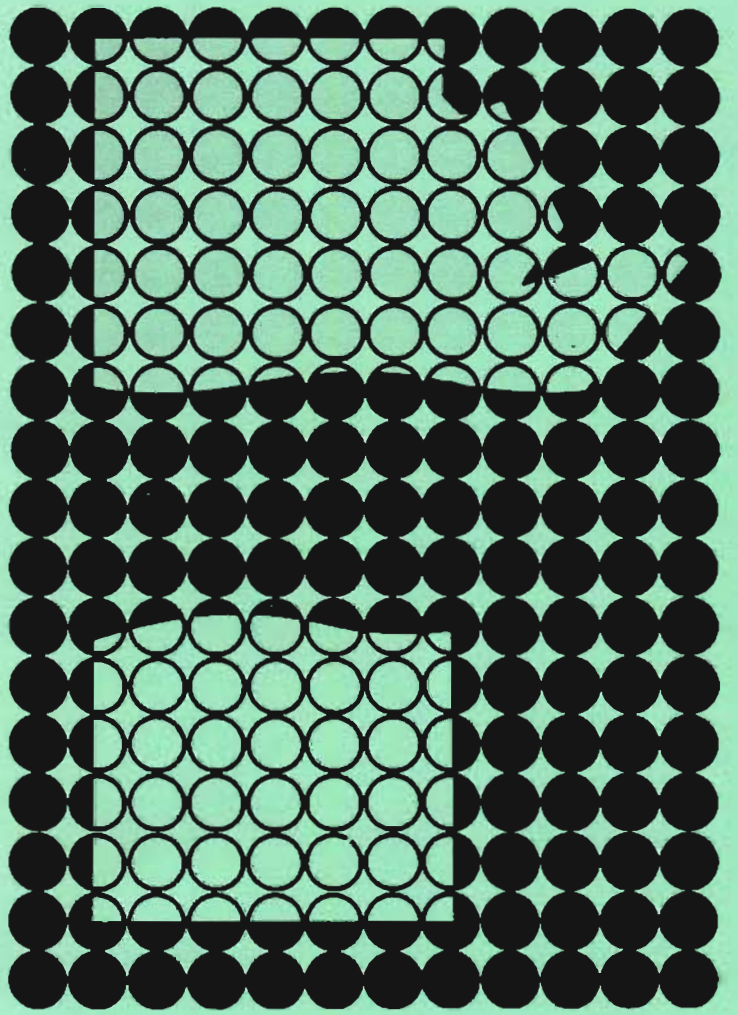

CANADA-MANITOBA Soil Survey

Minor Element Content of Agricultural Soils in Manitoba

Special Report Series 94-1

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MINOR ELEMENT CONTENT OF AGRICULTURAL SOILS IN MANITOBA

by

P. Haluschak[1], G. F. Mills[1] and R. G. Eilers[2]

[1]Manitoba Agriculture, Soils and Crops Branch, Soil Survey Unit

[2]Agriculture Canada, Manitoba Land Resource Unit

1994

PREFACE

This research was undertaken as part of a continuing effort by the Manitoba Soil Survey Unit and the Manitoba Land Resource Unit to characterize and evaluate the soil resource of the Province. The data compiled in this report provide an overview of the minor element content of agricultural soils in Manitoba. The initial analysis of the data represents the results of a long-term soil sampling program designed to document the background level of minor elements in major agricultural soil types in Manitoba.

Additional resources are required to expand the range of analysis on available samples and to collect and analyze samples from areas not yet characterized in sufficient detail.

In consideration of the intensive land management practices and the increasing use of agricultural land for waste management, it is important to document this type of information on Manitoba soils. Growing public concern for the sustainability of Manitoba's soil and water resources and for food safety serve to reinforce this need.

ACKNOWLEDGMENTS

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MINOR ELEMENT CONTENT OF AGRICULTURAL SOILS IN MANITOBA

BACKGROUND

Knowledge of the background level and distribution of minor element content in Manitoba soils is required for evaluation of soil quality for crop growth, forage and livestock production and for the safe application of sewage sludge and effluent disposal on agricultural land. Intensive management of agricultural crops and increased use of land for waste management can result in a potential buildup of high levels of minor elements which adversely impact on soil and water quality and safety of plant products forming the human diet.

Total minor element content of soil is a valuable indicator of possible excesses or deficiencies for plant nutrition and ultimately animal and human health (Dudas and Pawluk 1977; Boila et al. 1984, 1985; Kruger et al. 1985; Gupta 1986). The practical implication of minor elements in the environment relates to their availability for plant uptake from the soil and their release into water systems. Minor elements are released into the environment from natural weathering of rocks and minerals and from various sources related to human activity. The degree of contamination of soils by heavy metals relates to the quantities of minor elements added to the soil from man-made sources such as industrial emissions, sewage sludge and other wastes.

Research has been conducted to study the effects of sewage sludge application on agricultural land and on plant uptake of heavy metals (Zwarich and Mills 1979; Webber and Shamess 1987). However, limited information is available on background levels of minor elements in Manitoba soils (Haluschak and Russell 1971; Madden 1974; Mills and Zwarich 1975). Information of this kind is required to adequately address concerns related to plant and animal nutrition, food safety and quality of the environment.

OBJECTIVES

This study was undertaken to provide comprehensive background information on the level of minor elements in a wide range of agricultural soils in southern Manitoba. The specific objectives of this study are to:

1) assess background levels of minor elements in surface horizons of major agricultural soils, and

2) determine the geographic distribution of minor element concentrations in soils of southern Manitoba.

MATERIALS AND METHODS

Soil samples were collected from the A-horizon of soils at 694 cultivated sites selected within the agricultural area of Manitoba. Each sample was taken to a depth of 15 cm and assigned a site location and a soil series name based on field observations, measured soil properties and soil map information. The sampling strategy was organized on a broad grid designed to characterize polygons on the 1:1 million scale Soil Landscapes of Canada -Manitoba Map (Canada Soil Inventory 1989). This generalized map provides a means of extrapolating the minor element data from selected soil types to the agricultural landscapes of Manitoba. Distribution and frequency of sample sites is shown in Figure 7 (Appendix).

Precautions were taken to avoid contamination of samples during collection, preparation and analysis. Samples were analyzed according to procedures outlined in the Canada-Manitoba Soil Survey "Laboratory Methods of Soil Analysis" (Haluschak 1986). Particle size was determined by the sieve and pipette method with a pretreatment of hydrogen peroxide to remove organic matter. Readily oxidized organic carbon was measured by dichromate digestion. Concentrations of total iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), cobalt (Co), lead (Pb) and nickel (Ni) were determined following soil digestion with nitric, perchloric and hydrofluoric acid. All determinations were by flame atomic absorption spectroscopy.

Data was summarized and analyzed by use of a dBASE STATS™ (SPSS Inc. 1989) software package. Simple linear regression and multiple stepwise regression analyses were performed on selected soil properties and total minor element content of soils.

RESULTS AND DISCUSSION

Mean concentrations of total Fe, Mn, Zn, Cu, Co, Pb, and Ni in A-horizons of Manitoba soils are summarized according to textural class in Tables 1, 2 and 3. The predictability of minor element content from other soil properties is summarized in Tables 4 and 5. Physical and chemical properties for soils sampled from these soil landscape polygons are presented according to legal description and soil series names in Table 8 (Appendix). Soil series code and corresponding soil name are provided in Table 6 (Appendix). The small number of samples of coarse sand (CS), very fine sand (VFS), and sandy clay (SC) textures limits the reliability of the minor element data for these soils. Additional sampling is required to provide more reliable minor element data for some

textural classes; (CS), (VFS), loamy coarse sand (LCS), loamy very fine sand (LVFS), coarse sandy loam (CSL), silt loam (SIL) and (SC). A general trend among all samples is evident as the finer particle size (silt and clay) fractions contain greater amounts of minor elements than do the coarser particle size (sand) fractions. The relative concentration of minor elements in all textures tends to decrease according to the series: $Fe > Mn > Zn > Cu \approx Co \approx Pb \approx Ni$.

Total Minor Element Content

The relationship of Fe and Mn content to soil texture is illustrated in Figure 1. Average Fe content ranged from 0.91 % in sandy soils to 3.25 % in clay soils. Low Mn values of 281, 311, and 321 ppm are observed in fine sand (FS), (LVFS), and loamy fine sand (LFS) soils and high Mn values of 818, 877, and 1041 ppm are noted in clay loam (CL), silty clay loam (SiCL) and (CSL) textured soils. Mean concentration of Mn in clay soils is 655 ppm. The Mn concentration in the CSL textural class exceeds the range commonly observed in Manitoba soils. This may be attributed to the mineralogical composition of the parent material and/or the influence of groundwater (Swaine and Mitchell 1960). Levels of Mn reported in this study fall within the mid-range (100 to 1200 ppm) reported for Canadian soils (McKeague et al. 1979). Higher Fe and Mn concentrations that are not closely related to soil texture (Table 1) may be related to factors such as geological origin and mineralogy of the soil parent material, soil development, drainage and organic matter.

Mean Zn content ranged from 28 ppm in (VFS) textured soils to 108 ppm in clay soils (Table 1). Zinc concentrations up to 400 ppm have been reported for soils in Canada (Mckeague 1979). Most Manitoba soils fall into the low end of values reported for Canada. Several sites with extremely high Zn concentrations (1000 to 2210 ppm) were excluded from the data and the statistical analysis. Re-sampling of these sites and analysis for total Zn will be done to determine if these values are valid or whether Zn contamination during analysis was responsible for the unusually high values. High values of Zn (64 ppm) in (CS) and in (CSL) may be related to mineralogical composition of the parent material at these sites.

Concentrations of total Cu and Co varied from 5 to 35 ppm and 9 to 27 ppm respectively. Total amount of Zn, Cu and Co in soils increase with increasing clay content (Figure 2) and fall within the range of values that has been reported for Canadian soils (McKeague et al. 1979; Liang et al. 1990).

Mean concentration of Pb ranged from 14 to 31 ppm and Ni ranged from 7 to 40 ppm (Table 1). These two elements are non-essential for plant nutrition and exhibit a similar trend as other elements with lower values occurring in sandy textured soils and higher values in clayey soils (Figure 3). Levels of Pb and Ni in Manitoba soils are within the range of 5 to 50 ppm reported for Canadian soils (McKeague et al. 1979).

Total minor element content of soils is summarized according to six soil textural groupings in Table 2 and three broad textural groupings in Table 3. Mean concentrations of minor elements within these generalized textural groupings increase with increasing clay content following similar trends noted within individual textural classes. The concentration of Mn is an exception to this trend in that higher levels are noted in the loam (L), (SiL), sandy clay loam (SCL) and (SC), (CL), (SiCL) textural groups in contrast to those observed in the clayey group (Table 2). The relationship of soil textural groups to the content of minor elements can be used to provide a general assessment of background levels of minor elements in soils when more precise particle size data is not available.

Linear regression equations were computed to indicate the predictability of minor element content of soils from routinely measured physical and chemical soil properties (Table 4 and 5). Correlation coefficients (Table 4) indicate that 82 % of the variation in concentration of Cu, 78% of the variation of Fe content and 69% of the variation in concentration of Co is accounted for by clay content in soils. Therefore, clay content can be used in regression equations to predict the content of total Cu, Fe and Co in soil surface horizons (Table 4). However lower correlation coefficients, 0.54 for Zn, 0.54 for Ni, 0.37 for Pb and 0.28 for Mn, indicate that clay content does not provide as reliable an estimate of total concentrations of these elements. Other factors such as mineralogy of the parent material may influence content of Zn, Ni, Pb and Mn. In addition, concentrations of Mn usually increase in waterlogged and poorly aerated soil conditions. Multiple stepwise regression analysis did not improve the accuracy for prediction of total minor elements from particle size and/or organic carbon content (Table 5).

Minor Element Content of Soil Series

The soil series provides the most precise means of characterizing the minor element content of soil. A summary of average minor element content for individual soil series ($n \geq 3$) is presented in Table 7 (Appendix). Additional sampling is required to increase the reliability of minor element data for soil types with fewer than 10 samples.

Geographic Distribution of Minor Elements

Small scale soil maps provide a basis for indicating a general geographic distribution of minor elements in agricultural soils in Manitoba. The relationship of total minor element content to soil textural group (Table 2) is mapped on the basis of the dominant surface texture of each polygon on the 1:1 million scale Soil Landscapes of Canada-Manitoba Map (Canada Soil Inventory 1989). Soil areas with a dominance of sandy textures are characterized by lower concentrations of minor elements (Figures 4 and 5). However, map areas at this small scale include variation in surface texture, drainage and parent material type which results in the inclusion of soils often having different minor element content than that indicated on the maps.

Similarly, the established relationship between minor element content and soil texture can be used to predict minor element distribution for specific areas with detail soil maps (Figure 6). Mean concentrations of Fe, Zn, Cu, Co, Pb and Ni (Table 2) were assigned to each soil polygon. Using the dominant surface texture information from the 1:50,000 scale soil survey of the RM of Hanover (Hopkins et al. 1993) and the mean concentrations of minor elements (Table 2) one can estimate the general distribution of minor elements at any map scale. The sandy and gravelly soils in the southern portion of the RM of Hanover (Figure 6) are characterized by lower minor element concentrations in contrast to the higher concentrations observed for the silty and clayey soils in the northern part of the area.

SUMMARY

Soil texture has a major influence on the total concentration of selected minor elements in soil. Specifically, total Fe, Cu and Co concentration is strongly related to clay content. Therefore, clay content can be used to estimate the total content of Fe, Cu and Co in soil. The concentrations of Mn, Zn, Pb and Ni although related to clay content appear to be influenced by additional factors such as mineralogy of soil parent material and soil moisture regime.

The data from this study provide preliminary background levels of minor elements in Manitoba soils. The concentration of total Fe, Mn, Zn, Cu and Co can be used to identify those soils which may exhibit minor element deficiency or excess for crop growth and subsequent nutritional imbalances for animals consuming these crops. Total minor element concentration in soils also provides baseline data for assessing potential loading capacity of soils for the application of sewage sludge and other materials containing minor

elements. Analysis of a wide range of soils in this study indicates that total minor element content in surface horizons of Manitoba soils is generally lowest in sandy soils and highest in clayey soils. The concentration of these minor elements are within the range of values reported for Canadian soils.

Recommendations For Future Work

1) The need to improve the reliability of total minor element data. Additional sampling and analysis are recommended for:

a) coarse sand (CS),very fine sand (VFS), loamy coarse sand (LCS), loamy very fine sand (LVFS), coarse sandy loam (CSL), silt loam (SiL) and sandy clay (SC) textured soils.

b) specific soil textural groups and geographic areas.

c) soil series representative of major agricultural soils.

2) The need to investigate the cause of extremely high Zn (1000 to 2210 ppm) concentrations in several soils. Re-sampling and analysis of these soils is required.

3) The need to assess the status of additional minor elements in soils, such as Arsenic (As), Cadmium (Cd), Molybdenum (Mo) and Selenium (Se). The soil analysis conducted in this study should be expanded to include these additional key elements which impact on plant nutrition and animal and human health.

4) A more complete assessment of minor elements in the subsurface horizons or parent materials of Manitoba soils. Analysis of major parent material types is required to more accurately determine the natural source of each element in the environment and improve the extrapolation of existing data to other landscapes in the province.

5) The need to locate and characterize more precisely those soil areas with low minor element content which may be critical for crop growth and nutritional quality as well as soil areas in which minor elements may occur in concentrations which are toxic to plants or animals consuming those plants.

6) The need to study the relationship of total minor element content of soils and extractants used to measure plant availability of these elements.

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Table 1. Mean concentrations of total minor elements in soils by textural class

Textural class	n	Fe ±sd %	n	Mn ±sd ppm	n	Zn ±sd ppm	n	Cu ±sd ppm	n	Co ±sd ppm	n	Pb ±sd ppm	n	Ni ±sd ppm
CS	2	0.92 ±.51	2	392 ±359	2	64 ±26	2	8 ±2	2	9 ±1	2	25 ± 3	2	7 ± 3
S	22	0.91 ±.36	22	344 ±131	21	31 ±17	22	5 ±2	22	10 ±1	21	14 ± 4	21	11 ±10
FS	23	0.91 ±.33	23	281 ±118	23	31 ±15	23	5 ±2	23	10 ±2	21	15 ± 5	21	9 ± 5
VFS	2	1.01 ±.33	2	552 ± 59	2	28 ± 6	2	6 ±1	2	10 ±0	2	16 ± 1	2	10 ± 1
LCS	8	1.27 ±.30	8	645 ±287	8	42 ±11	8	7 ±4	8	13 ±3	8	22 ± 7	7	12 ± 2
LS	15	1.11 ±.29	15	496 ±183	14	39 ±14	15	9 ±6	15	11 ±3	15	19 ± 6	15	10 ± 3
LFS	40	0.93 ±.21	40	321 ± 80	37	34 ±14	40	6 ±3	40	12 ±2	35	15 ± 4	35	14 ±12
LVFS	7	0.99 ±.30	7	311 ± 93	7	35 ±13	7	7 ±2	7	12 ±2	7	18 ± 3	7	13 ± 8
CSL	7	1.75 ±.31	7	1041 ±326	7	64 ± 9	7	12 ±3	7	16 ±2	7	20 ± 6	7	16 ± 3
SL	28	1.22 ±.42	28	509 ±291	26	46 ±18	28	10 ±5	28	13 ±4	25	19 ± 6	25	14 ±12
FSL	49	1.22 ±.36	49	490 ±220	47	47 ±18	49	11 ±4	49	13 ±3	49	20 ± 7	49	14 ± 6
VFSL	28	1.16 ±.29	28	416 ±138	28	41 ±13	28	11 ±4	28	12 ±3	25	22 ± 7	25	13 ± 4
L	145	1.91 ±.30	145	787 ±296	145	71 ±17	145	18 ±4	145	17 ±4	136	23 ± 6	136	21 ± 5
SIL	7	1.76 ±.39	7	682 ±349	7	72 ±27	7	18 ±4	7	17 ±7	5	24 ± 9	5	18 ± 7
SCL	51	1.59 ±.47	51	575 ±267	51	63 ±27	51	15 ±4	51	15 ±4	49	23 ± 6	49	19 ±10
SC	3	1.79 ±.31	3	481 ± 37	2	91 ±29	3	21 ±1	3	22 ±7	3	18 ± 8	3	40 ±14
CL	109	2.08 ±.41	107	818 ±347	105	86 ±26	109	22 ±5	109	19 ±4	104	24 ± 6	104	25 ± 8
SICL	22	2.26 ±.43	22	877 ±241	21	93 ±25	22	24 ±6	22	20 ±4	20	30 ±10	20	25 ± 6
SIC	25	2.69 ±.50	25	815 ±222	20	105 ±23	25	29 ±4	25	23 ±5	24	28 ± 7	24	36 ±14
C	99	3.25 ±.75	101	655 ±340	80	108 ±28	99	35 ±8	101	27 ±7	101	31 ± 6	101	40 ±15

n= number of samples, sd= standard deviation

Table 2. Mean concentrations of total minor elements in soils for 6 textural groups

