

DRILLING WASTE LANDSPREADING FIELD TRIAL

**A JOINT RESEARCH PROJECT
OF
ALBERTA RESEARCH COUNCIL
ESSO RESOURCES CANADA LIMITED**

Report prepared by

T.M. MACYK

F.I. NIKIFORUK

Z.W. WIDTMAN

**ENVIRONMENTAL RESEARCH AND ENGINEERING DEPARTMENT
Alberta Research Council**

April 1992

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	i
LIST OF TABLES	iii
LIST OF FIGURES	iv
LIST OF PLATES	v
EXECUTIVE SUMMARY	vi
ACKNOWLEDGEMENTS	viii
1. INTRODUCTION	1
2. OBJECTIVE	2
3. MATERIALS AND METHODS	3
3.1 Plot Maintenance	3
3.2 Plant Tissue Collection	3
3.3 Yield Determination	3
3.4 Soil Sampling	9
3.5 Climate Monitoring	9
3.6 Methods Of Analysis	9
3.6.1 Drilling Waste and Soil Analyses	9
3.6.2 Methods of Plant Analysis	16
4. RESULTS AND DISCUSSION	17
4.1 Plot Treatments	17
4.2 Climate Data	17
4.2.1 Precipitation	18
4.3 Plot Yield	19
4.4 Field Plot Soil Properties	25
4.4.1 Chemical Properties	25
4.4.2 Saturated Paste Extract Data	32
4.4.2.1 Electrical conductivity (EC) values	37
4.4.2.2 Sodium adsorption ratio (SAR) values	41

	Page
4.4.2.3 Chloride values	41
4.4.3 Total Elemental Analysis Data	46
4.5 Tissue Analysis Data	46
5. SUMMARY	54
5.1 Plot Yield	54
5.2 Field Plot Soil Properties	54
5.2.1 Chemical Properties	54
5.2.3 Total Elemental Analysis Data	56
5.3 Tissue Analysis Data	56
6. CONCLUSIONS	57
6.1 Freshwater Gel	57
6.2 Potassium Chloride	58
6.3 Sodium Chloride	58
7. REFERENCES	59
APPENDIX I. Chemical properties of the soils and soil/waste mixtures in the ESSO field plots in 1991.	61
APPENDIX II. Saturated paste extract data for the soils and soil/waste mixtures in the ESSO field plots in 1991.	65
APPENDIX III. Total elemental analysis data for the soils and soil/waste mixtures in the ESSO field plots in 1991.	87

LIST OF TABLES

Table		Page
1.	Soil samples collected from the individual plots	10
2.	Waste application treatments	18
3.	Yield for the Esso Field Trial plots in June, 1991	20
4.	Comparison of the mean yield values for the Esso Field Trial plots in June 1991 .	21
5.	pH (CaCl ₂) and CaCO ₃ equivalent (%) for the various treatments	28
6.	Mean values for EC, Cl and SAR for the various treatments	33
7.	Elemental constituents of soils	49
8.	Total elemental analysis data for the brome grass tissue collected in the field trial plots in 1991	50
9.	ER (Enrichment Ratio) values for elements in the brome grass tissue for 1988, 1989, 1990 and 1991	51
10.	Summary of degree of limitation relative to EC, SAR and Cl levels in 1988, 1989, 1990 and 1991 for the 0 to 15 cm depth (zone of waste incorporation)	55

LIST OF FIGURES

	Page
Figure	
1. Location of drilling waste landspreading study area	4
2. Location of plot area and waste source sites	5
3. Schematic diagram of experimental design	6
4. Key to plot layout for sample collection and data reporting	7
5. Mean yield values (dry weight) in 1989	22
6. Mean yield values (dry weight) in 1990	23
7. Mean yield values (dry weight) in 1991	24
8. Mean EC values for the FWG5 plots	38
9. Mean EC values for the KCl 4 plots	39
10. Mean EC values for the NaCl 10 plots	40
11. Mean SAR values for the FWG5 plots	42
12. Mean SAR values for the KCl 4 plots	43
13. Mean SAR values for the NaCl 10 plots	44
14. Mean Cl values for the FWG5 plots	45
15. Mean Cl values for the KCl 4 plots	47
16. Mean Cl values for the NaCl 10 plots	48

LIST OF PLATES

	Page
Plate	
1. Harvesting by use of a lawn mower	8
2. Harvesting entire plots results in a tidy experimental site	8
3. Grass growth in the FW5 and FW4 treatments	26
4. Grass growth in the KCl 4 and KCl 5 treatments	26
5. Grass growth in the NaCl 6 and NaCl 10 treatments	27

EXECUTIVE SUMMARY

Drilling associated with the oil and gas industry generates wastes that must be disposed of in an environmentally safe manner. In 1988 a joint research program was developed and implemented by the Alberta Research Council and ESSO Resources Canada Limited to identify the impact of different loading rates of KCl, NaCl, and freshwater gel drilling wastes landspread on Luvisolic soils occurring in the Cold Lake area.

During 1991 five site visits were made to complete various tasks. The plots were harvested on June 25 and 26 and, again, on August 14 and 15 at which time soil sampling was also completed. Plant tissue was collected for analytical purposes on June 25.

Observations, relative to the brome grass growth on the various plot treatments, were made throughout the growing season. The yields obtained in 1991 were relatively similar for the three waste types. There were apparent yield differences between the different treatments for each of the waste types, however only differences for a few of the NaCl treatments were statistically significant.

The soil and soil/waste samples obtained were analyzed for a number of parameters, including pH, CaCO_3 equivalent, soluble ions in saturated paste extracts, and total elemental content.

In 1991 only treatment FW5 might present a very slight limitation to plant growth as a result of pH level in the 0 to 15 cm depth interval. The CaCO_3 equivalent values indicated that none of the treatments would be limiting to plant growth as a result of CaCO_3 levels.

The saturated paste extract data illustrated the changes that occurred in the soils as a result of waste application and the changes that occurred between the 1988, 1989, 1990 and 1991 sampling events. The mean EC values for all plots and all depths prior to waste application were well below 1.0 dS/m suggesting that there was no limitation to plant growth on the basis of EC (Alberta Soils Advisory Committee 1977). Data from the 1991 sampling program indicated that no limitations to plant growth should occur in the 0 to 15 cm depth interval for any of the treatments as a result of EC level.

The mean SAR values for all plots and all depths, prior to waste application, were below 1.0, suggesting that on the basis of SAR levels, the soils presented no limitation to plant growth. The 1991 data indicated that there were no limitations to plant growth on the basis of SAR for all treatments, except a moderate limitation associated with the NaCl 10 treatment. The data,

relative to Cl content in the field plots indicated that a significant amount was leached downward by the fall of 1991.

Elemental content levels increased or decreased slightly as a result of waste addition. Mean values, for the various elements determined, were within the range of values normally found in soils.

The effect of the addition of drilling wastes on the elemental enrichment of the brome grass was demonstrated by the enrichment ratio (ER). The tissue from the treated plots exhibited slightly elevated levels of chloride for all waste types. The addition of boron in waste resulted in tissue copper levels increasing from deficient to normal levels for some of the treatments.

The application of the different wastes at various rates had both positive and negative impacts on the soils and the plants grown thereon. Some conclusions with respect to waste application rates that can be applied were drawn. Determining maximum tolerable loading rates was difficult to do in the absence of guidelines as to how "tolerable" is defined. It was also concluded that liming potential as well as chloride addition should be used for assessing application rates for freshwater gel wastes.

ACKNOWLEDGEMENTS

The authors would like to thank Ms. D. Weiss and Mr. M. Moir of ESSO Resources Canada Limited Research Laboratory (Calgary) and ESSO Resources Canada Limited Cold Lake Operations staff for their assistance and input to the project. We would also like to thank Messrs. D. Thacker, C. Mascher, D. Stein and J. Beres for their assistance in conducting the field work and the Environmental Research and Engineering Laboratory staff (Alberta Research Council) for conducting the analytical work.

1. INTRODUCTION

Drilling associated with the oil industry generates wastes that must be disposed of in an environmentally safe manner. Drilling in the Cold Lake area generates a number of different types of wastes dominated by freshwater gel wastes and potassium chloride (KCl) and sodium chloride (NaCl) types to a lesser extent. Landspreading is one of the disposal options available and loading rate guidelines have been established by the Energy Resources Conservation Board (ERCB 1975).

The Alberta Research Council had conducted research into sampling and characterization strategies to characterize major drilling waste types on a province wide basis (Macyk et al. 1989b). Greenhouse work was conducted to assess the impact of these wastes on soils and plants. Field studies designed to validate and calibrate the greenhouse results are very helpful from an operations standpoint to define maximum or tolerable loading on the basis of waste type.

As a result a joint program was developed by the Alberta Research Council and ESSO Resources Canada Limited and undertaken in the Cold Lake area in 1988. This report describes the results of the research conducted in 1991.

2. OBJECTIVE

The objective of the experiment is to identify the impact of different loading rates of KCl, NaCl, and freshwater gel drilling wastes landsread on Luvisolic soils commonly occurring in the Cold Lake area. Emphasis will be placed on determining maximum tolerable loading rates.

3. MATERIALS AND METHODS

This section describes the procedures used in collecting tissue samples, determining yield and sampling the soils and waste/soil mixtures associated with the plots established in 1988 (Macyk et al. 1989a).

Figures 1 to 4 illustrate the location of the study area as well as the experimental design and key to plot layout for the purposes of sample collection and data reporting.

3.1 PLOT MAINTENANCE

Five site visits were made during the year to complete various tasks. While on site, weed control particularly in the border areas between plots was undertaken. During harvest operations additional rock and root picking was undertaken.

Fertilizer was applied at a rate of 130 kg/ha of 35-15-0 on May 7, 1991.

3.2 PLANT TISSUE COLLECTION

Tissue from the brome grass was collected on June 25, 1991. Approximately 30 percent of the crop was headed at the time of sampling. It appeared again in 1991 that a higher proportion of the crop was headed in the plots with the higher waste application rates as compared to the lower rate and control plots.

Plant material was collected from several locations within each plot and the samples were transported to the laboratory in paper bags and dried at 70°C for 24 hours prior to grinding and analysis.

3.3 YIELD DETERMINATION

The plots were harvested on June 25 and 26, 1991. A second harvest was completed August 14 and 15 to ensure that the plots are relatively residue free in the spring of 1992.

The harvesting was done by use of a lawn mower so that all plant material from each plot could be removed (Plate 1). Harvesting the entire plot removed any bias from randomly selecting smaller unit areas within each plot and the use of a mower set at a given height ensured, to the greatest extent possible, uniformity in harvest. Furthermore, harvesting entire plots results in a neat and tidy experimental area for subsequent monitoring events (Plate 2).

All material from each plot was weighed to determine the fresh weight. A subsample of this fresh material was weighed and transported to the laboratory for drying so that a dry weight could be determined for each plot.

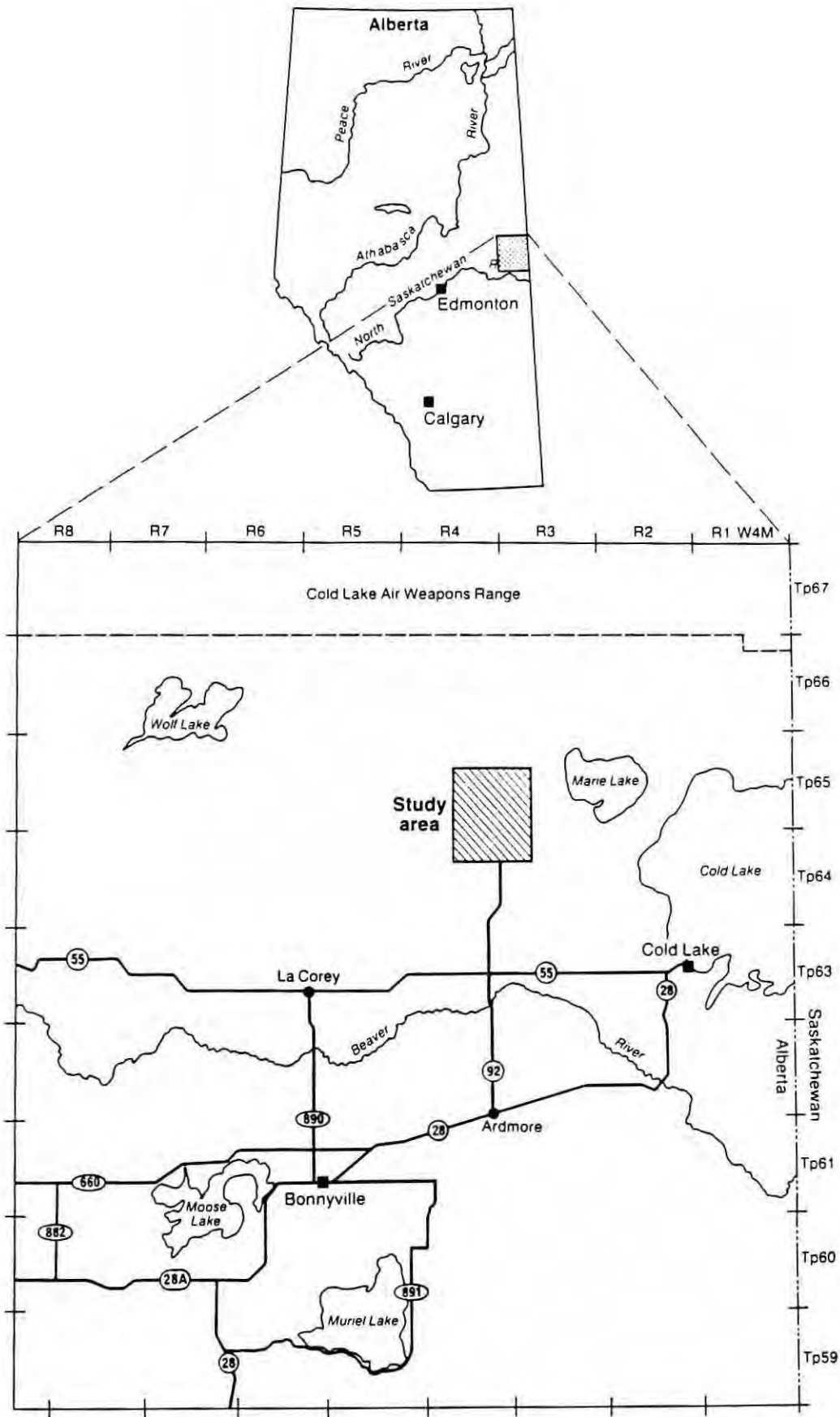


Figure 1. Location of drilling waste landspreading study area.

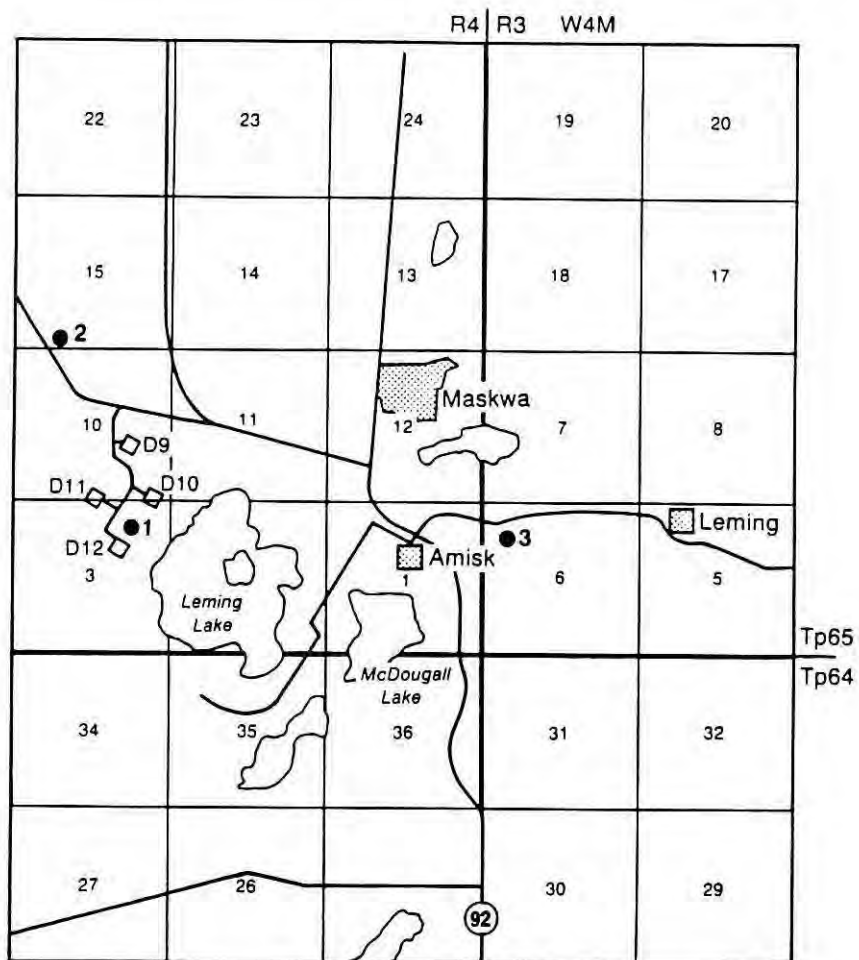


Figure 2. Location of plot area and waste source sites.

- 1 - Plot location
- 2 - NaCl sump site
- 3 - Freshwater gel sump site

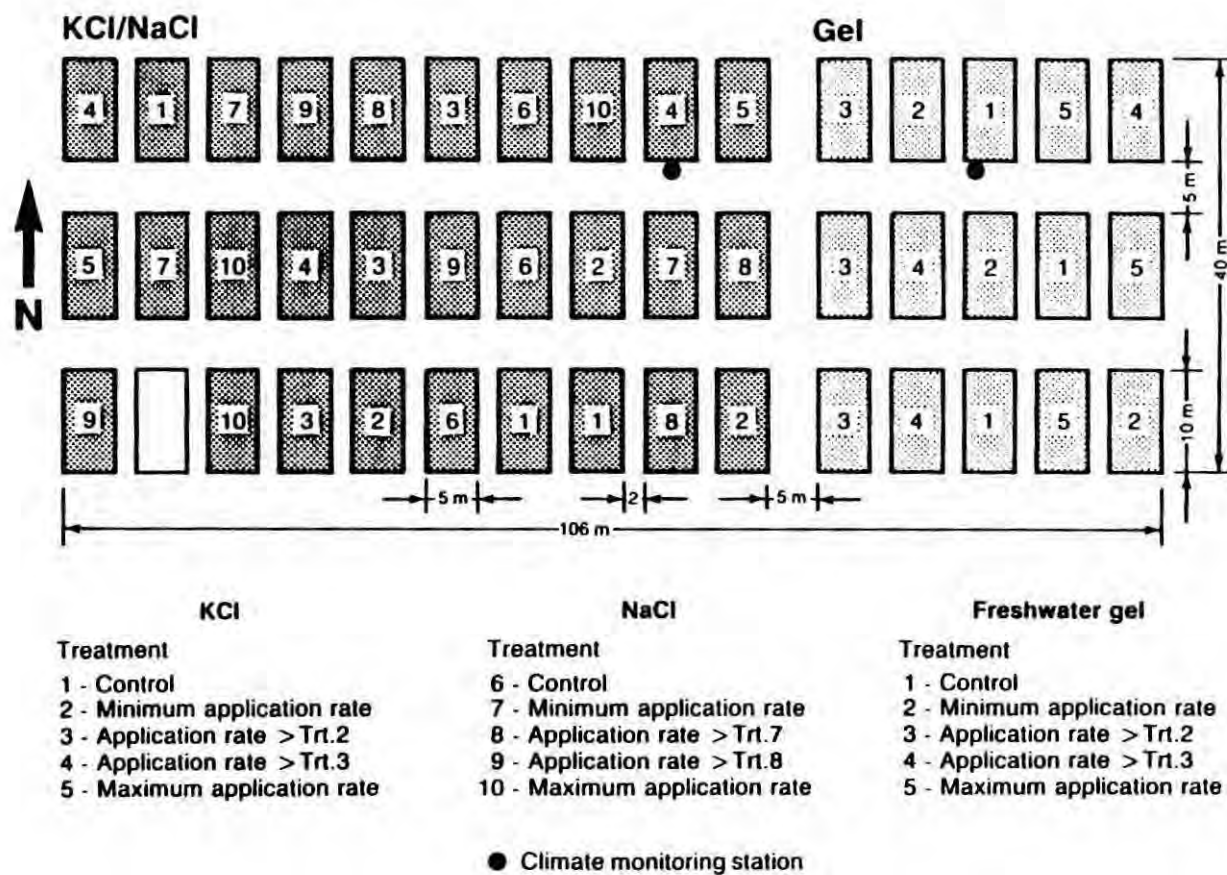


Figure 3. Schematic diagram of experimental design.

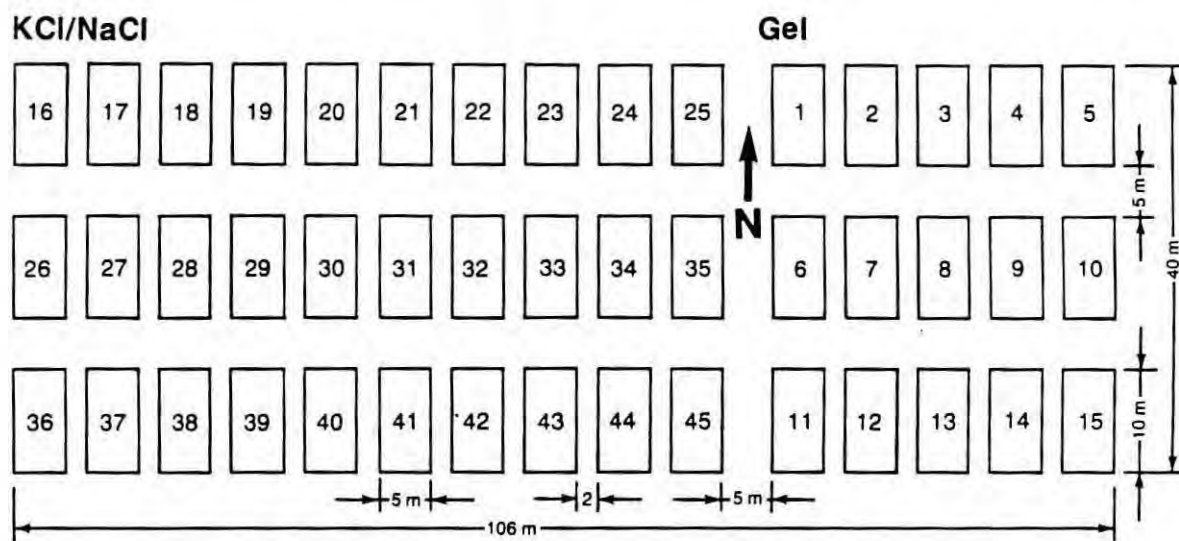


Figure 4. Key to plot layout for sample collection and data reporting.

Plate 1. Harvesting by use of a lawn mower.

Plate 2. Harvesting entire plots results in a tidy experimental site.

3.4 SOIL SAMPLING

Soil sampling was completed August 14 and 15, 1991. Samples from the 0 to 15 cm depth interval were taken from each plot. In some plots a composite sample of five locations was obtained and in selected plots five individual samples were collected to assess degree of variability of the chemical parameters. Use of a truck mounted core sampling unit allowed for sampling of the 15 to 30 cm, 30 to 45 cm, 45 to 60 cm, 60 to 75 cm, 75 to 90 cm, and additional depth intervals to 150 cm at some locations. Details regarding sample distribution are provided in Table 1.

3.5 CLIMATE MONITORING

Climate monitoring equipment installed at the experimental site in 1989 was maintained during 1991. Data collection included the measurement of air and soil temperature, precipitation, wind speed and direction, solar radiation and relative humidity. Rainfall amount and intensity was also measured.

3.6 METHODS OF ANALYSIS

This section describes the methods used for analysis of the soils, soil and waste mixtures, and the tissue collected.

3.6.1 Drilling Waste and Soil Analyses

Soil pH was measured in a paste (Doughty 1941) and in a 2:1 slurry of 0.01 M CaCl_2 (Peech 1965). Total carbon content was measured with a LECO CR12 carbon analyser (Leco Corporation 1979), and CaCO_3 equivalent by acid dissolution (Bascomb 1961). Saturated pastes were prepared according to the USDA Soil Salinity Laboratory method (USDA 1954; Rhoades 1982); were extracted and the extracts filtered through a 0.45 mm filter and analyzed for pH, electrical conductivity, alkalinity, chloride, and for soluble salts (Na, K, Ca, Al, Cr, Fe, V, Ti, Cd, Cu, Pb, Zn, Mn, Mg, Li, Sr, B, Ba, P, S, Mo, Ni, Se, As, Co, Si) using an ARL model 3680 Simultaneous Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES). Cation exchange capacity (CEC) and extractable cations were determined by extraction with a normal (1 M at pH 7.0) ammonium acetate solution (Holmgren et al. 1977), where NH_4 ions were determined by a Tecator Kjeltac Auto 1030 Analyser distillation and titration unit and the exchangeable ions by the ICP-AES.

Table 1. Soil samples collected from the individual plots.

PLOT	RATE	DEPTH	1991 Sample Number
1	FWG 3	0 to 15	TME 1
1		15 to 30	TME 2
1		30 to 45	TME 3
1		45 to 60	TME 4
1		60 to 75	TME 5
2	FWG 2	0 to 15	TME 6
3	FWG 1	0 to 15	TME 7
4*	FWG 5	0 to 15	TME 8 to TME 12
5	FWG 4	0 to 15	TME 13
5		15 to 30	TME 14
6	FWG 3	0 to 15	TME 15
7	FWG 4	0 to 15	TME 16
7		15 to 30	TME 17
7		30 to 45	TME 18
7		45 to 60	TME 19
7		60 to 75	TME 20
7		75 to 90	TME 21
7		90 to 110	TME 22
8	FWG 2	0 to 15	TME 23
8		15 to 30	TME 24
9	FWG 1	0 to 15	TME 25
10*	FWG 5	0 to 15	TME 26 to TME 30
10*		15 to 30	TME 31 to TME 35
10		30 to 45	TME 36
10		45 to 60	TME 37
10		60 to 75	TME 38
10		75 to 90	TME 39
10		90 to 105	TME 40
10		105 to 115	TME 41
11*	FWG 3	0 to 15	TME 42 to TME 46
12	FWG 4	0 to 15	TME 47

Table 1 (continued).

PLOT	RATE	DEPTH	1991 Sample Number
13	FWG 1	0 to 15	TME 48
13		15 to 30	TME 49
13		30 to 45	TME 50
13		45 to 60	TME 51
13		60 to 75	TME 52
13		75 to 90	TME 53
13		90 to 105	TME 54
14	FWG 5	0 to 15	TME 55
14		15 to 30	TME 56
14		30 to 45	TME 57
14		45 to 60	TME 58
14		60 to 75	TME 59
14		75 to 90	TME 60
14		90 to 105	TME 61
15	FWG 2	0 to 15	TME 62
16*	KCl 4	0 to 15	TME 63 to TME 67
16*		15 to 30	TME 68 to TME 72
16		30 to 45	TME 73
16		45 to 60	TME 74
16		60 to 75	TME 75
16		75 to 90	TME 76
16		90 to 110	TME 77
17	KCl 1	0 to 15	TME 78
18	NaCl 7	0 to 15	TME 79
19*	NaCl 9	0 to 15	TME 80 to TME 84
19*		15 to 30	TME 85 to TME 89
19		30 to 45	TME 90
19		45 to 60	TME 91
19		60 to 75	TME 92
19		75 to 90	TME 93
19		90 to 110	TME 94
19		105 to 120	TME 94a
19		120 to 140	TME 94b
20	NaCl 8	0 to 15	TME 95
21*	KCl 3	0 to 15	TME 96 to TME 100

Table 1 (continued).

PLOT	RATE	DEPTH	1991 Sample Number
22	NaCl 6	0 to 15	TME 101
22		15 to 30	TME 102
22		30 to 45	TME 103
22		45 to 60	TME 104
22		60 to 75	TME 105
22		75 to 90	TME 106
22		90 to 105	TME 107
22		105 to 120	TME 108
22		120 to 130	TME 109
23*	NaCl 10	0 to 15	TME 110 to TME 114
23*		15 to 30	TME 115 to TME 119
23		30 to 45	TME 120
23		45 to 60	TME 121
23		60 to 75	TME 122
23		75 to 90	TME 123
23		90 to 105	TME 124
23		105 to 120	TME 125
23		120 to 140	TME 126
24	KCl 4	0 to 15	TME 127
25*	KCl 5	0 to 15	TME 128to TME 132
25*		15 to 30	TME 133 to TME 137
25		30 to 45	TME 138
25		45 to 60	TME 139
25		60 to 75	TME 140
25		75 to 90	TME 141
25		90 to 105	TME 142
25		105 to 120	TME 143
25		120 to 135	TME 144
25		135 to 150	TME 144a
25		150 to 165	TME 144b
25		165 to 180	TME 144c
25		180 to 195	TME 144 d
25		195 to 210	TME 144e
26	KCl 5	0 to 15	TME 145
26		15 to 30	TME 146
27*	NaCl 7	0 to 15	TME 147 to TME 151
27		15 to 30	TME 152

Table 1 (continued).

PLOT	RATE	DEPTH	1991 Sample Number
28*	NaCl 10	0 to 15	TME 153 to TME 157
28*		15 to 30	TME 158 to TME 162
28		30 to 45	TME 163
28		45 to 60	TME 164
28		60 to 75	TME 165
28		75 to 90	TME 166
28		90 to 105	TME 167
28		105 to 120	TME 168
28		120 to 135	TME 169
28		135 to 150	TME 170
29	KCl 4	0 to 15	TME 171
29		15 to 30	TME 172
29		30 to 45	TME 173
29		45 to 60	TME 174
29		60 to 75	TME 175
29		75 to 90	TME 176
29		90 to 105	TME 177
29		105 to 120	TME 178
29		120 to 135	TME 179
30	KCl 3	0 to 15	TME 180
31*	NaCl 9	0 to 15	TME 181 to TME 185
31*		15 to 30	TME 186 to TME 190
31		30 to 45	TME 191
31		45 to 60	TME 192
31		60 to 75	TME 193
31		75 to 90	TME 193a
31		90 to 105	TME 193b
31		105 to 120	TME 193c
31		120to 135	TME 193d
31		135 to 150	TME 193e
32	NaCl 6	0 to 15	TME 194
33	KCl 2	0 to 15	TME 195
34*	NaCl 7	0 to 15	TME 196 to TME 200
34		15 to 30	TME 201

Table 1 (continued).

PLOT	RATE	DEPTH	1991 Sample Number
35*	NaCl 8	0 to 15	TME 202 to TME 206
35		15 to 30	TME 207
35		30 to 45	TME 208
35		45 to 60	TME 209
35		60 to 75	TME 210
35		75 to 90	TME 211
35		90 to 105	TME 212
35		105 to 120	TME 212a
35		120 to 135	TME 212b
36*	NaCl 9	0 to 15	TME 213 to TME 217
36		15 to 30	TME 218
37	KCl	0 to 15	TME 219
38*	NaCl 10	0 to 15	TME 220 to TME 224
38*		15 to 30	TME 225 to TME 229
38		30 to 45	TME 230
38		45 to 60	TME 231
38		60 to 75	TME 232
38		75 to 90	TME 233
38		90 to 105	TME 234
38		105 to 120	TME 235
38		120 to 140	TME 236
39	KCl 3	0 to 15	TME 237
40	KCl 2	0 to 15	TME 238
41	NaCl 6	0 to 15	TME 239
42*	KCl 1	0 to 15	TME 240 to TME 244
43	KCl 1	0 to 15	TME 245
43		15 to 30	TME 246
43		30 to 45	TME 247
43		45 to 60	TME 248
43		60 to 75	TME 249
43		75 to 90	TME 250
43		90 to 105	TME 251
43		105 to 120	TME 252
43		120 to 135	TME 253

Table 1 (concluded).

PLOT	RATE	DEPTH	1991 Sample Number
44*	NaCl 8	0 to 15	TME 254 to TME 258
44*		15 to 30	TME 259 to TME 263
44		30 to 45	TME 264
44		45 to 60	TME 265
44		60 to 75	TME 266
44		75 to 90	TME 267
44		90 to 105	TME 268
44		105 to 120	TME 269
44		120 to 135	TME 270
44		135 to 150	TME 271
45*	KCl 2	0 to 15	TME 272 to TME 276
45*		15 to 30	TME 277 to TME 281
45		30 to 45	TME 282
45		45 to 60	TME 283
45		60 to 75	TME 284
45		75 to 90	TME 285
45		90 to 105	TME 286
45		105 to 120	TME 287
45		120 to 135	TME 288

DTPA-NH₄HCO₃ extractable elements (Fe, Cd, Cu, Pb, Zn, Mn, Ca, Mg, Na, K, B, P, Mo, Ni, Se) were determined by the method of Soltanpour and Workman (1981). Total elemental analysis of the samples was done by digestion in a CEM microwave digestion system. The procedure used included ashing the material overnight in a 425°C muffle furnace, digestion in a teflon bomb in the microwave oven with 1.5 mL HNO₃, 4.5 mL HCl, and 10 mL HF for 10 min at 100% power, 20 min at 50% power, and 10 min at 100% power. The digested solutions were transferred and made up with saturated H₃BO₃ to 50 mL, and the metal concentrations measured using ICP-AES.

3.6.2 Methods of Plant Analysis

The grass samples were digested with a concentrated HNO₃ - HC10₄ acid mixture in a teflon bomb heated in a CEM microwave digestion unit and the solution concentration of Al, Fe, Zn, Mn, Ca, Mg, Na, K, Sr, P, Ba, Mo, B, S, Si, and As measured by ICP-AES and Cd and Pb by graphite furnace atomic absorption. Chloride content was determined by the sodium nitrate extraction procedure of Gaines et al. (1984).

4. RESULTS AND DISCUSSION

Data pertinent to the properties of the soils prior to waste application and subsequent to waste application were reported by Macyk et al. (1989a). Data pertinent to the climatic parameters measured, the properties of the soils and soil/waste mixtures, and the elemental composition of the brome grass tissue for the individual plots in 1990 are provided in this section of the report.

4.1 PLOT TREATMENTS

The plot treatments illustrated in Figure 3 represent various application rates of waste based on chloride concentration. Initially, the objective of the experiment was to apply 0 (control), 450 kg Cl/ha, 900 kg Cl/ha, 1800 kg Cl/ha, and 3600 kg Cl/ha. It was not possible to achieve anywhere near the suggested rates using the freshwater gel simply because of its low chloride content relative to the other waste types. Levels very close to the target values were achieved with the use of the KCl and NaCl materials. Table 2 provides the chloride levels applied for each of the treatments.

4.2 CLIMATE DATA

Climate data were obtained for most of the calendar year 1991. Data pertinent to air temperature, relative humidity, solar radiation, wind direction, wind speed, and rainfall intensity are available in hard copy form from the authors.

It is important to note that all data are recorded on a mean value per hour basis. Measurements are made every three minutes and mean values computed and recorded hourly. For example, a value recorded at 14:00 hr represents the scans and mean value for the time elapsed between 13:00 and 14:00 hr. Time is always expressed as Mountain Standard Time.

Table 2. Waste application treatments.

Treatment	Chloride Addition (kg Cl/ha)
Freshwater gel 1	0
Freshwater gel 2	15
Freshwater gel 3	30
Freshwater gel 4	60
Freshwater gel 5	120
KCl 1	0
KCl 2	500
KCl 3	1000
KCl 4	2000
KCl 5	4000
NaCl 6	0
NaCl 7	350
NaCl 8	700
NaCl 9	1400
NaCl 10	2800

4.2.1 Precipitation

The total amount of precipitation that occurs during the growing season is critical, however, the distribution of rainfall throughout the season is important for effective plant establishment and growth. The tipping bucket rain gauge is useful for assessing the distribution and intensity of rainfall events. A total of 196 mm occurred during the period May 7 to October 31, 1991. More specifically:

- May 7 to June 30 - 128 mm
- July 1 to July 31 - 9 mm
- August 1 to August 31 - 34 mm
- September 1 to September 30 - 7 mm
- October 1 to October 31 - 18 mm

A significant portion of the growing season precipitation occurred in May and June which accounted in part for the yield obtained in the latter part of June. The tipping bucket data indicated that there was no measurable precipitation from July 6 to August 22, 1992 at the experimental site.

4.3 PLOT YIELD

Observations relative to the brome grass growth on the various plot treatments were made throughout the growing season. The brome grass was harvested on June 25 and 26, 1991 to obtain yield values for the different treatments. A second harvest was undertaken August 14 and 15 however yields were extremely poor due to the lack of moisture in July and August.

The 1991 yield values for the individual plots are provided in Table 3 and a comparison of the mean yield values is presented in Table 4. The mean yield values for the different waste treatments for 1989, 1990 and 1991 are presented in Figures 5, 6 and 7 respectively.

There were apparent differences in yield for treatments in all three waste types (Table 4) however there were significant differences only between the different NaCl treatments. The NaCl 10 or highest application rate treatment had the highest yield for the NaCl plots.

The 1989 data (Figure 5) indicated that the freshwater gel plot yields were at least two fold higher than the KCl and NaCl plot yields. Furthermore, for each of the waste types the yield from lower waste application rates exceeded the control yield and the two highest application rates resulted in yield values below the respective control values.

In 1990 the yields (Figure 6) for the KCl and NaCl amended plots were only slightly below the freshwater gel yields. The FW2, FW3 and FW4 treatments had mean yields greater than the control. All of the KCl waste amended plots had mean yields less than the control whereas the NaCl 8 and NaCl 9 treatments had mean yields greater than the respective control (NaCl 6) plots.

In 1991 the mean yields (Figure 7) were relatively similar for all three waste types. Furthermore, it was apparent that for each of the three waste types the amended plots had higher mean yields than the respective controls with the exception of the KCL 2 and NaCl 7 treatments.

The changes in trends and yield relationships with time described above could be attributed to at least two factors. First of all, the limitations to growth due to chemical properties within the upper 30 cm of the soil have changed with time since the waste was applied in 1988. For example, the high chloride concentrations evident following waste application (Macyk et al. 1989) have been reduced with time (Macyk et al. 1991). This topic will be addressed in more detail in the section of the report dealing with the analytical data pertinent to the plot treatments.

Table 3. Yield for the Esso Field Trial Plots in June, 1991

Waste	Rate	Plot Number	Dry Wt. (g)
Freshwater	1	3	10368
Freshwater	1	9	9395
Freshwater	1	13	9863
Freshwater	2	2	14985
Freshwater	2	8	11209
Freshwater	2	15	9439
Freshwater	3	1	16634
Freshwater	3	6	9931
Freshwater	3	11	12524
Freshwater	4	4	12493
Freshwater	4	7	11502
Freshwater	4	12	12306
Freshwater	5	5	11203
Freshwater	5	10	12899
Freshwater	5	14	11754
KCl	1	17	9187
KCl	1	42	10931
KCl	1	43	13509
KCl	2	33	8778
KCl	2	40	14112
KCl	2	45	10109
KCl	3	21	10489
KCl	3	30	11985
KCl	3	39	16872
KCl	4	16	10471
KCl	4	24	11102
KCl	4	29	12222
KCl	5	25	17240
KCl	5	26	10540
NaCl	6	22	7254
NaCl	6	32	9487
NaCl	6	41	11887
NaCl	7	18	7898
NaCl	7	27	9129
NaCl	7	34	9350
NaCl	8	20	9903
NaCl	8	35	10261
NaCl	8	44	10249
NaCl	9	19	11676
NaCl	9	31	11237
NaCl	9	36	12917
NaCl	10	23	12542
NaCl	10	28	14854
NaCl	10	38	17479

Table 4. Comparison of the Mean Yield Values for the Esso Field Trial Plots in June, 1991.

Waste	Rate	N	Yield (g)
Freshwater	1	3	9875 a*
Freshwater	2	3	11878 a
Freshwater	3	3	13029 a
Freshwater	4	3	12100 a
Freshwater	5	3	11952 a
KCl	1	3	11209 a
KCl	2	3	11000 a
KCl	3	3	13116 a
KCl	4	3	11265 a
KCl	5	2	13890 a
NaCl	6	3	9542 ab
NaCl	7	3	8792 b
NaCl	8	3	10138 ab
NaCl	9	3	11944 ab
NaCl	10	3	14958 a

* Treatment means of each waste in any one column not followed by a common letter are significantly different at 0.01 probability by Tukey's Studentized Range (HSD) Test.

Figure 5. Mean yield values (dry weight) in 1989.

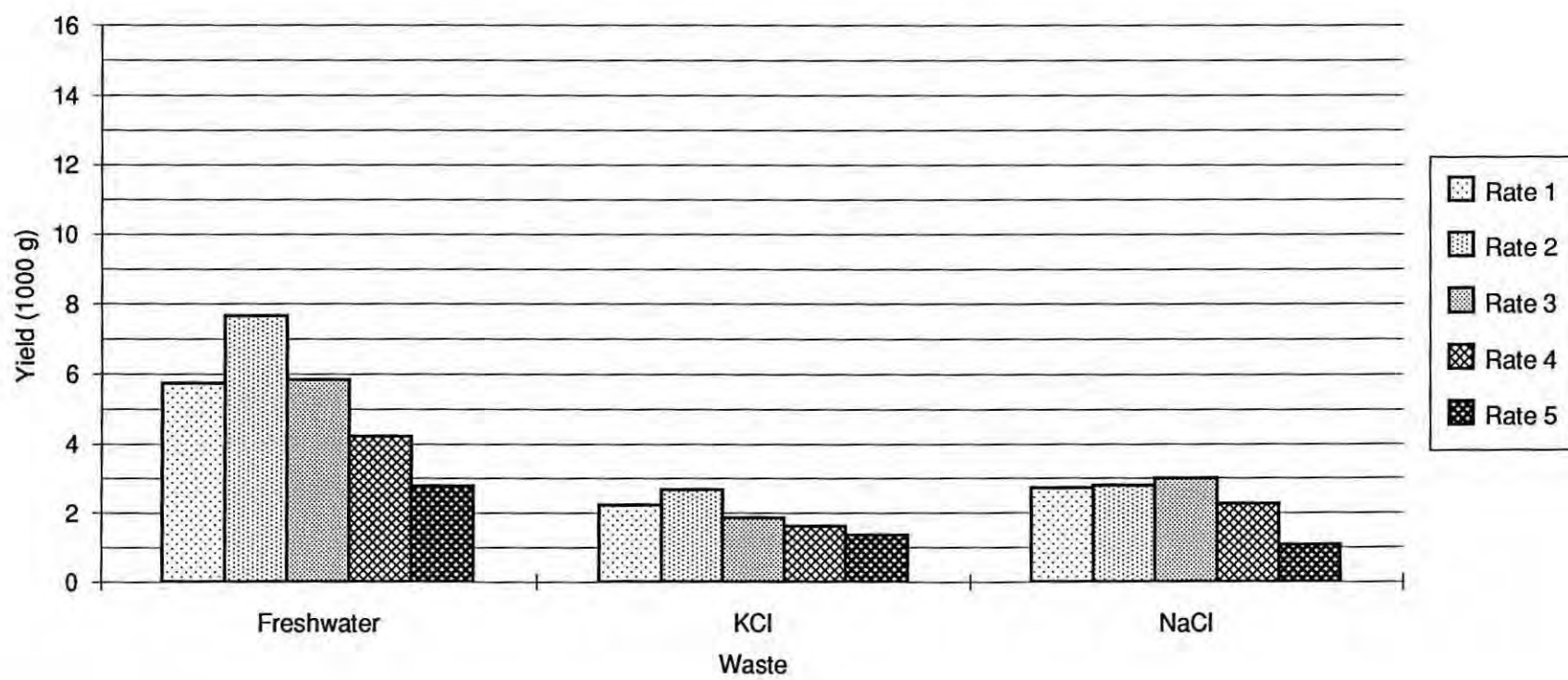


Figure 6. Mean yield values (dry weight) in 1990.

