SOIL RESOURCES

of the

DOIG RIVER INDIAN RESERVE NO. 206

by

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with a section on Residential Suitability

by

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PREFACE

This report contains information about the soils of the Doig River Indian Reserve, and their potential for agriculture and the construction of small buildings. First there is a brief description of the landscape. Then there are descriptions of the soils, followed by sections on Agricultural Capability and Residental Suitability. More detailed descriptions of the individual soil areas are contained in an appendix. Two maps accompany the report; one shows the different soil areas, identifies them by a number, and also shows their rating for agriculture, the other shows the same soil areas and their ratings for residential suitability.

The survey was done at the request of the Doig River Band, and I am grateful to the Band and their Band Council for granting us access to the Reserve. Russell Apsassin, Ken Denholm, Alan Lidstone, and Jeremy Joyce helped with the field work. Martin Kobayakawa, the District Planner for I.N.A.C. in Fort St. John, made many of the local arrangements necessary for the survey. Soil analyses were carried out by L.K. Chan, Agriculture Canada, and soil test results and fertilizer recommendations were furnished by the Soil Testing Laboratory, Ministry of Agriculture and Food, Kelowna. Mosaics and map overlays were prepared by Energy, Mines and Resources Canada and Nadir Mapping Corporation, Vancouver. Greg Cheesman, Ministry of Environment, Victoria, supplied the climate information upon which the Agricultural Capability was based, and John Jungen, Ministry of Environment, Kelowna, advised on some of the Agricultural Capability ratings. Jackie Melzer typed the Tables in the report.

Keith Valentine

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May 1985.

CONTENTS

GENERAL DESCRIPTION OF THE RESERVE AND ITS SURROUNDINGS

Location and Size

The Doig River Indian Reserve is approximately 80 km northeast of Fort St. John, on the Doig River. Access to the village is by a publicly maintained road that heads east from a paved road at Rose Prairie. The Reserve consists of 1180 ha (2913 acres), of which about one quarter has been cleared and left to grass. The rest is trees or open wetland. The Band also owns approximately 450 ha (1110 acres) of adjoining land to the west. All of this has been cleared. In 1984 the total membership of the Band was 120, of whom 75 lived on the Reserve.

Landscape and Geology

In this part of the Peace River District the landscape is a rolling plain with creeks and rivers draining southwards into the Peace River. The bigger rivers, such as the Doig, run through relatively narrow, steep-sided valleys that lie below the general level of the plain. The Doig River Reserve spans a part of the Doig River valley. It therefore comprises, on either side of the river, flat terraces, steep valley sides (many of which are eroding), and a strip of the rolling plain. The elevation of the river terraces is about 650m above sea level, and the elevation of the edge of the plain is about 700m.

The climate is continental; there are long cold winters and short warm summers, with a moderate amount of precipitation. The Atmospheric Environment Service climate station at Rose Prairie, just to the west, is typical of land on the plain. Average daily temperatures are above 0° celsius only from April through October. Average total precipitation is 470mm, most of which falls in the summer. Terraces in valley bottoms will be a little colder than land on the plain because cold air will flow down onto them. More details of the climate are given in the section on Agricultural Capability below.

The Reserve lies in the Boreal Forest Region (Rowe 1959), or the Boreal White and Black Spruce Biogeoclimatic Zone (Krajina 1969). Common tree species, in addition to white and black spruce, are trembling aspen, tamarack (in wetlands), and black cottonwood (in valleys). Shrubs include willows, common red-osier dogwood, soopolallie, wild rose and blueberries. Some common ground level plants, in addition to grasses, are twinflower, twinberry honeysuckle, common red indian paintbrush and blue-leaved wild strawberry.

The rocks lying under the Reserve are principally shales and sandstones of Cretaceous age. They are soft, flat lying, and extremely susceptible to slumping and erosion on steeper slopes. During the last Ice Age, until about 10 000 years ago, the whole area was covered by ice, which left behind a mantle of clayey glacial till on the higher parts of the plain. As the ice melted, what was to become the Peace River Valley and many of its major tributary valleys were transformed into a huge lake. In this lake were laid down clayey sediments, which, unlike the glacial till, contain no stones. Later still, this lake drained, and rivers such as the Peace, Doig, Beatton and Blueberry began to cut their valleys down through the lake sediments, glacial till, and bedrock. The rivers also left deposits of outwash sands spread across the plain on either side of their banks. This valley formation continues today, producing the steep

valley walls and terraces adjacent to the rivers. Any slopes, especially those undercut by the Doig River, are susceptible to slumping.

These deposits, laid down during or after the last ice age, are the materials in which the soils of the Reserve have formed. On the plain, on either side of the valley, there are glacial till and lacustrine clay soils. On the west side of the valley just on the edge of the plain is a stretch of sandy soils, which also extends a little way over the edge down the valley side. Most of the soils on the valley sides, however, are unstable clays that are quite thin over bedrock. The terraces, close to the river, have sandy alluvial soils. At a very general scale, the soils have been mapped for the whole of the Peace River District (Farstad et al. 1965, Lord and Green 1985). In these generalized surveys the edges of the plain, above the valleys, have been mapped as Beatton (well drained lacustrine), Clayhurst (well drained sands), Buick (poorly drained glacial till), or Goose (poorly drained lacustrine) Soils. The sides of the valleys are mapped as Rough Broken Land, and the terraces are shown as Alluvial Soils.

SURVEY METHODS

Soils

The Reserve was mapped from field observations of soil and land features, and from what could be seen on air photographs (scale 1:20 000). Stretches of land were mapped that had uniform soil or land characteristics. They are called Soil Areas in this report, and each is identified by a unique number. They were distinguished on the basis of the following characteristics:

- slope or topography
- texture and depth of soil materials
- moisture regime or water content
- erosion
- gravel content
- susceptibility to river flooding
- how complex the pattern of soils was

Five days were spent in the field. Soils were inspected with a one metre auger or a shovel. Land features, such as slope or any evidence of flooding, were noted as well. Most of the survey was done on foot. The total area mapped was 1180 ha, with 132 inspections of soil and land features. This means there was one inspection for every 9 ha of land, and 74% of the Soil Areas had at least one inspection, which makes this a Detailed Survey at a Survey Intensity Level of 2 (Mapping System Working Group 1981).

Descriptions of Soil Areas were recorded on standard forms, and are reproduced in Appendix 1. Definitions of terms used to describe soils may be found in Walmsley et al (1980) or Day (1983). Each Soil Area, identified by a number, is shown on the map that accompanies this report. General descriptions of the major features of the soils are given in the next section. Composite samples were taken from a number of Soil Areas and analyzed for their physical and chemical characteristics. Some samples were also sent to the Ministry of Agriculture and Food laboratory in Kelowna. The results of these analyses, with recommendations for improving the soil, are given in the section on Agricultural Capability.

Agricultural Capability

After each Soil Area had been described and mapped it was rated for agriculture. The ratings are shown on the map after the Area number. The Land Capability Classification for Agriculture used in British Columbia rates land according to its potential for field crops or grazing. Classes indicated relative potential, and subclasses indicate problems such as stoniness, lack of soil moisture or steep slopes. Classes 1 to 4 are capable of supporting field crops. Classes 5 and 6 are only suited to grazing, the Class 7 is non-agricultural. The classification is explained in the legend accompanying the map, and in two further publications listed in the References (Canada Land Inventory 1965, and Kenk 1983).

