

DRILLING WASTE LANDSPREADING FIELD TRIAL

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

Report prepared by

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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 currently occurring in the Cold Lake area.

During 1990 five site visits were made to complete various tasks. The plots were harvested on June 18 and 19 and, again, on August 14 and 15 at which time soil sampling was also completed. Plant tissue was collected for analytical purposes on June 18.

Observations, relative to the brome grass growth on the various plot treatments, were made throughout the growing season. The freshwater gel amended plots had the best growth overall, however, the KCl and NaCl plot yields were only slightly below those of the gel plots. There were apparent yield differences between the different treatments for each of the waste types, however none of the differences 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.

Following waste application, only treatments FW 4 and FW 5, might present a very slight limitation to plant growth as a result of pH level. 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 and 1990 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 1990 sampling program indicated that only slight limitations to plant growth might occur in the KCl 5 and NaCl 10 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 1990 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 in 1990, indicated that a significant amount was leached downward between the fall of 1989 and 1990.

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 and boron in the KCl amended plots in comparison with the tissue from the control plots.

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

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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 1990).

The Alberta Research Council is currently conducting research into sampling and characterization strategies to characterize major drilling waste types on a province wide basis (Macyk et al. 1989b). Greenhouse work is being conducted to assess the impact of these wastes on soils and plants. Field studies designed to validate and calibrate the greenhouse results would be 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 1990.

2. OBJECTIVE

The objective of the experiment is to identify the impact of different loading rates of KCl, NaCl, and freshwater gel drilling wastes landspread on Luvisolic soils commonly occurring in the Cold Lake area. Emphasis will be placed on determining maximum tolerable loading rates. The project is expected to continue for a minimum of three years to generate meaningful data for the development of recommendations.

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 on May 15, 1990 at a rate of 130 kg/ha of 35-15-0.

3.2 PLANT TISSUE COLLECTION

Tissue from the brome grass was collected on June 18, 1990. Approximately 30 percent of the crop was headed at the time of sampling. It appeared again in 1990 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 18 and 19, 1989. A second harvest was completed August 14 and 15 to ensure that the plots are relatively residue free in the spring of 1990.

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

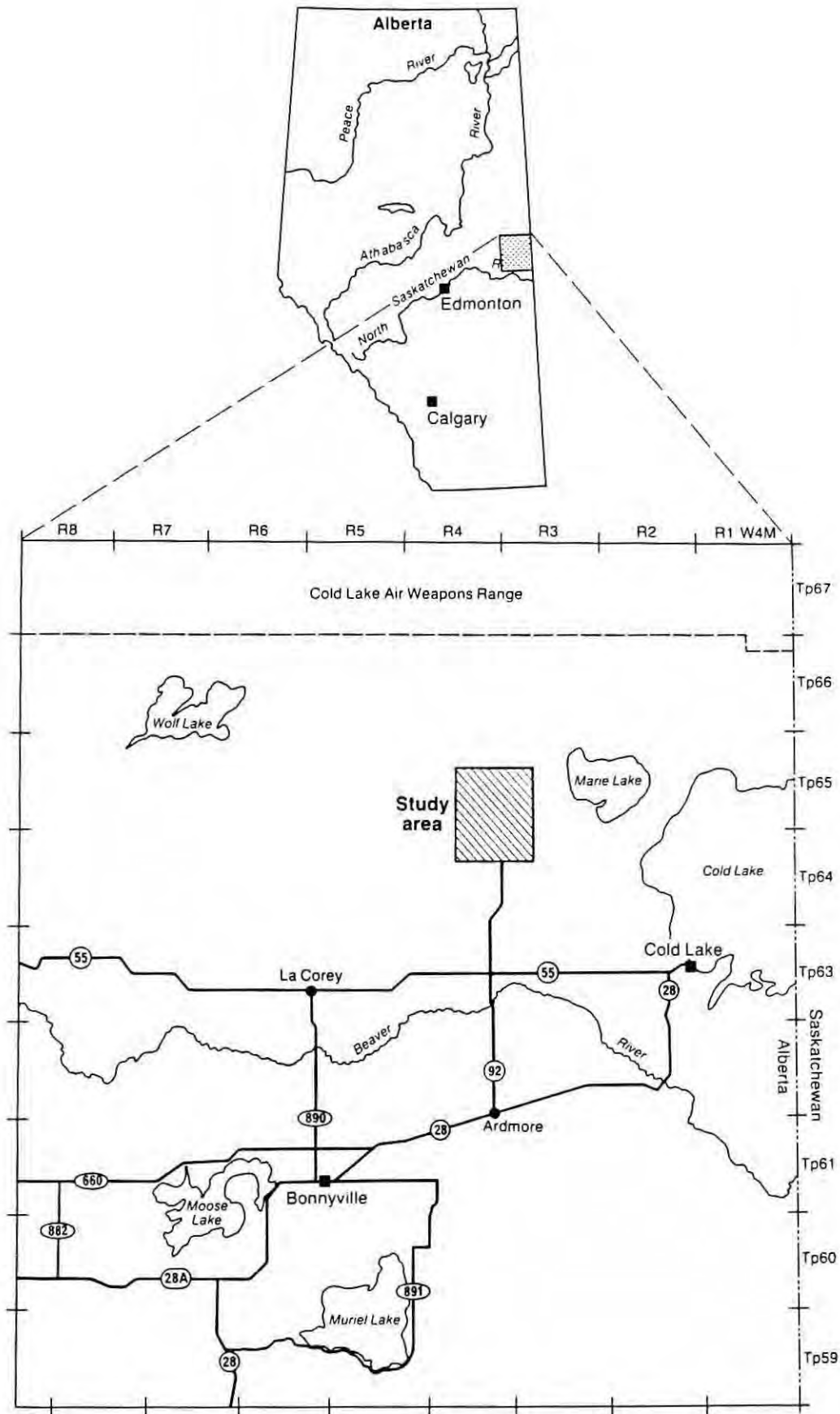


Figure 1. Location of drilling waste landspreading study area.

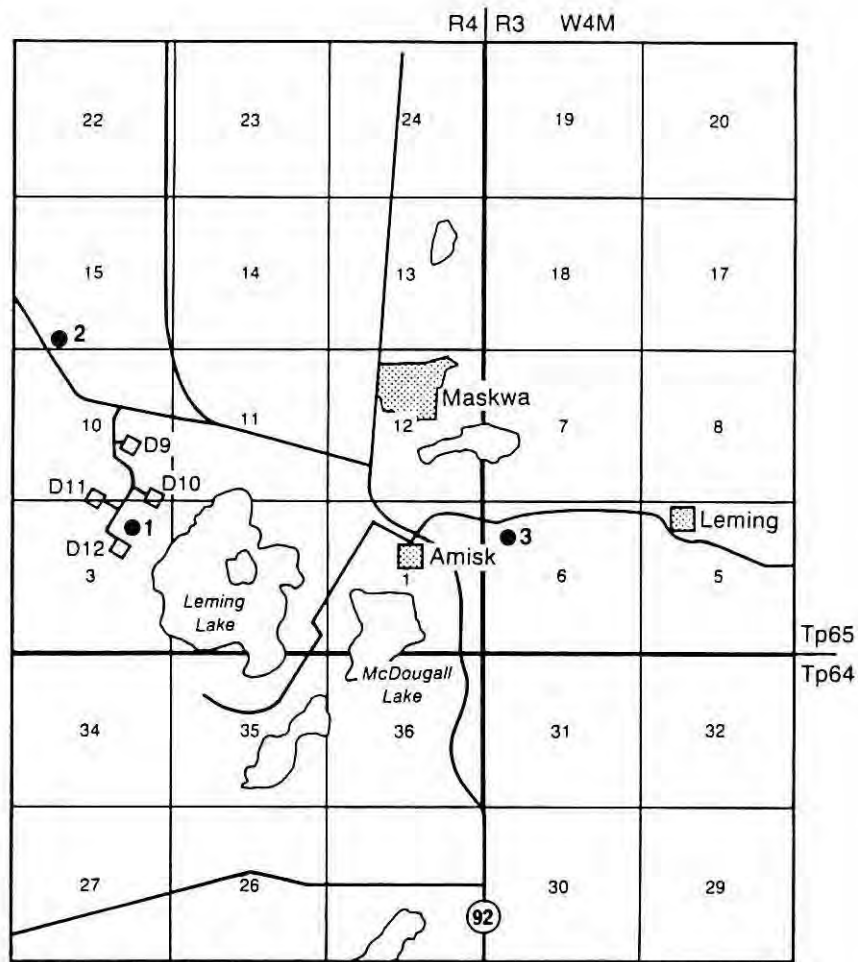


Figure 2. Location of plot area and waste source sites.

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

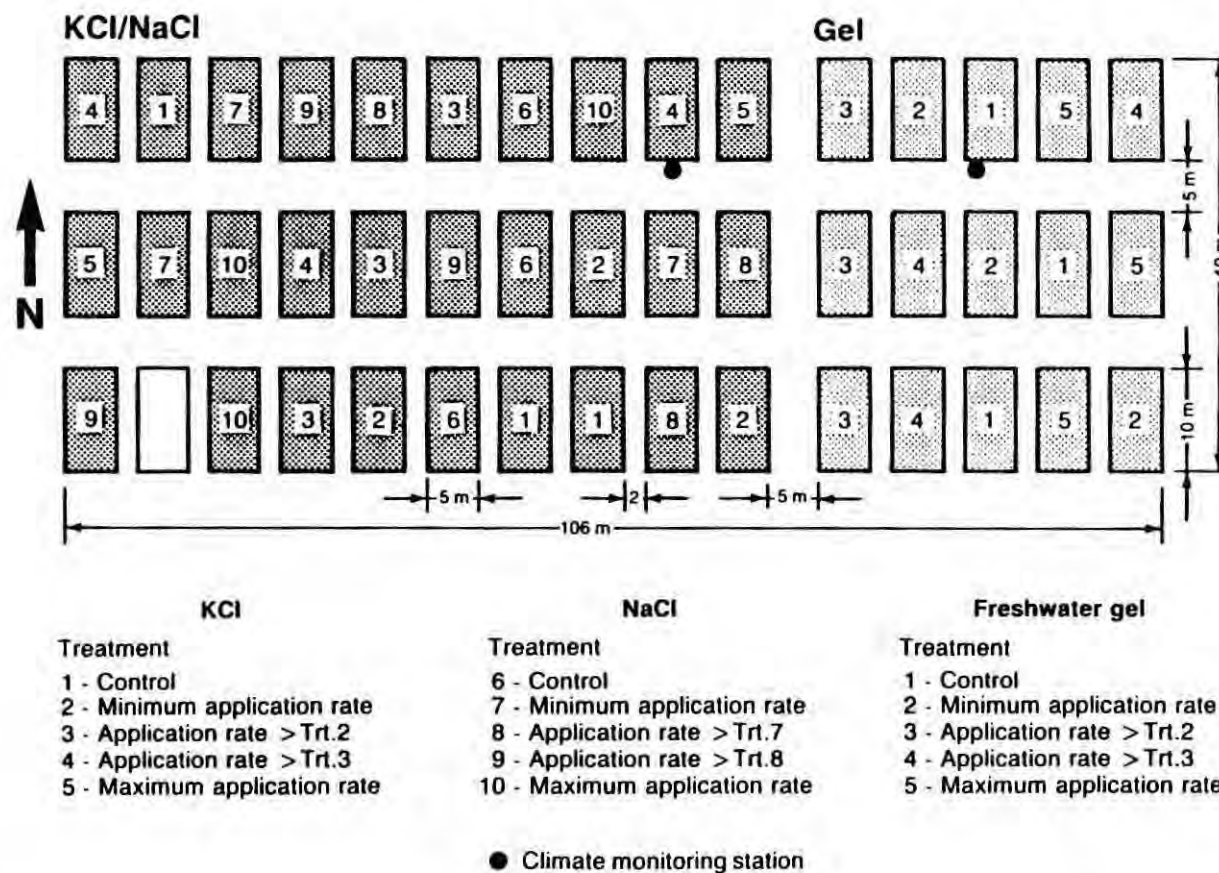


Figure 3. Schematic diagram of experimental design.

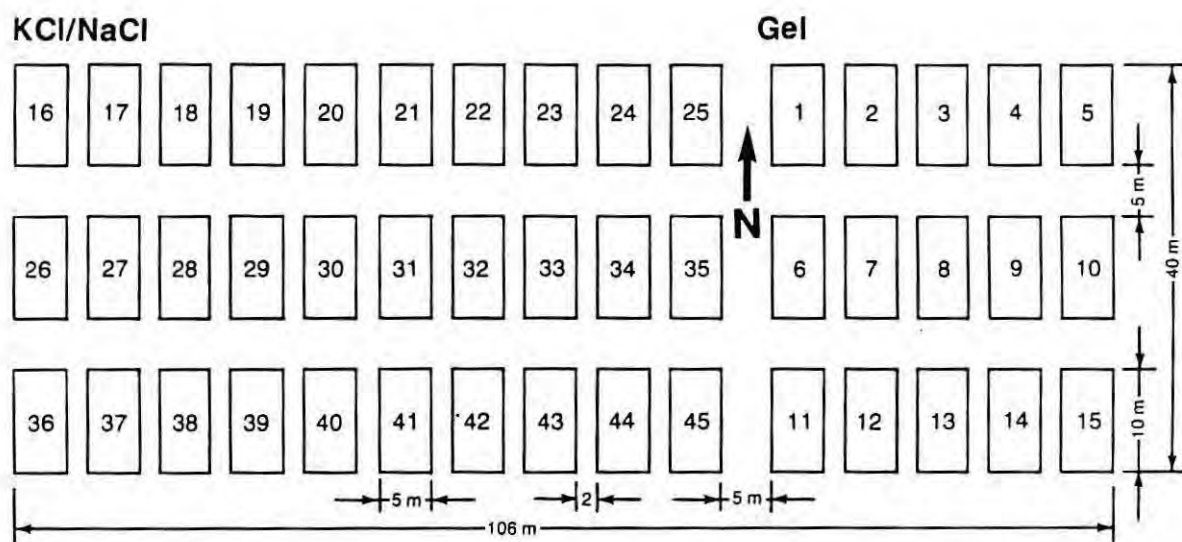


Figure 4. Key to plot layout for sample collection and data reporting.

Plate 1. Harvesting by use of a lawn mower.

areas within each plot and the use of a mower set at a given height ensured, to the greatest extent possible, uniformity in harvest.

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.

3.4 SOIL SAMPLING

Soil sampling was completed August 14 and 15, 1990. 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 (Plates 2 and 3). 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 1990. 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. In the latter part of the summer some of the equipment was dismantled and removed because of the problems associated with obtaining accurate soil moisture data in the KCl and NaCl plots.

3.6 METHODS OF ANALYSIS

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

Plate 2. Sampling with a core truck unit.

Plate 3. Zone of waste incorporation readily evident in core sample.

Table 1. Soil samples collected from the individual plots.

Plot No.	Treatment	Sample No.	Depth (cm)
1	FWG 3	TME 1	0 to 15
1		TME 2	15 to 30
1		TME 3	30 to 45
1		TME 3a	45 to 60
1		TME 3b	60 to 75
2	FWG 2	TME 4	0 to 15
3	FWG 1	TME 5	0 to 15
4	FWG 5	TME 6 to TME 10	0 to 15
5	FWG 4	TME 11	0 to 15
5		TME 12	15 to 30
6	FWG 3	TME 13	0 to 15
7	FWG 4	TME 14	0 to 15
7		TME 15	15 to 30
7		TME 16	30 to 45
7		TME 17	45 to 60
7		TME 17a	60 to 75
7		TME 18	75 to 90
7		TME 18a	90 to 110
8	FWG 2	TME 19	0 to 15
8		TME 20	15 to 30
9	FWG 1	TME 21	0 to 15
10	FWG 5	TME 22 to TME 26	0 to 15
10		TME 27 to TME 31	15 to 30
10		TME 32	30 to 45
10		TME 33	45 to 60
10		TME 33a	60 to 75
10		TME 34	75 to 90
10		TME 34a	90 to 105
10		TME 34b	105 to 115
11	FWG 3	TME 35 to TME 39	0 to 15
12	FWG 4	TME 40	0 to 15

continued . . .

Table 1. Continued.

Plot No.	Treatment	Sample No.	Depth (cm)
13	FWG 1	TME 41	0 to 15
13		TME 42	15 to 30
13		TME 43	30 to 45
13		TME 44	45 to 60
13		TME 44a	60 to 75
13		TME 44b	75 to 90
13		TME 44c	90 to 105
14	FWG 5	TME 45	0 to 15
14		TME 46	15 to 30
14		TME 47	30 to 45
14		TME 48	45 to 60
14		TME 48a	60 to 75
14		TME 48b	75 to 90
14		TME 48c	90 to 105
15	FWG 2	TME 49	0 to 15
16	KC1 4	TME 50 to TME 54	0 to 15
16		TME 55 to TME 59	15 to 30
16		TME 60	30 to 45
16		TME 61	45 to 60
16		TME 61a	60 to 75
16		TME 62	75 to 90
16		TME 62a	90 to 110
17	KC1 1	TME 63	0 to 15
18	NaCl 7	TME 64	0 to 15
19	NaCl 9	TME 65 to TME 69	0 to 15
19		TME 70 to TME 74	15 to 30
19		TME 75	30 to 45
19		TME 76	45 to 60
19		TME 76a	60 to 75
19		TME 77	75 to 90
19		TME 77a	90 to 110
20	NaCl 8	TME 78	0 to 15
21	KC1 3	TME 79 to TME 83	0 to 15
22	NaCl 6	TME 84	0 to 15
22		TME 85	15 to 30

continued . . .

Table 1. Continued.

Plot No.	Treatment	Sample No.	Depth (cm)
22	NaCl 6	TME 86	30 to 45
22		TME 87	45 to 60
22		TME 87a	60 to 75
22		TME 87b	75 to 90
22		TME 87c	90 to 105
22		TME 87d	105 to 120
22		TME 87e	120 to 130
23	NaCl 10	TME 88 to TME 92	0 to 15
23		TME 93 to TME 97	15 to 30
23		TME 98	30 to 45
23		TME 99	45 to 60
23		TME 99a	60 to 75
23		TME 99b	75 to 90
23		TME 99c	90 to 105
23		TME 99d	105 to 120
23		TME 99e	120 to 140
24	KCl 4	TME 100	0 to 15
25	KCl 5	TME 101 to TME 105	0 to 15
25		TME 106 to TME 110	15 to 30
25		TME 111	30 to 45
25		TME 112	45 to 60
25		TME 112a	60 to 75
25		TME 113	75 to 90
25		TME 113a	90 to 105
25		TME 113b	105 to 120
25		TME 113c	120 to 140
26	KCl 5	TME 114	0 to 15
26		TME 115	15 to 30
27	NaCl 7	TME 116 to TME 120	0 to 15
27		TME 121	15 to 30
28	NaCl 10	TME 122 to TME 126	0 to 15
28		TME 127 to TME 131	15 to 30
28		TME 131a	30 to 45
28		TME 131b	45 to 60
28		TME 131c	60 to 75
28		TME 131d	75 to 90
28		TME 131e	90 to 105
28		TME 131f	105 to 120

continued . . .

Table 1. Continued.

Plot No.	Treatment	Sample No.	Depth (cm)
28	NaCl 10	TME 131g	120 to 135
28		TME 131h	135 to 150
29	KCl 4	TME 132	0 to 15
29		TME 133	15 to 30
29		TME 134	30 to 45
29		TME 135	45 to 60
29		TME 135a	60 to 75
29		TME 136	75 to 90
29		TME 136a	90 to 105
29		TME 136b	105 to 120
29		TME 136c	120 to 135
30	KCl 3	TME 137	0 to 15
31	NaCl 9	TME 138 to TME 142	0 to 15
31		TME 143 to TME 147	15 to 30
31		TME 148	30 to 45
31		TME 149	45 to 60
31		TME 149a	60 to 75
32	NaCl 6	TME 150	0 to 15
33	KCl 2	TME 151	0 to 15
34	NaCl 7	TME 152 to TME 156	0 to 15
34		TME 157	15 to 30
35	NaCl 8	TME 158 to TME 162	0 to 15
35		TME 163	15 to 30
35		TME 164	30 to 45
35		TME 165	45 to 60
35		TME 165a	60 to 75
35		TME 166	75 to 90
35		TME 166a	90 to 105
36	NaCl 9	TME 167 to TME 171	0 to 15
36		TME 172	15 to 30
37	KCl	TME 173	0 to 15
38	NaCl 10	TME 174 to TME 178	0 to 15
38		TME 179 to TME 183	15 to 30
38		TME 184	30 to 45

continued . . .

Table 1. Concluded.

Plot No.	Treatment	Sample No.	Depth (cm)
38	NaCl 10	TME 185	45 to 60
38		TME 185a	60 to 75
38		TME 186	75 to 90
38		TME 186a	90 to 105
38		TME 186b	105 to 120
38		TME 186c	120 to 135
39	KCl 3	TME 187	0 to 15
40	KCl 2	TME 188	0 to 15
41	NaCl 6	TME 189	0 to 15
42	KCl 1	TME 190 to TME 194	0 to 15
43	KCl 1	TME 195	0 to 15
43		TME 195a	15 to 30
43		TME 195b	30 to 45
43		TME 195c	45 to 60
43		TME 195d	60 to 75
43		TME 195e	75 to 90
43		TME 195f	90 to 105
43		TME 195g	105 to 120
43		TME 195h	120 to 135
44	NaCl 8	TME 196 to TME 200	0 to 15
44		TME 201 to TME 205	15 to 30
44		TME 206	30 to 45
44		TME 207	45 to 60
44		TME 207a	60 to 75
44		TME 207b	75 to 90
44		TME 207c	90 to 105
44		TME 207d	105 to 120
44		TME 207e	120 to 135
44		TME 207f	135 to 150
45	KCl 2	TME 208 to TME 212	0 to 15
45		TME 213 to TME 217	15 to 30
45		TME 218	30 to 45
45		TME 219	45 to 60
45		TME 220	60 to 75
45		TME 221	75 to 90
45		TME 222	90 to 105
45		TME 223	105 to 120
45		TME 224	120 to 135

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 34000 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.

DTPA- NH_4HCO_3 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 HNO_3 , 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 H_3BO_3 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 HNO_3 - HClO_4 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 1990. Data pertinent to air temperature, relative humidity, solar radiation, wind direction, wind speed, and rainfall intensity are available in hard copy form for the period January 1 to October 30, 1990. During this period there were some gaps in the data due to equipment malfunction. October 30 represents the date when the last trip was made to the field to collect the data packs from the continuous monitoring equipment.

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 Air Temperature

The more important factors associated with air temperature relate to extremes including minimum and maximum values and their duration. Frost-free period is one parameter that can be obtained from these data. For example, on June 14 the mean air temperature was -0.3°C from 2:00 to 3:00 a.m., -0.8°C from 3:00 to 4:00 a.m., and -0.9°C from 4:00 to 5:00 a.m. On September 9 mean air temperature was below 0°C from 4:00 to 7:00 a.m. Using these data one calculates a frost-free period of 87 days.

The maximum mean hourly air temperature recorded during the measurement period was 32.5°C on August 6.

4.2.2 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 206 mm occurred during the period May 15 to October 30, 1990. More specifically:

- May 15 to May 31 - 2 mm
- June 1 to June 30 - 33 mm
- July 1 to July 31 - 96 mm
- August 1 to August 31 - 36 mm
- September 1 to September 30 - 23 mm
- October 1 to October 30 - 16 mm

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 18 and 19, 1990 to obtain yield values for the different treatments. The freshwater gel treated plots had the best growth overall with the FW 2, FW 3, and FW 4 treatments producing higher mean yields than the FW 1 (control)

treatment. Plates 4 and 5 illustrate the growth achieved in a FW 2 and a FW 5 treatment, respectively.

The 1989 data indicated that the freshwater gel plot yields were at least two fold higher than the KCl and NaCl plot yields (Macyk et al. 1990). In 1990 the yields for the KCl and NaCl amended plots were only slightly below the freshwater gel yields. The change in the yield relationship could be related to the fact that the limitations to growth due to chemical properties of the upper 30 cm of the soil profile have been reduced during the 1990 growing seasons. This topic will be addressed in more detail in the section of the report dealing with the analytical data pertinent to the plot treatments.

For the KCl amended plots the control (KCl 1) treatments had higher mean yields than the remaining treatments. For the NaCl amended plots the mean yields for the NaCl 8 and NaCl 9 treatments exceeded the mean yields for the other treatments including the control plots. Plates 6 and 7 illustrate the growth achieved in a KCl 3 and a KCl 5 treatment, respectively. Plates 8 and 9 illustrate the growth achieved in a NaCl 8 and NaCl 10 treatment, respectively.

The dry weights for the brome grass harvested from each of the plots are presented in Table 3. These data allow for some comparison between the treatments and the replicates within the treatments. Table 4 includes a comparison of mean yield values for the different waste amended plots. There were apparent differences but no significant differences in yield between the treatments for each of the waste types. Figure 5 illustrates the mean yield values obtained.

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.

Plate 4. Grass growth in a FW 2 treatment.

Plate 5. Grass growth in a FW 5 treatment.

Plate 6. Grass growth in a KCl 3 treatment.

Plate 7. Grass growth in a KCl 5 treatment.

Plate 8. Grass growth in a NaCl 8 treatment.

Plate 9. Grass growth in a NaCl 10 treatment.

Table 3. Yield (g) for the Esso Field Trial Plots in June, 1990.

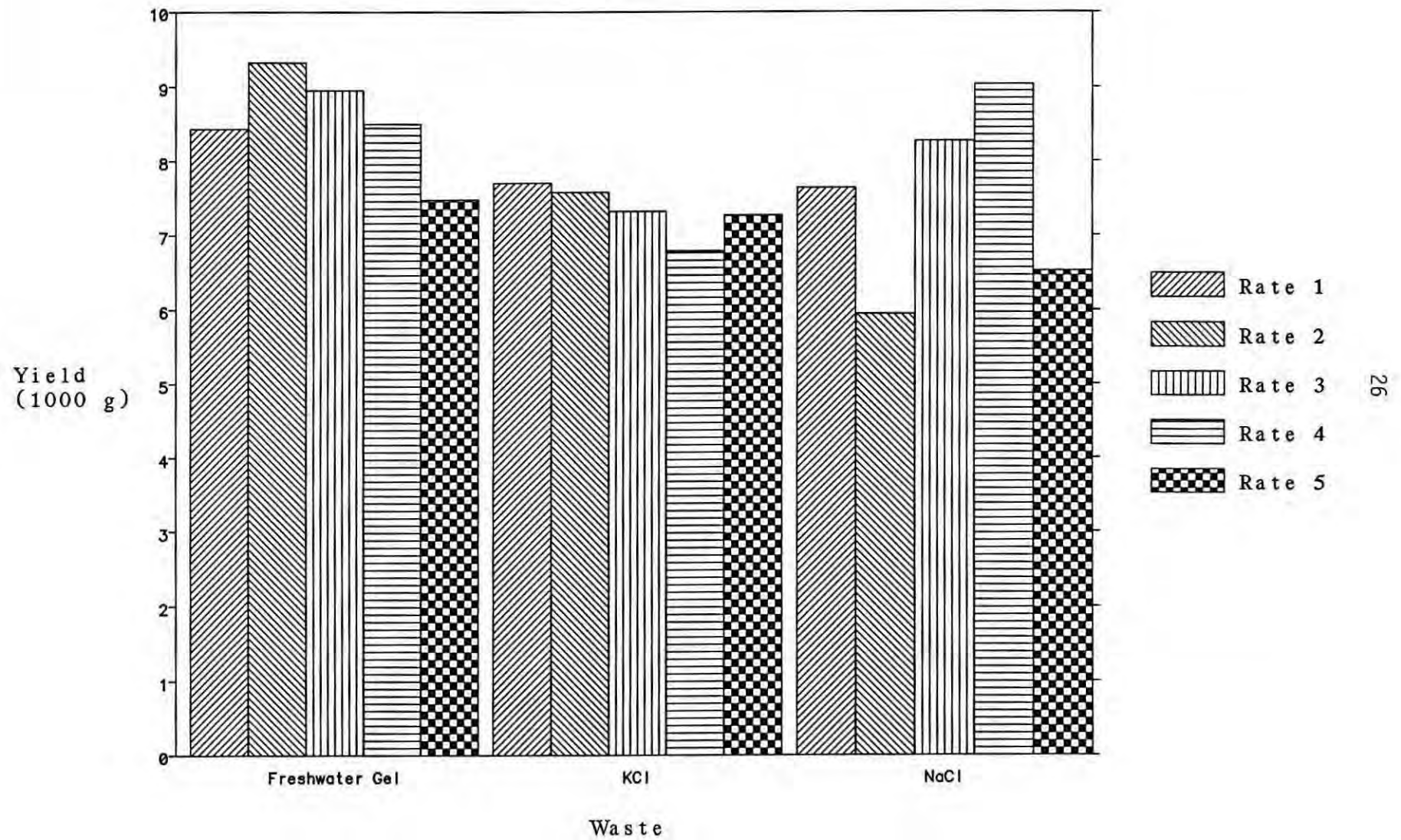
Waste	Rate	TME (FSN)	Dry Wt. (g)
Freshwater	1	3	8933
Freshwater	1	9	7756
Freshwater	1	13	8634
Freshwater	2	2	12186
Freshwater	2	8	8187
Freshwater	2	15	7616
Freshwater	3	1	12085
Freshwater	3	6	8856
Freshwater	3	11	5926
Freshwater	4	4	7614
Freshwater	4	7	8007
Freshwater	4	12	9897
Freshwater	5	5	6794
Freshwater	5	10	7129
Freshwater	5	14	8519
KCl	1	17	5846
KCl	1	42	9042
KCl	1	43	8252
KCl	2	33	5906
KCl	2	40	8933
KCl	2	45	7914
KCl	3	21	7101
KCl	3	30	8875
KCl	3	39	5988
KCl	4	16	5847
KCl	4	24	7031
KCl	4	29	7505
KCl	5	25	7951
KCl	5	26	6584
NaCl	6	32	6971
NaCl	6	41	7137
NaCl	6	18	8814
NaCl	7	27	6571
NaCl	7	34	5853
NaCl	7	20	5421
NaCl	8	35	7640
NaCl	8	44	9654
NaCl	8	19	7540
NaCl	9	31	10499
NaCl	9	36	8242
NaCl	9	23	8385
NaCl	10	28	6659
NaCl	10	38	5932
NaCl	10	37	7004

Table 4. Comparison of the Mean Yield Values for the Esso Field Trial Plots in 1990.

Waste	Rate	N	Yield (g)
Freshwater	1	3	8440a*
Freshwater	2	3	9330a
Freshwater	3	3	8960a
Freshwater	4	3	8510a
Freshwater	5	3	7480a
KCl	1	3	7710a
KCl	2	3	7580a
KCl	3	3	7320a
KCl	4	3	6790a
KCl	5	2	7270a
NaCl	6	3	7640a
NaCl	7	3	5950a
NaCl	8	3	8280a
NaCl	9	3	9040a
NaCl	10	3	6530a

* 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 1000 g) For the Waste Treatments



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 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 I. Table 5 provides mean values for $\text{pH}(\text{CaCl}_2)$ and CaCO_3 equivalent for the individual depths within the various treatments for 1988 to 1990 inclusive.

The Alberta Soils Advisory Committee (1977) suggests that no limitations to plant growth occur at pH levels in the surface soil of 6.5 to 7.5, 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 FW 5 treatments had a mean pH value of 8 which could result in slight limitations to plant growth. The mean value in 1990 was 7.6 which is just 0.1 units outside the "good" rating.