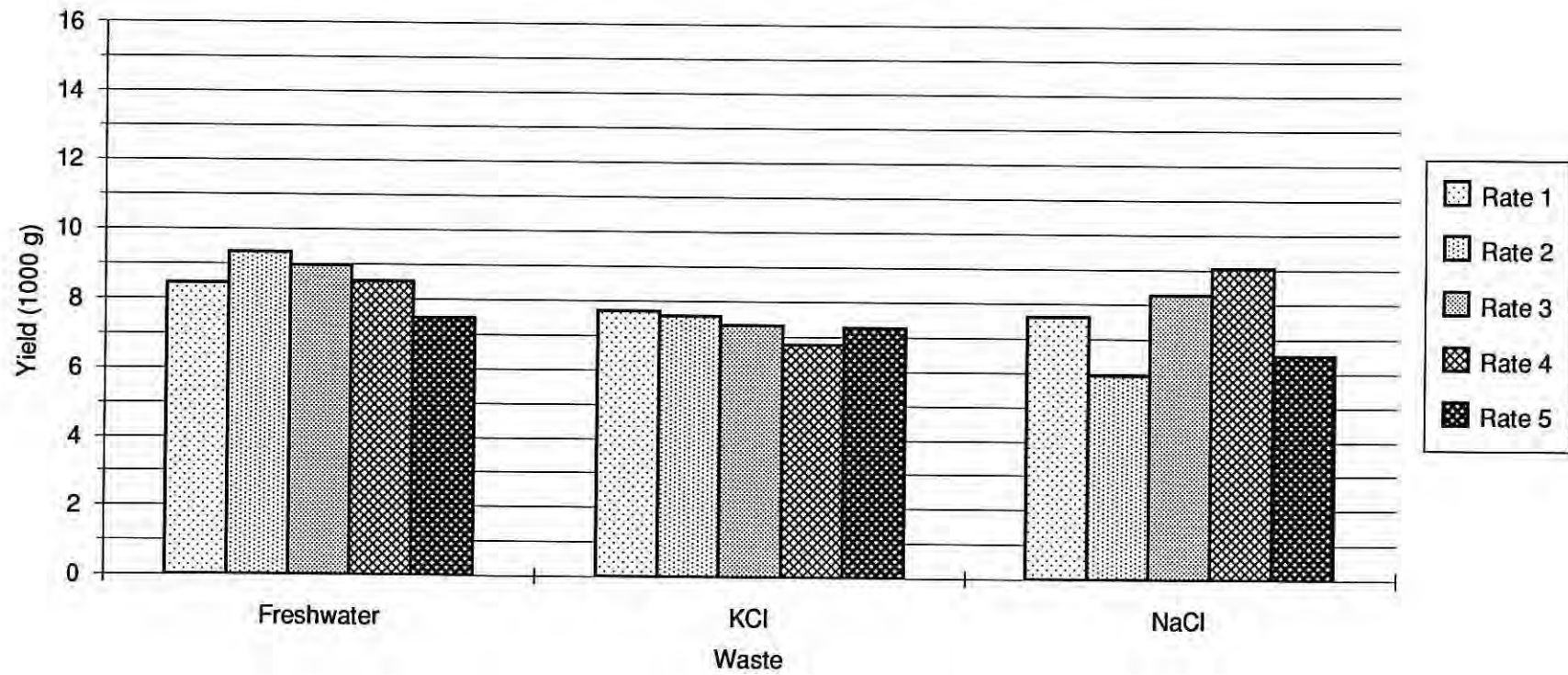
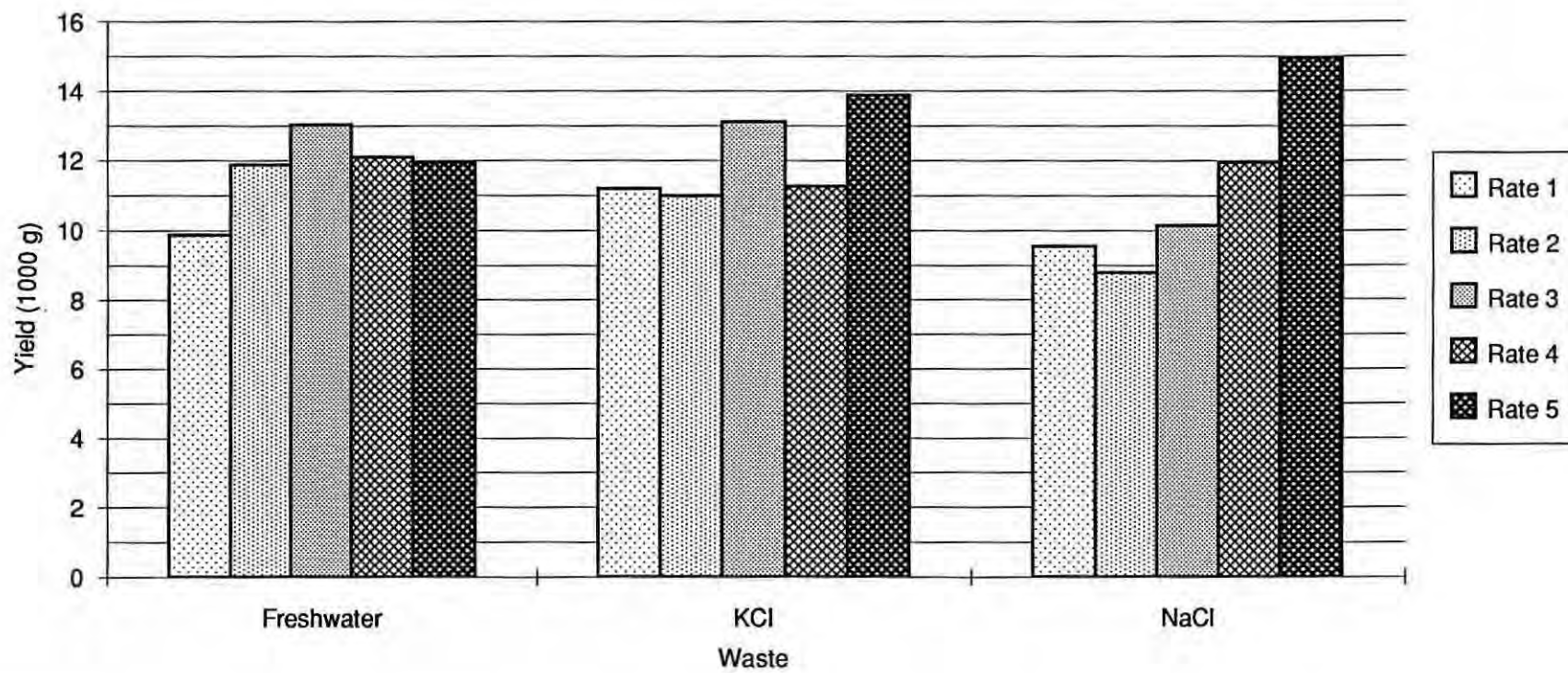


Figure 7. Mean yield values (dry weight) in 1991.



Secondly, the addition of the macroelements and microelements contained in the waste material appears to be manifesting itself in the enhanced growth at the higher waste application rates.

Plates 3 to 5 inclusive allow for a visual assessment of the growth achieved in selected plots.

4.4 FIELD PLOT SOIL PROPERTIES

A total of 77 soil samples were collected at the 45 plots prior to waste application and 207 samples were collected in mid-September 1988 approximately two months following waste application and incorporation (Macyk et al. 1989a). A total of 224 samples were collected in mid-August 1990 and 294 samples were collected in mid-August 1991.

Samples representing the 0 to 15 cm depth were collected at all plots and additional samples representing the 15 to 30 cm, 30 to 45 cm, 45 to 60 cm, 60 to 75 cm, 75 to 90 cm, 90 to 105 cm and additional depth intervals where possible were obtained at selected plots. For most plots the surface or 0 to 15 cm depth interval sample represented a composite of five sampling locations. In selected plots a total of five individual samples were collected from the 0 to 15 cm and the 15 to 30 cm depth intervals to assess variability within individual plots.

The samples obtained in 1988 and 1989 were analyzed for several chemical and physical properties, soluble ions in saturated paste extracts, plant available trace elements (DTPA extractable), and total elemental content (Macyk et al. 1989a). The samples obtained in 1990 and 1991 were analyzed for some chemical properties as well as soluble ions in saturated paste extracts and total elemental content to assess the extent of change in salt concentration (EC and chloride levels) and elemental levels at the various depths in the different treatments.

4.4.1 Chemical Properties

Data for chemical properties including pH and CaCO_3 equivalent are presented in Appendix 1. Table 5 provides mean values for pH (CaCl_2) and CaCO_3 equivalent for the individual depths within the various treatments for 1988 to 1991 inclusive.

The Alberta Soils Advisory Committee (1977) suggests that no limitations to plant growth occur at pH levels of 6.5 to 7.5 in the surface soil and that slight limitations occur at levels of 5.5 to 6.4 and 7.6 to 8.4. The mean pH values in the 0 to 15 cm depth interval of the freshwater gel plots ranged from 6.5 to 7.0 prior to waste application which indicates that these soils exhibited no limitation to plant growth. Following waste application, the 0 to 15 depth

Plate 3. Grass growth in the FW5 and FW4 treatments.

Plate 4. Grass growth in the KCl 4 and KCl 5 treatments.

Plate 5. Grass growth in the NaCl 6 and NaCl 10 treatments.

Table 5. pH (CaCl₂) AND CaCO₃ Equivalent (%) for the Various Treatments.

Waste	Rate	Depth cm	pH				
			Pre	Post	1989	1990	1991
Freshwater	1	0-15	6.5	7.0	7.1	7.2	7.3
	1	15-30	-	-	7.3	7.5	7.8
	1	30-45	-	-	7.6	7.6	7.8
	1	45-60	-	-	7.6	7.7	8.1
	1	60-75	-	-	-	7.7	7.9
	1	75-90	-	-	-	7.7	7.9
	1	90-105	-	-	-	7.6	7.9
	2	0-15	6.6	7.3	7.3	7.2	7.5
	2	15-30	-	7.3	-	6.9	7.4
	3	0-15	6.7	7.4	7.3	7.2	7.6
	3	15-30	5.0	5.8	6.9	5.4	6.3
	3	30-45	-	-	-	5.4	6.2
	3	45-60	-	-	-	4.6	5.3
	3	60-75	-	-	-	4.4	5.0
	4	0-15	6.9	7.7	7.6	7.6	7.7
	4	15-30	7.5	7.0	7.5	7.4	7.8
	4	30-45	7.7	7.8	7.8	7.9	8.1
	4	45-60	7.7	7.8	7.9	7.9	8.1
	4	60-75	-	-	-	7.9	8.1
	4	75-90	-	-	-	7.9	8.1
	4	90-105	-	-	-	7.9	8.1
	5	0-15	7.0	8.0	7.9	7.6	7.9
	5	15-30	7.5	7.5	7.4	7.5	7.6
	5	30-45	7.5	7.5	7.6	7.7	7.8
	5	45-60	7.5	7.5	7.7	7.7	7.8
	5	60-75	-	-	-	7.7	7.8
	5	75-90	-	-	-	7.7	7.9
	5	90-105	-	-	-	7.7	7.9
	5	105-120	-	-	-	7.7	7.8

CaCO ₃				
Pre	Post	1989	1990	1991
0.44	0.39	0.72	0.48	0.20
-	-	2.31	3.32	1.95
-	-	4.30	5.27	4.95
-	-	4.50	5.19	5.21
-	-	-	6.07	5.34
-	-	-	5.27	4.75
-	-	-	4.91	3.91
1.40	1.24	1.29	1.25	1.20
-	0.40	-	0.96	0.63
0.62	0.82	0.94	0.64	0.69
-	0.02	0.26	0.20	0.12
-	-	-	0.16	0.16
-	-	-	0.02	0.12
-	-	-	0.02	0.28
0.49	0.97	1.07	0.85	1.02
5.89	0.92	1.57	1.50	3.62
4.81	5.69	6.84	7.15	5.94
4.81	-	4.50	4.93	4.48
-	-	-	5.02	5.01
-	-	-	0.12	4.88
-	-	-	5.50	4.48
0.88	1.69	1.90	2.74	1.51
4.38	1.94	1.63	1.85	2.17
4.86	3.45	2.77	4.50	4.36
4.86	3.45	4.33	5.05	4.51
-	-	-	5.54	4.93
-	-	-	3.94	4.57
-	-	-	5.68	4.37
-	-	-	4.89	3.75

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

Table 5 (Continued). pH (CaCl₂) AND CaCO₃ Equivalent (%) for the Various Treatments.

Waste	Rate	Depth cm	pH				
			Pre	Post	1989	1990	1991
KCl	1	0-15	7.2	7.3	7.4	7.3	7.8
	1	15-30	-	-	-	7.4	7.6
	1	30-45	-	-	-	7.6	7.9
	1	45-60	-	-	-	7.8	7.9
	1	60-75	-	-	-	7.8	8.0
	1	75-90	-	-	-	7.8	8.0
	1	90-105	-	-	-	7.8	8.0
	1	105-120	-	-	-	7.7	8.0
	1	120-135	-	-	-	7.7	8.0
	2	0-15	7.2	7.3	7.4	7.2	7.4
	2	15-30	-	-	-	6.5	6.5
	2	30-45	-	-	-	5.3	5.4
	2	45-60	-	-	-	5.4	5.7
	2	60-75	-	-	-	5.4	5.5
	2	75-90	-	-	-	5.4	5.5
	2	90-105	-	-	-	5.3	5.6
	2	105-120	-	-	-	5.8	5.8
	2	120-135	-	-	-	5.8	6.3
	3	0-15	6.7	7.2	7.3	7.3	7.4
	4	0-15	6.8	7.4	7.4	7.4	7.5
	4	15-30	6.5	7.4	6.3	7.3	7.5
	4	30-45	7.1	6.9	6.1	7.4	6.7
	4	45-60	7.1	6.9	5.9	7.1	6.7
	4	60-75	6.5	5.9	5.4	6.7	6.8
	4	75-90	6.5	5.9	5.4	6.6	6.8
	4	90-105	-	-	-	7.1	7.0
	4	105-120	-	-	-	6.4	6.1
	4	120-135	-	-	-	7.4	7.6
	5	0-15	6.7	7.4	7.4	7.5	7.6
	5	15-30	6.3	6.0	-	6.9	6.5
	5	30-45	5.2	4.9	-	4.6	5.1
	5	45-60	5.2	-	-	4.6	4.8
	5	60-75	5.4	-	-	4.6	5.0

CaCO ₃				
Pre	Post	1989	1990	1991.00
1.73	1.25	2.02	1.98	1.64
-	-	-	0.91	2.06
-	-	-	3.82	3.80
-	-	-	4.97	5.14
-	-	-	6.10	6.28
-	-	-	5.50	6.12
-	-	-	5.42	5.16
-	-	-	5.10	5.48
-	-	-	4.68	4.99
1.73	1.25	2.02	1.52	0.35
-	-	-	2.53	0.23
-	-	-	-	0.16
-	-	-	-	0.22
-	-	-	-	0.20
-	-	-	-	0.31
-	-	-	-	0.20
-	-	-	-	0.16
-	-	-	-	0.16
0.66	0.47	0.87	1.11	0.52
0.19	1.09	0.64	0.68	0.65
1.64	1.36	0.49	0.73	0.69
0.46	0.71	1.86	0.22	0.65
0.46	0.35	3.41	0.39	1.80
0.73	-	-	0.04	2.16
0.73	-	-	0.07	1.02
-	-	-	0.50	1.03
-	-	-	0.08	0.00
-	-	-	2.84	1.52
0.53	0.83	1.20	0.42	0.60
0.22	-	-	0.55	0.07
-	-	-	0.18	0.16
-	-	-	0.04	0.08
0.04	-	-	-	0.16

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

Table 5 (Continued). pH (CaCl2) AND CaCO3 Equivalent (%) for the Various Treatments.

Waste	Rate	Depth cm	pH					CaCO3				
			Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991.00
KCl	5	75-90	5.4	-	-	4.8	5.7	-	-	-	-	0.23
	5	90-105	-	-	-	4.9	5.5	-	-	-	0.08	0.08
	5	105-120	-	-	-	5.0	5.6	-	-	-	-	0.19
	5	120-135	-	-	-	5.2	5.4	-	-	-	0.02	0.16
	5	135-150	-	-	-	-	5.7	-	-	-	-	0.08
	5	150-165	-	-	-	-	5.7	-	-	-	-	0.16
	5	165-180	-	-	-	-	5.7	-	-	-	-	0.14
	5	180-195	-	-	-	-	5.8	-	-	-	-	0.12
	5	195-210	-	-	-	-	5.8	-	-	-	-	0.04
NaCl	6	0-15	6.9	6.9	7.1	7.0	7.4	2.04	0.57	1.10	2.00	0.82
	6	15-30	-	-	7.3	7.5	8.0	-	-	2.49	3.76	5.44
	6	30-45	-	-	7.9	7.8	8.1	-	-	4.77	4.95	4.52
	6	45-60	-	-	7.9	7.8	8.1	-	-	4.69	6.24	4.13
	6	60-75	-	-	-	7.8	8.2	-	-	-	5.39	4.79
	6	75-90	-	-	-	7.8	8.1	-	-	-	4.79	5.05
	6	90-105	-	-	-	7.8	8.0	-	-	-	4.75	4.76
	6	105-120	-	-	-	7.8	8.1	-	-	-	5.15	5.15
	6	120-135	-	-	-	7.8	8.1	-	-	-	4.71	4.06
	7	0-15	6.7	7.2	7.1	7.1	7.3	1.00	0.84	0.76	0.65	0.50
	7	15-30	-	-	7.2	7.2	7.4	-	-	2.61	0.74	0.38
	8	0-15	6.6	7.6	7.4	7.2	7.5	0.37	1.27	1.00	0.92	0.54
	8	15-30	6.6	7.1	6.9	7.5	7.7	0.36	0.64	0.85	4.21	1.62
	8	30-45	6.6	6.6	7.1	7.7	7.9	4.28	3.78	5.29	4.38	4.20
	8	45-60	6.6	6.6	7.2	7.7	7.8	4.28	4.73	2.55	3.04	4.48
	8	60-75	5.5	5.4	6.3	7.8	7.9	-	-	-	3.70	4.58
	8	75-90	5.5	5.4	6.3	7.8	8.0	-	-	-	3.54	5.19
	8	90-105	-	-	-	7.8	8.0	-	-	-	3.12	5.18
	8	105-120	-	-	-	7.6	7.9	-	-	-	5.72	4.78
	8	120-135	-	-	-	7.7	8.0	-	-	-	5.36	5.11
	8	135-150	-	-	-	7.7	7.8	-	-	-	12.47	5.77

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

Table 5 (Concluded). pH (CaCl2) AND CaCO3 Equivalent (%) for the Various Treatments.

Waste	Rate	Depth cm	pH				
			Pre	Post	1989	1990	1991
NaCl	9	0-15	7.0	7.3	7.4	7.2	7.6
	9	15-30	6.4	6.2	6.9	6.8	7.3
	9	30-45	6.2	6.2	6.2	6.3	6.4
	9	45-60	6.2	6.1	6.3	6.3	6.4
	9	60-75	6.9	6.9	-	6.5	6.4
	9	75-90	6.9	6.9	-	7.6	6.6
	9	90-105	-	-	-	7.6	6.8
	9	105-120	-	-	-	-	7.3
	9	120-135	-	-	-	-	7.7
	9	135-150	-	-	-	-	7.8
	10	0-15	6.6	7.6	7.4	7.4	7.8
	10	15-30	6.6	7.1	6.9	7.2	7.3
	10	30-45	6.6	6.6	7.1	6.9	6.3
	10	45-60	6.6	6.6	7.2	6.5	6.3
	10	60-75	5.5	5.4	7.3	6.4	6.4
	10	75-90	5.5	5.4	7.3	6.4	6.5
	10	90-105	-	-	-	6.6	6.5
	10	105-120	-	-	-	7.1	6.8
	10	120-135	-	-	-	7.6	7.5
	10	135-150	-	-	-	7.5	7.7

CaCo3				
Pre	Post	1989	1990	1991.00
0.78	0.69	0.74	0.39	0.56
0.11	0.21	1.19	1.10	0.39
0.16	0.16	0.68	2.79	0.22
0.16	0.08	2.18	3.03	0.43
0.16	0.08	-	4.25	0.79
0.16	0.08	-	4.13	0.43
-	-	-	3.15	0.48
-	-	-	-	0.67
-	-	-	-	2.83
-	-	-	-	4.53
0.37	1.27	1.00	0.93	0.91
0.36	0.64	0.85	1.57	0.39
4.28	3.78	5.29	5.01	1.63
4.28	4.73	2.55	1.24	1.66
-	-	-	4.93	1.48
-	-	-	5.37	1.58
-	-	-	5.25	1.51
-	-	-	5.33	1.70
-	-	-	4.29	1.94
-	-	-	4.63	4.14

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

interval for the FW5 treatments had a mean pH value of 8 which could result in slight limitations to plant growth. The mean value in 1991 was 7.9 which is just 0.4 units outside the "good" rating.

The mean pH values in the 0 to 15 cm depth interval of the KCl plots ranged from 6.7 to 7.2 prior to waste application and 7.2 to 7.5 following waste application. In 1991 the mean pH values in the 0 to 15 cm depth interval ranged from 7.4 to 7.8 for the KCl treatments. These values indicate that pH could be a slightly limiting factor to plant growth.

The mean pH values in the 0 to 15 cm depth interval of the NaCl plots ranged from 6.6 to 7.0 prior to waste application and 6.9 to 7.6 following waste application. These values indicate that the NaCl waste additions did not result in pH values that could be considered limiting to plant growth except for the NaCl 10 treatment which had a mean pH of 7.6 in the fall of 1988 and 7.4 in the fall of 1989 and 1990. In 1991 the mean pH values in the 0 to 15 cm depth interval ranged from 7.3 to 7.8 for the NaCl treatments which indicate that pH could be a slightly limiting factor to plant growth.

Despite the fact that pH values for the 0 to 15 cm depth for most of the treatments exceeded a value of 7.0 there is no visual indication that pH is of concern to plant growth.

The Alberta Soils Advisory Committee (1987) suggests that a CaCO_3 equivalent value of less than 2% is rated as good in terms of evaluating the suitability of surface material for revegetation in the Northern Forest Region. Values of 2 to 20% would result in a "fair" rating. The mean CaCO_3 equivalent values in the 0 to 15 cm depth interval of the freshwater gel plots ranged from 0.44 to 1.40% prior to waste application and 0.39 to 1.90% following waste application. The FW5 treatment had a mean value of 1.51% in 1991 indicating that CaCO_3 equivalent levels of the treatments prior to and following waste application would result in a "good" rating in terms of soil suitability for plant growth. Even lower values were recorded for the KCl and NaCl treatments.

4.4.2 Saturated Paste Extract Data

Data for the saturated paste extract analyses are presented in Appendix 2. These data indicate the magnitude of the soluble components in a saturated solution of these materials and can be used to assess the suitability of these materials for plant growth and the possibility of trace element transport. Table 6 provides more detailed data for EC, SAR, and Cl for the individual depths within the various treatments. The data include values for the soils sampled in May 1988 prior to waste application and then in September 1988, August 1989, 1990 and 1991. Waste application and incorporation was completed in July 1988 (Macyk et al. 1989a).

Table 6. Mean Values for EC, Cl and SAR for the Various Treatments.

Waste	Rate	Depth cm	EC					Cl					SAR				
			Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991
Freshwater	1	0-15	0.62	0.76	1.06	0.40	0.50	20.3	25.1	12.2	8.8	8.3	0.3	0.5	0.3	0.2	0.2
	1	15-30	-	-	-	0.32	0.34	-	-	-	5.3	6.2	-	-	-	0.3	0.4
	1	30-45	-	-	-	0.23	0.30	-	-	-	4.2	5.5	-	-	-	0.4	0.4
	1	45-60	-	-	-	0.25	0.25	-	-	-	7.1	4.4	-	-	-	0.4	0.4
	1	60-75	-	-	-	0.23	0.26	-	-	-	5.4	4.8	-	-	-	0.4	0.4
	1	75-90	-	-	-	0.22	0.27	-	-	-	4.9	5.7	-	-	-	0.4	0.5
	1	90-105	-	-	-	0.22	0.26	-	-	-	5.5	6.2	-	-	-	0.4	0.5
	2	0-15	0.51	0.91	1.17	0.54	0.66	18.7	22.3	19.8	10.7	8.2	0.3	1.9	1.2	0.6	0.5
	2	15-30	-	0.53	-	0.65	0.53	-	11.7	-	11.9	8.5	-	0.7	-	1.0	0.7
	3	0-15	0.59	1.14	1.37	0.59	0.70	17.8	33.0	22.4	16.1	10.2	0.3	2.6	1.2	0.8	0.7
	3	15-30	0.25	0.36	0.93	0.35	0.65	15.9	15.8	19.3	11.5	28.6	0.4	0.7	0.8	1.0	1.2
	3	30-45	0.31	-	-	0.21	0.22	15.5	-	-	9.8	4.3	0.4	-	-	0.7	0.4
	3	45-60	0.31	-	-	0.25	0.24	15.5	-	-	13.8	8.9	0.4	-	-	1.7	0.3
	3	60-75	-	-	-	0.13	0.14	-	-	-	9.9	8.2	-	-	-	0.9	0.3
	4	0-15	0.59	1.10	1.11	0.66	0.58	18.2	36.3	16.0	17.5	8.6	0.3	2.0	1.4	0.9	0.7
	4	15-30	0.45	0.58	0.49	0.54	0.45	8.8	15.9	7.9	8.1	1.4	0.6	0.6	1.1	0.8	0.9
	4	30-45	0.36	0.35	0.39	0.34	0.39	11.3	11.6	6.9	5.7	0.1	0.7	0.7	0.6	0.5	0.8
	4	45-60	0.36	0.35	0.39	0.28	0.33	11.3	11.6	6.9	7.0	3.4	0.7	0.7	0.7	0.5	0.7
	4	60-75	-	-	-	0.27	0.32	-	-	-	6.0	0.1	-	-	-	0.6	0.8
	4	75-90	-	-	-	0.30	0.36	-	-	-	7.7	8.3	-	-	-	0.6	0.6
	4	90-105	-	-	-	0.28	0.30	-	-	-	8.6	14.8	-	-	-	0.5	0.6
	5	0-15	0.58	1.39	1.44	0.79	0.79	16.3	40.0	32.1	16.6	9.2	0.3	3.5	2.4	1.4	1.2
	5	15-30	0.31	0.80	0.73	0.61	0.63	9.6	37.9	13.5	10.9	8.8	0.4	1.7	1.3	1.0	1.2
	5	30-45	0.26	0.32	0.54	0.45	0.42	8.9	15.8	11.0	9.5	8.9	0.4	0.6	0.9	0.6	1.5
	5	45-60	0.26	0.32	0.46	0.44	0.38	8.9	15.8	9.9	18.2	5.6	0.4	0.6	0.4	0.5	1.0
	5	60-75	-	-	-	0.38	0.42	-	-	-	6.5	6.8	-	-	-	0.3	0.6
	5	75-90	-	-	-	0.41	0.39	-	-	-	7.3	6.0	-	-	-	0.3	0.5
	5	90-105	-	-	-	0.39	0.37	-	-	-	9.4	6.0	-	-	-	0.4	0.4
	5	105-120	-	-	-	0.52	0.51	-	-	-	12.0	6.8	-	-	-	0.4	0.5

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

Table 6 (Continued). Mean Values for EC, CI and SAR for the Various Treatments.

Waste	Rate	Depth cm	EC					CI					SAR				
			Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991
KCl	1	0-15	0.51	0.86	0.72	0.42	0.39	19.1	22.7	13.1	13.4	12.5	0.3	0.5	0.3	0.3	0.3
	1	15-30	-	-	-	0.42	0.46	-	-	-	5.8	10.6	-	-	-	0.3	0.3
	1	30-45	-	-	-	0.32	0.32	-	-	-	6.2	7.1	-	-	-	0.4	0.5
	1	45-60	-	-	-	0.25	0.34	-	-	-	5.1	10.1	-	-	-	0.4	0.5
	1	60-75	-	-	-	0.26	0.32	-	-	-	4.7	7.1	-	-	-	0.4	0.6
	1	75-90	-	-	-	0.25	0.31	-	-	-	5.4	12.3	-	-	-	0.4	0.5
	1	90-105	-	-	-	0.25	0.28	-	-	-	6.9	8.5	-	-	-	0.4	0.5
	1	105-120	-	-	-	0.24	0.27	-	-	-	6.6	6.5	-	-	-	0.4	0.5
	1	120-135	-	-	-	0.24	0.26	-	-	-	6.2	5.6	-	-	-	0.4	0.4
	2	0-15	0.54	1.20	1.09	0.51	0.55	20.6	396.0	118.8	49.5	27.5	0.3	0.8	0.7	0.4	0.3
	2	15-30	-	-	0.88	0.61	0.57	-	-	157.6	102.4	83.6	-	-	0.5	0.5	0.5
	2	30-45	-	-	0.25	0.32	0.29	-	-	51.4	87.8	60.2	-	-	0.4	0.4	0.6
	2	45-60	-	-	-	0.24	0.20	-	-	-	57.9	37.2	-	-	-	0.5	0.7
	2	60-75	-	-	-	0.16	0.18	-	-	-	36.8	24.8	-	-	-	0.5	0.6
	2	75-90	-	-	-	0.12	0.13	-	-	-	18.2	13.5	-	-	-	1.1	0.6
	2	90-105	-	-	-	0.10	0.13	-	-	-	17.8	7.8	-	-	-	0.6	0.6
	2	105-120	-	-	-	1.70	0.11	-	-	-	53.0	4.1	-	-	-	0.5	0.6
	2	120-135	-	-	-	0.09	0.08	-	-	-	5.5	5.1	-	-	-	0.5	0.5
	3	0-15	0.52	2.60	2.02	0.68	0.55	20.3	740.0	403.0	62.5	24.3	0.3	2.0	1.5	0.7	0.3
	4	0-15	0.61	2.87	2.75	0.99	0.55	22.7	1070.0	863.0	147.4	25.1	0.3	1.8	1.6	0.8	0.3
	4	15-30	0.31	0.47	1.09	0.71	0.56	11.5	69.1	386.0	150.5	24.1	0.4	0.4	0.9	0.6	0.4
	4	30-45	0.41	0.80	0.72	0.63	0.47	7.9	281.1	221.0	158.7	64.2	0.3	0.5	0.5	0.4	0.5
	4	45-60	0.41	0.54	0.72	0.37	0.35	7.9	52.5	43.2	74.8	49.9	0.3	0.3	0.5	0.5	0.5
	4	60-75	0.23	0.13	0.09	0.24	0.29	6.0	17.9	10.2	43.0	36.8	-	-	-	0.5	0.5
	4	75-90	0.23	0.13	0.09	0.26	0.31	6.0	17.9	10.2	50.5	30.7	0.5	0.6	1.1	0.6	0.5
	4	90-105	-	-	-	0.26	0.28	-	-	-	56.3	27.7	-	-	-	0.5	0.4
	4	105-120	-	-	-	-	0.23	-	-	-	-	45.5	-	-	-	-	0.6
	4	120-135	-	-	-	-	0.34	-	-	-	-	32.9	-	-	-	-	0.3
	5	0-15	0.47	3.54	1.59	2.68	1.02	18.2	3135.0	353.0	1214.0	120.0	0.3	1.9	1.1	1.3	0.7
	5	15-30	0.55	2.51	-	1.51	1.29	17.6	889.0	-	630.0	261.0	0.3	0.8	-	0.9	0.9
	5	30-45	0.19	1.65	-	0.49	0.65	6.7	555.0	-	146.5	146.0	0.5	0.6	-	0.5	0.5
	5	45-60	0.19	-	-	0.39	0.46	-	-	-	115.7	93.7	0.5	-	-	0.4	0.5
	5	60-75	-	-	-	0.21	0.31	-	-	-	56.8	56.8	-	-	-	0.4	0.4

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

Table 6 (Continued). Mean Values for EC, Cl and SAR for the Various Treatments.

Waste	Rate	Depth cm	EC					Cl					SAR				
			Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991
KCl	5	75-90	0.10	-	-	0.20	0.26	-	-	-	45.9	38.0	0.5	-	-	0.5	0.5
	5	90-105	-	-	-	0.14	0.16	-	-	-	29.5	23.3	-	-	-	0.5	0.5
	5	105-120	-	-	-	0.11	0.14	-	-	-	19.2	19.8	-	-	-	0.6	0.5
	5	120-135	-	-	-	0.08	0.14	-	-	-	12.3	14.1	-	-	-	0.5	0.5
	5	135-150	-	-	-	-	0.18	-	-	-	-	22.2	-	-	-	-	0.5
	5	150-165	-	-	-	-	0.14	-	-	-	-	13.7	-	-	-	-	0.5
	5	165-180	-	-	-	-	0.12	-	-	-	-	10.8	-	-	-	-	0.6
	5	180-195	-	-	-	-	0.10	-	-	-	-	10.2	-	-	-	-	0.6
	5	195-210	-	-	-	-	0.12	-	-	-	-	12.0	-	-	-	-	0.5
NaCl	6	0-15	0.53	0.70	0.89	0.42	0.39	25.9	35.6	37.2	26.7	14.0	0.4	0.5	0.3	0.4	0.4
	6	15-30	-	-	0.76	0.45	0.35	-	-	18.2	-	14.3	-	-	0.3	0.4	0.5
	6	30-45	-	-	0.24	0.26	0.29	-	-	8.2	-	9.5	-	-	0.4	0.5	0.4
	6	45-60	-	-	0.23	0.25	0.29	-	-	7.0	-	9.7	-	-	0.5	0.4	0.4
	6	60-75	-	-	-	0.24	0.30	-	-	-	-	8.3	-	-	-	0.4	0.5
	6	75-90	-	-	-	0.24	0.30	-	-	-	-	7.2	-	-	-	0.5	0.4
	6	90-105	-	-	-	0.24	0.29	-	-	-	-	6.8	-	-	-	0.5	0.4
	6	105-120	-	-	-	0.23	0.29	-	-	-	-	6.6	-	-	-	0.4	0.4
	6	120-135	-	-	-	0.22	0.29	-	-	-	-	5.8	-	-	-	0.5	0.4
	7	0-15	0.57	1.95	1.20	0.51	0.55	22.2	480.0	151.0	57.0	60.2	0.3	4.7	2.9	1.1	1.4
	7	15-30	-	-	0.58	0.97	0.84	-	-	75.0	190.8	145.0	-	-	1.1	2.2	2.2
	8	0-15	0.61	1.38	1.80	0.55	0.53	20.8	870.0	331.0	78.9	30.6	0.3	5.2	4.5	1.7	1.4
	8	15-30	0.55	0.49	2.01	0.62	0.60	13.1	85.1	496.5	134.9	73.3	0.3	0.5	2.7	2.1	2.8
	8	30-45	0.34	0.28	0.43	0.43	0.40	9.1	90.3	51.0	62.0	40.4	0.3	0.4	0.7	0.8	1.3
	8	45-60	0.34	0.27	0.33	0.56	0.50	9.1	9.7	41.1	113.9	87.0	0.3	-	0.5	0.5	0.6
	8	60-75	0.36	-	-	0.63	0.58	6.9	-	-	146.6	124.0	0.4	-	-	0.4	0.4
	8	75-90	0.36	-	-	0.60	0.52	6.9	-	-	136.7	105.0	0.4	-	-	0.4	0.5
	8	90-105	-	-	-	0.42	0.41	-	-	-	71.1	65.5	-	-	-	0.4	0.4
	8	105-120	-	-	-	0.25	0.34	-	-	-	20.1	35.0	-	-	-	0.4	0.5
	8	120-135	-	-	-	0.24	0.28	-	-	-	13.8	16.5	-	-	-	0.4	0.5
	8	135-150	-	-	-	0.24	0.32	-	-	-	7.6	15.1	-	-	-	0.4	0.4

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

Table 6 (Concluded). Mean Values for EC, Cl and SAR for the Various Treatments.

Waste	Rate	Depth cm	EC					Cl					SAR				
			Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991	Pre	Post	1989	1990	1991
NaCl	9	0-15	0.60	3.01	1.80	0.72	0.60	23.4	876.0	325.0	104.2	47.1	0.6	8.5	5.3	3.4	2.4
	9	15-30	0.39	-	1.26	0.69	0.68	19.2	168.0	307.0	129.6	90.1	0.4	1.3	2.6	3.4	3.7
	9	30-45	0.21	-	0.61	0.69	0.88	12.8	114.2	135.4	229.9	234.0	0.2	2.1	1.6	0.8	2.1
	9	45-60	0.21	-	0.47	0.52	0.85	12.8	188.2	116.5	120.0	256.0	0.2	4.1	1.7	0.6	1.7
	9	60-75	0.16	-	-	0.36	0.75	16.4	144.1	-	124.5	205.0	0.2	5.6	-	0.6	1.5
	9	75-90	0.16	-	-	0.37	0.61	16.4	144.1	-	59.0	160.0	0.2	5.6	-	0.6	1.2
	9	90-105	-	-	-	0.39	0.56	-	-	-	68.4	139.0	-	-	-	0.4	0.9
	9	105-120	-	-	-	-	0.48	-	-	-	-	113.0	-	-	-	-	0.8
	9	120-135	-	-	-	-	0.52	-	-	-	-	112.0	-	-	-	-	0.7
	9	135-150	-	-	-	-	0.57	-	-	-	-	125.0	-	-	-	-	0.6
	10	0-15	0.51	7.27	5.36	2.39	1.27	24.4	3352.0	1728.0	956.5	253.0	0.5	23.5	15.2	11.4	8.3
	10	15-30	0.46	0.96	1.98	2.03	1.67	14.6	206.1	539.0	598.0	415.0	0.5	0.9	4.4	6.5	6.9
	10	30-45	0.25	0.31	1.12	0.92	1.28	7.5	42.6	306.0	332.0	412.0	0.3	0.7	2.8	0.9	1.4
	10	45-60	0.25	0.22	0.82	0.38	0.85	7.5	25.4	192.0	129.2	261.0	0.3	0.8	2.8	0.5	0.8
	10	60-75	0.12	0.11	1.51	0.22	0.55	8.2	20.2	454.0	56.8	157.0	0.1	0.9	4.8	0.4	0.6
	10	75-90	0.12	0.11	1.51	0.21	0.49	8.2	20.2	454.0	58.6	130.0	0.1	0.9	4.8	0.6	0.5
	10	90-105	-	-	-	0.26	0.39	-	-	-	46.4	96.5	-	-	-	0.4	0.5
	10	105-120	-	-	-	0.26	0.35	-	-	-	34.3	80.8	-	-	-	0.4	0.4
	10	120-135	-	-	-	0.28	0.40	-	-	-	24.2	73.0	-	-	-	0.4	0.4
	10	135-150	-	-	-	0.25	0.35	-	-	-	20.0	48.9	-	-	-	0.3	0.4

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1991 = Sampled August 1991

These data illustrate the changes that occurred resulting from the waste application and the subsequent change with time. These data can be compared to existing criteria to assess soil quality or the extent of limitation to plant growth that may occur.

4.4.2.1 Electrical conductivity (EC) values. The Alberta Soils Advisory Committee (1977) suggests that no limitations to plant growth occur at EC levels of 0 to 2 dS/m, slight limitations occur at 2 to 4 dS/m, moderate limitations occur at 4 to 8 dS/m, and severe limitations occur at values greater than 8 dS/m.

The mean EC values for all plots and all depths prior to waste application were well below 1.0 dS/m with the highest values of about 0.6 dS/m in the 0 to 15 cm depth interval (Table 6). This indicated that on the basis of EC values the soils presented no limitation to plant growth. Following the application of waste materials the soil EC values increased at all locations. In the freshwater gel plots the maximum EC values were in the 1.39 to 1.44 dS/m range. These values suggested that the EC levels of the plot soils would present no limitation to plant growth. Changes in EC levels for the FW5 treatment are illustrated in Figure 8.

Changes in EC levels in the KCl plots were greater than those in the freshwater gel plots and are illustrated for KCl 4 plots in Figure 9. For all treatments the EC values in the 0 to 15 cm depth interval decreased from the fall of 1988 to August 1989 and similarly from 1989 to 1990 with the exception of the KCl 5 treatments. Further decreases were evident from 1990 to 1991 with the exception of the KCl 2 treatments. This indicates the degree of leaching that occurred. On the basis of the soil quality criteria described above, treatments 3, 4, and 5 would have had slight limitations to plant growth on the basis of EC for the 0 to 15 cm depth in the fall of 1988. By the fall of 1991 none of the treatments had a limitation to plant growth on the basis of EC.

In the NaCl plots the mean EC values were somewhat higher than in the freshwater gel and KCl plots. The trends regarding the changes that occurred with time are similar to the freshwater gel and KCl treatments. The highest application rate of NaCl waste resulted in EC levels that suggested a moderate limitation to plant growth. The mean EC value for the NaCl 10 treatment was 7.27 dS/m in the fall of 1988 and decreased to; 5.36 dS/m by the fall of 1989, 2.39 dS/m by the fall of 1990, and 1.27 dS/m by the fall of 1991 (Figure 10).

It is interesting to note that for almost all treatments except for the highest waste application rates that EC values in the 0 to 15 cm depth interval have decreased to baseline or pre-application levels. Subsoil EC values in the various treatments are still somewhat higher than baseline values.

Figure 8. Mean EC values for the FWG5 plots.

Depth (cm)	EC (dS/m)				
	Pre	Post	1989	1990	1991
0-15	0.6	1.4	1.4	0.8	0.8
15-30	0.3	0.8	0.7	0.6	0.6
30-45	0.3	0.3	0.5	0.5	0.4
45-60	0.3	0.3	0.5	0.4	0.4

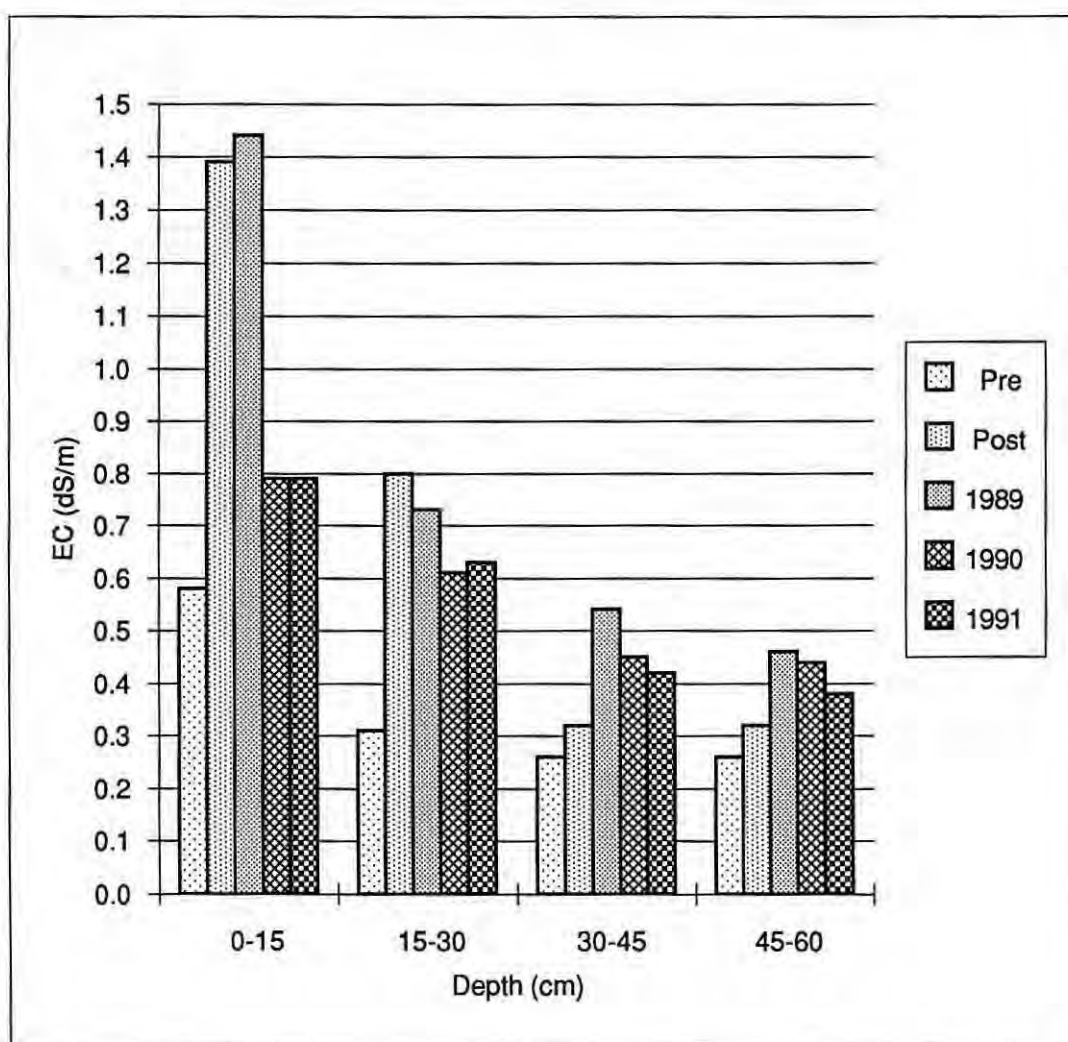


Figure 9. Mean EC values for the KCl4 plots.

Depth (cm)	EC (dS/m)				
	Pre	Post	1989	1990	1991
0-15	0.6	2.9	2.8	1.0	0.6
15-30	0.3	0.5	1.1	0.7	0.6
30-45	0.4	0.8	0.7	0.6	0.5
45-60	0.4	0.5	0.7	0.4	0.4
60-75	0.2	0.1	0.1	0.2	0.3
75-90	0.2	0.1	0.1	0.3	0.3

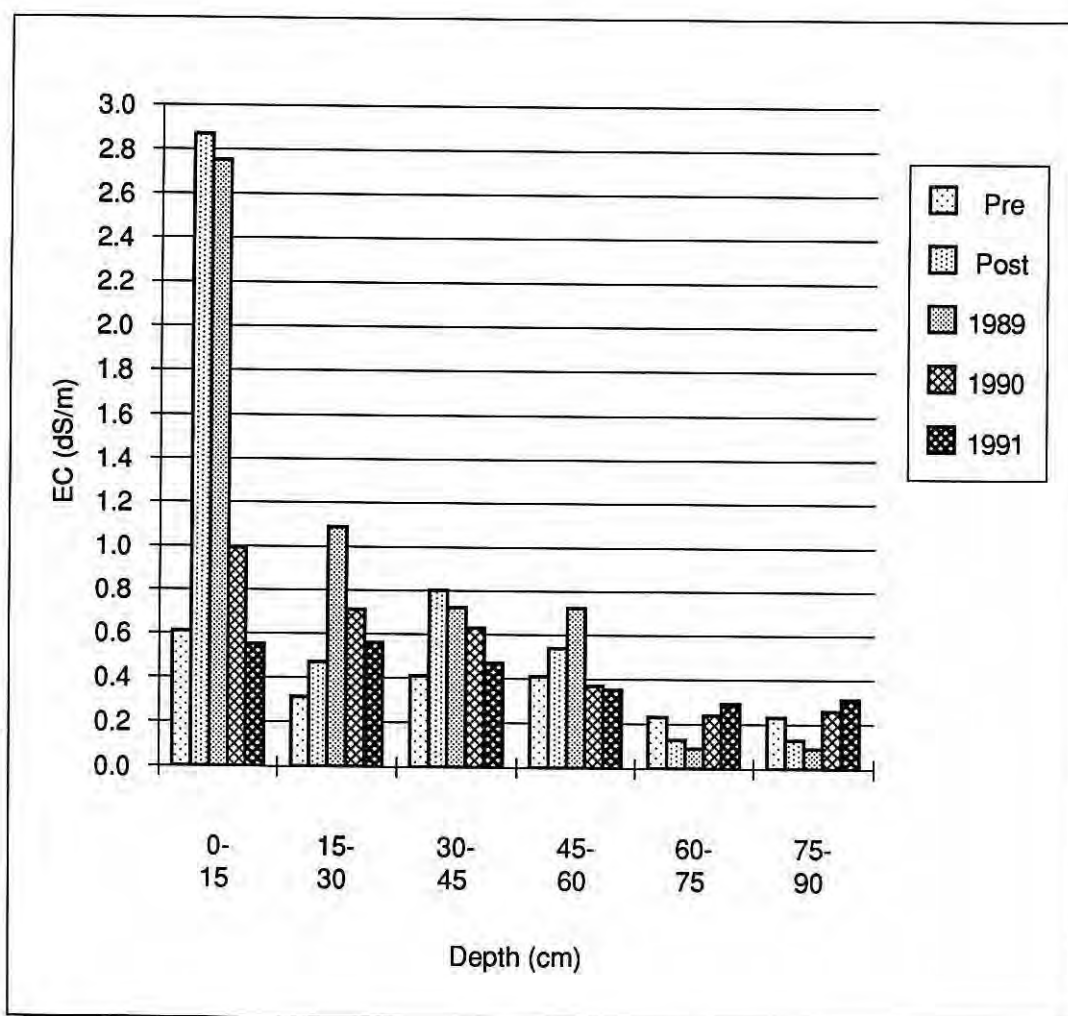
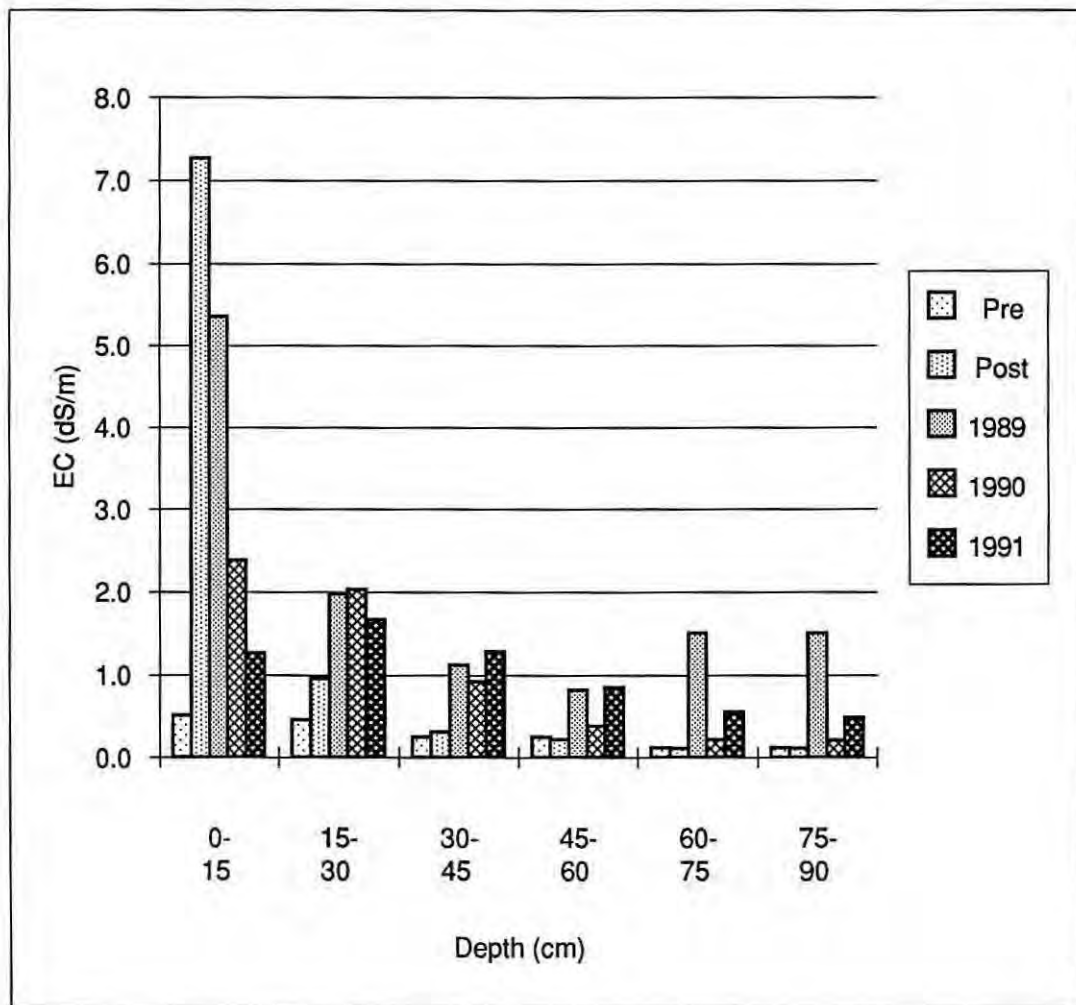


Figure 10. Mean EC values for the NaCl10 plots.

