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Soil Survey

OF THE

CRESTON AREA

BY

U. Wittneben and P. N. Sprout

Interim Report

OF THE

CRESTON VALLEY SOIL SURVEY

Map Reference
SOIL MAP OF THE CRESTON FLATS
Scale 1" = 2,640 feet

British Columbia Department of Agriculture
KELOWNA, BRITISH COLUMBIA
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ACKNOWLEDGEMENT

Soil mapping and classification in the Creston Flats area was undertaken by the Soils Division, British Columbia Department of Agriculture. The Air Surveys and Mapping Branch of the British Columbia Department of Lands, Forests and Water Resources, supplied the air photos as well as the required base maps and developed the autopositives from which prints of the soil map were taken.

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HOW TO USE A SOIL SURVEY MAP AND REPORT

A long-time farmer in a locality knows the soil variations on his and neighbouring farms. However, unless he can refer to a soil map and report, he cannot compare his soils with those on experimental stations and in other parts of the district where, perhaps, higher yields than his are reported. Regional similarities and differences among soils are evident after a soil map has been made. New techniques proven successful on a soil may then be transferred to the same or similar soils elsewhere, with least chance of failure.

To determine the kinds of soil on a farm or other land, locate the area on the soil map. Physical features such as rivers, lakes, roads, railways, towns and section numbers are shown to assist in location. Each kind of soil on the map is identified by a distinctive symbol. To find the name of the soil so marked, refer to the map legend and then enter the soil survey report for a description of the soil, including its land use and limitations.

When studying the soil descriptions note that soil separations are based on characteristics to a depth of two or more feet, not on surface soil character alone. Although several soils may have similar surfaces, subsoil characteristics can vary widely.

SCHEME OF WORK

Soil scientists made this survey to understand and record what kinds of soils exist in the Creston area, and where they are located.

The soils were mapped in detail at a scale of about 3,000 feet to the inch. Aerial photographs were used as field sheets and classification data was plotted on them. The soils were classified according to the system of the National Soil Survey Committee of Canada, 1968.

Numerous test pits, road cuts and other excavations were used to examine, classify and describe soil profiles and to sample them for laboratory analysis. The soils were examined to determine soil parent material, texture, structure, consistence, permeability, drainage, colour, horizon sequence and other observable features. Vegetation, stoniness, topography, agricultural practices and other external features were also noted. The Munsell Colour system was used to identify soil colours. Soil boundaries were established by bisecting them on roads, ditches, fence lines and by numerous traverses across fields.

Often soils are so intimately mixed that it was not practical to show them as discreet units on a map. These mapping units are shown as series complexes indicating (including percentage of each) the major kinds of soil series within such mapping units.

The soil boundaries were delineated on aerial photographs and transferred to a base map. The information from field work and photo-interpretation was then used to make the soil map. Using this soil map as a base, maps for different purposes may be developed, e.g. land capability maps for agriculture and forestry.

GENERAL DESCRIPTION OF THE AREA

Location and Extent

The Creston Valley area is located in south-eastern British Columbia, wholly within National Topographic Series Sheet 82F/SE, and adjoins the International Boundary. The area falls exclusively within the Purcell Trench south of Kootenay Lake at elevations below 2,500 feet, extending about 15 miles lengthwise and 4 to 6 miles in width, and containing approximately 90 square miles or nearly 57,000 acres.

The area lies in an intermountain valley drained by the Kootenay River and its tributaries. The Kootenay River enters from the south and flows in a north-westerly direction into Kootenay Lake. The Goat River flowing from the Purcell mountains enters the Kootenay system south of Creston. Boundary, Corn and Summit Creeks are the major streams entering the valley from the Selkirk mountains on the west and Duck Creek from the Purcell mountains on the east.

Slightly over half of the Creston Flats have been reclaimed through various dyking schemes. All undyked lands are annually inundated and during excessive spring run-offs the reclaimed lands have in this part suffered from periodic flooding. The remainder of the land is benchland which is well above the effects of the Kootenay River.

Kootenay Lake lies on the northwest edge of the area. Duck and Leach lakes are two small lakes near the outlet of Kootenay River into Kootenay Lake.

CRESTON AND ENVIRONS - CLIMATE

The climate of the Creston area is moderate. Summers are warm and winters cool but not cold with light to moderate precipitation.

The surrounding mountainous topography oriented northwest to southeast is found at right angles to the Pacific air masses that move eastward across the region. As a result the local climate is highly variable with rapid changes in day to day weather throughout the year. General climate is somewhat anomalous in B.C. with the summer warmth of the Okanagan (hence the fruit trees at Creston) and the precipitation pattern of the East Kootenays.

During the winter the Kootenay Valley at Creston is occasionally invaded by polar air which infiltrates southward through the Duncan and Lardeau valleys. These outbreaks are accompanied by the low extreme minimum temperatures of -24 to -27°F, very close to the lethal limit for fruit trees. Fortunately these temperatures do not persist for more than 2 or 3 days.

TEMPERATURE:

Associated with the topography, wind and precipitation patterns, temperature distribution is highly variable.

Local frost pockets are found on the Creston Flats and up on the benches in the vicinity of Erickson, Canyon, Lister and environs. Local air movement from the Goat River tends to destroy some of the frost pocket formations during critical prriods of low temperature.

Average annual temperature at Creston is 45°F with extremes of 103° to -27°F over a 10 year period. There are 3,025 and 2,800 growing degree days at Creston and West Creston, respectively, with an average frost free period of 132 days at Creston. See tables 1 and 2 and Figure 1 for annual distribution of temperature for the Creston station.

TABLE 1 CRESTON

LONG-TERM WEEKLY MEANS OF DAILY MAXIMUM AND MINIMUM TEMPERATURES AND AVERAGE WEEKLY PRECIPITATION AND PE TOTALS

WEEK BEGINNING Month	Day	MEAN MAX.	MEAN MIN.	PRECIPITATION	PE
1	1	31.8	19.4	0.6	0.0
1	8	31.0	18.1	0.6	0.0
1	15	30.5	16.9	0.6	0.0
1	22	30.8	16.4	0.6	0.0
1	29	31.9	16.8	0.5	0.0
2	5	33.6	17.8	0.4	0.0
2	12	35.4	19.2	0.4	0.0
2	19	37.5	20.8	0.4	0.0
2	26	39.5	22.4	0.3	0.0
3	5	41.8	24.0	0.3	0.0
3	12	44.5	26.0	0.3	0.0
3	19	47.3	27.9	0.3	0.1
3	26	50.2	29.6	0.3	0.2
4	2	53.4	31.3	0.3	0.3
4	9	56.7	33.1	0.2	0.4
4	16	59.3	34.7	0.2	0.5
4	23	61.3	36.1	0.2	0.5
4	30	63.4	37.5	0.2	0.6
5	7	65.6	39.2	0.3	0.7
5	14	67.7	41.1	0.3	0.7
5	21	69.4	42.9	0.3	0.8
5	28	70.6	44.5	0.4	0.8
6	4	71.4	45.8	0.4	0.9
6	11	72.2	46.8	0.5	0.9
6	18	73.5	47.5	0.4	0.9
6	25	75.6	48.3	0.3	1.0
7	2	78.6	49.6	0.2	1.1
7	9	81.6	50.9	0.2	1.2
7	16	83.6	51.6	0.2	1.3
7	23	83.8	51.4	0.2	1.3
7	30	83.1	50.6	0.2	1.2
8	6	82.2	49.8	0.2	1.1
8	13	80.8	49.0	0.2	1.1
8	20	78.6	48.1	0.3	0.9
8	27	76.2	46.8	0.3	0.8
9	3	73.8	45.3	0.3	0.7
9	10	71.0	43.3	0.3	0.6
9	17	67.8	41.2	0.3	0.5
9	24	64.6	39.2	0.3	0.3

TABLE 1 cont'd.

WEEK BEGINNING		MEAN MAX.	MEAN MIN.	PRECIPITATION	PE
Month	Day				
10	1	61.5	37.4	0.3	0.2
10	8	58.2	35.8	0.3	0.1
10	15	54.5	34.1	0.4	0.1
10	22	50.5	32.2	0.5	0.0
10	29	46.3	30.1	0.5	0.0
11	5	42.8	28.2	0.5	0.0
11	12	40.2	26.8	0.6	0.0
11	19	38.5	25.8	0.6	0.0
11	26	37.0	24.8	0.5	0.0
12	3	35.5	23.6	0.5	0.0
12	10	34.4	22.5	0.5	0.0
12	17	33.6	21.7	0.6	0.0
12	24	32.7	20.7	0.6	0.0

TABLE 2 CRESTON

LONG-TERM MONTHLY AND ANNUAL MEANS OF MAXIMUM AND MINIMUM TEMPERATURES AND MONTHLY AND ANNUAL TOTALS OF PRECIPITATION AND PE

MONTH	MEAN MAX.	MEAN MIN.	PRECIPITATION	PE
JANUARY	30.7	17.3	2.4	0.0
FEBRUARY	35.5	19.2	1.7	0.0
MARCH	44.7	26.2	1.3	0.2
APRIL	57.8	33.8	1.0	1.7
MAY	67.5	40.8	1.2	3.3
JUNE	72.4	46.8	1.9	3.9
JULY	82.4	51.1	0.8	5.6
AUGUST	80.3	48.9	1.0	4.6
SEPTEMBER	70.0	42.6	1.1	2.3
OCTOBER	55.4	34.6	1.8	0.4
NOVEMBER	40.2	26.7	2.2	0.0
DECEMBER	34.1	22.4	2.6	0.0
YEAR	55.9	34.2	18.9	22.0

FIGURE 1 CRESTON

MAXIMUM, MINIMUM AND MEAN DAILY TEMPERATURES

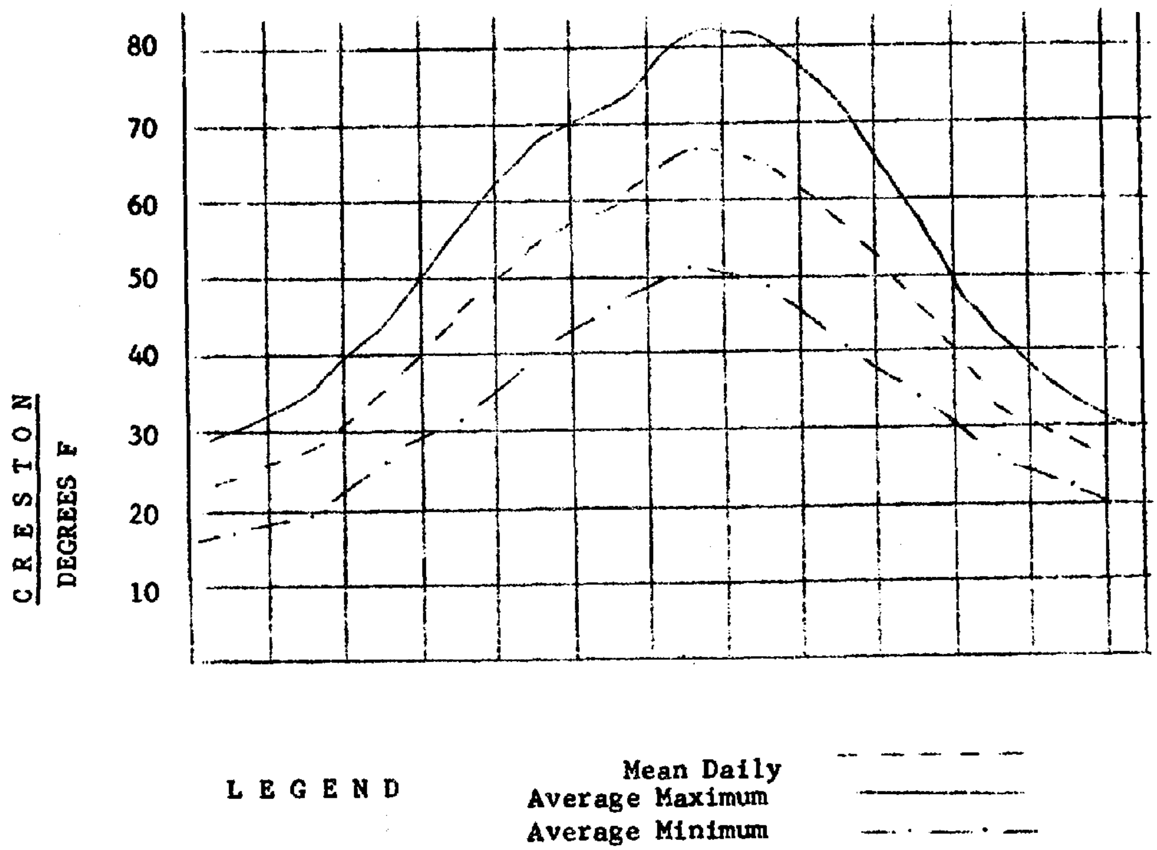


TABLE 3

LAST SPRING AND FIRST FALL DATE OF OCCURENCE: MINIMUM TEMPERATURES OF 26, 28, 30, 32, 34, 36, (°F)

FOR PROBABILITY 50% - 10%

CRESTON (35 Years)

SPRING
Last Occurrence (°F)

		<26	<28	<30	<32	<34	<36
	SE	2.6	2.7	2.3	2.4	2.2	2.2
Mean	50%	Apr 8	Apr 18	Apr 29	May 14	May 24	May 25
	40%	Apr 12	Apr 22	May 2	May 17	May 27	May 28
	30%	Apr 15	Apr 26	May 6	May 20	May 30	Jun 1
	20%	Apr 21	May 2	May 11	May 25	Jun 3	Jun 6
	10%	Apr 27	May 8	May 16	May 31	Jun 8	Jun 12

CRESTON (35 Years)

FALL
First Occurrence (°F)

		<36	<34	<32	<30	<28	<26
	SE	2.6	2.7	2.7	2.8	3.0	3.3
Mean	50%	Sep 14	Sep 22	Sep 29	Oct 7	Oct 17	Oct 25
	40%	Sep 10	Sep 18	Sep 25	Oct 3	Oct 13	Oct 20
	30%	Sep 6	Sep 14	Sep 21	Sep 29	Oct 8	Oct 15
	20%	Sep 1	Sep 8	Sep 16	Sep 23	Oct 2	Oct 8
	10%	Aug 25	Sep 1	Sep 9	Sep 16	Sep 25	Sep 30

MINIMUM PERIOD (DAYS) BETWEEN LAST SPRING AND FIRST FALL OCCURRENCE

FOR 50% - 90% PROBABILITY LEVELS

	<26	<28	<30	<32	<34	<36
50%	200	182	161	138	121	112
60%	191	174	154	131	114	104
70%	183	165	146	124	107	97
80%	170	153	135	114	97	87
87%	163	146	129	107	91	80
90%	156	140	123	101	85	74

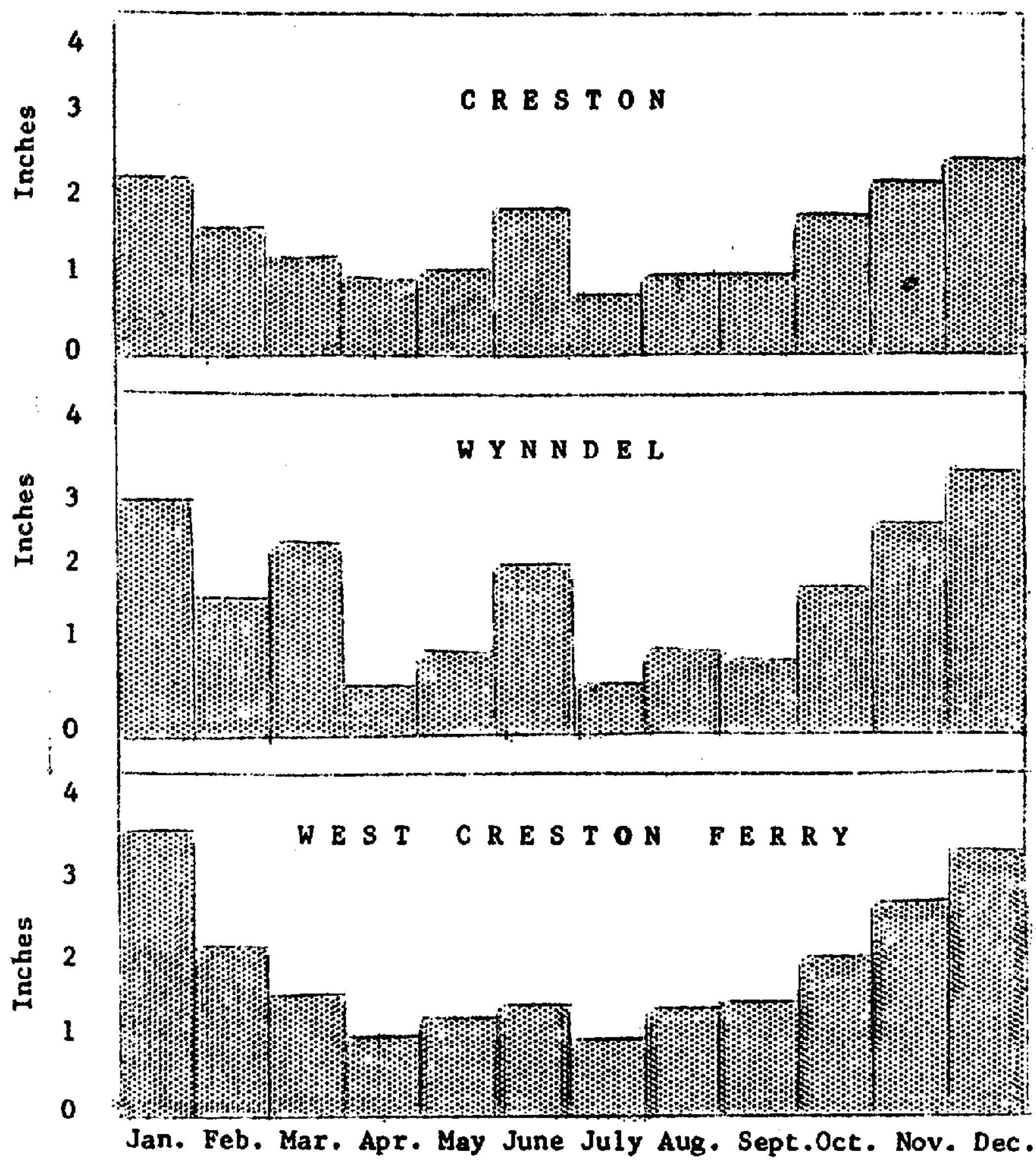
For 36° Shortest Period 1935 - 35 Days
34° Shortest Period 1937 - 70 Days
32° Shortest Period 1933 - 81 Days
30° Shortest Period 1933 - 107 Days
28° Shortest Period 1934 - 122 Days
26° Shortest Period 1946 - 134 Days

For 36° Longest Period 1967 - 156 Days
34° Longest Period 1958 - 173 Days
32° Longest Period 1962 - 211 Days
30° Longest Period 1962 - 224 Days
28° Longest Period 1965 - 242 Days
26° Longest Period 1963 - 257 Days

Elevation: 2085'
Note: This station is not representative of the Kootenay Valley at Creston.

