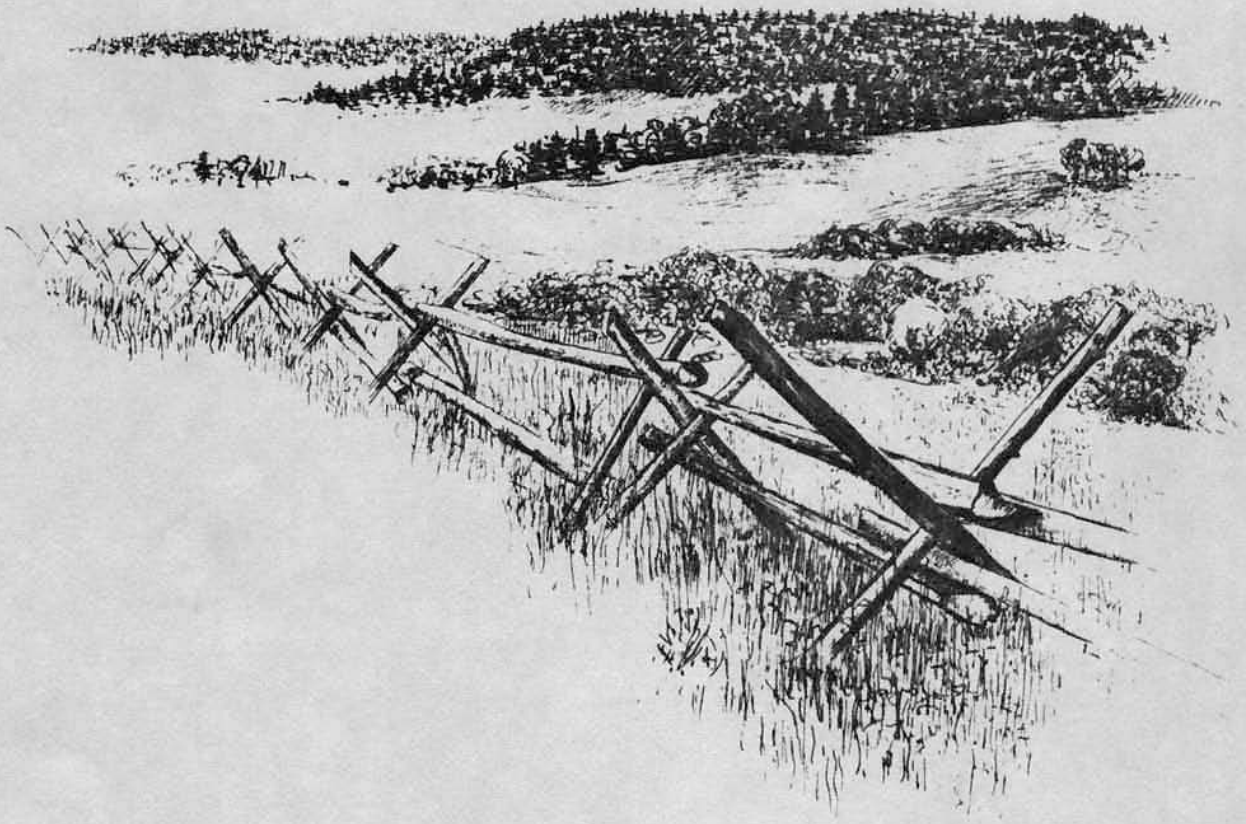
A Soil Resource and Land Use Survey of the

Toosey Indian Reserve

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



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Report No. 279
Research Station,
Agriculture Canada,
6660 N.W. Marine Drive,
Vancouver 8, B.C.

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Contents

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Ms. U. Bachinski drafted the figures. Mr. H. Reynolds assisted with the field work. Soil analyses were done by Mr. L. Chan.

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A SOIL RESOURCE AND LAND USE

SURVEY OF THE TOOSEY INDIAN RESERVE

Summary

This report presents the results of a survey of the soil resources of the Toosey Indian Reserve in British Columbia. A total of 12 soils are identified, described and mapped (Figure 3).

