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SOILS OF PERMANENT SAMPLE PLOTS IN THE  
ATHABASCA OIL SANDS AREA

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## 1. INTRODUCTION

Soils of permanent sample plots were investigated to provide baseline data for research related to monitoring of terrestrial ecosystems. More specifically, the objective of this project was to provide information on the kinds, characteristics, and distribution of soils in 16 permanent sample plots, each of about 5 ha area, established during 1981. The background and general purpose of the project are outlined in the Terms of Reference appended to this report.

General information about distribution and characteristics of soils in the oil sands area is provided in a report on the soils inventory of the Alberta Oil Sands Environmental Research Program study area (Turchenek and Lindsay 1982). Emphasis in 1981 was placed on selecting permanent sample plots with jack pine vegetation communities on Eluviated Dystric Brunisols. These soils are members of the Mildred and Heart soil groups which are described in the report of Turchenek and Lindsay (1982). Both of these soils groups are composed predominantly of Eluviated Dystric Brunisols. The Heart soils have developed in eolian sands while Mildred soils have formed in sandy glaciofluvial materials. Both soil groups are very sandy and usually contain less than 5% fine materials (clays and silt). The Mildred soils normally have a variable content of coarse fragments (larger than 2 mm) while Heart soils have no coarse materials. Two permanent sample plots were established in the Richardson Hills Upland. Soils in this area belong to the Firebag soil group; they have developed on sandy, gravelly and stony glaciofluvial ice-contact deposits, but are otherwise similar to the Mildred and Heart soil groups.

In this project, samples for laboratory analysis were taken from one or two sites within each permanent sample plot. For additional data and for making comparisons, analytical data for Heart, Mildred, and Firebag soils can be found in Volume 2 of the report by Turchenek and Lindsay (1982). Other soil surveys conducted in the general area are those of Hardy Associates Ltd. (1980) for the

Alsands lease, and Twardy (1978) for portions of the Syncrude lease. Information about general properties, moisture movement and retention, and nutrient cycling in soils near the AOSERP Mildred Lake research facility can be found in the report of McGill et al. (1980).



## Addendum

## PSP 2 - INSPECTION POINT 9 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	0	-	-	-	-	-
Ae	95	0	1	33	57	4	5
AB	94	0	1	28	59	6	6
Bm1	94	0	tr	25	64	5	6
Bm2	96	0	1	25	62	6	4
Bm3	98	0	tr	20	74	4	2
BC	99	0	0	27	69	3	1
C	99	0	0	13	82	4	1

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.5	0	44.78	0.59	76
Ae	5.1	4.4	0	1.56	0.04	39
AB	5.3	4.6	0	0.39	0.01	39
Bm1	5.5	4.7	0	0.13	0.01	13
Bm2	5.7	4.7	0	0.38	0.01	38
Bm3	5.8	4.8	0	0.09	0.00	9
BC	5.9	4.8	0	-	-	-
C	5.9	4.8	0	-	-	-

Horizon	Exch <sup>d</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.84	12.14	2.08	1.09	16.14	95
Ae	0.08	1.10	0.08	0.07	1.33	94
AB	0.04	0.18	0.03	0.02	0.26	84
Bm1	0.02	0.12	0.03	0.02	0.19	91
Bm2	0.01	0.24	0.05	0.02	0.32	96
Bm3	0.01	0.08	0.02	0.01	0.12	93
BC	0.01	0.06	0.02	0.01	0.09	92
C	0.01	0.12	0.02	0.01	0.16	95

## PSP 3 - INSPECTION POINT 8 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	97	tr	6	66	23	2	3
AB	97	1	9	68	18	1	3
Bm1	94	tr	6	64	22	2	6
Bm2	94	tr	8	67	17	2	6
Bm3	99	0	3	68	26	2	1
BC	98	0	2	50	36	2	2
C	98	0	1	52	44	1	2

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	4.1	0	19.08	0.47	41
Ae	5.1	4.2	0	1.16	0.05	23
AB	4.9	4.3	0	0.21	0.01	21
Bm1	5.4	4.7	0	0.13	0.01	13
Bm2	5.6	4.8	0	0.14	0.01	14
Bm3	5.8	4.9	0	0.04	0.00	-
BC	5.7	4.9	0	-	-	-
C	5.8	5.0	0	-	-	-

Horizon	Exch <sup>+</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.42	8.00	2.06	0.44	10.50	96
Ae	0.15	1.21	0.15	0.04	1.55	90
AB	0.12	0.18	0.03	0.02	0.35	66
Bm1	0.02	0.13	0.03	0.01	0.19	89
Bm2	0.02	0.14	0.02	0.01	0.19	89
Bm3	tr	0.14	0.02	0.01	0.17	99
BC	tr	0.07	0.01	0.01	0.09	99
C	tr	0.12	0.02	0.01	0.15	99

## PSP 4 - INSPECTION POINT 1 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
L	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-
Ae1	95	1	14	54	26	1	5
Ae2	94	1	14	54	25	1	6
AB	91	2	13	52	22	2	9
Bm	97	1	14	60	21	1	3
BC	99	tr	1	32	65	1	1
C	96	1	4	22	66	3	4

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
L	-	-	0	-	-	-
F	-	3.6	0	38.82	0.49	79
Ae1	5.4	4.6	0	0.31	0.01	31
Ae2	5.3	4.5	0	0.21	0.01	21
AB	5.3	4.5	0	0.16	0.01	16
Bm	5.7	4.8	0	0.08	0.01	8
BC	5.5	4.6	0	-	-	-
C	5.5	4.6	0	-	-	-

Horizon	Exch <sup>g</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
L	0.74	11.43	1.84	1.15	15.16	95
F	-	-	-	-	-	-
Ae1	0.02	0.50	0.06	0.03	0.61	97
Ae2	0.03	0.24	0.03	0.02	0.32	91
AB	0.05	0.13	0.02	0.02	0.22	77
Bm	0.01	0.30	0.01	0.07	0.39	97
BC	0.01	0.12	0.01	0.04	0.18	94
C	0.02	0.50	0.16	0.02	0.70	97

## PSP 4 - INSPECTION POINT 8 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae1	97	1	9	56	29	2	3
Ae2	97	2	14	55	24	2	3
Bfj	96	3	14	55	22	2	4
Bm	98	0	5	69	22	2	2
BC	97	0	2	57	36	2	3
C	98		2	50	44	2	2

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.6	0	41.73	0.27	155
Ae1	4.8	4.1	0	0.31	0.01	31
Ae2	4.8	4.3	0	0.06	0.00	-
Bfj	5.9	5.1	0	0.12	0.01	12
Bm	5.7	4.9	0	0.02	0.00	-
BC	5.8	5.0	0	-	-	-
C	5.9	5.0	0	-	-	-

Horizon	Exchangeable Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.92	11.33	1.98	1.22	15.45	94
Ae1	0.02	0.07	0.01	0.005	0.11	82
Ae2	0.01	0.10	0.03	0.02	0.16	94
Bfj	tr	0.42	0.11	0.07	0.60	99
Bm	tr	0.33	0.10	0.04	0.47	99
BC	tr	0.46	0.16	0.03	0.65	99
C	tr	0.56	0.15	0.02	0.73	99

## PSP 5 - INSPECTION POINT 6 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	96	2	3	54	35	2	4
AB	94	tr	3	59	30	2	6
Bm1	93	0	3	57	31	2	7
Bm2	98	0	3	69	25	1	2
Bm3	99	0	1	47	50	1	1
BC	98	0	2	53	42	1	2
C	98	0	1	40	55	2	2

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.7	0	32.84	0.49	67
Ae	4.7	4.1	0	1.13	0.04	28
AB	5.2	4.5	0	0.16	0.01	16
Bm1	5.5	4.7	0	0.15	0.01	15
Bm2	5.8	4.9	0	0.03	0.00	-
Bm3	6.1	5.1	0	-	0.00	-
BC	6.0	5.0	0	-	-	-
C	6.1	5.0	0	-	-	-

Horizon	Exch <sup>g</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	1.02	8.69	1.24	1.02	11.96	92
Ae	0.19	0.61	0.06	0.06	0.91	79
AB	0.05	0.19	0.03	0.02	0.28	84
Bm1	0.02	0.18	0.03	0.02	0.26	91
Bm2	0.01	0.24	0.05	0.02	0.32	96
Bm3	tr	0.18	0.03	0.02	0.24	99
BC	tr	0.19	0.04	0.02	0.25	99
C	tr	0.36	0.08	0.02	0.46	99

## PSP 5 - INSPECTION POINT 9 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	95	0	6	58	29	2	5
AB	95	tr	8	63	23	1	5
Bm1	92	tr	7	60	24	1	8
Bfj	99	0	14	72	12	1	1
Bm2	99	tr	8	74	16	1	1
BC	99	0	1	60	37	1	1
C	99	0	3	61	33	2	1

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.4	0	31.71	0.36	88
Ae	4.8	4.1	0	0.56	0.02	28
AB	5.6	4.7	0	0.16	0.01	16
Bm1	5.7	4.8	0	0.12	0.01	12
Bfj	5.8	4.8	0	0.04	0.00	-
Bm2	5.7	4.8	0	-	0.00	-
BC	5.8	4.8	0	-	-	-
C	5.9	4.8	0	-	-	-

Horizon	Exch <sup>y</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.95	5.42	0.94	0.71	8.02	88
Ae	0.15	0.31	0.03	0.02	0.51	70
AB	0.02	0.22	0.02	0.01	0.27	93
Bm1	0.01	0.15	0.02	0.02	0.19	95
Bfj	tr	0.11	0.04	0.01	0.16	98
Bm2	tr	0.14	0.05	0.01	0.20	99
BC	tr	0.24	0.06	0.01	0.31	99
C	tr	0.19	0.05	0.01	0.25	99

## PSP 8 - INSPECTION POINT 6 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay*
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae1	-	-	-	-	-	-	-
Bmj	95	tr	3	55	34	3	5
Ae2	96	tr	3	57	31	2	4
AB	95	tr	3	55	33	3	5
Bm1	97	0	3	65	27	2	3
Bm2	98	tr	3	57	36	2	2
II BC	87	0	2	39	44	2	13(7)
III BC	98	0	3	44	48	3	2
III C	98	0	2	54	40	2	2

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.5	0	30.14	0.50	60
Ae1	-	-	0	-	-	-
Bmj	5.4	4.5	0	0.85	0.03	28
Ae2	5.4	4.6	0	0.25	0.01	25
AB	5.4	4.7	0	0.14	0.01	14
Bm1	5.6	4.9	0	0.03	0.01	3
Bm2	5.7	4.9	0	0.02	0.00	-
II BC	5.5	4.9	0	-	-	-
III BC	5.7	4.8	0	-	-	-
III C	5.7	4.8	0	-	-	-

Horizon	Exchangeable Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	1.59	5.22	0.62	0.41	7.84	80
Ae1	-	-	-	-	-	-
Bmj	0.08	1.09	0.08	0.05	1.30	94
Ae2	0.02	0.27	0.04	0.02	0.35	93
AB	0.01	0.10	0.02	0.02	0.15	93
Bm1	tr	0.18	0.05	0.02	0.26	99
Bm2	tr	0.20	0.05	0.02	0.27	99
II BC	tr	1.50	0.40	0.06	1.98	99
III BC	0.01	0.45	0.12	0.02	0.60	98
III C	0.01	0.35	0.09	0.02	0.47	98

\* clay content in brackets

## PSP 8 - INSPECTION POINT 9 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay*
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	97	1	4	62	28	2	3
AB	95	1	5	60	27	2	5
Bm1	95	1	5	67	20	2	5
Bm2	98	1	7	74	15	1	2
BC	97	0	2	28	61	6	3
II C	68	0	1	26	36	5	32 (19)
III C	98	0	2	60	35	1	2

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.2	0	27.66	0.75	37
Ae	5.0	4.1	0	1.82	0.05	36
AB	5.5	4.6	0	0.46	0.02	23
Bm1	5.8	4.8	0	0.12	0.01	12
Bm2	5.7	4.9	0	0.03	0.01	3
BC	5.8	4.9	0	-	-	-
II C	4.4	4.0	0	-	-	-
III C	5.8	4.6	0	-	-	-

Horizon	Exchangeable Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	1.42	6.10	0.80	0.56	8.88	84
Ae	0.12	1.43	0.10	0.06	1.71	93
AB	0.02	0.59	0.06	0.04	0.71	97
Bm1	tr	0.12	0.02	0.02	0.16	99
Bm2	0.01	0.20	0.04	0.01	0.26	96
BC	0.01	0.48	0.10	0.03	0.62	98
II C	1.37	2.37	0.76	0.06	4.56	70
III C	tr	0.37	0.11	0.01	0.48	99

\* clay content in brackets



## PSP 9 - INSPECTION POINT 3 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ahe	94	0	1	16	63	14	6
AB	94	0	1	11	65	17	6
Bm1	94	0	tr	10	68	16	6
Bm2	96	0	-	8	70	18	4
BC	96	0	-	9	72	15	4
C	97	0	tr	14	68	15	3

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.7	0	41.50	1.10	38
Ahe	5.4	4.7	0	2.01	0.06	34
AB	5.9	5.0	0	0.22	0.02	11
Bm1	6.0	5.2	0	0.13	0.01	13
Bm2	6.1	5.2	0	0.10	0.01	10
BC	6.2	5.3	0	-	-	-
C	6.0	5.0	0	-	-	-

Horizon	Exchangeable Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.60	16.13	2.31	2.08	21.12	97
Ahe	0.07	3.03	0.22	0.12	3.95	98
AB	0.02	1.07	0.22	0.10	1.41	99
Bm1	0.02	1.34	0.29	0.08	1.73	99
Bm2	0.02	1.65	0.34	0.10	2.12	99
BC	0.02	1.80	0.34	0.13	2.29	99
C	0.02	1.54	0.31	0.13	2.00	99

## PSP 9 - INSPECTION POINT 10 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
L	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-
Ae	94	tr	2	9	65	17	6
AB	90	tr	1	10	62	18	10
Bml	92	tr	1	11	66	14	8
Bmgj	94	0	tr	8	67	19	6
Bcgj	95	0	tr	7	67	21	5
Cgj	88	0	tr	2	58	28	12
Cg	-	-	-	-	-	-	-
lICg	97	0	tr	37	55	5	3

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
L	-	3.9	0	46.92	0.97	48
F	-	3.3	0	47.70	0.86	56
Ae	4.7	4.1	0	0.64	0.04	16
AB	5.2	4.5	0	0.54	0.03	18
Bml	5.6	4.8	0	0.14	0.01	14
Bmgj	5.5	4.7	0	0.07	0.01	7
BCgj	5.7	4.9	0	-	-	-
Cgj	5.7	5.0	0	-	-	-
Cg	-	-	-	-	-	-
lICg	7.5	7.0	0	0.11	-	-

Horizon	Exch <sup>d</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
L	0.66	24.23	5.69	3.75	34.34	98
F	1.08	11.74	2.49	3.41	18.72	94
Ae	0.43	0.83	0.09	0.09	1.43	70
AB	0.13	1.16	0.13	0.11	1.53	92
Bml	0.03	1.53	0.25	0.13	1.94	98
Bmgj	0.01	1.01	0.19	0.05	1.26	99
BCgj	0.02	1.78	0.31	0.09	2.20	99
Cgj	0.03	2.17	0.40	0.11	2.71	99
Cg	-	-	-	-	-	-
lICg	0.02	2.04	0.17	0.04	2.27	99

## PSP 10 - INSPECTION POINT 10 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	96	2	10	64	19	1	4
AB	95	1	10	64	18	2	5
Bm1	96	1	7	65	21	2	4
Bm2	96	1	12	61	20	2	4
Bm3	98	1	13	72	10	2	2
BC	99	1	9	73	14	2	1
C	99	1	6	67	24	1	1

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.8	0	34.81	0.49	71
Ae	5.2	4.6	0	0.80	0.02	40
AB	5.3	4.6	0	0.18	0.01	18
Bm1	5.4	4.7	0	0.14	0.01	14
Bm2	5.9	4.9	0	0.05	0.01	5
Bm3	5.8	5.1	0	0.02	0.00	-
BC	6.2	5.1	0	-	-	-
C	5.9	5.0	0	-	-	-

Horizon	Exch <sup>+</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.85	7.52	0.98	1.03	10.38	92
Ae	0.11	0.88	0.05	0.04	1.08	88
AB	0.02	0.26	0.02	0.01	0.31	94
Bm1	0.02	0.24	0.02	0.01	0.29	93
Bm2	0.01	0.35	0.04	0.01	0.41	98
Bm3	0.01	0.25	0.04	0.01	0.31	97
BC	0.01	0.22	0.04	0.01	0.28	96
C	0.01	0.26	0.07	0.01	0.35	97

## PSP 10 - INSPECTION POINT 13 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	97	1	11	65	18	2	3
AB	96	1	14	64	15	2	4
Bm1	94	1	11	67	13	2	6
Bm2	96	1	8	65	20	2	4
Bm3	98	0	7	75	14	2	2
BC	98	1	4	66	25	2	2
C	97	0	1	30	63	3	3

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.8	0	33.17	0.65	51
Ae	4.9	4.4	0	0.79	0.03	26
AB	5.1	4.5	0	0.20	0.01	20
Bm1	5.4	4.7	0	0.17	0.01	17
Bm2	5.6	4.9	0	0.05	0.00	-
Bm3	5.7	5.0	0	0.02	0.00	-
BC	5.7	4.9	0	-	-	-
C	5.6	4.7	0	-	-	-

Horizon	Exchangeable Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.84	10.76	1.44	1.62	14.65	94
Ae	0.10	0.28	0.04	0.04	0.46	79
AB	0.05	0.16	0.02	0.02	0.25	80
Bm1	0.13	0.02	0.02	0.01	0.18	28
Bm2	tr	0.12	0.02	0.01	0.16	98
Bm3	tr	0.10	0.02	0.01	0.13	98
BC	tr	0.13	0.04	0.01	0.18	99
C	0.01	0.28	0.07	tr	0.38	99

## PSP 12 - INSPECTION POINT 6 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	92	tr	2	41	46	3	8
AB	94	tr	3	44	44	3	6
Bm1	96	0	2	39	53	2	4
Bm2	99	0	1	32	64	2	1
11BC	97	0	3	60	33	1	3
111C	99	0	2	50	45	2	1

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.7	0	25.72	0.52	50
Ae	4.7	4.1	0	2.54	0.05	51
AB	5.0	4.3	0	0.21	0.01	21
Bm1	5.1	4.4	0	0.22	0.01	22
Bm2	5.4	4.8	0	0.07	0.00	-
11BC	5.4	4.7	0	0.75	-	-
111C	5.6	4.9	0	-	-	-

Horizon	Exchangeable Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.67	9.40	1.10	0.79	11.95	94
Ae	0.33	1.24	0.10	0.11	1.78	81
AB	0.09	0.11	0.03	0.02	0.25	64
Bm1	0.13	0.05	0.02	0.01	0.21	38
Bm2	tr	0.04	0.02	0.01	0.07	99
11BC	tr	0.08	0.02	0.01	0.11	99
111C	tr	0.23	0.05	0.02	0.30	99

## PSP 12 - INSPECTION POINT 9 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	96	0	2	46	45	3	4
AB	94	0	2	48	41	3	6
Bm1	97	0	2	48	45	2	3
Bm2	97	0	1	43	50	3	3
BC	99	0	2	61	35	1	1
C	99	0	3	64	31	1	1

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.8	0	42.47	0.79	54
Ae	4.7	4.1	0	1.12	0.05	22
AB	5.1	4.4	0	0.42	0.02	21
Bm1	5.3	4.7	0	0.22	0.01	22
Bm2	5.6	4.9	0	0.07	0.01	7
BC	5.6	4.9	0	-	-	-
C	5.9	4.9	0	-	-	-

Horizon	Exch. Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.68	11.52	2.05	1.19	15.45	96
Ae	0.15	0.56	0.06	0.04	0.80	81
AB	0.12	0.11	0.01	0.01	0.25	55
Bm1	0.01	0.03	0.01	0.01	0.06	83
Bm2	tr	0.02	tr	0.01	0.03	99
BC	tr	0.04	0.01	0.01	0.06	99
C	tr	0.06	0.01	0.01	0.09	99

## PSP 14 - INSPECTION POINT 7 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	89	3	16	42	26	2	11
AB	89	3	17	44	23	2	11
Bfj1	92	4	21	49	16	2	8
Bfj2	93	11	27	30	23	2	7
Bfj3	94	4	24	38	26	2	6
BC	97	2	14	53	26	2	3
C	-	-	-	-	-	-	-

