A HYDROGEOLOGICAL AND GEOPHYSICAL ASSESSMENT OF A CONTAMINANT PLUME EMANATING FROM THE TERRA NOVA REGIONAL WASTE DISPOSAL SITE

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by

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ABSTRACT

A 16 year study, started in 1977, was undertaken to assess a subsurface contaminant plume emanating from the Terra Nova Regional Waste Disposal Site in Newfoundland. Eleven (11) monitoring wells, installed at the waste site shortly after the first cell was dug, were sampled regularly to detect changes in background groundwater concentrations of selected chemical parameters. Four (4) surface water locations were also monitored to detect changes in surface water chemistry. A geophysical study was undertaken to provide data on the location of the contaminant plume and to derive useful information on sub surface conditions. A geotechnical soil description including the hydraulic properties of the overburden soils was obtained using several in situ and laboratory techniques. Chemical analysis of the leachate plume was obtained via monitoring well water sampling.

Groundwater sampling and the geophysical survey show that a leachate plume exists down stream of the waste site, but remains within the confines of the site boundaries. Electromagnetic (EM) surveys provide evidence that the leachate has preferentially flowed along bedrock channels. The geochemical sampling results exhibit variability with time suggesting preferential flow paths rather than a continuous uniform plume. Ion concentrations of surface water sites showed that water quality concentrations were below the Canadian Water Quality Guidelines for drinking water.

ACKNOWLEDGEMENTS

I would especially like to thank Dr. Wasi Ullah for his encouragement to pursue this graduate programme. This thesis was undertaken with the financial, field, and technical support of my employer, the Department of Environment. In particular I acknowledge the followings: Jim Robinson who designed and implemented the Terra Nova site monitoring program; Peter Ivany who conducted the induced tracer test; Robert Lethbridge who meticulously collected the water well data at the site; Lewis Janes who as resident site supervisor, collected water level and rain gauge data; Mr. Martin Batterson, Geologist, Terrain Sciences Division, Department of Natural Resources, who provided information on the surficial and bedrock geology at the site. Thanks to the Department of Environment senior staff members for agreeing to provide financial support for this work and Mr. Paul Neary, computer specialist, who was very helpful in procuring the coloured contour plots and tables.

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BOD	biological oxygen demand
COD	chemical oxygen demand
DO	dissolved oxygen
TDS	total dissolved solids
MW	monitoring well
bgl	below ground level
PVC	polyvinyl chloride
CWQG	Canadian Water Quality Guidelines
CCME	Canadian Council of Ministers of the Environment
ppm	parts per million
EM	electromagnetic
VLF	very low frequency
USC	unified soil classification system
t	tonnes
ρ	resistivity
$\varnothing$	dip angle
Z	depth
k	hydraulic conductivity

CHAPTER 1

INTRODUCTION AND SITE CHARACTERISTICS

1.1 General

Leachate from landfills is the name given to the liquid phase made up of the original liquid of the waste, and the products of percolation of precipitation down through waste cells. It is a complex mixture of liquids containing dissolved inorganic and organic constituents. Leachate moves in the direction of groundwater flow and is the main source of contamination to water resources in the vicinity of waste disposal sites. Present waste disposal practices in Newfoundland result in leachate plumes emanating from most if not all waste sites. The rate of movement of leachate and its natural chemical attenuation are of great importance for downstream sensitive receptors such as domestic and municipal water supplies, and recreational areas. However, surface stream pollution is another concern that must be kept in mind when controlling leachate flow. An illustration of this was given by the surface water contamination in early May, 1992, when an overland leachate flow was observed running from the site south into Square Pond (see **Figure 1.1**). Further information as to the cause and corrective measures of this event can be found in Guzzwell (1992).

The province of Newfoundland has approximately 240 active landfills which service 95% of the province's population and 227 abandoned landfill sites (Dominie, 1992). Because of a thin glacial till overburden in many locations, a wet maritime climate, and poor landfilling practices, leachates generated at landfills can move relatively quickly off site with concentrations sufficient to contaminate surface streams and groundwater supplies.

Landfills in Newfoundland are located either in remote areas away from down stream sensitive receptors, or adjacent to the sea coast. Natural attenuation over long travel distances are relied upon to alleviate environmental effects from the remote landfills, while landfills located near the sea coast rely on the dilution of the ocean to mitigate the generation of leachates. However, concentrated leachates that are able to utilize shorter flow paths in the geologic media have been known to contaminate water bodies down stream as has happened at the Terra Nova landfill site in the past (e.g., Guzzwell, 1992).

1.2 Location and Purpose of Study

The Terra Nova regional waste disposal site is situated near the northern entrance of Terra Nova National Park about 650 metres outside of the park boundary and 1 km from the intersection of the Trans Canada Highway and the major road leading to the Eastport Peninsula and the town of Glovertown (**Figure 1.1**).

In 1977, the Newfoundland Department of Environment chose the Terra Nova Regional Waste Disposal Site to study in detail the hydrogeological impact that a typical

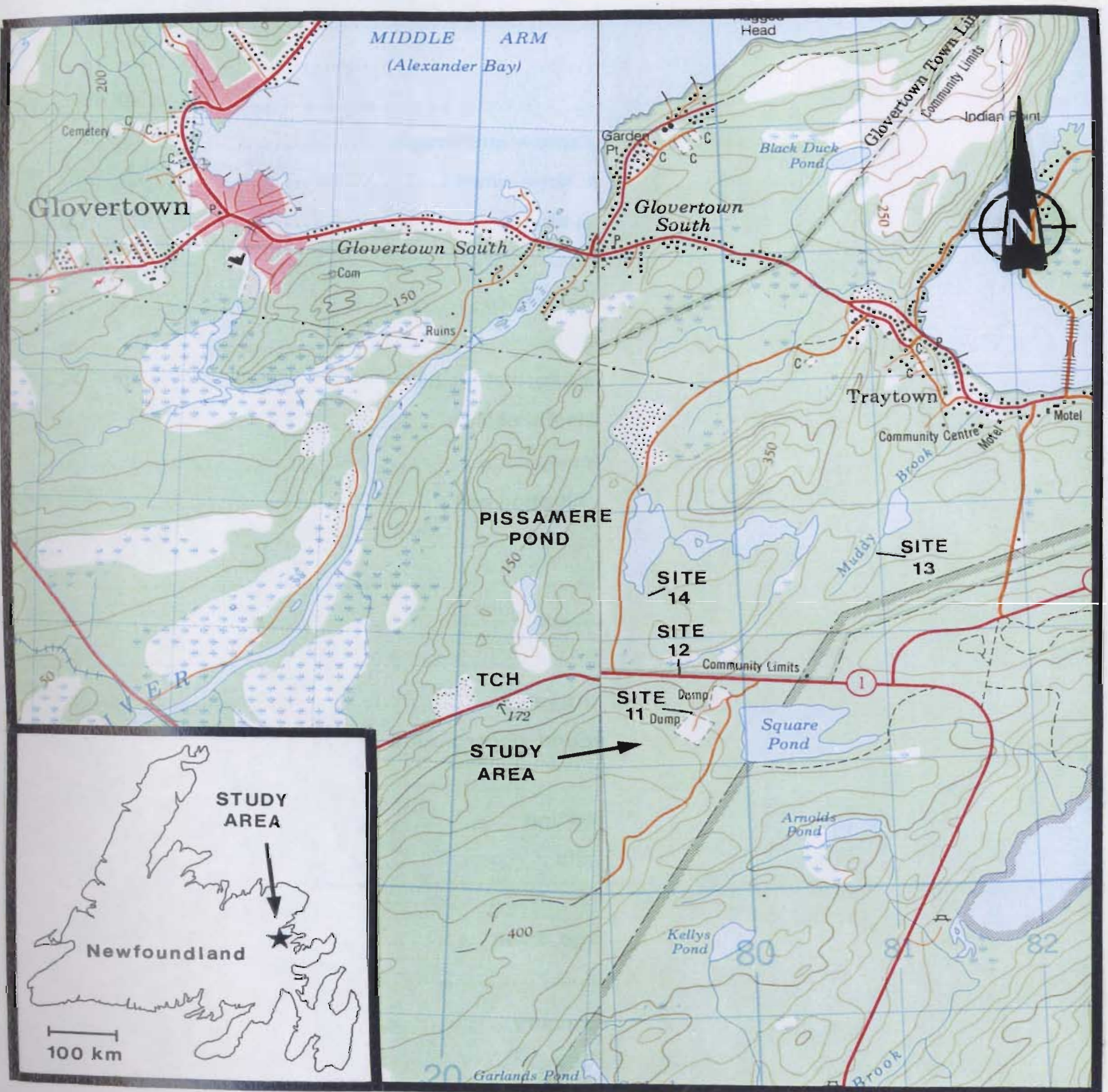

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Figure 1.1 Location map of study area showing surface water quality sampling sites waste disposal site in Newfoundland had on the surrounding environment, particularly on groundwater resources. The landfill had also just begun operations and officials of Terra Nova National Park were concerned about any deleterious affects the waste site would have on the park. At the same time, residents of Glovertown were concerned that Pissamere Pond, a designated alternative water supply, located between the waste site and the town, would be adversely affected by this new landfill. The study was initiated to determine leachate generation in the groundwater below the landfill, its movement, and the attenuation of chemical concentrations in the leachate with time and distance from the landfill. The results of this study to June 1991 are reported by J. W. Robinson (1991). The present thesis uses the database collected for that report and additional new data as follows:

1.) continued water quality sampling results of selected monitoring wells and surface water sampling sites since 1991
2.) a geophysical study of an area over and down stream of the site undertaken specifically for the thesis
3.) pit excavations and geotechnical soil analysis used to provide soil description, layering, and the hydraulic conductivity of the underlying soils
4.) information on a leachate leak which occurred May 1992

1.3 Previous Studies on Site

The site was originally investigated in 1975 along with four other sites to determine the best location for a regional landfill. That preliminary survey, done by Geotechnical Associates Ltd.(1975), consisted of hammer refraction seismic work, test boreholes and soil grain size analysis. Overburden thickness was judged to be from 1.8 m to 4.6 m, the water table was found to be 1.2 m to 3.6 m below existing ground elevations, and the soil type was determined to be fluvio-glacial material (mainly gravel and sand with some boulders). Soil permeabilities ranged from 2.3×10^{-2} cm/s to 4.9×10^{-3} cm/s. No water quality analysis was carried out at the time.

Two unpublished interim reports were issued in 1979 and 1982 respectively. In the first by Robinson and Lethbridge (1979), information was provided concerning the construction of monitoring wells, water quality results to date, and slug test permeability results. The second interim report (Robinson, 1982) described the leachate movement determined from water sampling at the monitoring wells. A leachate plume was found to be within the confines of the landfill as it existed at the time. There was no indication of a degradation in surface water from streams sampling down grade of the landfill or from Pissamere Pond, except for elevated concentrations of iron which was not a health hazard. A new background well became necessary when new waste cells were dug up stream of the background well.

Guzzwell (1987) carried out an EM-31 terrain conductivity survey and produced a map of terrain conductivity values associated with the leachate plume, thus demonstrating the usefulness of this technique. Electrical conductivity measurements on water samples from monitoring wells were in good agreement with the geophysical survey and outlined the present plume location.

Robinson (1988) discussed the retardation factors for a number of ion species using water quality data from the monitoring wells. The study indicated that retardation of the ion species in the soil was evident and was mainly due to adsorption.

A two well induced tracer test was carried out at the landfill in August, 1989 (Ivany, 1989) to obtain a more accurate value of the hydraulic conductivity of the glacial till overburden. Three monitoring wells were drilled in an arc on the down stream side of MW #10 so that one of them would be directly down stream from the well with respect to groundwater flow. An ionic tracer, the chloride ion, Cl^-, was used as the tracer. The hydraulic conductivity value was found to be $k = 4.1 \times 10^{-6}$ m/s which is in the range of sandy silts and till according to Fetter (1988) and was consistent with the type of till material which exists at the landfill.

Robinson (1991) performed slug tests on the landfill monitoring wells to obtain hydraulic conductivity values of the overburden glacial till material. He modified a computer program written by Thompson (1987) and analyzed the data from eleven monitoring wells at the landfill. With some assumptions concerning the effective porosity of the formation, the hydraulic conductivity in the saturated zone was evaluated and found to 4.5 x 10^{-7} m/s.

Finally, Guzzwell (1992) described the circumstances of an overland leachate flow earlier that year which reached Square Pond situated within the Terra Nova National Park boundary (**Figure 1.1**). The flow was caused by exceptionally high water table levels at a location within the waste site where a topographic low made it possible for the leachate to flow off site towards Square Pond. Partially frozen ground and a culvert under a woods road next to waste site allowed the leachate to run onto the ice and into the pond.

Two surficial hydrostratigraphic units have been identified within the region. Till and outwash sands, and gravels form these units. Of these two, the outwash sand and gravels have been recognized as the most productive with regards to well yield (Nolan Davis and Associates, 1981).

Because no monitoring wells were drilled into the bedrock, no direct measurements of bedrock permeability are available. However, information from two drilled water wells situated 600 m to the northeast of the landfill provides some indication of bedrock conditions (**Table 1.1**).

Table 1.1 - Water Well Information Near Landfill (Dept. of Environment, 1994)

Owner	Ultramar Service Station	Splash & Putt Cabins
Date Drilled	31/07/91	12/07/89
Depth	170.8 m	182.0 m
Casing Length	41.2 m	28.3 m
Water Found At	171.0 m	137.0 m
Yield	9.0 l/min.	36 l/min.
Static Water Level	6.1 m	
Lithology	Brown overburden to 41 m Grey rock 41 m to 171 m	Brown sand to 28 m Green siltstone 28 m to 182 m

It appears that no satisfactory water supply was found in the overburden and that the bedrock aquifer was used as the source of water to both these commercial establishments. Water was found at depths of 130 - 170 m in green/grey siltstone. In hydrogeological reports published by Water Resources Division, Department of Environment (Department of Environment, 1981), the Musgravetown Group offered good potential yields. From the 202 wells surveyed in this rock group, the mean yield was 28.6 l/min and the mean well depth was 44.7 m.

1.4 Climatological Data

Contaminant groundwater movement is highly influenced by precipitation events and seasonal recharge. Newfoundland's climate is characterized by cold conditions with temperatures moderated by the province's proximity to the ocean. Monthly mean values of temperature and precipitation at the Park Headquarters located 9 km south of the waste site for the period 1961-90 are shown on **Figure 1.2** and **Table 1.2**. The precipitation is evenly distributed throughout the year. From December to March precipitation is usually in the form of snow. The mean yearly precipitation total for this time period is 1184 mm. The warmest months are June, July and August, with July's mean temperature of 16.3°C. February is the coldest month with a mean temperature of - 6.6°C.

1.5 Common Landfill Operations in Newfoundland

Landfills in Newfoundland have typically been constructed by digging a pit or cell in the overburden to a depth of 2 to 3 m. The cell is then filled with refuse and compacted by heavy equipment until the garbage nears the natural elevation of the surrounding ground. A cover or cap of native fill is then placed over the cells and vegetation is allowed to grow on top of this cap. When a cell is filled and capped with native soil, a new cell is dug and the process is repeated. The depth of the cell should not be below the maximum water table level which usually occurs in April or early May. This is not possible in many areas of the province since water tables are close to the surface and/or there is little overburden above the water table. Overburden deposits in many locations of Newfoundland are of glacial origin with varying degrees of silt. Consequently hydraulic conductivities can vary widely ranging from 10^{-2} to 10^{-5} cm/s. The absence of clay content and consequently lower absorption rates, combined with high

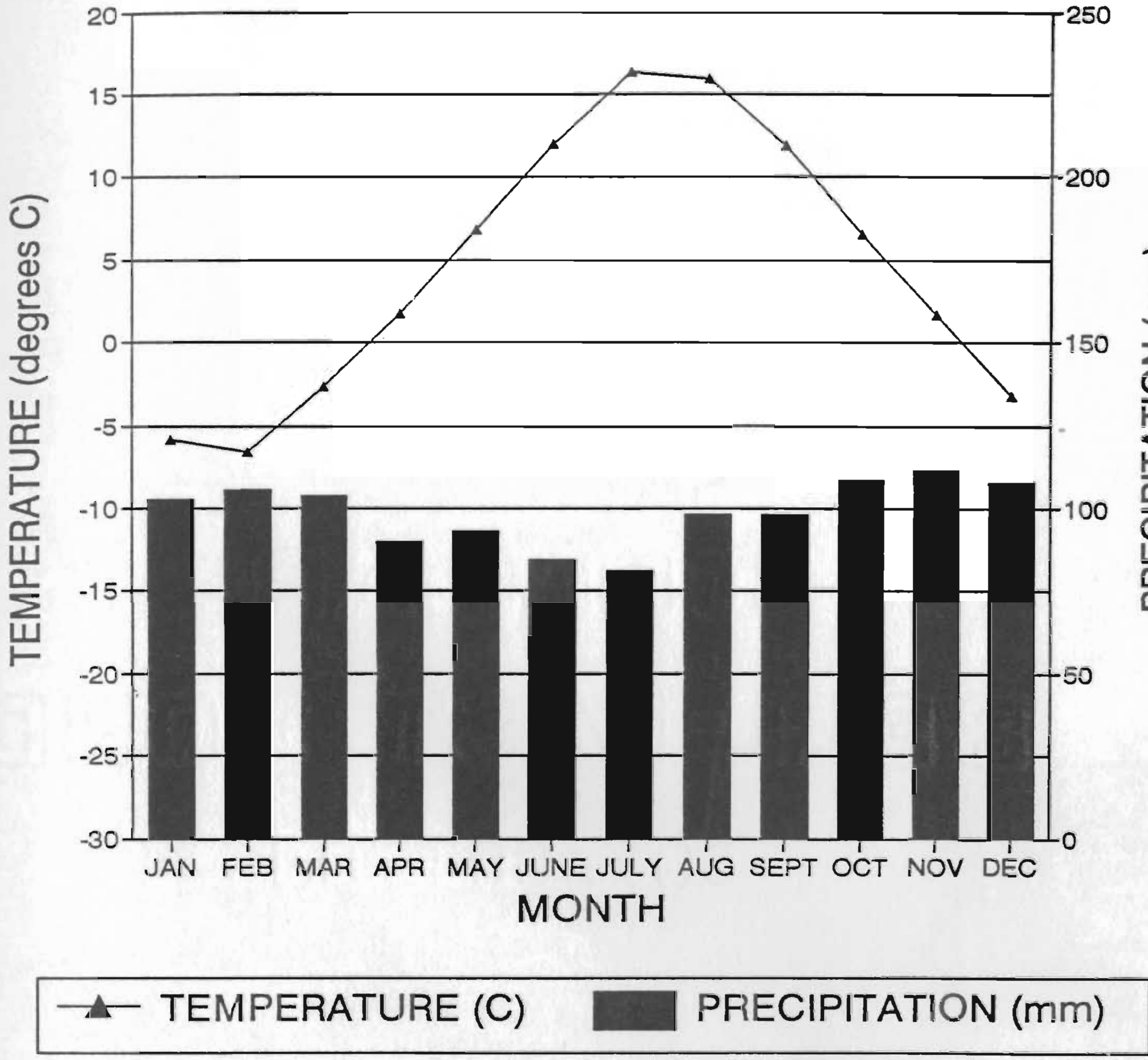


Figure 1.2 Climatic Norms 1962-1990 - Terra Nova National Park Headquarters (from Environment Canada)

Table 1.2

TERRA NOVA NATIONAL PARK HEADQUARTERS

48°33'N 53°59'W/O, 84m — *1962 to/à 1990*

	Jan janv	Feb févr	Mar mars	Apr avr	May mai	Jun juin	Jul juill	Aug août	Sep sept	Oct oct	Nov nov	Dec déc	Year année	
Temperature														**Température**
Daily Maximum (°C)	-2.1	-2.5	1.2	5.5	11.7	17.1	21.6	20.7	16.2	10.2	4.9	0.1	8.7	Maximum quotidien (°C)
Daily Minimum (°C)	-9.9	-10.8	-6.6	-1.9	2.1	6.6	11.0	11.2	7.5	2.8	-1.4	-6.8	0.3	Minimum quotidien (°C)
Daily Mean (°C)	-5.9	-6.6	-2.7	1.8	6.8	12.0	16.3	15.9	11.9	6.5	1.7	-3.2	4.5	Moyenne quotidien (°C)
Extreme Maximum (°C)	12.5	11.5	16.5	23.0	28.5	32.2	33.0	31.1	28.5	23.3	19.4	16.1		Maximum extrême (°C)
Date	983/13	984/05+	979/26	986/24	988/21	976/06+	981/04	976/23+	984/10	976/06	967/04	969/06		Date
Extreme Minimum (°C)	-27.8	-27.5	-28.5	-14.0	-9.4	-3.9	1.5	-2.0	-2.0	-8.0	-16.5	-22.8		Minimum extrême (°C)
Date	971/14	990/03	986/10	986/06	964/10	978/01+	987/07	980/19	986/30	986/27	989/28	972/31		Date
Degree-Days														**Degrés-jours**
Above 18 °C	N	N	0.0	0.0	0.1	2.9	22.3	17.9	1.4	0.1	N	0.0	N	Au-dessus 18°C
Below 18 °C	N	N	637.2	481.6	346.7	185.7	77.4	95.4	186.7	357.5	N	660.5	N	Au-dessous 18°C
Above 5 °C	N	N	2.0	12.6	85.2	209.1	347.8	325.5	205.1	72.7	N	1.8	N	Au-dessus 5°C
Below 0 °C	N	N	102.7	15.2	0.7	0.0	0.0	0.0	0.0	1.0	N	121.3	N	Au-dessous 0°C
Precipitation														**Précipitations**
Rainfall (mm)	37.7	41.1	52.7	60.3	88.2	83.6	81.1	97.9	98.1	104.4	88.4	52.5	886.0	Chutes de pluie (mm)
Snowfall (cm)	65.1	64.3	51.1	29.7	4.6	0.9	0.0	0.0	0.0	4.4	23.0	54.6	297.6	Chutes de neige (cm)
Precipitation (mm)	102.7	105.4	103.8	90.0	93.0	84.5	81.1	97.9	98.1	108.8	111.5	107.7	1184.3	Précipitations (mm)
Extreme Daily Rainfall (mm)	44.4	63.0	43.2	38.1	77.7	53.4	47.0	68.1	50.0	70.0	54.1	49.3		Extrême quotidien de pluie (mm)
Date	979/08	973/03	987/16	971/28	990/20	981/07	984/25	966/18	978/19	981/17	964/05	974/10		Date
Extreme Daily Snowfall (cm)	42.0	45.7	77.0	34.0	20.3	10.2	0.0	0.0	0.0	25.4	29.0	35.6		Extrême quotidien de neige (cm)
Date	989/03	967/03	988/08	988/13	962/23	976/13	990/31+	990/31+	990/30+	965/29	986/30	964/21		Date
Extreme Daily Pcpn. (mm)	44.4	63.0	77.0	38.1	77.7	53.4	47.0	68.1	50.0	70.0	54.1	49.3		Extrême quotidien de préc. (mm)
Date	979/08	973/03	988/08	971/28	990/20	981/07	984/25	966/18	978/19	981/17	964/05	974/10		Date
Month-end Snow Cover (cm)	38	N	35	N	0	0	0	0	0	1	5	19		Couver. de neige, fin de mois (cm)
Days With														**Journées avec**
Maximum Temperature > 0°C	N	N	19	28	31	30	31	31	30	31	26	15	N	Température maximale > 0°C
Measurable Rainfall	4	5	8	9	14	13	12	14	13	15	12	7	126	Hauteur de pluie mesurable
Measurable Snowfall	9	8	7	4	1	*	0	0	0	*	4	8	42	Hauteur de neige mesurable
Measurable Precipitation	13	11	13	12	14	13	12	14	13	15	15	14	160	Hauteur de précipitation mesurable

courtesy of Atmospheric Environment Services, Environment Canada hydraulic conductivities, lead to a rapid percolation of leachate around some landfill sites. Hence bedrock aquifers are susceptible to leachate contamination, in many areas.

For example, at the Terra Nova site, an overland leachate flow in 1992 (Guzzwell, 1992) clearly indicated that the water table can reach the ground level saturating the cells. This in combination with a frozen ground surface caused rapid overland flow of the leachate.

1.6 Previous History and Characteristics of the Terra Nova Landfill Site

The site has been used as a waste disposal site by the town of Glovertown since 1970, first with a teepee incinerator which was situated near the present entrance. In 1975 a number of sites in the area were assessed to select a regional waste site for domestic waste from the Eastport Peninsula and Terra Nova National Park. The chosen site started operation in the fall of 1976. **Table 1.3** is a list of the communities presently using this landfill site and their population. Three air photographs in **Appendix A** taken in 1964, 1976, and 1988, show how the waste site developed from a community based to a regional sized waste disposal site.

Table 1.3 List of Communities Using Terra Nova Landfill Site

Community		Population (1992)
Burnside/St. Chads		336
Salvage		271
Sandy Cove		193
Happy Adventure		354
Eastport		609
Sandringham		282
Charlottetown		280
Traytown		387
Glovertown		2184
Terra Nova National Park	(est.)	20
Total		4916

(Dominie, 1992)

A yearly generation of 0.5 tonnes of garbage per capita is currently used in determining the amount of waste entering a landfill (Dominie, 1992). Therefore, the yearly amount of garbage entering the Terra Nova landfill presently is estimated to be 2500 T/yr. The total waste disposed on this site from 1976 to the end of 1994 is roughly 42,000 tonnes.

The site has a locked gate and is open five days a week. Car wrecks and other ferrous metal commodities such as washers, stoves, etc., are dumped at a specific location for the purpose of recycling. A recycling company visits the site regularly to crush and load this material for transportation to a mainland recycling plant.

The site is 32 ha in size and the active trench is backfilled usually every 3 months. Up to the end of 1994, 17 cells had been dug, filled with garbage, and capped.

The cells are dug to about 2.5 m deep, rectangular in shape of varying sizes. The location of the cells filled from 1976 to 1984 and the general layout of the site is shown in **Figure 1.3**. Because of the time sequence of the establishment of the waste cells, the contribution of each cell to the total leachate plume is complicated, and may best be assessed by contaminant transport modelling and plume composition. Contaminant transport modelling was not undertaken for this thesis.

1.7 Physiography

The waste site area slopes gently northward towards Bonavista Bay 4 km away (**Figure 1.1**). The site is at an average elevation of 82 m. Surface drainage over the site converges to a stream which flows under the Trans Canada Highway, through a marsh, and then via a brook into Pissamere Pond. A brook flows out of this pond which empties into Northeast Arm at Traytown. A woods road bounds the eastern border of the waste site. Quarrying and logging operations use this road for transportation of materials.

1.8 Bedrock Geology

The latest bedrock geology map of the area (O'Brien, 1986) is shown in **Figure 1.4**. It shows that the underlying Hardynian age Musgravetown Group bedrock consists of parallel laminated and cross bedded green-grey siltstone, sandstone and minor conglomerate, with cherty and vitric tuff interbeds; minor unseparated rhyolite flows, and

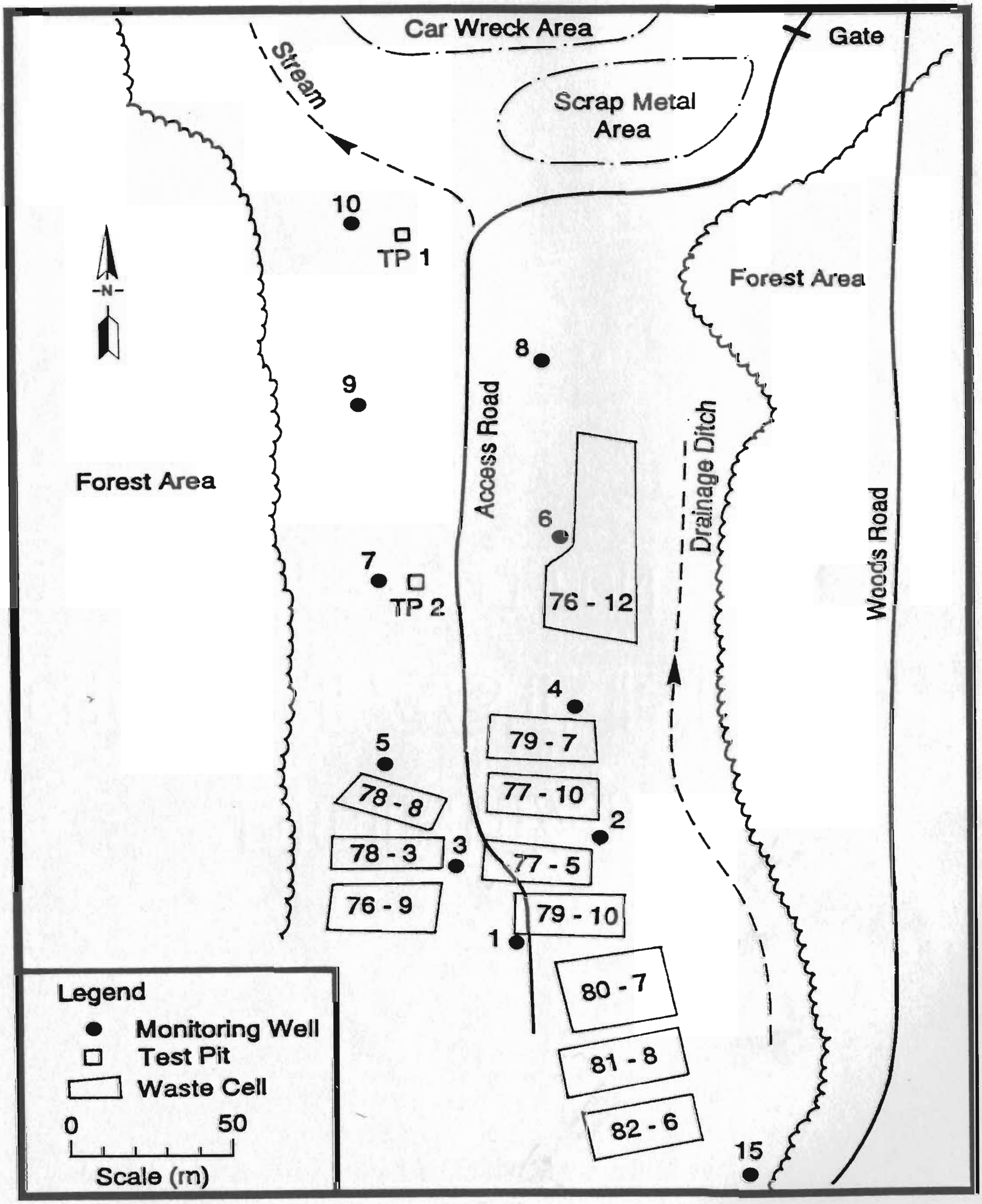
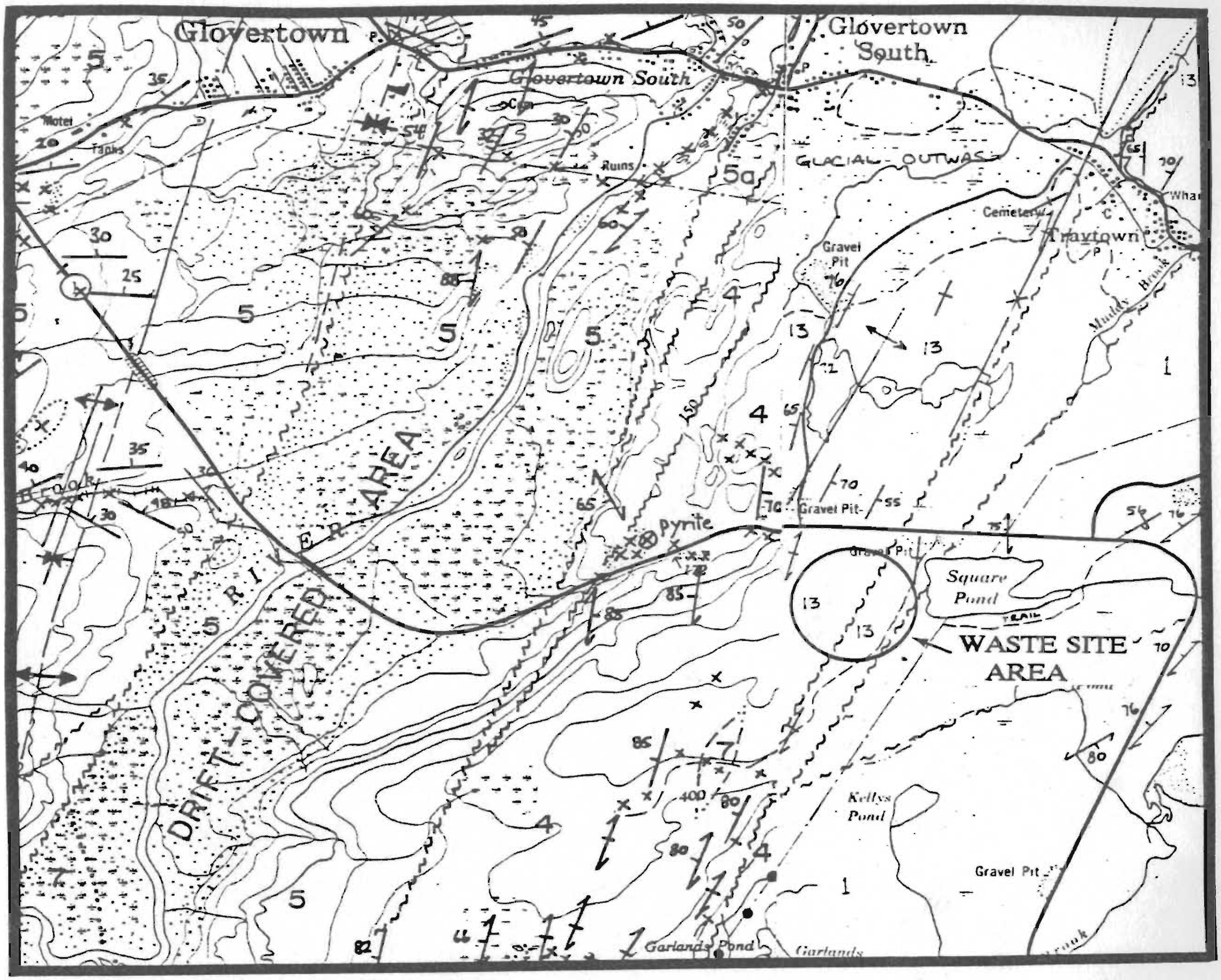


Figure 1.3 Location of waste cells and general area. Dates on waste cells indicate year and month filling commenced. Numbers 11-14 are surface water sampling sites as shown on **Figure 1.1**.



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Hadrynian
Musgravetown Group

13 parallel laminated and cross-bedded green-grey siltstone, sandstone and minor conglomerate scours, with cherty and vitric tuff interbeds; minor rhyolite flows, hornfels.

Figure 1.4 Bedrock geology map of waste site area (O'Brien, 1986).

hornfels. A NNE-trending fault is noted passing through the waste site bedrock. All of the monitoring wells drilled on the site were terminated upon encountering bedrock. From the bedrock depth and topography elevations, the bedrock gently slopes to the north towards the ocean and is roughly parallel to surface slope.

1.9 Surficial Geology

The surficial geology of the area has been studied and reported by Jenness (1963). Deposits of Pleistocene glacial till form a veneer over underlying bedrock and range in thickness from a few centimetres to over 10 m. The Terra Nova area features ground moraine, end moraine, indicator boulders, eskers, kames, kame terraces, outwash, and outwash deltaic sediments. The ice movement in the area was from inland towards the ocean in an easterly direction (Jenness, 1963). More recently, work by Kirby et al., (1988) has defined the overburden at the landfill site as morainal glacial till. The composition of the glacial till typically reflects the composition of the underlying rocks. The glacial till is composed of sandy or gravelly till with occasional boulders 0.5 m to 1 m in diameter. In test pits dug at the waste site in 1993 (see photographs #1 and #2 at the end of **Appendix A**), there was no evidence of more than one till layer. Grain size and a complete soil description can be found in the following section.