Textural group	n	Fe ±sd %	n	Mn ±sd ppm	n	Zn ±sd ppm	n	Cu ±sd ppm	n	Co ±sd ppm	n	Pb ±sd ppm	n	Ni ±sd ppm
CS, S, FS VFS	49	0.91 ±.34	49	325 ±141	48	32 ±17	49	5 ±2	49	10 ±2	46	15 ±5	46	10 ± 8
LCS, LS LFS, LVFS	70	1.01 ±.27	70	395 ±181	66	36 ±14	70	7 ±4	70	12 ±2	65	17 ±5	64	13 ± 9
CSL, SL FSL, VFSL	112	1.24 ±.38	112	510 ±268	108	46 ±17	112	11 ±4	112	13 ±3	106	20 ±7	106	14 ± 7
L, SIL SCL	203	1.82 ±.37	203	730 ±303	203	69 ±21	203	17 ±4	203	17 ±4	190	23 ±6	190	20 ± 7
SC, CL SICL	134	2.11 ±.42	132	820 ±332	128	87 ±26	134	22 ±5	134	19 ±4	127	25 ±7	127	26 ± 8
SIC, C	124	3.12 ±.76	126	687 ±325	100	108 ±27	124	34 ±7	126	26 ±6	125	31 ±6	125	39 ±15

n= number of samples, sd= standard deviation

Table 3. Mean concentrations of total minor elements in soils for 3 textural groups

Textural group	n	Fe ±sd %	n	Mn ±sd ppm	n	Zn ±sd ppm	n	Cu ±sd ppm	n	Co ±sd ppm	n	Pb ±sd ppm	n	Ni ±sd ppm
COARSE	203	1.09 ±.37	203	439 ±244	194	40 ±18	203	8 ±4	203	12 ±3	192	18 ±6	191	13 ± 8
MEDIUM	362	1.88 ±.46	362	741 ±321	357	73 ±25	362	18 ±6	362	17 ±4	339	24 ±7	339	22 ± 8
FINE	127	3.09 ±.77	127	682 ±323	102	108 ±27	127	34 ±8	129	26 ±7	128	30 ±7	128	39 ±15

n= number of samples, sd= standard deviation

Table 4. Simple Linear Regression Analysis

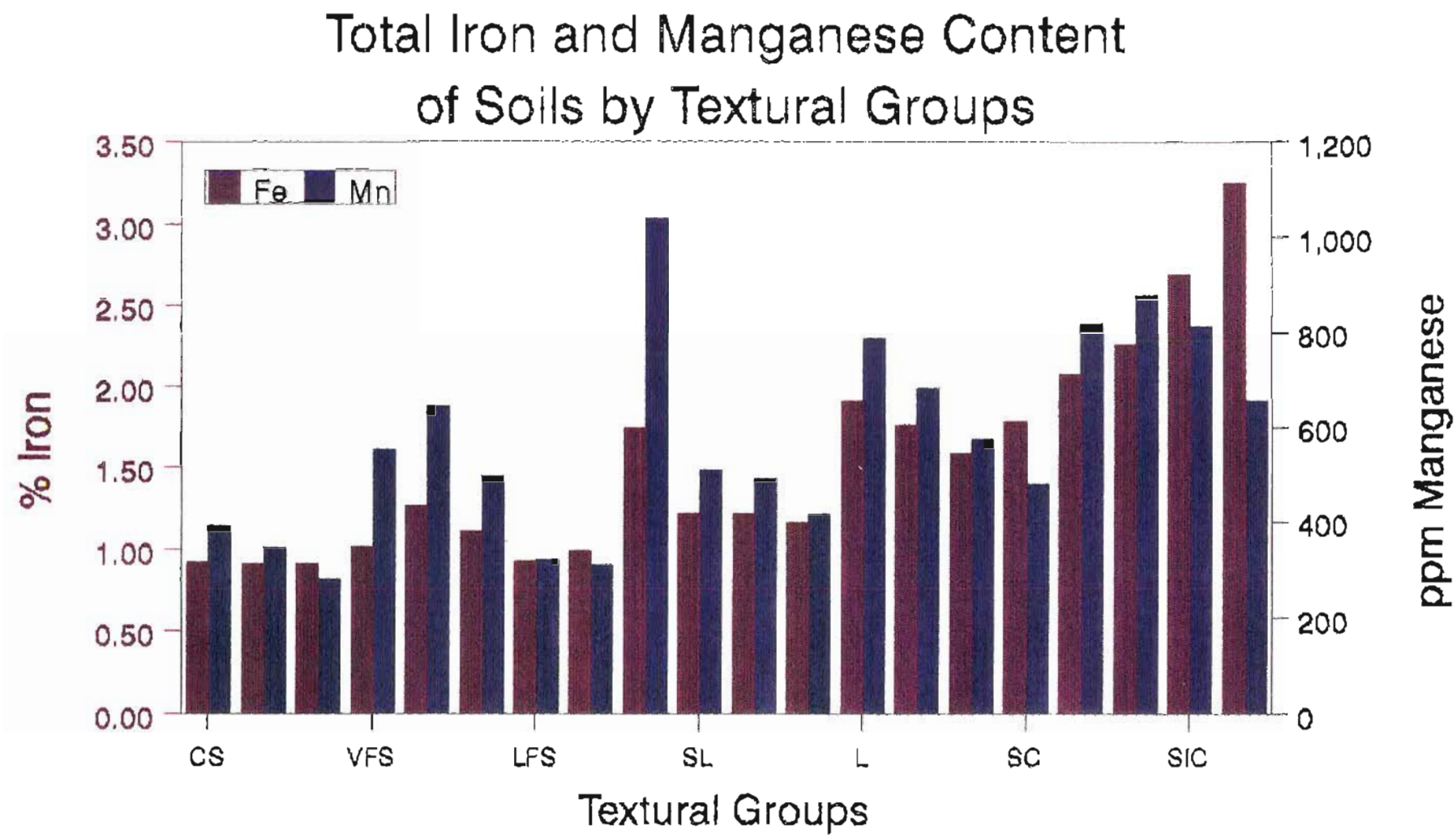
Fe % = 0.71 + 0.04 clay %	R^2 = 0.78
Mn ppm = 315 + 12.21 silt %	R^2 = 0.28
Zn ppm = 30.7 + 1.48 clay %	R^2 = 0.54
Cu ppm = 3.6 + 0.54 clay %	R^2 = 0.82
Co ppm = 8.8 + 0.31 clay %	R^2 = 0.69
Pb ppm = 15.9 + 0.27 clay %	R^2 = 0.37
Ni ppm = 7.2 + 0.56 clay %	R^2 = 0.54

Table 5. Multiple Regression Analysis

Fe % = 0.58 + 0.04 clay % + 0.01 silt %	R^2 = 0.80
Mn ppm = 310 + 11.96 silt % + 0.44 clay %	R^2 = 0.28
Zn ppm = 21.0 + 1.20 clay % + 0.63 silt %	R^2 = 0.60
Cu ppm = 1.7 + 0.50 clay % + 0.12 silt %	R^2 = 0.84
Co ppm = 10.5 + 0.34 clay % - 0.70 orgc %	R^2 = 0.71
Pb ppm = 23.1 + 0.15 clay % - 0.09 sand %	R^2 = 0.39
Ni ppm = 8.5 + 0.58 clay % - 0.52 orgc %	R^2 = 0.54

orgc= organic carbon

Figure 1.


Total Iron and Manganese Content
of Soils by Textural Groups
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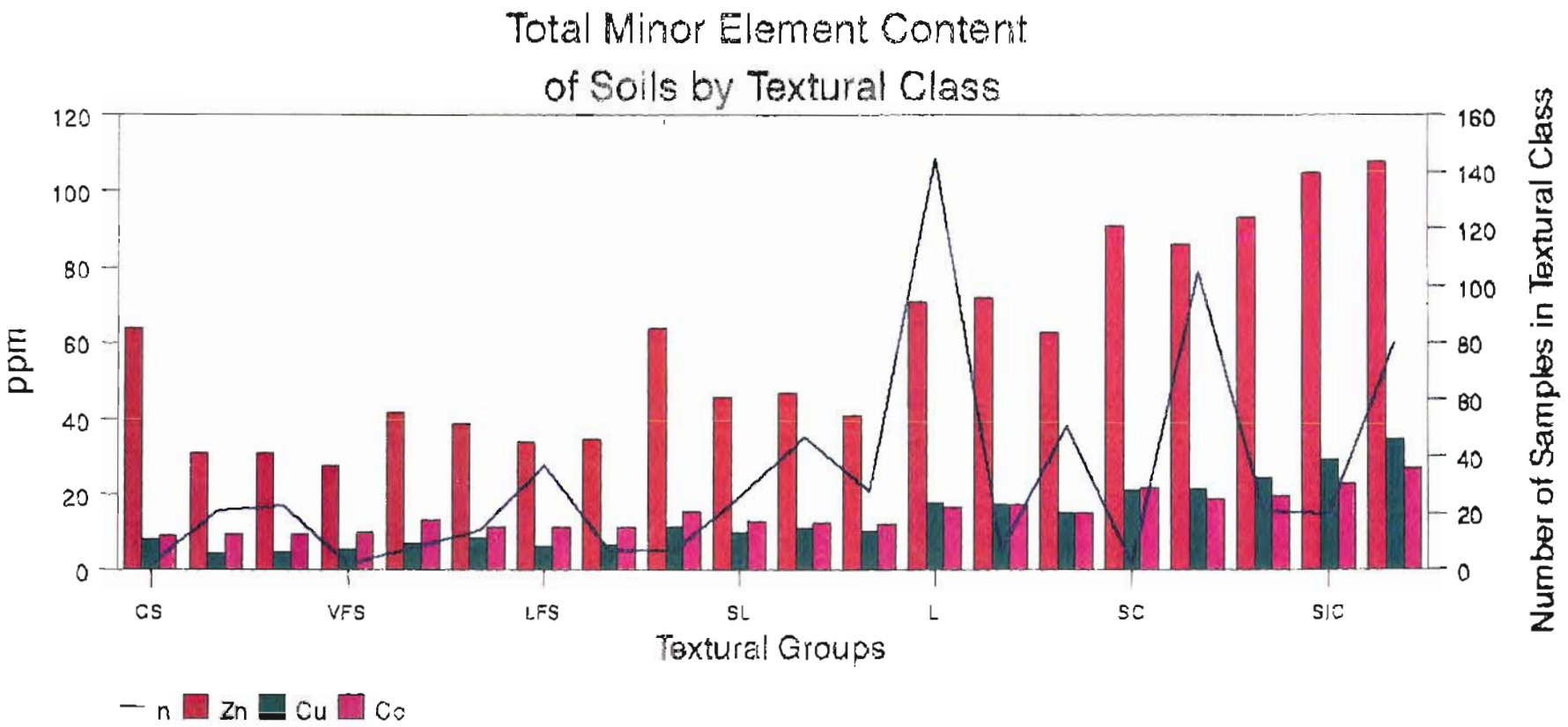
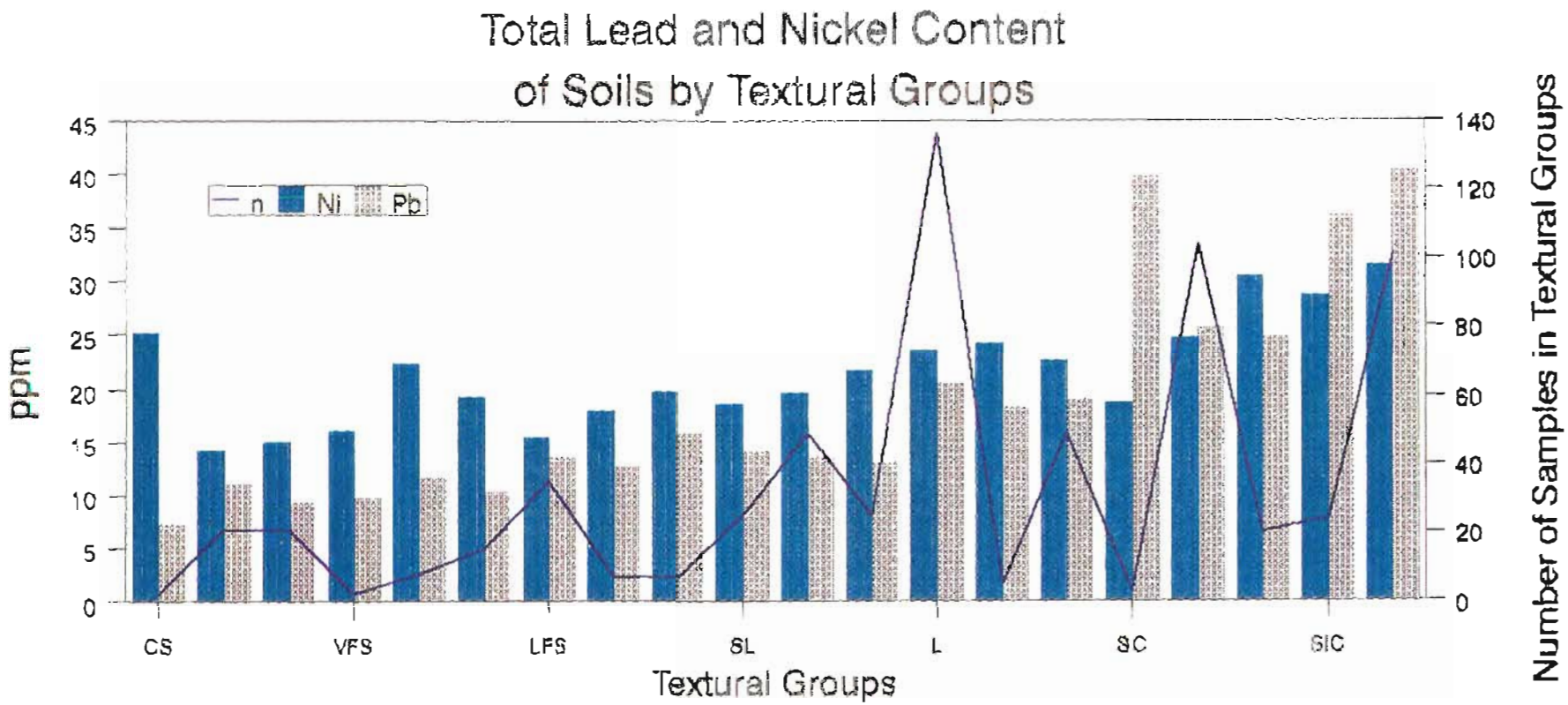
% Iron
ppm Manganese
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1,200
1,000
800
600
400
200
0
CS
VFS
LFS
SL
L
SC
SIC
Textural Groups

Figure 2.

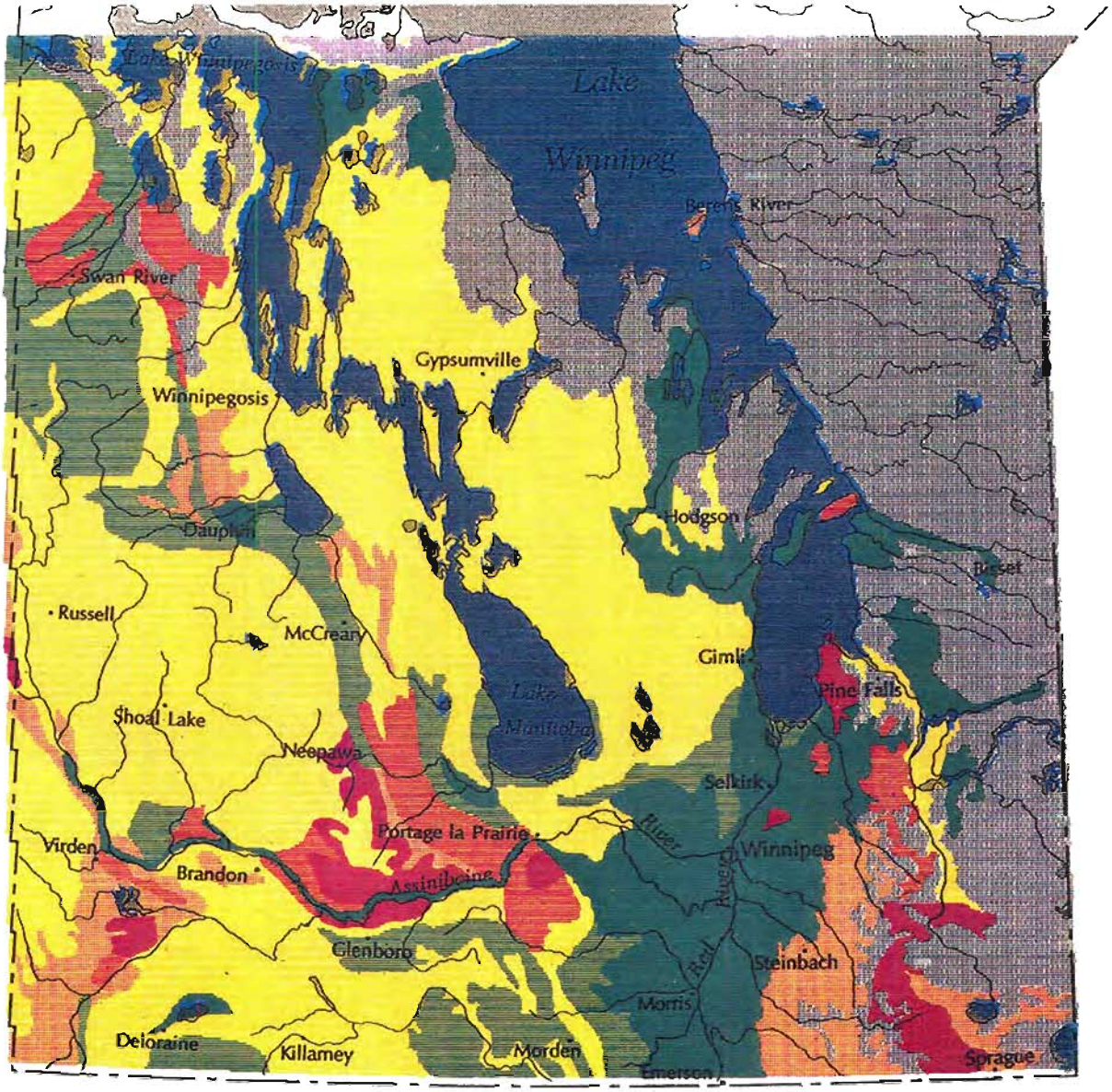


	CS	S	FS	VFS	LCS	LS	LFS	LVFS	CSL	SL	FSL	VFSL	L	SIL	SCL	SC	CL	SICL	SIC	C
n	2	21	23	2	8	14	37	7	7	26	47	28	145	7	51	2	105	21	20	80
Zn	64	31	31	28	42	39	34	35	64	46	47	41	71	72	63	91	86	93	105	108
Cu	8	5	5	6	7	9	6	7	12	10	11	11	18	18	15	21	22	24	29	35
Co	9	10	10	10	13	11	12	12	16	13	13	12	17	17	15	22	19	20	23	27

Figure 3.



	CS	S	FS	VFS	LCS	LS	LFS	LVFS	CSL	SL	FSL	VFSL	L	SIL	SCL	SC	CL	SICL	SIC	C
n	**2**	**21**	**21**	**2**	**8**	**15**	**35**	**7**	**7**	**25**	**49**	**25**	**136**	**5**	**49**	**3**	**104**	**20**	**24**	**101**
Ni	25	14	15	16	22	19	15	18	20	19	20	22	23	24	23	19	25	30	28	31
Pb	7	11	9	10	12	10	14	13	16	14	14	13	21	18	19	40	26	26	38	40



Mean concentrations of total minor elements

	Fe ±sd %	Zn ±sd ppm	Cu ±sd ppm	Co ±sd ppm	Pb ±sd ppm	Ni ±sd ppm
	0.91 ±.34	32 ±17	5 ±2	10 ±2	15 ±5	10 ± 8
	1.01 ±.27	36 ±14	7 ±4	12 ±2	17 ±5	13 ± 9
	1.24 ± 38	46 ±17	11 ±4	13 ±3	20 ±7	14 ± 7
	1.82 ±.37	69 ±21	17 ±4	17 ±4	23 ±6	20 ± 7
	2.11 ±.42	87 ±26	22 ±5	19 ±4	25 ±7	26 ± 8
	3.12 ± 76	108 ±27	34 ±7	26 ±6	31 ±6	39 ±15

Insufficient data

Water

Figure 4. Distribution and mean concentrations of Total Minor Elements in agricultural soils of Southern Manitoba.