FIGURE 2

AVERAGE MONTHLY PRECIPITATION FOR THREE CRESTON VALLEY STATIONS



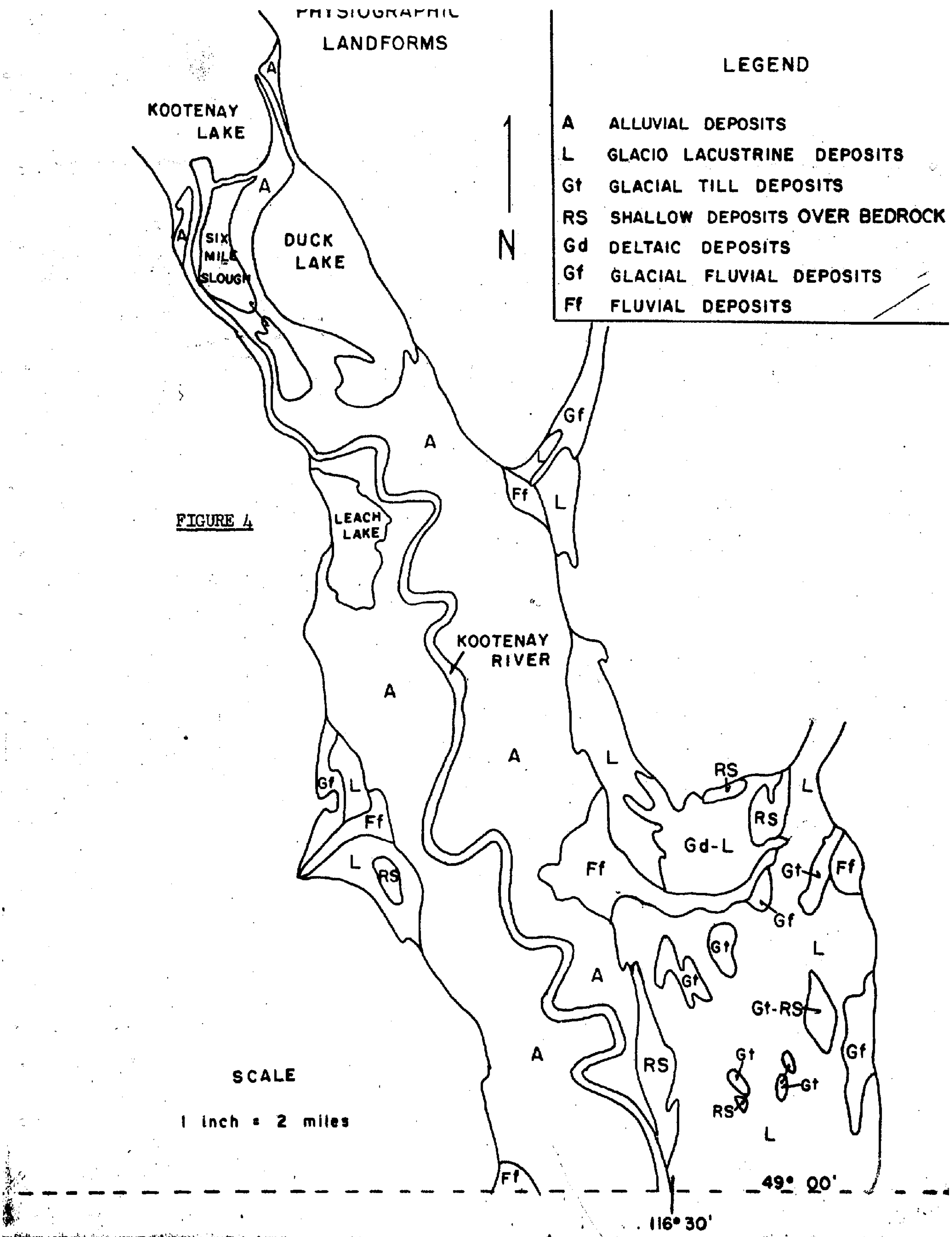
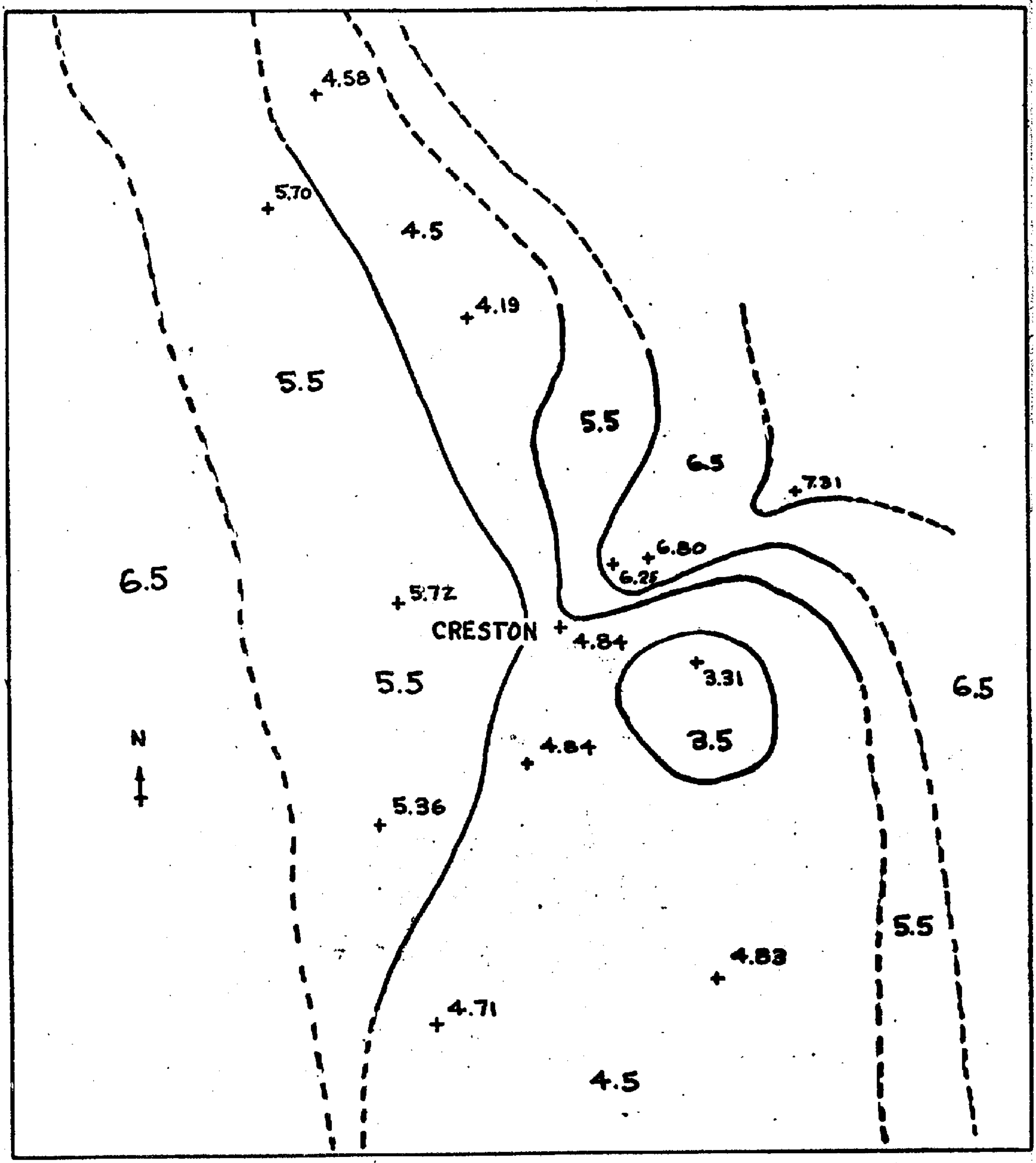

PHYSIOGRAPHIC
LANDFORMS
LEGEND
A ALLUVIAL DEPOSITS
L GLACIO LACUSTRINE DEPOSITS
Gt GLACIAL TILL DEPOSITS
RS SHALLOW DEPOSITS OVER BEDROCK
Gd DELTAIC DEPOSITS
Gf GLACIAL FLUVIAL DEPOSITS
Ff FLUVIAL DEPOSITS
N
KOOTENAY LAKE
SIX MILE SLOUGH
DUCK LAKE
LEACH LAKE
KOOTENAY RIVER
A
L
Gf
Ff
RS
Gt
Gd-L
Gt-RS
SCALE
1 inch = 2 miles
49° 00'
116° 30'

FIGURE 4



CLIMATOLOGY SECTOR
CANADA LAND INVENTORY

Estimated May - August PPT. (inches)
(30 yr. average)
N.T.S. Sheet 83F/SE
Scale: 1 inch = 2 miles

Figure 3

The average length of growing season is 214 days, with 199 days on the Creston Flats. See Table 3 for probability levels of spring and fall frosts occurrence at Creston.

The flow of radiatively cooled cold air results in a mosaic of temperature patterns.

PRECIPITATION:

Average weekly and monthly precipitation and potential evapotranspiration is given in tables 1 and 2 for Creston, West Creston Ferry and Wynndel in Figure 2. A mixture of orographic, convective and cold low precipitation results in a variety of distribution patterns. (See Figure 3 for a map showing summer season precipitation aereal distribution.) Snowfall is low to moderate in the valley bottom while on the adjacent mountains it is heavy. Creston has an average yearly snowfall of 56 inches while on the Salmo - Creston Skyway amounts in excess of 640* inches have been recorded.

Moisture on some of the lighter textured soils on the benchland is limiting during the growing season, while on the Creston Flats sub-irrigation alleviates most of this problem.

ORIGIN OF SOIL FORMING DEPOSITS

Principal Soil Parent Materials of the Creston Valley

(1) Alluvial Deposits
(2) Glacio-Lacustrine Deposits
(3) Glacial Till Deposits
(4) Deltaic Deposits
(5) Glacial Fluvial Deposits
(6) Fluvial Depsoits
(7) Shallow Deposits over Bedrock

ALLUVIAL DEPOSITS

The alluvial lowlands in the Creston Valley south of Kootenay Lake were formed by repeated action of river flooding. Kootenay Lake, in early times (i.e. immediately following ice retreat) extended further

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* winter of 1970-71 - B. C. Department of Highways

south than presently. The Kootenay River floodplain gradually grew through continuous deposition of material into this water body. The alluvial sediments were then deposited during annual spring floods. Medium silt to coarse sand deposits formed natural levees adjacent to the river, while the finer sediments are carried across the levee depositing only in quiet backwater swamps and temporary lakes. This type of flooding is clearly evident by the large areas of uniform textured deposits. Texture variations do occur but are restricted to abandoned channel areas, and stream entrances from the adjacent mountains. These deposits vary 20 feet in elevation from a low of 1,744 feet to a high of 1,764 feet.

GLACIO LACUSTRINE DEPOSITS

The lacustrine deposits occur on the higher bench lands up to approximately 2,400 feet in elevation. The origin of this deposit occurred during the melting stages of the last ice retreat. The main valley bottom probably contained the glacier for the longest period of time. The ice prevented or blocked the normal drainage system, impounding meltwaters between the glacier and the highlands. Into these temporary basins the meltwater streams discharged sediment. During spring and summer most of the melting occurs, resulting in greater movement and deposition of coarser sized particles while during times of less turbulent water find clay sized particles settled to the bottom. This process results in a layering effect (called varves) common in many lacustrine deposits. The stones and boulders found in these deposits were carried in by ice probably during the freshet season. The topography reflects the underlying relief only when the lacustrine deposit becomes shallow.

GLACIAL TILL

Glacial till deposits appear to underlie the glaciolacustrine areas and only occur on protruding knolls or in areas where the lacustrine sediments had been completely eroded away.

The origin of glacial till takes place during active ice movement. Glaciers slowly creep over the land abrading and quarrying bedrock and plastering or filling in hollows over which it passes. Basically the glacier acts as a land leveller by scraping off high spots and filling in low pockets. This process takes place with relatively little water action resulting in a characteristic unsorted material termed till. Till composition varies from region to region and valley to valley but usually localized areas tend to be fairly uniform. Its composition often reflects local bedrock but is greatly influenced by the distance which the glacier has moved. Thus, large broad valleys will contain tills that include material from local and distant sources.

DELTAIC DEPOSITS

Deltaic deposits in this map area are found in conjunction with the Goat River drainage system. Their formation is directly affected by stream action and is an extension of stream-bed deposition. Deposition always occurs beneath the surface of the water. Upon entering a body of water, a heavily loaded stream begins to reduce its load through sedimentation. Thus the same lake which existed for the formation of lacustrine deposits could serve for deltaic deposits where streams enter from the highlands (i.e. Goat River). Deltaic deposits generally exhibit a slight slope away from the source of water; they are well sorted and often display cross-bedding.

GLACIAL FLUVIAL DEPOSITS

Glacial fluvial landforms occur in relatively minor acreages in this report area. Heavily loaded glacial meltwater streams in constricting channels can carry tremendous loads of material. When this type of stream enters a broad slow-moving region its load is dropped. These deposits are usually well sorted gravel and sand, horizontally bedded. Topography is often level but may be moderately to steeply sloping depending on deposition and recent erosion.

FLUVIAL FANS

Fluvial fans are formed by the action of heavily loaded flood water. As the fast flowing streams enter a relatively flat area, considerable deposition occurs (usually coarse materials). Branching or fanning of materials results because one specific area cannot continue to receive deposition without eventually diverting the stream. The process results in gently to moderately sloping fan-shaped deposits with the apex at the entrance of the stream and the apron-like border merging into the surrounding flatter terrain. Fans around Creston are small in size and are coarse textured. The coarser fragments are more common at the apex of the fan while finer particles occur along the apron edges.

DESCRIPTION OF SOILS

Soils of the Alluvial Deposits

Soil development of this parent material is dominated by those of the Gleysolic and Regosolic [1] Orders.

1. See soil classification section in Appendix.

Gleyed soils are associated with wetness and have developed in the presence of a high fluctuating water table. Regosolic soils associated with Gleysolic soils have no horizon development and generally occupy the higher dryer levees. The following 14 series have been mapped on the alluvial deposits of the Kootenay River Floodplain.[1]

ACORN SERIES

The Acorn series occurs exclusively in the southern part of the Creston River flats. Elevations range from 1,746' to 1,750' with flat to very gently sloping topography of less than five percent gradients. Soils of this series are slightly depressional in relation to the surrounding soils. 382 acres of Acorn series were mapped.

The parent material of Acorn soils consists of uniform medium textured sediments from the Kootenay River. These soils are stone-free and textures vary from silt loam and silty clay loam in the surface horizons, changing to fine sandy loam at depth. The dark coloured surface horizon reflects the high organic matter content of former shallow peat bogs.

The Acorn soil series is classified as a Rego Humic Gleysol.

These soils are poorly to very poorly drained. Water tables will rise above the surface during periods of very high river levels.

All of the Acorn soils are presently under cultivation.

KUSKANOOK

The Kuskanook Series comprises one of the major soils on the alluvial lowlands. Elevations range from 1,750 to 1,760 feet above sea level and the topography is generally flat to gently sloping with slopes generally less than 2.5%. A total of 3,248 acres of Kuskanook series and 4,725 acres of Kuskanook soil complexes were classified.

The soil forming material is a mantle greater than 500 feet thick of alluvium. The deposits are soft and quite permeable. Surface texture ranges from silty clay loam to silt loam, while the subsoil texture is clay loam.

Kuskanook soils are moderately poorly to poorly drained. External drainage is slow. Internal drainage is moderately poor in the surface but poor in the subsoil due primarily to a perched water table as

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1. See Appendix for detailed soil descriptions.

evidenced by strong mottling and gleying.

Prior to dyking and clearing of the land, the native vegetation was cottonwood, willow, sedge, grasses, and bullrushes. The Kuskanook series is classified as a carbonated Orthic Gleysol. Profile development consists of a plow layer (Ap) with weak A and (Bg) horizons.

CORY

Cory soils occur in conjunction with Kuskanook series generally in the central and northern portion of the map sheet. The Cory series occupies exclusively the lowest depressions. Slopes are nearly level to gently undulating with gradients ranging from 0 - 2%.

These soils have developed from alluvial materials similar to those forming the parent material of the Kuskanook series. The parent material generally consists of alluvial fine textured silty clay loam. Surface and subsurface textures are silty clay and sandy loam respectively. Root penetration throughout the solum is good.

This soil is generally poorly to very poorly drained; mottling occurs right below the plow layer. Often a groundwater table is present at 6 inches from the surface. Lime is generally found throughout the profile. This soil has been classified as a Carbonated Orthic Gleysol.

The native vegetation consists of marshes and reeds in the bottom of the depressions, and lime and salt tolerant grasses around the periphery.

A total of 867 acres of Cory series and 1,314 acres of Cory complex were mapped.

HALL

The Hall series occupies small areas near the western edge of the floodplain. Elevation ranges from 1,744 to 1,750 feet.

The parent material consists of loamy sands over medium sand. Drainage is poor to very poor as Hall soils occur in very low depressional positions. High water tables in the early part of the growing season are a problem on this series. Topography is very gently sloping.

All Hall series mapped are presently dyked and under cultivation. Free lime is not present on this series.

The Hall series is classified as Rego Gleysol and a typical profile is described in the appendix. A total of 226 acres of Hall series were mapped.

SHAW

Shaw soils are dominant throughout the undyked area especially along the western edge of the Creston Flats. The topography ranges from nearly level to undulating with slopes in the range from 0 - 5%.

The parent material consists of a variable depth of alluvial silt loam overlying fine sand.

Shaw soils are very poorly drained, and during seasons of high floods of the Kootenay River they are completely inundated. This situation persists for a period of two to three months and generally occurs near the end of May to the middle of June.

Soil profile development is Rego Gleysol mainly due to the very poor drainage and periodic flooding. The present vegetative cover is composed of a variety of grasses and sedges.

A total of 164 acres of Shaw series and 1,756 acres of Shaw complex were mapped.

ALICE

Alice soils occupy a substantial acreage in the Kootenay River floodplain adjacent to former and present river channels. This soil series, often in conjunction with the Simmons series, occurs in the lowest elevations which range between 1,745 and 1,755 feet above sea level. Topography usually varies from depressional to level to gently sloping with slopes from 0 - 5%.

The parent material consists of medium to coarse textured alluvial deposits. Generally these are fine loamy sands with occasional fine sand. Interspersed throughout the solum and parent material are finer textured lenses of silt loam. Lime is almost always present throughout. Surficial and internal drainage is poor often due to the presence of groundwater within 6 inches of the surface.

The Alice series is classified as a carbonated Rego Gleysol.