1.10 Geotechnical Data

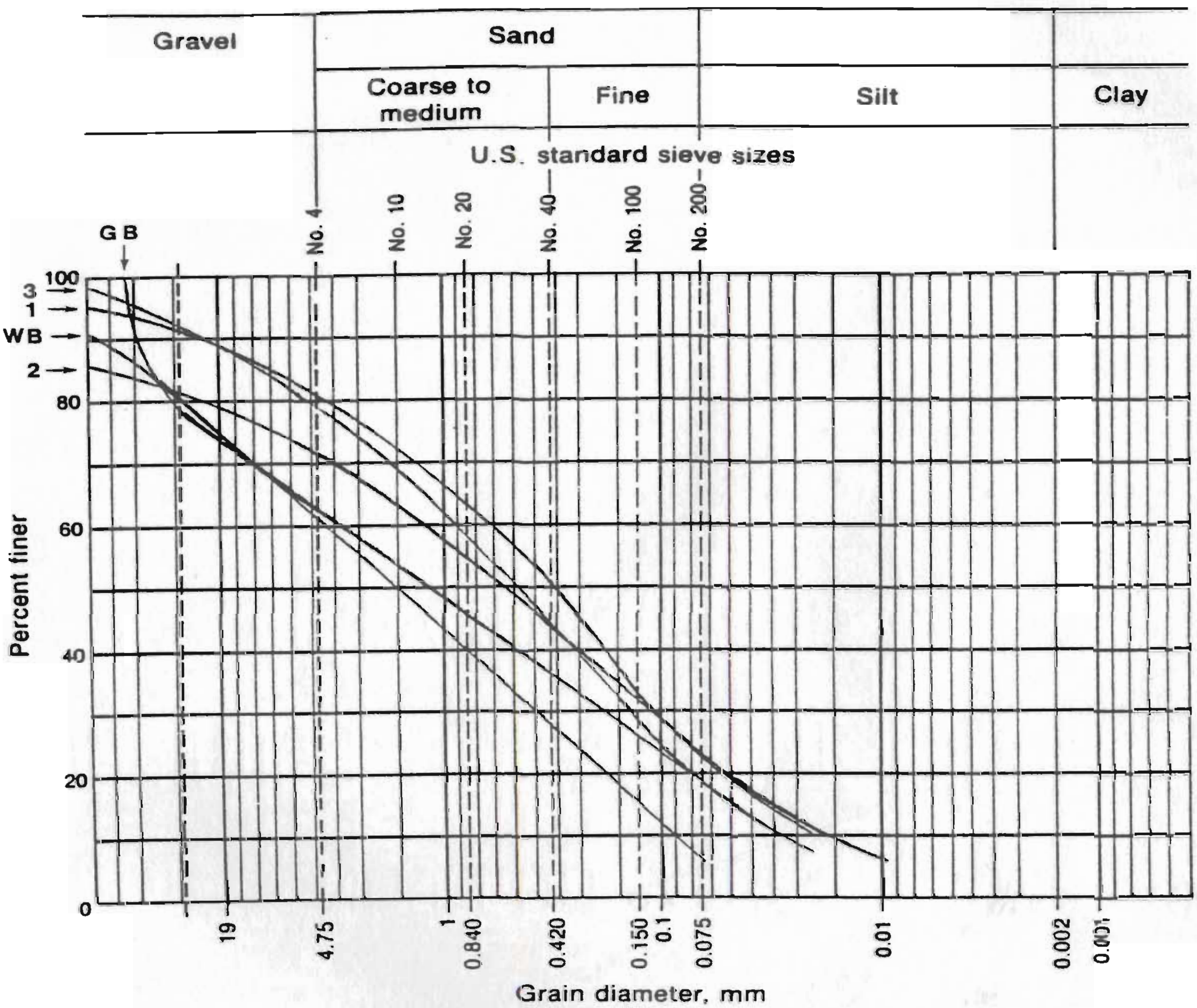
1.10.1 Test Pits

On September 21, 1993, two test pits were dug by an excavator (see photos, **Appendix A**) to determine if soil layering existed, to further describe the soils at depth by performing mechanical grain size analysis on grab samples at selected depths, to determine depth to bedrock (if possible) for use in ground truthing of future hammer seismic work, and to determine soil water content and hydraulic conductivity of the soils. The location of each test pit is also shown in **Figure 1.3**. Test pit #1 was dug near MW #10 (photograph #1 in **Appendix A**). Both pit sites were chosen so that they were not near any waste cell and were easily accessible to the excavator. Test pit #1 encountered bedrock at its maximum depth of 4.60 m below ground level (bgl). Water was observed entering the pit at a depth of 2.65 m bgl. Soil samples were collected at depths of 0.9 m and 1.5 m respectively. A bulk sample from test pit #1 was also collected at a depth of 1.5 m. The sides of the pit consisted of grey and brown fine sand and gravel till throughout its depth. The same type of soil was found at test pit #2, (photograph #2 in **Appendix A**). A soil sample was taken from this pit at a depth of 4.0 m bgl. and a bulk sample was obtained at a depth of 2.55 m bgl. No bedrock or groundwater was encountered to the final depth of 5.5 m. The test pit was not left open long enough for the water table level to stabilize in it.

1.10.2 Sieve Analysis and Water Content Determination

Mechanical grain size analysis was carried out on the test pit samples. **Figure 1.5** shows the grain size distribution curves for the 5 soil samples. Three grab bag samples and two bulk(bucket) samples were obtained as listed in **Figure 1.5**. Each curve is similar in shape and position on the semi-logarithmic graph paper. The material can be described as a light brown gravely sand with silt.

The water content of the three non bulk soil samples was carried out and found to range from 6.7% to 10.5%.



Sample ID	Depth(m)	Pit #	Description
1	1.5	1	Glacial Till
2	0.9	1	Glacial Till
3	4.0	2	Glacial Till
WB	1.5	1	Glacial Till
GB	2.2	2	Glacial Till

Figure 1.5 Grain size distribution (samples collected on 21/9/93 in test pits)

PART I METHODS AND HYDROGEOLOGICAL FRAMEWORK

CHAPTER 2

GROUNDWATER AND SURFACE WATER QUALITY MONITORING

2.1 Introduction

The Terra Nova Landfill site has been monitored for water quality since September 1977, one year after the landfill start up date. Since then, groundwater and surface water sampling has been done regularly from monitoring wells and surface water locations over and down stream of the landfill. Sampling frequency is further explained in section 2.4.2. In total, 14 monitoring wells have been installed. These are permanent sampling installations. Equipment and materials used in the construction of these wells varied as new construction techniques and drilling technologies were developed. The monitoring wells upon which the bulk of the work reported in this study is based, are similar to each other in construction and the data collected is believed to be consistent for analysis. As stated in Chapter 1, section 1.8 (bedrock geology), no monitoring wells have been installed in the bedrock. In addition to the monitoring wells, two surface water monitoring sites were established downstream of the site.

2.2 Installation of Monitoring Wells

Ten monitoring wells (MW) were installed in May and July, 1977. These wells were constructed using an air rotary drilling rig. The locations of these wells, numbered

1 to 10, are shown in **Figure 1.3**. At each site, a 153 mm (6") diameter cased hole was drilled to probable bedrock. The sampling wells were made up of 50 mm (2") diameter galvanized steel pipe equipped with a 50 mm brass, perforated well point, about 1 m in length. A cement plug was installed above each well screen. Natural materials were allowed to cave in around the screen as the casing was raised and removed. The annular space remaining was backfilled with drill cuttings. At the time these wells were constructed, small diameter PVC monitoring well casing and screens were not readily available. It is recognized that the galvanized steel pipe with brass well point of these earlier monitoring wells has the potential to bias metal results from water quality samples. However, given that plume position and travel times were calculated from non metal chemical parameters, any associated biasing is minimal. The construction details of a typical sampling well installation are shown in **Figure 2.1(a)**.

Due to the excavation of a new cell area south of MW #1, a new well, MW #15 was constructed in October, 1981 to take over MW #1, as a control well (see **Figure 1.3** for location). MW #15 was installed using a solid stem auger drill. This well was also advanced to bedrock. The well pipe and screen used for this well were of the same materials as used in the earlier wells. The pipe and screen was assembled and lowered into the hole with silica sand being placed around and just above the screen. Over the sand a bentonite seal was installed by pouring bentonite chips down the hole and adding water if needed. The remainder of the well annulus was backfilled with drill cuttings.

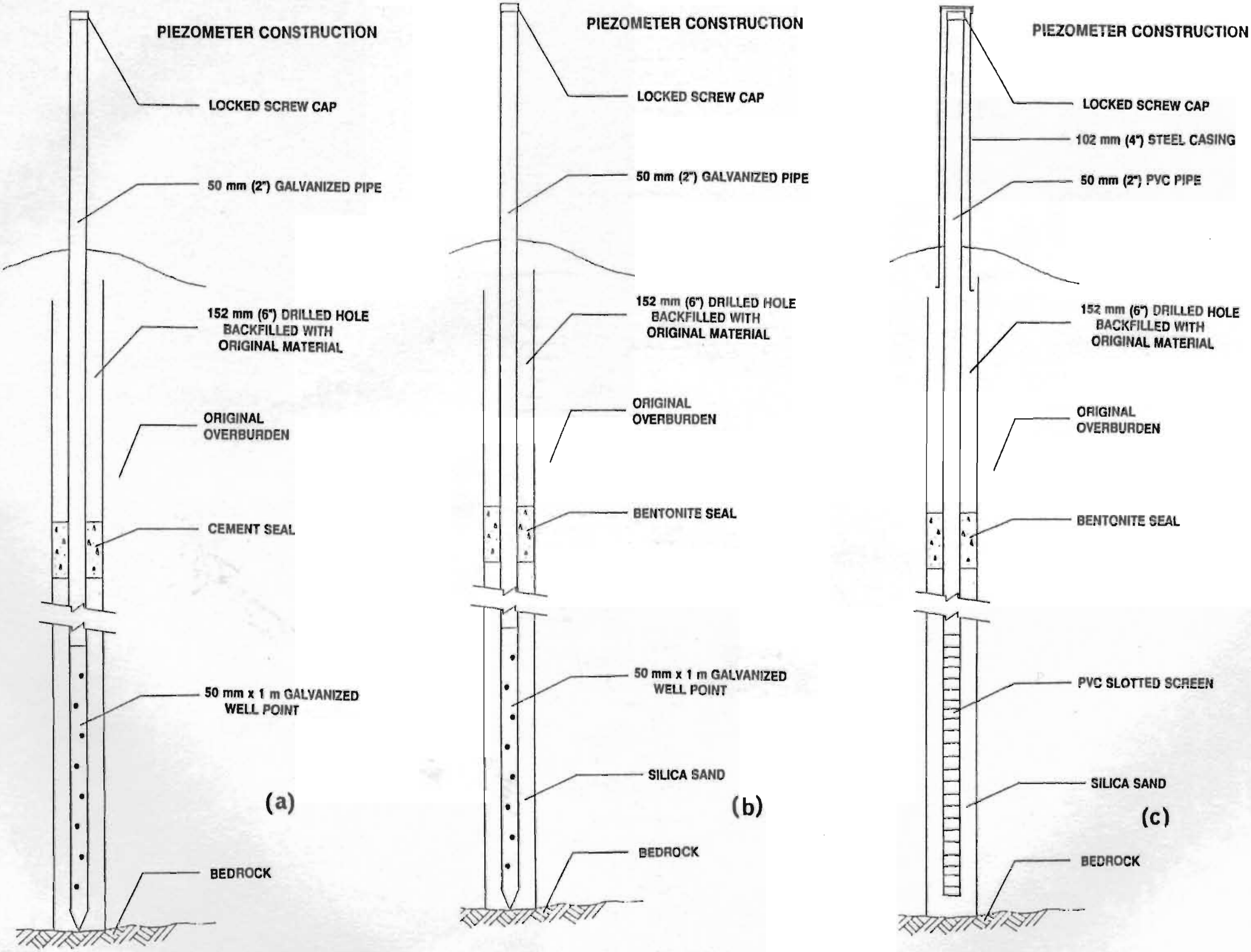


Figure 2.1 Monitoring well details showing: (a) MW #1-10, (b) MW #15, and (c), induced tracer test monitoring wells.

Figure 2.1(b) shows MW #15 construction. In 1989, waste cells were dug up stream of MW #15. However, by this time, the background chemical concentrations were well established (over a 13 year period).

Monitoring well depths below ground level and their elevation (relative to a temporary bench mark at ground level elevation at site 6) are shown in **Table 2.1**.

Table 2.1 Construction Details For Sampling Wells

Well #	Elevations of Top of Well (m)	Bottom of Well (m)	Ground Level (m)	Depth Below Ground (m)
1	37.94	32.46	36.88	5.49
2	37.60	30.27	36.94	7.35
3	36.99	31.64	36.00	5.36
4	36.05	29.11	35.27	6.95
5	35.98	29.05	35.02	6.92
6	31.48	24.75	30.45	6.74
7	31.51	26.40	30.48	5.12
8	27.93	22.25	26.94	5.67
9	28.79	22.28	27.92	6.49
10	26.40	19.32	25.36	7.07
[1] 15	45.47	40.56	44.56	4.00

[1] The reason why numbers 11 to 14 appear to have been skipped in the well numbering scheme are due to the fact that at the time of the original well installations, 4 surface water monitoring sites were established, as discussed in the next section.

Three more wells were constructed in the summer of 1989 for an induced gradient tracer test. The wells, numbered 16 to 18, were installed using PVC casing and screen and dug by a hollow stem auger. The construction procedure of these wells is found in Ivany (1989). **Figure 2.1(c)** shows their construction.

2.3 Surface Water Monitoring Locations

Four surface water monitoring locations (numbered 11 to 14) were established at the beginning of the study. They were located at a small stream immediately down grade of the monitoring well areas (site 11); on the upper side of the Trans Canada Highway where this stream flows under the highway (site 12); at Muddy Brook which flow into Alexander Bay (site 13); and at a point just above Pissamere Pond, where the same stream sampled at sites 11 flows into the pond. These locations were down stream of the landfill as shown in **Figure 1.1**. Two of the sites, #11 and #13 were sampled at the beginning of the study for a short period of time only, and were abandoned as it became apparent that they were not needed. Site 11 was considered too close to the landfill after a few samples were taken and analyzed, and Site 13 was located at a pond that did not receive any effluent from the landfill. Samples were obtained from sites 12 and 14 for the remainder of the study.

2.4 Water Quality Monitoring

2.4.1 Sampling Methods

Surface water sampling was done by lowering the sample bottle into the stream and sampling the stream from bottom to top by gradually lowering the bottle to the bottom as it filled. The sample was taken upstream from the sampler's position so as not to disturb sediment in the stream. Samples were taken in nalgene water sampling bottles cleaned by the respective lab the samples would be shipped. Each sample was placed in a cooler either to keep from freezing in the winter or with ice packs for preservation in the summer until delivered to the lab. No filtering was done with any samples. Groundwater sampling was done by several different methods because of advances in materials and equipment during the 1980's. In 1979, a copper bailer attached to a nylon cord was used. A peristaltic pump and plastic tubing was used to procure one set of monitoring well samples in August, 1982, but this technique proved to be too slow and was not repeated. This technique was tried as it was felt there maybe some biasing of sampling results due to the copper bailer.

Bailers of different types of plastic were tried in the early 1980's as they were introduced to the industry. Despite the potential risk to sample result integrity of changing materials, a PVC bailer and nylon cord was chosen for bailing the wells in January, 1986. The change doesn't appear to have affected the data collected from the control wells (Robinson, 1991). In November, 1988, dedicated, PVC, inertial pumps

(Waterra pumps) were installed in each well. This method of bailing is still in use during yearly sampling at the landfill. It is an easy system to use and reduces the likelihood of cross contamination. The chronology of the use of the various sampling equipment is summarized in **Table 2.2**.

Table 2.2 - Chronology of Sampling Equipment Used

Date	Equipment Used
1977-1986	Copper Bailer with Nylon Cord
August 1982	Peristaltic Pump and Plastic Tubing
1986-1988	PVC Bailer with Nylon Cord
1988-Present	Dedicated, PVC, Inertial Pumps

Up until 1991, well purging consisted of bailing a monitoring well until it went dry or two volumes of the water in it were withdrawn. If the well was purged dry, a water sample was taken several hours later after allowing the well to recover. After 1991, industry standards required that three volumes be withdrawn before sampling. Until 1985, samples to be analyzed for metals were preserved with nitric acid. This procedure was not followed after 1985 considering the short sample delivery time. Metals results from the background wells showed no significant difference in background levels before and after 1985. Samples have always been kept cool (4°C) and delivered to the lab within 3 or 4 days.

2.4.2 Analytical Parameters Determined

Surface and groundwater samples have been collected at prescribed time intervals since September 1977. The Water Analysis Facility, Memorial University analyzed the samples obtained from Sept., 1977 to July, 1987. Ocean Chem Labs renamed Fenwick Labs of Halifax analyzed samples from July, 1987 to June, 1990. Finally, Water Analysis Laboratories of Mt. Pearl analyzed the samples from June, 1990 to the present. An initial monthly sampling took place from September 1977 until June 1979 in monitoring wells 1 to 10 to establish the baseline chemistry and allow the groundwater time to recover from the installation procedures. **Table 2.3** lists the 10 parameters obtained during this period. Quarterly samples were taken starting in June 1979, for an expanded number of parameters. These parameters are also shown in **Table 2.3**. In November 1981, this sampling included the new control well, MW #15.

Starting in September 1982, less water sampling with a smaller number of parameters tested for each sample was begun in order to reduce costs. Only monitoring wells that were affected by leachate at that time were sampled. More parameters were determined for the wells that were most affected by contamination. Once a year, all well samples were analyzed as if they were in the first category with some additional parameters. These changes in sampling frequency and parameters sampled are listed in **Table 2.4**.

Table 2.3 - Water Quality Parameters Obtained

Monthly Samples September 1977 to June 1979	
Alkalinity (as $CaCO_3$)	Iron
Kjeldahl nitrogen	Nickel
pH	Potassium
Total phosphorus	Lead
Manganese	Zinc
Quarterly Samples June 1979 to August 1982	
Alkalinity (as $CaCO_3$)	Total Dissolved Solids (TDS)
Hardness (Ca+Mg)	Chemical Oxygen Demand (COD)
Kjeldahl nitrogen	Biological Oxygen Demand (BOD)
Nitrate	Specific Conductance
pH	Chloride
Calcium	Sulphate
Manganese	Ammonia
Iron	Magnesium
Copper	Lead
Lead	Zinc

Table 2.4 - Water Quality Parameters Obtained after August 1982

Contaminated Wells, Control Well and Surface Water	
Alkalinity	TDS
Hardness	COD
Kjeldahl nitrogen	BOD
Nitrate	Spec. Conductance
pH	Copper
Total Phosphorus	Chloride
Calcium	Magnesium
Manganese	Lead
Iron	Potassium
Sodium	Zinc
Suspect Wells	
Hardness	Magnesium
Spec. Conductance	Chloride
Calcium	TDS
Non Suspect Wells	
Chloride	Spec. Conductance
Once a Year Sampling	
All Above +	Ortho Phosphate
Cadmium	Nitrite
Arsenic	Arsenic
Chromium	Fluoride
Sulphide	

The analytical results of the sampling program for each of the monitoring wells and surface water sampling sites from 1977 to 1994 are shown in **Appendix D**.

2.4.3 Background Concentrations of Selected Ions

Background concentrations of selected ions were determined from early sampling of MW #1, which was up gradient of the waste cells, and at Surface Water Site 14. Results are shown in **Table 2.5**. The maximum acceptable concentrations for drinking water as defined by the Canadian Water Quality Guidelines (1993) (CWQG) are also listed in this table for comparison.

It will be noted from this table that the natural groundwater can be classified as a soft good quality water. The trace metal ions iron, cadmium, lead, manganese, and zinc, however, are present in higher concentrations than the recommended maximum CWQG standards.

Table 2.5 Background Water Quality

Parameter mg/l	MW #1 # of samples	MW #1 average	MW #1 S.D.	Surface water site #14 # of samples	Surface water site #14 average	Surface water site #14 S.D.	CWQG Maximum
Alkalinity	25	62.83	25.75	43	16.11	26.71	ND
Ammonia	3	0.009	0.010	3	0.02	0.03	ND
Arsenic	3	0.001	NA	18	0.015	0.022	0.05
BOD	3	3.0	1.7	2	2.5	0.7	ND
Cadmium	8	0.009	NA	23	0.005	0.005	0.005
Calcium	14	8.34	10.60	37	9.20	9.71	ND
Chloride	11	10.73	4.43	18	47.93	52.08	250
Chromium	8	0.01	0.01	11	0.02	0.08	0.05
Cobalt	1	0.01	NA	2	0.008	2.58	ND
Conductivity (μS/cm)	7	106.76	29.55	33	253.98	335.40	ND
Copper	16	0.05	0.06	29	0.67	0.31	1.0
COD	8	14.79	9.81	21	34.48	19.62	ND
Fluoride	1	0.04	NA	4	0.14	0.04	1.5
Hardness	8	20.46	13.42	20	35.49	29.47	ND
Iron	26	0.65	0.80	39	0.49	1.02	0.3
K. Nitrogen	26	0.27	0.22	14	0.44	0.52	ND
Lead	24	0.04	0.02	36	0.02	0.02	0.05
Lithium	1	0.005	NA	1	0.005	NA	ND
Magnesium	12	1.60	2.25	36	2.59	3.75	ND
Manganese	26	0.45	0.40	39	0.03	0.04	0.05
Nickel	19	0.1	0.1	31	0.02	0.04	ND
Nitrate	8	0.01	0.01	8	0.02	0.02	10.0
Nitrite	4	0.03	0.04	3	0.02	0.03	1.0
pH	22	7.11	0.31	34	6.65	0.49	6.5 - 8.5
Potassium	23	1.33	1.20	34	2.51	3.82	ND
Sodium	12	5.60	2.15	35	25.27	24.18	ND
Sulphate	13	4.38	2.41	16	0.09	0.09	500
T. Phosphorus	20	0.08	0.04	16	0.09	0.09	ND
TDS	9	109.56	44.38	30	8.28	6.19	500
Zinc	26	25.20	12.46	36	0.15	0.51	5.0

ND - not defined; NA - not available; CWQG - Canadian Water Quality Guidelines

CHAPTER 3

PHYSICAL HYDROGEOLOGY AND HYDRAULIC PROPERTIES

3.1 Measurement of Water Table Fluctuations

Climatological data have been presented in **Table 1.1** (Chap. 1) and are reported in **Table 3.1**, together with evapotranspiration data. The potential maximum evapotranspiration, and the monthly potential available amount of recharge shown in the table were calculated using the Thornthwaite Potential Evapotranspiration Model. A description and sample equations used in this model can be found in Thornthwaite et al., (1957). The model results are shown in **Appendix B**. One can see that the water budget for June, July, and August is negative meaning potential evapotranspiration is greater then precipitation. Also, little water infiltrates to recharge groundwater when the ground is frozen (months of Dec., Jan., Feb., March).

Figure 3.1 is a plot of the mean monthly water table levels taken over 9 years of data for well # 1, and the mean monthly precipitation. As can be seen, water table highs correspond to spring runoff in April and May, and to precipitation events in October and November. During these periods, the waste cells are partly below the saturated zones and leachate can be transported (migrate) from them, thus contaminating the groundwater. At the same time, since the flow rate of groundwater is higher, the rate of pollutant release will increase.

Table 3.1 Potential Available Amount of Recharge Water
(Thornthwaite's Model, 1957)

Month	Mean Precipitation (P) (mm)*	Estimated Potential Evapotranspiration (ET) (mm)	Runoff R** (P(RC)) (mm)	Potential Recharge (mm)
January	102.7	0.0	0	102.7
February	105.4	0.0	0	105.4
March	103.8	0.0	0	103.8
April	90.0	15.0	11.7	63.3
May	93.0	55.0	12.1	25.9
June	84.5	91.0	11.0	-17.5
July	81.1	119.0	10.5	-48.4
August	97.9	107.0	12.7	-21.8
September	98.1	71.0	12.7	14.4
October	108.8	37.0	14.1	57.7
November	111.5	9.0	14.5	88.0
December	107.7	0.0	0	107.7

* see (**Table 1.2**)

** The runoff coefficient (RC) was assigned a value of 0.13 by obtaining a table of runoff coefficients which assigns coefficient values based on slope (6%), vegetative cover, and soil conditions for the landfill. In most cases surface water runoff coefficients for landfill conditions lie within the range of 0.07 - 0.2 (Qasim and Chiang, 1994).

The infiltration (I) is calculated from the equation:

$$P = ET + I + R$$

where P and ET are defined as above, and R, the runoff, is calculated by multiplying the mean monthly precipitation (P) by a runoff coefficient (RC).

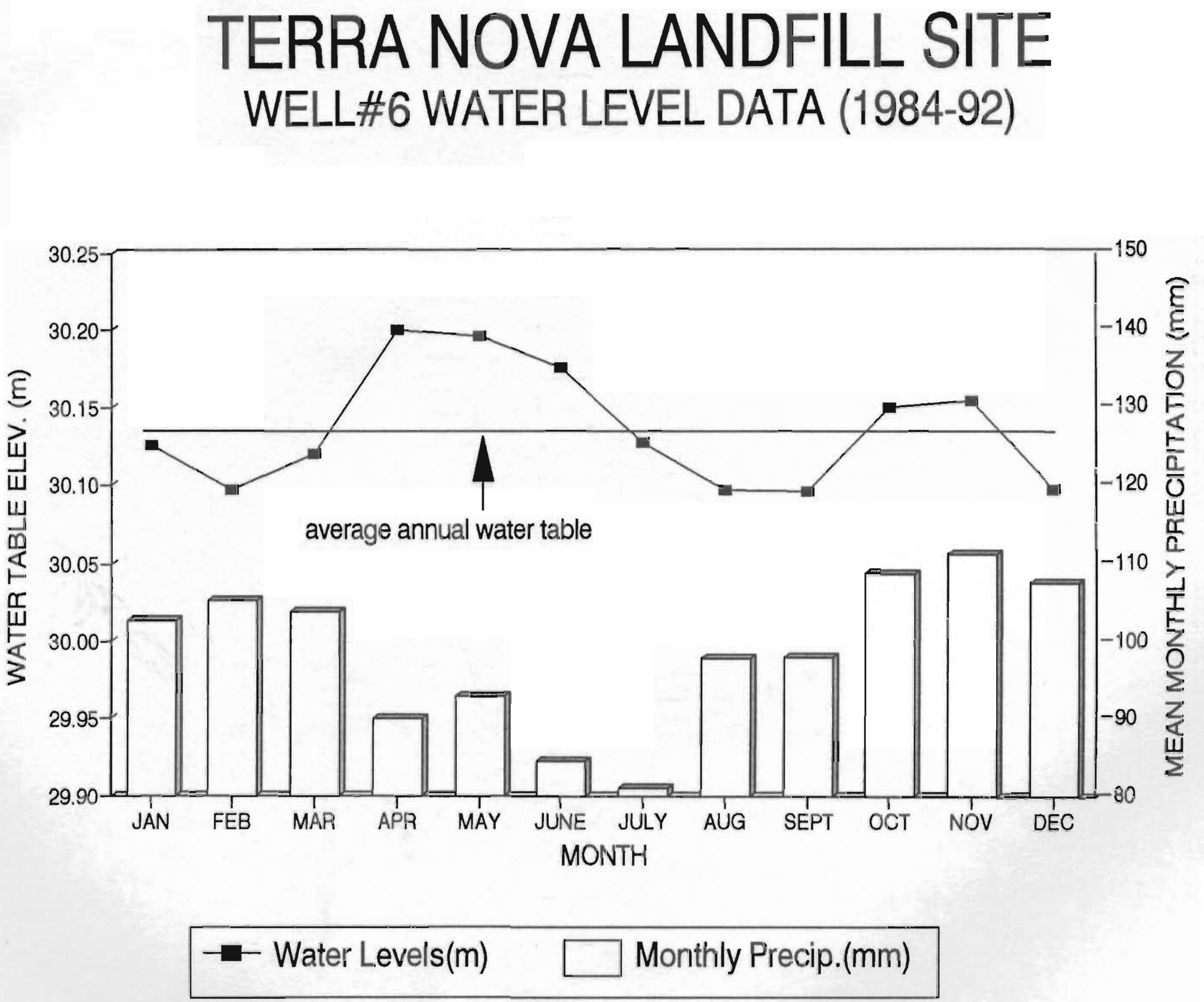


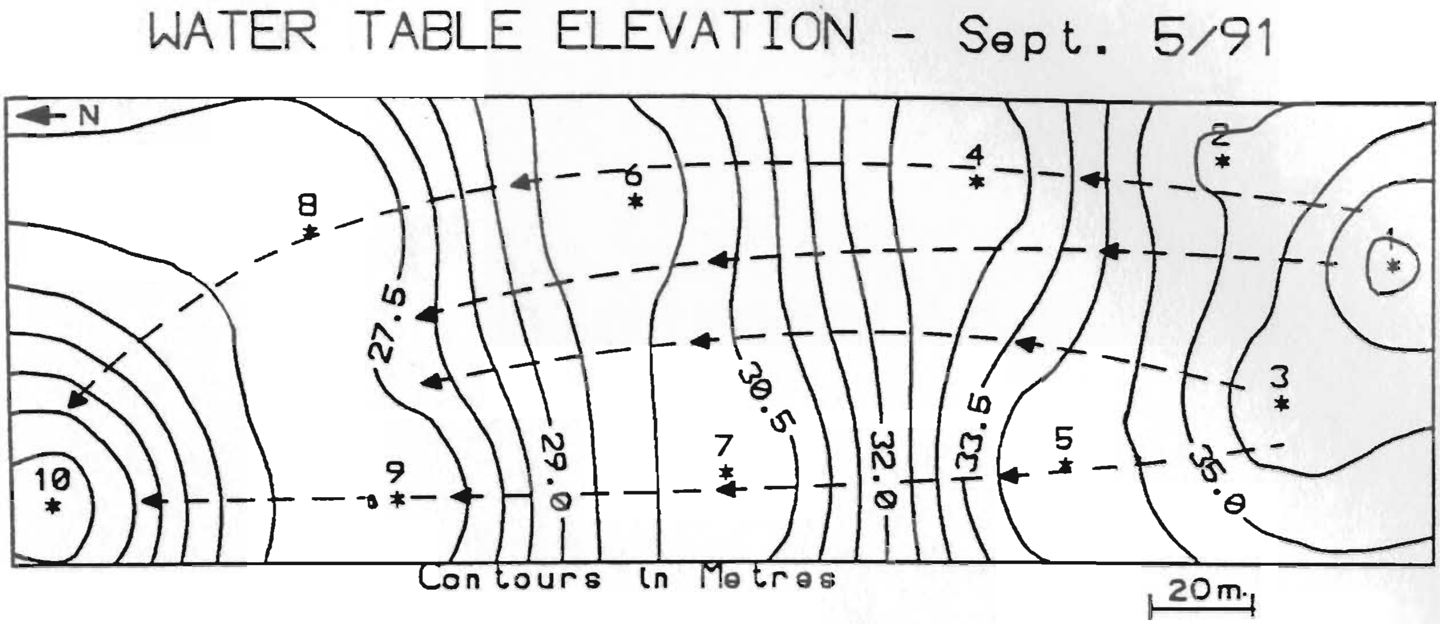
Figure 3.1 Mean monthly water table levels and precipitation taken over 9 years of data. Elevations relative to MW #6 ground level.

Little recharge takes place from December to March due to frozen ground conditions. The precipitation falling is mostly snow that accumulates and contributes to spring runoff. The water table level in February is about at the same level as the lowest water table levels in September meaning that there are two low water table periods during the year.

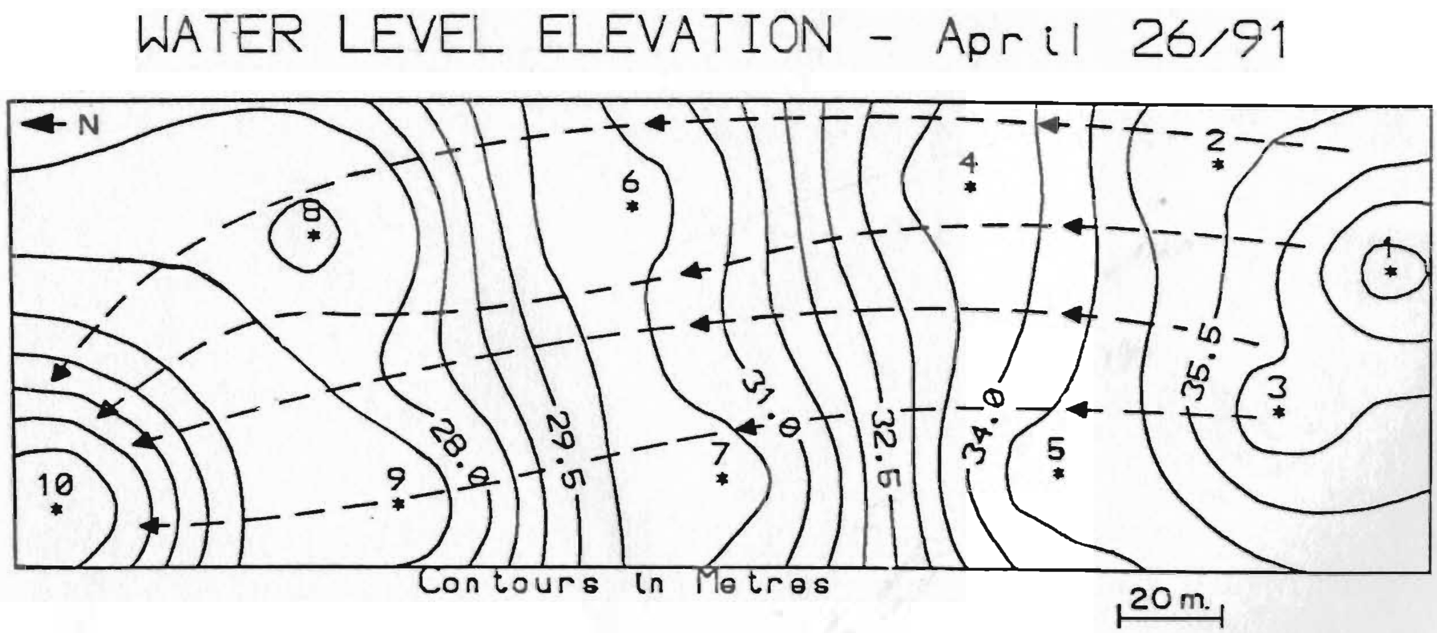
A compilation of water level measurements taken weekly from all the monitoring wells from 1977 to 1993 can be obtained from the provincial Department of Environment.

3.2 Measurement of Groundwater Flow

As mentioned earlier, weekly water levels were taken at each monitoring well since the landfill began operation. A visual representation of the slope of the water table can be shown by plotting one set of water table elevations taken on the same day for all the monitoring wells. Knowing the position of the monitoring wells, this data was plotted using the contour software "Surfer". Assuming isotropic conditions, groundwater flow lines were then drawn perpendicular to these contour lines. **Figure 3.2** is a plot showing these flow lines for two times of the year: September, when the water levels are low, and April, when they are high. They both indicate the direction of flow is not substantially affected by seasonal groundwater fluctuations (which range about 0.4 m). Since the monitoring wells were screened over an appreciable length, with no special attention paid to impervious seals (for wells 1 to 10 at least), the vertical hydraulic gradient was not measured. **Figure 3.3** gives the location of two geologic cross-sections shown in **Figure 3.4**. These cross-sections provide information on depths to bedrock, topography, and demonstrates the seasonal water table fluctuations of each monitoring well. In an isotropic (same hydraulic conductivity value in all directions), unconfined aquifer, groundwater movement is parallel to the hydraulic gradient which is perpendicular to the water table contours. This is a reasonable assumption for glacial till overburden which is present at this site.



A. Low Water Table Contour - September 5, 1991



B. High Water Table Contour - April 26, 1991

Figure 3.2 Water Table Elevation Comparisons

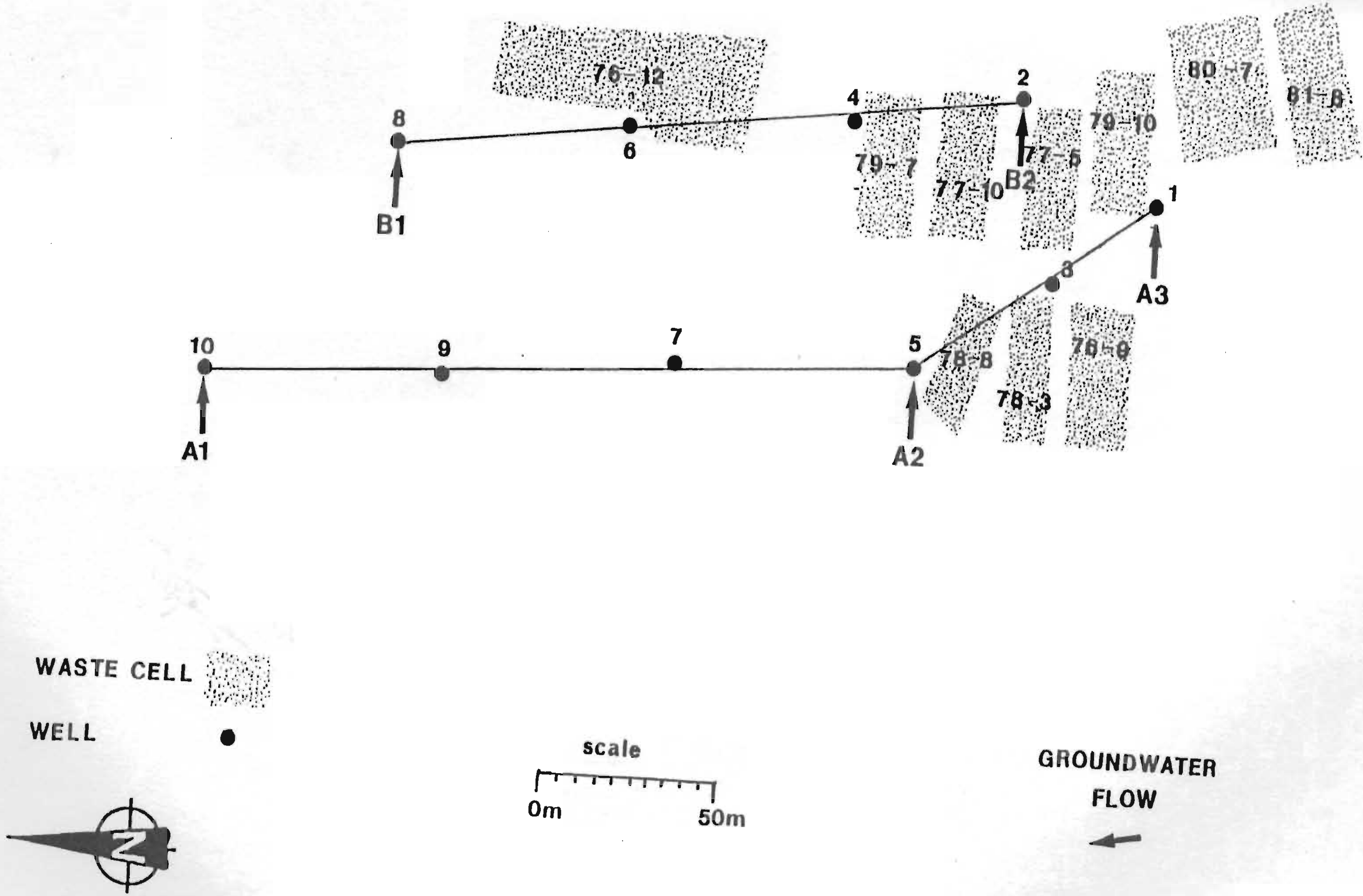


Figure 3.3 Location of two geologic cross-sections.