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

Waste	Rate	Depth cm	pH				CaCO ₃			
			Pre	Post	1989	1990	Pre	Post	1989	1990
Freshwater	1	0-15	6.5	7.0	7.1	7.2	0.44	0.39	0.72	0.48
	1	15-30	-	-	7.3	7.5	-	-	2.31	3.32
	1	30-45	-	-	7.6	7.6	-	-	4.30	5.27
	1	45-60	-	-	7.6	7.7	-	-	4.50	5.19
	1	60-75	-	-	-	7.7	-	-	-	6.07
	1	75-90	-	-	-	7.7	-	-	-	5.27
	1	90-105	-	-	-	7.6	-	-	-	4.91
	2	0-15	6.6	7.3	7.3	7.2	1.40	1.24	1.29	1.25
	2	15-30	-	7.3	-	6.9	-	0.40	-	0.96
	3	0-15	6.7	7.4	7.3	7.2	0.62	0.82	0.94	0.64
	3	15-30	5.0	5.8	6.9	5.4	-	0.02	0.26	0.20
	3	30-45	-	-	-	5.4	-	-	-	0.16
	3	45-60	-	-	-	4.6	-	-	-	0.02
	3	60-75	-	-	-	4.4	-	-	-	0.02
	4	0-15	6.9	7.7	7.6	7.6	0.49	0.97	1.07	0.85
	4	15-30	7.5	7.0	7.5	7.4	5.89	0.92	1.57	1.50
	4	30-45	7.7	7.8	7.8	7.9	4.81	5.69	6.84	7.15
	4	45-60	7.7	7.8	7.9	7.9	4.81	-	4.50	4.93
	4	60-75	-	-	-	7.9	-	-	-	5.02
	4	75-90	-	-	-	7.9	-	-	-	0.12
	4	90-105	-	-	-	7.9	-	-	-	5.50
	5	0-15	7.0	8.0	7.9	7.6	0.88	1.69	1.90	2.74
	5	15-30	7.5	7.5	7.4	7.5	4.38	1.94	1.63	1.85
	5	30-45	7.5	7.5	7.6	7.7	4.86	3.45	2.77	4.50
	5	45-60	7.5	7.5	7.7	7.7	4.86	3.45	4.33	5.05
	5	60-75	-	-	-	7.7	-	-	-	5.54
	5	75-90	-	-	-	7.7	-	-	-	3.94
	5	90-105	-	-	-	7.7	-	-	-	5.68
	5	105-120	-	-	-	7.7	-	-	-	4.89

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

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

Waste	Rate	Depth cm	pH		pH		CaCO ₃		CaCO ₃	
			Pre	Post	1989	1990	Pre	Post	1989	1990
KCl	1	0-15	7.2	7.3	7.4	7.3	1.73	1.25	2.02	1.98
	1	15-30	-	-	-	7.4	-	-	-	0.91
	1	30-45	-	-	-	7.6	-	-	-	3.82
	1	45-60	-	-	-	7.8	-	-	-	4.97
	1	60-75	-	-	-	7.8	-	-	-	6.10
	1	75-90	-	-	-	7.8	-	-	-	5.50
	1	90-105	-	-	-	7.8	-	-	-	5.42
	1	105-120	-	-	-	7.7	-	-	-	5.10
	1	120-135	-	-	-	7.7	-	-	-	4.68
	2	0-15	7.2	7.3	7.4	7.2	1.73	1.25	2.02	1.52
	2	15-30	-	-	-	6.5	-	-	-	2.53
	2	30-45	-	-	-	5.3	-	-	-	-
	2	45-60	-	-	-	5.4	-	-	-	-
	2	60-75	-	-	-	5.4	-	-	-	-
	2	75-90	-	-	-	5.4	-	-	-	-
	2	90-105	-	-	-	5.3	-	-	-	-
	2	105-120	-	-	-	5.8	-	-	-	-
	2	120-135	-	-	-	5.8	-	-	-	-
	3	0-15	6.7	7.2	7.3	7.3	0.66	0.47	0.87	1.11
	4	0-15	6.8	7.4	7.4	7.4	0.19	1.09	0.64	0.68
	4	15-30	6.5	7.4	6.3	7.3	1.64	1.36	0.49	0.73
	4	30-45	7.1	6.9	6.1	7.4	0.46	0.71	1.86	0.22
	4	45-60	7.1	6.9	5.9	7.1	0.46	0.35	3.41	0.39
	4	60-75	6.5	5.9	5.4	6.7	0.73	-	-	0.04
	4	75-90	6.5	5.9	5.4	6.6	0.73	-	-	0.07
	4	90-105	-	-	-	7.1	-	-	-	0.50
	4	105-120	-	-	-	6.4	-	-	-	0.08
	4	120-135	-	-	-	7.4	-	-	-	2.84
	5	0-15	6.7	7.4	7.4	7.5	0.53	0.83	1.20	0.42
	5	15-30	6.3	6.0	-	6.9	0.22	-	-	0.55
	5	30-45	5.2	4.9	-	4.6	-	-	-	0.18
	5	45-60	5.2	-	-	4.6	-	-	-	0.04
	5	60-75	5.4	-	-	4.6	0.04	-	-	-
	5	75-90	5.4	-	-	4.8	-	-	-	-
	5	90-105	-	-	-	4.9	-	-	-	0.08
	5	105-120	-	-	-	5.0	-	-	-	-
	5	120-135	-	-	-	5.2	-	-	-	0.02

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

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

Waste	Rate	Depth cm	pH		1989		1990		CaCO3		1989	1990
			Pre	Post					Pre	Post		
NaCl	6	0-15	6.9	6.9	7.1	7.0			2.04	0.57	1.10	2.00
	6	15-30	-	-	7.3	7.5			-	-	2.49	3.76
	6	30-45	-	-	7.9	7.8			-	-	4.77	4.95
	6	45-60	-	-	7.9	7.8			-	-	4.69	6.24
	6	60-75	-	-	-	7.8			-	-	-	5.39
	6	75-90	-	-	-	7.8			-	-	-	4.79
	6	90-105	-	-	-	7.8			-	-	-	4.75
	6	105-120	-	-	-	7.8			-	-	-	5.15
	6	120-135	-	-	-	7.8			-	-	-	4.71
	7	0-15	6.7	7.2	7.1	7.1			1.0	0.84	0.76	0.65
	7	15-30	-	-	7.2	7.2			-	-	2.61	0.74
	8	0-15	6.6	7.6	7.4	7.2			0.37	1.27	1.00	0.92
	8	15-30	6.6	7.1	6.9	7.5			0.36	0.64	0.85	4.21
	8	30-45	6.6	6.6	7.1	7.7			4.28	3.78	5.29	4.38
	8	45-60	6.6	6.6	7.2	7.7			4.28	4.73	2.55	3.04
	8	60-75	5.5	5.4	6.3	7.8			-	-	-	3.70
	8	75-90	5.5	5.4	6.3	7.8			-	-	-	3.54
	8	90-105	-	-	-	7.8			-	-	-	3.12
	8	105-120	-	-	-	7.6			-	-	-	5.72
	8	120-135	-	-	-	7.7			-	-	-	5.36
	8	135-150	-	-	-	7.7			-	-	-	12.47
	9	0-15	7.0	7.3	7.4	7.2			0.78	0.69	0.74	0.39
	9	15-30	6.4	6.2	6.9	6.8			0.11	0.21	1.19	1.10
	9	30-45	6.2	6.2	6.2	6.3			0.16	0.16	0.68	2.79
	9	45-60	6.2	6.1	6.3	6.3			0.16	0.08	2.18	3.03
	9	60-75	6.9	6.9	-	6.5			0.16	0.08	-	4.25
	9	75-90	6.9	6.9	-	7.6			0.16	0.08	-	4.13
	9	90-105	-	-	-	7.6			-	-	-	3.15
	10	0-15	6.6	7.6	7.4	7.4			0.37	1.27	1.00	0.93
	10	15-30	6.6	7.1	6.9	7.2			0.36	0.64	0.85	1.57
	10	30-45	6.6	6.6	7.1	6.9			4.28	3.78	5.29	5.01
	10	45-60	6.6	6.6	7.2	6.5			4.28	4.73	2.55	1.24
	10	60-75	5.5	5.4	7.3	6.4			-	-	-	4.93
	10	75-90	5.5	5.4	7.3	6.4			-	-	-	5.37
	10	90-105	-	-	-	6.6			-	-	-	5.25
	10	105-120	-	-	-	7.1			-	-	-	5.33
	10	120-135	-	-	-	7.6			-	-	-	4.29
	10	135-150	-	-	-	7.5			-	-	-	4.63

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

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. These values indicate that the KCl waste additions did not result in pH values that could be considered limiting 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 1988 and 7.4 in the fall of 1989 and 1990.

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 FW 5 treatment had a mean value of 2.74% in 1990. These values indicate 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. Similar values were also 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 II. 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

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

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

Pre = Sampled prior to waste application
 Post = Sampled September 1988
 1989 = Sampled August 1989
 1990 = Sampled August 1990

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	Pre	Post	1989	1990	Pre	Post	1989	1990
KCI	1	0-15	0.51	0.86	0.72	0.42	19.1	22.7	13.1	13.4	0.3	0.5	0.3	0.3
	1	15-30	-	-	-	0.42	-	-	-	5.8	-	-	-	0.3
	1	30-45	-	-	-	0.32	-	-	-	6.2	-	-	-	0.4
	1	45-60	-	-	-	0.25	-	-	-	5.1	-	-	-	0.4
	1	60-75	-	-	-	0.26	-	-	-	4.7	-	-	-	0.4
	1	75-90	-	-	-	0.25	-	-	-	5.4	-	-	-	0.4
	1	90-105	-	-	-	0.25	-	-	-	6.9	-	-	-	0.4
	1	105-120	-	-	-	0.24	-	-	-	6.6	-	-	-	0.4
	1	120-135	-	-	-	0.24	-	-	-	6.2	-	-	-	0.4
	2	0-15	0.54	1.20	1.09	0.51	20.6	396.0	118.8	49.5	0.3	0.8	0.7	0.4
	2	15-30	-	-	0.88	0.61	-	-	157.6	102.4	-	-	0.5	0.5
	2	30-45	-	-	0.25	0.32	-	-	51.4	87.8	-	-	0.4	0.4
	2	45-60	-	-	-	0.24	-	-	-	57.9	-	-	-	0.5
	2	60-75	-	-	-	0.16	-	-	-	36.8	-	-	-	0.5
	2	75-90	-	-	-	0.12	-	-	-	18.2	-	-	-	1.1
	2	90-105	-	-	-	0.10	-	-	-	17.8	-	-	-	0.6
	2	105-120	-	-	-	1.70	-	-	-	53.0	-	-	-	0.5
	2	120-135	-	-	-	0.09	-	-	-	5.5	-	-	-	0.5
	3	0-15	0.52	2.60	2.02	0.68	20.3	740.0	403.0	62.5	0.3	2.0	1.5	0.7
	4	0-15	0.61	2.87	2.75	0.99	22.7	1070.0	863.0	147.4	0.3	1.8	1.6	0.8
	4	15-30	0.31	0.47	1.09	0.71	11.5	69.1	386.0	150.5	0.4	0.4	0.9	0.6
	4	30-45	0.41	0.80	0.72	0.63	7.9	281.1	221.0	158.7	0.3	0.5	0.5	0.4
	4	45-60	0.41	0.54	0.72	0.37	7.9	52.5	43.2	74.8	0.3	0.3	0.5	0.5
	4	60-75	-	-	-	0.24	-	-	-	43.0	-	-	-	0.5
	4	75-90	0.23	0.13	0.09	0.26	6.0	17.9	10.2	50.5	0.5	0.6	1.1	0.6
	4	90-105	-	-	-	0.26	-	-	-	56.3	-	-	-	0.5
	5	0-15	0.47	3.54	1.59	2.68	18.2	3135.0	353.0	1214.0	0.3	1.9	1.1	1.3
	5	15-30	0.55	2.51	-	1.51	17.6	889.0	-	630.0	0.3	0.8	-	0.9
	5	30-45	0.19	1.65	-	0.49	6.7	555.0	-	146.5	0.5	0.6	-	0.5
	5	45-60	0.19	-	-	0.39	-	-	-	115.7	0.5	-	-	0.4
	5	60-75	-	-	-	0.21	-	-	-	56.8	-	-	-	0.4
	5	75-90	0.10	-	-	0.20	-	-	-	45.9	0.5	-	-	0.5
	5	90-105	-	-	-	0.14	-	-	-	29.5	-	-	-	0.5
	5	105-120	-	-	-	0.11	-	-	-	19.2	-	-	-	0.6
	5	120-135	-	-	-	0.08	-	-	-	12.3	-	-	-	0.5

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

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

Waste	Rate	Depth cm	EC				CI				SAR			
			Pre	Post	1989	1990	Pre	Post	1989	1990	Pre	Post	1989	1990
NaCl	6	0-15	0.53	0.70	0.89	0.42	25.9	35.6	37.2	26.7	0.4	0.5	0.3	0.4
	6	15-30	-	-	0.76	0.45	-	-	18.2	-	-	-	0.3	0.4
	6	30-45	-	-	0.24	0.26	-	-	8.2	-	-	-	0.4	0.5
	6	45-60	-	-	0.23	0.25	-	-	7.0	-	-	-	0.5	0.4
	6	60-75	-	-	-	0.24	-	-	-	-	-	-	-	0.4
	6	75-90	-	-	-	0.24	-	-	-	-	-	-	-	0.5
	6	90-105	-	-	-	0.24	-	-	-	-	-	-	-	0.5
	6	105-120	-	-	-	0.23	-	-	-	-	-	-	-	0.4
	6	120-135	-	-	-	0.22	-	-	-	-	-	-	-	0.5
	7	0-15	0.57	1.95	1.20	0.51	22.2	480.0	151.0	57.0	0.3	4.7	2.9	1.1
	7	15-30	-	-	0.58	0.97	-	-	75.0	190.8	-	-	1.1	2.2
	8	0-15	0.61	1.38	1.80	0.55	20.8	870.0	331.0	78.9	0.3	5.2	4.5	1.7
	8	15-30	0.55	0.49	2.01	0.62	13.1	85.1	496.5	134.9	0.3	0.5	2.7	2.1
	8	30-45	0.34	0.28	0.43	0.43	9.1	90.3	51.0	62.0	0.3	0.4	0.7	0.8
	8	45-60	0.34	0.27	0.33	0.56	9.1	9.7	41.1	113.9	0.3	-	0.5	0.5
	8	60-75	0.36	-	-	0.63	6.9	-	-	146.6	0.4	-	-	0.4
	8	75-90	0.36	-	-	0.60	6.9	-	-	136.7	0.4	-	-	0.4
	8	90-105	-	-	-	0.42	-	-	-	71.1	-	-	-	0.4
	8	105-120	-	-	-	0.25	-	-	-	20.1	-	-	-	0.4
	8	120-135	-	-	-	0.24	-	-	-	13.8	-	-	-	0.4
	8	135-150	-	-	-	0.24	-	-	-	7.6	-	-	-	0.4
	9	0-15	0.60	3.01	1.80	0.72	23.4	876.0	325.0	104.2	0.6	8.5	5.3	3.4
	9	15-30	0.39	-	-	0.69	19.2	168.0	307.0	129.6	0.4	1.3	2.6	3.4
	9	30-45	0.21	-	-	0.69	12.8	114.2	135.4	229.9	0.2	2.1	1.6	0.8
	9	45-60	0.21	-	-	0.52	12.8	188.2	116.5	120.0	0.2	4.1	1.7	0.6
	9	60-75	0.16	-	-	0.36	16.4	144.1	-	124.5	0.2	5.6	-	0.6
	9	75-90	0.16	-	-	0.37	16.4	144.1	-	59.0	0.2	5.6	-	0.6
	9	90-105	-	-	-	0.39	-	-	-	68.4	-	-	-	0.4
	10	0-15	0.51	7.27	5.36	2.39	24.4	3352.0	1728.0	956.5	0.5	23.5	15.2	11.4
	10	15-30	0.46	0.96	-	2.03	14.6	206.1	539.0	598.0	0.5	0.9	4.4	6.5
	10	30-45	0.25	0.31	-	0.92	7.5	42.6	306.0	332.0	0.3	0.7	2.8	0.9
	10	45-60	0.25	0.22	-	0.38	7.5	25.4	192.0	129.2	0.3	0.8	2.8	0.5
	10	60-75	0.12	0.11	-	0.22	8.2	20.2	454.0	56.8	0.1	0.9	4.8	0.4
	10	75-90	0.12	0.11	-	0.21	8.2	20.2	454.0	58.6	0.1	0.9	4.8	0.6
	10	90-105	-	-	-	0.26	-	-	-	46.4	-	-	-	0.4
	10	105-120	-	-	-	0.26	-	-	-	34.3	-	-	-	0.4
	10	120-135	-	-	-	0.28	-	-	-	24.2	-	-	-	0.4
	10	135-150	-	-	-	0.25	-	-	-	20.0	-	-	-	0.3

Pre = Sampled prior to waste application

Post = Sampled September 1988

1989 = Sampled August 1989

1990 = Sampled August 1990

1988, August 1989 and August 1990. Waste application and incorporation was completed in July 1988 (Macyk et al. 1989a).

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. For all of the freshwater gel treatments the EC values in the 0 to 15 cm depth interval decreased from 1989 to 1990. Changes in EC levels for the FW 5 treatment are illustrated in Figure 6.

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 7. 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. 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. In the fall of 1990 only the FW 5 treatments would have had a slight

Figure 6. Change in Mean EC Values for the Freshwater Gel Rate 5 Plots.

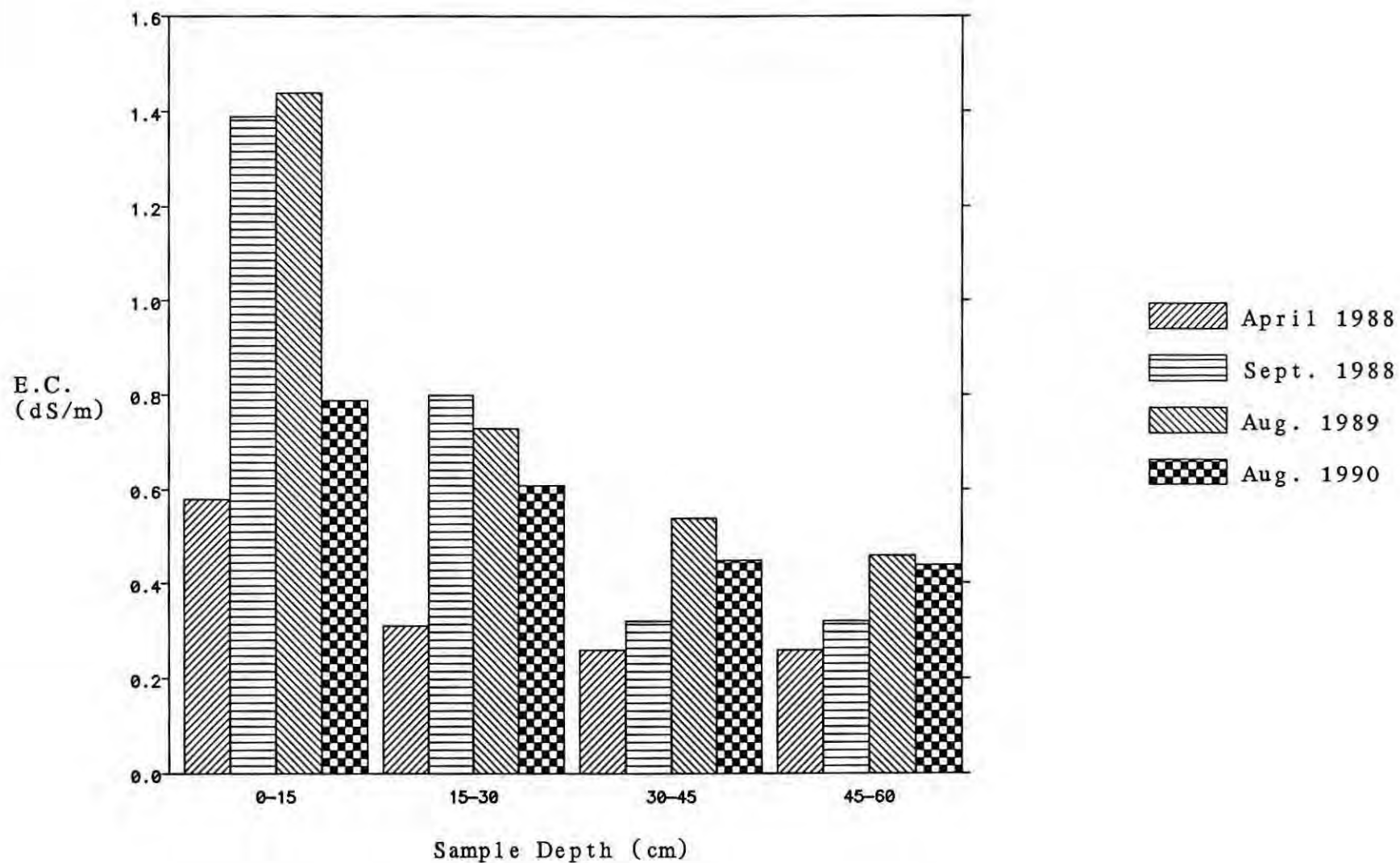
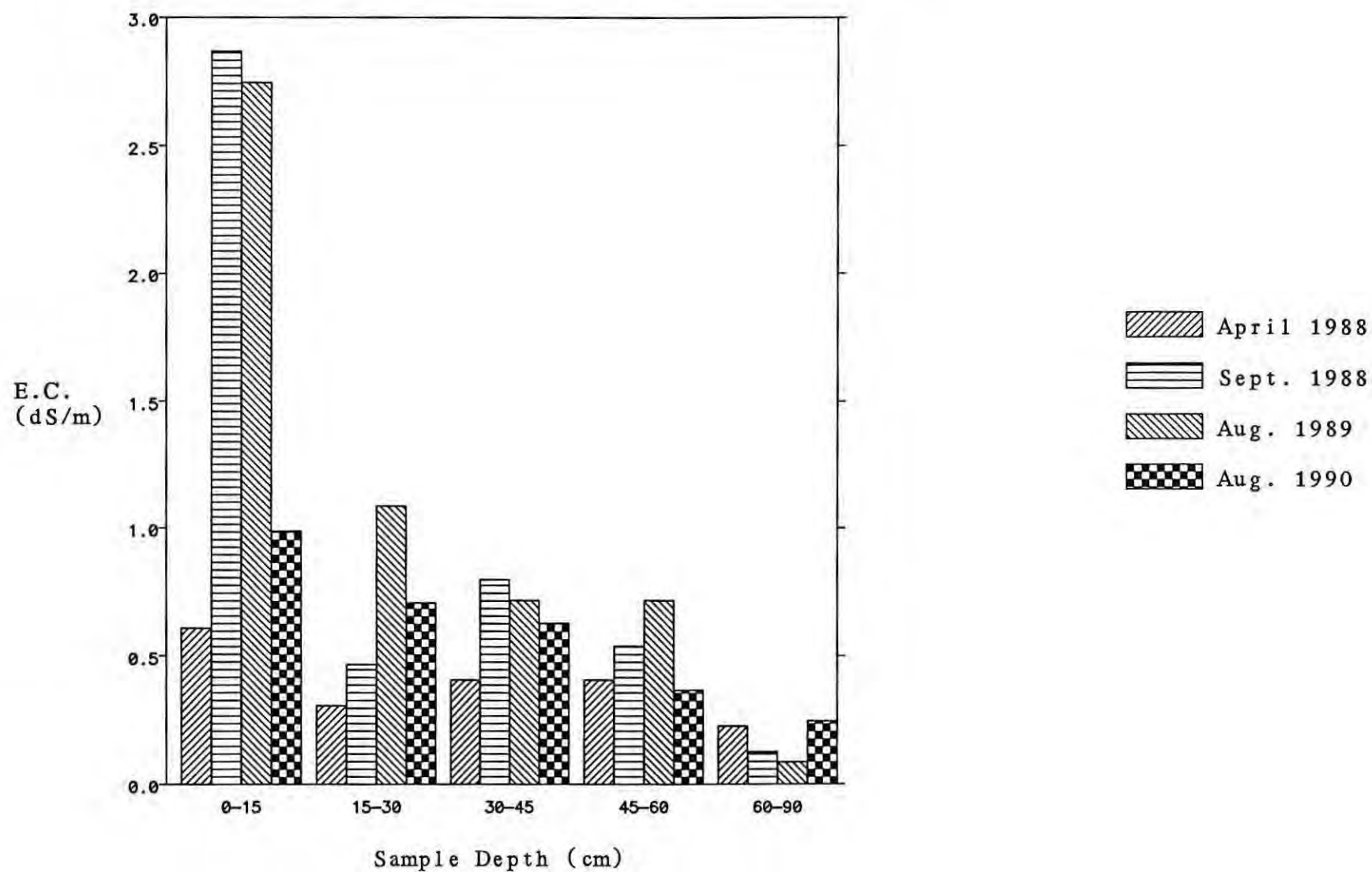


Figure 7. Change in Mean EC Values for the KCl Rate 4 Plots.



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 and 2.39 dS/m in the fall of 1990.

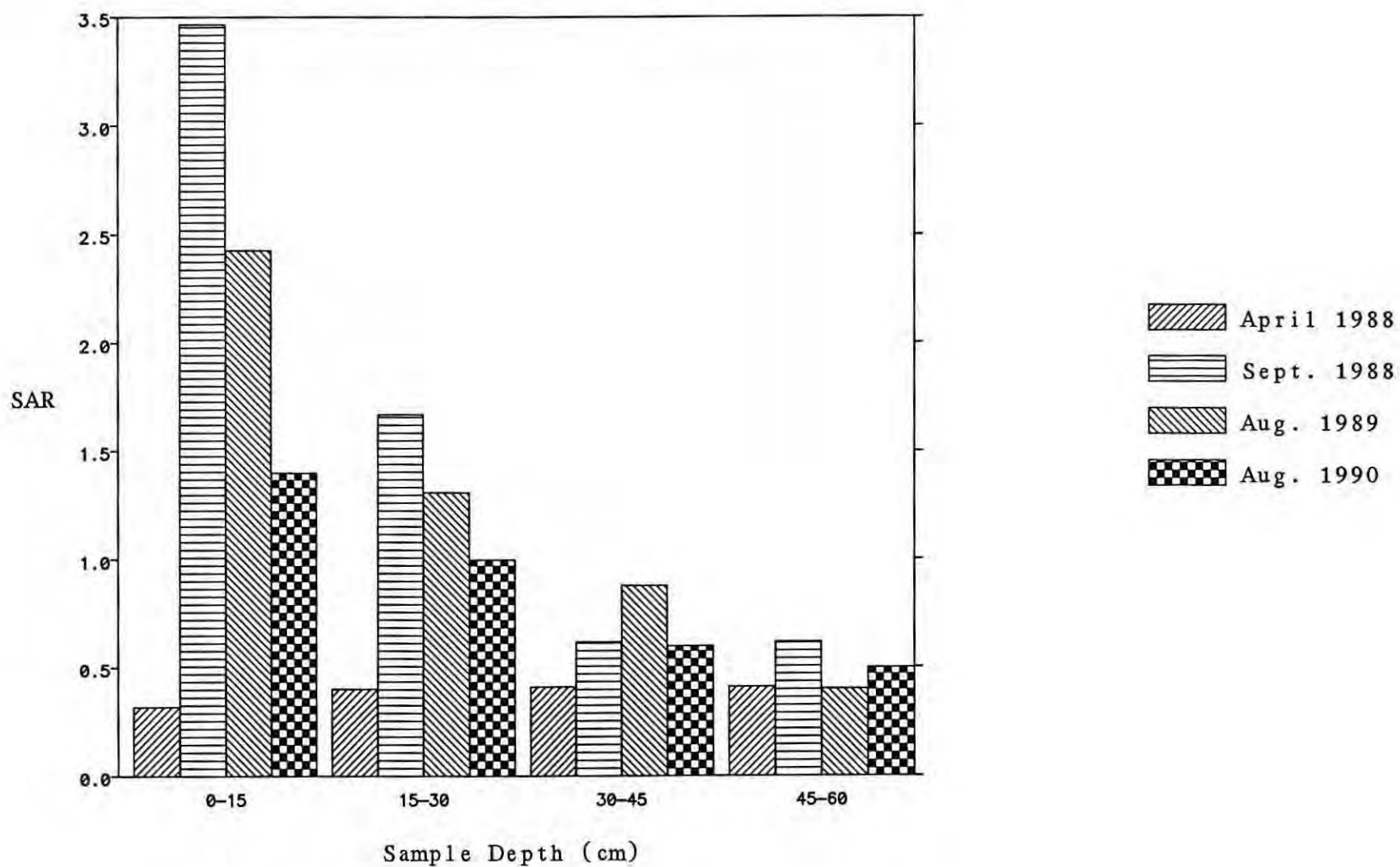
4.4.2.2 Sodium adsorption ratio (SAR) values. The Alberta Soils Advisory Committee (1977) presented the following criteria for SAR levels in soil:

	<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. 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 all depth intervals in the FW 5 treatments are illustrated in Figure 8.

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.

Figure 8. Change in Sodium Adsorption Ratio (SAR) Mean Values for the Freshwater Gel Rate 5 Plots.



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 6, 9, and 21 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 1990 indicate that only the NaCl 10 treatment has the potential for moderate limitation to plant growth due to SAR level (Figure 9).

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 22.7 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. Leaching of the Cl was evident by the changes that occurred between 1988 and 1990. 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 10. 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 and again in 1990.

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 11. Using the value of 1000 ppm Cl as the level in soil that begins to impact plant growth

Figure 9. Change in Sodium Adsorption Ratio (SAR) Mean Values for the NaCl Rate 10 Plots.

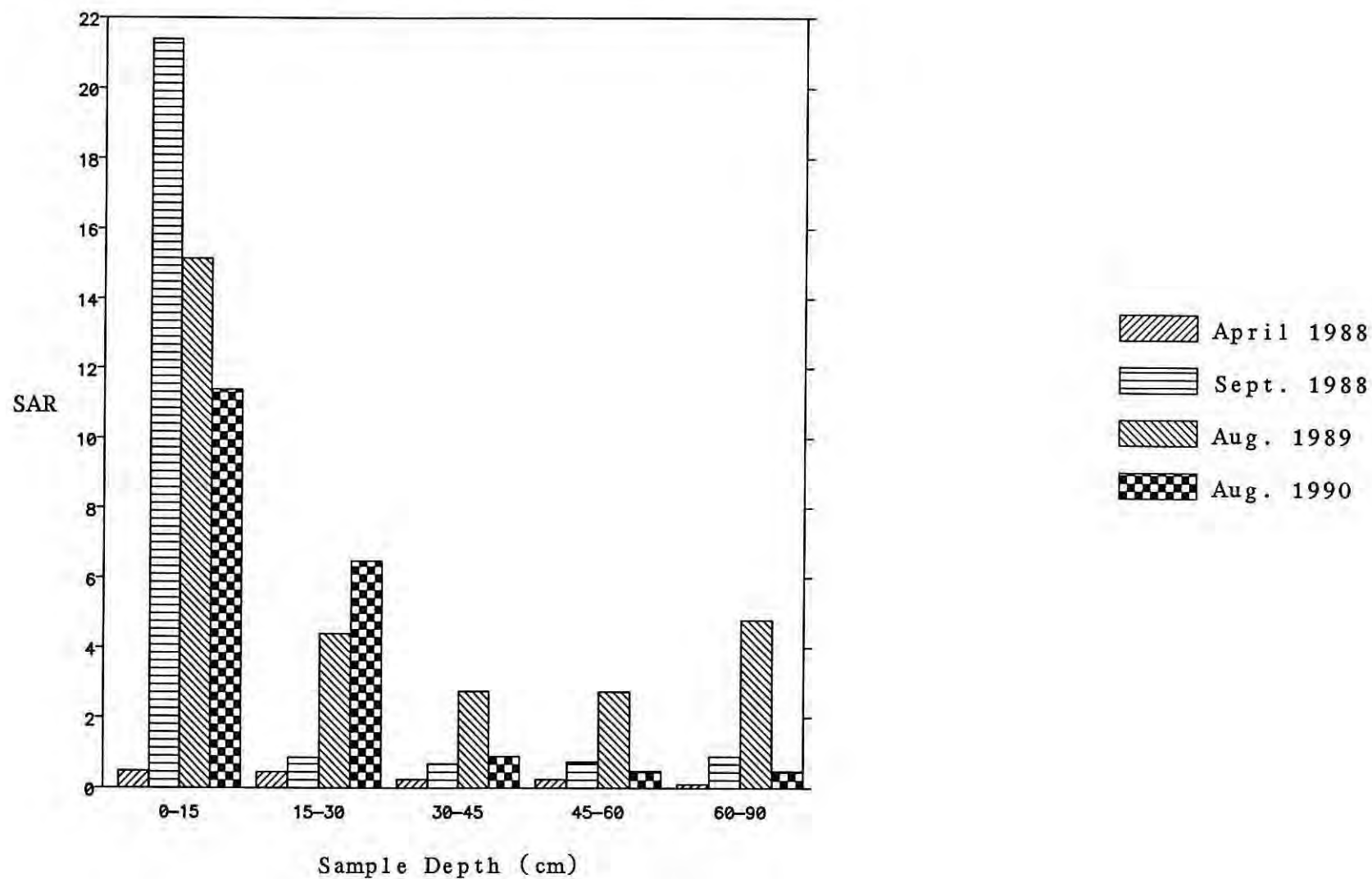


Figure 10. Change in Mean Chloride Values for the KCL Rate 4 Plots.

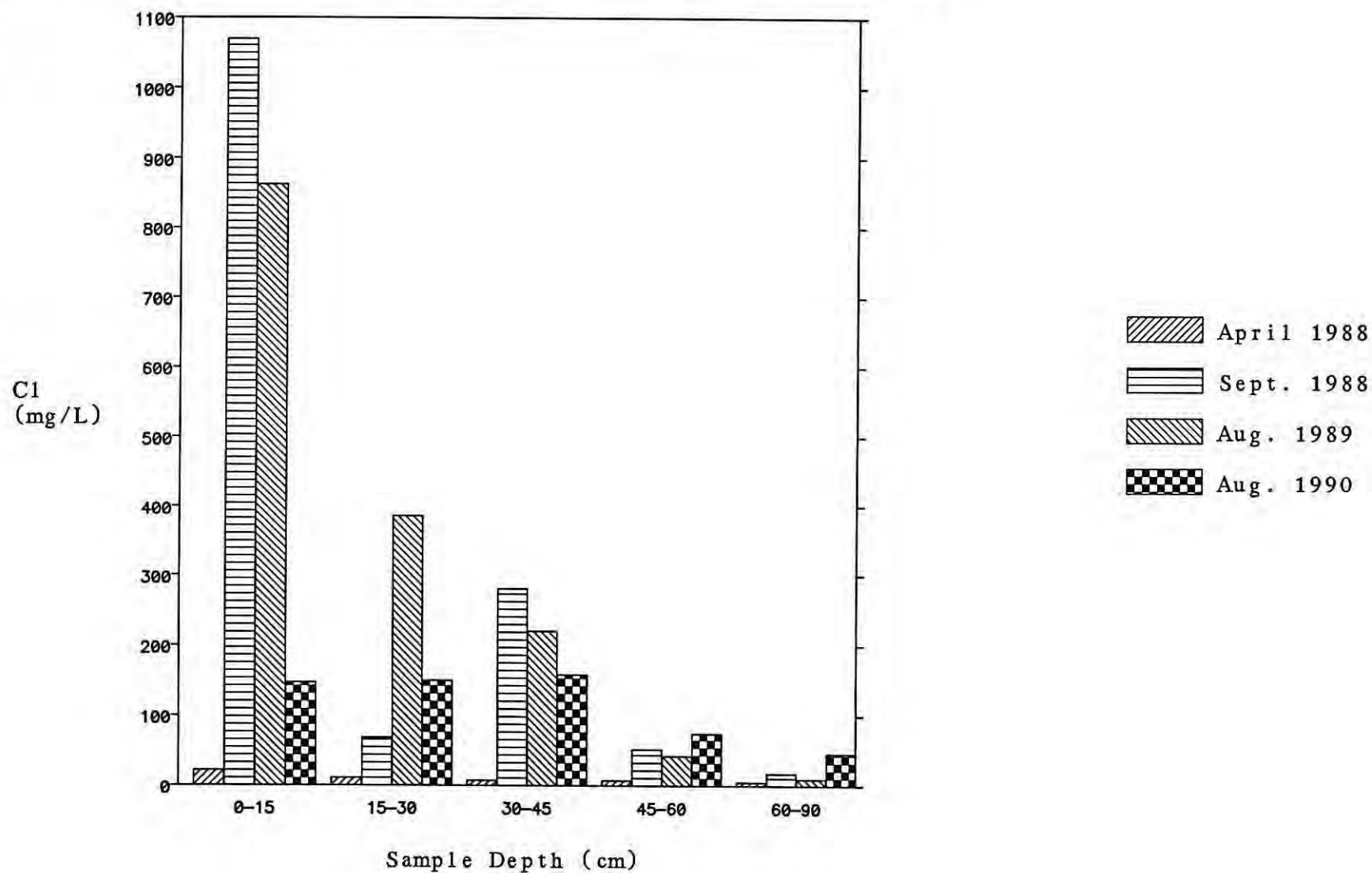
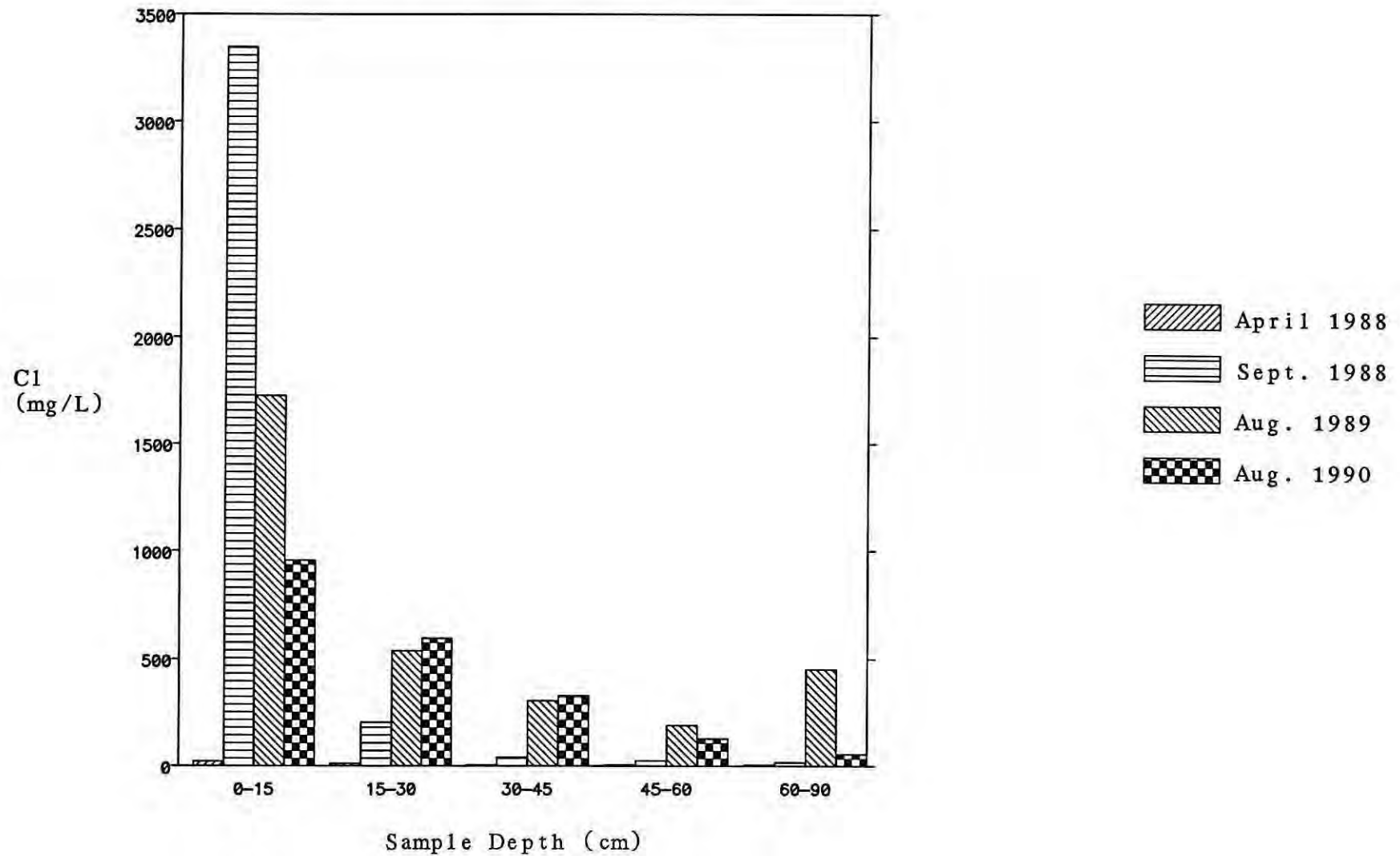


Figure 11. Change in Mean Chloride Values for the NaCl Rate 10 Plots.



indicated that in the fall of 1990 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 Table 7. 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 8 (Lindsay 1979). All mean values for the various elements shown in Table 7 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 1990 are presented in Table 9.