The macro-vegetative cover consists of cottonwoods while grasses and sedges dominate the understory.

A typical profile is described in the appendix. A total of 907 acres of Alice series and 1,092 acres of Alice complex were mapped.

BUCKWORTH

The Buckworth series occupies scattered locations throughout the floodplain. The topography is very gently undulating. Elevation ranges between 1,750 and 1.760 feet.

The parent material for Buckworth soils consists of a coarse textured subsoil covered by a variable thickness of medium texutred sediment. Surface textures are silt loam with loamy fine sand to fine sand beneath and often grading to layers of medium sand at depth.

The original vegetation has completely been removed by cultivation.

Buckworth soils are poorly drained. Internal drainage is slow despite the coarse texture because of the high water table.

The Buckworth series is classified as a Rego Gleysol and a typical Buckworth soil profile is described in the appendix. A total of 720 acres of Buckworth series and 1,059 of Buckworth complex were mapped.

LEACH

The Leach series occupies a major portion of the undyked sections of the Alluvial floodplain. Elevations range between 1,750 and 1,755 feet above sea level. Topography is very gently sloping to level.

The parent material is composed of medium textured deposits from the Kootenay River. Variable thicknesses of partially decomposed organic matter are interstratified with the silty loam mineral matrix. Surficial and internal drainage is very poor, and the Leach series is often inundated dor long periods during the growing season. Vegetation consists of sedges and grasses typically found in marshy alnd.

The Leach series is classified as a Carbonated Rego Gleysol. A typical description can be found in the appendix. A total of 1,285 acres of Leach series and 90 acres of Leach complex were mapped.

SIMMONS

The Simmons series occupies scattered depressional areas of the dyked floodplain, and are often found in conjunction with Kuskanook soils. Elevations range from 1,745 to 1,755 feet.

The parent material of Simmons soils consists of medium to moderately fine textured deposits from the Kootenay River. These deposits have very slightly undulating to nearly level topography.

Textures vary from fine sandy loam to silty clay loam. Simmons soils are poorly drained due to high water tables. Surface and internal drainage is slow. Short periods of inundation may occur periodically during the early part of the growing season. The original vegetation consisted of species typical of marshy wetland areas. Most Simmons soils are presently dyked and under cultivation.

Simmons soils show weak profile development and are classified as Carbonated Rego Gleysols. A typical profile description sampled in the central floodplain region can be found in the appendix. A total of 750 acres of Simmons series and 1,202 acres of Simmons complexes were mapped.

NICKS

Nicks soils occupy a minor acreage. They are only found on Nicks Island and in the area north-east towards Wynndel. Topographically they range from gently undulating to undulating with slope gradients between .5 and 5%.

The parent material of Nicks soils consists of silty clay loam to clay loam textured alluvial deposits.

Nicks soils are closely allied with Kuskanook soils and exhibit properties of eluviation and illuviation. They are thus classified as Low Humic Eluviated Gleysol while soils of the Kuskanook series were classified as Carbonated Orthic Gleysol.

Surficial and internal drainage is moderately poor and poor respectively due to the fine textured alluvial parent material. The original deciduous vegetation has completely been removed. Present vegetation in uncultivated areas consists of various species of grasses. However, the largest proportion of Nicks soils are under cultivation and planted to alfalfa. A typical profile description can be found in the appendix. Altogether, 32 acres of Nicks series and 522 acres of Nicks complex were mapped.

SIRDAR

The Sirdar series occupies small acreages in the report area, mostly between elevations of 1,750 and 1,760 feet. Sirdar soils are closely associated with the Kootenay River levees and occur mainly in the southern part of the map area.

Occupying the best drained positions on the natural river levees, Sirdar soils have developed on materials deposited from over-the-bank type of flooding which has occurred intermittently in the past. Surface textures are coarse, often loamy sand to fine sand and overlie stratified fine sandy loam. Topography is very gently sloping, generally away from the river. The profile is calcareous throughout.

Sirdar soils are moderately well drained and exhibit faint mottling below 2 feet from the surface. High water tables within this soil are rare and would only occur during extremely high river levels.

The native vegetation is deciduous and consists of aspen, cottonwood, willow and related undergrowth associated with river bottoms.

The Sirdar series is classified as an Orthic Regosol (calcareous). A typical profile description is outlined in the appendix. A total of 297 acres of Sirdar Series and 1,976 of Sirdar complex were mapped.

BENNY

Benny soils occur along the banks of the present and old Kootenay River channels at elevations of 1,750 feet to 1,760 feet above sea level. The topography consists of a gentle slope away from the river bank of up to five percent. A total of 3,791 acres of Benny series and 2,421 of Benny complex were mapped.

These soils have developed from friable and permeable loamy alluvial deposits. Surface textures are fine sandy loam grading to silt-loam in the subsoil and silty clay in the parent material. The soil is friable and easily penetrated by roots.

Benny soils are imperfectly drained. Surface drainage is moderately well while internal drainage is slow due primarily to the slightly finer textured parent material.

The native vegetation is cottonwood and willow with an understory of deciduous shrubs, grasses and forbes. However, much of this land is now under cultivation.

Benny soils are classified as Gleyed Orthic Regosols. Profile development consists mainly of a cultivated (Ap) horizon underlain by the gleyed and mottled parent material (Cg). A typical profile, located on the levee of the Kootenay River near Wynndel, is described in the appendix.

RYKERTS

Rykerts soils occupy some levee areas within the alluvial plain of the map sheet. Elevations range from 1,750 to 1,760 feet above sea level. The topography generally has a gentle slope away from the stream of 1 to 3 percent. A small acreage of Rykerts soils was mapped, totalling 428 acres of Rykerts series and 123 acres of Rykerts complex.

These soils have developed from loose, very permeable fine sandy levee deposits. Surface textures are loamy fine sand grading to fine sandy loam in the parent material. The soil is calcareous.

Rykerts soils are imperfectly drained due to a high water table during the growing season. Surface drainage is good although internal drainage is restricted while the water table is high.

Prior to dyking and clearing for the growth of such agricultural crops as grain, legumes and potatoes, the natural vegetation consisted of cottonwoods, willows and grasses.

Rykerts soils are classified as Gleyed Orthic Regosol (calcareous). The soil profile consists mainly of a weakly developed surface (Ap) horizon and the mottled parent material (Cg). A typical profile, located on the Duck Creek levee near Wynndel, is described in the appendix.

SANKA

Sanka soils occupy small areas on the Goat River alluvial fan and the Boundary Creek and Corn Creek alluvial fans, mainly between 1,748 and 1,770 feet elevations. A total of 879 acres of the Sanka series and 246 acres of Sanka complex were mapped.

These soils have developed on coarse textured, loose, permeable parent materials. Soil textures are loamy fine sand with some stones occurring in the lower part of the solum. The soil is friable and easily penetrated by roots.

Sanka soils are rapidly drained in most areas. The map units contain some low areas which are poorly drained due to a high water table. Surface drainage is good with internal drainage good to rapid except in the depressions.

The native vegetation consists of cedar and cottonwood, with grass forming the major component of the understory.

Sanka soils are classified as Orthic Regosols. The soil profile is composed of a shallow surface horizon (Ah or Ap) which grades clearly to the parent material. A typical profile, located just west of Creston on the Goat River fan, is described in the appendix.

SOILS OF THE GLACIO - LACUSTRINE PARENT MATERIALS

The benchlands adjacent to the Kootenay River flats are composed of lacustrine soil parent materials. The dominant soil development on the finer textured clayey parent material is Gray Wooded, while on coarser textures such as silt and silt loam it is Brunisolic. All together four series have been mapped on glacio-lacustrine deposits.

CRESTON

The Creston series occurs immediately east and in Creston, south towards Rykerts and in small pockets in the Wynndel area. Elevations range from 1,800 to 2,300 feet above sea level. Topography is generally gently to moderately rolling with slopes up to 15%. Often the land surface is dissected with rills and medium gullies which can have slopes of up to 20%.

The parent material of the Creston series consists of fresh water deposited lacustrine sediments. Surface and subsoil textures are silt loam. Reaction in the surface horizon is neutral, while that in the parent material is moderately to strongly alkaline. (pH 8.1 - 8.5). In higher elevations the Creston series is underlain by glacial till which is found at depths of 20 - 30 inches from the surface.

Creston soils are well drained and are classified as Orthic Eutric Brunisols. A typical profile, located 3 miles north of Rykerts beside the main highway, is described in the appendix. About 967 acres of Creston series and 1,270 acres of Creston complex were classified and mapped.

LISTER

Lister soils comprise a substantial acreage in the Creston map area. They are closely associated with the Candy series and occupy the gently to moderately sloping lands south-east of Creston. The slopes are generally between 2 and 15% and elevations range from 1,900 to about 2,300 feet above sea level. A total of 8,389 acres of Lister series and 2,034 acres Lister-Candy soil complexes were mapped. The parent material is dominantly composed of moderately fine to fine textured fresh water deposited lacustrine sediments. The depth of these varved sediments in many places exceeds 7 feet and is underlain by glacial till. The parent material is generally moderately calcareous. Lister soils are well to moderately well drained. Internal drainage is moderate to slow due to the fine textures. External drainage is good to rapid. Droughty conditions may develop during dry summers when sprinkler irrigation would be beneficial. Lister soils were classified as Orthic Gray Luvisol (synonymous with Orthic Gray Wooded).

The native vegetation consisted of Douglas fir, Ponderosa pine, western larch and aspen. A substantial acreage has been cleared and is now devoted to forage crops, mainly alfalfa.

CANDY

Candy soils occur in conjunction with the Lister series. They occur in depressional areas with slopes up to 2% and elevation range from 1,900 to about 2,100 feet above sea level. The calcareous parent material is composed of fine textured lacustrine sediments. Candy soils are imperfect to moderately well drained. Candy soils were classified as Gleyed Orthic Gray Luvisols; however, mapping units in which the Candy series is dominant may contain minor areas of carbonated and saline Orthic Gleysols.

LOVOLE

Lovole soils are found in the West Creston area at elevations ranging from 1,900 to 2,200 feet above sea level. These soils have gently to moderately rolling topography interspersed with numerous small rills and gullies. A total of 192 acres of Lovole soils were mapped.

Lovole soils have developed from fresh water deposited lacustrine sediments of generally silt loam to silty clay loam texture.

The mapping unit may contain some local areas of outwash up to 2 feet thick draped over these lacustrine sediments. Lime is generally present at depths between 3 and 4 feet. Internal drainage is moderately well to well; external drainage is good to rapid, depending upon topography. Lovole soils are classified as Bisequa Gray Wooded (Gray Luvisol). Native vegetation is second growth hemlock, spruce, larch and cedar.

SOILS DEVELOPED FROM GLACIAL TILL PARENT MATERIALS

Glacial till refers to the unstratified glacial dfift that was deposited directly by the ice and consists of clay, sand, silt, gravel and boulders intermingled in any proportion.

This till occurs under the lacustrine and alluvial deposits. However, it is only at the highest elevations south of Creston, towards Lister and Huscroft, where the till deposit appears at the surface. In the West Creston area till is present within 2 feet of the surface; therefore these soils have a lacustrine capping over the till and were accordingly classified as Russell or Lipsett series. An additional soil, the Tye series developed solely from glacial till is also described.

RUSSELL

The Russell series occurs mainly in the western part of the report area. It is found in association with the Setter and Lovole series at higher and lower elevation, respectively. Elevations vary from 1,900 to 2,400 feet above sea level. The topography is mostly gently to moderately rolling with slopes of up to 15%. This soil series occupies 258 acres, with another 289 acres mapped as a complex in which Russell soils predominate.

The parent material is composed of 15 to 25 inches of lacustrine sediments overlying glacial till. The silty clay loam lacustrine sediments are stone and gravel free, while the glacial till parent material is stony, loam to sandy loam in texture, and quite compact. Russell soils are moderately well to well drained, and the soil reaction is slightly acidic except for the parent material (IICk) which is basic.

Russell soils are classified as Bisequa Gray Wooded (Gray Luvisol).

LIPSETT

Lipsett soils occupy a minor area southwast of Creston, and are closely associated with the Lister and Tye series. They occupy narrow strips intermediate in elevation between the Lister series at lower and Tye series at higher elevation. Topography of most slopes is between 5 and 9%. A total of 802 acres of Lipsett series and 977 acres of Lipsett complex were mapped.

The parent material consists of fresh water deposited lacustrine sediments underlain at 30 inches from the surface by glacial till. These sediments are generally stone and pebble free silt loam or silty clay loam, while the underlying till is strongly compacted and a stony loam in texture. The C horizons and often the lower B horizons are found in this glacial till parent material while the A and upper B horizons are present in the lacustrine sediments.

Surface drainage is good while subsurface drainage and infiltration are slightly impeded due to the non-porous and compacted nature of the till parent material.

Lipsett soils are classified as Orthic Gray Wooded (Gray Luvisol) and have well developed eluvial and illuvial horizons. The illuviated horizons (Bt) often coincide with the change in parent materials.

TYE

A minor acreage of Tye soils were mapped in conjunction with Lister and Lipsett series south of Creston. Their presence is confined to a narrow belt found draped among the bedrock outcrops within an elevation range of 2,100 to 2,400 feet above sea level. They are generally present on these steeply sloping hills in association with the Setter series. A total of 390 acres of Tye series and 915 acres of Tye complex were mapped.

Tye soils have developed on glacial till parent material and are well to moderately well drained. Tye subsoils are strongly compacted and the solum can only be tilled with difficulty. On drying the soil becomes extremely hard.

Tye soils are classified as Orthic Gray Wooded (Gray Luvisol). The solum is neutral to slightly acid, while the parent material is slightly basic.

The description of a typical Tye soil profile, sampled near the golf course is found in the appendix.

SOILS OF DELTAIC DEPOSITS

Deltaic deposits are those that have formed by water deposition of successive layers of sediments. This material was brought downstream and distributed on the bottom of a basin at the mouth of the Goat River in the vicinity of Erickson and East Creston. In this area the dominant soil is the Elmo series.

ELMO

Elmo soils occur exclusively east of Creston, north of the Goat River. They occur in conjunction with the Creston series and are found between elevations of 1,900 feet to 2,400 feet above sea level. A total of 1,256 acres wrre mapped.

Elmo soils have developed from deep, moderately coarse textured deltaic sediments. The texture varies from loam to loamy fine sand.

The soil is stone free; rooting depth and moisture permeability is good, but water holding capacity is quite low. Irrigation is mandatory during the growing season. Large proportions of these soils are planted to tree fruits.

Elmo soils are classified as Orthic Eutric Brunisols. The solum and parent material is neutral in reaction. (pH 6.9 - 7.2).

GLACIOFLUVIAL DEPOSITS

Only one soil series was mapped with a glaciofluvial parent material. Relatively few areas are present in the mapped area. The most important is the large outwash kame area east of Lister, and smaller areas on the west side of the valley in the vicinity of Corn Creek.

KRIKUP

Krikup soils occupy small, scattered areas on the uplands mainly between 1,760 and 2,300 feet elevation. The topography is undulating to hummocky with slopes ranging from 5 to 15 %. A total of 1,179 acres of Krikup series and 753 acres of Krikup Complex were mapped.

These soils have developed from loose, extremely permeable, sandy and gravelly kame deposits. Surface textures are loamy-sand, which gradually grades to coarse sand and then gravelly or stony coarse sand in the subsoil. The upper solum is loose and easily penetrated by roots.

Krikup soils are rapidly drained. Surface drainage is good and internal drainage is rapid. Summer drought conditions will occur yearly.

The native vegetation consists of Douglas fir, western larch and lodgepole pine, with some shrubs and pinegrass in the understory.

Krikup soils are classified as Orthic Dystric Brunisols. The soil profile consists mainly of a thin litter layer, underlain by moderately well developed (Bm) horizons which grade to the undifferentiated parent material. A typical profile, located in a gravel pit not far from No. 6 Road is described in the appendix.

FLUVIAL PARENT MATERIALS

Three soil series which have developed from this parent material were mapped in the area. They are associated either with present stream deposits or fluvial fans of post-glacial age.

GOAT

Goat soils occupy minor acreages (147 acres of Goat series and 134 acres of Goat Complex along the present stream channels of the Goat River and Corn Creek. They occur in positions immediately adjacent to the present streams. The fluvial parent material consists of coarse to very coarse textured stony and bouldery deposits. Due to the juvenile nature of these deposits, no profile development has occurred and the soils are classed as Orthic Regosols.

The gravelly texture of the stream bed in conjunction with periodic flooding prevents the establishment of arable agriculture.

FLETCHER

The Fletcher series occupies relatively minor areas and is found in both the Wynndel and Canyon areas. It occupies positions in the uplands between the elevations of 1,750 and 2,500 feet. The topography varies from gently to moderately sloping, with gradients up to 9%. A hummocky micro topography also exists. A total of 99 acres of Fletcher series and 319 acres of Fletcher Complex were mapped.

These soils have developed from medium to coarse textured loamy sandy alluvial fan deposits. The fans slope slightly from the apex to the base with stoniness increasing toward the apex.

Drainage in these soils is well to rapid, depending upon the texture of the parent material. The upper profile is friable and has good permeability. Reaction is slightly acid to neutral, and the Fletcher series was classified as an Orthic Dystric Brunisol. Present native vegetation is composed of Douglas fir, larch, birch, poplar and cedar. A typical profile description is described in the appendix.

KAMDON

Kamdon soils occupy a very small section of the map area, primarily on the Goat River alluvial fan. The topography is gently undulating with slopes of approximately 2 to 5%. A total of 136 acres of Kamdon series and 539 acres of Kamdon Complex were mapped.

These soils have developed from loose, permeable, coarse textured alluvial fan deposits. Surface textures are loam, which grades to a loamy fine sand subsoil and then to gravelly coarse sandy parent material. The soils are friable and easily penetrated by roots.

Kamdon soils are well to rapidly drained. Surface drainage is moderately good while internal drainage is rapid. Droughty conditions develop during dry summers.

The native vegetation is generally cottonwood with grasses forming the understory.

Kamdon soils are classified as Orthic Dystric Brunisols. The soil profile consists of a dark coloured surface (Ap) horizon and a thin brownish (Bm) horizon. This latter grades abruptly to the parent material. A typical profile, located on the Goat River alluvial fan, is described in the appendix.

SHALLOW SOIL DEPOSITS OVER BEDROCK

On the upland bench areas, there is a substantial acreage of soils shallow to bedrock. Such soils are associated with bedrock outcrops in the Lister - Erickson, Northeast Creston and Creston to Wynndel areas. Prime units of bedrock were mapped on 19 acres. Two series of shallow soils over bedrock were mapped in the area.

BLAKE

The Blake series is restricted to upland areas generally below elevations of 2,500 feet, predominantly occurring in small scattered locales in the eastern and southeastern parts of the report area. A total of 920 acres of Blake series and 579 acres of Blake Complex were mapped.

