of soil or per effective rooting depth.

calcareous soil - Soil containing sufficient calcium carbonate, often with magnesium carbonate, to effervesce visibly when treated with cold 0.1N hydrochloric acid.

colluvium - A heterogeneous mixture of material that as a result of gravitational action has moved down a slope and settled at its base.

drainage soil - Classes used on Soil Map are as follows:

1) Rapidly drained - The soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions.

2) Well drained - The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year.

3) Moderately well drained - The soil moisture in excess of field capacity remains for a small but significant period of the year.

4) Imperfectly drained - The soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year.

5) Poorly drained - The soil moisture in excess of field capacity remains in all horizons for a large part of the year.

6) Very poorly drained - Free water remains at or within 12 inches of the surface most of the year.

dunes - Wind-built ridges and hills of sand formed in the same manner as snowdrifts.

evapotranspiration - Water transpired by plants, built into plant tissue, and evaporated from the soil surface.

field capacity - Soil water content retained by the soil following an irrigation or heavy rain, after downward movement of water has materially decreased. It is the upper limit of soil water available for plant use.

flood irrigation - Application of water by flooding to soil for the purpose of supplying the moisture essential for plant growth.

frost-free period - Average number of days between last spring frost and first fall frost, based on $32^{\circ}F$.

glaciofluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melted ice.

growing degree days (also, degree-days, above $42^{\circ}F$) - The number of degrees above 42 accumulated for all days during the growing season. This expresses the length and warmth of the growing season in a single figure.

growing season - The dates in spring and fall corresponding to a mean temperature of $42^{\circ}F$ are used as the start and end of the growing season.

irrigation interval - The number of days between the start of an irrigation at any one spot and the start of the next irrigation at the same spot.

irrigation requirement - The amount of water required by a crop in addition to the annual rainfall.

lacustrine deposit - Material deposited in lake water and later exposed either by lowering the water level or by uplifting of the land. These sediments range in texture from sands to clays.

leaching - The process of removing soluble material from the soil by passage of water through the soil.

outwash - Sediments washed out by flowing water beyond the glacier and laid down as stratified drift in thin forset beds. The particle size may vary from boulders to silt.

permanent wilting point - The water content of the soil when plants growing in it are wilted to the point where they will not recover when placed in the dark for 12 hours in an atmosphere

of 100% relative humidity. It occurs at about 15 bars of soil moisture tension.

permeability, soil (1) - The ease with which gases, liquids or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. In the absence of precise measurements, soils may be placed into relative permeability classes through studies of structure, texture, porosity and cracking in the soil profile in relation to local use experience. The relative classes presented in this report are estimated and are as follows:

	Possible rates in inches per hour
Slow	less than 0.20
Moderate	0.20 to 5.00
Rapid	over 5.00

pH - The negative logarithm of the hydrogen-ion activity of a soil. The degree of acidity or alkalinity of a soil as determined by means of a glass, quinhydrone, or other suitable electrode or indicator at a specified moisture content or soil-water ratio, and expressed in terms of the pH scale.

plow layer - Ap - A layer of soil disturbed by man's activities, that is, by cultivation or pasturing or both.

reaction, soil - The degree of acidity or alkalinity of a soil, usually expressed as a pH value. Descriptive terms, commonly associated with certain ranges in pH (H_2O) are: Moderately acid, 5.6 - 6.0; slightly acid, 6.1 - 6.5; neutral, 6.6 - 7.3;

slightly alkaline, 7.4 - 7.8; moderately alkaline, 7.9 - 8.4.

root zone - That part of the soil occupied by plant roots.

saline soil - A nonalkali soil that contains enough soluble salts to interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 mmhos/cm, the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

soil - (i) The unconsolidated material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

(ii) The naturally occuring unconsolidated material on the surface of the earth that has been influenced by parent material, climate, macro- and microorganisms, and topography, all acting over a period of time to produce soil that may differ from the material from which it was derived in many physical, chemical, mineralogical, biological, and morphological properties.

soil classification - The systematic arrangement of soils into groups or categories on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.

soil horizon - A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by soil forming processes.

soil profile - A vertical section of the soil through all its horizons and extending into the parent material.

soil series - This is the basic unit of soil classification, and consists of soils that are essentially alike in all major profile characteristics except the texture of the surface.

sprinkler irrigation system - For design purposes, this includes all equipment required to apply water to the design area from the source of water supplying the system to the revolving sprinklers, nozzles or perforated pipe.

stocking rate - The number of acres needed to graze a 1000-pound cow for one month (AUM). They are determined by calculating the amount of available forage, allowing for a 45 percent carryover to avoid damage to the range. About 660 pounds of available forage is needed per AUM.

stoniness - The classes of stoniness are defined as follows:

1) Slightly stony land - There are some stones, but they offer only slight to no hindrance to cultivation.
2) Moderately stony land - There are enough stones to cause some interference with cultivation.
3) Very stony land - There are enough stones to constitute a serious handicap to cultivation and some clearing is required.
4) Exceedingly stony land - There are enough stones to prevent cultivation until considerable clearing is done.

5) Excessively stony land - This land is too stony to permit any cultivation (boulder or stone pavement).

texture, soil - The percentages of sand (S), silt (Si), and clay (C) in a soil determine its texture. Size groups from 2 mm to 0.05 mm in diameter are called sand, those from 0.05 to 0.002 mm are called silt, and those less than 0.002 mm in diameter are called clay.

topography - definition of classes used on Soil Map (Fig. 3):

Simple topography Single slopes (regular surface)	Complex topography Multiple slopes (irregular surface)	Slope %
A depressional to level	a nearly level	0 to 0.5
B very gently sloping	b gently undulating	0.5+ to 2
C gently sloping	c undulating	2+ to 5
D moderately sloping	d gently rolling	5+ to 9
E strongly sloping	e moderately rolling	9+ to 15
F steeply sloping	f strongly rolling	15+ to 30
G very steeply sloping	g hilly	30+ to 60
H extremely sloping	h very hilly	over 60

topsoil - The layer of soil moved in cultivation.

wilting point - See permanent wilting point.