Before the soil can be rated for agriculture it is necessary to determine how suitable the climate is for agriculture. The climate is also rated in seven classes, and no soil can be rated higher than the climate class. The

Atmopsheric environment Service climate station at Rose Prairie is typical of land on the plain near the Reserve. Its records give the following information:

elevation (m)	670
growing degree days	988
freeze free period (days)	77
annual precipitation (mm)	470
growing season precipitation (mm)	318
potential evapotranspiration (mm)	377
climate moisture balance (mm)	-60

Any depressions, such as valleys of rivers like the Doig, will have even shorter freeze free periods and fewer growing degree days, because cold air drains into them.

On the basis of these figures the climate class of the Reserve has been set at 3 for the lands on the plain, and 4 for the slopes and terraces of the river valley. No Soil Area can be rated better than this.

The ratings eventually assigned to each Soil Area are shown on the Agricultural Capability map after the Area number.

Residential Suitability

After the soils had been mapped and assessed for agriculture, the map and soil descriptions were given to Martin Kobayakawa and Jeremy Joyce, who were District Planner and Student Assistant respectively of Indian and Northern Affairs Canada in Fort St. John. They rated the Soil Areas according to their suitability as sites for small residential buildings. The ratings are shown on the Development Suitability map included with this report. A description of how the ratings were done is given below in the section on Residential Suitability.

DESCRIPTIONS OF SOIL AREAS

The map shows 60 different soil areas. Each one is described in detail in Appendix 1. However, many of them were quite similar, and can be grouped together. The major similarities are among those areas on the edge of the plains, those on the sides of the river valleys, and those on the terraces. Within these three main parts of the landscape there are also some contrasting areas because of soil texture, water content or topography. This gives eight general types of soil areas, and these will be described in the following sections. They are shown diagrammatically, as a cross section across the valley, in Figure 1.

Plains, moderately dry, clay areas

Soils Areas 06, 08, 35, 46, 55.

The outer edges of the Reserve cover parts of the rolling plains where they border the river valleys. Slopes are usually less than 5%, but can be as steep as 10% in some places. The texture of the soil is clay loam or clay, both in the topsoil and subsoil. There are very few stones, and the soils have a strong blocky structure that allows roots to penetrate to well below 50 cm. The moisture regime is commonly humid to perhumid, and most soils are moderately well drained. Being so clayey, the soils are only slowly permeable to water. They are not susceptible to erosion, except when bare and exposed on steeper slopes. When wet they become very sticky, making driving difficult. Topsoils analyses from one of these areas (Table 1) show it to be acid, fairly rich in organic matter, and to have a cation exchange capacity typical of fine-textured topsoils. These areas have been mapped as the Beatton Soils on generalized maps of the area (Lord and Green 1985).

Plains, wet, clay areas

Soil Areas 07, 36, 47, 53, 56.

Water collects on some flatter areas of the plains to make the soil much wetter than those described above. Here slopes are usually less than 2%, and alwaysw less than 5%. Some areas are so wet that the topsoil is organic with no clay (eg. Area 56). The soil moisture regime is aquic or peraquic, and the soils are poorly or very poorly drained. Water is at, or close to the surface all year. On generalized soil maps these areas have been mapped as the Buick and Goose Soils (Lord and Green 1985).

Plains, dry, sand areas

Soil Areas 15, 21, 51, 54.

On the edge of the Plains immediately to the west of the Doig River valley there is a wide stretch of sand. The land is almost level, and most of it has been cleared. The soils are deep, have a semiarid to subhumid moisture regime and are rapidly drained. In one area (21) the soils are quite gravelly. Two topsoil sampfles taken from different parts of the larges area (15), were acid, had very little organic matter or nitrogen, and had a very low cation exchange capacity (Table 1). These areas have been mapped as the Clyhurst Soils (Lord and Green 1985).