The soils are also grouped into 8 management areas (Figure 4). Each soil management area is described and its agricultural use, including suitable crops, irrigation requirements and fertilization rates, is indicated in the discussions. Selected analyses of important soils are tabulated (Table 1).

Out of 5500 acres only 325 acres (Management Area B) are considered arable and productivity is largely dependent on irrigation. The remainder of the Reserve is rangeland, parts of which might be improved by seeding to higher yielding dry land grasses. Four hundred acres of mixed forest - grassland is low capacity grazing land.

At the present time, water from Riske Creek is used for a marginal flood irrigation operation on Management Area A. The water quality is rated as "Good" (2) and the supply is small but adequate for a more extensive irrigation development. Substitution of sprinklers for flood irrigation is recommended. Regardless of the method used, irrigation should be managed and handled by personnel specially trained for this work.

Employing both fertilizers and irrigation, the Reserve should produce from 1300 - 1500 tons of quality forage per year. This is enough to maintain a worthwhile herd of beef cattle or command considerable income on the open market.

Intensifying the agricultural operations requires a trained agricultural manager, large capital expenditures and considerable social and philosophical adjustments. These are not easily achieved, therefore, it is suggested that changes be carried out in steps as follows;

(a) install a wheel-move sprinkler irrigation system on Management Area B, at the same time continue flood irrigation on Area A,

(b) produce forage for the Reserve's beef herd selling any surplus for cash,

(c) expand sprinkler irrigation to Area A when the management aspects of forage production on Area B are mastered. This Area is narrow so a hand-move or permanent type of sprinkler system may be required.

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 Toosey Indian Reserve is located in the western part of the Cariboo region where grassland is preponderant. Ranching dominates the region including the Indian Reserves. Since the winters are severe, forage is required for winter feeding. Significant forage yields, in turn, depend on irrigation because of the limited rainfall. Thus, some irrigable land is advantageous for each ranching enterprise. Out of 5500 acres this Reserve has 325 acres capable of being irrigated.

At the present time some 150-175 acres are flood irrigated. The water control is indifferent and wasteful of soil nutrients. Also, salinity problems are appearing and being accentuated by excess flooding.

As with neighboring reserves, farming and ranching are not the main livelihood of the Reserve members. Nearby logging camps, construction projects and ranches provide outside employment. At the same time, this Reserve, like several others, is not realizing the full agricultural potential of the arable land. Greater success can be attained by understanding the various soils and their best use. Important also, is the utilization of irrigation and its correct application to irrigable land.

The purpose of this report is to outline the soil resources of the Reserve and to suggest soil management procedures which will increase agricultural income. Water and fertilizer management is outlined. Range management improvements are discussed. Soil conservation practices are suggested in several instances.