Depth (cm)	EC (dS/m)				
	Pre	Post	1989	1990	1991
0-15	0.5	7.3	5.4	2.4	1.3
15-30	0.5	1.0	2.0	2.0	1.7
30-45	0.3	0.3	1.1	0.9	1.3
45-60	0.3	0.2	0.8	0.4	0.9
60-75	0.1	0.1	1.5	0.2	0.6
75-90	0.1	0.1	1.5	0.2	0.5



4.4.2.2 Sodium adsorption ratio (SAR) values. The Alberta Soils Advisory Committee (1977) presented the following criteria for SAR levels in soil:

	<u>SAR Value</u>
No limitation	<4
Slight limitation	4 to 8
Moderate limitation	8 to 12
Severe limitation	>12

The mean SAR values for all plots and all depths prior to waste application were below 1.0 suggesting that on the basis of SAR levels the soils presented no limitation to plant growth. Following waste application the soil SAR values increased at almost all depths and all plots (Table 6). In the freshwater gel plots the maximum SAR values were in the range of 2 to 3 which suggest that the SAR levels of the plot soils would present no limitation to plant growth. For all treatments the mean SAR values in the 0 to 15 cm depth interval decreased between the fall of 1988 and 1989, and the fall of 1989 and 1990. Changes in SAR levels for the upper depth interval in the FW5 treatments are illustrated in Figure 11.

The maximum mean SAR value was 2 in the 0 to 15 cm depth interval for all of the KCl treatments following waste application indicating that the KCl plot treatments would not be limiting to plant growth on the basis of SAR levels. Changes in SAR levels for the upper depth intervals in the KCl 4 treatments are illustrated in Figure 12.

In the NaCl plots the mean SAR values were somewhat higher than in the freshwater gel and KCl plots. Following waste application treatments 8, 9, and 10 had mean SAR levels of 5, 9, and 24 respectively in the 0 to 15 cm depth interval. These SAR values reflect the potential for slight to severe limitations to plant growth. The changes that occurred from the fall of 1988 to the fall of 1991 indicate that only the NaCl 10 treatment still has the potential for moderate limitation to plant growth due to SAR level (Figure 13).

4.4.2.3 Chloride values. Maas (1986) indicated that the maximum chloride content that could be present in saturated extracts without loss of yield in grasses ranges from 1000 to 2600 ppm. Table 6 indicates that the mean chloride values for the various depths in the plot soils ranged from 6.0 to 25.9 mg/L (ppm) prior to waste application. Following the application of waste materials the Cl values increased at most depths in all plot treatments. The smallest change in Cl content occurred in the freshwater gel plots simply because of the low Cl levels in the gel wastes applied (Figure 14). Leaching of the Cl was evident by the changes that occurred between

Figure 11. Mean SAR values for the FWG5 plots.

Depth (cm)	SAR				
	Pre	Post	1989	1990	1991
0-15	0.3	3.5	2.4	1.4	1.2
15-30	0.4	1.7	1.3	1.0	1.2
30-45	0.4	0.6	0.9	0.6	1.5
45-60	0.4	0.6	0.4	0.5	1.0

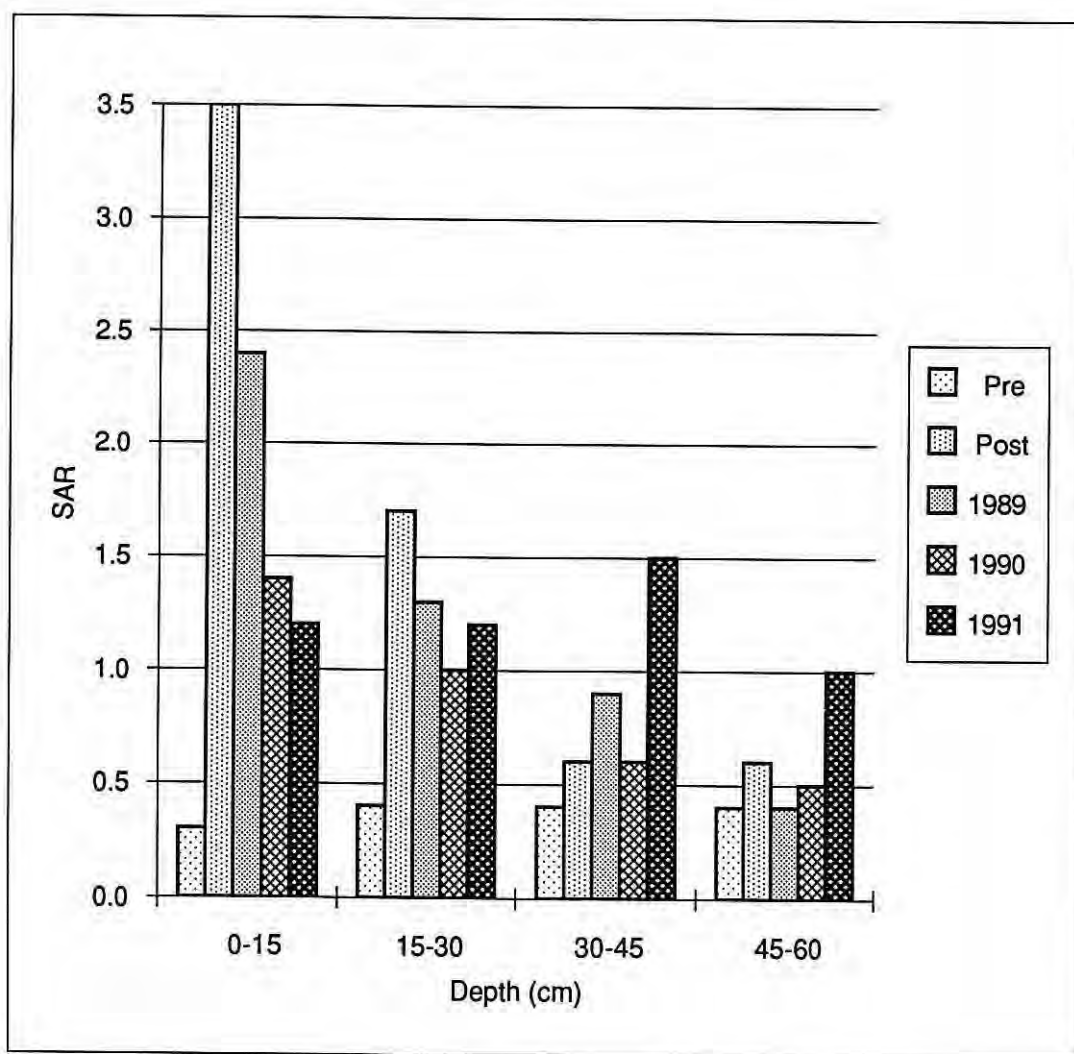


Figure 12. Mean SAR values for the KCl4 plots.

Depth (cm)	SAR				
	Pre	Post	1989	1990	1991
0-15	0.3	1.8	1.6	0.8	0.3
15-30	0.4	0.4	0.9	0.6	0.4
30-45	0.3	0.5	0.5	0.4	0.5
45-60	0.3	0.3	0.5	0.5	0.5

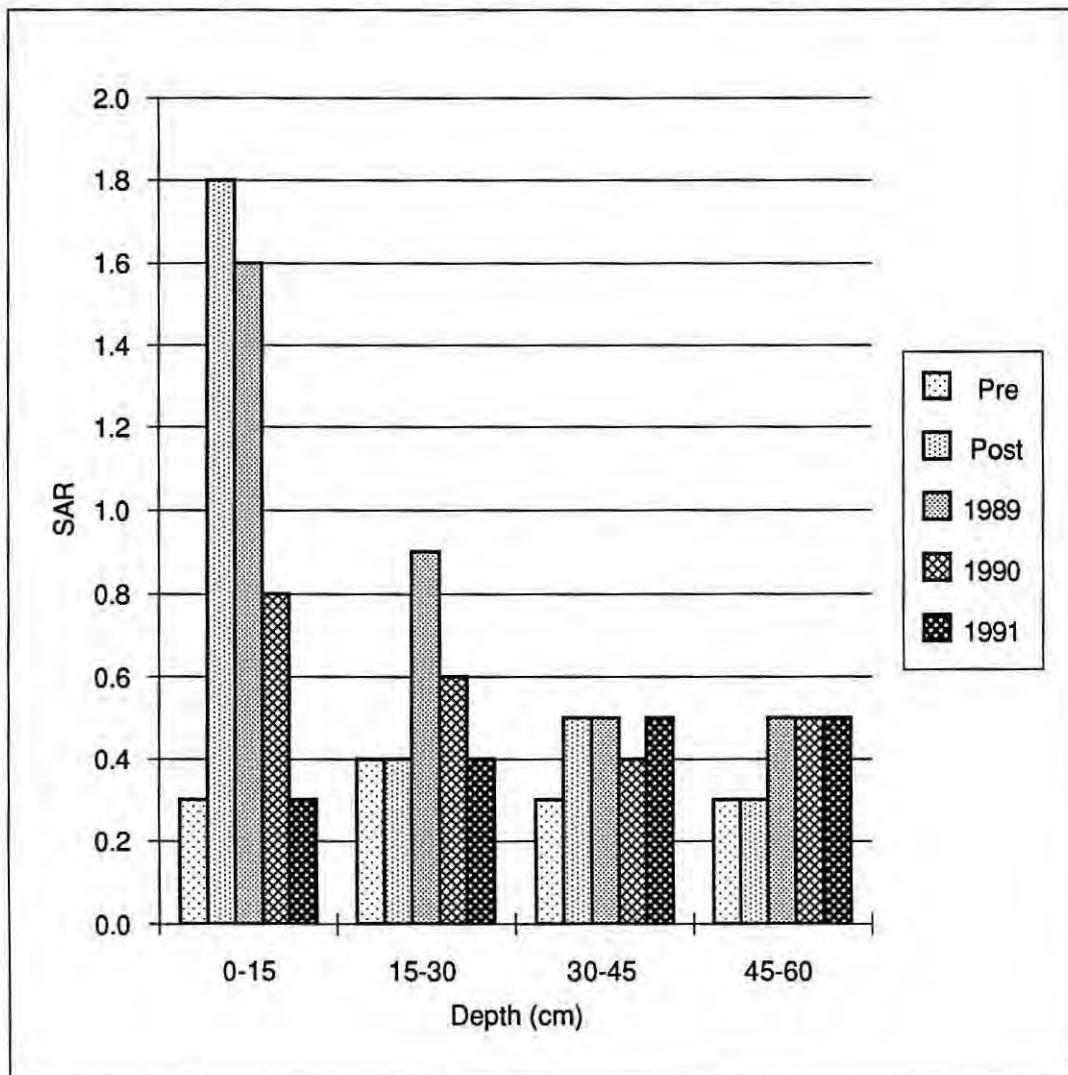


Figure 13. Mean SAR values for the NaCl10 plots.

Depth (cm)	SAR				
	Pre	Post	1989	1990	1991
0-15	0.5	23.5	15.2	11.4	8.3
15-30	0.5	0.9	4.4	6.5	6.9
30-45	0.3	0.7	2.8	0.9	1.4
45-60	0.3	0.8	2.8	0.5	0.8
60-75	0.1	0.9	4.8	0.4	0.6
75-90	0.1	0.9	4.8	0.6	0.5

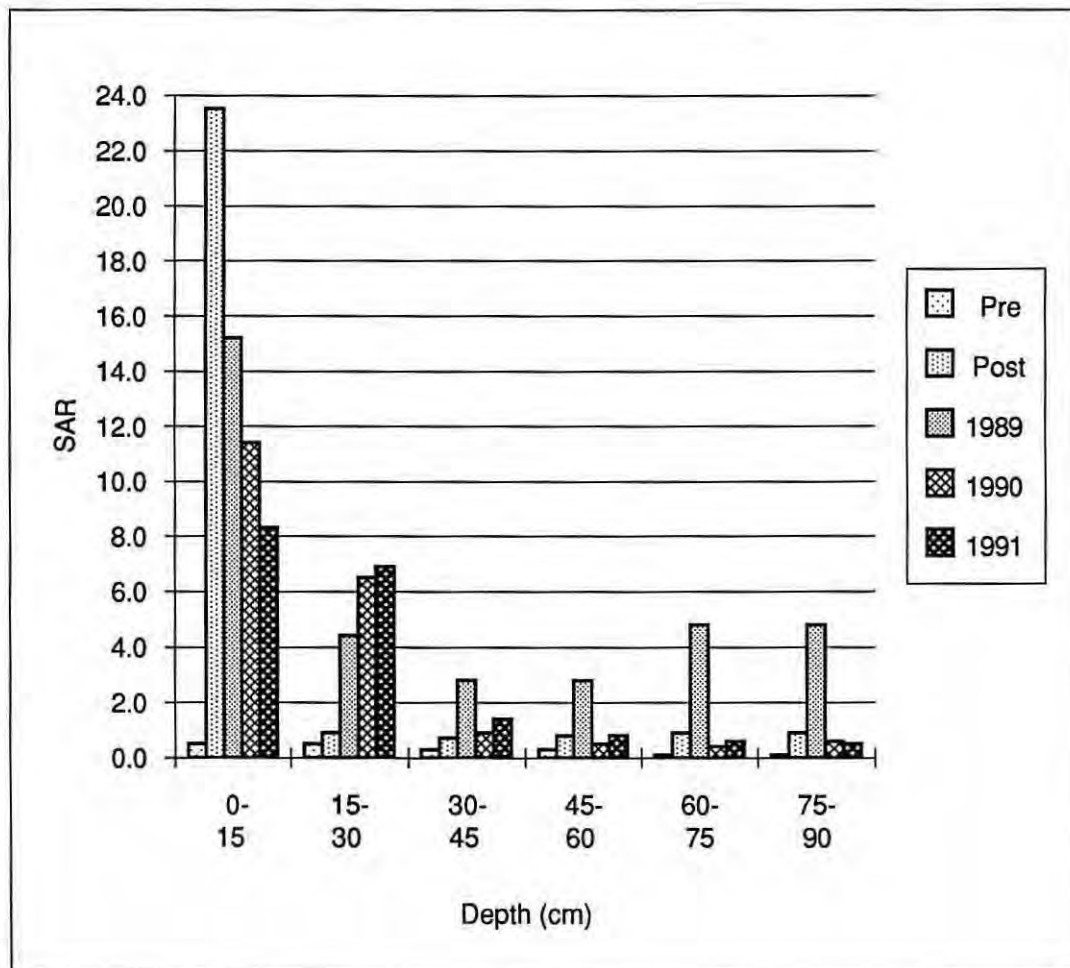
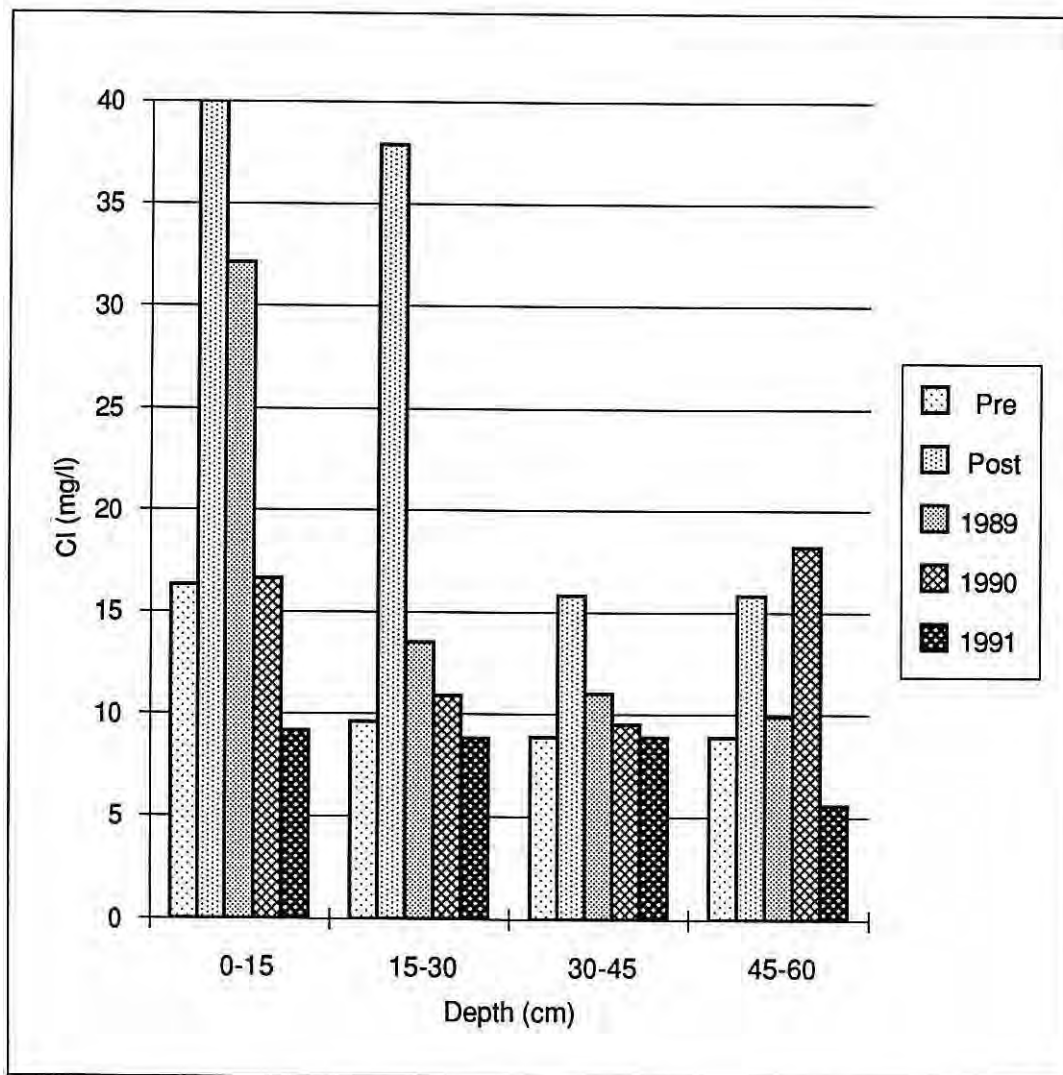


Figure 14. Mean CI values for the FWG5 plots.

Depth (cm)	CI (mg/l)				
	Pre	Post	1989	1990	1991
0-15	16	40	32	17	9
15-30	10	38	14	11	9
30-45	9	16	11	10	9
45-60	9	16	10	18	6



1988 and 1991. Using the criteria of Maas (1986) indicates that the chloride concentration in the plots should have no negative impact on plant growth.

The KCl treatments had considerably higher Cl additions than the freshwater gel treatments. The rapid leaching of the Cl following waste application is illustrated in Figure 15. Using the value of 1000 ppm Cl, as the level in soil that begins to impact plant growth, suggested that some limitation was possible for treatment KCl 4 and definitely a problem for treatment KCl 5 in the fall of 1988. The mean Cl values for the 0 to 15 cm depth decreased in 1989, 1990, and 1991.

The trends associated with Cl levels in the KCl waste treated plots were repeated in the NaCl waste treated plots. The rapid leaching of Cl is illustrated in Figure 16. Using the value of 1000 ppm Cl as the level in soil that begins to impact plant growth indicated that in the fall of 1991 there should not be a limitation associated with any of the plot treatments.

4.4.3 Total Elemental Analysis Data

Data for the total elemental analyses are presented in Appendix 3. These data can be used to assess the potential for heavy metal and other trace element contamination. Elemental content levels increased or decreased slightly as a result of waste addition. Values for the total elemental content of the various treatments were compared to the values for total elemental content of soils presented in Table 7 (Lindsay 1979). Values for the various elements provided in Appendix 3 were within the range of values normally found in soils, except for Ca which was slightly below the minimum levels indicated.

4.5 TISSUE ANALYSIS DATA

The total elemental content data for the brome grass tissue collected in 1991 are presented in Table 8.

The effect of the addition of drilling waste on the elemental enrichment of the affected plants can be demonstrated by the enrichment ratio (ER). The ER of a chemical element is calculated by dividing the elemental concentration of the waste affected plant tissue by that of the unaffected plant tissue. The higher ER of a chemical element indicates a greater degree of plant tissue enrichment in the affected soils. An enrichment ratio of <1 would be indicative of the reduced plant uptake of that element by plants. The ER for selected elements for 1988, 1989, 1990, and 1991 are presented in Table 9.

Figure 15. Mean Cl values for the KCl4 plots.

Depth (cm)	Cl (mg/l)				
	Pre	Post	1989	1990	1991
0-15	23	1070	863	147	25
15-30	12	69	386	151	24
30-45	8	281	221	159	64
45-60	8	53	43	75	50
60-75	6	18	10	43	37
75-90	6	18	10	51	31

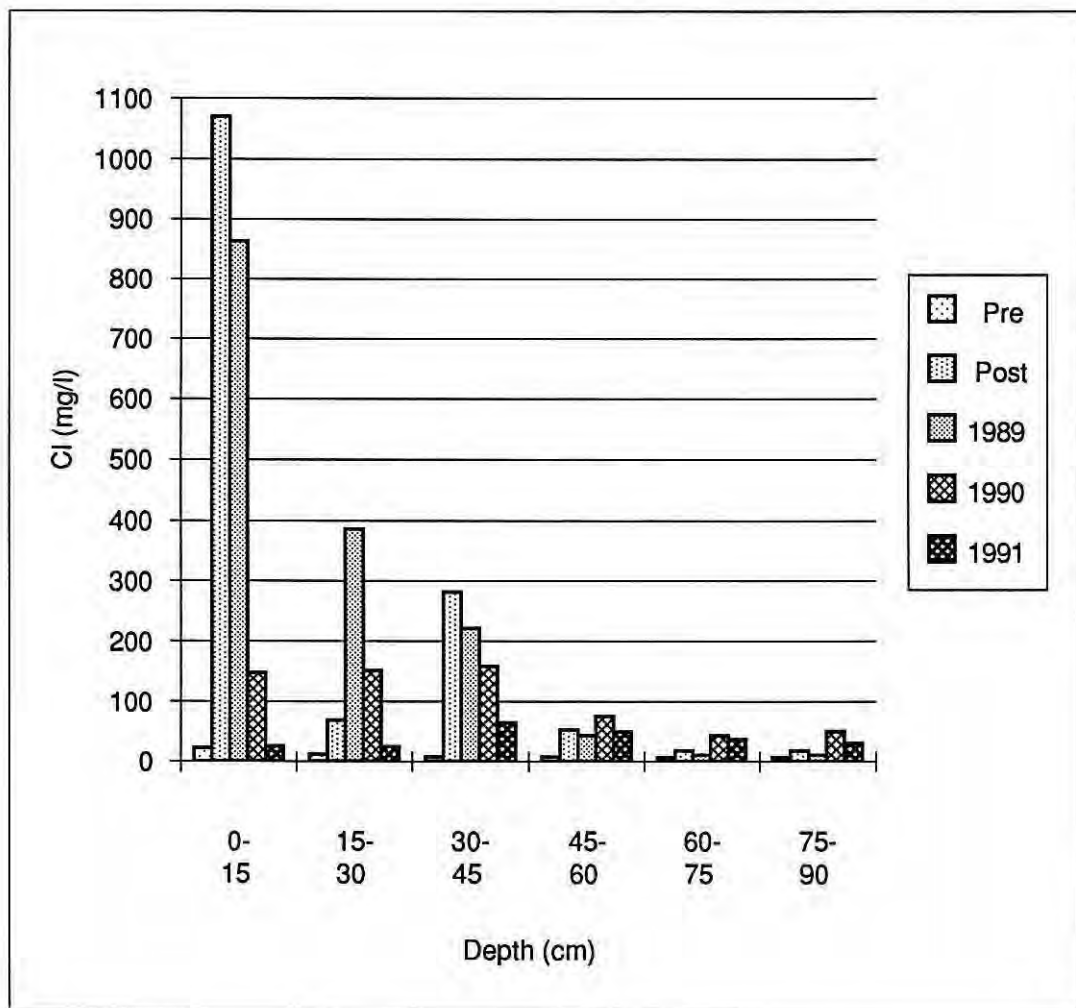


Figure 16. Mean Cl values for the NaCl10 plots.

Depth (cm)	Cl (mg/l)				
	Pre	Post	1989	1990	1991
0-15	24	3352	1728	957	253
15-30	15	206	539	598	415
30-45	8	43	306	332	412
45-60	8	25	192	129	261
60-75	8	20	454	57	157
75-90	8	20	454	59	130

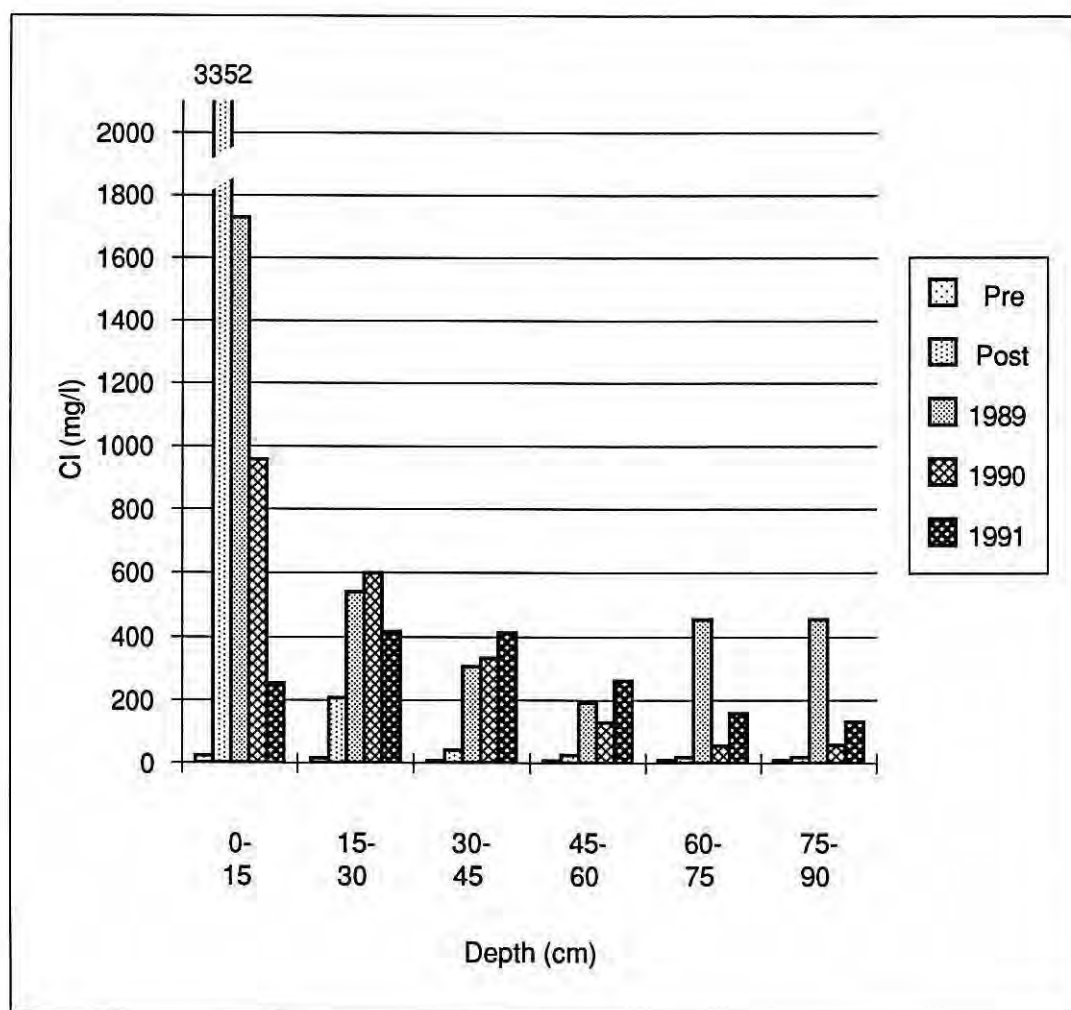


Table 7 . Elemental constituents of soils.

Element	Mean	Maximum	Minimum	Element	Mean	Maximum	Minimum
C (%)	2.00			Li ($\mu\text{g/g}$)	20.00	200.0	5.000
Ca (mg/g)	13.70	500.0	7.000	Cr ($\mu\text{g/g}$)	100.00	1000.0	1.000
Mg (mg/g)	5.00	6.0	0.600	Cu ($\mu\text{g/g}$)	30.00	100.0	2.000
Ti (mg/g)	4.00	10.0	1.000	Hg ($\mu\text{g/g}$)	0.03	0.3	0.010
Na (mg/g)	6.30	7.5	0.750	Ni ($\mu\text{g/g}$)	40.00	500.0	5.000
S (mg/g)	0.70	10.0	0.030	Pb ($\mu\text{g/g}$)	10.00	200.0	2.000
P (mg/g)	0.60	5.0	0.200	Co ($\mu\text{g/g}$)	8.00	40.0	1.000
Sr (mg/g)	0.20	1.0	0.050	Mo ($\mu\text{g/g}$)	2.00	5.0	0.200
Al (mg/g)	71.00	300.0	10.000	Cd ($\mu\text{g/g}$)	0.06	0.7	0.010
Si (mg/g)	320.00	350.0	230.000	Se ($\mu\text{g/g}$)	0.30	2.0	0.100
B (mg/g)	0.01	0.1	0.002	Ag ($\mu\text{g/g}$)	0.05	5.0	0.010
Ba (mg/g)	0.43	3.0	0.100	Zn ($\mu\text{g/g}$)	50.00	300.0	10.000
Fe (mg/g)	38.00	550.0	7.000	V ($\mu\text{g/g}$)	100.0	500.0	20.000
K (mg/g)	8.30	30.0	0.400	As ($\mu\text{g/g}$)	5.00	50.0	1.000
Mn (mg/g)	0.60	3.0	0.020	Zr ($\mu\text{g/g}$)	300.0	2000.0	60.0

From Lindsay (1979).

Table 8. Total Elemental Analysis Data for the Brome Grass Tissue Collected in the Field Trial Plots in 1991.

Waste	Rate	Plot	FSN (TMT-)	Ca	Mg	K (mg/g)	P	S	Cl	Cu	Zn	Fe	Mn	Na (ug/g)	Sr	Ba	Mo	Si	Cd
Freshwater	1	3	3	3.31	1.29	20.8	3.01	1.53	1.17	5.53	23.4	30.2	34.6	83.3	4.22	2.63	3.21	999	0.33
Freshwater	1	9	9	2.90	1.18	21.1	2.89	1.20	1.61	4.39	20.9	27.0	33.1	62.7	3.88	3.47	4.48	916	0.51
Freshwater	1	13	13	3.06	1.22	20.7	2.62	1.27	2.59	4.24	20.5	33.2	34.1	72.3	2.94	2.02	3.91	984	0.34
Freshwater	2	2	2	3.14	1.13	23.8	3.27	2.27	2.71	7.62	24.0	37.2	30.6	83.7	5.13	1.32	<1.80	621	0.40
Freshwater	2	8	8	3.08	1.08	21.1	2.69	1.50	3.01	4.44	20.8	30.8	28.4	86.0	5.69	1.95	3.10	768	0.39
Freshwater	2	15	15	3.30	1.28	20.5	3.07	1.59	2.73	5.50	26.1	36.3	29.9	89.2	4.65	2.06	4.99	758	0.33
Freshwater	3	1	1	2.40	0.93	25.2	2.80	1.61	3.01	4.49	23.6	32.8	69.6	87.0	5.28	2.77	<1.80	865	0.37
Freshwater	3	6	6	3.26	1.19	20.5	2.85	1.51	4.05	5.11	21.5	28.1	30.3	52.0	6.18	2.05	5.04	994	0.38
Freshwater	3	11	11	3.22	1.19	23.0	2.70	1.67	3.81	4.03	20.9	33.7	31.9	79.4	5.82	2.60	<1.80	556	0.41
Freshwater	4	5	5	3.10	1.10	21.9	2.70	1.66	2.87	5.49	19.9	27.4	35.9	101.1	5.09	2.16	2.60	1147	0.42
Freshwater	4	7	7	2.98	1.20	22.9	2.94	1.56	2.14	5.36	21.4	29.6	28.7	65.1	5.38	2.22	4.57	1216	0.61
Freshwater	4	12	12	2.65	1.01	21.6	2.67	1.65	2.98	4.55	19.6	33.2	26.7	89.4	4.71	2.20	<1.80	1078	0.35
Freshwater	5	4	4	3.16	1.11	22.9	2.86	1.87	3.05	6.22	26.1	36.1	42.2	70.1	5.62	1.74	<1.80	1165	0.49
Freshwater	5	10	10	2.79	0.90	19.6	2.59	1.47	2.76	4.13	19.4	33.6	27.7	71.0	5.67	2.04	<1.80	757	0.34
Freshwater	5	14	14	2.95	1.18	23.2	2.87	1.71	4.00	5.22	22.6	35.6	28.7	97.0	5.00	1.63	2.25	1228	0.27
KCl	1	17	17	2.85	1.11	20.8	2.59	1.10	4.23	3.73	17.6	26.6	30.5	76.6	4.07	4.65	5.87	729	0.27
KCl	1	42	42	3.90	1.36	20.0	2.63	1.49	1.60	4.36	18.8	41.4	37.0	62.5	3.74	3.11	4.12	1023	0.21
KCl	1	43	43	2.54	0.98	19.3	2.49	1.07	1.97	3.30	15.7	26.6	27.0	28.3	2.93	1.46	3.44	919	0.26
KCl	2	33	33	3.49	1.34	20.2	2.91	1.24	3.24	5.08	20.4	35.6	42.3	60.3	4.11	2.51	8.30	836	0.21
KCl	2	40	40	2.44	0.92	20.4	2.53	1.43	4.69	4.60	15.7	28.3	32.7	73.4	3.77	1.53	1.91	657	0.19
KCl	2	45	45	3.60	1.21	20.6	2.56	1.59	3.99	5.87	19.8	43.3	39.3	61.5	4.37	1.70	5.28	917	0.27
KCl	3	21	21	2.67	1.04	25.9	3.05	1.54	5.20	6.05	20.3	33.5	29.3	74.9	4.86	3.69	3.76	765	0.22
KCl	3	30	30	2.67	1.01	19.5	2.69	1.48	5.46	4.68	17.1	32.0	38.7	49.3	4.83	2.42	<1.80	661	0.28
KCl	3	39	39	2.47	0.83	17.8	2.41	1.28	5.00	2.37	14.9	32.6	27.5	42.8	3.60	1.72	<1.80	452	0.19
KCl	4	16	16	2.44	0.90	21.7	2.46	1.50	3.87	4.44	18.4	27.3	22.9	87.9	4.81	2.66	<1.80	768	0.29
KCl	4	24	24	2.08	0.84	21.6	2.63	1.37	4.89	5.24	20.0	31.0	31.8	63.7	4.68	2.41	2.21	776	0.18
KCl	4	29	29	1.99	0.78	21.3	2.24	1.15	6.08	4.82	17.3	29.3	38.0	40.1	3.90	1.91	<1.80	791	0.27
KCl	5	25	25	2.36	0.98	23.2	2.72	1.47	6.12	6.16	20.7	37.0	122	78.3	5.62	1.56	<1.80	740	0.17
KCl	5	26	26	2.42	0.89	21.9	2.48	1.38	4.96	4.50	19.4	30.3	36.5	78.1	4.69	2.25	2.92	743	0.21
KCl	5	37	37	3.20	1.07	22.3	2.54	1.40	4.53	4.12	20.6	34.2	37.7	75.1	4.82	2.77	2.69	954	<0.15
NaCl	6	22	22	3.11	1.20	22.8	2.76	1.19	4.70	4.88	19.5	27.8	36.7	87.5	4.40	2.98	7.42	1256	0.21
NaCl	6	32	32	2.93	1.20	23.8	3.07	1.20	4.15	4.66	18.2	28.9	36.9	46.1	3.49	2.47	7.18	1023	0.28
NaCl	6	41	41	2.37	0.94	17.0	2.26	0.94	4.54	2.41	13.3	25.8	27.5	36.0	3.04	1.53	2.81	631	0.27
NaCl	7	18	18	2.84	1.16	24.9	3.13	1.31	5.13	5.80	25.6	32.8	31.5	83.7	3.55	3.03	6.39	1123	0.37
NaCl	7	27	27	3.07	1.20	22.5	2.91	1.28	5.39	4.81	20.3	32.5	47.5	75.5	4.44	2.65	3.30	732	0.21
NaCl	7	34	34	2.34	0.94	20.6	2.74	1.19	5.54	4.96	18.2	38.3	38.7	84.0	4.17	2.87	3.68	657	0.20
NaCl	8	20	20	2.75	1.09	22.5	2.71	1.22	5.11	4.35	19.0	28.0	33.7	89.2	3.73	2.92	6.16	1083	0.21
NaCl	8	35	35	3.11	1.19	21.6	2.90	1.32	4.76	5.24	20.2	30.4	34.9	65.8	4.65	2.25	5.74	929	0.22
NaCl	8	44	44	3.06	1.13	21.7	2.86	1.22	5.42	4.69	18.5	36.4	33.9	79.8	3.93	2.44	4.91	894	0.27
NaCl	9	19	19	2.79	1.16	22.5	3.08	1.48	5.75	7.27	23.2	37.5	45.5	97.8	4.16	1.99	4.39	960	0.28
NaCl	9	31	31	2.55	1.11	19.3	2.61	1.28	4.97	4.83	17.4	34.6	48.0	108.2	3.82	2.27	4.19	807	0.28
NaCl	9	36	36	2.58	1.07	22.5	2.66	1.25	5.24	4.91	18.3	37.5	33.8	80.3	3.74	2.59	4.71	801	0.21
NaCl	10	23	23	2.66	1.15	23.8	3.07	1.46	6.30	5.77	23.2	34.0	64.9	53.8	4.22	1.41	2.51	877	0.29
NaCl	10	28	28	2.06	0.89	21.7	2.70	1.27	5.88	5.13	17.9	33.4	71.0	57.3	3.18	2.13	<1.80	773	0.29
NaCl	10	38	38	2.67	1.04	18.4	2.54	1.20	5.33	3.65	17.0	31.8	29.8	97.8	3.63	1.28	4.55	621	0.21

Elements (Al, Ti, Cr, V, Pb, Li, Ni, Se, As, Co) below the detection limit are excluded from this table.

Table 9. ER (Enrichment Ratio) Values for Elements in the Brome Grass Tissue for 1988, 1989, 1990 and 1991.

Waste	Rate	B				Ca				Cl				Cr			
		Post	1989	1990	1991	Post	1989	1990	1991	Post	1989	1990	1991	Post	1989	1990	1991
Freshwater	1	1.0	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	1.0	1.0	-
Freshwater	2	1.6	1.0	1.2	-	1.0	1.0	0.9	1.0	1.8	1.4	1.5	1.6	-	0.9	2.5	-
Freshwater	3	1.8	1.0	0.8	-	1.0	0.9	0.9	1.0	2.1	1.3	1.5	1.5	-	1.0	-	-
Freshwater	4	1.6	1.1	1.8	-	1.1	1.1	1.0	0.9	2.1	1.4	1.5	1.5	-	1.0	0.6	-
Freshwater	5	2.0	1.0	1.0	-	1.2	1.1	1.0	1.0	2.2	1.4	1.5	1.8	-	1.0	0.9	-
KCl	1	-	1.0	1.0	-	-	1.0	1.0	1.0	-	1.0	1.0	1.0	-	1.0	1.0	-
KCl	2	1.0	1.0	1.2	-	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.5	-	0.9	0.8	-
KCl	3	1.4	1.0	1.6	-	1.1	1.0	1.0	0.8	1.2	1.2	1.2	2.0	-	1.0	0.4	-
KCl	4	-	1.1	1.2	-	-	1.2	0.8	0.7	-	1.3	1.3	1.9	-	1.0	0.4	-
KCl	5	-	1.0	1.3	-	-	1.0	1.0	0.9	-	1.1	1.5	2.0	-	1.0	-	-
NaCl	6	1.0	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	1.0	1.0	-
NaCl	7	1.2	1.0	0.9	-	0.9	0.9	0.9	1.0	2.3	1.1	1.3	1.2	-	1.0	0.5	-
NaCl	8	1.0	1.0	0.8	-	1.1	0.9	0.9	1.1	2.1	1.1	1.2	1.1	-	1.3	0.9	-
NaCl	9	1.4	1.0	0.8	-	1.1	0.8	0.9	0.9	2.1	1.1	1.2	1.2	-	1.0	0.9	-
NaCl	10	-	1.0	0.8	-	-	0.8	0.8	0.9	-	1.3	1.4	1.3	-	1.0	2.8	-

Waste	Rate	Cu				K				Mg				Na			
		Post	1989	1990	1991	Post	1989	1990	1991	Post	1989	1990	1991	Post	1989	1990	1991
Freshwater	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Freshwater	2	1.1	1.3	1.4	1.2	1.0	1.1	1.0	1.0	0.9	0.9	0.9	0.9	2.4	1.0	1.0	1.2
Freshwater	3	1.1	0.9	0.9	1.0	1.1	1.1	1.0	1.1	0.9	0.9	0.9	0.9	3.2	0.9	2.1	1.0
Freshwater	4	1.0	1.2	1.1	1.1	1.0	1.0	1.0	1.1	0.9	1.0	1.0	0.9	2.4	0.9	0.5	1.1
Freshwater	5	1.0	1.0	0.9	1.1	1.0	1.0	0.9	1.1	0.9	1.0	0.9	0.9	9.5	1.3	1.4	1.1
KCl	1	-	1.0	1.0	1.0	-	1.0	1.0	1.0	-	1.0	1.0	1.0	-	1.0	-	1.0
KCl	2	1.0	0.9	1.2	1.4	1.0	1.0	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.2	-	1.2
KCl	3	0.8	2.6	1.2	1.2	0.9	1.1	1.0	1.0	0.9	0.9	0.9	0.8	2.6	2.0	-	1.0
KCl	4	-	2.9	1.1	1.3	-	1.5	1.0	1.0	-	1.0	0.8	0.7	-	1.4	-	1.1
KCl	5	-	1.2	0.9	1.3	-	1.1	1.1	1.1	-	1.0	0.8	0.9	-	1.4	-	1.4
NaCl	6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	1.0
NaCl	7	1.4	1.7	0.6	1.3	1.1	1.0	1.0	1.1	0.8	0.9	0.9	1.0	9.4	1.1	-	1.4
NaCl	8	1.2	1.9	0.8	1.2	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0	21.8	1.3	-	1.4
NaCl	9	1.3	1.6	0.8	1.4	0.9	1.0	1.0	1.0	0.9	0.9	0.9	1.0	29.0	2.3	-	1.7
NaCl	10	-	1.1	0.6	1.2	-	1.0	0.9	1.0	-	0.7	0.8	0.9	-	10.9	-	1.2

Post = Samples September 1988, 1989 = Samples August 1989; 1990 = Sampled August 1990; 1991 = Samples August 1991.

Table 9 (Concluded). ER (Enrichment Ratio) Values for Elements in the Brome Grass Tissue for 1988, 1989, 1990 and 1991.

Waste	Rate	P				S				Zn			
		Post	1989	1990	1991	Post	1989	1990	1991	Post	1989	1990	1991
Freshwater	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Freshwater	2	1.0	1.0	1.0	1.1	1.3	1.1	1.1	1.3	1.0	1.0	1.1	1.1
Freshwater	3	1.1	1.0	1.0	1.0	1.3	1.1	1.0	1.2	1.0	0.9	1.0	1.0
Freshwater	4	0.9	1.0	1.1	1.0	1.2	1.0	1.1	1.2	0.9	0.8	1.0	0.9
Freshwater	5	0.8	1.0	0.9	1.0	1.1	1.0	1.0	1.3	0.9	0.8	0.9	1.1
KCl	1	-	1.0	1.0	1.0	-	1.0	1.0	1.0	-	1.0	1.0	1.0
KCl	2	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.2	1.0	1.0	1.1	1.1
KCl	3	0.6	1.1	1.0	1.1	0.9	1.0	1.1	1.2	1.0	1.0	1.2	1.0
KCl	4	-	1.2	1.0	1.0	-	1.2	0.9	1.1	-	1.3	1.1	1.1
KCl	5	-	1.1	1.0	1.0	-	1.0	1.0	1.2	-	1.0	1.1	1.2
NaCl	6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
NaCl	7	1.1	1.0	1.0	1.1	1.4	1.0	1.0	1.1	1.3	1.0	1.0	1.3
NaCl	8	1.1	1.0	1.0	1.1	1.2	1.0	0.9	1.1	1.2	2.1	1.1	1.1
NaCl	9	1.2	1.0	1.0	1.0	1.2	1.0	0.9	1.2	1.1	1.1	1.0	1.2
NaCl	10	-	1.1	1.0	1.0	-	1.0	1.0	1.2	-	1.0	1.1	1.1

Post = Samples September 1988, 1989 = Samples August 1989; 1990 = Sampled August 1990; 1991 = Samples August 1991.