Table 7. Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Mn mg/g	Na mg/g	K mg/g	Ca mg/g	Mg mg/g	P mg/g	Al mg/g	Fe mg/g	Ti mg/g
3	TME5	0 to 15	FWG 1	0.296	6.32	9.29	5.05	2.90	0.384	31.09	10.92	1.757
9	TME21	0 to 15	FWG 1	0.359	6.85	9.67	5.93	3.17	0.414	32.36	10.68	1.851
13	TME41	0 to 15	FWG 1	0.384	6.42	9.08	4.89	2.88	0.361	33.42	12.26	1.740
13	TME42	15 to 30	FWG 1	0.328	5.72	9.99	4.46	3.20	0.360	31.86	16.08	1.876
13	TME43	30 to 45	FWG 1	0.299	4.70	9.32	4.34	3.12	0.348	27.29	16.23	1.740
13	TME44	45 to 60	FWG 1	0.279	5.28	8.98	9.64	4.68	0.326	29.37	15.77	1.796
13	TME44a	60 to 75	FWG 1	0.342	5.40	10.39	5.44	3.74	0.375	31.00	17.78	2.052
13	TME44b	75 to 90	FWG 1	0.332	4.82	9.01	5.16	3.67	0.344	27.12	15.29	1.785
13	TME44c	90 to 105	FWG 1	0.315	5.40	10.30	5.43	3.40	0.350	29.01	15.32	1.872
2	TME4	0 to 15	FWG 2	0.303	6.89	9.86	4.18	2.60	0.488	30.94	10.25	1.904
8	TME19	0 to 15	FWG 2	0.318	6.81	9.20	3.95	2.61	0.444	29.58	12.25	1.660
8	TME20	15 to 30	FWG 2	0.348	6.55	9.00	4.28	2.32	0.379	28.69	9.58	1.760
15	TME49	0 to 15	FWG 2	0.373	6.78	10.39	4.49	2.42	0.526	31.28	13.58	2.050
1	TME1	0 to 15	FWG 3	0.293	6.48	10.84	2.89	1.67	0.448	32.61	11.56	1.863
1	TME2	15 to 30	FWG 3	0.199	5.76	9.34	4.05	3.17	0.281	40.68	18.10	1.994
1	TME3	30 to 45	FWG 3	0.201	5.85	9.57	3.55	2.62	0.253	39.25	17.45	1.945
1	TME3a	45 to 60	FWG 3	0.228	3.31	5.05	3.41	1.91	0.823	17.81	9.18	0.918
1	TME3b	60 to 75	FWG 3	0.087	1.44	2.32	4.50	1.13	0.849	8.11	4.19	0.552
6	TME13	0 to 15	FWG 3	0.348	6.98	9.46	4.83	2.90	0.463	30.08	10.48	1.857
11	TME35	0 to 15	FWG 3	0.374	6.71	9.49	4.25	2.87	0.405	34.01	13.02	1.898
11	TME36	0 to 15	FWG 3	0.337	6.76	9.24	3.72	2.45	0.359	31.87	11.07	1.935
11	TME37	0 to 15	FWG 3	0.370	6.54	9.09	4.35	2.51	0.344	32.36	11.40	1.931
11	TME38	0 to 15	FWG 3	0.275	6.19	9.33	3.84	2.40	0.376	31.42	11.47	1.810
11	TME39	0 to 15	FWG 3	0.310	6.55	9.45	4.52	2.97	0.419	34.93	13.30	1.907
5	TME11	0 to 15	FWG 4	0.311	6.51	9.89	4.26	3.25	0.510	32.38	12.66	1.846
5	TME12	15 to 30	FWG 4	0.307	6.39	9.98	3.40	2.47	0.438	31.17	12.10	1.778
7	TME14	0 to 15	FWG 4	0.406	6.36	10.14	4.15	2.65	0.441	31.75	13.37	1.772
7	TME15	15 to 30	FWG 4	0.336	6.36	10.18	4.62	3.25	0.433	30.96	14.85	1.733
7	TME16	30 to 45	FWG 4	0.373	5.13	10.97	6.70	4.84	0.451	28.08	18.47	2.048
7	TME17	45 to 60	FWG 4	0.321	6.05	10.71	7.64	5.43	0.459	30.74	17.34	1.882
7	TME17a	60 to 75	FWG 4	0.285	5.61	10.33	6.18	4.32	0.421	28.00	16.39	1.817
7	TME18	75 to 90	FWG 4	0.300	5.75	10.30	7.20	4.89	0.403	28.51	15.81	1.764
7	TME18a	90 to 110	FWG 4	0.227	5.49	10.53	4.84	3.54	0.406	27.04	15.32	1.722
12	TME40	0 to 15	FWG 4	0.318	6.38	9.41	4.33	2.92	0.413	33.38	12.55	1.948
4	TME6	0 to 15	FWG 5	0.304	6.64	10.07	4.49	3.32	0.507	32.92	14.60	1.830
4	TME7	0 to 15	FWG 5	0.297	6.51	9.98	3.94	3.01	0.485	32.27	13.33	1.807
4	TME8	0 to 15	FWG 5	0.303	6.60	9.97	4.47	3.31	0.545	31.88	14.15	1.887
4	TME9	0 to 15	FWG 5	0.339	6.64	9.78	6.17	4.40	0.558	32.29	13.66	1.831
4	TME10	0 to 15	FWG 5	0.307	6.64	10.11	4.32	3.38	0.588	32.10	13.49	1.866
10	TME22	0 to 15	FWG 5	0.358	6.23	9.90	2.88	2.25	0.472	28.90	12.91	1.759
10	TME23	0 to 15	FWG 5	0.332	6.35	10.73	4.47	3.16	0.587	31.50	14.97	1.936
10	TME24	0 to 15	FWG 5	0.373	6.56	8.42	4.59	3.13	0.509	29.40	11.53	1.808
10	TME25	0 to 15	FWG 5	0.396	6.89	10.21	3.79	2.64	0.514	30.31	11.96	1.941
10	TME26	0 to 15	FWG 5	0.336	6.74	10.43	5.53	4.00	0.554	32.75	13.93	1.984

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Cu ug/g	Zn ug/g	Mo ug/g	V ug/g	Cr ug/g	Ba ug/g	Ni ug/g	Sr ug/g	Li ug/g	Zr ug/g
3	TME5	0 to 15	FWG 1	7.85	33.2	14.9	30.3	40.0	312.1	13.9	91.6	11.0	81.9
9	TME21	0 to 15	FWG 1	BD	42.7	BD	29.8	36.4	386.0	BD	100.2	BD	79.0
13	TME41	0 to 15	FWG 1	BD	27.8	BD	BD	24.5	207.0	BD	90.6	BD	17.0
13	TME42	15 to 30	FWG 1	BD	35.6	BD	17.2	33.3	129.5	BD	72.0	BD	32.6
13	TME43	30 to 45	FWG 1	BD	36.0	BD	19.6	37.1	91.3	BD	57.9	BD	28.7
13	TME44	45 to 60	FWG 1	BD	57.8	BD	BD	31.2	148.1	BD	86.5	BD	18.6
13	TME44a	60 to 75	FWG 1	BD	48.9	BD	22.3	30.7	117.2	BD	66.8	BD	37.6
13	TME44b	75 to 90	FWG 1	BD	33.7	BD	17.1	24.8	104.9	BD	61.0	BD	21.3
13	TME44c	90 to 105	FWG 1	BD	117.5	BD	16.7	36.8	151.6	BD	67.9	BD	39.0
2	TME4	0 to 15	FWG 2	8.91	41.6	14.3	33.5	38.6	145.5	12.4	93.9	13.2	83.7
8	TME19	0 to 15	FWG 2	11.72	37.1	22.1	35.2	60.6	104.7	19.8	93.2	12.3	73.1
8	TME20	15 to 30	FWG 2	7.70	31.1	16.9	30.8	50.7	231.6	20.1	90.7	11.7	77.5
15	TME49	0 to 15	FWG 2	BD	41.8	11.7	33.4	10.3	118.7	BD	85.5	BD	69.7
1	TME1	0 to 15	FWG 3	6.93	32.7	17.7	38.0	45.4	153.2	18.8	89.0	13.4	70.5
1	TME2	15 to 30	FWG 3	6.42	39.6	21.7	53.8	66.1	377.4	24.9	94.2	19.0	73.6
1	TME3	30 to 45	FWG 3	7.12	34.1	21.6	50.4	62.0	313.5	21.1	92.7	18.7	75.2
1	TME3a	45 to 60	FWG 3	16.53	70.7	16.5	24.8	117.4	186.1	109.2	54.2	BD	44.7
1	TME3b	60 to 75	FWG 3	28.00	105.4	BD	13.3	37.0	127.9	23.5	30.6	BD	26.1
6	TME13	0 to 15	FWG 3	5.39	36.9	17.3	30.5	49.1	184.1	17.8	98.6	BD	82.2
11	TME35	0 to 15	FWG 3	BD	40.1	BD	9.1	24.9	147.3	BD	96.2	BD	39.8
11	TME36	0 to 15	FWG 3	BD	35.9	BD	BD	18.5	91.2	BD	93.3	BD	36.5
11	TME37	0 to 15	FWG 3	BD	32.6	BD	BD	71.1	179.7	BD	94.7	BD	20.6
11	TME38	0 to 15	FWG 3	BD	29.4	BD	7.2	22.2	152.0	BD	86.3	BD	32.7
11	TME39	0 to 15	FWG 3	BD	34.2	BD	BD	27.1	160.6	BD	95.3	BD	29.4
5	TME11	0 to 15	FWG 4	7.45	39.9	19.4	40.5	38.6	108.3	13.0	86.5	12.8	79.3
5	TME12	15 to 30	FWG 4	9.88	36.8	19.8	39.0	36.8	86.4	13.3	82.0	15.6	85.0
7	TME14	0 to 15	FWG 4	7.18	37.8	16.1	36.1	57.4	171.6	21.3	85.9	12.0	78.7
7	TME15	15 to 30	FWG 4	12.28	40.0	20.0	44.3	58.5	188.7	22.2	83.5	17.1	80.3
7	TME16	30 to 45	FWG 4	18.04	53.6	BD	61.6	66.3	137.2	27.6	68.5	19.9	86.0
7	TME17	45 to 60	FWG 4	14.30	48.0	BD	51.3	59.2	210.6	23.8	82.2	17.7	89.5
7	TME17a	60 to 75	FWG 4	12.78	43.0	17.9	48.9	57.0	175.8	20.4	74.0	16.0	83.8
7	TME18	75 to 90	FWG 4	15.97	41.3	21.4	52.2	56.2	174.6	25.1	76.6	19.5	87.9
7	TME18a	90 to 110	FWG 4	12.34	42.0	20.3	49.6	55.5	123.1	22.8	67.6	15.8	81.3
12	TME40	0 to 15	FWG 4	BD	35.4	BD	BD	21.4	135.5	BD	89.3	BD	24.8
4	TME6	0 to 15	FWG 5	9.53	53.3	17.1	43.0	58.8	120.8	16.1	89.5	13.3	81.9
4	TME7	0 to 15	FWG 5	10.25	41.8	18.8	44.0	43.3	71.8	16.8	81.8	15.8	79.0
4	TME8	0 to 15	FWG 5	10.37	54.0	13.6	45.2	53.2	70.2	19.4	84.8	14.9	81.1
4	TME9	0 to 15	FWG 5	10.64	46.0	18.4	43.4	46.0	132.2	16.1	91.1	13.2	79.9
4	TME10	0 to 15	FWG 5	13.07	44.6	17.1	45.8	46.4	83.9	19.8	84.7	15.0	84.1
10	TME22	0 to 15	FWG 5	15.79	40.7	21.3	46.9	45.5	41.6	24.4	69.9	18.9	81.1
10	TME23	0 to 15	FWG 5	10.94	45.5	15.6	51.6	45.8	80.6	17.2	83.9	15.6	84.4
10	TME24	0 to 15	FWG 5	14.96	45.1	26.6	43.9	59.1	104.0	28.6	89.5	17.5	83.6
10	TME25	0 to 15	FWG 5	12.87	47.9	21.3	44.4	44.4	76.7	16.9	87.4	14.9	89.8
10	TME26	0 to 15	FWG 5	11.19	51.1	22.6	50.0	48.8	109.5	21.5	92.4	16.2	84.3

BD = Below Detection

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Mn mg/g	Na mg/g	K mg/g	Ca mg/g	Mg mg/g	P mg/g	Al mg/g	Fe mg/g	Ti mg/g
10	TME27	15 to 30	FWG 5	0.383	6.22	8.99	3.55	2.19	0.356	27.29	8.94	1.733
10	TME28	15 to 30	FWG 5	0.322	6.07	10.10	5.48	3.84	0.440	29.15	14.21	1.775
10	TME29	15 to 30	FWG 5	0.249	4.81	8.37	3.13	2.25	0.320	22.82	11.69	1.452
10	TME30	15 to 30	FWG 5	0.324	5.76	8.15	2.89	1.90	0.324	24.11	7.72	1.566
10	TME31	15 to 30	FWG 5	0.289	5.14	8.32	6.55	4.13	0.348	25.02	12.33	1.554
10	TME32	30 to 45	FWG 5	0.231	4.88	8.22	5.99	4.51	0.341	24.72	12.70	1.483
10	TME33	45 to 60	FWG 5	0.244	4.46	7.65	4.14	3.17	0.287	22.07	12.52	1.375
10	TME33a	60 to 75	FWG 5	0.194	3.84	6.57	4.30	2.94	0.252	19.37	10.89	1.229
10	TME34	75 to 90	FWG 5	0.208	3.62	5.95	3.72	2.64	0.230	17.57	10.07	1.146
10	TME34a	90 to 105	FWG 5	0.316	5.61	10.11	3.70	2.83	0.397	28.57	16.45	1.934
10	TME34b	105 to 115	FWG 5	0.270	6.13	9.75	6.70	4.22	0.366	30.99	15.99	1.826
14	TME45	0 to 15	FWG 5	0.384	6.44	9.64	3.05	1.84	0.442	30.91	11.85	1.903
14	TME46	15 to 30	FWG 5	0.333	6.07	10.05	5.39	3.79	0.375	38.44	17.06	1.964
14	TME47	30 to 45	FWG 5	0.315	5.21	9.47	5.41	3.76	0.351	30.94	16.28	1.855
14	TME48	45 to 60	FWG 5	0.349	5.86	9.81	5.97	3.67	0.401	29.00	17.35	1.975
14	TME48a	60 to 75	FWG 5	0.463	5.94	11.13	5.96	3.84	0.457	31.07	19.35	2.127
14	TME48b	75 to 90	FWG 5	0.321	5.82	10.21	8.10	4.78	0.420	30.43	17.87	1.995
14	TME48c	90 to 105	FWG 5	0.396	6.04	10.53	5.80	3.19	0.414	26.40	16.61	1.945
17	TME63	0 to 15	KCI 1	0.342	6.01	8.91	4.78	2.64	0.371	30.72	10.77	1.781
42	TME190	0 to 15	KCI 1	0.350	7.26	11.56	7.30	5.19	0.423	37.35	15.89	2.026
42	TME191	0 to 15	KCI 1	0.383	7.04	12.01	6.50	4.68	0.479	35.22	16.59	2.088
42	TME192	0 to 15	KCI 1	0.376	6.67	11.79	4.75	3.39	0.540	33.81	16.76	2.040
42	TME193	0 to 15	KCI 1	0.354	7.35	11.70	6.67	4.60	0.498	36.42	15.51	2.055
42	TME194	0 to 15	KCI 1	0.360	6.93	12.35	6.18	3.86	0.521	34.03	15.57	2.078
43	TME195	0 to 15	KCI 1	0.372	7.22	11.73	5.42	3.89	0.443	36.27	15.33	2.070
43	TME195a	15 to 30	KCI 1	0.363	7.46	12.50	6.38	4.16	0.491	41.69	18.14	2.132
43	TME195b	30 to 45	KCI 1	0.378	6.28	12.21	4.85	3.60	0.486	33.22	19.35	2.032
43	TME195c	45 to 60	KCI 1	1.358	6.34	12.19	5.20	3.62	0.452	31.51	18.69	2.085
43	TME195d	60 to 75	KCI 1	0.933	6.78	12.69	8.86	6.43	0.467	36.18	19.12	2.170
43	TME195e	75 to 90	KCI 1	0.876	6.36	12.25	7.02	4.97	0.448	33.13	18.04	2.056
43	TME195f	90 to 105	KCI 1	0.994	6.53	12.06	7.81	5.26	0.455	34.03	17.92	2.110
43	TME195g	105 to 120	KCI 1	1.058	6.19	11.58	8.28	5.70	0.410	32.75	17.80	2.043
43	TME195h	120 to 135	KCI 1	1.182	6.53	12.23	7.13	5.09	0.434	33.69	18.21	2.113
33	TME151	0 to 15	KCI 2	0.374	6.96	10.43	5.02	3.50	0.412	33.53	12.06	1.980
40	TME188	0 to 15	KCI 2	0.391	7.28	11.39	6.65	4.49	0.484	37.22	15.16	2.037
45	TME208	0 to 15	KCI 2	0.999	7.33	11.59	4.98	3.41	0.367	35.46	13.83	1.974
45	TME209	0 to 15	KCI 2	1.139	7.65	10.58	4.08	2.59	0.369	32.11	10.37	1.958
45	TME210	0 to 15	KCI 2	1.260	7.58	10.85	4.37	2.77	0.351	32.74	11.11	2.080
45	TME211	0 to 15	KCI 2	0.903	7.29	11.21	4.92	2.85	0.906	35.35	12.54	1.984
45	TME212	0 to 15	KCI 2	0.952	7.05	12.02	4.88	3.29	0.728	39.30	17.15	2.075
45	TME213	15 to 30	KCI 2	1.246	6.09	12.34	4.33	3.14	0.321	43.23	20.00	2.098
45	TME214	15 to 30	KCI 2	1.204	7.03	11.48	6.29	4.40	0.408	33.08	15.48	1.970
45	TME215	15 to 30	KCI 2	1.226	6.38	11.75	5.35	3.66	0.423	31.65	16.98	1.933
45	TME216	15 to 30	KCI 2	0.589	7.19	11.32	4.08	2.61	1.135	36.41	13.53	1.916

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Cu ug/g	Zn ug/g	Mo ug/g	V ug/g	Cr ug/g	Ba ug/g	Ni ug/g	Sr ug/g	Li ug/g	Zr ug/g
10	TME27	15 to 30	FWG 5	11.61	35.1	21.8	34.8	39.2	117.0	26.4	81.0	15.2	90.9
10	TME28	15 to 30	FWG 5	16.30	42.7	22.8	51.7	45.0	168.1	28.1	75.3	18.8	92.2
10	TME29	15 to 30	FWG 5	16.89	31.2	19.2	42.0	42.2	101.7	24.3	54.9	19.8	82.5
10	TME30	15 to 30	FWG 5	14.25	32.8	13.5	32.1	30.2	89.1	17.3	72.2	17.3	74.1
10	TME31	15 to 30	FWG 5	18.23	34.5	16.0	46.3	44.3	191.3	31.1	67.0	20.8	91.7
10	TME32	30 to 45	FWG 5	22.07	37.6	21.8	49.2	46.4	156.5	28.6	62.5	24.1	90.0
10	TME33	45 to 60	FWG 5	10.55	34.6	BD	43.9	57.0	119.5	30.9	51.7	14.2	77.3
10	TME33a	60 to 75	FWG 5	7.47	30.4	BD	34.0	35.4	110.1	10.4	46.3	BD	51.1
10	TME34	75 to 90	FWG 5	27.20	70.1	BD	31.4	33.6	103.6	11.0	43.6	BD	53.5
10	TME34a	90 to 105	FWG 5	3.23	41.0	BD	40.2	59.1	85.7	16.4	63.3	BD	78.2
10	TME34b	105 to 115	FWG 5	BD	37.3	BD	20.6	42.5	157.0	BD	76.6	BD	39.8
14	TME45	0 to 15	FWG 5	BD	31.4	BD	BD	25.7	72.7	BD	81.8	BD	29.5
14	TME46	15 to 30	FWG 5	BD	34.0	BD	12.8	31.3	281.3	BD	90.3	BD	26.7
14	TME47	30 to 45	FWG 5	BD	33.5	BD	16.0	37.6	182.5	BD	71.4	BD	31.1
14	TME48	45 to 60	FWG 5	4.04	45.2	14.6	40.1	31.4	143.9	12.5	71.3	BD	78.1
14	TME48a	60 to 75	FWG 5	7.05	51.3	18.6	50.1	36.2	146.2	17.9	70.5	12.3	85.1
14	TME48b	75 to 90	FWG 5	2.89	48.0	BD	42.8	28.3	179.1	9.7	76.8	BD	68.7
14	TME48c	90 to 105	FWG 5	BD	46.7	13.2	38.0	18.3	98.9	10.3	63.8	BD	70.0
17	TME63	0 to 15	KCI 1	7.89	32.7	16.6	34.0	38.6	256.6	16.6	92.0	13.9	79.5
42	TME190	0 to 15	KCI 1	15.94	53.1	24.8	44.6	58.8	248.6	28.3	107.8	19.8	112.8
42	TME191	0 to 15	KCI 1	16.93	54.7	26.2	49.4	60.9	130.9	32.2	97.6	20.6	136.0
42	TME192	0 to 15	KCI 1	17.05	48.1	22.3	47.1	67.4	74.2	27.6	90.0	20.1	111.3
42	TME193	0 to 15	KCI 1	16.39	49.8	26.2	44.7	60.2	170.5	27.7	108.5	19.7	113.8
42	TME194	0 to 15	KCI 1	15.23	50.7	24.5	45.9	63.3	178.9	30.0	95.9	18.6	111.8
43	TME195	0 to 15	KCI 1	16.16	51.2	23.7	43.6	62.2	113.4	26.7	103.7	18.3	108.8
43	TME195a	15 to 30	KCI 1	17.09	47.9	26.2	50.4	72.4	190.9	30.2	115.7	21.1	114.2
43	TME195b	30 to 45	KCI 1	22.88	56.9	29.8	56.1	104.6	76.9	51.6	80.9	23.1	113.1
43	TME195c	45 to 60	KCI 1	12.43	51.9	16.3	56.3	94.2	64.4	38.9	80.7	BD	92.0
43	TME195d	60 to 75	KCI 1	9.58	60.8	BD	56.2	73.3	107.4	29.1	98.8	BD	84.9
43	TME195e	75 to 90	KCI 1	12.32	55.0	15.8	56.2	60.5	95.2	28.1	86.0	BD	95.4
43	TME195f	90 to 105	KCI 1	9.89	45.9	18.9	55.7	65.6	132.9	25.0	93.4	BD	89.8
43	TME195g	105 to 120	KCI 1	6.06	42.7	BD	50.4	64.5	181.6	19.6	92.9	BD	86.0
43	TME195h	120 to 135	KCI 1	7.46	44.2	BD	52.2	62.8	125.7	22.7	93.0	BD	91.5
33	TME151	0 to 15	KCI 2	17.09	42.2	25.1	43.8	47.0	131.7	27.8	101.2	22.2	112.2
40	TME188	0 to 15	KCI 2	15.37	48.6	22.1	42.7	59.0	199.5	23.1	112.8	18.7	109.7
45	TME208	0 to 15	KCI 2	5.39	36.0	16.4	42.0	45.4	89.0	12.2	105.2	BD	88.7
45	TME209	0 to 15	KCI 2	6.41	35.0	BD	34.4	46.9	59.4	14.3	107.8	BD	83.9
45	TME210	0 to 15	KCI 2	2.94	33.7	BD	33.7	46.0	80.4	12.8	108.2	BD	85.8
45	TME211	0 to 15	KCI 2	6.51	34.0	18.1	38.8	67.3	77.8	26.0	109.8	BD	86.9
45	TME212	0 to 15	KCI 2	5.18	38.6	15.8	50.1	50.7	73.4	11.8	108.3	BD	87.6
45	TME213	15 to 30	KCI 2	13.91	42.6	17.6	64.7	66.4	48.8	30.1	93.9	BD	98.5
45	TME214	15 to 30	KCI 2	10.31	39.5	15.3	47.1	60.7	126.7	19.7	98.1	BD	91.6
45	TME215	15 to 30	KCI 2	10.72	37.8	14.4	53.8	50.0	83.3	19.5	86.0	BD	89.9
45	TME216	15 to 30	KCI 2	2.59	28.0	14.2	38.1	43.3	89.1	13.0	106.2	BD	89.9

BD = Below Detection

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Mn mg/g	Na mg/g	K mg/g	Ca mg/g	Mg mg/g	P mg/g	Al mg/g	Fe mg/g	Ti mg/g
45	TME217	15 to 30	KCl 2	1.223	5.64	12.58	4.01	3.50	0.462	44.45	26.73	2.204
45	TME218	30 to 45	KCl 2	0.977	6.49	11.43	4.22	3.61	0.323	40.26	17.40	1.877
45	TME219	45 to 60	KCl 2	1.227	6.74	11.62	4.45	3.57	0.357	40.74	18.43	1.970
45	TME220	60 to 75	KCl 2	0.863	6.86	11.18	4.16	3.08	0.393	39.43	17.61	1.952
45	TME221	75 to 90	KCl 2	0.989	6.49	11.01	4.05	3.03	0.408	38.86	18.11	1.984
45	TME222	90 to 105	KCl 2	0.847	6.90	11.27	5.02	4.14	0.404	41.23	18.54	2.021
45	TME223	105 to 120	KCl 2	1.078	7.21	11.95	4.35	3.04	0.438	41.62	19.34	2.138
45	TME224	120 to 135	KCl 2	1.176	7.19	12.03	4.79	3.57	0.423	41.44	18.59	2.088
21	TME79	0 to 15	KCl 3	0.209	4.02	5.69	2.35	1.56	0.265	18.10	6.26	1.057
21	TME80	0 to 15	KCl 3	0.244	4.28	6.15	3.22	1.98	0.288	19.60	7.20	1.127
21	TME81	0 to 15	KCl 3	0.274	4.26	6.03	3.19	1.78	0.247	20.22	7.39	1.178
21	TME82	0 to 15	KCl 3	0.233	4.45	6.56	2.48	1.59	0.292	19.96	7.11	1.226
21	TME83	0 to 15	KCl 3	0.187	3.82	5.47	2.87	1.53	0.216	17.77	5.89	1.072
30	TME137	0 to 15	KCl 3	0.355	6.42	10.42	3.63	2.00	0.414	31.71	12.53	1.844
39	TME187	0 to 15	KCl 3	0.368	7.40	12.12	6.09	4.60	0.474	38.31	16.77	2.068
16	TME50	0 to 15	KCl 4	0.399	6.99	10.88	4.88	2.98	0.461	34.80	14.50	2.008
16	TME51	0 to 15	KCl 4	0.416	7.63	10.72	4.91	2.93	0.556	34.22	13.88	1.993
16	TME52	0 to 15	KCl 4	0.406	6.93	10.57	4.06	2.72	0.459	34.47	14.93	1.998
16	TME53	0 to 15	KCl 4	0.429	7.15	11.97	4.27	2.82	0.534	37.28	16.74	2.160
16	TME54	0 to 15	KCl 4	0.368	7.10	10.22	5.07	3.07	0.442	33.82	14.14	1.960
16	TME55	15 to 30	KCl 4	0.327	6.50	10.68	6.52	4.57	0.368	35.76	16.54	1.808
16	TME56	15 to 30	KCl 4	0.279	6.22	8.96	4.98	3.12	0.372	30.85	11.54	1.582
16	TME57	15 to 30	KCl 4	0.292	5.74	9.73	3.95	3.29	0.326	35.57	17.33	1.750
16	TME58	15 to 30	KCl 4	0.250	5.61	9.55	3.90	2.75	0.368	31.15	14.89	1.673
16	TME59	15 to 30	KCl 4	0.265	6.00	9.33	4.58	2.89	0.329	33.59	14.01	1.661
16	TME60	30 to 45	KCl 4	0.299	6.07	10.19	4.29	3.36	0.358	33.79	17.29	1.802
16	TME61	45 to 60	KCl 4	0.233	6.40	10.09	3.55	2.54	0.269	33.77	14.13	1.363
16	TME61a	60 to 75	KCl 4	0.358	6.80	10.69	3.39	2.34	0.336	36.27	14.68	1.503
16	TME62	75 to 90	KCl 4	0.357	6.97	11.83	4.15	2.86	0.424	42.70	18.85	2.044
16	TME62a	90 to 110	KCl 4	0.305	6.75	12.52	4.26	2.86	0.434	41.74	20.82	2.162
24	TME100	0 to 15	KCl 4	0.335	7.56	10.88	5.04	3.09	0.449	33.39	11.89	1.970
29	TME132	0 to 15	KCl 4	0.380	7.88	12.03	4.36	3.26	0.582	39.66	16.19	2.114
29	TME133	15 to 30	KCl 4	0.399	8.18	13.21	5.66	4.12	0.515	46.82	19.86	2.260
29	TME134	30 to 45	KCl 4	0.343	8.00	12.69	6.29	4.54	0.526	48.53	22.00	2.284
29	TME135	45 to 60	KCl 4	0.347	7.85	13.02	4.66	3.34	0.538	46.06	20.37	2.219
29	TME135a	60 to 75	KCl 4	0.330	7.89	12.76	4.53	3.33	0.521	45.70	19.57	2.209
29	TME136	75 to 90	KCl 4	0.387	6.91	12.68	4.19	2.87	0.446	42.26	19.71	2.100
29	TME136a	90 to 105	KCl 4	0.348	6.40	11.54	4.10	2.69	0.430	38.14	18.61	1.954
29	TME136b	105 to 120	KCl 4	0.322	6.44	11.01	4.57	3.03	0.432	37.25	16.64	1.891
29	TME136c	120 to 135	KCl 4	0.273	5.95	10.90	5.39	4.12	0.400	32.01	16.21	1.795
25	TME101	0 to 15	KCl 5	0.385	7.76	11.93	3.29	2.11	0.450	32.93	12.56	1.886
25	TME102	0 to 15	KCl 5	0.360	7.82	12.05	5.11	3.28	0.419	36.33	13.56	1.883
25	TME103	0 to 15	KCl 5	0.315	8.01	12.00	5.14	3.19	0.453	35.40	13.25	2.036
25	TME104	0 to 15	KCl 5	0.452	7.90	12.36	3.78	2.68	0.438	33.79	13.73	2.037