This soil has developed on shallow lacustrine, glacial till and/or colluvial material over bedrock. Bedrock to the surface occurs as a minor variation within areas mapped as this series. Stones occur throughout the solum. The topography is extremely variable but is predominantly very steeply sloping with gradients varying between 5 and 60%. Textures vary from silt loam to sandy loam. Free lime usually can be found near the solum-rock interface boundary. Drainage is well to rapid.

Vegetation is typically park-like, with a predominance of Douglas fir and occasional Ponderosa pine.

The Blake series is classified as an Orthic Eutric Brunisol. A typical profile description is located in the appendix.

SETTER

The Setter series occupies an area of 316 acres and occurs at an approximate elevation range of 1,785 to 2,400 feet above sea level. The topography is usually very steeply sloping; however, gently sloping areas are not uncommon. Slope gradients vary between 5 and 60%.

These soils have developed from a thin veneer of colluvium or glacial till underlain by bedrock. Contact to bedrock varies from 4 to 40 inches.

Stones and bedrock fragments are common throughout the solum. Textures are generally sandy loam.

These soils are generally well drained. Profile development is Orthic Dystric Brunisol and Bm horizons are well defined. Lithic subgroups of Orthic Dystric Brunisol soils have been included as the depth to bedrock is variable within this mapping unit. The vegetative cover is Douglas fir, Ponderosa pine and western larch. The underbrush is dominated by spirea, willow, Oregon grape, pinegrass and others. A description of a typical profile is located in the appendix.

SUMMARY

TABLE 4 - SOIL CLASSIFICATION

ALLUVIAL DEPOSITS

Soil Series	Great Group	Subgroup
Acorn	Humic Gleysol	Rego Humic Gleysol
Kuskanook	Gleysol	Carb. Orthic Gleysol
Cory	Gleysol	Carb. Orthic Gleysol
Hall	Gleysol	Rego Gleysol
Shaw	Gleysol	Rego Gleysol
Alice	Gleysol	Carb. Rego Gleysol
Buckworth	Gleysol	Carb. Rego Gleysol
Leach	Gleysol	Carb. Rego Gleysol
Simmons	Gleysol	Carb. Rego Gleysol
Nicks	Eluviated Gleysol	Low Humic Eluviated Gleysol
Sirdar	Regosol	Orthic Regosol
Benny	Regosol	Gleyed Orthic Regosol
Rykerts	Regosol	Gleyed Orthic Regosol
Sanka	Regosol	Gleyed Orthic Regosol

GLACIOLACUSTRINE DEPOSITS

Soil Series	Great Group	Subgroup
Creston	Eutric Brunisol	Orthic Eutric Brunisol
Lister	Gray Wooded	Orthic Gray Wooded
Candy	Gray Wooded	Gleyed Orthic Gray Wooded
Lovole	Gray Wooded	Bisequa Gray Wooded

GLACIO TILL DEPOSITS

Soil Series	Great Group	Subgroup
Russell	Gray Wooded	Bisequa Gray Wooded
Lipsett	Gray Wooded	Orthic Gray Wooded
Tye	Gray Wooded	Orthic Gray Wooded

DELTAIC DEPOSITS

Elmo	Eutric Brunisol	Orthic Eutric Brunisol

GLACIOFLUVIAL

Krikup	Eutric Brunisol	Orthic Eutric Brunisol

TABLE 4 (cont'd)

FLUVIAL

Soil Series	Great Group	Subgroup
Goat	Regosol	Orthic Regosol
Fletcher	Dystric Brunisol	Orthic Dystric Brunisol
Kamdon	Dystric Brunisol	Orthic Dystric Brunisol

SHALLOW DEPOSITS OVER BEDROCK

Soil Series	Great Group	Subgroup
Setter	Dystric Brunisol	Orthic Dystric Brunisol
Blake	Eutric Brunisol	Orthic Eutric Brunisol

CHEMICAL ANALYSES AND THEIR INTERPRETATION

Chemical analyses of selected soils in the Creston area are given in Tables 8 and 9. The analyses provide helpful soil classification information and serve as a general guide to their fertility and management. They are not intended to serve as a basis for specific fertilizer recommendations for any soils on individual farms.

Methods of Analysis

The pH was measured by two methods. The first utilized a glass electrode in a 1:1 soil-water suspension for mineral soils and a 1:5 suspension for those that are organic. The second method employed 0.01 M $CaCl_2$ solution instead of water as outlined by Clark (4). Soil organic matter was determined by the wet combustion method described by Peach et al (9) while the Kjeldahl method, described by Atkinson et al (1) and modified by a selenium catalyst as suggested by Bremner (3), was used to determine total nitrogen. Laverty's (6) procedures, modified by John (5), were used to determine available (P1) and available plus acid soluble (P2) phosphorus. Total exchange capacity was ascertained using the method described by Peach et al (9) while exchangeable cations were determined on ammonium acetate soil extracts using a Model AA4 Techtron atomic absorption spectrophotometer. Sulphur was determined by the method of Bardsley and Landcaster (2) while copper and zinc were extracted according to the procedure of Lunblad, Svanberg and Ekman 7 and determined using the atomic absorption spectrophotometer. Electriaal conductivity was ascertained by the method outlined in U.S.D.A. Handbook No. 60 (10).

Soil Reaction

Soil reaction or pH, defined as the negative logarithm of hydrogen ion activity in solution, is expressed in values from almost zero to 14. Seven represents neutrality, and decreasing values below seven express increasing acidity. Increasing values above seven represent increasing intensities of alkalinity.

The reaction classes and terminology are as follows:

	pH		pH
Extremely acid	below 4.5	Neutral	6.5 - 7.3
Very strongly acid	4.6 - 5.0	Mildly alkaline	7.4 - 7.8
Strongly acid	5.1 - 5.5	Moderately alkaline	7.9 - 8.4
Medium acid	5.6 - 6.0	Strongly alkaline	8.5 - 9.0
Slightly acid	6.1 - 6.5	Very strongly alkaline	above 9.0

Using the soil-water method, most of the lowland mineral soils are mildly to moderately alkaline (pH: 7 - 8) throughout the solum (A and B horizons) while the parent material is moderately alkaline. This is due to the high lime parent material which was deposited by the Kootenay River since the retreat of the valley glacier. Sulphur content is low in all profiles except those of the Simmons, Kuskanook, Shaw, and Cory series where it is high.

The 0.01M $CaCl_2$ pH method reduces the effect of varying concentrations of soil salts and is more nearly the pH of the soil solution under actual field conditions. Values by this method for the same lowland soils are usually 0.5 to 1.0 pH units less than with water.

In the upland soils, the sola are generally neutral in reaction while the parent materials tend to be mildly alkaline.

Plants vary in their ability to grow at differenc pH valuss. Although pH itself may not be responsible for limiting growth, nutrient availability to various plants at different pH values is significant. For example, in alkaline soils of the semi-arid and arid regions, or when soils are over-limed, growth may be curtailed by low availability of iron, manganese, and linc. In some acid soils on the other hand, manganese, iron and aluminum may be solubilized to the extent of being toxic to many plants.

In this map area there seems to be little need to incorporate lime into the soil. Most if not all lowland soils have adequate levels of lime. In the upland soils of the Creston area, ph alone cannot be used to estimate the amount and frequency of liming. Better criteria appear to be concentration of soluble and exchangeable aluminum and manganese or the exchangeable aluminum-calcium ratio. The importance of this ratio is borne out by the accumulating evidence that aluminum and/or manganese toxicity is the main factor responsible for poor growth in acid soils. The most important function of liming, therefore, is to reduce the concentration of soluble and exchangeable aluminum and manganese in the soil.

Less lime per application is required for coarse textured soils with low cation exchange capacities than for finer textured soils with higher exchange capacities to raise the pH a similar amount. Some soil borne diseases can be controlled by varying pH since the disease organisms can survive only in a relationly narrow pH range.

Organic Matter

Soil organic matter results from the decomposition and incorporation of leaves, twigs, roots and other organic material. The amount which accumulates is related to precipitation, drainage, vegetation, temperature and other factors. It can vary from less than one percent in mineral soils to 100% in organic ones. In cultivated mineral soils, organic matter maintenance is very important.

Organic matter affects the chemical, physical and biological properties of the soil. Large portions of soil nitrogen, phosphorus and sulphur are held in organic combinations unavailable to growing plants until released by soil micro-organism activity. Satisfactory organic matter contents endure good micro-organism populations for release of plant nutrients.

Good organic matter content also makes soils less susceptible to crusting and puddling, more friable, better aerated and more resistant to erosion. Moisture holding and cation exchange capacities are also increased.

A general guide to amount of organic matter as used in this report is as follows:

Low	- less than 5%
Moderate	- 5 - 10%
Moderately high	- 10 - 20%
High	- 20 - 30%
Very high	- more than 30%

All soils in the Creston area have low amounts of organic matter with the exception of the Acorn series. Generally, organic matter content is highest in the surface mineral horizon and rapidly decreases downward in the soil profile. Soil management should include the incorporation of green manure and/or barnyard manure to maintain adequate levels in soils low in organic matter.

Nitrogen

Nitrogen is required in large amounts by plants, chiefly in the nitrate form which is easily lost from the soil by leaching. Soil organic matter and commercial fertilizers are the major nitrogen sources although small amounts are washed from the atmosphere by rain.

Micro-organisms play an important role in the provision of nitrogen to plants. The ammonifying and nitrifying bacteria convert nitrogen in organic matter and the atmosphere into forms available for plant uptake.

Only under favourable soil and climatic conditions can total nitrogen values aid in estimating the nitrogen supplying power of the soil. For this purpose, the following levels may serve as a guide:

Very low	- less than 0.10%
Low	- 0.10 - 0.25%
Medium	- 0.25 - 0.40%
High	- more than 0.40%

Most soils contain low to very low levels of nitrogen which are a reflection of their low organic matter contents. Some surface horizons of notably the Cory and Shaw soil series have high levels of nitrogen. Subsoil total nitrogen levels of all the mineral soils are very low.

Phosphorus

Phosphorus is one of the major essential elements required for plants. Most occurs in the soil in forms not immediately available for growing plants; rather it is held in various organic and inorganic compounds. Plants can utilize only inorganic forms, therefore, organic forms must be mineralized by micro-organisms before plant uptake is possible.

Phosphate fertilizers do not move far from the point of application and should be placed near the roots to ensure that the growing plant will be supplied. Top-dressings are satisfactory for crops having abundant feeding roots near the surface but for deeper rooted crops, the best results are usually obtained by drilling or banding the fertilizer with the seed.

Results from two phosphorus analysis methods are given in this report. The P1 method, considered an index of phosphate availability, extracts the available absorbed forms of iron and aluminum phosphate. The P2 and P1 values are useful in delineating soils high in calcium phosphate.

The following table taken from the "Guide to Fertilizer Use for the Lower Mainland", indicates the various levels of phosphorus availability based on the P1 method. This may also be true for the Creston area, however caution should be used for interpreting these values as insufficient data is available.

Very low	- less than 5 p.p.m.
Low	- 5 - 10 p.p.m.
Medium	- 10 - 20 p.p.m.
Moderately high	- 20 - 30 p.p.m.
High	- over 30 p.p.m.

The lowland mineral soils are variable in P1 values in the surface horizon indicating the effect of phosphate fertilization. Subsoil values, however, are generally low indicating available phosphorus in the profile is low. The relatively high P2 values indicate most of the phosphorus is present in calcium forms and mostly unavailable. Generally, plant responses can be expected from additions of phosphate fertilizers. Some upland soil P1 values are high and phosphate response could be doubtful.

Cation Exchange Capacity

The ability of soils to hold exchangeable cations is termed the cation exchange capacity and is expressed as milli-equivalents of cations required to balance the negative charge of 100 grams of soil at pH 7.0. Exchange sites are mainly supplied by organic matter and clay minerals. Therefore, depending on the organic matter content and the type and amount of clay minerals present, the exchange capacities can range from less than 10 to over 100 milli-equivalents per 100 grams of soil. The following values may be used as a guide to the relative levels of the exchange capacities of soils.

	Milli-equivalents/100 grams
Very low	- less than 3
Low	- 5 - 10
Medium	- 10 - 20
High	- more than 20

Very high cation exchange capacities occur in heavy textured soils and those with high organic matter contents.

The mineral lowland soils' exchange capacities are mostly medium in the surface horizon and decrease to low in the subsoil.

Exchangeable Cations and Base Saturation

Calcium, magnesium, potassium, sodium, aluminum and hydroxy-aluminum ions are the most abundant exchangeable cations. Their proportions vary from soil to soil depending on soil characteristics and past management practices.

Aluminum cations predominate in acid soils while calcium and magnesium are the most common in near neutral soils. Strongly alkaline or saline soils may contain large proportions of exchangeable sodium as well as calcium and magnesium. Exchangeable calcium and magnesium, removed by crops and lost by leaching, are usually replaced by aluminum and results in a decrease in pH through hydrolysis. In the Creston area, due to the large amounts of free lime in the soil parent material, all exchange sites on the exchange complex are dominated by basic cations with calcium being the dominant cation. This results in the base saturation of cations being 100%.

Exchangeable potassium is in equilibrium with the fixed forms in the soil. This equilibrium is disturbed when plants remove the exchangeable forms and, to re-establish equilibrium, some fixed potassium is released. The maintenance of an adequate supply depends upon the reserve and the rate of release. As a guide the following levels of exchangeable potassium may be used:

Very low	- less than 30 p.p.m. *
Low	- 30 - 60 p.p.m.
Moderate	- 61 - 90 p.p.m.
Moderately High	- 91 - 120 p.p.m.
High	- more than 120 p.p.m.

The analyses for the alluvial soils indicate that very low levels of potassium exist in the soils. Potassium levels for the upland soils are high. Magnesium levels are moderate throughout. Sodium is generally low on both alluvial lowland and upland soils.

Percent base saturation indicates how much of the total cation exchange capacity is satisfied by the sum of the calcium, magnesium, potassium and sodium cations present. That portion of the total cation exchange capacity not satisfied by basic cations is mostly occupied by aluminum and hydrogen.

Base saturation in the solum of the upland soils is low compared to the lowland alluvial soils in which it is always 100%.

Copper and Zinc

According to the work of Lunblad, et al (7), the copper available to plants in the lowlands is sufficient to meet their requirements. Analyses for zinc are also given although no correlation between plant requirements and zinc are available.

Sulphur

Sulphur, a minor but essential element for crop growth is moderate to very low for all soils in the Creston area except the Leach, Simmons, Shaw and Kuskanook series.. In these soils the Sulphur status ranges from moderate to high in that order.

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* parts per million - To obtain parts per million of potassium from milli-equivalents per 100 grams multiply by 391.

The following values may be used as a guide to the relative requirements of available sulphur:

	Parts per million	Pounds per acre
Very low	less than 2	less than 4
Low	2 - 6	4 - 12
Moderate	6 - 10	12 - 20
Moderately high	10 - 20	20 - 40
High	more than 20	more than 40

Soil testing for nutrient requirements on individual fields for grouping crops:

Chemical analyses indicate similarities that occur within soil series and emphasize variations due to individual farm managements.

The fertility status of soils varies from farm to farm and field to field. Soil tests on individual fields provide the most reliable means of predicting fertilizer requirements. It is advisable to sample fields with different soils and cultural practices separately for soil testing in order to determine the most economical fertilizer rates. The B. C. Department of Agriculture provides a soil testing service for this purpose.

Instructions for taking soil samples for soil testing purposes, the necessary application forms and any further information on this service is available through all regional Agriculture Offices (District Agriculturists) or through the Soil Testing Laboratory at Kelowna, British Columbia.

SOIL INTERPRETATIONS FOR AGRICULTURE, WILDLIFE AND FORESTRY

AGRICULTURE

The total surveyed lands in the Creston Area comprise 56,790 acres. The agricultural lands comprise approximately 46,440 acres. 10,350 acres are presently unsuitable for cultivation due to high water levels or severe soil limitations. Of the total arable acreage, the bench-lands include 23,913 acres on lacustrine, glacial till and shallow to bedrock deposits near Creston, Lister and Erickson. The remaining 22,527 acres occur on the Creston Flats area and consist of fertile alluvial deposits.

Table No. 4 is an attempt to rate the suitability of various soils to the crops most generally grown in the valley. It has been assumed that these crops are climatically well suited to the area,

TABLE 4

Soil \ Crop	Spring Wheat	Winter Wheat	Oats	Barley	Corn	Alfalfa	White Clover	Seed Peas	Pasture	Potatoes[1]	Strawberries[1]
Acorn	M	M	M	M	M	L	M	L-M	M	M	M
Benny	M	M	M	H	M	H	H	M	M	L	L
Blake*	0	0	0	0	0	0	0	0	L	0	0
Buckworth	M	M	M	H	M	L	M	M	M-H	M	L
Candy*	L	L	L	L	L	L	L	L	M	L	L
Cory	L	L	L	L	L	0-0	L-0	L-0	L	0	0
Creston*	M	M	M	M	L	M	M	M	M	M	M
Elmo*	L	L	L	L	L-M	M	M	L-M	L	L	L
Fletcher*	L	L	L	L	L	L-M	L	L	L	L	L
Goat	0	0	0	0	0	0	0	0	0-L	0	0
Hall	L	L	L	L	L	L	L	L	L-M	L	L
Kamdon*	0	0	0	0	0	0	0	0	L	0	0
Krikup	0	0	0	0	0	0	0	0	0-L	0	0
Kuskanook	M-H	M-H	M-H	H	M	M-L	M	M	M	L	L
Lipsett*	M-L	M-L	M-L	M-L	M	M	M	M	M	M	L-M
Lister*	L	L	L	M	L	M	M	L	M	L	L
Lovole	L	L	L-M	L	L	M-L	H-M	M	M	L-M	L-M
Nicks	M	M	M	M	L-M	L	L	L	L-M	L	L-0
Russell*	L	L	L	L	L	L	M	M	M	L	L
Rykerts	M-H	M-H	H	H	H	M-H	M-H	M	M	M-H	M
Setter	0	0	0	0	0	0	0	0	0-L	0	0
Simmons	M	M	M	H	M-H	L	M-H	M	M	L	L
Sirdar	L	L	L	L	L	M	L	L	L	L	L
Tye*	L	L	L	L	L	M	M	L	M	L	L

* Upland Soils; ratings for dryland farming.

1 Potatoes and strawberries are best suited to well drained soils with pH values ranging from 5-6. These soils have been rated according to their inherent pH - therefore, pH correction through the use of chemical fertilizers containing elemental sulphur should be added to the rooting zone.

0 = Nil; L = Low; M = Medium; H = High.

SUITABILITY CLASSES OF CRESTON VALLEY SOILS FOR VARIOUS CROPS and therefore can be used as indicators for the different soils. The soil criteria used include: texture, topography, drainage, soil reaction or pH and soil structure. These factors indicate relative water holding capacity, water table level, fertility and effective rooting depth of the soils. No attempt has been made to rate the soils for irrigation; however, it can be assumed that the benchland soils can be rated one suitability class or more higher if irrigation water was available. Table No. 4 does not include those soils that are not dyked. It is assumed that they are not suitable for any crop other than for limited use pasture land.