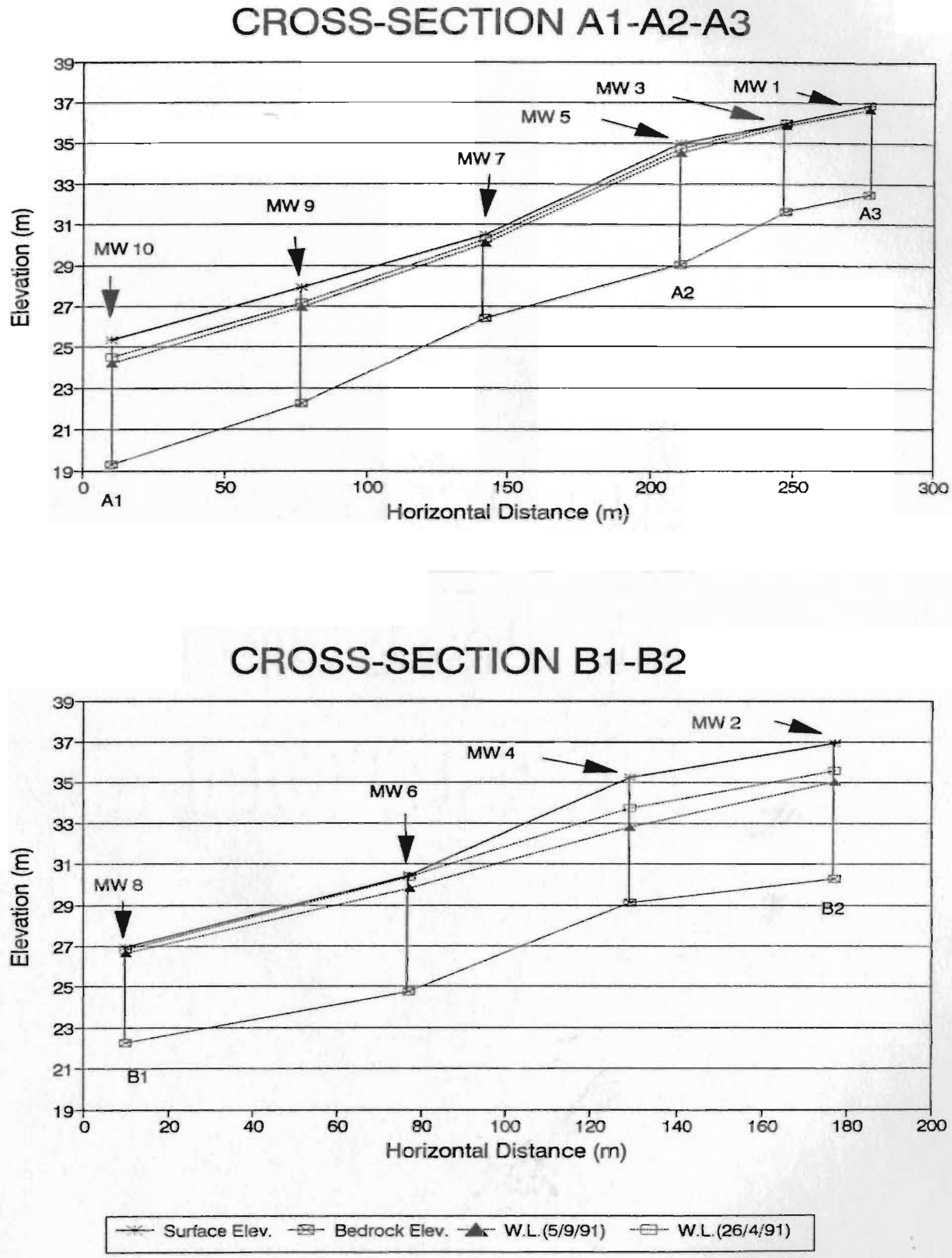


Figure 3.4 Geologic cross-sections A1-A2-A3, and B1-B2. Elevations are relative to MW# 6 ground level.

3.3 Hydraulic Conductivity Measurements - Constant and Falling Head Methods

The constant and falling head laboratory methods were used to estimate the saturated hydraulic conductivity(k) of two bulk remolded samples taken from two test pits at the Terra Nova landfill. Two samples were considered sufficient to characterize the overburden at the landfill since both test pits exposed the same type of soil which did not change lithology with depth. The k value is meaningful only for the glacial till soil at the point and depth of sampling. In conducting the permeameter tests, a sample of the soil is taken from the bulk sample and repacked in a cylindrical container or cell of known dimensions. The cell soil is saturated with water and by two methods, the constant and falling head methods, the hydraulic conductivity k, is calculated.

The constant head test applies a constant differential head across the cross sectional area of the cylindrical cell. The soil is enclosed between two porous plates and the flow rate of water through the sample is measured. In the falling head test, the same sample is used, but a burette of known cross sectional area filled with water is allowed to slowly empty by gravity through the cell. Measurements of the change in height in the burette with time are used for conductivity calculations. **Figure 3.5** shows the set up of each testing method.

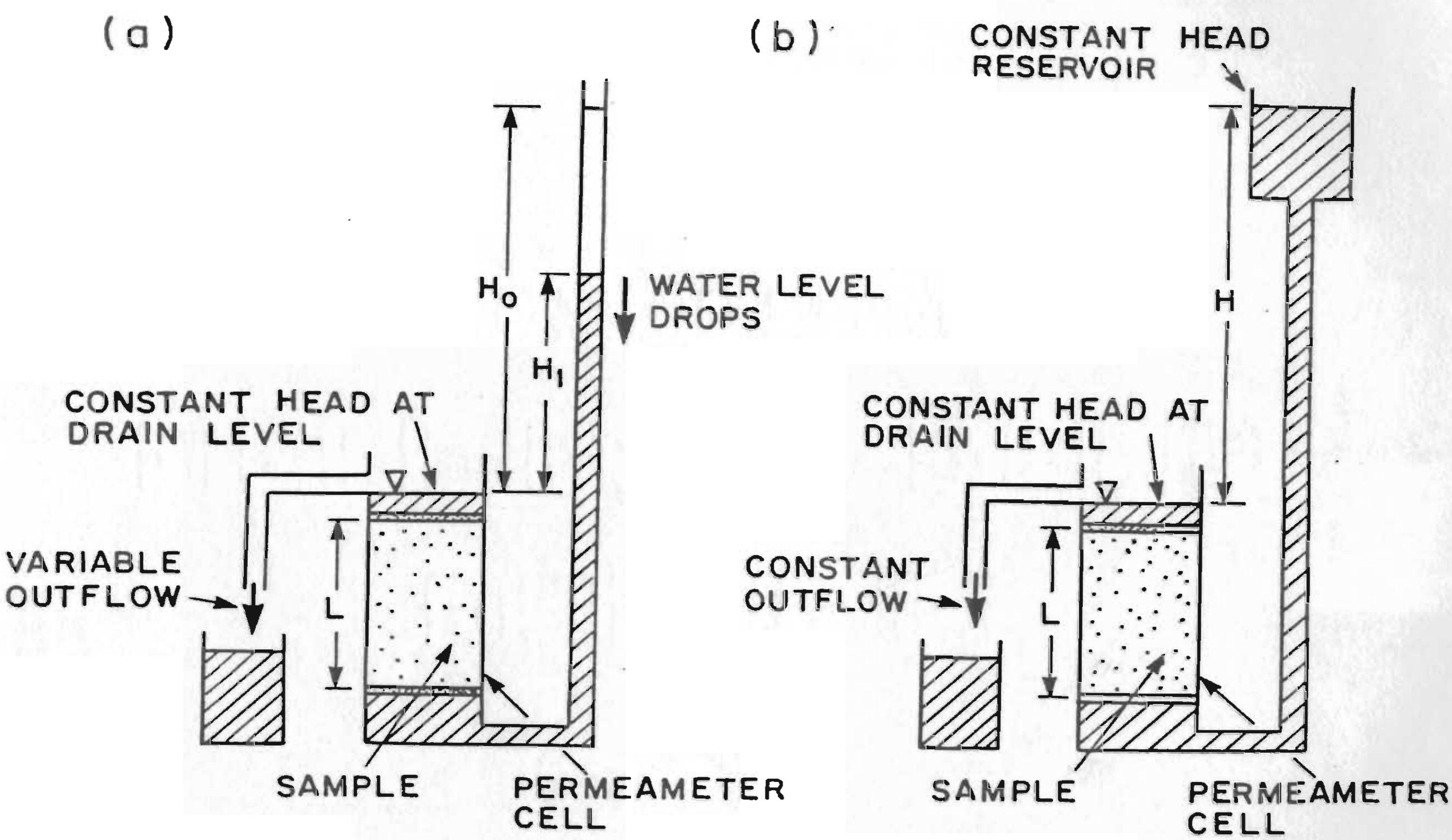


Figure 3.5 Hydraulic Conductivity Measurements showing (a) Falling Head Permeameter Test; and (b) Constant Head Permeameter Test (after Freeze and Cherry, 1979).

The equation used to calculate the hydraulic conductivity using the constant head setup is:

$$k=\frac{QL}{AH}$$

where:

k = hydraulic conductivity (m/s)

Q = water flow rate through the cell (m^3/s)

L = soil sample length (m)

A = cross sectional area of the sample (m^2), and

H = constant hydraulic head difference (m)

The equation for calculating the falling head permeability is:

$$k=\frac{aL}{At}\ln\left(\frac{h_0}{h_1}\right)$$

where:

k = hydraulic conductivity (m/s)

a = cross sectional area of the burette (m^2)

L = soil sample length (m)

A = cross sectional area of the soil sample (m^2)

t = duration of the test (s)

h_0 = initial hydraulic head (m)

h_1 = final hydraulic head (m)

The spread sheets showing the calculations and falling head graphs can be found in **Appendix B**. A summary of the results is shown in **Table 3.2**.

Table 3.2 Test Pits Falling and Constant Head Permeability Results

Sample #	**Test Pit #1**	**Test Pit #2**	**Averages**
Depth (m)	1.5	2.2	-
Dry Density (kg/m^3)	2160	1940	-
Constant Head Permeability (m/s)	1.96×10^{-7}	5.37×10^{-7}	3.67×10^{-7}
Falling Head Permeability (m/s)	1.39×10^{-7}	2.61×10^{-7}	2.00×10^{-7}
Permeability Average (per test pit) m/s	1.68×10^{-7}	3.99×10^{-7}	**2.84** $\times 10^{-7}$

However, laboratory permeability tests give only an indication of the permeabilities of the matrix of the soil in a reconstructed state. They cannot take into account the formation, heterogeneities, anisotropy - and other spatial variations of the overburden. They are also affected by the degree of saturation of the specimen and some experimental uncertainties (flow along the permeameter walls) (Bowles, 1986).

A better evaluation of the hydraulic properties of the overburden can be obtained using in situ tests (e.g., slug tests or induced tracer tests). Consequently, falling and constant head permeability values were not used in further calculations.

3.4 Summary

The value of the hydraulic conductivity determined by previous tests and the falling and constant head laboratory methods are summarized in **Figure 3.6**. There is an order of magnitude between the highest hydraulic conductivity, the tracer test, and the lowest, the laboratory tests. However, hydraulic conductivities frequently vary by over two magnitudes in the same lithological unit (Fetter, 1988). Also, a closer value to the actual hydraulic conductivity is usually made from in situ measurements, rather than disturbing the soil by removal to a laboratory for study.

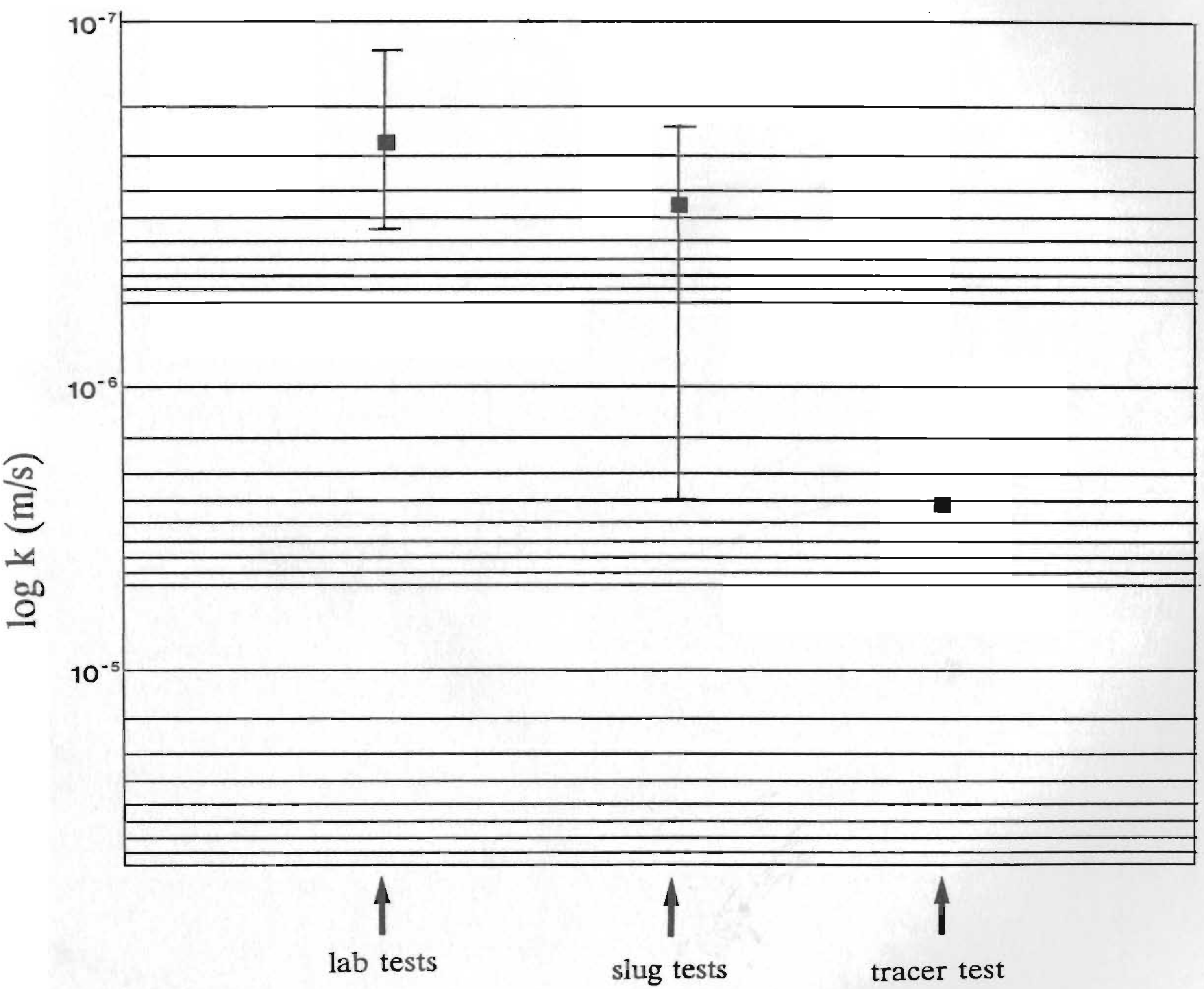


Figure 3.6 Hydraulic conductivity tests results showing average and range of values.

CHAPTER 4

GEOPHYSICS: METHODS AND INSTRUMENTATION

4.1 Objective of Geophysical Investigation

It is realized that investigations of contaminant existence, movement, and concentrations at landfills greatly benefit from geophysical techniques providing subsurface information inferred from surface surveys (Benson et al, 1983). Subsurface conditions in areas between monitoring wells can be inferred from information gathered at each survey point, and geophysics gives a broad view of the subsurface that complements specific point information from monitoring wells. Successive geophysical surveys provide information on measured pattern changes with time (Greenhouse and Monier-Williams, 1985).

Four geophysical techniques were used at the Terra Nova Waste Disposal Site: terrain conductivity measurements, VLF-EM (very low frequency-electromagnetic), resistivity measurements, and refraction hammer seismic. The objectives of the geophysical surveys were:

1. to map any leachate plume(s) in areas down stream of the landfill if the plume is of different conductivity then the surroundings.
2. to outline the waste cells from detection of buried metal targets and identification of areas of high electrical conductivity.

3. to obtain information on changes in conductivity of soil with depth.

4. to obtain information on depth to bedrock derived from VLF - resistivity and refraction seismic measurements.

5. evaluate depth to bedrock using refraction surveys and correlate to bedrock depths obtained during well installation.

6. provide information on any bedrock channelling of leachate.

4.2 Detecting Leachate Plumes by Conductivity Measurements

Terrain conductivity and VLF surveys respond to changes in the electrical conductivity of the subsurface soil, rock, and groundwater (Benson et al., 1981). Conductivity, the inverse of resistivity, can vary over several magnitudes and can change with many environmental factors, both man made and naturally occurring. Generally, electrical current flows through the electrolyte contained in the moisture-filled pores and passages within the insulating matrix. Conductivity is determined by (McNeill, 1980):

(1) porosity: shape and size of pores, number, size and shape of interconnecting passages

(2) the extent to which the pores are filled with water (saturation)

(3) concentration of dissolved electrolytes in the pore fluid

(4) temperature and phase state of the porewater

(5) amount and composition of colloids

A leachate plume will have a higher conductivity reading than background but the meter will not fluctuate rapidly. It is this contrast that is detected and mapped to infer contaminant plumes emanating from landfills (Benson et al., 1981). Measurements of conductivity in the subsurface do not provide an absolute value of the conductivity of a particular lithology or cultural feature as there are heterogeneities in most subsurface environments. The value observed is called the apparent conductivity and is a composite value that represents the combined effects of the thickness of soil or rock layers, their depths, and the specific conductivities of the materials. In most cases however, conductivity contrasts rather than absolute values are what is looked for. The reader is directed to a paper by Greenhouse and Slaine (1983) as to the effects different types of geological settings and cultural features have on electromagnetic surveys of leachate migration.

4.3 Previous Geophysical Surveys

During the selection of a regional waste disposal site (Geotechnical Associates, 1975), a number of locations in the general area were chosen for preliminary investigation. At each location, refraction seismic was used to obtain depth to bedrock information. Unfortunately, the specific location of the refraction seismic work then cannot be easily determined and therefore the results obtained can only be used as a rough estimate of the depths to bedrock in the area (Geotechnical Associate Ltd., 1975). The results however, suggest that overburden thickness is in the range of 1.8 - 4.6 m.

4.4 Survey Grid System and Cell Locations for the Present Study

The geophysical surveys for the present study were conducted on a grid laid out on the site by the author on May 20, 1993. The grid was designed to encompass much of the contaminant plume emanating from the cells and travelling in the direction of groundwater flow as determined from water level measurements in the 11 monitoring wells. Due to waste cells being used at the time of the grid survey, the piling of cover material, and the burning of existing waste at the site during the survey grid creation, the grid extended south to bisect waste cell 80-7, but did not reach MW #15 (see **Figure 4.1**). The maximum grid width was important since it had to include an area of background or unaltered groundwater chemistry on either side of the suspected plume so that geophysical detection and mapping could be accomplished.

The rectangular grid was surveyed on June 15-16, 1993 (**Figure 4.1**) having station and line spacings each of 50 ft (15.24 m). After bush clearing in the vicinity of each station, the location was marked by a survey stake identified with the station number. A total of 227 stations were installed. The grid had irregular sides due to terrain and cultural features in the area. The final grid was 350.5 m (1150 ft) by 167.6 m (550 ft) with the longer axis roughly parallel to the plumes expected longitudinal axis. All existing monitoring wells with the exception of MW #15, are situated within the grid.

The ground surface elevation was determined by standard levelling procedures at

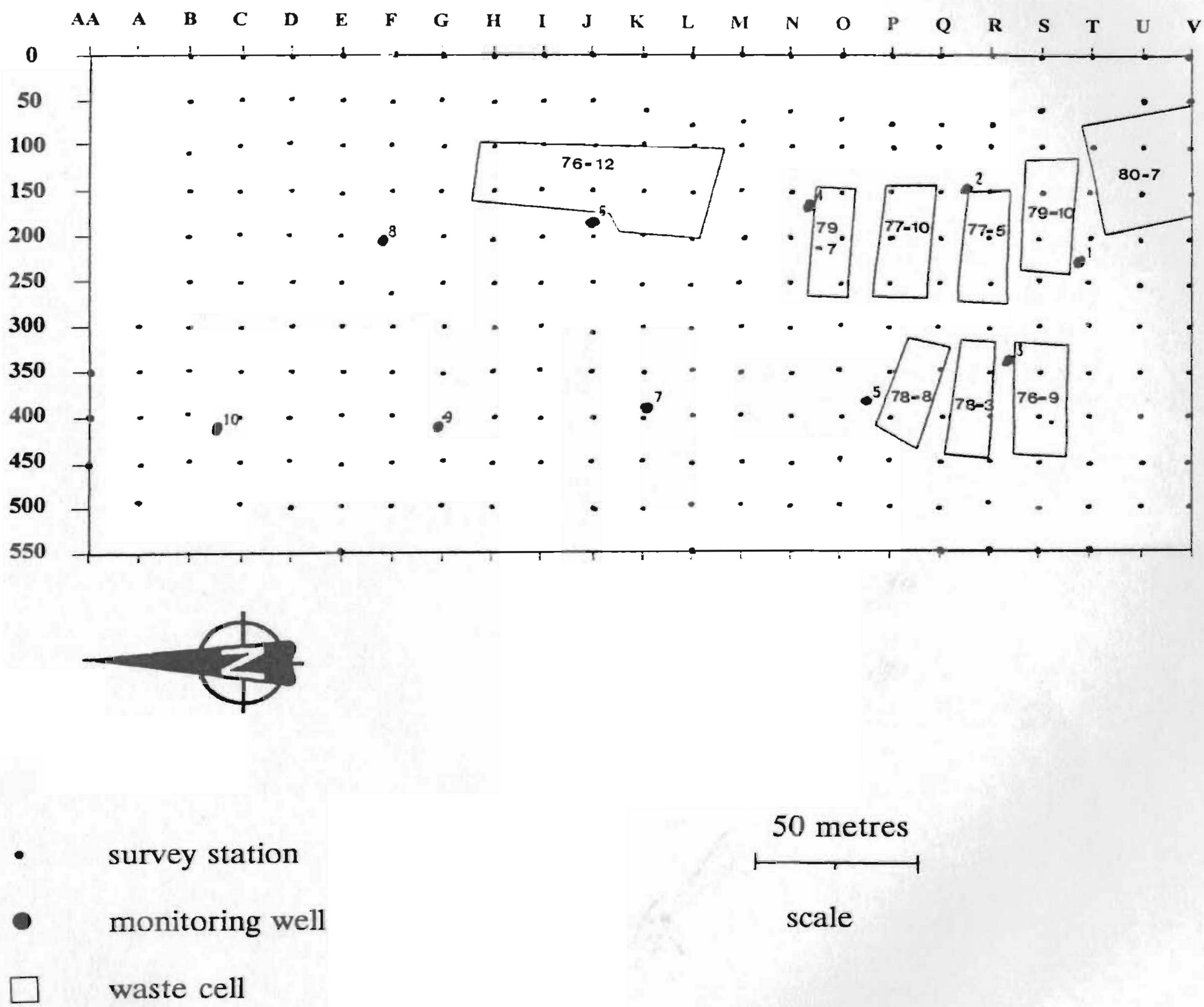


Figure 4.1 Survey grid system over waste site showing cell locations and inception dates.

each of the 227 stations and tied into the monitoring well elevations obtained from previous work to obtain a topographical map of the area. This information was also used to tie in bedrock depths between monitoring wells by geophysical measurements. Terrain conductivity measurements (EM-31), VLF resistivity, and VLF-EM geophysical data were collected at each station site.

Cell locations were determined by measuring open pit locations during use and recording the date of inception. This was made easier due to the fact that a full time landfill supervisor is employed at this landfill. Cell locations and their month and year of inception are shown in **Figure 4.1**. This figure is useful in properly interpreting EM-31 results for leachate plume detection as nearby metal anomalies will affect the more subtle leachate response. Also we are more interested in EM-31 responses down stream of the waste cells rather than over them. EM responses due to lithological changes and groundwater constituent concentrations are of interest to plume mapping now and in the future.

There were a number of blank or missing values in the data sets due to the value being removed because of cultural features. The Spyglass contouring software used to provide the colour plots has a number of ways of treating missing values before contouring. All assign a value to a missing data point by replacing it with a value based on neighbouring data. The Spyglass contouring software used Kernel smoothing to assign a value to these missing points. Kernel smoothing assigns a value to a missing data point by using the average of the missing value's eight neighbours. Multiple passes are used until no more missing data points remain. The method has a heavy smoothing effect not only on the missing values but also on the known values. Consequently, original data is not always preserved, but the results are very close to the original value (Spyglass Manual, 1994).

4.5 Instrumentation

4.5.1 EM-16/16R Equipment for Very Low Frequency Electromagnetic (VLF-EM) Method

The earth's conductivity can be measured by transmitting an electromagnetic field into the earth and measuring the induced secondary magnetic field caused by the primary magnetic field as it is perturbed by a subsurface conductor.

The Geonics EM-16 measures the tilt angle of the magnetic field, while an add on piece of instrumentation is plugged into the main instrument to make it into an EM-16R. The EM-16R measures the apparent earth resistivity and a phase angle which is the angle between the horizontal electrical (E_x) and magnetic (H_y) components of the electromagnetic field. The EM-16R attachment has two probes (dipoles) that are driven into the ground 10 m apart to measure the electric field and hence the apparent resistivity of the earth between the probes as well as the phase angle.

Overburden resistivity calculations from VLF EM-16R survey data were obtained using a 2 layer inversion program (Miller, 1985) as shown in **Appendix C**. To use this program, an assumption is made that there are two layers of media below the survey point, a surface layer of resistivity ρ_1, and thickness h_1, and an infinitely thick substratum of resistivity ρ_2. This is a valid assumption at this location since data from 10 monitoring wells have indicated the area is covered with a relatively uniform glacial till overlying bedrock. The program calculates h_1 and ρ_2 values consistent with the input values ρ_1, and the apparent resistivity ρ_a and phase angle ϕ, measured at each station by the EM-16R instrument, and the transmitter frequency, f, which in this case is 24000 Hz.

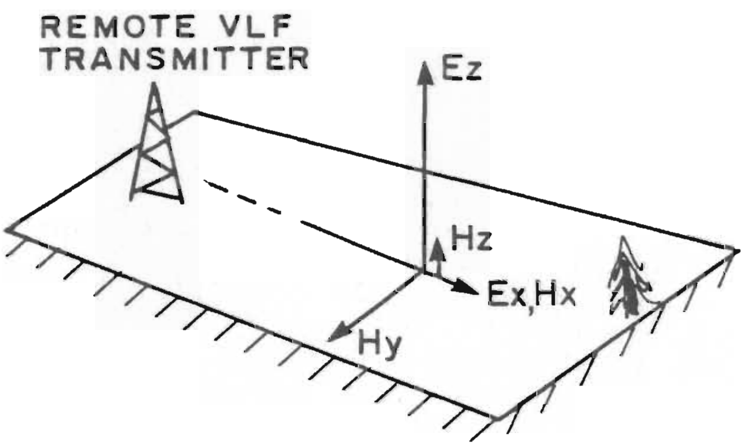
In order to obtain layer 1 resistivity values, ρ_1, the thickness of the overburden at each monitoring well location, as recorded during the drilling was used. The 10 monitoring wells are spaced relatively symmetrically over the survey area and were therefore used to infer layer 1 resistivity and thickness between and surrounding them. Since the input parameters of the program are ρ_1(unknown), and ρ_a and ϕ, giving output values h_1 (known at each well) and ρ_2, an iteration was done to obtain the best ρ_1 value at each well that would give a layer 1 thickness h_1 closest to the actual value as recorded on the drilling log.

The "best fit" ρ_1 values at the monitoring well locations were then used to assign layer 1 resistivity values to the remaining stations in the grid by a process known as kernel smoothing.

Further information on instrumentation and interpretation of results using this instrument is described in detail by Green (1991), CCME (1994), Geonics (1985), Telford et al., (1987), and McNeill and Labson (1993). **Figure 4.2** shows the electromagnetic field components of a VLF transmitter.

4.5.2 EM-31 Terrain Conductivity Meter Method

Terrain conductivity measurements are probably the single most used geophysical techniques for contaminated site investigations. The Geonics EM-31 was used for terrain conductivity measurements at each of the 227 stations of the grid on August 23-24, 1993. The weather was overcast and no instrument problems were encountered. Both profiling and sounding were done at each grid point. Profiling involves moving from one measurement point to another taking a reading while the instrument is slung over your shoulder. The distance between the transmitter and receiver remains constant. Sounding involves separating the transmitter-receiver distance so that the signal depth into the ground is increased with greater transmitter-receiver separation. This is not possible with the EM-31 since its transmitter-receiver distance is fixed. However some indication of conductivity variation with depth can be obtained by varying the instrument height above



Electric Field

E_z: vertical component
E_x: horizontal component (propagation direction)

Magnetic Field

H_z: vertical component
H_x: horizontal component
H_y: horizontal component (perpendicular to x)

Figure 4.2 Electromagnetic field components for a VLF transmitter

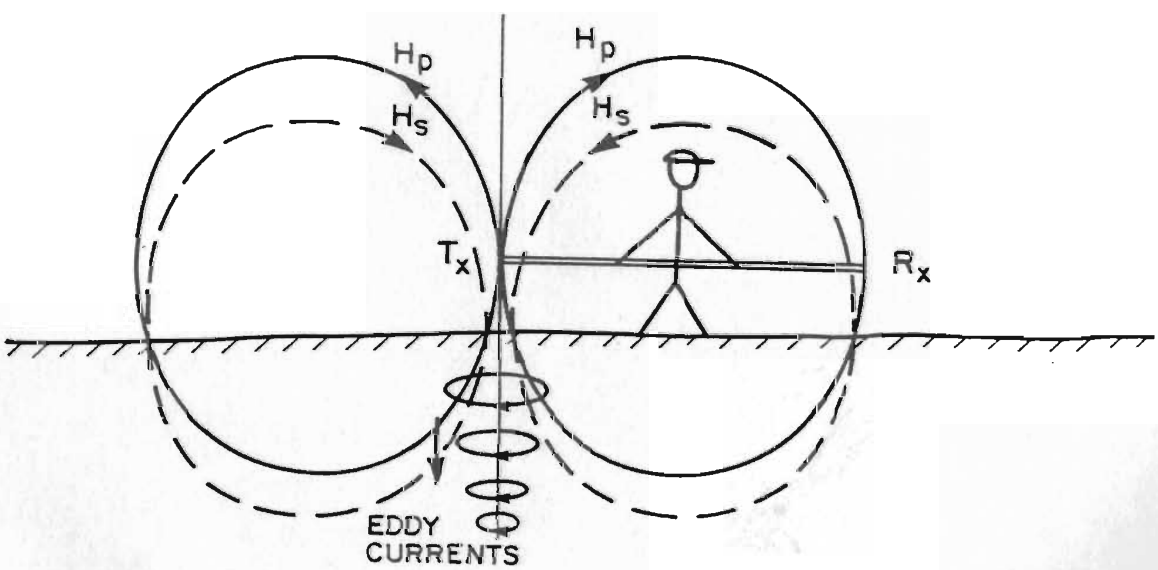


Figure 4.3 EM-31 electromagnetic induction diagram (McNeill, 1980)

the ground, plotting this data, and comparing the curve to known response curves supplied with the instrument manual (Geonics, 1985). **Figure 4.3** shows how the primary and secondary electromagnetic fields are generated by the instrument. Further information on instrumentation, uses, and interpretation of the EM-31 can be found in the publications by Benson et al., (1981), Greenhouse and Slaine (1983), Geonics (1984), and CCME (1986).

4.5.3 Refraction Seismic Method Using Hammer Seismic

A hammer refraction seismic survey using a Huntec FS-3 portable facsimile seismograph unit was done at 13 locations (see **Table 5.2** for grid locations) at the landfill on November 15, 1993. The unit is a single channel time-distance plotting instrument which permanently records an entire seismic event produced by either a hammer blow on a metal plate laid on the ground or by an electrically detonated explosive charge. A pair of geophones records the returning sound wave after it has travelled through and along the interface of one or more soil and rock layers. The information obtained to be used to determine the overburden thickness. The arrival times of the seismic waves at various distances were accomplished by fixing the receivers or geophones at one location and moving the energy source incremental distances from the geophones. More information on instrumentation and interpretation of refraction seismic results can be found in Haeni (1988), and Huntec (1970)

PART II RESULTS AND INTERPRETATION

CHAPTER 5

GEOPHYSICS

5.1 Overburden Resistivity and Thickness Calculations from the EM-16R Measurements

Table 5.1 shows the values of layer 1, ρ_1, for each grid coordinate as explained in section 4.5.1. These values were then used in the 2 layer inversion program (Miller) to obtain a value of h_1 and ρ_2 at all the grid coordinates. **Figures 5.1, 5.2, 5.3** show the contour maps of ρ_1, thickness, and ρ_2. Using the thickness h_1 obtained, and survey data on topography elevation for each station, a bedrock elevation contour map was then generated (**Figure 5.4**). The EM-16R inversion program results and calculated bedrock elevation data can be found in **Appendix C** along with levelling data done at each station and well location. The EM-16/16R field data are found in **Appendix C**.