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Cu ug/g	Zn ug/g	Mo ug/g	V ug/g	Cr ug/g	Ba ug/g	Ni ug/g	Sr ug/g	Li ug/g	Zr ug/g
45	TME217	15 to 30	KCl 2	6.12	42.3	16.6	67.3	69.3	163.4	18.1	94.6	BD	105.0
45	TME218	30 to 45	KCl 2	11.35	34.4	BD	53.3	67.5	196.8	27.1	103.9	BD	92.6
45	TME219	45 to 60	KCl 2	12.98	39.2	17.4	54.0	66.1	140.1	23.0	108.5	BD	97.3
45	TME220	60 to 75	KCl 2	16.46	40.0	14.7	56.7	50.8	86.7	23.2	105.8	BD	101.7
45	TME221	75 to 90	KCl 2	18.36	40.6	16.7	61.2	55.4	74.3	29.2	101.5	BD	104.0
45	TME222	90 to 105	KCl 2	16.70	39.5	20.8	60.0	68.9	351.8	30.0	113.5	BD	96.8
45	TME223	105 to 120	KCl 2	15.97	41.3	16.2	62.0	65.5	84.0	29.2	109.0	BD	104.4
45	TME224	120 to 135	KCl 2	11.04	40.3	BD	54.1	61.0	165.8	21.0	113.7	BD	96.6
21	TME79	0 to 15	KCl 3	5.78	23.4	BD	17.1	20.4	BD	BD	52.9	BD	19.8
21	TME80	0 to 15	KCl 3	6.64	24.9	BD	18.5	22.7	4.2	BD	57.0	BD	21.3
21	TME81	0 to 15	KCl 3	3.36	22.0	BD	15.8	25.3	82.2	BD	57.7	BD	16.8
21	TME82	0 to 15	KCl 3	4.43	23.9	BD	17.9	22.8	6.2	BD	56.2	BD	19.9
21	TME83	0 to 15	KCl 3	5.15	18.4	BD	13.6	18.7	55.6	BD	50.7	BD	12.7
30	TME137	0 to 15	KCl 3	8.05	39.1	19.6	38.5	45.4	42.8	18.7	87.7	14.1	83.1
39	TME187	0 to 15	KCl 3	15.78	45.8	24.9	46.1	66.7	119.8	29.1	106.2	20.0	110.7
16	TME50	0 to 15	KCl 4	BD	51.6	16.4	32.4	14.2	228.5	BD	98.4	BD	76.2
16	TME51	0 to 15	KCl 4	BD	47.5	14.6	31.7	13.0	173.1	BD	109.3	BD	55.4
16	TME52	0 to 15	KCl 4	BD	43.8	15.7	33.3	13.4	142.1	BD	93.9	BD	69.2
16	TME53	0 to 15	KCl 4	BD	47.4	16.1	38.7	19.2	160.4	BD	97.7	BD	73.1
16	TME54	0 to 15	KCl 4	BD	42.5	BD	27.5	9.5	240.6	BD	102.0	BD	61.6
16	TME55	15 to 30	KCl 4	10.02	35.5	15.7	46.1	56.6	239.5	27.4	95.6	14.4	79.6
16	TME56	15 to 30	KCl 4	7.38	30.4	14.8	33.5	37.5	155.9	16.2	93.4	11.6	78.9
16	TME57	15 to 30	KCl 4	15.88	35.9	18.0	51.3	56.2	80.7	26.3	83.8	18.2	88.5
16	TME58	15 to 30	KCl 4	9.53	32.2	15.9	42.9	55.4	94.9	21.1	78.5	13.6	78.5
16	TME59	15 to 30	KCl 4	11.44	34.1	14.9	42.3	41.8	175.1	21.3	90.2	14.9	78.2
16	TME60	30 to 45	KCl 4	13.44	38.1	14.5	51.8	61.4	76.2	28.2	77.6	17.6	78.7
16	TME61	45 to 60	KCl 4	13.61	30.4	16.8	43.1	46.5	97.8	22.9	84.2	16.3	66.9
16	TME61a	60 to 75	KCl 4	10.61	34.7	14.4	43.5	41.5	106.5	21.9	92.1	15.5	78.9
16	TME62	75 to 90	KCl 4	15.03	49.5	19.5	60.6	54.9	132.7	27.2	97.8	20.7	95.1
16	TME62a	90 to 110	KCl 4	16.98	47.9	20.3	64.1	66.0	92.4	29.2	89.6	21.0	103.8
24	TME100	0 to 15	KCl 4	4.88	47.8	15.7	36.1	39.1	188.8	11.1	102.8	12.5	67.3
29	TME132	0 to 15	KCl 4	23.08	54.3	95.0	49.7	57.3	98.8	29.9	114.3		123.8
29	TME133	15 to 30	KCl 4	21.91	52.3	99.8	57.8	63.1	245.7	42.0	122.5		120.1
29	TME134	30 to 45	KCl 4	28.59	59.4	96.4	68.1	84.4	274.4	49.9	125.0		141.0
29	TME135	45 to 60	KCl 4	23.75	54.9	93.0	64.8	76.7	166.2	46.5	117.5		121.2
29	TME135a	60 to 75	KCl 4	24.35	56.4	94.3	62.1	69.0	159.1	48.3	115.1		126.9
29	TME136	75 to 90	KCl 4	18.01	51.5	23.2	62.0	73.7	112.9	33.7	99.8	23.2	102.3
29	TME136a	90 to 105	KCl 4	12.99	46.2	21.8	54.3	78.7	107.8	34.0	90.7	17.7	93.3
29	TME136b	105 to 120	KCl 4	12.69	46.0	22.3	52.2	53.6	105.7	25.7	94.7	17.5	91.9
29	TME136c	120 to 135	KCl 4	11.11	41.3	18.5	48.1	67.7	89.9	27.0	80.7	14.8	81.2
25	TME101	0 to 15	KCl 5	6.52	51.7	14.0	37.1	42.1	81.3	13.0	95.8	14.3	70.7
25	TME102	0 to 15	KCl 5	9.72	43.9	19.7	43.1	45.3	163.1	15.8	102.0	BD	68.9
25	TME103	0 to 15	KCl 5	6.81	55.3	BD	42.4	38.9	194.2	11.5	109.1	13.9	71.1
25	TME104	0 to 15	KCl 5	8.83	48.0	17.2	41.5	42.5	83.6	12.2	102.0	12.9	75.5

BD = Below Detection

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Mn mg/g	Na mg/g	K mg/g	Ca mg/g	Mg mg/g	P mg/g	Al mg/g	Fe mg/g	Ti mg/g
25	TME105	0 to 15	KCl 5	0.332	7.58	12.27	4.09	3.12	0.420	36.00	14.62	1.921
25	TME106	15 to 30	KCl 5	0.487	7.96	10.16	4.20	2.13	0.266	31.35	10.41	1.859
25	TME107	15 to 30	KCl 5	0.390	7.32	9.14	4.75	2.13	0.298	28.38	9.65	1.563
25	TME108	15 to 30	KCl 5	0.430	7.37	10.11	3.24	1.86	0.268	28.68	9.19	1.871
25	TME109	15 to 30	KCl 5	0.396	7.59	10.29	3.92	2.20	0.258	31.82	10.88	1.802
25	TME110	15 to 30	KCl 5	0.277	7.05	12.45	4.63	3.67	0.296	42.32	17.27	2.028
25	TME111	30 to 45	KCl 5	0.181	6.78	11.14	3.49	2.67	0.274	39.74	18.69	1.910
25	TME112	45 to 60	KCl 5	0.238	6.75	11.44	3.73	2.95	0.282	39.40	19.55	1.870
25	TME112a	60 to 75	KCl 5	0.527	6.46	12.09	2.91	1.97	0.404	38.30	20.87	1.851
25	TME113	75 to 90	KCl 5	1.031	0.80	11.25	4.02	3.10	0.387	38.74	17.70	1.902
25	TME113a	90 to 105	KCl 5	0.911	6.52	11.54	3.23	2.36	0.468	39.90	18.99	1.917
25	TME113b	105 to 120	KCl 5	0.529	6.86	12.02	3.74	2.95	0.448	41.56	18.77	1.983
25	TME113c	120 to 140	KCl 5	0.626	6.82	11.85	3.95	3.23	0.459	42.50	19.52	2.029
26	TME114	0 to 15	KCl 5	0.331	6.78	10.39	3.18	2.50	0.486	31.87	12.90	1.821
26	TME115	15 to 30	KCl 5	0.341	6.66	10.27	5.04	3.53	0.437	32.85	12.88	1.838
37	TME173	0 to 15	KCl 5	0.394	7.46	12.26	4.22	3.18	0.497	36.54	15.33	2.064
22	TME84	0 to 15	NaCl 6	0.128	2.49	3.76	1.65	1.09	0.140	12.31	4.23	0.653
22	TME85	15 to 30	NaCl 6	0.122	1.97	3.25	1.79	1.37	0.113	9.26	4.27	0.541
22	TME86	30 to 45	NaCl 6	0.286	5.91	10.48	6.79	4.84	0.395	28.95	15.76	1.810
22	TME87	45 to 60	NaCl 6	0.370	6.03	11.55	5.87	4.39	0.421	30.38	17.58	1.984
22	TME87a	60 to 75	NaCl 6	0.343	6.03	10.55	7.40	5.01	0.382	28.99	15.58	1.775
22	TME87b	75 to 90	NaCl 6	0.322	5.62	10.09	6.10	4.31	0.366	27.38	14.97	1.708
22	TME87c	90 to 105	NaCl 6	0.275	6.11	10.93	4.95	3.80	0.381	27.84	15.49	1.786
22	TME87d	105 to 120	NaCl 6	0.223	5.46	10.25	6.05	3.68	0.365	26.90	15.03	1.722
22	TME87e	120 to 130	NaCl 6	0.268	6.22	11.26	6.78	4.26	0.400	29.40	15.56	1.845
32	TME150	0 to 15	NaCl 6	0.398	6.89	10.53	5.13	3.30	0.431	33.18	12.36	1.949
41	TME189	0 to 15	NaCl 6	0.339	7.02	11.02	5.19	3.83	0.440	33.54	13.68	2.023
18	TME64	0 to 15	NaCl 7	0.421	6.29	9.49	3.36	2.34	0.396	29.63	11.71	1.828
27	TME116	0 to 15	NaCl 7	0.419	6.77	9.93	3.48	2.44	0.449	31.48	11.51	1.769
27	TME117	0 to 15	NaCl 7	0.387	6.45	9.15	4.75	2.91	0.411	32.85	12.48	1.820
27	TME118	0 to 15	NaCl 7	0.363	6.34	9.66	3.42	2.24	0.441	31.30	12.12	1.725
27	TME119	0 to 15	NaCl 7	0.366	6.73	9.86	4.29	2.72	0.470	31.96	12.08	1.730
27	TME120	0 to 15	NaCl 7	0.358	6.25	8.67	4.24	2.50	0.461	29.59	10.69	1.542
27	TME121	15 to 30	NaCl 7	0.336	6.50	9.09	4.52	2.78	0.410	32.39	12.11	1.728
34	TME152	0 to 15	NaCl 7	0.375	7.40	11.14	3.98	2.75	0.434	33.12	11.35	2.025
34	TME153	0 to 15	NaCl 7	0.337	7.36	12.24	5.58	4.12	0.466	38.45	15.95	2.126
34	TME154	0 to 15	NaCl 7	0.342	7.07	11.61	5.65	3.41	0.448	34.82	14.34	2.038
34	TME155	0 to 15	NaCl 7	0.379	6.86	9.97	4.32	2.53	0.390	31.34	10.89	1.883
34	TME156	0 to 15	NaCl 7	0.430	7.10	10.46	4.95	2.70	0.437	32.44	11.31	1.949
34	TME157	15 to 30	NaCl 7	0.401	7.09	11.67	4.13	3.23	0.412	36.18	16.46	1.996
20	TME78	0 to 15	NaCl 8	0.232	4.07	5.69	2.17	1.40	0.234	18.22	6.18	1.124
35	TME158	0 to 15	NaCl 8	0.442	7.47	11.42	2.69	2.51	0.487	34.65	13.10	1.994
35	TME159	0 to 15	NaCl 8	0.388	7.37	10.67	5.40	2.99	0.455	33.86	11.38	2.068
35	TME160	0 to 15	NaCl 8	0.380	7.04	10.54	5.53	2.75	0.456	33.73	11.20	2.004

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Cu ug/g	Zn ug/g	Mo ug/g	V ug/g	Cr ug/g	Ba ug/g	Ni ug/g	Sr ug/g	Li ug/g	Zr ug/g
25	TME105	0 to 15	KCl 5	6.71	47.0	13.9	45.0	40.3	114.3	16.2	101.9	13.7	70.8
25	TME106	15 to 30	KCl 5	BD	41.7	BD	24.0	42.0	145.7	10.0	104.0	BD	68.3
25	TME107	15 to 30	KCl 5	BD	42.1	BD	23.6	33.2	252.2	BD	97.1	BD	65.4
25	TME108	15 to 30	KCl 5	5.48	36.5	12.1	27.2	36.3	98.1	10.0	92.4	10.5	71.0
25	TME109	15 to 30	KCl 5	BD	43.4	17.9	29.3	32.5	104.1	BD	98.7	BD	72.1
25	TME110	15 to 30	KCl 5	5.79	50.5	17.1	52.7	44.1	171.1	14.3	100.4	17.4	78.9
25	TME111	30 to 45	KCl 5	BD	49.9	13.9	51.9	45.0	130.8	13.9	91.0	15.2	71.7
25	TME112	45 to 60	KCl 5	BD	42.9	16.4	49.4	47.0	174.4	12.0	94.3	14.4	79.3
25	TME112a	60 to 75	KCl 5	7.13	35.9	20.3	53.5	51.7	68.9	17.8	83.4	16.3	74.2
25	TME113	75 to 90	KCl 5	7.33	35.0	19.0	47.8	45.1	195.0	15.5	96.1	14.9	92.9
25	TME113a	90 to 105	KCl 5	36.86	46.7	89.0	61.5	71.9	67.2	55.0	93.2		150.0
25	TME113b	105 to 120	KCl 5	54.78	50.6	107.6	79.1	86.9	102.9	85.2	103.2		204.2
25	TME113c	120 to 140	KCl 5	52.66	50.4	93.6	72.4	83.8	111.0	80.7	103.9		187.2
26	TME114	0 to 15	KCl 5	40.59	53.0	85.8	61.4	48.4	66.6	54.9	97.4		149.9
26	TME115	15 to 30	KCl 5	52.70	46.7	75.3	61.6	59.8	159.3	75.3	102.1		195.3
37	TME173	0 to 15	KCl 5	11.39	52.2	18.8	43.4	53.5	67.3	21.2	102.8	16.7	96.9
22	TME84	0 to 15	NaCl 6	16.62	12.8	BD	16.0	16.0	BD	11.0	32.6	15.4	16.0
22	TME85	15 to 30	NaCl 6	21.27	12.8	BD	19.0	20.1	BD	16.7	24.7	18.4	21.0
22	TME86	30 to 45	NaCl 6	13.74	40.2	16.3	47.2	53.2	164.9	22.1	77.3	18.1	85.8
22	TME87	45 to 60	NaCl 6	17.77	46.2	18.0	58.2	59.3	132.6	28.4	72.7	21.9	96.2
22	TME87a	60 to 75	NaCl 6	18.52	39.3	15.4	49.4	60.1	168.9	27.2	78.9	19.9	82.5
22	TME87b	75 to 90	NaCl 6	14.22	37.8	13.5	46.4	52.5	146.2	22.3	73.3	17.4	80.9
22	TME87c	90 to 105	NaCl 6	15.59	44.9	14.2	48.4	56.7	135.4	27.7	72.0	19.3	83.3
22	TME87d	105 to 120	NaCl 6	11.27	37.4	15.0	45.1	52.4	173.1	20.8	71.8	15.9	77.2
22	TME87e	120 to 130	NaCl 6	14.10	40.0	17.5	47.3	56.9	180.5	28.7	77.6	17.5	80.7
32	TME150	0 to 15	NaCl 6	17.92	45.1	25.2	42.8	52.1	108.4	25.8	100.8	22.4	115.4
41	TME189	0 to 15	NaCl 6	15.37	47.2	25.0	41.4	55.7	81.2	27.7	96.3	18.9	102.1
18	TME64	0 to 15	NaCl 7	12.46	37.9	18.4	40.9	40.1	42.8	22.2	80.7	16.8	86.2
27	TME116	0 to 15	NaCl 7	39.24	43.8	93.3	47.6	52.9	76.6	55.9	96.2		156.1
27	TME117	0 to 15	NaCl 7	26.80	49.0	72.1	39.5	50.7	207.5	41.0	97.1		122.7
27	TME118	0 to 15	NaCl 7	37.91	43.6	77.2	50.3	55.1	90.9	58.9	90.7		156.2
27	TME119	0 to 15	NaCl 7	48.85	47.5	103.9	58.6	61.5	155.7	75.6	103.4		184.0
27	TME120	0 to 15	NaCl 7	36.99	42.1	91.6	49.4	57.9	180.4	60.0	93.7		144.9
27	TME121	15 to 30	NaCl 7	29.35	43.3	59.6	47.1	53.7	176.4	43.3	97.8		133.4
34	TME152	0 to 15	NaCl 7	18.44	45.6	26.4	41.5	52.2	84.0	27.4	104.0	22.0	107.6
34	TME153	0 to 15	NaCl 7	21.84	53.0	29.8	54.5	61.0	132.2	32.1	110.6	26.1	116.9
34	TME154	0 to 15	NaCl 7	17.73	48.7	23.5	49.5	52.4	134.4	26.5	103.2	22.5	111.1
34	TME155	0 to 15	NaCl 7	17.71	40.3	25.5	40.3	49.9	89.1	26.0	100.6	22.0	105.5
34	TME156	0 to 15	NaCl 7	20.31	41.7	27.1	42.6	53.9	125.0	30.5	106.1	23.4	115.4
34	TME157	15 to 30	NaCl 7	24.28	50.5	25.6	55.1	65.8	66.0	36.0	96.3	27.3	116.0
20	TME78	0 to 15	NaCl 8	4.34	31.1	BD	16.9	21.5	BD	BD	50.2	BD	26.8
35	TME158	0 to 15	NaCl 8	19.83	45.5	26.0	44.4	63.7	103.1	31.6	105.9	22.9	104.5
35	TME159	0 to 15	NaCl 8	11.65	52.3	22.4	36.2	54.5	105.5	21.1	108.6	14.8	114.3
35	TME160	0 to 15	NaCl 8	9.57	43.1	24.2	35.3	47.8	329.0	14.7	108.6	14.4	97.8

BD = Below Detection

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Mn mg/g	Na mg/g	K mg/g	Ca mg/g	Mg mg/g	P mg/g	Al mg/g	Fe mg/g	Ti mg/g
35	TME161	0 to 15	NaCl 8	0.427	7.22	10.45	5.94	2.84	0.417	33.94	11.47	2.053
35	TME162	0 to 15	NaCl 8	0.406	7.23	10.86	6.40	3.01	0.440	33.15	10.99	2.054
35	TME163	15 to 30	NaCl 8	0.392	6.46	10.81	8.52	5.02	0.436	28.52	16.33	1.988
35	TME164	30 to 45	NaCl 8	0.382	6.74	11.48	9.61	5.77	0.452	31.68	16.40	1.906
35	TME165	45 to 60	NaCl 8	0.387	6.68	11.84	8.14	5.11	0.436	29.26	17.85	1.966
35	TME165a	60 to 75	NaCl 8	0.424	6.03	11.94	6.68	4.30	0.463	30.08	19.35	2.098
35	TME166	75 to 90	NaCl 8	0.449	6.45	12.68	5.58	4.25	0.490	31.41	20.49	2.209
35	TME166a	90 to 105	NaCl 8	0.310	7.76	13.92	7.56	4.73	0.463	35.89	19.90	2.047
44	TME196	0 to 15	NaCl 8	1.170	7.35	11.51	5.24	3.72	0.443	35.12	14.72	2.066
44	TME197	0 to 15	NaCl 8	1.271	7.54	11.37	4.68	2.96	0.368	35.33	13.23	2.187
44	TME198	0 to 15	NaCl 8	1.262	7.76	11.79	4.05	2.91	0.373	37.13	14.51	2.184
44	TME199	0 to 15	NaCl 8	1.145	7.45	11.23	4.90	3.61	0.414	34.63	13.09	2.123
44	TME200	0 to 15	NaCl 8	1.297	7.29	10.80	4.95	3.30	0.420	33.43	12.35	2.038
44	TME201	15 to 30	NaCl 8	1.115	7.32	12.09	5.20	3.98	0.382	36.62	16.59	2.002
44	TME202	15 to 30	NaCl 8	1.189	7.65	11.57	4.67	3.04	0.374	36.89	13.53	2.093
44	TME203	15 to 30	NaCl 8	1.217	7.45	11.03	3.51	2.13	0.340	34.02	12.83	2.022
44	TME204	15 to 30	NaCl 8	1.093	7.43	11.52	5.58	3.87	0.432	35.50	14.61	2.053
44	TME205	15 to 30	NaCl 8	1.267	7.14	11.18	5.40	3.66	0.417	32.22	14.72	1.959
44	TME206	30 to 45	NaCl 8	0.947	6.87	10.88	6.33	4.97	0.444	35.99	17.23	1.963
44	TME207	45 to 60	NaCl 8	1.182	5.94	11.03	5.13	3.62	0.416	29.21	17.02	1.969
44	TME207a	60 to 75	NaCl 8	0.895	6.18	11.24	8.66	6.31	0.423	31.81	17.65	2.041
44	TME207b	75 to 90	NaCl 8	1.306	5.60	11.79	4.37	3.00	0.422	28.78	18.46	2.053
44	TME207c	90 to 105	NaCl 8	0.956	5.85	10.89	6.05	4.30	0.400	29.57	17.33	1.959
44	TME207d	105 to 120	NaCl 8	1.515	5.49	11.09	4.36	3.14	0.415	28.22	17.21	2.006
44	TME207e	120 to 135	NaCl 8	1.138	5.87	11.34	5.03	3.58	0.426	29.64	17.27	1.997
44	TME207f	135 to 150	NaCl 8	1.139	5.60	11.38	5.77	3.84	0.428	29.89	17.80	2.032
19	TME65	0 to 15	NaCl 9	0.513	6.39	9.25	5.06	2.61	0.474	30.59	10.64	1.792
19	TME66	0 to 15	NaCl 9	0.390	6.34	9.78	4.39	2.75	0.397	32.27	12.29	1.768
19	TME67	0 to 15	NaCl 9	0.460	6.49	9.56	4.63	2.94	0.418	32.87	12.51	1.949
19	TME68	0 to 15	NaCl 9	0.369	6.49	9.32	3.96	2.44	0.420	30.53	10.61	1.841
19	TME69	0 to 15	NaCl 9	0.359	6.54	9.47	4.03	2.59	0.400	30.40	12.13	1.816
19	TME70	15 to 30	NaCl 9	0.651	6.84	9.76	3.40	2.17	0.357	31.10	11.60	1.840
19	TME71	15 to 30	NaCl 9	0.362	5.59	10.86	3.93	2.93	0.356	34.67	18.33	2.056
19	TME72	15 to 30	NaCl 9	0.464	6.49	9.11	3.82	2.49	0.355	30.90	11.27	1.768
19	TME73	15 to 30	NaCl 9	0.408	6.87	9.99	4.95	3.21	0.422	34.69	12.59	1.936
19	TME74	15 to 30	NaCl 9	0.361	6.82	10.02	4.90	3.07	0.410	35.23	13.19	1.930
19	TME75	30 to 45	NaCl 9	0.398	6.70	12.93	4.92	3.47	0.445	40.23	20.66	2.149
19	TME76	45 to 60	NaCl 9	0.320	6.22	11.42	6.08	4.42	0.436	37.76	18.75	2.063
19	TME76a	60 to 75	NaCl 9	0.277	5.33	10.40	4.14	2.78	0.392	29.19	15.91	1.828
19	TME77	75 to 90	NaCl 9	0.275	5.69	10.01	6.19	4.06	0.384	31.46	15.81	1.838
19	TME77a	90 to 110	NaCl 9	0.235	5.73	9.74	5.21	3.75	0.375	31.50	15.80	1.770
31	TME138	0 to 15	NaCl 9	0.413	6.94	10.31	5.17	3.31	0.452	34.21	14.15	1.895
31	TME139	0 to 15	NaCl 9	0.404	6.97	10.37	4.48	2.46	0.438	33.95	13.63	1.925
31	TME140	0 to 15	NaCl 9	0.398	7.12	11.23	5.51	3.06	0.425	36.96	15.27	1.966

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Cu ug/g	Zn ug/g	Mo ug/g	V ug/g	Cr ug/g	Ba ug/g	Ni ug/g	Sr ug/g	Li ug/g	Zr ug/g
35	TME161	0 to 15	NaCl 8	9.73	43.6	20.9	34.8	57.5	313.1	21.2	111.4	14.4	111.2
35	TME162	0 to 15	NaCl 8	11.30	49.3	19.5	33.6	54.2	238.9	20.5	109.7	15.4	112.8
35	TME163	15 to 30	NaCl 8	21.89	50.3	25.0	55.7	66.5	127.7	35.0	81.9	23.6	120.8
35	TME164	30 to 45	NaCl 8	20.12	50.4	25.2	55.8	63.5	176.8	35.7	93.2	23.2	109.9
35	TME165	45 to 60	NaCl 8	13.83	63.1	16.7	52.2	55.9	121.3	24.5	83.9	17.6	111.2
35	TME165a	60 to 75	NaCl 8	17.85	54.9	18.6	58.8	72.7	90.1	29.9	75.1	18.9	104.2
35	TME166	75 to 90	NaCl 8	16.25	68.3	21.3	60.9	80.4	85.1	32.8	72.7	18.3	114.1
35	TME166a	90 to 105	NaCl 8	11.85	67.3	19.6	54.0	63.4	165.1	27.0	92.9	20.4	94.8
44	TME196	0 to 15	NaCl 8	3.83	39.8	BD	41.0	48.1	56.3	17.4	101.7	BD	83.2
44	TME197	0 to 15	NaCl 8	BD	36.6	13.1	36.1	50.7	93.0	10.7	107.1	BD	86.2
44	TME198	0 to 15	NaCl 8	3.66	47.5	15.2	41.9	52.3	45.6	18.3	106.0	BD	94.5
44	TME199	0 to 15	NaCl 8	BD	41.9	BD	35.0	43.6	56.1	BD	100.8	BD	78.0
44	TME200	0 to 15	NaCl 8	BD	38.5	BD	33.9	43.0	62.8	9.4	101.8	BD	78.3
44	TME201	15 to 30	NaCl 8	6.37	43.2	BD	47.4	61.3	61.0	16.9	98.4	BD	84.0
44	TME202	15 to 30	NaCl 8	BD	34.8	BD	39.1	38.3	67.7	11.4	108.0	BD	83.1
44	TME203	15 to 30	NaCl 8	3.67	32.4	BD	36.1	41.2	32.7	11.0	99.6	BD	82.9
44	TME204	15 to 30	NaCl 8	BD	36.9	BD	36.9	47.4	100.3	11.7	103.5	BD	83.2
44	TME205	15 to 30	NaCl 8	4.89	36.6	BD	39.9	60.0	75.2	19.1	90.4	BD	78.5
44	TME206	30 to 45	NaCl 8	9.97	35.0	BD	48.9	68.0	90.9	24.2	97.3	BD	95.1
44	TME207	45 to 60	NaCl 8	13.16	37.1	14.7	54.5	60.3	73.2	29.2	71.6	BD	90.8
44	TME207a	60 to 75	NaCl 8	15.61	42.4	BD	59.9	62.8	122.7	28.7	83.8	BD	95.3
44	TME207b	75 to 90	NaCl 8	14.07	42.9	12.2	58.2	63.9	66.5	24.8	66.1	BD	86.1
44	TME207c	90 to 105	NaCl 8	13.10	45.3	BD	54.1	65.5	86.9	25.4	78.3	BD	91.7
44	TME207d	105 to 120	NaCl 8	13.52	48.4	BD	55.5	59.5	48.2	29.5	66.6	BD	89.7
44	TME207e	120 to 135	NaCl 8	14.58	48.1	15.4	57.5	60.5	67.2	28.1	72.9	BD	88.6
44	TME207f	135 to 150	NaCl 8	14.84	44.0	15.8	62.6	59.9	78.0	28.7	69.4	BD	89.0
19	TME65	0 to 15	NaCl 9	9.51	43.8	15.8	32.9	42.6	208.3	16.7	93.1	13.3	84.1
19	TME66	0 to 15	NaCl 9	7.77	37.1	18.3	36.6	41.1	139.3	16.0	90.5	14.0	83.2
19	TME67	0 to 15	NaCl 9	9.04	39.6	18.9	37.0	46.9	148.6	19.2	94.4	14.7	85.6
19	TME68	0 to 15	NaCl 9	9.12	44.6	15.6	34.9	41.2	100.8	17.7	89.9	14.6	93.5
19	TME69	0 to 15	NaCl 9	5.61	38.3	13.9	34.9	49.0	105.9	13.9	87.1	11.7	85.9
19	TME70	15 to 30	NaCl 9	7.82	34.5	15.7	31.1	53.8	86.9	19.2	90.2	11.4	80.1
19	TME71	15 to 30	NaCl 9	12.46	47.3	15.8	56.7	66.3	69.1	27.3	70.5	19.0	95.0
19	TME72	15 to 30	NaCl 9	8.27	27.4	13.7	33.3	42.6	88.9	16.8	89.4	14.0	83.5
19	TME73	15 to 30	NaCl 9	8.71	48.2	13.8	39.5	40.5	163.0	18.7	97.1	13.8	85.8
19	TME74	15 to 30	NaCl 9	10.35	40.8	17.8	42.0	43.7	159.3	19.3	96.9	15.5	87.1
19	TME75	30 to 45	NaCl 9	15.93	47.8	20.0	63.3	66.6	134.0	29.7	86.4	18.8	97.1
19	TME76	45 to 60	NaCl 9	15.03	43.2	18.3	59.6	55.0	193.2	26.8	86.2	19.6	90.2
19	TME76a	60 to 75	NaCl 9	11.94	46.5	16.3	49.9	50.1	74.0	24.7	63.6	15.8	86.0
19	TME77	75 to 90	NaCl 9	9.88	39.3	15.3	47.8	46.0	166.2	21.1	76.7	14.6	75.4
19	TME77a	90 to 110	NaCl 9	10.85	37.8	BD	46.9	53.7	139.0	22.2	75.0	15.4	78.1
31	TME138	0 to 15	NaCl 9	6.72	40.6	18.7	40.9	46.2	142.4	16.4	97.4	12.6	78.3
31	TME139	0 to 15	NaCl 9	11.30	39.7	18.5	42.0	51.8	83.4	20.3	96.2	16.8	86.3
31	TME140	0 to 15	NaCl 9	10.25	39.7	19.5	45.5	58.0	170.7	19.5	102.2	16.0	89.2

BD = Below Detection

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Mn mg/g	Na mg/g	K mg/g	Ca mg/g	Mg mg/g	P mg/g	Al mg/g	Fe mg/g	Ti mg/g
31	TME141	0 to 15	NaCl 9	0.526	7.18	10.25	5.04	2.65	0.421	33.98	12.61	1.977
31	TME142	0 to 15	NaCl 9	0.386	7.13	10.42	5.17	2.84	0.445	34.39	12.36	2.016
31	TME143	15 to 30	NaCl 9	0.282	7.58	13.59	5.29	4.60	0.480	47.25	20.74	2.163
31	TME144	15 to 30	NaCl 9	0.455	7.11	10.39	4.46	2.81	0.434	33.96	12.63	1.905
31	TME145	15 to 30	NaCl 9	0.422	7.27	11.90	5.70	3.64	0.426	40.15	16.70	2.065
31	TME146	15 to 30	NaCl 9	0.333	6.92	11.60	4.83	3.25	0.443	39.91	18.05	2.009
31	TME147	15 to 30	NaCl 9	0.346	7.13	10.63	5.72	3.16	0.436	34.97	12.38	1.956
31	TME148	30 to 45	NaCl 9	0.364	7.41	14.36	4.22	2.97	0.475	46.31	20.85	2.262
31	TME149	45 to 60	NaCl 9	0.355	7.24	14.55	4.01	2.58	0.488	46.29	21.37	2.286
31	TME149a	60 to 75	NaCl 9	0.372	7.60	13.83	5.00	4.03	0.478	47.69	20.86	2.268
36	TME167	0 to 15	NaCl 9	0.324	7.11	10.50	5.89	3.71	0.392	34.85	13.10	1.988
36	TME168	0 to 15	NaCl 9	0.356	6.97	10.91	6.52	4.45	0.436	36.40	14.92	2.077
36	TME169	0 to 15	NaCl 9	0.370	7.09	11.10	7.10	4.27	0.487	37.58	14.74	1.956
36	TME170	0 to 15	NaCl 9	0.540	7.51	11.22	5.42	3.74	0.466	36.65	14.65	1.974
36	TME171	0 to 15	NaCl 9	0.360	7.07	11.03	4.88	3.21	0.432	35.74	14.86	2.038
36	TME172	15 to 30	NaCl 9	0.398	7.65	14.01	5.27	3.09	0.505	46.32	21.81	2.395
23	TME88	0 to 15	NaCl 10	0.365	7.52	10.47	3.85	2.37	0.405	32.39	11.45	1.917
23	TME89	0 to 15	NaCl 10	0.358	6.80	9.10	5.87	3.03	0.340	30.40	10.52	1.727
23	TME90	0 to 15	NaCl 10	0.380	6.86	10.30	4.71	3.17	0.331	34.80	13.20	1.910
23	TME91	0 to 15	NaCl 10	0.401	7.48	10.62	5.61	3.52	0.494	32.45	11.88	1.781
23	TME92	0 to 15	NaCl 10	0.419	7.78	10.68	4.07	2.92	0.520	31.60	12.03	1.742
23	TME93	15 to 30	NaCl 10	0.338	6.12	10.56	7.15	4.59	0.397	29.60	15.13	1.800
23	TME94	15 to 30	NaCl 10	0.426	6.88	9.80	4.65	3.15	0.340	31.33	11.70	1.751
23	TME95	15 to 30	NaCl 10	0.330	6.51	9.61	4.23	2.89	0.276	32.32	12.11	1.750
23	TME96	15 to 30	NaCl 10	0.387	6.77	10.00	11.21	6.02	0.387	33.54	13.55	1.638
23	TME97	15 to 30	NaCl 10	0.438	6.62	8.94	6.74	3.77	0.349	28.80	11.44	1.768
23	TME98	30 to 45	NaCl 10	0.277	6.49	10.22	10.05	6.77	0.360	32.09	15.24	1.694
23	TME99	45 to 60	NaCl 10	0.305	5.94	10.33	6.45	4.36	0.371	28.75	15.28	1.765
23	TME99a	60 to 75	NaCl 10	0.338	6.77	10.68	7.89	5.45	0.381	31.32	15.28	1.741
23	TME99b	75 to 90	NaCl 10	0.268	6.17	10.66	5.60	3.97	0.414	28.47	15.80	1.767
23	TME99c	90 to 105	NaCl 10	0.234	5.83	10.07	7.55	4.86	0.377	28.27	15.24	1.772
23	TME99d	105 to 120	NaCl 10	0.234	5.57	10.44	5.31	3.79	0.405	27.25	15.63	1.791
23	TME99e	120 to 140	NaCl 10	0.260	5.86	10.25	6.68	4.61	0.379	28.38	15.66	1.810
28	TME122	0 to 15	NaCl 10	0.530	6.94	8.92	3.42	2.15	0.443	27.67	9.22	1.743
28	TME123	0 to 15	NaCl 10	0.317	6.85	9.96	2.73	1.76	0.414	31.58	13.12	1.827
28	TME124	0 to 15	NaCl 10	0.339	6.83	9.87	4.05	3.10	0.478	33.28	13.65	1.858
28	TME125	0 to 15	NaCl 10	0.347	6.53	8.89	3.17	2.00	0.430	28.38	10.96	1.708
28	TME126	0 to 15	NaCl 10	0.356	6.93	9.07	3.51	2.18	0.443	28.50	11.18	1.730
28	TME127	15 to 30	NaCl 10	0.398	6.84	11.53	4.47	3.61	0.482	41.55	18.54	1.991
28	TME128	15 to 30	NaCl 10	0.313	6.85	9.49	4.85	3.02	0.425	33.72	13.69	1.797
28	TME129	15 to 30	NaCl 10	0.301	6.96	10.92	5.02	3.72	0.507	39.64	17.32	1.994
28	TME130	15 to 30	NaCl 10	0.342	7.01	10.55	4.80	2.83	0.374	34.73	15.70	1.924
28	TME131	15 to 30	NaCl 10	0.342	6.90	9.66	4.36	2.81	0.383	31.89	12.11	1.843
28	TME131a	30 to 45	NaCl 10	0.297	6.87	11.36	5.07	3.85	0.400	40.45	17.40	1.985