The soils of the Creston Valley comprise some of the best arable lands of British Columbia. These soils lend themselves well to more intensive forms of cultivation, which appears to be the trend for the future.

The suitability class symbols used in Table 4 are as follows:

H - high
M - medium
L - low
O - not suited

WILDLIFE

The unreclaimed lands of the Creston Flats consist of a series of sloughs, potholes, marches and open lakes. These lands comprise approximately 20,000 acres, of which about 10,350 acres were soil mapped. The remaining 9,650 acres are open water bodies.

The Creston Valley's wetlands constitute a portion of the vast Pacific Flyway. As a result, the greatest importance of the area for wildlife is in providing habitat for migratory and overwintering waterfowl, which include five species of grebes, two of swans, five of geese, nine of dabbling ducks, and twelve of diving ducks. Other migratory species include shore birds, loons, hawks and owls.

Peak numbers, approaching 80,000 birds and including ducks, geese and swans, occur in mid-April and again in October. A smaller number nest and overwinter in the area. These include Great Blue heron, probably whistling swan, Canada goose, five species of grebes, the nine species of dabbling ducks and, amongst the diving ducks, the American goldeneye, ruddy duck, American and hooded merganser, and probably the canvasback and greater scaup. The production of dabbling duck, geese and swans approaches 500 per year while that of the diving ducks approaches 1,500 per year.

The Creston Valley has a moderate to high capability to produce suitable habitat (feed and cover) to support large numbers of migratory and overwintering species of waterfowl. However, at present the area has low-to-medium capability for nesting and production of waterfowl. This is due to the coincidence of the flooding of the Kootenay River with the nesting season of most species. Consequently, for a critical period, water levels are too high and aquatic flora and fauna production is too low. However, with completion of the Libby Dam project on the Kootenay River, it is conceivable that nesting and rearing conditions will improve. With the floodwater levels somewhat controlled, fewer nests will be destroyed and perhaps more nesting sites will be made available. Also, the production of the necessary flora and fauna for the young birds may increase due to the naturally high fertility and good texture of the soil. With pH's ranging from 7.0 to 8.0 it is conceivable that in some areas the waters associated with these soils will have a correspondingly high fertility and thus be able to support more luxuriant vegetation.

The future outlook of the waterfowl mnnagement program is extremely good. This is particularly true since the establishment of the Creston Valley Wildlife Management Area in 1968. This group, under the auspices of the Canadian Wildlife Service and the British Columbia Fish and Wildlife Branch, has launched an intensive management program to improve the migration, overwintering and waterfowl production habitats of the area.

In the upland areas of the Creston Valley (Creston, Lister and Erickson areas) the production of game has been depressed because of intensive agricultural practices and by urban and industrial development. However, the area does support pheasant, deer and a myriad of small rodents.

FORESTRY

With settlement of the fertile Creston Flats and Lister upland area in the late 1800's, much forested land was cleared and most, if not all, of the native conifers were utilized locally for building materials, fence posts, and fuel.

The dominant tree species in the alluvial lowland area is Black Cottonwood (Populus trichocarpa). Presently this species grows mainly on Benny, Lykerts, Simmons and Alice series, and attains heights of up to 100 feet on these deep sandy loam alluvial soils.

The lowland soils are well endowed with abundant groundwater moisture, nutrients and oxygen (in moderately well drained soils). In addition, high amounts of lime, as well as high pH values (pH 7.0 - 8.3) should cause these soils to be rated highly for production of commercial plantations of Black Cottonwood.

As it is difficult to find suitable stands for forestry plots in the Creston area, data from other areas having similar characteristics have been interpolated and applied to the alluvial soils near Creston. Mean annual increments of wood production per acre per year well in excess of 130 cubic feet should be attained if suitable management procedures are observed.

TABLE 5

Map Symbols and Acreages of Soil Series and their complexes

Soil Name	Map Symbol	Acres	Total
Alice series	AE	907	
Alice - Simmons soil complex	AE-SS	572	
Alice - Cory soil complex	AE-CY	291	
Alice - Shaw soil complex	AE-SW	229	1,999
Acorn series	AN	382	
Acorn - Simmons soil complex	AN-SS	82	
Acorn - Kuskanook soil complex	AN-KK	467	931
Blake series	BE	920	
Black - rock outcrop soil complex	BE-RO	480	
Blake - Tye soil complex	BE-TY	99	1,499
Buckworth series	BH	720	
Buckworth - Kuskanook soil complex	BH-KK	735	
Buckworth - Simmons soil complex	BH-SS	324	1,779
Benny series	BY	3,791	
Benny - Rykerts soil complex	BY-RS	243	
Benny - Kuskanook soil complex	BY-KK	465	
Benny - Simmons soil complex	BY-SS	553	
Benny - Buckworth soil complex	BY-BH	353	
Benny - Sirdar soil complex	BY-SR	454	
Benny - Leach soil complex	BY-LH	245	
Benny - Acorn soil complex	BY-AN	94	
Benny - Cory soil complex	BY-CY	14	6,212
Creston series	CN	967	
Creston - Blake soil complex	CN-BE	107	
Creston - Tye - Blake soil complex	CN-TY-BE	318	
Creston - Elmo soil complex	CH-EO	845	2,237
Cory series	CY	867	
Cory - Kuskanook soil complex	CY-KK	402	
Cory - Shaw soil complex	CY-SW	94	
Cory - Alice soil complex	CY-AE	274	
Cory - Simmons soil complex	CY-SS	59	
Cory - Acorn soil complex	CY-AN	83	
Cory - Wetland soil complex	CY-WW	402	2,181
Elmo series	EO	1,256	1,256

TABLE 5 (cont'd)

Soil Name	Map Symbol	Acres	Total
Fletcher series	FR	99	
Fletcher - Russell soil complex	FR-RL	69	
Fletcher - Elmo soil complex	FR-EO	250	418
Goat series	GT	147	
Goat - Wetland soil complex	GT-W	134	281
Hall series	HL	226	226
Kamdon series	KD	136	
Kamdon - Sanka soil complex	KD-SA	539	675
Kuskanook series	KK	3,258	
Kuskanook - Cory soil complex	KK-CY	1,135	
Kuskanook - Nicks soil complex	KK-NS	443	
Kuskanook - Buckworth soil complex	KK-BH	1,246	
Kuskanook - Simmons soil complex	KK-SS	733	
Kuskanook - Acorn soil complex	KK-AN	704	
Kuskanook - Benny soil complex	KK-BY	464	7,983
Kirkup series	KR	1,179	
Kirkup - Lipsett soil complex	KR-LT	69	
Kirkup - Russell soil complex	KR-RL	437	
Kirkup - Setter soil complex	KR-ST	61	
Kirkup - Blake soil complex	KR-BE	58	
Kirkup - Lister soil complex	KR-LR	128	1,932
Lovole series	LE	192	192
Leach series	LH	1,285	
Leach - Wetland soil complex	LH-WW	90	1,375
Lister series	LR	8,389	
Lister - Lovole soil complex	LR-LE	280	
Lister - Tye soil complex	LR-TY	506	
Lister - Candy soil complex	LR-CA	1,206	
Lister - Lipsett soil complex	LR-IT	42	10,423
Lipsett series	LT	802	
Lipsett - Creston soil complex	LT-CN	529	
Lipsett - Setter soil complex	LT-ST		
Lipsett - Candy soil complex	LT-CA	93	
Lipsett - Lister soil complex	LT-LR	238	1,779
Nicks series	NS	328	
Nicks - Kuskanook soil complex	NS-KK	522	850

TABLE 5 (cont'd)

Soil Name	Map Symbol	Acres	Total
Russell series	RL	258	
Russell - Lovole soil complex	RL-LE	43	
Russell - Setter soil complex	RL-ST	246	547
Rock outcrop	RO	19	
Rock outcrop - Blake soil complex	RO-BE	5	24
Rykerts series	RD	428	
Rykerts - Alice soil complex	RS-AE	70	
Rykerts - Sirdar soil complex	RS-SR	53	551
Sanka series	SA	879	
Sanka - Leach soil complex	SA-LH	246	1,125
Sirdar series	SR	297	
Sirdar - Benny soil complex	SR-BY	1,628	
Sirdar - Rykerts soil complex	SR-RS	260	
Sirdar - Buckworth soil complex	SR-BH	88	2,273
Simmons series	SS	750	
Simmons - Alice soil complex	SS-AE	265	
Simmons - Leach soil complex	SS-LH	54	
Simmons - Cory soil complex	SS-CY	109	
Simmons - Buckworth soil complex	SS-BH	371	
Simmons - Benny soil complex	SS-BY	201	
Simmons - Kuskanook soil complex	SS-KK	202	1,952
Setter series	ST	316	
Setter- Russel soil complex	ST-RL	153	
Setter - Rock outcrop soil complex	ST-RO	426	895
Shaw series	SW	164	
Shaw - Alice soil complex	SW-AE	1,571	
Shaw - Hall soil complex	SW-HL	24	
Shaw - Kuskanook soil complex	SW-KK	78	
Shaw - Wetland soil complex	SW-WW	83	1,920
Tye series	TY	390	
Tye - Blake soil complex	TY-BE	128	
Tye - Lister soil complex	TY-LR	344	
Tye - Lipsett - Blake soil complex	TY-LT-BE	312	
Tye - Lipsett soil complex	TY-LT	131	1,305

TABLE 5 (cont'd)

Soil Name	Map Symbol	Acres	Total
Wetland series	WW	1,837	
Wetland - Alice soil complex	WW-AE	80	
Wetland - Leach soil complex	WW-LH	53	1,970
TOTAL		56,790	56,790

TABLE 6

Acreage of Soil Parent Materials in the Creston Map Area

Parent Materials	Acres	Total
FLOODPLAIN		
Alluvial deposits (vertical acretion)	17,192	
Alluvial deltaic deposits	4,679	
Alluvial levees	9,036	
Wetland	1,970	32,877
UPLAND		
Glaciolacustrine deposits	12,852	
Glaciolacustrine over Glacial till deposits	2,326	
Glacial till deposits	1,305	
Deltaic deposits	1,256	
Glaciofluvial deposits	1,932	
Fluvial deposits	1,824	
Shallow materials over bedrock	2,394	
Rock outcrop	24	23,913
TOTAL	56,790	56,790

TABLE 7

Physical Analyses of the Creston Area Soil Series

Soil Series:	Acorn	Drainage:	Poor
Parent Material:	Alluvium	Location:	2 Miles South East of West Creston Ferry
Classification:	Rego Humic-Gleysol	Slope:	0 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Ap	0 - 8	7.6	Abrupt	10 YR 3/1 (m)	Loam to Silt Loam	Medium Granular	Very Firm	Abundant	
Om	8 -13	6.2	Abrupt	10 YR 4/4 (m)		Platy	Hard	Abundant	Few Fine Faint
AFg	13-15	7.5	Clear	10 YR 4/2 (m)	Silty Clay Loam	Platy to Massive	Very Firm	Common	Few Fine Faint
Bg	15-23	7.5	Clear	10 YR 4/2 (m)	Silty Clay Loam	Weak Coarse Blocky	Extremely Firm	Occasional	
BCg	23-29	7.8	Diffuse	10 YR 4/2 (m)	Silty Clay Loam	Massive	Firm	none	Few Fine Faint
Cgk_1	29-40	8.0	Diffuse	10 YR 5/2 (m)	Silt Loam	Massive to Sub Angular Blocky	Firm	none	Few Fine Faint
Cgk_2	40+	8.0		5 Y 4/4 (m)	Fine Sandy Loam	Massive to Sub Angular Blocky	Slightly Plastic	none	Few Medium Faint

TABLE 7 (cont'd)

Soil Series: Alice
Parent Material: Alluvium
Classification: Carbonated Rego Gleysol

Drainage: Poorly
Location: West Creston
Slope: 0 -.5 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Cgk_1	0 -12	7.7	Diffuse	10 YR 5/2(m)	Fine Loamy Sand	Granular	non coherent	Abundant	Few Fine Faint
Cgk_2	12-24	7.9	Diffuse	10 YR 5/2(m)	Fine Loamy Sand	Granular	non coherent	Occasional	Few Fine Faint
Cgk_3	24-40	7.8	Diffuse	10 YR 5/2(m)	Fine Loamy Sand	Granular	non coherent		

Remarks: Alternating layers of fine loamy sand to sandy loam occur within the horizons.

TABLE 7 (cont'd)

Soil Series:	Benny	Drainage:	Imperfect
Parent Material:	Alluvium	Location:	Central Flats
Classification:	Gleyed Orthic Regosol	Slope:	0 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Apgk	0 - 9	7.9	Abrupt	2.5Y 5/2(m)	Fine Sandy Loam	Weak Granular to Massive	Friable to Firm	Abundant	Few Fine Faint
Cgk_1	9 -18	8.1	Abrupt	10 YR 6/2(m)	Fine Sandy Loam	Massive	Firm	Occasional	Many Medium Distinct
Cgk_2	18-26		Clear	10 YR 4/2(m)	Silt Loam	Massive	Firm	Occasional	Many Medium Distinct
Cgk_3	26-32	8.2	Clear	10 YR 4.5/2(m)	Silty Clay Loam	Weak fine Granular	Friable to Firm	Occasional	Few Medium Distinct
Cgk_4	32+	8.4	Gradual	2.5 Y 5/4(m)	Silt Loam	Massive	Firm	none	Few Medium Faint

TABLE 7 (cont'd)

Soil Series:	Blake	Drainage:	Well
Parent Material:	Shallow lacustrine over Bedrock	Location:	2 Miles North of Rykerts near highway
Classification:	Orthic Eutric Brunisol	Slope:	2-15 %

HORIZON	DEPTH INCHES	pH H_2O	pH $(CaCl_2)$	Horizon BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
Bm_1	0-7	7.2	6.66	Clear	7.5YR 4/4(m)	Silt Loam	Very Fine Granular	Very Friable	Abundant
Bm_2	7-15	7.1	6.60	Clear	7.5YR 4/4(m)	Silt Loam to Loam	Weak Fine Granular	Very Friable	Abundant
BC	15-26	7.0	6.5	Abrupt	10 YR 6/6(d) 10 YR 5/6(m)	Silt Loam	Moderate Medium sub Angular Blocky	Slightly Hard	Abundant
Cca	26-33	8.0		Abrupt	10 YR 8/3(d) 10 YR 7/2(m)	Silt Loam	Weak Massive to Pseudo Platy	Slightly Hard	Common
R	33+	shattered argillaceous quartzite bedrock							

TABLE 7 (cont'd)

Soil Series: Buckworth
Parent Material: Alluvial deposits / deltaic Sands
Classification: Carbonated Rego Gleysol
Drainage: Poor
Location: West Creston Flats
Slope: 0-.5 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry, m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Apk	0-10	7.9	Abrupt	10 YR 6/1(d)	Very Fine Sandy Loam	Fine Granular	Friable	Common	Fine Medium Faint
Cg	10-15	7.6	Abrupt	10 YR 7/2(d)	Loamy Fine Sand	Massive to Slightly Columnar	Very Hard	Abundant	Many Medium Distinct
$IICg_1$	15-31	7.4	Abrupt	10 YR 7/2(d)	Fine to Medium Sand	Single grain	Non coherent to soft	Occasional	Common Medium Distinct
$IICg_2$	31+	6.8		10 YR 7/2(d)	Medium to Coarse Sand	Single grain	Non coherent	Occasional	Few coarse prominent

TABLE 7 (cont'd)

Soil Series: Cory
Parent Material: Alluvial-Lacustrine
Classification: Orthic Gleysol

Drainage: Very Poor
Location: Undyked South end of Nicks Island
Slope: 0 - 1 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Ap	0-6	7.6	Abrupt	10 YR 6/1(d) 10 YR 4/1(m)	Silty Clay Loam	Moderate Fine Granular	Friable	Abundant	
Bg_1	6-9	7.6	Clear	2.5 YR 6/2(d)	Silty Clay	Medium blocky Coarse Columnar	Extremely Firm	Common	Common Medium distinct
Bg_2	9-14	7.8	Gradual	2.5 YR 6/2(d)	Silty Clay	Coarse blocky to Massive	Very Firm	Common	Common Medium distinct
BCg	14-26	8.0	Gradual	10 YR 7/2(d)	Silty Clay Loam	Pseudo-Massive	Very Firm	Common	Many Medium Prominent
Cgk	26-34	8.2	Clear	10 YR 5/3(m)	Silty Clay Loam	Massive	Very Firm	Common	Many Coarse Prominent
II Cgk	34+	8.2		10 YR 6/1(m)	Silt Clay	Massive	Friable	Occasional	Few Coarse Prominent

TABLE 7 (cont'd)

Soil Series: Creston
Parent Material: Glacio-lacustrine
Classification: Orthic Eutric Brunisol

Drainage: Well
Location: 1 mile north of Rykerts
Slope: 20 %

HORIZON	DEPTH INCHES	pH H_2O	pH $(CaCl_2)$	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
L-F	½-0	7.0		Abrupt					Abundant
Dm_1	0-4	7.1	6.54	Clear	7.5 YR 4/4(d) 7.5 YR 4/2(m)	Silt Loam-Loam	Weak Granular	Friable	Abundant
Dm_2	4-18	7.2	6.65	Gradual	7.5 YR 4/4(m)	Silt Loam	Fine columnar sub-angular Blocky	Hard Very	Common
BC	18-24	7.5		Abrupt	10 YR 6/4(d)	Silt Loam	Weak sub-angular blocky	Hard	Common
Ck_1	24-31	8.1		Abrupt	2.5 Y 8/2(d)	Loam	Weak sub-angular blocky	Slightly Hard	Common
Ck_2	31+	8.5			10 YR 8/3(d)	Silt Loam	Massive	Slightly Hard	none

TABLE 7 (cont'd)

Soil Series; Elmo
Parent Material: Deltaic
Classification: Orthic Eutric Brunisol

Drainage: Well
Location: East Side of Creston
Slope: 5 - 9 %

HORIZON	DEPTH INCHES	pH H_2O	pH ($CaCl_2$)	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
Ap	0-9	7.0	6.36	Clear	10 YR 4/3(d)	Loam	Granular	Soft	Abundant
Bm_1	9-15	7.25	6.7	Gradual	10 YR 5/3(d)	Loamy Fine Sand	Granular	Soft	Common
Bm_2	15-22	6.9	6.27	Gradual	10 YR 6/2(d)	Loamy Fine Sand	Granular	Soft	Common
C	22+	7.2			10 YR 7/4(d)	Loamy Fine Sand	Massive Granular	Slightly Hard	Occasional

TABLE 7 (cont'd)