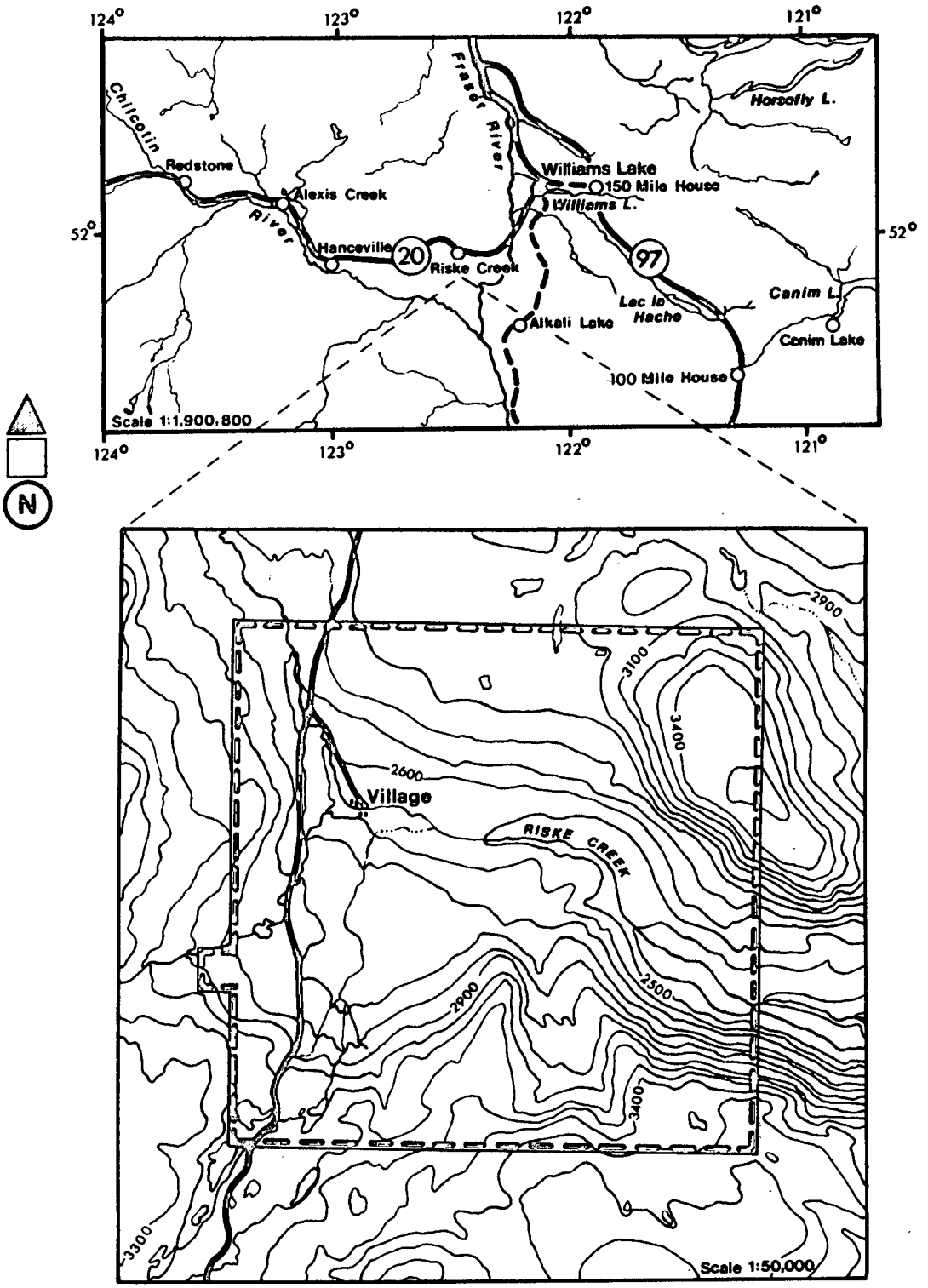

Figure 1. Location map of Toosey Indian Reserve.

Highway

Reserve boundary

Contour Line

Contour Interval 100 ft.

Location and Size

The Toosey Indian Reserve (Figure 1) is located in the western part of the Cariboo region of British Columbia. It is 30 miles west of Williams Lake, 1.5 miles south of Highway 20. Riske Creek flows east through the Reserve to join eventually, the Fraser River.

The size of the Reserve is approximately 5500 acres[1] of which about 325 acres are irrigable.

The Reserve lies within National Topographic Sheet No. 92-O/15.

Nature of the Landscape

An aerial view of the Reserve would reveal a square of territory with sides slightly over 3 miles in length. The Riske Creek enters the Reserve at the north-west corner, and flows across it in a south-east direction crossing the eastern boundary approximately one mile north of the south-east corner.

There are alluvial fans on either side of the Creek leading to grassland slopes which rise gradually to a grassland plateau. The north-east and south-east corners of the Reserve are partly forested.

The elevation of the Reserve varies from 2300 feet (creek bottom) to 3500 feet in the uplands.

Climate

Annual precipitation -	11 inches
May through September precipitation -	7 inches
Annual snowfall -	40 inches
Frost free period - 75 days (Riske Creek) to	100 days (upper slopes)
Growing degree days above 42^{o}F -	2235^{o}

The Riske Creek valley has a colder climate than the upland grass areas, sometimes referred to as a "frost pocket". In this instance the irrigable land lies in the frost pocket.