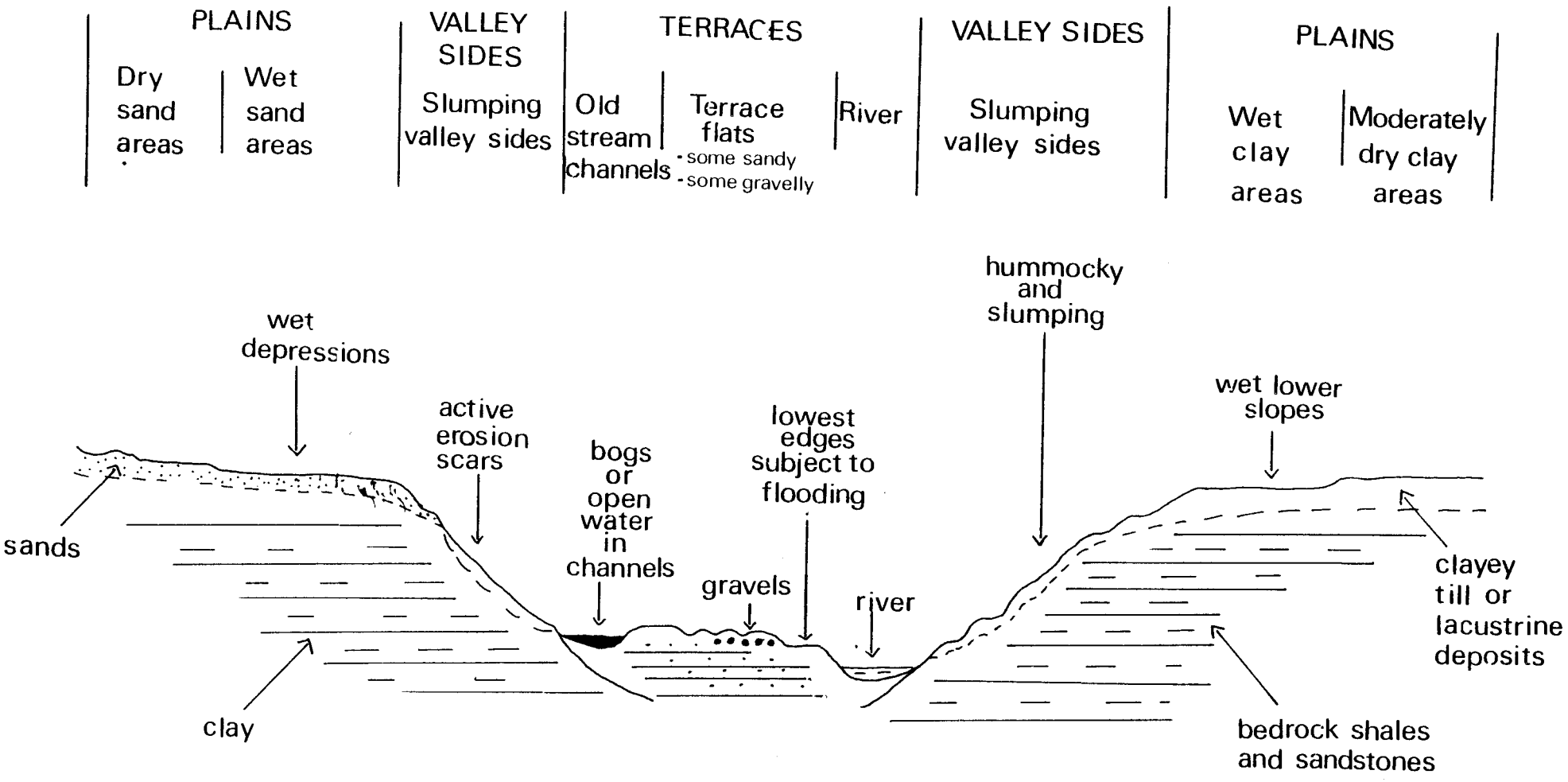


Figure 1 Generalized Cross Section of the valley

Table 1: Soil Analyses

Soil Area Number	Sample Depth(cm)	pH ($CaCL_2$)	Organic Matter(%)	Total N (%)	C:N	C.E.C.* (me/100g)
Plains, Moderately, Dry Clay Areas						
06	0-20	5.8	4.1	0.21	12	20
Plains, dry, sand areas						
15	0-20	5.6	1.1	0.03	25	4
15	0-20	5.3	2.2	0.04	37	6
Terraces, flats, sandy						
24	0-20	5.3	10.3	0.46	13	29
32	0-20	5.3	5.4	0.22	14	17
39	0-20	5.3	5.3	0.37	11	22
Terraces, flats, gravelly						
11	0-20	5.1	4.0	0.17	14	12

*C.E.C. is Cation Exchange Capacity

Plains, wet, sand area

Soil Areas 16, 20, and 52.

Wherever the land is very flat or slightly depressional, across this sandy stretch, it becomes very wet. This is because the sand is underlain by the clays which cover most of the plain. Therefore, water collects in these very shallow sandy dpressions and cannot drain away because of the clay underneath. Some areas are so wet than they have organic topsoils with sphagnum moss, willows and black spruce (eg. area 16). These soils have an aquic to peraquic moisture regime and are very poorly drained.

River Valley Sides

Soil Areas 09, 14, 17, 22, 25, 28, 29, 30, 37 and 45.

From the edge of the plains the ground slopes down to the Doig river and its terraces at angles of between 20 and 30%. The soils are mostly clays or clay loams, but on the upper parts of the western valley side there is a surface layer of sand over the clays. The soils are either well or moderately well drained. Their moisture regimes are either humid or perhumid. However, their most important characteristic is their susceptibility to slumping and erosion. On treed or grass slopes this will show as irregular hummocks. Where the river is undercutting the foot of the slope there will be active erosion scars and exposed bedrock. One much flatter area within the western side of the valley (22) is very wet. The river valley sides have been mapped on generalized soil maps as Rough Broken Land (Lord and Green 1985).

Terraces, flats, sandy

Soil Areas 01, 03, 05, 12, 18, 19, 24, 26, 27, 32, 39, 40, 41, 42, 43, 44, 48, 49, 50, 58, 59.

The Doig River winds from one side of its valley to the other, leaving alternate terraces on either side. The general slope of these terraces is less than 2%, but often there are parallel ridges running across them. The ridges can be one or two metres high, and their sides can slope as steeply as 25%. Topsoil textures are sandy loam or loamy sand, and subsoil textures, below 50cm, are sand. Soil moisture regimes are humid or subhumid, and all soils are well drained. Permeability is rapid, and no soils suffer from excess water. On the other hand, the lowest edges of the terraces, bordering the river, are subject to flooding. Topsoils samples (Table 1) were acid, contained considerable organic matter, and moderate amounts of nitrogen. These terraces have been mapped as Alluvial Soils on generalized soil maps (Lord and Green 1985).

Terraces, flats, gravelly

Soil Areas 10, 11, 34, and 60.

Some of the terraces have layers of gravel on their surface. Nowhere were these layers very thick and they were quite irregular. Apart from their gravel content these terraces are very similar to the sandy terraces (Table 1).

Terraces, Old Stream Channels

Soil Areas 02, 04, 13, 23, 31, 33, 38, 57.

On some terraces there are remnants of previous channels of the Doig River. Some are small marshy lakes. Some are bogs with organic soils, sphagnum peat and black spruce. They are too small to be shown separately on generalized soil maps, but would be similar to the Kenzie Soils, and would be included in areas mapped as Alluvial Soils (Lord and Green 1985).

AGRICULTURAL CAPABILITY AND FERTILIZER RECOMMENDATIONS

Plains, Moderately Dry, Clay Areas

The Agricultural Capability Climate Class for these areas is 3. This means that soils that would otherwise be excellent for agriculture can be rated no better than moderately productive, because primarily of a short growing season. Agricultural Capability ratings refer to the potential of the soils to produce field crops like wheat or barley (Kenk 1983). In fact most of soils in these areas suffer from the additional limitation of wetness. Their clay or clay loam texture means that water can move through them only slowly. They remain wet and cold for a considerable time after snow melt in the spring. However, they do eventually dry out so that they can be seeded and cultivated. They have been rated 4w; marginal for field crops. A few areas have been rated 3c.

The results of soil test analyses done on composite samples taken from two of these areas (06 and 55) are given in Table 2. Both areas were moderately acid and although they had appreciable organic matter they had little nitrate nitrogen. Both were also deficient in phosphorus. The fertilizer recommendations in Table 3 show application rates for nitrogen and phosphorus. For oats and barley nitrogen should be broadcast and incorporated into the soil before seeding. For rapeseed (canola) it should be applied in early spring. There are two rates shown for grass-legumes. The first (80kg ha^{-1}) should be applied in early spring. The second (55kg ha^{-1}) should be applied after the first cut to encourage regrowth for a second cut or fall grazing. Although each area was moderately acid, no liming is required at this stage.

Plains, Wet Clay Areas

Wherever the land is flat or depressional the plains are wet. Soils stay wet even through the summer; the cultivation of field crops is impossible. However, some areas have a good cover of native grasses, and have potential for grazing. They have been rated 5w, or 6w. Two very wet spots (36 and 56) have been rated 7w; unusable for agriculture.

Plains, dry, sand areas

The lack of soil moisture and low natural fertility restricts the use of this land to grazing or the cultivation of forage crops. These areas have been rated 5a or 6ap. One composite sample was taken from area 51. The soil test results and fertilizer recommendations are given in tables 2 and 3. A deep rooted crop such as alfalfa is best suited to this land, if possible cultivated under irrigation. The recommendations for grass-legumes include applications of nitrogen and potash. Nitrogen should be applied as recommmended for the dry clay areas.

Plains, wet, sand areas

Most of these areas are too wet for any form of agriculture; they have been rated 7w. Small spots with some grazing potential are rated 6w.