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	4.0	0	43.91	1.10	40
Ae	4.9	4.2	0	0.15	0.01	15
AB	5.2	4.5	0	0.11	0.01	11
Bfj1	5.7	4.9	0	0.09	0.01	9
Bfj2	6.0	5.1	0	0.11	0.02	6
Bfj3	6.0	5.1	0	0.07	0.00	-
BC	6.0	5.2	0	-	-	-
C	-	-	-	-	-	-

Horizon	Exch. Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	1.16	18.40	2.63	1.27	23.46	95
Ae	0.06	0.15	0.04	0.02	0.27	78
AB	0.10	0.56	0.07	0.07	0.80	88
Bfj1	0.02	0.85	0.15	0.07	1.09	98
Bfj2	0.01	1.34	0.29	0.06	1.70	99
Bfj3	0.02	1.22	0.31	0.05	1.60	99
BC	0.01	0.80	0.22	0.04	1.07	99
C	-	-	-	-	-	-

## PSP 14 - INSPECTION POINT 9 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
L	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-
Ae	96	1	20	58	16	1	4
AB	93	1	22	56	14	1	7
Bm1	98	1	14	63	19	1	2
Bm2	99	1	11	65	21	1	1
BC	98	1	15	61	20	1	2
IIC	98	1	3	34	56	4	2
IIIC	-	-	-	-	-	-	-
IIICg	-	-	-	-	-	-	-

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
L	-	-	0	-	-	-
F	-	4.1	0	41.24	0.64	64
Ae	5.2	4.5	0	0.15	0.01	15
AB	5.3	4.6	0	0.13	0.01	13
Bm1	5.7	5.0	0	0.05	0.00	-
Bm2	6.1	5.1	0	0.02	0.00	-
BC	6.0	5.0	0	-	-	-
IIC	5.7	4.8	0	-	-	-
IIIC	-	-	0	-	-	-
IIICg	-	-	0	-	-	-

Horizon	Exchange Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
L	0.67	20.93	3.16	1.39	26.16	97
F	0.67	21.92	3.34	1.44	27.36	98
Ae	0.01	0.26	0.04	0.02	0.33	97
AB	0.03	0.16	0.04	0.33	0.56	95
Bm1	0.01	0.16	0.04	0.03	0.24	96
Bm2	tr	0.19	0.05	0.03	0.27	99
BC	tr	0.23	0.06	0.02	0.31	99
IIC	tr	0.35	0.10	0.02	0.48	99
IIIC	-	-	-	-	-	-
IIICg	-	-	-	-	-	-



## PSP 15 - INSPECTION POINT 6 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay *
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae1	50	2	5	18	20	5	50
Ae2	66	2	7	24	28	5	34
AB	77	2	7	29	35	4	23
Bt	50	2	5	17	21	5	50 (30)
BC	45	1	3	12	20	9	55
C	48	1	4	16	21	6	52

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	4.3	0	47.08	1.18	40
Ae1	4.9	4.2	0	0.51	0.03	17
Ae2	5.0	4.4	0	0.36	0.02	18
AB	5.6	4.8	0	0.14	0.01	14
Bt	6.4	5.9	0	0.75	0.03	25
BC	7.4	7.2	5.4	-	-	-
C	7.7	7.4	14.7	-	-	-

Horizon	Exch <sup>y</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	0.56	33.11	7.57	2.90	44.13	99
Ae1	0.34	1.40	0.48	0.08	2.30	85
Ae2	0.13	1.20	0.52	0.05	1.90	93
AB	0.01	0.91	0.37	0.03	1.32	99
Bt	0.07	7.68	3.60	0.04	11.39	99
BC	0.07	6.90	2.95	0.04	9.97	99
C	0.06	5.17	1.96	0.03	7.21	99

\* clay content in brackets

## PSP 16 - INSPECTION POINT 5 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay #
	Sand	VCS	CS	MS	FS	VFS	
L	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-
Ae	69	1	5	19	36	8	31(2)
Bmj	45	1	1	3	22	18	55(11)
AB	38	1	2	6	17	12	62(30)
Bt1	36	1	2	7	18	8	64(35)
Bt2	64	1	1	4	39	19	36(5)
BC	26	1	2	5	11	7	74(37)
C	23	1	1	4	10	7	77(39)

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
L	-	-	0	-	-	-
F	-	3.8	0	46.12	0.97	48
Ae	4.5	4.0	0	0.55	0.02	28
Bmj	5.3	4.5	0	0.22	0.02	11
AB	4.9	4.4	0	0.26	0.02	13
Bt1	5.5	5.3	0	0.44	0.04	11
Bt2	5.5	4.6	0	0.29	0.02	15
BC	5.2	4.8	0	-	-	-
C	5.3	4.9	0	-	-	-

Horizon	Exch <sup>g</sup> Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
L	-	-	-	-	-	-
F	0.98	21.95	4.29	3.21	30.43	97
Ae	0.42	0.69	0.14	0.06	1.31	68
Bmj	0.19	1.58	0.58	0.09	0.19	58
AB	0.35	5.08	2.15	0.15	7.73	95
Bt1	0.08	8.48	3.65	0.10	12.30	99
Bt2	0.14	0.57	0.17	0.04	0.93	85
BC	0.07	3.38	1.45	0.07	1.48	99
C	0.07	5.01	2.19	0.10	7.36	99

\* clay content in brackets

## 2. STUDY AREAS

Potential permanent sample plots were selected during the autumn of 1980 by R. Ellis, Department of Botany, University of Alberta, and L.W. Turchenek. The sites selected included white spruce-aspen and black spruce communities as well as jack pine communities. Documentation of soil observations at these sites was submitted to the Research Management Division, Alberta Environment, in late 1980. Dr. LaRoi and his research group established 16 permanent sample plots at sites selected from these and from several others visited during 1981. The soil investigations were to be carried out at these 16 sites. Their locations are presented in Table 1 and in Figure 1. The permanent sample plots have been renumbered according to LaRoi (1982). La Roi has also provided airphoto co-ordinates for locating each of the plots.

Table 1. Location of permanent sample plots.

<u>Permanent Sample Plot</u>	<u>Age (yrs)</u>	<u>Location</u>
PSP - 1	17	NE(NW?)26-99-8-W4
PSP - 2	37	SE20-98-8-W4
PSP - 3	32	SE19-93-10-W4
PSP - 4	34	SE17-93-9-W4
PSP - 5	40	SE6, SW5-94-9-W4
PSP - 6	36	SE7, SW8-102-7-W4
PSP - 7	37	NE12-88-13-W4
PSP - 8	37	NE1-94-10-W4
PSP - 9	54	NW15(SE16?)88-13-W4
PSP - 10	85	SE1-94-10-W4
PSP - 11	78	NE(NW?)25-99-8-W4
PSP - 12	80	NE17-98-8-W4
PSP - 13	98	SE7, NE6-102-7-W4
PSP - 14	140	SE17-93-9-W4
PSP - 15	33	NE33-92-9-W4
PSP - 16	40	NW23-92-8-W4

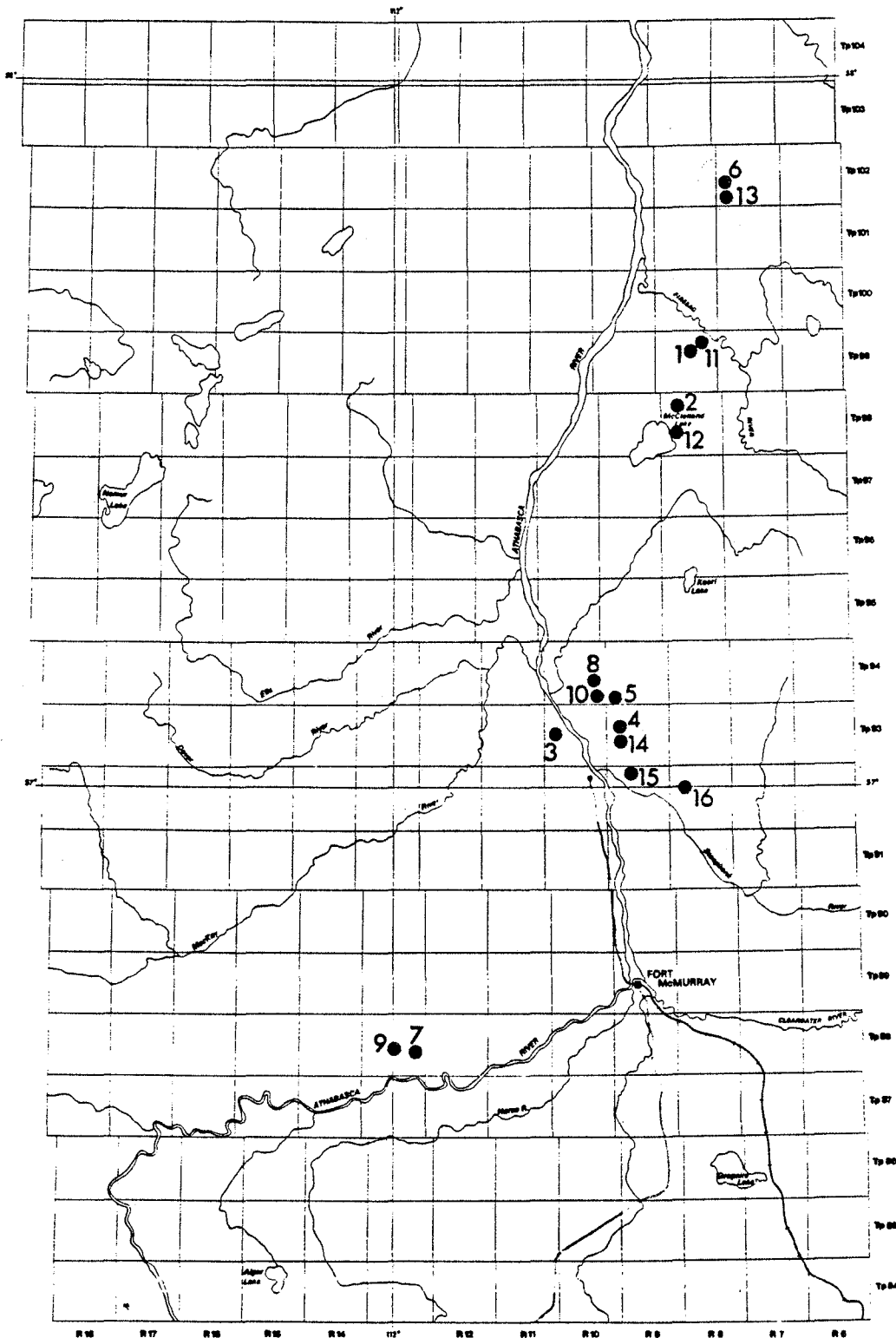


Figure 1. Locations of permanent sample plots.

### 3. METHODS

A systematic soil inspection and sampling scheme, in which sampling or inspection points are located at regular intervals on a grid, was used in this survey. This scheme was selected to reduce bias in selecting sample points while at the same time making them easy to locate and index. A disadvantage of systematic sampling is that the selected grid could coincide with regular periodicity in the soil population. As one criterion for selecting permanent sample plots was general uniformity within ecosystem components, the possibility of periodicity within plots was considered to be minimal. Recurring patterns were not apparent when the actual field investigations were carried out.

A limit of one day's field work was established for each permanent sample plot. This time limit determined the number of inspections that could be made per plot. The number selected was 16 inspections on a 4 x 4 grid, but in fact it became necessary to delete a few inspection points from most plots. At PSP 6, near the Mildred Lake research facility, inspections using a 5 x 5 grid were attempted but it was found that 2 days were necessary to complete the plot.

Soil classification and terminology used in soil descriptions was that of the Canadian System of soil classification (Canada Soil Survey Committee 1978a 1978b).

Inspection points were hand augered, usually to a depth of about 120 cm. Horizon thicknesses and morphology were recorded. Site features such as slope, stoniness, vegetation, and distance of sample points from the nearest trees were recorded. At each inspection point, small grab samples for pH determination were collected at depths of 0-5, 15-20, 45-50, and at 100 cm. Pits were dug at one or two of the inspection points and about 2 kg of sample from each horizon were taken for laboratory analysis.

Grab samples were kept cold and moist until pH was determined. Samples from pits were air dried and passed through a

2 mm sieve. The content of fragments larger than 2 mm was determined. The pH of grab samples was determined in 0.01 M $\text{CaCl}_2$  solution (1:2 soil:solution ratio).

The pH of other samples was determined in 0.01 M $\text{CaCl}_2$  and also in  $\text{H}_2\text{O}$ . Cation exchange capacity (CEC) and exchangeable cations were determined after extraction with 2N NaCl solution. CEC determined by this method, called permanent charge CEC, is determined at the pH of the soil. Contents of exchangeable cations in solution were determined by Inductively Coupled Plasma Atomic Emission Spectroscopy. Total carbon was determined by dry combustion and total nitrogen by the semi-micro Kjeldahl method.

Access to permanent sample plots was by helicopter and location of plots was made with the aid of 1:60,000 airphotos. Grid inspection points were selected within plot boundaries established by LaRoi (1982). The grid was laid out by use of a compass and a hip-chain measuring instrument.

No attempt was made to delineate differing soils and topography within the permanent sample plots. Without large scale airphotos, determining boundary locations is rather difficult and time-consuming. The grid diagrams in Section 4 do not indicate permanent sample plot boundaries. Again, determination of these would have been time-consuming, particularly for the irregularly shaped permanent sample plots. It is hoped that large scale airphotos will be obtained in the future; plot, soil, vegetation, landform, drainage, and other boundaries could then be quite easily added.

Statistical procedures utilized the Michigan Interactive Data Analysis System (MIDAS) conducted with the Amdahl 470V/8 mainframe at the University of Alberta computing centre. The procedures are outlined by the Statistical Research Laboratory, The University of Michigan (1976).

#### 4. RESULTS AND DISCUSSION

##### 4.1 SOIL DESCRIPTIONS

Field descriptions and data for soils within the various permanent sample plots are presented in this section. Four of the 16 plots were not investigated because the forest cover had been destroyed by fires and it was not known, at the time of the field work, if research would proceed on these plots. If permanent sample plots are to be re-established at these sites, the soils information can be collected during 1982. Sites 15 and 16, which had very stony soils, were difficult to dig in and were not examined as thoroughly as others. PSP 7 was not completed due to problems encountered at the site but will hopefully be completed during 1982.

At the time of preparing this report, laboratory analyses of soil samples was still being carried out. Therefore, only field descriptions and results of pH determinations are presented herein.

Data from each plot are presented on the following pages using a standard format as described below.

- 1) A diagram of the inspection grid indicates potential inspection points by use of crosses (x), inspection actually examined by use of circled crosses (⊗), and inspection points sampled by a solid circle (●).
- 2) A table derived from a computer printout of some descriptive measures follows the grid diagram. The data are for horizon thicknesses and pH. The actual data for all plots are presented in the Appendix. Abbreviations and definitions are as follows:  
Variable = horizon thickness or pH; A = sum of Ae and AB horizons; ABM = sum of Ae, AB, and Bm horizon thicknesses; Solum = sum of all A and B horizon thicknesses; pH5 = pH of 0-5 cm sample; pH 20 = pH of 15-20 cm sample; pH 50 = pH of 45-50 cm sample; pH 100 = pH of sample taken at 100 cm.



4.1.1 PSP 2

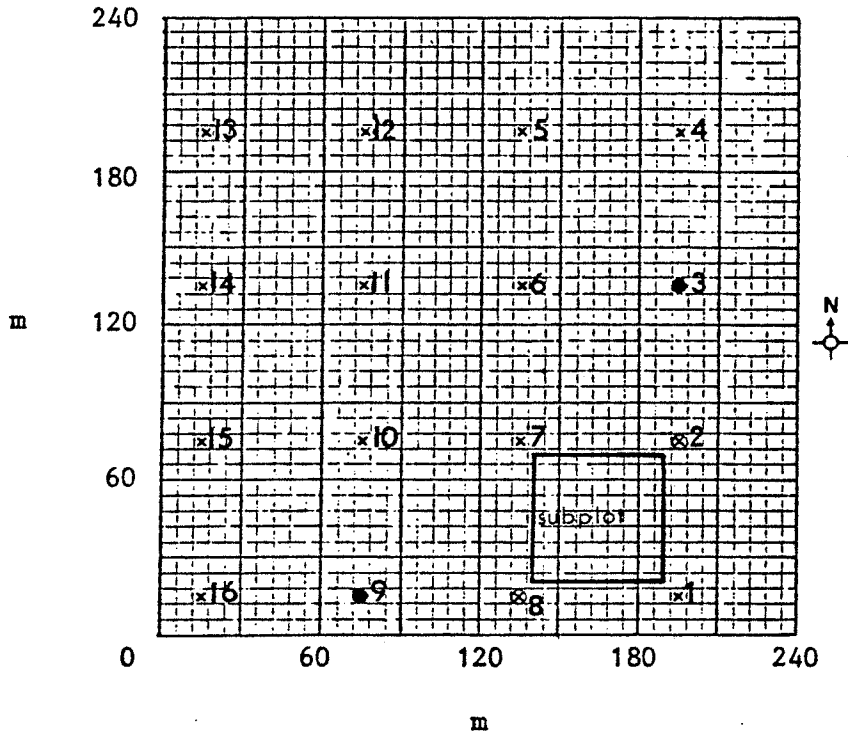


Figure 2. Inspection points in PSP 2.

Table 2. Horizon thicknesses and pH in PSP 2.

DESCRIPTIVE MEASURES (2) PLOT:2						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERV
LP	4	1	2	1.7500	.50000	(1.1617, 2.3383)
AE	4	4	5	5.2500	.85743	(4.1234, 6.3766)
AB	4	5	10	7.5000	1.7321	(5.4518, 9.5381)
A	4	11	18	12.750	2.3628	(8.9686, 16.530)
BM	4	45	84	62.250	8.2208	(42.577, 81.923)
ABM	4	58	75	65.000	7.2572	(55.481, 73.538)
BC	4	15	57	38.250	17.851	(15.127, 57.373)
SOLUM	4	90	115	101.25	11.087	(88.204, 114.30)
PH5	3	4.24	4.83	4.5287	.29535	(4.0267, 5.0246)
PH20	3	4.84	4.97	4.7800	.21517	(4.3972, 5.1228)
PH50	3	5.08	5.21	5.1300	.75488	(5.0027, 5.2573)
PH100	2	4.95	5.08	5.0150	.91824	(4.6046, 5.4254)

PSP 2 - INSPECTION POINT 3Site Description

Plot Location: SE20-98-8-W4  
 Landform:  
 Genetic Material: Glaciofluvial; sandy; possible eolian influence in top few cm  
 Surface Expression: Undulating; very gentle slopes (2-5%)  
 Site Features: Lower to mid position of very gentle slope; northwest aspect; rapidly drained; high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - lichens - Polytrichum

Profile Description

- LF - 2 to 0 cm; slightly to moderately well decomposed needles, lichens, and mosses; some charcoal fragments at mineral contact; mixed gray, black and brown colours; few, very fine to medium, horizontal roots; abrupt, wavy boundary.
- Ae - 0 - 6 ( $\pm 1$ ) cm; 'salt and pepper' colours, generally dark yellowish brown (10YR 3/6 d, and 10YR 4/4 d); sand; single grain; loose, abundant, very fine to medium, horizontal roots; very few coarse fragments; clear, wavy boundary; pH 4.3.
- AB - 6 to 13 ( $\pm 1$ ) cm; light yellowish brown (10YR 6.5/5 d); sand; single grain; loose; abundant, fine to coarse, horizontal roots; no coarse fragments; gradual, wavy boundary; pH 4.6.
- Bm1 - 13 to 30 ( $\pm 1$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose, plentiful, fine to medium, horizontal and oblique roots; trace of coarse fragments; gradual wavy boundary; pH 4.6.
- Bm2 - 30 to 43 ( $\pm 1$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; few, fine, oblique roots; about 3% coarse fragments; gradual, wavy boundary.
- Bm3 - 43 to 58 ( $\pm 5$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; very few roots; no coarse fragments; clear, irregular and broken boundary with tonguing into BC; pH 4.9.
- BC - 58 to 115 cm; very pale brown (10YR 7/3.5 m); sand; single grain; loose; no roots; no coarse fragments; pH 4.9.
- C - 115 to 138+ cm; very pale brown (10YR 7/3 m); sand; single grain; no coarse fragments; pH 4.9.