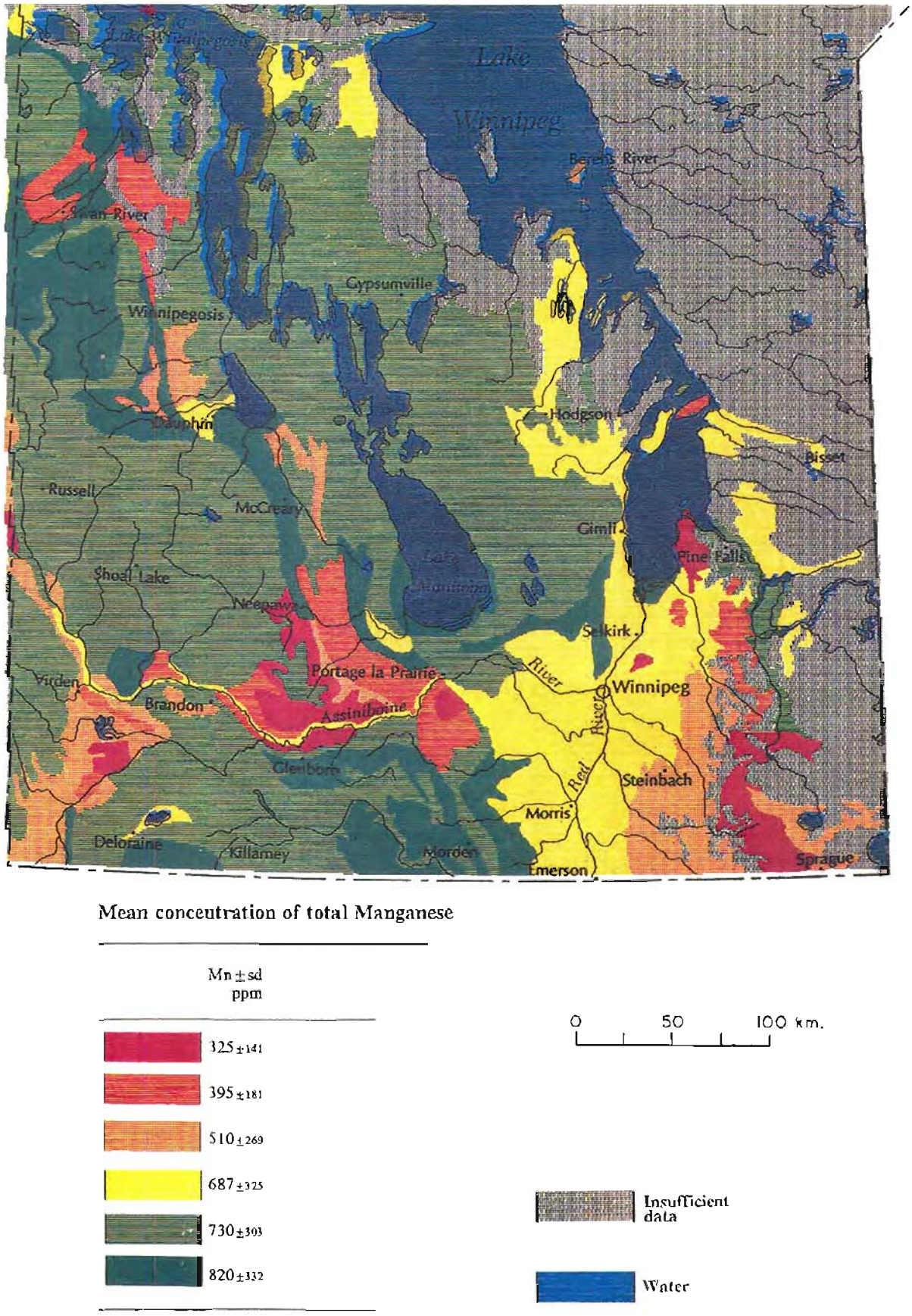
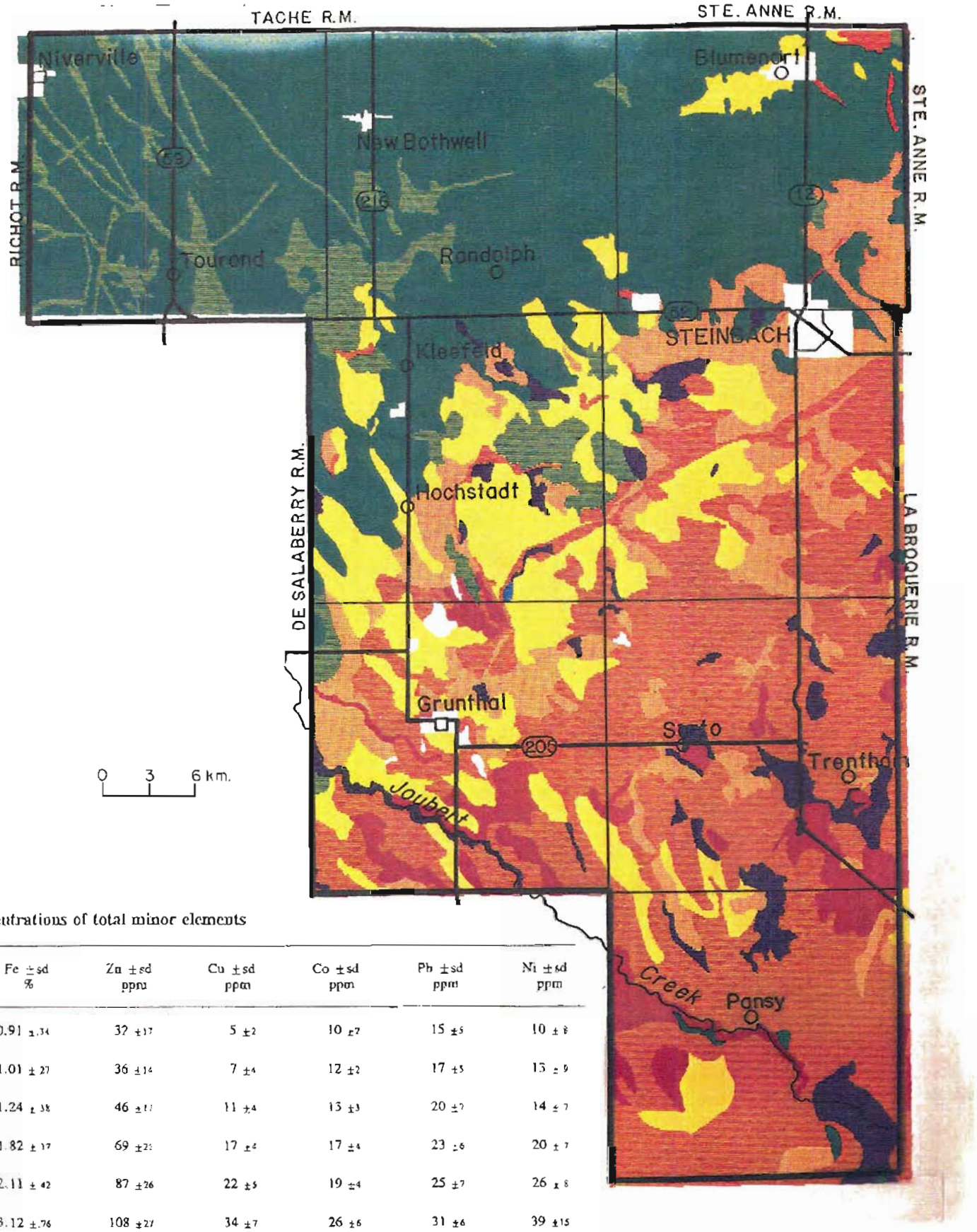


Figure 5. Distribution and mean concentration of Total Manganese in Agricultural soils of Southern Manitoba.



Mean concentrations of total minor elements

	Fe ±sd %	Zn ±sd ppm	Cu ±sd ppm	Co ±sd ppm	Pb ±sd ppm	Ni ±sd ppm
	0.91 ±.34	32 ±17	5 ±2	10 ±7	15 ±5	10 ±8
	1.01 ±.27	36 ±14	7 ±4	12 ±2	17 ±5	13 ±9
	1.24 ±.38	46 ±17	11 ±4	13 ±3	20 ±7	14 ±7
	1.82 ±.37	69 ±23	17 ±4	17 ±4	23 ±6	20 ±7
	2.11 ±.42	87 ±26	22 ±5	19 ±4	25 ±7	26 ±8
	3.12 ±.76	108 ±27	34 ±7	26 ±6	31 ±6	39 ±15

Organic Water Urban area

Figure 6. Distribution and mean concentrations of Total Minor Elements of agricultural soils in the R.M. of Hanover.

APPENDIX

Table 6. Soil series name and code

Table 7. Summary of minor element content by soil series

Table 8. Physical and chemical properties of Manitoba soils (surface horizons)

Figure 7. Frequency and distribution of sampling sites

Table 6. Soil series name and code

Series code	Soil series name	Series code	Soil series name
ABG	Arborg	FND	Fairland
AND	Aneda	FOY	Foley
ANV	Anvil Lake	FTE	Fortier
ARD	Arden	FYL	Fyala
ASB	Assiniboine	GBO	Glenboro
ASS	Almasippi	GBT	Gilbert
ASZ	Agassiz	GCS	Glencross
ATN	Altamont	GDC	Grande-Clairiere
AWH	Arrow Hills	GDH	Gnadenthal
BAM	Balmoral	GFS	Glenfields
BCS	Blackstone	GFT	Grifton
BED	Bede	GHP	Glenhope
BIC	Bernice	GOI	Goose Island
BMN	Bermont	GOL	Goodlands
BOH	Broomhill	GOO	Glenmoor
BOW	Bower	GRH	Garrioch
BSF	Beresford	GRR	Gretna
BVR	Beaverdam Lake	GSO	Garson
BWO	Barwood	GUO	Gunton
BYD	Berry Island	GCS	Gervais
CXT	Capell	GYV	Graysville
CBY	Colby	HAT	Halstead
CIO	Caliento	HCL	Hecla
CKD	Crookdale	HCZ	Halicz
CKG	Clarkleigh	HEB	Hebbot
CLN	Clementi	HHF	Hochfeld
CME	Cranmer	HHY	Hathaway
CMR	Cameron	HIT	Hilton
CSE	Coatstone	HMD	Homestead
CVA	Cordova	HND	Horndean
CXF	Carroll	HOT	Horton
CYN	Croyon	HRG	Harding
DBW	Denbow	HRY	Hartney
DCS	Dencross	ISF	Isafold
DGF	Darlingford	IWO	Inwood
DHO	Deadhorse	JYL	Joyale
DLY	Daly	KIS	Kingsley
DOM	Dromore	KLI	Kline
DOT	Dorset	KRW	Kergwenan
DPH	Dauphin	KUD	Knudson
DRB	Durban	KUY	Kilmury
DTT	Dutton	LAM	Lambert
DXM	Druxman	LBU	Libau
DZW	Dezwood	LGV	Langvale
ECK	Erickson	LKD	Lakeland
EEK	Elm Creek	LLT	Lelant
ELV	Elva	LNO	Lenore
EMV	Elm River	LOP	Long Plain
EWS	Edwards	LRY	Leary
EYT	Eddystone	LSW	Lenswood
FIR	Firdale	LUD	Lauder

Table 6. Soil series name and code (Cont'd)

Series code	Soil series name	Series code	Soil series name
LUR	Lundar	RFD	Reinfeld
LYT	Lyleton	RGD	Rignold
LYW	Ladywood	RGT	Regent
MCR	McCreary	RIV	Red River
MEB	Meleb	RLD	Reinland
MEH	Meharry	RTO	Ralston
MGT	Magnet	RUF	Rufford
MHY	Methley	RWL	Rathwell
MLI	McKinley	RYS	Ryerson
MND	McClernon	SCH	Scarth
MNT	Malonton	SCK	Stockton
MOT	Montgomery	SCL	Sclater
MOW	Mowbray	SDI	Sandilands
MPS	Maples	SHX	Shilox
MRE	Margaret	SKL	Skelding
MRH	Marringhurst	SLB	St Labre
MRQ	Marquette	SOU	Souris
MRS	Morris	SPG	Sprague
MWK	Meadowbrook	STU	Stanton
MXI	Miniota	SUE	St Claude
MXS	Manitou	SWF	Swanford
MXT	Melland	SWZ	Switzer
NBG	Neuenberg	TAV	Traverse
NDL	Newdale	TGL	Tiger Hills
NEI	Neelin	TGR	Taggart
NGT	Norgate	THG	Thalberg
NIV	Niverville	TOC	Torcan
NKK	Nikkel	TRO	Tarno
NPK	Napinka	TUV	Turtle River
NUH	Neuhorst	TWC	Two Creeks
NWS	Newstead	VDL	Vandal
OBO	Osborne	VIT	Vita
OHV	Ochre River	VLY	Valley
OIV	Oliver	VRC	Varcoe
PAN	Pansy	VTL	Vartel
PBI	Pembina	WDF	Woodfield
PDA	Prodan	WGE	Wintergreen
PGU	Peguis	WKD	Waskada
PIY	Piney	WOG	Woodridge
PLE	Pleasant	WOM	Woodmore
PLN	Pelan	WTD	Wentland
PMG	Plum Ridge	WTV	Waitville
POR	Porple	WWB	Willowbend
PPL	Poppleton	WWC	Willowcrest
PRG	Pine Ridge	WWD	Wellwood
PUS	Plumas	WWS	Wawanesa
PVW	Plainview	ZIM	Zinman
PWL	Powell	ZPI	Zaplin
PAM	Ramada	ZRT	Zarnet
RBK	Rosebank		
RDG	Rose Ridge		

Table 7. Summary of Minor Element Content by Soil Series

Soil Series	Series Code	n	Fe %	Mn ppm	Zn ppm	Cu ppm	Co ppm	Pb ppm	Ni ppm
Assiniboine	ASB	5	2.76	1049	108	24	26	25	30
Almasippi	ASS	12	0.87	284	39	7	11	14	17
Altamont	ATN	3	2.05	1354	101	19	20	23	32
Balmoral	BAM	3	2.54	555	74	24	24	15	25
Bede	BED	3	0.96	442	27	4	13	14	11
Barwood	BWO	3	1.84	785	71	16	18	17	20
Berry Island	BYD	3	0.88	325	43	13	10	18	11
Clarkleigh	CKG	8	1.94	422	71	21	15	27	20
Coatstone	CSE	4	1.93	786	70	15	18	23	19
Cordova	CVA	12	2.01	770	71	22	15	27	22
Carroll	CXF	5	2.13	936	86	18	19	25	24
Dencross	DCS	7	2.64	708	137	38	22	31	38
Darlingford	DGF	3	2.32	1466	129	28	20	23	37
Deadhorse	DHO	5	2.50	966	148	33	18	26	35
Dorset	DOT	4	1.31	597	51	9	10	22	11
Dauphin	DPH	3	2.49	1048	122	30	25	28	44
Dezwood	DZW	4	1.76	1234	126	17	17	21	22
Erickson	ECK	9	2.13	949	79	21	21	21	25
Fairland	FND	3	1.78	645	65	15	17	19	18
Fyala	FYL	5	2.81	566	80	29	22	33	47
Gnadenthal	GDH	5	1.81	647	104	22	15	21	17
Glenfields	GFS	4	1.99	569	60	28	19	29	27
Glenhope	GHP	10	1.24	417	45	13	13	22	13
Hathaway	HHY	15	1.83	754	65	16	18	22	21
Hilton	HIT	9	1.83	787	64	15	19	21	20
Inwood	IWO	8	1.60	420	52	14	15	25	17
Joyale	JYL	4	2.10	1094	94	21	19	23	24
Lakeland	LKD	14	1.64	534	59	19	16	32	19
Long Plain	LOP	4	0.76	234	25	5	10	14	16
Lenswood	LSW	14	0.91	404	38	8	12	18	13
Lauder	LUD	5	0.87	329	29	6	13	11	8
Lundar	LUR	18	1.52	454	55	16	13	27	17
Lyleton	LYT	3	1.45	566	48	9	15	17	9
McCreary	MCR	7	1.71	469	58	19	15	29	21
Meharry	MEH	6	1.93	560	69	19	19	23	26
Methley	MHY	3	1.97	560	66	21	18	42	21
Malonton	MNT	3	0.88	267	33	8	13	24	10
Marringburst	MRH	10	1.32	590	49	9	12	23	24
Marquette	MRQ	15	2.84	551	100	31	24	34	33
Miniota	MXI	8	1.57	988	54	11	14	16	22
Manitou	MXS	4	1.86	876	113	24	17	23	22
Neuenberg	NBG	4	1.30	465	63	13	13	23	15
Newdale	NDL	41	2.17	851	79	22	17	23	24
Neuhorst	NUH	4	2.59	883	100	27	21	30	36
Newstead	NWS	3	1.55	659	61	13	16	17	14
Osborne	OBO	31	3.72	615	123	38	30	33	42
Prodan	PDA	3	1.70	882	89	16	16	18	19
Peguis	PGU	5	2.90	542	124	30	26	32	49

Table 7. Summary of Minor Element Content by Soil Series (cont'd)

Soil Series	Series Code	n	Fe %	Mn ppm	Zn ppm	Cu ppm	Co ppm	Pb ppm	Ni ppm
Piney	PIY	3	1.33	293	66	11	13	25	11
Pelan	PLN	6	1.21	328	38	11	13	20	18
Plum Ridge	PMG	12	1.25	416	49	12	13	23	13
Poppleton	PPL	5	0.99	332	31	7	11	20	8
Plainview	PVW	4	2.82	1064	122	28	26	26	41
Ramada	RAM	6	1.98	886	101	21	22	20	27
Rignold	RGD	4	2.07	507	79	20	20	23	23
Red River	RIV	22	3.42	576	112	38	29	32	42
Reinland	RLD	8	1.06	366	41	9	13	19	14
Rufford	RUF	8	1.86	781	66	16	18	21	22
Stockton	SCK	6	0.92	398	33	6	12	16	11
Sandilands	SDI	6	0.68	315	30	4	10	17	10
Shilox	SHX	8	1.19	355	33	6	11	14	15
St Labre	SLB	3	0.77	223	21	3	8	23	7
Souris	SOU	9	0.94	408	31	5	12	16	8
Stanton	STU	5	1.06	395	36	5	12	15	10
St Claude	SUE	4	0.88	287	46	9	10	29	8
Swanford	SWF	3	1.40	635	53	13	12	19	17
Thalberg	THG	3	2.61	614	69	29	19	27	22
Vandal	VDL	5	1.69	827	84	15	13	20	19
Valley	VLY	4	1.87	731	88	22	18	19	25
Varcoe	VRC	10	2.02	772	74	20	17	24	26
Waskada	WKD	8	1.89	754	70	16	19	23	22
Woodridge	WOG	5	1.07	422	54	9	8	18	5
Wentland	WTD	3	1.30	369	57	18	12	27	18
Willowcrest	WWC	3	1.01	299	29	7	10	16	11
Wellwood	WWD	8	2.28	746	86	21	17	22	22
Zinman	ZIM	3	1.85	1208	62	18	20	25	31