It is evident from looking at contour maps **Figure 5.2** and **Figure 5.4** that a north-south oriented bedrock channel exists which kinks to the west splitting into two deeper distinct channels. The overburden thickness map, **Figure 5.2**, displays this most prominently but is also evident on the bedrock elevation contour map. Although the overburden thickness contour map displays thickness, the ground surface over this area

Table 5.1

Best fit layer 1 resistivity values (ρ_1) at station nearest well locations using well overburden thickness data and EM-16R inversion program

Well #	Nearest Station	X(m)	Y(m)	Layer 1 Thickness (m)	EM-16R Data ρ_a (ohm-m)	EM-16R Data Phase (degrees)	Program Output Best fit ρ_1 (ohm-m)	Program Output ρ_2 ohm-m)
1	T-250	302	69	4.4	70	27	26	231
2	Q-150	268	44	6.7	140	24	50	637
3	S-300	280	102	4.4	290	32	78	566
4	N-150	219	50	6.2	1000	16	115	8251
5	O-400	237	117	6.0	95	15	29	1688
6	J-200	152	55	5.7	1200	21	136	5325
7	K-400	170	119	4.1	750	20	76	3638
8	F-200	89	62	4.7	2600	20	166	12008
9	G-450	105	125	5.6	1200	19	126	6568
10	B-400	38	126	6.0	1600	18	151	9708

Figure 5.1 Upper Layer Resistivity - Terra Nova Waste Site

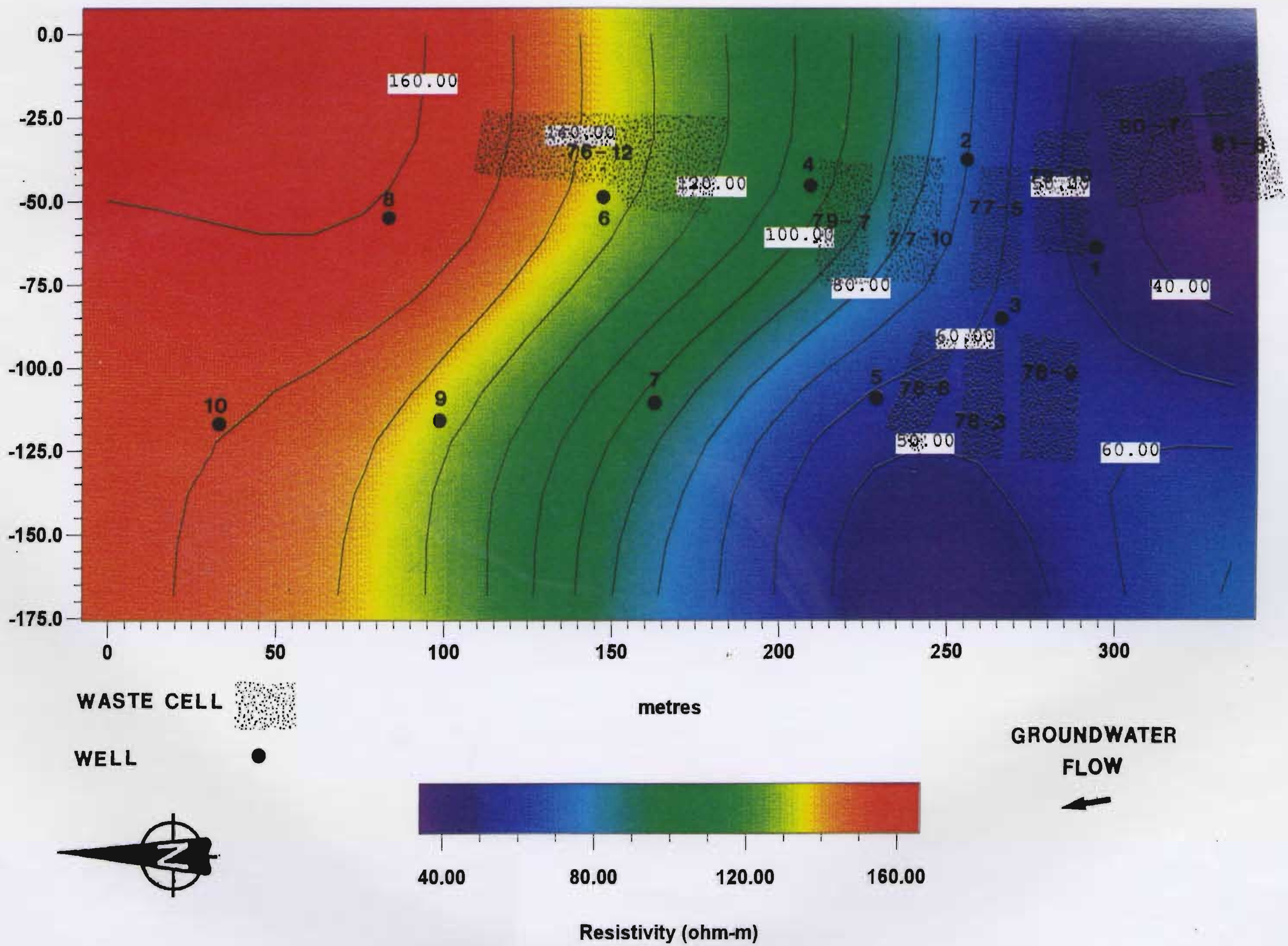


Figure 5.2 **Overburden Thickness from EM-16R Data - Terra Nova Waste Site**

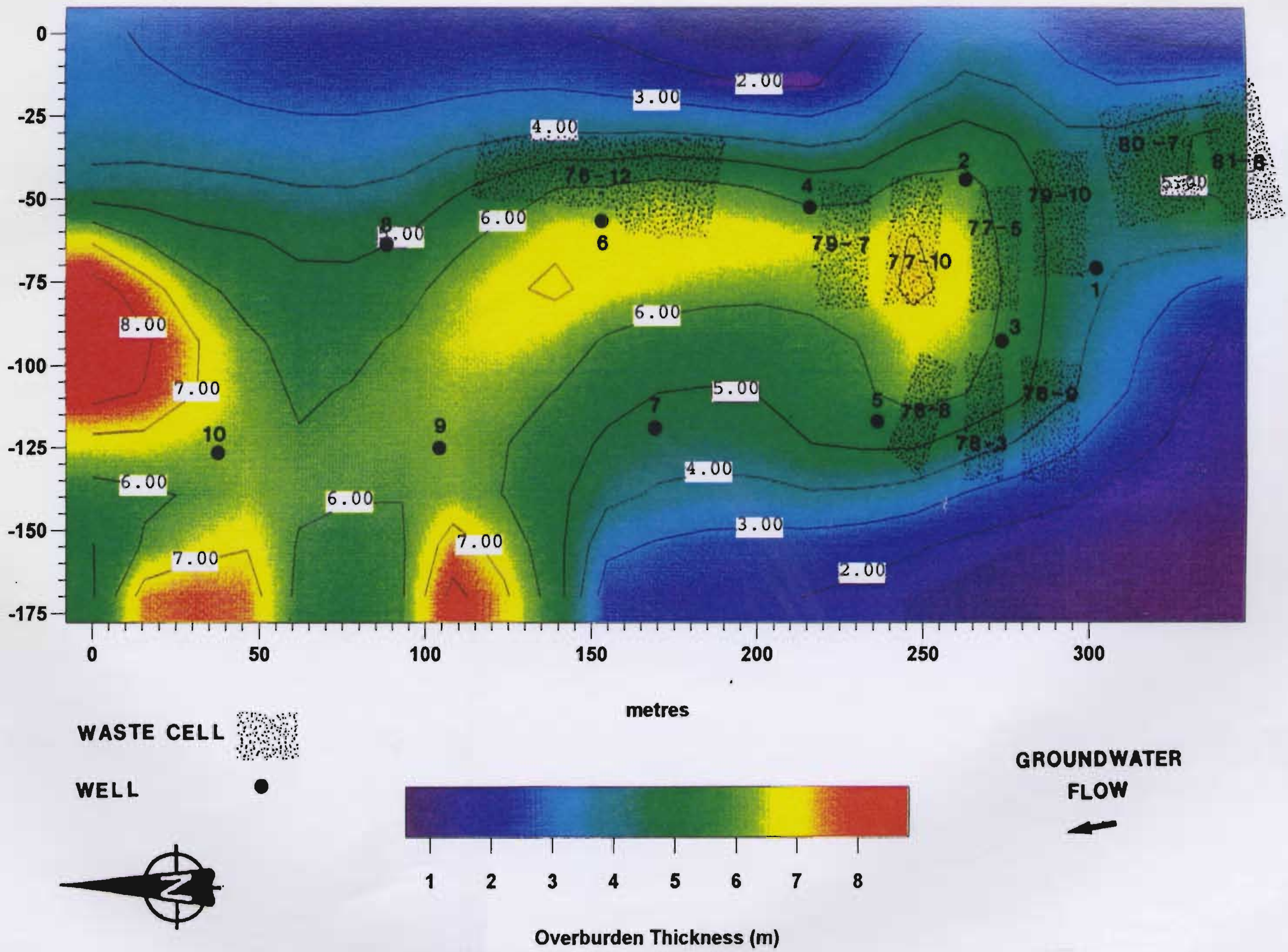


Figure 5.3 Lower Layer Resistivity - Terra Nova Waste Site

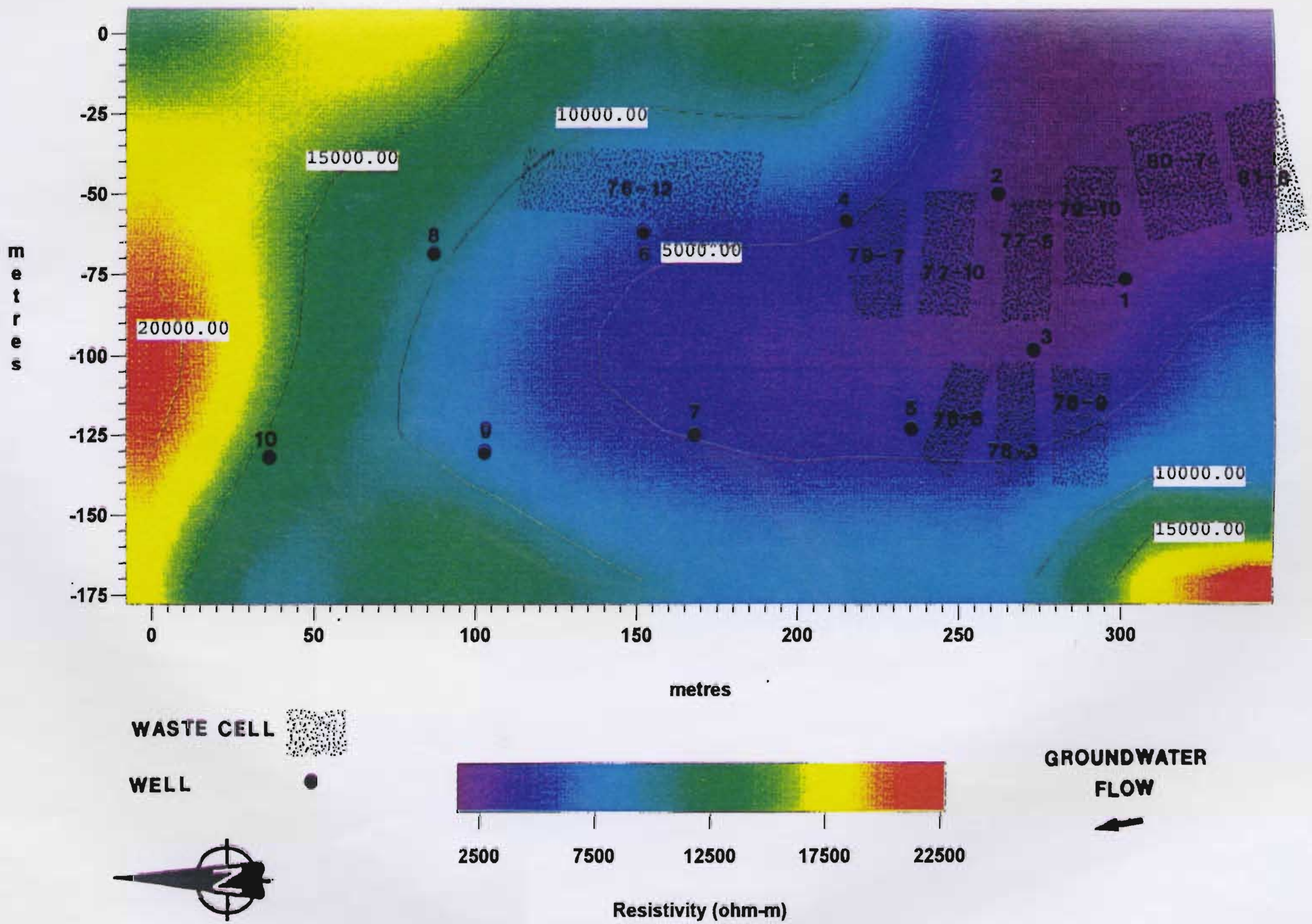
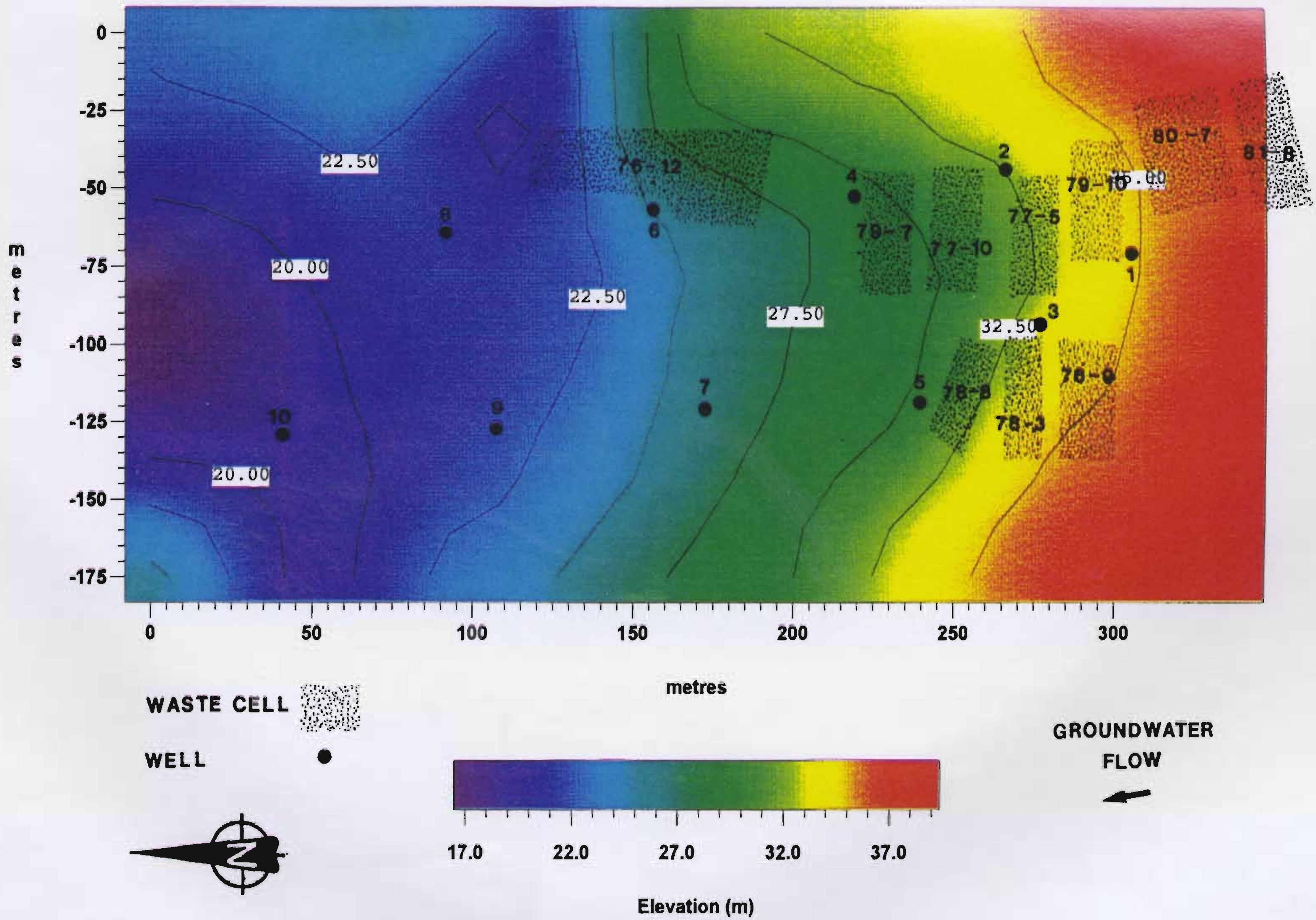


Figure 5.4 Bedrock Elevation - Terra Nova Waste Site



slopes monotonically downgrade to the north so that any change in overburden thickness would be a change in bedrock elevation and not a variance in ground surface elevation. This bedrock channel or increased overburden thickness is a likely pathway for leachate movement off site. **Figure 5.1**, the upper layer resistivity, shows a gradual increase in resistivity of this layer to the north. As expected, resistivity is low over the later waste cells probably due to the percolation of dissolved solids ongoing downwards in the waste cells. Waste cells 76-12, 79-7, and 77-10, did not show any low resistivity pattern similar to the other waste cells. This could be due to all the dissolved solids in these waste cells being leached out of the cell and surrounding overburden material during the 13 to 18 years since these cells were in operation. Also it is evident that the kernel smoothing method of the Spyglass software has reduced subtle resistivity changes since this contour map was derived from the 10 monitoring well points and not the 227 grid points. **Figure 5.3**, the lower layer resistivity, shows an area of low resistivity (high conductivity) over and down stream of the waste cells. There is also an indication of low resistivity in the channels as interpreted earlier. Again waste cell 76-12 does not appear to have an influence on the low resistivity contours suggesting that there is little leachable material left in this waste cell.

5.2 Fraser Filter Applied to EM-16 Data

Interpreting VLF-EM16 data can be difficult due to the dynamic range of values, and the fact that a cross over response is apparent when traversing features such as vertical dykes or waste disposal cells. Fraser (1969) overcame this problem by devising a simple numerical filter which converts in-phase (tilt angle) cross overs into peak responses by subtracting successive values of tilt angle measurements along a survey profile. The Fraser filter is widely used today in the reduction of VLF data. Given 4 data points (a, b, c, d) in a profile, the filter uses the equation (a+b)-(c+d) to give a value which would be contoured at a point midway between c and d. The equation is then applied to the values (b,c,d,e) to produce a value located midway between the position d and e, and so on. The filter shifts the dip angle data by 90° to convert cross-overs into peaks and it attenuates long spatial wavelengths. This filter does not increase random noise in the data, and is easy to use (McNeill and Labson, 1993). **Figure 5.5** shows the contoured Fraser filter data while the data may be found in **Appendix C**. In general, the area the waste cells is encompassed with the higher Fraser filter dip angle values (ie. > 20). There is also evidence of a linear anomaly (conductive high, dip angle >20 degrees) downstream of the waste cells and the splitting of anomaly at the bottom of the contouring grid area.

5.3 Plume Outline for EM-31 Conductivity Measurements

The EM-31 terrain conductivity instrument was expected to give the best contour map and outline of any leachate plume produced emanating the waste cells. **Figure 5.6** presents the contoured results while the data may be found in **Appendix C**. The plume outline from this contour map is shown in the lighter blue shades. Higher conductivity

Figure 5.5 EM16 Fraser Filter Data - Terra Nova Waste Site

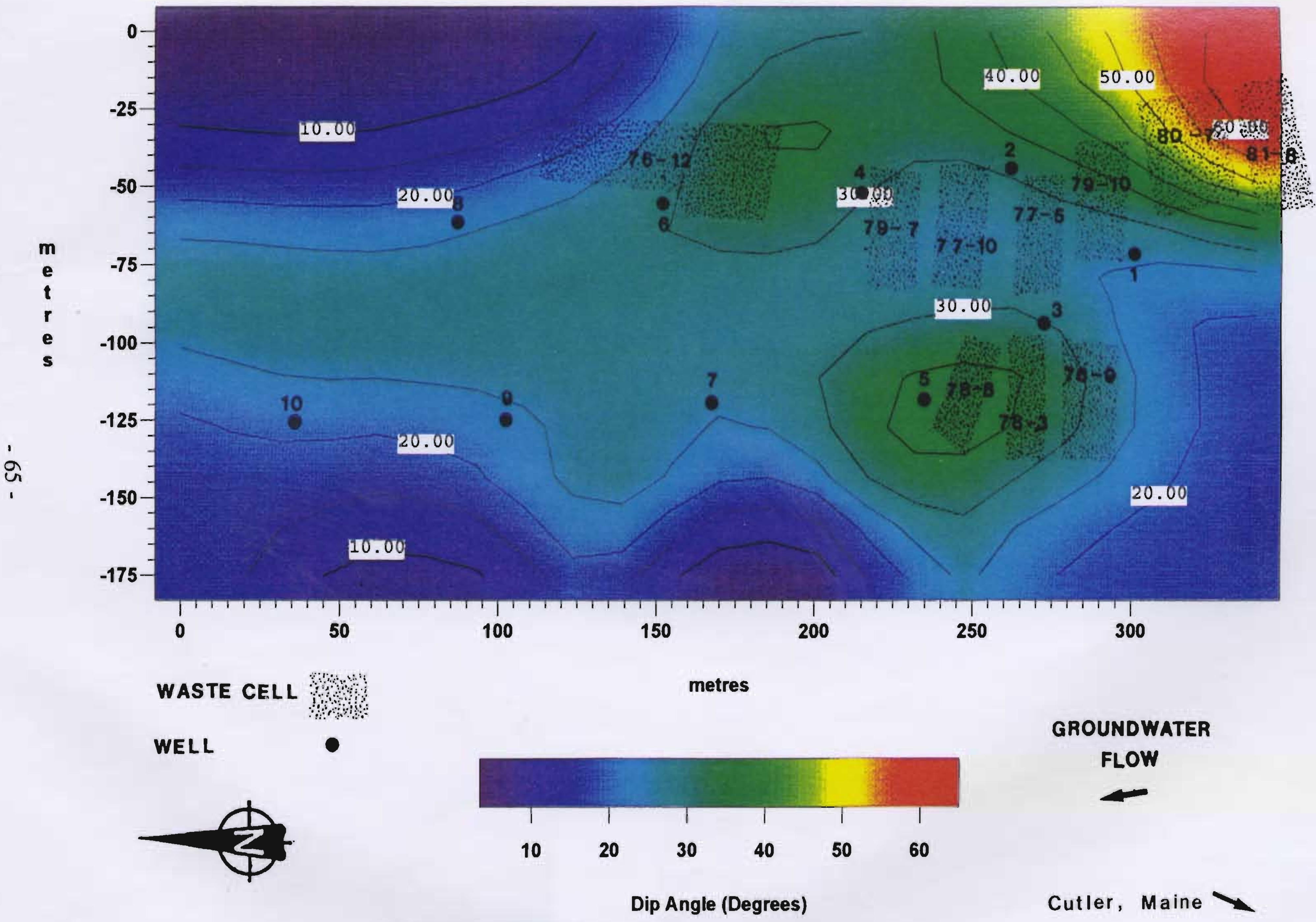
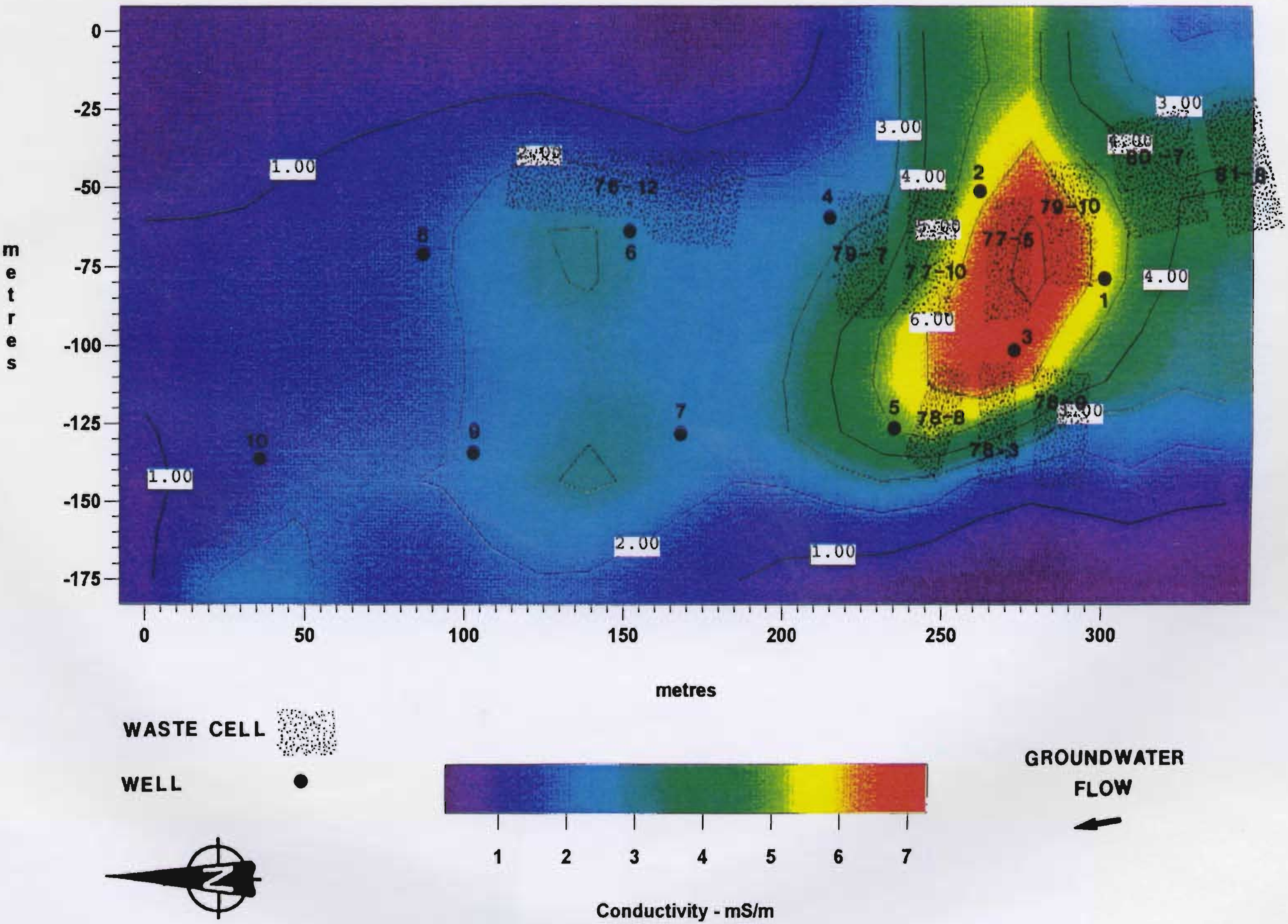


Figure 5.6 EM-31 Terrain Conductivity - Terra Nova Waste Site



values down stream of the waste cells are indicative of a possible leachate plume. The background conductivity is about 0.9 mS/m. As can be seen from this plot, the apparent leachate plume has travelled at least 150 m from the nearest waste disposal cells and seems to be channelling in several areas leading off the grid system. The highest conductivity channel is seen on the horizontal axis at about the 40 metre position. This leachate channel indicates that leachate has gone beyond the site survey. The other channels indicated are on the horizontal axis at about 135 metres and a weaker conductivity channel on the vertical axis at about 110 metres.

The high conductivity values noted on the contour plot correlate with the location of the waste cells and derelict scrap metal on the surface east of monitoring well #2. Responses to cultural features were evident by large fluctuations near vehicle wrecks and over the waste cells. These abnormal results were confirmed by rotating the instrument and observing major needle deflections. While these results helped in identifying waste cell location, the large values suppressed the colour contouring outline of subtle changes down gradient of the site due to the plume. It was therefore necessary to arrange the EM-31 results in ascending order and remove values above 7 mS/m so that a better colour outline of the contaminant plume would be evident on the colour contouring. The amount of data removed for contouring purposes was 19%

A leachate plume appears to be up gradient of waste cell 80-7 because there are few grid points in this area and the contouring software has coloured a gradual high to low conductivity plot.

We can compare the EM-31 conductivity response over the survey grid area with the specific conductance of water samples obtained from the monitoring wells. **Figure 5.7** is a contour plot of water conductivity taken 10 months after the EM-31 survey. Here there is data from only 10 points, the 10 monitoring wells, while the EM-31 plot has 184 data points. One should not put much faith in the grid area contouring between the monitoring wells and the grid edges. Also because of an extremely low conductivity value at MW #8, it was necessary to truncate the plotting of the area east of this well, hence the black area on the contour plot. Although of different conductivity units, the monitoring wells specific conductance and the EM-31 response are in general agreement with each other. This is an important comparison since it correlates, remote sensing response to an actual sub surface measurement. This is sometimes called "ground truthing".

5.4 Hammer Seismic Results

The hammer refraction seismic results to determine depth to bedrock are shown in **Table 5.2**. Results from this seismic survey were disappointing. No interpretation of data was possible over the waste cells as was expected due to the loss of seismic wave energy and the absence of reflectors while travelling through the landfill waste. Other

Figure 5.7 Monitoring Well Conductivity - May 1994

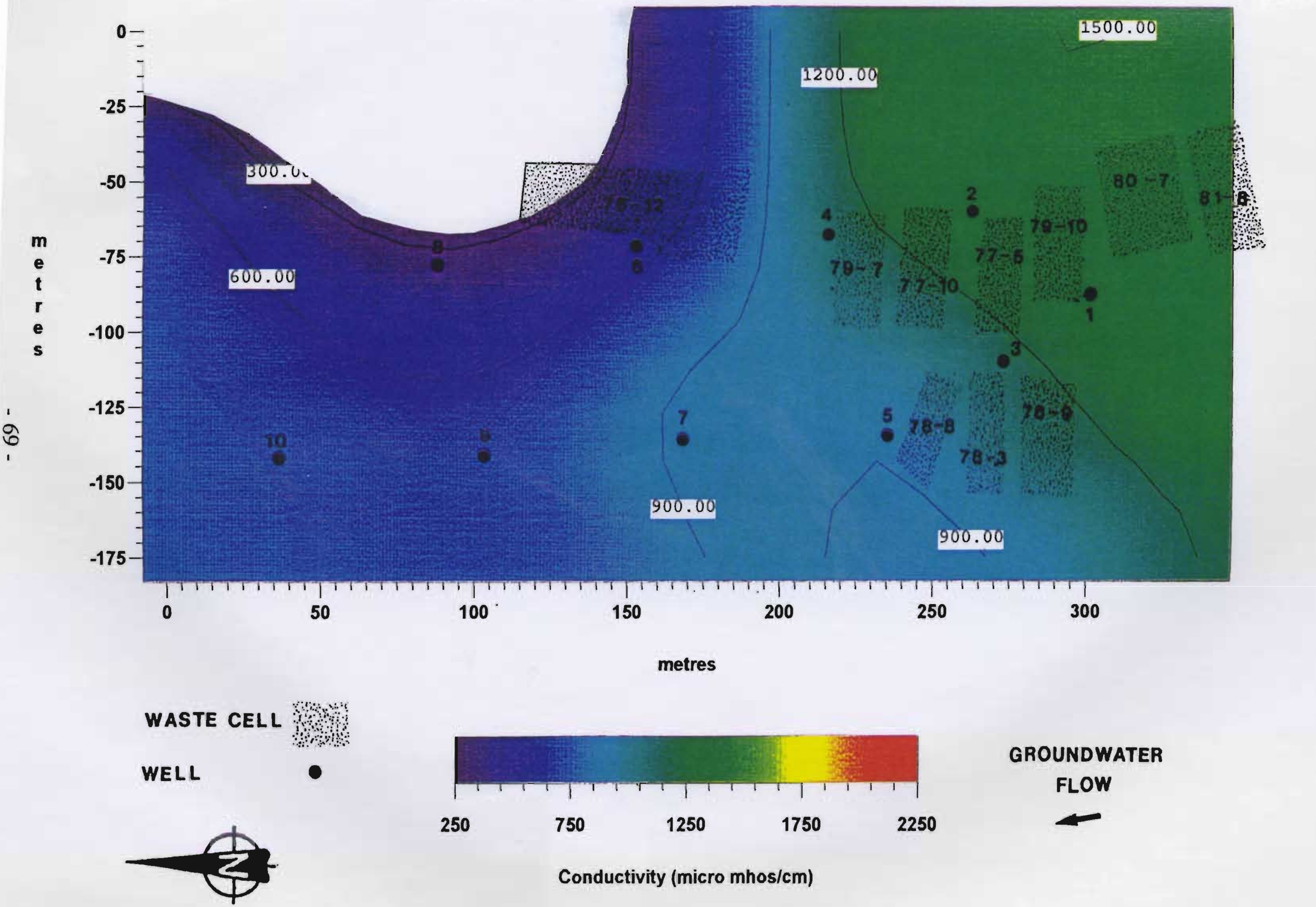


Table 5.2

Hammer seismic results

No.	Coordinates X(m)	Coordinates Y(m)	Seismic Velocity V_1(m/sec)	Seismic Velocity V_2(m/sec)	Critical distance X_c(m)	Depth Z(m)
1	30	-40	1333	2000	8.0	1.8
2	46	-122	325	4500	6.5	3.0
3	61	-103	1750	4667	14.0	4.7
4	91	-80	800	3500	4.0	1.2
5	122	-82	667	1167	4.0	1.0
6	152	-83	500	1750	3.0	1.1
7	183	-84	667	1667	4.0	1.3
8	213	-85	571	1667	3.0	0.8
9	244	-69	NI	NI		waste cell
10	274	-63	NI	NI		waste cell
11	302	-132	NI	NI		waste cell
12	305	-66	545	1167	6.5	2.0
13	320	-155	NI	NI		waste cell

V_1 = velocity of overburden

V_2 = velocity of bedrock

X_c = critical distance - distance from the origin at which two straight line segments, representing different velocities, intersect.

Z = depth to reflector

NI = not interpreted

Depth Equation:

$$Z = \frac{X_C}{2}\sqrt{\frac{V_2 - V_1}{V_1 + V_2}}$$

locations produced depths to reflectors from 0.80 m to 4.7 m. These values were much less than depth to bedrock information from the monitoring wells drilling logs or from two test pits. A possible explanation is that the reflectors encountered were the top of the water table with no interpretable reflector below. Early experimentation with the hammer seismic equipment revealed that the layer of extensive moss and shrub growth covering the ground at the landfill would have to be removed where ever the metal plate was placed in order to provide a good energy coupling between the plate and the overburden. Since this survey was not our primary source of depth to bedrock information, shot points were done on the roadway which traverses the landfill site. This may have lead to another problem of seismic energy being lost along the raised gravel roadbed/glacial till interface. A number of results of the seismic refraction survey indicated that seismic velocity was decreasing with depth. These were usually over areas of the waste cells and were not used to determine depth to bedrock. Consequently, none of the calculated depths from this seismic refraction survey were incorporated into **Figure 5.4**, bedrock elevation.

5.5 Summary

From EM-31 and EM-16/16R results, the leachate plume was found to have migrated at least 150 m down stream of the nearest waste disposal cell. There appears to be channelling of the leachate along preferred bedrock channels leading off the survey grid system used for contouring purposes. A comparison of colour contour plots of groundwater specific conductance from the 10 monitoring wells and the EM-31 terrain conductivity response were in general agreement with each other. However, the lack of data points (10) of the monitoring well specific conductance plot compared to the number of data points (184) of the EM-31 plot detracts from both plots comparing more favourably. Hammer seismic results were not reliable due to poor energy coupling.

CHAPTER 6

GEOCHEMISTRY

6.1 Water Quality Results

Tables showing the water quality sampling results from all monitoring wells and surface sampling sites are shown in **Appendix D**. A plot of concentration versus time for selected sampled constituents for each monitoring well is also shown in **Appendix D**. Water sampling started in 1977 and presently occurs once a year. Basically two persons were involved in sample procurement at this landfill, Mr. Robert Lethbridge and the author. One or two samples sets showed a pronounced variability with respect to a recognized trend of sample sets taken before and after. These were not included in any curve fitting. The reasons for these outlyers may have been mislabelled samples or cross contamination from other monitoring wells.

6.2 Breakthrough Curves for Contaminant Migration

Since the start up dates and location of each cell are known along with the background groundwater concentrations of the area, these plots can be considered break-through curves for the travel of contaminant leachate plumes from the waste cells as they pass a down gradient monitoring well. Long term monitoring was needed to gain useful data from all monitoring wells due to groundwater velocities and the distance of the farthest well, MW #10 from the closest waste cell. From these plots it is possible to determine the rate of contaminant movement by species. Looking at **Figure 3.3**, section A1-A2, multiple peaks can be expected with respect to time due different start up dates of the waste cells. With time and distance from the source, the concentration peaks will diminish in height, broaden, and overlap.

The shape of each curve is a result of many factors, both physical and chemical. Physically, the primary driving force for leachate movement is the hydraulic gradient that produces groundwater flow advection. The characteristics of the matrix that the leachate is travelling through will affect advective transport. However, mechanical and molecular diffusion disperse contaminants, although the effect of molecular diffusion contributes little to contaminant movement except at very low groundwater velocities.

Chemical reactions will predominantly reduce the concentration of contaminants (attenuation). The most important chemical reactions are solution-precipitation, oxidation-reduction, adsorption-desorption, acid-base reactions, and microbial cell synthesis (Driscoll, 1986).

From looking at the plots from each monitoring well and comparing the well's location with respect to the centre of the nearest up gradient waste cell, a conceptual view of the leachate plume can be obtained. Several types of plots can be observed. Some wells are influenced by leachate from only one waste cell while others are influenced by more than one waste cell. This is mainly indicated by the number of concentration peaks in the plots. Also, for monitoring wells that are at longer distances from the waste cells, a concentration peak may not have passed the well location yet. Finally some plots show no significant rise or fall in concentrations over time.

An example of a single peak plot is shown in **Figure 6.1**. Here calcium from MW #6 has a well defined peak. A waste cell directly above the monitoring well started December, 1976 and the next cell was started in May, 1977. Therefore, the first cell was in use for 5 months before being covered. It is possible that source concentrations were increasing over the 5 months it took to fill the cell. This would depend mainly on rainfall events while the cell was opened. A slight broadening of the concentration peaks would result. MW #6 is immediately adjacent and down stream of this waste cell. A concentration rise with a maximum peak occurred during 1982, 3 years after the closed cell start up and abandonment. It appears that most of the leachate had passed the monitoring well by November, 1984, if one looks at the plots of many of the sampled parameters for MW #6. This time varies by element upon observation of MW #6 concentrations plot and by a cells width in the direction of groundwater flow when other concentrations plots are assessed. It was observed by analysing these plots that after 4 or 5 years, most of the soluble material has leached from a waste cell. Even after this time period has elapsed, some contaminants will still leach from the waste cells since the concentrations plots do not diminish in concentration to their original background values. Indeed, it has been observed that landfills used during the Roman Empire times still produce leachate (Freeze and Cherry, 1979).