Soil Series: Fletcher
Parent Material: Fluvial Fan

Classification: Orthic Dystric Brunisol

Drainage: Well to rapid
Location: No. 2 Road South East of Canyon near Park
Slope: 2 %

HORIZON	DEPTH INCHES	pH H_2O	pH ($CaCl_2$)	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
Ap	0-8	6.3	5.75	Clear	7.5YR 5/3(d) 7.5YR 3/2(m)	Sandy Loam	Weak Granular	Friable	Abundant
Bm	8-12	6.6	5.71	Clear	7.5YR 5/4(d) 7.5YR 4/4(m)	Sandy Loam	Granular to weak fine Blocky	Friable	Abundant
BC	12-17	6.7		Clear	10 YR 6/4(d) 10 YR 5/3(m)	Sandy Loam to loamy Sand	Weak Medium sub angular Blocky	Friable	Common
C_1	17-32	6.5		Diffuse	10 YR 7/4(d) 10 YR 5/3(m)	Fine Sand	Granular to weak Blocky	Friable	Occasional
C_2	32-40	6.8			10 YR 7/4(d) 10 YR 5/3(m)	Fine Sand	Granular to Weak Blocky	Friable	Occasional

TABLE 7 (cont'd)

Soil Series: Hall
Parent Material: Alluvial deltaic
Classification: Orthic Rego Gleysol

Drainage: Very Poor
Location: West Creston Flats
Slope: Flat

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Apg	0 - 10	5.1	Abrupt	7.5 YR 4/2(m)	Loamy Sand	Single Grain	non coherent	Occasional	
Cg	10-32	5.8	Abrupt	10 YR 8/1(m)	Medium Sand	Single Grain	non coherent	Occasional	Few Coarse Prominent
IICg	32+	6.2		10 YR 3/2(m)	Fine Sand	Massive	non sticky	Common	Few Coarse Prominent

TABLE 7 (cont'd)

Soil Series: Kamdon
Parent Material: Glacial Fluvial Fan
Classification: Orthic Dystric Brunisol

Drainage: Well to rapid
Location: Goat River south of Creston
Slope: 1 - 5%

HORIZON	DEPTH INCHES	pH H_2O	pH $(CaCl_2)$	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
Ap	0-5	7.3	5.92	Abrupt	10 YR 3/2(m)	Loam	Strongly Granular	Friable	Abundant
Bm	5-8	7.2	5.58	Diffuse	10 YR 4/3(m)	Loam to fine sand	Massive breaking to granular	Friable to Firm	Abundant
II C	8+	7.0			10 YR 5/4(d)	Gravelly Coarse Sand	Single Grain	non coherent	Abundant

TABLE 7 (cont'd)

Soil Series: Krikup
Parent Material: Kame
Classification: Orthic Dystric Brunisol

Drainage: Rapid
Location: Gravel pit off No. 6 Road
Slope: 5 %

HORIZON	DEPTH INCHES	pH H_2O	pH ($CaCl_2$)	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
L-F	$\frac{3}{4}$ - 0	5.6		Abrupt					
Bm_1	0 - 5	7.4	6.92	Clear	7.5 YR 5/4(d) 7.5 YR 4/2(m)	Loamy Sand	Granular	Soft	Abundant
Bm_2	5 - 9	7.5	6.89	Clear	10 YR 7/4(d) 10 YR 5/3(m)	Loamy Sand	Granular to weak fine subangular blocky	Soft	Common
C_1	9 -24	7.0		Diffuse		Gravelly Coarse Sand	Structureless		Occasional
C_2	24-40	6.7				Gravelly Coarse Sand	Structureless		Occasional

TABLE 7 (cont'd)

Soil Series: Kuskanook
Parent Material: Alluvial lacustrine
Classification: Carbonated Orthic Gleysol

Drainage: Poorly
Location: Hwy 3 near bridge
Slope: level

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Apgk	0-6	8.0	Abrupt	2.5Y 5/2(m)	Silty Clay Loam	Weak subangular Blocky	Friable	Abundant	Fine Medium Faint
AEgk	6-8	8.0	Clear	10 YR 5/2(m)	Silt Loam	Weak Coarse Platy	Firm	Abundant	Fine Medium Distinct
Bg_1	8-15	8.2	Clear	2.5Y 5/2(m)	Silt Loam	Moderate Coarse Columnar	Firm	Abundant	Fine Medium Distinct
Bg_2	15-24	8.2	Diffuse	10 YR 5/2(m)	Silty Clay Loam	Moderate coarse Columnar	Firm	Common	Fine Medium Distinct
BCg	24-32	8.1	Diffuse	10 YR 4/2(m)	Silty Clay Loam	Massive to Angular	Friable	Occasional	Fine Medium Distinct
Cgk_1	32-40	8.1	Diffuse	10 YR 5/2(m)	Silty Clay Loam	Massive	Friable	none	Fine Medium Distinct
Cgk_2	40+	8.3		10 YR 5/2(m)	Silty Clay Loam	Massive	Friable	none	Fine Medium Distinct

TABLE 7 (cont'd)

Soil Series: Leach
Parent Material: Alluvial
Classification: Carbonated Rego Gleysol

Drainage: Very Poor
Location: I.R. South of Creston
Slope: 0 - 1 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Cgk_1	0-5	7.6	Abrupt	10 YR 5/2(m)	Silt Loam	Moderate Medium Granular	Friable	Abundant	Many Fine Distinct
$Abgk_1$	5-10	8.0	Abrupt	10 YR 3/2(m)	Silt Loam	Strong, Fine Granular	Very Friable	Abundant	Few Fine Faint
Cgk_2	10-14	8.2	Abrupt	10 YR 5/2(m)	Silt Loam	Moderate Medium Blocky	Friable to Firm	Common	Many Medium Distinct
$Abgk_2$	14-17	8.2	Abrupt	10 YR 4/2(m)	Silt Loam	Weak Medium Blocky	Firm	Common	Few Medium Faint
Cgk_3	17-26	8.4	Abrupt	10 YR 6/1(m)	Very Fine Sandy Loam	Weak Medium Blocky	Friable to Firm	Occasional	Few Fine Faint
ACgk	26-29	8.3	Abrupt	10 YR 4/2(m)	Silt Loam	Weak Medium Blocky	Firm	Occasional	Few Fine Distinct
Cgk_4	29-37	8.3	Diffuse	10 YR 6/1(m)	Silt Loam	Massive	Firm	Occasional	Common Distinct Medium
Cgk_5	37+	8.4		10 YR 5/2(m)	Silt Loam	Massive	Firm	none	Many Medium Distinct

TABLE 7 (cont'd)

Soil Series: Lipsett
Parent Material: Glacio-lacustrine over basal till
Classification: Orthic Gray Luvisol
Drainage: Well
Location: Butterman road near golf course
Slope: 2 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTANCE	ROOTS
L-F	3/4-0	6.7	Abrupt					
Ae	0 -5	7.1	Clear	10 YR 5/3(d) 10 YR 3/3(m)	Loam	Granular	Soft	Abundant
AB	5-10	7.2	Diffuse	10 YR 5/3(d) 10 YR 4/3(m)	Silt Loam	Moderate Medium subangular Blocky	Hard	Abundant
BA	10-16	7.1	Clear	10 YR 6/3(d) 10 YR 3/3(m)	Silty Clay Loam	Moderate Medium subangular Blocky	Very Hard	Abundant
Bt	16-24	7.0	Abrupt	2.5 Y 6/2(d) 2.5 Y 4/4(m)	Clay Loam	Moderate Medium Blocky	Extremely Hard	Common
C	24-29	6.9	Abrupt	2.5 Y 6/4(d) 2.5 Y 5/4(m)	Silt Loam	Weak sub angular Blocky	Slightly Hard	Common
IICca	29-33	8.1	Clear	10 YR 7/4(d) 10 YR 5/4(m)	Loam	Massive	Extremely Hard	Occasional
IICk	33+	8.2		10 YR 6/3(d) 10 YR 5/2(m)	Loam	Massive	Extremely Hard	none

TABLE 7 (cont'd)

Soil Series: Lister
Parent Material: Glacio-lacustrine
Classification: Orthic Gray Luvisol

Drainage: Well
Location: South of golf course
Slope: 2 - 5 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
LH	1/4-0	6.7	Abrupt					
Ae	0 -6	6.6	Clear	10 YR 8/3(d) 10 YR 6/3(m)	Silty Clay Loam	Moderate Medium Platy	Very Hard	Abundant
BA	6 -9	6.3	Gradual	10 YR 8/3(d) 10 YR 8/3(m)	Silty Clay Loam	Medium sub-angular blocky	Extremely Hard	Common
Bt	9-15	6.3	Gradual	10 YR 7/3(d) 10 YR 6/3(m)	Clay Loam-Clay	Weakly Columnar	Extremely Hard	Occasional
BC	15-20	7.6	Abrupt	10 YR 8/3(d) 2.5 Y 7/2(m)	Clay Loam	Moderately Blocky	Extremely Hard	Occasional
Cca	20-30	8.0	Abrupt	2.5 Y 7/2(d) 2.5 Y 7/2(m)	Silty Clay Loam	Massive	Very Hard	Occasional
Ck	30-54+	8.3		2.5 Y 5/2(m)	Silty Clay Loam	Massive	Very Hard	none

TABLE 7 (cont'd)

Soil Series: Lovole
Parent Material: Glacio-lacustrine
Classification: Bisequa Gray Luvisol
Drainage: Moderately well
Location: Lower bench near West Creston
Slope: 2 - 5 %

HORIZON	DEPTH INCHES	pH H_2O	pH ($CaCl_2$)	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
LH	½-0	6.4		Abrupt					
Bf_1	0-6	6.5	5.87	Diffuse	10YR 6/4(m)	Loam silt loam	Structureless Weak Granular	Soft	Abundant
Bf_2	6-12	6.3	5.4	Abrupt	10 YR 6/4(m)	Loam silt loam	Weak granular	Soft	Abundant
Ae_2	12-14	6.2		Gradual	10 YR 7/3(m)	Silt Loam	Moderate Coarse platy	Very Hard	Common
AB	14-17	6.1		Gradual	10 YR 5/4(m)	Clay Loam	Medium Strong blocky	Extremely Hard	Occasional
Bt_1	17-24	6.2		Diffuse	10 YR 4/4(m)	Clay Loam Clay	Medium Strong blocky	Very Hard	Occasional
Bt_2	24-30	6.4		Diffuse	10 YR 4/3(m)	Clay Loam Clay	Medium Strong blocky	Very Hard	Occasional
BC	30-39	6.5		Gradual	2.5Y 4.5/3(m)	Clay Loam Clay	Medium Strong blocky	Very Hard	Occasional
CB	39-45	7.6		Clear	2.5Y 4/2(m)	Silt Loam	Varved Platy	Firm	Occasional
Ck	45+	8.0			2.5Y 5/4(m)	Silty Clay Loam	Varved Platy	Extremely Hard	Occasional

TABLE 7 (cont'd)

Soil Series: Nicks
Parent Material: Alluvium
Classification: Low Humic Eluviated Gleysol

Drainage: Poor
Location: Nicks Island
Slope: 0 - .5 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Ap	0-9	7.8	Abrupt	10 YR 5/2(m)	Clay Loam	Weak Medium Granular	Friable to Firm	Abundant	Few Fine Faint
Aeg	9-11	7.5	Gradual	10 YR 6/1(m)	Silty Clay Loam	Moderate Medium Platy	Extremely Firm	Abundant	Many Medium Distinct
Btg_1	11-16	7.7	Diffuse	10 YR 6/2(m)	Clay Loam to Clay	Strong blocky to weakly columnar	Extremely Firm	Abundant	Many Medium Distinct
Btg_2	16-22	7.9	Diffuse	10 YR 6/2(m)	Clay Loam	Weakly Colu-mnar to co-arse subangu-lar blocky	Very Firm	Common	Many fine Distinct
BCg	22-28	8.0	Diffuse	10 YR 5/2(m)	Clay Loam	Massive	Firm	Common	Many Medium Distinct
Cg	28-35+	8.0		10 YR 4/2(m)	Silty Clay Loam	Massive	Firm	Occasional	Many Fine Faint

TABLE 7 (cont'd)

Soil Series: Russell
Parent Material: Glacio-lacustrine over basal till
Classification: Bisequa Gray Luvisol
Drainage: Well
Location: Corn Creek West Creston
Slope: 6 %

HORIZON	DEPTH INCHES	pH H_2O	pH ($CaCl_2$)	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
Bfh	0-2½	6.8	5.83	Clear	10 YR 4/3(d) 10 YR 3/4(m)	Loam	Fine Granular	Friable	Abundant
Bf	2½-5	6.9	5.95	Clear	7.5YR 5/6(d) 7.5YR 4/4(m)	Silty Clay Loam	Fine Granular	Friable	Abundant
Ae_2	5-7	6.9		Clear	7.5YR 6/4(d) 7.5YR 5/4(m)	Clay Loam	Coarse Platy fine subangular blocky	Firm	Common
AB	7-8	6.8		Clear	10YR 6/3(d) 10 YR 5/3(m)	Silty Clay Loam	pseudo platy	Firm	Common
Bt_1	8-17	6.8		Gradual	10 YR 6/3(d) 10 YR 5/3(m)	Clay loam Clay	Weakly columnar to coarse sub-angular blocky	Very Firm	Common
Bt_2	17-26	6.8		Gradual	10 YR 6/3(d) 10 YR 6/4(m)	Clay Loam	Weakly columnar to coarse sub-angular blocky	Firm	Common
ICk	26-30	8.0		Abrupt	10YR 5/2(m)	Silty Clay Loam	Platy breaking to blocky	Firm	Occasional
$IICk_1$	30-40	8.2		Diffuse	2.5Y 6/3(d) 2.5Y 6/2(m)	Loam	Massive breaking to blocky	Extremely Hard	none
$IICk_2$	40+	8.3			10 YR 6/3(d) 10 YR 5/3(m)	Loam	Massive breaking to blocky	Extremely Hard	none

TABLE 7 (cont'd)

Soil Series: Rykerts
Parent Material: Alluvium
Classification: Gleyed Orthic Regosol

Drainage: Imperfect
Location: Central Creston **Flats**
Slope: 0 - 1 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Apk	0-9	7.5	Abrupt	10 YR 4/2(m)	Fine Loamy Sand	Weak subangular Blocky	**Soft**	**Abundant**	
Cgk_1	9-18	7.7	Diffuse	10 YR 6/2(m)	Fine Sandy Loam	Structureless	**Soft**	**Common**	**Common Medium Distinct**
Cgk_2	18-30	8.0	Diffuse	10 YR 6/2(m)	Fine Sandy Loam	Weak to moderate fine blocky	**Slightly Hard**	**Common**	**Many Medium Distinct**
Cgk_3	30-42	8.1	Diffuse	10 YR 6/2(m)	Fine Sandy Loam	Weak to moderate fine blocky	**Slightly Hard**	**Occasional**	**Many Medium Distinct**
Cgk_4	42+	7.9	[illegible]	10 YR 5/2(m)	Silt Loam	Massive	**Firm**	**Occasional**	**Many Medium prominent**

TABLE 7 (cont'd)

Soil Series: Sanka
Parent Material: Deltaic
Classification: Gleyed Orthic Regosol

Drainage: Rapid to poor in depressions
Location: Near Goat River off main highway south of Creston
Slope: 0 - 1 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
Ap	0-3	6.9	Clear	10 YR 5/3(d)	Loamy Fine Sand	Granular to Single Grain	Friable	Abundant
C_1	3-9	7.3	Clear	10 YR 6/3(d)	Loamy Fine Sand	Granular to Single Grain	Soft	Abundant
C_2	9-18	7.1	Diffuse	10 YR 6/4(d)	Loamy Fine Sand	Fine granular to single grain	Soft	Abundant
C_3	18+	6.7		10 YR 7/4(d)	Loamy Fine Sand	Single Grain	Soft	Abundant

TABLE 7 (cont'd)

Soil Series: Setter
Parent Material: Shallow Colluvium over bedrock
Classification: Orthic Dystric Brunisol

Drainage: Well to rapid
Location: South East of Wynndel
Slope: 5 %

HORIZON	DEPTH INCHES	pH H_2O	pH ($CaCl_2$)	HORIZON BOUNDARY	COLOR D=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
L-H	3/4-0	7.0		Abrupt					Common
Bm_1	0 -9	6.9	6.16	Clear	7.5 YR 4/4(m)	Sandy Loam	Weak granular	Friable	Abundant
Bm_2	9 -19	6.5	5.76	Diffuse	7.5 YR 4/4(m)	Sandy Loam	Weak granular	Friable	Abundant
BC	19-33	6.4		Abrupt	7.5 YR 5/4(m)	Sandy Loam	Weak granular	Friable	Common
	33+						Shattered Rock		none

TABLE 7 (cont'd)

Soil Series: Shaw
Parent Material: Alluvium
Classification: Orthic Rego Gleysol

Drainage: Imperfect
Location: Creston flats (Western undyked part)
Slope: Flat

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Cg_1	0-14	6.6	Gradual	10 YR 3/3(m)	Silt Loam	Weak Fine Granular to Masssive	Slightly Sticky	Abundant	none
Cg_2	14-22	6.1	Clear	10 YR 3/2(m)	Silt Loam	Massive	Slightly Sticky	Abundant	none
Cg_3	22-27	6.0	Clear	5Y 5/1(m)	Silt Loam	Massive	Slightly Sticky	Occasional	none
II Cg	27+	5.2	Clear	5Y 5/1(m)	Fine Sand	Massive to Single Grain	non sticky	Occasional	none

TABLE 7 (cont'd)

Soil Series: Simmons
Parent Material: Alluvial-lacustrine
Classification: Carbonated Rego Gleysol

Drainage: Poor
Location: Central Flats
Slope: Nil

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
Apgk	0 - 8	8.1	Abrupt	2.5 Y 5/2(m)	Silty Clay Loam	Weak subangular blocky to strong granular	Friable	Abundant	Few Medium Faint
Cgk_1	8 -18	8.3	Gradual	2.5 Y 6/2(m)	Silty Clay Loam	Massive breaking to subangular blocky	Friable	Common	Common Coarse Prominent
Cgk_2	18-33	8.1	Gradual	2.5 Y 6/2(m)	Silt Loam	Massive	Friable	Common	Many Coarse Prominent
Cgk_3	33+	7.7		2.5 Y 5/2(m)	Silt Loam	Massive	Friable	none	Many Coarse Prominent

TABLE 7 (cont'd)

Soil Series: Sirdar
Parent Material: Alluvium
Classification: Orthic Regosol

Drainage: Moderately Well
Location: I.R. South of Creston
Slope: 0 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS	MOTTLES
L-H	¼-0		Diffuse				Soft	Abundant	
C_1	0-3	7.6	Diffuse	10 YR 6/2(d)	Fine Sand	Structureless	Soft	Abundant	
C_2	3-14	8.0	Abrupt	10 YR 5/1(d)	Fine Sand	Structureless	Soft	Common	
II C_1	14-33	7.9	Abrupt	10 YR 6/2(d)	Loamy Sand	Structureless	Soft	Common	
III C_1	33+	7.9		10 YR 5/2(d)	Fine Sandy Loam	Single Grain	Slightly Hard	Occasional	Few Fine Faint