## PSP 2 - INSPECTION POINT 3 - ANALYSIS

Horizon	Particle Size Distribution (%)						Silt & Clay
	Sand	VCS	CS	MS	FS	VFS	
LF	-	-	-	-	-	-	-
Ae	93	0	1	34	54	4	7
AB	96	0	1	41	51	3	4
Bm1	96	0	1	34	58	3	4
Bm2	96	tr	1	29	61	4	4
Bm3	99	0	tr	26	69	4	1
BC	99	0	0	35	61	3	1
C	99	0	0	46	51	2	1

Horizon	pH		CaCO <sub>3</sub> eq. (%)	Org. C %	Total N %	C/N
	H <sub>2</sub> O	CaCl <sub>2</sub>				
LF	-	3.3	0	39.32	0.59	67
Ae	5.1	4.3	0	1.02	0.04	26
AB	5.2	4.6	0	0.14	0.01	14
Bm1	5.2	4.6	0	0.22	0.01	22
Bm2	5.4	4.6	0	0.11	0.01	11
Bm3	5.5	4.9	0	0.04	0.00	-
BC	5.7	4.9	0	-	-	-
C	5.9	4.9	0	-	-	-

Horizon	Exch. Cations & CEC-Neutral Salt (me/100g)					Base Sat. (%)
	Al	Ca	Mg	K	Total	
LF	1.16	9.85	1.09	0.83	12.94	91
Ae	0.08	0.88	0.05	0.03	1.04	92
AB	0.04	0.08	0.02	0.02	0.16	78
Bm1	0.03	0.05	0.02	0.02	0.12	74
Bm2	tr	0.03	0.01	0.01	0.06	93
Bm3	tr	0.03	0.01	0.01	0.05	95
BC	tr	0.06	0.01	0.01	0.08	97
C	tr	0.11	0.02	0.01	0.15	98

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4.1.2 PSP 3

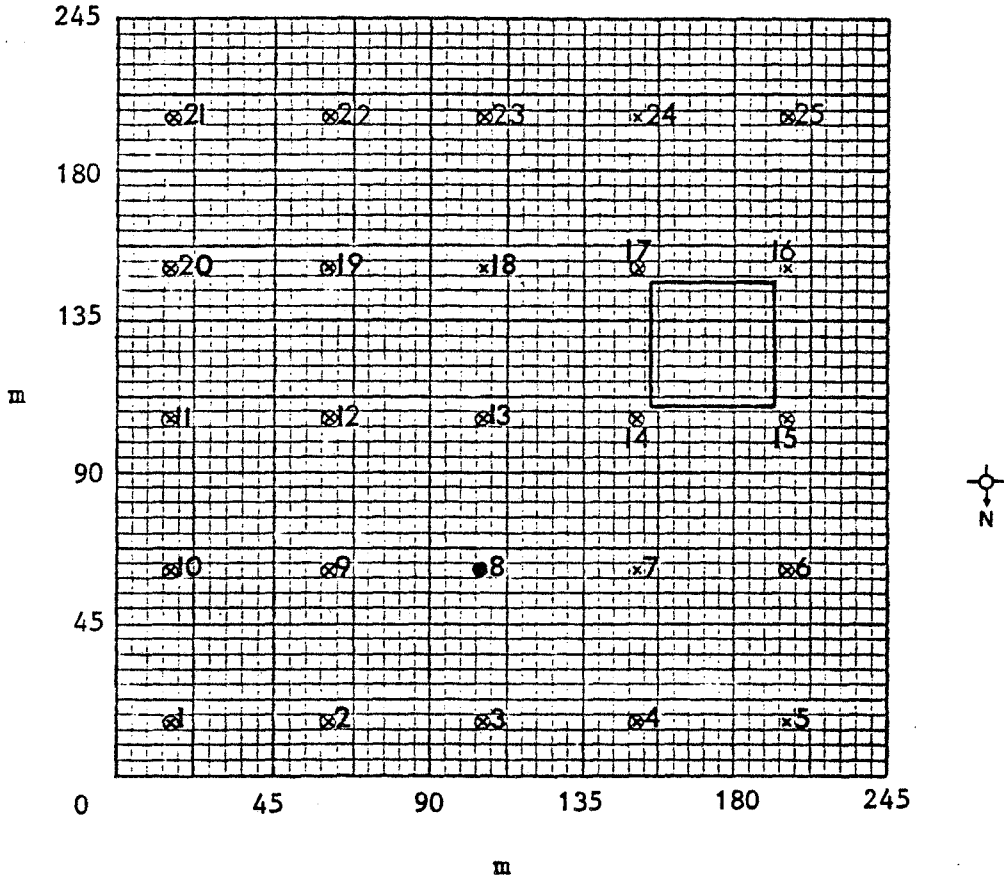


Figure 3. Inspection points in PSP 3.

Table 3. Horizon thicknesses and pH in PSP 3.

DESCRIPTIVE MEASURES (3) PLOT:3						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.8000 CONFIDENCE INTERV
LF	18	1	5	2.7368	1.0978	(2.3002,3.1735)
AE	20	1	14	6.3000	3.5558	(4.8253,7.8747)
AB	18	0	20	6.6316	5.5599	(4.4158,8.8474)
A	18	2	30	12.842	8.9941	(10.050,15.625)
BM	18	31	80	80.111	14.004	(64.359,85.853)
ABM	18	40	90	73.000	13.952	(57.275,78.725)
BC	18	15	50	30.444	11.748	(25.827,35.062)
SDLUM	18	72	120	103.44	13.878	(87.714,109.17)
PHE	20	3.82	4.71	4.2100	.34088	(4.0722,4.3418)
PH20	20	3.81	4.88	4.3875	.30430	(4.2888,4.5052)
PH50	20	3.88	4.98	4.5970	.28840	(4.4824,4.7116)
PH100	18	4.28	5.14	4.7732	.20768	(4.5905,4.8558)

PSP 3 - INSPECTION POINT 8Site Description

Plot Location: SE19-93-10-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Undulating; nearly level (0.5-2.5% slopes)  
 Site Features: Sample point in basin between slopes; relief about  $\frac{1}{2}$  m;  
 rapidly drained; high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - aspen - alder - blueberry - lichens

Profile Description

- LF - 1-2 to 0 cm; mixed colours, mainly grayish brown; moderately decomposed lichens and needles; plenty of charcoal fragments; plentiful, fine to medium, horizontal roots; abrupt, smooth boundary.
- Ae - 0 to 5 ( $\pm 1$ ) cm; 'salt and pepper' colours, mainly grayish brown (10YR 5/2 d); some charcoal particles; sand; single grain; loose; abundant, very fine to medium, horizontal roots; about 1% coarse fragments; clear, wavy boundary; pH 4.2.
- AB - 5 to 14 ( $\pm 1$ ) cm; light yellowish brown (10YR 6/4 d; 10YR 5/4 m); some faint grayish blotches; sand; single grain; loose; abundant; fine to coarse, horizontal and oblique roots; about 1% coarse fragments; clear, wavy boundary; pH 4.3.
- Bm1 - 14 to 24 ( $\pm 2$ ) cm; light yellowish brown to brownish yellow (10YR 6.5/5 d; 10YR 5/6 m); sand; single grain; loose; plentiful, fine to medium, horizontal and oblique roots; about 5%, well rounded to subangular, gravel and cobbles; clear, wavy boundary; pH 4.7.
- Bm2 - 24 to 46 ( $\pm 2$ ) cm; light yellowish brown to brownish yellow (10YR 6/5 d; 10YR 4.5/6 m); very few, fine, oblique roots; about 5% gravel and cobbles; clear, wavy boundary; pH 4.8.
- Bm3 - 46 to 66 ( $\pm 2$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; very few roots; about 1% coarse fragments; clear, wavy boundary; pH 4.9.
- BC - 66 to 90 ( $\pm 3$ ) cm; very pale brown (10YR 7/4 m); sand; single grain; loose; very few roots; trace of coarse fragments; gradual, smooth boundary; pH 4.9.
- C - 90 to 140+ cm; pale brown (10YR 6.5/3 m); sand; single grain; loose; no roots; trace of coarse fragments; pH 5.0.

4.1.3 PSP 4

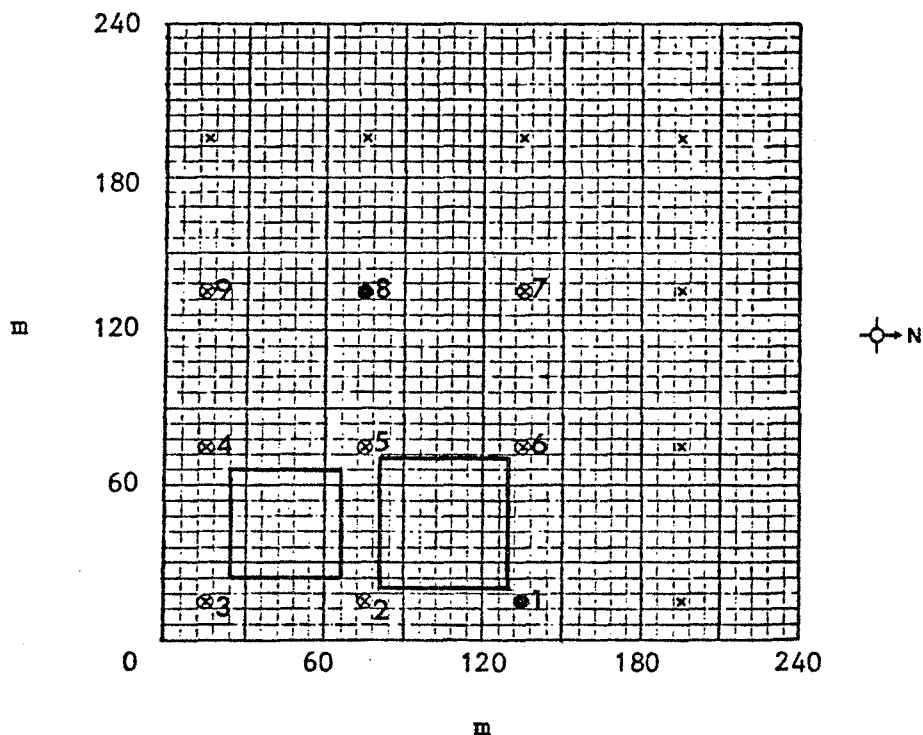


Figure 4. Inspection points in PSP 4.

Table 4. Horizon thicknesses and pH in PSP 4.

DESCRIPTIVE MEASURES <4> PLOT:4						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERVAL
LF	8	1	5	2.0000	1.3083	(1.1230, 2.8770)
AE	9	7	26	15.333	8.3836	(11.378, 19.290)
AB	9	0	15	7.3333	8.0488	(4.2032, 10.463)
A	9	14	28	22.557	8.0249	(18.552, 26.561)
BM	9	18	55	38.444	14.205	(28.540, 47.249)
ARM	9	45	80	61.111	12.893	(53.243, 68.979)
BC	9	10	47	21.855	11.852	(14.333, 29.378)
EDLUM	9	55	97	82.887	11.833	(75.515, 89.915)
PH5	9	3.55	5.52	4.5256	.69475	(4.0845, 4.9667)
PH20	9	4.27	5.54	4.7378	.55273	(4.5129, 4.9626)
PH50	9	4.34	5.14	4.7822	.28265	(4.5107, 4.9738)
PH100	9	4.82	5.22	4.8000	.20380	(4.7736, 5.0264)

PSP 4 - INSPECTION POINT 1Site Description

Plot Location: SE17-93-9-W4

Landform:

Genetic Material: Glaciofluvial; sandy

Surface Expression: Undulating; very gentle slopes (2-5%)

Site Features: Mid position of 3-4% slope; northeast aspect; relief about 1 m; rapidly drained; high perviousness; water table at about 115 cm.

Soil Classification: Eluviated Dystric Brunisol

Soil Series: Mildred

Vegetation: Jack pine - blueberry - cowberry - bearberry - grasses - Tichens - Polytrichum

Profile Description

- L - 1.5 to 1 cm; non to slightly decomposed needles and lichens.
- F - 1 to 0 cm; dark brown, slightly to moderately decomposed needles, lichens, and mosses; abrupt, wavy boundary.
- Ae1 - 0 to 7 ( $\pm 1$ ) cm; very pale brown to pink (7.5YR 7/4 m) with dark yellowish brown (10YR 4/5 m) at top; sand; single grain; loose; plentiful, very fine to medium, horizontal roots; about 1% coarse fragments; clear, wavy boundary; pH 4.6.
- Ae2 - 7 to 17 ( $\pm 2$ ) cm; pinkish gray (7.5YR 7/2 m); sand; single grain; loose plentiful, fine to medium, horizontal roots; about 1% coarse fragments; clear, wavy boundary; pH 4.5.
- AB - 17 to 24 ( $\pm 4$ ) cm; light yellowish brown (10YR 6/4 m), yellowish brown (10YR 5/6 m), and other colours; sand; single grain; loose; few, fine to medium, horizontal and oblique roots; 2-3% coarse fragments; clear, irregular boundary; pH 4.5.
- Bm - 24 to 50 ( $\pm 2$ ) cm; yellowish brown (10YR 5/8 m); sand; single grain; loose; few, fine, oblique roots; 3-5%, rounded to subrounded, gravel and cobbles; clear, wavy boundary; pH 4.8.
- BC - 50 to 97 cm; light yellowish brown (10YR 6.5/4 m); faintly blotchy; single grain; loose; very few roots; about 1% coarse fragments; clear, smooth boundary; pH 4.6.
- C - 97 to 110+ cm; yellowish brown (10YR 5/4 m); sand; single grain; loose; no roots; thin band of gravel and cobbles at top of C; pH 4.6.

PSP 4 - INSPECTION POINT 8Site Description

Plot Location: SE17-93-9-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Undulating; very gentle slopes (25%)  
 Site Features: Mid to upper position of 4-5% slope; west aspect; relief about 1-2 m; rapidly drained; high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - blueberry - bearberry - bunchberry - lichens

Profile Description

- LF - 2 ( $\pm$ 1) to 0 cm; dark brown and black; slightly to moderately decomposed needles, lichens, and leaves; few, very fine to fine, horizontal roots; abrupt, wavy boundary.
- Ae1 - 0 to 6 ( $\pm$ 2) cm; light gray (10YR 7/2 m); sand; single grain; loose; plentiful, fine to medium, horizontal roots; 1-2% coarse fragments; clear, wavy boundary; pH 4.8.
- Ae2 - 6 to 16 ( $\pm$ 4) cm; light gray (10YR 7/2 m) some blotches of Bfj material; sand; single grain; loose; plentiful, fine to medium, horizontal roots; 1-2% coarse fragments; abrupt, wavy boundary; pH 4.8.
- Bfj - 16 to 28 ( $\pm$ 4) cm; strong brown (7.5YR 5/6 m); sand; single grain; very friable; some finer material in thin band at Ae2-Bfj contact; few, fine to medium, horizontal and oblique roots; trace of coarse fragments; clear, wavy boundary; pH 5.9.
- Bm - 28 to 49 ( $\pm$ 3) cm; brownish yellow (10YR 6/6 m); faintly blotchy with Bfj colours; sand; single grain; loose; very few, fine, oblique and vertical roots; trace of coarse fragments; pH 5.7.
- BC - 49 to 72 ( $\pm$ 2) cm; yellowish brown (10YR 5.5/5 m); faintly blotchy with Bm colours; sand; single grain; loose; very few roots; trace of coarse fragments; clear, smooth boundary; pH 5.8.
- C - 72 to 110+ cm; yellowish brown (10YR 5.5/4 m); sand; single grain; loose; no roots; trace of coarse fragments; thin, dark band near top of C may contain comminuted tar sand; pH 5.9.



4.1.4 PSP 5

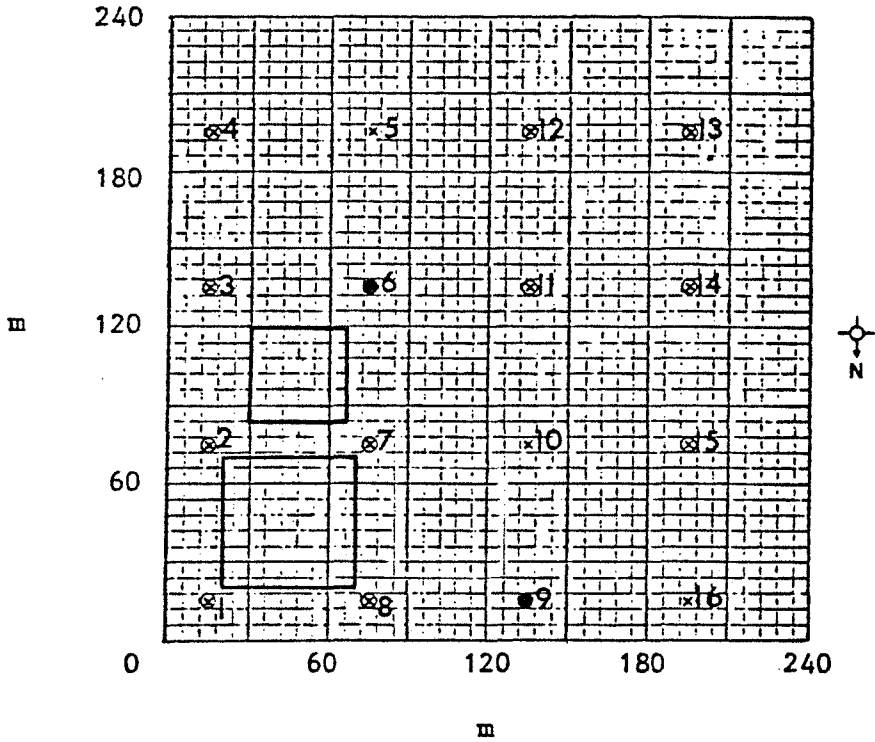


Figure 5. Inspection points in PSP 5

Table 5. Horizon thicknesses and pH in PSP 5.

DESCRIPTIVE MEASURES (S) PLOT:5						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERVAL
LF	13	1	2	1.8823	.48038	(1.4548, 1.9298)
AE	13	2	9	4.8482	1.5720	(4.0885, 5.6237)
AB	13	5	14	8.3077	2.1384	(6.2518, 10.384)
A	13	10	15	14.184	1.7723	(13.278, 15.030)
BM	13	45	75	62.462	8.8187	(55.102, 66.821)
ABM	13	55	80	75.515	10.021	(71.662, 81.569)
BC	13	15	35	18.515	5.8388	(15.728, 21.502)
SDLUM-	13	71	105	85.231	10.101	(80.238, 90.22)
PH5	13	4.87	4.97	4.4038	.27542	(4.2872, 4.5405)
PH20	13	4.85	5.12	4.7438	.18705	(4.5513, 4.9284)
PH50	13	4.86	5.04	4.8254	.13263	(4.7897, 4.9010)
PH100	13	4.70	5.18	4.8015	.12535	(4.6398, 4.9535)

PSP 5 - INSPECTION POINT 6Site Description

Plot Location: SE6, SW5-94-9-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Level  
 Site Features: Level sample site; rapidly drained; high perviousness; slightly stony.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - bearberry - blueberry - lichens

Profile Description

LF - 2 to 0 cm; brown; needles and lichens; very few roots; abrupt, smooth boundary.  
 Ae - 0 to 4 ( $\pm 1$ ) cm; brownish yellow (10YR 5/5 and 6/5 m); blotchy; sand; single grain; loose; abundant, very fine to medium, horizontal roots; 1-2% coarse fragments; clear, wavy boundary; pH 4.1.  
 AB - 4 to 10 ( $\pm 2$ ) cm; brownish yellow (10YR 6/5 m); sand; single grain; loose; abundant, fine to medium, horizontal roots; 1-2% coarse fragments; gradual, wavy boundary; pH 4.5.  
 Bm1 - 10 to 25 ( $\pm 3$ ) cm; yellowish brown (10YR 5.5/7 m); sand; single grain; loose; plentiful, fine to medium, horizontal and oblique roots; 5-10%, rounded to subangular gravels and cobbles in band near top; gradual, wavy boundary; pH 4.7.  
 Bm2 - 25 to 41 ( $\pm 2$ ) cm; yellowish brown (10YR 5/8 m); sand; single grain; loose; few, fine to medium, oblique and vertical roots; 2-3% coarse fragments; clear, wavy boundary; pH 4.9.  
 Bm3 - 41 to 56 ( $\pm 2$ ) cm; yellowish brown (10YR 5.5/7 m) sand; single grain; loose; few, very fine to medium, oblique and vertical roots; trace of coarse fragments; clear, smooth boundary; pH 5.1.  
 BC - 56 to 71 ( $\pm 3$ ) cm; yellowish brown (10YR 5.5/4 m) sand; single grain; loose; very few roots; trace of coarse fragments; clear, smooth boundary; pH 5.0.  
 C - 71 to 110+ cm; pale brown (10YR 6/3 m); sand; single grain; loose; no roots; trace of coarse fragments; pH 5.0.