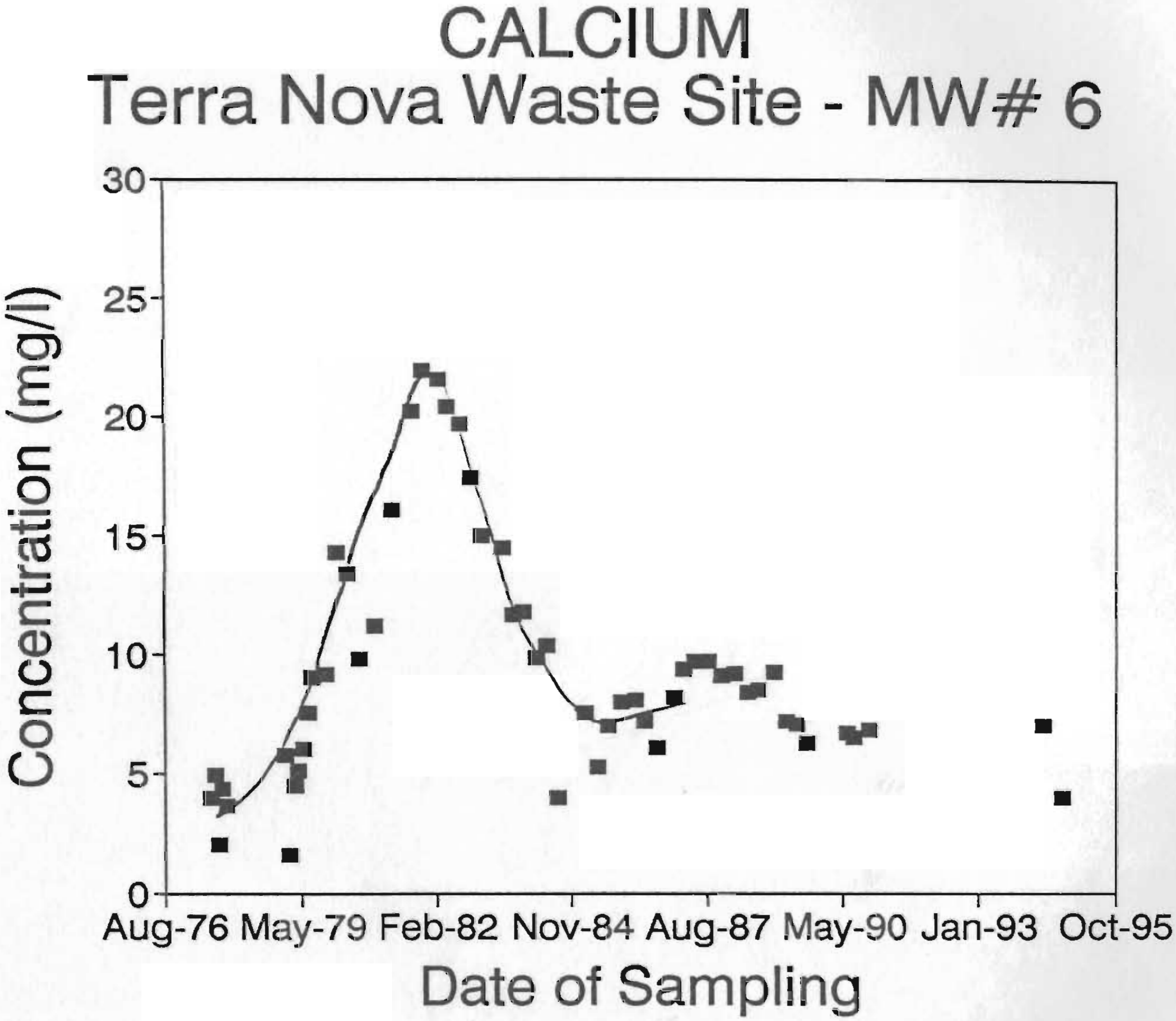


Figure 6.1 Example of a single peak concentration plot

An example of a double peak plot is shown in **Figure 6.2**. Here the leachate plume from possibly two or more waste cells are contributing to the chloride concentrations of MW #4.

A third type of plot is one which has no defined peak but a continuing rise in concentration since sampling began. The concentration versus time plots for many of the chemical parameters sampled in MW #10 shows this trend. **Figure 6.3** shows that the concentration gradient of manganese is still rising meaning the maximum plume front concentration has not yet reached this monitoring well. Monitoring wells that are at longer distances from the waste cells, showed a more erratic concentration value between samples as the plume front is passing the monitoring well location. Concentrations are varying in magnitude with each sample taken as can be seen in **Figure 6.3**. It is possible that this is due to a tortuous path travelled by the contaminants which have caused "mini slugs" of contaminant to arrive at the well over time. Mirecki et al., 1993, suggested in a study on the geochemistry of a landfill near Memphis, Tennessee, that leachate flowing away from this landfill, which is situated in an alluvial aquifer, does so as discrete "pulses" along preferential flow paths rather than as a continuous plume. This could explain the increasing variability with time of the sampling results as shown in **Figure 6.3**.

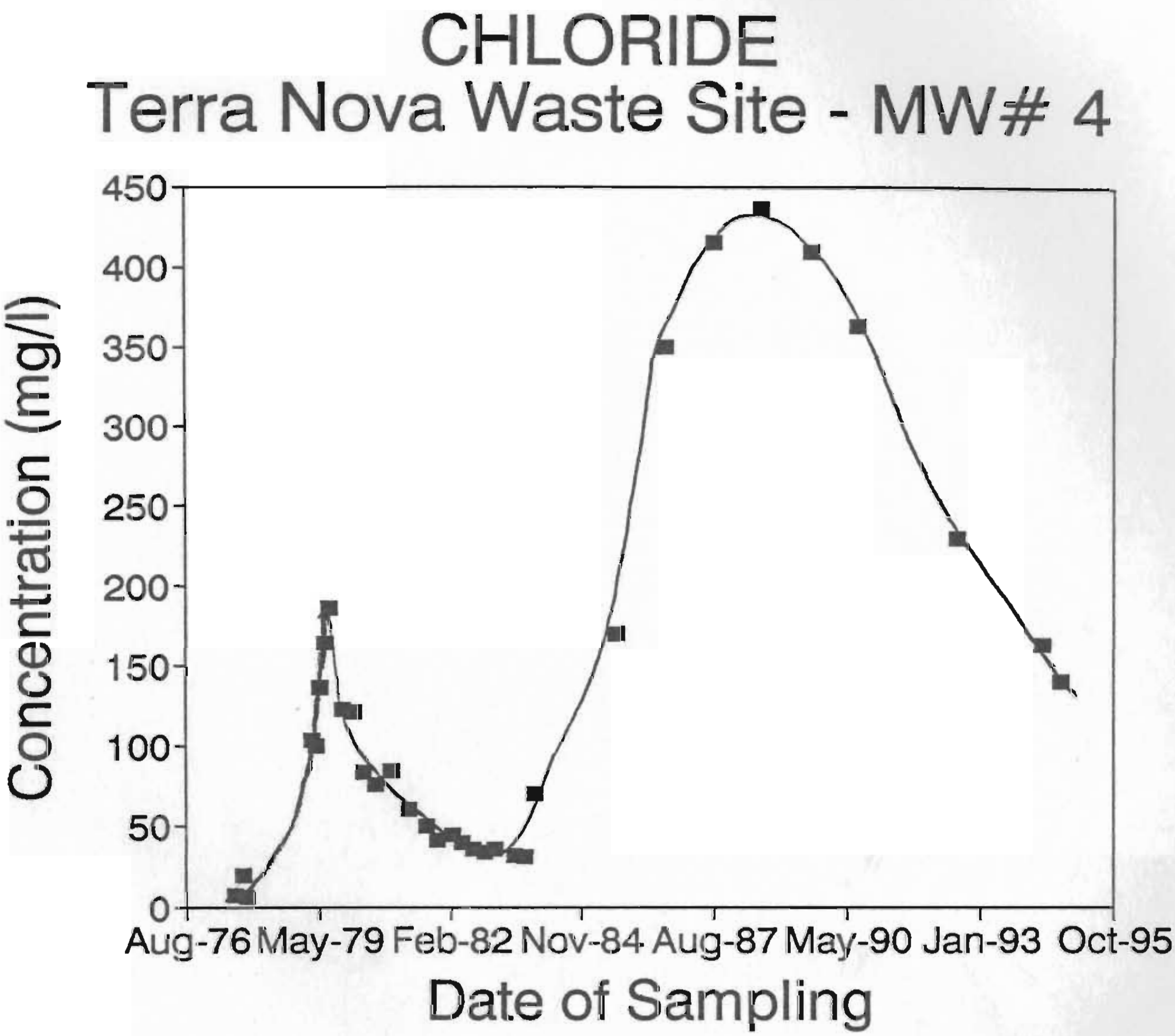


Figure 6.2 Example of a double peak concentration plot

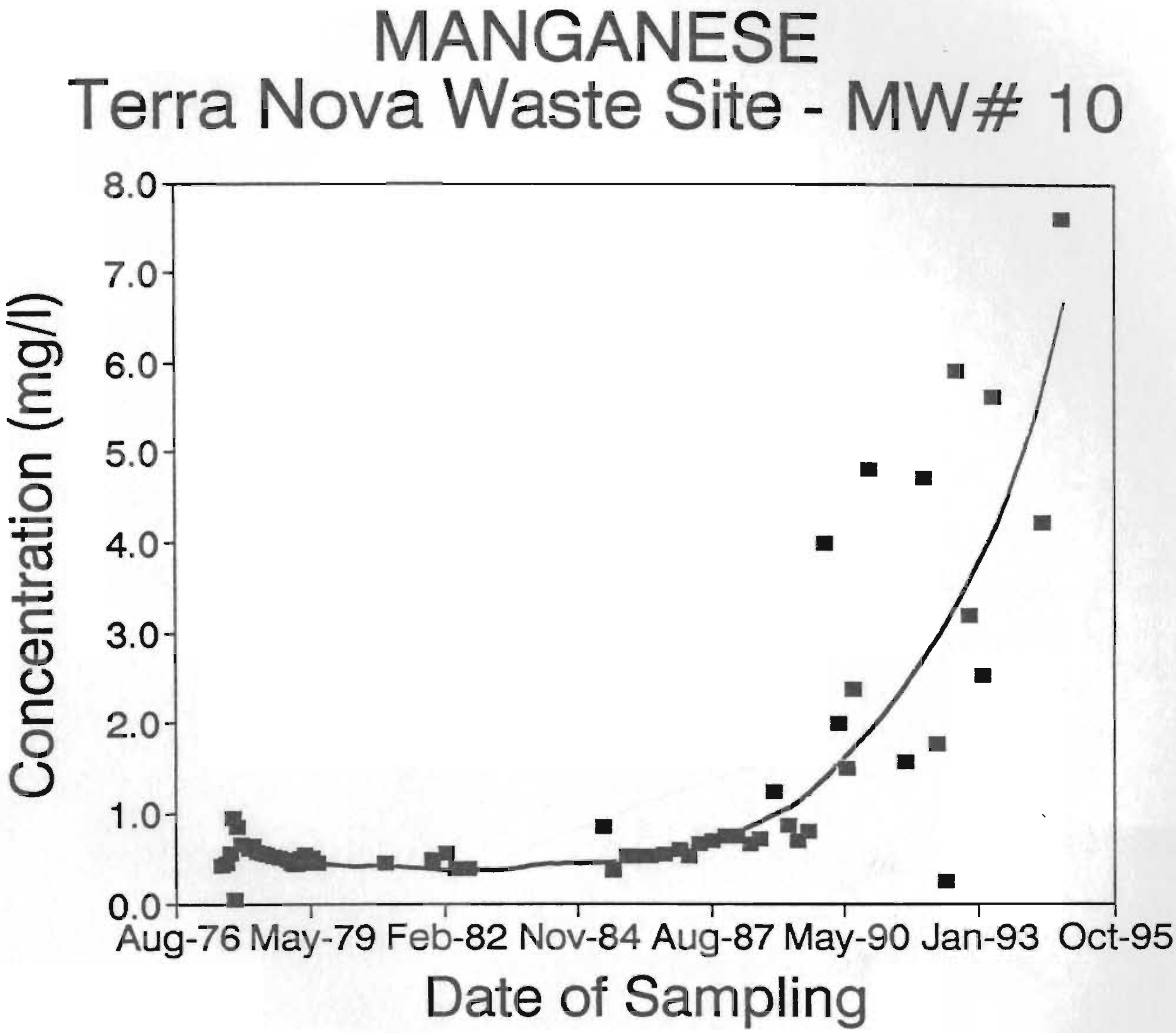


Figure 6.3 Example of a continuously increasing concentration plot

Finally, for some of the parameters sampled, after a first concentration peak had moved past the monitoring well, concentrations remained elevated and highly variable. **Figure 6.4**, a plot of iron concentrations for MW #7, is an example of such a plot that after 1980, remained elevated in concentration and highly variable.

An important difficulty with the interpretation of the results from the sampling of the monitoring wells is that each monitoring well has one screen set just above bedrock and not multiple screens where discrete sections of the well could be sampled. It is possible that plume detection could be delayed due to leachate passing a well above the well screen and not being detected until part of this plume has reached down to the well screen. There are no LNAPLs (light non aqueous phase liquids) in the leachate make up, therefore, this would preclude a separation of species based on liquid density. Also samples taken from deep wells can be viewed as a systematic bias. However, it allows relative concentration peaks and trends to show up.

6.3 Velocity Determinations from Breakthrough Curves

A table of the time and maximum peak concentrations of different species as they pass a monitoring well can be constructed based on a review of water quality sampling results. From the water quality results of **Appendix D**, **Table 6.1** shows the time of peak concentrations for each monitoring well for selected chemical parameters. Some had double peaks. The average velocity of the solute for selected ions can be calculated from

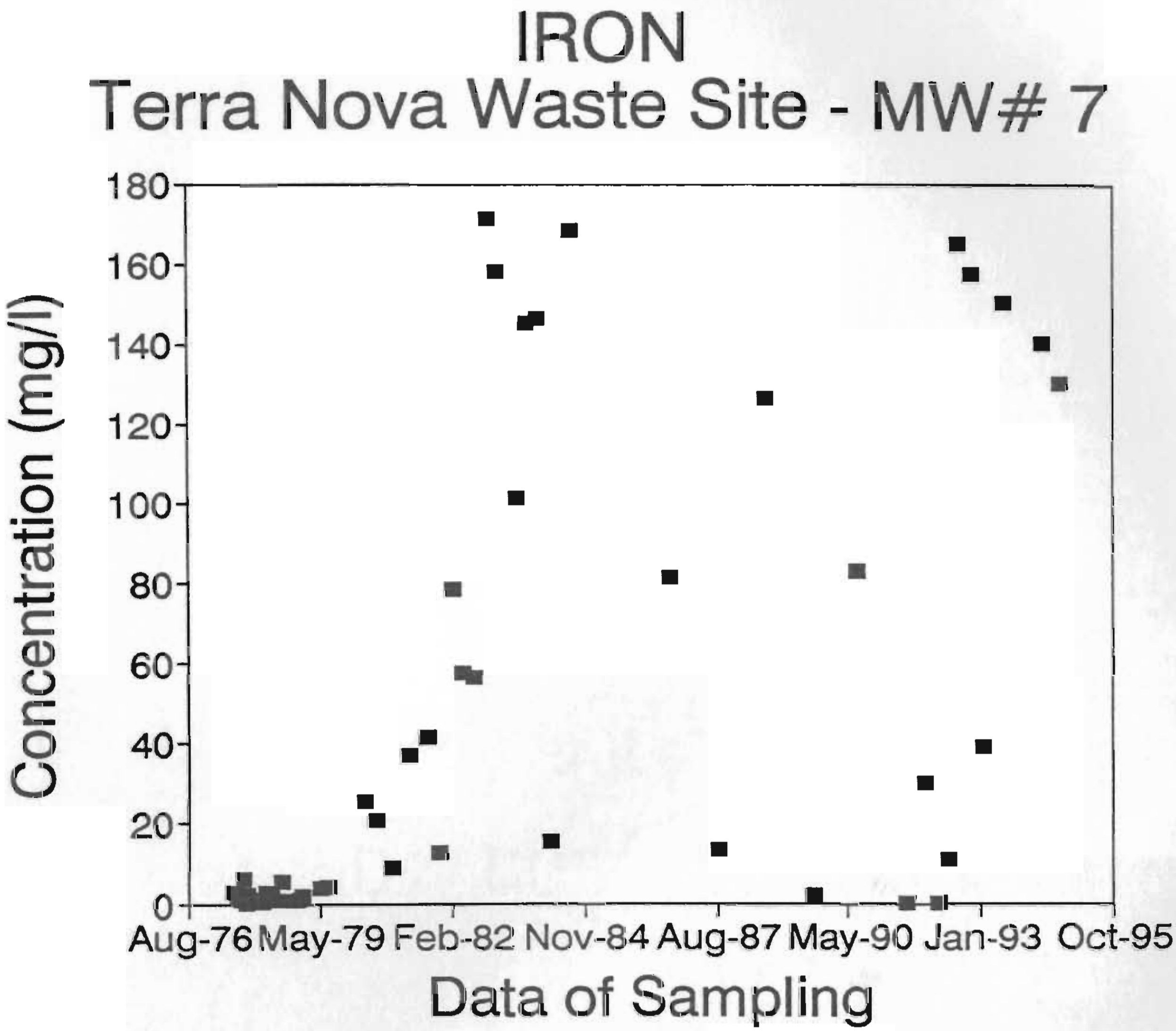


Figure 6.4 Example of a concentration plot with no perceived trend.

TABLE 6.1 PEAK CONCENTRATION DATES AND VALUES - TERRA NOVA REGIONAL WASTE DISPOSAL SITE

	Alk (mg/l)	Ca (mg/l)	Cl (mgf/l)	Cond. (micromhos/cm)	Fe (mg/l)	K Nitro. (mg/l)	Pb (mg/l)	Mg (mg/l)	Mn (mg/l)	Ni (mg/l)	K (mg/l)	Na (mg/l)	TDS (mg/l)	Zn (mg/l)
MW #1														
Date	23/5/89	28/11/88	17/2/88	23/8/89	17/8/92	NA	28/11/89	28/11/88	17/8/92	NA	27/3/90	17/8/92	28/11/88	28/11/88
Conc.	668	269.9	361	2350	70		5.19	60.4	55		29.6	190	1930	161
Date(2)											17/8/90		10/5/89	
Conc.											10		1470	
MW #2														
Date	23/5/89	23/5/89	26/5/88	23/5/89	13/12/89	NA	1/6/90	10/3/89	23/5/89	NA	13/12/89	17/8/92	28/11/88	18/5/84
Conc.	1060	376	532	3500	178		0.54	75	78		11	200	2360	58
MW #3														
Date	13/12/89	13/11/90	17/8/92	2/10/94	17/8/92	NA	NA	17/8/92	17/8/92	NA	NA	4/10/94	4/10/94	NA
Conc.	138	67	247	1210	112			17	21			230	1110	
MW #4														
Date	29/4/80	17/7/79	14/8/79	14/8/79	19/8/92	4/10/94	NA	17/7/79	14/8/79	7/8/88	19/8/92	19/8/92	21/11/79	14/8/79
Conc.	537	210	187	1495	189	3.9		134.3	58.3	0.11	15	210	1173	255.5
Date(2)	7/8/89	11/8/87	7/8/88	18/7/90				11/8/87	7/8/88				7/8/89	
Conc.	542	228	436	2240				39	129				2260	
MW #5														
Date	NA	9/11/81	9/11/81	9/11/81	9/11/81	NA	17/8/92	1/4/81	9/11/81	NA	1/4/81	9/11/81	9/11/81	9/11/81
Conc.		125	100	1590	200.5		0.92	26.7	8.5		49.4	105	1402	211
Date(2)				26/5/88					4/10/94				28/11/89	26/5/88
Conc.				850					9.5				1100	105
MW #6														
Date	10/8/82	9/11/81	10/8/82	10/5/82	2/3/82	NA	1/6/90	9/11/81	9/11/81	NA	2/3/82	2/3/82	10/5/82	NA
Conc.	173	21.9	77	370	65.6		2.35	4.48	19.4		2.6	25.2	243	
Date(2)									29/4/82			4/5/87	11/8/87	
Conc.									20.5			12.4	245	
MW #7														
Date	10/11/82	10/11/82	10/11/82	5/8/84	NA	29/4/80	NA	10/11/82	10/11/82	31/7/91	24/7/80	29/4/80	29/4/80	29/4/80
Conc.	564	240	162	1840		28.1		48.3	122	0.315	54.9	181	1084	107.6
Date(2)								5/8/84				29/2/84	10/11/82	10/11/82
Conc.								35.4				84	1853	
Date(3)													29/02/84	
Conc.													1820	
MW #8														
Date	23/11/83	11/8/87	11/8/87	11/8/87	Cl	NA	NA	11/8/87	NA	NA	NA	Cl	11/8/87	NA
Conc.	140	35.1	90.1	620				5.59					575	
MW #9														
Date	23/2/87	11/8/87	4/5/87	26/5/88	Cl	NA	NA	11/8/87	11/8/87	NA	24/10/77	3/3/86	11/8/87	18/5/84
Conc.	512	602	97	1500				148.3	48.3		48.5	23	940	135
MW #10														
Date	13/11/90	Cl	13/12/89	13/11/90	Cl	NA	Cl	Cl	Cl	NA	NA	Cl	Cl	Cl
Conc.	602		42.7	965										
MW #15														
Date	28/11/88	18/11/87	13/11/85	26/5/88	15/2/85	NA	NA	3/3/86	22/5/85	NA	NA	22/3/90	13/11/85	13/11/85
Conc.	788	131	350	2500	300			50	133			714	1659	93
Date(2)			26/5/88					18/11/87					18/11/87	
Conc.			350					53.4					1610	

NA - no concentration peak or trend was evident
Cl - continuously increasing concentration

this table, given that for each well we know the date of start up of the nearest up gradient cell, and the distance from the centre of the cell to a well. Not all ions had a discrete mass breakthrough curve as can be seen from **Table 6.1**.

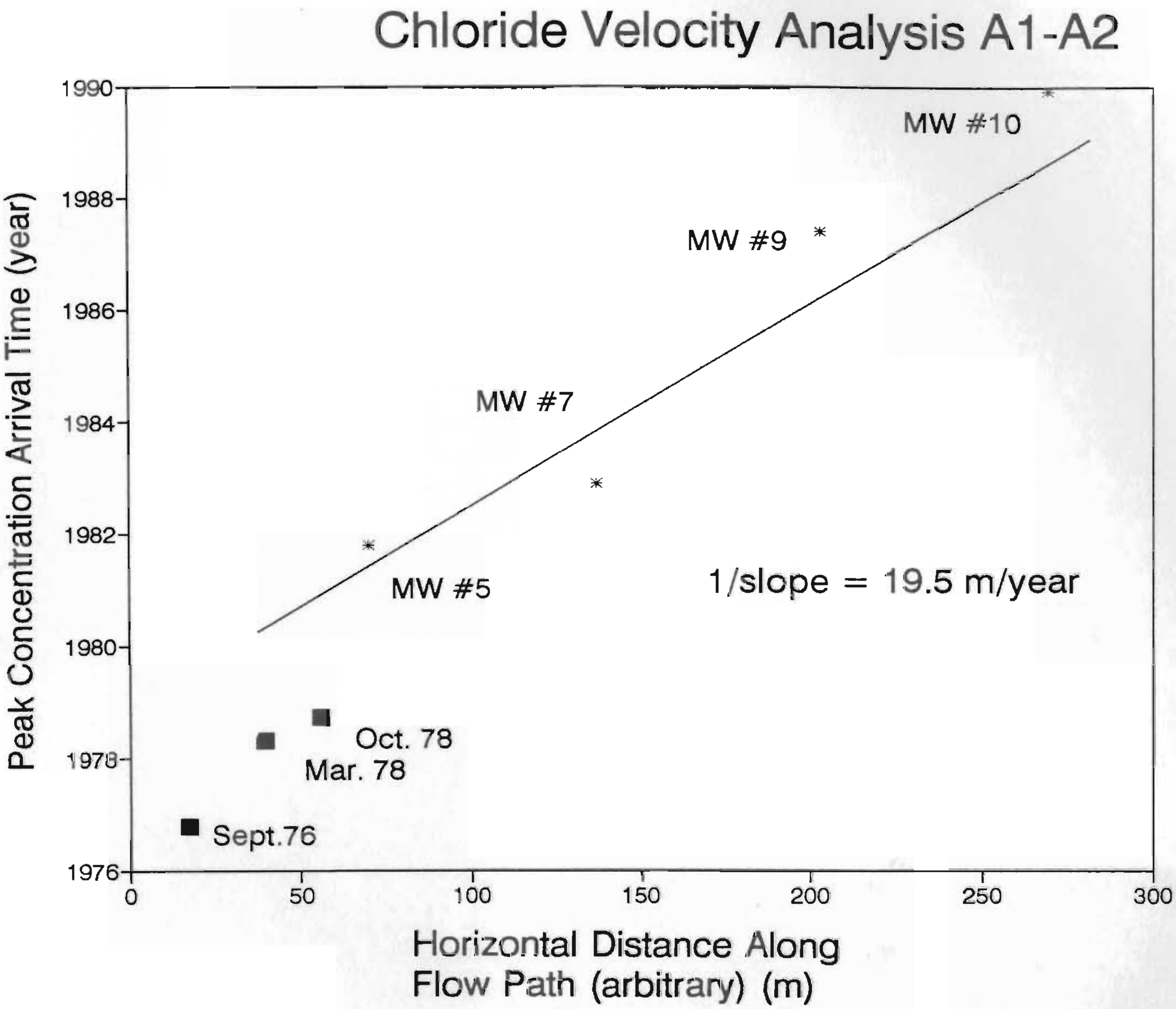
What we would like to find is the average linear groundwater velocity which is faster than the average velocity of the solute front for chemical species. Because leachate is made up of a number of chemical species that adhere to the native soils at different rates, the reactive chemical parameters will travel slower than unaltered groundwater in the area. This reduction of the solute velocity or retardation differs from species to species. A retardation factor r_f can be obtained using the following equation:

$$r_f = \frac{v_x}{v_c}$$

where: v_x = average linear velocity

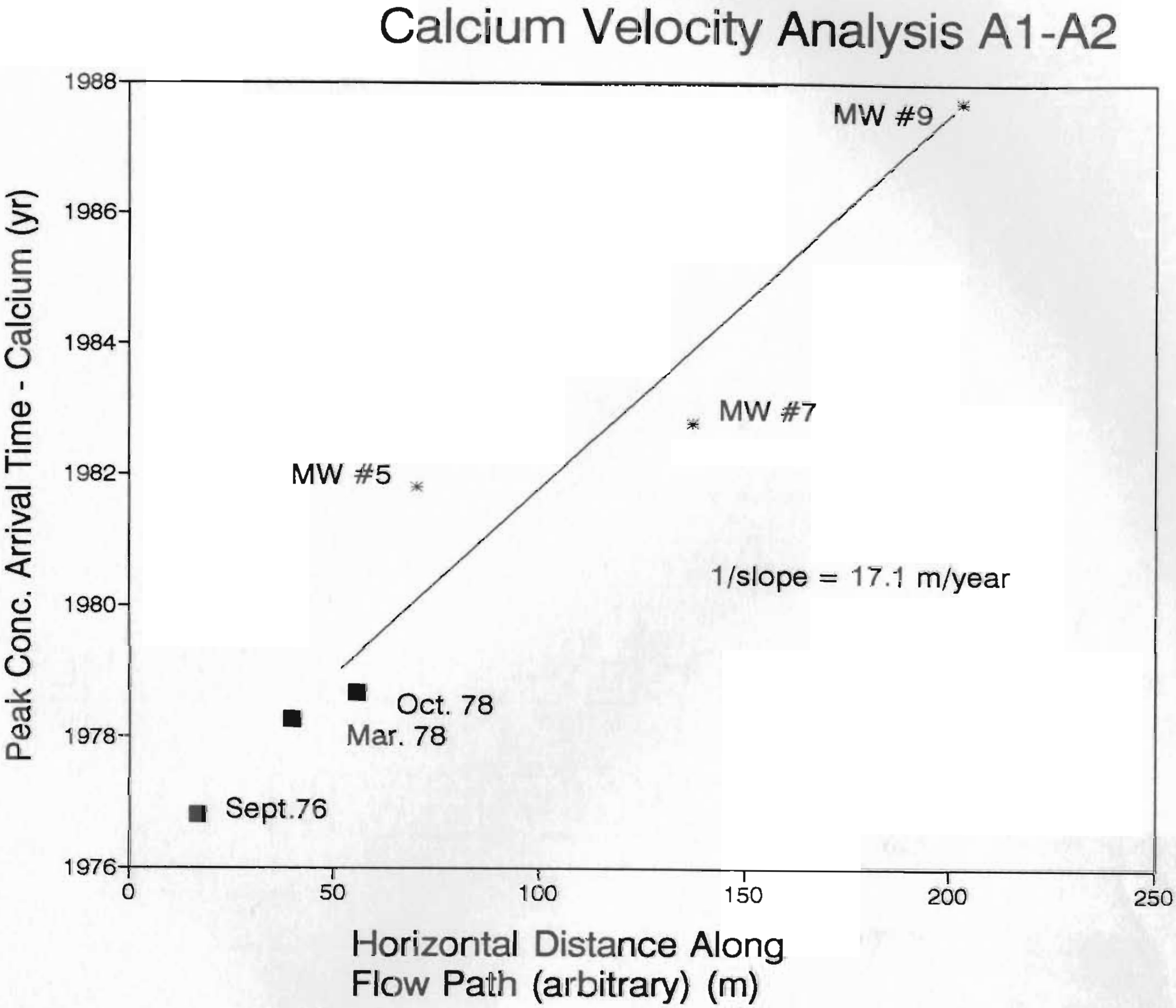
v_c = average velocity of solute front

We can obtain an average linear groundwater velocity using the chloride ion peak concentration velocity information from selected wells. The chloride ion is not very reactive, does not participate in redox reactions, is not sorbed onto mineral or organic surfaces, and does not form insoluble precipitates (Fetter, 1992). Therefore, its average peak concentration velocity will closely represent the true groundwater velocity. This is why the chloride ion is suitable as a conservative species to use in tracer tests. An estimate of the groundwater velocity can be calculated from the time of peak concentration arrivals of chloride of MW #5, #7, #9, and #10. These wells are in a straight line along cross section A1-A2 in the direction of groundwater flow and down stream of all the waste cells (see **Figure 3.3**). For most parameters tested, the contaminant front has not yet reached MW #10, however for chloride, it has peaked. This is related to the chloride ion's conservatism meaning that it reacts little with native soil and groundwater but moves through the sub surface at near the velocity of the groundwater. Therefore it should be th first chemical species to arrive at a well in advance of other non conservative species. A plot of peak concentration arrival times of chloride versus distance along the groundwater flow path for these four wells is shown in **Figure 6.5**. The three cells that provide the major leachate contribution or contaminant to these wells as seen in **Figure 3.3** are also plotted along with dates of cell start up. From the slope of the line drawn, the chloride ion velocity was found to be 19.5 m/yr. Plots of other species an be done similar to the one for chloride. A plot of calcium for three wells, **Figure 6.6**, shows that the calcium ion velocity was calculated to be 17.1 m/yr. A slower velocity is indicative of a more reactive ionic species. **Figures 6.7** and **6.8** are similar plots for geological-cross section B1-B2 (see **Figure 3.3**). The chloride and calcium ion velocities were averaged for the two lines on each graph and found to be 17.4 and 16.9 m/yr respectively. The chloride ion should be the faster travelling ion due to its retardation factor nearly equal to one. The closeness of the two waste cells started in 1978 and the earlier cell started in 1976 up gradient of the first two has provided for a merged leachate by the time the plume reached the first monitor well due to the time lag of the 1976 cell inception.



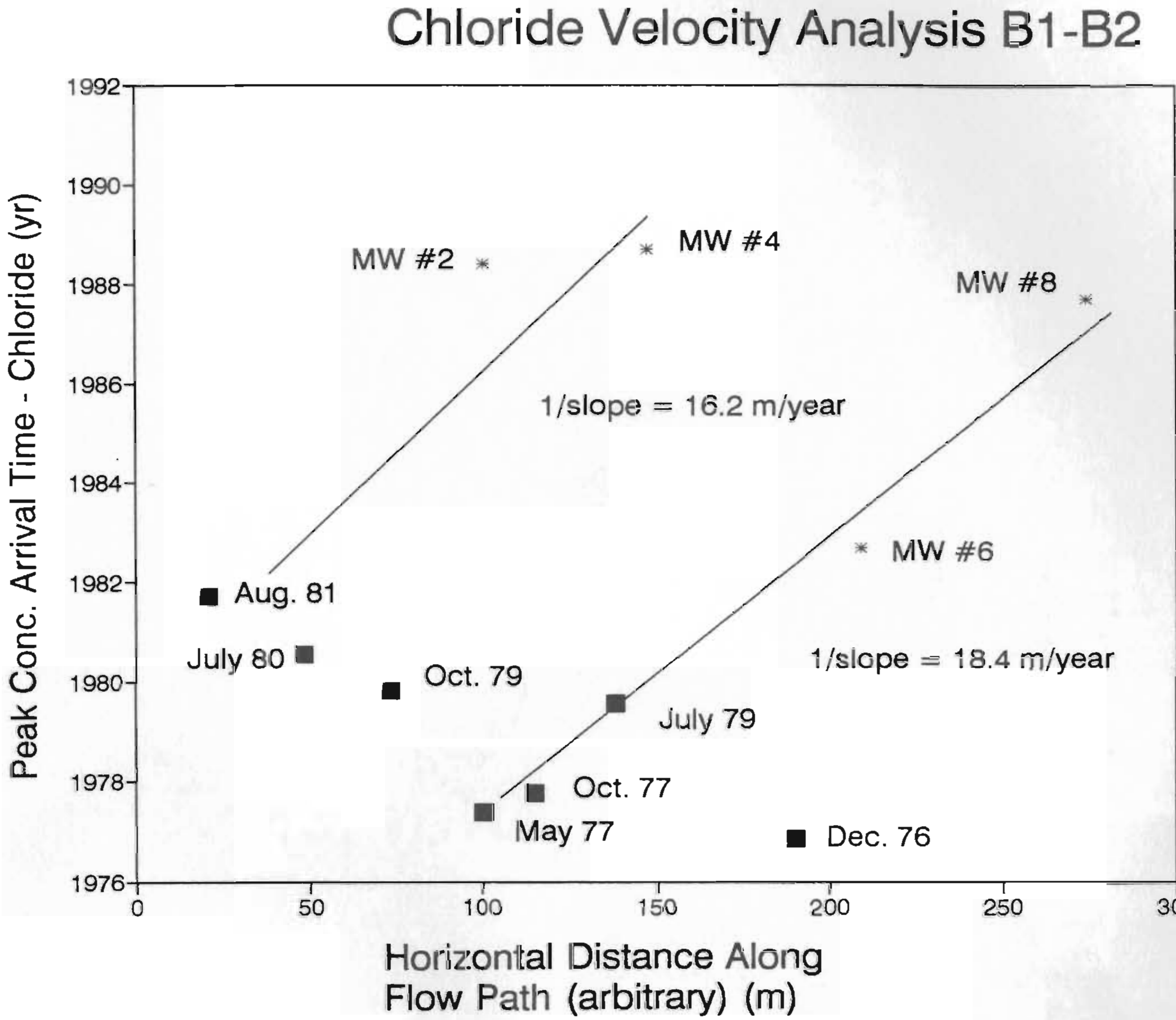
■ waste cell and start up time

Figure 6.5 Chloride velocity analysis using A1-A2 peak concentration arrival times for chloride.