The tissue from the treated plots exhibited slightly elevated levels of chloride for all waste types.

Copper levels in the tissue in 1991 were higher than the 1990 values but lower than those recorded in 1988 and 1989. Tissue levels of 1.0 to 5.1 ppm and 5.2 to 18.0 ppm copper are considered deficient and normal, respectively. Tissue grown in the control plots had copper levels above the mid-point of the deficient range. Addition of waste resulted in increased tissue copper values in 1988 and 1989 with some of the values occurring in the normal range for grasses (Macyk et al. 1990). However, in 1990 the values were back down in the deficient range in the control plots as well as the waste amended plots (Macyk et al. 1991). In 1991 the trend reversed somewhat with higher tissue Cu levels occurring.

Substantial differences in the uptake of Na between 1988 and 1989 were evident from the ER values reported in Macyk et al. (1990). This is related to the fact that the sodium was leached downward from the zone of waste incorporation and out of the currently established root zone. Normal and excessive levels of sodium in grasses are 300 to 1100 ppm and 3200 to 43700 ppm, respectively. The values reported for 1991 (Table 8) indicated Na levels below the normal level and ER values (Table 9) indicated that only tissue from the NaCl amended plots had any real measurable increase in Na over the control plot values.

Tissue chloride values for 1988 ranged from 3.82 mg/g (3820 ppm) to 18.45 mg/g (19450 ppm), and for 1989 ranged from 2.89 mg/g (2890 ppm) to 6.01 mg/g (6010 ppm) (Macyk et al. 1990). Chapman (1966) reports an intermediate range of 7000 ppm and a high range of 8700 to 15400 ppm for chloride in grasses. Using these values as a guideline suggests that the application of all wastes resulted in high levels of chloride in the tissue in 1988 particularly the tissue from the KCl and NaCl treated plots. It is difficult to assess the impact of chloride levels on plant health and growth, because the only consistent or general symptom of excess chloride is reduced leaf size and slower growth rate. However, for many plants sharply reduced growth occurs without leaf symptoms (Chapman 1966). The chloride levels in the tissue in 1989 and 1990 were considerably lower than those in 1988 and decreased even more in 1991. The decrease in tissue chloride levels in 1990 is directly related to the decrease in soil/waste chloride levels, described in Section 4.4.2.3 of this report. The ER values for Cl in 1991 (Table 9) were similar to the 1990 values for the freshwater gel and NaCl treatments and somewhat higher for the KCl treatments.

5. SUMMARY

5.1 PLOT YIELD

Observations, relative to the brome grass growth on the various plot treatments, were made throughout the growing season. The brome grass was harvested in late June and again in mid-August, however, only the data and interpretation, thereof, for the June harvest were presented.

The yields associated with the three waste types were very similar in comparison to previous years when the freshwater gel plot yields were higher. There were apparent yield differences between the different treatments for each of the waste types, however only differences for a few of the NaCl treatments were statistically significant.

5.2 FIELD PLOT SOIL PROPERTIES

A total of 294 samples were collected in mid-August 1991. Samples representing the 0 to 15 cm depth were collected at all plots, and additional samples representing the 15 to 30 cm, 30 to 45 cm, 45 to 60 cm, 60 to 75 cm, 75 to 90 cm, 90 to 105 cm and additional depth intervals where possible were obtained at selected plots.

5.2.1 Chemical Properties

The samples were analyzed to determine pH and CaCO_3 equivalent. Following waste application, only treatment FW5 (0 to 15 cm depth) might present a very slight limitation to plant growth as a result of pH level. The CaCO_3 equivalent values indicated a "good" rating in terms of soil suitability for plant growth for all treatments prior to and following waste application.

5.2.2 Saturated Paste Extract Data

Table 10 provides a summary of the degree of limitation associated with the EC, SAR, and Cl status of the plot treatments in 1988, 1989, 1990 and 1991 for the 0 to 15 cm depth or zone of incorporation. The degree of limitation has declined annually for a number of the parameters and the respective treatments. Only the NaCl 10 treatment had a limitation (moderate) on the basis of SAR.

Table 10. Summary of degree of limitation relative to EC, SAR, and CI levels in 1988, 1989, 1990 and 1991 for the 0 to 15 cm depth (zone of waste incorporation).

Waste Treatment	Degree of Limitation*											
	EC				SAR				CI			
	1988	1989	1990	1991	1988	1989	1990	1991	1988	1989	1990	1991
FW 1	none	none	none	none	none	none	none	none	none	none	none	none
FW 2	none	none	none	none	none	none	none	none	none	none	none	none
FW 3	none	none	none	none	none	none	none	none	none	none	none	none
FW 4	none	none	none	none	none	none	none	none	none	none	none	none
FW 5	none	none	none	none	none	none	none	none	none	none	none	none
KCl 1	none	none	none	none	none	none	none	none	none	none	none	none
KCl 2	none	none	none	none	none	none	none	none	none	none	none	none
KCl 3	slight	slight	none	none	none	none	none	none	slight	none	none	none
KCl 4	slight	slight	none	none	none	none	none	none	slight	none	none	none
KCl 5	slight	slight	slight	none	none	none	none	none	severe	slight	none	none
NaCl 6	none	none	none	none	none	none	none	none	none	none	none	none
NaCl 7	none	none	none	none	slight	none	none	none	none	none	none	none
NaCl 8	none	slight	none	none	slight	slight	none	none	none	none	none	none
NaCl 9	slight	none	none	none	moderate	slight	none	none	none	none	none	none
NaCl 10	moderate	moderate	slight	none	severe	severe	moderate	moderate	severe	moderate	slight	none

5.2.3 Total Elemental Analysis Data

Elemental content levels increased or decreased slightly as a result of waste addition. Mean values, for the various elements determined, were within the range of values normally found in soils, except for Ca which in some instances was below the minimum levels provided.

5.3 TISSUE ANALYSIS DATA

The effect of the addition of drilling wastes on the elemental enrichment of the brome grass was demonstrated by the enrichment ratio (ER). The tissue from the treated plots exhibited slightly elevated levels of chloride for all waste types. Tissue grown in the control plots had copper levels in the deficient range, however, the addition of waste resulted in some of the values increasing into the normal range for grasses in 1988, 1989 and in 1991.

Tissue chloride levels were generally lower in 1991 than in 1990. This can be attributed to the decrease in chloride levels in the root zone soil/waste material.

6. CONCLUSIONS

Observations made and results obtained pertinent to the field study in 1991 again form the basis for the preliminary conclusions presented herein. The application of the different wastes at various rates had both positive and negative impacts on the soils and the plants grown thereon. The project objective was to identify the impact of different loading rates of the wastes on the soils and plants grown thereon with emphasis to be placed on determining maximum tolerable loading rates.

The report describes the impact of the different loading rates of the wastes. Determining maximum tolerable loading rates is difficult to do in the absence of some guidelines as to how "tolerable" may be defined. Furthermore, the time at which the characteristics of the soil/waste mixtures are characterized to evaluate the "degree of limitation" or impact of the waste is critical. The results of an assessment days or weeks after waste application will be considerably different from the results of an assessment made one, two or more years hence.

It is important to note that the trend established relative to yield has completely reversed from 1989 to 1991. In 1989 the highest application rate for each waste type resulted in the lowest yield whereas by 1991 the highest yields occurred on the highest waste rate plots. During the next few years it will be vital to evaluate whether the trend of change from 1989 to 1991 will continue.

Comments will be provided regarding the impact of the application of the three different wastes at the various rates.

6.1 FRESHWATER GEL

The current guideline for maximum loading rate for Cl is 450 kg Cl/ha (ERCB 1975). In this study the maximum rate of Cl applied was 120 kg Cl/ha which translated into a layer about 10 cm thick. This maximum rate resulted in a slight limitation to soil quality as a result of pH. There were no limitations due to EC, SAR or Cl levels in the soil. Yield increases compared to the control plots were realized as a result of the freshwater gel waste application, however these increases were not statistically significant.

One can conclude that freshwater gel wastes with properties similar to the waste used in this experiment can be added to soil with minimal negative impact and some positive potential benefit depending upon the amount applied. One could also suggest that Cl addition is not the most appropriate parameter for developing freshwater gel additions and that liming potential in combination with chloride content would likely be more suitable.

6.2 POTASSIUM CHLORIDE

The addition of KCl wastes in this experiment resulted in Cl additions of 500, 1000, 2000, and 4000 kg Cl/ha. Initially yield declined from control levels as waste application rate increased, however the values obtained were not statistically significant (lower). In 1991 the KCl 3 and KCl 5 treatment yields exceeded control values. Limitations relative to EC and Cl levels in the 0 to 15 cm depth interval were evident following waste application and declined with time. For example, slight limitations due to EC for KCl 3, 4 and 5 were evident in the fall of 1988. By the fall of 1991 there was no limitation due to EC.

It appears that in this experiment the KCl waste could be applied at 500 kg Cl/ha with no negative impact on soil quality. In fact the rate that could be applied with no apparent impact likely lies somewhere between 500 and 1000 kg Cl/ha. Higher rates could be applied if a slight to moderate impact was acceptable for a 2 to 4 year period following waste application.

6.3 SODIUM CHLORIDE

The addition of NaCl wastes in this experiment resulted in Cl additions of 350, 700, 1400 and 2800 kg Cl/ha. The addition of these waste materials resulted in some increases in yield, particularly in 1991 when the NaCl 8, NaCl 9 and NaCl 10 treatment yields exceeded control values. The 1991 results indicated only a moderate limitation for the 2800 kg Cl/ha rate (NaCl 10) due to SAR levels. Initially the NaCl 10 (2800 kg Cl/ha) rate resulted in moderate and severe limitations for EC, SAR and Cl respectively following waste application. In 1990 the limitations for these parameters ranged from slight to moderate.

For the NaCl wastes the material could be applied with no negative impact at the equivalent rate of 350 kg Cl/ha or likely between the 350 and 700 kg Cl/ha rate. Higher rates could be applied if slight to moderate limitations were acceptable.

7. REFERENCES

- Alberta Soils Advisory Committee. 1977. Soil quality criteria for agriculture. Report printed by Agriculture Canada.
- Alberta Soils Advisory Committee. 1987. Soil quality criteria relative to disturbance and reclamation. Soil Quality Criteria Working Group, Soil Reclamation Subcommittee.
- Bascomb, C.L. 1961. A calcimeter for routine use on soil samples. Chemistry and Industry (Part II):1826-1827.
- Chapman, H.D. (ed.). 1966. Diagnostic criteria for plants and soils. Department of Soils and Plant Nutrition, University of California Citrus Research Center and Agricultural Experiment Station, Riverside, California.
- Doughty, J.L. 1941. The advantages of a soil paste for routine pH determination. Soil Science 22:135-138.
- ERCB. 1975. Interim Directive ID-OG 75-2: sump fluid disposal requirements.
- Gaines, T.P., M.B. Parker, and G.J. Gascho. 1984. Automated determination of chlorides in soil and plant tissue by sodium nitrate extraction. Agronomy Journal 76:371-374.
- Holmgren, G.G.S., R.L. Juve, and R.C. Geschwender. 1977. A mechanically controlled variable rate leaching device. Soil Science Society of America Journal 32:568-570.
- Leco Corporation. 1979. CR-12 carbon system 781-600. Instrument Manual 200-195.
- Lindsay, W.L. 1979. Chemical equilibria in soils. John Wiley and Sons, New York.
- Maas, E.V. 1986. Physiological response of plants to chloride: In: T.L. Jackson (ed.). Chloride and crop production. Papers of an American Society of Agronomy Annual Meeting (November 1984), published by the Potash and Phosphate Institute (August 1986).
- Macyk, T.M., F.I. Nikiforuk, and Z.W. Widtman. 1991. Drilling waste landspreading field trial - a joint research project of Alberta Research Council and ESSO Resources Canada Limited. Environmental Research and Engineering Department, Alberta Research Council Report prepared for ESSO Resources Canada Limited.
- Macyk, T.M., F.I. Nikiforuk, and Z.W. Widtman. 1990. Drilling waste landspreading field trial - a joint research project of Alberta Research Council and ESSO Resources Canada Limited. Terrain Sciences Department, Alberta Research Council Report prepared for ESSO Resources Canada Limited.
- Macyk, T.M., F.I. Nikiforuk, and S.A. Abboud. 1989a. Drilling waste landspreading field trial - a joint research project of Alberta Research Council and ESSO Resources Canada Limited. Terrain Sciences Department, Alberta Research Council Report prepared for ESSO Resources Canada Limited.

- Macyk, T.M., F.I. Nikiforuk, S.A. Abboud and Z.W. Widtman. 1989b. Detailed sampling, characterization and greenhouse pot trials relative to drilling wastes in Alberta. Alberta Land Conservation and Reclamation Council Report No. RRTAC 89-6. 228 pp.
- Peech, M. 1965. Hydrogen-ion activity. In: 'Methods of Soil Analysis, Part 2', C.A. Black et al. (ed.). Agronomy 9:914-926. American Society of Agronomy, Inc., Madison, Wisconsin.
- Rhoades, J.D. 1982. Soluble salts. In: 'Methods of Soil Analysis, Part 2', A.L. Page et al. (ed.). Agronomy 9:167-179. American Society of Agronomy, Inc., Madison, Wisconsin.
- Soltanpour, P.N. and S.M. Workman. 1981. Soil-testing methods used at Colorado State University soil-testing laboratory. Colorado State University.
- USDA. 1954. Diagnosis and improvement of saline and sodic soils. Agriculture Handbook 60, United States Department of Agriculture.

APPENDIX I. Chemical properties of the soils and soil/waste mixtures in the ESSO field plots in 1991.

Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	---- H2O	pH --- CaCl2	CaCO3 Eq(%)	Waste	Rate	Plot	FSN (TME-)	Depth (cm)	---- H2O	pH --- CaCl2	CaCO3 Eq(%)
Freshwater	1	3	7	0-15	7.30	7.20	0.430	Freshwater	5	10	36	30-45	7.80	7.80	5.360
Freshwater	1	9	25	0-15	7.40	7.20	0.000	Freshwater	5	10	37	45-60	7.80	7.80	5.280
Freshwater	1	13	48	0-15	7.30	7.00	0.160	Freshwater	5	10	38	60-75	7.80	7.80	5.020
Freshwater	1	13	49	15-30	7.80	7.60	1.950	Freshwater	5	10	39	75-90	7.80	7.80	3.320
Freshwater	1	13	50	30-45	7.80	7.60	4.950	Freshwater	5	10	40	90-105	7.80	7.80	4.630
Freshwater	1	13	51	45-60	8.05	7.60	5.210	Freshwater	5	10	41	105-115	7.80	7.80	3.755
Freshwater	1	13	52	60-75	7.90	7.60	5.340	Freshwater	5	14	55	0-15	7.70	7.30	0.860
Freshwater	1	13	53	75-90	7.90	7.70	4.755	Freshwater	5	14	56	15-30	7.60	7.50	1.170
Freshwater	1	13	54	90-105	7.90	7.70	3.910	Freshwater	5	14	57	30-45	7.80	7.50	3.360
Freshwater	2	2	6	0-15	7.20	7.10	0.510	Freshwater	5	14	58	45-60	7.80	7.60	3.750
Freshwater	2	8	23	0-15	7.60	7.30	0.550	Freshwater	5	14	59	60-75	7.80	7.60	4.850
Freshwater	2	8	24	15-30	7.40	7.20	0.630	Freshwater	5	14	60	75-90	8.00	7.60	5.830
Freshwater	2	15	62	0-15	7.70	7.50	2.540	Freshwater	5	14	61	90-105	7.90	7.60	4.110
Freshwater	3	1	1	0-15	7.20	7.00	0.320	KCl	1	17	78	0-15	7.30	7.00	0.310
Freshwater	3	1	2	15-30	6.30	6.00	0.120	KCl	1	42	240	0-15	7.90	7.50	2.220
Freshwater	3	1	3	30-45	6.20	5.90	0.160	KCl	1	42	241	0-15	8.00	7.50	2.450
Freshwater	3	1	4	45-60	5.30	4.70	0.120	KCl	1	42	242	0-15	7.80	7.40	1.500
Freshwater	3	1	5	60-75	5.00	5.40	0.280	KCl	1	42	243	0-15	7.90	7.50	2.060
Freshwater	3	6	15	0-15	7.50	7.30	0.710	KCl	1	42	244	0-15	7.90	7.50	1.740
Freshwater	3	11	42	0-15	7.60	7.40	0.740	KCl	1	43	245	0-15	7.70	7.30	1.190
Freshwater	3	11	43	0-15	7.40	7.30	0.430	KCl	1	43	246	15-30	7.60	7.40	2.060
Freshwater	3	11	44	0-15	7.60	7.50	1.130	KCl	1	43	247	30-45	7.90	7.60	3.800
Freshwater	3	11	45	0-15	7.50	7.30	0.510	KCl	1	43	248	45-60	7.90	7.70	5.140
Freshwater	3	11	46	0-15	7.70	7.50	0.430	KCl	1	43	249	60-75	8.00	7.70	6.280
Freshwater	4	5	13	0-15	7.80	7.60	1.190	KCl	1	43	250	75-90	8.00	7.70	6.120
Freshwater	4	5	14	15-30	7.70	7.60	1.710	KCl	1	43	251	90-105	8.00	7.60	5.160
Freshwater	4	7	16	0-15	7.60	7.50	1.050	KCl	1	43	252	105-120	8.00	7.70	5.480
Freshwater	4	7	17	15-30	7.90	7.80	5.540	KCl	1	43	253	120-135	8.00	7.70	4.990
Freshwater	4	7	18	30-45	8.10	7.90	5.940	KCl	2	33	195	0-15	7.40	7.00	0.440
Freshwater	4	7	19	45-60	8.10	7.90	4.480	KCl	2	40	238	0-15	7.80	7.30	0.790
Freshwater	4	7	20	60-75	8.10	7.90	5.010	KCl	2	45	272	0-15	7.50	7.30	0.750
Freshwater	4	7	21	75-90	8.10	7.90	4.880	KCl	2	45	273	0-15	7.40	7.00	0.160
Freshwater	4	7	22	90-110	8.10	7.90	4.480	KCl	2	45	274	0-15	7.10	6.80	0.120
Freshwater	4	12	47	0-15	7.60	7.30	0.820	KCl	2	45	275	0-15	7.30	6.90	0.080
Freshwater	5	4	8	0-15	8.00	7.80	1.230	KCl	2	45	276	0-15	7.00	6.50	0.080
Freshwater	5	4	9	0-15	7.80	7.70	0.830	KCl	2	45	277	15-30	6.80	6.60	0.200
Freshwater	5	4	10	0-15	8.10	7.90	1.390	KCl	2	45	278	15-30	7.20	6.90	0.160
Freshwater	5	4	11	0-15	8.00	7.90	2.260	KCl	2	45	279	15-30	6.90	6.60	0.270
Freshwater	5	4	12	0-15	7.90	7.80	1.620	KCl	2	45	280	15-30	5.80	5.50	0.270
Freshwater	5	10	26	0-15	7.80	7.70	1.370	KCl	2	45	281	15-30	5.60	5.30	0.240
Freshwater	5	10	27	0-15	8.10	7.90	2.630	KCl	2	45	282	30-45	5.40	5.20	0.160
Freshwater	5	10	28	0-15	7.90	7.70	2.080	KCl	2	45	283	45-60	5.70	5.00	0.220
Freshwater	5	10	29	0-15	7.60	7.50	1.370	KCl	2	45	284	60-75	5.50	5.30	0.200
Freshwater	5	10	30	0-15	7.60	7.40	0.980	KCl	2	45	285	75-90	5.50	5.40	0.310
Freshwater	5	10	31	15-30	7.80	7.70	3.860	KCl	2	45	286	90-105	5.60	5.50	0.200
Freshwater	5	10	32	15-30	7.60	7.80	3.860	KCl	2	45	287	105-120	5.80	5.50	0.160
Freshwater	5	10	33	15-30	7.70	7.50	2.000	KCl	2	45	288	120-135	6.30	6.00	0.160
Freshwater	5	10	34	15-30	7.40	7.30	0.670	KCl	3	21	96	0-15	7.30	7.00	0.390
Freshwater	5	10	35	15-30	7.50	7.50	1.450	KCl	3	21	97	0-15	7.30	6.90	0.350
								KCl	3	21	98	0-15	7.40	7.10	0.470

(Continued). Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	---- H2O	pH --- CaCl2	CaCO3 Eq(%)
KCl	3	21	99	0-15	7.10	6.80	0.235
KCl	3	21	100	0-15	7.40	7.20	0.670
KCl	3	30	180	0-15	7.40	6.90	0.040
KCl	3	39	237	0-15	7.70	7.40	1.500
KCl	4	16	63	0-15	7.40	7.20	0.390
KCl	4	16	64	0-15	7.40	7.20	0.660
KCl	4	16	65	0-15	7.60	7.30	0.700
KCl	4	16	66	0-15	7.60	7.30	0.740
KCl	4	16	67	0-15	7.60	7.40	0.900
KCl	4	16	68	15-30	7.70	7.60	1.760
KCl	4	16	69	15-30	7.30	7.10	0.390
KCl	4	16	70	15-30	7.60	7.50	0.660
KCl	4	16	71	15-30	7.50	7.30	0.590
KCl	4	16	72	15-30	7.60	7.40	0.510
KCl	4	16	73	30-45	7.60	7.50	1.300
KCl	4	16	74	45-60	7.70	7.60	3.610
KCl	4	16	75	60-75	7.90	7.60	4.270
KCl	4	16	76	75-90	7.60	7.60	2.030
KCl	4	16	77	90-110	8.00	7.50	2.010
KCl	4	24	127	0-15	7.60	7.40	0.660
KCl	4	29	171	0-15	7.50	7.40	0.480
KCl	4	29	172	15-30	7.20	7.00	0.240
KCl	4	29	173	30-45	5.90	5.70	0.000
KCl	4	29	174	45-60	5.70	5.40	0.000
KCl	4	29	175	60-75	5.80	5.60	0.040
KCl	4	29	176	75-90	6.10	6.00	0.000
KCl	4	29	177	90-105	6.00	5.80	0.040
KCl	4	29	178	105-120	6.10	5.90	0.000
KCl	4	29	179	120-135	7.60	7.40	1.520
KCl	5	25	128	0-15	7.30	7.40	0.510
KCl	5	25	129	0-15	7.50	7.30	0.390
KCl	5	25	130	0-15	7.50	7.20	0.270
KCl	5	25	131	0-15	7.80	7.50	0.740
KCl	5	25	132	0-15	7.80	7.60	0.820
KCl	5	25	133	15-30	5.40	5.20	0.000
KCl	5	25	134	15-30	6.60	6.30	0.000
KCl	5	25	135	15-30	6.80	6.80	0.000
KCl	5	25	136	15-30	7.00	6.80	0.120
KCl	5	25	137	15-30	5.75	5.70	0.040
KCl	5	25	138	30-45	5.10	4.70	0.160
KCl	5	25	139	45-60	4.80	4.50	0.080
KCl	5	25	140	60-75	5.00	4.80	0.160
KCl	5	25	141	75-90	5.70	5.60	0.230
KCl	5	25	142	90-105	5.50	4.90	0.080
KCl	5	25	143	105-120	5.60	5.00	0.190
KCl	5	25	144	120-135	5.40	5.20	0.160
KCl	5	25	144a	135-150	5.70	5.40	0.080
KCl	5	25	144b	150-165	5.70	5.40	0.160
KCl	5	25	144c	165-180	5.70	5.40	0.140
KCl	5	25	144d	180-195	5.80	5.40	0.120
KCl	5	25	144e	195-210	5.80	5.50	0.040

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	---- H2O	pH --- CaCl2	CaCO3 Eq(%)
KCl	5	26	145	0-15	7.40	7.10	0.550
KCl	5	26	146	15-30	7.40	7.00	0.230
KCl	5	37	219	0-15	7.70	7.30	0.900
NaCl	6	22	101	0-15	7.00	6.50	0.430
NaCl	6	22	102	15-30	8.00	7.80	5.440
NaCl	6	22	103	30-45	8.10	7.80	4.520
NaCl	6	22	104	45-60	8.10	7.80	4.130
NaCl	6	22	105	60-75	8.20	7.80	4.790
NaCl	6	22	106	75-90	8.10	7.80	5.050
NaCl	6	22	107	90-105	8.00	7.80	4.760
NaCl	6	22	108	105-120	8.10	7.80	5.150
NaCl	6	22	109	120-130	8.10	7.80	4.060
NaCl	6	32	194	0-15	7.50	7.10	0.600
NaCl	6	41	239	0-15	7.80	7.40	1.420
NaCl	7	18	79	0-15	7.60	7.30	1.220
NaCl	7	27	147	0-15	6.80	6.40	0.800
NaCl	7	27	148	0-15	7.10	6.80	0.270
NaCl	7	27	149	0-15	7.20	6.80	0.120
NaCl	7	27	150	0-15	6.90	6.40	0.040
NaCl	7	27	151	0-15	6.70	6.30	0.000
NaCl	7	27	152	15-30	7.20	6.80	0.080
NaCl	7	34	196	0-15	7.60	7.10	0.600
NaCl	7	34	197	0-15	7.80	7.50	1.280
NaCl	7	34	198	0-15	7.70	7.40	0.920
NaCl	7	34	199	0-15	7.10	6.80	0.040
NaCl	7	34	200	0-15	7.30	6.90	0.200
NaCl	7	34	201	15-30	7.60	7.30	0.680
NaCl	8	20	95	0-15	7.50	7.10	0.430
NaCl	8	35	202	0-15	7.30	6.90	0.360
NaCl	8	35	203	0-15	7.40	7.00	0.280
NaCl	8	35	204	0-15	7.30	6.80	0.120
NaCl	8	35	205	0-15	7.20	6.70	0.040
NaCl	8	35	206	0-15	7.20	6.70	0.120
NaCl	8	35	207	15-30	8.10	7.60	4.770
NaCl	8	35	208	30-45	8.20	7.80	5.440
NaCl	8	35	209	45-60	7.90	7.80	5.840
NaCl	8	35	210	60-75	7.90	7.80	5.570
NaCl	8	35	211	75-90	8.00	7.80	5.840
NaCl	8	35	212	90-105	8.10	7.80	5.170
NaCl	8	35	212a	105-120	8.00	7.80	4.770
NaCl	8	35	212b	120-135	8.10	7.80	4.900
NaCl	8	44	254	0-15	7.90	7.50	2.090
NaCl	8	44	255	0-15	7.50	7.20	0.685
NaCl	8	44	256	0-15	7.60	7.10	0.240
NaCl	8	44	257	0-15	7.80	7.30	0.640
NaCl	8	44	258	0-15	7.70	7.30	0.880
NaCl	8	44	259	15-30	8.10	7.50	1.510
NaCl	8	44	260	15-30	7.30	6.80	0.280
NaCl	8	44	261	15-30	7.30	6.80	0.160
NaCl	8	44	262	15-30	7.70	7.40	1.270

(Concluded). Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	---- H2O	pH --- CaCl2	CaCO3 Eq(%)
NaCl	8	44	263	15-30	7.90	7.40	1.750
NaCl	8	44	264	30-45	7.70	7.50	2.950
NaCl	8	44	265	45-60	7.70	7.50	3.110
NaCl	8	44	266	60-75	7.90	7.60	3.580
NaCl	8	44	267	75-90	8.00	7.60	4.530
NaCl	8	44	268	90-105	7.80	7.60	5.190
NaCl	8	44	269	105-120	7.80	7.60	4.790
NaCl	8	44	270	120-135	7.90	7.60	5.320
NaCl	8	44	271	135-150	7.80	7.60	5.775
NaCl	9	19	80	0-15	7.50	7.20	0.350
NaCl	9	19	81	0-15	7.50	7.20	0.430
NaCl	9	19	82	0-15	7.50	7.30	0.670
NaCl	9	19	83	0-15	7.40	7.00	0.200
NaCl	9	19	84	0-15	7.50	7.10	0.200
NaCl	9	19	85	15-30	7.60	7.40	0.910
NaCl	9	19	86	15-30	7.50	7.40	0.670
NaCl	9	19	87	15-30	7.50	7.10	0.240
NaCl	9	19	88	15-30	7.20	6.90	0.160
NaCl	9	19	89	15-30	7.30	6.80	0.200
NaCl	9	19	90	30-45	7.40	7.20	0.350
NaCl	9	19	91	45-60	7.50	7.20	0.750
NaCl	9	19	92	60-75	7.60	7.30	1.540
NaCl	9	19	93	75-90	7.50	7.20	0.750
NaCl	9	19	94	90-110	7.50	7.30	0.590
NaCl	9	19	94a	105-120	7.70	7.40	1.220
NaCl	9	19	94b	120-140	7.80	7.50	2.480
NaCl	9	31	181	0-15	7.90	7.50	0.640
NaCl	9	31	182	0-15	7.70	7.30	0.320
NaCl	9	31	183	0-15	7.50	7.10	0.160
NaCl	9	31	184	0-15	7.60	7.20	0.320
NaCl	9	31	185	0-15	7.60	7.10	0.320
NaCl	9	31	186	15-30	5.90	5.70	0.080
NaCl	9	31	187	15-30	7.50	7.20	0.280
NaCl	9	31	188	15-30	7.50	7.10	0.200
NaCl	9	31	189	15-30	7.60	7.30	0.520
NaCl	9	31	190	15-30	7.00	6.70	0.140
NaCl	9	31	191	30-45	5.30	5.30	0.080
NaCl	9	31	192	45-60	5.40	5.20	0.120
NaCl	9	31	193	60-75	5.30	5.20	0.040
NaCl	9	31	193a	75-90	5.70	5.60	0.120
NaCl	9	31	193b	90-105	6.20	5.80	0.360
NaCl	9	31	193c	105-120	6.90	6.60	0.120
NaCl	9	31	193d	120-135	7.70	7.50	3.170
NaCl	9	31	193e	135-150	7.80	7.60	4.530
NaCl	9	36	213	0-15	7.80	7.50	1.330
NaCl	9	36	214	0-15	7.80	7.50	1.410
NaCl	9	36	215	0-15	7.80	7.30	0.550
NaCl	9	36	216	0-15	7.70	7.30	1.100
NaCl	9	36	217	0-15	7.70	7.20	0.470
NaCl	9	36	218	15-30	7.70	7.30	0.860

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	---- H2O	pH --- CaCl2	CaCO3 Eq(%)
NaCl	10	23	110	0-15	7.50	7.20	0.350
NaCl	10	23	111	0-15	7.70	7.30	0.470
NaCl	10	23	112	0-15	7.60	7.10	0.470
NaCl	10	23	113	0-15	7.50	7.20	0.740
NaCl	10	23	114	0-15	7.90	7.50	0.970
NaCl	10	23	115	15-30	7.00	7.10	1.050
NaCl	10	23	116	15-30	7.00	6.70	0.190
NaCl	10	23	117	15-30	7.00	6.70	0.190
NaCl	10	23	118	15-30	7.50	7.30	0.510
NaCl	10	23	119	15-30	7.50	7.10	0.270
NaCl	10	23	120	30-45	7.50	7.90	4.740
NaCl	10	23	121	45-60	7.90	7.90	4.870
NaCl	10	23	122	60-75	7.90	7.90	4.370
NaCl	10	23	123	75-90	7.90	7.90	4.630
NaCl	10	23	124	90-105	7.90	7.90	4.500
NaCl	10	23	125	105-120	7.90	7.90	4.910
NaCl	10	23	126	120-140	8.00	7.80	4.510
NaCl	10	28	153	0-15	8.10	7.50	1.130
NaCl	10	28	154	0-15	7.80	7.30	0.470
NaCl	10	28	155	0-15	7.70	7.30	0.350
NaCl	10	28	156	0-15	7.60	7.40	0.820
NaCl	10	28	157	0-15	7.50	7.10	0.390
NaCl	10	28	158	15-30	6.40	6.40	0.120
NaCl	10	28	159	15-30	7.30	6.90	0.080
NaCl	10	28	160	15-30	7.00	6.70	0.080
NaCl	10	28	161	15-30	7.30	7.20	0.350
NaCl	10	28	162	15-30	7.20	7.00	0.000
NaCl	10	28	163	30-45	5.50	5.40	0.000
NaCl	10	28	164	45-60	5.50	5.30	0.040
NaCl	10	28	165	60-75	5.60	5.40	0.040
NaCl	10	28	166	75-90	5.80	5.60	0.040
NaCl	10	28	167	90-105	5.90	5.70	0.000
NaCl	10	28	168	105-120	6.50	6.30	0.120
NaCl	10	28	169	120-135	7.60	7.50	1.200
NaCl	10	28	170	135-140	7.70	7.60	4.140
NaCl	10	38	220	0-15	7.90	7.50	1.100
NaCl	10	38	221	0-15	7.90	7.40	1.020
NaCl	10	38	222	0-15	8.20	7.60	1.640
NaCl	10	38	223	0-15	7.70	7.40	1.330
NaCl	10	38	224	0-15	7.80	7.50	2.430
NaCl	10	38	225	15-30	7.40	7.10	0.430
NaCl	10	38	226	15-30	7.80	7.20	0.390
NaCl	10	38	227	15-30	7.85	7.50	0.430
NaCl	10	38	228	15-30	7.60	7.30	0.510
NaCl	10	38	229	15-30	7.80	7.50	1.220
NaCl	10	38	230	30-45	5.90	5.60	0.160
NaCl	10	38	231	45-60	5.50	5.50	0.080
NaCl	10	38	232	60-75	5.80	5.40	0.040
NaCl	10	38	233	75-90	5.90	5.50	0.080
NaCl	10	38	234	90-105	5.80	5.50	0.040
NaCl	10	38	235	105-120	6.00	5.80	0.080
NaCl	10	38	236	120-135	6.80	6.50	0.120

APPENDIX II. Saturated paste extract data for the soils and soil/waste mixtures in the ESSO field plots in 1991.

Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	HCO3	CO3	OH (mg/L)	Al	Fe	Ti
Freshwater	1	3	7	0-15	41.5	0.54	7.20	7.75	197.0	196.7	0.293	0.008	<0.200	0.157	<0.010
Freshwater	1	9	25	0-15	40.5	0.45	7.00	8.58	188.0	187.8	0.177	0.005	<0.200	0.054	<0.010
Freshwater	1	13	48	0-15	51.5	0.51	6.90	8.56	204.0	203.8	0.152	0.004	<0.200	0.103	<0.010
Freshwater	1	13	49	15-30	32.5	0.34	7.40	6.23	171.0	170.6	0.403	0.013	<0.200	<0.010	<0.010
Freshwater	1	13	50	30-45	31.5	0.30	7.50	5.47	142.0	141.6	0.421	0.016	<0.200	<0.010	<0.010
Freshwater	1	13	51	45-60	37.5	0.25	7.50	4.41	122.0	121.6	0.362	0.016	<0.200	<0.010	<0.010
Freshwater	1	13	52	60-75	33.0	0.26	7.50	4.79	130.0	129.6	0.385	0.016	<0.200	<0.010	<0.010
Freshwater	1	13	53	75-90	30.5	0.27	7.60	5.72	130.0	129.5	0.485	0.020	<0.200	<0.010	<0.010
Freshwater	1	13	54	90-105	29.0	0.26	7.70	6.17	126.0	125.4	0.591	0.025	<0.200	<0.010	<0.010
Freshwater	2	2	6	0-15	44.0	0.90	7.00	6.05	212.0	211.8	0.199	0.005	<0.200	0.159	<0.010
Freshwater	2	8	23	0-15	41.5	0.57	6.80	10.00	238.0	237.9	0.141	0.003	<0.200	0.087	<0.010
Freshwater	2	8	24	15-30	37.0	0.53	7.20	8.52	256.0	255.6	0.381	0.008	<0.200	0.037	<0.010
Freshwater	2	15	62	0-15	40.8	0.51	7.15	10.07	203.5	203.2	0.270	0.007	<0.200	<0.010	<0.010
Freshwater	3	1	1	0-15	45.0	0.74	7.00	8.57	202.0	201.8	0.190	0.005	<0.200	0.087	<0.010
Freshwater	3	1	2	15-30	41.0	0.65	6.45	28.58	86.3	86.3	0.023	0.001	<0.200	0.272	<0.010
Freshwater	3	1	3	30-45	35.0	0.22	6.60	4.32	81.9	81.9	0.031	0.002	1.327	6.004	0.416
Freshwater	3	1	4	45-60	86.0	0.24	5.60	8.90	53.5	53.5	0.002	0.000	3.441	8.156	0.222
Freshwater	3	1	5	60-75	61.4	0.14	5.30	8.28	17.8	17.8	0.000	0.000	1.294	0.907	0.012
Freshwater	3	6	15	0-15	39.5	0.54	7.20	5.76	204.0	203.7	0.303	0.008	<0.200	0.072	<0.010
Freshwater	3	11	42	0-15	41.5	0.64	7.10	12.89	216.0	215.7	0.255	0.006	<0.200	0.048	<0.010
Freshwater	3	11	43	0-15	36.0	0.90	7.10	10.45	213.0	212.7	0.252	0.006	<0.200	0.036	<0.010
Freshwater	3	11	44	0-15	36.0	0.94	7.30	16.01	241.0	240.5	0.451	0.010	<0.200	0.039	<0.010
Freshwater	3	11	45	0-15	38.0	0.54	6.95	7.28	218.0	217.8	0.182	0.004	<0.200	0.051	<0.010
Freshwater	3	11	46	0-15	39.5	0.58	7.10	10.43	188.0	187.8	0.222	0.006	<0.200	0.041	<0.010
Freshwater	4	5	13	0-15	39.5	0.53	7.30	5.89	176.0	175.7	0.329	0.010	<0.200	0.038	<0.010
Freshwater	4	5	14	15-30	38.5	0.42	7.55	1.61	189.0	188.4	0.628	0.018	<0.200	<0.010	<0.010
Freshwater	4	7	16	0-15	39.0	0.54	7.40	8.86	218.0	217.5	0.513	0.013	<0.200	0.054	<0.010
Freshwater	4	7	17	15-30	37.0	0.48	7.80	1.11	174.0	172.9	1.026	0.032	<0.200	<0.010	<0.010
Freshwater	4	7	18	30-45	36.5	0.39	7.70	0.11	148.0	147.3	0.694	0.025	<0.200	<0.010	<0.010
Freshwater	4	7	19	45-60	33.5	0.33	7.80	3.43	144.0	143.1	0.849	0.032	<0.200	<0.010	<0.010
Freshwater	4	7	20	60-75	36.0	0.32	7.90	0.06	141.0	139.9	1.045	0.040	<0.200	<0.010	<0.010
Freshwater	4	7	21	75-90	36.0	0.36	7.90	8.27	146.0	144.9	1.082	0.040	<0.200	<0.010	<0.010
Freshwater	4	7	22	90-110	34.0	0.30	7.90	14.76	133.0	132.0	0.985	0.040	<0.200	<0.010	<0.010
Freshwater	4	12	47	0-15	45.0	0.66	7.00	11.03	223.0	222.8	0.209	0.005	<0.200	0.038	<0.010
Freshwater	5	4	8	0-15	39.5	0.60	7.50	11.10	233.0	232.3	0.691	0.016	<0.200	0.065	<0.010
Freshwater	5	4	9	0-15	46.5	0.67	7.20	6.52	217.0	216.7	0.323	0.008	<0.200	0.107	<0.010
Freshwater	5	4	10	0-15	43.5	1.55	7.50	10.62	262.0	261.2	0.776	0.016	<0.200	0.062	<0.010
Freshwater	5	4	11	0-15	43.0	0.80	7.60	7.66	226.0	225.1	0.843	0.020	<0.200	0.019	<0.010
Freshwater	5	4	12	0-15	42.0	1.11	7.40	5.56	230.5	229.9	0.543	0.013	<0.200	0.043	<0.010
Freshwater	5	10	26	0-15	43.5	0.59	7.30	13.25	231.0	230.6	0.432	0.010	<0.200	0.028	<0.010
Freshwater	5	10	27	0-15	43.5	0.61	7.40	10.18	244.0	243.4	0.575	0.013	<0.200	0.023	<0.010
Freshwater	5	10	28	0-15	45.0	0.64	7.30	8.55	216.0	215.6	0.404	0.010	<0.200	0.024	<0.010
Freshwater	5	10	29	0-15	50.0	0.75	6.90	8.36	228.0	227.8	0.170	0.004	<0.200	0.057	<0.010
Freshwater	5	10	30	0-15	49.0	0.66	6.90	8.64	214.0	213.8	0.160	0.004	<0.200	0.081	<0.010

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO3/L; HCO3, CO3, OH reported as mg CaCO3/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cu	Zn	Mn	Ca	Mg	Na (mg/L)	K	Sr	B	Ba	P
Freshwater	1	3	7	0-15	0.036	0.072	0.067	115.5	24.38	10.72	6.92	0.219	<0.040	0.075	0.284
Freshwater	1	9	25	0-15	0.021	0.107	0.059	96.4	19.09	10.36	7.08	0.144	<0.040	0.089	0.395
Freshwater	1	13	48	0-15	0.012	0.085	0.229	107.3	24.56	11.11	7.91	0.171	<0.040	0.151	0.333
Freshwater	1	13	49	15-30	0.033	0.053	0.008	60.7	15.09	13.26	4.35	0.076	<0.040	0.074	0.100
Freshwater	1	13	50	30-45	0.017	0.039	0.007	48.5	13.19	12.92	3.31	0.061	<0.040	0.065	0.100
Freshwater	1	13	51	45-60	0.016	0.020	0.006	38.5	10.50	11.14	2.99	0.048	<0.040	0.066	0.100
Freshwater	1	13	52	60-75	0.011	0.024	0.006	39.2	10.88	11.71	3.33	0.046	<0.040	0.064	0.100
Freshwater	1	13	53	75-90	0.016	0.024	0.006	40.2	10.80	12.52	4.18	0.057	<0.040	0.066	0.100
Freshwater	1	13	54	90-105	0.015	0.042	0.006	37.9	10.55	13.23	4.21	0.048	<0.040	0.060	0.100
Freshwater	2	2	6	0-15	0.016	0.071	0.164	190.8	32.16	42.44	11.66	0.402	0.146	0.103	0.383
Freshwater	2	8	23	0-15	0.025	0.108	0.200	119.1	21.58	17.77	12.74	0.244	0.065	0.145	0.533
Freshwater	2	8	24	15-30	0.054	0.058	0.067	105.0	19.79	30.56	8.85	0.172	<0.040	0.106	0.198
Freshwater	2	15	62	0-15	0.027	0.059	0.006	102.6	16.26	19.21	5.34	0.196	0.087	0.080	0.292
Freshwater	3	1	1	0-15	0.023	0.115	0.248	145.9	25.24	45.44	12.22	0.339	0.125	0.113	0.382
Freshwater	3	1	2	15-30	0.052	0.117	0.603	97.2	24.87	49.67	9.51	0.229	0.074	0.074	0.192
Freshwater	3	1	3	30-45	0.067	0.082	1.283	35.0	7.80	8.99	7.19	0.112	0.085	0.086	0.341
Freshwater	3	1	4	45-60	0.041	0.158	1.477	34.1	5.69	6.74	9.66	0.097	0.040	0.152	2.095
Freshwater	3	1	5	60-75	0.041	0.172	0.123	17.2	2.27	4.76	4.78	0.044	<0.040	0.087	3.227
Freshwater	3	6	15	0-15	0.026	0.074	0.048	114.1	19.08	20.19	4.93	0.306	0.117	0.086	0.289
Freshwater	3	11	42	0-15	0.029	0.084	0.053	123.8	23.59	36.98	8.15	0.283	0.097	0.109	0.349
Freshwater	3	11	43	0-15	0.038	0.060	0.154	202.1	30.93	24.35	11.47	0.441	0.086	0.147	0.198
Freshwater	3	11	44	0-15	0.047	0.061	0.078	185.0	33.54	54.18	8.22	0.453	0.178	0.077	0.232
Freshwater	3	11	45	0-15	0.026	0.086	0.039	119.7	20.61	18.18	5.90	0.216	<0.040	0.118	0.310
Freshwater	3	11	46	0-15	0.016	0.112	0.045	118.0	19.58	27.16	8.49	0.308	0.166	0.113	0.322
Freshwater	4	5	13	0-15	0.027	0.099	0.021	107.6	16.34	30.53	7.26	0.240	0.175	0.105	0.317
Freshwater	4	5	14	15-30	0.042	0.073	0.018	75.2	13.00	33.35	6.65	0.112	<0.040	0.087	0.158
Freshwater	4	7	16	0-15	0.036	0.045	0.037	107.3	17.24	33.22	8.10	0.300	0.115	0.066	0.239
Freshwater	4	7	17	15-30	0.026	0.028	0.011	57.3	28.25	30.89	7.21	0.185	<0.040	0.067	0.100
Freshwater	4	7	18	30-45	0.019	0.033	0.006	40.1	24.83	26.32	5.75	0.143	<0.040	0.056	0.100
Freshwater	4	7	19	45-60	0.019	0.036	0.009	39.6	17.20	19.90	6.31	0.175	<0.040	0.054	0.100
Freshwater	4	7	20	60-75	0.020	0.026	0.007	30.6	19.15	22.12	6.55	0.132	<0.040	0.042	0.100
Freshwater	4	7	21	75-90	0.016	0.027	0.007	44.0	19.60	18.15	7.53	0.186	<0.040	0.049	0.100
Freshwater	4	7	22	90-110	0.020	0.020	0.016	34.5	18.74	17.56	7.43	0.114	<0.040	0.075	0.100
Freshwater	4	12	47	0-15	0.022	0.077	0.055	143.3	22.83	22.42	11.19	0.292	0.096	0.133	0.318
Freshwater	5	4	8	0-15	0.063	0.070	0.029	117.3	13.55	45.75	9.18	0.311	0.245	0.077	0.349
Freshwater	5	4	9	0-15	0.029	0.111	0.047	136.5	17.66	49.33	9.15	0.332	0.200	0.099	0.367
Freshwater	5	4	10	0-15	0.055	0.052	0.055	306.0	36.53	155.09	12.76	0.702	0.293	0.115	0.326
Freshwater	5	4	11	0-15	0.052	0.069	0.026	144.0	19.05	70.67	9.01	0.391	0.282	0.096	0.336
Freshwater	5	4	12	0-15	0.047	0.063	0.046	211.1	25.67	98.62	10.33	0.502	0.267	0.125	0.518
Freshwater	5	10	26	0-15	0.033	0.067	0.027	111.6	17.44	36.98	11.44	0.289	0.250	0.102	0.269
Freshwater	5	10	27	0-15	0.047	0.084	0.013	109.3	15.45	52.64	7.94	0.266	0.273	0.092	0.784
Freshwater	5	10	28	0-15	0.033	0.081	0.036	126.8	19.52	33.35	8.92	0.282	0.201	0.110	0.792
Freshwater	5	10	29	0-15	0.010	0.065	0.131	159.4	25.33	30.58	10.08	0.356	0.165	0.122	0.542
Freshwater	5	10	30	0-15	0.013	0.073	0.262	137.1	22.22	24.89	11.00	0.306	0.149	0.127	0.415