PSP 5 - INSPECTION POINT 9Site Description

Plot Location: SE6, SW5-94-9-W4  
 Landform:  
 Genetic Material: Glaciofluvial; sandy  
 Surface Expression: Level to undulating (0.5-2.5% slopes)  
 Site Features: Mid position of 0.5% slope; east aspect; rapidly drained;  
 high perviousness; slightly stony.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - blueberry - bearberry - cowberry - lichens

Profile Description

- LF - 2 to 0 cm; brown; slightly to moderately decomposed lichens, needles, and leaves; very few roots; abrupt, wavy boundary.
- Ae - 0 to 6 ( $\pm 1$ ) cm; brown (10YR 4/3 m) to yellowish brown (10YR 5/4 m); blotchy; sand; single grain; loose; abundant, very fine to medium, horizontal roots; 1-2% coarse fragments; clear, wavy boundary; pH 4.1.
- AB - 6 to 15 ( $\pm 1$ ) cm; yellowish brown (10YR 5/4 m); faintly blotchy; sand; single grain; loose; abundant, fine to medium, horizontal roots; 1-2% coarse fragments; clear, wavy boundary; pH 4.7.
- Bm1 - 15 to 32 ( $\pm 2$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; plentiful, fine to medium, horizontal and oblique roots; 5-10%, rounded to subangular gravel and cobbles, with about 20-30% at Bm1 - Bm2 boundary; clear, smooth boundary; pH 4.8.
- Bfj - 32 to 51 ( $\pm 1$ ) cm; strong brown (7.5YR 5/8 m); sand; single grain; loose; few, fine to medium, oblique and vertical roots; 1-2% coarse fragments; gradual, smooth boundary; pH 4.8.
- Bm2 - 51 to 68 ( $\pm 2$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; very few roots; trace of coarse fragments; clear, smooth boundary; pH 4.8.
- BC - 68 to 84 ( $\pm 2$ ) cm; light yellowish brown (10YR 6/4 m); brownish yellow (10YR 6/6 m); blotches and streaks; sand; single grain; loose; no roots; trace of coarse fragments; pH 4.8.
- C - 84 to 120+ cm; pale brown (10YR 6/3 m); sand; single; loose; no roots; trace of coarse fragments; pH 4.8.

4.1.5 PSP 7

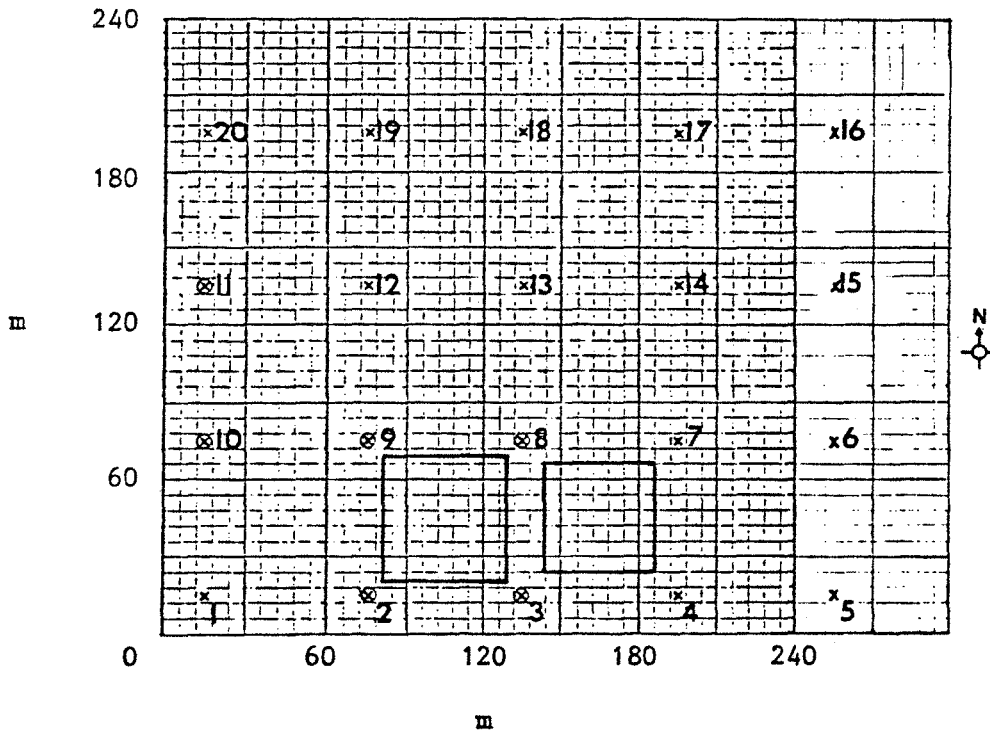


Figure 6. Inspection points in PSP 7.

Table 6. Horizon thicknesses and pH in PSP 7.

DESCRIPTIVE MEASURES	<7> PLOT:7					
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERV
LF	8	2	5	3.9000	1.0954	(2.0988, 5.9012)
AE	8	4	5	5.0000	1.0733	(3.9235, 6.0765)
AB	8	5	10	7.3333	1.7512	(5.5827, 9.0739)
A	8	8	15	12.333	3.0111	(9.3553, 14.8110)
GM	8	58	85	74.500	8.3188	(73.304, 83.696)
ABM	8	85	85	90.833	4.9180	(85.789, 94.877)
BC	8	20	30	22.500	4.1833	(19.089, 25.911)
SDLUM	8	105	120	113.33	5.1840	(109.08, 117.58)
PHE	8	4.54	5.28	4.8733	.31841	(4.6114, 5.1353)
PH20	8	4.82	5.58	5.0383	.28048	(4.8075, 5.2690)
PH50	8	4.35	5.17	4.8157	.28984	(4.5700, 5.0613)
PH100	8	4.59	5.20	4.8887	.17189	(4.8153, 5.0881)

PSP 7 - GENERAL DESCRIPTION \*Site Description

Plot Location: NE12-88-13-W4  
 Landform:  
   Genetic Material: Eolian; sandy  
   Surface Expression: Undulating; very gentle slopes (2-5%)  
 Site Features: Slopes mainly 2-4%; relief about 0.5 to 1 m; rapidly drained;  
   high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Heart  
 Vegetation: Jack pine - cowberry - blueberry - bearberry - alder - lichens

Composite Profile Description

LF - 2 (1) to 0 cm; slightly to moderately decomposed needles and lichens, with  
 feathermosses and leaves in places; abrupt, smooth boundary.  
 Ae - 0 to 5 ( $\pm 3$ ) cm; grayish brown (10YR 5/2 m), or light brownish gray  
 (10YR 6/2 m); sand; single grain; loose.  
 AB - 5 to 13 ( $\pm 3$ ) cm; dark yellowish brown (10YR 4/4 m) to yellowish brown  
 (10YR 5/6 m); sand; single grain; loose.  
 Bm1 - 13 to 40 ( $\pm 5$ ) cm; yellowish brown (10YR 5/4 and 5/6 m) to brownish yellow  
 (10YR 6/5 and 6/6 m); sand; single grain; loose.  
 Bm2 - 40 to 70 ( $\pm 5$ ) cm; yellowish brown (10YR 5/5 to 5/7 m); sand; single grain;  
 loose.  
 Bm3 - 70 to 85 ( $\pm 10$ ) cm; dark yellowish brown (10YR 4/5 m) to yellowish brown  
 (10YR 5/5 m); sand; single grain; loose.  
 BC - 85 to 105 ( $\pm 15$ ) cm; brown (10YR 5/3 m) to yellowish brown (10YR 5/4 m);  
 sand; single grain; loose.  
 C - below 105 ( $\pm 15$ ) cm; brown (10YR 5/3 m) to yellowish brown (10YR 5/4 m); sand;  
 single grain; loose.

\* No samples were taken at this site. The descriptions are a composite of observations from 6 auger holes.

## 4.1.6 PSP 8

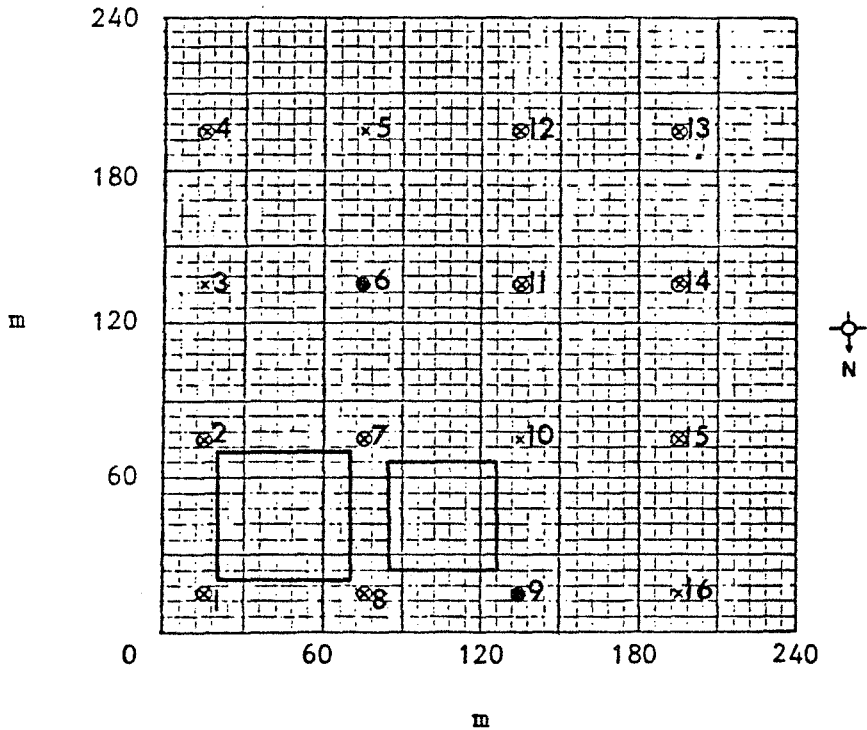


Figure 7. Inspection points in PSP 8.

Table 7. Horizon thicknesses and pH in PSP 8.

DESCRIPTIVE MEASURES (8) PLOT:8						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERVAL
LF	12	1	1	1.0000		
AE	12	1	8	2.1857	1.9824	(1.1327, 3.1986)
AB	12	7	17	11.857	2.8291	(10.195, 13.136)
A	12	9	20	13.833	3.1266	(12.211, 15.455)
BM	12	28	84	51.500	10.220	(46.202, 56.796)
ABM	12	47	75	65.333	10.030	(60.133, 70.532)
BC	12	10	48	26.750	12.672	(20.181, 33.319)
BDLUM	12	65	110	82.083	18.023	(82.740, 101.42)
pH5	12	4.87	5.23	4.8523	.29663	(4.3477, 4.7890)
pH20	12	4.85	5.26	4.8608	.18273	(4.8851, 5.0355)
pH50	12	4.84	5.12	4.8142	.17438	(4.7238, 4.9045)
pH100	12	4.33	5.12	4.7887	.20218	(4.8618, 4.8715)

PSP 8 - INSPECTION POINT 6Site Description

Plot Location: NE1-94-10-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Undulating; nearly level (0.5-2.5% slopes)  
 Site Features: Mid position of 1% slope; relief less than 0.5 m; rapidly drained; high perviousness  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation Jack Pine - bearberry - lichens

Profile Description

- LF - ( $\frac{1}{2}$ -1) to 0 cm; various brown colours; slightly to moderately decomposed needles and lichens; few, fine, horizontal roots; abrupt, wavy boundary.
- Ae1 - 0 to 0.5 cm; 'salt and pepper' colours; sand; single grain; loose; few, fine, horizontal roots; no coarse fragments; clear, wavy boundary.
- Bmj - 0.5 to 6 ( $\pm 2$ ) cm; brown (10YR 4/3 m); small blotches of Ae colours; sand; single grain; loose; plentiful, fine to coarse, horizontal roots; no coarse fragments; clear, wavy boundary; pH 4.5.
- Ae2 - 6 to 13 ( $\pm 2$ ) cm; light yellowish brown (10YR 6/4 m); faintly blotchy; sand; single grain; loose; plentiful, fine to medium, horizontal roots; clear, wavy boundary; pH 4.6.
- AB - 13 to 20 ( $\pm 2$ ) cm; brownish yellow (10YR 6.5/6 m); sand; single grain; loose; few, fine to medium, horizontal and oblique roots; no coarse fragments; clear, smooth boundary; pH 4.7.
- Bm1 - 20 to 46 ( $\pm 2$ ) cm; yellowish brown (10YR 5.5/8 m); sand; single grain; loose; few, fine, oblique roots; 1-3%, well rounded to subrounded coarse fragments; clear, smooth boundary; pH 4.9.
- Bm2 - 46 to 62 ( $\pm 2$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; some blotches of Bm1 colours; very few roots; 2-5% coarse fragments; abrupt smooth boundary; pH 4.9.
- IIBC - 62 to 72 ( $\pm 3$ ) cm; brown (7.5YR 4/4 m); blotchy; sandy loam, with sandy and clayey patches; amorphous; very friable; very few roots; trace of coarse fragments; abrupt, smooth boundary; pH 4.9.
- IIIBC - 72 to 110 cm; light yellowish brown (10YR 6/5 m); sand; single grain; loose; no roots; trace of coarse fragments; clear, smooth boundary; pH 4.8.
- IIIC - 110+ cm; very pale brown (10YR 7/4 m); sand; single grain; loose; no roots; trace of coarse fragments; pH 4.8.

PSP 8 - INSPECTION POINT 9Site Description

Plot Location: NE1-94-10-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy; about 10 cm eolian overlay  
   Surface Expression: Level  
 Site Features: Level site; rapidly drained; high perviousness  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - blueberry - bearberry - lichens

Profile Description

- LF - 1 ( $\pm 0.5$ ) to 0 cm; mixed brown colours; slightly to moderately decomposed lichens and needles; some charcoal fragments; few roots; abrupt, wavy boundary.
- Ae - 0 to 2 ( $\pm 1$ ) cm; light gray (10YR 6/1 m) and dark gray (10YR 3/1 m); 'salt and pepper' colours; sand; single grain; loose; plentiful, very fine to medium, horizontal roots; no coarse fragments; clear, wavy boundary; pH 4.1.
- AB - 2 to 9 ( $\pm 3$ ) cm; brown (10YR 5/3 m), pale brown (10YR 6/3 m), and yellowish brown (10YR 5/4 m); blotchy, with Ae and Bm colours; sand; single grain; loose; plentiful, very fine to medium, horizontal roots; no coarse fragments; clear, wavy boundary; pH 4.6.
- Bm1 - 9 to 28 ( $\pm 2$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; few, fine to medium, oblique roots; 2-3%, rounded, gravelly coarse fragments; gradual, wavy boundary; pH 4.8.
- Bm2 - 28 to 47 ( $\pm 3$ ) cm; reddish yellow (7.5YR 6/6 m); sand; single grain; loose; very few, fine to medium, oblique roots; trace of coarse fragments; clear, wavy boundary; pH 4.9.
- BC - 47 to 66 ( $\pm 2$ ) cm; light yellowish brown (10YR 6.5/4 m); faintly blotchy with Bm colours; sand; single grain; loose; very few roots; no coarse fragments; clear, wavy boundary; pH 4.9.
- IIC - 66 to 78 ( $\pm 2$ ) cm; brown (7.5YR 5/4 m); streaky and blotchy with pink, light brown, and rusty colours; sandy loam; amorphous, soft; very few, fine, oblique roots; no coarse fragments; clear, wavy boundary; pH 4.0.
- IIIC - 78 to 100 $\pm$  cm; light yellowish brown (10YR 6/4 m); sand; single grain; loose; no roots; trace of coarse fragments; pH 4.6.



4.1.7 PSP 9

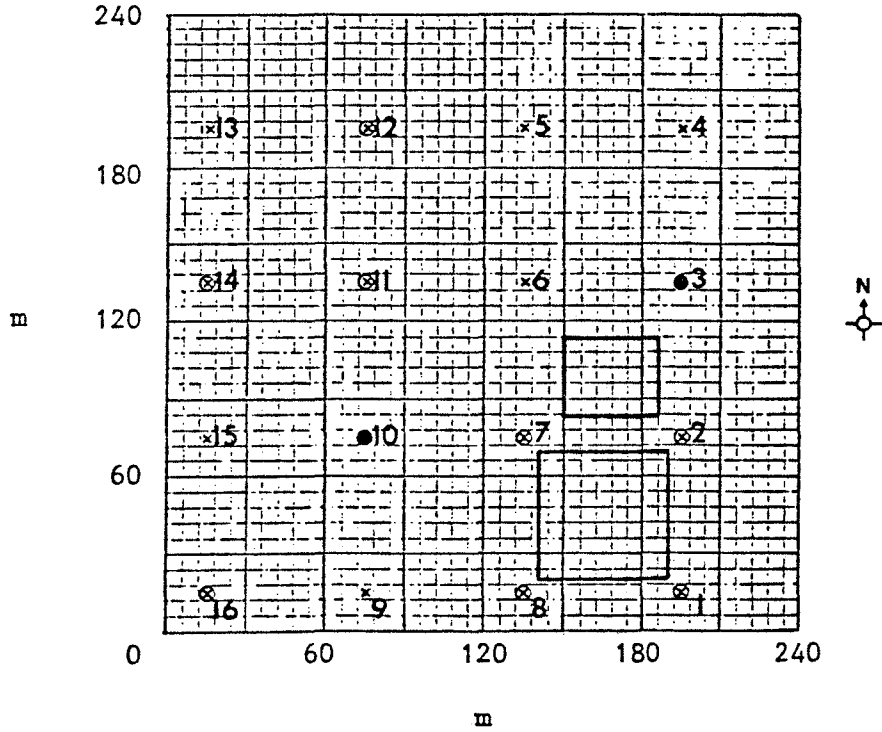


Figure 8. Inspection points in PSP 9.

Table 8. Horizon thicknesses and pH in PSP 9.

DESCRIPTIVE MEASURES <B> PLDT:9						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERVAL
LF	7	2	10	3.8571	3.0783	(1.5882, 6.1180)
AE	8	4	17	8.4444	4.2753	(5.7844, 12.094)
AB	8	3	15	9.8889	3.4440	(7.7841, 12.024)
A	9	12	25	18.333	4.2720	(16.585, 21.881)
BM	9	31	70	55.222	11.958	(48.811, 62.533)
ABM	9	52	85	75.558	11.833	(68.221, 82.890)
BC	9	10	33	21.111	7.1317	(16.591, 25.532)
SOLUM	9	85	110	95.857	9.3541	(90.855, 102.45)
PH5	10	3.73	4.73	4.3050	.34239	(4.1088, 4.5038)
PH20	10	4.44	5.17	4.8320	.25529	(4.5940, 4.9800)
PH50	10	4.52	5.40	5.0230	.29956	(4.8484, 5.1988)
PH100	10	4.47	5.29	5.0880	.23244	(4.9512, 5.2207)

PSP 9 - INSPECTION POINT 3Site Description

Plot Location: NW15-88-13-W4  
 Landform:  
   Genetic Material: Eolian; sandy  
   Surface Expression: Undulating; very gentle slopes (2-5%)  
 Site Features: Mid position of 2% slope; less than 1 m relief; rapidly drained; high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Heart  
 Vegetation: Jack pine - bearberry - lichens - grasses

Profile Description

- LF - 2 to 0 cm; mainly brown; needles and lichens with plenty of fungal hyphae; abundant, very fine to medium, horizontal roots; abrupt, smooth boundary.
- Ahe - 0 to 12 ( $\pm 3$ ) cm; dark brown (10YR 4/3 m); fine sand; single grain; loose; abundant, very fine to medium, horizontal roots; no coarse fragments; clear, wavy boundary; pH 4.7.
- AB - 12 to 21 ( $\pm 2$ ) cm; yellowish brown (10YR 5/4 m); fine sand; single grain; loose; plentiful, very fine to medium, oblique and vertical roots; no coarse fragments; gradual, smooth boundary; pH 5.0.
- Bm1 - 21 to 33 ( $\pm 2$ ) cm; yellowish brown (10YR 5/6 m); fine sand; single grain; loose; few, fine to medium, oblique and vertical roots; no coarse fragments; gradual, smooth boundary; pH 5.2.
- Bm2 - 33 to 52 ( $\pm 2$ ) cm; yellowish brown (10YR 5.5/6 m); fine sand; single grain; loose; few, fine to medium, oblique and vertical roots; no coarse fragments; gradual, smooth boundary; pH 5.2.
- BC - 52 to 85 cm; light olive brown (2.5Y 5/4 m); fine sand; single grain; loose; very few roots; no coarse fragments; gradual, smooth boundary; pH 5.3.
- C - 85 to 100+ cm; light olive brown (2.5Y 5.5/4 m); fine sand; single grain; loose; very few roots; no coarse fragments; pH 5.0.

PSP 9 - INSPECTION POINT 10Site Description

Plot Location: NW15-88-13-W4  
 Landform:  
   Genetic Material: Eolian; sandy  
   Surface Expression: Undulating; nearly level (0.5-2.5% slopes)  
 Site Features: Level sample site; microtopography hummocky in places due to windthrow and feathermoss patches; well drained; high perviousness; water table at 140 cm.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Heart  
 Vegetation: Jack pine - alder - rose - cowberry - bunchberry - lichens - feathermosses

Profile Description

- L - 7 ( $\pm 2$ ) to 3 ( $\pm 1$ ) cm; brown feathermoss remnants; few, very fine and fine, horizontal roots.
- F - 3 ( $\pm 1$ ) to 0 cm; gray; moderately decomposed feathermosses; many fungal hyphae; charcoal fragments at mineral contact; abundant, very fine to medium, horizontal roots; abrupt, wavy boundary.
- Ae - 0 to 9 ( $\pm 1$ ) cm; pale brown (10YR 6/3 m); some brown blotches; fine sand; single grain; loose; plentiful, fine to medium, horizontal and oblique roots; no coarse fragments; clear, wavy boundary; pH 4.7.
- AB - 9 to 12 ( $\pm 1$ ) cm; yellowish brown (10YR 5/4 m); some gray blotches; fine sand; single grain; loose; plentiful, fine to medium, horizontal and oblique roots; no coarse fragments; clear, wavy boundary; pH 5.2.
- Bm1 - 12 to 32 ( $\pm 2$ ) cm; yellowish brown (10YR 5/6 m); fine sand; single grain; loose; plentiful, fine to medium, horizontal and oblique roots; no coarse fragments; gradual, wavy boundary; pH 5.6.
- Bmgj - 32 to 63 ( $\pm 3$ ) cm; light olive brown (2.5Y 5.5/4 m); plentiful, fine and medium, distinct mottles coloured light olive brown (2.5Y 5/6 m) and yellowish brown (10YR 5/6 m); fine sand; single grain; loose; few, fine to medium, oblique and vertical roots; no coarse fragments; gradual, smooth boundary; pH 5.5.
- BCgj - 63 to 90 cm; light olive brown (2.5Y 5/4 m); plentiful, fine and medium, distinct mottles coloured yellowish brown (10YR 5/6 m); fine sand; single grain; loose; very few roots; gradual, smooth boundary; pH 5.7.
- Cgj - 90 to 120 cm; olive brown (2.5Y 4/4 m); plentiful, fine and medium, distinct mottles coloured yellowish brown (10YR 5/6 m); fine sand; single grain; loose; very few roots; gradual, smooth boundary; pH 5.7.
- Cg - 120 to 140 cm; like Cgj, but more strongly mottled.
- IICg - 140+ cm; dark grayish brown (2.5Y 4/2 m); sand; single grain; loose; no roots; no coarse fragments; at water table; pH 7.5.

4.1.8 PSP 10

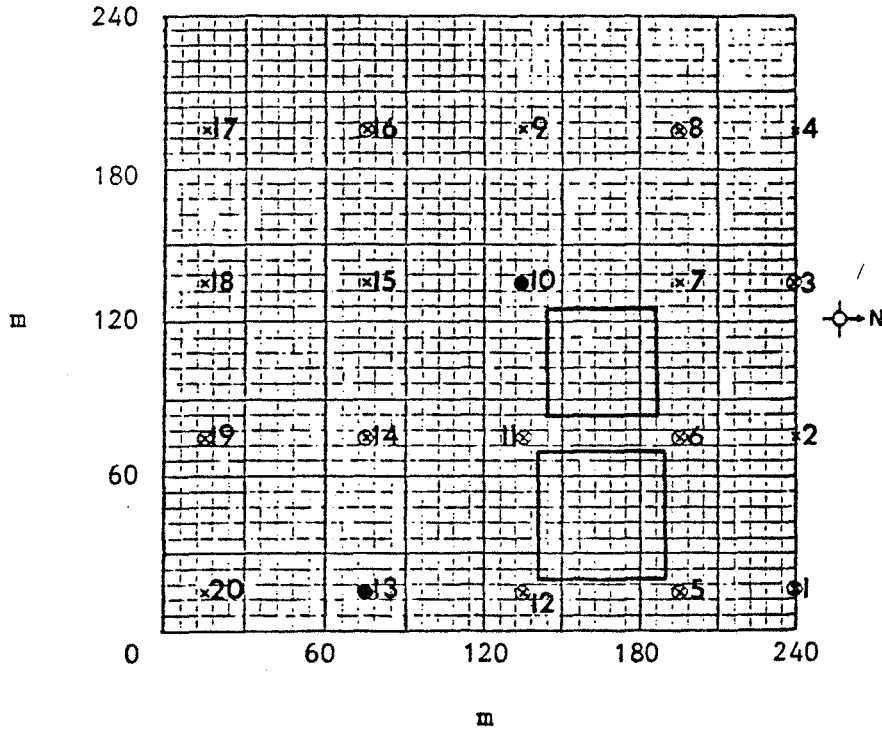


Figure 9. Inspection points in PSP 10.

Table 9. Horizon thicknesses and pH in PSP 10.

DESCRIPTIVE MEASURES <10> PLOT:10

VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERV
LF	11	1	2	1.5182	.40452	(1.5871, 2.0292)
AZ	12	4	7	5.8887	1.1867	(5.0460, 6.2853)
AB	12	7	11	8.7500	1.2681	(8.0822, 9.4178)
A	12	13	18	14.417	1.0636	(13.855, 14.978)
BM	12	48	81	67.250	10.887	(51.601, 72.899)
ABM	12	65	105	82.083	10.544	(71.817, 97.550)
SC	12	15	45	31.083	8.4473	(26.704, 35.463)
SOLUM	12	98	120	112.75	7.5574	(105.53, 119.97)
PH5	12	4.28	4.82	4.3842	.10157	(4.3115, 4.4168)
PH20	12	4.34	4.78	4.5000	.13418	(4.5304, 4.8996)
PH50	12	4.44	5.08	4.7883	.18187	(4.8888, 4.8978)
PH100	12	4.38	5.04	4.6700	.17225	(4.7502, 4.9898)

PSP 10 - INSPECTION POINT 10Site Description

Plot Location: SE1-94-10-W4  
 Landform:  
   Genetic Material: Glacioluvial; sandy  
   Surface Expression: Level to undulating (0.5-2.5% slopes)  
 Site Features: Level sample site; rapidly drained, high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - blueberry - cowberry - lichens - feathermosses

Profile Description

- LF - 2 to 0 cm; brown; slightly decomposed lichens, needles, and leaves; plentiful, very fine to coarse, horizontal roots; abrupt, wavy boundary.
- Ae - 0 to 7 ( $\pm 1$ ) cm; brown (10YR 5/3 m), and 'salt and pepper' colours; sand; single grain; loose; abundant, very fine to coarse horizontal roots; trace of coarse fragments; clear, wavy boundary; pH 4.6.
- AB - 7 to 16 ( $\pm 2$ ) cm; light yellowish brown (10YR 6/4 m); blotchy, with Ae and Bm colours; sand; single grain; loose; abundant; very fine to coarse, horizontal roots; 2-3% coarse fragments; clear, wavy boundary; pH 4.6.
- Bm1 - 16 to 29 ( $\pm 1$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; abundant, very fine to coarse, horizontal and oblique roots; 3-5%, subangular and rounded gravelly fragments; clear, wavy boundary; pH 4.7.
- Bm2 - 29 to 45 ( $\pm 2$ ) cm; brownish yellow (10YR 6/8 m); sand; single grain; loose; plentiful, fine to medium, horizontal and oblique roots; 3-5% gravel; clear, wavy boundary; pH 4.9.
- Bm3 - 45 to 65 ( $\pm 2$ ) cm; yellowish brown (10YR 5.5/6 m); sand; single grain; loose; few, fine to medium, oblique and vertical roots; trace of coarse fragments; clear, smooth boundary; pH 5.1.
- BC - 65 to 105 cm; brownish yellow (10YR 6/5 m); some streaks of Bm3 colours; sand; single grain; loose; no roots; trace of coarse fragments; gradual, smooth boundary; pH 5.1.
- C - 105 to 150+ cm; pale brown (10YR 6/3 m); sand; single grain; loose; no roots; trace of coarse fragments; pH 5.0.

PSP 10 - INSPECTION POINT 13Site Description

Plot Location: SE1-94-10-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Nearly level (0.5-2.5% slopes)  
 Site Features: Mid position of 1% slope; west aspect; less than 0.5 m relief; rapidly drained; high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - blueberry - cowberry - bearberry - lichens

Profile Description

- LF - 2 to 0 cm; dark brown; lichens and needles; plentiful, very fine to medium horizontal roots at mineral contact; abrupt, wavy boundary.
- Ae - 0 to 6 ( $\pm 1$ ) cm; dark grayish brown (10YR 4/2 d), brown (10YR 5/3 d), and light brownish gray (10YR 6/2 d); sand; single grain; loose; abundant, very fine to medium, horizontal and oblique roots; trace of coarse fragments; clear, wavy boundary; pH 4.4.
- AB - 6 to 13 ( $\pm 1$ ) cm; light yellowish brown (10YR 6/4 m) and light brownish gray (10YR 6/2 m); some dark splotches; sand; single grain; loose; abundant, very fine to medium, horizontal and oblique roots; 1-2% coarse fragments; clear, wavy boundary; pH 4.5.
- Bm1 - 13 to 30 ( $\pm 2$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; plentiful, very fine to medium, horizontal and oblique roots; 3-5% coarse fragments; layer of rounded to subangular gravel and cobbles at Bm1-Bm2 boundary; clear, wavy boundary; pH 4.7.
- Bm2 - 30 to 52 ( $\pm 2$ ) cm; yellowish brown (10YR 5.5/8 m); sand; single grain; loose; few, fine to medium, oblique and vertical roots; 3-5% coarse fragments; clear, wavy boundary; pH 4.9.
- Bm3 - 52 to 74 ( $\pm 1$ ) cm; brownish yellow (10YR 6/6 m); sand; single grain; loose; very few roots; 1-2% coarse fragments; clear, wavy boundary; pH 5.0.
- BC - 74 to 98 ( $\pm 2$ ) cm; light yellowish brown (10YR 6/4 m); many faint, brownish yellow (10YR 6/6 m) blotches; sand; single grain; loose; very few roots; 1-2% coarse fragments; clear, wavy boundary; pH 4.9.
- C - 98 to 130+ cm; pale brown (10YR 6/3 m); faintly banded; sand; single grain; loose; no roots; trace of coarse fragments; pH 4.7.

4.1.9 PSP 12

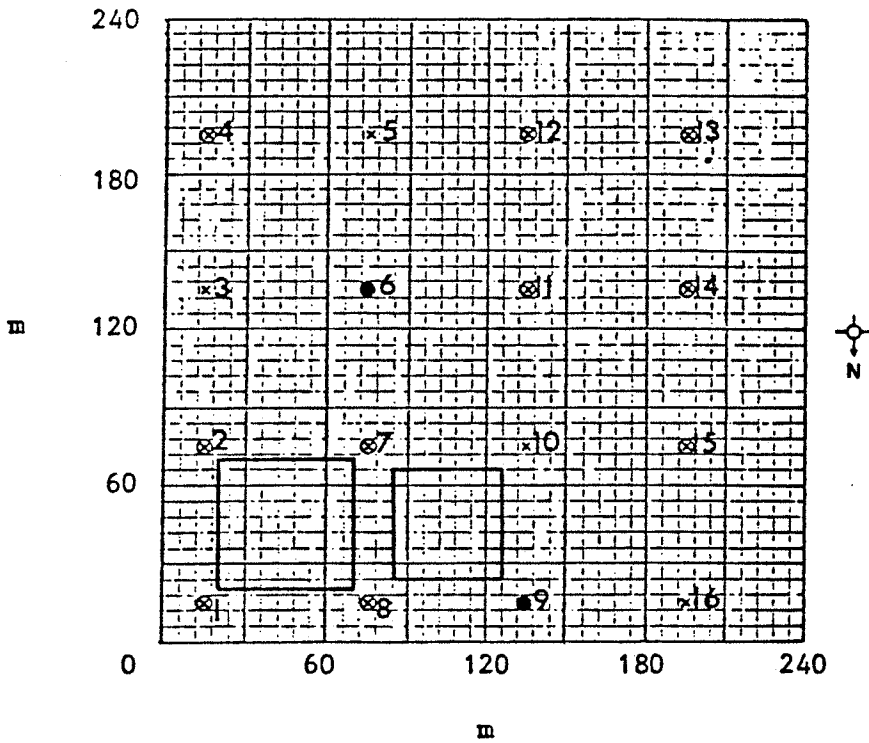


Figure 10. Inspection points in PSP 12.

Table 10. Horizon thicknesses and pH in PSP 12.

DESCRIPTIVE MEASURES <12> PLOT:12						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERV
LF	12	1	5	1.7500	1.1382	(1.1698, 2.3401)
AE	12	1	4	2.9167	1.0826	(2.3649, 3.4704)
AB	12	4	14	9.8887	3.8248	(7.8293, 11.494)
A	12	5	18	12.563	4.1222	(10.446, 14.720)
BM	12	34	81	49.750	12.843	(43.092, 56.405)
ABM	12	50	90	62.333	11.734	(55.250, 68.417)
BC	10	5	45	27.100	14.333	(18.791, 35.405)
SDLUM	10	70	105	91.900	11.080	(85.477, 98.323)
PH5	12	4.13	4.95	4.4575	.24378	(4.3411, 4.5939)
PH20	12	4.48	4.91	4.6392	.12189	(4.6751, 4.7023)
PH50	12	4.28	5.10	4.7733	.24077	(4.8485, 4.8982)
PH100	10	4.42	5.08	4.8040	.18804	(4.7990, 5.0130)

PSP 12 - INSPECTION POINT 6Site Description

Plot Location: NE17-98-8-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Undulating; very gentle slopes (2-5%)  
 Site Features: Mid position of 2-3% slope; northwest aspect; relief about 1 m; rapidly drained; high perviousness.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - cowberry - feathermosses - Polytrichum - lichens

Profile Description

- LF - 1 to 0 cm; variable colours, mainly dark brown; slightly to moderately decomposed needles and lichens; charcoal fragments at mineral contact; few roots; abrupt, smooth boundary.
- Ae - 0 to 3 ( $\pm 1$ ) cm; light brownish gray (10YR 6/2 d); sand; single grain; loose; abundant, very fine to medium, horizontal roots; trace of coarse fragments; clear, wavy boundary; pH 4.1.
- AB - 3 to 15 ( $\pm 1$ ) cm; brownish yellow (10YR 6/5 d); faintly blotchy; sand; single grain; loose; plentiful, fine to medium, horizontal roots; 3-5%, well rounded gravelly fragments composed mainly of tar sands; clear, smooth boundary; pH 4.3.
- Bm1 - 15 to 40 ( $\pm 3$ ) cm; brownish yellow (10YR 5.5/7 m); sand; single grain; loose; few, fine to medium, oblique roots; trace of coarse fragments; clear, wavy boundary; pH 4.4.
- Bm2 - 40 to 51 ( $\pm 2$ ) cm; brownish yellow (10YR 6.5/5 m); faintly blotchy with tar sands; sand; single grain; loose; few, fine, vertical roots; trace of coarse fragments; clear, smooth boundary; pH 4.8.
- IIBC - 51 to 93 ( $\pm 2$ ) cm; brown (10YR 5/3 m); discontinuous, black, horizontal bands, probably tar sands; sand; single grain; loose; few, fine to medium, oblique and vertical roots; 3-5% coarse fragments, mainly tar sands; clear smooth boundary; pH 4.7.
- IIIC - 93 to 130+ cm; light yellowish brown (10YR 6/4 m); faintly blotchy with light brown colours; sand; single grain; loose; no roots; trace of tar sand fragments; pH 4.9.



PSP 12 - INSPECTION POINT 9Site Description

Plot Location: NE17-98-8-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Undulating; gentle slopes (6-9%)  
 Site Features: Mid position of 7% slope; northwest aspect; relief about 2 m; rapidly drained; high perviousness; sampled in bearberry patch.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - bearberry - cowberry - blueberry - lichens - Polytrichum

Profile Description

- LF - 2 ( $\pm$ 1) to 0 cm; variable dark brown colours; slightly to moderately decomposed needles, lichens, and leaves; plentiful, very fine to medium, horizontal roots; abrupt, smooth boundary.
- Ae - 0 to 4 ( $\pm$ 1) cm; gray (10YR 5/1.5 m); 'salt and pepper' colours; sand; single grain; loose; plentiful, very fine to medium, horizontal roots; trace of coarse fragments; clear, wavy boundary; pH 4.1.
- AB - 4 to 13 ( $\pm$ 1) cm; dark yellowish brown (10YR 4/6 m); some light blotches; sand; single grain; loose; plentiful, fine to medium, horizontal roots; trace of coarse fragments; clear, wavy boundary; pH 4.4.
- Bm1 - 13 to 26 ( $\pm$ 2) cm; brownish yellow (10YR 6/7 m); sand; single grain; loose; few, very fine to medium, horizontal and oblique roots; 1-3% tar sand fragments; clear, irregular boundary, with some tonguing into Bm2; pH 4.7.
- Bm2 - 26 to 67 ( $\pm$ 2) cm; brownish yellow (10YR 6/7 m) and light yellowish brown (10YR 6.5/4 m); sand; single grain; loose; plentiful, fine to medium, oblique and vertical roots; trace of coarse fragments; clear, wavy boundary; pH 4.9.
- BC - 67 to 105 ( $\pm$ 5) cm; pale brown (10YR 6.5/3 m) some blotches of Bm2 colours; sand; single grain; loose; no roots; trace of tar sand fragments; clear, smooth boundary; pH 4.9.
- C - 105 to 140+ cm; light brownish gray (10YR 6.5/2 m); blotchy with tar sands; sand; single grain; loose; no roots; trace of tar sand fragments; pH 4.9.

PSP 14 - INSPECTION POINT 9Site Description

Plot Location: SE17-93-9-W4  
 Landform:  
   Genetic Material: Glaciofluvial; sandy  
   Surface Expression: Undulating; nearly level and very gentle slopes (2-5%).  
 Site Features: Mid position of about 2% slope; relief less than 1 m;  
   rapidly drained; high perviousness; water table at 180 cm.  
 Soil Classification: Eluviated Dystric Brunisol  
 Soil Series: Mildred  
 Vegetation: Jack pine - bearberry - cowberry - blueberry - bunchberry -  
northern commondra - toadflax - twinflower - lichens

Profile Description

- L - 3 to 2 cm; dark brown; non to slightly decomposed needles, leaves, lichens, and twigs.  
 F - 2 ( $\pm$ 1) to 0 cm; dark brown to black; slightly to moderately decomposed; plenty of fungal hyphae; some charcoal fragments; abundant, very fine to medium, horizontal roots; abrupt, wavy boundary.  
 Ae - 0 to 9 ( $\pm$ 3) cm; light gray (10YR 7/2 d); plenty of small, yellowish brown blotches; sand; single grain; loose; plentiful, very fine to medium, horizontal roots; trace of coarse fragments; clear, wavy boundary; pH 4.5.  
 AB - 9 to 25 ( $\pm$ 10) cm; light yellowish brown (10YR 6/4 m), and brownish yellow (10YR 6/6 m); many blotches of Bm colour; sand; single grain; loose; few, fine to medium, horizontal and oblique roots; 3-5% coarse fragments; clear, irregular boundary; pH 4.6.  
 Bm1 - 25 to 40 ( $\pm$  3) cm; yellowish brown (10YR 5.5/8 m); sand; single grain; loose; few, very fine and fine, oblique and vertical roots; trace of coarse fragments; gradual, smooth boundary; pH 5.0.  
 Bm2 - 40 to 55 cm; brownish yellow (10YR 6/7 m); sand; single grain; loose; very few roots; trace of coarse fragments; gradual, smooth boundary; pH 5.1.  
 BC - 55 to 100 cm; yellowish brown (10YR 5.5/5 m); sand; single grain; loose; very few roots; trace of coarse fragments; abrupt, smooth boundary; pH 5.0.  
 IIC - 100 to 130 cm; blotchy gray and reddish brown; sandy loam; massive; sticky; very few roots; no coarse fragments; abrupt, smooth boundary; pH 4.8.  
 IIIC - 130 to 180 cm; brown (10YR 5/3 w); sand; single grain; loose; very few roots; trace of coarse fragments.  
 IIICg - 180+ cm; wet, gleyed sand.