TABLE 7 (cont'd)

Soil Series: Tye
Parent Material: Basal Till
Classification: Orthic Gray Luvisol

Drainage: Well
Location: Near golf course
Slope: 1 - 5 %

HORIZON	DEPTH INCHES	pH H_2O	HORIZON BOUNDARY	COLOR d=dry; m=moist	TEXTURE	STRUCTURE	CONSISTENCE	ROOTS
L-H	½ - 0	6.4	Abrupt					
Ae	0 - 6	6.7	Abrupt	10 YR 6/4(d) 10 YR 5/3(m)	Silty Clay Loam	Moderate Coarse Platy	Soft	Common
Bt_1	6-14	6.5	Gradual	10 YR 7/3(d) 10 YR 6/3(m)	Clay Loam	Strong Medium Columnar	Extremely Hard	Common
Bt_2	14-19	7.1	Gradual	2.5 Y 5/2(m)	Silty Clay Loam-Clay	Strong Medium Columnar	Extremely Hard	Occasional
BC	19-33	7.2	Abrupt	10 YR 6/3(m)	Clay Loam	Massive breaking to granular	Hard	Occasional
Cca	33-37	8.0	Abrupt	10 YR 6/3(m)	Clay Loam	Massive breaking to granular	Very Hard	none
Ck	37+	8.4		10 YR 6/3(m)	Clay Loam	Massive breaking to granular	Hard	none

TABLE 8

Chemical Analyses of Selected Soil Profiles

Horizon	Depth (Inches)	Texture	pH H_2O	pH 0.01 M $CaCl_2$	Organic Matter %	Total N %	C/N Ratio	Phosphorus P1 p.p.m.	Phosphorus P2 p.p.m.	Ca	Mg	K	Na	Cation Exchange Capacity	Base Saturation %
										Exchangeable Cations and Exchange Capacity - Milli-equivalents/100 grams					
Benny series - Gleyed Regosol (Calcareous)															
Apgk	0 - 9	fsl	7.9							25.38	1.35	0.13	0.05	11.03	100
Cgk1	9 - 18	fsl	8.1							24.75	1.15	0.04	0.05	6.17	100
Cgk2	18 - 26	sil								26.88	1.96	0.10	0.13	15.12	100
Cgk3	26 - 32	sicl	8.2												
Cgk4	32+	sil	8.4												
Cory Series - Carbonated Orthic Gleysol															
Ap	0 - 6	sicl	7.6							31.83	2.80	0.20	0.09	27.27	100
Bg1	6 - 9	sic	7.6							19.00	2.92	0.07	0.09	14.04	100
Bg2	9 - 14	sic	7.8							18.17	2.80	0.09	0.08	16.04	100
BCg	14 - 26	sicl	8.0							16.09	2.63	0.06	0.08	13.07	100
Cgk	26 - 34	sicl	8.2							27.12	1.64	0.04	0.09	7.66	100
IICgk	34+	sil	8.2												
Creston Series - Orthic Eutric Brunisol															
IF	½ - 0		7.0			1.105		97.64	197.4	42.38	9.76	2.90	0.08	70.80	77.85
Bm1	0 - 4	sil-l	7.1	6.54		0.105		60.9	107.5	10.47	2.03	0.57	0.04	13.59	96.50
Bm2	4 - 18	sil	7.2	6.65		0.048		50.7	93.2	7.85	2.14	0.41	0.08	11.38	92.1
BC	18 - 24	sil	7.5					32.1	123.6	9.76	1.56	0.16	0.11	12.45	93.1
Ck1	24 - 31	l	8.1					9.3	15.0						
Ck2	31+	sil	8.5					9.8	10.2						

TABLE 8 (cont'd)

Horizon	Depth (Inches)	Texture	pH H_2O	pH 0.01 M $CaCl_2$	Organic Matter %	Total N %	C/N Ratio	Phosphorus P1 p.p.m.	Phosphorus P2 p.p.m.	Exchangeable Cations and Exchange Capacity - Milli-equivalents/100 grams Ca	Mg	K	Na	Cation Exchange Capacity	Base Saturation %
Elmo Series - Orthic Eutric Brunisol															
Ap	0 - 9	l	7.0	6.36		0.145		85.9	202.2						
Bm1	9 - 15	lfs	7.25	6.70		0.034		48.4	73.3						
Bm2	15 - 22	lfs	6.9	6.27		0.019		29.3	49.3						
C	22+	lfs	7.2					5.0	10.9						
Kuskanook Series - Carbonated Orthic Gleysol															
Apgk	0 - 6	sicl	8.0			0.195		10.6	17.7	27.55	1.76	0.10	0.24	13.46	100
ABgk	6 - 8	sil	8.0			0.107		1.7	10.1	28.75	2.22	0.06	0.15	11.18	100
Bg1	8 - 15	sil	8.2			0.085		2.1	19.4	26.45	2.63	0.07	0.11	10.95	100
Bg2	15 - 24	sicl	8.2			0.091		2.6	58.9	14.36	[illegible]	0.09	0.10	14.29	100
BCg	24 - 32	sicl	8.1					3.7	119.4	16.90	3.11	0.08	0.10	14.19	100
Cgk1	32 - 40	sicl	8.1					2.5	14.5	28.84	2.53	0.09	0.09	10.34	100
Cgk2	40+	sicl	8.3					2.8	7.1						
Leach Series - Rego Gleysol (Carbonated)															
Cgk1	0 - 5	sil	7.6			0.189		1.5	4.1	31.02	1.68	1.56	0.13	12.13	100
Abgk1	5 - 10	sil	8.0		4.74	0.236	11.65:1	1.7	57.2	25.28	2.75	0.09	0.11	23.15	100
Cgk2	10 - 14	sil	8.2		1.76	0.149	6.85:1	1.7	172.4						
Abgk2	14 - 17	sil	8.2		2.22	0.118	10.93:1	1.3	132.4						
Cgk3	17 - 26	vfsl	8.4		0.50	0.937	7.85:1	1.3	3.2						
ACgk	26 - 29	sil	8.3		1.77			1.3	18.1						
Cgk4	29 - 37	sil	8.3		1.48			5.5	8.8						
Cgk5	37+	sil	8.4					1.5	3.1						

TABLE 8 (cont'd)

Horizon	Depth (Inches)	Texture	pH H_2O	pH 0.01 M $CaCl_2$	Organic Matter %	Total N %	C/N Ratio	Phosphorus P1 p.p.m.	Phosphorus P2 p.p.m.	Exchangeable Cations and Exchange Capacity - Milli-equivalents/100 grams: Ca	Mg	K	Na	Cation Exchange Capacity	Base Saturation %
Lipsett Series - Orthic Grey Luvisol															
LF	¾ - 0		6.7							49.50	10.26	2.50		59.28	100
Ae	0 - 5	l	7.1							11.00	1.96	0.45	0.03	11.99	100
AE	5 - 10	sil	7.2							9.00	1.48	0.43	0.06	9.66	100
BA	10 - 16	sicl	7.1							10.63	2.41	0.54	0.05	12.34	100
Bt	16 - 24	cl	7.0							9.50	2.54	0.33	0.05	11.97	100
IC	24 - 29	sil	6.9												
IICca	29 - 33	l	8.1												
II Ck	33+	l	8.2												
Lister Series - Orthic Grey Luvisol															
LF	¼ - 0		6.7												
Ae	0 - 6	sicl	6.6			0.091				6.58	1.65	0.62	0.05	11.42	77.93
BA	6 - 9	sicl	6.3			0.061		25.2	38.6	6.35	1.91	0.70	0.06	12.08	74.7
Bt	9 - 15	cl-c	6.3			0.061		16.3	47.9	9.55	2.29	0.61	0.08	14.83	84.5
BC	15 - 20	cl	7.6			0.055		7.4	46.8	24.40	2.37	0.47	0.06	12.26	100
Cca	20 - 30	sicl	8.0					2.1	4.9	20.92	1.70	0.28	0.06	8.59	100
Ck	30+	sicl	8.3					2.1	4.0						

TABLE 8 (cont'd)

Horizon	Depth (Inches)	Texture	pH H_2O	pH 0.01 M $CaCl_2$	Organic Matter %	Total N %	C/N Ratio	Phosphorus P1 p.p.m.	Phosphorus P2 p.p.m.	Ca	Mg	K	Na	Cation Exchange Capacity	Base Saturation %
										Exchangeable Cations and Exchange Capacity - Milli-equivalents/100 grams					
Lovole Series - Bisequa Grey Luvisol															
LH	½ - 0	l-sil	6.4	5.87		0.917		41.2	157.9	59.91	5.17	1.32	0.05	76.47	86.90
Bf1	0 - 6	l-sil	6.5	5.40		0.071		347.7	400	3.34	0.29	0.51	0.05	13.99	29.90
Bf2	6 - 12	sil	6.3			0.066		333.7	400	4.25	0.60	0.45	0.06	13.85	38.70
Ae2	12 - 14	cl	6.2			0.044		39.7	66.6	3.28	1.00	0.34	0.06	7.19	65.10
AB	14 - 17	cl-c	6.1			0.031		3.8	6.4	3.16	0.76	0.33	0.06	8.02	53.90
Bt1	17 - 24	cl-c	6.2			0.037		7.2	13.7	6.72	1.70	0.39	0.05	10.61	83.51
Bt2	24 - 30	cl-c	6.4					6.2	22.2	6.85	1.70	0.39	0.05	10.47	85.86
BC	30 - 39	cl-c	6.5					7.8	68.5	8.51	1.99	0.39	0.06	12.93	84.69
CE	39 - 45	sil	7.6					2.3	68.9	9.25	1.56	0.29	0.05	10.76	100
Ck	45+	sicl	8.0					2.1	5.2	24.59	1.77	0.33	0.06	10.37	100
Nicks Series - Low Humic Eluviated Gleysol															
Ap	0 - 9	cl	7.8			0.162		4.2	81.4	14.88	3.01	0.11	0.09	14.77	100
Aeg	9 - 11	sicl	7.5			0.064		2.1	76.3	14.88	3.01	0.08	0.09	13.68	100
Btg1	11 - 16	cl-c	7.7			0.057		2.8	126.0	14.17	3.11	0.09	0.09	13.36	100
Btg2	16 - 22	cl	7.9					3.2	262.5	11.64	3.90	0.12	0.06	13.68	100
BCg	22 - 28	cl	8.0					2.2	103.8	12.53	4.84	0.10	0.06	14.10	100
Cg	28+	sicl	8.0					3.2	157.2	11.42	3.43	0.07	0.03	10.72	100

TABLE 8 (cont'd)

Horizon	Depth (Inches)	Texture	pH H_2O	pH 0.01 M $CaCl_2$	Organic Matter %	Total N %	C/N Ratio	Phosphorus P1 p.p.m.	Phosphorus P2 p.p.m.	Exchangeable Cations and Exchange Capacity - Milli-equivalents/100 grams: Ca	Mg	K	Na	Cation Exchange Capacity	Base Satura-tion %
Russell Series - Bisequa Grey Luvisol															
Lfh	0 - 2½	l	6.8	5.83	5.93	0.243	14.16:1	296.0	503.6	9.76	1.24	1.54	0.04	18.71	67.2
Bf	2½ - 5	sicl	6.9	5.95	2.83	0.110	14.91:1	202.3	425.1	8.21	1.09	1.28	0.05	16.61	64.0
Ae2	5 - 7	cl	6.9		0.89	0.057	9.12:1	8.3	19.2	6.07	1.05	1.01	0.09	9.29	88.5
AB	7 - 8	sicl	6.8			0.052		14.5	25.3	6.07	0.82	1.37	0.11	8.39	99.8
Bt1	8 - 17	cl-c	6.8			0.053		6.1	8.6	9.13	1.99	0.57	0.05	12.67	92.6
Bt2	17 - 26	cl	6.8			0.050		5.5	71.1	11.57	2.45	0.59	0.04	15.37	95.0
IC(k)	26 - 30	sicl	8.0					1.6	5.6	23.66	1.90	0.40	0.05	9.93	100
IICk1	30 - 40	l	8.2					2.4	10.6						
IICk2	40+	l	8.3					1.7	12.1						
Rykerts series - Gleyed Orthic Regosol (Calcareous)															
Ap(k)	0 - 9	fls	7.5			0.133		5.0	23.0	18.73	0.92	0.07	0.08	7.83	100
Cg1k	9 - 18	fsl	7.7			0.069		1.2	6.1	19.56	1.11	0.04	0.04	5.36	100
Cg2k	18 - 30	fsl	8.0					1.7	4.8	16.40	0.59	0.05	0.05	5.26	100
Cg3k	30 - 42	fsl	8.1					1.7	4.5						
Cg4k	42+	sil	7.9					2.3	114.5						
Shaw Series - Rego Gleysol															
Cg1	0- 14	sil	6.6			0.895		11.8	40.4	18.39	4.45	0.23	0.22	33.22	70.11
Cg2	14 - 22	sil	6.1			0.618		5.1	13.1	11.33	1.80	0.06	0.16	30.16	44.26
Cg3	22 - 27	sil	6.0			0.158		4.2	7.5						
IICg	27+	fs	5.2												

TABLE 8 (cont'd)

Horizon	Depth (Inches)	Texture	pH H_2O	pH 0.01 M $CaCl_2$	Organic Matter %	Total N %	C/N Ratio	Phosphorus P1 p.p.m.	Phosphorus P2 p.p.m.	Ca	Mg	K	Na	Cation Exchange Capacity	Base Saturation %
										Exchangeable Cations and Exchange Capacity - Milli-equivalents/100 grams					
Simmons Series - Carbonated Rego Gleysol															
Apgk	0 - 8	sicl	8.1			0.187		29.9	40.1	22.78	2.25	0.10	0.11	11.70	100
Cgk1	8 - 18	sicl	8.3			0.079		1.8	4.0	22.33	1.64	0.04	0.06	7.19	100
Cgk2	18 - 33	sil	8.1					2.0	3.6						
Cgk3	33+	sil	7.7					6.0	66.0						

TABLE 9

Copper, Zinc and Sulphur Analyses for Selected Soils of the Creston Valley

Horizon	Depth (Inches)	Texture	Available and Organically Complexed Cu p.p.m.	Available and Organically Complexed Zn p.p.m.	Available S p.p.m.
Cory Series					
Ap	0 - 6	sicl	30.3	143.0	8.9
Bg1	6 - 9	sic	25.8	121.6	3.2
Bg2	9 - 14	sic	25.4	123.2	4.4
BCg	14 - 26	sicl	22.5	112.7	2.4
Cgk	26 - 34	sicl	17.9	85.8	7.5
IICgk	34+	sil	16.4	71.8	9.1
Creston Series					
LF	½ - 0		15.02	119.37	6.2
Bm1	0 - 4	sil-l	21.30	97.62	4.2
Bm2	4 - 18	sil	23.56	82.32	2.0
BC	18 - 24	sil	25.84	78.02	1.3
Ck1	24 - 31	l	20.52	56.99	0
Ck2	31+	sil	17.60	49.70	0
Elmo Series					
Ap	0 - 9	l	16.9	68.8	2.2
Bm1	9 - 15	lfs	17.1	56.0	2.0
Bm2	15 - 22	lfs	18.9	47.0	1.4
C	22+	lfs	23.1	51.0	1.8
Kuskanook Series					
Apgk	0 - 6	sicl	19.8	100.1	11.2
ABgk	6 - 8	sil	20.5	101.3	9.2
Bg1	8 - 15	sil	20.2	101.2	8.6
Bg2	15 - 24	sicl	21.3	113.1	3.2
BCg	24 - 32	sicl	20.8	113.1	2.5
Cgk1	32 - 40	sicl	20.2	91.1	8.1
Cgk2	40+	sicl	18.4	95.5	6.4

TABLE 9 (cont'd)

Horizon	Depth (Inches)	Texture	Available and Organically Complexed Cu p.p.m.	Available and Organically Complexed Zn p.p.m.	Available S p.p.m.
Leach Series					
Cgk1	0 - 5	sil	20.8	119.3	7.0
Abgk1	5 - 10	sil	26.0	128.2	5.7
Cgk2	10 - 14	sil	24.8	106.0	6.6
Abgk2	14 - 17	sil	25.7	106.7	6.1
Cgk3	17 - 26	vfsl	15.1	66.8	11.6
ACgk	26 - 29	sil	20.3	102.9	13.4
Cgk4	29 - 37	sil	17.5	94.4	16.4
Cgk5	37+	sil	16.9	83.3	14.2
Lister Series					
LF	0 - 6				
Ae	6 - 9	sicl		149.3	1.4
BA	9 - 15	sicl	38.8	119.3	1.4
Bt	15 - 20	cl-c	64.9	324.6	1.0
BC	20 - 30	cl	43.6	123.2	1.0
Cca	30 - 54	sicl	33.1	115.8	0
Ck	54+	sicl	36.1	118.6	0
Lovole Series					
LH	½ - 0		10.9	138.9	7.4
Bf1	0 - 6	l-sil	13.9	170.2	2.1
Bf2	6 - 12	l-sil	18.3	143.4	1.4
Ae2	12 - 14	sil	21.9	88.3	1.9
AB	14 - 17	cl	27.0	85.9	1.0
Bt1	17 - 24	cl-c	42.8	94.2	1.9
Bt2	24 - 30	cl-c	42.1	100.2	0.6
BC	30 - 39	cl-c	40.6	352.8	1.9
CB	39 - 45	sil	37.0	94.2	1.8
Ck	45+	sicl	40.1	116.1	0
Nicks Series					
Ap	0 - 9	cl	18.06	132.25	0.6
Aeg	9 - 11	sicl	17.04	113.17	0.2
Btg1	11 - 16	cl-c	23.63	109.25	6.8
Btg2	16 - 22	cl	23.65	119.53	0.1
BCg	22 - 28	cl	23.14	114.46	1.2
Cg	28+	sicl	22.38	89.01	0.4

TABLE 9 (cont'd)

Horizon	Depth (Inches)	Texture	Available and Organically Complexed Cu p.p.m.	Available and Organically Complexed Zn p.p.m.	Available S p.p.m.
Russell Series					
Bfh	0 - 2.5	l	18.7	175+	1.7
Bf	2.5 - 5	sicl	22.3	175+	1.4
Ae2	5 - 7	cl	29.4	103.0	1.6
AB	7 - 8	sicl	24.8	86.0	0.7
Bt1	8 - 17	cl-c	46.1	106.5	1.3
Bt2	17 - 26	cl	45.7	271.9	1.3
ICk	26 - 30	sicl	35.4	102.7	0
IICk1	30 - 40	l	30.3	78.3	0
IICk2	40+	l		73.1	0
Rykerts Series					
Apk	0 - 9	fls	12.90	99.94	3.5
Cgk1	9 - 18	fsl	14.88	70.64	4.9
Cgk2	18 - 30	fsl	15.89	74.42	4.9
Cgk3	30 - 42	fsl	16.35	74.19	4.1
Cgk4	42+	sil	22.04	108.92	0.5
Shaw Series					
Cg1	0 - 14	sil	23.6	108.6	44.6
Cg2	14 - 22	sil	22.4	72.1	6.0
Cg3	22 - 27	sil	16.9	80.9	5.8
IICg	27+	fs	8.5	41.4	3.1
Simmons Series					
Apgk	0 - 8	sicl	20.8	94.4	35.5
Cgk1	8 - 18	sicl	17.4	74.4	14.9
Cgk2	18 - 33	sil	15.1	68.6	12.4
Cgk3	33+	sil	19.1	89.0	9.1

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APPENDIX 1

SOIL CLASSIFICATION

The Soil Order is the highest level of generalization in the Canadian soil classification scheme; all of the soils within an order have one or more basic profile characteristic in common. Of the eight orders in the classification scheme, (the Chernozemic, Solonetzic, Luvisolic, Podzolic, Brunisolic, Regosolic, Gleysolic and Organic) only four of these (the Luvisolic, Brunisolic, Regosolic and Gleysolic) are represented in the soil survey of the Creston Area.