Table 2 Soil Test Analyses

Soil Area	Lab #	Organic Matter %	pH ($CaCl_2$)	NO_3-N (ug mL^{-1})	P (ug mL^{-1})	K (ug mL^{-1})	Salts (d m^{-1})
Plains, dry, clay areas							
55	84/642-3	6.6	5.3	13	27	234	2.7
06	84/642-4	5.0	5.6	11	44	190	1.6
Plains, dry, sand areas							
51	84/642-2	1.8	5.3	9	106	37	5.5
Terraces							
24	84/642-1	6.0	5.3	12	18	100	0.4
03	84/642-5	8.3	5.0	11	27	182	1.2
32	84/642-6	8.3	5.7	11	39	166	0.6

Analyses were done by Soil Testing Laboratory, Ministry of Agriculture and Food, Kelowna.

Table 3. Fertilizer Recommendations for Crops (Kg/ha)

	Oats	Barley	Rapeseed (Canola)	Grass-Legumes
Plains, clay, dry Soil Area #55				
Nitrogen (N)	40	50	66	80/55
Phosphate (P_2O_5)	40	50	60	50
Potash (K_2O)	0	0	0	0
Lime (t ha^{-1})	0	0	0	0
Soil Area #06				
Nitrogen (N)	40	50	66	80/55
Phosphate (P_2O_5)	20	30	40	30
Potash (K_2O)	0	0	0	0
Lime (t ha^{-1})	0	0	0	0
Plains, sand, dry soil Area #51 F				
Nitrogen (N)	40	50	66	80/55
Phosphate (P_2O_5)	0	0	0	0
Potash (K_2O)	60	80	100	100
Lime (t ha^{-1})	0	0	0	0
Terraces Soil Area #24				
Nitrogen (N)	40	50	66	80/55
Phosphate (P_2O_5)	60	70	80	70
Potash (K_2O)	30	10	50	50
Lime (t ha^{-1})	0	0	0	0
Soil Area #03				
Nitrogen (N)	40	50	66	80/55
Phosphate (P_2O_5)	40	50	60	50
Potash (K_2O)	0	0	0	0
Lime (t ha^{-1})	0	3.0	3.0	3.0
Soil Area #32				
Nitrogen (N)	40	50	66	80/55
Phosphate (P_2O_5)	30	40	50	40
Potash (K_2O)	15	30	40	40
Lime (t ha^{-1})	0	0	0	0

Recommendations from Soil Testing Laboratory, Ministry of Agriculture and Food, Kelowna.

Lime application rates are for the pH level recommended for the crop.

River Valley Sides

The slopes along the Doig River valley are so steep and unstable that they are completely unsuitable to any form of cultivation. However, under the trees there is often a dense cover of native grasses and herbs. Such areas have some potential for grazing and have been rated 6te. Steeper and actively eroding land has been rated 7te. This is all but impossible to graze.

Terraces, flats, sandy

The Agricultural Capability Climate Class of the terraces is 4. They suffer not only the short growing season of this part of the Peace River District, but also are susceptible to additional frost hazard due to cold air drainage. Even soils that are otherwise excellent for agriculture can be rated no higher than class 4. In fact these soils have few other limitations for agriculture. Their topsoils are loamy sand, and their subsoils are invariably sand. Their ability to hold water and nutrients would require some levelling before cultivation. But generally they offer limitations that are no more severe than the overall limitation of climate. Most have therefore been rated as 4ct. Those where the ridges are particularly large have been rated as 5t. However, even though 4ct imples that field crops such as barley or oats could be cultivated, it would probably be better to retain them in their present use, that of native hay production. Small wet depressions that are common on some of the terraces have been rated 7w.

Composite samples were taken from three areas (03, 24, and 32) for soil test analyses and fertilizer recommendations. The results are shown in Tables 2 and 3. Although each area is well supplied with organic matter, they have little nitrate nitrogen and little phosphorus. For grass-legumes, applications of nitrogen and phosphate are recommended. Application methods are the same as those for the dry, clay areas of the plains above. The topsoils of each area are moderately acid, and liming is recommended for one (03).

Terraces, flats, gravelly

Because of the irregular layers of gravel these terraces have been rated 5ap or 6pa. They are considered too gravelly for cultivated field crops, but could be used for grazing.

Terraces, Old Stream Channels

On some terraces there are inundated depressions that were old stream channels. They contain either marshy vegetation or open water. Most have no potential for agriculture and have been rated 7w. A few have some grazing potential and have been rated 6w.

RESIDENTAL SUITABILITY

By Martin Kobayakawa and Jeremy Joyce.

There were three steps to assessing residential suitability; collecting information about the soil in the field, interpreting this information for specific types of development, and determining an overall rating for residential suitability. Specific and overall ratings are shown on the map of "Development Suitability" that accompanies this report. The following paragraphs explain how these ratings were made.

Collecting Field Information

This was done by the Agriculture Canada soil survey crew. Residential Suitability was determined for the same Soil Areas, using the same information about each area (Appendix 1), as were used to assess Agricultural Capability.

Interpretations for Specific types of Development

Suitability for the following types of development was assessed for each Soil Area:

buildings with basements
local roads
septic tank fields
sand and/or gravel extraction.

Development suitability was determined by evaluating a number of critical factors for each type of development as shown in Tables 4, 5 and 6. Table 7 gives the critical factors for frost action and shrink swell, which are additional limitations to the construction of buildings with basements and local roads.

Three classes of ratings were derived systematically as shown in Figure 2. They are defined as follows:

Good	Site characteristics which are generally favorable for the rated use, with limitations that are minor and easily overcome;
Moderate	Site characteristics that are unfavorable, but that can be overcome or modified by special planning and design;
Poor	Site characteristics that are so unfavourable, and so difficult to overcome, that they require major soil reclamation and/or special designs.

Determinating the Overall Suitability Rating

This rating combines the three assessments for buildings with basements, local roads, and septic tanks. A Soil Area is rated GOOD if all the specific ratings are GOOD. It is rated as MODERATE if one or more of the specific ratings is MODERATE, and POOR if any one of the specific ratings is POOR.

Table 4: Limiting Factors for Constructing Buildings with Basements and Local Roads

Limiting Factors	Rating Classes and Criteria		
	Good	Moderate	Poor
Slope	0-10%	11-20%	>20%
Soil Texture	Sand to Sandy Loam	Fine Sandy Loam to Sandy Clay Loam	Clay Loam, Clay and Organic
Soil Coarse Fragments	0-29%	30-59%	60-99%
Soil Coarse Fragments, larger than 2.5 cm dia.	0-19%	20-39%	40-99%
Drainage Class	Rapid	Well to Moderately Well	Imperfect to Very Poor
Permeability Class	Rapid	Moderate	Slow to Very Slow
Excess Water	None to Occasional	Ocassional minor damage to frequent	Frequent (perennial) to Submerged
Flooding	None	-	Occasional to Flooded
Erosion Class	None	Slight to Moderate	Severe to Eroded

References: Maynard (1979), and TERA Environmental Consultants Ltd., and T.M. Thomson and Associates Ltd. (1984).

Table 5: Limiting Factors for Septic Tank Effluent Absorption

Limiting Factors	Rating Classes and Criteria		
	Good	Moderate	Poor
Slope	0-10%	11-15%	>15%
Soil Texture	Sandy Loam to Silt Loam	Loamy Sand to Silty Clay Loam	Sand; Clay and Organic
Soil Coarse Fragments	0-19%	20-49%	50-99%
Soil Coarse Fragments, larger than 2.5 cm dia.	0-9%	10-19%	20-99%
Drainage Class	Well	Moderately well or rapid	Imperfect, Poor to Very Poor
Excess Water	None to Occasional	Ocassional minor to Frequent	Frequent (perennial) to Submerged
Flooding	None	None	Occasional to Flooded
Erosion Class	None	Slight	Moderate to Eroded
Moisture Regime	-	Subaquic to Peraquic	Subaquic to Peraquic
Shallowest Dept of Ground Water during year	>99 cm	>99 cm	<100 cm
Structure	Granular, sub angular blocky	Block, platy or Prismatic	Massive or Structureless

References: EPP (1984)

Table 6: Suitability for Sand and/or Gravel Extraction

Soil Characteristics	Rating Classes and Criteria		
	Good	Moderate	Poor
Texture	Sand to Loamy Sand	Sand Loam to Fine Sandy Loam	Loam, Clay Loam, Clay and Organic
Coarse Fragments	60-99%	30-59%	0-29%
Coarse Fragments larger than 2.5 cm dia.	20-99%	10-19%	0-9%
Coarse Fragments larger than 7.5 cm dia.	20-99%	10-19%	0-9%

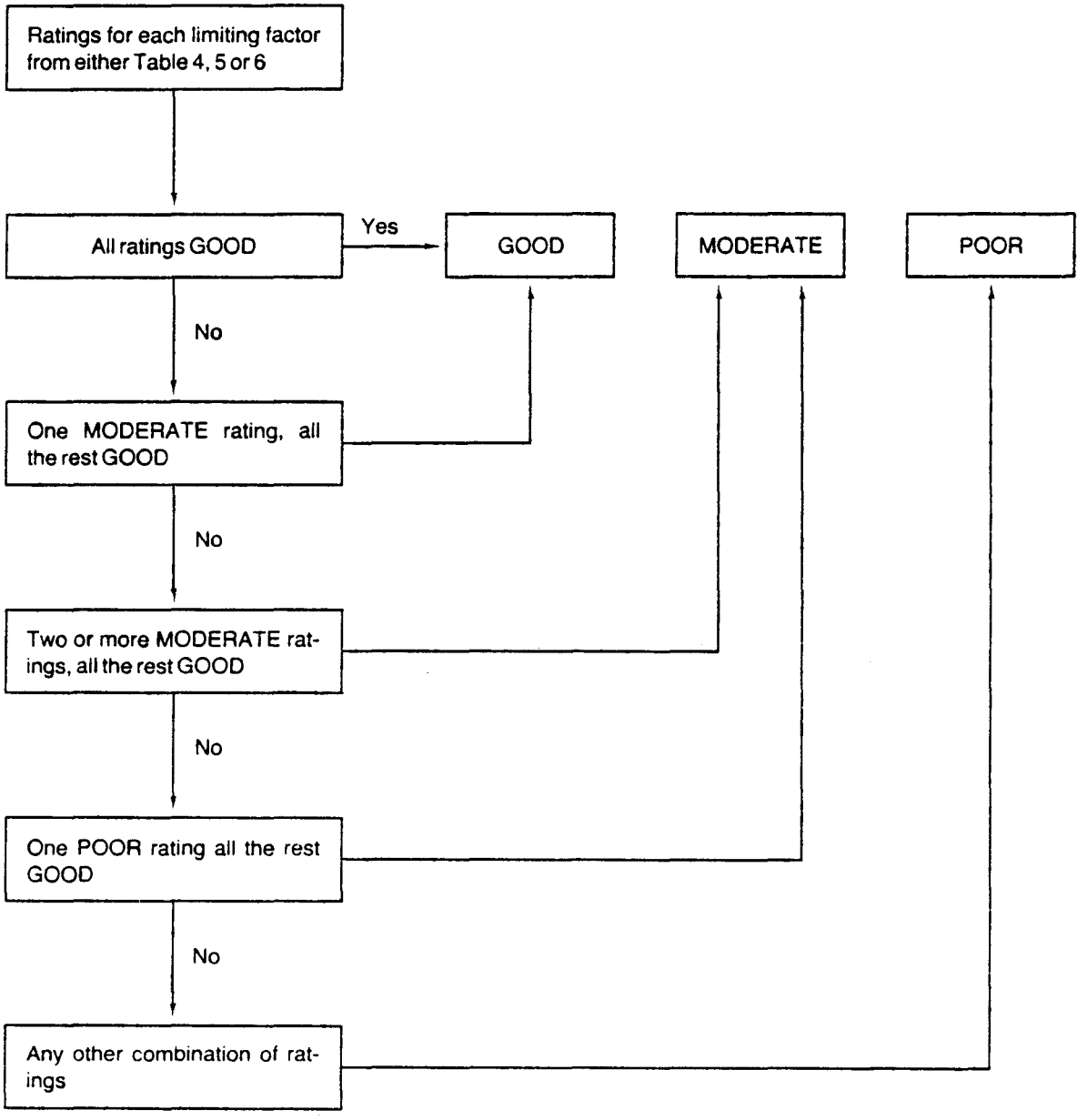
Reference: Maynard (1979)

Table 7: Limiting Criteria for Classes of Frost Action and Shrink-Swell

FROST ACTION		Texture		
		Silt Loam, Silty Clay, Clay Loam	Clay, Fine Sandy Loam, Loam	Sand, Loamy Sand, Sandy Loam, Organic
Moisture Regime	Semiarid to Perhumid	Moderate	Low	Low
	Subaquic to Peraquic	High	Moderate	Moderate

SHRINK SWELL				
		Silt Loam, Silty Clay, Clay Loam	Clay, Fine Sandy Loam, Loam	Sandy, Loamy Sand, Sandy Loam, Organic
Moisture Regime	Semiarid to Perhumid	Low	Low	High
	Subaquic to Peraquic	High	Moderate	High

Figure 2. Derivation of ratings for buildings with basements, local roads, or septic tank fields.



Note: Some Soil Areas contain two contrasting soils. In this case each soil was rated separately. If the two ratings differed, the whole Soil Area was rated as follows:

A GOOD rating with a MODERATE or POOR rating = MODERATE

A MODERATE rating with a POOR rating = POOR

REFERENCES

Canada Land Inventory. 1965. Soil Capability Classification for Agriculture. Rept. No. 2, Dept. Environment, Ottawa, 16pp.

Day, J.H. (ed). 1983. The CanSIS Soil Information System; Manual for describing soils in the field. Expert Committee on Soil Survey, Agriculture Canada, Ottawa.

Epp, P.F. 1984. Soil Constraints for Septic Tank Effluent Absorption. Min. Environment, Kelowna, B.C., 90pp.

Farstad, L., Lord, T.M., Green, A.J., and Hortie, H.J. 1965. Soil Survey of the Peace River Area in British Columbia. B.C. Soil Survey Rept. No. 8, Univ. British Columbia, B.C. Dept. of Agric. and Canada Dept. of Agric.

Kenk, E. 1983. Land Capability Classification for Agriculture in British Columbia. MOE, Manual 1, Ministries of Environment and Agriculture and Food, Kelowna, B.C., 62pp.

Krajina, V.J. 1969. Ecology of Forest Trees in British Columbia. Ecology of Western North America, 2(1), 1-146.

Lord, T.M., and Green, A.J. 1985. Soils of the Fort St John-Dawson Creek Area, British Columbia. B.C. Soil Survey, Rept. No. 42, Agriculture Canada, Ottawa.

Mapping System Working Group. 1981. A Soil Mapping System for Canada: Revised. Land Resource Research Institute, Contribution No. 142, Agriculture Canada, Ottawa, 94 pp.

Maynard, D. 1979. Terrain Capability for Residential Settlements, R.A.B. Working Rept., B.C. Min. Environment, Victoria, B.C., 152pp.

Rowe, J.S. 1959. Forest Regions of Canada. Dept. of Northern Affairs and National Resources, Forestry Branch, Ottawa, Bull. 123, 71pp.

TERA Environmental Consultants (B.C.) Ltd. and T.M. Thomson and Associates Ltd. 1984. Salteau Reserve Capability Mapping Study. I.N.A.C., Fort St. John, B.C., 32pp and 2 Appendices.

Walmsley, M., Utzig, G., Vold, T., Moon, D., and van Barnevald, J. 1980. Describing Ecosystems in the Field. RAB Technical Paper No. 2 and Land Management Rept. No. 7, Ministries of Environment and Forests, Victoria, B.C.

APPENDIX 1 DESCRIPTION OF SOIL AREAS

The characteristics of each soil area are described here. Part 1 is a Key. It defines all the characteristics briefly, then lists classes of them with numbers that signify each class. Part 2 lists all Soil Areas and describes them by numbers to signify the class of each characteristic. Thus in Part 2, for Soil Area 03, the key number for the flattest slope is 1 and the key number for the texture of the upper 50 cm of soil is 8. The Key in Part 1 shows that 1 means that the flattest slope is less than 2%, and 8 means that the texture of the upper 50 cm is clay loam.

The first three lines of each Soil Area description show how many times the area was inspected, and, if there were two types of soil, what their proportions were (in tenths). The Areas with two types of soil have two columns of numbers. The first, headed "1", describes the more common soil. The second, headed "2", describes the less common soil.

Further definitions of terms such as moisture regime and drainage class, or what is meant by frequent flooding or severe erosion may be found in the publications of Kenk (1983), Walmsley et al (1980) or Day (1983).

PART 1: KEY TO CLASSES OF SOIL AND LAND CHARACTERISTICS

Characteristic and Definition	Key #	Class Description
1 Slope The steepest or flattest slope in %	1	<3
	2	3-5
	3	6-10
	4	11-15
	5	16-20
	6	21-30
	7	>30
2 Soil Texture	1	Sand
	2	Loamy sand
	3	Sandy loam
	4	Fine sandy loam
	5	Loam
	6	Silt loam
	7	Silty clay loam
	8	Clay Loam
	9	Clay
	0	Organic
3 Total Coarse Fragments Mineral particles larger than 2 mm in diameter (%)	0	0-9
	1	10-19
	2	20-29
	3	30-39
	4	40-49
	5	50-59
	6	60-69
	7	70-79
	8	80-89
	9	90-100
4 Stones Mineral soil particles larger than 2.5 cm in diameter (%)	Same numbers and class descriptions as Total Coarse Fragments	
5 Cobbles Mineral soil particles larger than 7.5 cm in diameter (%)	Same numbers and class descriptions as Total Coarse Fragments	
6 Structure Shape and size of stable soil aggregates	1	Structure-less
	2	Blocky
	3	Platy
	4	Prismatic
7 Fertility General fertility estimated from nutrient content, pH, carbonates, or toxic compounds (other than salts)	1	Fertile
	2	Minor problems
	3	Moderate
	4	Major problmes
	5	Severe problems (improveable)
	6	Severe problems (unimproveable)
	7	Infertile
8 Moisture Regime Soil moisture content and seasonal variation	1	Semiarid
	2	Subhumid
	3	Humid
	4	Perhumid
	5	Subaquic
	6	aquic
	7	Peraquic
9 Drainage Class Rate at which water is removed from the soil, and the seasonal variation in water content	1	Rapidly
	2	Well
	3	Moderately well
	4	Imperfectly
	5	Poorly
	6	Very poorly
10 Permeability Class Rate at which water can move through the soil	1	Rapid
	2	Moderate
	3	Slow
	4	Very slow
11 Depth of Groundwater Depth when closest to the surface	1	Deeper than 99 cm
	2	Shallower than 100 cm

Characteristic and Definition	Key #	Class Description	Characteristic and Definition	Key #	Class Description
12 Excess Soil Water High watertables, seepage or runoff that cause crop damage	1 2 3 4 5 6 7	None Occasional Occasional, minor damage Frequent Frequent, forage only Continuous Submerged	13 Root Restriction Depth in cm of any layer that restricts roots; hardpan, rock, watertable etc.	1 2 3 4	deeper than 75 75-50 49-25 shallower than 25
14 Soil Erosion Damage from past erosion that limits agriculture	1 2 3 4 5 6 7	None Slight Moderate Severe Very Severe Extremely severe Eroded	15 Stream Flooding Inundation caused by overbank flow from streams or lakes	1 2 3 4 5 6 7	None Occasional Frequent Frequent, flooded Frequent, extended Extended Flooded
16 Organic Soil Depth Depth in cm to underlying rock or mineral soil	1 2 3 4	Deeper than 180 150-180 120-149 Shallower than 120	17 Organic Soil Decomposition Degree to which plant tissue has broken down	1 2 3 4	Mesic Mesic and mineral Humic or Fibric Aquatic muck

PART 2. CHARACTERISTICS OF EACH SOIL AREA

SOIL AREA NUMBER	01	02	03	04	05	06	07
Times Area inspected	4	4	3	2	5	4	4
Major soil (1), Minor soil (2)	1 2	1 2	1 2	1 2	1 2	1 2	1 2
Proportions (tenths)		6 4		6 4	8 2	6 4	6 4
CHARACTERISTICS							
Slope, flattest	2	1 2	2	1 2	2 1	1 1	1 1
Slope, steepest	4	1 5	4	1 5	4 6	2 2	1 2
Texture, 0-50 cm	2	0 6	4	0 6	4 0	8 8	8 8
Texture, 50-100 cm	1	0 3	2	0 3	2 1	9 9	9 9
Total Coarse Fragments, 0-50 cm	0	0 0	0	0 0	0 0	0 0	0 0
Total Coarse Fragments, 50-100 cm	4	0 0	0	0 0	0 0	0 0	0 0
Stones, 0-50 cm	2	0 0	0	0 0	0 0	0 0	0 0
Cobbles, 0-50 cm	1	0 0	0	0 0	0 0	0 0	0 0
Structure	1	1 2	1	1 2	1 1	2 2	2 2
Fertility	3	3 2	2	3 2	2 3	2 2	2 2
Moisture Regime	2	7 3	3	7 3	3 6	3 3	5 3
Drainage Class	1	6 2	2	6 2	2 6	3 2	5 3
Permeability	1	2 2	1	2 2	1 2	3 3	3 3
Depth to Groundwater	1	2 1	1	2 1	1 2	1 1	2 1
Excess Soil Water	1	7 1	1	7 1	1 6	4 3	6 4
Root Restriction	1	5 2	1	5 2	1 5	2 2	4 2
Soil Erosion	1	1 1	1	1 1	1 1	1 1	1 1
Stream Flooding	1	1 1	1	1 1	1 1	1 1	1 1
Organic Soil Depth	-	4 -	-	4 -	- -	- -	- -
Organic Soil Decomposition	-	1 -	-	1 -	- -	- -	- -

SOIL AREA NUMBER	08		09		10		11		12		13	14	
Times Area inspected	1		2		5		7		3		3	4	
Major soil (1), Minor soil (2)	1	2	1	2	1	2	1	2	1	2	1 2	1	2
Proportions (tenths)	6	4	6	4	6	4	7	3	6	4		7	3
CHARACTERISTICS													
Slope, flattest	1	1	7	4	2	2	2	2	2	2	3	4	5
Slope, steepest	2	2	7	5	4	5	4	4	4	5	7	6	7
Texture, 0-50 cm	8	8	8	8	2	2	2	2	4	4	1	8	2
Texture, 50-100 cm	9	9	9	9	1	1	1	1	7	7	1	9	1
Total Coarse Fragments, 0-50 cm	0	0	0	0	5	0	0	5	0	0	2	0	0
Total Coarse Fragments, 50-100 cm	0	0	0	0	6	0	0	6	0	0	1	0	0
Stones, 0-50 cm	0	0	0	0	3	0	0	3	0	0	0	0	0
Cobbles, 0-50 cm	0	0	0	0	1	0	0	0	0	0	0	0	0
Structure	2	2	2	2	1	1	1	1	2	2	1	2	1
Fertility	2	2	2	2	3	3	3	3	2	2	7	2	3
Moisture Regime	3	3	3	3	2	3	3	2	3	3	7	3	2
Drainage Class	3	2	3	4	1	2	2	1	2	2	6	2	2
Permeability	3	3	3	3	1	1	1	1	2	2	3	2	1
Depth to Groundwater	1	1	1	2	1	1	1	1	1	1	2	1	1
Excess Soil Water	4	3	1	2	1	1	1	1	1	1	7	1	1
Root Restriction	2	2	1	2	1	1	1	1	1	1	5	2	1
Soil Erosion	1	1	7	4	1	1	1	1	1	1	1	6	2
Stream Flooding	1	1	1	1	1	1	1	1	1	1	1	1	1
Organic Soil Depth	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic Soil Decomposition	-	-	-	-	-	-	-	-	-	-	-	-	-

SOIL AREA NUMBER	15		16		17		18		19		20		21	
Times Area inspected	15		6		5		2		2		3		3	
Major soil (1), Minor soil (2)	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Proportions (tenths)					8	2								
CHARACTERISTICS														
Slope, flattest	1		1		4	4	1		1		1		1	
Slope, steepest	1		1		6	7	5		2		2		1	
Texture, 0-50 cm	1		0		1	1	2		4		0		1	
Texture, 50-100 cm	1		0		1	1	3		1		1		1	
Total Coarse Fragments, 0-50 cm	0		0		0	0	0		0		0		2	
Total Coarse Fragments, 50-100 cm	0		0		3	3	0		0		0		0	
Stones, 0-50 cm	0		0		1	1	0		0		0		1	
Cobbles, 0-50 cm	0		0		0	0	0		0		0		0	
Structure	1		1		1	1	1		1		1		1	
Fertility	3		3		3	3	3		3		4		3	
Moisture Regime	2		7		2	2	3		3		7		1	
Drainage Class	1		6		1	1	2		2		6		1	
Permeability	1		3		1	1	1		1		2		1	
Depth to Groundwater	1		2		1	1	1		1		2		1	
Excess Soil Water	1		7		1	1	1		1		7		1	
Root Restriction	1		5		1	1	1		1		5		1	
Soil Erosion	1		1		3	7	1		1		1		1	
Stream Flooding	1		1		1	1	1		1		1		1	
Organic Soil Depth	-		3		-	-	-		-		4		-	
Organic Soil Decomposition	-		3		-	-	-		-		3		-	

SOIL AREA NUMBER	22		23		24		25		26		27		28	
Times Area inspected	0		2		3		1		1		5		4	
Major soil (1), Minor soil (2)	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Proportions (tenths)											8	2	6	4
CHARACTERISTICS														
Slope, flattest	1		1		1		2		2		1	2	4	6
Slope, steepest	1		1		2		6		5		4	6	7	7
Texture, 0-50 cm	0		0		3		4		3		3	3	3	8
Texture, 50-100 cm	2		2		2		3		3		1	1	2	9
Total Coarse Fragments, 0-50 cm	0		0		0		0		0		0	0	0	0
Total Coarse Fragments, 50-100 cm	0		0		0		0		0		4	4	0	0
Stones, 0-50 cm	0		0		0		0		0		2	2	0	0
Cobbles, 0-50 cm	0		0		0		0		0		0	0	0	0
Structure	1		1		2		1		1		1	1	1	2
Fertility	4		4		3		3		2		2	2	2	2
Moisture Regime	7		7		3		3		3		2	2	2	3
Drainage Class	6		6		2		2		3		1	1	2	2
Permeability	3		3		2		2		2		1	1	1	3
Depth to Groundwater	2		2		1		1		1		1	1	1	1
Excess Soil Water	7		7		1		1		1		1	1	1	1
Root Restriction	5		5		1		1		1		1	1	1	1
Soil Erosion	1		1		1		1		1		1	1	4	7
Stream Flooding	1		1		1		1		1		1	1	1	1
Organic Soil Depth	4		4		-		-		-		-	-	-	-
Organic Soil Decomposition	3		3		-		-		-		-	-	-	-

SOIL AREA NUMBER	29		30		31		32		33		34		35	
Times Area inspected	0		4		3		3		1		0		4	
Major soil (1), Minor soil (2)	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Proportions (tenths)	6	4	7	3										
CHARACTERISTICS														
Slope, flattest	4	6	4	6	1		1		1		1		2	
Slope, steepest	7	7	7	7	2		4		2		2		3	
Texture, 0-50 cm	3	8	8	3	0		3		0		2		8	
Texture, 50-100 cm	2	9	9	2	9		2		9		1		2	
Total Coarse Fragments, 0-50 cm	0	0	0	0	0		0		0		4		0	
Total Coarse Fragments, 50-100 cm	0	0	0	0	0		0		0		1		0	
Stones, 0-50 cm	0	0	0	0	0		0		0		2		0	
Cobbles, 0-50 cm	0	0	0	0	0		0		0		1		0	
Structure	1	2	1	2	1		2		1		1		1	
Fertility	2	2	2	2	4		2		4		3		2	
Moisture Regime	2	3	3	2	7		3		7		2		3	
Drainage Class	2	2	2	2	6		2		6		1		2	
Permeability	1	3	3	1	4		1		4		1		2	
Depth to Groundwater	1	1	1	1	2		1		2		1		1	
Excess Soil Water	1	1	1	1	7		1		7		1		1	
Root Restriction	1	1	1	1	5		1		5		1		3	
Soil Erosion	4	7	7	4	1		1		1		1		1	
Stream Flooding	1	1	1	1	1		1		1		3		1	
Organic Soil Depth	-	-	-	-	4		-		4		-		-	
Organic Soil Decomposition	-	-	-	-	3		-		3		-		-	

SOIL AREA NUMBER	36	37	38	39	40	41	42
Times Area inspected	2	0	4	3	3	2	0
Major soil (1), Minor soil (2)	1 2	1 2	1 2	1 2	1 2	1 2	1 2
Proportions (tenths)		7 3	6 4				8 2
CHARACTERISTICS							
Slope, flattest	1	4 6	1 4	1	2	1	2 6
Slope, steepest	1	7 7	1 6	2	3	2	4 1
Texture, 0-50 cm	0	8 3	0 2	3	4	3	4 2
Texture, 50-100 cm	8	9 2	8 1	2	1	1	0 1
Total Coarse Fragments, 0-50 cm	0	0 0	0 4	0	0	0	0 0
Total Coarse Fragments, 50-100 cm	0	0 0	0 2	0	0	0	0 0
Stones, 0-50 cm	0	0 0	0 1	0	0	0	0 0
Cobbles, 0-50 cm	0	0 0	0 0	0	0	0	0 0
Structure	1	1 2	1 1	1	1	1	1 1
Fertility	4	2 2	4 3	2	2	2	2 3
Moisture Regime	6	3 2	7 2	3	3	3	3 6
Drainage Class	6	2 2	6 1	2	2	2	2 6
Permeability	3	3 1	4 1	2	2	1	1 2
Depth to Groundwater	2	1 1	2 1	1	1	1	1 2
Excess Soil Water	7	1 1	7 1	1	1	1	1 6
Root Restriction	4	1 1	5 3	1	1	1	1 5
Soil Erosion	1	1 1	1 1	1	1	1	1 1
Stream Flooding	1	1 1	3 1	1	1	1	1 1
Organic Soil Depth	-	- -	- -	-	-	-	- -
Organic Soil Decomposition	-	- -	- -	-	-	-	- -

SOIL AREA NUMBER	43		44		45		46		47		48		49	
Times Area inspected		0		0		0		0		0		0		0
Major soil (1), Minor soil (2)	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Proportions (tenths)			8	1	7	2			6	4			8	2
CHARACTERISTICS														
Slope, flattest	2		2	6	4	5	1		1	1	2		2	6
Slope, steepest	4		4	1	6	7	3		2	3	4		4	1
Texture, 0-50 cm	4		4	2	8	9	8		8	9	4		4	2
Texture, 50-100 cm	2		0	1	8	9	9		8	9	2		0	1
Total Coarse Fragments, 0-50 cm	0		0	0	0	0	0		0	0	0		0	0
Total Coarse Fragments, 50-100 cm	0		0	0	0	0	0		0	0	0		0	0
Stones, 0-50 cm	0		0	0	0	0	0		0	0	0		0	0
Cobbles, 0-50 cm	0		0	0	0	0	0		0	0	0		0	0
Structure	1		1	1	2	2	2		2	2	1		1	1
Fertility	2		2	3	2	2	2		2	2	2		2	3
Moisture Regime	3		3	6	3	3	4		6	4	3		3	6
Drainage Class	2		2	6	2	3	3		6	3	2		2	6
Permeability	1		1	2	3	3	3		4	3	1		1	2
Depth to Groundwater	1		1	2	1	1	1		2	1	1		1	2
Excess Soil Water	1		1	6	1	1	4		6	4	1		1	6
Root Restriction	1		1	5	2	2	3		4	3	1		1	5
Soil Erosion	1		1	1	4	7	1		1	1	1		1	1
Stream Flooding	1		1	1	1	1	1		1	1	1		1	1
Organic Soil Depth	-		-	-	-	-	-		-	-	-		-	-
Organic Soil Decomposition	-		-	-	-	-	-		-	-	-		-	-

SOIL AREA NUMBER	50		51		52		53		54		55		56
Times Area inspected	0		4		6		7		4		3		3
Major soil (1), Minor soil (2)	1	2	1	2	1	2	1	2	1	2	1	2	1 2
Proportions (tenths)	6	4			7	3	6	4			6	4	
CHARACTERISTICS													
Slope, flattest	1		1		1	1	1	1	1		1	1	1
Slope, steepest	4		2		2	2	2	2	2		2	2	1
Texture, 0-50 cm	3		1		0	1	3	3	1		8	8	0
Texture, 50-100 cm	1		1		1	1	8	8	1		9	9	9
Total Coarse Fragments, 0-50 cm	0		0		0	0	0	0	0		0	0	0
Total Coarse Fragments, 50-100 cm	4		0		0	0	0	0	0		0	0	0
Stones, 0-50 cm	2		0		0	0	0	0	0		0	0	0
Cobbles, 0-50 cm	0		0		0	0	0	0	0		0	0	0
Structure	1		1		1	1	1	1	1		2	2	1
Fertility	2		3		4	4	2	2	4		2	2	4
Moisture Regime	2		2		7	6	5	5	3		4	4	7
Drainage Class	1		1		6	6	4	4	2		4	5	6
Permeability	1		1		3	2	3	3	2		4	4	3
Depth to Groundwater	1		1		2	2	2	2	1		2	2	2
Excess Soil Water	1		1		7	6	5	4	2		4	5	7
Root Restriction	1		1		5	5	4	3	1		2	3	5
Soil Erosion	1		1		1	1	1	1	1		1	1	1
Stream Flooding	1		1		1	1	1	1	1		1	1	1
Organic Soil Depth	-		-		-	-	-	-	-		-	-	4
Organic Soil Decomposition	-		-		-	-	-	-	-		-	-	3

SOIL AREA NUMBER	57		58		59		60	
Times Area inspected		0		0		0		0
Major soil (1), Minor soil (2)	1	2	1	2	1	2	1	2
Proportions (tenths)	6	4	8	2	8	2		
CHARACTERISTICS								
Slope, flattest	1	2	2	1	2	1	2	
Slope, steepest	1	5	4	6	4	6	4	
Texture, 0-50 cm	0	6	4	0	4	0	2	
Texture, 50-100 cm	0	3	2	1	2	1	2	
Total Coarse Fragments, 0-50 cm	0	0	0	0	0	0	0	
Total Coarse Fragments, 50-100 cm	0	0	0	0	0	0	0	
Stones, 0-50 cm	0	0	0	0	0	0	0	
Cobbles, 0-50 cm	0	0	0	0	0	0	0	
Structure	1	2	1	1	1	1	1	
Fertility	4	2	3	4	3	4	4	
Moisture Regime	7	3	3	6	3	6	2	
Drainage Class	6	2	2	6	2	6	2	
Permeability	2	2	1	2	1	2	1	
Depth to Groundwater	2	1	1	2	1	2	1	
Excess Soil Water	7	1	1	6	1	6	4	
Root Restriction	5	2	1	5	1	5	1	
Soil Erosion	1	1	1	1	1	1	5	
Stream Flooding	1	1	1	1	1	1	6	
Organic Soil Depth	4	-	-	-	-	-	-	
Organic Soil Decomposition	1	-	-	-	-	-	-	