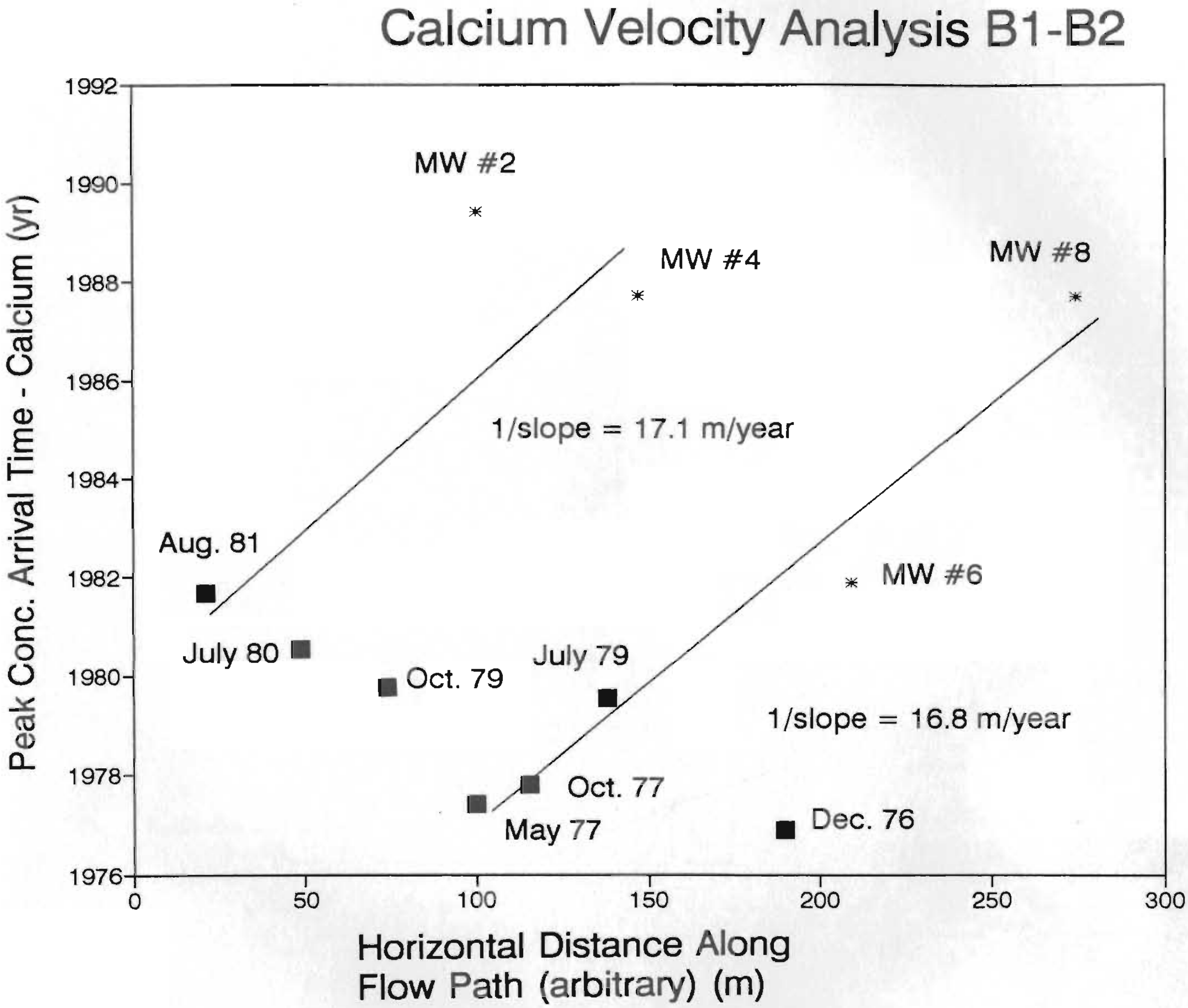
■ waste cell and start up time

Figure 6.6 Calcium velocity analysis using cross section A1-A2 peak concentration arrival times for calcium.



■ waste cell and start up time

Figure 6.7 Chloride velocity analysis using cross section B1-B2 peak concentration arrival times for chloride.



■ waste cell and start up time

Figure 6.8 Calcium velocity analysis using cross-section B1-B2 peak concentration arrival times for calcium.

6.4 Future Position of Contaminant Plume

Hydrogeological and geophysical data obtained during the study indicates that the underground contaminant plume is still within the confines of the waste disposal site area. There is slightly increased concentrations of constituents at the surface water sampling site, however, all parameters tested are within the Canadian drinking water guidelines (CCME, 1988). More information on surface water impairment can be found in section 6.5.

The future position of the plume can be estimated from continuing the line of **Figure 6.5** a distance equal to the distance to the Trans Canada Highway. This extrapolation assumes no significant changes in lithology, gradient, or additional in waste input into the system. Knowing that the Trans Canada Highway is about 275 m along the groundwater flow path from MW #10 and using regression analysis, the estimated date of the contaminant front arrival is the year 2002. **Figure 6.9** shows the graph of the results of regression analysis.

6.5 Surface Water Sampling Results

While this thesis deals primarily with the groundwater contamination of the Terra Nova waste disposal site, two surface water sites have been monitored since the landfills inception (**Figure 1.1**). Site #12 is located where surface drainage from the landfill

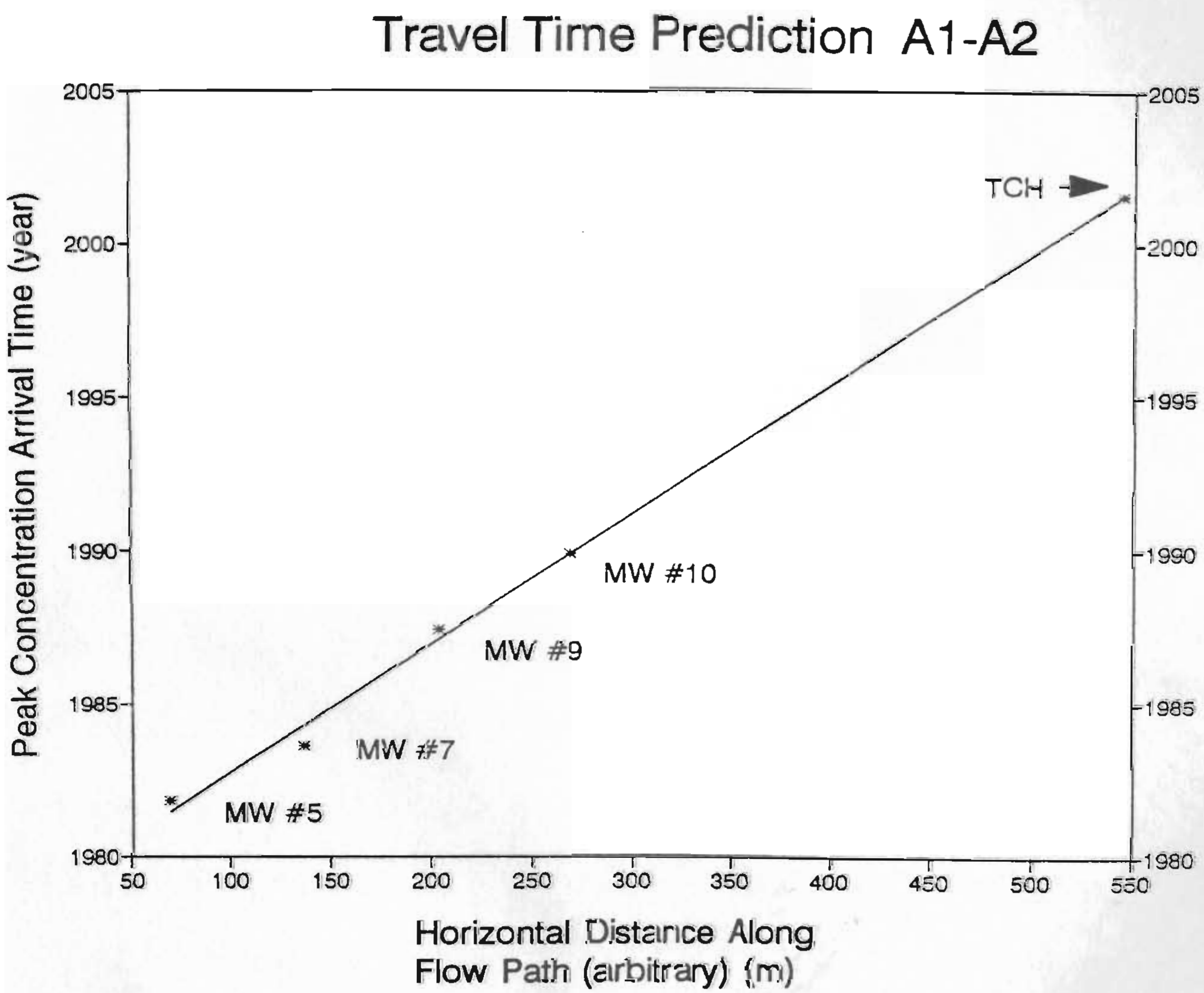


Figure 6.9 Prediction of contaminant plume arriving at Trans Canada Highway using chloride concentration peaks.

crosses the Trans Canada Highway via a culvert, while site #14 is a brook that is sampled as it runs into Pissamere Pond. Field surveys have found that the topographical map of **Figure 1.1** is incorrect since this brook actually drains a marsh area that receives surface drainage from the landfill and enters Pissamere Pond at the site #12 location. The concentration versus time plots of water sampling for site #12 and #14 are presented in **Appendix D**, page . Surface water sampling of site #12 over a 14 year time frame show a gradual increase in concentrations for alkalinity, calcium, chloride, magnesium, potassium and total dissolved solids. The concentration increases range from a seven fold increase of calcium (4 to 30 ppm) to a two fold increase for total dissolved solids (100 to 200 ppm).

Site #14 was also sampled over a 14 year period and showed a gradual increase then a gradual decrease in concentrations of a number of parameters (calcium, chloride, potassium, magnesium, sodium, and total dissolved solids) during the time period August/76 to October/94. Other chemical parameters such as lead and manganese had no perceived trend, while zinc and iron did not vary above background concentrations. Concentrations were over all lower than at site #12. As an example, calcium peaked at 30 ppm at site #12 in May 1990 while site #14 highest value was 11 ppm. This is in agreement with its location which is further away from the landfill and draining from a marsh which would attenuate the overall concentration of constituents in the water by biodegradation and oxidation-reduction reactions. The increases in concentration with time at site# 14 are not considered substantial. There were substantial concentration peaks (above CWQG) of iron and manganese at site #12 during the study period. Both had high peaks in 1981-82 showing a degradation of down-gradient surface waters most probably due to leachate runoff from the landfill. Ion concentrations of both sites are presently within the Canadian Water Quality Guidelines for drinking water. Iron concentrations above drinking water quality guidelines for site #12 were noted in background concentrations at the start of the study and until 1982 where they peaked, but have gone down substantially in recent years.

6.6 Geochemical Zonation

6.6.1 Discussion

It is important to discuss the concept of oxidation and reduction reactions at landfills and how they are controlled by the presence of organic material. Many inorganic chemical reactions are controlled largely by the presence of organic compounds (Fetter, 1992). For example, glucose, which is a sugar found in organic waste, decomposes in the presence of oxygen to carbon dioxide and water. The carbon dioxide in turn forms carbonic acid in the leachate. The presence of liquid and solid waste materials at a landfill creates decomposition processes that play an important part of a landfill's geochemical system. In the study of leachate plumes at landfills, a three part geochemical zonation based on the supply and depletion of available oxygen has been found to exist. The zones consist of an anaerobic zone that represents the landfill, a transition zone, where leachate is mixing with oxygenated water, and an oxidation or aerobic zone farther down stream, where there is abundant amounts of dissolved oxygen due to the dilution of the leachate with natural groundwaters (Fetter, 1992; Sudicky et al., 1983) **Figure 6.10** presents a schematic drawing of these zones. Geochemical zonation of organic matter in the groundwater down stream of a landfill is governed mainly by the amount of dissolved oxygen in groundwater as it comes in contact with waste material. The decay of organic material in groundwater is largely through biological activity (Baedecker and Back, 1979). Initially, decomposition occurs under aerobic conditions, however, once the oxygen is consumed, anaerobic decomposition is favoured. Anaerobic decomposition produces reduced gases such as methane. When reduced leachate, leachate that reaches the water table, the leachate becomes more oxidized from dissolved oxygen available in the groundwater. Baedecker and Back (1979), found that the ratio of Kjeldahl nitrogen to the nitrate cation (Kjl N/NO_3^-), was greatest in the anaerobic zone, where ammonia was present, decreased in the transition zone, and was very low in the aerobic zone, where the nitrogen was primarily in the form of nitrate.

6.6.2 Results

Figure 6.11 is a plot of the ratio of reduced nitrogen to nitrate (Kjl N/NO_3) versus time for MW #5 situated 15 m down stream along the groundwater flow path from a waste cell begun in Aug/78 and closed in July/79. Referring to **Figure 6.11,**

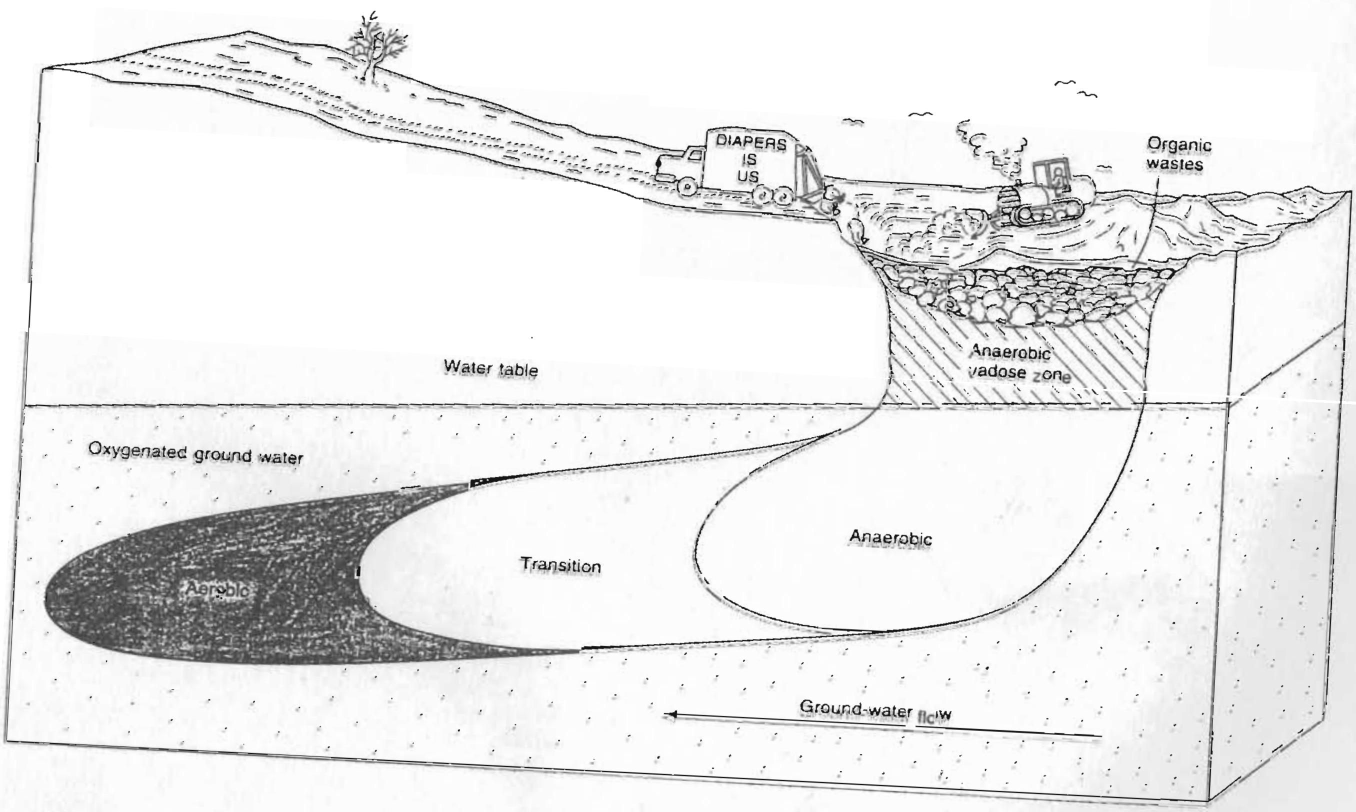


Figure 6.10 Geochemical zonation of the leachate plume from a landfill receiving organic material (Fetter, 1992).

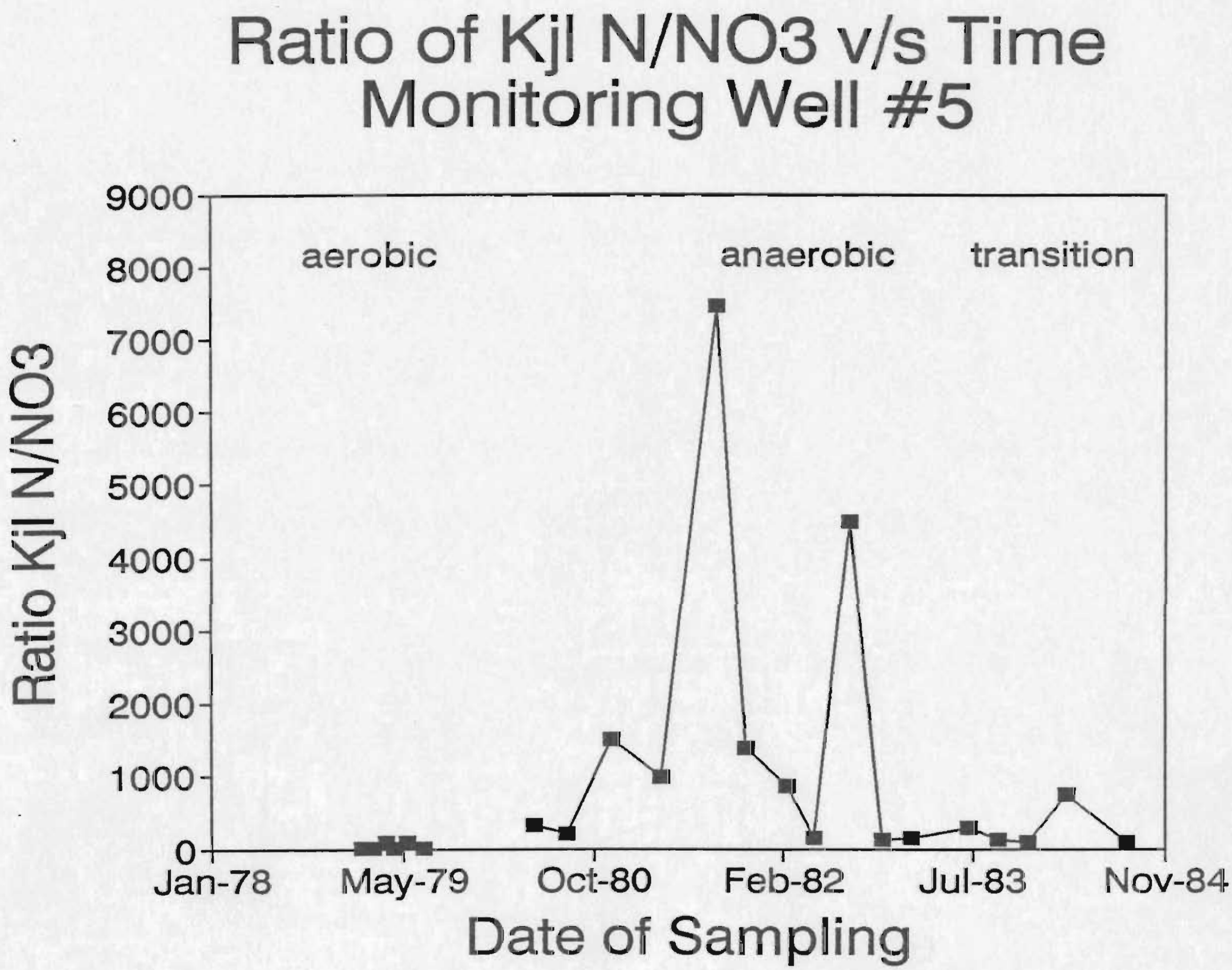


Figure 6.11 Geochemical zonation of MW #5.

initially, no leachate had reached the monitoring well and the ratio is quite low. However, by late 1980 the ratio had increased many fold indicating that MW #5 was then now in an anaerobic zone where ammonia was present and microorganisms were decomposing matter obtaining their oxygen from the reduction of sulphate and nitrate. Finally, a transition zone is seen from about late 1982. The transition zone occurs because the upstream cells have been closed since 1976 and 1978 respectively and leachate production is decreasing over time. Consequently, there is less demand for dissolved oxygen from natural groundwaters because of this decreasing leachate production. Similar geochemical zonation occurs at other monitoring wells.

It is difficult to use these results for a quantitative estimate of the advance of the contaminant plume. However these data could be useful for validating further numerical modeling of the site.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The leachate plume emanating from the Terra Nova Regional Waste Disposal site has been studied. Chemical sampling of monitoring wells over and down gradient of the waste cells along with geophysical surveys indicate the leachate plume has not yet reached the Trans Canada Highway, but has moved in the glacial till overburden along bedrock channels since the site's inception in 1977. A period of 4 to 5 years is a good estimate of the time it took for the major portion of material to have leached from the waste cells. However, a much smaller amount of leachate will still be generated from these cells for many years after closure. The landfill is presently receiving domestic garbage from the region's communities and future monitoring will be necessary.

Test pit logs, sieve analysis, and borehole logs, confirm that the stratigraphy is uniform over the study area and consists of glacial sand and gravel till. Permeability tests performed in the laboratory, and slug and tracer tests performed on site gave a resulting hydraulic conductivity value of between 10^{-4} and 10^{-5} cm/s for the till.

EM and VLF geophysical surveys show evidence of channelling in the bedrock where the leachate plume has preferentially flowed. Hammer seismic results were disappointing due to poor energy coupling.

Contaminant migration average velocities were calculated to be between 16 m/yr and 25 m/yr by plotting the chloride ion concentrations along the groundwater flow path. A linear extrapolation from the 17 year observation period indicates that by the year 2002 the edge of the contaminant plume will reach the Trans Canada Highway.

There has been some impairment to surface water quality down gradient of the landfill, and as expected, the farthest site from the landfill, a brook flowing into Pissamere Pond, shows only slightly elevated concentrations with respect to background concentrations. Surface sampling site #12 showed elevated iron and manganese during 1981-82 which greatly exceeded CWQG for drinking water. Recent sampling show that these chemical parameters are presently lower in water samples taken than the maximum acceptable concentration for drinking purposes.

7.2 Recommendations

Existence of leachate plumes around waste disposal sites in Newfoundland creates the risk of possible detrimental effects to down stream receptors due to leachate migration over time. It would be prudent to monitor more landfills in the province on a continuing basis as waste contaminant plumes cannot be observed.

The following recommendations specific to this site to further the scientific understanding of leachate migration are listed below;

1) It is recommended that computer modelling using commercially available flow and transport software be done to predict the movement of leachate. Calibration of the modelling process can be done using existing information.

2) Surface water quality sampling should continue on a yearly basis to report any significant changes in downstream water bodies. This precautionary measure is mandatory in some countries. MW #9 and #10 should be sampled until the highest concentration peak for other chemical constituents of the leachate plume have reached these wells.

3) Geophysical mapping of the contaminant plume using the EM-31 terrain conductivity instrument should be done every few years to see if this method can cheaply follow the leachate plume's movement. The results would also indicate the relative concentration of the plume.

4) Work should be done on predicting the leachate plume concentration at distances farther than the present monitoring well system. A question that needs to answered is "How far away do you need to be from this landfill for natural attenuation to remove all contaminants related to the landfill from the ground-water?

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APPENDIX A

Aerial and Test Pit Photographs

1964 Air Photograph of Waste Site Area

1976 Air Photograph of Waste Site Area

1988 Air Photograph of Waste Site Area

Photograph #1 - Test pit #1 showing non layering of glacial till overburden - Sept. 21, 1993

Photograph #2 - Test pit #2, close up showing soil characteristics

APPENDIX B

Evapotranspiration Model Results & Test Pit Soil Permeabilities

THORNTHWAITE'S POTENTIAL EVAPOTRANSPIRATION MODEL

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Lat.
Latitude Adjustment Factors												
0.81	0.80	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75	45.0
0.79	0.81	1.02	1.13	1.29	1.31	1.32	1.22	1.04	0.94	0.79	0.74	46.0
0.77	0.80	1.02	1.14	1.30	1.32	1.33	1.22	1.04	0.93	0.78	0.73	47.0
0.76	0.80	1.02	1.14	1.31	1.33	1.34	1.23	1.05	0.93	0.77	0.72	48.0
0.75	0.79	1.02	1.14	1.32	1.34	1.35	1.24	1.05	0.93	0.76	0.71	49.0
0.74	0.78	1.02	1.15	1.33	1.36	1.37	1.25	1.06	0.92	0.76	0.70	50.0

Latitude of Waste Site 48 degrees

Monthly Mean Temperatures in Degrees C. - Terra Nova National Park HQ 1962-1990

-5.9	-6.6	-2.7	1.8	6.8	12.0	16.3	15.9	11.9	6.5	1.7	-3.2

Intermediate Results

0.76	0.80	1.02	1.14	1.31	1.33	1.34	1.23	1.05	0.93	0.77	0.72
0.0	0.0	0.0	1.8	6.8	12.0	16.3	15.9	11.9	6.5	1.7	0.0
0.00	0.00	0.00	0.21	1.59	3.76	5.98	5.76	3.72	1.49	0.20	0.00

Parameter ISUM = 22.7

Parameter A = 0.868

Monthly Potential Evapotranspiration (cm)

0.0	0.0	0.0	1.5	5.4	9.0	11.9	10.6	7.1	3.7	1.0	0.0

Total (cm) = 50.2

Monthly Mean Precipitation(mm) - Terra Nova National Park HQ 1962-1990

102.7	105.4	103.8	90.0	93.0	84.5	81.1	97.9	98.1	108.8	111.5	107.7

Potential Amount Available for Recharge(mm)

102.7	105.4	103.8	75.1	38.7	-5.7	-37.4	-8.6	27.4	71.8	101.9	107.7

Latitude Ajustment Factors relate to the potential amount of sunlight available per month for a certain location on the earth

Input parameters are:
Monthly mean temperature of location
Latitude of location
Monthy mean precipitation of location

Parameters ISUM and A are used to calculate potential available evapotranspiration

PERMEABILITY DATA

Sample ID:	Test pit #1		Sample area A	58.09	cm2
Depth:	1.5	m	Tube area a	0.102	cm2
H	8.8	cm	Dry mass	1103	g
Diameter D	8.6	cm	Sample volum	551.2	cm3
diameter d	0.36	cm	Dry density	2.16	g/cm3

Constant Head Permeability

Q 0.01813 cm3/sec
h 140 cm

k=Q*H/(h*A) cm/s = **1.96E-05** cm/sec

Falling Head Permeablity

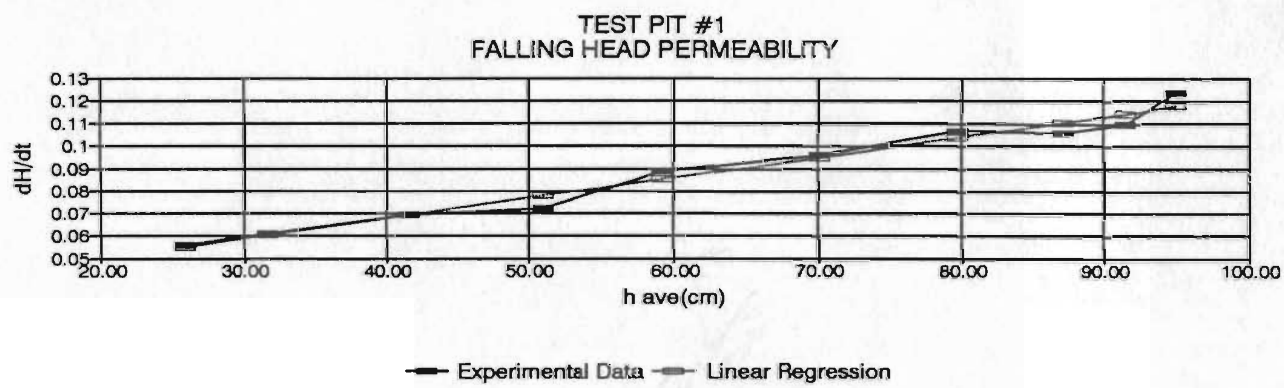
h (cm)	time (min)	time (sec)	dh/dt (cm/sec)	h ave(cm)	reg. dh/dt
96.8	0.00	0.00			
93.1	0.50	30.00	0.123	95.0	0.118
89.8	1.00	60.00	0.110	91.5	0.114
84.5	1.83	109.98	0.106	87.2	0.111
74.9	3.33	199.98	0.107	79.7	0.104
65.3	5.00	300.00	0.096	70.1	0.095
53.3	7.25	435.00	0.089	59.3	0.085
48.6	8.33	499.98	0.072	51.0	0.078
34.7	11.67	699.96	0.070	41.7	0.069
28.6	13.33	799.98	0.061	31.7	0.060
23.0	15.00	900.00	0.056	25.8	0.055

Regression Output:

Constant	0.031772343
Std Err of Y Est	0.003959955
R Squared	0.973882882
No. of Observations	10
Degrees of Freedom	8

X Coefficient(s) 0.00090406541
Std Err of Coef. 5.2343664E-05

slope 0.00090407
k=slope*(a*H)/A = **1.39E-05** cm/sec



PERMEABILITY DATA

Sample ID:	Test pit #2		Sample area A	58.09	cm2
Depth:	2.2	m	Tube area a	0.102	cm2
H	9.5	cm	Dry mass	1069.7	g
Diameter D	8.6	cm	Sample volume	551.84	cm3
diameter d	0.36	cm	Dry density	1.94	g/cm3

Constant Head Permeability

Q		0.04594	cm3/sec
h		140	cm

k=Q*H/(h*A) cm/s = **5.37E-05** cm/sec

Falling Head Permeability

h (cm)	time (min)	time (sec)	dh/dt (cm/sec)	h ave(cm)	reg. dh/dt
98.0	0.00	0.00			
92.1	0.50	30.00	0.197	95.1	0.194
86.5	1.00	60.00	0.187	89.3	0.185
79.5	1.67	100.02	0.175	83.0	0.175
64.0	3.33	199.98	0.155	71.8	0.158
50.8	5.00	300.00	0.132	57.4	0.135
39.1	6.67	400.02	0.117	45.0	0.116
29.4	8.33	499.98	0.097	34.3	0.099
20.6	10.00	600.00	0.088	25.0	0.084

Regression Output:

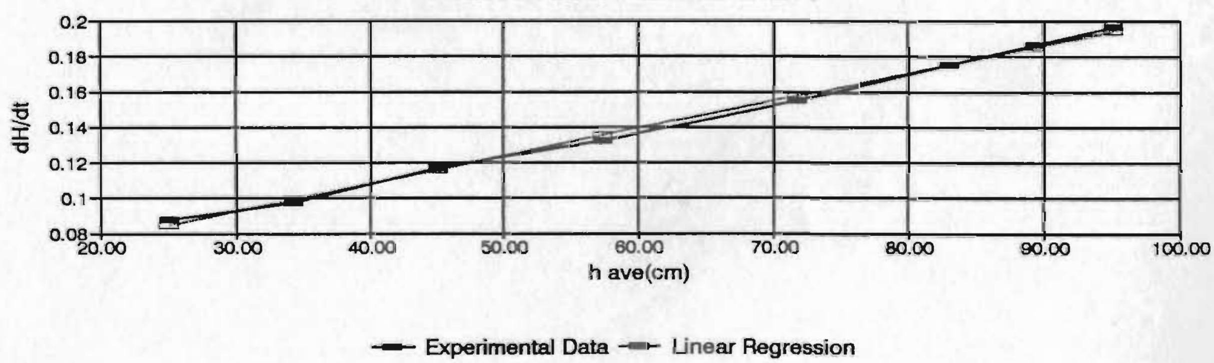
Constant	0.0453180514
Std Err of Y Est	0.0026933124
R Squared	0.9963387443
No. of Observations	8
Degrees of Freedom	6

X Coefficient(s)	0.0015672757
Std Err of Coef.	3.878656E-05

slope 0.00156728

k=slope*(a*H)/A = **2.61E-05** cm/sec

TEST PIT #2
FALLING HEAD PERMEABILITY



APPENDIX C

Geophysical Details and Results

Inversion Program For EM16R Data (after Miller)

rho1/rho2	= upper/lower layer resistivity;
rhoa	= apparent resistivity
frequency	= remote transmitter operating frequency;
phase	= phase angle by which the horizontal electric field(E_x) leads the vertical magnetic field(H_y)

```
C This program will invert EM 16R data

10    write(*,*)'Enter rho1,frequency'
      read(*,*)r1,f
      write(*,*)'Enter rhoa,phase'
      read(*,*)ra,ph
      if ((ra .gt. r1 .and. ph .gt. 45.0) .or.
     .   (ra .lt. r1 .and. ph .lt. 45.0)) then
        print *,'No two layer solution possible'
        goto 291
      endif
      q=sqrt(ra/r1)
      q1=(45.0-ph)*3.14159/180.0
      a1=q*cos(q1)-1.0
      a2=q*sin(q1)
      a3=sqrt(a1*a1 + a2*a2)
      a4=atan(a2/a1)
      if (ph .gt. 45.0) a4=a4 + 3.14159
      b1=q*cos(q1) + 1.0
      b2=q*sin(q1)
      b3=sqrt(b1*b1 + b2*b2)
      b4=atan(b2/b1)
      rl1=a3/b3
      rl2=a4-b4
      if(ph .lt. 45.0) then
        v1=-rl2
      else
        v1=-(rl2-3.14159)
      endif
      v2=exp(-v1)
      h = 79.758*abs(v1)*sqrt(10*r1/f)
      if(ph .lt. 45.0) then
        rl=rl1*v2
      else
        rl = -rl1*v2
      endif
      rl3 = (1.0+rl)/(1.0-rl)
      r2 = r1*rl3*rl3
      print *,' f = ',f
      print *,' r1 = ',r1
      print *,' r2 = ',r2
      print *,' h = ',h
291   print *,' Do you want another solution? 1=yes,0=no'
      read(*,*)II
      if(II .gt. 0) goto 10
310   end
```

Table C-1 Terra Nova Waste Site - EM16R Inversion Program Results and Bedrock Elevation Calculations

STATION	COORDINATES X (m)	Y (m)	ρ_1 interp. ohm-m	ρ_2 ohm-m	THICKNESS DEPTH Z(m)	TOPO ELEV. (m)	CALCULATED BEDROCK ELEV.(m)
AA-350	0	-107	151.1	24541	7.1	25.0	17.9
AA-400	0	-122	151.0	38865	5.1	24.8	19.7
AA-450	0	-137	151.0	37737	5.2	25.6	20.4
A-300	15	-91	151.8	19710	8.8	25.8	17.0
A-350	15	-107	151.3	27076	19.1	25.7	6.2
A-400	15	-122	151.0	20387	5.2	25.5	20.3
A-450	15	-137	150.9	20335	4.7	26.8	22.1
A-500	15	-152	150.9			27.1	
B-00	30	0	166.0	12477	3.2	26.2	23.0
B-50	30	-15	166.0	13572	3.1	25.8	22.7
B-110	30	-34	164.6	20152	3.2	25.5	22.3
B-150	30	-46	162.0	17017	4.5	24.5	20.0
B-200	30	-61	158.2	24187	5.0	25.1	20.1
B-250	30	-76	155.2	17158	5.4	24.8	19.4
B-300	30	-91	152.0	14610	9.7	24.0	14.3
B-350	30	-107	151.4	16923	4.2	24.4	20.2
B-400	30	-122	150.6	9696	5.0	25.1	20.1
B-450	30	-137	150.2	16913	4.2	25.1	20.9
C-00	46	0	166.0	14766	2.2	26.6	24.4
C-50	46	-15	166.0	25503	2.0	26.2	24.2
C-100	46	-30	165.3	25498	2.6	25.8	23.2
C-150	46	-46	163.6	8913	5.0	25.3	20.3
C-200	46	-61	160.5	1756	8.5	25.3	16.8
C-250	46	-76	156.9	19041	1.7	25.8	24.1
C-300	46	-91	153.4	25072	6.1	25.4	19.3
C-350	46	-107	150.7	14519	5.8	25.7	19.9
C-400	46	-122	149.0	12756	4.9	25.3	20.4
C-450	46	-137	148.2	7175	7.3	25.1	17.8
C-500	46	-152	148.0	4296	10.4	24.9	14.5
D-00	61	0	165.8	13784	2.1	27.2	25.1
D-50	61	-15	165.8	19769	2.1	26.8	24.7
D-100	61	-30	165.5	14311	2.7	26.5	23.8
D-150	61	-46	164.4	17472	2.7	26.1	23.4
D-200	61	-61	161.7	10714	4.9	26.1	21.2
D-250	61	-76	157.6	17607	6.0	25.9	19.9
D-300	61	-91	152.9	8551	5.3	26.1	20.8
D-350	61	-107	148.8	8667	6.4	26.1	19.7
D-400	61	-122	145.9	13089	6.8	25.8	19.0
D-450	61	-137	144.5	7109	8.2	25.4	17.2
D-500	61	-152	144.0	10183	4.4	25.4	21.0
E-00	76	0	164.9	15866	2.3	27.7	25.4
E-50	76	-15	164.9	26270	2.3	27.3	25.0
E-100	76	-30	164.7	10966	3.4	26.9	23.5
E-150	76	-46	163.6	8085	4.8	26.8	22.0
E-200	76	-61	161.0	10539	4.8	26.9	22.1
E-250	76	-76	156.5	9262	4.7	26.2	21.5
E-300	76	-91	150.7	9697	6.0	26.7	20.7
E-350	76	-107	145.2	10150	5.5	26.7	21.2
E-400	76	-122	141.2	8584	6.0	26.4	20.4
E-450	76	-137	139.1	8619	6.7	26.2	19.5
E-500	76	-152	138.3	22072	2.7	26.2	23.5
E-550	76	-168	138.2				
F-00	91	0	162.3	16048	1.9	28.3	26.4
F-50	91	-15	162.3	24462	1.7	28.0	26.3