4.1.11 PSP 15

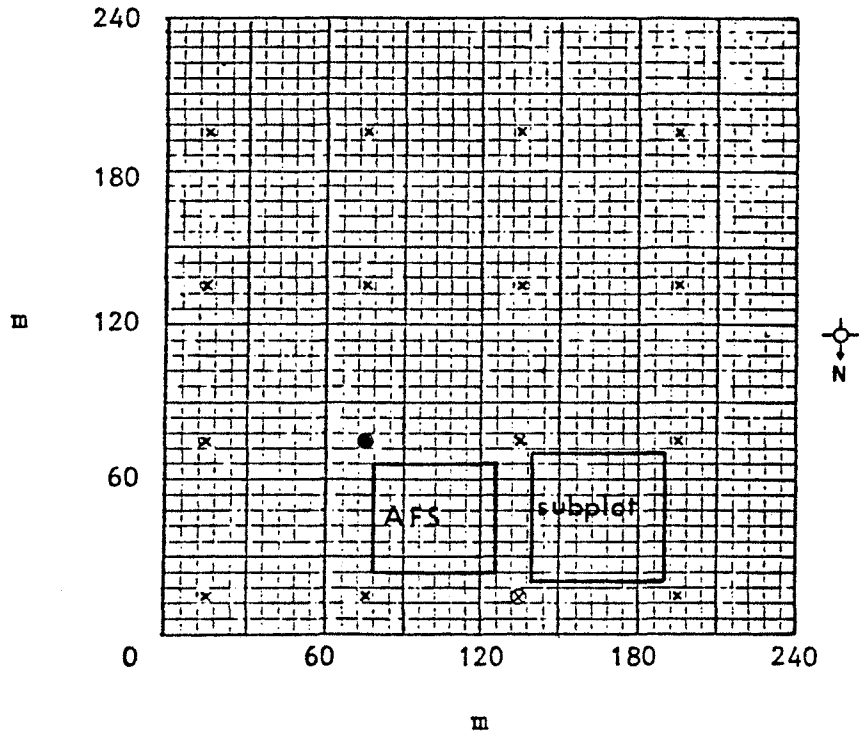


Figure 12. Inspection points in PSP 15.

Table 12. Horizon thicknesses and pH in PSP 15.

DESCRIPTIVE MEASURES (15) PLOT:15						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERVAL
LF	1	3	3	3.0000		
AE	2	28	50	39.0000	15.555	(-30.451, 108.45)
AB	2	0	8	4.5000	5.3640	(-23.912, 32.912)
A	2	37	60	43.500	9.1824	(2.4505, 84.539)
BM	2	21	35	28.000	9.8985	(-18.195, 72.198)
ABM	2	55	85	71.500	19.082	(-13.735, 156.74)
BC	2	17	25	21.000	5.5559	(-4.2550, 46.255)
BDLUM	2	75	110	92.500	24.749	(-17.951, 202.99)
PH5	2	4.25	4.73	4.4950	.33234	(3.0112, 5.9787)
PH20	2	4.59	5.97	5.7800	1.5828	(-1.7324, 13.283)
PH50	2	4.72	5.29	5.5050	1.1102	(.54871, 10.451)
PH100	2	7.28	7.88	7.4750	.28153	(6.3070, 8.6430)

PSP 15 - INSPECTION POINT 6Site Description

Plot Location: NE33-92-9-W4  
 Landform:  
   Genetic Material: Morainal; fine-loamy;  
   Surface Expression: Nearly level (0.5-2.5% slopes)  
 Site Features: Upper position of 0.5% slope; southwest aspect; relief less than 0.5 cm; well drained; high perviousness in surface 35 to 40 cm, medium below; very stony.  
 Soil Classification: Orthic Gray Luvisol  
 Soil Series: Variant of Kinosis  
 Vegetation: Jack pine - aspen - Labrador tea - blueberry - rose - cowberry - bunchberry - twinflower

Profile Description

- LF - 3 (2) to 0 cm; dark brown; moderately decomposed leaves and needles with plenty of fungal hyphae; abundant, fine to medium, horizontal roots; abrupt, wavy boundary.
- Ae1 - 0 to 14 cm; light gray (10YR 7/1 d); very fine sand; strong, medium platy; friable; plentiful, very fine to coarse, horizontal roots; about 10% gravel, cobbles and stones; clear, wavy boundary; pH 4.2.
- Ae2 - 14 to 28 cm; light gray (10YR 7.5/1.5 d); very fine sand; strong, medium platy; friable; plentiful, very fine to coarse, horizontal roots; about 10% gravel and cobbles; some coarse sand lenses; abrupt, wavy boundary; pH 4.4.
- AB - 28 to 37 ( $\pm 1$ ) cm; brown (10YR 5/3 d); partly gray; sandy loam; moderate, medium, subangular blocky to weak, medium platy; very hard; very few clay skins; plentiful, very fine to medium, horizontal and oblique roots; about 20 to 30%, rounded to subangular, gravel, cobbles, and stones; clear, wavy boundary; pH 4.8.
- Bt - 37 to 58 ( $\pm 2$ ) cm; dark brown (7.5YR 3.5/2 m); clay loam; strong, fine, subangular blocky; friable; thin, continuous clay skins on ped surfaces; few, fine to medium, horizontal and oblique roots; about 30%, rounded to subangular, gravel, cobbles, and stones; clear, smooth boundary; pH 5.9.
- BC - 58 to 75 cm; dark grayish brown (10YR 4/2 m); speckled and faintly blotchy; clay loam; moderate, fine, subangular blocky; soft; thin, discontinuous clay skins on ped surfaces; few, fine to medium, oblique roots; 10-20% gravel and cobbles; clear, smooth boundary; pH 7.2.
- C - 75+ cm; very dark grayish brown (2.5YR 3/2 m); some rusty and grayish speckles and blotches; clay loam; massive; soft; no clay skins; very few roots; 10 to 20% coarse gravel and cobbles; pH 7.4.

4.1.12 PSP 16

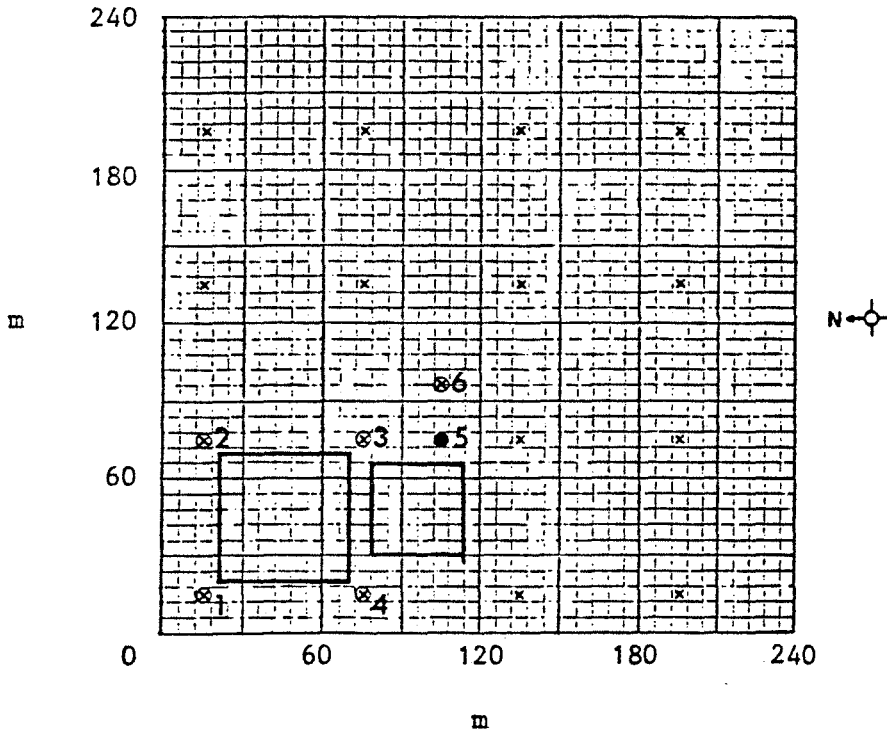


Figure 13. Inspection points in PSP 16.

Table 13. Horizon thicknesses and pH in PSP 16.

DESCRIPTIVE MEASURES (16) PLOT: 16						
VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	.9000 CONFIDENCE INTERVAL
LF	8	3	8	4.6000	1.2247	(3.4925, 5.6075)
AE	8	7	18	12.500	3.3912	(8.7103, 16.290)
AB	8	5	28	15.000	3.1240	(11.3158, 21.683)
A	8	15	40	27.500	8.2185	(20.741, 34.259)
BH	8	15	80	40.833	15.263	(27.453, 54.204)
ABM	8	85	80	83.333	13.663	(57.084, 70.573)
BC	8	10	25	15.833	4.8150	(11.789, 19.877)
.SGLUM	8	70	105	84.167	12.416	(73.952, 94.381)
PNE	8	3.68	4.24	3.8883	.26047	(3.7920, 4.2047)
PN20	8	4.30	4.69	4.4517	.12881	(4.3456, 4.5577)
PN50	8	4.44	5.33	4.7717	.32878	(4.5012, 5.0421)
PN100	8	4.98	7.60	5.4867	1.0623	(5.5919, 7.3414)

PSP 16 - INSPECTION POINT 5Site Description

Plot Location: NE23-92-8-W4  
 Landform:  
 Genetic Material: Morainal and mixed glaciolacustrine; fine-loamy  
 Surface Expression: Level  
 Site Features: Level sample site; moderately well drained; medium perviousness; water table at 115 cm; slightly to moderately stony.  
 Soil Classification: Orthic Gray Luvisol  
 Soil Series: Variant of Kinosis  
 Vegetation: Jack pine - black spruce - cowberry - bunchberry - lichens - feathermosses - blueberry - Labrador tea

Profile Description

- L - 4 to 3 cm; non to slightly decomposed needles, leaves, lichens, and mosses.  
 F - 3 ( $\pm$ 1) to 0 cm; brown; mainly moderately decomposed mosses; plenty of yellow fungal hyphae; abundant, very fine to medium, horizontal roots; abrupt, wavy boundary.  
 Ae - 0 to 13 ( $\pm$ 3) cm; light gray (10YR 7/2 m); faint light brown blotches; sand to loamy sand; weak, medium platy; very friable; plentiful, fine to medium, horizontal roots; 3-5% rounded and subrounded coarse fragments; clear, wavy boundary; pH 4.0.  
 Bmj - 13 to 19 ( $\pm$ 3) cm; yellowish brown (10YR 5/6 m); faintly blotchy; loamy sand; amorphous; very friable; plentiful, fine to medium, horizontal and oblique roots; 3-5% rounded and subrounded coarse fragments; clear, wavy boundary; pH 4.5.  
 AB - 19 to 25 ( $\pm$ 3) cm; pale brown (10YR 6/3 m); blotchy and speckled; loamy sand; weak, medium platy; very friable; clear, wavy boundary; pH 4.4.  
 Bt1 - 25 to 40 ( $\pm$ 2) cm; brown (7.5YR 4.5/4 m); some sandy lenses, and yellowish and rusty splotches; fine sandy clay loam; moderate, fine, subangular blocky; firm; thin clay skins on ped surfaces; few, very fine to medium, horizontal and oblique roots; 3-5%, rounded coarse fragments; clear, smooth boundary; pH 5.3.  
 Bt2 - 40 to 80 cm; brown (10YR 4/3 m) and dark yellowish brown (10YR 4/4 m); clay; strong, fine, subangular blocky; very firm; thin clay skins on ped surfaces; plentiful, very fine to fine, oblique roots; 3-5% rounded to subangular coarse fragments; gradual, smooth boundary; pH 4.6.  
 BC - 80 to 90 cm; dark brown (10YR 3.5/3 m); some dark gray and pink blotches; some sand lenses; clay loam; weak, fine, subangular blocky; firm; very thin, discontinuous clay skins on ped surfaces; very few roots; 3-5% rounded to subangular coarse fragments; gradual, smooth boundary; pH 4.8.  
 C - 90 to 115+ cm; dark brown (10YR 3/3 m); pink and rusty blotches; clay; massive; firm; no roots; 3-5% coarse fragments; pH 4.9.

- 3) A description of the site features and soil morphology of inspection points sampled for laboratory analyses is then presented. In a future update of this report, results of laboratory analyses will accompany these descriptions.

#### 4.2 COMPARISONS OF SOIL PROPERTIES AMONG PERMANENT SAMPLE PLOTS

An analysis of variance was conducted to determine the equality of some soil parameters among the permanent sample plots. The parameters tested were thicknesses of horizons and pH determined at various depths as indicated in the previous section. The analysis of variance (ANOVA) provides an F-test of the quality of different population means. The basic assumptions underlying the F-test are that the various samples are independent and that each has been generated from some underlying normal population with perhaps a different mean, but having the same (unknown) variance.

Prior to doing ANOVA, the normalities of the soil variables of interest were investigated by determining descriptive measures, including skewness and kurtosis, of all samples taken (Table 14). Histograms of frequency distributions of the various properties were also generated (Appendix). These analyses were performed only on sample data from plots with Brunisolic soils. Soils in PSP 15 and PSP 16 are Luvisolic, and were obviously different in many ways from soils of all other plots. This is shown to some extent by the descriptive measures of variables using data from all plots (Table 15). In particular, the pH of lower horizons is seen to have higher skewness and kurtosis when composed with data in Table 14.

The descriptive measures indicate that except for thicknesses of LF and Ae horizons, the populations appear to be more or less normal. Data for LF and Ae thicknesses are strongly skewed to the right and the ANOVA for these probably has little

Table 14.

DESCRIPTIVE STATISTICS FOR HORIZON THICKNESSES AND pH IN PLOTS 2-14

DESCRIPTIVE MEASURES CASES=PLOT:2,3,4,5,7,8,9,10,12,14

VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	SKEWNESS	KURTOSIS	.9000 CONFIDENCE INTERV
3.LF	103	1.0000	10.000	2.1553	1.3182	2.873	11.340	(1.8385, 2.3711)
4.AE	108	1.0000	25.000	5.5185	4.7488	1.894	2.555	(5.7503, 7.2787)
5.AB	107	0.	20.000	8.8785	2.8398	-.280	.507	(8.2455, 9.5105)
12.A	107	2.0000	30.000	15.363	5.3248	-.458	.233	(14.529, 16.237)
8.BM	106	18.000	91.000	56.774	14.511	-.167	-.138	(54.435, 58.113)
13.ABM	105	40.000	105.00	72.238	13.323	-.142	-.530	(70.088, 74.383)
7.BC	104	5.0000	57.000	25.808	11.182	-.617	-.377	(23.883, 27.823)
14.SDLUM	104	55.000	120.00	88.423	14.074	-.425	-.255	(86.132, 100.71)
8.PH5	108	3.5200	5.5200	4.4164	.35325	-.270	.844	(4.3504, 4.4764)
9.PH20	108	3.5100	5.5800	4.5902	.28578	-.091	1.533	(4.5430, 4.7374)
10.PH50	108	3.8800	5.4000	4.7821	.25678	-.447	.353	(4.7505, 4.8258)
11.PH100	104	4.2100	5.2900	4.8553	.22253	-.642	.287	(4.8291, 4.9015)

Table 15.

DESCRIPTIVE STATISTICS FOR HORIZON THICKNESSES AND pH IN ALL PLOTS

DESCRIPTIVE MEASURES

VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STD DEV	SKEWNESS	KURTOSIS	.9000 CONFIDENCE INTERV
3.LF	110	1.0000	10.000	2.2908	1.4100	2.177	7.385	(2.0879, 2.5138)
4.AE	118	1.0000	50.000	7.3878	5.5505	3.076	14.728	(5.3778, 8.3980)
5.AB	115	0.	25.000	8.1217	4.4845	.383	1.851	(8.4313, 8.8121)
12.A	115	2.0000	50.000	18.504	7.0988	1.539	4.245	(15.407, 17.502)
8.BM	114	18.000	91.000	55.430	15.315	-.241	-.117	(53.051, 57.808)
13.ABM	114	40.000	105.00	72.018	13.312	-.097	-.819	(69.950, 74.085)
7.BC	112	5.0000	57.000	25.188	11.054	-.892	-.258	(23.455, 26.920)
14.SDLUM	112	55.000	120.00	87.854	14.382	-.358	-.487	(85.299, 89.808)
8.PH5	118	3.5200	5.5200	4.3880	.35782	-.282	.808	(4.3414, 4.4547)
9.PH20	118	3.5100	5.5700	4.5868	.35100	2.075	12.783	(4.6411, 4.7522)
10.PH50	118	3.8800	5.2900	4.8042	.30058	.705	4.335	(4.7578, 4.8505)
11.PH100	112	4.2100	7.5500	4.8977	.58411	3.223	11.354	(4.8061, 5.0882)



meaning. It should be noted that means of variables from some plots are based on very few samples and any comparisons with other plots should be made carefully.

The results for the ANOVA are given in Tables 16 to 20 and in the Appendix. In addition to the usual ANOVA computations, random effects calculations are provided by the computer program. These are ETA (square root of ETA-SQR), ETA-SQR (the ratio of among stratum sum of squares to total sum of squares), the estimated among-groups (or strata) variance component, and the percentage of variance among groups. These are not discussed and reference to MIDAS documentation should be made for further information. The ANOVA printout also provides a test for equality of variance, a listing of individual plot statistics, and a grand (or combined) sample mean, variance, and standard deviation.

The ANOVA indicated significant differences in means among plots for all variables. The class means and the sizes of the differences among them were then examined. This was done only for solum thicknesses and for the pH data. Duncan's multiple range test was used to compare the means, and data are presented in Table 21. The table presents means of variables in decreasing order of magnitude. Plot numbers not followed by the same letter are significantly different from each other at the 5% level of significance as judged by the test. (Duncan's multiple range test was chosen for ease of computation and was only cursorily examined for appropriateness. The test is apparently adequate, but will have to be examined in more detail in any subsequent studies).

The results for comparison of means show that most sola are not significantly different from each other. However, PSP 4 is relatively shallow, while PSP 7 and PSP 10 are relatively deep. Comparing the depths of sola in these soils may not be very meaningful because changes with depth are very gradual and it is difficult to locate boundaries between B and C horizons in the field. However, differences in depths may provide clues to differences in other soil features such as depth to calcareous or relatively

Table 16. ANOVA for solum thickness.

ANALYSIS OF VARIANCE OF 14.SOLUM N= 104 OUT OF 108  
 SOURCE DF SUM OF SQRS MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 9 7631.9 847.99 6.2414 .0000  
 WITHIN 94 12771. 135.87  
 TOTAL 103 20403. (RANDOM EFFECTS STATISTICS)  
 ETA= .6116 ETA-SQR= .3741 (VAR COMP= 69.432 %VAR AMONG= 33.82)  
 EQUALITY OF VARIANCES: DF= 9, 4688.7 F= 1.8642 .0526

PLOT	N	MEAN	VARIANCE	STD DEV
(2)	4	101.25	122.82	11.087
(3)	18	103.44	185.32	13.876
(4)	9	82.867	133.00	11.533
(5)	13	95.231	102.03	10.101
(7)	6	113.33	26.667	5.1640
(8)	12	92.083	324.81	18.023
(9)	9	86.867	87.500	9.3541
(10)	12	112.75	57.114	7.5574
(12)	10	91.900	122.77	11.080
(14)	11	86.364	65.455	8.0904
GRAND	104	98.423	198.09	14.074

Table 17. ANOVA for pH at 0-5 cm.

ANALYSIS OF VARIANCE OF 8.PH5 N= 108 OUT OF 108  
 SOURCE DF SUM OF SORS MEAN SOR F-STATISTIC SIGNIF  
 BETWEEN 9 2.6636 .29595 2.5318 .0118  
 WITHIN 98 11.466 .11890  
 TOTAL 107 14.118 (RANDOM EFFECTS STATISTICS)  
 ETA= .4343 ETA-SOR= .1886 (VAR COMPE= .16671 -1 VAR AMONG= 12.61)  
 EQUALITY OF VARIANCES: DF= 9, 3896.4 F= 4.4757 .0000

PLDT	N	MEAN	VARIANCE	STD DEV
(2)	3	4.5267	.87233 -1	.29535
(3)	20	4.2100	.11625	.34095
(4)	8	4.8255	.48258	.69475
(5)	13	4.4038	.76408 -1	.27842
(7)	6	4.8733	.10138	.31841
(8)	12	4.5533	.15735	.39668
(9)	10	4.3050	.11723	.34239
(10)	12	4.3642	.10317 -1	.10157
(12)	12	4.4675	.59420 -1	.24376
(14)	11	4.4108	.23428 -1	.15307
GRAND	108	4.4184	.13195	.36326

Table 18. ANOVA for pH at 15-20 cm.

ANALYSIS OF VARIANCE OF 9.PH20 N= 108 OUT OF 108  
 SOURCE DF SUM OF SORS MEAN SOR F-STATISTIC SIGNIF  
 BETWEEN 9 3.8516 .42786 7.6139 .0000  
 WITHIN 98 5.5084 .56208 -1  
 TOTAL 107 9.3600 (RANDOM EFFECTS STATISTICS)  
 ETA= .6415 ETA-SOR= .4115 (VAR COMPE= .35027 -1 VAR AMONG= 36.38)  
 EQUALITY OF VARIANCES: DF= 9, 3896.4 F= 2.3745 .0113

PLDT	N	MEAN	VARIANCE	STD DEV
(2)	3	4.7600	.48300 -1	.21617
(3)	20	4.3875	.82898 -1	.30430
(4)	8	4.7378	.13157	.36273
(5)	13	4.7438	.27808 -1	.16705
(7)	6	5.0383	.78657 -1	.28046
(8)	12	4.8608	.33380 -1	.18273
(9)	10	4.8320	.65173 -1	.25529
(10)	12	4.8000	.18000 -1	.13416
(12)	12	4.8382	.14808 -1	.12169
(14)	11	4.6591	.56088 -1	.23683
GRAND	108	4.6802	.87477 -1	.29576

Table 19. ANOVA for pH at 45-50 cm.

ANALYSIS OF VARIANCE OF 10.PH50 N= 108 OUT OF 108  
 SOURCE DF SUM OF SQRs MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 9 1.9580 .21755 3.7687 .0004  
 WITHIN 98 5.8571 .57726 -1  
 TOTAL 107 7.8151 (RANDOM EFFECTS STATISTICS)  
 ETA= .5071 ETA-SQR= .2571 (VAR EDMPE .15058 -1 VAR AMONG= 20.88)  
 EQUALITY OF VARIANCES: DF= 9, 3896.4 F= 1.7002 .0634

PLOT	N	MEAN	VARIANCE	STD DEV
(2)	3	5.1300	.57000 -2	.75498 -1
(3)	20	4.5970	.87854 -1	.29640
(4)	9	4.7922	.85789 -1	.29286
(5)	13	4.8354	.17544 -1	.13253
(7)	6	4.8187	.89907 -1	.29984
(8)	12	4.8142	.30408 -1	.17438
(9)	10	5.0230	.89734 -1	.29856
(10)	12	4.7883	.36852 -1	.19187
(12)	12	4.7733	.57870 -1	.24077
(14)	11	4.8882	.44396 -1	.21070
GRAND	108	4.7931	.71169 -1	.26678

Table 20. ANOVA for pH at 100 cm.

ANALYSIS OF VARIANCE OF 11.PH100 N= 104 OUT OF 108  
 SOURCE DF SUM OF SQRs MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 9 1.0685 .11872 2.7646 .0066  
 WITHIN 94 4.0365 .42842 -1  
 TOTAL 103 5.1050 (RANDOM EFFECTS STATISTICS)  
 ETA= .4875 ETA-SQR= .2083 (VAR EDMPE .74222 -2 VAR AMONG= 14.74)  
 EQUALITY OF VARIANCES: DF= 9, 2093.2 F= 1.1887 .2876

PLOT	N	MEAN	VARIANCE	STD DEV
(2)	2	5.0150	.84500 -2	.91824 -1
(3)	18	4.7732	.43123 -1	.20756
(4)	8	4.8000	.41575 -1	.20390
(5)	13	4.8015	.15714 -1	.12536
(7)	6	4.9587	.29547 -1	.17189
(8)	12	4.7667	.40878 -1	.20219
(9)	10	5.0860	.54027 -1	.23244
(10)	12	4.8700	.30018 -1	.17326
(12)	10	4.8040	.35360 -1	.18804
(14)	11	4.7427	.89662 -1	.29801
GRAND	104	4.8553	.49553 -1	.22253

Table 21. Comparisons of means among permanent sample plots for solum thickness and pH at various depths.

Solum - cm	pH 0-5 cm	pH 15-20 cm	pH 45-50 cm	pH 100 cm
7 - 113.3 a*	7 - 4.87 a	7 - 5.04 a	2 - 5.13 a	9 - 5.09 a
10 - 112.8 a	8 - 4.55 ab	8 - 4.96 ab	9 - 5.02 ab	2 - 5.02 a
3 - 103.4 ab	2 - 4.53 ab	9 - 4.83 abc	14 - 4.89 b	7 - 4.96 ab
2 - 101.2 b	4 - 4.53 ab	2 - 4.76 bc	5 - 4.84 bc	12 - 4.90 ab
9 - 96.7 b	12 - 4.47 b	5 - 4.74 bc	8 - 4.81 bc	5 - 4.90 ab
14 - 96.4 b	14 - 4.41 b	4 - 4.74 bc	10 - 4.80 bc	4 - 4.90 ab
5 - 95.2 b	5 - 4.40 b	14 - 4.66 c	4 - 4.79 bc	10 - 4.87 ab
8 - 92.1 bc	10 - 4.36 b	12 - 4.64 c	12 - 4.77 bc	3 - 4.77 b
12 - 91.9 bc	9 - 4.30 b	10 - 4.60 cd	7 - 4.62 c	8 - 4.77 b
4 - 82.7 c	3 - 4.21 b	3 - 4.39 d	3 - 4.60 c	14 - 4.74 b

\* Sequence is PSP no., mean value, and significance indicator. PSP's not followed by the same letter are significantly different from each other.

alkaline material. The pH data suggest that shallow depths to materials richer in lime or salts is not likely in any of the plots. Possibly, the depth of soil development in PSP 4 has been influenced by a relatively shallow water table.

PSP 7 has relatively thicker sola and significantly higher pH of surface horizons than other plots. PSP 3 is relatively more acidic in the surface horizons as compared to other plots. These are the only two plots that show some consistency in differences. The soils in PSP 7 have developed in eolian rather than glaciofluvial deposits. Although some differences between soils formed on the two types of materials may be expected, a second plot on eolian materials (PSP 9) does not appear to have soils significantly different from those formed on glaciofluvial materials.

The purpose of these comparisons among permanent sample plots is to indicate variations in soil properties which may influence present studies within the plots, to assist researchers in selecting plots for certain experiments, and to assist in various studies within the ecological monitoring program with researchers using the soil data as they see fit. However, the results of the ANOVA should not be used by themselves in determining similarity of plots because the variables tested are only a few of many important soil properties. Properties already discussed above and those described but not quantified are summarized for individual permanent sample plots below. Only those characteristics which apparently deviate from modal or mean values are indicated.

- PSP 2 - slope and relief relatively high
- whole profile slightly less acidic than in most other plots
  - gravelly to very large (inpenetrable) tar sand fragments occur in soil throughout much of the plots

- PSP 3 - much dust on plant cover and soil surface noticed;  
probable origin is nearby road and Syncrude dike  
- whole profile generally more strongly acidic than in  
other plots
- PSP 4 - has thinnest solum, on the average  
- profile gleyed in parts of plot, especially south side  
- shallow water table in much of plot  
- thin band of relatively fine-textured material occurs  
in profile in parts of the plot
- PSP 5 - gravel and cobble bands in profile in parts of plot  
- some surface stones  
- apparently modal in most features
- PSP 7 - eolian parent material, but probably not very different  
from glaciofluvial  
- deeper solum and higher surface pH than in most other  
plots
- PSP 8 - higher slope and relief than in most other plots  
- bands of finer material occur below 60 cm in parts of  
plot
- PSP 9 - eolian parent material, as in PSP 7  
- water table at about 130 cm in parts of plot  
- relatively thick LF horizon in parts of plot
- PSP 10 - apparently modal in most characteristics  
- thin gravelly layers occur in Bm horizon in some parts  
of plot

- PSP 12 - impenetrable tar sand layer occurs at about 50 cm in parts of the plot  
- higher slope and relief than most plots
- PSP 14 - apparently modal in most characteristics  
- some gravelly fragments and surface stones
- PSP 15 - Orthic Gray Luvisol  
- gleyed in lower part of profile in part of plot  
- fine sandy Ae, clayey B, and fine-loamy C horizons  
- very stony
- PSP 16 - Orthic Gray Luvisol, much like PSP 15  
- calcareous at about 1 m in parts of plot



5. SUMMARY AND CONCLUSIONS

Soils of all plots except PSP 15 and PSP 16 are Eluviated Dystric Brunisols developed in glaciofluvial sands or in eolian deposits. Statistical analyses of horizon thicknesses and pH at various depths indicated that soils of most plots were very similar to each other. Factors to consider in determining soil uniformity among plots are the extreme values found for mean solum thicknesses and pH at various depths, the occurrence of gleyed soils, shallow depth to water table, presence of fine-textured bands, and presence of large amounts of coarse fragments, particularly tar sands. Presence or absence of one or more of these properties could affect the nutrient and moisture status of the soil.

Soils of PSP 15 and PSP 16 were Orthic Gray Luvisols. Their surfaces are as acidic as those of the Brunisols, but their subsurfaces are somewhat less acidic. Their nutrient and moisture status is very different from that of Brunisol due to the clayey nature of the subsoil. Both sites are very stoney and it is likely that any experimental procedures involving soil instrumentation would be very difficult to carry out.

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7. APPENDIX

7.1 DATA TABLES AND FIGURES

Table 22.

DATA FOR HORIZON THICKNESSES AND pH IN PERMANENT SAMPLE PLOTS

PLDT	PROFILE	LF	As	As	A	Bm	Asm	SC	SDLUM	pH5	pH20	pH50	pH100
2.	2.	2.	5.	10.	18.	49.	55.	30.	95.	4.53	4.57	5.12	5.08
2.	3.	2.	5.	7.	13.	45.	55.	57.	115.	4.24	4.54	5.21	4.95
2.	4.	2.	5.	5.	11.	40.	55.	75.	80.	4.51	4.77	5.05	-0.
2.	8.	1.	4.	7.	11.	51.	52.	43.	105.	0.	0.	0.	0.
3.	1.	1.	2.	0.	2.	35.	40.	32.	72.	4.51	4.52	4.89	4.77
3.	2.	3.	5.	0.	8.	57.	55.	30.	85.	3.55	4.23	4.34	4.40
3.	3.	2.	4.	7.	11.	59.	50.	20.	100.	4.47	4.42	4.52	4.52
3.	4.	2.	5.	7.	13.	77.	50.	30.	120.	4.07	4.05	4.53	4.75
3.	5.	4.	10.	15.	25.	55.	50.	40.	120.	3.50	4.00	4.44	4.59
3.	8.	2.	5.	9.	14.	52.	55.	24.	90.	4.05	4.50	4.99	4.55
3.	9.	1.	4.	0.	4.	55.	70.	50.	120.	4.42	4.71	4.99	5.03
3.	10.	3.	2.	12.	14.	52.	55.	49.	115.	4.71	4.23	4.55	4.55
3.	11.	3.	5.	5.	10.	55.	75.	20.	95.	4.22	4.44	4.55	4.93
3.	12.	3.	14.	0.	14.	55.	70.	15.	85.	4.28	4.20	4.50	4.52
3.	13.	2.	5.	7.	12.	53.	55.	30.	95.	3.50	4.51	4.99	5.00
3.	14.	4.	10.	20.	30.	55.	55.	35.	120.	4.27	4.20	4.27	4.74
3.	15.	2.	5.	5.	5.	50.	55.	20.	105.	4.44	4.95	4.70	4.55
3.	17.	2.	5.	7.	13.	77.	50.	15.	105.	4.37	4.49	4.75	4.85
3.	19.	3.	4.	5.	9.	45.	57.	45.	105.	4.40	4.35	4.53	4.89
3.	20.	4.	11.	13.	24.	31.	55.	40.	95.	3.52	3.51	4.47	4.54
3.	22.	4.	12.	0.	12.	73.	55.	35.	120.	3.75	4.59	4.47	5.14
3.	23.	5.	4.	5.	12.	75.	50.	15.	105.	4.25	4.57	4.55	4.57
3.	21.	2.	5.	0.	0.	0.	0.	0.	0.	4.34	4.52	3.55	4.25
3.	25.	0.	5.	7.	12.	0.	0.	0.	0.	4.52	4.19	4.15	0.
4.	1.	1.	17.	8.	25.	25.	50.	47.	97.	4.52	4.53	4.57	4.52
4.	2.	1.	10.	15.	25.	40.	55.	20.	85.	5.07	4.51	5.04	5.05
4.	3.	2.	17.	10.	27.	18.	45.	30.	75.	3.59	4.50	4.55	4.91
4.	5.	2.	15.	9.	25.	55.	50.	15.	95.	4.45	4.54	4.43	4.95
4.	6.	0.	7.	12.	19.	51.	70.	25.	95.	4.50	5.05	5.14	5.04
4.	7.	2.	23.	7.	24.	52.	55.	10.	75.	5.37	4.73	4.94	4.72
4.	8.	2.	18.	0.	15.	34.	50.	22.	72.	5.24	4.54	5.04	5.22
4.	9.	5.	25.	0.	25.	50.	75.	10.	85.	4.05	4.57	4.55	4.51
5.	1.	2.	14.	18.	15.	74.	90.	15.	105.	4.57	4.91	5.00	4.57
5.	2.	1.	5.	11.	15.	51.	77.	25.	102.	4.18	5.12	4.52	4.50
5.	3.	2.	4.	9.	13.	57.	70.	35.	105.	4.27	4.57	4.55	4.54
5.	4.	1.	5.	8.	13.	57.	70.	20.	90.	4.34	4.55	4.54	4.54
5.	5.	2.	4.	5.	10.	45.	55.	15.	71.	4.40	4.75	5.04	5.15
5.	7.	2.	9.	5.	15.	75.	50.	15.	105.	4.48	4.57	4.59	4.55
5.	8.	2.	4.	8.	12.	55.	70.	20.	90.	4.27	4.59	4.55	4.97
5.	9.	2.	5.	9.	15.	53.	55.	17.	85.	4.25	4.51	4.55	4.52
5.	11.	2.	4.	10.	14.	55.	50.	20.	100.	4.52	4.50	4.70	4.70
5.	12.	1.	5.	11.	15.	59.	75.	15.	90.	4.33	4.53	4.54	4.99
5.	13.	2.	5.	9.	15.	55.	50.	15.	95.	4.07	4.52	4.51	4.97
5.	14.	1.	5.	10.	15.	75.	90.	15.	105.	4.55	4.55	4.52	4.57
5.	15.	2.	5.	10.	15.	55.	50.	15.	95.	4.20	4.55	4.54	4.72
7.	2.	3.	4.	8.	12.	73.	55.	30.	115.	4.53	4.55	4.55	4.55
7.	3.	3.	5.	10.	15.	59.	55.	20.	105.	5.28	5.58	4.43	4.55
7.	5.	3.	4.	7.	11.	54.	55.	20.	115.	5.03	4.52	4.42	4.55
7.	8.	5.	4.	5.	10.	55.	95.	20.	115.	4.55	5.05	4.35	5.04
7.	10.	2.	4.	5.	8.	51.	90.	20.	110.	4.54	4.54	5.17	5.20
7.	11.	2.	5.	5.	15.	75.	55.	25.	120.	5.12	4.89	4.57	4.55
8.	1.	1.	17.	15.	42.	45.	50.	45.	105.	5.23	5.12	4.73	4.51
8.	2.	1.	14.	15.	50.	75.	35.	110.	4.70	4.55	4.74	4.49	
8.	4.	1.	14.	15.	40.	55.	25.	80.	5.05	5.07	5.01	4.55	
8.	5.	1.	12.	20.	42.	52.	45.	110.	4.33	4.54	4.54	4.73	
8.	6.	1.	15.	15.	35.	75.	20.	95.	4.50	5.04	4.87	4.33	
8.	7.	1.	10.	10.	54.	75.	35.	110.	4.18	4.55	4.55	4.55	
8.	8.	1.	7.	8.	38.	47.	18.	55.	4.70	4.75	4.54	4.75	
8.	11.	1.	3.	8.	12.	53.	75.	35.	110.	4.38	4.74	4.50	4.55
8.	12.	1.	2.	10.	12.	45.	50.	10.	70.	3.57	4.90	4.75	4.74
8.	13.	1.	2.	10.	12.	43.	55.	10.	85.	4.14	4.57	5.12	5.12
8.	14.	1.	3.	11.	14.	55.	70.	20.	90.	4.54	4.57	4.54	4.54
8.	15.	1.	1.	11.	12.	53.	75.	20.	95.	4.91	5.25	4.90	4.51
8.	1.	2.	4.	11.	15.	70.	55.	20.	105.	4.51	5.03	5.05	5.04
8.	2.	2.	5.	13.	19.	55.	55.	25.	110.	4.50	4.51	4.73	5.17
8.	3.	2.	12.	9.	21.	31.	52.	33.	85.	4.73	5.04	5.40	5.29
8.	7.	2.	5.	15.	20.	50.	70.	20.	90.	4.53	5.02	5.33	5.27
8.	8.	5.	8.	5.	17.	55.	55.	10.	85.	3.54	4.44	4.52	4.47
8.	10.	1.	9.	3.	12.	51.	53.	27.	90.	3.55	5.05	4.70	5.05
8.	11.	0.	17.	5.	25.	50.	55.	15.	115.	3.73	5.17	5.32	5.21
8.	12.	3.	9.	11.	20.	55.	75.	15.	90.	4.54	4.54	5.14	5.14
8.	14.	0.	14.	11.	25.	55.	50.	15.	95.	4.35	4.55	5.15	5.07
8.	16.	0.	0.	0.	0.	0.	0.	0.	0.	4.42	4.55	4.91	5.14
10.	1.	2.	4.	11.	15.	50.	50.	45.	120.	4.30	4.57	4.44	4.55
10.	3.	2.	4.	9.	13.	72.	55.	30.	115.	4.25	4.71	5.00	4.50
10.	5.	1.	5.	9.	15.	50.	75.	30.	105.	4.37	4.79	4.83	4.52
10.	6.	1.	7.	5.	15.	75.	55.	25.	120.	4.30	4.55	4.52	4.35
10.	8.	2.	5.	8.	14.	75.	90.	25.	115.	4.50	4.74	4.75	4.75
10.	10.	2.	7.	9.	15.	49.	55.	40.	105.	4.33	4.43	4.57	5.00
10.	11.	0.	5.	8.	13.	52.	75.	30.	105.	4.27	4.57	4.55	4.54
10.	12.	2.	5.	9.	15.	55.	50.	35.	115.	4.35	4.53	4.57	4.50
10.	13.	2.	4.	7.	13.	52.	75.	23.	95.	4.35	4.50	4.57	4.52
10.	14.	2.	4.	8.	14.	55.	50.	40.	120.	4.35	4.55	4.54	4.55
10.	15.	2.	5.	9.	14.	51.	50.	15.	120.	4.35	4.59	5.05	5.04
10.	18.	2.	7.	7.	14.	55.	50.	35.	115.	4.52	4.34	4.51	4.57
10.	19.	2.	7.	14.	18.	47.	55.	5.	70.	4.55	4.57	4.51	4.52
12.	1.	2.	3.	8.	12.	35.	50.	0.	0.	4.55	4.55	5.00	0.
12.	4.	2.	2.	7.	8.	41.	50.	45.	95.	4.55	4.51	4.57	4.55
12.	5.	1.	3.	12.	15.	35.	51.	43.	94.	4.20	4.51	4.50	5.03
12.	7.	2.	4.	12.	15.	49.	55.	30.	95.	4.58	4.54	4.75	5.03
12.	8.	1.	4.	14.	18.	52.	70.	25.	95.	4.12	4.59	5.10	4.54
12.	9.	2.	4.	9.	13.	54.	57.	38.	105.	4.22	4.52	4.51	5.05
12.	11.	1.	1.	4.	5.	55.	60.	15.	75.	4.54	4.73	4.41	4.59
12.	12.	1.	2.	9.	11.	49.	50.	40.	100.	4.59	4.49	4.74	4.52
12.	13.	1.	4.	5.	8.	51.	70.	20.	80.	4.42	4.70	4.55	4.55
12.	14.	1.	2.	14.	15.	34.	50.	0.	0.	4.40	4.51	4.28	0.
12.	15.	2.	9.	7.	9.	51.	90.	10.	100.	4.25	4.51	4.52	4.57
14.	1.	2.	11.	2.	22.	38.	50.	50.	100.	4.25	4.51	4.59	4.59
14.	2.	2.	10.	10.	20.	55.	75.	25.	100.	4.55	4.52	4.55	4.75
14.	3.	3.	7.	13.	20.	50.	70.	15.	85.	4.37	4.53	4.44	4.53
14.	4.	3.	4.	10.	14.	51.	75.	15.	90.	4.33	4.54	4.70	5.05
14.	5.	3.	5.	12.	20.	50.	70.	20.	90.	4.40	4.57	5.15	4.53
14.	5.	2.	14.	11.	25.	45.	70.	25.	95.	4.52	4.37	5.14	4.51
14.	7.	3.	20.	0.	20.	50.	60.	15.	85.	4.27	4.28	4.55	5.22
14.	8.	4.	15.	5.	21.	39.	50.	25.	115.	4.34	4.57	4.52	4.21
14.	8.	2.	8.	18.	25.	30.	55.	45.	100.	4.58	4.55	5.11	4.55
14.	10.	1.	7.	5.	15.	54.	50.	20.	100.	4.54	4.51	4.75	4.52
14.	11.	2.	7.	15.	22.	45.	70.	30.	100.	4.32	5.11	4.54	4.59
15.	2.	0.	50.	0.	50.	35.	55.	25.	110.	4.25	4.55	4.72	7.29
15.	5.	3.	25.	9.	37.	21.	55.	17.	75.	4.73	4.57	4.29	7.55
15.	1.	3.	15.	9.	25.	35.	50.	15.	75.	4.23	4.59	4.55	5.54
15.	2.	3.	15.	15.	30.	35.	55.	15.	80.	4.15	4.45	5.35	7.50
15.	3.	3.	14.	25.	40.	15.	55.	15.	70.	3.72	4.41	4.54	5.5