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Cu ug/g	Zn ug/g	Mo ug/g	V ug/g	Cr ug/g	Ba ug/g	Ni ug/g	Sr ug/g	Li ug/g	Zr ug/g
31	TME141	0 to 15	NaCl 9	9.54	42.0	19.1	38.1	47.7	138.6	16.5	102.7	15.9	83.3
31	TME142	0 to 15	NaCl 9	9.43	36.5	19.2	36.8	48.3	143.5	16.1	105.2	15.8	97.6
31	TME143	15 to 30	NaCl 9	22.01	51.2	28.3	65.7	82.0	252.0	38.9	115.5	26.2	110.0
31	TME144	15 to 30	NaCl 9	12.12	52.6	19.2	38.7	47.9	92.8	19.8	99.3	17.7	99.6
31	TME145	15 to 30	NaCl 9	15.10	46.7	20.5	51.6	61.0	276.1	26.2	110.0	19.9	99.2
31	TME146	15 to 30	NaCl 9	18.81	42.7	23.9	53.7	66.0	177.3	29.9	105.7	21.8	98.8
31	TME147	15 to 30	NaCl 9	12.34	47.9	20.6	40.6	46.4	297.4	21.2	108.7	18.5	96.1
31	TME148	30 to 45	NaCl 9	19.85	52.9	23.4	66.4	65.7	183.5	32.8	108.2	24.2	115.5
31	TME149	45 to 60	NaCl 9	22.46	56.3	25.0	69.7	80.3	114.6	37.4	104.5	25.8	112.3
31	TME149a	60 to 75	NaCl 9	22.47	55.9	26.8	69.3	74.9	302.3	38.4	116.4	27.5	120.4
36	TME167	0 to 15	NaCl 9	8.74	56.6	19.6	33.7	49.7	179.3	15.7	107.3	13.3	97.9
36	TME168	0 to 15	NaCl 9	9.95	48.6	16.2	40.6	56.8	190.4	17.6	106.9	15.3	92.4
36	TME169	0 to 15	NaCl 9	14.87	55.2	25.5	40.9	58.1	221.9	25.7	107.0	20.6	101.2
36	TME170	0 to 15	NaCl 9	10.20	52.1	18.7	37.2	56.2	159.0	19.3	107.8	14.9	93.7
36	TME171	0 to 15	NaCl 9	10.18	47.9	20.6	38.0	55.7	103.1	18.2	102.6	14.5	98.0
36	TME172	15 to 30	NaCl 9	19.57	66.6	25.4	59.6	76.2	105.7	31.5	111.6	21.9	113.3
23	TME88	0 to 15	NaCl 10	8.68	33.9	16.3	35.0	42.6	111.0	13.5	92.6	15.1	81.4
23	TME89	0 to 15	NaCl 10	10.29	39.7	17.6	35.0	37.6	351.4	13.5	91.8	15.6	80.3
23	TME90	0 to 15	NaCl 10	8.51	38.4	15.7	41.5	47.5	182.3	17.8	89.7	16.8	82.8
23	TME91	0 to 15	NaCl 10	12.56	35.5	17.1	38.0	48.9	212.2	20.8	97.0	17.1	82.6
23	TME92	0 to 15	NaCl 10	12.27	37.9	20.5	38.2	51.5	81.3	22.1	90.5	18.0	79.3
23	TME93	15 to 30	NaCl 10	14.31	38.6	15.1	49.8	52.1	191.4	25.5	79.5	19.7	78.2
23	TME94	15 to 30	NaCl 10	9.98	29.4	17.4	38.6	37.6	147.6	16.6	88.8	16.4	86.7
23	TME95	15 to 30	NaCl 10	9.74	31.2	13.7	39.2	37.7	121.6	17.2	86.4	18.2	86.4
23	TME96	15 to 30	NaCl 10	17.49	37.9	20.4	45.2	52.5	348.3	24.5	96.5	21.9	83.9
23	TME97	15 to 30	NaCl 10	11.45	35.4	BD	35.2	45.8	297.1	15.5	87.8	13.9	79.6
23	TME98	30 to 45	NaCl 10	14.52	37.8	BD	47.1	54.5	244.9	22.3	90.7	19.4	80.3
23	TME99	45 to 60	NaCl 10	12.51	39.7	13.9	48.0	51.7	166.3	21.4	75.0	17.2	76.8
23	TME99a	60 to 75	NaCl 10	11.14	44.5	16.4	44.5	49.2	206.0	17.3	86.4	15.5	77.4
23	TME99b	75 to 90	NaCl 10	15.17	61.7	14.4	47.1	64.2	126.5	29.0	69.3	17.6	82.9
23	TME99c	90 to 105	NaCl 10	10.23	46.9	BD	44.7	49.6	177.4	19.5	76.3	14.7	72.8
23	TME99d	105 to 120	NaCl 10	11.86	49.1	BD	48.6	51.6	111.9	22.8	64.4	16.1	72.8
23	TME99e	120 to 140	NaCl 10	7.45	42.1	BD	45.0	48.0	163.9	13.6	75.0	13.1	70.6
28	TME122	0 to 15	NaCl 10	43.57	43.6	75.4	46.6	52.3	77.4	61.5	94.3		162.5
28	TME123	0 to 15	NaCl 10	38.51	44.3	77.5	54.1	53.4	61.2	58.2	86.5		160.3
28	TME124	0 to 15	NaCl 10	52.29	51.7	97.1	65.3	65.9	99.9	72.8	97.9		195.0
28	TME125	0 to 15	NaCl 10	28.83	42.5	64.6	42.0	49.4	70.5	44.8	85.7		125.3
28	TME126	0 to 15	NaCl 10	42.05	46.9	86.9	49.4	61.6	89.8	60.4	93.5		164.9
28	TME127	15 to 30	NaCl 10	42.87	51.9	104.4	70.8	72.2	185.6	63.6	104.4		162.7
28	TME128	15 to 30	NaCl 10	45.10	50.9	84.7	57.3	65.8	264.2	64.0	105.9		176.6
28	TME129	15 to 30	NaCl 10	51.09	51.1	100.5	73.0	74.7	285.5	72.7	109.8		187.5
28	TME130	15 to 30	NaCl 10	7.33	35.7	17.8	40.1	58.6	115.8	19.8	98.5	14.2	86.0
28	TME131	15 to 30	NaCl 10	10.78	37.3	18.9	37.9	50.7	81.0	17.5	94.4	15.4	83.9
28	TME131a	30 to 45	NaCl 10	15.03	39.5	22.6	54.5	75.2	276.9	35.7	106.8	19.4	103.1

BD = Below Detection

Table 7 (Continued). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Mn mg/g	Na mg/g	K mg/g	Ca mg/g	Mg mg/g	P mg/g	Al mg/g	Fe mg/g	Ti mg/g
28	TME131b	45 to 60	NaCl 10	0.353	6.86	12.07	4.39	2.94	0.409	40.19	17.91	1.999
28	TME131c	60 to 75	NaCl 10	0.318	6.94	12.02	4.68	3.23	0.418	40.41	18.66	2.010
28	TME131d	75 to 90	NaCl 10	0.343	6.26	11.32	4.12	2.86	0.417	38.11	17.14	1.965
28	TME131e	90 to 105	NaCl 10	0.293	6.84	11.86	4.66	3.13	0.443	39.64	17.89	1.993
28	TME131f	105 to 120	NaCl 10	0.311	6.67	11.93	4.40	3.12	0.429	36.88	18.21	1.989
28	TME131g	120 to 135	NaCl 10	0.330	6.57	11.06	7.56	5.18	0.501	35.78	19.77	2.135
28	TME131h	135 to 150	NaCl 10	0.387	6.66	12.06	6.31	4.35	0.498	35.95	19.31	2.220
38	TME174	0 to 15	NaCl 10	0.350	7.05	11.33	4.94	3.26	0.450	34.66	13.96	2.063
38	TME175	0 to 15	NaCl 10	0.410	7.75	11.59	6.19	4.32	0.433	38.28	15.22	2.170
38	TME176	0 to 15	NaCl 10	0.349	7.54	12.08	4.44	3.45	0.414	40.64	19.47	2.128
38	TME177	0 to 15	NaCl 10	0.422	6.96	12.23	4.69	3.27	0.480	33.86	16.84	2.058
38	TME178	0 to 15	NaCl 10	0.376	7.21	11.74	5.06	3.94	0.460	36.50	16.00	2.091
38	TME179	15 to 30	NaCl 10	0.375	7.55	11.41	4.69	3.11	0.426	38.33	14.99	2.049
38	TME180	15 to 30	NaCl 10	0.406	7.17	10.89	4.51	3.19	0.418	35.03	13.91	1.977
38	TME181	15 to 30	NaCl 10	0.404	7.58	12.88	4.80	3.29	0.463	36.49	17.15	2.119
38	TME182	15 to 30	NaCl 10	0.371	7.27	11.29	5.51	3.85	0.405	35.76	13.84	2.040
38	TME183	15 to 30	NaCl 10	0.404	7.76	12.22	6.66	4.54	0.467	40.29	16.18	2.096
38	TME184	30 to 45	NaCl 10	0.366	7.65	14.09	4.58	2.73	0.511	45.15	20.43	2.169
38	TME185	45 to 60	NaCl 10	0.349	7.37	15.11	4.51	2.93	0.532	48.73	23.07	2.413
38	TME185a	60 to 75	NaCl 10	0.389	7.82	14.68	5.15	3.70	0.529	48.93	22.23	2.349
38	TME186	75 to 90	NaCl 10	0.466	8.09	15.41	5.19	3.61	0.559	50.76	23.03	2.482
38	TME186a	90 to 105	NaCl 10	0.393	7.81	14.86	5.23	3.65	0.544	49.41	21.90	2.405
38	TME186b	105 to 120	NaCl 10	0.302	7.40	13.06	4.50	3.76	0.518	43.08	18.40	2.083
38	TME186c	120 to 135	NaCl 10	0.312	6.12	12.68	5.21	3.91	0.460	34.44	18.63	2.072

Table 7 (Concluded). Total Elemental Analysis Data for the Soils and Soil/Waste Mixtures in 1990.

Plot No:	Sample No:	Depth cm	Treatment	Cu ug/g	Zn ug/g	Mo ug/g	V ug/g	Cr ug/g	Ba ug/g	Ni ug/g	Sr ug/g	Li ug/g	Zr ug/g
28	TME131b	45 to 60	NaCl 10	14.93	40.6	21.7	54.0	65.2	107.2	30.1	101.7	19.4	95.6
28	TME131c	60 to 75	NaCl 10	14.12	45.0	20.1	53.1	66.9	168.6	26.1	103.0	18.3	95.9
28	TME131d	75 to 90	NaCl 10	13.85	60.3	21.3	54.4	53.4	94.4	26.4	94.4	19.2	94.6
28	TME131e	90 to 105	NaCl 10	13.88	43.9	24.5	53.6	65.7	129.2	25.8	102.6	18.3	105.1
28	TME131f	105 to 120	NaCl 10	14.72	57.2	21.2	54.1	86.2	66.1	35.0	90.7	18.6	95.1
28	TME131g	120 to 135	NaCl 10	18.56	52.6	76.6	53.1	69.9	218.6	33.5	93.6		105.7
28	TME131h	135 to 150	NaCl 10	24.51	53.1	78.2	60.1	65.3	174.6	40.5	87.7		119.2
38	TME174	0 to 15	NaCl 10	10.01	52.6	19.3	37.8	59.3	103.4	21.8	101.9	15.3	100.1
38	TME175	0 to 15	NaCl 10	8.55	49.9	20.5	39.9	62.4	238.7	21.1	112.5	15.1	106.0
38	TME176	0 to 15	NaCl 10	13.59	55.1	26.1	52.8	79.2	79.9	29.3	101.1	18.8	109.5
38	TME177	0 to 15	NaCl 10	15.54	78.2	19.2	46.6	64.2	70.5	26.2	92.2	18.7	102.3
38	TME178	0 to 15	NaCl 10	13.68	54.4	21.3	42.5	61.1	71.0	23.6	101.3	18.1	100.1
38	TME179	15 to 30	NaCl 10	11.90	59.5	22.9	40.5	54.4	92.1	22.7	109.9	16.7	106.0
38	TME180	15 to 30	NaCl 10	11.79	59.8	22.2	36.8	52.9	70.2	20.4	101.3	16.1	98.4
38	TME181	15 to 30	NaCl 10	14.38	81.1	21.6	49.5	69.3	77.3	29.0	95.0	19.0	103.5
38	TME182	15 to 30	NaCl 10	9.88	55.9	21.2	37.0	50.5	108.7	21.2	105.3	15.0	98.2
38	TME183	15 to 30	NaCl 10	11.45	71.7	20.8	43.4	61.5	221.5	23.2	116.0	18.1	112.1
38	TME184	30 to 45	NaCl 10	20.46	60.8	27.1	58.4	80.5	90.7	34.8	113.7	22.1	117.5
38	TME185	45 to 60	NaCl 10	22.20	79.9	26.6	69.7	93.2	110.0	41.5	110.2	24.6	124.6
38	TME185a	60 to 75	NaCl 10	18.45	61.7	30.0	62.0	96.9	221.7	42.1	122.0	22.2	117.7
38	TME186	75 to 90	NaCl 10	20.76	65.7	29.3	68.5	83.0	166.9	40.4	123.4	24.5	126.8
38	TME186a	90 to 105	NaCl 10	17.17	61.2	28.2	63.8	74.3	235.0	31.1	122.8	21.7	114.5
38	TME186b	105 to 120	NaCl 10	18.14	61.4	27.9	54.7	75.1	97.1	36.8	111.6	22.9	118.1
38	TME186c	120 to 135	NaCl 10	18.79	52.9	23.7	55.1	85.3	100.6	36.1	84.8	19.8	108.8

Table 8. 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 9. Total Elemental Analysis Data for the Brome Grass Tissue Collected in the Field Trial Plots in 1990.

Waste	Rate	Plot	FSN (T)	Ca	Mg	K (mg/g)	P	S	Cl	Cr	Cu (ug/g)	Zn	B
Freshwater	1	3	3	2.87	1.419	25.5	2.78	1.74	2.37	2.05	3.053	19.7	7.16
Freshwater	1	9	9	3.46	1.537	23.5	2.55	1.57	2.61	2.45	2.084	16.2	7.25
Freshwater	1	13	13	2.81	1.246	23.0	2.24	1.32	3.29	BD	1.957	15.4	7.31
Freshwater	2	2	2	2.91	1.242	25.1	2.83	1.81	3.95	5.55	3.410	23.2	10.33
Freshwater	2	8	8	2.46	1.081	22.9	2.40	1.40	3.50	BD	1.891	15.7	4.68
Freshwater	2	15	15	3.12	1.257	26.8	2.48	1.76	5.35	BD	4.257	19.3	9.97
Freshwater	3	1	1	2.20	0.942	18.0	1.92	1.17	3.12	BD	0.806	14.6	3.02
Freshwater	3	6	6	3.07	1.399	25.8	2.82	1.90	4.04	BD	3.785	19.5	7.67
Freshwater	3	11	11	2.95	1.241	25.3	2.45	1.54	5.26	BD	2.016	16.3	7.41
Freshwater	4	5	5	3.29	1.334	24.8	2.73	1.81	3.74	BD	2.542	17.7	24.76
Freshwater	4	7	7	2.94	1.410	23.5	2.70	1.74	3.91	BD	2.369	17.1	6.30
Freshwater	4	12	12	3.02	1.292	26.3	2.76	1.72	4.86	1.38	2.596	18.5	8.02
Freshwater	5	4	4	2.85	1.180	22.8	2.26	1.62	4.44	BD	2.236	14.5	7.13
Freshwater	5	10	10	2.96	1.214	22.0	2.09	1.40	4.17	2.06	2.780	16.5	7.67
Freshwater	5	14	14	3.30	1.348	22.2	2.33	1.46	4.20	BD	1.156	14.2	5.83
KCl	1	17	17	2.86	1.188	23.9	2.27	1.29	5.41	BD	1.482	16.9	6.27
KCl	1	42	42	2.95	1.280	22.7	1.93	1.30	4.01	BD	1.882	12.5	2.56
KCl	1	43	43	2.72	1.227	23.1	2.22	1.48	2.97	4.23	2.930	14.6	5.09
KCl	2	33	33	3.10	1.361	18.6	2.31	1.28	3.45	3.27	1.817	16.1	4.46
KCl	2	40	40	2.99	1.243	20.9	2.35	1.52	6.07	BD	3.833	18.8	6.23
KCl	2	45	45	2.86	1.123	23.2	2.27	1.34	5.79	BD	2.121	15.4	5.59
KCl	3	21	21	2.50	1.162	26.5	2.73	1.65	4.88	BD	3.188	19.0	7.67
KCl	3	30	30	2.71	1.062	25.2	2.26	1.37	5.76	1.58	2.568	18.6	8.09
KCl	3	39	39	2.96	1.130	20.1	1.66	1.30	4.82	BD	1.490	14.3	5.87
KCl	4	16	16	2.73	1.181	23.3	2.44	1.60	4.07	BD	2.124	17.0	6.86
KCl	4	24	24	2.00	0.940	22.6	2.14	1.15	5.33	2.01	3.243	15.3	5.36
KCl	4	29	29	2.34	0.898	21.9	1.98	1.05	6.36	1.73	1.575	14.1	5.08
KCl	5	25	25	2.80	0.923	26.6	2.12	1.39	7.38	BD	1.998	18.8	7.40
KCl	5	26	26	2.65	1.073	23.3	2.21	1.25	5.18	BD	1.740	14.3	5.02
KCL	5	37	37	2.79	1.097	20.6	2.23	1.37	5.33	2.21	2.261	19.6	4.47
NaCl	6	22	22	3.54	1.534	24.6	2.62	1.42	3.93	BD	2.638	18.7	10.32
NaCl	6	32	32	2.56	1.219	23.2	2.47	1.22	4.06	3.53	2.767	18.7	4.18
NaCl	6	41	41	3.00	1.301	21.7	2.14	1.31	5.21	BD	2.483	15.5	4.19
NaCl	7	18	18	2.51	1.256	23.5	2.59	1.32	4.88	1.70	2.105	20.6	6.27
NaCl	7	27	27	3.03	1.192	22.8	2.09	1.16	6.32	2.13	1.092	15.5	6.55
NaCl	7	34	34	2.50	1.168	21.8	2.41	1.32	5.73	1.84	1.475	16.8	3.85
NaCl	8	20	20	2.90	1.287	23.7	2.41	1.22	4.88	BD	2.137	16.1	6.71
NaCl	8	35	35	2.61	1.184	22.4	2.59	1.29	5.05	5.43	2.174	28.7	4.35
NaCl	8	44	44	2.57	1.134	22.7	2.35	1.24	5.37	1.26	2.086	15.4	4.61
NaCl	9	19	19	2.72	1.197	25.4	2.70	1.33	5.87	2.85	3.153	21.2	8.31
NaCl	9	31	31	2.50	1.115	22.5	2.16	1.13	4.96	BD	1.421	14.7	3.16
NaCl	9	36	36	2.86	1.175	19.7	2.15	1.19	4.55	3.83	1.407	18.7	2.98
NaCl	10	23	23	2.17	1.049	13.3	2.57	1.26	5.70	BD	1.247	21.5	5.14
NaCl	10	28	28	2.50	1.016	26.5	2.45	1.37	6.75	9.80	2.497	22.1	4.47
NaCl	10	38	38	2.78	1.105	20.9	1.99	1.26	6.02	BD	1.288	15.7	5.77

Elements (Ti, V, Li, Se and Co) below the detection limit are excluded from this table.
BD - below detection

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 and 1990 are presented in Table 10.

The tissue from the treated plots exhibited slightly elevated levels of chloride for all waste types and boron in the KCl amended plots. Boron levels increased two-fold over control levels for the FW 5 treatment in 1988, however, they were down to control levels in 1989 and 1990. The boron levels reported in Table 9 are below the intermediate range of 15 to 800 ppm B in grasses reported by Chapman (1966).

Copper levels in the tissue were lower in 1990 than 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 at about 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.

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 1990 tissue Na values were determined to be below detection limit for the analytical technique. The procedures will be

Table 10. ER (Enrichment Ratio) Values for Elements in the Brome Grass Tissue for 1988, 1989 and 1990.

Waste	Rate	B			Ca			Cl			Cr			Cu			K		
		Post	1989	1990	Post	1989	1990	Post	1989	1990	Post	1989	1990	Post	1989	1990	Post	1989	1990
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	1.0
Freshwater	2	1.6	1.0	1.2	1.0	1.0	0.9	1.8	1.4	1.5	—	0.9	2.5	1.1	1.3	1.4	1.0	1.1	1.0
Freshwater	3	1.8	1.0	0.8	1.0	0.9	0.9	2.1	1.3	1.5	—	1.0	—	1.1	0.9	0.9	1.1	1.1	1.0
Freshwater	4	1.6	1.1	1.8	1.1	1.1	1.0	2.1	1.4	1.5	—	1.0	0.6	1.0	1.2	1.1	1.0	1.0	1.0
Freshwater	5	2.0	1.0	1.0	1.2	1.1	1.0	2.2	1.4	1.5	—	1.0	0.9	1.0	1.0	0.9	1.0	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	—	1.0	1.0
KCl	2	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.1	1.2	—	0.9	0.8	1.0	0.9	1.2	1.0	1.0	0.9
KCl	3	1.4	1.0	1.6	1.1	1.0	1.0	1.2	1.2	1.2	—	1.0	0.4	0.8	2.6	1.2	0.9	1.1	1.0
KCl	4	—	1.1	1.2	—	1.2	0.8	—	1.3	1.3	—	1.0	0.4	—	2.9	1.1	—	1.5	1.0
KCl	5	—	1.0	1.3	—	1.0	1.0	—	1.1	1.5	—	1.0	—	—	1.2	0.9	—	1.1	1.1
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	1.0	1.0
NaCl	7	1.2	1.0	0.9	0.9	0.9	0.9	2.3	1.1	1.3	—	1.0	0.5	1.4	1.7	0.6	1.1	1.0	1.0
NaCl	8	1.0	1.0	0.8	1.1	0.9	0.9	2.1	1.1	1.2	—	1.3	0.9	1.2	1.9	0.8	1.0	1.0	1.0
NaCl	9	1.4	1.0	0.8	1.1	0.8	0.9	2.1	1.1	1.2	—	1.0	0.9	1.3	1.6	0.8	0.9	1.0	1.0
NaCl	10	—	1.0	0.8	—	0.8	0.8	—	1.3	1.4	—	1.0	2.8	—	1.1	0.6	—	1.0	0.9

Waste	Rate	Mg			Na			P			S			Zn		
		Post	1989	1990	Post	1989	1990	Post	1989	1990	Post	1989	1990	Post	1989	1990
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
Freshwater	2	0.9	0.9	0.9	2.4	1.0	1.0	1.0	1.0	1.0	1.3	1.1	1.1	1.0	1.0	1.1
Freshwater	3	0.9	0.9	0.9	3.2	0.9	2.1	1.1	1.0	1.0	1.3	1.1	1.0	1.0	0.9	1.0
Freshwater	4	0.9	1.0	1.0	2.4	0.9	0.5	0.9	1.0	1.1	1.2	1.0	1.1	0.9	0.8	1.0
Freshwater	5	0.9	1.0	0.9	9.5	1.3	1.4	0.8	1.0	0.9	1.1	1.0	1.0	0.9	0.8	0.9
KCl	1	—	1.0	0.9	—	1.0	—	—	1.0	1.0	—	1.0	1.0	—	1.0	1.0
KCl	2	1.0	1.0	1.0	1.0	1.2	—	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.1
KCl	3	0.9	0.9	0.9	2.6	2.0	—	0.6	1.1	1.0	0.9	1.0	1.1	1.0	1.0	1.2
KCl	4	—	1.0	0.8	—	1.4	—	—	1.2	1.0	—	1.2	0.9	—	1.3	1.1
KCl	5	—	1.0	0.8	—	1.4	—	—	1.1	1.0	—	1.0	1.0	—	1.0	1.1
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
NaCl	7	0.8	0.9	0.9	9.4	1.1	—	1.1	1.0	1.0	1.4	1.0	1.0	1.3	1.0	1.0
NaCl	8	1.0	0.9	0.9	21.8	1.3	—	1.1	1.0	1.0	1.2	1.0	0.9	1.2	2.1	1.1
NaCl	9	0.9	0.9	0.9	29.0	2.3	—	1.2	1.0	1.0	1.2	1.0	0.9	1.1	1.1	1.0
NaCl	10	—	0.7	0.8	—	10.9	—	—	1.1	1.0	—	1.0	1.0	—	1.0	1.1

Post = Sampled September 1988; 1989 = Sampled August 1989; 1990 = Sampled Aut 1st 1990.

repeated and the results re-evaluated however, normal levels were not exceeded in previous years and would be less likely to do so subsequently.

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 which is demonstrated by the ER values in Table 10. 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.

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 freshwater gel amended plots had the best growth overall, however the KCl and NaCl plot yields were only slightly below the freshwater gel amended plot yields. There were apparent yield differences between the different treatments for each of the waste types, however none of the differences were statistically significant.

5.2 FIELD PLOT SOIL PROPERTIES

A total of 224 samples were collected in mid-August 1990. 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 treatments FW 4 and FW 5 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 11 provides a summary of the degree of limitation associated with the EC, SAR, and Cl status of the plot treatments in

Table 11. Summary of degree of limitation relative to EC, SAR, and Cl levels in 1988, 1989 and 1990 for the 0 to 15 cm depth (zone of waste incorporation).

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

1988, 1989 and 1990 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. The KCl 5 and NaCl 10 treatments were the only ones to show a slight limitation on the basis of EC and only the NaCl 10 treatment had a limitation (moderate) on the basis of SAR. Limitation on the basis of Cl levels decreased from severe to moderate to slight for 1988 through 1990 for the NaCl 10 treatment.

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 slightly 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 and boron in the KCl amended plots in comparison with the tissue from the control plots. 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 and 1989. This beneficial effect of waste addition was reduced in 1990 as tissue copper levels were generally in the deficient range for the control plots as well as the amended plots.

Tissue chloride levels were comparable to 1989 values and somewhat below the 1988 values. 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 1990 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. Emphasis was 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. 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 C1 is 450 kg C1/ha (ERCB 1975). In this study the maximum rate of C1 applied was 120 kg C1/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 C1 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 C1 addition is not the most appropriate parameter for developing freshwater gel additions. Liming potential and 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. Yield declined from control levels as waste application rate increased, however the values obtained were not statistically significant (lower). Limitations relative to EC and Cl levels 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 1990 only the KCl 5 treatments had a slight limitation due to EC. Similarly Cl content presented a severe limitation for the KCl 5 (4000 kg Cl/ha) rate in 1988 and improved to no limitation in 1990.

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, however these were not statistically significant. The results indicated no limitation for the 350 kg Cl/ha rate and only a slight limitation due to SAR levels for the 700 kg Cl/ha rate. For the 1400 kg Cl/ha rate slight limitations were evident due to EC and moderate due to SAR initially and were not a limitation in 1990. 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. 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, and S.A. Abboud. 1989b. Oil and gas reclamation research program: drilling mud disposal: detailed sampling, characterization and greenhouse pot trials for the Cold Lake, Foothills, and Grande Prairie/Peace River regions. Terrain Sciences Department, Alberta Research Council Report prepared for the Land Conservation and Reclamation Council, Reclamation Research Technical Advisory Committee, Alberta Environment.
- 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 1990.

Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1990.

Waste	Rate	Plot	Sample Number	Depth (cm)	H2O	pH CaCl2	CaCO3 Eq
Freshwater	1	3	TME5	0-15	7.50	7.1	0.24
Freshwater	1	9	TME21	0-15	7.60	7.2	0.56
Freshwater	1	13	TME41	0-15	7.50	7.2	0.64
Freshwater	1	13	TME42	15-30	7.90	7.5	3.32
Freshwater	1	13	TME43	30-45	8.10	7.6	5.27
Freshwater	1	13	TME44	45-60	8.00	7.7	5.19
Freshwater	1	13	TME44a	60-75	8.10	7.7	6.07
Freshwater	1	13	TME44b	75-90	8.00	7.7	5.27
Freshwater	1	13	TME44c	90-105	7.90	7.6	4.91
Freshwater	2	2	TME4	0-15	7.30	6.9	0.52
Freshwater	2	8	TME19	0-15	7.70	7.3	0.92
Freshwater	2	8	TME20	15-30	7.30	6.9	0.96
Freshwater	2	15	TME49	0-15	7.80	7.5	2.31
Freshwater	3	1	TME1	0-15	7.00	6.9	0.24
Freshwater	3	1	TME2	15-30	5.60	5.4	
Freshwater	3	1	TME3	30-45	5.60	5.4	0.16
Freshwater	3	1	TME3a	45-60	5.20	4.6	0.02
Freshwater	3	1	TME3b	60-75	5.00	4.4	0.02
Freshwater	3	6	TME13	0-15	7.70	7.3	0.92
Freshwater	3	11	TME35	0-15	7.70	7.4	0.84
Freshwater	3	11	TME36	0-15	7.70	7.3	0.48
Freshwater	3	11	TME37	0-15	7.80	7.5	0.84
Freshwater	3	11	TME38	0-15	7.75	7.4	0.84
Freshwater	3	11	TME39	0-15	7.80	7.3	0.80
Freshwater	4	5	TME11	0-15	7.80	7.5	0.83
Freshwater	4	5	TME12	15-30	7.70	7.4	0.96
Freshwater	4	7	TME14	0-15	7.80	7.5	0.75
Freshwater	4	7	TME15	15-30	7.70	7.4	1.95
Freshwater	4	7	TME16	30-45	8.10	7.9	7.15
Freshwater	4	7	TME17	45-60	8.10	7.9	4.93
Freshwater	4	7	TME17a	60-75	8.10	7.9	5.02
Freshwater	4	7	TME18	75-90	8.10	7.9	0.12
Freshwater	4	7	TME18a	90-110	8.10	7.9	5.50
Freshwater	4	12	TME40	0-15	7.90	7.5	0.96
Freshwater	5	4	TME6	0-15	8.10	7.8	1.30
Freshwater	5	4	TME7	0-15	7.90	7.7	1.07
Freshwater	5	4	TME8	0-15	8.10	7.9	1.59
Freshwater	5	4	TME9	0-15	8.00	7.8	1.35
Freshwater	5	4	TME10	0-15	8.10	7.8	0.87
Freshwater	5	10	TME22	0-15	7.90	7.5	1.72
Freshwater	5	10	TME23	0-15	8.10	7.9	2.31
Freshwater	5	10	TME24	0-15	7.80	7.4	1.40
Freshwater	5	10	TME25	0-15	7.30	7.5	1.40
Freshwater	5	10	TME26	0-15	7.70	7.7	2.28
Freshwater	5	10	TME27	15-30	8.05	7.5	3.04
Freshwater	5	10	TME28	15-30	8.00	7.7	3.84

CaCO3 Eq = Calcium carbonate equivalent (g CaCO3 eq/100g).

Continued. Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1990.

Waste	Rate	Plot	Sample Number	Depth (cm)	pH H2O	pH CaCl2	CaCO3 Eq
Freshwater	5	10	TME29	15-30	7.30	7.1	0.02
Freshwater	5	10	TME30	15-30	7.60	7.3	0.76
Freshwater	5	10	TME31	15-30	7.90	7.6	4.62
Freshwater	5	10	TME32	30-45	7.90	7.7	4.88
Freshwater	5	10	TME33	45-60	7.90	7.7	5.16
Freshwater	5	10	TME33a	60-75	8.00	7.7	5.27
Freshwater	5	10	TME34	75-90	7.90	7.7	4.31
Freshwater	5	10	TME34a	90-105	7.90	7.7	4.77
Freshwater	5	10	TME34b	105-115	7.80	7.7	4.89
Freshwater	5	14	TME45	0-15	7.60	7.3	5.16
Freshwater	5	14	TME46	15-30	7.60	7.5	1.23
Freshwater	5	14	TME47	30-45	7.70	7.6	4.13
Freshwater	5	14	TME48	45-60	7.80	7.7	4.93
Freshwater	5	14	TME48a	60-75	7.90	7.7	5.80
Freshwater	5	14	TME48b	75-90	7.90	7.7	3.57
Freshwater	5	14	TME48c	90-105	7.80	7.7	6.59
KCI	1	17	TME63	0-15	7.50	7.0	0.29
KCI	1	42	TME190	0-15	7.80	7.5	2.48
KCI	1	42	TME191	0-15	8.00	7.6	3.65
KCI	1	42	TME192	0-15	7.70	7.5	2.86
KCI	1	42	TME193	0-15	7.80	7.5	3.02
KCI	1	42	TME194	0-15	7.90	7.6	3.77
KCI	1	43	TME195	0-15	7.80	7.4	2.50
KCI	1	43	TME195a	15-30	7.50	7.4	0.91
KCI	1	43	TME195b	30-45	7.80	7.6	3.82
KCI	1	43	TME195c	45-60	7.90	7.8	4.97
KCI	1	43	TME195d	60-75	8.00	7.8	6.10
KCI	1	43	TME195e	75-90	8.00	7.8	5.50
KCI	1	43	TME195f	90-105	8.00	7.8	5.42
KCI	1	43	TME195g	105-120	8.00	7.7	5.10
KCI	1	43	TME195h	120-135	7.95	7.7	4.68
KCI	2	33	TME151	0-15	7.60	7.2	0.76
KCI	2	40	TME188	0-15	7.80	7.4	1.49
KCI	2	45	TME208	0-15	7.70	7.4	1.09
KCI	2	45	TME209	0-15	7.40	7.1	5.08
KCI	2	45	TME210	0-15	7.60	7.3	4.81
KCI	2	45	TME211	0-15	6.80	6.6	0.24
KCI	2	45	TME212	0-15	7.20	6.8	0.40
KCI	2	45	TME213	15-30	6.80	6.5	0.24
KCI	2	45	TME214	15-30	7.70	7.5	3.54
KCI	2	45	TME215	15-30	7.80	7.7	3.82
KCI	2	45	TME216	15-30	5.80	5.5	
KCI	2	45	TME217	15-30	5.70	5.5	
KCI	2	45	TME218	30-45	5.60	5.3	
KCI	2	45	TME219	45-60	5.50	5.4	
KCI	2	45	TME220	60-75	5.50	5.4	
KCI	2	45	TME221	75-90	5.60	5.4	
KCI	2	45	TME222	90-105	5.50	5.3	

CaCO3 Eq = Calcium carbonate equivalent (g CaCO3 eq/100g).