Table C-1 Terra Nova Waste Site - EM16R Inversion Program Results and Bedrock Elevation Calculations

STATION	COORDINATES X (m)	Y (m)	ρ_1 interp. ohm-m	ρ_2 ohm-m	THICKNESS DEPTH Z(m)	TOPO ELEV. (m)	CALCULATED BEDROCK ELEV.(m)
F-100	91	-30	162.1	9491	4.3	27.6	23.3
F-150	91	-46	161.1	10904	4.0	27.3	23.3
F-200	91	-61	158.3	11963	4.5	27.1	22.6
F-250	91	-76	153.3	11933	4.3	26.6	22.3
F-300	91	-91	146.5	5200	7.1	27.3	20.2
F-350	91	-107	139.9	7145	6.0	27.7	21.7
F-400	91	-122	135.0	7176	5.1	27.4	22.3
F-450	91	-137	132.4	8491	5.6	26.8	21.2
F-500	91	-152	131.4	20871	2.9	27.1	24.2
G-00	107	0	157.5	22847	1.5	30.1	28.6
G-50	107	-15	157.5	31461	1.5	29.3	27.8
G-100	107	-30	157.3	9826	4.1	28.6	23.6
G-150	107	-46	156.2	17904	3.5	27.7	24.2
G-200	107	-61	153.2	132061	4.1	27.8	23.7
G-250	107	-76	147.6	10083	7.3	27.1	19.8
G-300	107	-91	140.1	4944	8.1	27.6	19.5
G-350	107	-107	132.7	5498	7.6	27.7	20.1
G-400	107	-122	127.2	3858	7.6	27.7	20.1
G-450	107	-137	124.2	6552	5.5	27.5	22.0
G-500	107	-152	123.1	13461	13.2		
H-00	122	0	150.1				
H-50	122	-15	150.3	5156	3.3		
H-100	122	-30	150.4	10124	2.7	29.7	27.0
H-150	122	-46	149.4	5625	6.9	30.5	23.6
H-200	122	-61	146.2	3341	8.0	28.7	20.7
H-250	122	-76	140.1	6351	7.5	28.2	20.7
H-300	122	-91	131.8	5720	6.6	28.6	22.0
H-350	122	-107	123.6	4817	6.1	29.1	23.0
H-400	122	-122	117.5	4274	5.8	29.0	23.2
H-450	122	-137	114.1	4662	5.4	28.5	23.1
H-500	122	-152	113.0				
I-00	137	0	141.3				
I-50	137	-15	142.0	11820	1.8	32.1	30.3
I-100	137	-30	142.6	8632	2.1	31.2	29.1
I-150	137	-46	141.8	4552	13.5	31.4	17.9
I-200	137	-61	138.4	3991	5.1	29.8	24.7
I-250	137	-76	131.6	3594	11.0	28.6	17.6
I-300	137	-91	122.4	3813	7.3	28.7	21.4
I-350	137	-107	113.2	5358	5.1	29.0	23.9
I-400	137	-122	106.4	5312	4.8	28.8	24.0
I-450	137	-137	102.7	4054	5.5	28.7	23.2
J-00	152	0	132.2				
J-50	152	-15	133.5	6948	2.4	31.7	29.3
J-100	152	-30	134.9	18363	1.6	32.5	30.9
J-150	152	-46	134.6	11158	3.2	32.2	29.0
J-200	152	-61	130.9	5296	5.5	30.8	25.3
J-250	152	-76	123.3	3939	6.3	30.2	23.9
J-300	152	-91	113.0	4436	5.2	30.1	24.9
J-350	152	-107	102.8	5226	5.2	29.7	24.5
J-400	152	-122	95.3	4034	5.7	29.3	23.6
J-450	152	-137	91.3	4670	4.8	29.3	24.5
J-500	152	-152	89.9	13664	1.9	29.4	27.5
K-00	168	0	125.0				
K-60	168	-18	126.5	16086	1.2	33.4	32.2

Table C-1 Terra Nova Waste Site - EM16R Inversion Program Results and Bedrock Elevation Calculations

STATION	COORDINATES X (m)	Y (m)	ρ_1 interp. ohm-m	ρ_2 ohm-m	THICKNESS DEPTH Z(m)	TOPO ELEV. (m)	CALCULATED BEDROCK ELEV.(m)
K-100	168	-30	128.2	12088	1.4	33.4	32.0
K-150	168	-46	127.9	2481	13.8	33.0	19.2
K-200	168	-61	123.8	2793	12.0	32.8	20.8
K-250	168	-76	115.3	2295	4.9	31.5	26.6
K-300	168	-91	103.9	4488	4.2	31.0	26.8
K-350	168	-107	92.9	4803	4.3	31.3	27.0
K-400	168	-122	84.9	3708	4.7	30.3	25.6
K-450	168	-137	80.9	4305	4.0	30.2	26.2
K-500	168	-152	79.5	10602	1.9	30.0	28.1
L-00	183	0	119.6				
L-75	183	-23	121.6	10737	1.2	34.4	33.2
L-100	183	-30	122.3	10157	1.1	34.1	33.0
L-150	183	-46	121.5	1310	11.3	33.8	22.5
L-200	183	-61	116.6				
L-250	183	-76	106.9	3165	4.0	33.7	28.6
L-300	183	-91	94.4	4189	4.9	32.6	26.8
L-350	183	-107	82.7	2568	5.3	31.7	26.3
L-400	183	-122	74.6	3428	4.2	31.6	27.6
L-450	183	-137	70.7	3400	4.0	31.8	27.7
L-500	183	-152	69.4	10923	1.6	31.7	29.3
L-550	183	-168	69.2				
M-00	198	0	114.8				
M-75	198	-23	115.8	14078	1.2	30.9	32.7
M-100	198	-30	116.2	6081	1.2	33.9	32.7
M-150	198	-46	114.6	4544	5.8	33.9	27.6
M-200	198	-61	108.6	7786	10.8	33.4	22.4
M-250	198	-76	97.8	3936	4.3	33.2	28.3
M-300	198	-91	84.2	3876	3.6	32.6	28.5
M-350	198	-107	72.0	3355	8.7	32.1	23.7
M-400	198	-122	63.8	1697	4.6	32.4	27.2
M-450	198	-137	59.9	3777	2.5	31.8	29.8
M-500	198	-152	58.7	3949	2.4	32.3	29.7
N-00	213	0	107.8			32.1	
N-60	213	-18	108.1	30217	0.6	33.1	32.5
N-100	213	-30	108.0	4243	2.3	34.6	32.3
N-150	213	-46	105.8	8085	5.7	34.3	28.6
N-200	213	-61	99.3	8443	17.0	33.6	16.6
N-250	213	-76	88.1	3384	3.8	33.7	29.9
N-300	213	-91	74.2	2810	2.9	32.9	30.0
N-350	213	-107	61.9	2007	7.6	33.1	25.5
N-400	213	-122	53.5			32.7	
N-450	213	-137	49.5			32.9	
N-500	213	-152	47.9				
0-00	229	0	96.7				
0-70	229	-21	96.8	4868	1.7	34.7	33.0
0-100	229	-30	96.4	3769	2.0	35.6	33.6
0-150	229	-46	94.2	3245	4.2	35.1	30.9
0-200	229	-61	88.3	3543	4.1	34.5	30.4
0-250	229	-76	78.5			34.3	34.3
0-300	229	-91	66.3	786	2.5	33.7	31.2
0-350	229	-107	55.1	1933	2.6	34.0	31.4
0-400	229	-122	47.2	5111	10.6	34.5	23.9
0-450	229	-137	42.6	5348	1.7	34.5	32.8
0-500	229	-152	40.3	21396	1.6	35.3	33.7

Table C-1 Terra Nova Waste Site - EM16R Inversion Program Results and Bedrock Elevation Calculations

STATION	COORDINATES X (m)	Y (m)	ρ_1 interp. ohm-m	ρ_2 ohm-m	THICKNESS DEPTH Z(m)	TOPO ELEV. (m)	CALCULATED BEDROCK ELEV.(m)
P-00	244	0	82.3				
P-75	244	-23	82.2	596	2.6	35.6	33.0
P-100	244	-30	81.7			35.3	
P-150	244	-46	80.2			35.2	
P-200	244	-61	76.3			34.9	
P-250	244	-76	69.8	46444	11.7	34.4	22.7
P-300	244	-91	61.4	4816	2.7	34.7	32.0
P-350	244	-107	53.1	43172	14.0	35.5	21.5
P-400	244	-122	46.3	1763	5.1	35.3	30.2
P-450	244	-137	41.3	1379	4.0	35.3	31.3
P-500	244	-152	37.6	3710	1.2	35.5	34.3
Q-00	259	0	67.7			36.6	
Q-75	259	-23	67.3	662	4.1	36.3	36.3
Q-100	259	-30	66.6	1317	7.9	36.8	28.9
Q-150	259	-46	65.9	805	9.9	36.2	26.3
Q-200	259	-61	64.5	916	9.6	35.9	26.3
Q-250	259	-76	62.3	1099	9.4	36.0	26.6
Q-300	259	-91	59.0			35.7	
Q-350	259	-107	55.1			36.2	
Q-400	259	-122	50.5			36.3	
Q-450	259	-137	45.4	4031	0.8	37.1	36.3
Q-500	259	-152	40.4	3933	1.0	36.7	35.7
Q-550	259	-168	37.2	9191		36.8	
R-0	274	0	56.2			37.2	
R-75	274	-23	55.3			36.7	
R-100	274	-30	54.2	1828			
R-150	274	-46	53.6	368			
R-200	274	-61	54.1		4.0	36.6	32.6
R-250	274	-76	55.6		2.0	36.1	34.1
R-300	274	-91	57.2			36.3	
R-350	274	-107	58.1			36.6	
R-400	274	-122	56.7			36.9	
R-450	274	-137	52.6	4552	2.4	37.2	34.8
R-500	274	-152	46.9	5646	1.7	37.6	35.9
R-550	274	-168	42.7	9617	1.3	37.7	36.4
S-0	290	0	48.7				
S-60	290	-18	47.2	1188	2.2	38.1	35.9
S-100	290	-30	45.2	3836	2.5	37.4	34.9
S-150	290	-46	44.3	4856	2.9	37.3	34.4
S-200	290	-61	45.5		3.0	37.0	34.0
S-250	290	-76	49.1			36.8	
S-300	290	-91	54.2	547	2.8	36.6	33.8
S-350	290	-107	59.3	1592	8.8	36.4	27.6
S-400	290	-122	61.7	1842	4.7	37.0	32.3
S-450	290	-137	60.3	3956	2.5	37.2	34.7
S-500	290	-152	55.8	28704	0.5	37.5	37.0
S-550	290	-168	51.8	85857	0.4	37.9	37.5
T-00	305	0	43.7				
T-75	305	-23	39.5	1758	1.9	39.0	37.1
T-100	305	-30	38.9	908	7.9	39.4	31.5
T-150	305	-46	37.5	3462	2.6	38.2	35.6
T-200	305	-61	38.5			38.0	
T-250	305	-76	42.6	361	9.4	37.4	28.0
T-300	305	-91	49.0	2681	1.7	38.0	36.3

Table C-1 Terra Nova Waste Site - EM16R Inversion Program Results and Bedrock Elevation Calculations

STATION	COORDINATES X (m)	Y (m)	ρ_1 interp. ohm-m	ρ_2 ohm-m	THICKNESS DEPTH Z(m)	TOPO ELEV. (m)	CALCULATED BEDROCK ELEV.(m)
T-350	305	-107	56.9	3765	2.4	38.0	35.6
T-400	305	-122	63.2			37.2	
T-450	305	-137	65.9	109272	0.5	37.7	37.2
T-500	305	-152	64.4	85907	0.6	38.0	37.4
T-550	305	-168	62.0	68690	0.7	39.2	38.5
U-00	320	0	39.7	3870	0.3	40.9	40.6
U-50	320	-15	37.4	1290	0.9	39.7	38.8
U-100	320	-30	34.4	2184	7.2	40.7	33.5
U-150	320	-46	32.7	1272	6.5	39.9	33.4
U-200	320	-61	33.1	793	5.2	39.8	34.6
U-250	320	-76	36.5	6226	0.9	38.3	37.4
U-300	320	-91	42.8	11853	1.0	37.9	36.9
U-350	320	-107	52.0	8811	1.6	38.6	37.0
U-400	320	-122	61.5			38.8	
U-450	320	-137	68.7			39.3	
U-500	320	-152	71.1			39.1	39.1
V-00	335	0	71.1	4491	0.5	41.7	41.2
V-50	335	-15	37.2	1586	0.4	41.2	40.8
V-100	335	-30	34.8	101	12.1	41.3	29.2
V-150	335	-46	31.8			40.3	
V-200	335	-61	30.0	444	2.0	40.1	38.1
V-250	335	-76	32.7			39.3	
V-300	335	-91	38.4			39.1	
V-350	335	-107	48.0			38.6	
V-400	335	-122	59.2			38.4	
V-450	335	-137	69.3			39.7	
V-500	335	-152	74.5				

Table C-2 Terra Nova Waste Site EM-16/16R Survey (freq. = 24000 hz)

	Coordinates		EM-16		EM-16	
STATION	X (m)	Y (m)	In Phase (%)	Quadrature (%)	Resistivity (ohm-m)	Phase Angle (deg.)
AA-350	0	-106.68	5	-2	1600	12
AA-400	0	-121.92	-2	-6	2900	12
AA-450	0	-137.16	-8	-6	2800	12
A-300	15.24	-91.44			1100	12
A-350	15.24	-106.68	-4	-6	300	14
A-400	15.24	-121.92	-4	-6	2400	15
A-450	15.24	-137.16	-10	-8	2800	16
A-500	15.24	-152.4	-14	-9		
B-00	30.48	0	28	4	4000	24
B-50	30.48	-15.24	28	4	4000	23
B-110	30.48	-33.528	30	4	5000	21
B-150	30.48	-45.72	29	3	3000	18
B-200	30.48	-60.96	24	2	2900	15
B-250	30.48	-76.2	21	0	2300	16
B-300	30.48	-91.44	7	-1	900	13
B-350	30.48	-106.68	-2	-4	3000	18
B-400	30.48	-121.92	-8	-2	1600	18
B-450	30.48	-137.16	-14	-7	3000	18
C-00	45.72	0	25	4	6000	27
C-50	45.72	-15.24	26	4	9000	25
C-100	45.72	-30.48	27	4	7000	22
C-150	45.72	-45.72	25	2	2100	21
C-200	45.72	-60.96	23	2	600	27
C-250	45.72	-76.2	18	0	2200	15
C-300	45.72	-91.44	5	-1	2100	13
C-350	45.72	-106.68	-1	-4	1900	16
C-400	45.72	-121.92	-5	-5	2200	18
C-450	45.72	-137.16	-9	-5	1100	18
C-500	45.72	-152.4	-15	-7	600	19
D-00	60.96	0	25	6	6000	28
D-50	60.96	-15.24	28	5	7500	26
D-100	60.96	-30.48	27	4	5000	25
D-150	60.96	-45.72	23	2	2700	17
D-200	60.96	-60.96	24	2	2300	20
D-250	60.96	-76.2	19	1	2000	15
D-300	60.96	-91.44	5	-3	1800	20
D-350	60.96	-106.68	-3	-2	1400	18
D-400	60.96	-121.92	-5	-4	1400	15
D-450	60.96	-137.16	-9	-4	900	17
D-500	60.96	-152.4	-18	-8	2200	20
E-00	76.2	0	23	6	6000	26
E-50	76.2	-15.24	27	5	10000	26
E-100	76.2	-30.48	26	4	3500	24
E-150	76.2	-45.72	22	3	2100	22
E-200	76.2	-60.96	19	1	2000	19
E-250	76.2	-76.2	17	2	2200	21
E-300	76.2	-91.44	2	-2	1600	18
E-350	76.2	-106.68	-2	-3	1700	18
E-400	76.2	-121.92	-17	-4	1400	18
E-450	76.2	-137.16	-16	-5	1200	17
E-500	76.2	-152.4	-22	-9	5000	20
E-550	76.2	-167.64	-17	-8		
F-00	91.44	0	22	5	7000	28
F-50	91.44	-15.24	25	6	10000	27
F-100	91.44	-30.48	27	5	2500	22
F-150	91.44	-45.72	21	2	2900	22
F-200	91.44	-60.96	17	2	2600	20
F-250	91.44	-76.2	5	-1	2600	20
F-300	91.44	-91.44	1	-2	1000	20

Table C-2 Terra Nova Waste Site EM-16/16R Survey (freq. = 24000 hz)

	Coordinates		EM-16		EM-16	
STATION	X (m)	Y (m)	In Phase (%)	Quadrature (%)	Resistivity (ohm-m)	Phase Angle (deg.)
AA-350	0	-106.68	5	-2	1600	12
F-350	91.44	-106.68	-5	-4	1300	19
F-400	91.44	-121.92	-10	-5	1500	20
F-450	91.44	-137.16	-18	-5	1400	18
F-500	91.44	-152.4	-30	-10	4250	19
G-00	106.68	0	20	5	10000	28
G-50	106.68	-15.24	25	8	12000	26
G-100	106.68	-30.48	24	5	2600	22
G-150	106.68	-45.72	23	4	4000	20
G-200	106.68	-60.96	19	1	2900	20
G-250	106.68	-76.2	15	0	1200	16
G-300	106.68	-91.44	-3	-3	800	19
G-350	106.68	-106.68	-9	-3	1100	20
G-400	106.68	-121.92	-11	-4	700	20
G-450	106.68	-137.16	-20	-6	1200	19
G-500	106.68	-152.4	-25	-8	3000	20
H-00	121.92	0				
H-50	121.92	-15.24	25	6	2200	28
H-100	121.92	-30.48	22	4	3800	26
H-150	121.92	-45.72	19	1	1100	20
H-200	121.92	-60.96	16	0	750	22
H-250	121.92	-76.2	-2	0	950	18
H-300	121.92	-91.44	-8	-4	1000	19
H-350	121.92	-106.68	-10	-2	950	20
H-400	121.92	-121.92	-13	-3	950	21
H-450	121.92	-137.16	-25	-7	800	19
H-500	121.92	-152.4				
I-00	137.16	0				
I-50	137.16	-15.24	25	8	5500	29
I-100	137.16	-30.48	30	8	4000	29
I-150	137.16	-45.72	23	4	400	18
I-200	137.16	-60.96	14	0	1200	24
I-250	137.16	-76.2	11	0	450	19
I-300	137.16	-91.44	-2	-1	700	20
I-350	137.16	-106.68	-6	-2	1100	20
I-400	137.16	-121.92	-13	-3	1100	20
I-450	137.16	-137.16	-25	-6	800	20
J-00	152.4	0				
J-50	152.4	-15.24	25	10	3000	28
J-100	152.4	-30.48	29	9	7500	27
J-150	152.4	-45.72	30	8	3000	22
J-200	152.4	-60.96	14	0	1200	21
J-250	152.4	-76.2	5	-1	850	21
J-300	152.4	-91.44	-2	-2	1000	21
J-350	152.4	-106.68	-6	-2	950	19
J-400	152.4	-121.92	-13	-3	700	19
J-450	152.4	-137.16	-25	-5	850	19
J-500	152.4	-152.4	-28	-12	3750	22
K-00	167.64	0				
K-60	167.64	-18.288	24	8	8000	30
K-100	167.64	-30.48	30	9	6000	30
K-150	167.64	-45.72	18	2	300	21
K-200	167.64	-60.96	12	-1	350	20
K-250	167.64	-76.2	-1	-2	800	26
K-300	167.64	-91.44	-5	-2	1150	22
K-350	167.64	-106.68	-7	-2	1000	20
K-400	167.64	-121.92	-18	-4	750	20
K-450	167.64	-137.16	-25	-6	900	20
K-500	167.64	-152.4	-27	-8	2900	22

Table C-2 Terra Nova Waste Site EM-16/16R Survey (freq. = 24000 hz)

	Coordinates		EM-16		EM-16	
STATION	X (m)	Y (m)	In Phase (%)	Quadrature (%)	Resistivity (ohm-m)	Phase Angle (deg.)
AA-350	0	-106.68	5	-2	1600	12
L-00	182.88	0				
L-75	182.88	-22.86	23	8	6000	32
L-100	182.88	-30.48	32	11	6000	33
L-150	182.88	-45.72	27	14	300	25
L-200	182.88	-60.96	-11	-6	100	22
L-250	182.88	-76.2	- 4	-3	1050	25
L-300	182.88	-91.44	- 4	-1	850	20
L-350	182.88	-106.68	- 7	-2	550	21
L-400	182.88	-121.92	-18	-5	700	20
L-450	182.88	-137.16	-25	-6	700	20
L-500	182.88	-152.4	-25	-8	3000	22
L-550	182.88	-167.64	-20	-5		
M-00	198.12	0				
M-75	198.12	-22.86	24	8	7000	30
M-100	198.12	-30.48	29	9	3000	30
M-150	198.12	-45.72	37	10	900	20
M-200	198.12	-60.96	-9	-7	400	14
M-250	198.12	-76.2	-2	-4	1000	22
M-300	198.12	-91.44	-2	-2	1000	22
M-350	198.12	-106.68	-1	-1	250	16
M-400	198.12	-121.92	-29	-8	400	22
M-450	198.12	-137.16	-29	-8	1000	22
M-500	198.12	-152.4	-23	-5	1050	22
N-00	213.36	0				
N-60	213.36	-18.288	23	8	16000	31
N-100	213.36	-30.48	25	8	1950	29
N-150	213.36	-45.72	26	8	1000	16
N-200	213.36	-60.96	3	-2	170	17
N-250	213.36	-76.2	-2	-4	950	23
N-300	213.36	-91.44	1	-1	950	25
N-350	213.36	-106.68	6	-1	220	18
N-400	213.36	-121.92	-55	-14		
N-450	213.36	-137.16	-40	-13		
N-500	213.36	-152.4				
0-00	228.6	0				
0-70	228.6	-21.336	22	7	2400	30
0-100	228.6	-30.48	20	3	1850	30
0-150	228.6	-45.72	13	1	900	23
0-200	228.6	-60.96	5	-2	900	22
0-250	228.6	-76.2	1	-3		
0-300	228.6	-91.44	2	-2	450	33
0-350	228.6	-106.68	2	3	650	25
0-400	228.6	-121.92	-13	2	95	15
0-450	228.6	-137.16	-33	-6	1200	20
0-500	228.6	-152.4	-28	-6	6500	23
P-00	243.84	0				
P-75	243.84	-22.86	32	11	400	36
P-100	243.84	-30.48	25	6	15	25
P-150	243.84	-45.72	2	-4	15	37
P-200	243.84	-60.96	0	-4	60	24
P-250	243.84	-76.2	1	-2	180	10
P-300	243.84	-91.44	3	-3	1050	20
P-350	243.84	-106.68	-6	-4	80	15
P-400	243.84	-121.92	-29	-8	240	18
P-450	243.84	-137.16	-31	-6	260	20
P-500	243.84	-152.4	-31	-8	1300	25
Q-00	259.08	0				
Q-75	259.08	-22.86	29	11	300	30

Table C-2 Terra Nova Waste Site EM-16/16R Survey (freq. = 24000 hz)

Coordinates			EM-16		EM-16	
STATION	X (m)	Y (m)	In Phase (%)	Quadrature (%)	Resistivity (ohm-m)	Phase Angle (deg.)
AA-350	0	-106.68	5	-2	1600	12
Q-100	259.08	-30.48	23	13	210	21
Q-150	259.08	-45.72	12	5	140	24
Q-200	259.08	-60.96	11	2	140	23
Q-250	259.08	-76.2	7	3	525	30
Q-300	259.08	-91.44	15	2	5	27
Q-350	259.08	-106.68	-33	4	10	18
Q-400	259.08	-121.92	-44	-3	55	30
Q-450	259.08	-137.16	-40	-10	2000	30
Q-500	259.08	-152.4	-33	-7	1600	27
Q-550	259.08	-167.64	-22	-2	1900	19
R-00	274.32	0				
R-75	274.32	-22.86	36	14	60	52
R-100	274.32	-30.48	25	6	15	36
R-150	274.32	-45.72	-2	-5	45	26
R-200	274.32	-60.96	-4	-2	400	21
R-250	274.32	-76.2	5	4	260	37
R-300	274.32	-91.44	20	9		
R-350	274.32	-106.68	0	11		
R-400	274.32	-121.92	-1	5		
R-450	274.32	-137.16	-38	-9	1000	20
R-500	274.32	-152.4	-29	-5	1400	21
R-550	274.32	-167.64	-19	-2	2200	20
S-00	289.56	0				
S-60	289.56	-18.288	26	11	500	28
S-100	289.56	-30.48	26	10	750	19
S-150	289.56	-45.72	9	6	650	16
S-200	289.56	-60.96	0	4		
S-250	289.56	-76.2	-8	1		
S-300	289.56	-91.44	-10	6	290	32
S-350	289.56	-106.68	-4	7	160	19
S-400	289.56	-121.92	-18	4	390	21
S-450	289.56	-137.16	-41	-9	1050	22
S-500	289.56	-152.4	-21	-2	11000	26
S-550	289.56	-167.64	-22	-4	22000	21
T-00	304.8	0				
T-75	304.8	-22.86	25	8	600	25
T-100	304.8	-30.48	17	4	90	20
T-150	304.8	-45.72	-10	-1	525	17
T-200	304.8	-60.96	-18	2		
T-250	304.8	-76.2	-20	4	70	27
T-300	304.8	-91.44	-24	0	1000	26
T-350	304.8	-106.68	-23	2	1000	22
T-400	304.8	-121.92	-31	-3	60	29
T-450	304.8	-137.16	-37	-8	28000	21
T-500	304.8	-152.4	-29	-5	22000	21
T-550	304.8	-167.64	-21	-3	16000	20
U-00	320.04	0	14	9	2800	37
U-50	320.04	-15.24	32	12	800	34
U-100	320.04	-30.48	11	3	95	15
U-150	320.04	-45.72	-26	-6	95	17
U-200	320.04	-60.96	-38	-6	120	20
U-250	320.04	-76.2	-30	-2	2200	25
U-300	320.04	-91.44	-23	-1	3000	21
U-350	320.04	-106.68	-36	-6	2000	20
U-400	320.04	-121.92	-46	-10		
U-450	320.04	-137.16	-38	-9		
U-500	320.04	-152.4	-31	-6		
V-00	335.28	0	15	8	3400	38

Table C-2 Terra Nova Waste Site EM-16/16R Survey (freq. = 24000 hz)

	Coordinates		EM-16		EM-16	
STATION	X (m)	Y (m)	In Phase (%)	Quadrature (%)	Resistivity (ohm-m)	Phase Angle (deg.)
AA-350	0	-106 68	5	-2	1600	12
V-50	335.28	-15.24	30	9	1200	38
V-100	335.28	-30.48	22	2	38	37
V-150	335.28	-45.72	-24	0		
V-200	335.28	-60.96	-43	-7	210	30
V-250	335.28	-76.2	-27	-2		
V-300	335.28	-91.44	-23	0		
V-350	335.28	-106.68	-35	-5		
V-400	335.28	-121.92				
V-450	335.28	-137.16				
V-500	335.28	-152.4	-42	-10		

Table C-3 Terra Nova Waste Site - Fraser Filter Data

STATION	X (m)	Y (m)	Y(midway) (m)	EM-16 in phase(%)	Fraser Filter (%)
AA-350	0.0	-106.7	-114.3	5	
AA-400	0.0	-121.9	-129.5	-2	
AA-450	0.0	-137.2	-114.3	-8	
A-300	15.2	-91.4	-99.1		
A-350	15.2	-106.7	-114.3	-4	
A-400	15.2	-121.9	-129.5	-4	16
A-450	15.2	-137.2	-144.8	-10	
A-500	15.2	-152.4	-76.2	-14	
B-00	30.5	0.0	-7.6	28	
B-50	30.5	-15.2	-24.4	28	3
B-110	30.5	-33.5	-39.6	30	5
B-150	30.5	-45.7	-53.3	29	14
B-200	30.5	-61.0	-68.6	24	25
B-250	30.5	-76.2	-83.8	21	40
B-300	30.5	-91.4	-99.1	7	38
B-350	30.5	-106.7	-114.3	-2	27
B-400	30.5	-121.9	-129.5	-8	
B-450	30.5	-137.2	-68.6	-14	
C-00	45.7	0.0	-7.6	25	
C-50	45.7	-15.2	-22.9	26	1
C-100	45.7	-30.5	-38.1	27	6
C-150	45.7	-45.7	-53.3	25	11
C-200	45.7	-61.0	-68.6	23	25
C-250	45.7	-76.2	-83.8	18	37
C-300	45.7	-91.4	-99.1	5	29
C-350	45.7	-106.7	-114.3	-1	18
C-400	45.7	-121.9	-129.5	-5	18
C-450	45.7	-137.2	-144.8	-9	
C-500	45.7	-152.4	-76.2	-15	
D-00	61.0	0.0	-7.6	25	
D-50	61.0	-15.2	-22.9	28	3
D-100	61.0	-30.5	-38.1	27	8
D-150	61.0	-45.7	-53.3	23	7
D-200	61.0	-61.0	-68.6	24	23
D-250	61.0	-76.2	-83.8	19	41
D-300	61.0	-91.4	-99.1	5	32
D-350	61.0	-106.7	-114.3	-3	16
D-400	61.0	-121.9	-129.5	-5	19
D-450	61.0	-137.2	-144.8	-9	18
D-500	61.0	-152.4	-76.2	-18	
E-00	76.2	0.0	-7.6	23	
E-50	76.2	-15.2	-22.9	27	2
E-100	76.2	-30.5	-38.1	26	12
E-150	76.2	-45.7	-53.3	22	12
E-200	76.2	-61.0	-68.6	19	22
E-250	76.2	-76.2	-83.8	17	36
E-300	76.2	-91.4	-99.1	2	38
E-350	76.2	-106.7	-114.3	-2	33
E-400	76.2	-121.9	-129.5	-17	19
E-450	76.2	-137.2	-144.8	-16	6
E-500	76.2	-152.4	-160.0	-22	
E-550	76.2	-167.6	-83.8	-17	
F-00	91.4	0.0	-7.6	22	
F-50	91.4	-15.2	-22.9	25	1
F-100	91.4	-30.5	-38.1	27	14
F-150	91.4	-45.7	-53.3	21	26

Table C-3 Terra Nova Waste Site - Fraser Filter Data

STATION	X (m)	Y (m)	Y(midway) (m)	EM-16 in phase(%)	Fraser Filter (%)
F-200	91.4	-61.0	-68.6	17	32
F-250	91.4	-76.2	-83.8	5	26
F-300	91.4	-91.4	-99.1	1	21
F-350	91.4	-106.7	-114.3	-5	24
F-400	91.4	-121.9	-129.5	-10	33
F-450	91.4	-137.2	-144.8	-18	
F-500	91.4	-152.4	-76.2	-30	
G-00	106.7	0.0	-7.6	20	
G-50	106.7	-15.2	-22.9	25	2
G-100	106.7	-30.5	-38.1	24	7
G-150	106.7	-45.7	-53.3	23	13
G-200	106.7	-61.0	-68.6	19	30
G-250	106.7	-76.2	-83.8	15	46
G-300	106.7	-91.4	-99.1	-3	32
G-350	106.7	-106.7	-114.3	-9	19
G-400	106.7	-121.9	-129.5	-11	25
G-450	106.7	-137.2	-144.8	-20	
G-500	106.7	-152.4	-76.2	-25	
H-00	121.9	0.0	-7.6		
H-50	121.9	-15.2	-22.9	25	
H-100	121.9	-30.5	-38.1	22	12
H-150	121.9	-45.7	-53.3	19	27
H-200	121.9	-61.0	-68.6	16	45
H-250	121.9	-76.2	-83.8	-2	32
H-300	121.9	-91.4	-99.1	-8	13
H-350	121.9	-106.7	-114.3	-10	20
H-400	121.9	-121.9	-129.5	-13	
H-450	121.9	-137.2	-144.8	-25	
H-500	121.9	-152.4	-76.2		
I-00	137.2	0.0	-7.6		
I-50	137.2	-15.2	-22.9	25	
I-100	137.2	-30.5	-38.1	30	18
I-150	137.2	-45.7	-53.3	23	28
I-200	137.2	-61.0	-68.6	14	28
I-250	137.2	-76.2	-83.8	11	33
I-300	137.2	-91.4	-99.1	-2	28
I-350	137.2	-106.7	-114.3	-6	30
I-400	137.2	-121.9	-129.5	-13	
I-450	137.2	-137.2	-68.6	-25	
J-00	152.4	0.0	-7.6		
J-50	152.4	-15.2	-22.9	25	
J-100	152.4	-30.5	-38.1	29	10
J-150	152.4	-45.7	-53.3	30	40
J-200	152.4	-61.0	-68.6	14	41
J-250	152.4	-76.2	-83.8	5	27
J-300	152.4	-91.4	-99.1	-2	22
J-350	152.4	-106.7	-114.3	-6	30
J-400	152.4	-121.9	-129.5	-13	34
J-450	152.4	-137.2	-144.8	-25	
J-500	152.4	-152.4	-76.2	-28	
K-00	167.6	0.0	-9.1		
K-60	167.6	-18.3	-24.4	24	
K-100	167.6	-30.5	-38.1	30	24
K-150	167.6	-45.7	-53.3	18	37
K-200	167.6	-61.0	-68.6	12	36
K-250	167.6	-76.2	-83.8	-1	23

Table C-3 Terra Nova Waste Site - Fraser Filter Data

STATION	X (m)	Y (m)	Y(midway) (m)	EM-16 in phase(%)	Fraser Filter (%)
K-300	167.6	-91.4	-99.1	-5	19
K-350	167.6	-106.7	-114.3	-7	31
K-400	167.6	-121.9	-129.5	-18	27
K-450	167.6	-137.2	-144.8	-25	
K-500	167.6	-152.4	-76.2	-27	
L-00	182.9	0.0	-11.4		
L-75	182.9	-22.9	-26.7	23	
L-100	182.9	-30.5	-38.1	32	39
L-150	182.9	-45.7	-53.3	27	74
L-200	182.9	-61.0	-68.6	-11	24
L-250	182.9	-76.2	-83.8	-4	4
L-300	182.9	-91.4	-99.1	-4	17
L-350	182.9	-106.7	-114.3	-7	32
L-400	182.9	-121.9	-129.5	-18	25
L-450	182.9	-137.2	-144.8	-25	2
L-500	182.9	-152.4	-160.0	-25	
L-550	182.9	-167.6	-83.8	-20	
M-00	198.1	0.0	-11.4		
M-75	198.1	-22.9	-26.7	24	
M-100	198.1	-30.5	-38.1	29	25
M-150	198.1	-45.7	-53.3	37	77
M-200	198.1	-61.0	-68.6	-9	32
M-250	198.1	-76.2	-83.8	-2	8
M-300	198.1	-91.4	-99.1	-2	26
M-350	198.1	-106.7	-114.3	-1	55
M-400	198.1	-121.9	-129.5	-29	22
M-450	198.1	-137.2	-144.8	-29	
M-500	198.1	-152.4	-76.2	-23	
N-00	213.4	0.0	-9.1		
N-60	213.4	-18.3	-24.4	23	
N-100	213.4	-30.5	-38.1	25	19
N-150	213.4	-45.7	-53.3	26	50
N-200	213.4	-61.0	-68.6	3	30
N-250	213.4	-76.2	-83.8	-2	6
N-300	213.4	-91.4	-99.1	1	48
N-350	213.4	-106.7	-114.3	6	88
N-400	213.4	-121.9	-129.5	-55	
N-450	213.4	-137.2	-144.8	-40	
N-500	213.4	-152.4	-76.2		
0-00	228.6	0.0	-10.7		
0-70	228.6	-21.3	-25.9	22	
0-100	228.6	-30.5	-38.1	20	24
0-150	228.6	-45.7	-53.3	13	27
0-200	228.6	-61.0	-68.6	5	15
0-250	228.6	-76.2	-83.8	1	2
0-300	228.6	-91.4	-99.1	2	14
0-350	228.6	-106.7	-114.3	2	50
0-400	228.6	-121.9	-129.5	-13	50
0-450	228.6	-137.2	-144.8	-33	
0-500	228.6	-152.4	-76.2	-28	
P-00	243.8	0.0	-11.4		
P-75	243.8	-22.9	-26.7	32	
P-100	243.8	-30.5	-38.1	25	55
P-150	243.8	-45.7	-53.3	2	26
P-200	243.8	-61.0	-68.6	0	2
P-250	243.8	-76.2	-83.8	1	4