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SW22-23-03E	ABG	4.11	0	0	6	6	24	70	C	NR	399	64	19.0	17.0	34.0	11.0
NE25-12-07E	AND	2.44	6	56	6	69	8	23	SCL	1.38	290	40	15.0	8.0	12.0	9.0
SE28-20-28W	ANV	3.32	5	10	15	34	41	25	L	1.83	564	71	19.0	16.0	NR	NR
SE05-16-14W	ARD	3.99	7	17	19	48	23	29	SCL	1.96	502	78	23.0	15.0	17.0	56.0
NE34-09-24W	ASB	3.64	0	0	1	1	41	58	SIC	3.53	1156	130	28.0	33.0	31.0	40.0
NW26-10-20W	ASB	2.87	2	10	15	28	33	39	CL	2.90	950	110	26.0	27.0	27.0	25.0
SE23-13-27W	ASB	5.62	0	0	10	10	18	72	C	2.88	1227	134	28.0	30.0	23.0	38.0
NE32-05-17W	ASB	3.48	2	3	8	15	52	33	SICL	1.88	1151	76	16.0	20.0	21.0	20.0
SW08-17-28W	ASB	1.96	1	9	19	29	39	32	CL	2.59	761	91	21.0	22.0	23.0	28.0
NW12-08-05W	ASS	2.08	0	32	55	87	5	8	LVFS	0.93	292	32	5.5	11.0	23.0	8.3
SW25-08-05W	ASS	1.38	1	40	47	88	6	6	LFS	0.81	300	32	11.0	14.0	14.0	26.0
NW27-06-06W	ASS	1.17	2	72	16	90	3	7	FS	0.96	230	78	7.6	10.0	16.0	8.8
NE35-08-06W	ASS	2.58	3	65	21	89	7	4	FS	0.96	238	21	2.8	9.6	19.0	5.2
NW19-08-05W	ASS	2.76	1	52	32	85	8	7	LFS	0.91	370	NR	11.0	11.0	16.0	26.0
NW22-08-06W	ASS	1.87	4	64	19	88	7	5	LFS	0.75	390	91	15.0	12.0	12.0	59.0
SE23-08-07W	ASS	1.87	8	56	22	86	7	7	LFS	0.91	350	NR	9.0	12.0	16.0	8.0
SW03-08-07W	ASS	1.22	9	48	29	86	6	8	LFS	0.93	225	26	4.0	12.0	16.0	26.0
NE25-14-13W	ASS	1.65	8	56	23	89	5	6	FS	0.97	284	26	4.0	8.4	12.0	7.3
SW27-16-12W	ASS	1.83	2	48	38	88	7	5	LFS	0.95	304	26	4.8	6.4	9.8	8.4
NW17-13-11W	ASS	2.20	4	50	29	83	7	10	LFS	0.72	247	25	6.2	10.0	NR	NR
NE08-12-09W	ASS	1.92	1	45	46	92	3	5	FS	0.64	178	36	6.0	12.0	10.0	9.0
NW10-22-16W	ASZ	3.37	20	55	11	92	4	4	FS	0.73	227	17	3.8	5.0	4.4	5.6
NW08-05-08W	ATN	4.08	6	9	7	28	45	27	L	1.87	1047	150	19.0	20.0	20.0	23.0
SE23-01-06W	ATN	3.13	4	5	10	23	43	34	CL	2.50	968	88	23.0	20.0	26.0	40.0
NE29-01-06W	ATN	2.71	10	12	9	40	37	23	L	1.79	2048	64	16.0	19.0	NR	NR
NE01-12-25W	AWR	3.52	12	18	21	58	24	18	FSL	1.78	1261	74	14.0	18.0	15.0	19.0
SE02-21-28W	AWR	4.36	12	12	7	45	28	27	L	2.58	468	94	19.0	24.0	NR	NR
NE05-09-12E	BAM	3.26	0	0	2	2	37	61	C	3.09	592	83	28.0	30.0	42.0	34.0
SW14-37-25W	BAM	7.42	1	8	9	18	41	41	SIC	2.76	703	95	27.0	23.0	23.0	29.0
NE15-23-01E	BAM	2.78	0	0	6	6	68	26	SIL	1.78	371	45	16.0	19.0	39.0	13.0
NW17-33-29W	BCS	3.82	2	4	5	12	46	42	SIC	3.08	1072	138	27.0	29.0	26.0	32.0
SW24-01-29W	BED	1.74	30	13	4	82	9	9	LCS	1.06	497	29	3.0	14.0	10.0	11.0
NE33-04-25W	BED	0.41	27	55	9	93	1	6	FS	0.73	304	21	3.0	11.0	7.0	12.0
SC01-05-26W	BED	1.14	39	16	5	83	7	10	LS	1.10	525	32	5.0	14.0	25.0	9.0
SE20-05-17W	BIC	3.56	18	22	11	58	23	19	FSL	1.80	682	56	13.0	17.0	22.0	15.0
SE28-07-18W	BMN	3.48	7	10	12	33	43	24	L	2.20	900	72	16.0	21.0	24.0	22.0
SE01-04-29W	BOH	2.80	25	9	4	69	17	14	CSL	1.74	814	59	9.4	16.0	21.0	12.0
NE08-03-15W	BOW	6.38	11	4	9	32	31	37	CL	1.70	868	74	20.0	18.0	19.0	19.0
NE13-11-19W	BSF	3.30	2	18	19	39	30	31	CL	2.30	954	88	18.0	22.0	22.0	28.0
NC09-11-17W	BSF	3.86	2	6	19	28	38	34	CL	2.65	819	96	26.0	26.0	12.0	38.0
SW19-11-08E	BVR	1.39	41	30	2	84	8	8	LS	1.11	240	22	7.5	8.0	13.0	7.5
SW04-18-03E	BVR	3.69	20	21	7	61	16	23	SCL	0.73	368	27	8.0	15.0	31.0	13.0
SW21-02-14W	BWO	3.23	11	14	15	50	26	24	SCL	1.69	720	65	15.0	18.0	20.0	21.0
NW29-02-13W	BWO	3.60	7	12	19	48	29	23	L	1.90	642	65	15.0	19.0	10.0	22.0
SE33-06-17W	BWO	6.61	5	8	9	25	43	32	CL	1.93	994	84	17.0	16.0	20.0	17.0
SW30-02-08E	BYD	3.76	24	24	7	73	12	15	SL	0.99	255	48	11.0	13.0	23.0	10.0
SW19-02-07E	BYD	5.44	26	31	5	71	15	14	FSL	0.85	500	62	13.0	12.0	15.0	11.0
SW06-13-09E	BYD	9.99	0	3	59	62	21	17	VFSL	0.80	220	19	15.0	5.0	16.0	12.0
NE22-01-04E	CBY	2.80	7	44	26	82	7	11	LFS	0.84	282	31	7.0	13.0	16.0	10.0
NW29-14-12W	CBY	2.60	5	50	28	83	8	9	LFS	0.92	291	33	7.4	9.4	NR	NR

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SW21-01-13E	CIO	1.08	23	34	14	85	10	5	LS	1.00	350	NR	5.5	11.0	22.0	6.3
SE14-07-14W	CKD	2.90	3	42	11	56	23	21	SCL	1.85	731	64	15.0	18.0	17.0	18.0
NE04-17-04W	CKG	4.61	3	9	12	27	36	37	C	2.52	316	105	21.0	26.0	20.0	13.0
SW29-17-04W	CKG	5.41	5	7	4	20	33	47	C	2.56	240	98	26.0	26.0	20.0	29.0
NW04-24-16W	CKG	5.43	6	8	26	46	28	26	SCL	1.10	461	43	9.7	16.0	27.0	8.5
NE35-20-14W	CKG	6.16	11	8	7	36	37	27	CL	0.78	426	51	11.0	15.0	35.0	13.0
NE31-16-03W	CKG	7.67	20	13	9	54	26	20	SCL	1.80	475	55	17.0	9.0	20.0	17.0
NE33-16-03W	CKG	9.99	15	13	5	42	33	25	L	1.56	615	48	17.0	7.0	22.0	16.0
SE02-20-05W	CKG	7.80	4	6	6	19	44	37	SICL	2.54	620	83	31.0	11.0	41.0	33.0
SE02-20-05W	CKG	7.47	3	6	6	18	38	44	C	2.63	222	88	34.0	12.0	31.0	31.0
SE36-11-18W	CLN	4.86	3	5	7	16	47	37	SICL	2.62	886	99	27.0	26.0	23.0	27.0
NE23-06-14W	CLN	2.32	2	9	20	33	32	35	CL	2.62	945	81	19.0	24.0	22.0	26.0
SW05-04-20W	CME	3.58	5	8	14	31	37	32	CL	2.21	929	87	19.0	20.0	24.0	24.0
SW21-03-21W	CME	4.02	4	7	21	33	34	33	CL	1.57	780	75	16.0	18.0	25.0	25.0
NE09-07-21W	CMR	3.18	2	4	31	38	40	22	L	1.98	688	73	18.0	21.0	22.0	17.0
SW23-05-24W	CMR	3.34	1	4	31	36	37	27	L	1.75	679	69	15.0	19.0	18.0	23.0
SW35-02-19W	CSE	3.25	10	15	13	43	32	25	L	1.84	944	73	16.0	18.0	21.0	18.0
NE34-02-22W	CSE	2.34	13	17	12	50	27	23	SCL	1.90	780	64	15.0	17.0	21.0	20.0
SW06-04-19W	CSE	2.76	7	9	12	33	40	27	L	2.17	756	80	17.0	20.0	23.0	22.0
SE01-03-29W	CSE	2.56	9	13	5	39	37	24	L	1.79	665	63	13.0	17.0	28.0	17.0
SW14-15-29W	CVA	3.84	10	15	13	45	33	22	L	1.94	746	79	19.0	17.0	20.0	21.0
NE18-20-29W	CVA	4.71	7	10	9	32	35	33	CL	2.46	802	104	23.0	18.0	34.0	22.0
NW20-14-26W	CVA	3.67	10	13	10	40	38	22	L	2.00	1000	69	24.0	12.0	21.0	22.0
NE21-17-23W	CVA	4.55	7	15	16	41	29	30	CL	1.74	769	78	17.0	19.0	12.0	27.0
SW36-14-16W	CVA	2.64	11	23	13	52	26	22	SCL	1.54	675	50	19.0	12.0	32.0	22.0
SW36-14-16W	CVA	2.50	9	19	10	42	33	25	L	1.71	652	45	16.0	13.0	23.0	23.0
NW29-12-18W	CVA	3.15	7	10	8	29	37	34	CL	2.18	775	64	28.0	11.0	23.0	30.0
SW31-12-17W	CVA	7.51	6	9	8	27	41	32	CL	2.27	810	89	29.0	11.0	24.0	23.0
SW05-21-27W	CVA	2.96	10	12	2	42	33	25	L	2.01	565	60	23.0	13.0	26.0	18.0
NE26-20-28W	CVA	3.60	11	14	12	43	27	30	CL	2.49	1044	86	18.0	22.0	NR	NR
SE20-18-26W	CVA	4.36	15	12	10	41	33	26	L	2.09	750	66	21.0	14.0	27.0	20.0
SE09-20-26W	CVA	5.08	8	11	10	36	39	25	L	1.74	650	67	23.0	12.0	51.0	19.0
NW30-09-22W	CXF	4.47	1	2	10	13	58	29	SICL	2.27	1115	105	20.0	20.0	32.0	28.0
NW31-07-20W	CXF	4.52	2	4	26	33	39	28	CL	2.35	950	85	20.0	19.0	20.0	21.0
SW01-08-20W	CXF	4.75	1	2	15	18	56	26	CL	2.30	946	84	19.0	19.0	27.0	23.0
SW11-08-19W	CXF	3.20	9	20	19	52	26	22	SCL	2.00	836	67	13.0	17.0	23.0	18.0
SW13-10-22W	CXF	4.54	1	5	7	13	54	33	SICL	1.75	832	90	20.0	21.0	21.0	28.0
NE18-06-10W	CXT	3.25	11	15	14	47	34	19	L	1.58	1015	96	19.0	16.0	18.0	17.0
SW26-03-13W	CYN	3.17	18	11	6	48	31	21	L	1.88	1100	84	14.0	16.0	16.0	16.0
NE25-09-21W	DBW	2.26	7	50	17	74	11	15	FSL	0.75	401	32	5.0	12.0	15.0	12.0
NW08-01-02E	DCS	2.87	0	1	11	12	48	40	SIC	2.16	728	67	23.0	19.0	38.0	23.0
SE11-04-01E	DCS	3.74	0	0	5	5	38	57	C	2.73	1010	NR	33.0	25.0	25.0	36.0
SW11-03-01E	DCS	4.26	1	5	10	16	44	40	SIC	2.13	645	NR	29.0	20.0	26.0	27.0
NW18-02-02E	DCS	3.84	1	4	8	13	44	43	SIC	2.08	800	NR	30.0	22.0	27.0	30.0
NE12-15-08E	DCS	3.41	0	0	3	3	27	70	C	3.83	330	106	NR	27.0	33.0	13.0
SW15-08-04E	DCS	4.49	0	0	2	2	47	51	SIC	3.26	843	95	37.0	25.0	38.0	36.0
NW22-06-04E	DCS	3.33	1	2	8	11	44	45	SIC	2.29	600	NR	26.0	19.0	29.0	98.0
NW19-02-09W	DGF	4.30	8	12	10	37	32	31	CL	1.93	1077	76	15.0	20.0	17.0	19.0
SE09-03-07W	DGF	4.97	5	10	4	23	43	34	CL	2.30	2025	192	36.0	17.0	27.0	33.0
NW16-02-07W	DGF	4.23	4	6	18	32	34	34	CL	2.74	1295	120	33.0	24.0	25.0	58.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SE29-01-01W	DHO	3.98	0	1	12	13	32	55	C	2.72	1311	118	34.0	25.0	31.0	42.0
SW28-06-03W	DHO	4.91	0	1	10	11	40	49	C	2.61	865	NR	37.0	16.0	28.0	50.0
NE29-12-05W	DHO	4.97	0	0	6	6	55	39	SICL	2.21	962	151	34.0	19.0	29.0	29.0
SW30-11-04W	DHO	3.05	0	0	7	7	53	40	SICL	2.75	800	159	30.0	19.0	32.0	25.0
NE32-12-04W	DHO	4.49	0	0	7	7	47	46	SIC	2.20	890	94	30.0	10.0	8.0	30.0
NW13-25-19W	DLY	4.40	0	0	3	3	25	72	C	4.14	1428	184	48.0	37.0	33.0	59.0
SE01-02-16W	DOM	3.45	20	8	4	62	21	17	CSL	1.78	991	69	12.0	15.0	19.0	15.0
NW04-17-29W	DOT	3.85	54	13	1	84	8	8	LS	1.08	559	53	7.8	7.3	27.0	9.1
SE23-16-29W	DOT	2.72	40	12	2	89	6	5	CS	1.28	645	45	7.1	8.4	27.0	9.3
NW03-11-16W	DOT	2.77	43	23	5	83	9	8	LS	1.46	585	63	10.0	15.0	17.0	12.0
SW07-17-26W	DOT	3.21	46	13	5	81	8	11	LS	1.42	600	43	13.0	8.0	16.0	13.0
SE01-21-15W	DPH	5.32	3	6	11	21	35	44	C	2.02	643	87	19.0	18.0	33.0	23.0
NW07-25-19W	DPH	7.09	2	6	8	18	30	52	C	2.56	500	130	31.0	26.0	32.0	39.0
NE19-24-19W	DPH	5.22	0	0	7	7	33	60	C	2.88	2002	149	41.0	30.0	20.0	69.0
NE11-35-28W	DRB	4.55	9	16	28	58	24	18	VFSL	1.78	790	78	13.0	16.0	16.0	19.0
SE25-34-29W	DRB	3.48	10	23	16	54	33	13	FSL	1.54	742	68	11.0	16.0	17.0	18.0
NW15-24-20W	DTT	6.08	3	7	9	22	42	36	CL	2.49	652	117	30.0	24.0	27.0	35.0
NE19-36-25W	DTT	1.81	15	37	9	68	20	12	FSL	1.55	480	61	15.0	11.0	19.0	19.0
SE25-02-06W	DXM	3.46	37	16	2	82	9	9	LCS	1.54	1304	45	9.0	12.0	16.0	13.0
NW11-07-11W	DZW	5.33	8	11	6	35	32	33	CL	1.82	2207	198	22.0	16.0	23.0	26.0
NW11-07-11W	DZW	4.53	8	8	7	35	32	33	CL	1.65	NR	117	21.0	16.0	19.0	33.0
SW07-06-10W	DZW	1.42	15	16	8	48	30	22	L	1.60	865	87	13.0	16.0	18.0	21.0
SW07-06-10W	DZW	1.99	14	13	7	43	34	23	L	1.65	815	85	16.0	18.0	19.0	20.0
NW15-05-10W	DZW	3.43	6	6	6	25	49	26	L	1.95	1048	133	17.0	19.0	22.0	19.0
SE06-20-29W	ECK	5.35	7	10	9	32	43	25	L	2.04	637	88	21.0	16.0	32.0	21.0
NW28-23-28W	ECK	2.58	14	17	13	52	30	18	FSL	1.94	860	61	21.0	14.0	22.0	19.0
SE35-28-29W	ECK	2.60	18	17	8	51	29	20	L	1.71	701	51	12.0	18.0	16.0	17.0
NW08-28-28W	ECK	4.35	5	6	5	19	50	31	SICL	2.42	773	100	21.0	24.0	21.0	24.0
NW16-26-28W	ECK	4.29	12	15	9	44	32	24	L	2.34	909	77	18.0	22.0	20.0	21.0
SE04-21-28W	ECK	1.60	11	16	12	45	33	22	L	2.08	790	71	19.0	28.0	NR	NR
NW17-17-18W	ECK	5.08	6	9	14	34	43	23	L	1.96	942	92	27.0	21.0	15.0	30.0
SE27-34-27W	ECK	2.70	6	12	18	41	35	24	L	2.70	1357	78	24.0	22.0	28.0	30.0
SE02-17-18W	ECK	3.49	7	9	13	35	39	26	L	2.01	1575	92	25.0	23.0	14.0	34.0
NW30-07-04W	EEK	1.94	1	44	20	65	14	21	SCL	1.81	485	60	17.8	11.0	19.0	16.0
SW03-06-23W	ELV	3.96	1	3	17	21	50	29	CL	2.01	710	84	16.0	21.0	23.0	21.0
NW14-11-06W	EMV	2.65	9	8	9	29	48	23	L	1.77	589	79	16.0	19.0	20.0	35.0
SW03-18-15W	EWS	4.36	10	3	1	22	31	47	C	2.41	727	96	16.0	18.0	22.0	22.0
NW22-14-02W	EYT	3.02	11	52	6	72	15	13	FSL	1.16	290	35	11.0	6.0	14.0	14.0
SE27-12-13W	FIR	2.21	1	16	24	41	40	19	L	1.77	600	54	20.0	9.0	16.0	17.0
NE15-11-12W	FIR	2.67	1	17	28	47	33	20	L	1.84	600	68	20.0	19.0	22.0	21.0
SE12-12-24W	FND	3.60	21	15	8	55	27	18	SL	1.72	802	65	14.0	17.0	16.0	17.0
SE18-07-12W	FND	3.48	1	10	33	44	31	25	L	2.06	655	79	18.0	21.0	23.0	22.0
SE35-14-15W	FND	3.44	0	9	50	59	24	17	VFSL	1.56	479	52	12.0	14.0	17.0	16.0
NW20-13-11E	FOY	7.28	1	17	64	82	10	8	LVFS	0.80	175	19	10.0	7.0	16.0	8.0
SE23-36-24W	FOY	5.91	15	41	11	71	15	14	FSL	1.15	349	33	10.0	10.0	13.0	16.0
SW18-11-04W	FTE	4.46	4	12	8	25	32	43	C	2.40	713	102	25.0	21.0	26.0	33.0
NW14-11-05W	FTE	2.49	0	0	2	2	55	43	SIC	2.95	831	102	27.0	26.0	20.0	30.0
SE13-15-07E	FYL	9.99	0	0	4	4	39	57	C	2.71	300	69	39.0	13.0	25.0	32.0
SE05-16-06E	FYL	7.13	0	0	6	6	26	68	C	3.91	722	111	38.0	28.0	35.0	93.0
NW30-15-06E	FYL	7.74	0	0	8	8	27	65	C	3.62	1110	116	37.0	30.0	48.0	70.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SE23-23-02E	FYL	4.80	1	8	46	55	15	30	SCL	1.72	241	49	15.0	19.0	30.0	18.0
NW14-23-01W	FYL	1.46	5	31	9	46	22	32	SCL	2.07	457	56	16.0	22.0	28.0	22.0
NE17-08-16W	GBO	3.34	11	13	17	45	31	24	L	2.14	809	76	18.0	22.0	18.0	22.0
SW24-25-22W	GBT	1.12	29	39	13	85	5	7	S	0.83	534	34	5.0	10.0	5.0	10.0
SE24-36-27W	GBT	2.68	10	60	19	90	4	6	FS	1.58	650	58	8.4	9.8	17.0	16.0
NW01-05-07W	GCS	3.33	10	14	7	40	27	33	CL	2.60	660	NR	39.0	24.0	31.0	60.0
NE02-03-06W	GCS	2.81	22	24	9	71	14	15	SL	1.28	538	85	11.0	11.0	19.0	11.0
NW21-08-25W	GDC	2.84	13	49	25	88	5	7	LFS	0.80	346	27	3.0	13.0	10.0	8.0
SW06-04-04W	GDH	3.11	1	11	48	61	15	24	SCL	1.08	270	175	9.5	11.0	17.0	6.0
SE02-02-03W	GDH	1.68	1	2	58	62	18	20	SCL	1.39	496	41	18.9	16.0	24.0	14.0
SW35-12-07W	GDH	3.96	9	22	5	36	33	31	CL	1.79	675	NR	32.0	15.0	25.0	24.0
NW03-12-07W	GDH	5.57	1	5	10	16	52	32	SICL	2.43	934	105	29.0	14.0	19.0	22.0
SE20-14-11W	GDH	3.30	1	9	25	35	29	36	CL	2.38	861	93	19.0	19.0	NR	NR
SW21-15-10E	GFS	9.62	5	26	7	39	27	34	CL	1.88	320	62	34.0	10.0	17.0	22.0
NW01-14-08E	GFS	3.34	0	1	21	22	49	29	CL	1.67	685	53	16.0	19.0	31.0	21.0
NW24-16-02E	GFS	5.45	1	3	5	11	45	44	SIC	2.60	675	NR	36.0	24.0	38.0	30.0
SW19-14-10W	GFS	4.47	0	0	9	9	40	51	SIC	1.79	594	65	25.0	21.0	28.0	33.0
C21-38-28W	GFT	1.66	10	18	19	55	28	17	SL	2.25	1020	41	11.0	13.0	NR	NR
NE22-06-06E	GHP	3.94	19	35	10	72	16	12	FSL	0.89	198	NR	8.0	13.0	24.0	2.8
SE33-24-17W	GHP	4.70	1	3	45	49	30	21	L	1.32	416	51	17.0	15.0	27.0	10.0
SE06-27-19W	GHP	4.93	13	36	20	73	13	14	FSL	0.89	299	29	7.4	9.6	15.0	7.7
NE22-27-22W	GHP	4.04	5	39	18	65	16	19	SCL	0.84	334	36	8.1	12.0	23.0	8.4
SW18-31-21W	GHP	6.98	8	23	4	38	34	28	CL	1.98	784	67	24.0	21.0	27.0	30.0
NW13-26-19W	GHP	3.11	4	9	56	72	15	13	VFSL	1.38	493	44	12.0	13.0	26.0	13.0
SE26-28-19W	GHP	4.20	3	10	27	43	29	28	L	1.89	542	64	18.0	17.0	27.0	19.0
SE02-29-19W	GHP	5.32	2	5	21	29	48	23	L	1.86	646	73	16.0	20.0	28.0	21.0
SW22-23-15W	GHP	3.20	2	5	55	63	21	16	VFSL	0.77	275	25	8.0	7.0	18.0	11.0
SW23-23-15W	GHP	6.86	36	30	4	75	14	11	SL	0.61	180	20	9.0	4.0	8.0	9.0
32-44-24W	GOI	2.87	32	5	5	73	20	7	SL	0.73	70	13	9.0	5.0	NR	NR
SW06-03-22W	GOL	3.14	4	16	18	39	29	32	CL	1.84	708	71	15.0	20.0	22.0	25.0
SE23-15-10E	GOO	3.59	1	3	8	12	39	49	C	3.15	950	80	42.0	17.0	27.0	17.0
NE01-16-07E	GOO	5.66	2	4	4	10	23	67	C	3.16	605	110	37.0	31.0	32.0	46.0
NW34-16-02E	GRH	5.25	26	11	2	59	22	19	SL	1.14	335	NR	30.0	16.0	33.0	12.0
NE28-01-06W	GRR	5.33	1	4	6	13	50	37	SICL	1.70	1135	77	16.0	17.0	NR	NR
SE13-17-03E	GSO	1.82	12	15	7	43	22	35	CL	2.46	540	73	19.0	22.0	30.0	23.0
SW30-02-07E	GUO	2.23	31	19	6	82	11	7	LCS	1.29	627	32	5.4	15.0	25.0	9.6
NE29-14-11W	GVS	4.95	0	4	19	23	56	21	SIL	1.60	614	80	15.0	16.0	NR	NR
NW32-14-11W	GYV	3.70	0	0	6	6	54	40	SIC	2.55	757	109	25.0	22.0	NR	NR
SW08-11-12W	HAT	2.47	3	39	26	68	18	14	FSL	1.54	510	51	13.0	16.0	18.0	14.0
SW16-06-14W	HCL	4.61	3	2	11	26	44	30	CL	2.04	1808	87	17.0	23.0	15.0	30.0
SW36-24-19W	HCZ	2.94	2	5	15	23	31	46	C	2.26	1324	109	29.0	24.0	14.0	33.0
SE35-03-14W	HEB	4.10	7	6	8	37	36	27	L	2.02	1810	82	17.0	19.0	17.0	25.0
SE30-03-05W	HHF	1.39	6	20	57	86	6	8	LVFS	1.51	455	56	8.0	13.0	19.0	14.0
NW10-12-29W	HHY	3.23	12	14	10	46	33	21	L	1.73	845	75	16.0	19.0	13.0	22.0
NW25-03-17W	HHY	1.43	15	17	13	58	21	21	SCL	2.28	684	55	13.0	20.0	23.0	20.0
SW34-04-23W	HHY	2.42	5	7	11	26	48	26	L	1.88	936	61	16.0	20.0	33.0	24.0
SE05-06-20W	HHY	2.51	11	12	13	45	35	20	L	1.89	749	55	13.0	16.0	16.0	15.0
SW23-05-20W	HHY	3.54	8	12	18	43	31	26	L	1.63	731	67	18.0	18.0	17.0	19.0
SE06-03-18W	HHY	2.89	10	13	10	41	33	26	L	2.16	779	72	17.0	21.0	24.0	23.0
NE34-02-22W	HHY	1.50	9	12	12	41	33	26	L	1.89	799	55	16.0	19.0	33.0	25.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SE24-04-21W	HHY	2.96	15	12	12	51	27	22	SCL	1.66	732	63	13.0	16.0	19.0	17.0
NE25-04-22W	HHY	2.84	10	10	16	44	34	22	L	1.79	728	66	14.0	18.0	21.0	20.0
NE36-02-23W	HHY	7.20	3	5	11	20	48	32	CL	2.01	884	93	18.0	17.0	18.0	35.0
NW17-04-19W	HHY	3.57	10	12	14	48	28	24	L	1.54	623	60	17.0	17.0	19.0	19.0
SW20-06-18W	HHY	4.54	6	8	14	34	34	32	CL	1.33	511	58	15.0	18.0	19.0	20.0
NE28-08-28W	HHY	2.32	11	15	12	45	32	23	L	1.90	703	60	15.0	17.0	26.0	19.0
SW20-07-28W	HHY	3.05	9	14	13	41	34	25	L	1.93	725	66	16.0	17.0	25.0	17.0
NE05-07-27W	HHY	3.47	9	13	10	37	39	24	L	1.87	887	70	17.0	17.0	25.0	15.0
NE17-05-14W	HIT	3.60	10	17	15	49	31	20	L	2.04	779	63	14.0	20.0	18.0	19.0
SW21-05-15W	HIT	4.20	8	13	11	39	36	25	L	1.98	1218	67	15.0	18.0	25.0	22.0
SW30-07-18W	HIT	4.03	8	11	12	38	33	29	CL	2.41	794	69	18.0	22.0	25.0	25.0
NE15-07-19W	HIT	1.77	7	10	13	38	34	28	CL	1.23	455	44	12.0	18.0	25.0	18.0
SW04-07-18W	HIT	5.20	4	6	12	25	42	33	CL	1.50	569	81	18.0	19.0	25.0	20.0
NW29-02-13W	HIT	4.08	12	16	12	49	31	20	L	1.96	807	64	14.0	17.0	20.0	17.0
NW18-02-13W	HIT	3.88	11	14	18	53	26	21	SCL	1.65	843	61	14.0	18.0	15.0	18.0
SE33-06-17W	HIT	4.10	10	15	16	47	31	22	L	1.87	760	63	14.0	20.0	20.0	21.0
NW04-06-15W	HIT	3.90	15	15	11	52	29	19	L	1.83	861	62	14.0	16.0	18.0	18.0
SW04-33-22W	HMD	5.52	5	26	6	38	31	31	CL	2.54	1330	97	25.0	21.0	23.0	33.0
SW33-02-01W	HND	3.55	1	3	9	13	43	44	SIC	2.25	1500	134	35.0	24.0	27.0	44.0
NE13-01-01E	HND	3.89	1	1	9	11	38	51	C	2.93	938	99	28.0	22.0	26.0	34.0
SE10-02-20W	HOT	2.69	10	14	13	43	35	22	L	1.88	758	66	17.0	22.0	21.0	19.0
SE10-02-22W	HOT	2.12	13	20	14	55	24	21	SCL	1.98	612	52	14.0	19.0	22.0	21.0
SW10-09-21W	HRG	3.86	0	0	5	5	45	50	SIC	3.67	871	121	33.0	31.0	32.0	35.0
NE21-08-24W	HRY	1.90	6	22	38	66	20	14	VFSL	1.32	583	47	9.3	11.0	16.0	11.0
SW08-20-04W	ISF	7.36	10	13	9	40	33	27	CL	1.77	552	76	18.0	22.0	27.0	26.0
NE32-08-08E	IWO	1.68	21	21	26	75	12	13	FSL	1.38	334	36	8.9	16.0	16.0	14.0
SE05-04-08E	IWO	3.08	16	26	9	69	14	17	SL	1.21	259	36	10.0	13.0	20.0	9.0
SE09-01-14E	IWO	1.98	1	2	38	41	33	26	L	1.67	450	99	17.0	16.0	26.0	23.0
SE24-19-02E	IWO	1.77	3	34	23	62	19	19	FSL	1.36	350	36	17.0	14.0	26.0	15.0
NE21-20-01W	IWO	1.97	13	14	11	57	32	11	SL	1.11	329	30	8.8	16.0	24.0	8.6
SW35-18-01W	IWO	3.11	10	12	11	44	31	25	L	2.25	686	67	13.0	23.0	31.0	19.0
NE36-22-07W	IWO	3.41	20	10	5	49	33	18	L	2.14	450	58	19.0	11.0	25.0	25.0
NW35-22-08W	IWO	6.37	10	12	8	39	50	11	L	1.71	500	52	21.0	11.0	29.0	20.0
SW24-01-06W	JYL	4.70	3	5	10	22	49	29	CL	2.38	1663	108	26.0	19.0	NR	NR
NE24-01-10W	JYL	3.76	7	9	7	28	42	30	CL	2.09	938	81	16.0	20.0	20.0	23.0
NE14-03-11W	JYL	4.76	3	4	8	19	51	30	SICL	1.73	91[illegible]	91	19.0	19.0	23.0	27.0
NW16-03-08W	JYL	6.16	5	5	10	24	45	31	CL	2.19	864	95	24.0	16.0	27.0	22.0
NW08-07-08W	KIS	2.44	5	8	20	39	43	18	L	2.00	1537	71	14.0	19.0	19.0	20.0
SW06-11-07E	KLI	9.99	9	10	4	30	23	47	C	1.42	250	47	23.0	9.0	22.0	5.0
NE20-04-07E	KRW	1.45	26	49	9	89	8	3	S	0.70	213	21	2.9	11.0	15.0	5.7
NW16-05-09W	KUD	4.14	4	5	11	24	46	30	CL	2.10	857	160	23.0	21.0	24.0	21.0
SE27-10-26W	KUY	2.99	16	23	16	61	22	17	FSL	1.47	663	55	13.0	13.0	15.0	16.0
SE14-02-05E	LAM	4.99	14	39	7	65	18	17	FSL	0.85	325	42	11.0	13.0	25.0	9.5
NE18-18-04E	LBU	2.63	0	0	9	9	25	66	C	3.66	550	NR	42.0	28.0	39.0	47.0
SE03-04-28W	LGV	2.84	18	33	21	78	11	11	FSL	0.83	425	28	8.0	14.0	10.0	12.0
SW18-01-02E	LKD	2.93	1	1	13	15	53	32	SICL	2.13	721	67	24.0	23.0	43.0	25.0
NE09-03-01E	LKD	3.10	1	3	18	22	42	36	CL	2.74	742	81	30.0	24.0	34.0	28.0
SE17-01-02E	LKD	3.18	0	1	22	23	40	37	CL	1.69	644	56	18.0	18.0	34.0	20.0
SW09-07-04E	LKD	3.52	0	0	8	8	55	37	SICL	2.17	659	101	34.0	20.0	42.0	23.0
NE21-16-09W	LKD	2.91	1	7	33	41	37	22	L	1.32	442	37	11.0	14.0	36.0	13.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SW15-16-09W	LKD	3.40	0	4	29	33	41	26	L	1.51	678	42	15.0	15.0	39.0	14.0
NW03-16-09W	LKD	4.04	1	4	37	42	36	22	L	1.66	524	52	14.0	16.0	37.0	16.0
NW34-14-09W	LKD	3.69	2	6	20	29	46	25	L	1.76	591	67	20.0	17.0	29.0	19.0
SW25-13-04W	LKD	4.61	4	23	27	55	24	21	SCL	1.19	450	51	18.0	6.0	20.0	16.0
SW16-14-01W	LKD	5.22	2	12	23	38	32	30	CL	1.29	292	52	17.0	18.0	25.0	24.0
NE07-15-11W	LKD	3.50	3	13	33	50	23	27	SCL	1.32	399	58	13.0	14.0	NR	NR
NW10-22-15W	LKD	6.13	1	4	25	31	41	28	CL	1.50	365	57	22.0	16.0	19.0	16.0
SW12-24-15W	LKD	3.99	0	0	8	8	64	28	SICL	1.66	559	57	19.0	14.0	33.0	14.0
NE31-13-09W	LKD	4.17	2	13	37	53	24	23	SCL	1.03	412	49	10.0	14.0	20.0	13.0
NE25-08-06W	LLT	7.76	2	28	24	54	16	30	SCL	0.86	368	36	9.7	11.0	NR	NR
NW34-10-25W	LNO	2.64	27	9	7	61	19	20	SL	1.57	977	55	9.0	20.0	10.0	18.0
NW10-07-05W	LOP	1.58	1	35	53	89	3	8	LVFS	0.98	296	30	5.3	11.0	19.0	7.7
NW36-08-08W	LOP	1.26	4	79	9	92	4	4	FS	0.90	274	23	5.8	10.0	14.0	26.0
SE06-10-05W	LOP	1.57	5	54	30	89	4	7	FS	0.57	191	22	4.0	11.0	10.0	13.0
SW17-13-11W	LOP	1.96	4	70	20	94	3	3	FS	0.59	174	24	4.2	8.0	NR	NR
SE21-12-05E	LRY	0.96	12	67	6	89	6	5	FS	1.28	316	25	4.1	11.0	20.0	6.4
SE04-20-13W	LRY	1.96	48	15	4	80	9	11	SL	1.04	364	38	4.0	13.0	17.0	12.0
NW18-02-05E	LSW	2.37	3	21	60	85	6	9	LVFS	0.73	287	24	5.0	12.0	14.0	12.0
SE09-26-22W	LSW	2.76	29	31	6	78	12	10	FSL	0.89	412	32	5.9	13.0	16.0	9.9
SW17-25-21W	LSW	5.17	14	52	5	73	13	14	FSL	0.61	300	20	5.4	12.0	18.0	7.6
NW10-26-22W	LSW	6.01	20	38	8	73	12	15	FSL	1.62	420	92	20.0	16.0	24.0	37.0
SE14-26-22W	LSW	6.17	6	42	17	69	14	17	FSL	1.22	318	58	13.0	14.0	33.0	17.0
SW20-25-21W	LSW	6.87	11	45	12	70	12	18	FSL	0.58	480	33	9.0	11.0	15.0	9.0
SW01-36-28W	LSW	4.20	4	33	39	77	9	14	VFSL	1.22	558	40	8.9	12.0	27.0	13.0
SW20-36-26W	LSW	2.33	4	62	20	87	7	6	LFS	1.08	523	58	5.6	12.0	12.0	11.0
SE16-38-25W	LSW	4.62	0	2	64	66	15	19	VFSL	1.02	673	43	13.0	11.0	18.0	15.0
NE23-38-27W	LSW	2.31	3	35	55	93	2	5	VFS	0.78	510	23	6.0	10.0	15.0	10.0
NE24-26-21W	LSW	3.25	9	37	27	76	11	13	FSL	1.13	363	38	8.4	11.0	13.0	12.0
NE14-26-21W	LSW	4.15	22	50	8	86	7	7	LS	0.74	373	24	5.4	10.0	16.0	9.3
NW34-26-21W	LSW	3.83	11	54	17	84	6	10	LFS	0.54	234	24	3.0	11.0	15.0	6.0
SE03-19-13W	LSW	2.03	21	48	8	81	9	10	LFS	0.59	208	23	4.0	11.0	12.0	8.0
SW32-01-28W	LUD	2.03	17	39	14	74	12	14	FSL	0.88	406	30	9.0	13.0	9.0	11.0
SW29-01-27W	LUD	1.76	23	40	10	79	10	11	FSL	1.18	409	42	7.3	14.0	16.0	9.3
NW11-04-27W	LUD	1.00	17	39	27	88	5	7	LFS	0.87	374	21	2.0	13.0	10.0	7.0
NW20-06-23W	LUD	3.04	13	44	26	84	6	10	LFS	0.76	277	25	6.0	13.0	5.0	9.0
NW16-05-25W	LUD	1.70	47	36	7	94	1	5	S	0.64	177	25	3.6	11.0	16.0	4.5
SE14-22-16W	LUR	5.12	9	31	10	56	23	21	SCL	1.58	496	59	16.0	13.0	23.0	15.0
SE04-29-17W	LUR	5.96	7	15	25	52	28	20	SCL	2.11	942	68	17.0	18.0	24.0	17.0
SE29-29-21W	LUR	4.85	22	26	10	66	16	18	SL	1.19	336	47	13.0	13.0	17.0	13.0
NW34-26-19W	LUR	3.85	6	14	38	61	22	17	VFSL	1.31	469	44	12.0	13.0	19.0	13.0
NW10-28-16W	LUR	4.51	29	7	4	47	29	24	L	2.44	444	82	16.0	18.0	39.0	19.0
NW12-22-15W	LUR	7.04	12	13	11	46	36	18	L	1.34	485	48	16.0	7.0	15.0	13.0
NW08-21-11W	LUR	4.94	10	17	10	44	29	27	CL	1.47	472	45	13.0	13.0	23.0	15.0
SE31-17-09W	LUR	4.52	7	50	6	66	12	22	SCL	0.74	339	26	9.4	8.4	31.0	6.7
NW31-14-09W	LUR	5.17	12	35	5	59	24	17	FSL	0.88	396	47	9.6	9.1	29.0	8.3
SE06-19-04W	LUR	6.13	7	10	8	31	45	24	L	1.84	440	69	22.0	10.0	25.0	23.0
SW34-17-04W	LUR	5.40	10	13	9	38	23	39	CL	1.98	440	77	17.0	22.0	25.0	24.0
SE36-16-03W	LUR	6.25	15	16	9	47	33	20	L	1.31	460	49	24.0	7.0	20.0	15.0
SE36-18-05W	LUR	5.28	6	8	6	26	44	30	CL	2.18	530	72	22.0	11.0	24.0	23.0
SE02-21-05W	LUR	5.30	7	19	7	35	36	29	CL	1.49	355	60	22.0	8.0	23.0	20.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SW36-17-02E	LUR	3.95	16	17	8	56	21	23	SCL	1.19	235	51	15.0	18.0	30.0	17.0
SW34-17-01E	LUR	3.02	8	48	10	72	18	10	FSL	0.82	276	30	8.0	15.0	40.0	14.0
SW34-18-02E	LUR	6.88	10	12	10	40	32	28	CL	1.76	614	65	18.0	22.0	50.0	23.0
NE28-21-05W	LUR	5.12	10	12	7	38	38	24	L	1.76	450	58	19.0	7.0	21.0	19.0
NE18-05-26W	LYT	2.40	26	11	5	66	20	14	SL	1.58	691	59	9.7	16.0	20.0	12.0
NW13-07-26W	LYT	2.42	17	29	19	68	18	14	FSL	1.46	607	52	8.8	15.0	16.0	7.4
SW10-08-21W	LYT	1.07	3	56	28	87	6	7	LFS	1.30	400	33	7.2	13.0	16.0	7.4
NW24-15-02E	MCR	4.58	4	7	19	33	42	25	L	1.36	266	33	18.0	17.0	35.0	37.0
NW07-13-02W	MCR	5.21	4	14	17	39	32	29	CL	1.64	548	60	14.0	14.0	27.0	12.0
NW07-14-01W	MCR	3.37	0	13	22	37	32	31	CL	1.73	436	51	17.0	15.0	38.0	14.0
NE24-13-03W	MCR	2.56	2	32	17	52	18	30	SCL	1.50	350	44	17.0	9.0	25.0	19.0
NW22-24-17W	MCR	5.05	2	4	26	33	32	35	CL	2.10	605	73	24.0	19.0	34.0	21.0
SE03-30-19W	MCR	4.33	3	8	25	37	33	30	CL	2.18	549	81	24.0	16.0	23.0	21.0
NE09-18-13W	MCR	6.09	9	11	4	28	31	41	C	1.45	529	65	18.0	18.0	21.0	24.0
SW13-20-03E	MEB	2.30	8	4	23	43	21	36	CL	2.74	511	77	21.0	20.0	40.0	25.0
SW11-18-02E	MEB	5.84	11	7	4	28	29	43	C	1.92	350	146	23.0	17.0	28.0	21.0
SE25-28-22W	MEH	5.97	7	14	11	39	36	25	L	1.86	477	53	18.0	17.0	25.0	17.0
NW20-27-21W	MEH	5.02	8	13	12	39	36	25	L	1.98	485	67	19.0	18.0	30.0	19.0
NE35-29-22W	MEH	4.17	5	16	32	58	21	21	SCL	1.93	597	54	16.0	17.0	15.0	21.0
NW19-25-24W	MEH	5.18	11	35	6	53	15	32	SCL	1.91	591	71	18.0	20.0	19.0	38.0
SE27-25-21W	MEH	6.26	9	14	11	38	28	34	CL	1.81	446	87	18.0	19.0	22.0	27.0
SE09-24-21W	MEH	3.41	5	8	12	31	41	28	CL	2.09	762	82	24.0	23.0	25.0	33.0
SE03-18-13W	MGT	4.83	11	14	8	39	32	29	CL	1.02	405	46	13.0	16.0	17.0	18.0
SE05-26-15W	MHY	4.57	6	7	6	25	47	28	CL	2.04	548	61	19.0	17.0	41.0	19.0
NE33-25-15W	MHY	5.30	3	3	4	13	58	29	SICL	2.27	647	86	26.0	20.0	42.0	26.0
NE19-28-17W	MHY	3.51	4	5	21	33	42	25	L	1.59	486	50	19.0	18.0	43.0	17.0
SE01-07-07E	MLI	9.99	3	39	19	62	13	25	SCL	1.03	110	74	21.0	10.0	15.0	11.0
SE32-25-20W	MND	3.96	2	7	36	47	17	36	SC	2.13	440	111	22.0	30.0	25.0	41.0
SE11-05-06E	MNT	2.31	7	56	21	85	7	8	LFS	0.78	153	NR	7.0	12.0	17.0	14.0
SW30-03-08E	MNT	4.88	1	27	38	66	16	18	VFSL	1.24	373	32	9.2	15.0	30.0	10.0
NE14-26-21W	MNT	8.50	4	18	34	57	19	24	SCL	0.61	275	33	7.4	13.0	26.0	5.9
NE25-01-25W	MOT	1.96	2	3	11	17	52	31	SICL	1.98	706	63	15.0	19.0	26.0	23.0
NE30-03-15W	MOT	5.86	8	6	6	29	52	19	SIL	1.69	473	79	18.0	15.0	24.0	14.0
NW23-02-09W	MOW	5.47	5	5	2	20	43	37	CL	2.04	1752	112	18.0	20.0	18.0	25.0
NE21-05-16W	MPS	3.76	16	23	10	60	23	17	FSL	1.69	951	68	12.0	16.0	21.0	13.0
NW15-01-29W	MRE	2.78	22	29	12	69	16	15	FSL	1.37	555	49	8.9	14.0	15.0	10.0
NW03-17-29W	MRH	2.84	50	13	2	86	8	6	LS	1.34	687	55	8.9	10.0	33.0	11.0
NW11-16-19W	MRH	2.84	33	10	2	83	10	7	LCS	1.43	736	55	13.0	14.0	22.0	NR
SW20-19-29W	MRH	3.18	15	12	3	66	17	17	CSL	1.72	803	65	13.0	13.0	32.0	15.0
NW17-19-29W	MRH	2.37	47	7	1	83	8	9	LCS	1.06	505	46	6.8	8.6	30.0	11.0
SW02-17-29W	MRH	2.09	50	17	1	91	3	6	S	1.01	563	38	6.3	10.0	16.0	7.0
WC21-11-21W	MRH	4.56	22	9	8	65	18	17	CSL	1.37	798	63	10.0	17.0	17.0	17.0
SW34-11-16W	MRH	2.60	41	33	7	85	7	8	LS	1.19	401	41	7.1	11.0	17.0	15.0
NE01-11-16W	MRH	1.18	45	33	9	93	2	5	S	1.36	455	39	7.8	11.0	18.0	52.0
NW03-11-16W	MRH	1.79	29	31	10	84	7	9	LS	1.51	514	49	8.4	13.0	24.0	13.0
NW15-11-16W	MRH	1.89	45	34	6	90	3	7	S	1.24	433	35	6.9	10.0	20.0	17.0
SE12-13-06E	MRQ	3.93	0	0	9	9	22	69	C	4.06	680	113	34.0	36.0	33.0	44.0
SW06-14-06E	MRQ	4.06	7	8	6	27	32	41	C	2.30	525	66	26.0	13.0	31.0	30.0
SW09-13-06E	MRQ	4.34	3	5	17	30	26	44	C	2.53	575	73	32.0	15.0	24.0	31.0
NW22-12-06E	MRQ	5.06	0	0	8	8	27	65	C	3.05	612	102	33.0	31.0	25.0	41.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SW25-12-02W	MRQ	4.86	0	0	5	5	24	71	C	4.24	706	128	45.0	33.0	34.0	40.0
NE33-11-05E	MRQ	4.14	2	16	15	33	21	46	C	2.43	500	65	30.0	16.0	46.0	29.0
NE30-13-03E	MRQ	5.63	0	0	7	7	42	51	SIC	3.54	603	100	38.0	27.0	38.0	42.0
SW16-13-02E	MRQ	5.26	3	6	9	22	36	42	C	2.46	522	77	26.0	24.0	34.0	27.0
NW07-14-02W	MRQ	4.11	2	5	4	13	26	61	C	3.32	640	110	36.0	25.0	43.0	38.0
SE25-13-02W	MRQ	3.19	2	6	4	14	26	60	C	1.95	275	200	20.0	19.0	31.0	19.0
NE31-12-02E	MRQ	4.12	2	3	4	11	28	61	C	3.32	552	NR	40.0	28.0	36.0	41.0
SE01-13-01E	MRQ	5.01	0	0	8	8	29	63	C	3.09	552	106	36.0	29.0	27.0	24.0
NW27-13-02W	MRQ	3.29	1	4	11	17	33	50	C	2.46	333	83	21.0	23.0	25.0	48.0
SE08-14-10W	MRQ	7.15	2	4	6	13	46	41	SICL	1.89	742	NR	29.0	18.0	55.0	19.0
NE18-13-08W	MRQ	6.25	2	5	15	23	39	38	CL	1.91	456	79	20.0	19.0	32.0	19.0
SW12-10-05W	MRS	5.34	0	0	4	4	38	58	C	3.64	568	118	39.0	30.0	33.0	36.0
NE28-35-26W	MWK	3.69	1	3	20	25	45	30	CL	2.32	1134	103	23.0	21.0	33.0	23.0
SW05-11-24W	MXI	1.98	39	8	2	78	11	11	CSL	1.44	879	50	9.6	18.0	11.0	14.0
SW35-13-26W	MXI	2.50	10	38	21	73	14	13	FSL	1.64	780	49	15.0	9.0	17.0	18.0
NE13-12-22W	MXI	1.68	27	7	3	74	13	13	CSL	1.84	1400	63	8.5	18.0	19.0	19.0
NE25-11-22W	MXI	1.98	37	14	7	80	10	10	SL	1.02	709	39	5.0	14.0	12.0	13.0
NW12-15-27W	MXI	3.11	23	8	3	60	21	19	CSL	2.33	1600	79	18.0	13.0	19.0	18.0
NW31-13-26W	MXI	1.18	52	20	2	85	8	7	LS	1.12	891	39	6.4	12.0	17.0	13.0
NE01-14-27W	MXI	1.23	37	17	2	79	10	11	SL	1.69	935	56	10.0	15.0	20.0	70.0
NW06-13-26W	MXI	2.40	26	18	5	60	21	19	SL	1.50	709	58	14.0	14.0	16.0	14.0
SW01-04-10W	MXS	5.93	5	6	6	23	49	28	CL	1.83	1144	93	20.0	25.0	17.0	22.0
NW31-03-08W	MXS	6.65	5	7	12	28	42	30	CL	2.16	931	102	21.0	17.0	33.0	31.0
SE28-02-08W	MXS	5.07	4	6	9	23	45	32	CL	1.54	602	120	27.0	13.0	20.0	17.0
NE25-04-09W	MXS	6.08	6	7	7	26	46	28	CL	1.92	825	135	29.0	14.0	23.0	18.0
SE15-07-12W	MXT	4.03	1	3	13	17	45	38	SICL	2.64	1130	97	23.0	24.0	29.0	24.0
SW24-02-02W	N8G	2.31	1	4	62	67	14	19	VFSL	1.38	556	53	11.0	14.0	18.0	18.0
SE06-02-02W	N8G	2.43	0	4	63	67	15	18	VFSL	1.30	414	52	9.2	13.0	18.0	15.0
SW18-14-11W	N8G	3.16	2	15	24	41	32	27	L	1.68	529	71	17.0	16.0	NR	NR
SW16-13-10W	N8G	2.00	1	44	30	75	9	16	FSL	0.83	360	74	14.0	10.0	33.0	12.0
NE31-10-26W	NDL	3.47	10	13	10	39	36	25	L	2.07	770	79	19.0	19.0	20.0	20.0
NW15-10-29W	NDL	3.43	12	15	13	51	29	20	L	1.91	756	61	14.0	18.0	21.0	13.0
NE09-14-29W	NDL	3.56	12	15	13	50	29	21	L	1.99	944	78	19.0	17.0	20.0	22.0
NE30-14-28W	NDL	5.27	10	12	10	42	35	23	L	1.88	807	79	17.0	17.0	20.0	19.0
SE06-17-22W	NDL	4.65	7	10	10	31	39	30	CL	2.22	800	77	25.0	18.0	21.0	23.0
SE17-17-23W	NDL	4.61	10	17	15	47	29	24	L	1.96	700	67	20.0	15.0	22.0	18.0
SW25-17-25W	NDL	4.83	6	9	9	28	41	31	CL	2.21	780	83	27.0	20.0	23.0	19.0
NW05-16-26W	NDL	3.37	9	20	16	49	30	21	L	2.15	925	77	24.0	16.0	24.0	20.0
SW17-17-24W	NDL	4.15	6	9	13	33	37	30	CL	2.24	891	94	22.0	23.0	20.0	30.0
SE28-16-15W	NDL	5.70	5	7	5	20	40	40	CL	3.08	1151	108	30.0	25.0	33.0	31.0
SE13-15-16W	NDL	4.15	5	8	15	33	33	34	CL	2.09	759	80	21.0	22.0	20.0	33.0
NE26-14-17W	NDL	5.60	9	16	5	32	34	34	CL	1.96	932	69	23.0	13.0	25.0	22.0
SE22-14-18W	NDL	3.69	9	14	8	37	32	31	CL	2.04	1000	79	24.0	14.0	24.0	24.0
NE24-13-19W	NDL	4.91	6	9	8	27	41	32	CL	2.59	1010	85	32.0	15.0	24.0	26.0
NW30-12-16W	NDL	4.69	7	9	9	31	40	29	CL	2.24	750	86	29.0	13.0	22.0	27.0
NE14-12-20W	NDL	4.18	8	12	10	36	38	26	L	2.18	923	77	19.0	20.0	23.0	24.0
NW26-14-16W	NDL	5.10	4	7	13	27	38	35	CL	2.34	779	99	26.0	23.0	33.0	33.0
SW31-13-17W	NDL	5.08	6	8	11	30	32	38	CL	2.30	1914	92	24.0	23.0	21.0	35.0
SW31-15-19W	NDL	4.34	10	12	8	38	39	23	L	1.78	627	63	23.0	14.0	30.0	18.0
NE04-16-20W	NDL	3.57	9	12	10	38	37	25	L	1.84	562	56	19.0	12.0	26.0	25.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
NW21-16-21W	NDL	4.34	7	10	9	30	39	31	CL	2.21	700	74	25.0	18.0	24.0	23.0
NE25-13-25W	NDL	2.72	11	15	13	45	31	24	L	2.16	700	61	22.0	13.0	22.0	22.0
NW28-13-23W	NDL	3.88	10	12	12	40	35	25	L	2.05	760	75	24.0	12.0	22.0	18.0
NW27-13-22W	NDL	3.45	11	15	15	49	33	18	L	1.77	675	63	21.0	9.0	22.0	18.0
NW30-13-20W	NDL	5.48	10	12	10	39	38	23	L	2.26	800	80	28.0	14.0	25.0	23.0
NW22-17-24W	NDL	4.45	8	12	9	35	37	28	CL	2.41	848	101	21.0	19.0	21.0	24.0
SW06-15-19W	NDL	4.23	11	13	10	42	33	25	L	2.01	806	71	19.0	15.0	19.0	20.0
SE04-15-21W	NDL	4.18	11	11	9	42	32	26	L	2.07	795	93	20.0	14.0	29.0	22.0
NE31-14-21W	NDL	4.81	9	11	11	37	39	24	L	2.40	854	80	21.0	18.0	34.0	22.0
SW02-15-23W	NDL	5.01	8	12	13	39	37	24	L	2.30	1020	86	23.0	17.0	34.0	24.0
NW35-14-25W	NDL	3.54	10	13	13	43	32	25	L	2.51	791	81	20.0	18.0	29.0	25.0
NE36-14-26W	NDL	3.48	7	9	9	29	44	27	L	2.47	826	100	22.0	19.0	22.0	22.0
SE23-15-19W	NDL	3.04	8	10	13	37	32	31	CL	1.94	670	69	18.0	21.0	16.0	38.0
SE30-16-21W	NDL	3.64	6	8	8	28	38	34	CL	2.10	672	91	20.0	21.0	15.0	32.0
NE36-17-26W	NDL	3.23	19	19	9	56	23	21	SCL	2.15	855	57	20.0	15.0	19.0	18.0
NW34-21-28W	NDL	5.05	7	10	13	34	41	25	L	2.23	805	86	27.0	15.0	23.0	38.0
NW34-21-28W	NDL	2.47	9	12	13	39	41	20	L	1.98	960	62	23.0	16.0	20.0	19.0
NW35-19-28W	NDL	5.16	10	14	10	41	35	24	L	2.11	945	70	25.0	13.0	20.0	23.0
SE35-18-28W	NDL	4.16	11	14	10	42	37	21	L	2.17	945	78	24.0	13.0	25.0	25.0
SW15-17-28W	NDL	3.58	10	13	14	42	37	21	L	2.12	835	79	19.0	21.0	20.0	20.0
SW34-20-28W	NDL	5.20	6	8	9	26	39	35	CL	2.30	841	105	21.0	19.0	NR	NR
SW20-03-14W	NEI	4.59	12	13	9	45	30	25	L	1.93	1509	85	15.0	18.0	21.0	20.0
NW15-19-15W	NGT	5.42	10	12	6	36	18	46	C	2.97	759	137	22.0	20.0	25.0	37.0
SE01-13-02E	NIV	4.24	0	14	20	34	29	37	CL	1.64	442	NR	27.0	17.0	36.0	20.0
NW11-07-11W	NKK	4.44	8	11	8	38	36	26	CL	1.61	NR	137	19.0	15.0	19.0	28.0
NE13-05-28W	NPK	2.38	32	24	6	74	11	15	SL	0.95	484	39	6.4	11.0	22.0	8.3
NW04-02-03W	NUH	4.06	1	2	41	44	26	30	CL	2.19	739	82	23.0	21.0	32.0	51.0
NW15-12-07W	NUH	4.32	0	0	8	8	52	40	SIC	2.63	880	105	29.0	17.0	29.0	35.0
NE22-12-06W	NUH	4.44	1	5	10	16	44	40	SIC	2.82	935	106	28.0	19.0	23.0	26.0
NE31-14-11W	NUH	4.62	0	0	7	7	53	40	SIC	2.71	975	106	28.0	25.0	37.0	32.0
NE23-01-28W	NWS	1.74	35	22	6	76	10	14	SL	0.87	381	28	8.0	14.0	8.0	10.0
NW32-01-26W	NWS	3.56	11	7	14	47	33	20	L	1.96	763	75	14.0	18.0	21.0	15.0
NW33-03-15W	NWS	4.59	8	8	7	37	38	25	L	1.83	832	80	17.0	17.0	22.0	17.0
NE07-06-02W	OBO	3.98	0	0	5	5	26	69	C	2.73	575	110	36.0	27.0	29.0	35.0
SW14-07-02W	OBO	4.02	0	0	4	4	27	69	C	3.32	750	NR	41.0	34.0	31.0	45.0
SE24-07-04W	OBO	5.49	0	0	2	2	31	67	C	3.67	654	104	41.0	28.0	29.0	44.0
SE15-03-01W	OBO	2.39	1	4	10	15	33	52	C	3.14	776	108	33.0	25.0	34.0	33.0
SE25-03-01W	OBO	3.33	0	0	4	4	20	76	C	4.27	417	117	43.0	35.0	31.0	48.0
SW28-04-01W	OBO	3.14	0	0	4	4	23	73	C	4.49	1325	108	43.0	34.0	39.0	59.0
SE03-04-01W	OBO	4.48	0	0	5	5	28	67	C	3.93	514	110	41.0	36.0	38.0	40.0
NW29-07-02W	OBO	2.96	0	0	4	4	34	62	C	4.48	721	120	39.0	36.0	38.0	47.0
SE10-04-03W	OBO	3.84	1	2	17	20	27	53	C	2.52	640	NR	32.0	24.0	26.0	36.0
NW02-03-03E	OBO	3.38	0	0	3	3	19	78	C	4.69	494	110	37.0	40.0	32.0	45.0
SW02-05-03E	OBO	3.02	0	0	7	7	25	68	C	3.99	315	102	29.0	32.0	36.0	38.0
SE24-15-03E	OBO	5.28	0	0	5	5	22	73	C	3.45	210	105	41.0	24.0	32.0	38.0
SW06-14-08E	OBO	9.99	1	2	21	24	26	50	C	2.21	299	73	28.0	21.0	24.0	26.0
NE29-16-08E	OBO	2.33	2	10	12	25	29	46	C	3.20	696	88	32.0	29.0	28.0	37.0
SW14-06-01E	OBO	4.36	0	0	4	4	32	64	C	4.29	710	125	41.0	31.0	37.0	53.0
SW30-09-01E	OBO	4.08	0	0	6	6	28	66	C	3.26	400	NR	45.0	31.0	29.0	41.0
SE36-10-04E	OBO	2.74	0	0	1	1	36	63	C	4.13	399	103	35.0	31.0	33.0	44.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SW15-09-03W	OBO	3.37	0	0	3	3	31	66	C	3.20	810	NR	43.0	31.0	29.0	40.0
SW05-11-02W	OBO	3.88	0	0	2	2	24	74	C	3.73	375	NR	52.0	25.0	35.0	36.0
01-11-02E	OBO	4.78	2	6	8	18	26	56	C	3.42	730	110	29.0	33.0	41.0	35.0
NE25-09-01E	OBO	5.55	0	0	3	3	27	70	C	4.24	748	123	37.0	37.0	40.0	41.0
SW03-11-06E	OBO	4.57	0	0	5	5	31	64	C	3.82	550	107	47.0	28.0	28.0	53.0
SW26-08-05E	OBO	3.12	0	0	2	2	39	59	C	3.17	959	101	33.0	24.0	28.0	72.0
NE05-09-04E	OBO	2.34	0	0	2	2	34	64	C	4.06	374	99	38.0	31.0	37.0	42.0
NW17-09-04E	OBO	3.75	0	0	1	1	23	76	C	4.24	298	110	40.0	33.0	37.0	45.0
NW17-09-04E	OBO	3.31	0	0	2	2	32	66	C	4.16	453	110	37.0	32.0	36.0	39.0
NW02-09-06E	OBO	5.09	0	0	2	2	32	66	C	4.43	606	121	41.0	33.0	40.0	44.0
NW24-09-05E	OBO	5.02	0	0	3	3	24	73	C	4.33	792	128	42.0	36.0	34.0	43.0
NE26-14-02E	OBO	4.02	0	0	2	2	37	61	C	3.80	680	104	35.0	34.0	36.0	40.0
SW33-11-04W	OBO	4.25	0	0	2	2	35	63	C	4.11	1048	132	34.0	26.0	37.0	36.0
SW36-13-07W	OBO	5.10	0	0	3	3	50	47	SIC	2.90	735	108	32.0	18.0	19.0	35.0
NW34-23-17W	OHV	4.86	0	0	3	3	38	59	C	3.72	1397	152	36.0	29.0	27.0	52.0
NE11-25-19W	OHV	5.65	3	5	7	16	31	53	C	2.63	1780	151	36.0	27.0	30.0	60.0
NW14-06-13W	OIV	4.47	7	6	1	15	50	35	SICL	2.11	1606	105	20.0	22.0	16.0	27.0
SE21-04-07E	PAN	1.24	33	35	2	89	6	5	S	0.78	195	NR	6.2	12.0	19.0	10.0
SW14-04-12W	PBI	2.89	8	12	15	39	39	22	CL	1.93	1625	66	15.0	19.0	20.0	25.0
SW11-08-10W	PDA	2.19	6	29	18	58	25	17	SCL	1.46	1070	118	14.0	14.0	18.0	19.0
SW06-02-11W	PDA	3.33	3	19	21	44	35	21	L	1.60	602	62	16.0	14.0	18.0	15.0
NW23-03-11W	PDA	4.40	6	9	8	27	47	26	L	2.03	973	86	18.0	20.0	18.0	24.0
NE08-11-12E	PGU	4.32	5	7	11	26	27	47	C	3.20	273	88	28.0	29.0	36.0	30.0
NW17-22-04E	PGU	7.30	3	2	9	17	33	50	C	3.26	695	87	29.0	28.0	29.0	30.0
SW04-15-04E	PGU	4.57	6	7	5	23	28	49	C	2.54	650	NR	31.0	21.0	30.0	43.0
SE33-15-04E	PGU	3.07	1	11	7	20	38	42	C	2.20	532	NR	33.0	19.0	31.0	95.0
SW06-17-04E	PGU	2.08	4	6	4	17	21	62	C	3.28	559	84	31.0	35.0	34.0	48.0
NE26-02-10E	PIY	2.69	6	17	14	40	39	21	L	1.52	370	69	13.0	13.0	29.0	10.0
NE12-01-14E	PIY	1.64	28	21	5	75	12	13	SL	1.06	210	67	9.0	12.0	22.0	12.0
NW01-02-11E	PIY	2.14	6	20	32	62	21	17	VFSL	1.42	300	62	11.0	14.0	23.0	12.0
NW23-09-19W	PLE	1.74	30	34	13	78	12	10	FSL	1.42	556	40	11.0	16.0	19.0	12.0
SW01-03-04E	PLN	3.21	1	19	33	53	11	36	SC	1.72	510	NR	21.0	20.0	21.0	53.0
SW04-04-05E	PLN	3.67	14	19	20	72	15	13	SL	0.91	225	61	12.0	14.0	26.0	7.5
SW33-01-05E	PLN	1.54	13	49	20	87	6	7	LFS	0.74	253	24	4.0	11.0	15.0	11.0
NW21-03-06E	PLN	2.58	31	19	5	74	14	12	SL	1.18	231	NR	12.0	14.0	23.0	8.6
NW27-01-14E	PLN	2.13	11	21	14	54	19	27	SCL	1.72	410	37	14.0	15.0	25.0	20.0
NE10-35-20W	PLN	1.65	1	1	73	75	18	7	VFSL	0.99	340	29	5.9	5.4	9.8	9.8
NW32-03-05E	PMG	5.00	13	24	19	61	18	21	FSL	1.18	390	35	11.0	13.0	27.0	10.0
NE32-16-09W	PMG	5.11	5	9	55	78	11	11	VFSL	1.08	357	30	7.8	16.0	34.0	8.8
NE06-15-02E	PMG	3.25	3	44	14	62	19	19	FSL	1.15	450	NR	17.0	13.0	31.0	18.0
SE13-14-01W	PMG	2.18	1	16	10	27	47	26	L	0.80	194	85	14.0	15.0	13.0	11.0
NW14-16-12W	PMG	2.69	1	21	44	67	15	18	VFSL	1.01	334	44	8.7	12.0	NR	NR
SW22-18-12W	PMG	3.58	10	32	16	63	19	18	FSL	1.39	350	39	13.0	11.0	18.0	11.0
NE19-18-14W	PMG	5.30	12	37	7	61	20	19	FSL	1.80	628	92	19.0	13.0	16.0	24.0
NE09-31-19W	PMG	4.88	1	4	49	54	29	17	VFSL	1.39	541	45	12.0	11.0	19.0	14.0
NW25-27-19W	PMG	6.18	1	3	62	66	16	18	VFSL	1.26	485	41	12.0	12.0	27.0	11.0
NE02-28-19W	PMG	2.79	2	8	48	59	26	15	VFSL	0.96	386	27	8.3	13.0	26.0	8.3
NE16-23-14W	PMG	3.21	13	11	14	43	36	21	L	1.80	330	53	14.0	8.0	17.0	17.0
NW27-24-15W	PMG	3.91	0	1	46	47	31	22	L	1.16	541	44	11.0	16.0	28.0	12.0
SW08-12-22W	POR	3.86	23	18	8	58	26	16	SL	2.09	1003	81	16.0	19.0	20.0	24.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
NE26-02-05E	PPL	2.89	19	25	16	76	12	12	SL	1.33	283	35	8.3	13.0	23.0	10.0
SW24-02-05E	PPL	4.32	9	43	16	73	13	14	FSL	1.01	283	44	11.0	12.0	26.0	8.6
NE34-03-05E	PPL	1.38	11	58	14	88	7	5	LFS	0.93	297	25	5.4	11.0	20.0	6.4
SW19-38-26W	PPL	0.73	2	34	57	93	3	4	VFS	1.24	594	32	5.1	10.0	17.0	9.3
NW22-19-13W	PPL	2.76	44	25	4	79	10	11	SL	0.43	201	18	4.0	10.0	12.0	8.0
NW35-10-10E	PRG	0.92	29	44	3	90	6	4	S	0.61	185	15	3.0	14.0	22.0	5.0
NW26-35-23W	PRG	3.01	40	32	1	91	5	4	S	1.71	367	43	2.7	8.2	9.0	5.5
SW06-27-18W	PUS	3.38	1	3	71	75	15	10	VFSL	0.97	398	32	8.8	12.0	22.0	9.3
NE08-26-21W	PVW	8.22	2	5	12	22	33	45	C	2.79	475	201	35.0	27.0	30.0	56.0
SW17-25-23W	PVW	3.80	0	0	6	6	48	46	SIC	3.38	700	116	32.0	31.0	31.0	40.0
SE28-28-21W	PVW	4.67	2	10	11	24	35	41	C	3.01	1750	119	27.0	30.0	27.0	42.0
SW14-33-23W	PVW	6.40	10	35	3	51	23	26	SCL	2.09	1330	53	19.0	17.0	14.0	26.0
SC28-44-27W	PWL	3.70	0	1	17	18	71	11	SIL	1.32	930	50	15.0	14.0	NR	NR
WC31-10-23W	RAM	3.96	1	21	22	44	24	32	CL	1.70	667	89	20.0	20.0	23.0	29.0
NE36-07-11W	RAM	4.51	1	2	17	20	46	34	CL	2.11	700	150	26.0	19.0	23.0	35.0
NE10-07-17W	RAM	4.58	2	3	6	12	63	25	SIL	2.18	938	101	21.0	25.0	20.0	21.0
SE22-08-19W	RAM	4.16	5	16	17	41	36	23	L	1.66	671	71	17.0	21.0	20.0	24.0
NE14-03-12W	RAM	4.83	0	0	7	7	68	25	SIL	2.35	1200	107	24.0	26.0	21.0	29.0
NE14-01-11W	RAM	4.69	5	6	10	27	45	28	CL	1.89	1138	86	16.0	19.0	15.0	23.0
NW07-14-12W	RBK	1.70	3	40	37	81	10	9	LFS	1.04	262	35	6.8	10.0	NR	NR
NE18-36-29W	RDG	2.97	2	6	13	23	40	37	CL	3.08	836	78	25.0	26.0	27.0	31.0
SE15-08-09W	RFD	3.21	3	36	14	54	22	24	SCL	1.72	750	137	15.0	14.0	20.0	17.0
NE29-03-04W	RFD	2.64	1	10	63	75	11	14	VFSL	1.48	407	58	11.0	14.0	NR	NR
SW01-06-05W	RGD	3.36	1	10	34	45	22	33	SCL	2.42	648	89	26.0	22.0	24.0	25.0
NW11-05-05W	RGD	2.52	1	3	42	46	23	31	SCL	2.29	461	83	19.0	17.0	27.0	21.0
SW25-03-04W	RGD	3.64	1	4	52	57	14	29	SCL	1.88	482	70	16.0	22.0	22.0	23.0
NE24-04-05W	RGD	3.52	1	5	52	58	15	27	SCL	1.69	436	74	17.0	20.0	17.0	24.0
EC12-02-21W	RGT	3.10	7	11	16	39	33	28	CL	2.11	798	65	22.0	23.0	17.0	24.0
NE06-05-02W	RIV	3.84	1	10	5	17	26	57	C	2.76	582	NR	33.0	27.0	26.0	33.0
SW23-02-01W	RIV	5.16	1	1	13	15	34	51	C	2.07	912	NR	30.0	20.0	24.0	30.0
NE03-03-02W	RIV	5.24	0	0	6	6	27	67	C	2.84	318	NR	36.0	26.0	28.0	34.0
NE29-04-03W	RIV	4.04	1	2	12	15	28	57	C	2.91	605	107	32.0	30.0	23.0	41.0
NE33-13-07E	RIV	4.21	3	16	13	33	15	52	C	2.42	477	85	26.0	26.0	24.0	34.0
SW23-09-02W	RIV	5.12	0	0	6	6	37	57	C	3.95	602	130	40.0	30.0	34.0	38.0
SE01-08-02E	RIV	3.08	0	0	3	3	24	73	C	4.57	747	120	41.0	33.0	41.0	43.0
NE24-07-01W	RIV	6.02	0	0	3	3	30	67	C	3.91	419	153	48.0	24.0	43.0	40.0
SE20-08-02E	RIV	4.51	0	0	3	3	23	74	C	3.50	620	NR	45.0	37.0	35.0	41.0
SE11-07-01E	RIV	4.41	0	0	5	5	24	71	C	3.20	650	NR	38.0	33.0	31.0	40.0
SW26-05-01E	RIV	3.53	0	0	4	4	22	74	C	3.52	683	NR	41.0	36.0	32.0	41.0
04-13-04W	RIV	3.33	0	0	5	5	24	71	C	3.35	310	NR	46.0	25.0	32.0	95.0
15-11-01W	RIV	4.36	0	0	5	5	21	74	C	3.27	250	NR	51.0	28.0	35.0	40.0
NW33-10-05E	RIV	4.08	0	0	4	4	38	58	C	3.61	775	92	47.0	27.0	23.0	50.0
08-09-03E	RIV	4.16	1	2	13	16	27	57	C	3.78	780	101	34.0	31.0	38.0	41.0
NW30-04-03E	RIV	4.44	2	4	3	11	24	65	C	4.01	734	111	33.0	33.0	34.0	41.0
NW12-06-03E	RIV	3.74	0	0	9	9	53	38	SICL	3.45	697	93	30.0	30.0	32.0	37.0
SW06-14-04E	RIV	3.24	0	0	5	5	20	75	C	4.59	615	113	42.0	39.0	34.0	49.0
16-09-05E	RIV	4.18	0	0	2	2	42	56	SIC	2.70	648	NR	35.0	25.0	31.0	42.0
25-08-06E	RIV	4.38	0	0	2	2	21	77	C	3.37	229	NR	36.0	27.0	32.0	38.0
NE21-07-06E	RIV	4.75	0	0	4	4	18	78	C	3.14	432	NR	42.0	21.0	29.0	38.0
NW31-08-07E	RIV	5.26	0	0	5	5	21	74	C	4.23	573	125	40.0	33.0	36.0	40.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
NE04-02-04W	RLD	1.44	0	4	78	82	8	10	LVFS	1.29	407	47	9.2	15.0	19.0	29.0
NW02-03-05W	RLD	2.18	1	46	36	83	6	11	LFS	1.03	330	75	16.0	11.0	16.0	14.0
NW18-06-04W	RLD	1.78	1	35	45	81	6	13	VFSL	1.71	468	35	11.0	16.0	20.0	17.0
NW06-03-03W	RLD	1.94	3	46	27	77	9	14	FSL	1.25	410	40	9.5	13.0	34.0	12.0
SE13-08-08W	RLD	4.61	6	58	9	74	12	14	FSL	0.73	527	33	9.0	10.0	18.0	7.0
SE34-14-12W	RLD	1.08	2	35	47	85	7	8	LFS	1.04	240	30	6.9	11.0	NR	NR
NE17-16-12W	RLD	2.69	1	23	58	82	7	11	LVFS	0.71	265	34	4.0	12.0	15.0	9.0
SW22-17-12W	RLD	2.38	1	9	62	72	12	16	VFSL	0.74	280	33	5.0	13.0	12.0	9.0
NW08-05-24W	RTO	0.99	12	60	19	92	2	6	FS	0.83	275	25	3.0	12.0	14.0	7.0
SW08-12-28W	RUF	3.15	11	16	14	48	29	23	L	1.69	695	60	16.0	16.0	23.0	20.0
NE04-13-29W	RUF	1.98	9	16	15	46	31	23	L	2.11	779	69	17.0	19.0	20.0	23.0
NE16-10-27W	RUF	3.23	11	13	10	43	33	24	L	1.94	796	66	18.0	17.0	30.0	22.0
NE17-10-28W	RUF	3.25	10	16	13	46	32	22	L	1.68	730	64	15.0	15.0	24.0	18.0
SW20-12-23W	RUF	1.70	19	14	9	58	21	21	SCL	1.35	569	55	11.0	18.0	16.0	22.0
NW15-10-21W	RUF	2.91	10	33	20	64	19	17	FSL	1.51	660	57	12.0	16.0	13.0	13.0
NE30-08-18W	RUF	2.53	9	14	14	41	35	24	L	2.19	740	64	15.0	21.0	18.0	20.0
NE06-15-16W	RUF	4.35	7	11	9	33	43	24	L	2.39	1281	94	27.0	23.0	25.0	39.0
SE17-08-08W	RWL	3.53	1	6	6	13	47	40	SIC	2.49	775	153	26.0	18.0	25.0	30.0
SW02-02-17W	RYS	6.22	9	12	11	39	34	27	L	1.93	1991	69	15.0	14.0	22.0	21.0
SE29-05-21W	RYS	2.88	4	5	23	35	42	23	L	2.26	785	76	19.0	21.0	17.0	23.0
SE14-07-24W	SCH	1.11	4	56	27	87	6	7	LFS	1.07	272	34	6.2	11.0	21.0	11.0
NW24-07-25W	SCH	1.53	6	55	19	80	8	12	LFS	1.35	386	43	7.6	12.0	22.0	11.0
SW14-10-24W	SCK	1.55	28	34	16	82	8	10	LS	0.94	603	27	3.0	15.0	10.0	9.0
NW07-09-19W	SCK	2.53	9	56	19	84	6	10	LFS	0.69	369	31	5.0	10.0	23.0	9.0
SE07-08-11W	SCK	1.16	14	50	25	89	4	7	FS	1.24	434	41	8.9	11.0	27.0	11.0
NE20-07-15W	SCK	1.03	28	24	16	89	5	6	S	0.98	384	29	5.0	13.0	16.0	14.0
NW13-07-15W	SCK	1.51	15	60	12	88	5	7	LFS	0.82	316	32	5.0	11.0	14.0	11.0
SW22-13-15W	SCK	1.59	17	48	16	81	9	10	FSL	0.84	283	37	7.0	11.0	8.0	13.0
NW20-40-26W	SCL	3.11	7	19	13	44	30	26	L	2.90	345	37	12.0	19.0	NR	NR
NW25-12-09E	SDI	3.06	19	3	2	87	8	5	LCS	0.76	423	26	3.0	16.0	24.0	13.0
SE12-01-09E	SDI	0.83	21	59	7	93	5	2	FS	0.50	120	53	5.0	8.8	14.0	3.5
SW08-08-12E	SDI	0.91	6	75	11	93	3	4	FS	0.58	329	22	2.0	10.0	15.0	9.0
NW10-12-05E	SDI	1.73	27	50	4	87	7	6	LFS	0.94	348	37	6.7	11.0	22.0	6.3
SE17-15-07E	SDI	1.44	31	47	13	92	6	2	S	0.69	368	18	7.4	6.2	12.0	19.0
SW16-15-07E	SDI	0.61	39	45	5	92	5	2	S	0.58	300	22	2.4	5.3	15.0	9.1
NW26-07-14W	SHX	0.90	44	37	7	92	4	4	S	1.19	330	36	7.5	13.0	13.0	10.0
SE30-12-13W	SHX	0.83	43	38	3	93	3	4	S	0.81	375	22	6.0	8.0	8.0	10.0
NE04-11-15W	SHX	1.00	19	57	12	89	5	6	FS	1.20	326	33	6.2	13.0	13.0	11.0
SW04-09-11W	SHX	0.47	25	58	9	92	5	3	FS	1.16	389	28	4.9	9.9	14.0	9.3
NW01-10-12W	SHX	0.67	2	75	15	92	2	2	FS	1.22	323	35	4.6	11.0	14.0	11.0
SW09-08-16W	SHX	1.02	31	47	10	90	6	4	S	1.29	380	32	7.5	14.0	12.0	9.4
SW20-10-13W	SHX	1.53	4	65	16	85	5	10	LFS	1.31	356	44	6.6	12.0	22.0	49.0
NE20-10-13W	SHX	0.52	2	72	17	91	3	6	FS	1.35	358	33	5.3	11.0	17.0	9.5
NE23-09-07W	SKL	2.90	69	9	3	92	4	4	S	0.56	462	47	3.0	10.0	11.0	7.0
NW03-10-07W	SKL	0.35	50	38	4	95	3	2	S	0.58	263	25	2.0	9.0	17.0	10.0
08-44-26W	SLB	0.74	53	18	2	91	8	1	S	0.45	170	8	1.0	3.0	NR	NR
NW02-17-07E	SLB	1.10	22	16	4	86	9	5	LCS	1.68	435	46	5.8	16.0	29.0	9.7
NW11-18-07E	SLB	0.53	18	66	4	93	6	1	FS	0.17	63	10	2.8	4.7	17.0	3.8
NE36-03-28W	SOU	1.12	12	43	23	81	10	9	LFS	1.06	393	33	5.6	12.0	22.0	8.6
SW19-08-23W	SOU	1.37	6	34	44	86	7	7	LFS	1.19	413	38	5.9	12.0	16.0	5.4

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series (cont'd)

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SE22-05-26W	SOU	1.42	24	45	14	89	5	6	S	1.08	409	29	4.5	11.0	15.0	8.3
NW22-09-24W	SOU	4.20	54	14	3	78	10	12	SL	0.92	554	35	8.4	11.0	25.0	9.0
SE24-06-25W	SOU	1.82	43	20	9	87	5	8	LS	0.95	420	33	5.8	13.0	17.0	12.0
SC08-07-24W	SOU	2.15	6	49	33	88	5	7	LFS	0.93	321	37	4.0	15.0	11.0	10.0
SW02-08-24W	SOU	2.55	12	44	28	84	5	11	LFS	0.55	345	21	3.0	11.0	12.0	8.0
SE25-08-23W	SOU	0.73	13	59	21	93	3	4	FS	0.93	274	26	3.8	9.3	17.0	3.7
SW20-09-24W	SOU	3.43	45	24	6	78	8	14	SL	0.86	540	29	3.0	12.0	10.0	10.0
NW29-14-12W	SPG	2.32	4	58	22	85	7	9	LFS	0.68	174	25	5.2	9.4	NR	NR
SE14-07-27W	STU	1.47	41	19	3	82	9	9	LS	1.28	550	45	6.6	13.0	17.0	6.1
NW07-09-22W	STU	1.49	41	40	6	88	6	6	S	1.47	544	37	5.8	12.0	12.0	10.0
NE11-07-25W	STU	1.66	5	52	31	89	4	7	LFS	1.00	299	42	6.9	9.3	17.0	17.0
NW02-09-24W	STU	3.05	9	66	13	88	4	8	LFS	0.71	366	22	2.0	12.0	11.0	5.0
SE24-05-25W	STU	1.40	10	55	23	88	5	7	LFS	0.83	214	34	5.4	14.0	16.0	11.0
NE04-12-10W	SUE	5.60	1	25	27	53	19	28	SCL	0.83	300	90	16.0	10.0	46.0	5.5
NE05-13-11W	SUE	6.52	2	36	32	70	12	18	VFSL	0.85	201	36	8.1	12.0	NR	NR
NE30-11-11W	SUE	3.14	2	53	20	75	10	15	FSL	1.04	380	41	8.0	12.0	22.0	12.0
NW15-20-12W	SUE	2.21	20	50	6	78	9	13	FSL	0.78	268	18	5.4	6.1	19.0	7.7
NW14-36-24W	SWF	2.13	4	41	28	75	13	12	FSL	1.34	378	31	6.7	11.0	13.0	14.0
SE26-37-26W	SWF	8.41	0	4	20	24	50	26	L	1.82	1228	78	23.0	16.0	34.0	18.0
SE01-36-28W	SWF	7.85	5	48	14	68	12	20	FSL	1.03	298	49	9.4	10.0	11.0	18.0
NE19-05-24W	SWZ	2.57	12	48	25	86	4	10	LFS	1.38	508	46	9.0	16.0	15.0	17.0
NE17-10-20W	TAV	4.44	1	19	29	49	29	22	L	1.74	767	75	17.0	17.0	28.0	16.0
SE24-06-17W	TGL	2.72	5	9	19	37	45	18	L	1.33	920	47	13.0	19.0	24.0	19.0
SW34-05-12W	TGL	1.78	17	9	7	55	24	21	SCL	2.12	1347	63	12.0	20.0	18.0	27.0
SW01-11-18W	TGR	2.73	4	31	21	56	25	19	FSL	1.67	669	57	15.0	18.0	26.0	20.0
SW05-14-11E	THG	4.75	1	2	17	20	43	37	SICL	2.74	760	66	31.0	16.0	25.0	10.0
NW36-14-10E	THG	2.52	1	13	22	36	29	35	CL	2.45	635	56	26.0	13.0	25.0	24.0
SW21-16-08E	THG	2.98	2	12	12	26	25	49	C	2.65	446	84	29.0	28.0	30.0	33.0
SW08-12-22W	TOC	2.72	8	7	10	31	46	23	L	1.73	835	65	15.0	18.0	19.0	19.0
NE19-16-03E	TRO	3.96	0	0	5	5	49	46	SIC	2.41	412	70	22.0	25.0	33.0	33.0
SW02-25-16W	TUV	5.04	1	24	46	71	16	13	VFSL	0.84	261	36	12.0	10.0	29.0	11.0
NE32-06-20W	TWC	3.62	8	7	16	37	43	20	L	1.73	760	68	14.0	15.0	16.0	14.0
NE18-06-10W	VDL	0.47	25	17	6	81	11	8	LCS	1.32	635	55	10.0	11.0	22.0	14.0
NE18-06-10W	VDL	1.46	22	22	12	71	15	14	SL	1.40	675	62	11.0	11.0	16.0	16.0
NW23-06-08W	VDL	1.36	9	10	13	39	40	21	L	1.98	990	104	21.0	15.0	21.0	21.0
NW23-06-08W	VDL	1.17	7	9	19	40	37	23	L	2.13	995	140	19.0	15.0	21.0	25.0
NE03-05-12W	VDL	2.48	13	28	13	59	21	20	SCL	1.60	841	57	12.0	14.0	18.0	18.0
SE30-02-07E	VIT	1.57	17	31	29	83	8	9	LFS	1.02	397	29	5.2	12.0	16.0	8.5
SW11-02-07E	VIT	2.22	6	36	31	80	10	10	VFSL	1.14	283	26	6.0	14.0	20.0	12.0
SW25-36-25W	VLY	3.20	3	8	45	57	16	27	SCL	1.69	820	70	18.0	18.0	15.0	22.0
SE27-37-25W	VLY	6.14	3	11	11	25	37	38	CL	2.18	812	97	28.0	21.0	23.0	28.0
SE10-37-25W	VLY	5.79	1	16	28	46	19	35	SC	1.52	494	70	21.0	16.0	10.0	25.0
NW14-34-29W	VLY	4.59	3	30	18	52	19	29	SCL	2.09	796	113	22.0	15.0	29.0	23.0
SE21-11-27W	VRC	4.85	7	11	8	30	43	27	CL	2.06	809	88	23.0	19.0	20.0	22.0
NW15-10-29W	VRC	5.58	10	13	10	40	36	24	L	1.96	822	83	17.0	18.0	23.0	17.0
SW29-20-29W	VRC	4.48	9	9	11	45	28	27	SCL	2.20	905	79	21.0	18.0	35.0	57.0
NE01-17-24W	VRC	3.23	8	11	14	39	35	26	L	1.94	758	73	19.0	22.0	20.0	30.0
SW36-14-16W	VRC	3.23	13	27	14	60	24	16	FSL	1.54	680	41	12.0	12.0	25.0	20.0
NE26-14-17W	VRC	5.81	8	13	5	31	36	33	CL	2.11	750	50	21.0	12.0	22.0	22.0
NW34-14-12W	VRC	3.27	10	12	10	39	35	26	L	2.19	901	83	19.0	17.0	31.0	24.0

NR = No Record

Table 8. PHYSICAL AND CHEMICAL PROPERTIES OF MANITOBA SOILS (SURFACE HORIZONS) sorted by soil series

LOCATION	SER	ORGC %	MS %	FS %	VF %	TS %	SI %	CL %	TEXT	FE %	MN ppm	ZN ppm	CU ppm	CO ppm	PB ppm	NI ppm
SW05-21-27W	VRC	5.24	8	13	10	36	38	26	L	2.19	850	75	26.0	15.0	19.0	23.0
NE09-21-28W	VRC	4.68	6	8	7	25	38	37	CL	2.15	613	102	21.0	19.0	NR	NR
SW04-14-27W	VRC	3.72	11	14	13	45	32	23	L	1.84	632	62	18.0	17.0	21.0	21.0
NW23-06-08W	VTL	1.43	14	22	12	54	31	15	FSL	1.54	1080	87	15.0	13.0	20.0	16.0
SE10-09-19W	WDF	5.64	2	4	18	25	45	30	CL	2.14	810	81	19.0	22.0	24.0	21.0
SW01-02-09E	WGE	2.85	25	44	12	88	7	5	LS	0.40	149	15	27.0	10.0	17.0	9.0
NW27-07-14E	WGE	1.21	1	46	44	91	5	4	FS	1.01	327	24	4.8	9.5	24.0	7.1
NE25-05-24W	WKD	3.39	1	3	21	25	48	27	L	1.99	723	76	18.0	21.0	25.0	26.0
SW05-02-13W	WKD	3.09	13	12	11	49	32	19	L	1.77	739	62	14.0	16.0	24.0	15.0
NW32-04-18W	WKD	3.09	10	13	12	44	31	25	L	2.11	830	67	17.0	20.0	27.0	25.0
SW15-01-14W	WKD	2.73	12	16	13	45	31	24	L	1.64	593	69	15.0	18.0	21.0	22.0
NE06-04-18W	WKD	3.15	9	11	14	42	31	27	CL	1.49	601	57	17.0	17.0	23.0	20.0
NW15-05-23W	WKD	2.48	10	10	17	45	33	22	L	1.93	837	65	12.0	20.0	19.0	22.0
NE36-01-26W	WKD	2.88	9	12	16	42	32	26	L	2.38	953	93	13.0	23.0	23.0	27.0
SW31-03-22W	WKD	4.39	6	7	18	35	39	26	L	1.80	753	74	20.0	19.0	25.0	22.0
NE35-12-10E	WOG	5.81	12	20	11	49	31	20	L	1.75	550	42	26.0	11.0	20.0	7.0
SW15-08-10E	WOG	0.35	43	43	3	94	4	2	S	0.34	100	8	1.4	4.3	17.0	3.4
NW25-02-09E	WOG	1.12	36	18	3	92	6	2	CS	0.56	138	82	9.3	10.0	23.0	5.0
NW36-01-10E	WOG	1.35	34	29	11	86	10	4	S	1.05	370	90	6.0	11.0	11.0	5.0
NE19-35-23W	WOG	1.05	25	21	8	74	17	9	SL	1.63	950	46	4.0	6.0	NR	NR
SW35-01-05E	WOM	3.14	6	22	35	72	15	13	VFSL	0.80	330	28	8.0	14.0	21.0	12.0
NE19-16-11W	WTD	3.30	2	8	19	30	37	33	CL	1.74	464	67	13.0	16.0	27.0	16.0
SE12-25-16W	WTD	4.35	0	7	63	70	14	16	VFSL	0.78	398	62	26.0	13.0	37.0	25.0
NE20-23-14W	WTD	4.06	1	3	26	30	50	20	SIL	1.37	245	43	14.0	7.0	16.0	14.0
SW31-40-26W	WTV	1.49	9	15	15	48	39	13	L	1.41	280	29	6.0	8.0	NR	NR
SE04-15-11W	WWB	5.52	1	2	8	11	53	26	SICL	2.32	951	89	23.0	20.0	NR	NR
NW36-09-08W	WWC	1.91	18	26	39	85	7	8	LFS	1.14	320	32	6.4	11.0	17.0	10.0
NW25-12-12W	WWC	2.43	6	52	27	85	7	8	LFS	1.11	394	31	8.8	10.0	14.0	11.0
SE28-14-12W	WWC	1.46	3	67	21	91	4	5	FS	0.79	184	24	4.7	9.0	NR	NR
SW25-06-14W	WWD	3.94	4	10	27	44	27	29	CL	1.78	981	78	16.0	20.0	17.0	23.0
SE15-12-16W	WWD	4.01	1	18	19	38	34	28	CL	2.52	765	92	22.0	18.0	26.0	22.0
SW26-12-16W	WWD	4.67	1	7	25	33	38	29	CL	2.26	767	93	21.0	18.0	21.0	21.0
SW36-12-16W	WWD	3.80	3	6	18	28	39	33	CL	2.74	658	98	25.0	22.0	26.0	23.0
SE32-12-15W	WWD	3.86	1	7	17	25	47	28	CL	2.50	675	81	24.0	14.0	25.0	20.0
NW22-12-14W	WWD	4.04	1	6	22	29	42	26	L	2.45	750	81	26.0	12.0	18.0	25.0
SE09-11-14W	WWD	3.14	3	30	14	47	33	20	L	1.90	544	69	16.0	16.0	19.0	16.0
SW07-11-14W	WWD	5.15	4	15	13	32	42	26	L	2.08	827	96	20.0	21.0	27.0	22.0
NW30-07-24W	WWS	4.45	2	28	31	61	13	26	SCL	0.98	320	44	8.8	15.0	28.0	10.0
SW07-06-10W	ZAP	2.78	5	7	11	26	46	28	CL	1.97	713	NR	21.0	19.0	23.0	23.0
SW23-01-06W	ZIM	2.11	3	4	6	16	41	43	SIC	2.48	1040	82	24.0	25.0	25.0	31.0
SE22-01-06W	ZIM	5.13	7	11	12	37	41	22	L	1.45	1091	52	15.0	16.0	NR	NR
NW01-01-06W	ZIM	2.31	8	10	9	34	48	18	L	1.62	1493	52	15.0	19.0	NR	NR
SW14-04-12W	ZPI	4.08	6	10	18	38	35	27	L	2.07	1344	72	17.0	19.0	16.0	23.0
SW34-14-14W	ZRT	4.34	3	30	22	56	23	21	SCL	1.37	416	56	15.0	14.0	27.0	14.0

NR = No Record

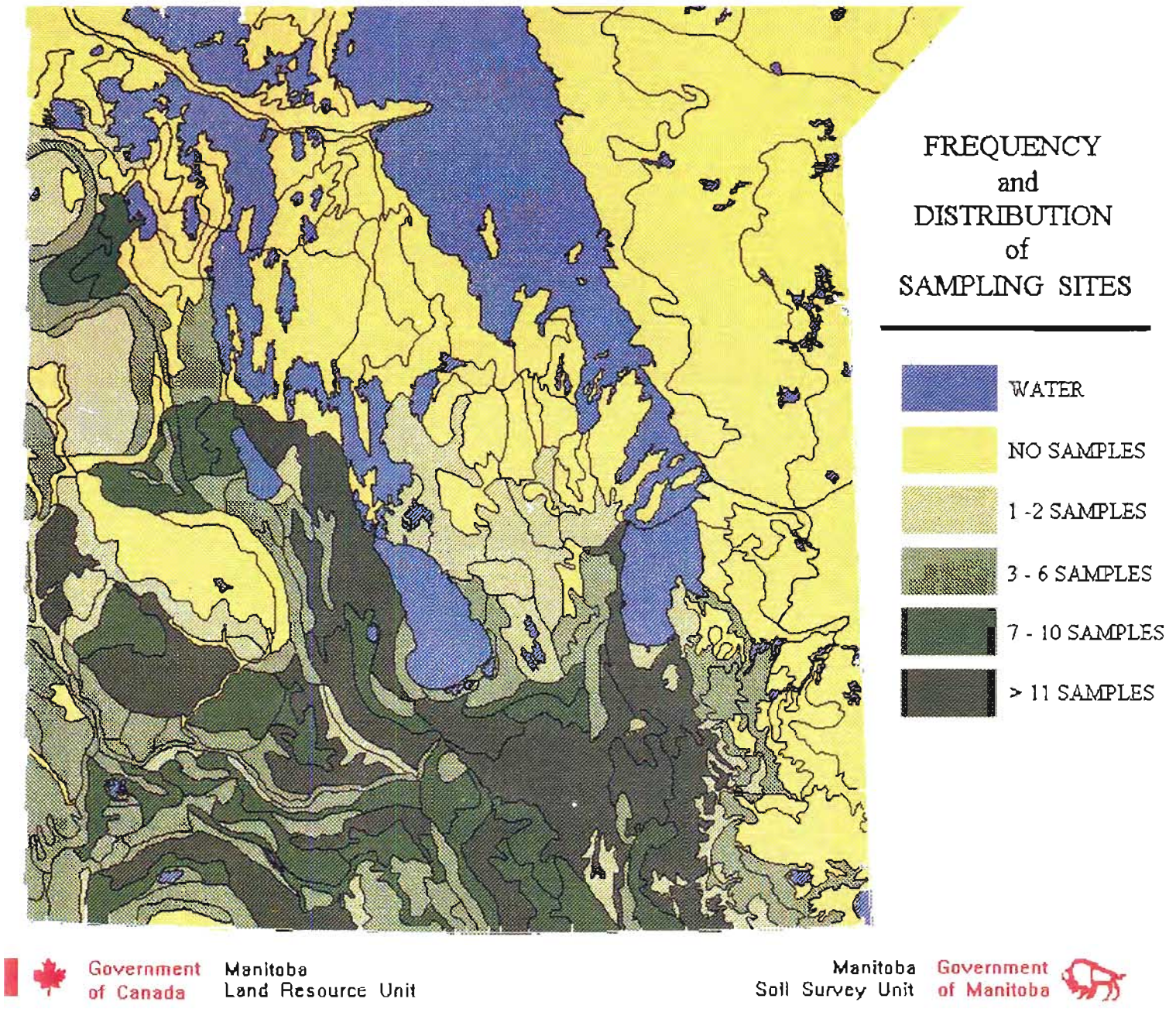


Figure 7. Frequency and distribution of sampling sites