Continued. Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1990.

Waste	Rate	Plot	Sample Number	Depth (cm)	H2O	pH CaCl2	CaCO3 Eq
KCI	2	45	TME223	105-120	5.80	5.8	
KCI	2	45	TME224	120-135	5.90	5.8	
KCI	3	21	TME79	0-15	7.60	7.2	0.44
KCI	3	21	TME80	0-15	7.65	7.4	0.80
KCI	3	21	TME81	0-15	7.70	7.2	0.48
KCI	3	21	TME82	0-15	7.70	7.2	0.52
KCI	3	21	TME83	0-15	7.50	7.1	0.32
KCI	3	30	TME137	0-15	7.40	7.1	0.14
KCI	3	39	TME187	0-15	7.80	7.5	2.67
KCI	4	16	TME50	0-15	7.60	7.3	0.72
KCI	4	16	TME51	0-15	7.70	7.3	0.99
KCI	4	16	TME52	0-15	7.60	7.3	0.76
KCI	4	16	TME53	0-15	7.70	7.3	0.80
KCI	4	16	TME54	0-15	7.80	7.4	0.76
KCI	4	16	TME55	15-30	7.70	7.5	2.43
KCI	4	16	TME56	15-30	7.70	7.4	0.76
KCI	4	16	TME57	15-30	7.70	7.5	0.79
KCI	4	16	TME58	15-30	7.80	7.5	1.23
KCI	4	16	TME59	15-30	7.60	7.4	0.44
KCI	4	16	TME60	30-45	7.70	7.6	0.20
KCI	4	16	TME61	45-60	7.60	7.5	0.76
KCI	4	16	TME61a	60-75	7.20	7.2	0.04
KCI	4	16	TME62	75-90	7.30	7.1	0.12
KCI	4	16	TME62a	90-110	7.50	7.3	0.95
KCI	4	24	TME100	0-15	7.70	7.4	0.84
KCI	4	29	TME132	0-15	7.70	7.4	0.40
KCI	4	29	TME133	15-30	7.20	7.1	0.32
KCI	4	29	TME134	30-45	7.20	6.9	0.24
KCI	4	29	TME135	45-60	6.50	6.6	0.02
KCI	4	29	TME135a	60-75	6.10	6.2	
KCI	4	29	TME136	75-90	6.00	6.0	0.02
KCI	4	29	TME136a	90-105	6.00	5.9	0.04
KCI	4	29	TME136b	105-120	6.60	6.4	0.08
KCI	4	29	TME136c	120-135	7.80	7.4	2.84
KCI	5	25	TME101	0-15	7.40	7.3	0.48
KCI	5	25	TME102	0-15	7.40	7.5	0.44
KCI	5	25	TME103	0-15	7.50	7.6	0.96
KCI	5	25	TME104	0-15	7.40	7.6	0.80
KCI	5	25	TME105	0-15	7.80	7.7	0.92
KCI	5	25	TME106	15-30	5.60	5.5	0.04
KCI	5	25	TME107	15-30	6.90	6.7	0.08
KCI	5	25	TME108	15-30	6.90	6.8	0.14
KCI	5	25	TME109	15-30	6.30	6.3	0.20
KCI	5	25	TME110	15-30	6.90	6.8	0.28
KCI	5	25	TME111	30-45	4.90	4.6	0.18
KCI	5	25	TME112	45-60	4.90	4.6	0.04
KCI	5	25	TME112a	60-75	5.00	4.6	

CaCO3 Eq = Calcium carbonate equivalent (g CaCO3 eq/100g).

Continued. Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1990.

Waste	Rate	Plot	Sample Number	Depth (cm)	— H2O —	pH — CaCl2 —	CaCO3 Eq
KCl	5	25	TME113	75-90	5.10	4.8	
KCl	5	25	TME113a	90-105	5.10	4.9	0.08
KCl	5	25	TME113b	105-120	5.20	5.0	
KCl	5	25	TME113c	120-140	5.40	5.2	0.02
KCl	5	26	TME114	0-15	7.80	7.4	0.12
KCl	5	26	TME115	15-30	7.70	7.3	0.95
KCl	5	37	TME173	0-15	7.70	7.3	1.68
NaCl	6	22	TME84	0-15	6.90	6.5	
NaCl	6	22	TME85	15-30	7.90	7.5	3.76
NaCl	6	22	TME86	30-45	8.10	7.8	4.95
NaCl	6	22	TME87	45-60	8.00	7.8	6.24
NaCl	6	22	TME87a	60-75	8.10	7.8	5.39
NaCl	6	22	TME87b	75-90	8.00	7.8	4.79
NaCl	6	22	TME87c	90-105	8.10	7.8	4.75
NaCl	6	22	TME87d	105-120	8.10	7.8	5.15
NaCl	6	22	TME87e	120-130	8.00	7.8	4.71
NaCl	6	32	TME150	0-15	7.60	7.1	0.76
NaCl	6	41	TME189	0-15	7.90	7.5	3.15
NaCl	7	18	TME64	0-15	7.80	7.3	1.11
NaCl	7	27	TME116	0-15	7.30	6.7	0.20
NaCl	7	27	TME117	0-15	7.40	6.9	0.20
NaCl	7	27	TME118	0-15	7.40	6.8	0.20
NaCl	7	27	TME119	0-15	7.10	6.5	0.16
NaCl	7	27	TME120	0-15	6.90	6.4	0.08
NaCl	7	27	TME121	15-30	7.20	6.9	0.12
NaCl	7	34	TME152	0-15	7.70	7.2	
NaCl	7	34	TME153	0-15	7.80	7.5	1.16
NaCl	7	34	TME154	0-15	7.80	7.5	1.20
NaCl	7	34	TME155	0-15	7.30	7.0	0.16
NaCl	7	34	TME156	0-15	7.50	7.0	0.18
NaCl	7	34	TME157	15-30	7.70	7.5	1.36
NaCl	8	20	TME78	0-15	7.70	7.2	0.36
NaCl	8	35	TME158	0-15	7.10	6.6	0.14
NaCl	8	35	TME159	0-15	7.50	7.1	0.48
NaCl	8	35	TME160	0-15	7.10	6.7	0.12
NaCl	8	35	TME161	0-15	7.40	6.9	0.08
NaCl	8	35	TME162	0-15	7.40	7.0	0.32
NaCl	8	35	TME163	15-30	7.90	7.6	6.56
NaCl	8	35	TME164	30-45	8.10	7.8	6.01
NaCl	8	35	TME165	45-60	8.10	7.8	0.72
NaCl	8	35	TME165a	60-75	8.00	7.8	1.04
NaCl	8	35	TME166	75-90	8.00	7.8	0.72
NaCl	8	35	TME166a	90-105	8.10	7.8	0.48
NaCl	8	44	TME196	0-15	7.80	7.5	1.75
NaCl	8	44	TME197	0-15	7.70	7.3	1.23
NaCl	8	44	TME198	0-15	7.60	7.3	4.68
NaCl	8	44	TME199	0-15	7.90	7.6	1.75

CaCO3 Eq = Calcium carbonate equivalent (g CaCO3 eq/100g).

Continued. Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1990.

Waste	Rate	Plot	Sample Number	Depth (cm)	pH H2O	pH CaCl2	CaCO3 Eq
NaCl	8	44	TME200	0-15	7.90	7.5	1.47
NaCl	8	44	TME201	15-30	7.90	7.6	1.94
NaCl	8	44	TME202	15-30	7.30	7.1	0.63
NaCl	8	44	TME203	15-30	7.40	7.2	0.44
NaCl	8	44	TME204	15-30	7.90	7.5	2.10
NaCl	8	44	TME205	15-30	7.90	7.6	4.20
NaCl	8	44	TME206	30-45	7.70	7.5	2.74
NaCl	8	44	TME207	45-60	7.80	7.6	5.36
NaCl	8	44	TME207a	60-75	7.80	7.7	6.36
NaCl	8	44	TME207b	75-90	7.90	7.7	6.36
NaCl	8	44	TME207c	90-105	7.90	7.7	5.76
NaCl	8	44	TME207d	105-120	7.90	7.6	5.72
NaCl	8	44	TME207e	120-135	7.90	7.7	5.36
NaCl	8	44	TME207f	135-150	7.90	7.7	12.47
NaCl	9	19	TME65	0-15	7.60	7.0	0.40
NaCl	9	19	TME66	0-15	7.60	7.1	0.64
NaCl	9	19	TME67	0-15	7.70	7.1	0.56
NaCl	9	19	TME68	0-15	7.70	7.0	0.29
NaCl	9	19	TME69	0-15	7.90	7.4	1.07
NaCl	9	19	TME70	15-30	7.30	6.6	0.18
NaCl	9	19	TME71	15-30	7.40	7.3	2.99
NaCl	9	19	TME72	15-30	7.30	6.8	2.91
NaCl	9	19	TME73	15-30	7.60	7.0	4.23
NaCl	9	19	TME74	15-30	7.40	7.1	4.19
NaCl	9	19	TME75	30-45	7.70	7.5	2.79
NaCl	9	19	TME76	45-60	7.70	7.5	3.03
NaCl	9	19	TME76a	60-75	7.90	7.6	4.25
NaCl	9	19	TME77	75-90	7.80	7.6	4.13
NaCl	9	19	TME77a	90-110	7.80	7.6	3.15
NaCl	9	31	TME138	0-15	7.90	7.4	0.40
NaCl	9	31	TME139	0-15	7.60	7.2	0.18
NaCl	9	31	TME140	0-15	7.80	7.2	0.24
NaCl	9	31	TME141	0-15	7.60	7.1	0.06
NaCl	9	31	TME142	0-15	7.40	7.0	0.08
NaCl	9	31	TME143	15-30	6.00	5.9	
NaCl	9	31	TME144	15-30	7.60	7.0	0.16
NaCl	9	31	TME145	15-30	7.20	6.9	0.10
NaCl	9	31	TME146	15-30	7.00	6.7	0.12
NaCl	9	31	TME147	15-30	7.60	7.2	0.16
NaCl	9	31	TME148	30-45	5.20	5.2	0.08
NaCl	9	31	TME149	45-60	5.30	5.2	0.04
NaCl	9	31	TME149a	60-75	5.30	5.3	0.04
NaCl	9	36	TME167	0-15	7.80	7.4	1.01
NaCl	9	36	TME168	0-15	7.80	7.5	1.32
NaCl	9	36	TME169	0-15	8.00	7.4	0.73
NaCl	9	36	TME170	0-15	7.70	7.3	0.73
NaCl	9	36	TME171	0-15	7.70	7.1	0.69
NaCl	9	36	TME172	15-30	7.20	6.7	0.16
NaCl	10	23	TME88	0-15	7.60	7.2	0.16

CaCO3 Eq = Calcium carbonate equivalent (g CaCO3 eq/100g).

Concluded. Chemical Properties of the Soils and Soil/Waste Mixtures in the ESSO Field Plots in 1990.

Waste	Rate	Plot	Sample Number	Depth (cm)	pH H2O	pH CaCl2	CaCO3 Eq
NaCl	10	23	TME89	0-15	7.90	7.4	0.48
NaCl	10	23	TME90	0-15	7.60	7.3	0.48
NaCl	10	23	TME91	0-15	7.90	7.5	1.09
NaCl	10	23	TME92	0-15	8.00	7.5	0.84
NaCl	10	23	TME93	15-30	7.70	7.7	4.90
NaCl	10	23	TME94	15-30	7.60	7.4	5.14
NaCl	10	23	TME95	15-30	7.30	7.1	0.56
NaCl	10	23	TME96	15-30	7.90	7.6	3.34
NaCl	10	23	TME97	15-30	7.70	7.5	2.41
NaCl	10	23	TME98	30-45	7.90	7.8	5.01
NaCl	10	23	TME99	45-60	8.00	7.8	1.24
NaCl	10	23	TME99a	60-75	8.00	7.8	4.93
NaCl	10	23	TME99b	75-90	8.00	7.7	5.37
NaCl	10	23	TME99c	90-105	8.10	7.8	5.25
NaCl	10	23	TME99d	105-120	8.10	7.8	5.33
NaCl	10	23	TME99e	120-140	8.00	7.8	5.01
NaCl	10	28	TME122	0-15	7.40	6.9	0.36
NaCl	10	28	TME123	0-15	7.50	7.3	0.40
NaCl	10	28	TME124	0-15	7.80	7.5	0.67
NaCl	10	28	TME125	0-15	7.60	7.4	0.55
NaCl	10	28	TME126	0-15	7.40	7.3	0.40
NaCl	10	28	TME127	15-30	6.60	6.3	0.08
NaCl	10	28	TME128	15-30	7.00	6.8	0.12
NaCl	10	28	TME129	15-30	6.80	6.6	0.15
NaCl	10	28	TME130	15-30	7.10	6.9	0.10
NaCl	10	28	TME131	15-30	7.30	7.0	0.12
NaCl	10	28	TME131a	30-45	5.60	5.4	
NaCl	10	28	TME131b	45-60	5.50	5.5	
NaCl	10	28	TME131c	60-75	5.80	5.7	
NaCl	10	28	TME131d	75-90	5.90	5.7	
NaCl	10	28	TME131e	90-105	6.10	6.0	
NaCl	10	28	TME131f	105-120	7.50	7.2	1.36
NaCl	10	28	TME131g	120-135	8.00	7.5	4.39
NaCl	10	28	TME131h	135-150	7.80	7.5	4.63
NaCl	10	38	TME174	0-15	7.70	7.3	1.13
NaCl	10	38	TME175	0-15	7.80	7.4	1.32
NaCl	10	38	TME176	0-15	7.60	7.5	0.73
NaCl	10	38	TME177	0-15	8.00	7.6	3.06
NaCl	10	38	TME178	0-15	7.80	7.5	2.21
NaCl	10	38	TME179	15-30	7.40	7.0	0.26
NaCl	10	38	TME180	15-30	7.60	7.3	0.93
NaCl	10	38	TME181	15-30	7.70	7.6	3.53
NaCl	10	38	TME182	15-30	7.80	7.5	1.50
NaCl	10	38	TME183	15-30	7.70	7.4	0.95
NaCl	10	38	TME184	30-45	6.40	6.3	
NaCl	10	38	TME185	45-60	5.90	5.7	
NaCl	10	38	TME185a	60-75	6.20	5.8	
NaCl	10	38	TME186	75-90	6.00	5.8	
NaCl	10	38	TME186a	90-105	6.10	5.9	
NaCl	10	38	TME186b	105-120	6.50	6.3	
NaCl	10	38	TME186c	120-135	7.80	7.6	3.47

CaCO3 Eq = Calcium carbonate equivalent (g CaCO3 eq/100g).

APPENDIX II. Saturated paste extract data for the soils and soil/waste mixtures in the ESSO field plots in 1990.

Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Plot	Field Sample	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	Al	Fe	Ti (mg/L)	Cu	Zn	Mn
Freshwater	1	3	TME5	0-15	38.5	0.35	7.20	8.84	195.00	0.418	0.092	0.012	0.012	0.121	0.021
Freshwater	1	9	TME21	0-15	39.5	0.36	7.20	7.50	206.00	0.493	0.061	0.016	0.018	0.095	0.037
Freshwater	1	13	TME41	0-15	42.5	0.48	7.20	10.00	268.00	0.559	0.068	0.028	0.015	0.149	0.134
Freshwater	1	13	TME42	15-30	34.5	0.32	7.40	5.32	168.00	0.261	<0.010	<0.010	0.016	0.046	<0.006
Freshwater	1	13	TME43	30-45	34.5	0.23	7.40	4.23	113.00	0.237	0.026	<0.010	0.012	0.039	<0.006
Freshwater	1	13	TME44	45-60	29.0	0.25	7.60	7.07	131.00	0.229	<0.010	<0.010	0.013	0.052	<0.006
Freshwater	1	13	TME44a	60-75	34.0	0.23	7.80	5.38	112.00	<0.200	<0.010	<0.010	0.013	0.038	<0.006
Freshwater	1	13	TME44b	75-90	31.0	0.22	7.65	4.86	110.00	0.202	<0.010	<0.010	0.013	0.037	<0.006
Freshwater	1	13	TME44c	90-105	29.5	0.22	7.70	5.51	107.00	0.216	0.011	<0.010	0.014	0.034	0.008
Freshwater	2	2	TME4	0-15	43.5	0.68	7.10	11.10	246.00	0.688	0.086	0.023	<0.010	0.105	0.060
Freshwater	2	8	TME19	0-15	37.5	0.52	7.20	10.20	214.00	0.680	0.064	0.021	0.013	0.178	0.028
Freshwater	2	8	TME20	15-30	36.5	0.65	7.10	11.90	244.00	0.774	0.093	0.033	0.016	0.203	0.149
Freshwater	2	15	TME49	0-15	37.0	0.43	7.45	11.44	210.00	0.449	0.050	0.014	0.032	0.105	0.008
Freshwater	3	1	TME1	0-15	41.0	0.70	6.95	20.20	226.00	0.761	0.141	0.035	<0.010	0.190	0.183
Freshwater	3	1	TME2	15-30	35.5	0.35	6.40	11.50	45.40	0.997	1.989	0.272	0.027	0.233	0.610
Freshwater	3	1	TME3	30-45	29.0	0.21	6.60	9.84	45.90	1.385	10.390	1.161	0.070	0.290	0.498
Freshwater	3	1	TME3a	45-60	337	0.25	5.80	13.80	17.30	3.539	4.481	0.251	0.036	0.247	0.462
Freshwater	3	1	TME3b	60-75	487	0.13	5.40	9.88	4.84	1.175	0.589	0.026	0.017	0.187	0.051
Freshwater	3	6	TME13	0-15	42.5	0.48	7.30	10.80	184.00	0.560	0.077	0.019	0.012	0.114	0.015
Freshwater	3	11	TME35	0-15	40.0	0.61	7.30	17.10	225.00	0.533	0.038	0.011	<0.010	0.081	0.028
Freshwater	3	11	TME36	0-15	37.0	0.68	7.40	20.90	246.00	0.621	0.042	0.017	0.015	0.102	0.070
Freshwater	3	11	TME37	0-15	39.5	0.80	7.35	23.90	232.00	0.695	0.042	0.022	0.016	0.091	0.033
Freshwater	3	11	TME38	0-15	36.5	0.45	7.20	14.10	195.00	0.509	0.081	0.017	0.017	0.076	0.030
Freshwater	3	11	TME39	0-15	32.5	0.45	7.20	11.00	188.00	0.477	0.043	0.013	0.020	0.101	0.024
Freshwater	4	5	TME11	0-15	35.0	0.61	7.40	13.00	211.00	0.699	0.050	0.022	0.016	0.151	0.019
Freshwater	4	5	TME12	15-30	37.0	0.55	7.40	8.67	208.00	0.571	0.046	0.020	0.026	0.116	0.019
Freshwater	4	7	TME14	0-15	40.5	0.74	7.40	24.60	201.00	0.743	0.035	0.022	0.017	0.115	0.018
Freshwater	4	7	TME15	15-30	33.0	0.53	7.55	7.56	176.00	0.420	0.012	0.010	0.026	0.107	0.014
Freshwater	4	7	TME16	30-45	39.5	0.34	7.80	5.69	130.00	0.206	<0.010	<0.010	0.011	0.042	<0.006
Freshwater	4	7	TME17	45-60	37.5	0.28	7.90	7.01	132.00	<0.200	<0.010	<0.010	0.012	0.036	<0.006
Freshwater	4	7	TME17a	60-75	33.0	0.27	7.90	6.02	132.00	<0.200	<0.010	<0.010	0.013	0.023	<0.006
Freshwater	4	7	TME18	75-90	35.5	0.30	7.85	7.67	124.00	<0.200	<0.010	<0.010	0.012	0.041	<0.006
Freshwater	4	7	TME18a	90-110	33.5	0.28	7.90	8.63	125.00	<0.200	<0.010	<0.010	<0.010	0.033	<0.006
Freshwater	4	12	TME40	0-15	39.5	0.62	7.30	14.80	221.00	0.562	0.061	0.014	0.013	0.096	0.025
Freshwater	5	4	TME6	0-15	41.0	0.96	7.60	17.00	255.00	0.846	0.060	0.022	0.019	0.081	0.022
Freshwater	5	4	TME7	0-15	39.0	0.79	7.50	14.00	261.00	0.771	0.087	0.026	0.040	0.209	0.023
Freshwater	5	4	TME8	0-15	44.0	1.27	7.60	13.80	270.00	0.996	0.075	0.028	0.032	0.109	0.028
Freshwater	5	4	TME9	0-15	40.5	1.08	7.55	16.40	241.00	0.824	0.042	0.023	0.040	0.121	0.043
Freshwater	5	4	TME10	0-15	41.3	0.83	7.60	12.25	234.50	0.626	0.033	0.016	0.026	0.087	0.012
Freshwater	5	10	TME22	0-15	41.0	0.83	7.30	16.50	280.00	0.745	0.035	0.022	0.013	0.084	0.055
Freshwater	5	10	TME23	0-15	40.5	0.57	7.40	20.60	232.00	0.502	0.041	<0.010	0.019	0.151	0.074
Freshwater	5	10	TME24	0-15	44.5	0.78	7.20	11.10	241.00	0.842	0.035	0.020	<0.010	0.127	0.100
Freshwater	5	10	TME25	0-15	45.5	0.92	7.30	11.90	265.00	0.785	0.034	0.018	<0.010	0.103	0.221
Freshwater	5	10	TME26	0-15	40.5	0.62	7.40	22.30	226.00	0.534	0.045	0.012	0.022	0.201	0.059
Freshwater	5	10	TME27	15-30	33.0	0.59	7.60	8.13	160.00	0.385	0.016	<0.010	0.022	0.073	<0.006
Freshwater	5	10	TME28	15-30	35.0	0.64	7.50	12.40	189.50	0.462	0.026	0.011	0.024	0.067	0.014

Sat'n = Percent Saturation; E.C. = Electrical Conductivity; Alk. = Alkalinity (mg CaCO₃/L); Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Depth (cm)	Ca	Mg	Na	K	Sr	B (mg/L)	Ba	P	S	Si	As	SAR
Freshwater	1	0-15	67.35	14.94	10.01	5.16	0.143	0.041	0.054	0.265	6.98	6.03	0.102	0.3
Freshwater	1	0-15	73.07	14.37	7.44	4.90	0.119	0.051	0.071	0.268	6.21	6.43	0.120	0.2
Freshwater	1	0-15	98.23	20.24	10.56	9.26	0.158	0.053	0.103	0.211	9.46	5.69	0.114	0.3
Freshwater	1	15-30	55.69	13.39	10.36	4.40	0.079	<0.040	0.043	<0.100	8.68	5.69	0.106	0.3
Freshwater	1	30-45	34.78	9.63	9.23	2.26	0.043	<0.040	0.023	<0.100	8.11	7.59	0.064	0.4
Freshwater	1	45-60	37.56	10.13	10.59	2.47	0.049	<0.040	0.033	<0.100	8.39	7.73	0.070	0.4
Freshwater	1	60-75	34.05	9.52	9.04	2.60	0.039	<0.040	0.035	<0.100	6.64	7.75	0.062	0.4
Freshwater	1	75-90	32.84	9.16	9.54	2.75	0.044	<0.040	0.024	<0.100	5.94	7.52	0.066	0.4
Freshwater	1	90-105	31.20	8.60	9.56	3.01	0.042	<0.040	0.037	<0.100	5.81	7.33	0.059	0.4
Freshwater	2	0-15	120.95	20.06	30.10	8.64	0.304	0.142	0.089	0.245	62.27	9.60	0.093	0.7
Freshwater	2	0-15	100.10	16.66	20.52	6.88	0.222	0.167	0.078	0.369	33.35	9.24	0.114	0.5
Freshwater	2	15-30	108.44	21.08	42.10	8.53	0.196	0.122	0.097	0.344	47.26	6.06	0.151	1.0
Freshwater	2	0-15	82.60	13.80	24.43	2.58	0.154	0.163	0.067	0.246	18.01	11.31	0.112	0.7
Freshwater	3	0-15	105.47	20.13	54.78	10.29	0.232	0.147	0.094	0.338	55.89	6.63	0.125	1.3
Freshwater	3	15-30	37.56	10.79	26.49	6.56	0.116	0.145	0.065	0.149	46.15	11.62	0.038	1.0
Freshwater	3	30-45	21.11	6.10	14.36	5.29	0.095	0.106	0.033	0.262	18.21	14.07	0.043	0.7
Freshwater	3	45-60	17.38	3.54	28.88	9.33	0.049	0.088	0.080	3.039	28.93	11.31	0.078	1.7
Freshwater	3	60-75	14.74	2.23	13.65	3.49	0.045	0.113	0.058	1.145	12.59	4.08	<0.030	0.9
Freshwater	3	0-15	80.86	13.88	27.65	3.62	0.236	0.175	0.068	0.209	33.06	10.23	0.106	0.7
Freshwater	3	0-15	110.65	19.80	33.48	5.90	0.273	0.138	0.080	0.173	48.32	8.88	0.127	0.8
Freshwater	3	0-15	125.94	20.29	29.30	10.63	0.343	0.145	0.086	0.158	56.31	9.31	0.116	0.6
Freshwater	3	0-15	141.47	23.73	41.85	8.99	0.328	0.168	0.111	0.180	80.44	11.07	0.110	0.9
Freshwater	3	0-15	86.47	13.65	16.93	6.40	0.174	0.115	0.073	0.212	17.54	7.45	0.116	0.4
Freshwater	3	0-15	90.16	13.95	18.23	6.72	0.200	0.095	0.072	0.261	24.50	6.50	0.099	0.5
Freshwater	4	0-15	104.10	16.15	39.51	6.96	0.249	0.201	0.122	0.235	51.96	10.34	0.103	1.0
Freshwater	4	15-30	88.51	15.85	39.31	6.17	0.165	0.094	0.091	0.175	42.54	4.89	0.188	1.0
Freshwater	4	0-15	128.99	20.71	40.86	9.60	0.245	0.129	0.103	0.157	78.73	8.31	0.117	0.9
Freshwater	4	15-30	80.02	21.41	28.03	5.87	0.155	<0.040	0.076	<0.100	49.68	4.04	0.122	0.7
Freshwater	4	30-45	34.06	21.04	15.59	4.85	0.118	<0.040	0.069	<0.100	19.23	8.45	0.097	0.5
Freshwater	4	45-60	26.77	17.94	14.95	4.57	0.100	<0.040	0.043	<0.100	7.66	8.09	0.096	0.5
Freshwater	4	60-75	24.89	17.25	15.36	4.68	0.105	<0.040	0.056	<0.100	7.17	7.54	0.096	0.6
Freshwater	4	75-90	27.48	20.23	16.64	5.67	0.111	0.041	0.038	<0.100	9.88	7.78	0.099	0.6
Freshwater	4	90-110	26.61	16.96	14.72	5.46	0.103	0.041	0.066	<0.100	7.10	6.94	0.094	0.5
Freshwater	4	0-15	114.99	17.79	34.37	7.71	0.248	0.163	0.069	0.368	50.79	11.32	0.097	0.8
Freshwater	5	0-15	162.20	19.54	86.40	8.42	0.399	0.327	0.094	0.448	121.66	11.77	0.156	1.7
Freshwater	5	0-15	135.37	17.14	68.90	7.01	0.341	0.262	0.071	0.329	82.03	10.97	0.141	1.5
Freshwater	5	0-15	198.45	24.87	139.07	9.53	0.536	0.378	0.089	0.312	191.22	12.81	0.137	2.5
Freshwater	5	0-15	156.19	20.57	121.07	9.16	0.425	0.304	0.064	0.646	151.44	11.73	0.125	2.4
Freshwater	5	0-15	117.44	17.74	88.88	6.16	0.322	0.346	0.048	0.340	99.41	12.78	0.130	2.0
Freshwater	5	0-15	143.34	23.42	50.12	12.34	0.345	0.286	0.101	0.223	78.78	12.60	0.148	1.0
Freshwater	5	0-15	102.57	13.38	41.45	6.96	0.264	0.294	0.080	0.642	37.25	13.66	0.126	1.0
Freshwater	5	0-15	156.71	24.30	25.48	10.18	0.380	0.223	0.086	0.369	82.36	15.48	0.107	0.5
Freshwater	5	0-15	168.42	27.54	53.36	10.82	0.405	0.230	0.083	0.261	112.24	14.73	0.107	1.0
Freshwater	5	0-15	109.63	17.29	41.74	6.99	0.258	0.256	0.073	0.552	48.58	14.04	0.110	1.0
Freshwater	5	15-30	74.81	20.46	52.70	3.42	0.101	0.040	0.035	0.101	64.51	6.70	0.086	1.4
Freshwater	5	15-30	87.53	19.54	60.74	3.61	0.159	0.123	0.063	0.130	65.74	9.14	0.100	1.5

SAR = Sodium Adsorption Ratio; Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Plot	Field Sample	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	Al	Fe	Ti (mg/L)	Cu	Zn	Mn
Freshwater	5	10	TME29	15-30	40.0	0.84	7.20	12.20	306.00	0.768	0.079	0.028	0.011	0.097	0.215
Freshwater	5	10	TME30	15-30	37.5	0.92	7.25	12.20	282.00	0.810	0.068	0.023	0.011	0.136	0.111
Freshwater	5	10	TME31	15-30	39.0	0.75	7.30	17.20	188.00	0.492	0.011	<0.010	0.022	0.075	0.029
Freshwater	5	10	TME32	30-45	31.5	0.48	7.30	9.02	106.00	0.301	<0.010	<0.010	<0.010	0.060	<0.006
Freshwater	5	10	TME33	45-60	33.0	0.49	7.50	8.26	94.30	0.350	<0.010	<0.010	<0.010	0.050	<0.006
Freshwater	5	10	TME33a	60-75	33.0	0.51	7.60	7.55	111.00	0.378	<0.010	<0.010	<0.010	0.044	<0.006
Freshwater	5	10	TME34	75-90	32.0	0.60	7.50	7.34	105.00	0.461	<0.010	0.012	<0.010	0.045	<0.006
Freshwater	5	10	TME34a	90-105	30.5	0.54	7.70	12.00	92.90	0.362	<0.010	<0.010	<0.010	0.047	<0.006
Freshwater	5	10	TME34b	105-115	31.5	0.52	7.60	12.00	108.00	0.356	<0.010	<0.010	<0.010	0.040	<0.006
Freshwater	5	14	TME45	0-15	43.0	0.65	7.10	18.60	229.00	0.638	0.097	0.022	0.020	0.198	0.065
Freshwater	5	14	TME46	15-30	31.0	0.48	7.45	9.46	153.00	0.362	<0.010	<0.010	0.019	0.087	0.010
Freshwater	5	14	TME47	30-45	33.5	0.43	7.30	9.88	109.00	0.350	<0.010	<0.010	0.011	0.063	<0.006
Freshwater	5	14	TME48	45-60	35.5	0.39	7.40	29.50	106.00	0.322	<0.010	<0.010	0.013	0.045	<0.006
Freshwater	5	14	TME48a	60-75	33.0	0.25	7.60	5.48	113.00	<0.200	<0.010	<0.010	<0.010	0.041	<0.006
Freshwater	5	14	TME48b	75-90	33.5	0.23	7.65	7.25	109.00	0.216	<0.010	<0.010	0.011	0.026	<0.006
Freshwater	5	14	TME48c	90-105	30.0	0.25	7.70	6.83	120.00	0.213	<0.010	<0.010	0.012	0.043	<0.006
KCl	1	17	TME63	0-15	37.5	0.44	7.15	21.30	224.00	0.418	0.056	0.015	0.019	0.105	0.070
KCl	1	42	TME190	0-15	35.5	0.37	7.30	16.00	175.00	0.326	0.019	<0.010	0.019	0.068	0.014
KCl	1	42	TME191	0-15	34.5	0.38	7.40	14.40	189.00	0.343	0.019	<0.010	0.018	0.027	0.017
KCl	1	42	TME192	0-15	37.5	0.46	7.20	16.09	215.00	0.544	0.064	0.023	0.026	0.043	0.030
KCl	1	42	TME193	0-15	34.0	0.40	7.10	14.70	232.00	0.388	0.055	<0.010	0.015	0.098	0.050
KCl	1	42	TME194	0-15	34.0	0.38	7.10	12.70	206.00	0.375	0.039	<0.010	0.024	0.102	0.034
KCl	1	43	TME195	0-15	35.5	0.41	7.10	11.90	226.00	0.411	0.053	0.010	0.020	0.077	0.042
KCl	1	43	TME195a	15-30	35.5	0.42	7.20	5.80	211.00	0.279	0.018	<0.010	0.013	0.068	0.020
KCl	1	43	TME195b	30-45	32.0	0.32	7.40	6.20	164.00	<0.200	0.014	<0.010	<0.010	0.046	0.015
KCl	1	43	TME195c	45-60	32.0	0.25	7.55	5.10	138.00	<0.200	<0.010	<0.010	<0.010	0.028	<0.006
KCl	1	43	TME195d	60-75	33.5	0.26	7.60	4.70	152.00	<0.200	<0.010	<0.010	<0.010	0.032	<0.006
KCl	1	43	TME195e	75-90	33.5	0.25	7.70	5.40	139.00	<0.200	<0.010	<0.010	<0.010	0.035	<0.006
KCl	1	43	TME195f	90-105	32.5	0.25	7.70	6.90	136.00	<0.200	0.014	<0.010	<0.010	0.038	<0.006
KCl	1	43	TME195g	105-120	31.0	0.24	7.60	6.56	131.00	<0.200	0.028	<0.010	<0.010	0.028	<0.006
KCl	1	43	TME195h	120-135	30.5	0.24	7.50	6.20	127.00	<0.200	<0.010	<0.010	<0.010	0.044	<0.006
KCl	2	33	TME151	0-15	34.5	0.35	7.30	9.20	218.00	0.307	0.057	<0.010	0.016	0.054	<0.006
KCl	2	40	TME188	0-15	39.5	0.60	7.25	35.14	250.00	0.609	0.048	0.024	0.025	0.089	0.056
KCl	2	45	TME208	0-15	35.0	0.47	7.30	35.75	216.00	0.363	0.053	<0.010	0.027	0.108	0.029
KCl	2	45	TME209	0-15	38.5	0.51	7.10	28.97	243.00	0.591	0.081	0.029	0.021	0.117	0.144
KCl	2	45	TME210	0-15	37.3	0.59	7.23	31.56	238.50	0.551	0.083	0.026	0.026	0.067	0.049
KCl	2	45	TME211	0-15	33.5	0.81	6.90	175.20	150.00	0.653	0.106	0.030	0.029	0.138	0.116
KCl	2	45	TME212	0-15	40.0	0.51	7.10	47.36	236.00	0.516	0.150	0.027	0.031	0.092	0.029
KCl	2	45	TME213	15-30	36.5	0.65	7.20	60.05	258.00	0.487	0.014	0.012	0.011	0.041	0.080
KCl	2	45	TME214	15-30	35.5	0.51	7.40	38.44	259.00	0.460	0.031	0.017	0.028	0.059	0.029
KCl	2	45	TME215	15-30	34.5	0.41	7.40	29.22	172.00	0.281	0.022	<0.010	0.016	0.034	<0.006
KCl	2	45	TME216	15-30	28.5	0.98	6.40	296.00	25.20	0.896	0.110	0.023	0.019	0.248	0.856
KCl	2	45	TME217	15-30	39.5	0.48	6.40	88.45	108.00	0.468	0.115	0.020	0.020	0.245	0.307
KCl	2	45	TME218	30-45	32.5	0.32	6.40	87.80	15.00	0.245	0.039	0.014	0.013	0.108	0.029
KCl	2	45	TME219	45-60	32.0	0.24	6.60	57.85	21.20	<0.200	0.081	0.011	<0.010	0.066	0.023
KCl	2	45	TME220	60-75	30.0	0.16	6.60	36.83	23.60	0.367	0.215	0.063	0.034	0.067	0.019
KCl	2	45	TME221	75-90	32.5	0.12	6.70	18.22	19.90	2.624	3.844	0.586	0.029	0.056	0.015
KCl	2	45	TME222	90-105	29.0	0.10	6.70	17.75	14.80	0.610	1.039	0.155	0.020	0.042	0.007

Sat'n = Percent Saturation; E.C. = Electrical Conductivity; Alk. = Alkalinity (mg CaCO₃/L); Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Depth (cm)	Ca	Mg	Na	K	Sr	B (mg/L)	Ba	P	S	Si	As	SAR
Freshwater	5	15-30	158.50	27.82	43.63	12.12	0.318	0.160	0.090	0.351	78.65	9.08	0.150	0.8
Freshwater	5	15-30	162.75	29.04	58.55	11.50	0.332	0.184	0.084	0.330	108.24	10.00	0.125	1.1
Freshwater	5	15-30	100.72	23.91	75.06	4.73	0.125	<0.040	0.049	<0.100	88.05	9.69	0.113	1.7
Freshwater	5	30-45	62.52	21.78	28.94	1.96	0.069	<0.040	0.047	<0.100	59.61	8.73	0.064	0.8
Freshwater	5	45-60	73.53	24.63	17.69	2.42	0.083	<0.040	0.042	<0.100	68.00	8.82	0.053	0.5
Freshwater	5	60-75	74.20	25.31	14.54	2.86	0.073	<0.040	0.040	<0.100	68.36	8.16	0.050	0.4
Freshwater	5	75-90	88.29	30.76	15.58	4.02	0.099	<0.040	0.076	<0.100	88.78	7.81	0.043	0.4
Freshwater	5	90-105	76.93	27.07	15.94	3.83	0.092	<0.040	0.088	<0.100	72.34	7.81	0.042	0.4
Freshwater	5	105-115	74.60	26.03	15.46	4.17	0.097	<0.040	0.097	<0.100	66.61	7.68	0.049	0.4
Freshwater	5	0-15	106.40	18.05	49.91	9.79	0.212	0.162	0.072	0.426	45.26	10.84	0.122	1.2
Freshwater	5	15-30	67.38	22.66	31.36	1.64	0.078	<0.040	0.036	<0.100	49.78	6.15	0.081	0.8
Freshwater	5	30-45	63.85	21.48	13.80	1.25	0.061	<0.040	0.037	<0.100	48.21	6.96	0.061	0.4
Freshwater	5	45-60	55.12	16.22	16.66	1.29	0.049	<0.040	0.035	<0.100	29.70	6.65	0.059	0.5
Freshwater	5	60-75	37.38	10.61	8.76	1.11	0.039	<0.040	0.021	<0.100	10.51	6.39	0.056	0.3
Freshwater	5	75-90	35.59	9.61	8.86	1.18	0.047	<0.040	0.027	<0.100	6.98	6.35	0.058	0.3
Freshwater	5	90-105	37.87	10.35	10.21	1.44	0.050	<0.040	0.046	<0.100	7.72	6.61	0.073	0.4
KCl	1	0-15	75.23	16.38	10.89	18.71	0.134	0.063	0.088	0.292	5.71	5.45	0.105	0.3
KCl	1	0-15	69.02	13.95	10.72	4.96	0.100	<0.040	0.085	0.125	6.14	5.49	0.115	0.3
KCl	1	0-15	64.83	15.62	12.84	6.08	0.113	<0.040	0.081	0.141	5.76	7.06	0.119	0.4
KCl	1	0-15	85.59	17.30	11.89	6.93	0.121	<0.040	0.097	0.228	9.65	6.77	0.134	0.3
KCl	1	0-15	77.54	15.99	12.42	6.15	0.113	<0.040	0.083	0.180	5.94	5.99	0.115	0.3
KCl	1	0-15	67.90	17.15	11.65	5.36	0.101	<0.040	0.084	0.209	4.80	7.00	0.117	0.3
KCl	1	0-15	83.44	16.49	10.92	6.57	0.120	<0.040	0.081	0.198	11.05	5.19	0.137	0.3
KCl	1	15-30	78.89	18.56	11.30	8.52	0.115	<0.040	0.067	0.120	20.16	3.95	0.115	0.3
KCl	1	30-45	51.02	13.60	12.41	5.12	0.068	<0.040	0.046	<0.100	11.69	5.39	0.094	0.4
KCl	1	45-60	36.88	10.20	10.10	4.95	0.050	<0.040	0.044	<0.100	4.75	7.17	0.086	0.4
KCl	1	60-75	38.09	10.99	10.76	5.51	0.051	<0.040	0.058	<0.100	4.18	7.39	0.084	0.4
KCl	1	75-90	36.31	10.73	9.57	5.83	0.050	<0.040	0.062	<0.100	4.13	7.06	0.077	0.4
KCl	1	90-105	34.97	10.07	10.98	5.67	0.048	<0.040	0.061	<0.100	4.38	6.99	0.079	0.4
KCl	1	105-120	34.94	10.15	9.57	6.09	0.048	<0.040	0.063	<0.100	4.52	6.89	0.074	0.4
KCl	1	120-135	34.76	9.73	10.49	6.08	0.050	<0.040	0.064	<0.100	4.28	6.58	0.090	0.4
KCl	2	0-15	72.44	14.93	12.39	4.20	0.109	<0.040	0.081	0.235	4.36	6.20	0.061	0.3
KCl	2	0-15	99.66	18.66	16.74	27.70	0.186	0.042	0.160	0.214	19.72	6.05	0.136	0.4
KCl	2	0-15	89.49	15.46	14.65	24.37	0.155	<0.040	0.141	<0.100	13.39	4.44	0.122	0.4
KCl	2	0-15	97.69	16.52	10.46	26.62	0.168	0.049	0.148	0.243	11.15	4.18	0.149	0.3
KCl	2	0-15	101.01	17.86	16.96	36.15	0.198	0.076	0.161	0.212	29.49	6.03	0.147	0.4
KCl	2	0-15	117.02	24.71	25.40	34.63	0.181	0.065	0.200	0.139	20.05	4.09	0.103	0.6
KCl	2	0-15	85.55	15.66	12.70	49.66	0.149	0.059	0.150	0.172	16.26	3.33	0.132	0.3
KCl	2	15-30	105.34	27.80	19.85	10.78	0.202	<0.040	0.156	<0.100	20.08	3.03	0.144	0.4
KCl	2	15-30	88.00	21.10	18.26	9.09	0.134	0.041	0.112	0.162	10.16	7.40	0.154	0.5
KCl	2	15-30	70.75	17.13	19.98	7.57	0.108	<0.040	0.078	<0.100	16.07	7.63	0.078	0.6
KCl	2	15-30	132.16	29.83	28.86	31.54	0.230	0.069	0.314	<0.100	23.65	8.39	0.049	0.6
KCl	2	15-30	62.50	14.58	17.68	22.44	0.134	0.053	0.162	0.105	21.04	6.08	0.063	0.5
KCl	2	30-45	37.13	11.75	11.08	7.88	0.088	0.050	0.101	<0.100	7.42	12.97	<0.030	0.4
KCl	2	45-60	26.88	9.04	11.36	5.86	0.059	0.047	0.075	<0.100	6.87	13.98	<0.030	0.5
KCl	2	60-75	15.81	5.65	9.40	3.95	0.038	0.072	0.059	<0.100	6.08	14.69	0.048	0.5
KCl	2	75-90	6.96	4.76	15.19	2.63	0.054	0.073	0.035	0.179	6.56	25.25	0.032	1.1
KCl	2	90-105	10.49	3.03	8.42	2.58	0.024	0.065	0.042	0.113	6.23	20.31	<0.030	0.6

SAR = Sodium Adsorption Ratio; Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Plot	Field Sample	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	Al	Fe (mg/L)	Ti	Cu	Zn	Mn
KCI	2	45	TME223	105-120	35.5	1.70	6.20	533.00	36.90	0.611	<0.010	0.014	<0.010	0.146	0.073
KCI	2	45	TME224	120-135	31.0	0.09	6.70	5.50	41.80	0.978	0.580	0.088	0.018	0.052	0.010
KCI	3	21	TME79	0-15	41.5	0.68	6.90	29.60	212.00	0.508	0.182	0.033	0.024	0.233	0.070
KCI	3	21	TME80	0-15	42.5	0.72	7.20	22.80	267.00	0.527	0.076	0.019	0.017	0.132	0.059
KCI	3	21	TME81	0-15	43.0	0.56	7.10	19.80	254.00	0.585	0.076	0.033	0.022	0.101	0.072
KCI	3	21	TME82	0-15	42.0	0.60	7.00	25.10	220.00	0.591	0.149	0.028	0.019	0.121	0.055
KCI	3	21	TME83	0-15	41.5	0.52	7.00	20.00	213.00	0.453	0.163	0.025	0.018	0.135	0.055
KCI	3	30	TME137	0-15	37.0	0.60	7.10	36.94	264.00	0.464	0.087	0.012	0.019	0.102	0.118
KCI	3	39	TME187	0-15	39.0	0.84	7.30	126.90	196.00	0.575	0.033	0.022	0.020	0.056	0.031
KCI	4	16	TME50	0-15	39.0	0.65	7.40	22.50	240.00	0.525	0.045	0.019	0.019	0.066	0.037
KCI	4	16	TME51	0-15	42.0	0.65	7.40	14.80	238.00	0.502	0.040	0.014	0.016	0.075	0.009
KCI	4	16	TME52	0-15	39.0	0.70	7.40	21.10	235.00	0.569	0.042	0.021	0.020	0.048	0.042
KCI	4	16	TME53	0-15	39.0	0.65	7.30	20.70	223.00	0.451	0.063	0.017	0.024	0.091	0.013
KCI	4	16	TME54	0-15	40.0	0.65	7.15	18.60	220.00	0.489	0.048	0.012	0.014	0.100	0.021
KCI	4	16	TME55	15-30	29.0	0.37	7.30	10.40	152.00	0.324	0.012	<0.010	0.017	0.082	0.009
KCI	4	16	TME56	15-30	35.0	0.47	7.25	15.40	211.00	0.434	0.030	0.013	0.020	0.113	0.026
KCI	4	16	TME57	15-30	34.0	0.40	7.40	8.72	176.00	0.380	0.025	0.013	0.025	0.078	0.018
KCI	4	16	TME58	15-30	36.0	0.37	7.30	16.20	160.00	0.354	0.028	0.011	0.028	0.069	<0.006
KCI	4	16	TME59	15-30	33.0	0.41	7.40	17.40	192.00	0.424	0.025	0.014	0.032	0.076	0.010
KCI	4	16	TME60	30-45	33.5	0.34	7.50	15.00	145.00	0.311	0.013	<0.010	0.018	0.070	0.007
KCI	4	16	TME61	45-60	28.5	0.31	7.50	14.40	165.00	0.288	0.019	<0.010	0.021	0.099	0.008
KCI	4	16	TME61a	60-75	27.0	0.17	7.30	7.83	61.80	0.316	1.583	0.107	0.031	0.151	0.015
KCI	4	16	TME62	75-90	33.0	0.18	7.40	7.19	60.10	<0.200	0.022	<0.010	0.019	0.058	<0.006
KCI	4	16	TME62a	90-110	38.0	0.21	7.45	9.26	76.80	0.207	0.012	<0.010	0.016	0.038	0.007
KCI	4	24	TME100	0-15	37.5	1.05	7.30	123.00	232.00	0.537	0.078	<0.010	<0.010	0.126	0.039
KCI	4	29	TME132	0-15	35.5	1.25	7.30	147.40	229.00	0.571	0.068	0.010	0.019	0.101	0.062
KCI	4	29	TME133	15-30	35.0	1.03	7.40	150.50	230.00	0.728	0.014	0.017	0.012	0.035	0.045
KCI	4	29	TME134	30-45	36.5	0.92	7.40	158.70	214.00	0.669	<0.010	0.015	<0.010	0.024	0.070
KCI	4	29	TME135	45-60	34.5	0.44	6.90	74.84	62.00	0.279	<0.010	<0.010	<0.010	0.036	0.016
KCI	4	29	TME135a	60-75	34.0	0.31	6.80	43.01	33.50	0.213	<0.010	<0.010	0.013	0.049	0.020
KCI	4	29	TME136	75-90	35.5	0.34	6.60	50.46	24.20	0.203	<0.010	<0.010	<0.010	0.073	0.024
KCI	4	29	TME136a	90-105	33.5	0.30	6.40	56.32	22.00	0.261	0.037	0.010	<0.010	0.057	0.126
KCI	4	29	TME136b	105-120	37.0	0.25	6.90	36.64	64.80	0.359	0.123	0.017	<0.010	0.043	0.077
KCI	4	29	TME136c	120-135	32.0	0.28	7.40	29.13	115.00	0.225	0.015	<0.010	<0.010	<0.020	0.011
KCI	5	25	TME101	0-15	38.5	2.49	7.10	514.60	197.00	0.983	0.102	0.018	<0.010	0.110	0.211
KCI	5	25	TME102	0-15	35.5	3.56	7.20	906.30	164.00	1.550	0.042	0.037	0.014	0.106	0.175
KCI	5	25	TME103	0-15	35.0	5.56	7.10	1532	168.00	2.254	0.058	0.053	0.024	0.190	0.201
KCI	5	25	TME104	0-15	35.5	8.15	7.10	2459	173.00	3.058	0.020	0.062	0.027	0.125	0.706
KCI	5	25	TME105	0-15	35.5	3.21	7.30	659.60	173.00	1.204	0.038	0.028	0.027	0.086	0.064
KCI	5	25	TME106	15-30	37.0	1.58	5.80	464.40	46.90	1.565	0.890	0.054	0.029	0.370	20.200
KCI	5	25	TME107	15-30	33.5	2.05	6.70	544.30	177.00	1.234	0.140	0.041	0.023	0.122	9.376
KCI	5	25	TME108	15-30	35.0	3.18	6.80	925.80	186.00	1.815	0.133	0.054	0.029	0.164	18.225
KCI	5	25	TME109	15-30	34.0	2.59	6.60	754.40	123.00	1.384	0.265	0.036	0.027	0.165	30.140
KCI	5	25	TME110	15-30	38.5	2.20	7.00	461.20	226.00	1.257	0.078	0.031	0.019	0.073	0.991
KCI	5	25	TME111	30-45	38.5	0.49	5.70	146.50	113.00	1.238	0.877	0.021	0.020	0.186	1.403
KCI	5	25	TME112	45-60	31.5	0.39	5.80	115.70	15.40	1.299	1.123	0.044	0.021	0.445	0.644
KCI	5	25	TME112a	60-75	36.0	0.21	5.70	56.77	5.03	5.763	5.817	1.118	0.029	0.106	0.477

Sat'n = Percent Saturation; E.C. = Electrical Conductivity; Alk. = Alkalinity (mg CaCO3/L); Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Depth (cm)	Ca	Mg	Na	K	Sr	B (mg/L)	Ba	P	S	Si	As	SAR
KCl	2	105-120	135.52	52.43	162.33	5.12	0.248	0.051	0.292	<0.100	24.61	13.04	<0.030	3.0
KCl	2	120-135	10.18	3.69	7.43	1.82	0.021	0.061	0.031	<0.100	3.88	18.76	0.036	0.5
KCl	3	0-15	76.69	11.89	19.21	119.27	0.204	0.153	0.146	0.696	37.64	7.91	0.098	0.5
KCl	3	0-15	104.16	16.77	16.53	94.46	0.249	0.161	0.130	0.408	42.63	10.32	0.118	0.4
KCl	3	0-15	99.20	17.27	9.50	46.19	0.208	0.091	0.144	0.334	17.13	6.31	0.127	0.2
KCl	3	0-15	85.22	13.84	13.41	82.14	0.204	0.123	0.126	0.634	24.97	9.06	0.117	0.4
KCl	3	0-15	71.52	13.57	15.13	67.60	0.148	0.093	0.135	0.608	16.79	8.14	0.114	0.4
KCl	3	0-15	93.54	16.75	18.99	65.75	0.190	0.052	0.142	0.249	20.48	5.91	0.052	0.5
KCl	3	0-15	108.95	20.13	51.96	30.86	0.206	0.049	0.133	0.149	36.69	4.91	0.124	1.2
KCl	4	0-15	103.69	17.42	13.26	60.23	0.229	0.084	0.129	0.204	42.00	5.34	0.114	0.3
KCl	4	0-15	101.87	15.93	10.92	60.37	0.266	0.115	0.111	0.199	44.84	9.06	0.103	0.3
KCl	4	0-15	112.09	18.14	13.32	65.75	0.284	0.102	0.156	0.199	53.48	6.45	0.110	0.3
KCl	4	0-15	78.42	14.49	20.79	92.22	0.250	0.111	0.086	0.210	44.02	5.58	0.110	0.6
KCl	4	0-15	98.47	15.33	11.97	79.08	0.247	0.115	0.139	0.258	49.79	6.82	0.119	0.3
KCl	4	15-30	63.96	13.87	13.17	5.72	0.093	<0.040	0.048	<0.100	21.30	4.82	0.095	0.4
KCl	4	15-30	82.04	17.00	12.65	20.77	0.148	0.058	0.088	0.221	22.00	4.59	0.099	0.3
KCl	4	15-30	69.64	14.99	15.23	6.35	0.112	<0.040	0.062	<0.100	23.07	2.91	0.096	0.4
KCl	4	15-30	62.49	11.73	12.91	16.90	0.100	<0.040	0.074	0.112	18.01	3.03	0.079	0.4
KCl	4	15-30	73.91	14.57	14.19	9.66	0.120	0.048	0.063	0.144	18.53	4.36	0.084	0.4
KCl	4	30-45	57.82	14.67	12.36	2.03	0.081	<0.040	0.029	<0.100	16.48	5.03	0.078	0.4
KCl	4	45-60	52.20	15.69	15.36	1.92	0.083	<0.040	0.025	<0.100	12.44	4.60	0.099	0.5
KCl	4	60-75	24.21	6.37	10.56	4.69	0.051	0.065	0.022	0.110	13.59	7.08	0.034	0.5
KCl	4	75-90	22.11	6.96	10.02	2.53	0.035	0.040	0.024	<0.100	12.60	7.37	0.032	0.5
KCl	4	90-110	27.93	8.64	10.56	1.65	0.042	<0.040	0.019	<0.100	11.63	7.12	0.046	0.4
KCl	4	0-15	125.37	22.42	41.43	161.41	0.326	0.171	0.175	0.296	73.54	8.43	0.092	0.9
KCl	4	0-15	128.30	20.10	49.37	218.60	0.325	0.126	0.142	0.235	92.80	5.59	0.070	1.1
KCl	4	15-30	160.69	34.55	41.63	34.68	0.291	<0.040	0.147	<0.100	59.75	3.11	0.063	0.8
KCl	4	30-45	146.43	33.49	24.75	18.50	0.262	<0.040	0.128	<0.100	37.06	3.15	0.033	0.5
KCl	4	45-60	51.10	13.27	17.23	24.90	0.111	<0.040	0.088	<0.100	21.06	5.66	<0.030	0.6
KCl	4	60-75	31.92	8.66	15.60	20.62	0.071	0.045	0.056	<0.100	26.89	8.22	<0.030	0.6
KCl	4	75-90	32.20	10.54	20.82	15.23	0.131	0.042	0.026	<0.100	28.79	9.83	<0.030	0.8
KCl	4	90-105	32.07	10.81	14.13	12.00	0.055	<0.040	0.047	<0.100	17.90	12.41	<0.030	0.6
KCl	4	105-120	29.69	11.21	8.48	9.12	0.039	<0.040	0.047	<0.100	9.21	9.82	<0.030	0.3
KCl	4	120-135	36.80	12.95	9.80	8.15	0.039	<0.040	0.043	<0.100	6.57	7.13	<0.030	0.4
KCl	5	0-15	228.30	30.50	87.75	469.20	0.705	0.256	0.214	0.233	132.94	8.00	0.081	1.4
KCl	5	0-15	361.60	54.07	125.81	533.10	1.104	0.213	0.209	0.119	190.07	4.64	0.062	1.6
KCl	5	0-15	568.90	93.21	205.80	864.40	1.935	0.346	0.265	0.135	307.60	6.46	0.038	2.1
KCl	5	0-15	846.50	129	269.90	1217	2.823	0.278	0.379	0.136	293.50	6.78	0.044	2.3
KCl	5	0-15	269.20	44.95	123.14	600.90	0.929	0.278	0.257	0.128	231.10	6.02	0.037	1.8
KCl	5	15-30	191.21	43.24	52.82	82.61	0.448	0.258	0.436	0.366	42.01	10.75	<0.030	0.9
KCl	5	15-30	249.10	36.27	57.81	199.22	0.531	0.170	0.265	0.249	69.38	4.03	0.059	0.9
KCl	5	15-30	417.30	73.73	84.77	242.30	0.936	0.234	0.348	0.281	122.07	4.25	0.035	1.0
KCl	5	15-30	312.70	70.95	82.86	189.34	0.794	0.165	0.292	0.266	94.10	6.72	<0.030	1.1
KCl	5	15-30	280.90	66.68	87.23	178.27	0.731	0.112	0.148	0.132	150.50	3.83	0.041	1.2
KCl	5	30-45	56.10	15.21	15.90	7.45	0.164	0.154	0.241	0.160	8.38	15.22	<0.030	0.5
KCl	5	45-60	48.70	12.18	12.80	7.32	0.142	0.112	0.181	0.130	3.51	15.89	<0.030	0.4
KCl	5	60-75	27.64	6.38	9.34	7.74	0.091	0.201	0.111	0.164	3.32	27.95	<0.030	0.4

SAR = Sodium Adsorption Ratio; Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Plot	Field Sample	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	Al	Fe	Ti (mg/L)	Cu	Zn	Mn
KCl	5	25	TME113	75-90	28.0	0.20	6.15	45.92	27.70	1.993	6.192	1.333	0.040	0.159	0.822
KCl	5	25	TME113a	90-105	32.0	0.14	6.20	29.49	31.60	1.922	10.629	1.614	0.050	0.117	0.319
KCl	5	25	TME113b	105-120	31.5	0.11	6.50	19.23	14.20	2.809	7.934	1.092	0.052	0.163	0.063
KCl	5	25	TME113c	120-140	32.3	0.08	6.80	12.00	11.40	2.382	6.632	0.714	0.043	0.082	0.025
KCl	5	26	TME114	0-15	38.0	0.78	7.30	25.66	208.00	0.458	0.256	0.027	0.019	0.056	0.014
KCl	5	26	TME115	15-30	37.0	0.70	7.30	35.54	224.00	0.519	0.091	0.019	0.018	0.023	0.035
KCl	5	37	TME173	0-15	35.0	0.56	7.20	35.38	229.00	0.823	0.083	0.048	0.053	0.131	0.070
NaCl	6	22	TME84	0-15	41.0	0.32	6.80	19.60	148.00	0.416	0.245	0.058	0.023	0.149	0.009
NaCl	6	22	TME85	15-30	33.5	0.45	7.50	17.00	253.00	0.344	0.026	<0.010	0.022	0.055	0.026
NaCl	6	22	TME86	30-45	32.0	0.26	7.70	11.40	123.00	0.201	0.019	<0.010	0.010	0.024	<0.006
NaCl	6	22	TME87	45-60	37.0	0.25	7.80	10.00	126.00	<0.200	<0.010	<0.010	0.011	<0.020	<0.006
NaCl	6	22	TME87a	60-75	31.0	0.24	7.80	8.65	121.00	0.203	0.012	<0.010	<0.010	0.031	<0.006
NaCl	6	22	TME87b	75-90	31.0	0.24	7.75	7.67	128.00	<0.200	<0.010	<0.010	<0.010	0.029	<0.006
NaCl	6	22	TME87c	90-105	31.0	0.24	7.70	6.78	124.00	<0.200	0.012	<0.010	<0.010	0.038	<0.006
NaCl	6	22	TME87d	105-120	31.0	0.23	7.70	6.65	117.00	<0.200	<0.010	<0.010	<0.010	<0.020	<0.006
NaCl	6	22	TME87e	120-130	31.3	0.22	7.70	6.14	105.50	<0.200	0.021	<0.010	0.010	0.034	<0.006
NaCl	6	32	TME150	0-15	37.0	0.41	7.30	16.74	224.00	0.362	0.060	<0.010	0.015	0.049	0.017
NaCl	6	41	TME189	0-15	36.0	0.52	7.30	43.81	224.00	0.491	0.041	0.017	0.029	0.064	0.038
NaCl	7	18	TME64	0-15	39.5	0.44	7.30	19.40	231.00	0.430	0.055	0.016	0.019	0.097	0.024
NaCl	7	27	TME116	0-15	41.0	0.79	7.00	89.62	269.00	0.707	0.155	0.031	0.019	0.099	0.220
NaCl	7	27	TME117	0-15	45.0	0.59	7.10	77.63	210.00	0.557	0.077	0.026	0.026	0.114	0.107
NaCl	7	27	TME118	0-15	39.5	0.80	7.10	159.00	199.00	0.466	0.130	0.019	0.018	0.114	0.091
NaCl	7	27	TME119	0-15	39.0	0.37	6.80	23.42	182.00	0.535	0.348	0.046	0.020	0.124	0.134
NaCl	7	27	TME120	0-15	43.0	0.43	6.60	34.79	187.00	0.665	0.288	0.042	0.022	0.160	0.247
NaCl	7	27	TME121	15-30	40.0	0.99	7.00	209.70	212.00	0.628	0.148	0.021	0.019	0.097	0.626
NaCl	7	34	TME152	0-15	36.5	0.61	7.00	55.72	246.00	0.397	0.241	0.026	0.022	0.159	0.048
NaCl	7	34	TME153	0-15	36.5	0.39	7.40	11.60	206.00	0.254	0.080	<0.010	0.012	0.049	0.010
NaCl	7	34	TME154	0-15	39.5	0.49	7.30	18.00	234.00	0.343	0.075	<0.010	0.023	0.051	0.008
NaCl	7	34	TME155	0-15	36.5	0.54	6.95	70.31	198.00	0.459	0.037	0.011	0.014	0.119	0.100
NaCl	7	34	TME156	0-15	36.0	0.48	6.90	29.69	219.00	0.409	0.123	0.012	0.014	0.118	0.066
NaCl	7	34	TME157	15-30	35.0	0.95	7.20	171.80	213.00	0.519	0.061	<0.010	0.030	0.089	0.059
NaCl	8	20	TME78	0-15	42.5	0.51	7.20	19.90	281.00	0.400	0.068	0.018	0.022	0.111	0.078
NaCl	8	35	TME158	0-15	40.5	0.42	6.60	37.49	180.00	0.533	0.285	0.043	<0.010	0.200	0.174
NaCl	8	35	TME159	0-15	42.0	0.55	6.90	29.05	232.00	0.523	0.094	0.022	0.014	0.176	0.131
NaCl	8	35	TME160	0-15	39.0	0.40	6.80	27.69	176.00	0.494	0.121	0.027	0.020	0.191	0.147
NaCl	8	35	TME161	0-15	37.5	0.53	6.95	45.47	235.00	0.492	0.165	0.026	0.020	0.124	0.078
NaCl	8	35	TME162	0-15	42.5	0.51	7.00	26.27	229.00	0.564	0.097	0.019	<0.010	0.112	0.090
NaCl	8	35	TME163	15-30	33.0	0.45	7.40	31.18	217.00	0.310	0.025	<0.010	0.029	0.065	0.011
NaCl	8	35	TME164	30-45	32.5	0.40	7.55	47.41	150.00	0.250	<0.010	<0.010	0.013	0.062	0.009
NaCl	8	35	TME165	45-60	34.5	0.67	7.60	145.80	127.00	0.335	0.017	<0.010	<0.010	0.040	0.007
NaCl	8	35	TME165a	60-75	34.5	0.89	7.50	237.40	111.00	0.515	0.013	0.011	<0.010	0.052	0.013
NaCl	8	35	TME166	75-90	34.0	0.84	7.40	223.50	115.00	0.497	<0.010	0.011	<0.010	0.031	<0.006
NaCl	8	35	TME166a	90-105	33.0	0.54	7.40	107.40	124.00	0.323	<0.010	<0.010	<0.010	<0.020	<0.006
NaCl	8	44	TME196	0-15	32.5	0.50	6.80	39.54	222.00	0.642	0.091	0.024	0.023	0.147	0.036
NaCl	8	44	TME197	0-15	38.0	0.58	7.20	60.60	247.00	0.388	0.102	0.010	0.022	0.105	0.065
NaCl	8	44	TME198	0-15	35.0	0.64	7.30	83.60	252.00	0.433	0.105	0.019	0.017	0.058	0.054
NaCl	8	44	TME199	0-15	35.5	0.83	7.40	101.50	263.00	0.308	0.077	<0.010	0.017	0.110	0.008