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[1] Acreages are measured from aerial photographs.

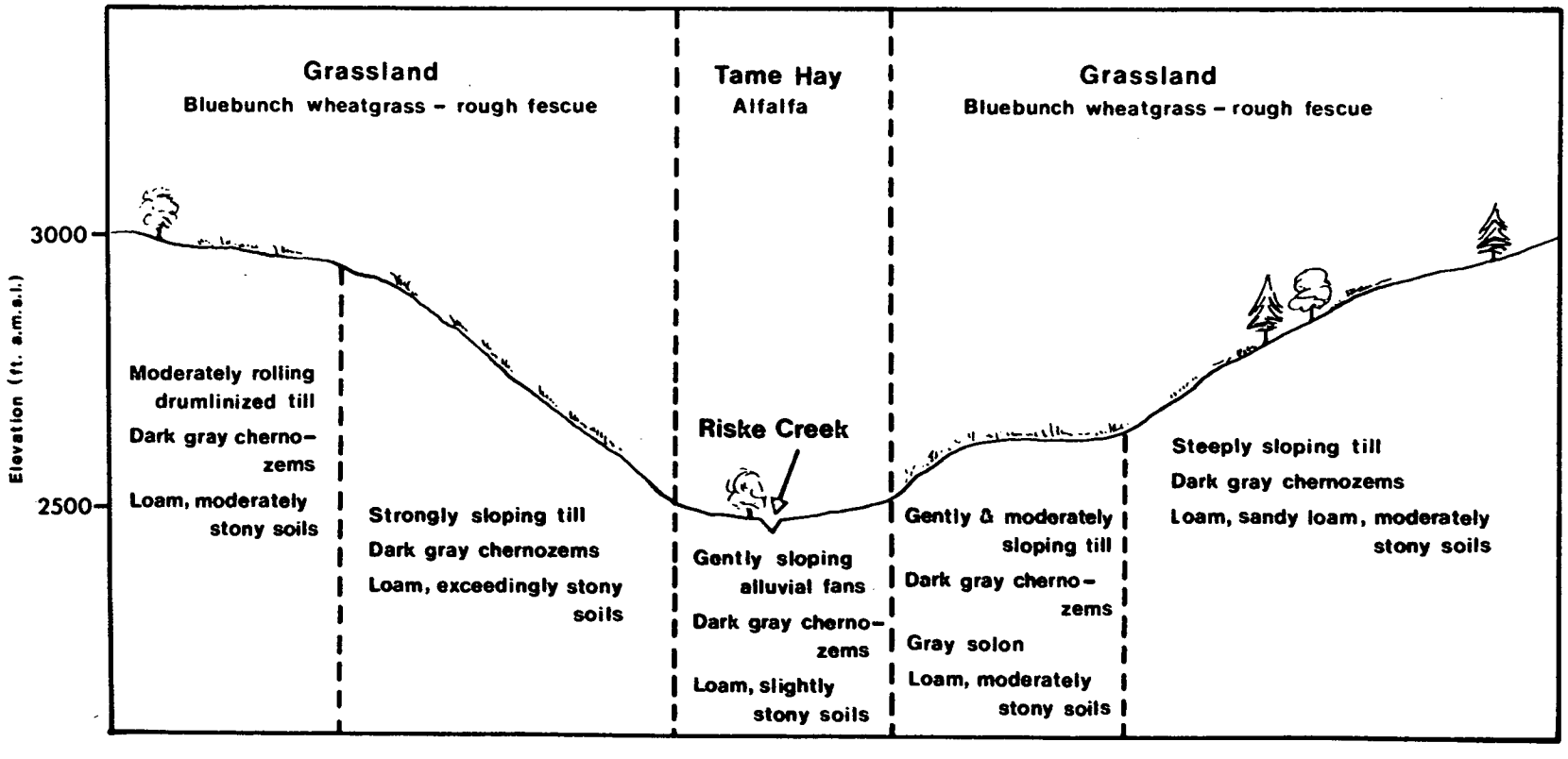

Figure 2. Idealized cross-section of Toosey Indian Reserve showing vegetation, landforms, soils, texture, and stoniness.

Annual rainfall is insufficient for crop production except on the most marginal terms. Native grasses would support only a few cattle per acre. Drought during the summer is often severe. Coupled with limited rainfall, is a short frost-free period in the valley.

Vegetation and Crops

The greater part of the Reserve is grassland. The uplands grow bluebunch wheatgrass, rough fescue and several blue grasses. Douglas-fir, aspen and lodgepole pine dominate the treed areas with the native grasses, particularly pine grass, as immediate ground cover. Wet areas along the creek grow sedges, aspen and willows.

Where irrigation is used, all the ordinary northern forage crops grow well. This includes alfalfa, red, alsike and sweet clovers as well as the tame grasses, timothy, crested wheat grass, brome and fescues. As in any location alfalfa cannot tolerate continuous excessive flooding.

Barley and oats are used as cover crops, giving protection to grass and legume seedlings and preventing erosion. These cereals also can be used as forage. However used, irrigation is required for satisfactory growth.

Commercial vegetable production is marginal. If irrigated the cool weather vegetables grow satisfactorily for home use on the southern slopes.

Range Resources

The grazing range on the Toosey Reserve consists of grassland and forest types both occupying approximately 3700 acres. The extent and quality of the rangeland determine, to a large extent, the size of the basic ranch operation. Also related is the growing of winter feed because the winters are too severe to maintain cattle unless supplemental feed is available.

The grassland on this Reserve is variable ranging from gently rolling to the steeply sloping grass parts of Management Area G (Figure 4). Drainage also is variable and salinity is a problem in certain parts, especially Management Area E.

The principal grass species are bluebunch wheatgrass and rough fescue. Also, there is an abundance of forbs including lupines and balsamroot.

The management of the range grassland is fundamentally important to the agricultural well-being of this Reserve. Over-grazing must be avoided because it results in the replacement of wheatgrass and fescue by less desirable species. Continued over-use results in a weedy cover dominated by unpalatable forbs. Because of the dry summers this kind of range is best used during the early spring and late fall. It should have a grazing capacity of 1.1 acres/A.U.M. but poor management easily can lower this to 2 or more acres/A.U.M. (4).

At the present time the grassland requires renovation. This can be done naturally by permitting it to rest or it can be re-seeded. A combination of the two methods is likely to be the best procedure. In any event, the restoration of depleted grasslands must be a major management objective.

The forest range of the Toosey Reserve is characterized by relatively open tree stands. This encourages a well developed under-cover of herbs and shrubs. Pine grass is the principal grass while many broadleaf plants including vetch, peavine, aster, wild rose and willow provide valuable forage. The forest range tends to develop late in the spring and early frosts cause rapid deterioration in the fall so the season of use is from mid-June to the end of September. The stocking rate of good forest range averages 4 acres/A.U.M. (4). When grazing is too heavy there is a marked decline in the more palatable species, especially among the forbs. Accessibility is not a problem because of the open tree stands.

Both types of range require a rest after close grazing. This permits the plant to restore top growth and manufacture food as well as protect the crown from climatic extremes. In general, the forest land should be grazed in the hot summer months and the grasslands in the spring and fall. Also, a grazing rotation system for both grass and forest lands would help to prevent over-grazing.

At the present time, there is a steadily increasing demand for animal products and increased prices encourage the intensification of the ranching industry. On the Toosey Reserve appreciable increases in production must come from a more intensive use of the existing ranges and an increased production of tame hay. Also, a greater emphasis must be placed on the pounds of meat produced by the animals rather than using the numbers of livestock maintained as the index of production.

Cultivation Practices

Soils in all of the management areas suited for crop production may be cultivated with modern equipment such as plows, discs and cultivators using methods normal to the region. A disc with seeding attachment or seed drill may be used for sowing cereal crops whereas a spreader may be used for sowing forage crops. Because of fall weather conditions swathing is required for cereal crops. A swather or mower and rake, and baler are used to harvest the forage.

Fertilizers may be applied with a spreader or a fertilizer attachement on a seed drill. The soil should be moist or irrigated immediately following fertilization to minimize volatilization of the nitrogen fertilizers. Over-irrigation, however, will result in the loss of fertilizers by leaching particularly if the soil is rapidly permeable.

Clean, germination tested seed adopted to the region should be used. Seeding and fertilizer rates can be reduced for cover crops.

In seeding areas for dry land pasture the soil surface should be disturbed usually by a disc. Seeding is done by spreader either early in the spring or late fall so that sufficient moisture is available to germinate the seed and permit a vigorous seedling development.

Soil fertility can change according to cultural practices. Thus, the cultivated soils should be sampled regularly and analyzed for available plant nutrients. The services of the local District Agriculturist should be utilized. This official can also supply useful publications.

Irrigation

Riske Creek is the only source of irrigation water. The water quality is rated as Class 2 meaning "good" (2). Extended use might cause minor soil salinity particularly if uncontrolled flood irrigation is practiced. In this case drainage systems would be necessary. However, with well managed sprinkler irrigation systems, salinity should not become a problem. The quantity of water in Riske Creek is not large but is reasonably constant during the summer period.

In this report, water in the soil is expressed as inches of water per foot of soil. The total amount of water available to plants is known as the Available Water Storage Capacity (AWSC). Technically, it is the difference in soil moisture content between Field Capacity and Permanent Wilting Point.

Water is not uniformly available to plants over the entire range of the AWSC. For example, the first 35 percent of the range may be readily available to a given crop and then become 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 AWSC is readily available to plants. Evapotranspiration requirement for a forage crop is considered to be 0.20 inches per day for the growing season. In the recommended irrigation requirement for each soil management area, a limited contribution from precipitation is considered but application losses are excluded. If irrigation efficiency is 50 percent, application rates, in terms of irrigation system design, must be doubled (1).

When the AWSC has not been measured 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.

Soil Management Areas

Soils of this Reserve could be grouped in many ways, depending on present and probable use. The present and probable future use of these lands is not intensive. The soils, therefore, have been grouped geographically for broad planning and land use purposes. These groups, called soil management areas, are shown on a map (Figure 4) at the back of this report. In preparing these groupings the kinds of soil, parent material, topography and climate are considered. Each area consists of a single soil or a group of soils which, in a general way, lend themselves to similar systems of management or rotation and have the same potential ability to respond and produce the desired crop. However, within each management area some soils may be included that are markedly different. These are incorporated because the acreage is small or because they occur in small, isolated individual areas, making separate management impracticable.

In this report, each of the eight soil management areas is shown on the map by capital letters (Figure 4). The data used in discussing water requirements, fertilizer rates and crop yields are based on local experience, regional records and soil characteristics.

Management Area A (175 acres)

Management Area A is located on the gently sloping loam deposits on both sides of Riske Creek, downstream from the Indian village. A third part of this Area is found towards the eastern boundary of the Reserve. Soil No.1 (Figure 3) predominates in this Area.

The soils are well drained, slightly stony and calcareous in places. These loams are moderately fertile with an organic matter content of approximately 5 percent.

Most of this Area is flood irrigated and the water application is not well controlled. The installation of a sprinkler system would remedy this problem and should increase the productivity. However, the Area is relatively small and divided into three parts so a wheel-move sprinkler system may not be justified on economic grounds. If this is the case, alternative methods of sprinkler irrigation may be evaluated or the management of the present system must be improved.

Flood irrigation as used at the present time, results in over-irrigation in some places while others receive too little water. Also, over-irrigation may have caused the lime layer in the soil to move upward resulting in the present calcareous condition of the surface soil. Over-irrigating also tends to kill alfalfa if the soil is wet over a long period of time.

The water storage capacity for these soils is estimated to be 6 inches of available water per 3 foot depth but only half of this is considered to be readily available for plants. Therefore, assuming a 3 foot rooting depth, 3 inches of water should be applied about every 18 days. If a shorter irrigation interval is desired, less water should be applied, for example 2 inches every 12 days.

The Area is capable of growing all the forages adapted to the northern temperate climate. These include alfalfa, alsike, red and sweet clovers and brome, timothy and crested wheat grasses. Also, barley and oats can be grown as livestock feed. The cool weather vegetables can be grown but as previously noted a local market is lacking.

The use of commercial fertilizers is recommended. For grass-legume mixtures, 50 lb. N and 60 lb. of P_2O_5 per acre should be applied every year. For grasses alone, the nitrogen can be increased to 200 lb. per acre per year. To take advantage of natural soil nitrogen fixation, legume inoculation should accompany legume seeding. With proper fertilization and a well managed irrigation system approximately 4-5 tons per acre of forage can be produced yearly on Management Area A.

Management Area B (150 acres)

This area consisting of two parts is located on moderately sloping alluvial fans along Riske Creek (2) in the eastern half of the Reserve. Soil No. 2 (Figure 3) is characteristic.

The soils are well drained gravelly sandy loam and sandy loam, moderately to very stony. They tend to be hard and compact when dry but loosen up when wetted. Frequent cultivation should be avoided because of stoniness, thus forage production is indicated as the best management procedure.

For irrigation, Area B requires a sprinkler system. The slopes are too steep and the soils are too permeable for flood irrigation. Both parts of the Area are reasonably close to the source of water. The available water storage capacity of these soils is approximately 3.5 inches in the top 3 feet - the average rooting depth. Assuming one half of this water to be available to plants, about 1.75 inches of water should be applied every 10 days.

On the southern sloping fans the same crops as listed for Management Area A can be grown. Alfalfa production on the northern slopes could prove to be marginal because of cooler conditions. Oats and barley can be used as cover crops during the establishment of forage perennials.

The fertilizer requirements are 50 lb. of N and 50 lb. of P_2O_5 per acre per year applied in the spring. For grass-legume mixtures the fertilizer application should be split, one half in the spring and the remainder at mid-summer. For grasses alone the nitrogen should be increased to 250 lb. per acre per year.

As in Management Area A, forage yields of 4-5 tons per acre should be possible. The two Areas might be treated as one except that stoniness in Area B greatly restricts cultivation and flood irrigation is not possible.

Management Area C (50 acres)

This quite small Area consists of the gently sloping alluvial fans upstream from the Indian village.

Except for a small area growing hay, the soils are saline. The restricted area combined with the salinity and narrow shape are not conducive to improvements so the only agricultural use is grazing. It is made up of Soil No. 3(Figure 3).

Management Area D (2600 acres)

This, the largest Management Area is grassland on the upper slopes of the Reserve.

The soils (No.4,5,7 and 8) are generally well drained loams, moderately stony and occasionally saline. Topographically the Area is undulating to moderately rolling. The summer climate is warm and dry. Water is not readily available for irrigation purposes.

The Area is best used as rangeland. It is a bluebunch wheatgrass - rough fescue site which has a present estimated grazing capacity of 2 acres/A.U.M. This could be improved to 1.5 or 1.0 acres/A.U.M. if the range is brought into good condition. This range is best suited for spring and fall grazing.

Management Area E (400 acres)

This Management Area (Soil No.6) is very similar to Area D except that most of the soils are saline. It is a groundwater discharge region as reflected by the presence of a number of seepage sites and the accumulation of salts in the topsoil.

Basically, the Area can be managed as Area D except salt tolerant grass species should be used if range improvement is being considered.

Management Area F (400 acres)

Area F is mixed forest and grassland, the former dominant. The topography ranges from gently rolling to hilly to steeply sloping. The soils are moderately well to well drained, sandy loams, loams and clay loams. There are no salinity, alkalinity or acidity problems.

Although the Area is forested, the potential for timber is poor. Some trees have been removed and more may be logged but the timber supply is limited and for practical purposes is non-renewable.

This Area is best used as rangeland. It has a potential grazing capacity of about 4 acres/A.U.M. As much of the forest as possible should be retained to encourage wildlife and preserve some of the original ecology of the Reserve. It should be incorporated with Areas D and E in a rotational grazing plan.

Management Area G (330 acres)

Management Area G is made up of the very steeply sloping valley walls located in the eastern central part of the Reserve. The Area is dissected by gullies.

The soils are varied (a large range of textures) and are stony containing mostly angular rocks. The depth to bedrock ranges from a few inches to several feet. Aside from these features, the topography prohibits agricultural improvement of this Area.

Some grazing is available but overgrazing would cause erosion. Disturbance of these soils must be avoided.

Management Area H (120 acres)

This Area consists of the banks and deposits immediately adjacent to Riske Creek. It has no potential for agricultural development but the vegetation is essential for the well being of the stream. The willows and poplars help to reduce silting of the Creek which may result from erosion of the stream banks and adjacent fields during the summer. This Area also has aesthetic value in that it is a relatively cool shaded haven in dry hot surroundings. As far as possible it should be undisturbed.

Management Area	pH ($CaCl_2$)	Organic Matter %	Nitrogen %	Sulfur %	Phosphorous ppm	Potassium me./100g.
A	7.39	5.67	0.305	0.049	122	2.33
A	7.43	4.90	0.248	0.030	60	0.78
A	7.65	4.28	0.213	0.026	60	0.91
B	6.91	2.91	0.183	0.025	142	1.95

Table 1. - Toosey Indian Reserve: Selected chemical analyses of the topsoils of two management areas

Notes

1. Analyses procedures are those commonly used in the laboratory of the Soil Survey Section, Research Station, Canada Department of Agriculture, Vancouver.

2. Each sample is a composite of 4 sub-samples.

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2. Canada Department of Agriculture. Suitability for irrigation of water from lakes and streams in the southern interior of British Columbia. Publication 1179, 1963.

3. Canada Department of Agriculture. The system of soil classification for Canada, Ottawa, Ontario, 1970.

4. Tisdale, E.W., A. McLean and S.E. Clarke. Jour. of Range Management, Vol. 7, No. 1, 1954.

Glossary

alkaline soil - Any soil that has a pH greater than 7.0. 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, 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°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°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°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.

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 forest 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.

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 occurring 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 difference 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 rates - The number of acres needed to graze a 1000-pound cow for 1 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.

From: Toogood, J. A.—A Simplified Textural Classification Diagram. Can. J. Soil 38: 54-55. 1958

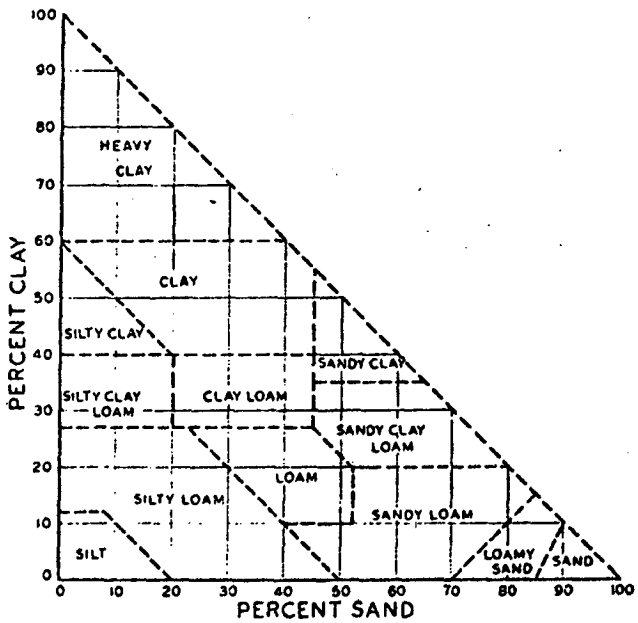

Chart showing proportions of soil separates.

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.