## HISTOGRAM - LF THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 3.LF (EACH X= 1)
1.0000	30.1	31 +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
2.0000	46.6	48 +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3.0000	12.6	13 +XXXXXXXXXXXXXXXXXXXX
4.0000	4.9	5 +XXXXX
5.0000	3.9	4 +XXXX
6.0000	1.0	1 +X
7.0000	0.	0 +
8.0000	0.	0 +
9.0000	0.	0 +
10.000	1.0	1 +X
MISSING		5
TOTAL		109 (INTERVAL WIDTH= 1.0000)

## HISTOGRAM - Ae THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 4.AE (EACH X= 1)
1.0000	16.7	18 +XXXXXXXXXXXXXXXXXXXX
3.6667	26.0	27 +XXXXXXXXXXXXXXXXXXXX
5.3333	30.6	33 +XXXXXXXXXXXXXXXXXXXX
8.0000	13.0	14 +XXXXXXXXXXXXXXXXXXXX
11.667	3.7	4 +XXXX
14.333	3.7	4 +XXXX
17.000	4.6	5 +XXXXX
18.667	.9	1 +X
22.333	.8	1 +X
25.000	.8	1 +X
MISSING		1
TOTAL		109 (INTERVAL WIDTH= 2.6667)

## HISTOGRAM - AB THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 5.AB (EACH X= 1)
0.	7.6	8 +XXXXXXXX
2.2222	.9	1 +X
4.4444	6.5	7 +XXXXXXX
5.8887	17.5	18 +XXXXXXXXXXXXXXXXXXXX
8.8889	26.2	27 +XXXXXXXXXXXXXXXXXXXX
11.111	26.2	28 +XXXXXXXXXXXXXXXXXXXX
12.333	8.4	9 +XXXXXXXXXX
15.555	5.6	6 +XXXXXXX
17.775	.8	1 +X
20.000	.8	1 +X
MISSING		2
TOTAL		109 (INTERVAL WIDTH= 2.2222)

## HISTOGRAM - A(Ae+AB) THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 12.A (EACH X= 1)
2.0000	.9	1 +X
5.1111	2.8	3 +XXX
8.2222	8.5	7 +XXXXXXX
11.222	19.6	21 +XXXXXXXXXXXXXXXXXXXX
14.444	29.9	32 +XXXXXXXXXXXXXXXXXXXX
17.555	17.8	18 +XXXXXXXXXXXXXXXXXXXX
20.667	10.3	11 +XXXXXXXXXXXX
23.775	8.3	10 +XXXXXXXXXXXX
26.889	1.8	2 +XX
30.000	.8	1 +X
MISSING		2
TOTAL		109 (INTERVAL WIDTH= 3.1111)

Figure 14. Histograms of horizon thicknesses and pH in permanent sample plots.

## HISTOGRAM - BM THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 6.BM (EACH X= 1)
18.000	1.9	2 +XX
26.111	1.9	2 +XX
34.222	8.5	9 +XXXXXXXX
42.333	8.5	9 +XXXXXXXX
50.444	20.6	22 +XXXXXXXXXXXXXXXXXXXX
58.556	23.6	25 +XXXXXXXXXXXXXXXXXXXX
66.667	17.9	19 +XXXXXXXXXXXXXXXXXXXX
74.778	8.4	10 +XXXXXXXX
82.889	6.6	7 +XXXXXX
91.000	.9	1 +X
MISSING		3
TOTAL		109 (INTERVAL WIDTH= 8.1111)

## HISTOGRAM - A+Bm THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 13.ABM (EACH X= 1)
40.000	.8	1 +X
47.222	7.5	8 +XXXXXXXX
54.444	8.5	9 +XXXXXXXX
61.667	15.1	15 +XXXXXXXXXXXXXXXXXX
68.889	17.0	18 +XXXXXXXXXXXXXXXXXXXX
76.111	15.1	15 +XXXXXXXXXXXXXXXXXXXX
83.333	21.7	23 +XXXXXXXXXXXXXXXXXXXX
90.556	8.4	10 +XXXXXXXX
97.778	3.8	4 +XXXX
105.00	.9	1 +X
MISSING		3
TOTAL		109 (INTERVAL WIDTH= 7.2222)

## HISTOGRAM - BC THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 7.BC (EACH X= 1)
5.0000	1.0	1 +X
10.778	5.8	6 +XXXXXX
16.556	21.2	22 +XXXXXXXXXXXXXXXXXXXX
22.333	32.7	34 +XXXXXXXXXXXXXXXXXXXX
28.111	12.5	13 +XXXXXXXXXXXX
33.889	9.6	10 +XXXXXXXX
39.667	5.8	6 +XXXXXX
45.444	5.7	6 +XXXXXXXX
51.222	1.9	2 +XX
57.000	1.0	1 +X
MISSING		5
TOTAL		108 (INTERVAL WIDTH= 5.7778)

## HISTOGRAM - SOLUM THICKNESSES IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 14.SOLUM (EACH X= 1)
65.000	2.9	3 +XXX
71.111	4.8	6 +XXXX
77.222	3.8	4 +XXXX
83.333	5.8	5 +XXXXX
89.444	12.5	13 +XXXXXXXXXXXX
95.556	20.2	21 +XXXXXXXXXXXXXXXXXXXX
101.67	8.7	9 +XXXXXXXX
107.78	22.1	23 +XXXXXXXXXXXXXXXXXXXX
113.89	8.6	10 +XXXXXXXX
120.00	5.6	10 +XXXXXXXX
MISSING		5
TOTAL		108 (INTERVAL WIDTH= 5.1111)

Figure 14. Continued.

HISTOGRAM - pH AT 0-5 CM IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 8.PH5 (EACH X= 1)
3.5200	1.9	2 +XX
3.7422	5.5	7 +XXXXXXXX
3.9644	5.5	5 +XXXXXX
4.1867	15.5	20 +XXXXXXXXXXXXXXXXXXXX
4.4089	23.3	35 +XXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.6311	22.2	24 +XXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.8533	3.7	4 +XXXX
5.0755	4.5	5 +XXXXX
5.2978	2.8	3 +XXX
5.5200	.8	1 +X
MISSING		1
TOTAL		108 (INTERVAL WIDTH= .22222)

HISTOGRAM - pH AT 15-20 CM IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 9.PH20 (EACH X= 1)
3.8100	.8	1 +X
3.8289	0.	0 +
4.0475	1.9	2 +XX
4.2657	8.3	8 +XXXXXXXXXX
4.4855	22.2	24 +XXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.7044	37.0	40 +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4.9233	15.7	14 +XXXXXXXXXXXXXXXXXXXXXXXXXXXX
5.1422	10.2	11 +XXXXXXXXXXXX
5.3611	.8	1 +X
5.5800	1.9	2 +XX
MISSING		1
TOTAL		108 (INTERVAL WIDTH= .21889)

HISTOGRAM - pH AT 50 CM IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 10.PH50 (EACH X= 1)
3.8800	.8	1 +X
4.0688	0.	0 +
4.2175	2.8	3 +XXX
4.3867	11.1	12 +XXXXXXXXXXXX
4.5555	10.2	11 +XXXXXXXXXXXX
4.7244	21.3	23 +XXXXXXXXXXXXXXXXXXXX
4.8933	27.8	30 +XXXXXXXXXXXXXXXXXXXXXXXXXXXX
5.0622	18.4	21 +XXXXXXXXXXXXXXXXXXXX
5.2311	3.7	4 +XXXX
5.4000	2.8	3 +XXX
MISSING		1
TOTAL		108 (INTERVAL WIDTH= .18889)

HISTOGRAM - pH AT 100 CM IN PLOTS 2-14

MIDPOINT	HIST%	COUNT FOR 11.PH100 (EACH X= 1)
4.2100	1.0	1 +X
4.3300	2.8	3 +XXX
4.4500	5.8	8 +XXXXXX
4.5700	3.8	4 +XXXX
4.6900	13.5	14 +XXXXXXXXXXXX
4.8100	18.3	17 +XXXXXXXXXXXXXXXX
4.9300	27.9	28 +XXXXXXXXXXXXXXXXXXXXXXXXXXXX
5.0500	15.3	17 +XXXXXXXXXXXXXXXXXXXX
5.1700	10.8	11 +XXXXXXXXXXXX
5.2900	1.8	2 +XX
MISSING		5
TOTAL		108 (INTERVAL WIDTH= .12000)

Figure 14. Concluded.

Table 23. ANOVA for LF thickness.

UNIVARIATE 1-WAY ANOVA CASES=PLDT:2,3,4,5,7,8,9,10,12,14

ANALYSIS OF VARIANCE OF 3.LF N= 103 DUT DF 108  
 SOURCE DF SUM OF SQRs MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 8 54.840 6.855 4.6194 .0000  
 WITHIN 93 122.67 1.3191  
 TOTAL 102 177.51 (RANDOM EFFECTS STATISTICS)  
 ETA= .8558 ETA-SQR= .3088 (VAR COMP= .47163 LVAR AMONG= 25.34)  
 EQUALITY OF VARIANCES: DF= 8, 3625.6 F= 6.3048 .0000

PLDT	N	MEAN	VARIANCE	STD DEV
(2)	4	1.7500	.25000	.50000
(3)	18	2.7368	1.2047	1.0976
(4)	8	2.0000	1.7143	1.3093
(5)	13	1.8923	.23077	.48038
(7)	6	3.0000	1.2000	1.0954
(8)	12	1.0000	0.	0.
(9)	7	3.8571	8.4782	3.0783
(10)	11	1.8182	.16384	.40452
(12)	12	1.7500	1.2856	1.1382
(14)	11	2.4545	.87273	.92020
GRAND	103	2.1553	1.7403	1.3182

Table 24. ANOVA for Ae thickness.

ANALYSIS OF VARIANCE OF 4.AE N= 108 DUT DF 109  
 SOURCE DF SUM OF SQRs MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 8 1373.2 171.65 14.381 .0000  
 WITHIN 98 1038.8 10.610  
 TOTAL 107 2412.0 (RANDOM EFFECTS STATISTICS)  
 ETA= .7844 ETA-SQR= .5891 (VAR COMP= 13.381 LVAR AMONG= 55.74)  
 EQUALITY OF VARIANCES: DF= 8, 4880.6 F= 6.8688 .0000

PLDT	N	MEAN	VARIANCE	STD DEV
(2)	4	5.2500	.9167	.95743
(3)	20	5.3000	12.642	3.5556
(4)	9	15.333	40.750	6.3836
(5)	12	4.8482	2.4744	1.5730
(7)	6	5.0000	2.8000	1.6733
(8)	12	2.1667	3.8889	1.9720
(9)	9	9.4444	18.278	4.2753
(10)	12	5.8667	1.3333	1.1547
(12)	12	2.9167	1.1742	1.0836
(14)	11	10.182	20.884	4.5786
GRAND	108	6.5185	22.851	4.7828



Table 25. ANOVA for AB thickness.

ANALYSIS OF VARIANCE OF 5. AB N= 107 OUT OF 109  
 SOURCE DF SUM OF SQRs MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 9 273.24 30.360 2.1462 .0325  
 WITHIN 97 1372.2 14.146  
 TOTAL 106 1645.4 (RANDOM EFFECTS STATISTICS)  
 ETA= .4075 ETA-SQR= .1661 (VAR COMP= 1.5380 LVAR AMONG= 9.81)  
 EQUALITY OF VARIANCES: DF= 9, 4859.1 F= 3.8923 .0001

PLOT	N	MEAN	VARIANCE	STD DEV
(2)	4	7.5000	3.0000	1.7321
(3)	19	8.5315	31.023	5.5598
(4)	9	7.3333	25.500	5.0498
(5)	13	9.3077	4.5641	2.1364
(7)	6	7.3333	3.0667	1.7512
(8)	12	11.667	8.0606	2.8391
(9)	9	9.8889	11.861	3.4440
(10)	12	8.7500	1.8891	1.2881
(12)	12	9.6667	12.424	3.5248
(14)	11	10.273	19.218	4.3839
GRAND	107	8.8785	15.523	3.9399

Table 26. ANOVA for A(Ae+AB) thickness.

ANALYSIS OF VARIANCE OF 12.A N= 107 OUT OF 109  
 SOURCE DF SUM OF SQRs MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 9 1260.8 140.08 7.7890 .0000  
 WITHIN 97 1744.5 17.881  
 TOTAL 106 3005.3 (RANDOM EFFECTS STATISTICS)  
 ETA= .6477 ETA-SQR= .4185 (VAR COMP= 11.582 LVAR AMONG= 38.17)  
 EQUALITY OF VARIANCES: DF= 9, 4859.1 F= 5.2810 .0000

PLOT	N	MEAN	VARIANCE	STD DEV
(2)	4	12.750	5.5033	2.3529
(3)	18	12.842	48.918	6.9941
(4)	9	22.667	25.250	5.0248
(5)	13	14.154	3.1410	1.7723
(7)	6	12.333	9.0667	3.0111
(8)	12	13.833	9.7878	3.1286
(9)	9	19.333	18.250	4.2720
(10)	12	14.417	1.1742	1.0836
(12)	12	12.583	16.982	4.1222
(14)	11	20.455	10.873	3.2974
GRAND	107	15.383	28.352	5.3246

Table 27. ANOVA for Bm thickness.

ANALYSIS OF VARIANCE DF 6.BM N= 106 OUT OF 109  
 SOURCE DF SUM OF SQRS MEAN SQ F-STATISTIC SIGNIF  
 BETWEEN 8 8074.4 1009.3 7.4250 .0000  
 WITHIN 96 13036. 135.78  
 TOTAL 105 22111. (RANDOM EFFECTS STATISTICS)  
 ETA= .6406 ETA-SQR= .4104 (VAR COMP= 83.434 %VAR AMONG= 38.06)  
 EQUALITY OF VARIANCES: DF= 8, 4835.3 F= .78853 .6271

PLDT	N	MEAN	VARIANCE	STD DEV
(2)	4	82.250	87.583	8.2208
(3)	18	80.111	186.10	14.004
(4)	9	38.444	201.78	14.205
(5)	13	82.462	77.769	8.8187
(7)	6	78.800	38.800	6.3166
(8)	12	81.800	104.45	10.220
(9)	9	56.222	142.84	11.956
(10)	12	87.250	118.75	10.897
(12)	12	48.750	184.93	12.843
(14)	11	81.818	133.86	11.574
GRAND	106	56.774	210.58	14.511

Table 28. ANOVA for A(Ae+Ab) + Bm thickness.

ANALYSIS OF VARIANCE DF 13.ABM N= 106 OUT OF 109  
 SOURCE DF SUM OF SQRS MEAN SQ F-STATISTIC SIGNIF  
 BETWEEN 9 8889.7 741.07 5.9437 .0000  
 WITHIN 96 11869. 124.68  
 TOTAL 105 18639. (RANDOM EFFECTS STATISTICS)  
 ETA= .6982 ETA-SQR= .3578 (VAR COMP= 58.945 %VAR AMONG= 32.10)  
 EQUALITY OF VARIANCES: DF= 8, 4835.3 F= .89040 .6329

PLDT	N	MEAN	VARIANCE	STD DEV
(2)	4	88.000	82.867	7.2572
(3)	18	73.000	184.84	13.612
(4)	9	81.111	181.11	12.893
(5)	13	76.615	100.42	10.021
(7)	6	90.833	24.187	4.9180
(8)	12	88.333	100.81	10.030
(9)	9	78.555	140.03	11.823
(10)	12	82.083	111.17	10.544
(12)	12	82.333	137.70	11.734
(14)	11	72.273	81.818	9.0422
GRAND	106	72.236	177.82	13.323

Table 29. ANOVA for BC thickness.

ANALYSIS OF VARIANCE OF 7 BC N= 104 OUT OF 109  
 SOURCE DF SUM OF SQRs MEAN SQR F-STATISTIC SIGNIF  
 BETWEEN 8 2316.3 287.37 2.2054 .0218  
 WITHIN 94 10494. 111.64  
 TOTAL 102 12810. (RANDOMM EFFECTS STATISTICS)  
 ETAF .4252 ETA-SQRF .1808 (VAR COMPE 14.209 %VAR AMONGF 11.29)  
 EQUALITY OF VARIANCES: DF= 9, 4688.7 F= 2.1561 .0220

PLOT	N	MEAN	VARIANCE	STD DEV
(2)	4	36.250	322.25	17.851
(3)	18	30.444	138.03	11.748
(4)	8	21.886	135.78	11.652
(5)	13	18.615	34.090	5.8386
(7)	6	22.500	17.500	4.1833
(8)	12	26.750	160.57	12.672
(9)	8	21.111	60.861	7.1317
(10)	12	31.083	71.356	8.4473
(12)	10	27.100	205.43	14.333
(14)	11	24.091	79.081	8.8833
GRAND	104	25.808	124.37	11.152

ECOLOGICAL MONITORINGTHE RESPONSE OF VEGETATIONAL COMMUNITIES TO AERIAL  
EMISSIONS. PERMANENT SAMPLE PLOTSTERMS OF REFERENCE

## 1. INTRODUCTION

Research addressing the impacts of aerial emissions on components of terrestrial ecosystems to date has concentrated on detailing the chemical form, concentration and distribution of existing aerial emissions and examining the physiological responses of vegetation to varying concentrations of specific contaminants under rigidly controlled laboratory conditions.

The ability to relate the results generated from the above programs in a predictive manner to actual impacts on the terrestrial ecosystem created by the current levels of aerial emissions in the area has not been available. Therefore the development of a monitoring program which would possess an early warning capability closely relating emission levels to ecosystem response is clearly warranted.

The evolution of the concepts and technologies required for the implementation of an accurate, applicable and predictive ecosystem monitoring program capable of detecting impacts on terrestrial ecosystems has not, and will not, be a simple nor inexpensive task.

## 2. GENERAL PROGRAM OBJECTIVE

To develop a terrestrial ecosystem monitoring program which would detect the impact of aerial emissions, originating from the oil sands plants, on the terrestrial ecosystem and relate this impact to changes in the structure and function of the terrestrial ecosystem.

### 3. SPECIFIC PROGRAM OBJECTIVES

1. Determine structural dynamics in the boreal forest and compare these changes to those induced by aerial emissions.
2. Develop sensitive and predictive indicators to aerial emissions (as in early warning) involving process related phenomena and to establish the relationship between changes occurring in these processes and the structure and function of the terrestrial ecosystem.

### 4. BACKGROUND

The initial phase in the development of a research program in support of a terrestrial ecosystem monitoring program involved the establishment of eight reference plots in the Hondo region of Alberta during 1980-81 in an area free from aerial emissions. The establishment of these plots was jointly funded by Alberta Environment and the Natural Science and Engineering Research Council.

The second phase of this program involves the establishment of a series of permanent sample plots during 1981-82 in the Athabasca Oil Sands region of northeastern Alberta. Concurrent with the establishment of these plots will be a detailed vegetational survey.

This project will provide the detailed soil survey of the permanent sample plots in the Athabasca Oil Sands region.

### 5. PROJECT OBJECTIVE

To provide information on the kinds, characteristics, and distribution of soils in ten to twenty permanent sample plots, each of 5 hectares area.

### 6. WORK OUTLINE

Basic soils information on the plots will be obtained by conducting a detailed soil survey at a proposed mapping scale of

1:1000 to 1:2000. The survey will be carried out by a "transect" method and data will be gathered such that statistical procedures can be applied to determine composition and variability of soils within and between plots. Observations in the field will be supported by laboratory analyses. This will be accomplished by the following procedure:

- obtain airphotos and expand to 1:1000 to 1:2000 scale.
- examine airphotos with stereoscope.
- select 3 or 4 transects at each plot and examine soils at specific points along transect.
- examine and record morphological and some chemical soil features, and site features.
- take samples at 2 to 4 sites representative of the dominant soils in each plot.
- analyze samples in the laboratory.
- soil delineations and symbols to be added to airphoto bases by Drafting Section, Alberta Research Council.
- statistical analyses of data.

#### 7. REPORTING

The above information will be presented in the form of maps on airphoto bases, legend, report and tables of data. A draft report is to be submitted by 1 March 1982.

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