Each soil order is further subdivided into Great Soil Groups. These are groups of soils having certain morphological features in common that reflect a similar pedologic environment. A further subdivision of great soil groups are subgroups. The differentiated soil series, each being the basic mapping unit, are grouped into soil subgroups according to their pedologic development.

1) Gleysolic Order of Soils:

These soils are saturated with water and are under reducing conditions continuously or during some period of the year unless they are artificially drained. Localized oxidation of iron and deposition of iron oxides gives these soils distinct or prominent mottles of high chroma. Drainage is always moderately poor to very poor.

a) Humic Gleysol Great Group:

These moderately poorly to very poorly drained soils are characterized by a dark coloured surface horizon greater than three inches thick under virgin conditions. When cultivated to a depth of 6 inches the plow layer (Ap) contains more than three percent organic matter and is appreciably darker in color than the underlying horizon. Subsurface horizons are strongly gleyed and/or mottled and weakly developed eluvial and illuvial horizons may be present. These soils may have an organic surface layer of less than 16 inches of mixed peat or up to 24 inches of fibric moss peat.

i) Rego Humic Gleysol:

Humic Gleysol soil with a noneffervescent Ah or Ap layer and without a gleyed B horizon.
Profile Type: (L-H), Ah, Cg or C or CKg
Series: ACORN

APPENDIX 1 (cont'd)

b) Gleysol Great Group:

These Gleysolic soils have either no Ah horizon or one less than 3 inches thick. When cultivated to a depth of 6 inches they have an Ap layer with either less than 3% organic matter or a color value higher than 3.5.

ii) Rego Gleysol:

Gleysol soils without a B horizon. They lack a surface horizon which effervesces
Profile Type: (L-H), (Ah), Cg or CKg or Ccag.
Series: Hall, Shaw.

iii) Carbonated Orthic Gleysol:

Gleysol soils with a gleyed B and a surface horizon which effervesces.
Profile Type: (L-H), (Ahk), (Ahek), Bgk, Ckg
Series: Cory, Kuskanook

iv) Carbonated Rego Gleysol:

Gleysol soils without a gleyed B horizon but with a surface horizon which effervesces.
Profile Type: (L-H), (Ahk), Ckg or Ccag.
Series: Alice, Buckworth, Leach, Simmons

c) Eluviated Gleysol Great Group:

These Gleysolic soils have Aeg and Btg horizons.

i) Low Humic Eluviated Gleysol:

Eluviated Gleysol soils without an Ah or Ap horizon lower in color value of 3.5.
Profile Type: (L-H), (Ah), (Ahe), Aeg, Btg, Cg or Ckg
Series: Nicks

2) Regosolic Order of Soils:

These well and imperfectly drained soils with good to moderate oxid- conditions have horizon development too weak to meet the soil requirement of other Orders.

a) Regosol Great Group:

Well and imperfectly drained soils with weak horizon developments

APPENDIX 1 (cont'd)

i) Orthic Regosol:

These soils have a nonchernozemic Ah horizon. The organic matter content decreases with depth.
Profile Type: (L-H), (Ah), Ck or C
Series: Goat

ii) Gleyed Regosol:

These are Regosolic soils with mottling and dull colors within 20 inches of the surface.
Profile Type: (L-H), (Ah), Ckg or Cg.
Series: Benny, Rykerts, Sanka

iii) Orthic Regosol (Carbonated):

Regosolic soils with free lime to the surface
Profile Type: (L-H), (Ahk), Ck
Series: Sirdar

3. Brunisolic Order of Soils

These soils have brownish-colored sola indicative of good to imperfect drainage. They have developed under forest or mixed forest and grass ecological communities. All have brownish Bm horizon but none have a Bt or a podzolic B horizon.

a) Eutric Brunisol Great Group:

These soils have organic surface horizons over Bm horizons in which the base saturation is 100% and the $CaCl_2$ pH is usually 5.5 or higher. The parent material is usually calcareous.

i) Orthic Eutric Brunisol:

These soils have organic surface horizons, overlying Bm horizons that usually have a chroma of 3 or more.

Profile Type: L-H or Ap, (Ah), Bm, (Ck), (Cca)
Series: Blake, Creston, Elmo

b) Dystric Brunisol Great Group:

These are Brunisol soils that, under virgin conditions, have organic surface horizons (L-H), over Bm horizons in which the base saturation is usually 65-100% and the $CaCl_2$ pH is 5.5 or lower. The parent material is usually acidic.

APPENDIX 1 (cont'd)

i) Orthic Dystric Brunisol:

These are Dystric Brunisols that, under virgin conditions, have organic surface horizons (L-H) over Bm horizon.
Profile Type: L-H or Ap, (Ah), Bm, (Ck), (Cca)
Series: Fletcher, Kaurdon, Kirkup, Setter

4) Luvisolic Order of Soils:

These soils have thin organic layers (L-H) with light-colored eluvial horizons and with illuviated horizons in which clay is the main accumulation product. The solum generally has medium to high degree of base saturation.

a) Gray Wooded (Gray Luvisol) Great Group:

The Gray Wooded (Gray Luvisol) soils have developed in moderately cool climates and under boreal forest or mixed forest in the grassland-forest transition zone, generally on basic materials.

i) Orthic Gray Wooded (Orthic Gray Luvisol):

These soils have characteristics of the great group, also organic surface horizon (L-H), light-colored Ae and illuviated Bt horizons.
Profile Type: L-H, (Ah or Ahe), Ae, Bt, (Cca or Ck or C).
Series: Lipsett, Lister, Tye.

ii) Gleyed Gray Wooded (Gleyed Gray Luvisol):

Soils of the same profile type as Orthic Gray Wooded but due to periodic wetness, Ae and Bt horizons are mottled.
Profile Type: L-H, Aegj, Btgj, (Btg), (Cg), (C)
Series: Candy

iii) Bisequa Gray Wooded (Bisequa Gray Luvisol):

Soils with the same characteristics as Orthic Gray Wooded, but in which a podzolic sequence of horizons (Ae, Bfh, or Bf or both) has developed in the Ae horizon of the Gray Wooded and is underlain by a depth of 18 inches or less by a continuous Bt horizon.
Profile Type: L-H or Ap, (Ae), Bf, Ae, Bt, (Ck), C
Series: Lovole, Russell

APPENDIX 2 - SOIL HORIZON NOMENCLATURE

Horizon nomenclature - Capital and lower case letters used to designate and describe soil horizons. Those used in this report are as follows:

Organic layers (contain 30% or more organic matter) - Two groups of these layers are recognized.

1. O - An organic layer(s) developed under poorly drained conditions or under conditions of being saturated most of the year or on wet soils that have been artificially drained.

   Of - This is the least decomposed layer. It has large amounts of well preserved fiber that is readily identifiable as to its botanical origin and is called fibric.

   Om - This is an intermediately decomposed layer. It has intermediate amounts of physically and biochemically altered fiber and is called mesic.

   Oh - This is the most highly decomposed layer. It has the least amount of plant fiber, the highest bulk density, the lowest water holding capacity and is called humic.

2. L-F-H - Organic layers developed under imperfectly to well drained conditions.

   L - An organic layer characterized by an accumulation of organic matter in which the original structures are easily discernible.

   F - An organic layer characterized by an accumulation of partly decomposed organic matter. The original structures in part are difficult to recognize.

   H - An organic layer characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible.

Master Mineral Horizons and Layers

A - A mineral horizon or horizons formed at or near the surface in the zone of removal of materials in solution and suspension and/or maximum in situ accumulation of organic matter. Included are: - (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 having characteristics of (1) and (2) above but transitional to underlying B or C (AB or A and B), (4) horizons markedly disturbed by cultivation or pasture (Ap).

APPENDIX 2 (cont'd)

B - A mineral horizon or horizons characterized by one or more of the following: - (1) an enrichment in silicate clay, iron, aluminum, or humus, alone or in combination (Bt, Bf, Bfh, Bhf and Bh); (2) a prismatic or columnar structure which exhibits pronounced coatings or stainings and with significant amounts of exchangeable sodium (Bn); (3) on alteration by hydrolysis, reduction or oxidation to give a change in colour or structure from horizons above and/or below and does not meet the requirements of (1) and (2) above (Bm, Bg).

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 calcium and magnesium carbonates and more soluble salts (Cca, Csa, Cg and C).

R - Consolidated bedrock that is too hard to break in the hands or dig with the spade when moist and which does not meet the requirements of a C horizon. The boundary between the R layer and overlying unconsolidated material is called a lithic contact.

Lower Case Suffixes

b - Buried soil horizon.

c - A cemented (irreversible) pedogenic horizon.

cc- Cemented (irreversible) pedogenic concretions.

e - A horizon characterized by removal of clay, iron, aluminum or organic matter alone or in combination and are lighter in colour than the underlying B horizon. It is used only with A horizons.

f - A horizon enriched with hydrated iron and is redder in colour than horizons above or below. It is used only with B horizons.

g - A horizon characterized by gray colours and/or prominent mottling indicative of permanent or periodic intense reduction. It may be used with A, B or C horizons.

h - A horizon enriched with organic matter. It may be used only with A or B horizons.

j - Used as a modifier of suffixes e, g, n and t to denote an expression of, but failure to meet, the specified limits of the suffix it modifies. It must be placed to the right and adjacent to the suffix it modifies.

m - A horizon slightly altered by hydrolysis, oxidation and/or solution to give a change in colour and/or structure. It is used only with B horizons.

p - A layer disturbed by man's activities, i.e., by cultivation and/or pasturing. It is used only with A horizons.

APPENDIX 2 (cont'd)

s - A horizon with salts including gypsum which may be detected as crystals or veins, or as surface crusts of salt crystals, or by distressed crop growth, or by the presence of salt tolerant plants.

sa- A horizon with secondary enrichment of salts more soluble than calcium or magnesium carbonates where the concentration exceeds that present in the unenriched parent material.

t - A horizon enriched with silicate clay. It is used only with B horizons.

Additional terms

(1) Litholgic changes are indicated by Roman numeral prefixes (II, III, with I assumed).

(2) Horizon subdivisions are denoted by numbers used as suffixes, i.e., Ap1, Ap2.

(3) If more than one lower case suffix is required, they are recorded in order of dominance, i.e., Bfc, Bfh.

(4) Transition horizons need capitals only, i.e. AB, BC.

APPENDIX 3

GLOSSARY *

Alluvium - A general term for all deposits of modern rivers and streams. Soils derived from alluvium are called alluvial soils.

Available plant nutrients - That portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

Base saturation percentage - The extent to which the adsorption complex of a soil is saturated with exchangeable cations other than hydrogen and aluminum. It is expressed as a percentage of the total cation exchange capacity.

Capability class - The class indicates the general suitability of the soils for agricultural use. It is a grouping of subclasses that have the same relative degree of limitation of hazard. The limitation or hazard becomes progressively greater from Class 1 to Class 7.

Capability subclass - This is a grouping of soils with similar kinds of limitations and hazards and provides information on the kind of conservation problem or limitation.

Cation exchange - The interchange between a cation in solution and another on the surface of any surface-active material such as clay or organic colloid.

Cation exchange capacity - The sum total of exchangeable cations that a soil can absorb and is usually expressed in milli-equivalents per 100 grams of soil.

Cemented - The soil has a hard, brittle consistency because the particles are held together by cementing substances such as humus, calcium carbonate, or the oxides of silicon, iron and aluminum.

Chroma - The relative purity strength or saturation of a colour and is directly related to the dominance of the determining wave length of the light and inversely related to grayness. It is one of the three variables of colour.

Concretion - A local concentration of a chemical compound, such as calcium carbonate or iron oxide, in the form of a grain or nodule of varying size, shape, hardness and colour.

Consistency - The resistance of a material to deformation or rupturing or, the degree of cohesion or adhesion of the soil mass. Terms used for describing consistency at various soil moisture contents are:

wet soil - non-sticky, slightly sticky, sticky, very sticky, non-plastic, slightly plastic, plastic and very plastic;

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* Most of the definitions are from the "Glossary of Soil Terms", prepared by the Canadian Society of Soil Science.

APPENDIX 3 (cont'd)

moist soil - loose, very friable, friable, firm, very firm and extremely firm;

dry soil - loose, soft, slightly hard, hard, very hard and extremely hard;

cementation - weakly cemented, strongly cemented and indurated.

Crust - A surface layer on soils, ranging in thickness from a few millimetres to perhaps an inch, that is much more compact, hard and brittle, when dry than the material immediately beneath it.

Delta - A fan shaped area formed by deposition of successive layers of debris brought down from the land and spread out on the bottom of a basin at the mouth of the river. Goat River delta.

Dryland farming - The practice of crop production in low-rainfall areas without irrigation.

Eluvial horizon - A light coloured mineral horizon from which material has been removed in solution or water suspension.

Floodplain - Alluvial deposits which may be subject to overflow. It is generally characterized by a series of laterally accreted deposits near the river channel and a gentle downslope to a swampy inner margin.

Friable - A term referring to a moist soil aggregate easily crushed between the fingers but which coheres when pressed together.

Glacial outwash - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice.

Glacial till - An unsorted, compact to loose heterogeneous mixture of materials deposited by glacial ice.

Gleysation - A soil forming process, operative under poor drainage, that results in the reduction of iron and other elements and in gray colours and mottles.

Gravel - Rounded or subrounded rock fragments up to three inches in diameter.

Green manure - Plant material incorporated with the soil while green, for improving the soil. Crops grown for use as green manure are termed green-manure crops.

Groundwater - That portion of the total precipitation which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

APPENDIX 3 (cont'd)

Horizon - A layer of soil or soil material approximately parallel to the land surface that differs from adjacent genetically related layers in properties such as colour, structure, texture, consistency, chemical, biological and mineralogical composition.

Hue - One of the three variables of colour. It is caused by light of certain wave lengths and changes with the wave length.

Illuvial horizon - A soil layer or horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension. The layer of accumulation.

Illuviation - The process of deposition of soil material removed from one horizon to another in the soil; usually from an upper to a lower horizon in the soil profile. Illuviated substances include silicate clay, iron and aluminum hydrous oxides and/or organic matter.

Impeded drainage - A condition which hinders the movement of water through soils under the influence of gravity.

Impervious - Resistant to penetration by fluids or roots.

Infiltration - The downward entry of water into the soil.

Ions - Atoms, groups of atoms, or compounds, which are electrically charged as a result of the loss of electrons (cations) or the gain of electrons (anions).

Leaching - The removal of materials in solution from the soils.

Mottles - Spots or blotches of different colour or shades of colour interspersed with the dominant colour.

Muck - An organic soil with highly decomposed materials.

Orthic - A term used to define the subgroup of soils considered to be the central concept of a great soil group. Other subgroups are departures from the Orthic.

Parent material - The unconsolidated and more or less chemically unweathered mineral or organic matter from which the solum of a soil is developed by pedogenic processes.

Parts per million (p.p.m.) - Weight units of any given substance per one million equivalent weight units of oven-dry soil; or the weight units of solute per one million weight units of solution.

APPENDIX 3 (cont'd)

Peat - Unconsolidated soil material consisting largely of undecomposed, or only slightly decomposed, organic matter.

Ped - A unit of soil structure such as a prism, block or granule, formed by natural processes.

Pedology - Those aspects of soil science involving the constitution, distribution, genesis and classification of soils.

Percolation - The downward movement of water through the soil.

Permeability - The ease with which gases, liquids or plant roots penetrate or pass through a bulk mass of soil or layer of soil.

pH - A logarithmic designation of the relative acidity or alkalinity of soil or other materials and is expressed in values from 0 to 14.

Porosity - The volume percentage of the total bulk not occupied by solid particles.

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

Reaction, soil - The degree of acidity or alkalinity of a soil, usually expressed as a pH value.

Saline soil - A non-alkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than four millimhos. per centimeter, the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

Saturation extract - The extract from a soil sample that has been saturated with water.

Soil drainage - The frequency and duration of periods when the soil is free of water saturation. The following drainage classes were used in this report:-

Rapidly drained - Soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions.

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

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

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

APPENDIX 3 (cont'd)

Poorly drained - Soil moisture in excess of field capacity remains in all horizons for a large part of the year.

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

Soil structure - The combination or arrangement of primary soil particles into secondary particles, units, or peds. The secondary units are characterized and classified on the basis of size, shape and degree of distinctness into classes, types and grades, respectively. The following structure descriptions are used in this report:-

Platy - Thin, horizontal plates; the horizontal axis is longer than the vertical.

Prismatic - Aggregates with vertical axis longer than the horizontal and with well defined surfaces and edges.

Blocky - Block-like aggregates; the vertical and horizontal axes are about the same length, usually with sharp edges.

Subangular blocky - Block-like aggregates; the vertical and horizontal axes are about the same length with subrounded edges.

Granular - More or less rounded aggregates with an absence of smooth faces and edges.

Massive - A cohesive soil mass with no observable aggregation of soil particles.

Single-grain - A loose, incoherent mass of individual particles, as in sand.

Soil survey - The systematic examination, description, classification and mapping of soils in an area.

Solum - The upper horizons of a soil in which the parent material has been modified and within which most plant roots are confined. It consists usually of the A and B horizons.

Water holding capacity - The amount of water held by the soil after excess water has drained away due to gravity.

Water table - The elevation of the upper limit in the soil or underlying material which is saturated by water.

Water table, perched - The water table of a saturated layer of soil which is separated from an underlying saturated layer by an unsaturated layer.

Weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface.