RECONNAISSANCE SOIL SURVEY

of

The Takhini and Dezadeash Valleys

in the

YUKON TERRITORY

J. H. DAY

SOIL RESEARCH INSTITUTE
CENTRAL EXPERIMENTAL FARM
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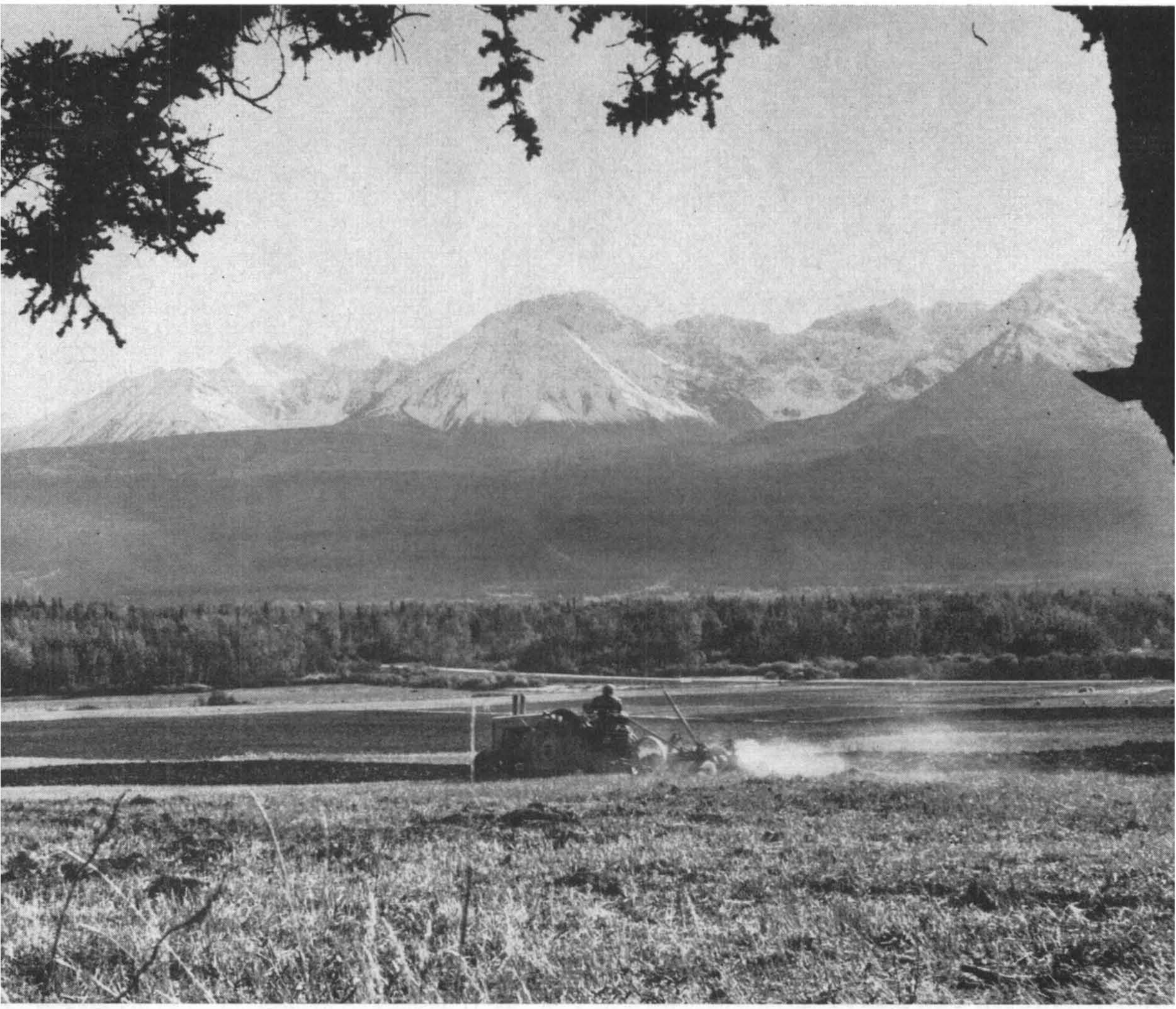

Frontispiece illustration.—Fall plowing of stubble land at the Experimental Farm, Mile 1019, Alaska Highway, Yukon Territory. *Courtesy of J. Y. Tsukamoto.*

ACKNOWLEDGMENTS

The author acknowledges assistance from personnel of the Department of Mines and Technical Surveys, Ottawa. Dr. J. O. Wheeler, Geologist, gave advice and reviewed the sections of the report on physiography and geology of the area. Also, base maps were supplied by the department.

The following gave material aid in the survey: Mr. H. N. Spence, Field Surveys Chief, Topographical Survey, Department of Mines and Technical Surveys, Ottawa; the late Mr. W. H. Hough and Mr. J. Y. Tsukamoto, Experimental Farm, Mile 1019, Alaska Highway.

Mr. G. W. Robertson, Agrometeorology Section, Plant Research Institute, Ottawa, seconded from the Meteorological Branch, Department of Transport, supplied climatic data obtained in part from the Meteorological Branch of the Department of Transport. He reviewed the section on climate.

The chemical determinations were made by the Soil Chemistry Unit, Chemistry Division, Science Service, now part of the Soil Research Institute, Research Branch, Canada Department of Agriculture.

Mr. C. Woodward of Ottawa was student assistant in 1957 and Mr. A. J. Green, Pedologist stationed at Vancouver, assisted in 1958. Dr. A. Leahey, Associate Director of Program (Pedology), and Dr. P. C. Stobbe, Director of the Soil Research Institute, gave advice on classification of the soils and reviewed the manuscript. The soil maps were prepared for publication by the cartographic section of the Soil Research Institute, Ottawa.

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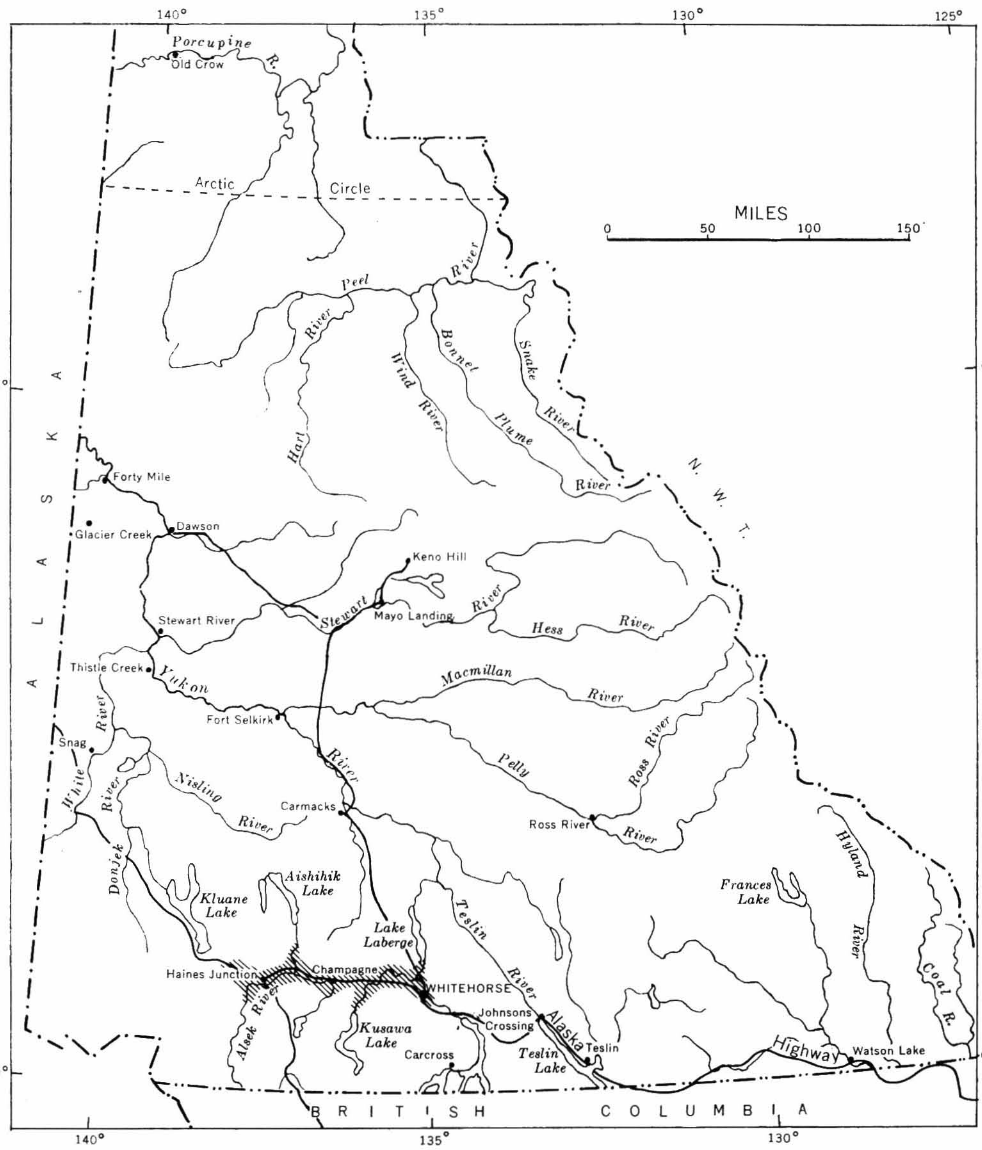

FIGURE 1.—Map of southern Yukon Territory showing the surveyed area.

INTRODUCTION

This report deals with the soils of the Takhini and Dezadeash valleys in the Yukon Territory. The area was surveyed on a reconnaissance basis during the summers of 1957 and 1958.

The first section presents a general description of the area, including population, transportation, agricultural services, vegetation, climate, physiography, drainage and geology. The second section deals with soil formation, mapping and classification. The main body of the report describes the individual soils in detail; the distribution and area of each are noted and their uses for agriculture are discussed. Other sections of the report include chemical and physical analyses, ratings of the soils and problems in agricultural development.

The accompanying map, printed on a scale of two miles per inch, identifies soil areas by colors and symbols. The map, also indicates location of settlements, highways, lakes and rivers. The report and the map are complementary and both should be consulted for information about the soils of the area. The report also will assist in the formulation of an optimum land use policy.

GENERAL DESCRIPTION OF THE AREA

Location and Extent

The surveyed area (Figure 1) is in the southwestern corner of the Yukon Territory. It includes the Yukon River Valley between Whitehorse and Lake Laberge, the valley of the Takhini River, and the valley of the Dezadeash River between Champagne and the big bend where the river turns south to join the Alsek River. Also surveyed was the area west of the big bend of Dezadeash River to Bear Creek summit. The surveyed area is bisected roughly by north latitude 60° 45′. It is bounded on the east by west longitude 135° 49′. The survey covered 441,050 acres.

Population

The population of the Yukon Territory has increased markedly in the last decade. This is probably largely because of increased activity in exploration for

Table 1.—Population of Yukon Territory[1]

	1956	1951
Total population	12,190	9,096
Rural, total	9,620	6,502
farm	40	44
non-farm	9,580	6,458
Urban	2,570	2,594

[1] Census of Canada.

minerals and the defense establishment at Whitehorse. Table 1 gives population data for 1951 and 1956. Between those dates the rural farm population decreased by four and the rural non-farm population increased greatly.

Whitehorse, population 2,570, is the only incorporated town. Included in the non-farm rural population are 851 people in Dawson and 249 in Mayo Landing. The latest estimate[1] of population for the Territory is 14,000 on June 1, 1960. In the surveyed area, which includes Whitehorse, the population is about 3,500 people.

The flow of tourists during summer greatly increases the demand for services. In the years 1957 to 1959 an annual average of 10,196 entry permits were issued for private passenger vehicles at the Canadian Customs port at Snag. The average number of passengers is three[2]. Thus an average of well over 30,000 people traveled south from Alaska through the surveyed area each year. It is presumed about the same number traveled north to Alaska.

Transportation

Whitehorse is the northern terminus of the White Pass and Yukon Railway from Skagway, Alaska. Most of the heavy freight for the Yukon is shipped in by this narrow-gauge railway.

Lighter and perishable freight is brought into the Yukon largely by commercial trucks. These usually connect with the railheads at Dawson Creek and Fort St. John, B.C., the terminals of the Northern Alberta Railway from Edmonton and the Pacific Great Eastern Railway from Vancouver, respectively. However, some of the trucks travel from more southerly points. The surveyed area has truck and bus service over the Alaska and Mayo highways.

The Canadian Pacific Airlines provides domestic passenger and mail service. Several airline companies have float-equipped aircraft available for charter to points not served by scheduled flights.

Cultural and Recreational Facilities

Whitehorse is the headquarters of the territorial government. It is the largest settlement in the Yukon. In the government buildings are offices of the territorial and Dominion governments, the Royal Canadian Mounted Police and the Canadian Army. The town is well supplied with hotels, restaurants, motels, churches, a hospital, stores and other facilities.

In the remainder of the surveyed area in 1958 such facilities as lunch counters, sleeping accommodations and automobile garages were found only at Cracker Creek, Canyon, Haines Junction and Bear Creek.

Opportunities are excellent for hunting, fishing, and other outdoor recreations. Black and grizzly bears, moose and Dall sheep inhabit the mountainous areas near the surveyed area. Moose and bears are scarce in the valleys along the Alaska highway. Grayling are plentiful in the rivers of the area, particularly the upper Takhini and Dezadeash rivers. Salmon are taken by Indians in the Takhini River, and lake trout are found in the large lakes nearby. Ducks are common along the rivers.

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[1] Dominion Bureau of Statistics, Census Division.
[2] Travel between Canada and other countries in 1957. Dominion Bureau of Statistics, Ottawa.

Agricultural Services

The Canada Department of Agriculture maintains an experimental farm at Mile 1019 on the Alaska Highway. Hardy crops are studied and methods of achieving maximum crop production in the north. The farm program includes the introduction, breeding and testing of new crops that might adapt to northern conditions.

Vegetation

In the eastern part of the area, lodgepole pine and white spruce are the main trees in dense or open but seldom tall stands. Lodgepole pine is less common in the center of the area; west of Stoney Creek it is absent.

The commonest species of tree in the area is aspen (*Populus tremuloides*), usually with white spruce (*Picea glauca*) and willows (*Salix* spp.). Aspen occurs on both burned and unburned sites. White spruce occurs in fairly solid stands in unburned areas. Tamarack is absent and black spruce is rare.

Most poorly drained sites are densely covered with willow and ground birch (*Betula glandulosa*) and a few black spruce. Sites that are very wet or are ponded in the spring are covered with sedges or rushes. Poorly drained sites that are affected by soluble salts may be bare of vegetation and have salt crusts on the soil surface, or they may be covered sparsely with species of *Salicornia*, alkali grass (*Puccinellia*) and *Carex*.

In the center of the area, mostly between Stoney Creek and Champagne, numerous open grassy glades are being invaded by young aspen trees. Wheat grass, needle grass, oat grass, and many ericaceous plants and lichens are present in these glades. The grassy cover of hillsides with southern exposures is mainly *Calamagrostis* spp. and rough fescue. These 'hard sod' grasses cure to make a winter fodder of fair quality that for many years has supported a considerable number of horses throughout the winters.

The principal species found on the different soils are listed under the descriptions of the soil series.

Climate

Some climatic data recorded at Haines Junction, Whitehorse, Mayo Landing and Teslin are given in Table 2. Haines Junction has the lowest summer temperature and Mayo Landing the coldest winters. At each of the four places the total annual precipitation is low; Haines Junction has the least precipitation in summer. July is the only month without snowfall at any of the stations.

The mean annual temperature of 24.7°F. (—4.1°C.) at Mayo Landing is the lowest reported at the stations. The Meteorological Division of the Department of Transport has conjectured that the southern limit of permanently frozen soil is about at the mean annual isotherm of —5° C. Patches of permafrost have been reported in the Mayo district.

Dates of last and first frosts and the average lengths of frost-free seasons are given in Table 3. Haines Junction has the shortest season, possibly because it is near the ice and snowfields of the Kluane Ranges and possibly because the weather station is in a depression. The other three stations are in areas with less rugged relief.

Table 3 also gives temperature and precipitation data useful in assessing the climate for agricultural production. The vegetative period is considered as

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Table 2.—Mean Monthly Temperatures, Total Precipitation, Snowfall, and Extreme Maximum and Minimum Temperatures at Selected Stations, 1945-1958

	Haines Junction					Whitehorse (airport)					Mayo Landing					Teslin (airport)				
	Mean temp. ° F.	Total pptn. In.	Snow In.	Ext. max. ° F.	Ext. min. ° F.	Mean temp. ° F.	Total pptn. In.	Snow In.	Ext. max. ° F.	Ext. min. ° F.	Mean temp. ° F.	Total pptn. In.	Snow In.	Ext. max. ° F.	Ext. min. ° F.	Mean temp. ° F.	Total pptn. In.	Snow In.	Ext. max. ° F.	Ext. min. ° F.
Jan.	-5	0.7	7.1	45	-65	-1	0.8	7.5	46	-62	-15	0.9	8.6	45	-68	-3	1.1	10.9	44	-63
Feb.	1	0.4	4.2	48	-65	5	0.6	5.5	43	-59	-8	0.5	4.9	49	-61	5	0.7	7.3	46	-52
March	15	0.3	2.6	52	-45	18	0.5	5.3	51	-37	12	0.4	2.6	53	-56	18	0.7	6.5	50	-42
April	29	0.3	2.0	69	-23	31	0.5	4.5	69	-15	29	0.3	2.2	68	-30	30	0.6	4.8	68	-14
May	42	0.5	0.8	82	12	46	0.4	0.7	86	19	46	0.7	0.5	89	9	44	0.6	1.0	83	11
June	49	1.1	0.1	86	20	55	1.0	T[1]	89	29	56	1.1	0.0	95	28	53	1.0	T	93	25
July	54	1.3	0.0	88	26	58	1.4	0.0	91	34	58	1.5	0.0	96	27	56	1.6	0.0	88	30
Aug.	51	1.0	0.0	83	12	55	1.4	T	86	24	54	1.5	0.0	86	18	53	1.4	T	84	25
Sept.	42	1.1	1.0	78	1	46	1.0	1.7	75	14	44	1.0	0.5	77	4	45	1.3	1.3	77	14
Oct.	28	1.3	7.5	65	-23	33	0.7	4.4	66	-12	27	0.9	6.2	59	-19	33	1.0	4.9	65	-8
Nov.	11	1.4	7.5	57	-53	17	0.8	7.8	51	-41	5	0.9	8.5	49	-59	17	1.2	10.7	50	-35
Dec.	-4	1.3	10.3	47	-58	2	0.8	8.3	41	-50	-12	0.8	8.4	43	-72	0	1.2	11.3	44	-53
Year	26	10.7	43.1	88	-65	30	9.8	45.7	91	-62	25	10.5	42.4	96	-72	29	12.4	69.9	93	-63

[1]Traces.

the period during which the mean monthly temperature is at or above 42° F.; it is shortest at Haines Junction and longest at Whitehorse. The number of day-degrees above 42° F. in the vegetative period is lowest at Haines Junction and highest at Whitehorse. Haines Junction also receives the least precipitation during the vegetative season. However, because of the short growing period and cool temperatures the water deficiency is less at Haines Junction than at the other stations.

Table 3.—Durations and Dates of Vegetative Period and Frost-free Period, Day-degrees, Total Daylight, Precipitation and Water Deficiency During the Vegetative Period and other Information from Selected Stations, 1945-1958

	Haines Junction	Whitehorse (airport)	Mayo Landing	Teslin (airport)
North latitude	60° 51′	60° 43′	63° 35′	60° 10′
West longitude	135° 51′	135° 5′	137° 33′	132° 44′
Feet above mean sea level	2,030	2,289	1,625	2,300
Vegetative period[1]				
beginning	May 16	May 5	May 8	May 12
end	Sept 15	Sept 24	Sept 18	Sept 23
duration, days	122	142	133	134
Frost, 32° F.				
mean date of last in spring	July 7	June 3	June 8	June 12
mean date of first in fall	July 31	Sept 1	Aug 14	Aug 27
frost-free period, days	24	90	67	76
Frost, 28° F.				
mean date of last in spring	June 21	May 17	May 25	May 29
mean date of first in fall	Aug 13	Sept 13	Aug 28	Sept 8
frost-free period, days	53	119	95	102
Day-degrees above 42° F. in vegetative period	828	1,431	1,397	1,254
Total daylight in vegetative period, hours	2,102	2,395	2,395	2,252
Precipitation during vegetative period, inches	3.7	4.9	5.2	5.3
Water deficiency during vegetative period, inches	6.3	7.7	7.0	6.5
Days from beginning of vegetative period to drought point	39	42	42	40
Mean date of drought point	June 24	June 16	June 19	June 21
An extra inch of rain delays drought point by, days	8	7	7	8
January daily mean minimum, ° F.	−16	−8	−24	−12
Heating day-degrees	14,172	12,606	14,701	13,030

[1]The period during which the mean daily temperature does not fall below 42° F.

The drought point occurs when plant growth and evaporation have exhausted stored soil moisture (assumed to be 4 inches). On soils with storage capacities of less than 4 inches, particularly on coarse-textured soils such as the Aishihik, Whitehorse and Alsek series, the drought point comes earlier than on finer-textured ones. For example, Table 3 shows that at Whitehorse an extra inch of rain delays the drought point by 7 days. Therefore, if the moisture storage capacity of a soil is only 3 inches, the drought point comes 7 days earlier and if the storage capacity is only 2 inches it comes 14 days earlier.

The heating day-degrees is a measure of the annual fuel consumption. Usually heat is needed in houses at all stations even in summer.

From the climatic data reported, Haines Junction has a less desirable climate for agriculture than the other stations. However, these data may not represent the surrounding district, possibly because of the situation of the weather station.

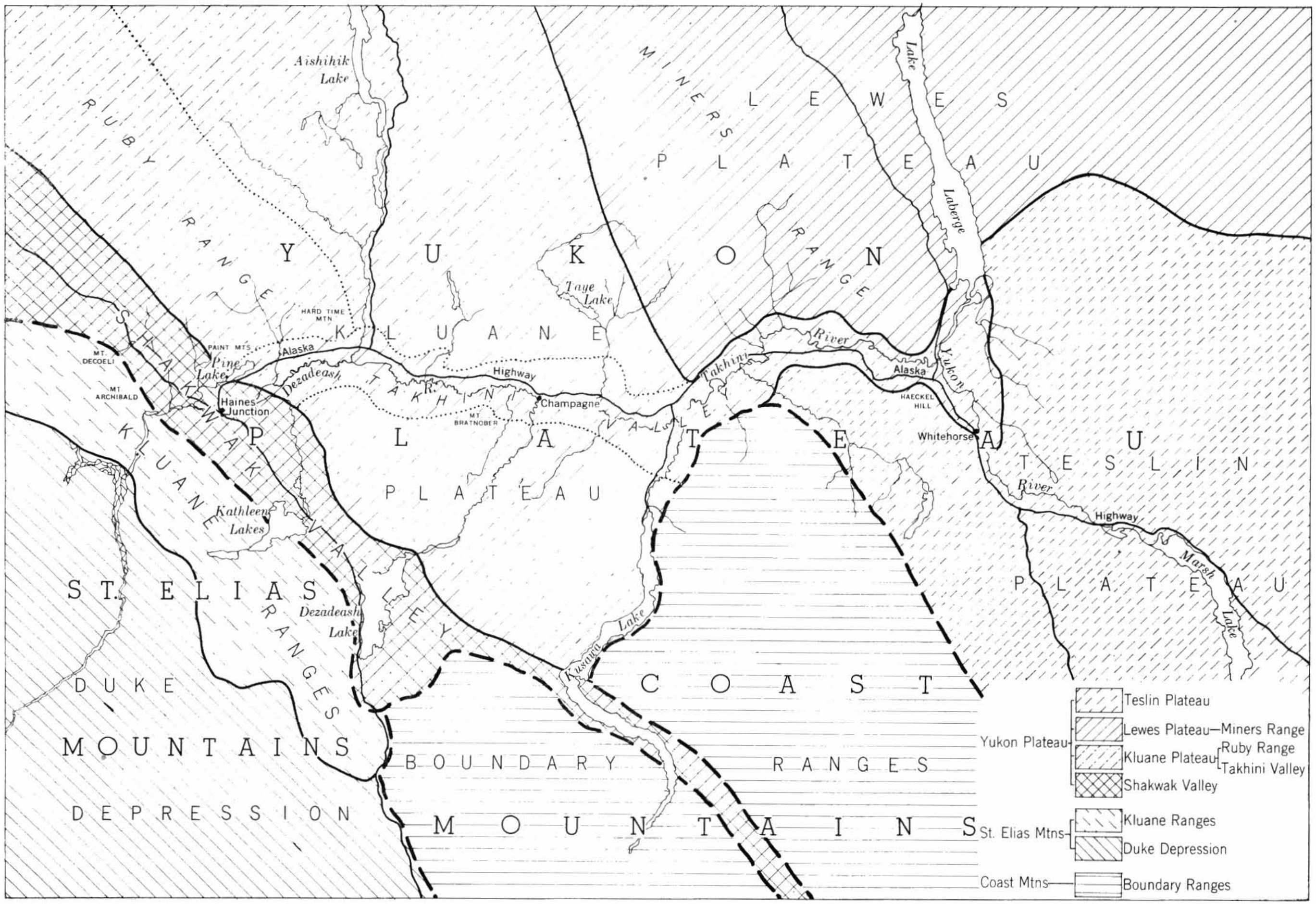

FIGURE 2.—Physiographic divisions of a southwestern portion of Yukon Territory

Physiography

The surveyed area (Figure 2) is partly in the western Yukon plateau and partly in the southern Yukon plateau. It is bounded on the southwest by ranges of the Coast and St. Elias mountains.

The Takhini Valley (Figure 3) physiographic unit includes the Dezadeash Valley and is a part of the Kluane Plateau. It is about 80 miles long and extends from Pine Lake on the west to the Yukon River on the east. The valley floor is a gently undulating lacustrine plain whose surface ranges from an elevation of 1,950 feet near the mouth of the Kathleen River to about 2,500 feet along the valley walls.

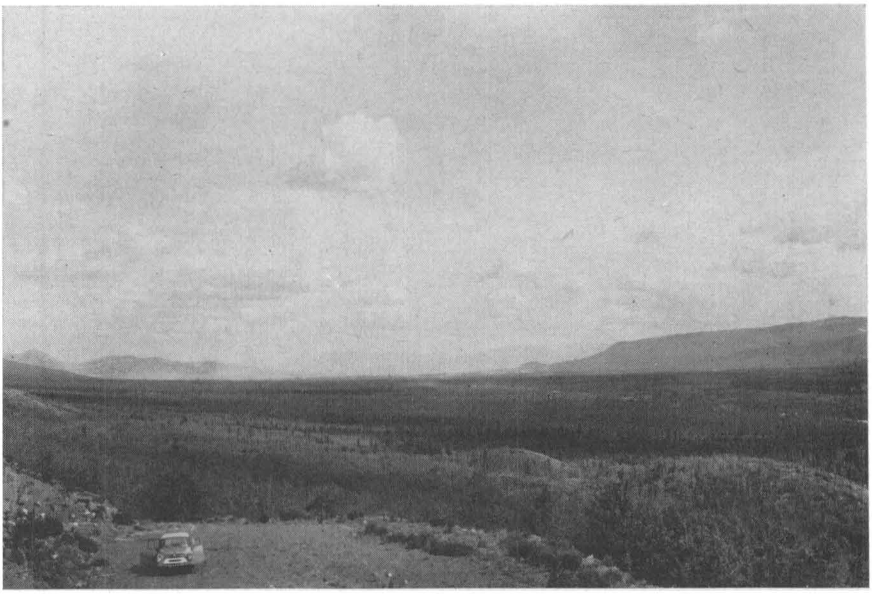

FIGURE 3.—View of Takhini Valley near Mile 982 in the Kluane Plateau.

The western end of the Takhini Valley cuts through the Shakwak Valley, which is one of the great trench-like valleys of the Cordillera. In general, the Shakwak Valley is a few hundred feet higher than the Takhini Valley. In Pleistocene time the Shakwak Valley formed a large trough where the ice from the great glaciers of the St. Elias Mountains coalesced and piled up before pushing on through the gaps in the ranges to the north. As a consequence it has been heavily scoured in its narrower parts and is mantled elsewhere by widespread drift deposits (1).

The walls of the Takhini and Shakwak valleys rise abruptly. In the center of the surveyed area Takhini Valley rises to the uplands of the Kluane Plateau (Figure 4). In this part the plateau surface is about 5,000 feet or more above sea level. It is separated into tablelands by a network of deep valleys. At the northwestern end of the Takhini Valley the walls rise abruptly to the Ruby Range, a ridge of mountains whose peaks reach elevations of about 7,000 feet. At the western end of the area, Shakwak Valley is bounded by the steep eastern face of the rugged Kluane Ranges, which are the outer ranges of the St. Elias

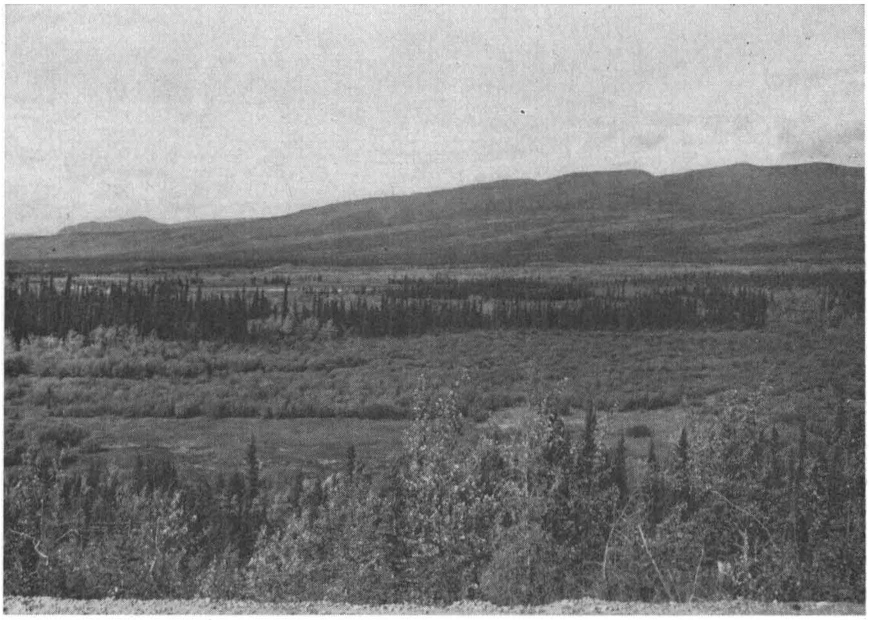

FIGURE 4.—The hills of the Kluane Plateau in the background are 2,500 feet higher than the floor of the valley at Champagne.

FIGURE 5.—The steep eastern face of the Kluane Ranges bounds the south side of the Shakwak Valley.

Mountains (Figure 5). At the eastern end of the area, the walls of the Takhini Valley rise smoothly to the Lewes and Teslin plateaux (Figure 6). Lewes Plateau is about 3,500 to 4,000 feet above sea level and the Teslin Plateau 4,500 to 5,000 feet.

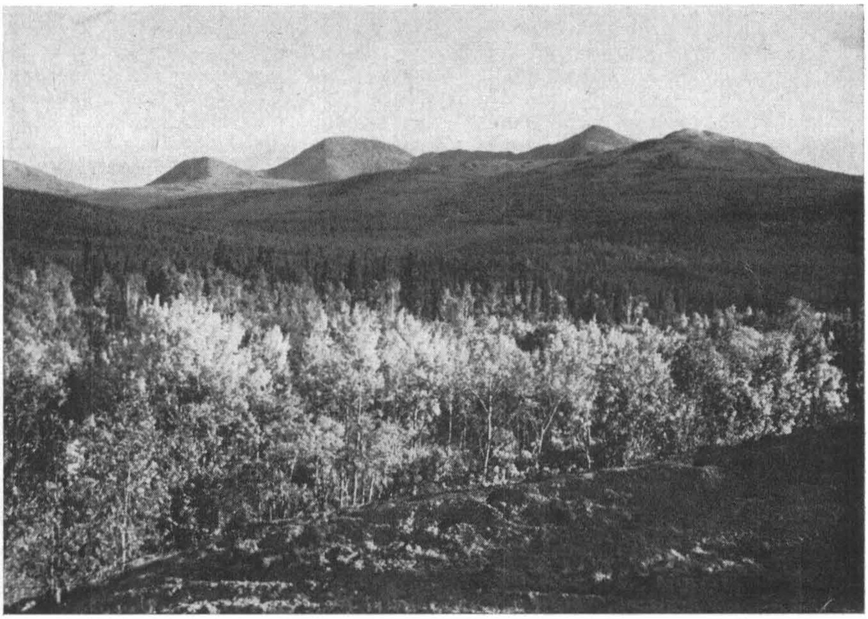

FIGURE 6.—At the eastern end the Takhini Valley rises smoothly to the Teslin Plateau.

Drainage

The area is dissected by rivers and streams. On the eastern side the Yukon River has cut a channel into 100 feet or more of lacustrine clays and north of the Takhini River it flows through a large alluvial plain before entering Lake Laberge.

From its junction with the Yukon River the Takhini at first winds between high clay banks, but in the area between the old highway crossing, at Mile 938, and Mendenhall Landing it winds less and the banks are low. In its upper reaches it winds considerably and flows faster in its narrower bed.

The Dezadeash River is for the most part a sluggish stream following a very sinuous course between low banks. Large boulders are common in its channel, which west of Marshall Creek is wide and braided until it turns south at the western end of the area. Here a number of streams join the Dezadeash. Bear and Pine creeks drain the north side of the valley at its western end. Marshall Creek, Aishihik River and Cracker Creek drain the north-central section of the Dezadeash Valley; Kathleen River and a large number of small creeks drain the south-central section.

In the center of the surveyed area the Takhini River has the following tributaries: Mendenhall River, Stony Creek, Thirty-seven Mile Creek and Little River on the north side, and the Ibex and a few small creeks on the south side.

In the area drained by the Yukon River, Croucher and Laberge creeks are the largest tributaries.

The relief of the area has strongly influenced surface and soil drainage, although indirectly. The hills on the south side of the valley are higher and have snowfields on their northern slopes during much of the summer; con-

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sequently there are many more small creeks on the south than on the north side of the valley (particularly west of Takhini River). Most of the poorly drained soils lie on the south side of the valley. Apparently the melting snowfields water these soils for most of the summer. The north side of the valley, in contrast, is much drier and grassland soils occur there.

Soil drainage conditions are described in detail in the soil descriptions.

Pleistocene Geology

During Pleistocene time great masses of ice gathered in the St. Elias (4), Coast and Cassiar mountains (7). Glacial grooving and striae disclose that ice from St. Elias and Coast mountains spread north and northeast, filling all the valleys and scouring and rounding off all peaks with elevations less than 6,500 feet. The ice from Cassiar moved west.

At the time of greatest glacial activity, the Takhini, Dezadeash and Shakwak valleys were ice-filled to an elevation of about 6,000 feet and this ice sheet spread north and covered the greater part of the Aishihik district.

During deglaciation the level of Cassiar ice fell progressively from the northwest and north to the south and southeast, and that of the St. Elias and Coast mountains from the northeast to the southwest. The ice sheet was then progressively segmented into numerous valley glaciers but in such a way that the ice level was always lower in the north-central part than in the eastern and western ends of the area.

Wheeler (7) states that the pro-glacial drainage during the early stages of deglaciation was characterized by both lateral and direct overflow streams. The channels cut by these streams and their gravelly deposits show on the east and west walls of the Yukon Valley and on the south wall of Takhini Valley west of Champagne.

The largest pro-glacial lakes during the later phases of deglaciation appear to have formed in the larger valleys such as those of the Dezadeash, Kathleen, Takhini and Yukon rivers. They were between the retreating ice-front and slight elevations or remnant ice masses in the valleys to the north and northeast. Kindle (4) has named the great glacial lake that filled these valleys Glacial Lake Champagne. In it were deposited glacial-lacustrine sediments, mainly clays in strata ranging from an inch or so to as much as 2 feet thick. A few icebergs in the lake dropped pebbles and occasional boulders into the sediments. Sand occurs near the mouths of incoming streams or near shorelines, from which it was distributed by wave action.

Glacial Lake Champagne left deposits of sand and gravel along its walls. The beaches are best developed on steep exposed slopes between elevations of 2,300 and 2,800 feet and on south-facing slopes. A good example of one of these beaches may be seen at Bear Creek. Wave action probably was stronger on south-facing than on north-facing slopes because the prevailing winds appear to have been southerly.

After Glacial Lake Champagne had drained, local winds, which usually blew down valleys, created parabolic dunes near the mouth of Takhini River, southwest of Dezadeash River around Dune Creek and around Champagne, north of Kusawa Lake, and south of Lake Laberge.

Later, the larger rivers of the present, such as the Yukon, Takhini and Dezadeash, cut narrow meandering valleys into the glacial-lacustrine and glacial-fluvial deposits (Figure 7). These rivers are at present building terraces on the margins of their channels.

FIGURE 7.—The Dezadeash River has excavated a channel in bedded lacustrine clay near Cracker Creek.

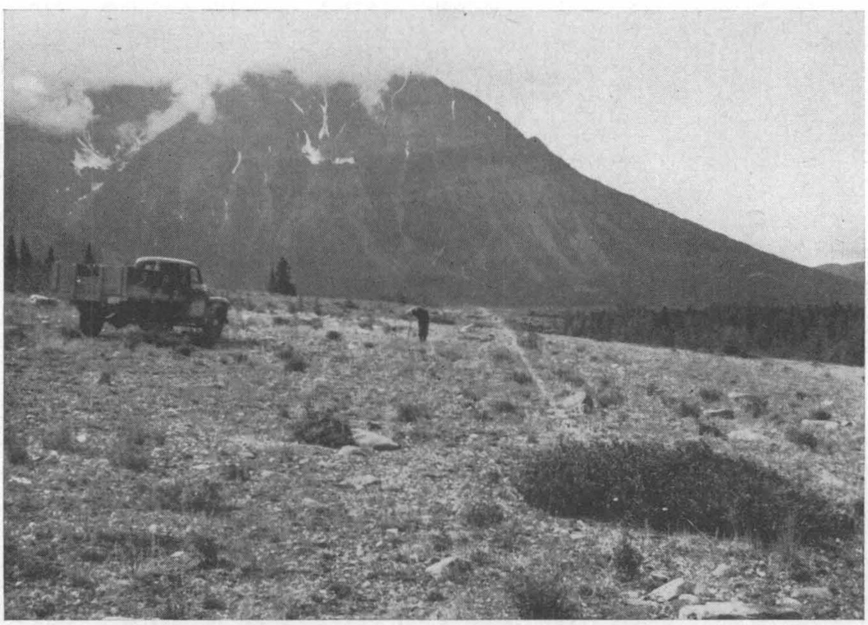

FIGURE 8.—Gravelly beaches such as this one of Recent Lake Alsek are the parent material of the Haines soil series.

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Comparatively recently Alsek River was dammed by an advance of Lowell Glacier. This ice-dam caused Alsek River to form an elongated lake, which Kindle (4) calls Recent Lake Alsek. In the surveyed area Recent Lake Alsek extended from where Dezadeash River bends south to Bear Creek, Pine Lake, and up the Dezadeash Valley nearly to Aishihik River. Shorelines of Recent Lake Alsek are well formed in some places, poorly in others, between elevations of 2,240 feet and the present level of Dezadeash River. The more conspicuous beach lines are marked by deposits of sand, gravel and boulders (Figure 8) and remnants of driftwood. In nearly all areas the presence of Recent Lake Alsek is confirmed by sand, silt and clay deposited over older materials on which soil profiles had developed. Evidently the oldest beaches were built along the shores of Recent Lake Alsek before 1725 and the lake disappeared about 1850 (4).

Relationship of Soils to Pleistocene Deposits

A section on the east bank of Marshall Creek, 0.35 mile north of the Alaska Highway, shows the age relationships between some of the Pleistocene deposits.

From the surface down there are (a) 3 feet of fine sand, which is probably windblown, (b) 7 feet of stratified gravel and sand, (c) 3 feet of bedded lacustrine silty clay containing a few pebbles, (d) 32 feet of gravelly clay loam glacial till over (e) bedded and well-stratified gravel. The total height of the river bank is about 150 feet.

Stratum *e* is assumed to be basal and older than the glacial till and may be preglacial glaciofluvial deposits of the advancing ice front. No other sections were found where this sequence could be corroborated and the lowest stratum apparently does not appear anywhere at the surface. The other strata occur at the surface in one place or another and are the parent materials of soils.

The glacial-till stratum *d* is found north and west of Bear Creek, south and east of Pine Lake, and in several exposures in the Dezadeash River channel near the mouth of Aishihik River. This till is believed to be a deposit of the St. Elias ice sheet or of coalescing ice sheets originating in the St. Elias and Coast mountains. The Archibald soil series is developed on this St. Elias till, and the Bear Creek series is developed on fluvial or beach deposits overlying the till.

Another glacial till, not represented in the Marshall Creek section described above, is the Cassiar till, which occurs around Whitehorse. It is a calcareous stony gravelly loam. According to Wheeler (7) the Cassiar till is about the same age as the St. Elias till and, like it, is assumed to be older than the glacial-lacustrine deposits of Lake Champagne. The Cassiar till is not the parent material of soils, because it is covered by shallow (20 to 40 inches) coarse-textured fluvial deposits of overflow streams that issued from the retreating ice sheet. These gravelly deposits, underlain by Cassiar till, are the parent material of the Haeckel soil series.

The bedded lacustrine silty clay in stratum *c* of the Marshall Creek section is a deposit of Glacial Lake Champagne (Figure 9), which covered a large area extending from Pine Creek at the western end of the surveyed area to Whitehorse at the eastern end. In the Marshall Creek section this deposit is thin (3 feet) but elsewhere it is usually very thick (50 feet or more). As in the Marshall Creek section, it rests on the St. Elias glacial till in the western and central sections of the surveyed area. In the eastern section, contact between the lacustrine deposit and the Cassiar glacial till was not seen. The surface of the deposit is generally smooth but it is pitted in the area south of Takhini River between Mile 932 and Mile 946. Most of the pits are 'thaw sinks' [3]caused by subsidence of frozen ground or permafrost, but some of them may be kettles

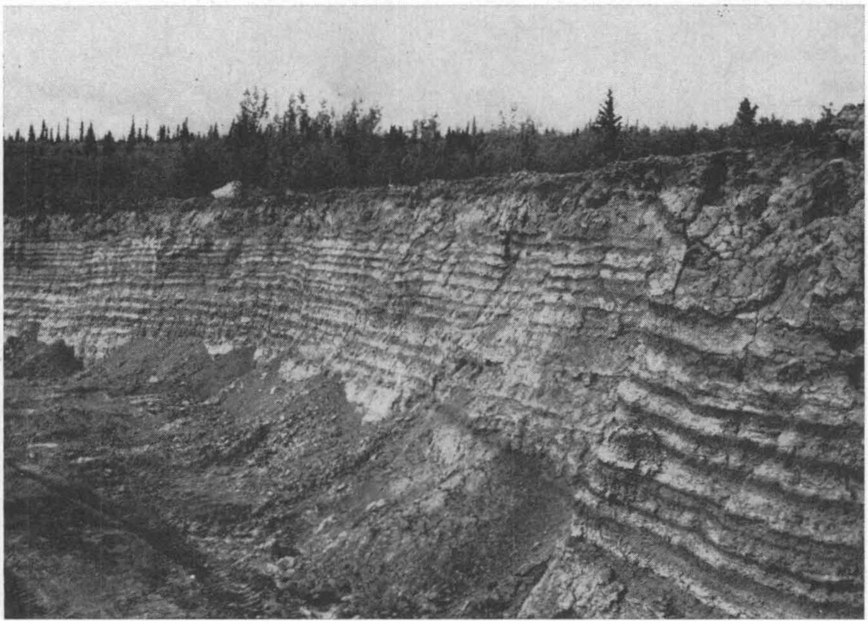

FIGURE 9.—A cross section of the lacustrine silty clay of Glacial Lake Champagne.

FIGURE 10.—A thaw sink, or kettle, in the lacustrine clay deposit of Glacial Lake Champagne north of Mile 941. The forest was burned about a week before the photograph was taken.

(Figure 10.) Soils developed on the lacustrine deposit are the Bratnober, Champagne, Ruby, Takhini, Jo-Jo, Mendenhall, Shaneinbaw and Van Bibber series.

At the margins of Lake Champagne (particularly on the northern side of the central and western sections) beach deposits of medium texture overlie the Champagne lacustrine deposit. These beach deposits are not present in the Marshall Creek section although they are extensive in the area. They are the parent material of the Klowtaton soil series.

There are other medium-textured deposits resting on the Champagne lacustrine deposits in the area where the Takhini River joins the Yukon River. These deposits are presumed to have originated through deposition of alluvium by the Yukon River on the lacustrine deposits. These medium-textured deposits, which are not present in the Marshall Creek section, are the parent material of the Lewes soil series.

The stratified gravel and sand in stratum *b* of the Marshall Creek section is the fluvial outwash of streams flowing into Glacial Lake Champagne, presumably at the end of the deglaciation. Deltas of this outwash are also found at the mouth of Aishihik River, along Dezadeash River at Champagne, south of Taye Lake, at the northern end of Kusawa Lake and in many small areas along the Valley walls, especially near Whitehorse. Soils developed on these deposits are the Aishihik and Canyon series.

The windblown sand in stratum *a* of the Marshall Creek section represents sandy fluvial deposits that have been modified and redeposited by wind, a process still occurring in places. The most important wind-modified deposits are the dunes east of the mouth of Takhini River and those west of Champagne near Dune Creek. Soils developed on these dunes belong to the Whitehorse soil series.

Other kinds of deposits not found in the Marshall Creek section are as follows: (a) Coarse to fine-textured deposits of Recent Lake Alsek, found along the Dezadeash River from Bear Creek to the mouth of Aishihik River, and around Pine Lake. These deposits are generally underlain by Lake Champagne deposits and form the parent materials of Alsek, Pine Creek, Auriol and Paint soil series.

(b) Coarse-textured fluvial deposits derived from ice- and snow-fields. Some of these deposits are fairly old and form the parent material of the Brown Wooded Summit series; others are recent or are still being deposited and are the parent material of the Regosolic Haines series. These fluvial deposits usually contain large angular boulders and much gravel, and their largest area is to the south and west of Bear Creek at the western end of the surveyed area.

(c) Medium-textured alluvium deposited by modern rivers and streams. These deposits are found throughout the surveyed area, and since they are young the soil profiles lack development. Since they are subject to flooding in many places they were mapped as alluvium land type. In the large area at the southern end of Lake Laberge the alluvium apparently is older than elsewhere, for soils with moderately well-developed profiles are present. These soils belong to the Croucher complex and the Yukon and Laberge soil series.

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[8] This mode of origin was suggested by Dr. J. G. Fyles, Geologist, Geological Survey of Canada, Ottawa.

SOIL FORMATION, MAPPING AND CLASSIFICATION

Soil Formation

Soils form as a result of the action of climate, vegetation and other living organisms, and soil moisture on the parent material over a period of time. All these factors come into play in the genesis of every soil. The relative importance of each differs from place to place; sometimes one is more important, sometimes another. In the Takhini and Dezadeash valleys a considerable number of soil types have developed. Because of the youth of the soil material, and the dry cool climate, most of the soil profiles are weakly developed. The two largest groups of soils that illustrate this weak development are the Brown Wooded great soil group, which covers 57 per cent of the area, and the Regosol group, which covers 11 per cent.

In some places the soil moisture supply is increased by surface runoff and seepage. There the soil is more poorly drained and contains more organic matter than most well-drained soils. The poorly drained soils, which belong to the Meadow and Gleysol great soil groups, occupy about 4 per cent of the area. In some wet areas, the accumulation of soluble salts resulted in the development of alkali soils, which also belong to the Gleysol great soil group. They cover one per cent of the area.

Where the vegetation has apparently been dominated by grasses, soils have formed with dark grayish brown surfaces, which resemble those of some prairie soils. These soils belong to the Chernozemic Dark Gray great soil group and cover 6 per cent of the area.

In some places soil development has progressed much farther than is general for the area. The reason for this may be greater soil moisture efficiency. In these well-drained locations soil development has resulted in the formation of eluvial and illuvial horizons characteristic of the Gray Wooded great soil group. The Gray Wooded soils cover 2 per cent of the area.

Soil Mapping and Classification

In 1957 soil inspections were made along the Alaska Highway and all other roads and trails. Traverses on foot were made away from the roads. In 1958 the party traveled by canoe down the Yukon River to Lake Laberge, then up the Takhini River to Mendenhall Landing. The canoe was transferred to the Dezadeash River at Champagne and the party then traveled downstream to the junction of the Aishihik River. Traverses and soil inspections were made on each side of the rivers. At the junction of the Aishihik River, the Dezadeash River was so low as to prevent further travel by canoe. The field work was completed by truck and traverses on foot.

The soils were systematically studied in test pits, highway and road cuts and other exposures. The arrangement, thickness, permeability, color, texture, and structure of the soil horizons were recorded. The depth of the root feeding zone, available soil moisture capacity, general nutrient supply, soil reaction, topography, drainage, erosion, stoniness, and other factors influencing soil character or land use were considered when the mapping units were established. Representative samples of each soil series were carefully collected for laboratory study.

From this information and interpretation of aerial photographs, the soil boundaries were plotted on maps. On the eastern side of the Yukon River plain, the southern side of the Dezadeash Valley between Canyon Creek and Haines Junction, and the northern side of the Dezadeash Valley west of Bear Creek, where traverses were widely spaced, the soil map is less reliable than for the remainder of the area.

The collection of pertinent information, as described above, permits the classification of the soils. A *soil series* includes soils similar in parent material, morphology, drainage condition, relief and other external characteristics. The series are given names of places near where they were first identified. The series are subdivided into *soil types* according to the texture of the surface soil. Thus textural names such as loam or silty clay, when added to the series name, give the name of the soil type, for example, Yukon fine sandy loam. In this survey the mapping unit was, with a few exceptions, the soil series, and the soil type or range in types is indicated in the soil map legend.

Land types are areas identified by the prominent external characteristics of relief, parent materials, or drainage rather than by soil profile characteristics. Land types referred to in this report are eroded river-banks, mucky peat, recent alluvium, rough mountainous land and rock outcrops, saline meadows, and sloughs.

The soil series and the land type are the basic units used in mapping the soils. The soils are usually shown on the map as a complex of two or more soil series, or of a soil series and a land type. In some areas the soils are intimately mixed and the components cannot be shown separately at the scale of mapping used. These complexes are shown on the map by a symbol for each component, followed by a number representing the percentage of that component in the complex, for example, Ch 60 — Ru 40. The percentage is an estimate for the whole area of the complex, so that the percentages of the components may differ locally from those shown on the map.

The soil series are grouped into great soil groups and subgroups. Soils in a great soil group are of the same genetic type and have similar kinds of horizons, color, morphology and chemical characteristics. The great soil groups represented in the surveyed area are described below. The percentage of the total area occupied by each is: Brown Wooded, 57; Regosol, 11; Chernozemic Dark Gray, 6; Gleysol, 3; Gray Wooded, 2; Meadow, 2. In addition, land types and water cover 19 per cent of the area.

Brown Wooded Great Soil Group

Brown Wooded soils are well drained and have developed under a forest cover. The orthic Brown Wooded subgroup is the only member of this great group found in the surveyed area. An organic surface layer (L-H) about 1 to 2 inches thick is underlain by a brown or yellowish-brown mineral horizon (Bm or Bmf). This in turn is underlain by grayish base-saturated parent material (C), which is usually calcareous.

The following soil series belong to the orthic Brown Wooded subgroup: Aishihik, Archibald, Bear Creek, Champagne, Canyon, Haeckel, Klowtaton, Lewes, Summit, Yukon and most of the Croucher complex.

Regosol Great Soil Group

Regosols include well and imperfectly drained soils that lack discernible horizons or have only organic (L-H) or nonchernozemic organic-mineral (Ah) surface horizons.

A number of Regosol soils occur in the area. The Haines and Hard Time series have only mineral surface horizons and are free of salts. The Pine Creek, Taye and Whitehorse series have weakly developed mineral-organic (Ah) surface horizons, which may be covered by a thin organic layer and lack evidence of salts. The Alsek and Auriol series are gleyed Regosols with mottled subsoils due to seasonal wetness.

Chernozemic Dark Gray Great Soil Group

Cherozemic Dark Gray soils are dark-coloured 'prairie' soils developed under a mixed vegetation of grasses, forbs and trees. The dominant ground cover is mesophytic grasses and forbs that are characteristic of areas in transition between grassland and forest. Ruby silty clay loam to silty clay is the only series in the area belonging to this great soil group and is representative of the orthic subgroup. It has a very dark grayish brown to black surface organic-mineral horizon (Ah). This is underlain by a thin, brownish-gray, platy, eluviated horizon (Ae). The illuviated mineral horizon (Bm) below is dark brown and is in turn underlain by gray, calcareous parent material (C).

Gleysol Great Soil Group

Gleysol soils are poorly drained, have strongly gleyed mineral horizons, and lack noticeable eluvial and illuvial horizons. They are developed under swamp-forest, heath or swamp vegetation. The Gleysols in the surveyed area belong to two subgroups.

Peaty calcareous Gleysols have a surface layer of 6 to 12 inches of peat. They may have a thin surface mineral horizon (Ah). Next is a strongly gleyed, calcareous parent material (Cg). The Cracker, Paint, and Van Bibber series belong to this subgroup.

Saline Gleysols may have an organic horizon less than 6 inches thick and a thin (less than 2 inches) mineral-organic horizon (Ah). Next is a strongly gleyed horizon or horizons containing enough water-soluble salts to affect plants of low salt tolerance. The Shaneinbaw series belongs to this subgroup.

Gray Wooded Great Soil Group

Gray Wooded soils are well drained and have developed under a mixed forest, mainly of aspen, spruce and willow. These soils have surface organic accumulations underlain by lighter-colored eluvial horizons (Ae) and lower still by illuvial horizons (Bt) in which clay is the main accumulation product. The parent material (C) is calcareous. Gray Wooded soils in the surveyed area belong to two subgroups.

Orthic Gray Wooded soils have a light-colored, platy, eluvial horizon (Ae) and a brownish illuvial horizon ($B\overline{tj}$ or Bt), which has accumulated some clay. They may have a surface mineral-organic horizon (Ah) less than 2 inches thick. The Bratnober and Kusawa series and some of the Croucher complex belong to this subgroup.

Dark Gray Wooded soils have a well-devolped mineral-organic horizon (Ah and Ahe) more than 2 inches thick, over a light-colored, platy, eluvial mineral horizon (Ae) underlain by a brownish horizon of clay accumulation (Bt). The Takhini series belongs to this subgroup. It is distinguished from the Bratnober series by a well-developed mineral-organic surface horizon (Ah) and by harder columnar structure in the mineral clay-accumulation horizon (Bt).

Meadow Great Soil Group

These are poorly drained soils that have developed under grasses, sedges and swamp-forests. The meadow soils in the surveyed area belong to two subgroups.

Orthic Meadow soils may have a peaty surface horizon up to 3 inches thick, over a noncalcareous mineral-organic horizon (Ah) more than 2 inches thick, and grading into a dull-colored, gleyed horizon. The underlying parent material (C) is usually calcareous. The Mendenhall series belongs to this subgroup.

Peaty orthic Meadow soils have peaty surface horizons 3 to 12 inches thick over mineral horizons similar to those of the orthic Meadow subgroup. The Jo-Jo and Laberge series belong to this subgroup.

Key to the Soils

The soils surveyed, and some of their principal characteristics, are as follows:

Table 4.—Classification of soils of the Takhini and Dezadeash Valleys in Yukon Territory

A. Soils developed on glacial till deposits	
Well drained	
Archibald gravelly clay loam	oBW
B. Soils developed on coarse-textured fluvial deposits underlain by glacial till deposits	
Well drained	
Bear Creek fine sandy loam	oBW
Haeckel gravelly loamy sand	oBW
C. Soils developed on fine-textured lacustrine deposits	
Well drained	
Bratnober clay loam	oGW
Champagne clay loam to silty clay	oBW
Ruby silty clay loam to silty clay	oCDG
Takhini clay	dGW
Poorly drained	
Jo-Jo peaty clay loam	poM
Mendenhall loam	oM
Shaneinbaw silty clay	sG
Van Bibber silty clay	pcG
D. Soils developed on coarse-textured fluvial and beach deposits underlain by lacustrine deposits	
Well drained	
Klowtaton sandy loam	oBW
Imperfectly drained	
Alsek sand	gR
E. Soils developed on medium- to fine-textured fluvial and beach deposits underlain by lacustrine deposits	
Well drained	
Lewes fine sandy loam to loam	oBW
Pine Creek loam to silty clay	R
Imperfectly drained	
Auriol silty clay	gR
Poorly drained	
Paint peaty silty clay loam	pcG

F. Soils developed on coarse-textured fluvial deposits

Well drained

Aishihik sand, loamy sand and sandy loam........................ oBW
Canyon gravelly sand to sandy loam.............................. oBW
Haines gravelly sand to sandy loam.............................. R
Summit cobbly loam.. oBW
Whitehorse sand and loamy sand.................................. R

G. Soils developed on medium-textured fluvial deposits

Well drained

Croucher complex.. oBW, oGW and R
Kusawa fine sandy loam.. oGW
Yukon loamy sand and fine sandy loam............................ oBW

Poorly drained

Laberge sandy loam.. poM

H. Soils developed on medium- to fine-textured fluvial deposits

Well drained

Taye loam... R

Poorly drained

Cracker peaty silt loam to silty clay loam....................... pcG

I. Soils developed on colluvial and creep deposits

Well drained

Hard Time silty clay.. R

J. Land types

1. Eroded river-banks
2. Mucky peat
3. Recent alluvium
4. Rough mountainous land and rock outcrops
5. Saline meadows
6. Sloughs

Legend: oBW orthic Brown Wooded
oCDG orthic Chernozemic Dark Gray
oGW orthic Gray Wooded
dGW dark Gray Wooded
pcG peaty calcareous Gleysol
sG saline Gleysol
oM orthic Meadow
poM peaty orthic Meadow
R Regosol
gR gleyed Regosol

DESCRIPTIONS OF SOILS

In the descriptions that follow the soil color is followed by a set of symbols that designate the color in the Munsell system.[4]

Soils Developed on Glacial Till Deposits

The Archibald soil series is the only soil developed directly on glacial till. The till parent material was deposited as a ground moraine by the St. Elias ice sheet, which originated in the St. Elias and Coast mountains.

[4] Munsell soil color charts. 1954 edition. Munsell Color Company Inc., Baltimore 2, Maryland, U.S.A.

Well-drained Soils

Archibald Series

Archibald soils, covering 12,300 acres, occur mostly at the western end of the surveyed area. These soils have developed from calcareous, stony, gravelly clay loam glacial till. They belong to the orthic Brown Wooded soil group and have 1 to 2 inches of brown mineral-organic surface horizon (Ah) underlain by 12 inches of pale-brown granular gravelly clay loam (Bm) that is neutral to alkaline. The parent material is grayish gravelly clay loam that is compact and moderately to slowly permeable.

Gravelly clay loam is the dominant soil type; there is some variation in the amount of gravel present. Usually stones are plentiful in the surface horizons.

The vegetation most commonly found on these soils consists of aspen, black poplar, white spruce and willow.

Archibald soils have irregularly sloping morainic topography. The approximate acreages by soil slope are: 0 to 5 per cent, 8,800 acres; 6 to 15 per cent, 3,450 acres; and 16 per cent and over, 50 acres. Nearly all of the soils have rough microtopography. The soil is naturally well drained; permeability is moderate in the solum but moderate to slow in the parent material. A gravelly loam profile that was sampled north of Bear Creek is described as follows:

Horizon	*Depth in inches*	
L-H	1 — 0	Litter of leaves and twigs.
Ah	0 — 1½	Brown (10YR 4/3 dry, 3/3 moist) clay loam; granular and friable; pH 7.2.
Bm	1½—11½	Pale-brown (10YR 6/3 dry, 4/2 moist) clay loam; weak very fine granular structure; friable consistence; 20 per cent small round pebbles; noncalcareous; pH 7.4.
C	11½+	Light brownish gray (2.5Y 6/2 dry, 5/2 moist) gritty clay loam till; weak very fine granular to amorphous structure; friable consistence; 31 per cent gravel; 11 per cent $CaCO_3$; pH 8.8.

In places the Bm horizon is thicker and somewhat more brightly colored. This soil series may grade into the Bear Creek series, which is a Brown Wooded soil developed on fine sandy loam underlain by the same glacial till. In one place west of the Experimental Farm, Mile 1019, an Archibald soil is very stony, perhaps due to concentration of the stones by lake wave-action during the existence of Lake Alsek. The Archibald series may occur in complex association with the Canyon and Champagne soil series.

Suitability for Agriculture

There is no agricultural development on this series at present. Though the soil texture favors retention of moisture, the stones normally present would have to be removed to permit cultivation. The amounts of organic matter, total nitrogen and total phosphorus are low, and cultivated crops would probably show a distinct response to these nutrients. The areas with 0 to 5 per cent slopes are judged as fair to poor for agricultural development, and those areas with steeper slopes are poor.

Soils Developed on Coarse-textured Fluvial Deposits Underlain by Glacial Till Deposits

The soils described here have coarse-textured surface layers deposited on glacial till. In the Bear Creek series, the coarse-textured surface layer apparently was deposited by stream action, or perhaps by the combined action of streams, beaching and wind. The underlying St. Elias till is a stony calcareous clay loam similar to the parent material of the Archibald soil series.

In the Haeckel soil series the coarse-textured surface layer apparently was deposited by overflow streams issuing from the glacier. The underlying Cassiar till is a stony calcareous loam.

WELL-DRAINED SOILS

Bear Creek Series

Bear Creek soils occur on 7,850 acres at the western end of the surveyed area. This series belongs to the orthic Brown Wooded soil group and may be recognized by a very thin organic surface litter underlain by 5 to 12 inches of brown, fine sandy loam. The gritty clay loam till horizon is olive brown to light gray and occurs at a depth of 5 to 12 inches.

Fine sandy loam is the main soil type but loams also occur. Gravel and stones are absent in the sandy surface layer, but are common in the underlying till. White spruce, willow and aspen are the most common trees, and the forest understory includes lupine and blueberry.

The slopes are mainly 0 to 5 per cent (7,200 acres), but some are 6 to 15 per cent (500 acres) and 16 per cent and over (150 acres). The soil is naturally well drained; permeability in the solum is rapid but moderate to slow in the till below. Some lateral movement of soil water above the till layer may occur during the spring thaw.

A profile that was sampled north of Bear Creek, on a 2 per cent slope with a southerly aspect, is described as follows:

Horizon	*Depth in inches*	
F-H	2 – 0	Black, moderately well decomposed organic litter; pH 7.2.
Bmf	0 – 9	Brown (7.5YR 5/4 dry, 4/4 moist) fine sandy loam; weak fine granular structure; friable consistence; pH 7.2; lower boundary abrupt.
IIBm	9 –17	Light olive brown (2.5Y 5/4 dry, 4/2 moist) gritty clay loam till containing gravel; weak fine granular structure; noncalcareous; moderately stony; pH 7.7; lower boundary gradual.
IIC	17+	Light-gray (2.5Y 7/2 dry and moist) gritty clay loam till; 12 per cent gravel; moderately stony; sticky and plastic when wet; 11 per cent $CaCO_3$; pH 8.2.

The F-H horizon is generally about 1 inch thick. The fine sandy loam is from 5 to 12 inches thick.

A variant in the series occurs under a cover of willow, grass and fireweed. It has 6 inches of muck over 5 inches of dark grayish brown, mottled, fine sandy loam. Below this is 7 inches of calcareous, cobbly, sandy loam over clay loam till. This soil belongs to the peaty Meadow soil group, but because of its small extent within the Bear Creek series it was not established as a separate series.

Suitability for Agriculture

There is no agricultural development on Bear Creek soil at present. The texture favors moderate soil moisture storage, rapid permeability in the solum, and rapid warming-up in the spring. There are no stones to remove from the soil surface and nearly all the land has a slope of 0 to 5 per cent. However, the content of organic matter and nitrogen is low, and the total phosphorus is moderate to low. This soil would probably respond to applications of nitrogen and phosphorus fertilizers soon after cultivation was begun. The areas with 0 to 5 per cent slopes are judged as fair for agricultural development, and areas with slopes over 6 per cent are poor.

Haeckel Series

Haeckel soils cover 8,300 acres in the eastern part of the surveyed area, near Whitehorse. These soils have developed from cobbly gravelly loamy sand underlain by gravelly loam glacial till. This series belongs to the orthic Brown Wooded soil group and has 20 to 40 inches of yellowish-brown cobbly, gravelly loamy sand over grayish calcareous gravelly loam glacial till.

Gravelly loamy sand is the main soil type, but there is variation in the content of gravel and stones. Normally the soil surface is moderately stony. The vegetation is mainly of lodgepole pine, aspen, white spruce, willow, fireweed, *Shepherdia* spp. and grasses.

The slopes range mainly from 6 to 15 per cent (4,300 acres); others are 16 per cent and over (3,500 acres) and 0 to 5 per cent (500 acres). The soil is well to excessively drained; permeability is rapid in the solum and moderate in the glacial till subsoil. A profile that was sampled on a 2 per cent slope, south of the Alaska Highway near Mile 930, is described as follows:

Horizon	*Depth in inches*	
L-F	1 — 0	Litter of pine needles and twigs.
C	0 — 3	Pale-brown (10YR 6/3 dry) loose sand containing a wavy, white layer of volcanic ash from 1½ to 3 inches thick; pH 5.8.
IIBmf	3 — 5	Yellowish-brown (10YR 5/4 dry, 5YR 4/3 moist) loamy sand containing some gravel; pH 5.9; lower boundary clear and smooth.
IIBm	5 —23	Light olive brown (2.5Y 5/5 dry, 4/2 moist) single-grained sand containing cobbles and 55 per cent gravel; noncalcareous; lower boundary abrupt and smooth.
IIIC	23 +	Light brownish gray (2.5Y 6/2 dry, 5/2 moist) gravelly loam till containing 20 per cent gravel and cobbles; friable and amorphous; 8 per cent $CaCO_3$; pH 8.1.

The depth to the loam till horizon ranges from 20 to 40 inches. Usually the surface texture is loamy sand, although there may be a thin layer of loam on the surface. The volcanic ash layer is often absent.

The Haeckel series is usually associated with the Canyon series, a Brown Wooded soil developed on stratified gravel and gravelly sand rather than glacial till.

Suitability for Agriculture

There is no agricultural development on this soil at present. It has low moisture-holding capacity, is rapidly permeable, and is rather stony. Fertility is medium to low and the topography is unfavourable for cultivation. The soil is judged to be unsuitable for agricultural development.

Soils Developed on Fine-textured Lacustrine Deposits

The lacustrine deposits of Glacial Lake Champagne are clay loams to clays, calcareous, permeable, stone-free, and from 31 to 150 feet or more in thickness. They cover the large area from Pine Creek to Whitehorse, at opposite ends of the surveyed area. In general, the surface of the deposit is gently undulating but in places it is pitted by kettles or 'thaw sinks'. At the upper margin of the deposit, glacial till may be near or at the surface, or coarser-textured fluvial deposits may cover the lacustrine material.

The well-drained series developed on these deposits are Champagne (orthic Brown Wooded), Bratnober (orthic Gray Wooded; apparently the degradation product of the Champagne series), Ruby (orthic Chernozemic Dark Gray), and Takhini (dark Gray Wooded; apparently the degradation product of the Ruby series). The poorly drained series, which are catenary associates of the well-drained series, are Mendenhall (orthic Meadow), Jo-Jo (peaty orthic Meadow), Shaneinbaw (saline Gleysol), and Van Bibber (peaty calcareous Gleysol). The soils of each group are described below in alphabetical order.

WELL-DRAINED SOILS

Bratnober Series

Bratnober soils, which belong to the orthic Gray Wooded group, cover 1,650 acres mainly around Mile 1000. Under a thin organic litter there is a pale-brown platy horizon (Ae), which in turn is underlain by a dark yellowish brown blocky horizon ($B\overline{tj}$). The calcareous parent material is very friable bedded silty clay that is highly permeable.

These clay loam soils, without gravel or stone, have generally level and gently sloping topography. There are 1,300 acres with slopes of 0 to 5 per cent, and 350 acres with slopes of 6 to 15 per cent. The soil is well drained, permeability is moderate, and the parent material apparently does not readily hold seepage water in borrow-pits. The vegetation is mainly aspen, fireweed, bearberry, bedstraw, anemone, rose and *Shepherdia* spp. A profile, sampled 100 yards north of the Alaska Highway at Mile 1004 on a 2 per cent slope, is described as follows:

Horizon	*Depth in inches*	
F-H	2 — 0	Very dark brown (10YR 2/2 dry) well-decomposed litter; pH 6.2.
Ah	0 — 1	Brown (10YR 4/3 dry, 3/3 moist) friable clay loam; weak, very fine, granular structure; pH 6.7.
Ae	1 — 7	Pale-brown (10YR 6/3 dry, 4/3 moist) clay loam; moderate, coarse to very coarse, platy structure; hard consistence; pH 6.8; lower boundary clear and smooth.
$B\overline{tj}$	7 —11	Dark yellowish brown (10YR 3/4 dry, 3/3 moist) on exterior, light brownish gray (2.5Y 6/2 dry) in interior of ped; silty clay; moderate, medium, blocky structure; friable to firm consistence; surfaces of the peds glisten faintly; root mats common; noncalcareous; pH 8.2; horizon boundary abrupt and smooth.

Horizon	Depth in inches	
C	11 + to 40	Light-gray (5Y 6/1 dry, 5/3 moist) friable, weakly bedded, silty clay that crumbles to weak, very fine, blocky structure; 15 per cent $CaCO_3$; pH 8.8. Root stains present to depth of 36 inches.

The Ah horizon is usually 1 to 2 inches thick but may be absent. The Ae horizon is pale brown and the Btj is dark brown. The Btj is finer-textured than either the Ae or C. The solum ranges from 10 to 18 inches thick.

Bratnober clay loam, associated with Champagne silty clay, strongly resembles Takhini clay, but can be distinguished from it by the thinner or absent Ah horizon, a more friable Bt horizon and higher soil reaction.

Suitability for Agriculture

There is no agriculture on this soil at present. The soil has good moisture-holding capacity and is permeable. It is stone-free and generally has favorable topography. In the Ae horizon, or the main root-feeding zone for crops, the nitrogen and phosphorus levels are low. It is likely that applications of fertilizer containing these nutrients would be required for crops. The soil with 0 to 5 per cent slopes is judged as good for farming and soil with 6 to 15 per cent slopes is good to fair.

Champagne Series

The Champagne soils, covering 108,450 acres, are the most extensive soils in the surveyed area. They occur through the center of the area, between Mile 930 in the east and Mile 1013 near Pine Lake in the west. These soils belong to the orthic Brown Wooded soil group and are identified by a very thin organic litter that is underlain by brown to dark yellowish brown clay loam to silty clay. This in turn grades into the grayish calcareous silty clay parent material.

Silty clay is the main soil type but clay loam and silty clay loam also occur. The soil is free of gravel, except for a few pebbles. Stones are absent except in one area south of the Dezadeash River opposite Mile 979, where they are fairly common. The vegetation is mainly aspen, grasses, bearberry, willow, anemone, firewood, rose and *Shepherdia* spp.

These Champagne soils have slopes in all topographic classes. Most common are 0 to 5 per cent slopes (83,850 acres), followed by 6 to 15 per cent (20,750) and 16 per cent and over (3,850). The soil is well drained and is moderately permeable. The parent material is coarsely bedded, friable and permeable. Ponds of water do not stand in borrow-pits; the construction of dugouts would require special steps to control seepage. A description of a silty clay profile, sampled near Mile 940.5 on a slope of 1 per cent, is as follows:

Horizon	Depth in inches	
F-H	½ — 0	Black, moderately well decomposed litter.
Ah	0 — 1	Very dark brown (10YR 2/2 moist and dry), very weak, fine, granular silty clay; pH 7.5.
Bmf	1 — 8	Brown (10YR 5/3 dry, 4/3 moist) silty clay; moderate, fine, blocky structure; friable; color variable in upper part due to inclusions of volcanic ash; noncalcareous; pH 7.4; lower boundary clear and smooth.

Horizon	Depth in inches	
C1	8 —14	Light brownish gray (2.5Y 6/2 dry, 4/2 moist) fine blocky, friable silty clay; many roots; 17 per cent $CaCO_3$; pH 7.8.
C2	14 —36	Light-gray (5Y 7/2 dry, 5/2 moist) silty clay with bands of silt and very fine sand; blocky and friable; small shells present; 26 per cent $CaCO_3$; pH 8.1.

The C1 and C2 horizons contain 0.6 and 0.8 per cent of soluble salts respectively. Some profiles have visible accumulations of salt at depth of 14 to 20 inches.

A clay loam profile sampled near Mile 1004 is described as follows:

Horizon	Depth in inches	
C1	8 —14	Semidecomposed litter; matted; nonfibrous.
Bmf	0 —10	Dark yellowish brown (10YR 4/4 dry, 3/4 moist) friable clay loam; moderate, fine, blocky structure; noncalcareous; pH 6.7; lower boundary clear and smooth.
Bm	10 —20	Grayish-brown (2.5Y 5/2 dry, 4.5/4 moist) clay loam; moderate, fine, blocky structure; friable consistence; noncalcareous; pH 7.0; thin root mat present at the abrupt, smooth lower boundary.
C	20 +	Light-gray (5Y 6/1 dry, 5/1 moist), weakly bedded to fine blocky structure; clay to silty clay; friable; 15 per cent $CaCO_3$; pH 8.4.

The C horizon contains 0.05 per cent soluble salts. In this profile the Ah is absent, the color of the Bmf horizon is darker and the depth to lime carbonate is greater than in the profile described first.

The Champagne series is associated with many soil series but probably most often with the Ruby series. These series grade into each other and in some places the separation is arbitrary.

Suitability for Agriculture

There is no agricultural development on Champagne soils at present. These are judged to have good moisture-holding capacity and are permeable. They should warm up quickly in the spring and are generally stone-free. The nitrogen and phosphorus levels are low and suitable fertilizers would be needed for optimum crop production. Care in timing cultural operations and the maintenance of organic matter should prevent deterioration of soil structure.

Land with slopes of 0 to 5 per cent is good for agricultural development, that with 6 to 15 per cent slopes is fair and that with slopes steeper than 15 per cent is poor.

Ruby Series

Ruby soils cover 27,800 acres in the Stony Creek—Champagne area. They belong to the orthic Chernozemic Dark Gray soil group. The profile has a very dark grayish brown mineral-organic surface (Ah), over a thin, weakly developed grayish platy horizon (Ae), over a dark-brown mineral subsoil (Bm). The parent material (C), which is at a depth of about 10 inches, is grayish, friable, weakly bedded silty clay. The main soil type is silty clay, but silty clay loam also occurs. Stones and gravel are absent.

The vegetation is mainly aspen and an occasional spruce, with a vigorous understory of grasses and other plants such as winter fat and yarrow. Many of the grassy areas characteristic of this series support a sod of wheat grass, needle grass and oat grass, which cure to make winter fodder of fair quality.

Slopes generally range from 0 to 5 per cent (22,400 acres), some are 6 to 15 per cent (4,550) and some 16 per cent and over (850). The steepest slopes are mainly in the area between Stony Creek and Mendenhall Creek and form grassy 'breaks' with southern aspects along the highway. Ruby soils are well drained and moderately permeable in both the solum and the parent material. A silty clay loam profile, sampled in a level area at Mile 972 on the Alaska Highway, is described as follows:

Horizon	*Depth in inches*	
Ah	0 — 4	Very dark grayish brown (10YR 3/2 dry, 2/2 moist) silty clay loam; cloddy structure; firm consistence; low bulk density; pH 7.1.
Ae	4 — 5½	Light brownish gray and dark grayish brown (10YR 6/2 and 4/2 dry, 4/2 moist) friable, silty clay to silty clay loam; moderate, fine, platy structure; lower part dark like the Bm, and the bottom of each plate darker than its top; pH 7.3.
Bm	5½—10	Dark brown (10YR 4/3 dry) on exterior, brown (10YR 5/3 dry, 3/2 moist) when crushed or rubbed; silty clay; moderate, very fine, blocky structure; friable; pH 8.2; boundary clear and smooth.
C	10 + to 40	Light olive gray (5Y 6/2 dry, 5/2 moist) friable silty clay; moderate, very fine, blocky structure; weakly bedded; 7.6 per cent $CaCO_3$; pH 8.7.

The Bm and the C horizons contain 0.13 and 0.09 per cent soluble salts respectively. The Ah ranges in thickness from 3 to 6 inches. This series is most commonly associated with the Champagne series and grades into Champagne when the Ah is thin and the Ae very weakly developed. It also is associated with the Takhini series and grades into it when the Ah is thinner than 3 inches, the Ae is thick and the Bm tends to have a prismatic structure.

Suitability for Agriculture

There is no agricultural development on the Ruby series at present. However, this land is widely grazed by horses and appears capable of supporting a livestock industry if supplementary feed is grown. The soils have good moisture-holding capacity and are permeable. The Ah probably would be rather powdery when cultivated and a cloddy soil surface should be maintained to control wind erosion.

The amounts of organic matter, nitrogen and total phophorus are favorable and as high as any soils of the area, but probably applications of phosphatic fertilizer would be needed after crops had been grown for some time. Shallow plowing would avoid bringing up the calcareous, and sometimes salty, parent material. Irrigation would be most advantageous wherever practical.

Slopes of 0 to 5 per cent are very good for agricultural development, 6 to 15 per cent slopes are good to fair, and slopes of 16 per cent and over are poor for cultivation and unsuitable for irrigation.

Takhini Series

The Takhini series, which covers 6,900 acres in the Stony Creek—Mendenhall Creek area, belongs to the dark Gray Wooded soil group. The profile has a thin mineral-organic surface horizon (Ah), underlain by a dark grayish brown to light-gray platy eluvial horizon (Ae). Under this horizon there is a grayish-brown to very dark grayish brown horizon of accumulation (Bt) that has weak prismatic and fine blocky structure and hard consistence. The parent material (C) is grayish calcareous weakly bedded silty clay.

Clay is the main soil type and gravel and stones are absent. The vegetation is mainly scattered aspen and spruce, with a grass understory having occasional *Shepherdia spp.*, rose, bedstraw, yarrow and strawberry. Soil slopes generally range from 0 to 5 per cent (4,000 acres), followed by 6 to 15 per cent (2,700) and 16 per cent and over (200). The soil is well drained and moderately permeable throughout the profile.

A clay profile, which was sampled in a level area on a side road leading northwest from Mile 963, is described as follows:

Horizon	*Depth in inches*	
F-H	1 — 0	Moderately well decomposed litter.
Ah	0 — 1	Very dark grayish brown (10YR 3/2 dry, 2/2 moist) friable clay; weak, very fine, granular to amorphous structure; very thin layer of volcanic ash in the lower part of the horizon; pH 5.9.
Ahe	1 — 4	Dark grayish brown to brown (10YR 4/2 to 5/3 dry, 3/3 moist) friable clay; weak, very fine, granular structure; pH 6.1; lower boundary clear and smooth.
Ae	4 —10	Grayish-brown to light-gray (10YR 5/2 to 7/2 dry, 5/3 moist) clay; compound weak, medium, blocky and moderate, coarse, platy structure; hard consistence; upper surfaces of the plates lighter-colored than the lower; pH 6.2; lower boundary clear and smooth.
Bt	10 —16	Grayish brown (10YR 5/2 dry) in upper part, very dark grayish brown (10YR 3/2 dry) at bottom, very dark grayish brown (10YR 3/2) when moist, interior of peds olive-brown (2.5Y 4/4 dry); heavy clay; compound weak, medium, prismatic and strong, fine, blocky structure; hard consistence; organic staining and clay skins particularly in the lower part; pH 6.3; small salt crystals at the lower boundary, which is clear and smooth.
Bm	16 —18	Olive-brown (2.5Y 4/4 moist) friable, granular clay; many fine roots; noncalcareous; boundary diffuse and smooth.
C	18 —30	Olive-gray (5Y 5/2 dry, 4/3 moist) friable, granular, silty clay; 2.4 per cent $CaCO_3$ as well as gypsum crystals; pH 7.8.
IIC	30 +	Gray clay loam till; moderately stony; amorphous and compact; strongly calcareous; depth to this horizon ranges from 30 to 42 inches.

The C horizon contains 0.78 per cent soluble salts. The Ah horizon ranges from 1 to 4 inches thick. The glacial till (IIC) horizon occurs near the upper limit of Glacial Lake Champagne but elsewhere the till was much deeper.

The Takhini series is commonly in complex association with the Ruby series. It grades into the Ruby series when the Ah horizon is 3 inches or more thick, and the Ae and Bt weakly developed. The Takhini series probably developed through degradation processes active in the Ruby series. It resembles the Bratnober series but is distinguished from it by having an Ah horizon and a much harder, prismatic Bt horizon.

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Suitability for Agriculture

There is no agricultural development on Takhini soils at present. The soils are judged to have good moisture-holding capacity; the Ae and Bt are more dense than in most other soils and may hold moisture in the upper solum. These dense horizons may also increase the erodability of these soils.

There is a fair amount of organic matter in the Ah and Ahe Nitrogen and phosphorus are low in the solum and appropriate fertilizers probably will be needed under continuous cropping. As with all soil in the area, irrigation would help crop production.

The soils with 0 to 5 per cent slopes are good for agricultural development, those with 6 to 15 per cent are good to fair and those with 16 per cent and over are poor.

Poorly Drained Soils

Jo-Jo Series

The Jo-Jo series covers 2,050 acres, mainly in the center of the area. These soils belong to the peaty orthic Meadow soil group. They have a peaty surface layer from 4 to 9 inches thick (F) underlain by grayish-brown clay loam (Ah) that is mottled and moderately high in organic matter. The parent material (C) is mottled calcareous silty clay. Clay loam is the main texture of the mineral soil, and the surface soil when cultivated would probably be a peaty clay loam. Gravel and stones are absent.

The vegetation is mainly sedge with some grasses, but occasionally there is a considerable amount of willow. The topography is level to depressional. The soils are poorly drained and show gleying. Usually the broad depressions in which these soils occur are surrounded by higher land that would make artificial drainage difficult.

A peaty clay loam profile sampled about half a mile south of Mile 970 is described as follows:

Horizon	*Depth in inches*	
F	4 — 0	Very dark grayish brown (10YR 3/2 moist and dry) moderately well decomposed peat bound together by roots; pH 7.0.
Ah	0 —14	Grayish-brown (2.5Y 5/2 dry, 4/2 moist) friable clay loam; very weak, very fine, granular structure; weakly mottled; noncalcareous; many roots; pH 7.0; lower boundary clear and smooth.
Cg	14 + to 26	Gray (5Y 5/1 dry, 4/1 moist) silty clay; moderate, fine, granular or bedded; slightly plastic; few, faint, fine mottles; pH 7.8; 3.2 per cent $CaCO_3$.

The peat is from 4 to 9 inches thick, the Ah 2 to 14 inches. The surface peat horizon may have a thin wavy layer of volcanic ash.

The Jo-Jo series is sometimes associated with the Mendenhall series, into which it grades as the peat horizon thins out to less than 4 inches.

Suitability for Agriculture

The only agricultural development on these soils is hay-making in an area east of Champagne. The amounts of organic matter, nitrogen and total phosphorus are good and soil acidity is not a problem. The land could be broken very easily for cultivation but it is probably water-saturated and cold in the spring. The soils are judged to be fair for agricultural development and the best use is likely to be in the production of hay.

Mendenhall Series

The Mendenhall series covers 2,900 acres chiefly in the Stony Creek—Cracker Creek area, and is in the orthic Meadow soil group. The profile (Figure 12) has a black to very dark brown surface horizon (Ah) high in organic matter, and underlain by grayish mottled blocky clay (Ahg), which in turn is underlain by gray calcareous mottled parent material (C).

Loam is the main soil type. Gravel and stones are absent. The vegetation (Figure 11) is willow, a few small spruce and aspen, winter fat, bearberry and grasses. The topography is level to depressional. The soils are poorly drained but moderately permeable.

A loam profile, sampled about half a mile south of Mile 969, is described as follows:

Horizon	*Depth in inches*	
L-F	1 — 0	Litter of twigs and leaves.
Ahl	0 — 3	Black to very dark brown (10YR 2/1 and 2/2 moist) mucky loam; friable; moderate, very fine, granular structure; high in organic matter; pH 5.6; lower boundary clear and smooth.
Ah2	3 — 5½	Very dark brown (10YR 2/2 moist) friable loam; moderate, fine, granular structure; lower in organic matter than Ahl; pH 5.7; boundary clear and smooth.
Ahg	5½— 7½	Dark olive gray (5Y 3/2 moist) friable clay; compound strong, fine blocky and subangular blocky structure; noncalcareous; weakly mottled; pH 6.6; boundary abrupt and smooth to wavy.
Cg	7½—17+	Olive-gray (5Y 5/2 moist) friable clay; amorphous to weak, fine, blocky structure; weakly mottled; 8.4 per cent $CaCO_3$; pH 8.1.

The thickness of the combined Ah horizons is from 5 to 10 inches; layers of gray volcanic ash may be found in this layer. Mottling in the Ahg and Cg may be distinct. Lime carbonate is from 8 to 12 inches below the surface.

The Mendenhall series usually does not have a peaty surface but it grades into the Jo-Jo series if the peat, when it is present, thickens to 4 inches. The Mendenhall series is associated also with the Shaneinbaw and, occasionally, the Champagne series.

Suitability for Agriculture

There is no agricultural development at present on these soils. They are poorly drained, and probably water-saturated and cold in the spring; cultural operations would thereby be retarded. The amounts of organic matter and nitrogen are fairly good, but the total phosphorus content is low. The Mendenhall series would be somewhat more difficult to break than the Jo-Jo series, but it could be readily brought into cultivation. The soils are fair for agricultural development. They should be among the best in the area for the production of hay crops.

Shaneinbaw Series

Shaneinbaw soils cover about 4,900 acres, mainly in the center of the surveyed area. The greatest portion of the series lies east of the Takhini River

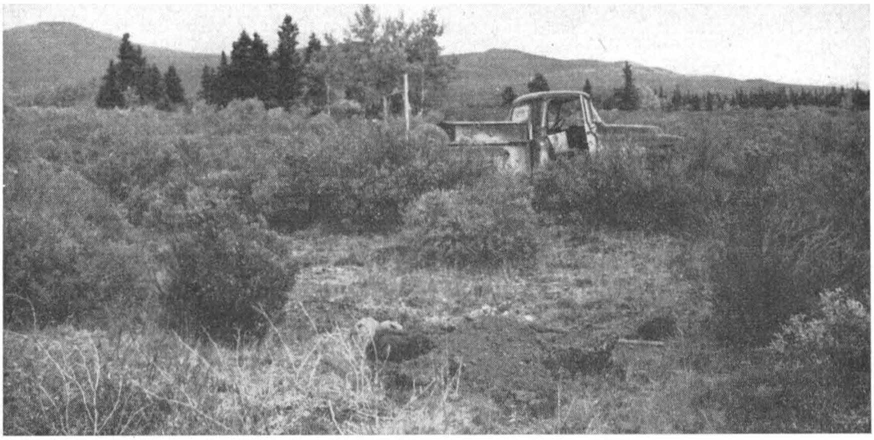

FIGURE 11.—The vegetative cover on the Mendenhall series is mainly willow, with an understory of winter fat, bearberry, and grass.

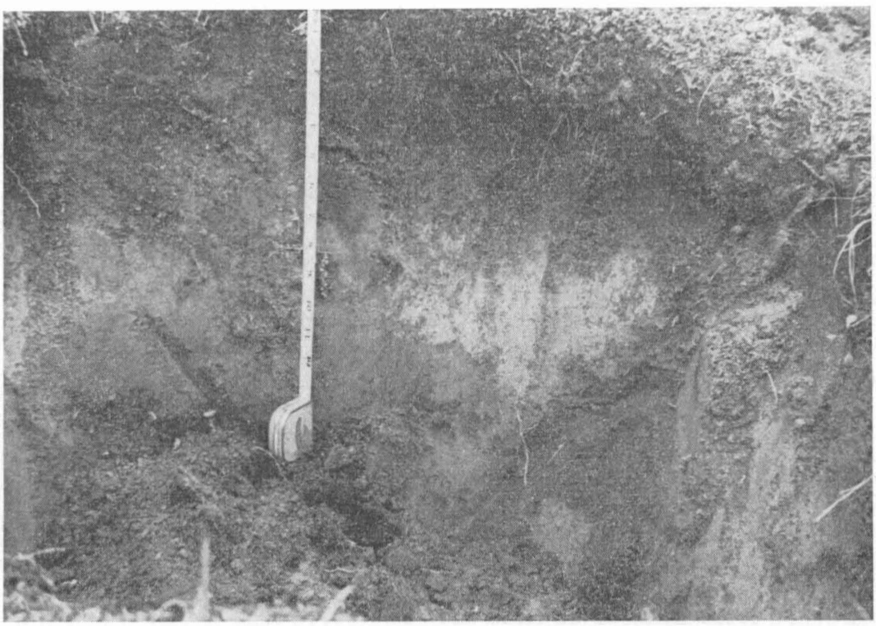

FIGURE 12.—Mendenhall loam has a very dark surface horizon underlain by gray clay. It is a Meadow soil.

bridge but some occurs in an area south and west of Mendenhall River bridge. The series belongs to the saline Gleysol soil group. The soil may have a crust of salt (Figure 13) on the surface and the profile is very dark gray to gray, weak granular silty clay containing salts, over grayish massive mottled clay containing pockets of gypsum.

Silty clay is the only type mapped. The vegetation is sparse; *Salicornia* sp., or grasswort, is dominant, with grasses such as meadow foxtail around the margin. Areas that have a white salt crust have no vegetation. The soil has level to gently undulating topography. The natural drainage is poor and permeability is moderate to slow.

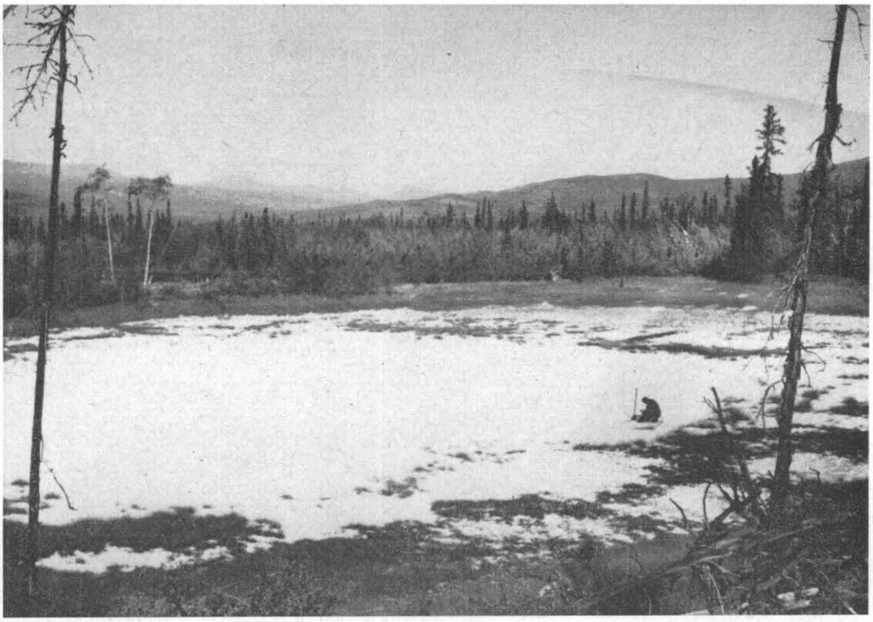

FIGURE 13.—An area of Shaneinbaw soil half a mile south of Mile 946. The white salt crust has no vegetation; the margin supports *Salicornia* spp. and Meadow foxtail.

A detailed description of Shaneinbaw silty clay follows. It was sampled east of Cracker Creek.

Horizon	*Depth in inches*	
Ah	0 — 2	Very dark gray (10YR 3/1 moist and dry) silty clay; weak, very fine, granular structure; friable; very porous and fluffy; salt crystals in pockets; strongly calcareous; pH 8.2.
C	2 —10	Olive-gray (5Y 5/2 dry, 4/2 moist (granular friable silty clay; white crystals of salt in pockets; more porous at top than bottom; pH 8.6.
Cg	10 —23	Light olive gray (5Y 6/2 dry and moist) clay; amorphous and firm; mottles common, fine and faint; pockets of white gypsum crystals; pH 8.6.

The concentrations of soluble salts are as follows; Ah, 2.33 per cent, C, 3.35 per cent, and Cg, 2.81 per cent. The main salt is sodium sulfate. Some of the soil has a white crust of salts on the surface, under which is a very dark gray, strongly gleyed sticky clay. The series is associated with the Mendenhall and Champagne series.

Suitability for Agriculture

There is no agricultural development on this series at present. The amounts of organic matter, nitrogen and total phosphorus are good to moderate. However, the high percentage of soluble salts and the poor drainage preclude any agricultural development. These soils could be reclaimed if copious supplies of irrigation water and a drainage outlet were available to allow washing the salts away. The availability of better soil makes such development uneconomic now.

These soils are unsuitable for agricultural development and the best use probably will be as poor pasture for stock.

Van Bibber Series

Van Bibber soils cover 8,700 acres in the Cracker Creek—Haines Junction area. They lie on the south side of the valley and have a northern aspect. They belong to the peaty calcareous Gleysol soil group and have a 6- to 12-inch layer of peat (F-H) over gray calcareous mottled clay (Cg).

Silty clay is the main soil type. If it was cultivated the surface texture would probably be a mucky silty clay. Gravel and stones are absent. The vegetation is mainly scrubby spruce, 10 to 15 feet high, cinquefoil, willow, alpine bearberry, moss, labrador tea and *Hedysarum* spp.

The slopes are mostly 6 to 15 per cent (5,000 acres) and 0 to 5 per cent (3,550). Only 150 acres have a slope of 16 per cent and over. The soil is poorly drained and moderately permeable. The northern aspect probably gives higher soil moisture efficiency, and the many small creeks from the mountains water the soils most of the year. These soils do not occur on the drier, northern side of the valley.

A Van Bibber silty clay profile taken 3 miles southeast of Cracker Creek on a gentle slope with rough microtopography is described as follows:

Horizon	*Depth in inches*	
F	7 — 3	Moderately well decomposed peaty muck; grayish brown (10YR 5.5/2 dry, 5YR 3/1.5 moist); strongly calcareous; pH 8.3; lower boundary clear and smooth.
H	3 — 0	Well-decomposed muck; grayish brown (10YR 5/1.5 dry, 5YR 3/1.5 moist); strongly calcareous; pH 8.3; boundary abrupt and smooth.
Cgl	0 — 6	Light-gray (5Y 7/1 dry, 6/2 moist) silty clay; bedded, breaking to strong, fine, subangular blocky structure; slightly plastic; moderately calcareous; yellowish-brown mottles few, fine and faint; pH 8.0.
Cg2	6 —24	As above but without mottles; bedding very pronounced below 12-inch depth; moderately calcareous; pH 8.0.

Roots penetrate 12 inches. This series is associated with the Champagne series.

Suitability for Agriculture

There is no agricultural development on this series. Since the topography is largely unfavorable, the aspect northerly and the soils poorly drained, these soils are poor for agricultural development.

Soils Developed on Coarse-Textured Fluvial and Beach Deposits Underlain by Lacustrine Deposits

The lacustrine deposits of Glacial Lake Champagne, near their upper margin, are covered in places by coarse-textured beach and fluvial deposits. The beach deposits, sometimes in a series, mark the shores of the lake between elevations of 2,300 and 2,800 feet (4). In other places in-flowing streams left fluvial deposits, which were modified by wave-action. The Klowtaton series is developed on these coarse-textured beach and fluvial deposits.

A few hundred years ago, in the western end of the surveyed area, Recent Lake Alsek created another set of beach and fluvial deposits overlying the lacustrine deposits. These beaches are between elevations of 1,970 and 2,240 feet (4). The deposits are very young and in many places cover soil profiles previously developed on the lacustrine deposits. The Alsek series is developed on these coarse-textured beach and fluvial deposits. It is a gleyed Regosol and is easily distinguished from the well-drained Klowtaton series by the different lithology and degree of profile development.

Well-drained Soils

Klowtaton Series

There are 17,450 acres of Klowtaton soils, mainly in the western third of the area. These soils belong to the orthic Brown Wooded soil group and have 4 inches of brown sandy loam (Bmf) over 8 to 20 inches of grayish sandy loam (Bm) underlain by bedded calcareous silty clay.

The most common soil type is sandy loam but loamy sand also occurs. The texture of the lower solum is variable because of the mode of formation. The vegetation is mainly willow, aspen, spruce, bearberry, *Shepherdia spp.*, rose and grasses.

There are 10,550 acres of Klowtaton soils with 0 to 5 per cent slopes, 6,400 with 6 to 15 per cent and 500 with 16 per cent and over. The soil is well drained. The solum is permeable and the clayey substratum slowly permeable. In some profiles this has caused mottling just over the clayey substratum.

A Klowtaton sandy loam at Mile 985 on a slope of 4 per cent has the following characteristics:

Horizon	*Depth in inches*	
F-H	½ — 0	Black, well-decomposed litter.
Bmf	0 — 4	Brown (10YR 5/3 dry, 4/4 moist) single-grained, friable, sandy loam; pH 5.9.
Bm	4 —10	Light brownish gray (2.5Y 6/2 dry, 5/2 moist) sandy loam; single-grained; friable; noncalcareous; pH 6.7. A thin lense of sandy clay loam in the middle and some gravel at the bottom of the horizon.
IIC	10 —24	Light olive gray (5Y 6/2 dry, 5/2 moist) bedded, calcareous silty clay; weak, fine blocky structure; pH 9.2.

This profile is shallower than most; the average depth of sandy material is about 24 inches, 36 inches being the maximum. Generally the texture is loamy sand to sandy loam in the surface and coarse sand over the bedded silty clay. This series is associated with the Champagne and Alsek series.

Suitability for Agriculture

There is no agricultural development on this series at present. The moisture-holding capacity and fertility are probably low. Therefore on cultivation nitrogen and phosphorus fertilizers would be required. Areas with 0 to 5 per cent slopes are fair to poor for agricultural development, and those with 6 to 15 per cent slopes are poor. Areas with slopes steeper than 15 per cent are not suitable for development. Those steeper than 6 per cent would be best used as pasture land.

Alsek Series

Alsek soils cover 2,300 acres in the western end of the surveyed area. They belong in the gleyed orthic Regosol soil group and have a light brownish gray sand surface (C), which grades into grayish sand above a silty clay substratum.

Sand is the only soil type mapped. In a few places there are scattered stones and some gravel. The vegetation is mainly aspen, spruce, black poplar, grass and *Hedysarum spp.* There are a few open grassy areas.

The topography is mainly sloping (2,000 acres); the slope is 6 to 15 per cent on 250 acres, and 16 per cent and over on 50 acres. The coarse-textured soil is rapidly permeable but the silty clay below impedes drainage at certain times of the year and makes the soil imperfectly drained.

As Alsek sand profile sampled near Mile 1017 on a slope of 2 to 9 per cent is described as follows:

Horizon	*Depth in inches*	
L-F	1 — 0	Semidecomposed leaves and twigs.
C	0 — 9	Light brownish gray (2.5Y 6/2 dry, 4/2 moist) single-grained soft sand; pH 6.6.
Cg1	9 —18	Light olive brown (2.5Y 5/4 dry, 4/2 moist) sand as above; common, medium and prominent mottles throughout; a thin layer of volcanic ash present at a depth of 14 inches; pH 6.1.
Cg2	18 +	Grayish-brown (2.5Y 5/2 dry) sand as above but less mottled; non-calcareous; pH 6.3.

This soil profile is representative of most of the series. Under grass cover there is 4 inches of very dark grayish brown (10YR 3/2 moist) sand over the horizons described above. The depth to a clay substratum varies from 1 to 4 feet. Most often it is bedded silty clay similar to the parent material of the Champagne series. The Alsek series is associated with the Klowtaton and Pine Creek series.

Suitability for Agriculture

A few acres of this soil are cultivated at the Experimental Farm, Mile 1019. The coarse texture, low moisture-holding capacity and low natural fertility make it unsuitable for cultivation and the soil is poor for agriculture. Its best use would be as rangeland for livestock.

Soils Developed on Medium- to Fine-Textured Fluvial and Beach Deposits Underlain by Lacustrine Deposits

In places the lacustrine deposits of Glacial Lake Champagne were covered by medium to fine-textured fluvial deposits. The Lewes series is developed on these fluvial materials, apparently deposited by the Yukon River where it is joined by the Takhini.

The Lake Champagne lacustrine deposits around Haines Junction were covered by beach deposits of Recent Lake Alsek. Soils developed on this material are the well-drained Pine Creek series, the imperfectly drained Auriol series, and the poorly drained Paint series. These soils, particularly the Pine Creek, may have in their solum a buried soil profile that resembles the Champagne series.

WELL-DRAINED SOILS

Lewes Series

The Lewes soils cover 5,150 acres in the area west of the junction of the Takhini River with the Yukon River. The series belongs to the orthic Brown Wooded soil group and is recognized by 3 to 6 inches of brown loam (Bm$\overline{\text{fj}}$) over 3 to 4 inches of yellowish-brown noncalcareous loam (Bm), over bedded silty clay (IIC) similar to the parent material of the Champagne and Ruby series.

Fine sandy loam and loam occur but were not mapped separately. Gravel and stones are absent. The vegetation is mainly aspen, spruce, willow, *Shepherdia spp.* and bearberry.

Soil slopes are mainly from 0 to 5 per cent (4,300 acres) and 16 per cent and over (100). The soil is well drained, and the solum is moderately permeable. The clayey substrata are slowly permeable.

Lewes loam, sampled near the Takhini Hotsprings road on a 2 per cent slope, is described as follows:

Horizon	*Depth in inches*	
L	3 — 2	Loose litter.
F-H	2 — 0	Mixture of volcanic ash and humus; from ½ to 2 inches thick; pH 5.9; wavy boundary.
Ah	0 — 1	Dark-brown (7.5YR 4/4 dry, 4/2 moist) soft, weak granular loam.
Bm$\overline{\text{fj}}$	1 — 6	Pale-brown (10YR 6/3 dry) loam; weak to moderate, fine, platy or bedded structure; soft consistence; pH 6.1; boundary gradual and smooth.
Bm	6 — 9	Light yellowish brown (2.5Y 6/4 dry) soft loam; weak, fine, platy or bedded structure; pH 6.7; boundary abrupt and smooth.
IIBm	9 —15	Light olive brown (2.5Y 5/4 dry) silty clay loam; very fine, subangular blocky and strong, fine, granular structure; noncalcareous; pH 7.3; boundary clear and smooth.
IIC	15 —29	Light olive gray (5Y 6/2 dry), strongly calcareous silty clay; strong, fine, blocky structure; friable consistence; roots penetrating to 24 inches; pH 8.2.

The surface texture ranges from fine sandy loam to loam, the Bm$\overline{\text{fj}}$ is from 3 to 6 inches in thickness, and the IIBm is from 6 to 26 inches deep. Platiness in the surface soil is due to deposition and is not developed by soil genesis. The Lewes series is finer-textured than the Klowtaton series, which it resembles. Lewes soils are associated with the Champagne, Takhini and Croucher series.

Suitability for Agriculture

There is no agricultural development on the Lewes series at present. The soil has good moisture-holding capacity and would be easy to cultivate without excessive danger of puddling in the spring. The amounts of organic matter, nitrogen and total phosphorus are low, and suitable fertilizers would be needed for maximum production.

Under irrigation there may be an erosion hazard on these soils. The surface is permeable, and if too much water were applied on sloping land, the slowly permeable subsoil would cause a saturated condition conducive to slumping.

The 0 to 5 per cent slopes are rated good to fair for agricultural development, those 6 to 15 per cent are fair to poor, and those 16 per cent and over are poor.

Pine Creek Series

The Pine Creek soils cover 5,000 acres at the western end of the mapped area. They belong to the Regosol soil group and having the following characteristics. The organic litter is underlain by 6 to 14 inches of grayish noncalcareous loam to silty clay, over brown silty clay (pIIBmf) 5 to 8 inches thick, over gray bedded calcareous silty clay (pIIC). The brown horizon is an old Brown Wooded soil surface buried by the upper deposit.

Soil textures range from loam to silty clay but the different types were not mapped. The clay loam to silty clay usually is on smooth, gently sloping topography and the loam to clay loam is on somewhat steeper topography and is often associated with gravelly beach lines.

The vegetative cover is mainly aspen, with some willow and spruce and a ground cover of grass, *Hedysarum and Shepherdia* spp., rose and strawberry. On north-facing slopes the trees are mainly white spruce and the soil surface has a thick moss cover.

Most of the soil is level or gently sloping (4,500 acres), although some is moderately or strongly sloping (500 acres). The soil is well drained and moderately permeable throughout. A Pine Creek clay loam sampled at the Experimental Farm, Mile 1019, on a 3 to 4 per cent slope is described as follows:

Horizon	*Depth in inches*	
(Ah)	0 – 6	Grayish-brown (2.5Y 5/2 dry, 10YR 3/2 moist) soft clay loam; very weak, fine, granular structure; many roots; many charcoal fragments in the bottom inch; pH 6.0.
(C)	6 –13	Light brownish gray (2.5Y 6/2 dry, 5/2 moist) silty clay; yellowish-brown (10YR 5/4 moist) mottles few, fine and faint; very weak, fine, subangular blocky structure; soft consistence; slightly vesicular; pH 6.3.
pIIBmf	13 –18	Brown (10YR 5/3 dry, 4/3 moist) friable silty clay; weak, very fine, granular structure; the upper inch very dark brown (10YR 3/2) like an old surface; noncalcareous; free of mottling; pH 7.2; boundary gradual and smooth.
pIIBm	18 –24	Light olive gray (5Y 6/2 dry, 4/2 moist) silty clay; friable; bedded; noncalcareous; pH 7.3.
pIIC	24 +	Gray (5Y 6/1 dry, 5/2 moist), weakly stratified silty clay that breaks into strong, very fine, blocky particles; 6.5 per cent $CaCO_3$; pH 8.0.

The upper deposit ranges from loam to silty clay. The clay loam to silty clay is from 6 to 14 inches thick and the loam to clay loam from 16 to 36 inches and may contain gravelly beach lines. The (C) horizon displays 'relic' mottling inherited from the deposits of Recent Lake Alsek. The present climate, vegetation, and amount of organic matter do not favor the formation of mottles in this soil. This series is associated with the Archibald, Alsek and Paint series.

Suitability for Agriculture

Some of the Pine Creek series has been cleared and cultivated at the Experimental Farm. The moisture-holding capacity of the profile described above is high and the profile is moderately permeable. The amounts of organic matter, nitrogen and total phosphorus are moderately high in the (Ah) horizon and medium in the lower part of the profile, and the soil reaction is favorable. Applications of fertilizer containing nitrogen and phosphorus will probably be needed after several years of cultivation.

At the Experimental Farm, hay, oats, barley and a great variety of vegetables grow well on this soil.

The level and gently sloping areas are good for agricultural development, and the moderately and strongly sloping areas fair.

Imperfectly Drained Soils

Auriol Series

The Auriol series covers only 700 acres, near Haines Junction. It belongs to the gleyed Regosol soil group and has 5 to 10 inches of grayish-brown silty clay (Ah) over a thin layer of very dark brown silty clay that is an old soil surface, over grayish-brown silty clay (C).

Silty clay is the only soil type. Gravel and stones are absent. The vegetation is mainly clumps of aspen with an understory of grasses, wood anemone, yarrow, rushes, flax, willows and sedge. The topography is level to very gently sloping. The soil is imperfectly drained and moderately permeable.

A silty clay profile was sampled in a level grassy area about 2 miles east of Haines Junction beside the pioneer road. It is described as follows:

Horizon	*Depth in inches*	
Ah	0 — 5	Grayish-brown (2.5Y 5/2 dry, 4/2 moist) friable silty clay; moderate, very fine, granular structure; noncalcareous; pH 6.7; boundary abrupt and smooth.
pAh1	5 — 5½	Very dark brown (10YR 2/2) silty clay; a buried surface.
pAh2	5½— 8	Grayish-brown (2.5Y 5/2 dry, 4/2 moist) friable silty clay; weak, very fine, granular structure; weakly calcareous; pH 7.5; boundary gradual and smooth.
pC	8 + to 20	Silty clay; few faint, fine yellowish-brown mottles; 4.1 per cent $CaCO_3$; pH 8.0.

The buried old surface is 5 to 10 inches deep. Lime carbonate may occur as shallow as 4 inches deep. This soil is associated with the Pine Creek series.

Suitability for Agriculture

Some Auriol soil is cultivated at the Experimental Farm, Mile 1019, where hay is the principal crop, and on a small farm east of Haines Junction, where vegetables are the principal crop. The amounts of organic matter, nitrogen and total phosphorus are fairly high in the soil surface, and moderate in the 5 to 8-inch horizon. The soil is permeable and has moderate to high moisture-holding capacity. At several places, water for irrigation is available and this soil should be well suited for market gardening. It is good for agricultural development.

Poorly Drained Soils

Paint Series

Paint soils cover only 500 acres, in the area west of Pine Lake. They belong to the peaty calcareous Gleysol soil group and have 6 to 12 inches of peat (F-H) over gray, mottled silty clay loam (Cg). Below a depth of about 12 inches there is a gray calcareous silty clay substratum (pIIC).

Peaty silty clay loam is the only soil type mapped. The vegetation is mainly sedge, with clumps of willow. The topography is level. The soil is poorly drained and slowly permeable.

A soil sampled north of Pine Creek and west of Pine Lake is described as follows:

Horizon	*Depth in inches*	
F-H	6 — 0	Very dark gray (5YR 3/1 moist and dry) moderately well decomposed mucky peat; somewhat fibrous; pH 7.0.
Cg	0 —12	Gray (5Y 5/1 dry, 4/1 moist) amorphous silty clay loam; common, medium, faint yellowish-brown mottles; noncalcareous in the upper inch but strongly calcareous below; 9.4 per cent $CaCO_3$; pH 8.0
pIIAh	12 —14	Dark-brown mucky silty clay; an old surface.
pIIC	14 +	Calcareous bedded silty clay.

The pIIC horizon is similar to that of the Pine Creek series and to the C horizon of the Champagne series. The Paint series is associated with the Pine Creek and Alsek series and with sloughs.

Suitability for Agriculture

The amounts of organic matter, nitrogen and total phosphorus are very high in the peat layer and moderately high in the Cg horizon. The soil is poorly drained, slow to warm up in the spring and difficult to underdrain ; it occurs in small, isolated patches that would be somewhat difficult to utilize.

This soil is fair for agricultural development and its best use would be for hay production. The peat could be used as a source of organic matter for gardening on other soils.

Soils Developed on Coarse-Textured Fluvial Deposits

The coarse-textured fluvial deposits occupy about a quarter of the surveyed area. Much of this material was deposited as deltas by streams flowing into Glacial Lake Champagne. When the lake receded some of these sandy deposits were modified by wind action, which in some places continues. The soils developed on the deltaic deposits are well drained and belong to the Aishihik, Canyon and Whitehorse series.

The remainder of the coarse-textured material was or is being deposited by mountain streams, some flowing from snowfields. The deposits are usually stony and gravelly. The older deposits are the parent material of the Summit series, and the young or more recent deposits are the parent material of the Haines series. In addition, some soils mapped as of the Haines series are developed on coarse-textured stony beach deposits of Recent Lake Alsek.

Well-drained Soils

Aishihik Series

Aishihik soils, which cover 33,500 acres, occur sporadically throughout the area. They are developed on calcareous fluvial sand, loamy sand and sandy loam free of gravel and stones. These soils belong to the orthic Brown Wooded soil group. Under a thin organic litter there is a brownish mineral horizon (Bmf) about 5 inches thick, over brownish to gray horizons transitional to the grayish calcareous parent material (C).

Loamy sand is predominant. Sand and sandy loam occur but were not mapped separately. The vegetation (Figure 14) is variable and includes white spruce, aspen, lodgepole pine, bearberry and grasses. The forest is less dense than on finer-textured soils.

The topography is mainly level and gently sloping (0 to 5 per cent slope, 23,300 acres). Moderately to strongly sloping (6 to 15 per cent, 6,700 acres) and strongly sloping and hilly areas (16 per cent and over, 3,500 acres) also occur. The soil is well to excessively drained and rapidly permeable. A loamy sand profile sampled on level topography south of Mile 998 beside the pioneer road is described as follows:

Horizon	*Depth in inches*	
L-F	1 — 0	Poorly decomposed leaf litter.
Bmf1	0 — 5	Brown to grayish-brown (10YR 4/3 to 5/2 dry, 4/2 moist) loamy fine sand; structureless; friable to loose but coherent *in situ;* containing organic matter and charcoal; pH 7.3.
	5 — 6	A wavy layer of grayish volcanic ash 5 to 9 inches deep.
Bmf2	6 —16	Yellowish-brown (10YR 5/4 dry, 4/2 moist) structureless loamy sand; pH 7.9.
Bm	16 —22	Gray to light-gray (5Y 5/1 to 7/2 dry, 5/3 moist) very friable sand; structureless; noncalcareous; pH 8.4.
C	22 + to 36	Sand as above; 0.9 per cent $CaCO_3$; pH 8.4.

The brown Bmf1 horizon is from 4 to 8 inches thick. The lime carbonate is from 15 to 36 inches below the surface. Aishihik soils are associated with the Canyon and Whitehorse series. Aishihik is distinguished from the Whitehorse series by brighter colors in the surface horizon (Bmf1).

Suitability for Agriculture

There is no agricultural development on the Aishihik series other than gardening at Whitehorse. The soil is low in fertility and moisture-holding capacity. It is unsatisfactory for agricultural development except for some level places with sandy loam texture that may be suited to production of potatoes and vegetables under irrigation.

Canyon Series

Canyon soils, which cover 29,650 acres, are scattered over the surveyed area. They are developed on fluvial gravelly sand to loamy sand over stratified sandy gravel that is slightly calcareous. These soils belong to the orthic Brown Wooded soil group and are characterized by 6 to 12 inches of brownish gravelly sand to sandy loam (Bmf) underlain by gravel (IIC).

Gravelly loamy sand is the main soil type. There are cobbles and some stones in the soil as well as gravel. The somewhat sparse vegetation includes white spruce, aspen, lodgepole pine, grasses, lupine, rose, larkspur, bearberry and *Shepherdia* spp.

Level and irregular gently sloping (0 to 5 per cent) land occupies 10,650 acres, irregular moderately and strongly sloping (6 to 15 per cent) 12,200, and irregular very strongly sloping and hilly (16 per cent and over) 6,800. The soil is well to excessively drained and rapidly permeable.

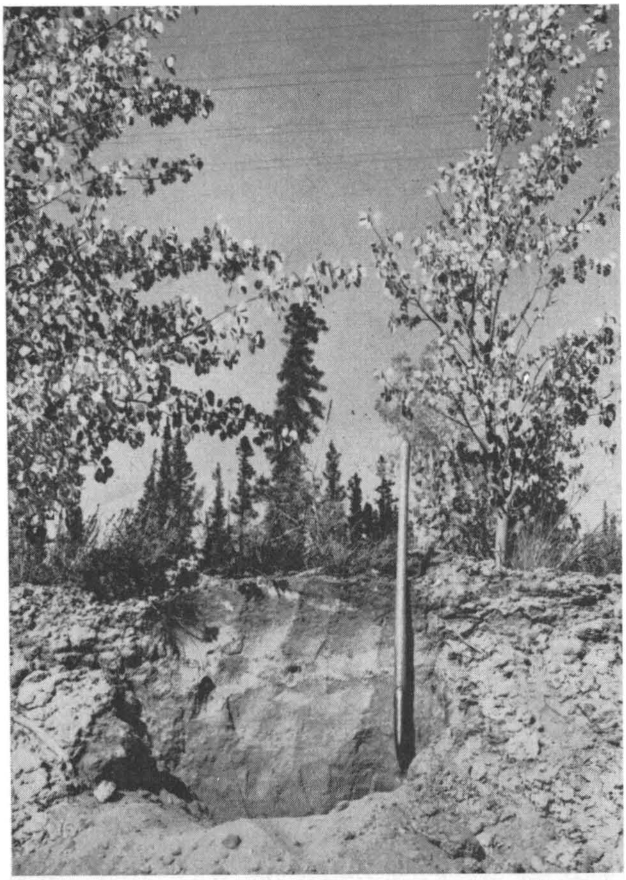

FIGURE 14.—A profile of Aishihik loamy sand at Mile 946. The trees are aspen and white spruce.

A sandy loam on level topography was sampled on the east bank of Marshall Creek north of the Alaska Highway. The profile is described as follows:

Horizon	*Depth in inches*	
F-H	3 — 1	Very dark brown semidecomposed fibrous organic litter containing some wind-blown sand; pH 7.8.
	1 — 0	Roots and organic matter containing pale-brown (10YR 6/3 dry, 3/3 moist) structureless volcanic ash; pH 7.3.
Bmf1	0 — 3	Yellowish-brown (10YR 5/4 dry, 7.5YR 4/4 moist) sandy loam; soft; very weak, fine, granular structure.
Bmf2	3 — 8	Light yellowish brown (10YR 6/4 dry, 4/4 moist) sandy loam as above; pH 6.9.
IIBm	8 —18	Grayish-brown (2.5Y 5/2 dry, 4/2 moist) cobbles, gravel and coarse sand; noncalcareous; pH 6.5; 71 per cent gravel.
IIC	18 +	As above but with coatings of lime on undersides of cobbles; pH 7.2; 74 per cent gravel.

The texture ranges from gravelly sand to sandy loam. The gravelly substratum is at a variable depth and in some places is at the surface. This soil is associated with the Aishihik and the Haeckel series.

Suitability for Agriculture

The gravelly subsoil, very rapid permeability and very low moisture-holding capacity make this soil unsuitable for any agricultural development.

Haines Series

Haines soils cover 4,550 acres in the areas south of Bear Creek and southeast of the outlet of Kusawa Lake. They are developed on the gravelly outwash of swift-flowing mountain streams and on gravel beaches. They belong to the Regosol soil group. The texture ranges from gravel to a few inches of sandy loam over gravelly sand. There are occasional stones on the surface. The very sparse vegetation is composed of grass, aster, winter fat and a few black poplar and willow trees.

The slopes are mainly 0 to 5 per cent (3,800 acres) but there are some 6 to 15 per cent (250 acres) and 16 per cent and over (500 acres). The soil is well drained except where the water of adjacent streams maintains a high water table. The profile is described as follows:

Horizon	*Depth in inches*	
C	0 — 8	Grayish-brown (2.5Y 5/2 dry, 4/2 moist) friable fine sandy loam with gravel; slightly to moderately calcareous to within 1 inch of surface.
IIC	8 +	Gravel and sand; moderately well developed lime coatings on the stones.

Generally the surface horizon is gravelly sand.

Suitability for Agriculture

This soil is not suited to cultivation. It is used in some areas as spring range for horses.

Summit Series

Summit soils cover 9,100 acres west of Bear Creek. They are developed on stony loam of fluvial origin underlain by glacial till. These soils lie above the upper limit of Glacial Lake Champagne and apparently were deposited by widespread swift-flowing mountain streams. The series belongs to the orthic Brown Wooded soil group and has a thin leaf litter above 5 inches of brown stony loam (Bmf) over gray clay loam glacial till (IIC).

The vegetation is mainly white spruce, willow, fireweed and grass. The soil texture is coarse. Stony loam is predominant but in places there are channels filled with stony sand. The stones are angular and of local origin.

There are 3,500 acres with slopes of 0 to 5 per cent, 5,550 with slopes of 6 to 15 per cent, and 50 with slopes of 16 per cent and over. The soil is well drained; the solum is moderately permeable, and the clay loam till slowly permeable.

A profile sampled on a 4 per cent slope beside the Alaska Highway one mile west of Bear Creek summit has the following characteristics:

Horizon	*Depth in inches*	
Ah	0 — 1½	Dark grayish brown (10YR 4/2 dry, 2/2 moist) loam; very weak, very fine, granular structure; friable; pH 7.2.

Horizon	Depth in inches	
Bmf	1½— 5½	Brown (7.5YR 5/4 dry, 5YR 4/2 moist) friable loam; very weak, very fine, granular structure; moderate amounts of round and angular gravel and stones; noncalcareous; pH 6.4.
IIC1	5½—44	Light brownish gray (2.5Y 6/2 dry, 5/4 moist) gritty clay loam till; stone content as above; noncalcareous; pH 6.0.
IIC2	44 +	As above but strongly calcareous.

The content of stones is variable, and in some places they are nearly continuous. The depth to the IIC1 horizon ranges from 5½ to about 18 inches.

The Summit series is found at considerably higher elevation than the Bear Creek series and is stonier. It is coarser-textured and stonier than the Archibald series.

Suitability for Agriculture

These soils are unsuitable for agriculture because of stoniness, and the high elevations at which they occur. Furthermore, most of the series has a northern exposure.

Whitehorse Series

Whitehorse soils cover 29,800 acres in two main areas, the first north of Whitehorse on the eastern side of Yukon River and the other west of Champagne on the south side of the Dezadeash River. Smaller areas are found at the outlet of Kusawa Lake and elsewhere. These soils are developed on fluvial sands that have been modified by wind action. The series belongs to the Regosol soil group and has a thin brownish mineral-organic surface horizon (Ahj) over very pale brown, pale-olive or light yellowish brown sand (A-C) that is lighter-colored as depth increases.

FIGURE 15. White spruce (*Picea glauca*) on Whitehorse loamy sand with a sparse understory of bearberry, rose and grass.

The texture is usually loamy sand, and occasionally sand. Gravel and stones are absent. The vegetation is sparse. Lodgepole pine is very prominent in the eastern section, and white spruce is prominent in the western section. The ground cover (Figure 15) is mainly bearberry, grass and rose, and there are patches of bare soil.

The topography is mostly very rough. There are 14,400 acres of very strongly sloping and hilly land (16 per cent and over), 9,600 moderately to strongly sloping (6 to 15 per cent) and only 5,800 level to gently sloping (0 to 5 per cent). Almost all of this soil type has dune topography and most of the dunes are U-shaped or parabolic. The soil is very well drained and rapidly permeable.

A loamy sand profile sampled 3 miles north of the mouth of Takhini River near the east bank of the Yukon River on the narrow ridge of a steep-sided dune is described as follows:

Horizon	*Depth in inches*	
Ahj	0 — 2	Dark grayish brown (10YR 4.5/2 dry) soft, structureless, loamy sand. pH 6.8.
	2 — 6	Light-gray to white (10YR 7/2 and 8/2 dry) soft, structureless, sandy loam containing a wavy layer of gray volcanic ash.
C1	6 —15	Pale-olive (5Y 6/3 dry) loamy sand; soft; single-grained; coherent *in situ;* weakly calcareous; pH 8.2.
C2	15 —25	Light yellowish brown (2.5Y 6/4 dry) loamy sand; weakly calcareous; pH 8.6.
C3	25 —36	Light brownish gray (2.5Y 6/2 dry, 6/4 moist) loamy sand; slightly calcareous; pH 8.7.
C4	36 +	Gray slightly calcareous sand; pH 8.7.

Whitehorse soils are associated with Aishihik soils, and are distinguished from them by the pale color of the solum.

Suitability for Agriculture

The low fertility, low moisture-holding capacity and very adverse topography make this soil unsuitable for agricultural development.

Soils Developed on Medium-Textured Fluvial Deposits

The medium-textured fluvial deposits were laid down by the Yukon, Takhini, and a few smaller rivers as they cut their channels. The deposits are calcareous, somewhat variable in texture, and free of stones and gravel. The well-drained soils developed on these deposits are the Croucher complex (Regosol, orthic Brown Wooded and orthic Gray Wooded), the Kusawa series (orthic Gray Wooded) and the Yukon series (orthic Brown Wooded). The only poorly drained soil is the Laberge series, a peaty orthic Meadow soil.

Well-Drained Soils

Croucher Complex

The Croucher complex covers 14,200 acres between Whitehorse and Lake Laberge. The soils vary in degree of profile development and represent the orthic Brown Wooded, orthic Gray Wooded and Regosol soil groups. At the scale of mapping used the various soils could not be mapped separately.

The texture is fine sandy loam to silt loam in the upper foot, and loam to silty clay below that. The subsoils are finer-textured than the surface soils. Gravel and stones are absent. The vegetation is mainly aspen, with white spruce, a few lodgepole pines and an understory of bearberry, grass, *Shepherdia* spp., and bedstraw.

The topography is mainly level and irregularly gently sloping (0 to 5 per cent, 14,000 acres) but there is some irregular moderately and strongly sloping soil (6 to 15 per cent, 200 acres). The soil is well drained and moderately permeable.

About 75 per cent of Croucher soils belong to the Brown Wooded soil group. An orthic Brown Wooded soil, found 1 mile east of Mile 9 on the Mayo Road on irregular very gently sloping land, is described as follows:

Horizon	*Depth in inches*	
Ah	0 – 2	Very dark brown (10YR 2/2 dry and moist) silt loam; weak, very fine, granular to amorphous structure; friable consistence; pH 6.4. A discontinuous layer, as thick as ½ inch, of grayish volcanic ash sometimes present at the bottom of this horizon.
Bmf	2 – 8	The upper third brown (7.5YR 4/4 moist) silt loam, the middle third pale-brown (10YR 6/3 moist) silty clay loam and the lower third yellowish-brown (10YR 5/6 moist) silty clay loam containing more clay than the layer above; friable consistence; bedded like the parent material; noncalcareous; pH 6.1.
C	8 + to 16	Light brownish gray (2.5Y 6/2 dry, 5Y 6/4 moist) silt loam; friable; moderately calcareous; finely bedded; pH 8.9.

The total thickness of the Bmf horizon is from 4 to 6 inches.

About 15 per cent of the Croucher complex soils are in the orthic Gray Wooded soil group. An example of this on gently undulating topography is described as follows:

Horizon	*Depth in inches*	
F-H	½– 0	Semidecomposed organic litter containing some mineral material.
Aej	0 – 7	Light-gray (10YR 7/2 dry) loam; weak, platy structure; the bottom of each plate darker than its top; pH 5.9. A thin wavy layer of volcanic ash occurs in this horizon.
Btj	7 –13	Pale-olive (5Y 6/4 dry) silty clay loam; some dark yellowish brown and yellowish-brown colors, particularly at the upper and lower boundaries; bedded; noncalcareous; pH 7.5; lower boundary clear and wavy to irregular.
C	13 +	Light olive gray (5Y 6/2 dry), moderately calcareous, bedded, silty clay.

The Aej horizon is from 6 to 10 inches thick, the Btj 4 to 10 inches. The lime carbonate is from 12 to 30 inches deep. In some places development is much stronger than in the described profile as shown by strong platy structure in the Ae horizon, and dark yellowish brown color and moderate medium subangular blocky structure in the Bt.

The remaining 10 per cent of Croucher soils are in the Regosol soil group. In these soils the upper few inches is the same as, or only slightly brighter than, the parent material. Lime carbonate is usually less than 6 inches deep.

In a few places the Croucher complex is associated with the Whitehorse and the Lewes series. The Croucher complex is distinguished from the Yukon series by its finer texture and by the absence of a sand substratum.

Suitability for Agriculture

Croucher soils are not cultivated at present. Analyses of the Brown Wooded member of this complex reveal that the Ah horizon is high in organic matter, moderate in nitrogen, and moderate to low in total phosphorus. The soil beneath the Ah is low in organic matter and nitrogen and moderately low in phosphorus.

Since the soil texture varies, the moisture-holding capacity will probably range from moderate to high. Permeability is moderate. The soil structure is weak and under cultivation considerable attention would be necessary to prevent deterioration.

This soil is good to fair for agricultural development. Irrigation is more feasible on these soils than on many others where water is scarce. Since the principal market for farm produce is nearby, these soils might be the first in the surveyed area to be developed for agricultural production.

Kusawa Series

Kusawa soils cover 1,050 acres in the area east and south of Mendenhall Landing near the Takhini River. They belong to the orthic Gray Wooded soil group, and under a thin organic surface have 5 inches of fine sandy loam (Ae). Beneath this is a 5-inch layer of brown clay (IIBt), then 5 inches of gray clay (IICk) that in turn rests on sand (IIIC).

Fine sandy loam is the only type mapped. Gravel and stones are absent. The vegetation is mainly spruce, aspen, bearberry, moss, juniper and grass. The topography is predominantly level and gently sloping (1,000 acres) but 50 acres of moderately sloping land were also mapped. The soil is well drained and moderately permeable.

A profile sampled southeast of Mendenhall Landing on very gently undulating topography has the following characteristics:

Horizon	*Depth in inches*	
F-H	2 — 0	Black fibrous organic litter.
Aeh	0 — 3	Brown (10YR 5/3 moist) fine sandy loam; soft; amorphous; pH 5.3; boundary clear and wavy.
Ae	3 — 5	Very pale brown (10YR 7.5/3 dry) fine sandy loam; weak, medium, platy structure; lower sides of plates brown (10YR 5/3); friable to firm; pH 6.0.
IIBt	5 —10	Dark-brown (10YR 3/3 moist) clay and clay loam; firm to slightly hard consistence; strong, medium, blocky structure in upper part, moderate, coarse and medium, blocky structure in lower part; interior of peds brown (10YR 5/3); pH 8.0; boundary abrupt and smooth.
IICk	10 —15	Light olive gray to pale-yellow (5Y 6/2 to 7/3 moist) clay that seems to be siltier than horizon above; amorphous to weak blocky structure; firm; strongly calcareous; roots penetrating to bottom of horizon.
IIIC	15 +	Light-gray (5Y 7/1 moist) soft, fine sand; structureless; non-calcareous.

In this profile the Aeh horizon is 3 to 4 inches thick, the Ae 2 to 3 inches, and the IICk 4 to 7 inches. In another profile the structure was weaker and the soil above the IIC horizon was only 12 inches deep. Probably development in the Ae is largely genetic and that in the IIBt largely depositional.

Suitability for Agriculture

The soil was not analyzed but the levels of organic matter, nitrogen and total phosphorus are probably low, as in most of the other soils. The moisture-holding capacity is moderate in the surface and high in the Bt horizon. This soil is fair for agricultural development.

Yukon Series

Yukon soils cover 7,150 acres near Lake Laberge. They belong to the orthic Brown Wooded soil group and are characterized by 20 to 30 inches of brown to pale-brown fine sandy loam over sand. The main texture is fine sandy loam but 545 acres of loamy sand was mapped near the shore of Lake Laberge, and occasionally loam textures occur. Gravel and stones are absent.

The vegetation is spruce, aspen, grass, bearberry, lupine and rose. The topography is level and gently undulating. The soil is well drained and moderately permeable.

A profile sampled 50 yards from the Yukon River, about 2 miles south of Lake Laberge, has the following characteristics:

Horizon	*Depth in inches*	
L-F	1½— 0	Litter of leaves and twigs.
Bm1	0 — 4	Pale-brown and very pale brown (10YR 6/3 and 7/3 dry) soft, fine sandy loam; weak, granular to amorphous structure; noncalcareous; pH 6.8; boundary wavy and clear.
Bm2	4 —10	Pale-brown (10YR 6/3 dry) soft, amorphous, fine sandy loam; noncalcareous; pH 7.8.
C	10 —20	Pale-brown, bedded, fine sandy loam; moderately calcareous; roots penetrating to 13 inches; pH 8.2.
IIC	20 +	Coarse sand, slightly calcareous.

The Bm1 is from 3 to 5½ inches thick and varies from very pale brown to yellowish brown. Lime carbonate generally is more than 10 inches below the surface and ranges from 7 to 30 inches. The sand (IIC) substratum is from 20 to 30 inches deep. Faint mottles may occur below 12 inches, but in places there are prominent ones thought to be 'relic' mottles from the parent material.

Yukon soils are distinguished from Croucher soils by their coarser texture and sand substratum.

Suitability for Agriculture

The amounts of organic matter, nitrogen and total phosphorus are moderately low. The moisture-holding capacity is moderate. The soil structure is poorly developed. After clearing and breaking, fertilizers will be needed for good production.

This soil is fair for agricultural production. Though not as good as Croucher soils, like them, the Yukon soils could be irrigated since water is abundant. The main market for crops is not far and these soils are worthy of early development.

Poorly Drained Soils

Laberge Series

Laberge soils cover 3,100 acres, mainly in the area between Whitehorse and Lake Laberge on the east side of the Yukon River. They belong to the peaty

Meadow soil group. They have 6 to 12 inches of peat (L-F) over dark-colored mineral soil high in organic matter. The subsoil is mottled fine sandy loam. Peaty sandy loam is the main soil type, but since there is a considerable variation in surface soil texture other types probably occur. Gravel and stones are absent.

The vegetation is sedge and rushes in some places and scrubby spruce with thick moss ground cover in others. The topography is level to depressional. The soil is poorly drained and permeability is slow.

A profile sampled east of Yukon River near Laberge Creek has the following characteristics:

Horizon	*Depth in inches*	
L	7 — 4	Living sedge roots.
L-F	4 — 0	Very dark gray (5YR 3/1 moist) raw fibrous peat and plant roots; pH 7.2.
Ah	0 — 2	Dark-brown and brown (10YR 5/3 and 3/3 moist) single-grained, sandy loam.
IIAh	2 — 5	Very dark gray (10YR 3/1 moist) amorphous clay loam; high in organic matter; pH 6.5.
ICg	5 —20	Gray (5Y 5/1 wet) fine sandy loam; olive-brown mottles (2.5Y 4/4) common, fine and distinct; nonsticky; slightly plastic; noncalcareous.

Suitability for Agriculture

The Laberge series is poorly drained and often surrounds wet sloughs. Most of the series is affected by a high water table and the depressional areas, in which the soils generally are situated, would be very difficult to drain. This soil is poor for agricultural development and its best use would be for producing wild and cultivated hay.

Soils Developed on Medium- to Fine-Textured Fluvial Deposits

The medium- and fine-textured fluvial deposits are recent, but deposition has stopped. The periodic depositions, which in places covered established soil surfaces, are calcareous, and have loam to silty clay loam texture. Soils developed on these deposits are the well-drained Taye series and the poorly drained Cracker series.

WELL-DRAINED SOILS

Taye Series

Taye soils cover 3,300 acres near Cracker Creek and in the Mendenhall Valley south of Taye Lake. They are young, weakly developed soils classified as Regosols. They have a few inches of dark-brown loam (Ah) over calcareous silty clay loam (C).

The only type mapped is loam. Gravel and stones are absent. The vegetation is scattered spruce, aspen, willow and grass. The forest is young and contains no large stumps. The topography is mainly moderately and strongly sloping (6 to 15 per cent, 2,950 acres) in the upper Mendenhall Valley, where the deposition appears to have occurred on top of wasting ice blocks. When the ice finally melted the land surface was pitted. Near Cracker Creek the topography is very gently undulating (0 to 5 per cent, 350 acres). The soil is well drained and moderately permeable.

A loam profile, sampled near the public camp ground at Cracker Creek on level topography, has the following characteristics:

Horizon	*Depth in inches*	
Ah	0 — 4	Very dark grayish brown (10YR 3/2 dry, 2/2 moist) loam; amorphous to weak, fine, granular structure; friable; noncalcareous; pH 7.6.
C	4 —17	Light brownish gray (2.5Y 6/2 dry, 5/2 moist) grading to light olive gray (5Y 6/2 dry, 6/3 to 5/4 moist) interbedded silty clay and silty clay loam; friable; amorphous; highly calcareous; slightly mottled in the lower part; pH 8.4. This material contains three dark grayish brown (10YR 4/2) old surface horizons high in organic matter, at depths of 8 inches and lower.

The Ah horizon is from 1 to 4 inches thick, and above the C there may be a pale-brown layer, probably volcanic ash. The Taye series is associated with the Cracker and Shaneinbaw series.

Suitability for Agriculture

This soil is probably low in nitrogen and phosphorus, like most other soils in the surveyed area. Its moisture-holding capacity is probably medium. The level areas are fair for agricultural development, but the moderately and strongly sloping ones are poor.

The lime carbonate is close to the surface and cultural operations should be designed to avoid bringing up the highly calcareous parent material.

Poorly Drained Soils

Cracker Series

There are only 350 acres of Cracker soils, in the Cracker Creek area. They belong in the peaty calcareous Gleysol soil group. They have 6 to 10 inches of peat (F-H) over calcareous silt loam to silty clay loam that is mottled below a depth of 10 inches. Gravel and stones are absent.

The vegetation is ground birch and willow with an occasional spruce and some grass. The topography is level to irregularly gently sloping. Some of the peat has been burned and here the surface is hummocky. The soil is poorly drained and slowly permeable. The profile has the following characteristics:

Horizon	*Depth in inches*	
F-H	6 — 0	Black (5YR 2/1 dry and moist) semidecomposed mucky peat; pH 8.0.
C	0 —10	Light olive gray (5Y 6/2 dry, 5/2 moist) silty clay loam to silt loam; amorphous; friable; strongly calcareous to within two inches of the upper surface; texture variable because of bedding; pH 8.8.
Cg	10 —23	Light olive gray silty clay loam to silt loam as above; yellowish-brown mottles common, medium and prominent; strongly calcareous; pH 8.6.

The peat is 6 to 10 inches deep. Cracker soils are associated with the Taye, Aishihik and Shaneinbaw series.

Suitability for Agriculture

Cracker soils are poorly drained and have lime carbonate close to the soil surface. The soil is poor for agricultural development. Its best use probably would be in the production of hay crops.

Soils Developed on Colluvial or Creep Deposits

Well-drained Soils

Hard Time Series

Hard Time soils cover 1,400 acres. They occur along the banks of the Takhini and Dezadeash rivers and are developed on calcareous silty clay deposited by Glacial Lake Champagne. Because of erosion and gravity the clay has been creeping, or slumping, and in many places the material appears to be still moving. Hard Time soils are classified as Regosols and have calcareous parent material (C) at the soil surface. Silty clay is the only type mapped. Gravel and stones are absent.

The vegetation is mainly scattered spruce, *Hedysarum* spp. and moss. The topography is predominantly irregularly moderately sloping (6 to 9 per cent, 1,000 acres) with a small amount of level and gently sloping (400 acres) land. The microtopography is very rough with deep vertical cracks. The soil is well drained and moderately permeable. However, there are indications that this material is water-saturated in the spring and therefore slumps along the banks of the rivers. The soil is characterized by the following profile.

Horizon	*Depth in inches*	
L-H	1 — 0	Well-decomposed litter of leaves and needles.
C	0 —15	Grayish-brown (2.5Y 5/2 dry, 4/2 moist) friable silty clay; weak, very fine, blocky structure; calcareous below about 2 inches from surface.

Occasionally the upper mineral soil shows weak brown color.

Suitability for Agriculture

Since this soil has moderately sloping topography and very rough microtopography, and since it is calcareous to the surface, low in organic matter and nitrogen, and since in many places it is still moving, it is not suitable for agricultural development.

Land Types

Eroded River-banks

This land type, covering 16,200 acres, occurs along all stream channels and in channels formerly occupied by streams. The banks are very steeply sloping; many are nearly vertical. They are composed of a variety of materials, but silty clay of Glacial Lake Champagne is predominant.

Mucky Peat

There are only about 100 acres of this land type in the surveyed area. It is close to Whitehorse and is a valuable source of organic material for use in construction of lawns and gardens. It is very high in organic matter, nitrogen and total phosphorus, and is neutral in reaction.

Recent Alluvium

This land type covers 41,950 acres. It is widespread, occurring in the valleys throughout the area. The soil ranges from gravelly loamy sand to silty clay loam, the finer textures being predominant. It is well drained to very poorly drained, and in some places is flooded annually during the spring runoff. Usually soil profile development is absent, but here and there on the higher terraces a surface mineral-organic horizon (Ah), and possibly a pale-brownish mineral horizon (Bmf), has had time to develop.

The topography is level to gently undulating (40,650 acres), the soil surface being dissected by shallow channels and meanders. The microtopography is often rough. There are about 1,300 acres of moderately and strongly sloping land (6 to 15 per cent), mostly along the north-facing valley wall.

Suitability for Agriculture

Much of this land type is poorly drained, is subject to flooding, and has rough microtopography, making it poor for agricultural development. However, small areas in higher positions are well drained and have suitable topography for good development. Also, an abundant supply of water is available for irrigation near most of this land type. These small areas of good land are well suited to crops adaptable to the area, while other areas that are lower and not so well drained are suited to the production of hay crops. Access to this alluvial land must be considered in plans for development; roads constructed over the eroded river-banks will be difficult to build, maintain and traverse.

Rough Mountainous Land and Rock Outcrops

This land type covers 4,800 acres in the surveyed area. It is either steeply sloping to hilly land on which Brown Wooded and Regosol soils have developed from a variety of parent materials (usually glacial till or beach deposits), or it is hilly outcrops of rock, and rock thinly covered by soil material. The mountainous areas that bound the surveyed area are of this land type.

Saline Meadows

This land type covers only 400 acres, near Mile 10 on the Mayo Road; an emergency airstrip is located on this land type. The topography is depressional with level to very gentle slopes and the soil drainage is imperfect to poor. In places the surface is covered with salt, and the vegetation is mainly salt-tolerant grasses. The soil is loam to silty clay loam and is of fluvial origin.

This land type has many of the characteristics of the Shaneinbaw series and is unsuitable for agricultural development.

Sloughs

Sloughs cover 7,650 acres. They occur in the area east of the Yukon River, along the southern side of the Dezadeash Valley and near Bear Creek. They are ponded areas vegetated mainly with sedges, rushes and willow.

ANALYSES OF SOIL SAMPLES

Chemical and physical data for most of the soils are given in Table 5. Soil texture was determined by the field method on most of the samples, but on a few the mechanical analysis was determined by the pipette method. Samples of most horizons were taken by means of a brass cylinder of 90 cc. capacity in order to determine bulk density. Conductivity and water-soluble salts were determined on a 1:2.5 soil:water extract. The data for organic matter, nitrogen and phosphorus are expressed both as grams per 100 grams of soil (per cent) and as grams per 100 cc. of soil.

Table 5.—Analyses of Certain Soils in the Takhini and Dezadeash Valleys

Soil series or land type — Soil Group	Aishihik — Brown Wooded				Alsek — Regosol			Archibald — Brown Wooded			Auriol — Regosol		
Horizon	Bmf1	Bmf2	Bm	C	C	Cg1	Cg2	Ah	Bm	C	Ah	pAh2	pC
Depth, inches	0–5	6–16	16–22	22–36	0–9	9–18	18+	0–1½	1½–11½	11½+	0–5	5½–8	8+
Texture	LS[1]	LS	S	S	S	S	S	CL	GCL	GCL	SiC	SiC	SiC
pH	7.3	7.9	8.4	8.4	6.6	6.1	6.3	7.2	7.4	8.8	6.7	7.5	8.0
Bulk density	1.16	1.26	1.25	—	1.27	1.25	1.39	0.86	1.25	1.43	0.83	1.10	1.07
Percentage													
organic matter	2.5	0.8	0.5	0.3	—	—	—	4.3	1.2	0.6	8.6	3.2	1.8
total N	0.08	0.03	0.02	0.01	—	—	—	0.14	0.05	0.02	0.39	0.16	0.09
total P	0.08	0.07	0.08	0.09	—	—	—	0.05	0.02	0.07	0.12	0.09	0.09
calcium carbonate	0.0	0.0	0.0	0.9	—	—	—	—	—	11.0	—	—	4.1
moisture equivalent	11.0	8.6	3.4	—	—	—	—	22.6	16.9	16.8	35.1	25.4	27.4
permanent wilting	4.2	3.7	1.7	—	—	—	—	10.3	7.6	8.2	18.1	15.4	13.7
Grams per 100 cc. soil													
organic matter	2.9	1.0	0.6	—	—	—	—	3.7	1.4	0.9	7.1	3.5	1.9
total N	0.09	0.04	0.03	—	—	—	—	0.12	0.06	0.03	0.32	0.18	0.10
total P	0.09	0.09	0.10	—	—	—	—	0.04	0.03	0.10	0.10	0.10	0.10
C:N ratio	18	17	15	17	—	—	—	18	14	18	13	12	11

Table 5.—Analyses of Certain Soils in the Takhini and Dezadeash Valleys—*Continued*

Soil series or land type — Soil group	Bear Creek — Brown Wooded				Bratnober — Gray Wooded					Champagne — Brown Wooded (Mile 940)			
Horizon	F-H	Bmf	IIBm	IIC	F-H	Ah	Ae	Btj	C	Ah	Bmf	Cl	C2
Depth, inches	2–0	0–9	9–17	17+	2–0	0–1	1–7	7–11	11+	0–1	1–8	8–14	14–36
Texture	O	FSL	CL	CL	O	CL	CL	SiC	SiC	SiC	SiC	SiC	SiC
pH	7.2	7.2	7.7	8.2	6.2	6.7	6.8	8.2	8.8	7.5	7.4	7.8	8.1
Bulk density	—	1.02	1.44	1.47	0.17	—	1.50	0.81	0.80	—	1.02	0.79	0.98
Percentage													
organic matter	42.8	3.6	1.1	1.3	52.4	4.1	1.1	2.5	1.3	11.9	2.9	3.9	1.9
total N	0.99	0.12	0.05	0.05	1.16	0.14	0.05	0.11	0.06	0.49	0.09	0.14	0.08
total P	0.12	0.06	0.02	0.08	0.10	0.04	0.03	0.07	0.07	0.08	0.04	0.06	0.05
calcium carbonate	—	—	—	11.3	—	—	—	2.4	14.7	—	—	17.0	25.8
moisture equivalent	—	20.8	15.3	19.2	102.6	—	18.4	30.2	29.9	45.8	27.8	38.0	32.1
permanent wilting	—	8.4	6.6	11.5	58.9	—	6.0	22.0	16.2	21.5	18.0	30.3	19.3
Grams per 100 cc. soil													
organic matter	—	3.6	1.5	1.9	—	0.7	1.7	2.0	1.0	—	2.9	3.1	1.9
total N	—	0.12	0.07	0.07	—	0.02	0.07	0.09	0.05	—	0.09	0.11	0.08
total P	—	0.06	0.03	0.12	—	0.01	0.05	0.06	0.06	—	0.04	0.05	0.05
C:N ratio	25	18	12	16	26	17	12	14	13	14	19	16	14

Table 5.—Analyses of Certain Soils in the Takhini and Dezadeash Valleys—*Continued*

Soil series or land type — Soil group	Champagne — Brown Wooded (Mile 1004)			Croucher — Brown Wooded			Haeckel — Brown Wooded				Jo-Jo — Meadow		
Horizon	Bmf	Bm	C	Ah	Bmf	C	C	IIBmf	IIBm	IIIC	F	Ah	Cg
Depth, inches	0–10	10–20	20+	0–2	2–8	8+	0–3	3–5	5–23	23+	4–0	0–14	14+
Texture	CL	CL	C-SiC	SiL	SiL-SiCL	SiL	LS	LS	GS	GL	O	CL	SiC
pH	6.7	7.0	8.4	6.4	6.1	8.9	5.8	5.9	6.0	8.1	7.0	7.0	7.8
Bulk density	0.99	1.24	1.13	—	—	—	—	—	—	—	0.23	0.73	1.10
Percentage													
organic matter	2.9	1.5	1.7	21.4	1.5	1.6	8.0	1.4	0.8	0.5	50.8	9.2	3.0
total N	0.11	0.05	0.08	0.65	0.07	0.08	0.19	0.05	0.03	0.02	2.06	0.43	0.15
total P	0.04	0.05	0.07	0.05	0.05	0.06	0.07	0.02	0.06	0.09	0.10	0.07	0.07
calcium carbonate	—	0.0	15.4	—	—	8.3	—	—	—	8.0	—	—	3.2
moisture equivalent	21.8	19.2	27.2	—	—	—	—	—	—	—	110.3	45.3	37.5
permanent wilting	10.5	11.9	13.1	—	—	—	—	—	—	—	57.9	23.0	21.8
Grams per 100 cc. soil													
organic matter	2.9	1.9	1.9	—	—	—	—	—	—	—	11.7	6.7	3.3
total N	0.11	0.06	0.09	—	—	—	—	—	—	—	0.47	0.31	0.16
total P	0.04	0.06	0.08	—	—	—	—	—	—	—	0.02	0.05	0.08
C:N ratio	15	18	13	19	12	12	24	16	17	15	14	12	11

Table 5.—Analyses of Certain Soils in the Takhini and Dezadeash Valleys—*Continued*

Soil series or land type — Soil group	Lewes — Brown Wooded				Mendenhall — Meadow				Mucky Peat		Paint — Gleysol	
Horizon	Bmfj	Bm	IIBm	IIC	Ah1	Ah2	Ahg	Cg			F-H	Cg
Depth, inches	1–6	6–9	9–15	15–29	0–3	3–5½	5½–7½	7½–17	2–18	18+	6–0	0–12
Texture	L	L	SiC	SiC	L	L	C	C	O	O	O	SiCL
pH	6.1	6.7	7.3	8.2	5.6	5.7	6.6	8.1	7.2	7.0	7.0	8.0
Bulk density	1.19	1.32	1.18	1.12	1.43	0.58	0.86	1.09	0.31	0.29	0.20	1.09
Percentage												
organic matter	1.1	0.4	0.7	0.9	29.9	21.2	8.7	1.9	34.4	37.7	60.4	5.3
total N	0.05	0.03	0.03	0.04	1.29	0.84	0.44	0.11	1.17	1.19	2.61	0.24
total P	0.03	0.04	0.04	0.06	0.07	0.05	0.05	0.05	0.10	0.10	0.13	0.08
calcium carbonate	—	—	—	7.8	—	—	—	8.4	—	—	—	9.4
moisture equivalent	15.3	11.1	21.1	29.0	66.7	51.9	38.4	33.4	—	—	—	—
permanent wilting	5.2	3.9	12.6	12.5	36.6	30.8	27.1	25.1	—	—	—	—
Grams per 100 cc. soil												
organic matter	1.3	0.5	0.8	1.0	12.9	12.3	7.5	2.1	10.7	10.9	12.1	5.8
total N	0.06	0.04	0.04	0.04	0.56	0.49	0.38	0.12	0.36	0.35	0.52	0.26

Table 5.—Analyses of Certain Soils in the Takhini and Dezadeash Valleys—*Continued*

Soil series or land type — Soil group	Pine Creek — Regosol					Ruby — Chernozemic Dark Grey				Shaneinbaw — Gleysol		
Horizon	(Ah)	(C)	pIIBmf	pIIBm	pIIC	Ah	Ae	Bm	C	Ah	C	Cg
Depth, inches	0–6	6–13	13–18	18–24	24+	0–4	4–5½	5½–10	10+	0–2	2–10	10–23
Texture	CL	SiC	SiC	SiC	SiC	SiCL	SiCL	SiC	SiC	SiC	SiC	C
pH	6.0	6.3	7.2	7.3	8.0	7.1	7.3	8.2	8.7	8.2	8.6	8.6
Bulk density	1.04	1.16	1.17	1.13	1.31	0.72	—	1.14	1.21	0.59	1.14	1.57
Percentage												
organic matter	11.9	1.6	1.1	1.1	1.1	13.7	3.1	3.9	0.7	8.3	1.8	0.5
total N	0.47	0.08	0.07	0.05	0.09	0.68	0.14	0.18	0.04	0.53	0.10	0.03
total P	0.11	0.08	0.06	0.04	0.08	0.10	0.06	0.07	0.08	0.08	0.07	0.08
calcium carbonate	—	—	—	—	6.5	—	—	0.0	7.6	3.7	14.6	7.7
moisture equivalent	39.0	23.2	23.0	29.0	25.7	39.2	26.1	24.6	30.3	—	—	—
permanent wilting	14.6	9.4	10.2	20.7	14.4	20.5	12.8	14.9	20.2	—	—	—
Grams per 100 cc. soil												
organic matter	12.4	1.9	1.3	1.2	1.4	9.9	—	4.4	0.8	4.9	2.0	0.8
total N	0.49	0.09	0.08	0.06	0.12	0.49	—	0.20	0.05	0.31	1.14	0.05
total P	0.11	0.09	0.07	0.05	0.10	0.07	—	0.08	0.10	0.05	0.08	0.13
C:N ratio	15	11	9	12	7	12	13	13	10	9	10	10

Table 5.—Analyses of Certain Soils in the Takhini and Dezadeash Valleys—*Concluded*

Soil series or land type — Soil group	Takhini — Gray Wooded					Whitehorse — Regosol					Yukon — Brown Wooded		
Horizon	Ah	Ahe	Ae	Bt	C	Ahj	C1	C2	C3	C4	Bm1	Bm2	C
Depth, inches	0–1	1–4	4–10	10–16	18–30	0–2	6–15	15–25	25–36	36+	0–4	4–10	10–20
Texture	C	C	C	HC	SiC	LS	LS	LS	LS	S	FSL	FSL	FSL
pH	5.9	6.1	6.2	6.3	7.8	6.8	8.2	8.6	8.7	8.7	6.8	7.8	8.2
Bulk density	—	0.95	1.24	1.19	1.12	—	—	—	—	—	0.91	0.97	1.15
Percentage													
organic matter	27.4	6.9	2.0	3.1	1.9	1.6	0.6	0.3	0.1	0.1	2.3	2.4	1.4
total N	1.00	0.24	0.09	0.12	0.06	0.05	0.03	0.01	0.01	0.02	0.08	0.09	0.06
total P	0.08	0.06	0.04	0.06	0.08	0.04	0.03	0.03	0.03	0.03	0.05	0.05	0.06
calcium carbonate	—	—	—	—	2.4	—	0.3	0.2	0.4	0.2	—	0.8	2.6
moisture equivalent	78.4	26.3	26.0	34.4	31.4	—	—	—	—	—	24.6	23.5	18.5
permanent wilting	41.7	14.4	14.9	26.2	21.1	—	—	—	—	—	6.8	6.7	5.3
Grams per 100 cc. soil													
organic matter	—	6.6	2.5	3.7	2.1	—	—	—	—	—	2.1	2.3	1.6
total N	—	0.23	0.11	0.14	0.07	—	—	—	—	—	0.07	0.09	0.07
total P	—	0.06	0.05	0.07	0.09	—	—	—	—	—	0.05	0.05	0.07
C:N ratio	16	17	13	15	18	19	12	17	6	3	17	15	14

[1] Symbols: C, clay; F, fine; G, gravelly; H, heavy; L, loam or loamy; O, organic; S, sand or sandy; Si, silt or silty.

Table 6.—pH, Conductivity, Total Soluble Salts and Milli-equivalents of Different Ions in Selected Horizons of Various Yukon Soils

Soil series	Horizon	Depth	pH	Con-ductivity	Total soluble salts	Water-soluble salts								
						Ca^{++}	Mg^{++}	K^{+}	Na^{+}	Total cations	HCO_3^{-}	Cl^{-}	SO_4^{-}	Total anions
		Inches		Milli-mhos	Per cent	Milli-equivalents per 100 gm. soil								
Aishihik	Bmf2	6–16	7.9	0.1	0.03	—	—	—	—	—	—	—	—	—
Champagne	C1	8–14	7.8	2.7	0.61	5.9	1.7	0.02	0.6	8.2	0.37	0.36	8.2	8.9
	C2	14–36	8.1	—	0.78	5.3	3.3	0.02	1.5	10.1	0.26	0.41	11.1	11.7
Champagne	C	20+	8.4	0.3	0.05	—	—	—	—	—	—	—	—	—
Ruby	Bm	5½–10	8.2	0.5	0.13	—	—	—	—	—	—	—	—	—
	C	10+	8.7	0.6	0.09	—	—	—	—	—	—	—	—	—
Shaneinbaw	Ah	0–2	8.2	11.9	2.33	4.3	4.5	0.43	22.0	31.2	0.47	0.60	30.4	31.5
	C	2–10	8.6	13.2	3.35	2.4	14.8	0.27	21.0	38.7	0.47	0.49	43.1	44.1
	Cg	10–23	8.6	9.8	2.81	4.4	14.4	0.04	10.7	29.5	0.19	0.67	34.1	35.0
Takhini	C	18–30	7.8	3.3	0.78	5.3	3.5	0.14	1.3	10.2	0.22	0.35	10.3	10.9

Some comments on the significance of the data in Tables 5 and 6 from the viewpoint of crop production are given below.

pH

Soil reaction is expressed in pH units. A pH of 7.0 is neutral; lower values indicate acidity and higher ones alkalinity. The desirable range for cultivated soils in northern Canada is from medium acid, pH 5.6, to mildly alkaline, pH 7.8. All the surface soils analyzed, with one exception, fell within this range; Shaneinbaw soils are saline and moderately to strongly alkaline. The subsoils are, for the most part, moderately to strongly alkaline, a few being mildly alkaline.

Bulk Density

Bulk density, or the weight of soil per unit of volume, is determined in order that the amounts of chemical elements may be expressed in relation to the volume of soil. Since the various horizons of a soil profile may differ widely in bulk density, a much better comparison of the amount of plant food, between horizons and between profiles, is given by expressing the amount of an element in grams per 100 cubic centimeters of soil rather than in grams per 100 grams of soil. This is especially true in comparing organic and mineral soils.

Organic Matter and Nitrogen

Generally the well-drained soils have medium to low amounts of organic matter and nitrogen. However, the Ruby series is high in these constituents. The imperfectly and poorly drained soils have peaty surface (L-H) horizons and mineral-organic (Ah) horizons high in organic matter and nitrogen. The average well-drained soil, of medium to low fertility, will probably require nitrogen fertilizer after a few years of cultivation.

Carbon-Nitrogen Ratio

A C:N ratio of 13 or less is desirable since it indicates greater availability of the nitrogen.

Phosphorus

The soils of the surveyed area contain about the same amount of total phosphorus as those in the Great Plains section of the Prairie Provinces. Limited evidence indicates that applications of phosphatic fertilizer increase the yields and hasten maturity.

Moisture Equivalent

The moisture equivalent percentage of a soil is the amount of moisture it holds at a force of 1000 times gravity expressed as a percentage of the oven-dry weight of the soil.

Permanent Wilting

The permanent wilting percentage of a soil is the amount of moisture it holds at the point when plants wilt expressed as a percentage of the oven-dry weight of the soil. It was determined by the desiccator method of Lehane and Staple (5).

The soil moisture available to plants is calculated by subtracting the permanent wilting percentage from the moisture equivalent percentage. To calculate in inches the available soil moisture the following formula is used:

$$\frac{\text{Moisture equivalent percentage} - \text{permanent wilting percentage} \times \text{depth of soil in inches} \times \text{bulk density}}{100}$$

Conductivity and Total Soluble Salts

The degree to which crop yields are reduced by soluble salts is indicated by the degree of conductivity, as follows:

Conductivity mmhos.	*Effects*
0— 2	No crop is seriously affected.
2— 4	Yields of very sensitive crops may be reduced.
4— 8	Yields of many crops are reduced.
4—16	Only tolerant crops yield satisfactorily.
16+	Only a few very tolerant crops yield satisfactorily.

The Shaneinbaw series is the only soil in the surveyed area with soluble salts in the surface horizons. With conductivities of 12 to 13 mmhos. in the upper foot of soil, this soil is too saline for production of most forage seed and hay crops.

A few other soils with strongly alkaline subsoils were tested for soluble salts, and Table 6 shows that these soil horizons are not sufficiently saline to seriously reduce crop growth. Table 6 also shows that the water-soluble salts in Shaneinbaw soils are mostly sodium sulfate, followed by magnesium and calcium sulfates.

Mechanical Analysis

The texture of most of the soils was determined in the field by the surveyor's hand method. However, two soil profiles were analyzed in the laboratory by the pipette method. Table 7 shows that Champagne clay loam (sampled at Mile 1004) has considerably more clay in the C horizon than in the horizons above. The Ruby series is similar. This is probably due to a gradual change in the character of the sediments during the retreat of Glacial Lake Champagne. The C horizons of the two profiles contain similar amounts of clay.

Table 7.—Mechanical Analyses of Certain Yukon Soils by the Pipette Method

Soil series	Horizon	Depth	Sand 2 to 0.05 mm.	Silt 0.05 to 0.002 mm.	Clay 0.002 mm. and smaller
		Inches	Per cent	Per cent	Per cent
Champagne..................	Bmf	0–10	28.7	45.4	25.9
Mile 1004	Bm	10–20	33.1	28.0	38.9
	C	20+	13.4	38.1	48.5
Ruby........................	Ah	0–4	12.0	53.4	34.6
	Ae	4–5½	7.3	52.4	40.3
	Bm	5½–10	8.2	50.7	41.1
	C	10+	4.3	45.1	50.6

RATINGS OF THE SOILS

The many soils of the Takhini and Dezadeash valleys differ widely in their value for agriculture. Some factors that determine the value are soil texture, moisture-holding capacity, natural fertility, natural structure, natural drainage, permeability, topography and salinity. On the basis of these characteristics the soil series and land types were grouped into four classes, which are defined below. The ratings are listed in Table 8.

Factors such as the cost of clearing, accessibility, the nature of the associated soils and the size or extent of the soil area were not considered in the ratings. In classes 1 and 2 these factors are probably more important than the soil ratings in the selection of land.

Class 1, Good Arable Land

Soils in this class have the best combination of physical and chemical characteristics in the surveyed area. They are fertile, have good soil moisture relationships and are expected to give good yields of all crops suitable to the area.

Class 2, Fair Arable Land

Soils in this class are fair for agricultural development but for general agriculture have some limiting factor, usually in topography, drainage or soil moisture relationships.

Class 3, Poor Arable Land

Soils of this class are poor for agricultural development because of critical limiting factors. They are very droughty, steeply sloping, poorly drained, or subject to flooding. However, they may be useful for gardening or other specialized uses where intensive cultivation, fertilization, irrigation, drainage, erosion control, or combinations of these are possible.

Class 4, Nonarable Land

The soils and land types of this class are not suitable for agricultural development. However, small areas in them may be suitable for gardening.

Table 8.—Ratings of the Soils in the Takhini and Dezadeash Valleys

Soil series or land type	Class 1 Good arable land	Class 2 Fair arable land	Class 3 Poor arable land	Class 4 Nonarable land
	Acres	Acres	Acres	Acres
Aishihik sand, loamy sand and sandy loam				33,400
Alluvium			41,950	
Alsek sand			2,300	
Archibald gravelly clay loam		8,800	3,500	
Auriol silty clay	700			
Bear Creek fine sandy loam		7,200	650	
Bratnober clay loam	1,300	350		
Canyon gravelly sand to sandy loam				29,650
Champagne clay loam to silty clay	83,850	20,750	3,850	
Cracker peaty silt loam to silty clay loam			350	
Croucher complex	14,000	200		
Eroded river-banks				16,200
Haeckel gravelly loamy sand				8,300
Haines gravelly sand to fine sandy loam				4,550
Hard Time silty clay				1,400

Table 8.—Ratings of the Soils in the Takhini and Dezadeash Valleys—*Continued*

Soil series or land type	Class 1 Good arable land	Class 2 Fair arable land	Class 3 Poor arable land	Class 4 Nonarable land
	Acres	Acres	Acres	Acres
Jo-Jo peaty clay loam		2,050		
Klowtaton sandy loam		10,550	6,400	500
Kusawa fine sandy loam		1,050		
Laberge sandy loam			3,100	
Lewes fine sandy loam to loam	4,300	750	100	
Mendenhall loam		2,900		
Mucky peat			100	
Paint peaty silty clay loam		500		
Pine Creek loam to silty clay	4,500	500		
Rivers and lakes				9,900
Rough mountainous land and rock outcrops				4,800
Ruby silty clay loam to silty clay	22,400	4,550	850	
Saline meadows				400
Shaneinbaw silty clay				4,900
Sloughs				7,650
Summit cobbly loam				9,100
Takhini clay	4,000	2,700	200	
Taye loam		350	2,950	
Van Bibber silty clay			8,550	150
Whitehorse sand and loamy sand				29,800
Yukon loamy sand and fine sandy loam		7,150		
Acres in each class	135,050	70,350	74,850	160,800
Percentage of the total of 441,050 acres in the Takhini-Dezadeash valleys	30.6	16.0	17.0	36.4

PROBLEMS IN AGRICULTURAL DEVELOPMENT

The physical problems of agricultural development in the surveyed area are not insurmountable. The economic aspects of development are not discussed. They concern homestead regulations, assistance in land clearing, freight subsidies on settlers' effects, livestock, farm machinery, fertilizer, and the feasibility of importing food from the south. The physical aspects of development are varied. They include land clearing, fertilization, irrigation and water supplies.

Land Clearing

The descriptions and ratings of the soils show the degree of variation in the vegetative cover, soil drainage conditions, stoniness and topography. The desirability of land for agricultural development is affected by these and other factors. The ease of land clearing and preparation depends largely on the density of the vegetative cover. The cost of land clearing is being studied at the Experimental Farm, Mile 1019.

Probably the poorly drained Auriol, Jo-Jo and Mendenhall soils are the easiest to clear and break since their cover is mainly willow and sedges. Of the well-drained soils, Ruby is the most fertile and the easiest to clear. The other well-drained soils have a mixed forest, mainly aspen and white spruce, and would be more costly to clear and break.

Stone removal is not a problem in most soils in the surveyed area. The Archibald series has some stone, and a few small areas in the Champagne series southwest of Champagne have a few large stones on the soil surface.

Plowing should be as shallow as possible on most soils. The upper 4 to 6 inches of soil is the most fertile and should be carefully preserved. The Champagne and Ruby series are calcareous at depths as shallow as 7 inches and sometimes contain soluble salts as well. In plowing poorly drained soils the organic layer should be kept at the surface rather than buried.

Fertilization

Newly broken soils in the surveyed area, particularly the better ones, give reasonably good yields for the first few years. Subsequently fertilizers are required if satisfactory yields are to be obtained. Most of the soils, with the possible exception of the Ruby series, will respond to chemical fertilizers. The well-drained soils need nitrogen and phosphorus, but the poorly drained ones, being high in organic matter and nitrogen, need phosphorous mainly.

At the Experimental Farm, Mile 1019, fertilizer trials have been conducted on Pine Creek loam to silty clay for a number of years. The following recommendations[5] apply in a general way to the soils of the surveyed area:

After damage by frost in early spring, tests showed that plants that had received phosphatic fertilizers recovered rapidly and matured 7 days earlier than normal. Since hastening of maturity is very important in the production of mature grain, because of the short growing season, farmers should apply 100 pounds of ammonium phosphate (11-48-0) fertilizer at the time of seeding.

Furthermore, barnyard manure and commercial fertilizer treatments have resulted in marked increases in oat yields. The residual effect of the manure treatment the second year after application was significantly greater than that of any other treatment. The addition of manure to the soil increased the moisture-holding capacity and the level of plant nutrients available to the crop.

In other tests, the application of ammonium nitrate (33-0-0) fertilizer at 250 pounds per acre to an established pasture mixture of bromegrass, creeping red fescue, western wheatgrass, crested wheatgrass and alfalfa gave the most economical response of all the various fertilizers tested.

Irrigation

Table 3 shows that there is a water deficiency of between 6 and 8 inches in the vegetative period, and this deficiency is based on an assumed soil moisture storage capacity of 4 inches. This value, proposed by Thornthwaite (6), is useful in comparing the climate of different areas. However, the magnitude of the moisture deficiency depends partly on the moisture storage capacity. Another value for available soil moisture has been found (2) better for the soils of the surveyed area.

The average amount of available moisture in the soils of the surveyed area is about 3 inches in the upper two feet of soil (Table 9); each 6-inch layer of soil contains about 0.75 inch of available moisture. A 0.75-inch application of water wets the soil to a depth of 6 inches, one of 1.5 inches to 12 inches, one of 2.2 inches to 18 inches, and so on.

The need for irrigation in the area is shown by a 341 per cent increase in the yield of marketable potatoes from an application of 3.5 inches of water at planting time at the Experimental Farm, Mile 1019.

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[5] Research highlights 1957-58, Experimental Farm, Mile 1019, Alaska Highway, Yukon Territory.

Table 9.—Available Soil Moisture, Expressed as the Accumulated Totals in Inches, for Certain Soils in the Takhini and Dezadeash Valleys

Soil series	Surface texture	Depth of soil, inches					
		6	12	18	24	36	48
Aishihik	LS[1]	0.4	0.8	1.1	1.2	1.5	1.7
Archibald	GCL	0.7	1.4	2.1	2.9	4.3	5.8
Auriol	SiC	0.8	1.6	2.4	3.2	4.9	6.5
Bear Creek	FSL	0.8	1.5	2.3	3.0	4.3	5.7
Bratnober	CL	1.1	1.6	2.3	3.0	4.3	5.6
Champagne, Mile 940	SiC	0.6	1.0	1.7	2.4	3.9	5.4
Champagne, Mile 1004	CL	0.7	1.3	1.8	2.7	4.6	6.5
Jo-Jo	PCL	0.8	1.8	2.8	3.7	5.6	7.5
Lewes	L	0.7	1.3	2.2	3.3	5.5	7.7
Mendenhall	L	0.8	1.3	1.9	2.4	3.5	4.6
Pine Creek	CL	1.5	2.5	3.4	3.9	5.7	7.5
Ruby	SiCL	0.8	1.5	2.1	2.7	3.9	5.1
Takhini	C	0.8	1.5	2.1	2.8	4.2	5.6
Yukon	FSL	1.1	2.0	2.9	3.9	5.7	7.5
Average	....	0.8	1.5	2.2	2.9	4.4	6.0

[1]Symbols: C, clay; F, fine; G, gravelly; L, loam or loamy; P, peaty; S, sand or sandy; Si, silt or silty.

Experimental work in progress at Ottawa[6] indicates that, as long as not more than half of the available soil moisture is used before either rainfall or irrigation, oats and alfalfa will not suffer from lack of moisture. It is therefore recommended that, in the Yukon, irrigation begin in the first week in June for sod crops, in mid-June for cereal crops and in the last week in June for hoed crops. Since an extra inch of rain or of irrigation water delays the drought point by 7 or 8 days (Table 3), one inch of irrigation water should be applied every 7 or 8 days, unless rain falls.

Water Supplies

There are several large rivers in the surveyed area. The Yukon at the eastern end, the Takhini in the eastern half, and the Dezadeash in the western half are suitable sources of water for irrigation. In places the river banks are high. The cost of pumping would be minimized by selecting suitable sites with low river-banks.

Other sources of irrigation water are the tributary streams. The important ones are Bear Creek, Pine Creek, Marshall Creek, Aishihik River, Cracker Creek, Mendenhall River, Stony Creek, Ibex River and Kathleen River. Most of these tributaries are entrenched, but it may be possible to develop low-cost gravity-flow distribution systems from the upper reaches to irrigation areas.

Apart from the main and tributary streams, water is scarce since there are few ponds. Efforts to store water for home and irrigation use would depend on construction of dugouts, although this approach might be unsatisfactory. Borrow-pits along the Alaska Highway, in the Lake Champagne lacustrine clay, do not hold water throughout the summer because in its natural state the clay is permeable. Research might indicate whether the use of plastic liners or puddling the clay in dugouts would be feasible.

Ground water may be tapped for domestic and irrigation use, but little or nothing is known about the ground water resources of the area.

[6]Bourget, S. J., Soil Research Institute, Canada Department of Agriculture, Ottawa, personal communication.

APPENDIX

Table 1.—Acreages of Soil Series and Land Types in the Takhini and Dezadeash Valleys

Soil series or land type	Level, or irregularly gently sloping (0–5 per cent)	Irregularly moderately to strongly sloping (6–15 per cent)	Irregularly very strongly sloping to hilly (16 per cent and over)	Total	Percentage of surveyed area
Aishihik sand, loamy sand and sandy loam	23,300	6,700	3,500	33,500	7.6
Alluvium	40,650	1,300	....	41,950	9.5
Alsek sand	2,000	250	50	2,300	0.5
Archibald gravelly clay loam	8,800	3,450	50	12,300	2.8
Auriol silty clay	700	....	....	700	0.2
Bear Creek fine sandy loam	7,200	500	150	7,850	1.8
Bratnober clay loam	1,300	350	....	1,650	0.4
Canyon gravelly sand to sandy loam	10,650	12,200	6,800	29,650	6.7
Champagne clay loam to silty clay	83,850	20,750	3,850	108,450	24.5
Cracker peaty silt loam to silty clay loam	350	....	....	350	0.1
Croucher complex	14,000	200	....	14,200	3.2
Eroded river-banks	....	....	16,200	16,200	3.7
Haeckel gravelly loamy sand	500	4,300	3,500	8,300	1.9
Haines gravelly sand to fine sandy loam	3,800	250	500	4,550	1.0
Hard Time silty clay	400	1,000	....	1,400	0.3
Jo-Jo peaty clay loam	2,050	....	....	2,050	0.5
Klowtaton sandy loam	10,550	6,400	500	17,450	4.0
Kusawa fine sandy loam	1,000	50	....	1,050	0.2
Laberge sandy loam	3,100	....	....	3,100	0.7
Lewes fine sandy loam to loam	4,300	750	100	5,150	1.2
Mendenhall loam	2,900	....	....	2,900	0.7
Mucky peat	100	....	....	100	
Paint peaty silty clay loam	500	....	....	500	0.1
Pine Creek loam to silty clay	4,500	500	....	5,000	1.1
Rivers and lakes	9,900	....	....	9,900	2.2
Rough mountainous land and rock outcrops	....	....	4,800	4,800	1.1
Ruby silty clay loam to silty clay	22,400	4,550	850	27,800	6.3

Table 1.—Acreages of Soil Series and Land Types in the Takhini and Dezadeash Valleys—*Continued*

Soil series or land type	Level, or irregularly gently sloping (0–5 per cent)	Irregularly moderately to strongly sloping (6–15 per cent)	Irregularly very strongly sloping to hilly (16 per cent and over)	Total	Percentage of surveyed area
Saline meadows	400			400	0.1
Shaneinbaw silty clay	4,900			4,900	1.1
Sloughs	7,650			7,650	1.7
Summit cobbly loam	3,500	5,550	50	9,100	2.1
Takhini clay	4,000	2,700	200	6,900	1.6
Taye loam	350	2,950		3,300	0.7
Van Bibber silty clay	3,550	5,000	150	8,700	2.0
Whitehorse sand and loamy sand	5,800	9,600	14,400	29,800	6.8
Yukon loamy sand and fine sandy loam	7,150			7,150	1.6
Acres in each topographic class, and totals	296,100	89,300	55,650	441,050	100.0

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GLOSSARY

Alkali soil—A soil that has either so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 per cent or higher), or both, that the growth of most crop plants is reduced.

Alluvium—Fine material, such as sand, silt or clay, deposited by streams.

Available nutrients—Plant nutrients in soluble form, i.e., readily available for absorption by plant roots.

Available soil moisture—The soil moisture available to plants. In this report it is the moisture equivalent percentage minus the permanent wilting percentage.

Bedded—In layers or strata.

Boulders—Rock fragments over 2 feet in diameter.

Bulk density—The weight of oven-dry soil (105° C.) divided by its volume at field moisture conditions, expressed in grams per cubic centimeter.

Calcareous material—Material containing a relatively high percentage of calcium carbonate. It visibly effervesces when treated with hydrochloric acid.

Cation exchange capacity—A measure of the absorptive capacity of a soil for cations: the amount of cations that can be absorbed, in milliequivalents per 100 grams of soil. A soil with a fairly high exchange capacity is preferred to one with a low capacity because it retains more plant nutrients and is less subject to leaching or exhaustion.

Cobbles—Rock fragments from 3 to 10 inches in diameter.

Color—Soil colors are measured by comparison with a Munsell color chart. The Munsell system specifies the relative degrees of the three simple variables of color: hue, value, and chroma. For example: 10YR 6/4 is a color of soil with a hue of 10YR, a value of 6, and a chroma of 4.

Colluvium—A deposit of rock fragments and soil material that has slid or fallen to the base of a steep slope.

Complex—An area of two or more soil series that are so intimately mixed that it is impractical to separate them at the scale of mapping used.

Consistence (soil)—The mutual attraction of the particles in a soil mass, or their resistance to separation or deformation. It is described in terms such as loose, soft, friable, firm, hard, sticky, plastic or cemented.

Creep—Mass movement of soil and soil material slowly down steep slopes, primarily by gravity but facilitated by saturation with water and alternate freezing and thawing.

Delta—An alluvial deposit at the mouth of a river emptying into a lake or sea.

Drift—Material of any sort moved from one position to another. The term is most commonly used of material deposited by glacial action. Glacial drift includes unstratified glacial till and stratified glacial outwash materials.

Dunes, parabolic—Deposits of wind-transported material. The best-developed examples are U or V-shaped, and the base or center is leeward of the arms or tails.

Eluvial horizon—A horizon from which material has been removed in solution or water suspension.

Glacial till—An unstratified mixture of stones, sand, silt and clay transported and deposited by glaciers.

Glaciofluvial material—Glacial material carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. These deposits are stratified and may be in the form of outwash plains, deltas, kames, eskers, or kame terraces.

Gley—A soil in which the material has been modified by a reduction process brought about by saturation with water for long periods in the presence of organic matter.

Gravel—Rock fragments from 2 mm. to 3 inches in diameter.

Horizon—A layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil-forming processes. The major organic horizons are defined as follows:

- L An organic layer characterized by the accumulation of organic matter in which the original structures are definable.
- F An organic layer characterized by the accumulation of partly decomposed organic matter in which the original structures are discernible with difficulty.
- H An organic layer characterized by an accumulation of decomposed organic matter in which the original structures are undefinable.

The major mineral horizons are defined as follows:

- A A mineral horizon or horizons formed at or near the surface in the zone of maximum removal of materials in solution and suspension and/or maximum *in situ* accumulation of organic matter. It includes (1) horizons in which organic matter has accumulated as a result of biological activity (Ah); (2) horizons that have been eluviated of clay, iron, aluminum and/or organic matter (Ae); (3) horizons dominated by 1 and 2 above but transitional to the underlying B or C (AB or A and B); (4) horizons markedly disturbed by cultivation or pasturing (Aa).
- B A mineral horizon or horizons characterized by one or more of the following: (1) an illuvial enrichment (exclusive of dolomite or salts more soluble in water) of silicate clay, iron, aluminum, or organic matter (Bt, Bf, Bh, Bfh); (2) a concentration of weathering products believed to have been formed *in situ* (Bt); (3) the removal of dolomite and salts more soluble in water (Bm); (4) an oxidation of sesquioxides that give a conspicuously darker, stronger, or redder color than overlying and/or underlying horizons in the same sequum (Bmf); (5) a prismatic or columnar structure characterized by the presence of exchangeable sodium (Bn).
- C A mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (1) the process of gleying and (2) the accumulation of dolomite and salts more soluble in water (Ck, Cs, Cg, and C).

The mineral horizons described in this report are denoted by the following lower-case suffixes:

- e A horizon characterized by the removal of clay, iron, aluminum or humus. Usually lighter-colored than the layer below.
- f A horizon enriched with hydrated iron.
- g A horizon characterized by reduction and gray colors, often mottled.
- h A horizon enriched with organic matter. It must show at least one Munsell unit of value darker than the horizon immediately below.
- j A horizon whose characteristics are weakly expressed.

k A horizon enriched with carbonate.
m A horizon characterized by the loss of water-soluble materials only.
p A relic (not currently dynamic) horizon (used as a prefix).
s A horizon enriched with salt, including gypsum.
t A horizon enriched with silicate clay.

Litholic changes are indicated by Roman numeral suffixes. If more than one lower-case suffix is required and if one only is a weak expression, then the j is linked to that suffix with a bar, i.e., Bm$\overline{\text{fj}}$. In bisequa profiles the first sequum designations are bracketed.

Horizon boundary—Boundaries vary in distinctness and in surface topography. The distinctness depends partly upon the contrast between the horizons and partly upon the width of the boundary itself. The width of boundaries between soil horizons is described as follows:

abrupt—less than 1 inch wide.

clear—1 to 2 inches wide.

gradual—2½ to 5 inches wide.

diffuse—more than 5 inches wide.

The topography of horizon boundaries is described as follows:
smooth—nearly a plane.
wavy—pockets are wider than deep.
irregular—pockets are deeper than wide.
broken—parts of the horizon are unconnected with other parts.

Illuvial horizon—A horizon that has received material in solution or suspension from some other part of the soil.

Kettle—A closed depression created by the melting of buried or partly buried blocks of ice after sedimentation has ceased.

Lacustrine materials—Materials deposited by or settled out of lake waters and exposed by lowering of the water levels or elevation of land. They usually are varved (layered annual deposits).

Moraine—The unstratified till deposited by a glacier.

Mottles—Irregularly marked spots or streaks, usually yellow or orange, sometimes blue. Mottling indicates poor aeration and lack of good drainage.

Parent material—The unaltered or essentially unaltered mineral material from which the soil profile develops.

Ped—An individual natural soil aggregate.

Permafrost—Permanently frozen material underlying the solum.

Permeability—The ease with which water and air pass through the soil to all parts of the profile. It is described as rapid, moderate or slow.

pH—The intensity of acidity or alkalinity, expressed as the logarithm of the reciprocal of the H^+ ion concentration. With this notation, pH 7 is neutral; lower values indicate acidity, higher values alkalinity.

Porosity—The percentage of the total soil volume not occupied by soil particles.

Potential evapotranspiration—The amount of water that would be transferred from the soil to the atmosphere by evaporation and transpiration if it were constantly freely available.

Profile—A vertical section of a soil through all its horizons and extending into the parent material.

Relief—The elevation or inequalities of the land surface when considered collectively. Minor surface configurations are referred to as microrelief.

Smooth—*See* Horizon boundary and Topography.

Soil reaction—The acidity or alkalinity of soil.

Acid reactions are characterized as follows:

Slightly acid	pH 6.1 to 6.5
Medium acid	pH 5.6 to 6.0
Strongly acid	pH 5.1 to 5.5
Very strongly acid	pH 4.5 to 5.0
Extremely acid	pH below 4.5

Solum—The part of the soil profile that is above the parent material and in which the processes of soil formation are active. It comprises the A and B horizons.

Stones—Rock fragments over 10 inches in diameter. The term *boulder* is sometimes used for fragments over 2 feet in diameter.

Structure—The aggregation of primary soil particles into compound particles, which are separated from adjoining aggregates by surfaces of weakness. Aggregates differ in grade (distinctness) of development and grade is described as structureless (no observable aggregation or no definite orderly arrangement: amorphous if coherent, single-grained if noncoherent), weak, moderate and strong. The aggregates vary in class (size) and are described as very fine, medium, coarse and very coarse. The size classes vary according to the type (shape) of structure. The types of structure mentioned in this report are:

Granular—having more or less rounded aggregates without smooth faces and edges, relatively nonporous.

Platy—having thin, plate-like aggregates with faces mostly horizontal.

Prismatic—having vertical prisms with well-defined faces and angular edges.

Blocky—having block-like aggregates with sharp, angular corners.

Subangular blocky—having block-like aggregates with rounded and flattened faces and rounded corners.

By convention one describes an aggregate in the order of grade, class and type. Two examples of this convention are:

strong medium blocky, moderate coarse granular.

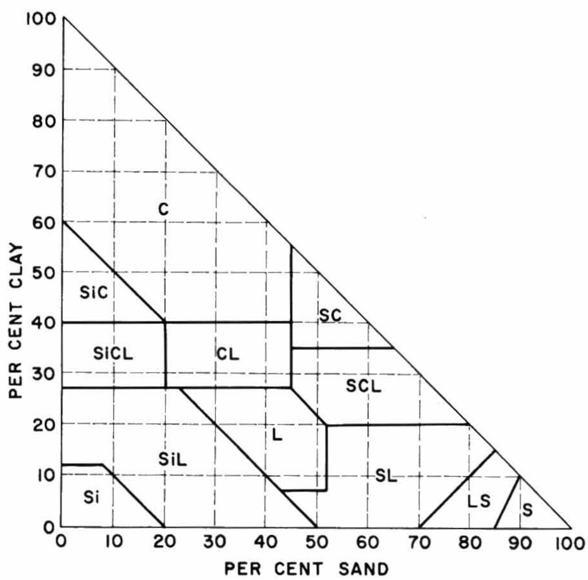

FIGURE 16.—Percentages of clay and sand in the main textural classes of soils; the remainder of each class is silt. See Toogood, J. A., Can. J. Soil. Sci. 38:54-55, 1958. The limits between classes are as in Soil Survey Manual, U.S.D.A. Handbook 18, 1951.

Texture—The percentages of sand, silt and clay in a soil determine its texture. Size groups from 2 mm. to 0.05 mm. in diameter are called sand, those from 0.05 mm. to 0.002 mm. are called silt, and those less than 0.002 mm. in diameter are called clay. Sands are coarse-textured, loams are medium-textured and clays are fine-textured.

Till—See Glacial till.

Topography—In this report, the soil slope may be smooth or irregular and the slope classes are defined as follows:

level or gently sloping—0 to 5 per cent.

moderately to strongly sloping—6 to 15 per cent.

very strongly sloping to hilly—16 per cent and over.

Variant—A soil that differs in one or more respects from a named soil series with which it occurs. It is not of sufficient known extent to warrant separation.

LEGEND

TOPOGRAPHIC CLASSES

Level and gently sloping 0-5%
Moderately and strongly sloping 6-15%
Very strongly sloping and hilly 16%+

OTHER FEATURES

Topographic Boundary
Soil Boundary

Where more than one soil type occurs in one area, percentage figures are used thus: 50

SERIES	Aishihik	Alluvium	Alsek	Archibald	Auriol	Bear Creek	Bratnober	Canyon
TYPE AND SYMBOL	sand, loamy sand and sandy loam	loamy sand to silty clay loam	sand	gravelly grey loam	silty clay	fine sandy loam	clay loam	gravelly sand to sandy loam
	As	A	Ak	Ar	Au	Br	Bt	Cn
SOIL GROUP	Orthic Brown Wooded		Gleyed Regosol	Orthic Brown Wooded	Gleyed Regosol	Orthic Brown Wooded	Orthic Grey Wooded	Orthic Brown Wooded
DRAINAGE	Well drained	Well to very poorly drained	Imperfectly drained	Well drained	Imperfectly drained	Well drained	Well drained	Well to excessively drained
DOMINANT TOPOGRAPHY	Level and irregular gently sloping	Level to hummocky	Irregular gently sloping	Level to irregular gently sloping	Level to irregular very gently sloping	Level to irregular gently sloping	Level to irregular gently sloping	Irregular moderately and strongly sloping
STONINESS	Stone-free	Stone-free	Slight surface stoniness	Slight surface stoniness	Stone-free	Stone-free on the surface	Stone-free	Slight surface stoniness
DESCRIPTION OF VIRGIN SOIL	5 inches of brownish loamy sand over brown fading to grey sand. The parent material is calcareous.	Greyish calcareous alluvium. Occasionally there may be a thin weakly developed brownish surface horizon over grey calcareous alluvium. Soil development is absent or weak, the materials are variable in texture but generally are fine textured and always calcareous.	Light brownish grey sand which grades into non-calcareous sandy parent material over a silty clay horizon.	Thin brown surface horizon underlaid by 12 inches of brown gravelly clay loam over greyish calcareous gravelly clay loam glacial till.	5 to 10 inches of greyish brown silty clay over a thin layer of very dark brown silty clay over greyish brown silty clay which is calcareous.	5 to 12 inches of brown fine sandy loam over greyish gritty clay loam till which is calcareous.	A thin brown surface horizon over a pale brown platy clay loam, which is underlaid by a dark yellowish brown blocky silty clay over friable bedded calcareous silty clay parent material.	6 to 12 inches of brownish gravelly sand to sandy loam over gravel.

Soil information by the Soil Research Institute, Research Branch, Canada Department of Agriculture, Ottawa.

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