Sat'n = Percent Saturation; E.C. = Electrical Conductivity; Alk. = Alkalinity (mg CaCO₃/L); Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Depth (cm)	Ca	Mg	Na	K	Sr	B (mg/L)	Ba	P	S	Si	As	SAR
KCl	5	75-90	25.10	5.33	10.74	7.32	0.087	0.110	0.084	0.238	4.29	23.82	<0.030	0.5
KCl	5	90-105	16.80	4.19	8.70	7.40	0.069	0.118	0.078	0.298	3.71	29.03	<0.030	0.5
KCl	5	105-120	11.52	2.94	8.47	6.36	0.047	0.104	0.062	0.252	2.95	24.24	<0.030	0.6
KCl	5	120-140	8.13	2.78	6.74	5.59	0.034	0.072	0.055	0.213	3.03	22.27	<0.030	0.5
KCl	5	0-15	65.52	9.24	25.71	187.70	0.200	0.247	0.103	0.284	56.91	7.11	0.051	0.8
KCl	5	15-30	87.97	15.74	35.43	95.66	0.191	0.132	0.118	0.294	37.07	5.85	0.055	0.9
KCl	5	0-15	75.20	18.85	25.97	31.39	0.204	0.107	0.152	0.354	21.76	5.45	0.137	0.6
NaCl	6	0-15	56.18	13.37	12.95	10.65	0.104	0.368	0.103	0.264	4.37	6.38	0.088	0.4
NaCl	6	15-30	68.93	25.05	16.79	10.02	0.154	0.445	0.115	0.170	4.95	8.54	0.112	0.4
NaCl	6	30-45	28.29	15.45	13.75	5.42	0.111	0.383	0.059	<0.100	3.64	7.65	0.075	0.5
NaCl	6	45-60	27.70	14.39	9.93	5.43	0.084	0.288	0.069	<0.100	3.23	7.14	0.071	0.4
NaCl	6	60-75	28.55	13.60	10.96	5.30	0.080	0.320	0.076	<0.100	3.76	7.14	0.069	0.4
NaCl	6	75-90	27.36	12.96	12.15	5.51	0.080	0.394	0.065	<0.100	4.07	7.04	0.065	0.5
NaCl	6	90-105	28.14	12.37	12.06	5.82	0.080	0.663	0.061	<0.100	4.75	7.07	0.064	0.5
NaCl	6	105-120	26.93	12.99	10.97	6.34	0.081	0.418	0.071	<0.100	5.30	6.79	0.063	0.4
NaCl	6	120-130	26.13	12.28	13.07	6.26	0.081	0.481	0.054	<0.100	6.78	6.84	0.064	0.5
NaCl	6	0-15	84.64	17.55	12.20	6.33	0.113	<0.040	0.086	0.237	5.45	6.21	0.057	0.3
NaCl	6	0-15	87.28	19.98	18.53	6.92	0.133	<0.040	0.104	0.160	8.96	5.16	0.124	0.5
NaCl	7	0-15	75.02	14.22	25.84	7.19	0.122	0.045	0.086	0.287	6.26	6.90	0.117	0.7
NaCl	7	0-15	108.57	22.52	82.23	13.27	0.219	0.073	0.106	0.290	13.57	7.86	0.056	1.9
NaCl	7	0-15	89.95	19.31	44.87	8.57	0.165	0.069	0.114	0.184	6.97	5.44	0.065	1.1
NaCl	7	0-15	80.96	19.04	109.48	7.75	0.149	0.041	0.119	0.216	13.39	5.48	0.041	2.8
NaCl	7	0-15	61.18	14.35	27.78	9.64	0.118	0.060	0.105	0.227	5.69	6.98	<0.030	0.8
NaCl	7	0-15	70.23	15.79	28.51	12.69	0.126	0.060	0.119	0.423	6.82	8.20	0.065	0.8
NaCl	7	15-30	125.61	29.76	89.48	14.93	0.229	0.075	0.151	0.280	16.94	5.39	0.088	1.9
NaCl	7	0-15	69.95	11.63	82.44	37.30	0.140	0.055	0.099	0.703	18.91	7.67	0.060	2.4
NaCl	7	0-15	62.80	10.05	30.70	29.77	0.127	0.047	0.076	0.177	14.43	5.89	<0.030	0.9
NaCl	7	0-15	79.67	16.01	39.57	24.84	0.153	0.076	0.094	0.223	15.72	9.37	0.032	1.1
NaCl	7	0-15	91.94	18.55	35.33	19.38	0.164	0.061	0.110	0.374	11.82	5.99	0.038	0.9
NaCl	7	0-15	78.48	13.74	22.32	45.33	0.153	0.072	0.119	0.412	12.45	6.54	0.087	0.6
NaCl	7	15-30	113.86	25.39	116.22	11.26	0.182	<0.040	0.113	0.231	35.30	4.66	0.091	2.6
NaCl	8	0-15	71.30	14.50	59.47	7.71	0.134	0.061	0.074	0.468	6.74	7.35	0.116	1.7
NaCl	8	0-15	72.18	15.76	29.06	22.16	0.137	0.057	0.123	0.691	11.41	8.42	0.094	0.8
NaCl	8	0-15	99.39	18.05	37.06	26.13	0.191	0.042	0.128	0.711	11.28	8.39	0.116	0.9
NaCl	8	0-15	72.97	14.81	9.73	30.64	0.142	0.045	0.115	0.632	7.44	6.92	0.081	0.3
NaCl	8	0-15	76.92	15.90	66.13	7.78	0.125	0.052	0.083	0.484	8.62	6.36	0.050	1.8
NaCl	8	0-15	104.95	21.34	9.48	26.01	0.184	<0.040	0.152	0.439	9.77	6.52	0.067	0.2
NaCl	8	15-30	51.65	20.17	58.46	3.42	0.100	<0.040	0.056	<0.100	9.18	11.38	0.034	1.7
NaCl	8	30-45	43.22	22.40	35.11	2.91	0.088	<0.040	0.051	<0.100	11.36	11.54	<0.030	1.1
NaCl	8	45-60	81.03	43.07	22.80	4.47	0.169	<0.040	0.095	<0.100	17.05	11.15	0.039	0.5
NaCl	8	60-75	105.25	55.37	22.52	5.88	0.223	<0.040	0.130	<0.100	13.50	9.87	0.032	0.4
NaCl	8	75-90	97.24	50.28	22.95	6.35	0.212	<0.040	0.115	<0.100	8.15	9.56	0.032	0.5
NaCl	8	90-105	62.38	32.37	19.85	5.16	0.146	<0.040	0.072	<0.100	9.64	8.93	0.032	0.5
NaCl	8	0-15	64.72	12.28	57.16	5.66	0.098	0.049	0.075	0.349	10.39	5.83	0.122	1.7
NaCl	8	0-15	82.78	15.77	58.51	7.29	0.131	<0.040	0.118	0.250	8.56	5.21	0.137	1.5
NaCl	8	0-15	80.70	15.36	75.03	4.67	0.127	<0.040	0.086	0.201	9.84	3.04	0.159	2.0
NaCl	8	0-15	72.52	12.16	145.93	4.57	0.108	0.049	0.088	0.266	34.78	7.09	0.129	4.2

SAR = Sodium Adsorption Ratio; Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Plot	Field Sample	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	Al	Fe	Ti	Cu	Zn	Mn
												(mg/L)			
NaCl	8	44	TME200	0-15	36.0	0.71	7.28	109.40	265.00	0.383	0.114	0.013	0.020	0.051	0.027
NaCl	8	44	TME201	15-30	31.5	0.46	7.40	49.42	187.00	0.251	0.031	<0.010	0.022	0.064	0.008
NaCl	8	44	TME202	15-30	32.0	0.88	7.30	147.50	309.00	0.506	0.174	0.015	0.022	0.115	0.167
NaCl	8	44	TME203	15-30	32.5	0.95	7.30	183.60	284.00	0.471	0.089	0.013	0.019	0.088	0.099
NaCl	8	44	TME204	15-30	31.5	0.81	7.40	116.70	234.00	0.327	0.044	<0.010	0.021	0.127	0.020
NaCl	8	44	TME205	15-30	34.0	0.84	7.35	177.10	223.00	0.303	0.040	<0.010	0.020	0.075	0.031
NaCl	8	44	TME206	30-45	34.5	0.46	7.35	76.60	134.00	0.262	<0.010	<0.010	<0.010	<0.020	<0.006
NaCl	8	44	TME207	45-60	33.0	0.44	7.10	81.90	128.00	0.267	<0.010	<0.010	<0.010	0.058	<0.006
NaCl	8	44	TME207a	60-75	36.5	0.37	7.30	55.80	126.00	0.225	<0.010	<0.010	<0.010	0.044	<0.006
NaCl	8	44	TME207b	75-90	32.0	0.36	7.45	49.89	133.00	0.220	0.014	<0.010	<0.010	0.043	<0.006
NaCl	8	44	TME207c	90-105	33.0	0.29	7.60	34.91	116.00	<0.200	<0.010	<0.010	<0.010	0.028	<0.006
NaCl	8	44	TME207d	105-120	33.5	0.25	7.60	20.10	164.00	0.219	0.014	<0.010	<0.010	0.029	<0.006
NaCl	8	44	TME207e	120-135	31.5	0.24	7.60	13.80	165.00	<0.200	<0.010	<0.010	0.010	0.028	<0.006
NaCl	8	44	TME207f	135-150	35.5	0.24	7.65	7.60	142.00	0.204	0.018	<0.010	<0.010	0.024	<0.006
NaCl	9	19	TME65	0-15	52.0	0.63	6.90	57.70	248.00	0.596	0.132	0.031	0.018	0.166	0.099
NaCl	9	19	TME66	0-15	44.5	0.53	7.20	29.40	252.00	0.734	0.085	0.050	0.042	0.079	0.053
NaCl	9	19	TME67	0-15	46.5	0.58	7.30	39.80	283.00	0.395	0.097	0.013	0.012	0.108	0.030
NaCl	9	19	TME68	0-15	51.5	0.75	6.95	55.00	329.00	0.980	2.354	0.285	0.023	0.312	0.132
NaCl	9	19	TME69	0-15	41.3	1.82	7.35	329.50	320.00	0.466	0.624	0.041	0.021	0.182	0.082
NaCl	9	19	TME70	15-30	44.5	0.88	7.10	142.00	256.00	0.587	0.129	0.031	0.027	0.114	0.408
NaCl	9	19	TME71	15-30	39.5	0.59	7.50	36.80	300.00	0.331	0.046	0.013	0.026	0.074	0.017
NaCl	9	19	TME72	15-30	46.0	0.80	7.15	112.00	288.00	0.477	0.125	0.022	0.017	0.147	0.233
NaCl	9	19	TME73	15-30	41.5	0.83	7.40	76.20	378.00	0.336	0.176	0.023	0.018	0.094	0.131
NaCl	9	19	TME74	15-30	36.0	1.46	7.20	310.00	257.00	0.534	0.072	0.013	0.025	0.100	0.048
NaCl	9	19	TME75	30-45	39.5	0.38	7.40	56.50	116.00	0.300	<0.010	0.011	0.016	0.034	<0.006
NaCl	9	19	TME76	45-60	34.5	0.32	7.50	43.40	103.00	0.242	<0.010	<0.010	0.014	0.040	0.006
NaCl	9	19	TME76a	60-75	33.0	0.31	7.60	40.10	104.00	0.256	0.018	<0.010	0.014	0.031	<0.006
NaCl	9	19	TME77	75-90	30.5	0.37	7.50	59.00	94.50	0.252	0.028	<0.010	<0.010	0.041	<0.006
NaCl	9	19	TME77a	90-110	33.0	0.39	7.60	68.40	91.50	0.298	0.016	<0.010	0.011	0.042	<0.006
NaCl	9	31	TME138	0-15	35.5	0.92	7.40	130.20	305.00	0.362	0.174	0.022	0.045	0.131	0.049
NaCl	9	31	TME139	0-15	41.0	1.23	7.10	272.50	255.00	0.498	0.132	0.017	0.022	0.081	0.171
NaCl	9	31	TME140	0-15	39.0	0.67	7.30	61.80	287.00	0.345	0.189	0.026	0.033	0.134	0.081
NaCl	9	31	TME141	0-15	36.5	0.53	6.90	40.83	237.00	0.473	0.204	0.043	0.018	0.123	0.077
NaCl	9	31	TME142	0-15	37.0	0.46	7.10	24.45	253.00	0.345	0.089	0.012	0.014	0.149	0.178
NaCl	9	31	TME143	15-30	37.0	0.92	6.60	239.20	84.30	0.261	0.042	<0.010	<0.010	0.104	0.112
NaCl	9	31	TME144	15-30	43.0	0.93	7.15	181.90	269.00	0.385	0.103	0.012	0.023	0.094	0.127
NaCl	9	31	TME145	15-30	36.0	0.65	7.20	94.26	226.00	0.206	0.113	0.014	0.032	0.081	0.092
NaCl	9	31	TME146	15-30	30.5	0.41	7.20	53.98	162.00	<0.200	0.366	0.026	0.027	0.043	0.020
NaCl	9	31	TME147	15-30	33.0	0.57	7.50	49.39	286.00	0.339	0.068	<0.010	0.021	0.121	0.068
NaCl	9	31	TME148	30-45	38.5	0.99	6.40	323.30	0.00	0.425	<0.010	<0.010	<0.010	0.118	0.172
NaCl	9	31	TME149	45-60	38.5	0.71	6.30	220.00	27.10	0.264	<0.010	<0.010	<0.010	0.120	0.110
NaCl	9	31	TME149a	60-75	39.5	0.41	6.40	124.50	16.80	<0.200	<0.010	<0.010	<0.010	0.175	0.034
NaCl	9	36	TME167	0-15	39.5	0.48	7.25	25.35	230.00	0.559	0.064	0.035	0.036	0.064	0.031
NaCl	9	36	TME168	0-15	37.0	0.43	7.30	18.33	222.00	0.539	0.030	0.022	0.032	<0.020	<0.006
NaCl	9	36	TME169	0-15	35.0	0.72	7.40	61.36	300.00	0.478	0.141	0.029	0.038	0.056	0.017
NaCl	9	36	TME170	0-15	39.5	0.68	7.00	62.97	257.00	0.697	0.200	0.062	0.039	0.083	0.060
NaCl	9	36	TME171	0-15	36.0	0.42	7.25	21.75	213.00	0.596	0.054	0.031	0.035	0.097	0.030
NaCl	9	36	TME172	15-30	37.0	0.46	7.50	19.57	235.00	0.503	0.030	0.035	0.051	0.058	0.017
NaCl	10	23	TME88	0-15	38.5	1.79	7.10	435.00	250.00	0.489	0.552	0.039	0.014	0.095	0.068

Sat'n = Percent Saturation; E.C. = Electrical Conductivity; Alk. = Alkalinity (mg CaCO₃/L); Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Depth (cm)	Ca	Mg	Na	K	Sr	B	Ba (mg/L)	P	S	Si	As	SAR
NaCl	8	0-15	74.53	12.26	103.48	7.21	0.121	0.045	0.095	0.281	11.41	5.44	0.141	2.9
NaCl	8	15-30	55.49	11.32	56.14	4.18	0.080	<0.040	0.063	0.129	9.38	3.58	0.114	1.8
NaCl	8	15-30	107.86	28.08	97.13	4.55	0.229	0.043	0.110	0.330	9.36	4.13	0.141	2.2
NaCl	8	15-30	105.83	24.09	110.89	6.73	0.176	0.042	0.135	0.298	11.38	4.16	0.135	2.5
NaCl	8	15-30	81.57	17.14	110.60	7.51	0.131	0.045	0.115	0.189	20.55	4.44	0.125	2.9
NaCl	8	15-30	82.86	16.70	118.09	7.34	0.127	<0.040	0.104	0.178	11.71	5.79	0.120	3.1
NaCl	8	30-45	68.02	16.24	20.04	2.81	0.081	<0.040	0.065	<0.100	8.36	5.02	0.084	0.6
NaCl	8	45-60	65.36	17.19	15.63	2.36	0.070	<0.040	0.072	<0.100	7.59	6.26	0.079	0.4
NaCl	8	60-75	56.31	15.09	11.24	2.23	0.060	<0.040	0.066	<0.100	5.53	6.27	0.083	0.3
NaCl	8	75-90	55.26	15.44	13.29	2.75	0.064	<0.040	0.055	<0.100	6.16	6.63	0.062	0.4
NaCl	8	90-105	43.09	12.78	11.09	3.13	0.051	<0.040	0.060	<0.100	4.39	6.44	0.071	0.4
NaCl	8	105-120	36.81	11.19	10.63	3.05	0.045	<0.040	0.058	<0.100	3.85	6.34	0.084	0.4
NaCl	8	120-135	36.27	11.34	10.20	3.00	0.045	<0.040	0.050	<0.100	4.21	6.20	0.080	0.4
NaCl	8	135-150	36.19	11.31	10.22	3.27	0.047	<0.040	0.054	<0.100	5.11	6.32	0.081	0.4
NaCl	9	0-15	75.17	14.69	66.06	19.77	0.152	0.135	0.117	0.465	8.15	7.17	0.143	1.8
NaCl	9	0-15	89.40	16.21	28.64	10.66	0.167	0.081	0.122	0.272	8.53	6.74	0.153	0.7
NaCl	9	0-15	72.85	13.36	76.17	8.12	0.157	0.066	0.060	0.362	7.36	8.06	0.119	2.2
NaCl	9	0-15	56.30	9.16	159.91	5.96	0.118	0.105	0.085	1.895	10.70	9.39	0.135	5.2
NaCl	9	0-15	69.60	11.47	414.80	7.16	0.135	0.144	0.070	1.065	53.56	7.90	0.131	12.1
NaCl	9	15-30	103.29	23.98	82.05	16.67	0.190	0.126	0.171	0.309	6.95	6.97	0.115	1.9
NaCl	9	15-30	60.75	15.08	89.02	4.43	0.119	0.042	0.058	0.133	9.42	4.41	0.148	2.6
NaCl	9	15-30	86.52	20.33	105.12	6.22	0.150	0.100	0.113	0.329	6.85	6.48	0.108	2.6
NaCl	9	15-30	64.15	14.02	167.81	8.27	0.123	0.090	0.090	0.478	10.35	6.42	0.137	4.9
NaCl	9	15-30	107.77	23.78	224.20	12.94	0.190	0.105	0.135	0.292	25.70	4.96	0.091	5.1
NaCl	9	30-45	50.07	14.53	16.43	5.43	0.067	0.041	0.062	<0.100	4.26	6.07	0.073	0.5
NaCl	9	45-60	38.97	11.34	17.95	4.84	0.044	<0.040	0.057	<0.100	4.81	6.36	0.063	0.7
NaCl	9	60-75	35.20	10.05	20.28	4.97	0.042	<0.040	0.053	<0.100	5.35	6.19	0.060	0.8
NaCl	9	75-90	45.53	12.96	18.02	5.64	0.049	<0.040	0.048	<0.100	7.90	6.31	0.046	0.6
NaCl	9	90-110	50.04	14.37	13.87	5.89	0.053	<0.040	0.062	<0.100	8.33	6.30	0.046	0.4
NaCl	9	0-15	64.42	10.98	201.70	8.47	0.120	0.051	0.084	0.522	21.67	5.67	0.071	6.1
NaCl	9	0-15	97.75	20.51	211.40	10.88	0.162	<0.040	0.109	0.455	10.10	5.83	0.066	5.1
NaCl	9	0-15	64.88	13.77	131.67	7.59	0.110	0.042	0.080	0.549	12.23	6.04	0.066	3.9
NaCl	9	0-15	59.70	12.01	74.75	7.14	0.097	0.043	0.080	0.364	6.06	4.84	0.098	2.3
NaCl	9	0-15	79.46	17.64	32.64	8.90	0.127	<0.040	0.110	0.286	5.23	5.07	0.101	0.9
NaCl	9	15-30	52.30	16.60	144.30	17.47	0.124	<0.040	0.082	<0.100	22.96	5.95	<0.030	4.5
NaCl	9	15-30	82.74	18.36	151.67	12.93	0.140	0.043	0.100	0.357	7.37	5.24	0.079	3.9
NaCl	9	15-30	48.48	13.08	121.35	9.25	0.082	<0.040	0.058	0.236	10.77	5.25	0.073	4.0
NaCl	9	15-30	29.59	6.96	78.49	8.42	0.062	<0.040	0.046	0.144	7.17	3.47	0.038	3.4
NaCl	9	15-30	87.32	17.67	58.88	12.44	0.139	0.040	0.115	0.335	5.41	3.84	0.050	1.5
NaCl	9	30-45	96.72	35.56	46.98	29.03	0.232	<0.040	0.297	<0.100	3.82	13.58	<0.030	1.0
NaCl	9	45-60	73.09	28.33	22.17	23.06	0.197	<0.040	0.216	<0.100	3.73	14.72	<0.030	0.6
NaCl	9	60-75	40.89	15.79	13.84	15.79	0.087	<0.040	0.193	<0.100	2.27	15.67	<0.030	0.5
NaCl	9	0-15	78.57	13.81	55.62	7.62	0.132	0.074	0.088	0.300	10.19	5.62	0.110	1.5
NaCl	9	0-15	90.08	17.03	18.06	6.83	0.155	0.064	0.097	0.200	7.98	5.65	0.063	0.5
NaCl	9	0-15	66.86	11.75	159.51	5.42	0.108	0.082	0.070	0.423	15.64	6.14	0.069	4.7
NaCl	9	0-15	76.93	13.95	114.79	5.80	0.142	0.081	0.077	0.683	13.95	6.87	0.125	3.2
NaCl	9	0-15	88.56	15.01	20.71	8.54	0.139	0.065	0.106	0.280	7.20	5.91	0.058	0.5
NaCl	9	15-30	46.01	10.12	90.13	9.19	0.085	0.073	0.078	0.224	8.24	3.34	0.148	3.1
NaCl	10	0-15	73.56	13.47	375.90	8.40	0.149	0.466	0.141	0.697	24.60	5.68	0.109	10.6

SAR = Sodium Adsorption Ratio; Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Continued. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Plot	Field Sample	Depth (cm)	Sat'n (%)	E.C. (dS/m)	pH	Cl	Alk	Al	Fe (mg/L)	Ti (mg/L)	Cu	Zn	Mn
NaCl	10	23	TME89	0-15	42.5	1.13	7.10	184.80	395.00	5.277	11.242	1.092	0.066	0.199	0.159
NaCl	10	23	TME90	0-15	36.0	1.06	7.50	132.70	365.00	0.691	2.693	0.163	0.030	0.124	0.064
NaCl	10	23	TME91	0-15	39.0	1.96	7.20	485.00	305.00	0.742	0.689	0.050	0.017	0.261	0.091
NaCl	10	23	TME92	0-15	40.0	1.63	7.10	352.40	379.00	1.032	5.307	0.485	0.041	0.246	0.137
NaCl	10	23	TME93	15-30	36.5	2.54	7.10	827.90	169.00	1.033	0.022	0.032	0.015	0.084	0.093
NaCl	10	23	TME94	15-30	34.5	1.85	7.25	479.80	256.00	0.632	0.155	0.029	0.018	0.137	0.143
NaCl	10	23	TME95	15-30	32.0	1.49	7.40	315.90	335.00	0.572	0.147	0.025	0.034	0.137	0.100
NaCl	10	23	TME96	15-30	39.5	1.18	7.40	284.60	240.00	0.472	0.046	0.016	0.035	0.232	0.031
NaCl	10	23	TME97	15-30	43.5	2.36	6.90	694.80	320.00	0.985	0.139	0.043	0.026	0.182	0.192
NaCl	10	23	TME98	30-45	33.0	1.09	7.30	331.10	88.50	0.560	<0.010	0.017	<0.010	0.046	0.018
NaCl	10	23	TME99	45-60	31.5	0.41	7.60	74.50	130.00	0.282	<0.010	<0.010	<0.010	0.026	<0.006
NaCl	10	23	TME99a	60-75	36.5	0.26	7.60	18.92	142.00	0.282	0.021	0.012	0.011	0.023	<0.006
NaCl	10	23	TME99b	75-90	32.5	0.26	7.70	12.26	153.00	0.237	<0.010	<0.010	0.011	<0.020	<0.006
NaCl	10	23	TME99c	90-105	33.0	0.25	7.70	7.15	150.00	<0.200	<0.010	<0.010	<0.010	<0.020	<0.006
NaCl	10	23	TME99d	105-120	31.0	0.26	7.70	9.58	149.00	0.204	<0.010	<0.010	<0.010	<0.020	<0.006
NaCl	10	23	TME99e	120-140	31.5	0.24	7.80	7.49	137.50	0.251	0.019	<0.010	0.013	0.030	<0.006
NaCl	10	28	TME122	0-15	44.5	2.38	6.50	356.90	261.00	0.831	0.505	0.037	<0.010	0.229	2.174
NaCl	10	28	TME123	0-15	37.0	5.22	7.20	1730	212.00	0.913	0.147	0.017	0.025	0.186	0.191
NaCl	10	28	TME124	0-15	46.0	2.01	7.35	526.00	263.00	0.849	1.864	0.179	0.027	0.178	0.204
NaCl	10	28	TME125	0-15	36.5	3.23	7.10	925.80	249.00	0.731	0.400	0.023	0.014	0.278	0.305
NaCl	10	28	TME126	0-15	37.5	6.97	6.90	2306	215.00	1.603	0.158	0.045	0.016	0.250	0.994
NaCl	10	28	TME127	15-30	37.5	0.96	6.90	278.30	68.80	0.387	0.034	0.010	0.012	0.073	1.737
NaCl	10	28	TME128	15-30	36.0	2.59	7.10	826.10	177.00	0.898	0.134	0.046	0.048	0.170	1.960
NaCl	10	28	TME129	15-30	38.5	2.15	7.10	636.90	176.00	0.583	0.071	0.012	0.014	0.095	0.717
NaCl	10	28	TME130	15-30	37.0	3.42	6.95	1105	190.00	1.037	0.156	0.023	0.017	0.119	3.248
NaCl	10	28	TME131	15-30	35.3	3.51	7.10	1149	202.00	1.059	0.099	0.026	0.016	0.129	1.853
NaCl	10	28	TME131a	30-45	35.5	0.63	6.60	190.10	0.00	0.343	0.015	<0.010	<0.010	0.216	0.172
NaCl	10	28	TME131b	45-60	35.5	0.31	6.60	92.34	4.42	0.265	0.031	0.011	<0.010	0.098	0.081
NaCl	10	28	TME131c	60-75	36.5	0.23	6.60	52.42	33.60	0.263	0.050	0.013	<0.010	0.056	0.412
NaCl	10	28	TME131d	75-90	32.5	0.22	6.70	56.87	17.60	0.254	0.064	0.012	<0.010	0.071	0.090
NaCl	10	28	TME131e	90-105	32.5	0.25	6.90	46.36	21.50	<0.200	<0.010	<0.010	<0.010	0.028	0.011
NaCl	10	28	TME131f	105-120	33.0	0.31	7.50	33.72	134.00	0.320	<0.010	0.015	0.014	<0.020	<0.006
NaCl	10	28	TME131g	120-135	32.0	0.26	7.50	24.24	114.00	<0.200	<0.010	<0.010	<0.010	<0.020	<0.006
NaCl	10	28	TME131h	135-150	34.5	0.25	7.60	19.81	123.00	0.212	0.013	<0.010	<0.010	0.043	<0.006
NaCl	10	38	TME174	0-15	35.5	1.24	7.30	238.30	276.00	0.778	0.115	0.044	0.056	0.106	0.080
NaCl	10	38	TME175	0-15	37.0	1.24	7.30	200.80	379.00	0.405	1.343	0.100	0.015	0.176	0.069
NaCl	10	38	TME176	0-15	37.0	4.59	6.95	1537	158.00	0.914	0.049	0.012	0.018	0.201	0.101
NaCl	10	38	TME177	0-15	36.5	0.77	7.35	89.45	254.00	0.423	0.046	0.014	0.026	0.086	0.064
NaCl	10	38	TME178	0-15	36.0	0.60	7.10	66.20	222.00	0.407	0.058	0.015	0.025	0.125	0.039
NaCl	10	38	TME179	15-30	36.0	1.85	7.00	543.50	184.00	0.603	0.058	0.011	0.012	0.123	0.407
NaCl	10	38	TME180	15-30	38.5	1.53	7.10	394.90	303.00	0.493	0.079	0.010	0.012	0.126	0.135
NaCl	10	38	TME181	15-30	36.5	3.21	7.20	1056	179.00	0.845	0.024	0.014	0.017	0.135	0.206
NaCl	10	38	TME182	15-30	36.0	0.94	7.25	177.85	251.00	0.422	0.072	0.013	0.018	0.112	0.053
NaCl	10	38	TME183	15-30	36.0	0.95	7.20	195.70	225.00	0.514	0.046	0.018	0.024	0.098	0.087
NaCl	10	38	TME184	30-45	36.5	1.05	6.70	333.70	51.50	0.498	<0.010	0.011	<0.010	0.104	0.126
NaCl	10	38	TME185	45-60	39.0	0.43	6.50	129.20	23.10	0.236	<0.010	<0.010	<0.010	0.114	0.042
NaCl	10	38	TME185a	60-75	34.0	0.18	6.70	36.54	47.60	<0.200	<0.010	<0.010	<0.010	0.075	0.011
NaCl	10	38	TME186	75-90	35.0	0.14	6.80	22.40	18.40	<0.200	<0.010	<0.010	<0.010	0.052	0.006
NaCl	10	38	TME186a	90-105	34.5	0.13	6.80	18.30	39.70	<0.200	0.017	<0.010	<0.010	0.046	<0.006
NaCl	10	38	TME186b	105-120	31.5	0.20	7.00	33.66	31.50	<0.200	0.019	<0.010	<0.010	0.058	0.006
NaCl	10	38	TME186c	120-135	32.5	0.35	7.50	49.34	81.30	<0.200	<0.010	<0.010	<0.010	<0.020	<0.006

Sat'n = Percent Saturation; E.C. = Electrical Conductivity; Alk. = Alkalinity (mg CaCO₃/L); Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.

Concluded. Saturated Paste Extract Data for the Soils and Soil/Waste Mixtures in the Esso Field Plots in 1990.

Waste	Rate	Depth (cm)	Ca	Mg	Na	K	Sr	B (mg/L)	Ba	P	S	Si	As	SAR
NaCl	10	0-15	61.09	9.33	287.60	5.73	0.142	0.194	0.157	2.407	22.52	16.89	0.125	9.1
NaCl	10	0-15	59.60	9.85	262.20	4.19	0.114	0.110	0.078	0.394	21.62	4.52	0.134	8.3
NaCl	10	0-15	81.91	13.05	443.60	17.36	0.172	0.721	0.102	1.882	37.42	9.67	0.098	12.0
NaCl	10	0-15	69.60	10.76	409.30	11.25	0.151	0.207	0.145	3.148	33.76	10.45	0.096	12.1
NaCl	10	15-30	215.80	91.24	233.20	18.70	0.555	0.803	0.432	<0.100	17.90	7.82	0.060	3.4
NaCl	10	15-30	100.18	23.87	346.60	12.06	0.180	0.147	0.131	0.399	30.47	4.59	0.098	8.1
NaCl	10	15-30	83.16	19.79	295.40	4.53	0.146	0.054	0.099	0.237	30.33	3.10	0.066	7.6
NaCl	10	15-30	75.79	19.94	226.50	11.59	0.158	0.112	0.091	0.220	18.23	6.88	0.113	6.0
NaCl	10	15-30	148.75	41.36	367.90	17.14	0.301	0.100	0.231	0.679	17.19	8.04	0.112	6.9
NaCl	10	30-45	108.25	59.62	35.60	10.75	0.332	0.051	0.178	<0.100	5.46	6.97	0.041	0.7
NaCl	10	45-60	44.39	22.71	17.43	7.23	0.125	0.058	0.061	<0.100	4.76	7.03	0.046	0.5
NaCl	10	60-75	30.93	15.13	12.15	6.34	0.088	0.054	0.049	<0.100	4.64	6.88	0.039	0.4
NaCl	10	75-90	30.89	14.89	13.60	6.18	0.086	0.061	0.052	<0.100	4.85	6.82	0.031	0.5
NaCl	10	90-105	28.87	14.28	12.98	5.79	0.089	0.042	0.057	<0.100	4.89	6.82	<0.030	0.5
NaCl	10	105-120	30.37	14.63	12.70	6.40	0.090	0.057	0.056	<0.100	5.66	6.71	<0.030	0.5
NaCl	10	120-140	29.13	13.37	12.38	6.61	0.085	0.053	0.060	<0.100	5.24	6.58	<0.030	0.5
NaCl	10	0-15	108.90	17.59	499.00	15.49	0.236	0.120	0.144	1.644	32.66	10.24	0.219	11.7
NaCl	10	0-15	180.48	32.99	1195.50	12.07	0.405	0.061	0.110	0.279	80.08	4.86	0.080	21.5
NaCl	10	0-15	65.39	9.57	484.50	5.42	0.136	0.078	0.100	1.608	33.37	7.14	0.103	14.8
NaCl	10	0-15	117.22	18.46	750.90	10.15	0.219	0.089	0.083	1.152	59.74	7.76	0.149	17.0
NaCl	10	0-15	309.20	55.13	1358.70	23.98	0.595	0.074	0.267	0.382	75.43	6.00	0.059	18.7
NaCl	10	15-30	64.34	16.17	131.44	16.37	0.145	<0.040	0.121	<0.100	13.69	5.39	<0.030	3.8
NaCl	10	15-30	131.27	30.58	490.10	13.08	0.259	0.076	0.178	0.276	33.84	4.68	0.092	10.0
NaCl	10	15-30	123.81	27.82	376.70	10.97	0.248	<0.040	0.158	0.159	25.67	3.95	0.054	8.0
NaCl	10	15-30	216.50	48.10	572.50	17.03	0.369	0.052	0.238	0.256	43.09	4.27	0.061	9.2
NaCl	10	15-30	230.65	48.99	585.15	14.49	0.402	0.054	0.268	0.231	32.74	4.17	0.063	9.1
NaCl	10	30-45	59.02	16.28	38.68	17.93	0.146	<0.040	0.182	<0.100	5.14	12.40	<0.030	1.1
NaCl	10	45-60	31.98	9.44	12.22	12.67	0.075	<0.040	0.143	<0.100	2.31	13.20	<0.030	0.5
NaCl	10	60-75	24.53	7.26	9.42	10.09	0.052	<0.040	0.081	<0.100	2.28	11.11	<0.030	0.4
NaCl	10	75-90	21.37	6.88	12.04	8.77	0.041	<0.040	0.091	<0.100	3.19	12.66	<0.030	0.6
NaCl	10	90-105	27.09	9.09	11.59	8.48	0.042	<0.040	0.049	<0.100	10.64	12.55	<0.030	0.5
NaCl	10	105-120	42.72	14.28	10.16	7.85	0.053	<0.040	0.083	<0.100	3.77	6.87	0.046	0.3
NaCl	10	120-135	35.52	10.86	10.10	6.62	0.044	<0.040	0.063	<0.100	3.79	6.39	<0.030	0.4
NaCl	10	135-150	35.85	10.68	8.99	6.74	0.040	<0.040	0.069	<0.100	3.15	6.45	<0.030	0.3
NaCl	10	0-15	107.23	19.30	234.80	9.07	0.210	0.108	0.120	0.565	17.57	35.00	0.149	5.5
NaCl	10	0-15	51.23	8.63	293.50	4.68	0.095	0.076	0.075	0.719	21.62	346.30	0.149	10.0
NaCl	10	0-15	198.01	40.57	900.50	7.36	0.360	0.042	0.167	0.181	62.89	3.13	0.080	15.2
NaCl	10	0-15	76.56	14.88	102.26	6.95	0.139	0.059	0.083	0.205	22.15	7.92	0.141	2.8
NaCl	10	0-15	78.43	14.63	56.24	7.67	0.139	0.042	0.087	0.186	7.81	5.66	0.121	1.5
NaCl	10	15-30	140.62	34.77	242.30	11.08	0.247	<0.040	0.192	0.188	17.91	3.90	0.102	4.7
NaCl	10	15-30	106.37	23.33	244.10	10.00	0.181	0.050	0.145	0.255	24.81	4.09	0.122	5.6
NaCl	10	15-30	192.59	45.51	509.30	11.05	0.339	<0.040	0.217	0.190	33.09	4.67	0.107	8.6
NaCl	10	15-30	78.90	16.65	144.10	7.12	0.130	0.042	0.095	0.276	15.29	4.61	0.127	3.9
NaCl	10	15-30	97.92	21.22	101.72	9.80	0.164	0.041	0.117	0.199	8.87	4.19	0.135	2.4
NaCl	10	30-45	114.88	30.34	46.95	17.98	0.256	<0.040	0.167	<0.100	7.41	5.31	0.038	1.0
NaCl	10	45-60	46.89	13.46	12.81	13.59	0.107	<0.040	0.129	<0.100	2.96	10.71	<0.030	0.4
NaCl	10	60-75	16.23	5.33	8.57	7.69	0.038	0.048	0.071	<0.100	2.46	11.57	<0.030	0.5
NaCl	10	75-90	13.15	3.68	9.06	6.22	0.029	0.050	0.047	<0.100	3.31	11.46	<0.030	0.6
NaCl	10	90-105	11.87	4.42	7.20	5.57	0.026	0.042	0.071	<0.100	3.21	12.67	<0.030	0.5
NaCl	10	105-120	19.30	7.31	8.73	6.66	0.035	<0.040	0.069	<0.100	3.67	11.90	<0.030	0.4
NaCl	10	120-135	42.05	15.49	13.11	7.43	0.123	<0.040	0.066	<0.100	5.37	7.96	0.063	0.4

SAR = Sodium Adsorption Ratio; Elements (Cr, V, Cd, Pb, Li, Mo, Ni, Se and Co) below the detection limit are excluded from this table.