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	S	Si	As	Cr	V (mg/L)	Li	Mo	Ni	Co	SAR
Freshwater	1	3	7	0-15	41.20	6.39	<0.030	0.036	<0.030	<0.040	<0.050	<0.030	<0.010	0.2
Freshwater	1	9	25	0-15	25.01	8.01	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
Freshwater	1	13	48	0-15	22.25	8.02	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
Freshwater	1	13	49	15-30	9.15	6.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	1	13	50	30-45	9.97	7.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	1	13	51	45-60	6.44	7.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	1	13	52	60-75	5.54	7.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	1	13	53	75-90	5.78	7.48	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	1	13	54	90-105	5.51	7.45	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	2	2	6	0-15	132.56	10.94	<0.030	0.047	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
Freshwater	2	8	23	0-15	38.46	11.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	2	8	24	15-30	24.83	4.63	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
Freshwater	2	15	62	0-15	35.56	13.16	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	3	1	1	0-15	82.69	9.13	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
Freshwater	3	1	2	15-30	97.60	7.41	<0.030	0.028	<0.030	<0.040	<0.050	<0.030	<0.010	1.2
Freshwater	3	1	3	30-45	7.16	12.34	<0.030	0.044	<0.030	<0.040	<0.050	0.036	<0.010	0.4
Freshwater	3	1	4	45-60	9.93	17.78	<0.030	0.058	0.037	<0.040	<0.050	0.038	0.012	0.3
Freshwater	3	1	5	60-75	4.65	3.98	<0.030	0.053	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
Freshwater	3	6	15	0-15	46.04	10.61	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	3	11	42	0-15	58.17	10.23	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
Freshwater	3	11	43	0-15	130.71	8.26	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	3	11	44	0-15	131.17	12.45	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
Freshwater	3	11	45	0-15	44.96	9.37	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	3	11	46	0-15	49.75	11.56	<0.030	<0.020	<0.030	<0.040	0.064	<0.030	<0.010	0.6
Freshwater	4	5	13	0-15	44.66	11.73	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
Freshwater	4	5	14	15-30	25.41	4.35	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
Freshwater	4	7	16	0-15	36.58	9.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
Freshwater	4	7	17	15-30	39.70	9.04	<0.030	<0.020	<0.030	0.046	<0.050	<0.030	<0.010	0.8
Freshwater	4	7	18	30-45	27.96	8.68	<0.030	<0.020	<0.030	0.059	<0.050	<0.030	<0.010	0.8
Freshwater	4	7	19	45-60	12.45	7.87	<0.030	<0.020	<0.030	0.049	<0.050	<0.030	<0.010	0.7
Freshwater	4	7	20	60-75	12.79	7.64	<0.030	<0.020	<0.030	0.053	<0.050	<0.030	<0.010	0.8
Freshwater	4	7	21	75-90	16.36	7.67	<0.030	<0.020	<0.030	0.050	<0.050	<0.030	<0.010	0.6
Freshwater	4	7	22	90-110	14.12	7.09	<0.030	<0.020	<0.030	0.050	<0.050	<0.030	<0.010	0.6
Freshwater	4	12	47	0-15	64.30	12.80	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	5	4	8	0-15	47.87	12.25	<0.030	<0.020	<0.030	<0.040	0.054	<0.030	<0.010	1.1
Freshwater	5	4	9	0-15	70.14	12.24	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.1
Freshwater	5	4	10	0-15	301.14	13.91	<0.030	0.027	<0.030	<0.040	0.119	<0.030	<0.010	2.2
Freshwater	5	4	11	0-15	104.11	15.23	<0.030	<0.020	<0.030	<0.040	0.054	<0.030	<0.010	1.5
Freshwater	5	4	12	0-15	184.21	13.29	<0.030	<0.020	<0.030	<0.040	0.075	<0.030	<0.010	1.7
Freshwater	5	10	26	0-15	46.19	15.42	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
Freshwater	5	10	27	0-15	50.82	15.83	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.2
Freshwater	5	10	28	0-15	63.26	15.99	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
Freshwater	5	10	29	0-15	93.06	17.28	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
Freshwater	5	10	30	0-15	66.77	16.39	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO3/L; HCO3, CO3, OH reported as mg CaCO3/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	HCO3	CO3	OH (mg/L)	Al	Fe	Ti
Freshwater	5	10	31	15-30	34.0	0.47	7.50	7.08	184.0	183.4	0.545	0.016	<0.200	<0.010	<0.010
Freshwater	5	10	32	15-30	36.0	0.55	7.40	8.72	217.5	217.0	0.512	0.013	<0.200	0.010	<0.010
Freshwater	5	10	33	15-30	38.5	0.57	7.20	12.36	220.0	219.7	0.327	0.008	<0.200	0.045	<0.010
Freshwater	5	10	34	15-30	49.5	0.85	7.00	8.67	225.0	224.8	0.211	0.005	<0.200	0.054	<0.010
Freshwater	5	10	35	15-30	44.0	0.77	7.20	8.55	245.0	244.6	0.364	0.008	<0.200	0.016	<0.010
Freshwater	5	10	36	30-45	34.5	0.43	7.70	6.19	152.0	151.3	0.713	0.025	<0.200	<0.010	<0.010
Freshwater	5	10	37	45-60	35.5	0.41	7.70	6.01	135.0	134.3	0.633	0.025	<0.200	<0.010	<0.010
Freshwater	5	10	38	60-75	33.0	0.47	7.80	6.64	116.0	115.3	0.684	0.032	<0.200	<0.010	<0.010
Freshwater	5	10	39	75-90	32.0	0.48	7.80	6.32	107.0	106.3	0.631	0.032	<0.200	<0.010	<0.010
Freshwater	5	10	40	90-105	32.0	0.48	7.80	6.46	114.0	113.3	0.672	0.032	<0.200	<0.010	<0.010
Freshwater	5	10	41	105-115	31.5	0.51	7.80	6.76	108.0	107.3	0.637	0.032	<0.200	<0.010	<0.010
Freshwater	5	14	55	0-15	47.0	0.66	7.15	10.42	220.0	219.7	0.292	0.007	<0.200	0.012	<0.010
Freshwater	5	14	56	15-30	33.5	0.56	7.40	7.63	166.0	165.6	0.391	0.013	<0.200	<0.010	<0.010
Freshwater	5	14	57	30-45	36.0	0.41	7.50	11.61	110.0	109.7	0.326	0.016	<0.200	<0.010	<0.010
Freshwater	5	14	58	45-60	33.5	0.35	7.70	5.09	113.0	112.4	0.530	0.025	<0.200	<0.010	<0.010
Freshwater	5	14	59	60-75	35.0	0.36	7.80	6.96	109.0	108.3	0.642	0.032	<0.200	<0.010	<0.010
Freshwater	5	14	60	75-90	33.0	0.29	7.80	5.72	112.0	111.3	0.660	0.032	<0.200	<0.010	<0.010
Freshwater	5	14	61	90-105	31.5	0.25	7.80	5.48	120.0	119.3	0.707	0.032	<0.200	<0.010	<0.010
KCl	1	17	78	0-15	40.5	0.49	7.00	20.45	226.0	225.8	0.212	0.005	<0.200	0.017	<0.010
KCl	1	42	240	0-15	34.0	0.35	7.20	11.99	186.0	185.7	0.277	0.008	<0.200	<0.010	<0.010
KCl	1	42	241	0-15	35.0	0.36	7.10	6.97	193.0	192.8	0.228	0.006	<0.200	<0.010	<0.010
KCl	1	42	242	0-15	40.0	0.39	6.60	10.72	192.0	191.9	0.072	0.002	<0.200	0.026	<0.010
KCl	1	42	243	0-15	35.0	0.39	6.90	12.91	202.0	201.8	0.151	0.004	<0.200	<0.010	<0.010
KCl	1	42	244	0-15	35.8	0.32	7.20	6.69	174.5	174.2	0.260	0.008	<0.200	<0.010	<0.010
KCl	1	43	245	0-15	37.5	0.45	7.00	17.96	231.0	230.8	0.217	0.005	<0.200	0.016	<0.010
KCl	1	43	246	15-30	38.0	0.46	7.10	10.63	239.0	238.7	0.282	0.006	<0.200	<0.010	<0.010
KCl	1	43	247	30-45	34.5	0.32	7.45	7.07	167.0	166.5	0.441	0.014	<0.200	<0.010	<0.010
KCl	1	43	248	45-60	34.0	0.34	7.50	10.14	175.0	174.5	0.519	0.016	<0.200	<0.010	<0.010
KCl	1	43	249	60-75	37.0	0.32	7.70	7.11	149.0	148.3	0.699	0.025	<0.200	<0.010	<0.010
KCl	1	43	250	75-90	34.5	0.31	7.70	12.27	149.0	148.3	0.699	0.025	<0.200	<0.010	<0.010
KCl	1	43	251	90-105	32.0	0.28	7.60	8.54	140.0	139.5	0.522	0.020	<0.200	<0.010	<0.010
KCl	1	43	252	105-120	32.0	0.27	7.55	6.52	132.0	131.5	0.439	0.018	<0.200	<0.010	<0.010
KCl	1	43	253	120-135	32.5	0.26	7.70	5.58	136.0	135.3	0.638	0.025	<0.200	<0.010	<0.010
KCl	2	33	195	0-15	38.5	0.44	6.90	10.18	217.0	216.8	0.162	0.004	<0.200	0.176	<0.010
KCl	2	40	238	0-15	47.5	0.44	6.95	14.36	212.0	211.8	0.177	0.004	<0.200	0.030	<0.010
KCl	2	45	272	0-15	39.0	0.56	7.00	21.95	215.0	214.8	0.202	0.005	<0.200	0.030	<0.010
KCl	2	45	273	0-15	37.0	0.62	6.90	26.74	207.0	206.8	0.154	0.004	<0.200	0.059	<0.010
KCl	2	45	274	0-15	36.5	0.94	6.80	74.94	213.0	212.9	0.126	0.003	<0.200	0.066	<0.010
KCl	2	45	275	0-15	37.0	0.42	6.90	17.19	167.0	166.9	0.125	0.004	<0.200	0.106	<0.010
KCl	2	45	276	0-15	32.0	0.42	6.75	26.88	172.0	171.9	0.091	0.003	<0.200	0.206	<0.010
KCl	2	45	277	15-30	36.5	0.52	7.00	39.14	211.0	210.8	0.198	0.005	<0.200	<0.010	<0.010
KCl	2	45	278	15-30	34.5	0.64	6.90	63.69	243.0	242.8	0.181	0.004	<0.200	0.121	<0.010
KCl	2	45	279	15-30	38.0	0.84	6.50	145	169.0	168.9	0.050	0.002	<0.200	0.173	<0.010
KCl	2	45	280	15-30	39.5	0.29	6.10	23.97	73.6	73.6	0.009	0.001	2.057	2.274	0.331
KCl	2	45	281	15-30	31.0	0.57	5.70	146	33.8	33.8	0.002	0.000	0.339	0.189	<0.010
KCl	2	45	282	30-45	32.0	0.29	6.30	60.23	37.3	37.3	0.007	0.001	<0.200	<0.010	<0.010

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO3/L; HCO3, CO3, OH reported as mg CaCO3/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cu	Zn	Mn	Ca	Mg	Na (mg/L)	K	Sr	B	Ba	P
Freshwater	5	10	31	15-30	0.032	0.052	0.010	58.9	14.49	53.79	3.19	0.090	0.067	0.051	0.100
Freshwater	5	10	32	15-30	0.043	0.071	0.030	75.1	14.72	66.37	4.35	0.150	0.190	0.064	0.149
Freshwater	5	10	33	15-30	0.041	0.082	0.029	97.4	17.36	51.72	6.52	0.178	0.139	0.088	0.316
Freshwater	5	10	34	15-30	0.013	0.101	0.172	163.8	31.82	50.04	13.38	0.320	0.130	0.102	0.422
Freshwater	5	10	35	15-30	0.028	0.055	0.101	152.8	28.81	40.20	11.10	0.296	0.144	0.103	0.365
Freshwater	5	10	36	30-45	0.020	0.028	0.006	35.6	12.54	66.69	1.74	0.049	<0.040	0.041	0.100
Freshwater	5	10	37	45-60	0.018	0.031	0.006	41.5	14.33	49.77	2.09	0.067	<0.040	0.049	0.100
Freshwater	5	10	38	60-75	0.013	0.028	0.006	63.1	19.67	30.24	3.38	0.086	<0.040	0.059	0.100
Freshwater	5	10	39	75-90	0.016	0.033	0.006	68.9	24.12	19.64	3.87	0.090	<0.040	0.064	0.100
Freshwater	5	10	40	90-105	0.016	0.044	0.007	72.0	23.29	18.46	4.66	0.078	<0.040	0.068	0.100
Freshwater	5	10	41	105-115	0.016	0.044	0.008	77.1	24.70	18.68	5.48	0.095	<0.040	0.085	0.100
Freshwater	5	14	55	0-15	0.017	0.076	0.053	114.6	19.88	59.41	9.18	0.230	0.183	0.102	0.301
Freshwater	5	14	56	15-30	0.023	0.041	0.008	77.9	26.18	37.13	3.14	0.085	<0.040	0.062	0.100
Freshwater	5	14	57	30-45	0.013	0.036	0.006	59.2	20.78	16.96	2.59	0.050	<0.040	0.059	0.100
Freshwater	5	14	58	45-60	0.019	0.030	0.006	54.2	16.55	12.25	2.71	0.051	<0.040	0.051	0.100
Freshwater	5	14	59	60-75	0.016	0.035	0.006	56.1	16.12	11.50	3.05	0.045	<0.040	0.057	0.100
Freshwater	5	14	60	75-90	0.012	0.037	0.006	44.1	12.13	11.46	2.96	0.049	<0.040	0.048	0.100
Freshwater	5	14	61	90-105	0.014	0.029	0.006	37.9	10.68	10.33	3.25	0.037	<0.040	0.057	0.100
KCl	1	17	78	0-15	0.015	0.119	0.102	97.6	20.40	12.28	17.42	0.163	<0.040	0.164	0.304
KCl	1	42	240	0-15	0.010	0.165	0.011	69.6	14.67	11.79	5.00	0.084	0.960	0.079	0.173
KCl	1	42	241	0-15	0.010	0.116	0.009	69.7	15.85	14.49	3.98	0.092	0.954	0.080	0.160
KCl	1	42	242	0-15	0.010	0.067	0.021	85.6	17.07	11.38	5.88	0.106	0.951	0.088	0.405
KCl	1	42	243	0-15	0.010	0.245	0.011	79.0	17.54	13.45	6.10	0.107	0.952	0.106	0.239
KCl	1	42	244	0-15	0.010	0.147	0.013	64.8	13.47	11.82	5.44	0.088	0.960	0.081	0.187
KCl	1	43	245	0-15	0.010	0.059	0.038	92.6	18.69	13.35	8.99	0.126	0.952	0.099	0.206
KCl	1	43	246	15-30	0.010	0.059	0.031	91.6	21.93	13.88	10.68	0.132	0.956	0.118	0.194
KCl	1	43	247	30-45	0.010	0.026	0.006	53.5	13.34	15.06	7.63	0.062	0.970	0.071	0.100
KCl	1	43	248	45-60	0.010	0.024	0.006	53.8	13.94	17.06	8.20	0.057	0.968	0.071	0.100
KCl	1	43	249	60-75	0.010	0.021	0.006	44.4	13.22	18.67	7.67	0.095	0.965	0.044	0.100
KCl	1	43	250	75-90	0.010	0.020	0.006	46.0	12.57	15.70	7.86	0.050	0.964	0.058	0.100
KCl	1	43	251	90-105	0.010	0.023	0.006	40.9	11.61	14.33	9.58	0.041	0.954	0.091	0.100
KCl	1	43	252	105-120	0.010	0.045	0.006	38.1	11.17	12.90	8.37	0.036	0.948	0.084	0.100
KCl	1	43	253	120-135	0.010	0.021	0.006	39.0	11.56	11.52	8.36	0.036	0.955	0.073	0.100
KCl	2	33	195	0-15	0.014	0.109	0.091	89.6	19.35	11.75	7.45	0.130	<0.040	0.104	0.391
KCl	2	40	238	0-15	0.010	0.043	0.040	88.5	16.77	12.39	18.40	0.151	0.990	0.121	0.253
KCl	2	45	272	0-15	0.010	0.106	0.073	111.6	19.31	10.84	35.09	0.197	0.987	0.211	0.217
KCl	2	45	273	0-15	0.010	0.098	0.197	132.5	24.77	16.71	20.84	0.218	0.986	0.175	0.300
KCl	2	45	274	0-15	0.010	0.131	0.504	185.9	34.11	24.81	51.82	0.319	1.002	0.185	0.338
KCl	2	45	275	0-15	0.010	0.101	0.051	76.6	15.09	9.68	32.88	0.123	0.985	0.132	0.255
KCl	2	45	276	0-15	0.010	0.105	0.146	76.6	15.55	13.62	30.39	0.129	0.995	0.156	0.342
KCl	2	45	277	15-30	0.010	0.108	0.040	86.4	23.72	18.73	12.38	0.165	0.956	0.149	0.100
KCl	2	45	278	15-30	0.010	0.082	0.447	128.6	27.87	22.31	16.42	0.208	1.008	0.179	0.393
KCl	2	45	279	15-30	0.010	0.094	0.848	143.8	32.82	30.49	35.45	0.239	1.036	0.167	0.358
KCl	2	45	280	15-30	0.010	0.110	0.107	37.9	8.47	13.48	21.90	0.082	0.977	0.121	0.201
KCl	2	45	281	15-30	0.010	0.216	0.482	68.1	15.47	21.27	32.73	0.117	0.969	0.223	0.100
KCl	2	45	282	30-45	0.010	0.101	0.052	30.9	11.28	14.09	6.74	0.063	0.973	0.075	0.100

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	S	Si	As	Cr	V (mg/L)	Li	Mo	Ni	Co	SAR
Freshwater	5	10	31	15-30	34.16	7.67	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.6
Freshwater	5	10	32	15-30	41.96	11.11	<0.030	<0.020	<0.030	<0.040	0.073	<0.030	<0.010	1.8
Freshwater	5	10	33	15-30	38.96	9.18	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.3
Freshwater	5	10	34	15-30	101.10	12.09	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
Freshwater	5	10	35	15-30	85.37	12.16	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
Freshwater	5	10	36	30-45	34.06	8.11	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.4
Freshwater	5	10	37	45-60	37.53	8.27	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.7
Freshwater	5	10	38	60-75	55.64	8.08	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
Freshwater	5	10	39	75-90	62.15	8.07	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	5	10	40	90-105	60.44	8.45	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	5	10	41	105-115	70.03	8.00	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	5	14	55	0-15	62.33	11.56	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.3
Freshwater	5	14	56	15-30	61.06	7.27	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
Freshwater	5	14	57	30-45	46.07	7.23	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
Freshwater	5	14	58	45-60	31.40	6.85	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	5	14	59	60-75	30.91	6.80	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
Freshwater	5	14	60	75-90	15.80	6.69	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
Freshwater	5	14	61	90-105	5.27	6.55	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	1	17	78	0-15	7.25	6.63	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	1	42	240	0-15	5.56	6.51	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	1	42	241	0-15	5.34	8.09	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	1	42	242	0-15	6.87	8.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	1	42	243	0-15	5.30	7.70	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	1	42	244	0-15	5.39	7.07	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	1	43	245	0-15	6.51	7.26	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	1	43	246	15-30	7.13	6.76	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	1	43	247	30-45	5.47	7.39	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	1	43	248	45-60	6.83	7.33	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	1	43	249	60-75	8.85	7.21	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	1	43	250	75-90	6.26	7.14	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	1	43	251	90-105	4.18	6.88	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	1	43	252	105-120	4.05	6.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	1	43	253	120-135	3.73	6.76	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	2	33	195	0-15	5.65	7.42	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	2	40	238	0-15	13.20	7.32	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	2	45	272	0-15	35.39	6.36	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.2
KCl	2	45	273	0-15	50.90	6.49	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	2	45	274	0-15	99.88	6.94	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	2	45	275	0-15	21.75	5.64	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	2	45	276	0-15	13.91	6.38	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	2	45	277	15-30	18.40	3.57	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	2	45	278	15-30	19.05	5.68	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	2	45	279	15-30	41.70	7.34	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	2	45	280	15-30	19.18	12.98	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	2	45	281	15-30	15.76	8.42	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	2	45	282	30-45	12.94	14.10	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	HCO3	CO3	OH	Al	Fe	Ti
													(mg/L)		
KCl	2	45	283	45-60	32.8	0.20	6.45	37.22	27.0	27.0	0.007	0.001	<0.200	0.118	0.019
KCl	2	45	284	60-75	32.5	0.18	6.50	24.81	41.7	41.7	0.012	0.002	<0.200	0.378	0.032
KCl	2	45	285	75-90	36.0	0.13	6.30	13.48	31.2	31.2	0.006	0.001	<0.200	1.405	0.135
KCl	2	45	286	90-105	33.5	0.13	6.60	7.82	42.8	42.8	0.016	0.002	<0.200	0.249	0.029
KCl	2	45	287	105-120	36.5	0.11	6.80	4.10	34.1	34.1	0.020	0.003	0.340	0.511	0.030
KCl	2	45	288	120-135	32.5	0.08	6.90	5.12	61.0	61.0	0.046	0.004	<0.200	<0.010	<0.010
KCl	3	21	96	0-15	46.0	0.53	6.50	26.57	202.0	201.9	0.060	0.002	<0.200	0.114	<0.010
KCl	3	21	97	0-15	47.0	0.56	6.30	22.00	274.0	273.9	0.051	0.001	<0.200	0.078	<0.010
KCl	3	21	98	0-15	46.0	0.54	6.80	17.63	208.0	207.9	0.123	0.003	<0.200	0.014	<0.010
KCl	3	21	99	0-15	43.0	0.47	6.40	17.59	202.0	202.0	0.048	0.001	<0.200	0.093	<0.010
KCl	3	21	100	0-15	42.5	0.64	6.60	29.44	228.0	227.9	0.085	0.002	<0.200	0.093	<0.010
KCl	3	30	180	0-15	38.0	0.50	6.95	24.19	191.0	190.8	0.160	0.004	<0.200	0.186	<0.010
KCl	3	39	237	0-15	35.5	0.61	7.10	32.57	234.0	233.7	0.277	0.006	<0.200	<0.010	<0.010
KCl	4	16	63	0-15	42.5	0.57	7.10	11.60	251.0	250.7	0.297	0.006	<0.200	<0.010	<0.010
KCl	4	16	64	0-15	47.0	0.57	6.80	13.91	230.0	229.9	0.136	0.003	<0.200	<0.010	<0.010
KCl	4	16	65	0-15	39.5	0.62	7.20	15.48	235.0	234.6	0.350	0.008	<0.200	<0.010	<0.010
KCl	4	16	66	0-15	44.0	0.60	7.05	16.35	209.0	208.8	0.220	0.006	<0.200	<0.010	<0.010
KCl	4	16	67	0-15	39.0	0.67	6.90	21.63	211.0	210.8	0.157	0.004	<0.200	0.012	<0.010
KCl	4	16	68	15-30	37.0	0.38	7.05	9.44	170.0	169.8	0.179	0.006	<0.200	<0.010	<0.010
KCl	4	16	69	15-30	44.5	0.60	7.00	11.23	274.0	273.7	0.257	0.005	<0.200	<0.010	<0.010
KCl	4	16	70	15-30	35.0	0.45	7.20	9.89	187.0	186.7	0.278	0.008	<0.200	<0.010	<0.010
KCl	4	16	71	15-30	44.0	0.59	7.10	13.59	244.0	243.7	0.288	0.006	<0.200	0.032	<0.010
KCl	4	16	72	15-30	39.0	0.55	7.20	15.44	222.0	221.7	0.330	0.008	<0.200	<0.010	<0.010
KCl	4	16	73	30-45	32.0	0.41	7.25	11.12	177.0	176.7	0.295	0.009	<0.200	<0.010	<0.010
KCl	4	16	74	45-60	35.0	0.31	7.70	9.51	128.0	127.4	0.600	0.025	<0.200	<0.010	<0.010
KCl	4	16	75	60-75	33.0	0.27	7.70	7.63	104.0	103.5	0.488	0.025	<0.200	<0.010	<0.010
KCl	4	16	76	75-90	32.0	0.29	7.65	6.76	126.0	125.5	0.527	0.022	<0.200	<0.010	<0.010
KCl	4	16	77	90-110	39.0	0.27	7.50	8.06	118.0	117.6	0.350	0.016	<0.200	<0.010	<0.010
KCl	4	24	127	0-15	42.0	0.76	7.00	49.81	216.0	215.8	0.203	0.005	<0.200	0.221	<0.010
KCl	4	29	171	0-15	42.5	0.73	6.90	47.09	217.0	216.8	0.162	0.004	<0.200	0.231	<0.010
KCl	4	29	172	15-30	35.5	0.80	7.15	85.05	198.0	197.7	0.263	0.007	<0.200	0.093	<0.010
KCl	4	29	173	30-45	37.0	0.53	6.55	117	26.7	26.7	0.009	0.002	<0.200	0.081	<0.010
KCl	4	29	174	45-60	34.5	0.38	6.50	90.25	24.5	24.5	0.007	0.002	<0.200	0.872	<0.010
KCl	4	29	175	60-75	34.0	0.30	6.50	65.97	32.0	32.0	0.010	0.002	<0.200	0.142	<0.010
KCl	4	29	176	75-90	35.0	0.33	6.60	54.60	60.2	60.2	0.023	0.002	<0.200	0.111	<0.010
KCl	4	29	177	90-105	37.5	0.28	6.60	47.25	44.1	44.1	0.016	0.002	0.208	0.172	<0.010
KCl	4	29	178	105-120	34.0	0.23	6.70	45.52	33.1	33.1	0.016	0.003	<0.200	0.122	<0.010
KCl	4	29	179	120-135	34.5	0.34	7.70	32.94	126.0	125.4	0.591	0.025	<0.200	0.092	<0.010
KCl	5	25	128	0-15	41.0	2.53	6.90	477	198.0	197.8	0.148	0.004	<0.200	0.233	<0.010
KCl	5	25	129	0-15	38.5	0.70	6.60	67.87	213.0	212.9	0.080	0.002	<0.200	0.196	<0.010
KCl	5	25	130	0-15	33.0	0.93	7.20	99.27	208.0	207.7	0.309	0.008	<0.200	0.230	<0.010
KCl	5	25	131	0-15	38.0	0.85	7.20	61.66	260.0	259.6	0.387	0.008	<0.200	0.202	<0.010
KCl	5	25	132	0-15	38.5	1.03	7.20	96.52	242.0	241.6	0.360	0.008	<0.200	0.172	<0.010

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO3/L; HCO3, CO3, OH reported as mg CaCO3/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cu	Zn	Mn	Ca	Mg	Na (mg/L)	K	Sr	B	Ba	P
KC1	2	45	283	45-60	0.010	0.089	0.029	18.7	6.90	13.08	5.54	0.038	0.984	0.062	0.100
KC1	2	45	284	60-75	0.010	0.082	0.022	18.3	7.12	12.60	2.02	0.032	0.985	0.049	0.100
KC1	2	45	285	75-90	0.010	0.086	0.016	12.0	4.97	10.50	1.02	0.021	0.989	0.061	0.100
KC1	2	45	286	90-105	0.010	0.075	0.006	11.7	4.38	9.69	0.20	0.015	0.991	0.062	0.100
KC1	2	45	287	105-120	0.010	0.048	0.006	7.7	2.78	7.43	0.39	0.010	0.982	0.057	0.100
KC1	2	45	288	120-135	0.010	0.052	0.006	15.3	5.86	9.98	0.50	0.017	0.979	0.048	0.100
KC1	3	21	96	0-15	0.037	0.137	0.125	95.2	16.57	10.69	51.63	0.201	0.086	0.201	0.822
KC1	3	21	97	0-15	0.013	0.138	0.169	99.9	18.70	10.84	50.07	0.198	0.053	0.167	0.932
KC1	3	21	98	0-15	0.024	0.114	0.119	99.2	17.63	9.75	44.32	0.210	0.053	0.172	0.629
KC1	3	21	99	0-15	0.015	0.108	0.173	80.0	15.44	10.85	48.35	0.161	0.061	0.155	1.252
KC1	3	21	100	0-15	0.022	0.195	0.090	93.5	15.34	15.52	103	0.244	0.105	0.137	1.544
KC1	3	30	180	0-15	0.058	0.149	0.152	85.7	16.54	14.44	39.34	0.168	<0.040	0.155	0.397
KC1	3	39	237	0-15	0.010	0.049	0.058	106.0	18.43	26.13	37.06	0.200	0.993	0.151	0.207
KC1	4	16	63	0-15	0.038	0.066	0.089	110.6	19.58	10.52	35.16	0.225	0.057	0.181	0.245
KC1	4	16	64	0-15	0.020	0.073	0.115	108.7	16.66	7.82	45.20	0.259	0.073	0.151	0.368
KC1	4	16	65	0-15	0.027	0.057	0.062	106.8	17.38	13.67	65.09	0.265	0.091	0.142	0.265
KC1	4	16	66	0-15	0.017	0.123	0.023	96.8	14.86	9.69	77.20	0.237	0.092	0.165	0.401
KC1	4	16	67	0-15	0.025	0.137	0.048	98.8	16.16	14.13	104	0.232	0.114	0.181	0.607
KC1	4	16	68	15-30	0.048	0.063	0.008	72.5	14.11	13.91	10.55	0.105	<0.040	0.086	0.115
KC1	4	16	69	15-30	0.030	0.080	0.175	113.5	22.83	11.48	36.40	0.212	0.060	0.189	0.339
KC1	4	16	70	15-30	0.043	0.053	0.016	71.3	14.50	13.31	35.57	0.127	<0.040	0.108	0.115
KC1	4	16	71	15-30	0.045	0.087	0.096	111.7	20.35	12.63	45.43	0.217	0.075	0.204	0.369
KC1	4	16	72	15-30	0.032	0.049	0.040	94.8	16.88	15.13	55.42	0.185	0.053	0.162	0.263
KC1	4	16	73	30-45	0.038	0.084	0.006	73.1	17.67	14.91	5.14	0.108	<0.040	0.083	0.100
KC1	4	16	74	45-60	0.015	0.032	0.006	45.9	14.18	14.01	2.97	0.053	<0.040	0.057	0.100
KC1	4	16	75	60-75	0.015	0.025	0.006	36.5	11.57	13.48	2.99	0.041	<0.040	0.053	0.100
KC1	4	16	76	75-90	0.020	0.039	0.006	42.2	13.07	13.82	3.48	0.050	<0.040	0.067	0.100
KC1	4	16	77	90-110	0.011	0.036	0.006	38.9	12.61	11.91	3.18	0.047	<0.040	0.059	0.100
KC1	4	24	127	0-15	0.031	0.100	0.046	89.4	16.65	25.95	133	0.299	<0.040	0.126	0.332
KC1	4	29	171	0-15	0.019	0.139	0.088	94.1	14.69	25.42	122	0.217	<0.040	0.163	0.466
KC1	4	29	172	15-30	0.031	0.086	0.058	122.6	26.31	31.98	29.91	0.215	<0.040	0.123	0.100
KC1	4	29	173	30-45	0.012	0.093	0.115	62.0	17.18	17.39	19.46	0.140	<0.040	0.102	0.100
KC1	4	29	174	45-60	0.011	0.072	0.060	39.1	11.30	14.28	17.35	0.094	<0.040	0.097	0.100
KC1	4	29	175	60-75	0.011	0.090	0.047	30.0	9.08	12.68	14.46	0.065	<0.040	0.074	0.100
KC1	4	29	176	75-90	0.012	0.064	0.048	36.3	11.27	15.12	14.09	0.072	<0.040	0.072	0.100
KC1	4	29	177	90-105	0.012	0.077	0.018	28.9	9.76	10.64	11.94	0.054	<0.040	0.057	0.100
KC1	4	29	178	105-120	0.014	0.072	0.034	21.3	7.62	10.42	9.43	0.035	<0.040	0.050	0.100
KC1	4	29	179	120-135	0.015	0.028	0.016	44.2	15.62	9.65	9.96	0.050	<0.040	0.066	0.100
KC1	5	25	128	0-15	0.041	0.094	0.457	303.2	43.50	87.75	384	0.832	0.097	0.204	0.229
KC1	5	25	129	0-15	0.030	0.111	0.039	82.1	10.22	15.15	107	0.226	<0.040	0.161	0.192
KC1	5	25	130	0-15	0.054	0.084	0.114	108.3	19.17	34.83	140	0.313	<0.040	0.149	0.284
KC1	5	25	131	0-15	0.071	0.106	0.079	90.1	14.89	27.47	191	0.282	<0.040	0.197	0.332
KC1	5	25	132	0-15	0.056	0.077	0.050	91.9	14.99	35.97	233	0.296	0.054	0.156	0.230

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	S	Si	As	Cr	V (mg/L)	Li	Mo	Ni	Co	SAR
KCl	2	45	283	45-60	8.50	17.35	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
KCl	2	45	284	60-75	8.04	18.37	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	2	45	285	75-90	6.59	24.61	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	2	45	286	90-105	4.05	23.07	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	2	45	287	105-120	2.80	22.22	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	2	45	288	120-135	3.77	16.19	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	3	21	96	0-15	16.55	8.96	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	3	21	97	0-15	24.19	9.90	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	3	21	98	0-15	25.43	8.99	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.2
KCl	3	21	99	0-15	16.41	10.22	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	3	21	100	0-15	38.30	11.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	3	30	180	0-15	16.12	6.69	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	3	39	237	0-15	34.83	6.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	4	16	63	0-15	27.50	7.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.2
KCl	4	16	64	0-15	31.03	10.38	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.2
KCl	4	16	65	0-15	39.85	8.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	4	16	66	0-15	34.18	8.90	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.2
KCl	4	16	67	0-15	41.18	8.85	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	4	16	68	15-30	18.13	3.91	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	4	16	69	15-30	22.06	7.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	4	16	70	15-30	23.05	3.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	4	16	71	15-30	28.20	6.81	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	4	16	72	15-30	30.25	4.91	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	4	16	73	30-45	21.57	5.46	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	4	16	74	45-60	12.34	6.39	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	4	16	75	60-75	10.86	6.43	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	4	16	76	75-90	10.70	6.63	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	4	16	77	90-110	9.43	6.70	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	4	24	127	0-15	48.54	8.78	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
KCl	4	29	171	0-15	42.16	7.71	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	4	29	172	15-30	54.97	3.22	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
KCl	4	29	173	30-45	29.32	10.20	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	4	29	174	45-60	12.23	12.28	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	4	29	175	60-75	10.07	11.59	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	4	29	176	75-90	15.11	9.80	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	4	29	177	90-105	12.96	11.83	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	4	29	178	105-120	7.75	13.87	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	4	29	179	120-135	5.15	7.21	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
KCl	5	25	128	0-15	210.03	8.37	<0.030	0.023	<0.030	<0.040	<0.050	<0.030	<0.010	1.2
KCl	5	25	129	0-15	27.22	6.71	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	5	25	130	0-15	62.40	5.87	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
KCl	5	25	131	0-15	57.56	8.31	<0.030	<0.020	<0.030	<0.040	0.074	0.036	<0.010	0.7
KCl	5	25	132	0-15	80.35	7.87	<0.030	<0.020	<0.030	<0.040	0.079	0.036	<0.010	0.9

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	HCO ₃	CO ₃	OH	Al	Fe	Ti
													(mg/L)		
KCl	5	25	133	15-30	38.5	1.97	5.60	597	58.5	58.5	0.002	0.000	0.747	1.029	0.012
KCl	5	25	134	15-30	39.5	1.07	6.30	196	162.0	162.0	0.030	0.001	0.333	0.697	0.017
KCl	5	25	135	15-30	37.5	1.20	6.60	326	158.0	157.9	0.059	0.002	<0.200	0.252	<0.010
KCl	5	25	136	15-30	39.0	1.32	7.20	184	228.0	227.7	0.339	0.008	<0.200	0.144	<0.010
KCl	5	25	137	15-30	43.5	1.61	6.20	250	128.0	128.0	0.019	0.001	<0.200	0.182	<0.010
KCl	5	25	138	30-45	38.0	0.65	5.60	146	30.5	30.5	0.001	0.000	0.752	0.589	<0.010
KCl	5	25	139	45-60	36.5	0.46	5.70	93.65	20.2	20.2	0.001	0.000	1.091	0.874	<0.010
KCl	5	25	140	60-75	32.5	0.31	5.70	56.79	25.8	25.8	0.001	0.000	1.318	1.944	0.187
KCl	5	25	141	75-90	32.0	0.26	6.15	37.95	47.2	47.2	0.006	0.001	0.832	3.509	0.447
KCl	5	25	142	90-105	34.0	0.16	6.20	23.25	23.2	23.2	0.003	0.001	2.033	9.587	1.095
KCl	5	25	143	105-120	30.0	0.14	6.40	19.76	32.1	32.1	0.008	0.001	0.699	4.807	0.300
KCl	5	25	144	120-135	34.0	0.14	6.50	14.09	35.5	35.5	0.011	0.002	0.699	4.679	0.360
KCl	5	25	144a	135-150	32.0	0.18	6.50	22.18	40.4	40.4	0.012	0.002	0.236	0.496	0.036
KCl	5	25	144b	150-165	31.0	0.14	6.70	13.72	33.3	33.3	0.016	0.003	<0.200	0.168	<0.010
KCl	5	25	144c	165-180	29.5	0.12	6.80	10.80	30.8	30.8	0.018	0.003	0.222	0.252	0.011
KCl	5	25	144d	180-195	34.0	0.10	6.60	10.20	26.5	26.5	0.010	0.002	0.242	0.238	<0.010
KCl	5	25	144e	195-210	30.0	0.12	6.80	11.96	32.4	32.4	0.019	0.003	<0.200	0.123	<0.010
KCl	5	26	145	0-15	37.3	0.62	6.95	18.61	252.5	252.3	0.211	0.004	<0.200	0.223	<0.010
KCl	5	26	146	15-30	36.5	0.56	7.10	16.60	239.0	238.7	0.282	0.006	<0.200	0.227	<0.010
KCl	5	37	219	0-15	38.5	0.50	6.70	17.13	211.0	210.9	0.099	0.003	<0.200	0.020	<0.010
NaCl	6	22	101	0-15	46.5	0.34	6.50	13.86	143.0	143.0	0.042	0.002	0.268	0.241	0.019
NaCl	6	22	102	15-30	33.5	0.35	7.60	14.34	177.0	176.3	0.660	0.020	<0.200	<0.010	<0.010
NaCl	6	22	103	30-45	36.0	0.29	7.70	9.50	146.0	145.3	0.684	0.025	<0.200	<0.010	<0.010
NaCl	6	22	104	45-60	35.0	0.29	7.70	9.72	142.0	141.3	0.666	0.025	<0.200	<0.010	<0.010
NaCl	6	22	105	60-75	33.5	0.30	7.60	8.27	149.0	148.4	0.555	0.020	<0.200	<0.010	<0.010
NaCl	6	22	106	75-90	34.5	0.30	7.70	7.19	140.0	139.3	0.656	0.025	<0.200	<0.010	<0.010
NaCl	6	22	107	90-105	32.0	0.29	7.80	6.81	138.0	137.2	0.813	0.032	<0.200	<0.010	<0.010
NaCl	6	22	108	105-120	32.5	0.29	7.60	6.63	136.0	135.5	0.507	0.020	<0.200	<0.010	<0.010
NaCl	6	22	109	120-130	34.5	0.29	7.60	5.76	135.0	134.5	0.503	0.020	<0.200	0.113	<0.010
NaCl	6	32	194	0-15	38.5	0.42	7.00	11.54	217.0	216.8	0.204	0.005	<0.200	0.189	<0.010
NaCl	6	41	239	0-15	36.0	0.40	7.00	16.46	204.0	203.8	0.192	0.005	<0.200	<0.010	<0.010
NaCl	7	18	79	0-15	43.0	0.47	6.80	19.51	240.0	239.9	0.142	0.003	<0.200	<0.010	<0.010
NaCl	7	27	147	0-15	41.0	0.49	6.20	70.95	160.0	160.0	0.024	0.001	0.473	1.249	0.047
NaCl	7	27	148	0-15	39.5	0.68	6.90	90.38	237.0	236.8	0.177	0.004	<0.200	0.238	<0.010
NaCl	7	27	149	0-15	39.5	0.87	6.85	166	225.0	224.8	0.150	0.004	<0.200	0.383	<0.010
NaCl	7	27	150	0-15	39.5	0.38	6.60	28.96	148.0	147.9	0.055	0.002	0.262	0.569	0.021
NaCl	7	27	151	0-15	40.5	0.35	6.60	22.29	147.0	146.9	0.055	0.002	0.235	0.339	0.011
NaCl	7	27	152	15-30	38.0	0.85	6.70	165	203.0	202.9	0.096	0.003	<0.200	0.309	0.011
NaCl	7	34	196	0-15	41.5	0.53	6.70	20.01	225.0	224.9	0.106	0.003	<0.200	0.280	<0.010
NaCl	7	34	197	0-15	37.3	0.44	7.13	14.99	202.0	201.7	0.253	0.007	<0.200	0.123	<0.010
NaCl	7	34	198	0-15	38.5	0.46	7.05	13.65	228.0	227.8	0.240	0.006	<0.200	0.171	<0.010
NaCl	7	34	199	0-15	41.0	0.87	6.70	188	147.0	146.9	0.069	0.003	<0.200	0.201	<0.010
NaCl	7	34	200	0-15	41.0	0.48	6.80	27.60	187.0	186.9	0.111	0.003	<0.200	0.177	<0.010
NaCl	7	34	201	15-30	36.0	0.83	7.20	124	255.0	254.6	0.379	0.008	<0.200	0.109	<0.010

Sat'n' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cu	Zn	Mn	Ca	Mg	Na (mg/L)	K	Sr	B	Ba	P
KCl	5	25	133	15-30	0.058	0.278	32	269.8	68.65	79.74	91.81	0.591	<0.040	0.316	0.338
KCl	5	25	134	15-30	0.020	0.149	3.712	170.5	24.76	49.26	147	0.337	0.070	0.198	0.533
KCl	5	25	135	15-30	0.046	0.116	2.596	240.4	66.79	49.84	38.87	0.478	<0.040	0.224	0.250
KCl	5	25	136	15-30	0.041	0.067	0.309	181.3	47.61	53.62	97.76	0.439	<0.040	0.159	0.135
KCl	5	25	137	15-30	0.026	0.118	0.428	256.7	62.35	81.39	91.83	0.620	<0.040	0.118	0.100
KCl	5	25	138	30-45	0.036	0.158	6.504	79.8	23.00	20.29	7.10	0.232	<0.040	0.359	0.170
KCl	5	25	139	45-60	0.049	0.212	2.734	56.7	14.47	15.18	8.68	0.169	<0.040	0.256	0.225
KCl	5	25	140	60-75	0.057	0.180	1.690	41.1	9.27	11.64	8.95	0.116	<0.040	0.145	0.124
KCl	5	25	141	75-90	0.061	0.206	1.226	35.0	8.01	12.60	9.02	0.101	<0.040	0.105	0.162
KCl	5	25	142	90-105	0.072	0.177	0.268	17.0	4.26	9.51	7.90	0.076	<0.040	0.124	0.305
KCl	5	25	143	105-120	0.084	0.235	0.085	14.0	3.70	8.41	7.05	0.044	<0.040	0.086	0.139
KCl	5	25	144	120-135	0.072	0.129	0.030	13.6	4.44	8.32	6.99	0.045	<0.040	0.086	0.149
KCl	5	25	144a	135-150	0.034	0.104	0.044	19.9	5.46	9.69	8.57	0.053	<0.040	0.063	0.100
KCl	5	25	144b	150-165	0.027	0.104	0.014	12.7	4.26	8.77	6.63	0.035	<0.040	0.074	0.100
KCl	5	25	144c	165-180	0.028	0.111	0.010	11.1	2.94	8.62	6.70	0.040	<0.040	0.063	0.100
KCl	5	25	144d	180-195	0.024	0.090	0.009	8.3	2.97	7.76	5.76	0.030	<0.040	0.056	0.100
KCl	5	25	144e	195-210	0.021	0.085	0.006	10.6	3.96	8.01	5.76	0.037	<0.040	0.055	0.100
KCl	5	26	145	0-15	0.025	0.108	0.077	93.6	16.48	16.63	85.63	0.229	<0.040	0.165	0.456
KCl	5	26	146	15-30	0.032	0.135	0.106	99.2	20.47	21.52	44.18	0.189	<0.040	0.137	0.340
KCl	5	37	219	0-15	0.010	0.079	0.034	98.9	16.91	13.39	21.41	0.169	0.999	0.124	0.281
NaCl	6	22	101	0-15	0.016	0.071	0.132	65.1	15.96	14.75	10.39	0.114	0.045	0.114	0.612
NaCl	6	22	102	15-30	0.023	0.023	0.006	45.6	21.09	14.78	9.70	0.127	<0.040	0.112	0.100
NaCl	6	22	103	30-45	0.015	0.032	0.006	32.7	18.75	12.49	7.22	0.105	<0.040	0.101	0.100
NaCl	6	22	104	45-60	0.013	0.023	0.006	32.6	18.32	12.68	7.52	0.111	<0.040	0.088	0.100
NaCl	6	22	105	60-75	0.014	0.047	0.006	33.8	18.05	13.82	7.87	0.111	<0.040	0.075	0.100
NaCl	6	22	106	75-90	0.010	0.045	0.006	32.7	18.68	12.49	8.13	0.118	<0.040	0.096	0.100
NaCl	6	22	107	90-105	0.015	0.047	0.006	32.8	17.67	12.84	8.17	0.106	<0.040	0.080	0.100
NaCl	6	22	108	105-120	0.012	0.043	0.006	33.3	17.00	12.71	8.47	0.101	<0.040	0.087	0.100
NaCl	6	22	109	120-130	0.018	0.029	0.009	32.9	17.17	11.23	8.33	0.140	<0.040	0.072	0.100
NaCl	6	32	194	0-15	0.027	0.104	0.094	88.9	19.65	10.49	6.10	0.120	<0.040	0.106	0.348
NaCl	6	41	239	0-15	0.017	0.319	0.021	76.9	18.72	15.08	4.46	0.109	0.963	0.086	0.177
NaCl	7	18	79	0-15	0.019	0.139	0.036	90.4	16.77	25.24	11.26	0.139	<0.040	0.129	0.698
NaCl	7	27	147	0-15	0.019	0.136	0.421	64.2	14.66	64.73	7.17	0.118	<0.040	0.122	1.052
NaCl	7	27	148	0-15	0.028	0.088	0.495	108.4	22.62	58.49	8.13	0.192	<0.040	0.114	0.324
NaCl	7	27	149	0-15	0.030	0.093	0.235	84.7	18.48	147.03	5.80	0.154	<0.040	0.082	0.506
NaCl	7	27	150	0-15	0.022	0.102	0.290	57.8	12.75	39.91	7.36	0.104	<0.040	0.070	0.747
NaCl	7	27	151	0-15	0.033	0.109	0.411	64.8	15.25	20.65	8.98	0.113	<0.040	0.098	0.482
NaCl	7	27	152	15-30	0.043	0.102	0.469	101.1	23.57	113.51	8.82	0.175	<0.040	0.160	0.398
NaCl	7	34	196	0-15	0.016	0.113	0.084	74.9	12.73	51.81	34.79	0.149	<0.040	0.107	1.399
NaCl	7	34	197	0-15	0.044	0.090	0.017	70.9	12.18	33.16	18.76	0.128	<0.040	0.133	0.253
NaCl	7	34	198	0-15	0.027	0.122	0.037	80.7	15.62	31.14	18.61	0.156	<0.040	0.123	0.324
NaCl	7	34	199	0-15	0.019	0.100	0.296	115.8	24.72	63.25	33.26	0.201	<0.040	0.227	0.466
NaCl	7	34	200	0-15	0.019	0.097	0.139	75.2	13.96	27.31	40.08	0.144	<0.040	0.151	0.669
NaCl	7	34	201	15-30	0.038	0.065	0.135	114.2	24.77	79.72	15.00	0.190	<0.040	0.164	0.270

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	S	Si	As	Cr	V (mg/L)	Li	Mo	Ni	Co	SAR
KCl	5	25	133	15-30	94.80	12.37	<0.030	0.050	<0.030	<0.040	<0.050	0.262	0.050	1.1
KCl	5	25	134	15-30	100.68	6.93	<0.030	<0.020	<0.030	<0.040	<0.050	0.037	<0.010	0.9
KCl	5	25	135	15-30	88.59	3.79	<0.030	0.032	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
KCl	5	25	136	15-30	113.94	5.32	<0.030	0.022	<0.030	<0.040	<0.050	0.038	<0.010	0.9
KCl	5	25	137	15-30	214.17	5.77	<0.030	0.029	<0.030	<0.040	<0.050	0.031	<0.010	1.2
KCl	5	25	138	30-45	8.68	16.00	<0.030	0.023	<0.030	<0.040	<0.050	0.066	0.055	0.5
KCl	5	25	139	45-60	4.56	18.76	<0.030	<0.020	<0.030	<0.040	<0.050	0.034	0.036	0.5
KCl	5	25	140	60-75	5.98	19.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	0.016	0.4
KCl	5	25	141	75-90	7.79	17.96	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	25	142	90-105	4.96	28.26	<0.030	<0.020	0.032	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	25	143	105-120	4.79	22.28	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	25	144	120-135	4.43	21.68	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	25	144a	135-150	7.11	16.60	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	25	144b	150-165	4.96	16.66	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	25	144c	165-180	5.07	17.70	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	5	25	144d	180-195	5.02	18.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
KCl	5	25	144e	195-210	5.83	18.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	26	145	0-15	30.83	9.33	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
KCl	5	26	146	15-30	26.23	6.49	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
KCl	5	37	219	0-15	18.87	7.92	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
NaCl	6	22	101	0-15	6.03	7.95	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	6	22	102	15-30	4.11	7.74	<0.030	<0.020	<0.030	0.040	<0.050	<0.030	<0.010	0.5
NaCl	6	22	103	30-45	3.39	7.43	<0.030	<0.020	<0.030	0.048	<0.050	<0.030	<0.010	0.4
NaCl	6	22	104	45-60	3.88	7.38	<0.030	<0.020	<0.030	0.048	<0.050	<0.030	<0.010	0.4
NaCl	6	22	105	60-75	5.24	7.03	<0.030	<0.020	<0.030	0.046	<0.050	<0.030	<0.010	0.5
NaCl	6	22	106	75-90	6.95	6.81	<0.030	<0.020	<0.030	0.047	<0.050	<0.030	<0.010	0.4
NaCl	6	22	107	90-105	7.91	6.82	<0.030	<0.020	<0.030	0.047	<0.050	<0.030	<0.010	0.4
NaCl	6	22	108	105-120	8.32	6.74	<0.030	<0.020	<0.030	0.046	<0.050	<0.030	<0.010	0.4
NaCl	6	22	109	120-130	8.16	6.62	<0.030	<0.020	<0.030	0.047	<0.050	<0.030	<0.010	0.4
NaCl	6	32	194	0-15	5.83	7.17	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
NaCl	6	41	239	0-15	6.57	6.27	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	7	18	79	0-15	6.71	9.89	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
NaCl	7	27	147	0-15	7.75	9.75	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.9
NaCl	7	27	148	0-15	8.69	7.88	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.3
NaCl	7	27	149	0-15	13.28	6.61	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.8
NaCl	7	27	150	0-15	7.57	8.17	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.2
NaCl	7	27	151	0-15	7.14	9.10	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
NaCl	7	27	152	15-30	15.46	6.18	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.6
NaCl	7	34	196	0-15	15.69	10.10	0.033	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.5
NaCl	7	34	197	0-15	12.84	6.45	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
NaCl	7	34	198	0-15	11.52	8.03	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
NaCl	7	34	199	0-15	19.21	7.33	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.4
NaCl	7	34	200	0-15	11.72	7.99	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
NaCl	7	34	201	15-30	19.39	5.92	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.8

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	HCO3	CO3	OH (mg/L)	Al	Fe	Ti
NaCl	8	20	95	0-15	43.0	0.52	6.90	29.05	223.0	222.8	0.166	0.004	<0.200	0.087	<0.010
NaCl	8	35	202	0-15	41.0	0.51	6.90	14.64	229.0	228.8	0.171	0.004	<0.200	0.167	<0.010
NaCl	8	35	203	0-15	41.5	0.50	6.75	15.90	217.0	216.9	0.115	0.003	<0.200	0.138	<0.010
NaCl	8	35	204	0-15	46.5	0.43	6.40	14.27	176.0	176.0	0.042	0.001	<0.200	0.170	<0.010
NaCl	8	35	205	0-15	40.5	0.41	6.70	14.27	187.0	186.9	0.088	0.003	<0.200	0.172	<0.010
NaCl	8	35	206	0-15	40.5	0.42	6.60	22.84	190.0	189.9	0.071	0.002	<0.200	0.177	<0.010
NaCl	8	35	207	15-30	34.0	0.43	7.40	15.15	215.0	214.5	0.506	0.013	<0.200	0.114	<0.010
NaCl	8	35	208	30-45	34.0	0.37	7.70	28.55	133.0	132.4	0.624	0.025	<0.200	0.094	<0.010
NaCl	8	35	209	45-60	36.0	0.52	7.40	91.16	105.0	104.7	0.247	0.013	<0.200	<0.010	<0.010
NaCl	8	35	210	60-75	36.0	0.73	7.40	176	99.6	99.4	0.235	0.013	<0.200	<0.010	<0.010
NaCl	8	35	211	75-90	37.0	0.65	7.60	151	102.0	101.6	0.380	0.020	<0.200	<0.010	<0.010
NaCl	8	35	212	90-105	35.5	0.48	7.60	86.27	120.0	119.5	0.447	0.020	<0.200	<0.010	<0.010
NaCl	8	35	212a	105-120	32.0	0.36	7.70	39.58	122.0	121.4	0.572	0.025	<0.200	<0.010	<0.010
NaCl	8	35	212b	120-135	36.5	0.27	7.50	11.28	123.0	122.6	0.364	0.016	<0.200	<0.010	<0.010
NaCl	8	44	254	0-15	39.0	0.45	7.00	24.92	214.0	213.8	0.201	0.005	<0.200	0.036	<0.010
NaCl	8	44	255	0-15	34.5	0.62	7.00	40.11	210.0	209.8	0.197	0.005	<0.200	0.053	<0.010
NaCl	8	44	256	0-15	34.0	0.78	7.00	102	254.0	253.8	0.239	0.005	<0.200	0.272	<0.010
NaCl	8	44	257	0-15	37.5	0.65	6.85	37.19	246.0	245.8	0.164	0.004	0.226	0.300	0.036
NaCl	8	44	258	0-15	37.0	0.51	6.70	21.86	196.0	195.9	0.092	0.003	<0.200	0.060	0.010
NaCl	8	44	259	15-30	34.5	0.42	7.30	28.23	197.0	196.6	0.369	0.010	<0.200	0.013	<0.010
NaCl	8	44	260	15-30	34.5	0.48	7.00	50.62	199.0	198.8	0.187	0.005	<0.200	0.333	0.019
NaCl	8	44	261	15-30	32.5	1.03	6.90	236	210.0	209.8	0.157	0.004	<0.200	0.563	0.026
NaCl	8	44	262	15-30	34.0	0.49	6.88	21.68	238.0	237.8	0.168	0.004	<0.200	0.035	<0.010
NaCl	8	44	263	15-30	33.0	0.75	7.20	88.48	306.0	305.5	0.455	0.008	<0.200	0.142	<0.010
NaCl	8	44	264	30-45	35.5	0.42	7.25	52.27	147.0	146.7	0.245	0.009	<0.200	<0.010	<0.010
NaCl	8	44	265	45-60	34.5	0.48	7.30	82.73	133.0	132.7	0.249	0.010	<0.200	<0.010	<0.010
NaCl	8	44	266	60-75	35.5	0.43	7.20	71.70	116.0	115.8	0.173	0.008	<0.200	<0.010	<0.010
NaCl	8	44	267	75-90	35.0	0.39	7.45	59.31	118.0	117.7	0.312	0.014	<0.200	<0.010	<0.010
NaCl	8	44	268	90-105	35.0	0.34	7.50	44.63	123.0	122.6	0.364	0.016	<0.200	<0.010	<0.010
NaCl	8	44	269	105-120	34.5	0.31	7.50	30.41	128.0	127.6	0.379	0.016	<0.200	<0.010	<0.010
NaCl	8	44	270	120-135	35.0	0.29	7.50	21.61	132.0	131.6	0.391	0.016	<0.200	<0.010	<0.010
NaCl	8	44	271	135-150	35.0	0.32	7.70	15.05	149.0	148.3	0.699	0.025	<0.200	<0.010	<0.010
NaCl	9	19	80	0-15	51.0	0.61	6.55	45.11	259.0	258.9	0.086	0.002	0.262	0.239	<0.010
NaCl	9	19	81	0-15	42.5	0.51	7.05	21.03	232.0	231.7	0.244	0.006	<0.200	0.033	<0.010
NaCl	9	19	82	0-15	43.8	0.52	6.95	20.80	272.5	272.3	0.228	0.004	<0.200	0.029	<0.010
NaCl	9	19	83	0-15	44.5	0.86	6.60	137	286.0	285.9	0.107	0.002	0.284	0.312	0.016
NaCl	9	19	84	0-15	49.0	0.59	6.50	32.56	296.0	295.9	0.088	0.002	0.253	0.591	0.025
NaCl	9	19	85	15-30	44.0	0.71	7.25	75.36	276.0	275.5	0.461	0.009	<0.200	<0.010	<0.010
NaCl	9	19	86	15-30	37.0	0.54	7.25	22.75	254.0	253.6	0.424	0.009	<0.200	<0.010	<0.010
NaCl	9	19	87	15-30	39.0	0.52	6.90	20.26	258.0	257.8	0.192	0.004	0.476	0.144	<0.010
NaCl	9	19	88	15-30	42.5	1.20	6.60	252	244.0	243.9	0.091	0.002	0.307	0.404	0.019
NaCl	9	19	89	15-30	47.5	0.63	6.50	45.22	296.0	295.9	0.088	0.002	5.060	6.569	0.529
NaCl	9	19	90	30-45	35.5	0.41	7.40	50.49	139.0	138.7	0.327	0.013	<0.200	<0.010	<0.010
NaCl	9	19	91	45-60	36.5	0.29	7.40	47.97	78.1	77.9	0.184	0.013	<0.200	<0.010	<0.010
NaCl	9	19	92	60-75	32.0	0.35	7.70	41.54	119.0	118.4	0.558	0.025	<0.200	<0.010	<0.010
NaCl	9	19	93	75-90	33.0	0.34	7.50	49.49	95.0	94.7	0.282	0.016	<0.200	<0.010	<0.010
NaCl	9	19	94	90-110	32.0	0.37	7.40	64.54	70.2	70.0	0.165	0.013	<0.200	<0.010	<0.010
NaCl	9	19	94a	105-120	35.5	0.38	7.40	63.57	83.4	83.2	0.196	0.013	<0.200	<0.010	<0.010
NaCl	9	19	94b	120-140	37.0	0.36	7.50	61.96	82.2	81.9	0.244	0.016	<0.200	<0.010	<0.010

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO3/L; HCO3, CO3, OH reported as mg CaCO3/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cu	Zn	Mn	Ca	Mg	Na (mg/L)	K	Sr	B	Ba	P
NaCl	8	20	95	0-15	0.028	0.137	0.078	75.0	15.56	68.79	7.04	0.126	<0.040	0.122	0.614
NaCl	8	35	202	0-15	0.028	0.091	0.142	94.0	19.07	30.87	12.90	0.170	<0.040	0.151	0.538
NaCl	8	35	203	0-15	0.013	0.095	0.114	95.6	21.01	21.59	11.65	0.164	<0.040	0.149	0.632
NaCl	8	35	204	0-15	0.029	0.078	0.144	83.2	17.33	12.75	17.50	0.164	<0.040	0.136	0.632
NaCl	8	35	205	0-15	0.019	0.097	0.137	77.7	15.79	13.92	16.75	0.132	<0.040	0.135	0.387
NaCl	8	35	206	0-15	0.016	0.102	0.148	78.0	17.13	18.99	10.92	0.133	<0.040	0.117	0.645
NaCl	8	35	207	15-30	0.043	0.049	0.006	34.7	12.07	74.46	3.27	0.065	<0.040	0.069	0.100
NaCl	8	35	208	30-45	0.023	0.027	0.006	29.7	13.88	49.20	2.39	0.062	<0.040	0.048	0.100
NaCl	8	35	209	45-60	0.010	0.047	0.006	53.4	31.38	26.11	3.63	0.103	0.805	0.064	0.100
NaCl	8	35	210	60-75	0.010	0.035	0.010	76.1	47.30	21.54	5.30	0.170	0.808	0.110	0.100
NaCl	8	35	211	75-90	0.010	0.029	0.006	65.9	42.73	20.53	6.35	0.155	0.812	0.105	0.100
NaCl	8	35	212	90-105	0.010	0.020	0.006	47.3	30.26	17.68	5.91	0.104	0.966	0.080	0.100
NaCl	8	35	212a	105-120	0.010	0.062	0.006	32.4	20.85	16.17	5.14	0.074	0.995	0.056	0.100
NaCl	8	35	212b	120-135	0.010	0.081	0.006	28.9	17.52	14.93	4.93	0.065	0.980	0.050	0.100
NaCl	8	44	254	0-15	0.010	0.109	0.024	63.3	11.49	58.81	6.21	0.085	0.963	0.083	0.270
NaCl	8	44	255	0-15	0.010	0.088	0.115	112.1	22.45	43.07	5.95	0.164	0.962	0.120	0.267
NaCl	8	44	256	0-15	0.010	0.176	0.122	70.5	13.32	147.72	4.21	0.106	0.982	0.086	0.371
NaCl	8	44	257	0-15	0.045	0.146	0.087	69.3	11.39	127.57	6.29	0.107	1.026	0.100	0.810
NaCl	8	44	258	0-15	0.033	0.134	0.045	106.9	21.55	20.51	7.85	0.156	0.997	0.136	0.584
NaCl	8	44	259	15-30	0.040	0.103	0.011	55.5	11.79	56.95	4.73	0.081	0.985	0.083	0.123
NaCl	8	44	260	15-30	0.028	0.183	0.146	69.5	15.01	63.82	2.95	0.117	1.001	0.121	0.316
NaCl	8	44	261	15-30	0.016	0.151	0.285	83.9	17.22	195.03	3.54	0.139	1.004	0.141	0.634
NaCl	8	44	262	15-30	0.010	0.110	0.039	75.7	16.67	41.68	5.00	0.112	0.973	0.096	0.350
NaCl	8	44	263	15-30	0.015	0.120	0.059	56.5	10.29	135.84	4.79	0.082	0.987	0.088	0.418
NaCl	8	44	264	30-45	0.010	0.067	0.006	67.0	16.38	23.81	2.60	0.070	0.953	0.065	0.100
NaCl	8	44	265	45-60	0.010	0.074	0.006	74.5	20.63	16.61	1.95	0.074	0.952	0.086	0.100
NaCl	8	44	266	60-75	0.010	0.058	0.006	64.4	18.19	13.27	1.85	0.066	0.946	0.080	0.100
NaCl	8	44	267	75-90	0.010	0.056	0.006	55.7	17.99	15.86	2.42	0.140	0.954	0.048	0.100
NaCl	8	44	268	90-105	0.010	0.056	0.006	52.6	15.65	12.40	3.13	0.058	0.960	0.073	0.100
NaCl	8	44	269	105-120	0.010	0.042	0.006	47.5	15.08	11.54	3.31	0.064	0.960	0.062	0.100
NaCl	8	44	270	120-135	0.010	0.043	0.006	43.6	14.01	10.73	3.47	0.049	0.955	0.074	0.100
NaCl	8	44	271	135-150	0.010	0.030	0.006	49.5	16.59	11.52	3.74	0.058	0.950	0.068	0.100
NaCl	9	19	80	0-15	0.024	0.109	0.024	85.9	16.42	81.82	23.32	0.170	0.158	0.159	1.296
NaCl	9	19	81	0-15	0.026	0.063	0.047	92.0	17.80	38.53	8.42	0.174	0.056	0.133	0.338
NaCl	9	19	82	0-15	0.028	0.078	0.048	94.2	17.43	40.59	7.66	0.189	0.056	0.123	0.460
NaCl	9	19	83	0-15	0.028	0.156	0.156	78.1	15.39	160.60	9.58	0.141	0.051	0.140	1.522
NaCl	9	19	84	0-15	0.014	0.083	0.099	64.7	12.13	106.22	9.95	0.115	0.053	0.114	1.491
NaCl	9	19	85	15-30	0.026	0.055	0.048	88.8	21.19	79.25	24.03	0.158	0.087	0.159	0.264
NaCl	9	19	86	15-30	0.031	0.141	0.031	71.8	15.99	73.96	5.34	0.113	0.042	0.114	0.310
NaCl	9	19	87	15-30	0.021	0.087	0.056	69.0	14.01	77.77	4.16	0.119	0.054	0.115	0.675
NaCl	9	19	88	15-30	0.025	0.126	0.291	85.6	18.85	232.19	8.65	0.182	0.069	0.155	1.317
NaCl	9	19	89	15-30	0.056	0.180	0.361	57.0	11.24	151.45	7.34	0.120	0.103	0.154	3.036
NaCl	9	19	90	30-45	0.028	0.062	0.006	51.2	15.34	29.66	6.22	0.063	<0.040	0.085	0.100
NaCl	9	19	91	45-60	0.014	0.081	0.006	30.2	8.82	31.48	5.37	0.038	<0.040	0.066	0.100
NaCl	9	19	92	60-75	0.017	0.063	0.006	33.9	9.77	40.94	6.65	0.042	<0.040	0.076	0.100
NaCl	9	19	93	75-90	0.017	0.075	0.006	33.7	9.99	34.34	6.05	0.039	<0.040	0.065	0.100
NaCl	9	19	94	90-110	0.013	0.067	0.006	38.3	11.99	27.31	6.18	0.037	<0.040	0.066	0.100
NaCl	9	19	94a	105-120	0.013	0.064	0.006	44.6	13.30	21.20	6.94	0.049	<0.040	0.063	0.100
NaCl	9	19	94b	120-140	0.013	0.042	0.006	46.7	13.57	15.72	6.75	0.051	<0.040	0.063	0.100

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	S	Si	As	Cr	V	Li	Mo	Ni	Co	SAR
					(mg/L)									
NaCl	8	20	95	0-15	8.69	7.31	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.9
NaCl	8	35	202	0-15	9.69	8.26	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
NaCl	8	35	203	0-15	8.58	8.07	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	35	204	0-15	8.01	8.59	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.3
NaCl	8	35	205	0-15	8.06	8.05	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	8	35	206	0-15	7.08	8.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	35	207	15-30	8.23	9.63	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.8
NaCl	8	35	208	30-45	12.56	10.10	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.9
NaCl	8	35	209	45-60	15.49	10.58	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
NaCl	8	35	210	60-75	11.13	10.24	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	35	211	75-90	6.65	9.52	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	35	212	90-105	6.17	8.81	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	35	212a	105-120	67.36	38.11	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	5.705	0.5
NaCl	8	35	212b	120-135	4.64	7.93	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	44	254	0-15	7.69	6.72	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.8
NaCl	8	44	255	0-15	44.72	6.14	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
NaCl	8	44	256	0-15	24.61	5.28	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	4.2
NaCl	8	44	257	0-15	30.17	7.89	0.031	0.022	0.034	<0.040	<0.050	0.037	0.012	3.7
NaCl	8	44	258	0-15	29.86	7.72	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	44	259	15-30	8.53	4.94	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.8
NaCl	8	44	260	15-30	9.24	5.41	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.8
NaCl	8	44	261	15-30	14.35	5.62	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	5.1
NaCl	8	44	262	15-30	9.46	5.71	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.1
NaCl	8	44	263	15-30	13.00	5.61	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	4.4
NaCl	8	44	264	30-45	8.62	5.40	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
NaCl	8	44	265	45-60	7.51	6.71	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	8	44	266	60-75	5.80	6.52	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	8	44	267	75-90	6.59	6.51	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	8	44	268	90-105	4.59	6.46	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	8	44	269	105-120	4.25	6.32	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	8	44	270	120-135	4.44	6.45	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	8	44	271	135-150	6.91	6.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	9	19	80	0-15	10.43	8.75	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.1
NaCl	9	19	81	0-15	9.42	8.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
NaCl	9	19	82	0-15	12.11	10.40	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
NaCl	9	19	83	0-15	16.84	8.32	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	4.3
NaCl	9	19	84	0-15	16.86	9.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.2
NaCl	9	19	85	15-30	7.23	7.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.0
NaCl	9	19	86	15-30	9.29	6.05	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.1
NaCl	9	19	87	15-30	8.77	7.62	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.2
NaCl	9	19	88	15-30	20.70	6.76	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	5.9
NaCl	9	19	89	15-30	12.81	19.20	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	4.8
NaCl	9	19	90	30-45	6.84	7.19	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
NaCl	9	19	91	45-60	5.85	6.97	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.3
NaCl	9	19	92	60-75	5.45	6.82	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.6
NaCl	9	19	93	75-90	7.27	7.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.3
NaCl	9	19	94	90-110	9.78	7.34	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
NaCl	9	19	94a	105-120	8.51	7.07	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
NaCl	9	19	94b	120-140	7.08	7.08	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	HCO3	CO3	OH (mg/L)	Al	Fe	Ti
NaCl	9	31	181	0-15	37.5	1.13	7.20	182	308.0	307.5	0.458	0.008	<0.200	0.432	0.018
NaCl	9	31	182	0-15	42.5	0.65	7.05	60.17	242.5	242.2	0.255	0.006	<0.200	0.236	0.010
NaCl	9	31	183	0-15	43.0	0.57	6.90	38.66	222.0	221.8	0.166	0.004	<0.200	0.292	<0.010
NaCl	9	31	184	0-15	39.0	0.55	7.00	29.58	235.0	234.8	0.221	0.005	<0.200	0.185	<0.010
NaCl	9	31	185	0-15	37.5	0.62	6.80	40.30	290.0	289.8	0.172	0.003	<0.200	0.259	<0.010
NaCl	9	31	186	15-30	34.5	0.94	6.50	247	60.1	60.1	0.018	0.002	<0.200	0.087	<0.010
NaCl	9	31	187	15-30	38.0	0.69	7.20	76.64	272.0	271.6	0.405	0.008	<0.200	0.185	<0.010
NaCl	9	31	188	15-30	41.0	0.44	7.10	40.02	240.0	239.7	0.284	0.006	<0.200	0.244	0.011
NaCl	9	31	189	15-30	34.0	0.55	7.30	45.96	297.0	296.4	0.556	0.010	<0.200	0.141	<0.010
NaCl	9	31	190	15-30	35.0	0.71	7.20	142	228.0	227.7	0.339	0.008	<0.200	0.221	<0.010
NaCl	9	31	191	30-45	37.0	1.35	6.10	418	27.8	27.8	0.003	0.001	<0.200	0.081	<0.010
NaCl	9	31	192	45-60	37.5	1.41	5.70	464	19.3	19.3	0.001	0.000	<0.200	0.091	<0.010
NaCl	9	31	193	60-75	39.0	1.15	5.90	369	19.9	19.9	0.001	0.000	<0.200	0.083	<0.010
NaCl	9	31	193a	75-90	38.0	0.88	6.30	270	24.2	24.2	0.005	0.001	<0.200	0.084	<0.010
NaCl	9	31	193b	90-105	36.0	0.75	6.70	213	61.9	61.9	0.029	0.003	<0.200	0.078	<0.010
NaCl	9	31	193c	105-120	38.5	0.58	6.90	163	39.3	39.3	0.029	0.004	<0.200	0.097	<0.010
NaCl	9	31	193d	120-135	36.5	0.67	7.40	162	90.4	90.2	0.213	0.013	<0.200	0.858	<0.010
NaCl	9	31	193e	135-150	34.5	0.57	7.40	125	95.0	94.8	0.224	0.013	<0.200	0.094	<0.010
NaCl	9	36	213	0-15	41.5	0.52	7.00	16.47	250.0	249.8	0.235	0.005	<0.200	0.011	<0.010
NaCl	9	36	214	0-15	43.0	0.46	7.10	14.91	225.0	224.7	0.266	0.006	<0.200	<0.010	<0.010
NaCl	9	36	215	0-15	40.5	0.46	7.00	14.63	233.0	232.8	0.219	0.005	<0.200	0.035	<0.010
NaCl	9	36	216	0-15	38.5	0.47	6.95	19.18	220.0	219.8	0.184	0.004	<0.200	0.025	<0.010
NaCl	9	36	217	0-15	43.0	0.55	6.60	34.11	252.0	251.9	0.094	0.002	<0.200	0.489	<0.010
NaCl	9	36	218	15-30	42.5	0.54	7.00	23.70	258.0	257.8	0.242	0.005	<0.200	0.067	<0.010
NaCl	10	23	110	0-15	44.0	2.03	6.40	534	249.0	248.9	0.059	0.001	0.237	0.749	0.018
NaCl	10	23	111	0-15	43.0	1.09	6.80	167	322.0	321.8	0.191	0.003	2.779	7.221	0.455
NaCl	10	23	112	0-15	37.5	0.73	7.20	57.10	303.0	302.5	0.451	0.008	1.131	5.095	0.314
NaCl	10	23	113	0-15	46.0	0.58	6.80	34.67	232.0	231.9	0.138	0.003	<0.200	0.407	<0.010
NaCl	10	23	114	0-15	44.5	1.02	7.10	142	310.0	309.6	0.366	0.006	0.916	3.301	0.242
NaCl	10	23	115	15-30	41.0	4.11	6.95	1392	225.0	224.8	0.188	0.004	<0.200	0.248	<0.010
NaCl	10	23	116	15-30	40.0	1.99	6.50	506	272.0	271.9	0.081	0.002	0.638	2.720	0.090
NaCl	10	23	117	15-30	37.0	0.94	6.90	179	222.0	221.8	0.166	0.004	3.046	21.334	0.789
NaCl	10	23	118	15-30	52.5	0.67	6.70	44.14	279.0	278.9	0.131	0.003	0.389	0.548	0.015
NaCl	10	23	119	15-30	42.5	1.59	7.25	248	388.0	387.3	0.647	0.009	0.368	2.009	0.122
NaCl	10	23	120	30-45	37.0	1.70	7.30	532	82.1	81.9	0.154	0.010	<0.200	0.113	<0.010
NaCl	10	23	121	45-60	34.5	1.13	7.40	316	96.6	96.4	0.228	0.013	<0.200	0.107	<0.010
NaCl	10	23	122	60-75	34.5	0.67	7.60	165	106.0	105.6	0.395	0.020	<0.200	0.106	<0.010
NaCl	10	23	123	75-90	33.0	0.53	7.60	107	116.0	115.5	0.432	0.020	<0.200	0.106	<0.010
NaCl	10	23	124	90-105	33.5	0.41	7.60	63.60	114.0	113.6	0.425	0.020	<0.200	0.106	<0.010
NaCl	10	23	125	105-120	34.0	0.32	7.70	30.98	124.0	123.4	0.581	0.025	<0.200	0.106	<0.010
NaCl	10	23	126	120-140	34.5	0.29	7.75	15.93	121.5	120.8	0.639	0.028	<0.200	0.107	<0.010
NaCl	10	28	153	0-15	42.5	1.57	7.30	398	308.0	307.4	0.577	0.010	6.551	10.607	0.540
NaCl	10	28	154	0-15	39.0	1.27	7.10	237	319.0	318.6	0.377	0.006	0.921	7.040	0.339
NaCl	10	28	155	0-15	39.0	1.20	6.50	229	312.0	311.9	0.093	0.002	1.538	9.344	0.367
NaCl	10	28	156	0-15	38.0	3.80	6.90	1122	283.0	282.8	0.211	0.004	<0.200	0.486	0.010
NaCl	10	28	157	0-15	38.5	1.28	7.00	220	303.0	302.7	0.285	0.005	<0.200	0.734	0.022

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO3/L; HCO3, CO3, OH reported as mg CaCO3/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cu	Zn	Mn	Ca	Mg	Na (mg/L)	K	Sr	B	Ba	P
NaCl	9	31	181	0-15	0.034	0.144	0.101	67.4	11.01	261.04	8.86	0.132	<0.040	0.094	0.763
NaCl	9	31	182	0-15	0.030	0.097	0.104	71.3	14.64	113.42	8.70	0.120	<0.040	0.134	0.509
NaCl	9	31	183	0-15	0.027	0.104	0.074	64.7	14.39	94.20	8.49	0.109	<0.040	0.104	0.853
NaCl	9	31	184	0-15	0.022	0.126	0.114	86.1	16.83	59.98	6.65	0.149	<0.040	0.112	0.495
NaCl	9	31	185	0-15	0.045	0.110	0.129	67.5	13.23	115.07	6.40	0.120	<0.040	0.131	0.780
NaCl	9	31	186	15-30	0.026	0.122	0.081	36.7	11.69	167.26	15.66	0.087	<0.040	0.154	0.100
NaCl	9	31	187	15-30	0.056	0.109	0.088	70.8	16.69	116.47	10.64	0.117	<0.040	0.115	0.418
NaCl	9	31	188	15-30	0.037	0.093	0.097	60.7	13.98	100.56	7.36	0.102	<0.040	0.115	0.432
NaCl	9	31	189	15-30	0.046	0.109	0.079	82.5	16.20	85.44	9.11	0.133	<0.040	0.109	0.269
NaCl	9	31	190	15-30	0.097	0.077	0.131	38.3	8.41	192.55	9.86	0.074	<0.040	0.074	0.201
NaCl	9	31	191	30-45	0.012	0.096	0.319	88.6	33.01	145.75	28.68	0.261	<0.040	0.142	0.100
NaCl	9	31	192	45-60	0.010	0.150	0.410	113.7	43.63	106.73	30.48	0.244	<0.040	0.250	0.100
NaCl	9	31	193	60-75	0.011	0.140	0.290	97.9	38.81	69.55	27.24	0.194	<0.040	0.256	0.100
NaCl	9	31	193a	75-90	0.010	0.082	0.137	79.5	31.94	46.68	20.76	0.135	<0.040	0.176	0.100
NaCl	9	31	193b	90-105	0.010	0.071	0.065	73.6	30.41	34.82	17.15	0.106	<0.040	0.154	0.100
NaCl	9	31	193c	105-120	0.010	0.046	0.010	55.4	21.80	28.26	12.99	0.072	<0.040	0.111	0.100
NaCl	9	31	193d	120-135	0.012	0.041	0.006	71.7	27.11	30.88	12.54	0.069	<0.040	0.105	0.100
NaCl	9	31	193e	135-150	0.011	0.037	0.008	65.2	22.48	23.47	11.73	0.065	<0.040	0.091	0.100
NaCl	9	36	213	0-15	0.010	0.307	0.046	89.5	16.03	39.38	7.12	0.161	1.010	0.090	0.193
NaCl	9	36	214	0-15	0.010	0.466	0.055	90.7	17.63	20.42	6.76	0.150	1.006	0.091	0.192
NaCl	9	36	215	0-15	0.010	0.154	0.023	71.3	12.30	51.10	4.46	0.119	1.010	0.076	0.277
NaCl	9	36	216	0-15	0.010	0.385	0.070	95.0	17.53	19.71	6.43	0.138	0.984	0.092	0.299
NaCl	9	36	217	0-15	0.010	0.070	0.084	64.1	12.01	89.81	2.69	0.100	1.012	0.079	1.103
NaCl	9	36	218	15-30	0.010	0.068	0.065	75.7	15.10	71.48	6.02	0.115	1.001	0.074	0.325
NaCl	10	23	110	0-15	0.034	0.125	0.206	94.0	16.00	466.55	8.83	0.202	<0.040	0.125	1.177
NaCl	10	23	111	0-15	0.059	0.156	0.264	60.7	9.95	281.20	5.47	0.143	<0.040	0.152	3.473
NaCl	10	23	112	0-15	0.050	0.230	0.136	51.2	9.78	183.18	3.91	0.127	<0.040	0.091	2.179
NaCl	10	23	113	0-15	0.019	0.083	0.088	87.0	14.91	72.61	13.62	0.188	<0.040	0.117	1.023
NaCl	10	23	114	0-15	0.045	0.119	0.159	59.9	9.72	252.46	10.57	0.142	<0.040	0.166	3.272
NaCl	10	23	115	15-30	0.049	0.081	6.295	397.9	120	481.29	31.39	0.748	<0.040	0.513	0.231
NaCl	10	23	116	15-30	0.035	0.164	1.926	90.0	19.49	463.04	6.34	0.198	<0.040	0.165	1.745
NaCl	10	23	117	15-30	0.078	0.126	0.261	49.5	10.37	224.51	4.24	0.131	<0.040	0.134	0.647
NaCl	10	23	118	15-30	0.030	0.090	0.138	71.0	13.36	128.64	7.18	0.148	<0.040	0.130	2.321
NaCl	10	23	119	15-30	0.066	0.162	0.235	70.2	16.06	382.56	4.67	0.151	<0.040	0.181	1.519
NaCl	10	23	120	30-45	0.011	0.043	0.008	165.5	78.50	92.03	13.48	0.451	<0.040	0.341	0.100
NaCl	10	23	121	45-60	0.014	0.041	0.007	109.3	52.71	63.19	10.90	0.331	<0.040	0.236	0.100
NaCl	10	23	122	60-75	0.013	0.038	0.006	69.6	32.55	31.57	9.22	0.194	<0.040	0.145	0.100
NaCl	10	23	123	75-90	0.016	0.034	0.006	59.2	26.50	20.12	8.65	0.176	<0.040	0.119	0.100
NaCl	10	23	124	90-105	0.035	0.037	0.006	47.2	20.38	15.58	7.67	0.154	<0.040	0.104	0.100
NaCl	10	23	125	105-120	0.019	0.040	0.006	38.0	16.35	14.25	7.22	0.119	<0.040	0.078	0.100
NaCl	10	23	126	120-140	0.020	0.026	0.009	33.8	13.92	14.01	7.17	0.109	<0.040	0.065	0.100
NaCl	10	28	153	0-15	0.082	0.117	0.216	64.2	8.61	493.26	7.80	0.167	<0.040	0.252	3.679
NaCl	10	28	154	0-15	0.050	0.121	0.395	63.3	8.90	356.52	3.84	0.143	<0.040	0.196	2.144
NaCl	10	28	155	0-15	0.056	0.100	0.414	57.9	8.59	321.69	5.57	0.131	<0.040	0.162	1.645
NaCl	10	28	156	0-15	0.029	0.103	0.439	136.9	22.80	884.88	10.34	0.259	<0.040	0.160	1.000
NaCl	10	28	157	0-15	0.040	0.102	0.403	78.9	11.92	288.14	6.51	0.151	<0.040	0.116	2.501

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	S	Si	As	Cr	V (mg/L)	Li	Mo	Ni	Co	SAR
NaCl	9	31	181	0-15	28.55	6.64	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	7.8
NaCl	9	31	182	0-15	12.02	6.80	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.2
NaCl	9	31	183	0-15	9.81	8.00	0.033	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.8
NaCl	9	31	184	0-15	8.48	7.06	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.5
NaCl	9	31	185	0-15	8.04	7.19	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.4
NaCl	9	31	186	15-30	29.56	6.94	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	6.2
NaCl	9	31	187	15-30	10.16	5.98	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.2
NaCl	9	31	188	15-30	9.17	6.04	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.0
NaCl	9	31	189	15-30	6.76	5.29	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.3
NaCl	9	31	190	15-30	12.83	4.59	<0.030	<0.020	<0.030	<0.040	<0.050	0.047	<0.010	7.3
NaCl	9	31	191	30-45	17.05	11.81	<0.030	<0.020	<0.030	0.042	<0.050	0.035	<0.010	3.4
NaCl	9	31	192	45-60	10.16	13.98	<0.030	<0.020	<0.030	0.050	<0.050	0.066	<0.010	2.2
NaCl	9	31	193	60-75	6.96	16.33	<0.030	<0.020	<0.030	0.052	<0.050	0.046	<0.010	1.5
NaCl	9	31	193a	75-90	7.00	13.97	<0.030	<0.020	<0.030	0.045	<0.050	<0.030	<0.010	1.1
NaCl	9	31	193b	90-105	6.55	11.28	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
NaCl	9	31	193c	105-120	6.01	9.86	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
NaCl	9	31	193d	120-135	8.22	7.27	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.8
NaCl	9	31	193e	135-150	7.00	7.15	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
NaCl	9	36	213	0-15	11.78	6.96	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
NaCl	9	36	214	0-15	11.68	7.16	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	9	36	215	0-15	8.40	6.64	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.5
NaCl	9	36	216	0-15	8.17	7.32	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	9	36	217	0-15	9.11	7.92	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.7
NaCl	9	36	218	15-30	9.34	6.08	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	2.0
NaCl	10	23	110	0-15	39.08	6.99	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	12
NaCl	10	23	111	0-15	21.56	14.01	0.036	0.021	0.032	<0.040	<0.050	0.038	<0.010	8.8
NaCl	10	23	112	0-15	15.42	9.09	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	6.1
NaCl	10	23	113	0-15	13.50	10.92	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.9
NaCl	10	23	114	0-15	27.51	13.21	0.032	0.029	<0.030	<0.040	<0.050	0.037	<0.010	8.0
NaCl	10	23	115	15-30	44.11	7.82	<0.030	0.060	<0.030	<0.040	<0.050	0.068	<0.010	5.4
NaCl	10	23	116	15-30	32.12	8.92	<0.030	0.023	<0.030	<0.040	<0.050	0.043	0.010	12
NaCl	10	23	117	15-30	21.39	8.23	<0.030	<0.020	0.061	<0.040	<0.050	0.039	<0.010	7.6
NaCl	10	23	118	15-30	10.78	9.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.7
NaCl	10	23	119	15-30	57.26	8.58	<0.030	<0.020	<0.030	<0.040	<0.050	0.035	<0.010	11
NaCl	10	23	120	30-45	10.14	6.80	<0.030	0.034	<0.030	0.062	<0.050	<0.030	<0.010	1.5
NaCl	10	23	121	45-60	10.52	6.95	<0.030	0.024	<0.030	0.057	<0.050	<0.030	<0.010	1.2
NaCl	10	23	122	60-75	6.82	6.97	<0.030	<0.020	<0.030	0.047	<0.050	<0.030	<0.010	0.8
NaCl	10	23	123	75-90	5.91	6.96	<0.030	<0.020	<0.030	0.043	<0.050	<0.030	<0.010	0.5
NaCl	10	23	124	90-105	5.73	6.78	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	10	23	125	105-120	5.25	6.53	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	10	23	126	120-140	6.43	6.27	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	10	28	153	0-15	46.70	22.58	0.038	0.037	0.044	<0.040	<0.050	0.047	0.014	15
NaCl	10	28	154	0-15	23.47	8.46	0.045	<0.020	<0.030	<0.040	<0.050	0.032	<0.010	11
NaCl	10	28	155	0-15	21.31	8.41	0.040	<0.020	<0.030	<0.040	<0.050	0.031	<0.010	10
NaCl	10	28	156	0-15	75.86	8.56	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	18
NaCl	10	28	157	0-15	24.91	9.25	0.046	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	8.0

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	HCO3	CO3	OH (mg/L)	Al	Fe	Ti
NaCl	10	28	158	15-30	39.0	2.46	6.70	782	114.0	113.9	0.054	0.003	<0.200	0.134	<0.010
NaCl	10	28	159	15-30	40.5	1.56	7.00	357	231.0	230.8	0.217	0.005	0.290	1.121	0.061
NaCl	10	28	160	15-30	37.5	1.67	7.00	411	235.0	234.8	0.221	0.005	<0.200	0.306	0.010
NaCl	10	28	161	15-30	35.8	2.54	7.08	756	219.5	219.2	0.245	0.006	<0.200	0.171	<0.010
NaCl	10	28	162	15-30	38.0	2.35	7.20	628	262.0	261.6	0.390	0.008	<0.200	0.263	<0.010
NaCl	10	28	163	30-45	36.0	1.21	6.25	381	27.9	27.9	0.005	0.001	<0.200	0.084	<0.010
NaCl	10	28	164	45-60	35.5	0.69	6.30	221	21.3	21.3	0.004	0.001	<0.200	0.092	<0.010
NaCl	10	28	165	60-75	36.0	0.42	6.50	118	24.2	24.2	0.007	0.002	<0.200	0.096	<0.010
NaCl	10	28	166	75-90	32.0	0.39	6.60	105	28.0	28.0	0.010	0.002	<0.200	0.088	<0.010
NaCl	10	28	167	90-105	34.5	0.26	6.60	63.61	25.9	25.9	0.010	0.002	<0.200	0.080	<0.010
NaCl	10	28	168	105-120	35.0	0.21	6.90	42.08	39.4	39.4	0.029	0.004	<0.200	0.100	<0.010
NaCl	10	28	169	120-135	34.5	0.33	7.60	42.10	105.0	104.6	0.391	0.020	<0.200	0.788	<0.010
NaCl	10	28	170	135-140	34.0	0.35	7.30	48.94	104.0	103.8	0.195	0.010	<0.200	0.095	<0.010
NaCl	10	38	220	0-15	38.0	1.02	7.20	176	297.0	296.6	0.442	0.008	<0.200	0.422	<0.010
NaCl	10	38	221	0-15	39.0	0.67	7.00	40.93	301.0	300.7	0.283	0.005	<0.200	0.133	<0.010
NaCl	10	38	222	0-15	38.0	1.70	7.18	381	290.5	290.1	0.408	0.007	<0.200	0.371	<0.010
NaCl	10	38	223	0-15	35.5	0.50	7.15	24.82	246.0	245.7	0.326	0.007	<0.200	0.014	<0.010
NaCl	10	38	224	0-15	39.0	0.54	7.10	25.98	257.0	256.7	0.304	0.006	<0.200	0.015	<0.010
NaCl	10	38	225	15-30	36.5	1.55	7.05	391	222.0	221.8	0.234	0.006	<0.200	<0.010	<0.010
NaCl	10	38	226	15-30	34.5	0.80	7.00	70.12	323.0	322.7	0.303	0.005	<0.200	1.119	0.038
NaCl	10	38	227	15-30	36.5	1.76	7.00	395	284.0	283.7	0.267	0.005	<0.200	0.258	<0.010
NaCl	10	38	228	15-30	36.0	0.54	7.20	22.10	267.0	266.6	0.397	0.008	<0.200	0.061	<0.010
NaCl	10	38	229	15-30	34.5	0.58	7.10	36.96	293.0	292.6	0.346	0.006	<0.200	0.057	<0.010
NaCl	10	38	230	30-45	36.5	0.94	6.30	323	19.3	19.3	0.004	0.001	<0.200	<0.010	<0.010
NaCl	10	38	231	45-60	41.0	0.74	6.10	248	26.0	26.0	0.003	0.001	<0.200	<0.010	<0.010
NaCl	10	38	232	60-75	41.5	0.56	6.20	187	19.9	19.9	0.003	0.001	<0.200	<0.010	<0.010
NaCl	10	38	233	75-90	39.0	0.55	6.30	178	24.7	24.7	0.005	0.001	<0.200	<0.010	<0.010
NaCl	10	38	234	90-105	41.5	0.51	6.30	162	22.8	22.8	0.004	0.001	<0.200	<0.010	<0.010
NaCl	10	38	235	105-120	35.0	0.53	6.50	169	23.3	23.3	0.007	0.002	<0.200	<0.010	<0.010
NaCl	10	38	236	120-135	35.0	0.57	7.00	161	58.5	58.4	0.055	0.005	<0.200	<0.010	<0.010

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO3/L; HCO3, CO3, OH reported as mg CaCO3/L; SAR = Sodium Adsorption Ratio.

(Continued). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cu	Zn	Mn	Ca	Mg	Na (mg/L)	K	Sr	B	Ba	P
NaCl	10	28	158	15-30	0.030	0.081	2.454	171.9	41.70	358.72	23.90	0.343	<0.040	0.334	0.100
NaCl	10	28	159	15-30	0.026	0.106	0.904	66.1	13.29	348.19	7.49	0.118	<0.040	0.108	0.741
NaCl	10	28	160	15-30	0.063	0.117	0.393	99.9	22.70	318.17	11.25	0.178	<0.040	0.154	0.377
NaCl	10	28	161	15-30	0.052	0.085	0.526	190.7	39.87	407.30	13.65	0.312	<0.040	0.233	0.293
NaCl	10	28	162	15-30	0.052	0.074	0.839	151.1	32.05	435.38	13.14	0.252	<0.040	0.152	0.377
NaCl	10	28	163	30-45	0.014	0.103	0.471	123.3	34.92	69.16	24.78	0.297	<0.040	0.349	0.100
NaCl	10	28	164	45-60	0.017	0.104	0.143	73.7	21.81	27.14	19.56	0.169	<0.040	0.203	0.100
NaCl	10	28	165	60-75	0.018	0.093	0.054	41.6	13.10	18.80	13.70	0.091	<0.040	0.136	0.100
NaCl	10	28	166	75-90	0.022	0.110	0.036	39.2	12.81	16.79	12.53	0.084	<0.040	0.144	0.100
NaCl	10	28	167	90-105	0.016	0.081	0.019	24.8	8.63	10.71	9.20	0.044	<0.040	0.110	0.100
NaCl	10	28	168	105-120	0.016	0.045	0.006	22.1	8.10	8.66	7.15	0.031	<0.040	0.085	0.100
NaCl	10	28	169	120-135	0.017	0.023	0.013	41.4	13.75	11.04	8.38	0.054	<0.040	0.087	0.100
NaCl	10	28	170	135-140	0.016	0.054	0.013	45.3	13.66	12.49	8.31	0.046	<0.040	0.085	0.100
NaCl	10	38	220	0-15	0.010	0.055	0.037	55.5	8.90	221.99	4.14	0.088	1.001	0.077	0.475
NaCl	10	38	221	0-15	0.010	0.511	0.095	69.0	12.32	122.29	6.60	0.116	1.019	0.088	0.457
NaCl	10	38	222	0-15	0.010	0.153	0.049	59.0	9.05	390.53	8.26	0.101	1.013	0.076	1.493
NaCl	10	38	223	0-15	0.010	0.190	0.029	88.6	16.21	36.12	9.22	0.144	0.987	0.110	0.251
NaCl	10	38	224	0-15	0.010	0.367	0.061	93.2	17.84	39.45	11.13	0.170	0.998	0.128	0.365
NaCl	10	38	225	15-30	0.010	0.276	0.090	111.7	24.41	233.28	15.61	0.191	0.987	0.151	0.146
NaCl	10	38	226	15-30	0.010	0.104	0.087	61.9	12.38	173.15	5.68	0.094	1.015	0.094	0.912
NaCl	10	38	227	15-30	0.010	0.077	0.056	76.6	14.73	385.58	10.47	0.125	1.012	0.108	0.768
NaCl	10	38	228	15-30	0.010	0.069	0.082	78.4	16.26	63.32	9.98	0.135	0.976	0.090	0.333
NaCl	10	38	229	15-30	0.010	0.186	0.052	66.8	14.95	107.78	7.95	0.100	0.987	0.091	0.391
NaCl	10	38	230	30-45	0.010	0.326	0.064	97.1	26.63	60.82	21.97	0.220	0.960	0.183	0.100
NaCl	10	38	231	45-60	0.010	0.270	0.044	88.7	26.29	20.66	21.58	0.191	0.972	0.216	0.100
NaCl	10	38	232	60-75	0.010	0.404	0.045	63.6	20.06	15.59	18.11	0.126	0.974	0.230	0.100
NaCl	10	38	233	75-90	0.010	0.433	0.032	60.2	20.85	16.71	16.46	0.110	0.977	0.213	0.100
NaCl	10	38	234	90-105	0.010	0.071	0.029	54.2	19.67	14.44	15.95	0.089	0.976	0.217	0.100
NaCl	10	38	235	105-120	0.010	0.062	0.049	58.5	21.05	14.73	14.59	0.081	0.972	0.188	0.100
NaCl	10	38	236	120-135	0.010	0.024	0.011	66.3	25.08	13.83	13.21	0.076	0.962	0.163	0.100

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L;
SAR = Sodium Adsorption Ratio.

(Concluded). Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	S	Si	As	Cr	V (mg/L)	Li	Mo	Ni	Co	SAR
NaCl	10	28	158	15-30	26.65	7.17	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	6.4
NaCl	10	28	159	15-30	30.65	5.34	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	10
NaCl	10	28	160	15-30	28.61	5.15	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	7.5
NaCl	10	28	161	15-30	28.49	5.59	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	7.0
NaCl	10	28	162	15-30	51.55	5.08	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	8.4
NaCl	10	28	163	30-45	6.61	11.36	<0.030	<0.020	<0.030	<0.040	<0.050	0.039	<0.010	1.4
NaCl	10	28	164	45-60	4.22	13.75	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
NaCl	10	28	165	60-75	4.54	14.07	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.7
NaCl	10	28	166	75-90	4.43	12.97	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.6
NaCl	10	28	167	90-105	3.37	14.54	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	10	28	168	105-120	3.02	11.13	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	10	28	169	120-135	3.65	7.24	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	10	28	170	135-140	4.40	6.79	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	10	38	220	0-15	13.11	5.91	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	7.3
NaCl	10	38	221	0-15	11.02	7.76	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.6
NaCl	10	38	222	0-15	34.43	7.57	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	13
NaCl	10	38	223	0-15	6.44	5.99	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.9
NaCl	10	38	224	0-15	7.33	9.96	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.0
NaCl	10	38	225	15-30	21.35	3.78	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	5.2
NaCl	10	38	226	15-30	15.98	5.73	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	5.3
NaCl	10	38	227	15-30	37.22	5.64	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	11
NaCl	10	38	228	15-30	7.72	5.41	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.7
NaCl	10	38	229	15-30	9.15	5.92	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	3.1
NaCl	10	38	230	30-45	8.98	9.41	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	1.4
NaCl	10	38	231	45-60	2.29	10.64	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	10	38	232	60-75	1.62	12.17	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	10	38	233	75-90	1.94	11.50	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.5
NaCl	10	38	234	90-105	1.73	13.42	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	10	38	235	105-120	2.03	13.02	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4
NaCl	10	38	236	120-135	2.17	8.72	<0.030	<0.020	<0.030	<0.040	<0.050	<0.030	<0.010	0.4

Satn' = Saturation Percent; E.C. = Electrical Conductivity; Alk = Alkalinity mg CaCO₃/L; HCO₃, CO₃, OH reported as mg CaCO₃/L; SAR = Sodium Adsorption Ratio.

APPENDIX III. Total elemental analysis data for the soils and soil/waste mixtures in the ESSO field plots in 1991.

Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Mn	Na	K	Ca	Mg (mg/g)	P	Al	Fe	Ti	Cu	Zn	Mo	V
Freshwater	1	3	7	0-15	0.353	7.31	12.9	4.46	2.89	0.407	34.4	13.81	2.05	16.6	40.3	<8.46	52.9
Freshwater	1	9	25	0-15	0.309	6.85	11.3	4.11	3.03	0.498	31.2	12.11	2.01	43.2	34.1	19.36	76.5
Freshwater	1	13	48	0-15	0.393	7.24	11.6	4.80	2.97	0.452	32.1	13.04	2.14	42.7	37.3	20.11	76.7
Freshwater	1	13	49	15-30	0.343	6.83	13.0	7.52	5.26	0.482	33.2	18.92	2.11	50.8	45.3	22.60	97.3
Freshwater	1	13	50	30-45	0.317	6.14	12.2	7.06	4.88	0.487	30.5	18.86	2.15	49.8	42.9	20.36	98.2
Freshwater	1	13	51	45-60	0.303	6.49	13.2	6.40	4.81	0.516	31.3	18.51	2.17	52.3	50.9	22.52	104.0
Freshwater	1	13	52	60-75	0.293	5.94	12.4	7.09	4.35	0.427	32.1	18.43	2.24	20.2	49.2	<8.46	73.4
Freshwater	1	13	53	75-90	0.268	5.50	11.2	5.94	3.76	0.373	27.9	15.71	1.90	19.6	38.6	<8.46	62.3
Freshwater	1	13	54	90-105	0.249	5.62	10.8	4.72	3.02	0.366	26.4	14.90	1.84	23.9	41.6	<8.46	64.6
Freshwater	2	2	6	0-15	0.320	7.81	12.5	2.74	1.55	0.475	29.5	10.98	1.93	17.7	45.9	<8.46	45.0
Freshwater	2	8	23	0-15	0.299	6.97	11.0	3.49	2.73	0.522	29.8	11.64	1.87	44.0	38.2	19.56	76.9
Freshwater	2	8	24	15-30	0.280	6.61	12.2	4.17	3.36	0.564	35.9	17.05	2.04	43.6	39.9	17.51	88.4
Freshwater	2	15	62	0-15	0.325	6.87	12.1	3.00	1.93	0.619	28.8	14.92	2.14	42.5	51.0	15.00	82.9
Freshwater	3	1	1	0-15	0.395	7.91	13.6	3.95	2.54	0.553	34.8	13.58	1.95	17.9	51.8	<8.46	52.7
Freshwater	3	1	2	15-30	0.275	6.93	12.9	3.54	2.42	0.277	37.8	16.37	1.98	19.7	47.3	<8.46	62.8
Freshwater	3	1	3	30-45	0.271	7.24	14.1	3.68	2.71	0.235	39.3	16.30	1.99	13.7	64.6	<8.46	58.0
Freshwater	3	1	4	45-60	0.199	6.70	11.0	3.86	1.41	0.410	26.2	9.57	1.69	15.3	46.0	<8.46	38.1
Freshwater	3	1	5	60-75	0.075	0.78	1.5	5.39	1.05	0.968	3.3	3.00	0.24	29.6	122.7	<8.46	17.5
Freshwater	3	6	15	0-15	0.336	7.37	11.4	4.13	2.69	0.476	30.6	11.78	2.07	35.6	37.5	16.05	67.6
Freshwater	3	11	42	0-15	0.333	7.01	11.1	3.45	2.70	0.465	29.6	11.99	2.02	39.5	42.1	16.30	73.0
Freshwater	3	11	43	0-15	0.360	7.83	12.4	4.29	2.86	0.494	33.6	13.08	2.21	41.5	45.4	19.61	77.4
Freshwater	3	11	44	0-15	0.286	7.10	11.2	5.90	2.94	0.441	30.1	11.76	1.95	44.2	41.0	20.04	77.9
Freshwater	3	11	45	0-15	0.281	7.55	12.3	4.72	3.04	0.506	33.8	13.13	2.19	38.9	39.5	19.05	75.5
Freshwater	3	11	46	0-15	0.325	7.82	12.9	3.99	3.09	0.615	35.5	14.78	2.22	40.9	52.7	18.77	86.2
Freshwater	4	5	13	0-15	0.296	6.99	11.9	4.06	2.90	0.506	34.7	16.22	2.21	27.3	48.4	9.19	69.4
Freshwater	4	5	14	15-30	0.318	6.85	12.6	3.53	3.10	0.529	35.2	19.48	2.23	36.0	39.2	15.87	83.2
Freshwater	4	7	16	0-15	0.462	8.03	14.1	4.55	3.54	0.596	39.5	19.40	2.30	38.5	45.6	16.83	87.3
Freshwater	4	7	17	15-30	0.291	5.85	11.6	5.89	4.36	0.434	27.3	16.49	1.92	40.5	41.3	14.74	86.5
Freshwater	4	7	18	30-45	0.282	5.76	11.8	6.41	4.80	0.421	27.5	16.88	1.99	42.1	41.9	15.35	90.5
Freshwater	4	7	19	45-60	0.245	6.72	13.2	6.12	5.06	0.483	30.8	17.29	2.07	45.9	49.1	19.15	94.0
Freshwater	4	7	20	60-75	0.315	5.84	11.1	5.69	4.48	0.418	26.5	15.42	1.82	47.5	39.4	18.82	90.5
Freshwater	4	7	21	75-90	0.268	6.10	12.2	5.52	4.27	0.465	27.9	16.50	1.95	50.3	49.2	20.42	96.1
Freshwater	4	7	22	90-110	0.210	6.01	11.6	6.28	4.19	0.452	27.8	15.75	1.96	48.4	45.2	19.86	93.2
Freshwater	4	12	47	0-15	0.365	7.56	13.4	3.65	2.99	0.647	37.2	17.21	2.39	42.7	46.3	19.75	89.8
Freshwater	5	4	8	0-15	0.311	7.22	12.9	3.62	2.38	0.505	32.5	15.24	1.99	20.3	45.3	<8.46	58.4
Freshwater	5	4	9	0-15	0.292	6.95	12.2	2.80	1.87	0.455	30.3	13.95	1.88	20.5	61.5	<8.46	54.7
Freshwater	5	4	10	0-15	0.348	7.43	13.0	4.72	2.84	0.534	31.7	15.07	2.05	23.9	49.8	<8.46	61.2
Freshwater	5	4	11	0-15	0.339	7.31	12.7	4.44	3.08	0.527	31.3	14.23	1.97	22.2	48.5	<8.46	59.9
Freshwater	5	4	12	0-15	0.289	6.54	11.2	4.05	3.27	0.500	32.9	14.61	2.14	20.7	39.9	<8.46	63.4
Freshwater	5	10	26	0-15	0.330	6.56	11.1	4.55	3.29	0.492	29.9	15.03	1.92	47.3	53.9	19.91	84.7
Freshwater	5	10	27	0-15	0.297	6.93	11.9	4.76	3.36	0.641	31.3	16.20	2.14	52.0	49.2	21.88	96.9
Freshwater	5	10	28	0-15	0.278	6.36	10.7	4.65	3.46	0.542	28.6	13.56	1.93	46.5	49.1	17.93	83.7
Freshwater	5	10	29	0-15	0.323	6.91	11.2	4.34	3.12	0.615	30.0	12.40	2.00	50.2	44.2	20.68	86.2
Freshwater	5	10	30	0-15	0.268	5.78	9.2	3.55	2.51	0.401	24.0	9.09	1.65	42.0	35.5	15.02	68.7

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cr	Ba	Ni	Sr	Li	Zr	Co	Cd	Pb
----- (ug/g) -----													
Freshwater	1	3	7	0-15	32.2	404	17.4	95.5	21.06	95.1	14.4	<0.90	15.73
Freshwater	1	9	25	0-15	67.1	344	51.8	99.2	40.55	132.6	29.9	<0.90	6.83
Freshwater	1	13	48	0-15	79.2	422	55.1	107.7	40.11	136.3	29.2	<0.90	12.24
Freshwater	1	13	49	15-30	104	248	70.5	94.6	46.30	146.1	33.6	<0.90	11.01
Freshwater	1	13	50	30-45	99.3	210	72.4	84.9	45.63	150.4	33.2	<0.90	10.61
Freshwater	1	13	51	45-60	81.9	180	69.1	83.4	48.85	151.1	35.4	<0.90	9.30
Freshwater	1	13	52	60-75	55.8	238	30.6	81.6	26.11	74.5	14.4	<0.90	12.29
Freshwater	1	13	53	75-90	43.3	205	27.7	76.5	23.61	65.8	<13.5	<0.90	9.93
Freshwater	1	13	54	90-105	46.7	186	31.8	71.8	26.35	69.5	14.7	<0.90	8.84
Freshwater	2	2	6	0-15	33.8	209	<16.9	91.1	18.54	93.4	<13.5	<0.90	22.47
Freshwater	2	8	23	0-15	63.7	196	50.7	98.5	40.10	121.1	28.5	<0.90	9.65
Freshwater	2	8	24	15-30	80.2	330	55.7	98.6	42.51	133.7	29.1	<0.90	9.35
Freshwater	2	15	62	0-15	65.1	154	44.8	77.3	38.34	121.7	25.4	<0.90	12.87
Freshwater	3	1	1	0-15	37.2	322	20.2	99.8	21.69	86.4	14.0	<0.90	14.69
Freshwater	3	1	2	15-30	32.7	384	20.7	92.8	26.92	84.6	16.7	<0.90	10.30
Freshwater	3	1	3	30-45	40.9	405	20.3	95.4	24.19	86.7	14.4	<0.90	23.68
Freshwater	3	1	4	45-60	31.2	397	<16.9	88.8	17.54	83.2	<13.5	<0.90	15.03
Freshwater	3	1	5	60-75	24.2	149	25.1	24.3	8.94	11.9	<13.5	<0.90	10.36
Freshwater	3	6	15	0-15	70.0	359	43.6	107.6	33.61	114.6	24.8	<0.90	19.09
Freshwater	3	11	42	0-15	61.7	221	46.7	96.7	37.16	127.6	26.5	0.92	14.19
Freshwater	3	11	43	0-15	72.8	356	50.5	113.8	39.29	133.7	29.4	<0.90	14.02
Freshwater	3	11	44	0-15	69.7	412	54.3	106.0	40.61	122.1	29.4	<0.90	21.67
Freshwater	3	11	45	0-15	72.8	435	48.7	113.0	38.10	132.8	28.5	<0.90	8.74
Freshwater	3	11	46	0-15	66.4	238	52.3	111.3	40.23	128.8	28.9	<0.90	15.49
Freshwater	4	5	13	0-15	79.7	228	41.0	98.5	28.94	100.7	19.3	<0.90	16.33
Freshwater	4	5	14	15-30	111	214	58.3	89.2	35.60	118.9	25.6	<0.90	14.11
Freshwater	4	7	16	0-15	82.4	339	59.8	112.8	40.06	133.5	29.7	<0.90	15.21
Freshwater	4	7	17	15-30	62.3	178	55.2	76.3	39.43	115.5	26.6	<0.90	11.03
Freshwater	4	7	18	30-45	59.2	168	53.9	76.4	41.22	128.3	27.6	<0.90	12.50
Freshwater	4	7	19	45-60	71.0	200	59.0	86.9	43.97	134.3	31.1	<0.90	10.37
Freshwater	4	7	20	60-75	70.0	171	64.0	75.8	44.13	130.3	30.4	<0.90	12.61
Freshwater	4	7	21	75-90	75.7	161	64.6	79.4	46.88	130.8	33.2	<0.90	7.42
Freshwater	4	7	22	90-110	71.1	201	60.3	85.9	45.63	134.5	31.1	<0.90	7.68
Freshwater	4	12	47	0-15	87.4	224	57.3	105.1	41.74	143.6	30.9	<0.90	11.28
Freshwater	5	4	8	0-15	38.4	245	18.2	89.7	22.47	86.2	14.3	<0.90	24.27
Freshwater	5	4	9	0-15	34.9	138	18.6	80.3	21.81	85.9	14.6	<0.90	29.55
Freshwater	5	4	10	0-15	28.5	257	18.9	93.0	23.42	90.6	14.7	0.95	36.48
Freshwater	5	4	11	0-15	24.1	199	17.7	90.4	22.99	87.6	14.7	3.56	22.77
Freshwater	5	4	12	0-15	45.7	167	29.9	91.8	25.02	79.9	15.4	<0.90	20.84
Freshwater	5	10	26	0-15	83.7	225	57.8	95.1	42.93	132.3	29.5	<0.90	16.38
Freshwater	5	10	27	0-15	80.1	174	60.7	96.1	46.78	137.8	33.2	<0.90	15.12
Freshwater	5	10	28	0-15	64.2	179	51.8	90.5	41.89	124.5	29.3	<0.90	16.47
Freshwater	5	10	29	0-15	63.2	215	56.5	99.4	44.61	135.3	31.5	<0.90	16.42
Freshwater	5	10	30	0-15	45.8	177	44.3	82.6	38.01	113.1	25.5	<0.90	19.56

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Mn	Na	K	Ca	Mg (mg/g)	P	Al	Fe	Ti	Cu	Zn	Mo	V
Freshwater	5	10	31	15-30	0.264	5.79	10.7	7.39	5.21	0.410	28.9	14.37	1.80	51.0	38.2	19.67	91.1
Freshwater	5	10	32	15-30	0.258	5.46	10.2	3.77	2.96	0.417	24.6	13.94	1.78	50.6	40.9	19.24	89.8
Freshwater	5	10	33	15-30	0.341	6.22	10.9	4.66	3.05	0.480	28.7	13.39	1.99	42.3	41.9	16.44	80.1
Freshwater	5	10	34	15-30	0.374	6.88	11.2	3.71	2.68	0.457	30.3	11.88	2.10	40.7	39.3	17.10	73.3
Freshwater	5	10	35	15-30	0.377	7.10	11.6	4.53	3.25	0.469	30.3	12.76	2.15	47.7	40.8	20.54	83.5
Freshwater	5	10	36	30-45	0.257	5.79	11.5	5.81	3.49	0.439	26.5	16.22	1.86	48.1	40.3	20.70	90.7
Freshwater	5	10	37	45-60	0.295	6.56	12.5	6.39	4.42	0.474	31.1	17.70	2.15	51.1	45.6	21.26	100.4
Freshwater	5	10	38	60-75	0.325	6.81	13.5	6.99	4.64	0.540	32.7	20.41	2.30	53.8	52.6	24.00	107.6
Freshwater	5	10	39	75-90	0.239	5.58	10.6	6.86	4.57	0.394	26.2	14.52	1.73	41.8	35.1	16.04	81.7
Freshwater	5	10	40	90-105	0.239	5.65	10.6	6.61	4.10	0.390	25.5	13.89	1.69	42.6	35.8	16.20	80.7
Freshwater	5	10	41	105-115	0.326	6.06	11.4	5.66	4.36	0.431	28.2	15.83	1.91	47.7	40.0	19.30	91.3
Freshwater	5	14	55	0-15	0.363	6.56	11.2	3.36	2.42	0.481	30.4	12.78	2.07	22.9	39.4	<8.46	60.0
Freshwater	5	14	56	15-30	0.280	5.91	11.6	2.95	2.55	0.415	32.9	16.60	1.99	29.4	42.2	<8.46	73.7
Freshwater	5	14	57	30-45	0.266	5.29	10.9	3.60	2.82	0.370	27.2	14.85	1.84	28.7	37.3	<8.46	69.2
Freshwater	5	14	58	45-60	0.285	5.55	11.5	4.32	3.14	0.427	28.7	16.85	2.04	28.1	46.7	<8.46	74.3
Freshwater	5	14	59	60-75	0.409	6.51	13.7	6.23	4.39	0.537	34.9	20.05	2.44	34.7	55.9	9.56	92.1
Freshwater	5	14	60	75-90	0.385	6.53	12.9	6.25	4.57	0.482	33.5	18.71	2.30	35.4	46.5	11.12	87.6
Freshwater	5	14	61	90-105	0.274	6.37	11.9	6.04	4.39	0.441	28.9	16.23	1.98	39.7	76.7	12.75	83.0
KCl	1	17	78	0-15	0.358	7.06	12.3	4.43	2.52	0.495	33.0	13.57	2.14	41.9	58.2	16.28	78.1
KCl	1	42	240	0-15	0.354	8.14	13.4	7.56	4.13	0.433	35.6	13.49	1.83	22.9	39.6	<8.46	53.5
KCl	1	42	241	0-15	0.365	7.88	13.3	7.28	4.22	0.442	34.6	13.23	1.77	24.7	47.1	<8.46	54.1
KCl	1	42	242	0-15	0.392	8.08	13.7	6.50	4.16	0.500	36.8	13.23	1.95	21.2	40.8	<8.46	53.2
KCl	1	42	243	0-15	0.328	8.10	13.1	7.06	4.15	0.452	34.3	11.73	1.88	25.5	38.7	<8.46	52.6
KCl	1	42	244	0-15	0.327	8.12	13.6	7.17	4.28	0.435	36.8	12.06	1.93	20.3	38.9	<8.46	50.6
KCl	1	43	245	0-15	0.439	7.93	13.8	6.67	4.60	0.480	39.8	14.83	1.89	26.3	44.7	8.72	59.7
KCl	1	43	246	15-30	0.427	7.52	14.1	5.52	3.46	0.520	37.2	14.71	1.95	22.9	46.6	<8.46	57.5
KCl	1	43	247	30-45	0.350	7.65	14.8	8.65	5.33	0.474	36.3	15.15	1.80	22.3	47.4	<8.46	57.8
KCl	1	43	248	45-60	0.397	6.49	14.4	5.48	3.69	0.460	31.9	16.20	1.87	27.3	51.8	<8.46	66.2
KCl	1	43	249	60-75	0.399	6.93	14.8	9.70	6.40	0.485	35.7	17.19	2.04	24.6	54.9	<8.46	67.6
KCl	1	43	250	75-90	0.314	7.06	14.1	8.23	5.32	0.472	33.5	15.42	1.87	25.6	47.2	<8.46	60.7
KCl	1	43	251	90-105	0.289	7.02	14.5	5.13	3.18	0.470	32.1	15.47	1.82	27.4	50.4	<8.46	62.0
KCl	1	43	252	105-120	0.262	6.68	13.6	7.06	4.27	0.429	31.9	14.53	1.72	26.7	52.7	<8.46	60.8
KCl	1	43	253	120-135	0.336	7.14	14.0	7.78	5.34	0.461	33.5	15.20	1.78	30.4	46.6	<8.46	65.1
KCl	2	33	195	0-15	0.433	7.41	12.5	6.48	3.72	0.478	32.9	13.12	2.06	36.9	39.2	17.65	71.7
KCl	2	40	238	0-15	0.426	8.26	14.1	6.66	4.30	0.468	38.7	12.98	1.94	23.9	43.6	<8.46	55.0
KCl	2	45	272	0-15	0.377	7.40	13.8	5.31	3.49	0.398	37.6	13.47	1.87	10.1	39.4	<8.46	45.3
KCl	2	45	273	0-15	0.353	7.68	12.0	5.35	2.37	0.280	32.2	8.86	1.73	7.4	33.3	<8.46	30.5
KCl	2	45	274	0-15	0.382	7.22	11.3	4.28	1.87	0.285	29.5	8.05	1.56	10.2	32.4	<8.46	30.6
KCl	2	45	275	0-15	0.276	7.27	12.1	4.43	2.19	0.451	32.8	9.25	1.65	7.4	33.2	<8.46	32.5
KCl	2	45	276	0-15	0.206	6.82	11.2	2.45	1.22	0.341	28.2	7.00	1.56	9.3	28.4	<8.46	28.4
KCl	2	45	277	15-30	0.291	6.16	12.9	5.01	3.67	0.303	42.0	15.25	1.74	12.3	40.1	<8.46	51.5
KCl	2	45	278	15-30	0.335	7.51	11.6	4.74	2.20	0.253	31.4	8.04	1.64	4.4	30.3	<8.46	27.7
KCl	2	45	279	15-30	0.407	7.50	11.9	5.02	1.90	0.270	31.4	8.42	1.61	4.6	29.6	<8.46	27.7
KCl	2	45	280	15-30	0.236	6.11	14.3	4.29	3.40	0.634	46.0	19.73	1.87	7.4	42.0	<8.46	62.8
KCl	2	45	281	15-30	0.144	7.97	13.5	4.39	2.30	0.849	38.4	8.78	2.05	<2.4	34.7	<8.46	29.9
KCl	2	45	282	30-45	0.357	6.48	13.0	4.27	3.23	0.285	40.7	14.82	1.67	13.3	34.2	<8.46	48.2
KCl	2	45	283	45-60	0.314	6.59	12.4	4.61	3.81	0.291	41.3	14.67	1.66	10.7	35.0	<8.46	46.0
KCl	2	45	284	60-75	0.315	6.47	12.4	4.46	3.35	0.310	40.3	15.55	1.59	12.5	36.4	<8.46	47.1

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cr	Ba	Ni	Sr	Li	Zr	Co	Cd	Pb
(ug/g)													
Freshwater	5	10	31	15-30	67.3	234	64.3	82.9	47.79	125.8	32.8	<0.90	2.76
Freshwater	5	10	32	15-30	58.4	169	58.2	68.3	45.94	124.8	31.0	<0.90	18.31
Freshwater	5	10	33	15-30	59.0	310	51.7	87.6	40.11	129.7	28.2	<0.90	16.29
Freshwater	5	10	34	15-30	68.2	235	51.5	96.5	37.70	129.3	27.4	1.42	15.65
Freshwater	5	10	35	15-30	71.9	268	57.7	99.2	43.70	136.8	31.1	<0.90	18.98
Freshwater	5	10	36	30-45	86.3	197	68.7	72.6	44.16	135.2	30.4	<0.90	15.48
Freshwater	5	10	37	45-60	82.1	215	71.1	84.4	47.49	135.2	33.7	<0.90	16.22
Freshwater	5	10	38	60-75	122	248	84.2	90.7	49.30	159.4	36.4	<0.90	17.16
Freshwater	5	10	39	75-90	62.4	178	55.8	73.3	39.40	114.2	26.8	<0.90	10.83
Freshwater	5	10	40	90-105	58.5	204	54.1	73.7	39.55	120.7	27.1	<0.90	15.01
Freshwater	5	10	41	105-115	66.5	176	63.4	77.3	44.34	128.3	31.3	0.94	11.02
Freshwater	5	14	55	0-15	49.3	213	31.5	90.1	25.62	89.8	15.5	<0.90	11.90
Freshwater	5	14	56	15-30	70.0	190	48.2	78.6	29.90	88.5	18.5	<0.90	9.76
Freshwater	5	14	57	30-45	47.8	193	36.4	68.3	29.00	83.4	17.3	<0.90	8.74
Freshwater	5	14	58	45-60	53.3	170	35.2	70.9	29.16	96.0	18.3	<0.90	9.36
Freshwater	5	14	59	60-75	58.7	226	46.6	84.5	36.15	109.7	23.7	1.16	11.02
Freshwater	5	14	60	75-90	58.5	228	47.6	89.2	36.11	115.7	24.1	<0.90	9.60
Freshwater	5	14	61	90-105	56.0	192	46.9	80.7	36.84	111.1	24.4	<0.90	9.95
KCl	1	17	78	0-15	64.1	421	47.0	103.2	39.19	124.4	27.3	<0.90	10.18
KCl	1	42	240	0-15	51.3	327	28.6	82.2	21.64	136.2	18.4	1.72	10.05
KCl	1	42	241	0-15	50.3	298	29.2	80.2	22.14	146.4	19.2	1.70	9.89
KCl	1	42	242	0-15	49.7	343	27.4	80.6	21.11	122.2	18.4	1.41	9.03
KCl	1	42	243	0-15	49.2	313	28.7	80.6	23.12	133.7	19.0	1.43	10.86
KCl	1	42	244	0-15	49.0	405	24.8	83.7	21.17	123.6	16.5	1.20	6.52
KCl	1	43	245	0-15	112	385	63.5	82.6	24.01	128.2	20.0	<0.90	9.25
KCl	1	43	246	15-30	62.2	280	36.5	73.5	22.03	125.3	17.9	<0.90	8.14
KCl	1	43	247	30-45	62.3	270	36.3	76.4	21.96	124.3	18.9	<0.90	9.52
KCl	1	43	248	45-60	60.0	142	37.9	53.8	25.25	117.5	19.5	<0.90	8.27
KCl	1	43	249	60-75	60.8	214	35.6	69.4	24.53	130.1	18.7	<0.90	9.14
KCl	1	43	250	75-90	75.3	222	44.7	67.9	23.34	121.7	19.4	<0.90	7.78
KCl	1	43	251	90-105	62.8	161	38.3	56.8	24.33	120.7	19.0	<0.90	8.64
KCl	1	43	252	105-120	52.6	207	33.4	61.3	24.80	120.9	18.4	<0.90	8.20
KCl	1	43	253	120-135	71.0	193	45.1	66.3	26.85	130.2	20.4	<0.90	9.40
KCl	2	33	195	0-15	63.1	430	48.2	107.5	33.46	150.8	30.0	1.30	8.45
KCl	2	40	238	0-15	55.0	488	29.7	90.0	22.70	139.8	20.4	1.96	11.75
KCl	2	45	272	0-15	55.9	396	24.6	79.5	15.24	90.4	<13.5	1.35	10.56
KCl	2	45	273	0-15	43.0	503	<16.9	85.1	11.81	90.5	<13.5	1.48	8.89
KCl	2	45	274	0-15	36.7	438	<16.9	78.5	13.06	88.8	<13.5	1.51	6.34
KCl	2	45	275	0-15	36.4	449	<16.9	79.7	12.59	85.6	<13.5	1.57	8.91
KCl	2	45	276	0-15	36.1	172	<16.9	65.1	13.34	89.6	<13.5	1.51	8.83
KCl	2	45	277	15-30	56.4	434	27.8	77.9	16.13	97.5	<13.5	1.44	11.79
KCl	2	45	278	15-30	32.9	457	<16.9	80.5	10.92	77.3	<13.5	1.72	9.48
KCl	2	45	279	15-30	36.9	489	<16.9	82.8	10.42	79.7	<13.5	1.86	77.32
KCl	2	45	280	15-30	45.8	473	20.4	74.1	18.93	84.5	<13.5	1.22	10.62
KCl	2	45	281	15-30	35.5	479	<16.9	85.9	12.98	92.1	<13.5	<0.90	8.57
KCl	2	45	282	30-45	45.3	415	24.5	75.5	16.14	90.6	<13.5	<0.90	8.67
KCl	2	45	283	45-60	45.9	440	22.1	79.9	14.63	83.7	<13.5	<0.90	10.34
KCl	2	45	284	60-75	44.5	421	23.2	77.8	15.28	85.0	<13.5	<0.90	8.83

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Mn	Na	K	Ca	Mg (mg/g)	P	Al	Fe	Ti	Cu	Zn	Mo	V
KCl	2	45	285	75-90	0.199	6.53	12.3	4.63	3.33	0.294	39.5	14.65	1.56	11.6	32.4	<8.46	45.3
KCl	2	45	286	90-105	0.283	7.09	13.3	4.65	3.30	0.359	43.4	15.63	1.84	11.6	40.6	<8.46	51.4
KCl	2	45	287	105-120	0.295	6.78	12.2	4.55	3.29	0.334	39.6	14.08	1.65	10.2	49.5	<8.46	45.8
KCl	2	45	288	120-135	0.235	6.76	12.1	3.99	2.45	0.330	36.9	12.76	1.51	10.4	34.8	<8.46	43.2
KCl	3	21	96	0-15	0.391	7.98	13.2	4.97	2.71	0.510	33.3	12.33	2.15	27.9	46.3	14.55	60.4
KCl	3	21	97	0-15	0.432	7.82	12.8	4.64	2.50	0.529	31.6	12.43	2.09	28.2	45.7	14.35	58.6
KCl	3	21	98	0-15	0.393	7.51	12.3	4.36	2.53	0.477	30.7	12.31	1.97	31.4	46.8	15.69	62.0
KCl	3	21	99	0-15	0.354	8.01	12.7	4.58	2.47	0.502	30.9	11.02	2.04	33.0	52.3	17.25	58.9
KCl	3	21	100	0-15	0.384	8.37	13.6	5.13	2.92	0.581	32.7	12.21	2.17	33.5	56.3	17.93	65.1
KCl	3	30	180	0-15	0.395	7.57	12.7	4.86	2.57	0.389	36.1	13.63	2.31	4.3	33.0	<8.46	42.3
KCl	3	39	237	0-15	0.347	8.57	14.5	5.09	3.58	0.489	37.6	13.27	1.91	24.4	43.0	<8.46	55.4
KCl	4	16	63	0-15	0.348	6.87	12.1	4.07	2.55	0.528	32.6	14.18	1.99	39.2	41.8	14.53	77.1
KCl	4	16	64	0-15	0.341	6.66	10.9	3.21	1.94	0.542	27.8	12.11	1.82	42.0	42.8	13.07	72.0
KCl	4	16	65	0-15	0.338	6.85	12.1	3.28	1.99	0.542	31.5	14.43	2.09	36.2	57.2	11.68	76.2
KCl	4	16	66	0-15	0.321	6.53	11.3	1.97	1.54	0.482	27.9	12.76	1.81	42.0	43.0	15.18	76.9
KCl	4	16	67	0-15	0.311	6.50	11.9	3.69	2.46	0.485	30.5	13.58	1.93	41.3	40.5	14.13	79.1
KCl	4	16	68	15-30	0.266	6.75	12.7	4.32	3.67	0.479	34.5	16.74	2.06	40.0	51.2	15.31	85.9
KCl	4	16	69	15-30	0.384	6.41	10.7	3.98	2.05	0.487	27.5	11.07	1.81	38.8	35.6	14.45	68.0
KCl	4	16	70	15-30	0.345	6.77	12.8	5.61	4.20	0.490	38.0	18.76	2.08	44.2	68.0	13.20	89.0
KCl	4	16	71	15-30	0.348	6.80	11.6	5.07	3.09	0.440	31.7	13.45	2.05	42.0	64.9	15.68	77.7
KCl	4	16	72	15-30	0.348	6.64	12.6	4.58	3.11	0.438	35.4	15.43	2.22	36.5	64.4	12.21	80.7
KCl	4	16	73	30-45	0.313	6.55	12.0	4.99	3.97	0.401	35.2	17.47	1.95	42.1	63.2	14.33	88.3
KCl	4	16	74	45-60	0.333	6.29	12.4	5.11	3.90	0.450	32.2	17.50	2.06	44.3	62.8	14.34	92.5
KCl	4	16	75	60-75	0.333	6.47	12.8	6.10	4.19	0.479	33.2	18.25	2.14	45.1	64.7	15.04	95.5
KCl	4	16	76	75-90	0.337	7.52	14.4	5.08	4.36	0.510	40.1	20.47	2.34	47.9	69.7	15.78	103.8
KCl	4	16	77	90-110	0.353	7.68	16.3	4.28	3.60	0.612	45.5	24.36	2.83	46.9	77.3	15.29	116.6
KCl	4	24	127	0-15	0.293	7.90	13.4	4.92	3.16	0.540	33.4	13.81	2.05	38.6	44.2	17.19	72.4
KCl	4	29	171	0-15	0.444	9.27	16.6	5.67	3.58	0.567	36.8	15.75	2.19	24.2	59.7	12.08	60.3
KCl	4	29	172	15-30	0.328	7.94	15.9	5.37	3.17	0.446	46.2	21.58	2.40	14.3	39.9	<8.46	68.1
KCl	4	29	173	30-45	0.345	7.38	14.4	5.18	3.40	0.455	45.5	20.61	2.45	11.5	39.0	<8.46	66.7
KCl	4	29	174	45-60	0.388	7.85	15.2	5.42	3.54	0.482	48.0	21.47	2.63	9.4	43.2	<8.46	66.9
KCl	4	29	175	60-75	0.310	7.08	13.6	4.79	3.05	0.398	42.1	18.13	2.23	5.5	35.7	<8.46	54.0
KCl	4	29	176	75-90	0.405	7.89	15.6	5.76	3.96	0.487	49.1	22.79	2.63	11.9	43.1	<8.46	72.2
KCl	4	29	177	90-105	0.351	7.56	15.1	5.32	3.47	0.457	47.0	21.20	2.50	8.2	40.1	<8.46	66.8
KCl	4	29	178	105-120	0.313	7.23	13.9	4.76	2.74	0.468	42.7	19.30	2.28	6.7	37.7	<8.46	58.5
KCl	4	29	179	120-135	0.306	6.61	13.2	5.30	3.62	0.399	38.6	17.45	2.15	6.6	36.3	<8.46	56.2
KCl	5	25	128	0-15	0.365	8.12	13.4	4.87	2.98	0.512	32.3	13.44	2.04	35.3	44.7	19.22	68.2
KCl	5	25	129	0-15	0.368	8.08	13.6	4.52	2.69	0.478	33.1	12.84	2.02	16.5	56.4	<8.46	51.9
KCl	5	25	130	0-15	0.305	7.90	13.6	4.30	2.25	0.413	33.3	12.23	2.02	7.0	36.5	<8.46	41.3
KCl	5	25	131	0-15	0.349	7.97	14.7	3.96	2.92	0.484	36.7	16.08	2.07	14.2	48.7	<8.46	58.3
KCl	5	25	132	0-15	0.353	7.94	15.1	5.18	3.73	0.518	39.4	18.20	2.14	13.4	50.1	<8.46	62.7
KCl	5	25	133	15-30	0.376	8.59	12.8	4.62	2.39	0.295	34.6	13.35	2.12	6.2	37.0	<8.46	41.1
KCl	5	25	134	15-30	0.438	6.99	10.3	5.01	1.73	0.314	24.7	8.87	1.52	5.9	46.0	<8.46	24.3
KCl	5	25	135	15-30	0.447	7.72	13.4	4.53	2.43	0.267	36.4	14.42	2.12	7.2	33.0	<8.46	48.0
KCl	5	25	136	15-30	0.358	7.36	15.5	4.82	3.01	0.378	43.9	21.01	2.36	16.4	50.7	<8.46	71.8
KCl	5	25	137	15-30	0.267	8.24	18.3	5.06	3.43	0.403	47.5	24.07	2.78	26.3	72.1	<8.46	91.6

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cr	Ba	Ni	Sr	Li	Zr	Co	Cd	Pb
(ug/g)													
KCl	2	45	285	75-90	41.6	426	19.7	77.5	15.03	80.7	<13.5	<0.90	8.81
KCl	2	45	286	90-105	38.3	455	20.3	82.1	16.12	93.4	<13.5	<0.90	<0.60
KCl	2	45	287	105-120	36.8	427	21.6	79.1	15.06	82.2	<13.5	<0.90	1.74
KCl	2	45	288	120-135	33.4	319	19.0	73.7	15.23	80.8	<13.5	<0.90	1.77
KCl	3	21	96	0-15	44.9	436	29.8	103.9	26.23	125.0	23.4	<0.90	11.78
KCl	3	21	97	0-15	55.2	397	31.9	100.2	25.59	127.9	22.9	<0.90	13.34
KCl	3	21	98	0-15	62.5	324	37.5	96.5	28.18	122.8	25.3	<0.90	14.67
KCl	3	21	99	0-15	76.7	393	41.6	99.7	28.48	132.9	25.4	<0.90	10.43
KCl	3	21	100	0-15	75.8	367	44.9	107.9	29.21	141.8	26.7	<0.90	16.25
KCl	3	30	180	0-15	<9.8	452	<16.9	108.5	11.98	90.3	<13.5	<0.90	9.03
KCl	3	39	237	0-15	56.8	361	29.4	87.1	22.59	123.9	18.9	1.45	9.57
KCl	4	16	63	0-15	60.9	406	45.9	102.8	37.40	107.8	25.2	<0.90	11.13
KCl	4	16	64	0-15	47.9	349	38.7	94.8	35.46	104.0	23.3	<0.90	22.05
KCl	4	16	65	0-15	53.6	323	40.5	97.5	33.67	115.3	22.8	<0.90	19.12
KCl	4	16	66	0-15	52.6	142	43.7	82.4	37.74	106.5	25.7	<0.90	13.55
KCl	4	16	67	0-15	57.3	338	45.7	94.6	38.39	111.3	25.9	<0.90	14.04
KCl	4	16	68	15-30	77.9	292	58.4	89.2	39.48	116.1	25.3	<0.90	9.11
KCl	4	16	69	15-30	51.1	388	42.1	92.9	35.45	112.8	24.3	<0.90	7.25
KCl	4	16	70	15-30	64.3	393	50.0	105.8	40.24	117.3	27.0	<0.90	10.32
KCl	4	16	71	15-30	62.7	433	45.6	102.8	38.76	109.3	25.7	<0.90	10.16
KCl	4	16	72	15-30	61.9	395	45.8	100.6	37.39	113.2	24.6	<0.90	12.06
KCl	4	16	73	30-45	84.8	344	65.3	94.8	40.42	112.1	26.2	<0.90	11.83
KCl	4	16	74	45-60	62.6	241	54.3	81.7	41.15	132.4	27.0	<0.90	11.65
KCl	4	16	75	60-75	64.2	239	55.7	82.9	42.14	128.7	27.8	<0.90	13.31
KCl	4	16	76	75-90	70.4	366	57.0	100.4	45.52	131.9	30.1	<0.90	16.36
KCl	4	16	77	90-110	91.2	266	67.9	95.8	45.98	145.1	31.1	<0.90	13.62
KCl	4	24	127	0-15	47.1	329	35.0	102.0	32.40	135.9	26.7	1.85	22.16
KCl	4	29	171	0-15	48.7	449	26.3	106.9	23.03	122.0	20.7	<0.90	16.32
KCl	4	29	172	15-30	33.3	438	19.5	113.6	19.91	94.7	14.5	<0.90	15.21
KCl	4	29	173	30-45	<9.8	452	<16.9	113.2	18.46	93.1	<13.5	<0.90	13.62
KCl	4	29	174	45-60	23.1	449	<16.9	119.5	17.66	98.5	<13.5	<0.90	11.46
KCl	4	29	175	60-75	<9.8	437	<16.9	107.2	13.56	81.1	<13.5	<0.90	13.39
KCl	4	29	176	75-90	25.2	488	<16.9	118.2	20.11	107.0	<13.5	<0.90	15.56
KCl	4	29	177	90-105	19.9	485	<16.9	114.6	17.47	94.3	<13.5	<0.90	13.92
KCl	4	29	178	105-120	<9.8	413	<16.9	106.5	15.62	82.5	<13.5	<0.90	9.39
KCl	4	29	179	120-135	<9.8	343	<16.9	92.8	15.11	74.2	<13.5	<0.90	13.39
KCl	5	25	128	0-15	68.6	355	45.5	104.9	30.66	136.3	26.9	1.16	16.27
KCl	5	25	129	0-15	28.9	341	<16.9	102.3	19.67	102.7	15.8	<0.90	17.86
KCl	5	25	130	0-15	22.6	398	<16.9	101.8	13.21	90.2	<13.5	<0.90	16.19
KCl	5	25	131	0-15	26.5	130	<16.9	96.9	18.02	99.0	<13.5	0.93	16.15
KCl	5	25	132	0-15	27.1	263	<16.9	106.3	17.95	99.6	<13.5	1.19	22.27
KCl	5	25	133	15-30	56.7	384	23.4	105.6	12.79	90.8	<13.5	<0.90	9.08
KCl	5	25	134	15-30	18.1	434	<16.9	92.2	7.99	75.6	<13.5	<0.90	7.37
KCl	5	25	135	15-30	29.3	366	<16.9	99.5	17.14	95.6	<13.5	<0.90	10.19
KCl	5	25	136	15-30	34.9	231	22.8	97.4	21.92	111.9	14.7	1.47	22.70
KCl	5	25	137	15-30	65.2	314	33.6	94.2	27.09	136.9	20.9	<0.90	10.99

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Mn	Na	K	Ca	Mg (mg/g)	P	Al	Fe	Ti	Cu	Zn	Mo (ug/g)	V
KCl	5	25	138	30-45	0.298	8.07	15.8	4.87	3.62	0.342	43.9	20.19	2.19	7.5	52.0	<8.46	65.4
KCl	5	25	139	45-60	0.366	7.63	15.6	4.21	3.14	0.337	42.1	20.06	2.03	9.1	41.5	<8.46	65.1
KCl	5	25	140	60-75	1.056	8.27	15.9	5.03	3.59	0.391	41.8	18.71	2.07	6.3	36.4	<8.46	56.5
KCl	5	25	141	75-90	1.151	11.0	16.3	4.17	2.62	0.771	44.3	24.08	2.89	13.9	46.0	<8.46	75.8
KCl	5	25	142	90-105	0.838	8.68	17.1	5.06	3.54	0.440	43.1	19.26	2.27	16.0	40.0	<8.46	60.8
KCl	5	25	143	105-120	0.612	7.73	16.0	4.62	3.37	0.419	41.0	19.08	2.13	14.2	38.8	<8.46	57.7
KCl	5	25	144	120-135	0.327	6.94	14.1	4.36	3.32	0.357	37.0	16.15	1.88	11.1	35.0	<8.46	50.8
KCl	5	25	144a	135-150	0.364	8.13	16.1	4.74	3.30	0.402	40.9	17.86	2.06	12.2	45.1	<8.46	55.8
KCl	5	25	144b	150-165	0.298	7.98	15.3	4.73	3.31	0.407	39.2	17.47	1.98	11.6	41.3	<8.46	54.4
KCl	5	25	144c	165-180	0.340	8.21	15.5	4.51	3.03	0.405	38.3	17.33	1.92	12.3	43.8	<8.46	52.3
KCl	5	25	144d	180-195	0.329	7.48	14.5	4.03	2.52	0.380	34.6	15.58	1.74	13.8	38.6	<8.46	50.0
KCl	5	25	144e	195-210	0.229	7.85	14.6	4.82	3.57	0.418	37.9	16.00	1.92	15.2	42.0	<8.46	55.6
KCl	5	26	145	0-15	0.356	7.95	13.2	5.72	2.91	0.439	30.7	11.62	1.81	9.2	39.8	<8.46	39.7
KCl	5	26	146	15-30	0.335	7.85	13.0	4.98	2.37	0.346	30.0	11.08	1.94	5.9	34.2	<8.46	34.9
KCl	5	37	219	0-15	0.375	7.28	12.2	5.90	3.74	0.520	32.3	13.97	1.90	40.3	43.2	19.35	75.6
NaCl	6	22	101	0-15	0.379	7.86	12.6	4.60	2.32	0.495	32.3	11.41	2.07	27.1	35.1	15.17	56.5
NaCl	6	22	102	15-30	0.384	6.32	13.5	6.62	4.11	0.498	29.0	17.95	2.11	34.0	45.8	17.16	78.6
NaCl	6	22	103	30-45	0.315	6.77	13.5	8.00	4.40	0.496	29.6	17.37	2.04	36.1	51.1	17.16	79.5
NaCl	6	22	104	45-60	0.241	5.56	11.0	6.13	3.33	0.389	23.1	12.77	1.54	29.4	43.5	13.91	60.4
NaCl	6	22	105	60-75	0.272	5.43	10.8	6.33	3.36	0.374	23.9	13.31	1.60	29.6	36.7	10.39	63.2
NaCl	6	22	106	75-90	0.211	5.60	10.9	6.52	3.78	0.389	24.5	14.60	1.66	31.5	37.2	12.41	64.8
NaCl	6	22	107	90-105	0.257	5.62	11.4	5.46	3.39	0.399	25.0	14.75	1.71	30.4	40.4	11.20	66.6
NaCl	6	22	108	105-120	0.230	5.78	11.6	5.67	3.24	0.388	25.1	13.98	1.70	27.2	44.7	9.64	62.4
NaCl	6	22	109	120-130	0.198	6.01	12.0	7.18	4.24	0.387	26.1	13.76	1.65	30.8	38.5	11.07	66.1
NaCl	6	32	194	0-15	0.399	6.88	11.6	3.95	2.96	0.426	29.1	11.53	1.82	35.7	38.0	16.38	65.2
NaCl	6	41	239	0-15	0.344	8.24	13.6	5.87	3.42	0.422	34.8	11.95	1.87	22.5	37.3	<8.46	51.2
NaCl	7	18	79	0-15	0.374	6.52	11.2	4.18	2.24	0.493	28.3	12.77	2.05	37.9	45.8	13.18	72.2
NaCl	7	27	147	0-15	0.470	7.56	11.8	3.38	1.33	0.346	25.8	9.37	1.65	7.0	35.0	<8.46	30.0
NaCl	7	27	148	0-15	0.382	7.49	12.1	3.29	1.87	0.388	27.5	10.46	1.70	10.4	33.4	<8.46	35.9
NaCl	7	27	149	0-15	0.360	7.50	12.1	4.12	1.82	0.349	27.5	9.67	1.81	8.0	29.9	<8.46	34.4
NaCl	7	27	150	0-15	0.437	7.65	12.3	4.66	1.92	0.383	28.3	10.27	1.77	5.8	32.7	<8.46	32.0
NaCl	7	27	151	0-15	0.374	7.55	12.4	4.71	2.10	0.360	28.3	9.91	1.82	6.3	29.3	<8.46	32.9
NaCl	7	27	152	15-30	0.412	7.75	12.5	4.43	1.83	0.348	28.5	10.61	1.78	7.5	30.7	<8.46	33.8
NaCl	7	34	196	0-15	0.384	7.68	12.9	5.20	3.04	0.523	32.0	12.39	2.06	36.7	43.8	18.61	69.7
NaCl	7	34	197	0-15	0.331	7.46	13.9	5.96	4.23	0.487	37.2	18.33	2.28	38.5	44.9	17.09	83.5
NaCl	7	34	198	0-15	0.349	6.99	12.3	4.05	2.68	0.437	30.5	13.31	2.00	33.2	42.0	14.68	68.4
NaCl	7	34	199	0-15	0.372	6.88	11.3	5.22	2.67	0.428	28.7	11.12	1.84	40.0	36.4	20.04	68.3
NaCl	7	34	200	0-15	0.439	7.73	13.1	5.43	2.73	0.545	32.7	12.65	2.12	37.5	44.3	19.68	71.0
NaCl	7	34	201	15-30	0.341	6.83	12.2	5.98	3.88	0.405	33.8	14.79	1.96	38.7	43.7	16.67	76.4
NaCl	8	20	95	0-15	0.401	7.41	12.3	4.67	2.60	0.443	31.6	12.77	2.02	27.6	41.9	12.65	58.6
NaCl	8	35	202	0-15	0.069	1.26	2.1	0.95	0.47	0.076	5.3	2.00	0.36	6.5	9.9	<8.46	11.6
NaCl	8	35	203	0-15	0.442	7.94	12.9	6.11	2.98	0.476	32.4	11.97	2.11	40.4	47.0	21.91	70.9
NaCl	8	35	204	0-15	0.429	7.69	12.4	4.63	2.45	0.479	30.9	11.08	2.09	35.9	44.7	18.79	64.9
NaCl	8	35	205	0-15	0.380	7.25	11.8	5.42	2.69	0.439	30.0	11.00	1.98	40.0	36.7	20.54	68.2
NaCl	8	35	206	0-15	0.369	7.17	11.6	4.94	2.46	0.467	29.4	10.91	1.89	39.3	55.4	20.40	67.4
NaCl	8	35	207	15-30	0.414	7.75	13.5	8.49	4.45	0.485	31.3	18.00	2.13	40.9	48.2	19.74	85.9
NaCl	8	35	208	30-45	0.389	7.11	14.2	6.69	4.05	0.525	30.7	19.32	2.12	45.1	51.6	22.31	92.6

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cr	Ba	Ni	Sr	Li (ug/g)	Zr	Co	Cd	Pb
KCl	5	25	138	30-45	47.6	432	22.6	97.1	19.66	99.0	18.1	<0.90	11.40
KCl	5	25	139	45-60	42.9	349	18.1	91.5	20.15	96.1	17.5	<0.90	9.45
KCl	5	25	140	60-75	35.3	423	39.7	99.9	16.03	101.3	20.2	<0.90	12.62
KCl	5	25	141	75-90	68.7	235	43.4	122.8	15.77	99.3	18.7	<0.90	13.08
KCl	5	25	142	90-105	47.1	442	31.9	103.8	18.09	106.8	14.6	<0.90	13.63
KCl	5	25	143	105-120	27.5	431	21.5	94.7	15.60	97.3	<13.5	<0.90	13.88
KCl	5	25	144	120-135	19.8	378	<16.9	85.9	14.22	86.2	<13.5	<0.90	12.44
KCl	5	25	144a	135-150	26.1	420	18.8	97.1	15.82	92.8	<13.5	<0.90	15.91
KCl	5	25	144b	150-165	26.4	416	<16.9	97.1	15.73	93.3	<13.5	<0.90	13.22
KCl	5	25	144c	165-180	42.1	408	28.2	96.5	15.66	97.2	<13.5	<0.90	14.92
KCl	5	25	144d	180-195	17.4	406	<16.9	87.5	16.11	92.0	<13.5	<0.90	15.18
KCl	5	25	144e	195-210	22.5	386	<16.9	94.5	18.63	99.1	<13.5	0.94	12.25
KCl	5	26	145	0-15	11.4	468	<16.9	97.5	13.16	84.7	<13.5	1.01	17.93
KCl	5	26	146	15-30	17.0	426	<16.9	92.3	11.34	89.0	<13.5	<0.90	11.23
KCl	5	37	219	0-15	65.1	420	53.7	108.8	35.13	156.6	31.2	2.52	12.62
NaCl	6	22	101	0-15	73.5	430	41.4	99.7	25.64	122.1	23.1	<0.90	10.13
NaCl	6	22	102	15-30	105	168	65.3	73.9	31.49	148.9	26.9	<0.90	11.22
NaCl	6	22	103	30-45	83.1	206	54.9	80.2	33.07	135.8	27.5	<0.90	14.51
NaCl	6	22	104	45-60	59.7	190	44.9	64.4	26.87	107.3	20.6	<0.90	11.58
NaCl	6	22	105	60-75	29.6	202	28.1	65.2	27.82	111.4	20.8	1.09	15.58
NaCl	6	22	106	75-90	53.0	199	35.7	69.0	28.65	113.9	22.4	1.16	14.19
NaCl	6	22	107	90-105	39.1	157	32.0	64.0	28.75	109.2	21.4	1.12	18.80
NaCl	6	22	108	105-120	37.1	191	28.2	66.6	26.09	112.8	19.6	1.52	16.96
NaCl	6	22	109	120-130	45.2	199	34.0	71.2	28.95	112.9	21.2	<0.90	15.55
NaCl	6	32	194	0-15	53.9	251	43.4	91.8	32.13	138.3	27.1	1.21	5.13
NaCl	6	41	239	0-15	49.2	329	27.3	80.5	21.75	127.2	18.5	1.09	10.38
NaCl	7	18	79	0-15	55.0	269	41.5	87.2	35.54	118.0	24.3	1.11	8.02
NaCl	7	27	147	0-15	14.4	308	<16.9	84.6	10.85	76.8	<13.5	<0.90	9.01
NaCl	7	27	148	0-15	16.8	217	<16.9	80.8	13.68	94.0	<13.5	<0.90	11.82
NaCl	7	27	149	0-15	13.5	370	<16.9	84.4	12.40	88.0	<13.5	<0.90	9.59
NaCl	7	27	150	0-15	13.9	416	<16.9	89.3	10.84	76.4	<13.5	<0.90	10.05
NaCl	7	27	151	0-15	12.4	406	<16.9	88.5	11.41	84.5	<13.5	<0.90	11.59
NaCl	7	27	152	15-30	22.6	401	<16.9	89.0	11.79	78.3	<13.5	<0.90	10.63
NaCl	7	34	196	0-15	62.5	405	46.4	108.8	32.89	151.9	28.9	0.94	9.70
NaCl	7	34	197	0-15	79.0	365	53.9	105.9	35.42	161.8	36.0	<0.90	7.67
NaCl	7	34	198	0-15	54.7	285	43.0	95.1	30.76	137.3	25.8	<0.90	8.10
NaCl	7	34	199	0-15	61.1	414	48.5	100.8	34.51	154.8	34.5	<0.90	4.85
NaCl	7	34	200	0-15	62.4	418	49.8	113.3	33.60	152.0	30.5	<0.90	7.43
NaCl	7	34	201	15-30	60.3	384	51.4	100.9	35.35	145.5	28.7	<0.90	5.31
NaCl	8	20	95	0-15	50.3	396	28.7	94.5	26.18	127.2	22.7	<0.90	9.44
NaCl	8	35	202	0-15	12.1	73	<16.9	18.2	5.63	28.0	<13.5	<0.90	1.55
NaCl	8	35	203	0-15	74.9	459	56.3	115.3	34.63	166.2	32.4	0.94	7.82
NaCl	8	35	204	0-15	63.2	382	49.4	107.7	31.40	145.9	28.7	<0.90	6.54
NaCl	8	35	205	0-15	69.6	429	54.1	106.7	34.09	162.3	31.1	<0.90	7.92
NaCl	8	35	206	0-15	64.1	410	59.5	103.8	33.39	152.1	29.4	1.43	6.29
NaCl	8	35	207	15-30	76.1	226	63.4	93.6	36.53	156.6	31.1	1.05	8.93
NaCl	8	35	208	30-45	86.2	190	70.4	86.1	38.73	157.3	33.7	1.60	8.55

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Mn	Na	K	Ca	Mg (mg/g)	P	Al	Fe	Ti	Cu	Zn	Mo	V
															(ug/g)		
NaCl	8	35	209	45-60	0.438	6.87	13.9	9.28	5.41	0.542	32.5	20.52	2.34	48.6	54.0	21.65	102.4
NaCl	8	35	210	60-75	0.441	7.00	14.3	9.13	6.19	0.547	34.5	21.10	2.28	48.5	61.4	21.45	102.3
NaCl	8	35	211	75-90	0.370	7.15	14.3	11	6.40	0.546	33.7	20.68	2.26	44.8	56.3	21.59	100.7
NaCl	8	35	212	90-105	0.312	6.77	13.8	9.24	6.01	0.537	32.0	19.73	2.22	40.7	50.5	19.24	92.9
NaCl	8	35	212a	105-120	0.304	6.79	13.4	8.44	5.76	0.524	31.5	19.31	2.12	41.4	53.1	19.07	91.1
NaCl	8	35	212b	120-135	0.323	6.71	13.6	5.86	3.84	0.547	29.3	20.15	2.22	45.6	52.7	22.27	94.5
NaCl	8	44	254	0-15	0.367	7.59	13.5	6.21	3.90	0.436	35.7	13.60	1.74	24.0	45.2	<8.46	55.0
NaCl	8	44	255	0-15	0.358	8.24	12.5	5.65	3.28	0.346	35.0	10.30	1.79	22.7	37.0	<8.46	46.0
NaCl	8	44	256	0-15	0.308	7.94	11.8	5.74	3.02	0.316	33.1	9.32	1.66	22.9	49.8	<8.46	42.4
NaCl	8	44	257	0-15	0.356	8.39	13.4	6.45	3.74	0.441	36.8	10.78	1.93	23.0	49.9	<8.46	48.2
NaCl	8	44	258	0-15	0.351	8.19	13.5	5.38	3.49	0.493	36.5	11.71	1.89	20.5	52.2	<8.46	47.3
NaCl	8	44	259	15-30	0.387	7.71	14.7	5.43	3.90	0.513	37.9	17.07	2.00	29.2	45.2	<8.46	63.5
NaCl	8	44	260	15-30	0.334	8.26	12.4	5.35	2.62	0.305	33.3	9.05	1.82	18.9	29.9	<8.46	39.6
NaCl	8	44	261	15-30	0.388	8.43	12.7	5.49	2.53	0.319	33.9	9.35	1.83	19.7	41.5	<8.46	41.1
NaCl	8	44	262	15-30	0.352	7.91	13.4	6.52	3.82	0.458	35.5	12.11	1.88	21.9	42.8	<8.46	49.9
NaCl	8	44	263	15-30	0.335	7.99	12.4	6.82	3.77	0.421	33.8	10.93	1.70	25.5	40.3	<8.46	49.1
NaCl	8	44	264	30-45	0.319	7.91	14.7	7.79	5.57	0.537	41.4	17.31	2.00	31.6	45.4	8.75	70.7
NaCl	8	44	265	45-60	0.346	7.39	14.2	6.84	4.58	0.415	39.9	16.59	1.97	12.9	43.4	<8.46	54.3
NaCl	8	44	266	60-75	0.362	6.69	13.3	8.07	5.30	0.405	35.4	15.83	1.90	17.0	44.2	<8.46	57.0
NaCl	8	44	267	75-90	0.285	7.08	13.9	8.09	5.35	0.387	35.7	15.07	1.84	12.8	42.2	<8.46	53.5
NaCl	8	44	268	90-105	0.265	6.25	12.1	7.51	4.64	0.360	30.8	13.68	1.65	12.8	38.2	<8.46	47.7
NaCl	8	44	269	105-120	0.306	6.81	13.3	6.82	4.49	0.407	32.5	15.31	1.81	13.8	48.7	<8.46	52.0
NaCl	8	44	270	120-135	0.300	6.69	13.6	7.84	4.93	0.419	33.8	15.95	1.91	15.6	44.9	<8.46	57.1
NaCl	8	44	271	135-150	0.320	6.65	14.4	8.06	4.90	0.407	34.3	16.83	1.93	15.1	47.6	<8.46	56.7
NaCl	9	19	80	0-15	0.396	7.03	12.3	3.41	2.23	0.667	32.3	14.34	2.07	39.7	56.2	16.28	76.0
NaCl	9	19	81	0-15	0.360	6.53	10.9	3.81	2.26	0.385	28.4	11.67	1.92	42.6	69.4	15.94	73.3
NaCl	9	19	82	0-15	0.436	6.27	10.5	2.89	1.84	0.408	25.9	10.53	1.89	35.8	52.5	13.68	64.8
NaCl	9	19	83	0-15	0.380	7.12	11.4	4.39	2.68	0.450	31.0	11.76	2.02	40.1	47.9	15.74	71.5
NaCl	9	19	84	0-15	0.373	6.92	11.3	2.51	1.88	0.463	29.0	11.08	2.01	38.5	46.7	15.00	68.1
NaCl	9	19	85	15-30	0.455	7.89	13.2	3.93	2.90	0.513	34.8	16.48	2.16	47.6	76.6	19.33	87.9
NaCl	9	19	86	15-30	0.389	7.08	12.0	3.91	3.11	0.418	32.5	13.92	2.03	46.8	71.3	18.59	84.3
NaCl	9	19	87	15-30	0.368	6.77	10.7	4.07	2.29	0.374	27.7	10.43	1.87	40.5	39.7	15.95	66.5
NaCl	9	19	88	15-30	0.419	7.50	11.5	3.40	2.14	0.380	28.8	10.85	1.88	16.5	37.6	8.74	42.2
NaCl	9	19	89	15-30	0.424	7.28	11.1	4.53	2.17	0.414	28.3	9.64	1.88	19.0	50.6	<8.46	39.1
NaCl	9	19	90	30-45	0.386	8.02	15.7	5.20	3.55	0.975	44.3	22.09	2.25	25.2	46.5	46.1	78.4
NaCl	9	19	91	45-60	0.313	6.86	13.4	4.97	3.28	0.438	38.0	18.43	2.07	24.8	41.4	<8.46	70.5
NaCl	9	19	92	60-75	0.252	6.67	11.9	5.45	3.39	0.402	32.5	15.39	1.78	23.0	45.2	<8.46	60.3
NaCl	9	19	93	75-90	0.230	7.28	13.7	5.92	3.97	0.464	38.5	17.17	2.09	25.8	39.2	9.48	68.6
NaCl	9	19	94	90-110	0.294	7.52	14.0	6.01	4.06	0.482	39.5	17.58	2.13	30.2	41.5	10.73	74.5
NaCl	9	19	94a	105-120	0.296	7.37	14.0	6.96	4.31	0.492	38.5	17.84	2.17	29.0	51.1	10.88	74.3
NaCl	9	19	94b	120-140	0.270	7.31	14.7	6.20	4.06	0.501	36.9	18.37	2.17	28.7	45.8	11.53	75.6
NaCl	9	31	181	0-15	0.367	7.44	12.6	5.38	3.00	0.390	37.0	15.77	2.17	3.3	35.1	<8.46	44.5
NaCl	9	31	182	0-15	0.393	7.30	13.0	5.31	3.09	0.406	38.6	15.65	2.27	4.8	33.1	<8.46	48.5
NaCl	9	31	183	0-15	0.372	7.25	12.5	3.28	2.10	0.429	36.1	15.04	2.21	7.1	36.3	<8.46	48.1
NaCl	9	31	184	0-15	0.395	7.34	12.1	4.17	2.02	0.401	33.6	12.99	2.26	4.8	47.5	<8.46	40.3
NaCl	9	31	185	0-15	0.377	7.16	11.7	3.90	2.07	0.416	32.4	12.53	2.04	5.9	29.7	<8.46	39.3

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cr	Ba	Ni	Sr	Li	Zr	Co	Cd	Pb
(ug/g)													
NaCl	8	35	209	45-60	76.4	213	69.2	91.5	42.72	178.3	36.9	2.31	10.66
NaCl	8	35	210	60-75	83.1	226	69.8	95.6	42.87	171.7	35.8	1.33	10.54
NaCl	8	35	211	75-90	97.6	237	72.8	99.7	39.95	168.2	34.7	<0.90	9.52
NaCl	8	35	212	90-105	84.1	211	65.9	95.0	37.52	157.5	32.1	<0.90	8.79
NaCl	8	35	212a	105-120	80.6	210	62.8	93.2	37.45	158.2	31.7	<0.90	10.16
NaCl	8	35	212b	120-135	92.5	176	68.2	81.2	37.89	177.4	34.0	<0.90	10.73
NaCl	8	44	254	0-15	54.9	320	34.5	76.5	22.63	119.0	17.5	<0.90	6.89
NaCl	8	44	255	0-15	48.5	472	25.5	86.9	21.81	128.3	17.6	0.93	7.75
NaCl	8	44	256	0-15	46.6	475	25.1	85.3	21.29	121.6	16.9	<0.90	5.27
NaCl	8	44	257	0-15	49.4	512	26.9	89.3	22.00	129.7	18.3	<0.90	6.25
NaCl	8	44	258	0-15	49.8	411	25.1	84.7	20.45	129.7	17.8	<0.90	7.23
NaCl	8	44	259	15-30	83.0	233	46.4	73.3	24.36	134.4	19.6	<0.90	9.56
NaCl	8	44	260	15-30	48.6	503	22.6	88.5	19.11	120.3	16.5	<0.90	7.66
NaCl	8	44	261	15-30	50.5	525	24.3	89.4	19.93	121.7	17.9	<0.90	4.99
NaCl	8	44	262	15-30	52.3	373	28.1	81.8	21.35	123.5	17.2	<0.90	8.59
NaCl	8	44	263	15-30	50.2	434	28.1	83.1	22.76	131.0	18.6	<0.90	7.71
NaCl	8	44	264	30-45	67.4	301	44.4	78.8	27.42	143.3	22.0	<0.90	6.73
NaCl	8	44	265	45-60	69.2	297	32.1	76.8	15.52	105.1	<13.5	<0.90	4.83
NaCl	8	44	266	60-75	57.9	245	28.9	67.3	18.07	109.1	<13.5	<0.90	7.10
NaCl	8	44	267	75-90	46.2	233	22.9	69.3	16.13	97.5	<13.5	<0.90	7.65
NaCl	8	44	268	90-105	44.9	199	22.1	61.8	15.31	83.8	<13.5	<0.90	5.02
NaCl	8	44	269	105-120	54.3	172	26.7	62.9	15.69	97.5	<13.5	<0.90	6.91
NaCl	8	44	270	120-135	54.0	198	28.3	63.3	17.35	96.8	<13.5	<0.90	6.24
NaCl	8	44	271	135-150	74.4	201	36.1	62.6	16.44	97.8	<13.5	<0.90	6.91
NaCl	9	19	80	0-15	84.0	342	55.4	98.6	36.83	112.0	25.2	1.10	5.50
NaCl	9	19	81	0-15	59.4	364	44.1	94.6	39.37	116.2	27.1	1.54	3.39
NaCl	9	19	82	0-15	51.1	263	39.0	85.8	34.09	102.8	23.5	1.28	23.34
NaCl	9	19	83	0-15	56.9	404	42.0	101.9	37.60	112.9	25.7	1.51	9.03
NaCl	9	19	84	0-15	58.2	204	41.9	89.4	36.17	112.2	24.9	1.31	14.69
NaCl	9	19	85	15-30	92.3	316	66.8	112.7	42.86	117.6	30.6	1.91	8.60
NaCl	9	19	86	15-30	65.7	312	51.7	96.3	43.75	119.8	29.9	<0.90	4.00
NaCl	9	19	87	15-30	57.2	391	42.3	97.3	36.61	114.5	25.6	0.99	5.56
NaCl	9	19	88	15-30	52.0	139	18.8	83.6	17.47	101.5	15.7	<0.90	9.33
NaCl	9	19	89	15-30	34.1	389	<16.9	90.4	15.65	98.5	14.0	<0.90	8.27
NaCl	9	19	90	30-45	52.6	376	39.0	102.9	26.35	116.2	475.2	1.31	12.01
NaCl	9	19	91	45-60	53.1	271	33.6	86.9	26.53	111.6	19.5	<0.90	10.67
NaCl	9	19	92	60-75	37.7	336	25.7	82.6	23.47	103.4	17.5	<0.90	8.62
NaCl	9	19	93	75-90	74.8	372	41.5	96.8	26.97	112.3	19.7	<0.90	12.91
NaCl	9	19	94	90-110	44.5	413	34.5	99.2	30.06	123.1	23.1	<0.90	8.33
NaCl	9	19	94a	105-120	43.1	433	32.7	98.3	28.86	124.1	22.9	<0.90	8.74
NaCl	9	19	94b	120-140	52.7	349	32.4	91.9	28.03	126.7	22.7	<0.90	8.14
NaCl	9	31	181	0-15	11.6	417	<16.9	103.8	11.99	92.9	<13.5	<0.90	11.06
NaCl	9	31	182	0-15	<9.8	424	<16.9	104.0	13.22	93.4	<13.5	<0.90	14.03
NaCl	9	31	183	0-15	<9.8	176	<16.9	94.1	14.20	82.8	<13.5	<0.90	9.40
NaCl	9	31	184	0-15	<9.8	398	<16.9	100.4	11.66	89.3	<13.5	<0.90	11.56
NaCl	9	31	185	0-15	<9.8	320	<16.9	98.1	12.28	77.8	<13.5	<0.90	10.17

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Mn	Na	K	Ca	Mg (mg/g)	P	Al	Fe	Ti	Cu	Zn	Mo (ug/g)	V
NaCl	9	31	186	15-30	0.343	7.91	15.1	5.53	3.80	0.459	48.0	23.08	2.53	11.3	38.4	<8.46	66.7
NaCl	9	31	187	15-30	0.400	7.21	12.5	5.46	2.84	0.388	37.7	15.59	2.30	3.6	36.8	<8.46	46.1
NaCl	9	31	188	15-30	0.350	6.96	11.9	5.20	3.03	0.380	36.1	14.79	2.13	5.3	29.7	<8.46	46.7
NaCl	9	31	189	15-30	0.446	7.92	13.8	4.60	2.68	0.441	38.2	16.04	2.33	15.9	44.3	<8.46	61.4
NaCl	9	31	190	15-30	0.324	7.63	14.4	4.77	3.56	0.490	41.9	19.75	2.25	24.3	42.6	<8.46	76.2
NaCl	9	31	191	30-45	0.389	8.04	16.7	4.56	3.91	0.507	47.5	22.02	2.49	31.0	48.5	10.55	91.2
NaCl	9	31	192	45-60	0.318	8.12	16.6	4.51	3.64	0.517	46.8	21.46	2.45	32.9	52.9	11.18	92.4
NaCl	9	31	193	60-75	0.369	8.51	17.7	4.72	3.68	0.584	50.4	23.70	2.74	34.9	56.5	12.83	101.5
NaCl	9	31	193a	75-90	0.348	7.93	16.2	4.29	3.19	0.549	45.8	21.38	2.47	33.1	52.1	12.37	92.3
NaCl	9	31	193b	90-105	0.421	7.66	15.3	4.92	3.32	0.570	42.4	21.06	2.38	35.5	48.8	15.87	89.0
NaCl	9	31	193c	105-120	0.428	7.83	15.1	5.24	3.92	0.573	43.1	20.12	2.35	37.7	52.2	16.07	92.4
NaCl	9	31	193d	120-135	0.364	7.09	14.3	6.49	4.98	0.508	36.2	18.95	2.21	38.2	49.4	16.51	89.2
NaCl	9	31	193e	135-150	0.385	6.86	14.0	8.67	5.66	0.522	34.0	18.51	2.12	40.5	54.2	18.23	90.2
NaCl	9	36	213	0-15	0.428	7.70	14.2	6.11	4.15	0.515	37.5	18.07	2.26	44.8	58.7	23.29	90.0
NaCl	9	36	214	0-15	0.461	7.48	13.2	6.03	4.23	0.524	35.3	17.19	2.18	44.0	48.8	22.19	85.5
NaCl	9	36	215	0-15	0.419	7.42	12.5	6.44	3.57	0.465	34.7	15.12	2.18	38.2	41.7	19.38	76.5
NaCl	9	36	216	0-15	0.409	7.67	13.3	6.92	4.00	0.537	35.9	17.78	2.14	44.3	48.2	21.90	85.2
NaCl	9	36	217	0-15	0.541	7.64	12.0	6.21	2.96	0.440	31.2	12.17	2.11	37.9	40.5	20.16	68.8
NaCl	9	36	218	15-30	0.413	7.97	13.1	7.32	4.36	0.478	36.6	16.15	2.28	42.4	47.0	22.35	82.0
NaCl	10	23	110	0-15	0.335	7.61	12.2	4.03	2.63	0.514	31.6	12.56	1.86	26.9	37.0	13.34	58.7
NaCl	10	23	111	0-15	0.394	7.38	11.5	2.88	1.83	0.434	27.5	10.73	1.74	28.0	45.2	12.75	53.3
NaCl	10	23	112	0-15	0.349	7.98	12.9	5.13	2.99	0.448	32.8	12.16	2.06	24.9	42.3	12.51	57.1
NaCl	10	23	113	0-15	0.358	7.00	11.4	5.09	2.67	0.440	27.9	10.26	1.90	25.2	38.3	10.72	52.1
NaCl	10	23	114	0-15	0.301	6.80	11.1	4.12	2.22	0.424	26.5	10.10	1.86	25.7	33.9	11.13	52.3
NaCl	10	23	115	15-30	0.362	6.99	11.8	4.29	3.22	0.438	29.3	13.54	1.80	31.5	35.3	13.93	64.7
NaCl	10	23	116	15-30	0.350	7.74	11.0	4.49	1.74	0.376	26.9	9.44	1.79	24.3	42.3	13.01	46.3
NaCl	10	23	117	15-30	0.323	7.68	14.7	5.07	3.46	0.385	43.3	19.15	2.43	28.6	45.3	15.27	80.5
NaCl	10	23	118	15-30	0.628	8.16	12.3	5.42	2.61	0.481	30.0	11.38	2.14	28.9	41.4	15.46	56.8
NaCl	10	23	119	15-30	0.547	8.70	12.7	5.26	2.41	0.434	31.8	11.82	2.12	29.6	37.1	15.43	56.9
NaCl	10	23	120	30-45	0.323	7.59	14.3	6.59	4.44	0.490	30.2	17.37	2.00	35.1	42.4	16.97	78.1
NaCl	10	23	121	45-60	0.340	7.21	13.4	7.86	4.95	0.488	30.1	17.03	2.03	34.1	43.3	16.02	76.0
NaCl	10	23	122	60-75	0.350	7.64	13.9	8.69	5.21	0.480	31.8	16.94	1.99	38.6	44.2	17.81	80.1
NaCl	10	23	123	75-90	0.231	6.40	12.4	8.18	4.54	0.436	27.7	14.86	1.78	38.0	46.2	15.77	74.1
NaCl	10	23	124	90-105	0.262	6.03	12.1	5.67	3.94	0.461	26.5	15.53	1.87	35.8	43.1	15.84	74.4
NaCl	10	23	125	105-120	0.265	6.56	12.8	8.30	4.97	0.460	29.2	16.21	1.89	37.5	50.7	16.96	77.7
NaCl	10	23	126	120-140	0.244	6.13	12.0	8.06	4.19	0.448	27.1	15.00	1.86	35.3	39.4	15.88	73.9
NaCl	10	28	153	0-15	0.498	8.76	13.8	5.25	3.06	0.443	30.7	11.64	2.08	10.4	43.1	<8.46	41.4
NaCl	10	28	154	0-15	0.358	7.58	11.7	5.23	2.48	0.351	27.3	10.09	1.78	7.3	38.8	<8.46	33.0
NaCl	10	28	155	0-15	0.335	6.92	11.2	4.49	2.50	0.317	27.4	10.60	1.62	7.3	31.8	<8.46	35.1
NaCl	10	28	156	0-15	0.348	7.46	11.1	4.57	2.33	0.343	25.1	9.31	1.68	6.6	34.4	<8.46	31.1
NaCl	10	28	157	0-15	0.370	7.34	11.8	3.34	1.84	0.397	26.2	10.25	1.74	6.8	36.0	<8.46	33.0
NaCl	10	28	158	15-30	0.354	7.95	16.2	4.25	2.69	0.448	40.2	19.34	2.22	16.2	54.3	<8.46	63.4
NaCl	10	28	159	15-30	0.334	7.25	11.6	3.89	1.78	0.313	26.9	10.12	1.62	7.8	29.4	<8.46	33.1
NaCl	10	28	160	15-30	0.309	7.78	13.0	5.05	2.56	0.401	31.7	11.98	1.86	8.7	34.5	<8.46	39.6
NaCl	10	28	161	15-30	0.398	7.65	12.2	4.50	2.30	0.341	28.7	11.61	1.76	8.2	32.7	<8.46	36.1
NaCl	10	28	162	15-30	0.297	8.34	14.1	5.21	2.75	0.382	33.9	13.63	2.07	14.1	38.7	<8.46	49.5
NaCl	10	28	163	30-45	0.309	7.78	15.6	4.29	3.09	0.431	38.4	17.04	1.97	18.5	39.7	<8.46	59.5
NaCl	10	28	164	45-60	0.382	8.87	17.0	4.52	2.95	0.490	41.5	18.82	2.19	24.5	44.9	<8.46	68.9
NaCl	10	28	165	60-75	0.357	8.49	15.8	4.50	3.02	0.454	39.5	17.22	2.08	18.7	41.7	<8.46	61.3

(Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cr	Ba	Ni	Sr	Li	Zr	Co	Cd	Pb
					(ug/g)								
NaCl	9	31	186	15-30	38.9	496	<16.9	117.3	16.84	98.4	<13.5	<0.90	12.51
NaCl	9	31	187	15-30	<9.8	450	<16.9	103.6	11.62	80.4	<13.5	<0.90	10.99
NaCl	9	31	188	15-30	<9.8	401	<16.9	99.3	12.95	80.0	<13.5	<0.90	12.44
NaCl	9	31	189	15-30	66.5	382	33.8	109.4	21.60	119.0	16.8	<0.90	10.23
NaCl	9	31	190	15-30	69.9	414	40.3	111.5	27.07	122.3	21.1	<0.90	11.06
NaCl	9	31	191	30-45	84.1	419	52.8	116.5	33.27	135.6	25.2	<0.90	14.53
NaCl	9	31	192	45-60	78.9	418	49.8	113.7	34.16	147.8	24.5	<0.90	13.06
NaCl	9	31	193	60-75	85.7	436	57.2	120.2	36.20	158.2	27.3	<0.90	10.76
NaCl	9	31	193a	75-90	73.3	352	53.3	110.6	34.40	142.5	25.6	<0.90	13.12
NaCl	9	31	193b	90-105	98.6	402	73.4	111.0	34.48	143.2	27.9	<0.90	29.04
NaCl	9	31	193c	105-120	73.2	432	62.4	115.8	36.88	161.5	29.4	<0.90	12.42
NaCl	9	31	193d	120-135	71.3	370	53.9	97.3	35.08	151.4	29.1	<0.90	9.06
NaCl	9	31	193e	135-150	80.9	252	65.8	92.2	36.70	161.3	30.1	1.24	7.13
NaCl	9	36	213	0-15	89.0	394	69.8	113.4	39.49	170.1	34.9	<0.90	11.34
NaCl	9	36	214	0-15	89.7	381	66.5	108.7	38.27	164.1	33.9	<0.90	10.63
NaCl	9	36	215	0-15	73.6	439	54.3	112.3	34.89	160.0	30.9	<0.90	9.42
NaCl	9	36	216	0-15	90.2	430	63.4	114.0	37.93	169.7	34.4	<0.90	10.94
NaCl	9	36	217	0-15	67.6	446	53.3	110.8	32.78	160.2	30.8	<0.90	11.12
NaCl	9	36	218	15-30	85.4	450	60.7	119.5	37.12	175.5	33.5	1.16	11.92
NaCl	10	23	110	0-15	60.2	288	37.7	89.4	26.88	115.9	21.9	<0.90	15.99
NaCl	10	23	111	0-15	44.5	165	29.3	82.6	25.48	112.1	21.2	<0.90	15.00
NaCl	10	23	112	0-15	49.3	416	28.9	98.8	25.34	120.2	21.5	1.26	12.46
NaCl	10	23	113	0-15	39.9	343	24.8	87.8	24.05	117.6	19.7	<0.90	2.87
NaCl	10	23	114	0-15	40.5	263	24.2	79.8	24.20	112.8	19.6	<0.90	6.10
NaCl	10	23	115	15-30	52.1	243	37.1	80.3	28.98	120.0	24.0	<0.90	6.65
NaCl	10	23	116	15-30	45.0	417	23.9	93.3	21.80	113.7	20.3	<0.90	1.90
NaCl	10	23	117	15-30	67.2	485	36.9	100.8	33.49	136.3	26.6	<0.90	1.40
NaCl	10	23	118	15-30	44.0	403	30.2	98.5	25.76	145.4	24.4	<0.90	<0.60
NaCl	10	23	119	15-30	53.0	466	31.5	104.0	25.54	129.5	24.4	<0.90	<0.60
NaCl	10	23	120	30-45	62.6	170	44.8	80.1	31.62	138.8	26.9	<0.90	2.33
NaCl	10	23	121	45-60	55.1	196	40.6	82.0	30.55	136.7	26.2	<0.90	1.21
NaCl	10	23	122	60-75	54.8	231	43.9	87.7	34.32	143.4	28.9	1.56	12.47
NaCl	10	23	123	75-90	45.5	223	37.4	76.4	32.71	137.3	25.9	1.15	12.07
NaCl	10	23	124	90-105	52.1	158	40.1	67.7	31.65	130.7	26.4	1.09	10.89
NaCl	10	23	125	105-120	53.0	221	41.2	80.4	33.54	134.9	27.8	1.49	12.82
NaCl	10	23	126	120-140	44.0	223	37.6	74.2	31.93	129.0	25.7	1.71	12.51
NaCl	10	28	153	0-15	24.3	362	<16.9	95.1	14.79	93.6	<13.5	<0.90	12.12
NaCl	10	28	154	0-15	15.2	383	<16.9	86.3	11.72	82.3	<13.5	<0.90	10.63
NaCl	10	28	155	0-15	<9.8	334	<16.9	78.2	12.25	79.1	<13.5	<0.90	10.72
NaCl	10	28	156	0-15	<9.8	336	<16.9	79.7	11.00	76.0	<13.5	<0.90	9.94
NaCl	10	28	157	0-15	17.8	266	<16.9	78.7	11.47	79.5	<13.5	<0.90	11.15
NaCl	10	28	158	15-30	59.0	346	33.6	89.5	18.77	110.2	<13.5	<0.90	11.76
NaCl	10	28	159	15-30	11.6	353	<16.9	79.9	11.55	76.0	<13.5	<0.90	55.51
NaCl	10	28	160	15-30	16.8	418	<16.9	90.0	13.22	84.0	<13.5	<0.90	10.90
NaCl	10	28	161	15-30	18.4	380	<16.9	85.4	11.87	84.1	<13.5	<0.90	7.56
NaCl	10	28	162	15-30	24.6	425	<16.9	95.1	17.80	117.3	15.6	<0.90	11.21
NaCl	10	28	163	30-45	27.7	370	19.7	92.4	20.35	101.6	14.2	<0.90	13.98
NaCl	10	28	164	45-60	57.5	313	37.3	99.4	23.45	113.8	19.3	<0.90	12.40
NaCl	10	28	165	60-75	38.4	381	26.5	95.0	20.40	118.1	16.2	<0.90	13.01

(Concluded). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1991.

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Mn	Na	K	Ca	Mg (mg/g)	P	Al	Fe	Ti	Cu	Zn	Mo (ug/g)	V
NaCl	10	28	166	75-90	0.349	7.59	14.8	4.22	2.69	0.419	36.8	16.44	1.96	17.2	38.9	<8.46	57.2
NaCl	10	28	167	90-105	0.429	8.45	16.1	4.48	2.88	0.446	39.4	16.98	2.15	19.7	41.3	<8.46	61.8
NaCl	10	28	168	105-120	0.370	8.11	15.3	4.88	3.28	0.453	38.3	16.59	2.02	18.1	41.3	<8.46	59.9
NaCl	10	28	169	120-135	0.345	8.11	15.9	6.58	4.09	0.476	36.5	17.57	2.13	19.7	45.9	<8.46	63.5
NaCl	10	28	170	135-140	0.368	7.71	16.3	6.87	4.49	0.491	32.7	18.37	2.18	21.1	48.3	<8.46	67.3
NaCl	10	38	220	0-15	0.405	8.07	13.5	7.33	4.67	0.499	38.0	16.99	2.31	41.9	49.1	22.58	85.1
NaCl	10	38	221	0-15	0.375	7.16	12.2	5.59	3.54	0.439	32.0	14.18	1.95	42.8	43.4	21.02	77.1
NaCl	10	38	222	0-15	0.353	7.27	12.0	4.60	3.09	0.490	31.3	16.74	2.00	45.5	48.6	22.26	82.0
NaCl	10	38	223	0-15	0.385	7.73	13.4	5.64	3.70	0.503	34.9	16.38	2.30	42.7	46.1	22.22	82.9
NaCl	10	38	224	0-15	0.383	7.31	12.9	7.48	3.73	0.570	32.9	17.51	2.21	39.9	46.8	19.42	80.1
NaCl	10	38	225	15-30	0.316	7.49	13.3	5.93	3.50	0.412	39.9	14.29	1.79	15.0	42.5	<8.46	48.2
NaCl	10	38	226	15-30	0.403	7.62	11.7	6.61	2.99	0.312	33.4	9.96	1.69	9.0	35.2	<8.46	34.0
NaCl	10	38	227	15-30	0.318	7.35	11.8	6.68	3.38	0.324	33.7	10.64	1.66	12.6	34.3	<8.46	39.5
NaCl	10	38	228	15-30	0.366	7.54	12.0	7.33	3.80	0.346	34.5	10.26	1.73	12.0	37.3	<8.46	38.5
NaCl	10	38	229	15-30	0.380	7.58	12.5	8.03	4.49	0.369	35.8	12.20	1.80	11.8	41.3	<8.46	42.3
NaCl	10	38	230	30-45	0.298	8.80	16.9	6.24	4.30	0.504	50.8	19.76	2.14	19.1	43.9	<8.46	62.0
NaCl	10	38	231	45-60	0.245	7.28	15.1	5.14	4.28	0.447	46.7	17.57	1.97	22.5	42.8	<8.46	64.6
NaCl	10	38	232	60-75	0.281	8.22	16.1	6.06	5.04	0.465	49.8	17.70	2.08	20.6	47.4	<8.46	63.8
NaCl	10	38	233	75-90	0.359	9.03	18.1	5.70	3.91	0.513	52.2	19.09	2.21	23.5	56.9	<8.46	69.8
NaCl	10	38	234	90-105	0.242	8.22	16.9	5.50	4.36	0.494	51.3	17.62	2.22	24.9	64.8	<8.46	71.4
NaCl	10	38	235	105-120	0.331	8.49	16.3	6.04	4.43	0.513	49.1	17.92	2.08	24.1	55.2	<8.46	66.2
NaCl	10	38	236	120-135	0.282	7.75	14.7	6.10	4.62	0.480	44.0	15.10	1.90	29.7	50.2	<8.46	65.9

Waste	Rate	Plot	FSN (TME-)	Depth (cm)	Cr	Ba	Ni	Sr	Li	Zr (ug/g)	Co	Cd	Pb
NaCl	10	28	166	75-90	30.1	383	17.4	90.7	19.52	107.6	14.3	<0.90	11.75
NaCl	10	28	167	90-105	26.8	353	20.0	95.8	20.89	107.0	16.8	<0.90	9.46
NaCl	10	28	168	105-120	18.3	405	<16.9	95.5	20.36	102.0	15.3	<0.90	12.15
NaCl	10	28	169	120-135	31.8	410	19.1	93.0	20.84	119.3	17.1	<0.90	13.96
NaCl	10	28	170	135-140	34.0	214	21.9	75.3	20.60	111.5	17.5	<0.90	10.10
NaCl	10	38	220	0-15	97.7	427	69.8	118.6	38.00	170.6	33.2	1.10	12.93
NaCl	10	38	221	0-15	74.6	384	56.7	105.3	37.28	162.2	32.8	1.16	10.98
NaCl	10	38	222	0-15	90.1	298	60.1	96.6	37.81	159.3	33.2	1.12	15.44
NaCl	10	38	223	0-15	82.6	375	59.6	108.4	37.74	173.3	33.7	1.50	11.37
NaCl	10	38	224	0-15	88.8	289	58.3	104.3	34.58	164.4	30.9	1.06	13.83
NaCl	10	38	225	15-30	64.0	444	30.9	84.1	17.74	94.8	<13.5	1.44	10.34
NaCl	10	38	226	15-30	54.1	498	17.0	84.7	13.33	90.5	<13.5	1.19	8.59
NaCl	10	38	227	15-30	50.6	464	19.8	79.9	16.23	99.6	<13.5	<0.90	6.85
NaCl	10	38	228	15-30	48.3	476	18.5	84.5	15.90	99.4	<13.5	<0.90	6.14
NaCl	10	38	229	15-30	53.8	410	21.7	83.5	16.12	106.6	14.5	<0.90	5.52
NaCl	10	38	230	30-45	82.1	542	38.6	101.7	20.48	119.2	14.7	<0.90	8.52
NaCl	10	38	231	45-60	57.6	422	30.9	84.2	23.71	124.9	15.4	1.14	11.09
NaCl	10	38	232	60-75	66.6	497	35.8	95.9	23.13	121.9	15.6	<0.90	10.37
NaCl	10	38	233	75-90	74.2	489	39.8	100.3	24.42	144.0	17.4	<0.90	9.00
NaCl	10	38	234	90-105	68.7	495	36.2	93.7	27.20	133.0	18.0	<0.90	7.21
NaCl	10	38	235	105-120	73.1	529	37.3	98.4	24.79	130.6	18.1	<0.90	8.67
NaCl	10	38	236	120-135	60.2	464	36.8	90.3	27.26	133.2	20.3	1.44	11.55