Table C-3 Terra Nova Waste Site - Fraser Filter Data

STATION	X (m)	Y (m)	Y(midway) (m)	EM-16 in phase(%)	Fraser Filter (%)
P-300	243.8	-91.4	-99.1	3	39
P-350	243.8	-106.7	-114.3	-6	57
P-400	243.8	-121.9	-129.5	-29	27
P-450	243.8	-137.2	-144.8	-31	
P-500	243.8	-152.4	-76.2	-31	
Q-00	259.1	0.0	-11.4		
Q-75	259.1	-22.9	-26.7	29	
Q-100	259.1	-30.5	-38.1	23	29
Q-150	259.1	-45.7	-53.3	12	37
Q-200	259.1	-61.0	-68.6	11	1
Q-250	259.1	-76.2	-83.8	7	36
Q-300	259.1	-91.4	-99.1	15	55
Q-350	259.1	-106.7	-114.3	-33	66
Q-400	259.1	-121.9	-129.5	-44	4
Q-450	259.1	-137.2	-144.8	-40	29
Q-500	259.1	-152.4	-160.0	-33	
Q-550	259.1	-167.6	-83.8	-22	
R-00	274.3	0.0	-11.4		
R-75	274.3	-22.9	-26.7	36	
R-100	274.3	-30.5	-38.1	25	67
R-150	274.3	-45.7	-53.3	-2	22
R-200	274.3	-61.0	-68.6	-4	31
R-250	274.3	-76.2	-83.8	5	21
R-300	274.3	-91.4	-99.1	20	26
R-350	274.3	-106.7	-114.3	0	59
R-400	274.3	-121.9	-129.5	-1	66
R-450	274.3	-137.2	-144.8	-38	9
R-500	274.3	-152.4	-160.0	-29	
R-550	274.3	-167.6	-83.8	-19	
S-00	289.6	0.0	-9.1		
S-60	289.6	-18.3	-24.4	26	
S-100	289.6	-30.5	-38.1	26	41
S-150	289.6	-45.7	-53.3	9	42
S-200	289.6	-61.0	-68.6	0	27
S-250	289.6	-76.2	-83.8	-8	6
S-300	289.6	-91.4	-99.1	-10	4
S-350	289.6	-106.7	-114.3	-4	45
S-400	289.6	-121.9	-129.5	-18	40
S-450	289.6	-137.2	-144.8	-41	16
S-500	289.6	-152.4	-160.0	-21	
S-550	289.6	-167.6	-83.8	-22	
T-00	304.8	0.0	-11.4		
T-75	304.8	-22.9	-26.7	25	
T-100	304.8	-30.5	-38.1	17	14
T-150	304.8	-45.7	-53.3	-10	45
T-200	304.8	-61.0	-68.6	-18	16
T-250	304.8	-76.2	-83.8	-20	9
T-300	304.8	-91.4	-99.1	-24	10
T-350	304.8	-106.7	-114.3	-23	21
T-400	304.8	-121.9	-129.5	-31	12
T-450	304.8	-137.2	-144.8	-37	18
T-500	304.8	-152.4	-160.0	-29	
T-550	304.8	-167.6	-83.8	-21	
U-00	320.0	0.0	-7.6	14	
U-50	320.0	-15.2	-22.9	32	
U-100	320.0	-30.5	-38.1	11	61

Table C-3 Terra Nova Waste Site - Fraser Filter Data

STATION	X (m)	Y (m)	Y(midway) (m)	EM-16 in phase(%)	Fraser Filter (%)
U-150	320.0	-45.7	-53.3	-26	107
U-200	320.0	-61.0	-68.6	-38	53
U-250	320.0	-76.2	-83.8	-30	11
U-300	320.0	-91.4	-99.1	-23	9
U-350	320.0	-106.7	-114.3	-36	29
U-400	320.0	-121.9	-129.5	-46	25
U-450	320.0	-137.2	-144.8	-38	13
U-500	320.0	-152.4	-76.2	-31	
V-00	335.3	0.0	-7.6	15	
V-50	335.3	-15.2	-22.9	30	
V-100	335.3	-30.5	-38.1	22	47
V-150	335.3	-45.7	-53.3	-24	119
V-200	335.3	-61.0	-68.6	-43	68
V-250	335.3	-76.2	-83.8	-27	17
V-300	335.3	-91.4	-99.1	-23	12
V-350	335.3	-106.7	-114.3	-35	
V-400	335.3	-121.9	-129.5		
V-450	335.3	-137.2	-144.8		
V-500	335.3	-152.4		-42	

Table C-4 Terra Nova Waste Site EM-31 Survey

STATION	Coordinates		Orientation and Height Above Ground of Instrument (units - millimhos/m)					
	X (m)	Y (m)	hip 1.0m	hip (90 deg)	hhigh 2.0m	ground 0m	ground (side)	knee 0.5m
AA-350	0	-107	9.0	17.0				
AA-400	0	-122	1.1	1.3	1.1	1.4	1.4	1.4
AA-450	0	-137	0.9	0.9	0.7	1.3	1.3	1.3
A-300	15	-91	8.5	30.0				
A-350	15	-107	1.5	1.5	1.2	2.1	1.6	1.9
A-400	15	-122	0.9	1.0	0.9	1.5	14.0	0.9
A-450	15	-137	0.6	0.5	0.5	0.9	0.5	0.6
A-500	15	-152	0.5	0.5	0.6	0.5	0.5	0.5
B-00	30	0	0.5	0.6	0.7	0.6	1.3	0.6
B-50	30	-15	0.6	0.6	0.8	1.1	0.5	0.5
B-110	30	-34	0.7	1.0	0.8	1.9	0.1	1.9
B-150	30	-46	0.1	1.3	0.8	5.0	0.1	1.8
B-200	30	-61	2.2	2.2	1.3	3.2	0.7	2.9
B-250	30	-76	2.7	2.9	2.0	2.6	4.0	2.8
B-300	30	-91	1.3	1.3	1.0	1.6	1.4	1.6
B-350	30	-107	1.1	1.0	0.9	1.5	1.0	1.5
B-400	30	-122	1.2	1.2	0.5	1.7	1.3	1.5
B-450	30	-137	0.5	0.5	0.5	0.5	0.6	0.6
C-00	46	0	0.5	0.5	0.5	0.7	0.9	0.5
C-50	46	-15	0.7	0.7	0.7	0.9	1.2	0.9
C-100	46	-30	1.2	1.1	1.1	1.1	2.6	0.8
C-150	46	-46	1.1	1.2	1.1	1.7	1.4	1.3
C-200	46	-61	1.5	1.4	1.3	2.6	1.4	2.1
C-250	46	-76	1.6	1.7	1.4	2.5	1.8	2.2
C-300	46	-91	1.1	1.1	1.1	1.4	1.5	1.4
C-350	46	-107	1.2	1.2	1.1	1.7	1.4	1.5
C-400	46	-122	2.6	2.6	1.7	3.3	2.6	3.1
C-450	46	-137	3.0	3.1	2.4	2.9	5.5	3.0
C-500	46	-152	0.6	0.6	0.5	0.5	0.5	0.5
D-00	61	0	0.4	0.4	0.4	0.6	0.7	0.5
D-50	61	-15	0.9	0.9	0.7	1.0	1.1	1.0
D-100	61	-30	1.6	1.6	1.4	1.7	2.8	1.7
D-150	61	-46	1.6	1.6	1.3	1.6	2.7	1.7
D-200	61	-61	1.8	1.9	1.4	2.5	2.5	2.2
D-250	61	-76	1.5	1.5	1.3	1.8	1.9	1.6
D-300	61	-91	1.3	1.3	1.0	1.8	1.2	1.5
D-350	61	-107	1.6	1.3	1.2	2.0	1.3	1.7
D-400	61	-122	3.2	3.2	2.5	3.9	4.0	4.0
D-450	61	-137	1.3	1.5		1.3		
D-500	61	-152	0.4	0.4	0.4	0.6	0.7	0.5
E-00	76	0	0.4	0.4	0.5	0.7	0.6	0.4
E-50	76	-15	1.2	1.2	1.1	1.1	2.5	1.1
E-100	76	-30	1.9		1.5	1.8	3.1	1.9
E-150	76	-46	1.6	1.4	1.1	2.0	2.6	1.5
E-200	76	-61	1.5	1.7	1.3	2.1	2.0	1.9
E-250	76	-76	1.8	1.8	1.4	2.5	1.7	2.3
E-300	76	-91	1.3	1.3	1.2	1.7	1.4	1.6
E-350	76	-107	1.7	1.7	1.4	2.4	1.6	2.0
E-400	76	-122	2.9	2.9	2.1	2.9	3.9	3.0
E-450	76	-137	0.4	0.5	0.4	0.3	1.6	0.4
E-500	76	-152	0.1	0.1	0.3	0.2	0.3	0.2
E-550	76	-168	0.2	0.2	0.3		1.3	0.0
F-00	91	0	1.6	1.7	1.3	1.0	3.0	1.6
F-50	91	-15	1.6	1.5	1.3	1.7	2.6	1.6
F-100	91	-30	1.2	1.3	0.9	1.7	2.3	1.7
F-150	91	-46	1.7	1.8	1.1	2.9	2.3	2.4
F-200	91	-61	1.3	1.4	1.2	1.5	2.1	1.2
F-250	91	-76	1.8	1.8	1.5	2.1	1.3	2.0
F-300	91	-91	1.2	1.2	1.1	1.7	1.1	1.4

Table C-4 Terra Nova Waste Site EM-31 Survey

STATION	Coordinates X (m)	Coordinates Y (m)	hip 1.0m	hip (90 deg)	hhigh 2.0m	ground 0m	ground (side)	knee 0.5m
F-350	91	-107	2.7	2.8	2.0	2.7	3.1	2.9
F-400	91	-122	1.1	1.1	0.8	1.1	1.5	1.0
F-450	91	-137	0.2	0.2	0.3	0.4	0.2	0.4
F-500	91	-152	0.3	0.0	0.3	0.3	0.4	0.3
G-00	107	0	1.4	1.5	1.3	2.0	2.7	0.8
G-50	107	-15	1.5	1.4	1.4	1.3	2.0	1.3
G-100	107	-30	1.7	1.8	1.5	1.8	2.5	1.8
G-150	107	-46	2.8	2.8	2.1	3.2	3.2	3.1
G-200	107	-61	2.5	2.5	1.8	3.0	2.7	2.9
G-250	107	-76	1.4	1.2	1.2	1.7	1.7	1.7
G-300	107	-91	1.6	1.5	1.2	2.3	1.6	2.1
G-350	107	-107	3.2	3.2	2.4	3.5	4.9	3.4
G-400	107	-122	1.7	1.7	1.4	1.2	3.1	1.7
G-450	107	-137						
G-500	107	-152	0.5	1.4	1.2	0.7	1.9	0.7
H-00	122	0	3.5	3.5	2.4	8.2		1.5
H-50	122	-15			9.5			
H-100	122	-30	5.0	1.8	3.6	6.6	7.0	6.6
H-150	122	-46	4.0	4.0	2.7	5.0	4.5	4.5
H-200	122	-61	2.6	2.8	2.2	3.5	2.5	3.3
H-250	122	-76	1.9	1.9	1.5	2.0	1.8	2.1
H-300	122	-91	2.6	2.7	2.0	2.9	2.9	2.9
H-350	122	-107	3.6	3.8	2.4	4.1	5.0	4.4
H-400	122	-122						
H-450	122	-137	0.3	0.3	0.3	0.9	0.6	0.5
H-500	122	-152			0.5		1.3	
I-00	137	0						
I-50	137	-15	5.0	6.4	4.8			
I-100	137	-30	4.1	3.7	2.7	4.0	4.9	4.6
I-150	137	-46	2.4	2.4	1.9	3.5	3.0	2.7
I-200	137	-61	2.3	2.2	1.8	2.9	2.3	2.6
I-250	137	-76	3.5	3.5	2.8	4.5	5.0	3.9
I-300	137	-91	4.9	4.9	3.2	4.5	6.8	5.0
I-350	137	-107						
I-400	137	-122	0.1	0.2	0.8	1.3	1.3	1.3
I-450	137	-137	0.2	0.4	0.6			
J-00	152	0	1.5	1.6	1.6	6.0	0.8	2.4
J-50	152	-15	2.7	2.7	2.3	3.2	3.3	3.2
J-100	152	-30	2.4	2.4	1.9	3.5	3.0	2.7
J-150	152	-46	2.7	2.1	1.9	3.3	1.7	2.8
J-200	152	-61	2.8	2.6	2.1	3.0	3.1	2.8
J-250	152	-76	4.5	4.5	3.1	5.3	5.0	5.0
J-300	152	-91	3.9	4.0	3.1	4.5	8.0	2.9
J-350	152	-107	1.1	1.3	1.0	1.3	1.5	1.2
J-400	152	-122						
J-450	152	-137	0.3			2.7	0.0	2.7
J-500	152	-152	0.2	0.2	0.3	2.1		1.0
K-00	168	0						
K-60	168	-18						
K-100	168	-30	1.9	1.9	1.3	3.1	1.7	2.6
K-150	168	-46	1.6	1.9	1.5	1.7	2.3	1.5
K-200	168	-61	1.8	1.8	1.7	2.5	2.2	1.7
K-250	168	-76	2.3	2.1	1.3	3.0	2.5	2.1
K-300	168	-91	2.8		2.3	2.9	3.3	2.9
K-350	168	-107	1.0		0.8	1.3	1.4	1.3
K-400	168	-122						
K-450	168	-137	0.3	0.3	0.3	1.0	0.8	0.8
K-500	168	-152						
L-00	183	0	5.0	5.8	18.0			

Orientation and Height Above Ground of Instrument (units - millimhos/m)

Table C-4 Terra Nova Waste Site EM-31 Survey

STATION	Coordinates		Orientation and Height Above Ground of Instrument (units - millimhos/m)					
	X	Y	hip	hip	hhigh	ground	ground	knee
	(m)	(m)	1.0m	(90 deg)	2.0m	0m	(side)	0.5m
L-75	183	-23						
L-100	183	-30	2.3	2.4	1.8	4.8	3.3	3.3
L-150	183	-46	2.0	2.0	1.7	3.7	1.5	2.6
L-200	183	-61	2.7	2.8	2.4	5.8	6.0	0.7
L-250	183	-76	3.0	2.8	2.0	4.2	2.8	3.3
L-300	183	-91	1.3	1.3	1.5	2.8	2.3	1 2
L-350	183	-107	1.0	1.1	0.9	2.2	1.7	1.2
L-400	183	-122						
L-450	183	-137	0.2	0.1	0.1	0.8	0.6	0.2
L-500	183	-152	0.1	0.1	0.5		40.0	
L-550	183	-168						
M-00	198	0						
M-75	198	-23	2.3	2.5	1.7	4.3	2.2	3.3
M-100	198	-30	1.3	2.5	2.0	0.4	4.0	0.3
M-150	198	-46	1.3					
M-200	198	-61	4.9	4.9	3.8	5.2	6.3	5.2
M-250	198	-76	1.1	0.6	1.3	2.2	1.0	1.3
M-300	198	-91	0.4	0.5	0.5	1.2	1.0	0.6
M-350	198	-107						
M-400	198	-122	0.4	0.4	0.3	1.7	0.3	0.9
M-450	198	-137	0.4	0.2	0.4	2.0	0.5	1.0
M-500	198	-152	4.0	2.2	6.2	15.0		
N-00	213	0						
N-60	213	-18	1.5	1.5	2.0	0.4	3.5	0.3
N-100	213	-30	3.6	3.4	2.8	4.4	3.1	3.8
N-150	213	-46						
N-200	213	-61	0.6	1.1	0.8	3.2	1.2	2.2
N-250	213	-76	3.5	4.7	2.8	5	5	4.6
N-300	213	-91	1.3	4.2	2.7	9.5		3.4
N-350	213	-107	3.5	3.5	2.8	5.1	1.9	4.3
N-400	213	-122	4.4	4.2	3	5	5.2	4.7
N-450	213	-137	6.8	6.4	5	7.7	8.5	6.9
N-500	213	-152						
0-00	229	0	8.8	16	20			
0-70	229	-21	1.7					
0-100	229	-30	0.3	0.3	0.5		2.8	
0-150	229	-46						
0-200	229	-61	7.8	9.4	5	13	25	12
0-250	229	-76						
0-300	229	-91						
0-350	229	-107	25	22	24			
0-400	229	-122	13	12	7	17	13	20
0-450	229	-137	6.6	7.2	5.8	7.5	7.5	6
0-500	229	-152						
P-00	244	0						
P-75	244	-23						
P-100	244	-30						
P-150	244	-46	2.6	7.8	5			
P-200	244	-61	22	24	18			
P-250	244	-76	12	10	22			
P-300	244	-91	18	15	16			
P-350	244	-107						
P-400	244	-122	80	130	100			
P-450	244	-137	92	55	88	42	320	44
P-500	244	-152	32					
Q-00	259	0						
Q-75	259	-23						
Q-100	259	-30	0.1	0.1	0.2	0.5		0.2
Q-150	259	-46						

Table C-4 Terra Nova Waste Site EM-31 Survey

STATION	Coordinates		Orientation and Height Above Ground of Instrument (units - millimhos/m)					
	X (m)	Y (m)	hip 1.0m	hip (90 deg)	hhigh 2.0m	ground 0m	ground (side)	knee 0.5m
Q-200	259	-61	10	10	6.5	10	10	11
Q-250	259	-76						
Q-300	259	-91						
Q-350	259	-107	7.5	8	6	11	11	9
Q-400	259	-122	7.7	7.9	6.5	16	5	15
Q-450	259	-137						
Q-500	259	-152	65	65	46	48	110	63
Q-550	259	-168	170	165	110	160	230	195
R-0	274	0						
R-75	274	-23						
R-100	274	-30	0.1	0.1	0.2	0.4	0.2	0.2
R-150	274	-46						
R-200	274	-61	1.1	1.7	1.5			
R-250	274	-76						
R-300	274	-91	11	6	15			
R-350	274	-107	21	21	17	3.7	50	3.7
R-400	274	-122	8	4.9				
R-450	274	-137						
R-500	274	-152						
R-550	274	-168						
S-0	290	0						
S-60	290	-18	0.7	0.7	0.4	0.9	0.4	0.6
S-100	290	-30	0.1	0.1	0.3	0.7	0.3	0.1
S-150	290	-46						
S-200	290	-61	2.6	5	5.8			
S-250	290	-76						
S-300	290	-91	4.2	11	12	8	54	4
S-350	290	-107						
S-400	290	-122						
S-450	290	-137	3.8	5.7	4.3	6.9	21	13
S-500	290	-152						
S-550	290	-168						
T-00	305	0	4.5	0.7	3.0	7.2	4.3	6.3
T-75	305	-23	0.1	0.2	0.1	0.1	0.3	0.1
T-100	305	-30	0.1	0.2	0.1	0.1	0.3	0.1
T-150	305	-46	0.5	0.5	0.3	1.2	0.3	1
T-200	305	-61	2.3	2.3	2.1	3.0	1.1	2.4
T-250	305	-76	18.0	18.0	30.0			
T-300	305	-91						
T-350	305	-107	4.7	4.7	9.5			
T-400	305	-122	2.8	3.0				
T-450	305	-137	2.5			3.9	1.8	
T-500	305	-152	2.5			3.0	2	
T-550	305	-168	0.5			1.2	0.5	
U-00	320	0	0.1			0.1	0.1	
U-50	320	-15						
U-100	320	-30	0.4	0.6	0.6	1.3		0.5
U-150	320	-46	5.9	6.2	6.6	1.4		
U-200	320	-61						
U-250	320	-76						
U-300	320	-91						
U-350	320	-107	2.4	2.0			11	6
U-400	320	-122	3.3	3.4			4.1	3
U-450	320	-137	6.7				8.1	10
U-500	320	-152						
V-00	335	0						
V-50	335	-15						
V-100	335	-30						
V-150	335	-46						

Table C-4 Terra Nova Waste Site EM-31 Survey

STATION	Coordinates		Orientation and Height Above Ground of Instrument (units - millimhos/m)					
	X (m)	Y (m)	hip 1.0m	hip (90 deg)	hhigh 2.0m	ground 0m	ground (side)	knee 0.5m
V-200	335	-61						
V-250	335	-76						
V-300	335	-91						
V-350	335	-107						
V-400	335	-122						
V-450	335	-137						
V-500	335	-152						

APPENDIX D

Water Quality Results and Concentration versus Time Plots

TERRA NOVA LANDFILLL SITE - ANALYTICAL RESULTS - WELL No. 1

Date	Na	K	Ca	Mg	HARDNES	Alk.	CARBONA	BICARBONA	Cl	Fe	Mn	Cu	Zn	T.D.S.	T.S.S.	Cond.	pH	Al	B	Ba	Be	Cr	Co	Ni	Sb	Se	Sn	V	Pb
20-Jul-77	7.11	3.91	13.99	3.72	53.14	70.8				0.51	1.11	0.02	22.98				7.39					0.005		0.010					0.051
04-Aug-77	5.73	1.20	7.58			118.6				0.19	1.32	0.01	3.24				6.98					0.009		0.006					0.038
05-Sep-77	1.25	5.92	7.77			46.8			9	0.02	1.03	0.01	25.31	196			7.27					0.005		0.008					0.041
05-Oct-77	6.81	1.54	5.23			74.4				0.14	1.01	0.01	31.97				6.83					0.006		0.007					0.023
24-Oct-77	5.45	1.45	4.49	1.02		40.4			14.2	0.66	1.15	0.04	14.33	76	29		6.3					0.033		0.006					0.059
08-Nov-77	10.31	0.80	45.50	8.19		122			22.7	0.05	0.01	0.01	0.01	173	7		7.87					0.005		0.005					0.010
23-Nov-77	5.56	1.41	5.05	1.00		49.8			5.8	3.82	1.09	0.08	31.42	94	4							0.005		0.009					0.050
21-Dec-77		1.07				125				0.15	0.75		3.89				7.03							0.005					0.019
22-Feb-78		0.95				47				0.31	0.32		30.03											0.010					0.028
20-Mar-78		0.87				56.4				0.33	0.26		26.80											0.010					0.055
18-Apr-78		0.85				68				0.32	0.25		30.90											0.010					0.024
29-May-78		0.79				67.2				0.42	0.40		63.41				7.4							0.025					0.028
28-Jun-78		0.77				61.4				0.31	0.19		30.19				7.16							0.025					0.011
17-Aug-78		0.96				52.8				0.61	0.16		23.65				7.12							0.010					0.060
04-Oct-78		0.87				62.2				0.20	0.17		30.84				7.15							0.010					0.022
06-Dec-78		0.80				67.4				0.74	0.27		36.74				6.99							0.058					0.036
28-Dec-78		0.69				65.6				0.08	0.15		32.35				7.13							0.014					0.073
16-Jan-79		0.76				68				0.37	0.17		34.84				7.32							0.010					0.031
07-Feb-79	5.14	0.83	4.95	0.76		65.2			11	0.41	0.15	0.03	32.25	69	6		7.18					0.010	0.010	0.010					0.062
09-Apr-79			5.46	0.79	19.58	38.8			6	1.29	0.22	0.00	14.59			51.53	6.76												0.045
02-May-79			4.95	0.64	17.76	48.4			11	1.29	0.26	0.05	21.94	88		110.35	6.93												0.045
06-Jun-79			4.01	0.91	16.97	46.4			10	1.54	0.26	0.03	17.33			112.12	6.89												0.040
17-Jul-79	5.06	1.36	4.06	0.71	13.29	61.8			11	0.09	0.28		23.87			145.59	7.04												0.122
14-Aug-79	4.30	0.79	3.58	0.58	13.43	53			11	0.99	0.31	0.08	22.11	83		96.08	7.03												0.043
21-Nov-79	3.87	0.73	3.97	0.47	12.8	47.7			9	0.40	0.16	0.23	23.96	103		102.37	7.61												
29-Apr-80	6.60	1.38	4.56	0.42	16.6	54.5			8	1.70	0.24	0.05	26.25	104		129.28	7.02												
24-Jul-80	4.66	0.80	4.49	0.84	17.83	42.6			20	1.54	0.21	0.25	21.13	81		128.9	6.4												0.155
20-Nov-80	5.20	1.07	3.92	0.80	17.14	62			10	2.05	0.21	0.10	24.97	82		100	6.99												0.057
01-Apr-81	5.40	0.90	4.54	0.96	21.4	62.1			3.7	3.21	0.20	0.38	27.30	88		120	6.85												0.330
18-Aug-81	5.60	1.27	4.77	0.80	68.1	52			4.2	2.75	0.21	0.61	29.80	79		130	6.63												0.040
09-Nov-81	6.85	2.22	5.40	1.19	53.8	43			4	2.91	0.22	0.22	19.50	34		70	6.39												0.065
02-Mar-82	7.39	0.92	5.03	0.91	17.8	19			6	1.74	0.12	0.11	18.60	61		120	7.24												0.100
10-May-82	5.10	0.75	5.66	1.12	71.4	63			3.8	3.15	0.07	0.02	30.60	82		140	7.12												0.040
10-Aug-82	5.18	0.70	5.94	1.21	30	35			3.5	5.59	0.08	0.01	31.50	88		140	6.5					0.001		0.010					0.044
10-Nov-82	5.84	0.91	6.94	1.36	26.7	65			10.4	1.82	0.26	0.21	41.00	105			7.05												0.052
26-Jan-83	5.44	0.84	6.88	1.15	25.1	35.7			11.5	1.54	0.21	0.07	28.30	109			7.43												0.030
23-Jun-83	5.61	0.94	7.73	1.59		51.4			11.3	2.89	0.21	0.48	29.80	83			6.62												0.095
07-Sep-83	5.82	1.02	6.57	1.26		39			9.9	3.65	0.20	0.27	20.70	100		140	7.17												0.050
23-Nov-83	5.69	0.87	7.14	1.26		35.9			9.7	3.00	0.25	0.27	33.20	120		140	7.37												0.170
29-Feb-84	6.99	1.03	7.32	1.42		55.2			14.2	4.69	0.24	0.30	24.40	120		107	6.06												0.085
18-May-84	7.80	1.29	13.90	2.64		87.9			24	6.10	0.47	0.30	48.50	185		270	7.06												0.068
05-Aug-84	8.40	1.32	7.60	2.90		88.4			33	5.80	0.68	0.33	63.00	309		305													0.310
15-Feb-85	8.80	1.27	17.00	4.20		98.4			40	8.40	1.29	0.15	50.00	199		310	6.81												0.064
22-May-85	9.50	1.87	18.60	4.40					48	5.50	1.54		41.00	232															
06-Aug-85	12.00	1.38	25.00	5.20		121			59	4.50	2.80	0.30	74.00	559		420	6.46												0.085
13-Nov-85	16.00	2.30	39.00	8.70		124			80	7.30	8.00		64.00	340		560													
03-Mar-86	20.00	1.90	78.00	13.00		132			140	9.30	13.00		60.00	479		768													
06-May-86	19.00	2.30	59.00	14.00		169			157	8.60	15.00		64.00	609		758													
13-Aug-86	22.00	2.60	82.00	18.00		226			200	13.00	21.00		81.00	682		988	6.52												
11-Dec-86	25.40	3.30	116.00	26.00		233			270	17.50	22.20		103.00	973		1290													
23-Feb-87	26.50	2.89	127.00	24.30		260			341	15.80	19.70		81.80	889		1340													
04-May-87	22.60	0.80	160.48	31.73		261				0.43	23.79	0.02	29.01	765		1760		0.2	0.16	0.19	0.02	0.170	0.050	0.100		0.17	0.2	0.08	0.600
11-Aug-87	41.40	3.30	170.48	35.73		368			295	7.49	32.23	0.04	46.94	1295		1975	6	0.16	0.27	0.54	0.01	0.840	0.220	0.130		0.42	0.1	0.02	0.980
18-Nov-87	33.00	4.00	174.86	36.42	586.5	235	0.1	286.5	310	3.51	26.80	0.08	22.01	1145		2000	6	0.19	0.13	0.45	0.01	0.350	0.080	0.080		0.17	0.1	0.17	0.050
17-Feb-88	34.60	3.42	2.02	44.80	189	445	0.1	542	381	14.00	37.00	0.08	67.40	1330		2000	7.54	0.64	0.17	0.04	0.01	0.510	0.130	0.100		0.08	0.32	0.08	0.180
26-May-88	34.30	3.37	235.00	55.80		552			288	15.40	34.70	0.18	61.90	1350		2000		0.89	0.27	0.05	0.01	0.210	0.060	0.050		0.08	0.06	0.08	0.500
07-Aug-88	41.30	3.86	244.00	56.50	841.8	565	0	688.7	330	16.10	40.80	0.20	48.10	1290		1950	7	1.48	0.33	0.07	0.005	0.280	0.080	0.060		0.18	0.07	0.09	0.440
28-Nov-88	40.70	8.50	269.92	60.40		630			328	34.63	33.90	0.47	161.00	1930		1730	7.01	14.9	0.28	0.14	0.008	0.270	0.080	0.070		0.14	0.1	0.14	5.190
10-Mar-89	45.70	4.04	250.00	60.00	871	636	0	775.3	291	27.00	38.90	0.13	104.00	1470	793	1630	7.05	4.4	0.05	0.12	0.01	0.010	0.110	0.030	0.05	0.1	0.22	0.01	1.700
23-May-89	46.20	4.66	233.00	68.00	812.3	668	0	814.5	310	30.00	35.50	32.00	97.00	1430	2930	2250	8.46	10.5	0.16	0.249	0.043	0.030	0.340	0.080	0.06	0.1	0.08	0.04	3.500
07-Aug-89	59.80	4.66	216.00	51.00	749.3	609	0	742.4	302	1.30	37.00	0.01	40.00	1470		1560	7.18	0.13	0.02	0.038	0.005	0.010	0.030	0.010	0.05	0.1	0.08	0.01	0.010
13-Dec-89	63.60	8.22	196.00	46.00	678	454			288	19.00	33.00	0.03	40.00	1330	1450	1300	6.42	1.51	0.02	0.081	0.011	0.110	0.010	0.020	0.05	0.1	0.34	0.03	0.640
27-Mar-90	331.00	29.60	211.00	44.00	708	540			274	13.00	34.00	0.02	23.00	1400	2710	1100	6.71	1.08	0.02	0.04	0.005	0.010	0.010	0.020	0.05	0.1	0.2	0.01	0.290
01-Jun-90	76.00	4.10	200.00	18.00	573	590	0.14	590	280	25.00	35.00	0.02	58.00	1120	1200	1930	6.4	8.48	0.05	0.165	0.007	0.160	0.010	0.020	0.05	0.1	0.33	0.01	1.480
18-Jul-90	86.90	4.30	205.00	51.00	721	518	0.19	518	270	41.00	49.00	0.08	61.00	1300		1900	6.6	6.25	0.03	0.16	0.008	0.010	0.040	0.020	0.07	0.1	0.63	0.04	1.240
13-Nov-90	90.00	8.90	185.00	43.00	639	535			200	64.00	37.00	0.23	69.00	1220	3960	1380	6.4	7.1	0.37	0.5	0.05	0.022	0.018	0.041	0.001	0.005	0.01	0.15	1.650
17-Aug-92	190.00	10.00	147.00	35.00	511	500			227	70.00	55.00	0.32	88.00	136	2310	1470	6.15	65	0.67	0.5	0.05	0.005	0.005	0.020	0.001	0.005	0.01	0.1	2.300
13-May-94	190.00	7.50	81.00	22.00	293	472			195	37.00	27.00	0.09	41.00	1050	546	1480	6.75	5.4	0.3	0.5	0.05	0.005	0.005	0.005	0.005	0.005	0.01	0.06	0.730

TERRA NOVA LANDFILLL SITE - ANALYTICAL RESULTS - WELL No. 1

continued

Date	Cd	As	Mo	P	Si	Sr	Ti	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	SO4	T.O.C.	F	I	B.O.D.	C.O.D.	D.O.	COLOR	TURB.	Acidity	Li	Organic N
20-Jul-77	0.01	0.001									0.406			0.114	1.59											
04-Aug-77	0.01	0.001									0.579			0.058	6.1											
05-Sep-77	0.01	0.001									0.45			0.043	1											
05-Oct-77	0.01										0.583			0.081	5.6						1.74					
24-Oct-77	0.013										0.116			0.128	5.6					10.89	4.01					
08-Nov-77	0.006										0.005			0.079	9.2					8.78			1.65			
23-Nov-77	0.005										0.227			0.071	1.7					7.25						
21-Dec-77											0.216			0.053												
22-Feb-78											0.327			0.074												
20-Mar-78											0.049			0.062												
18-Apr-78											0.241			0.074												
29-May-78											0.181			0.064												
28-Jun-78											0.128			0.069												
17-Aug-78											0.005			0.079												
04-Oct-78											0.095			0.044												
06-Dec-78											0.052			0.194												
28-Dec-78											0.06			0.059												
16-Jan-79											0.083			0.058												
07-Feb-79	0.01		0.01						0.008		0.135			0.112						16					0.006001	
09-Apr-79								0.016	0.005	0.075	0.495				4				2	36						0.479
02-May-79								0.005	0.005	0.006	0.253								5	11						
06-Jun-79								0.005	0.005	0.01	0.575				5				2	21						
17-Jul-79									0.005		0.412				3					7						
14-Aug-79									0.034		0.199				2											
21-Nov-79											0.363				6.2											
29-Apr-80									0.016		0.866			0.135	6											
24-Jul-80									0.171		0.281				22											
20-Nov-80									0.005		0.005			0.009	2				4	42						
01-Apr-81									0.005		0.229			0.235	65				3	19						
18-Aug-81									0.105		0.69				2					9						
09-Nov-81									0.022		0.44				2				13	17						
02-Mar-82									0.036		0.21				1.7				8	12						
10-May-82									0.008		0.58				1.4					9						
10-Aug-82	0.0032	0.005							0.002		0.27			0.069	0.9		0.02		1	8						
10-Nov-82									0.002		0.174			0.063	0.9				1	5						
26-Jan-83									0.028		0.19			0.181	0.7				2	13						
23-Jun-83									0.067		0.46			0.099	0.9		0.021			28						
07-Sep-83									0.019		0.17			0.048	0.9		0.06			39						
23-Nov-83									0.06		0.1			0.081	1		0.05			10			170			
29-Feb-84									0.03		0.21			0.162	0.8		0.04			19			170			
18-May-84									0.002		0.4			0.056	0.81		0.05			24						
05-Aug-84									0.002		0.29			0.053	0.65		0.04		1	32						
15-Feb-85									0.006		0.73			0.193	0.7		0.05		7.3	57			170			
22-May-85																										
06-Aug-85									0.03		0.21			0.162	0.8		0.04			21			170			
13-Nov-85																				36						
03-Mar-86																				26						
06-May-86																				34						
13-Aug-86																				54						
11-Dec-86																				58						
23-Feb-87																				60						
04-May-87	0.08	0.21				0.8	0.2	0.05	0.05	0.05	0.1	0.1	0.05		0.1	0.1		0.1								
11-Aug-87	0.16	0.59		4.7		0.8	0.1													99						
18-Nov-87	0.06	0.1		1.8		0.8	0.3																			
17-Feb-88	0.005	0.16		2.3	13.2	0.77	0.1																			
26-May-88	0.05	0.2		2.42	10.7	0.8	0.1																			
07-Aug-88	0.062	0.265		2.89		0.86	0.12																			
28-Nov-88	0.64	0.029		5.87	28	0.93	1.03													125						
10-Mar-89	0.181																			118						
23-May-89	0.28	0.016																								
07-Aug-89	0.005	0.008																		106						
13-Dec-89	0.127																			106						
27-Mar-90	0.01																			118						
01-Jun-90	0.08																									
18-Jul-90	0.09																									
13-Nov-90	0.198	0.005																		540						
17-Aug-92	0.0005	0.005									0.15			0.04			0.05			87						

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 2

Yr	M	D	Date	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Ti
77	7	20	20-Jul-77			0.001				0.01	5.565	0.014	0.022	2.617	0.077		1.066	1.307	0.014	0.01		2.573			9.086			
77	8	4	04-Aug-77			0.001				0.01	4.442	0.01	0.031	1.835	0.069			1.154	0.01	0.01		1.576			6.494			
77	9	5	05-Sep-77			0.001				0.01	3.67	0.014	0.026	1.1	0.058			0.81	0.014	0.005		6.12			1.456			
77	10	5	05-Oct-77							0.01	2.41	0.009	0.018	0.508	0.042			0.56	0.009	0.005		1.379			6.04			
77	10	24	24-Oct-77							0.01	3.03	0.107	0.023	4.109	0.056		0.738	1.137	0.107	0.008		3.4			8.235			
77	11	8	08-Nov-77						0.005	0.005	35.03	0.005	0.005	0.023	0.01		9.341	0.01	0.005	0.005		0.953			10.046			
77	11	23	23-Nov-77							0.005	2.51	0.007	0.02	1.429	0.035		0.527	1.034	0.007	0.005		1.508			4.055			
77	12	21	21-Dec-77											0.457	0.042			1.191		0.005		1.76						
78	2	22	22-Feb-78											0.671	0.018			1.106		0.01		1.625						
78	3	20	20-Mar-78											0.297	0.014			1.081		0.01		2.099						
78	4	18	18-Apr-78											0.599	0.01			0.848		0.01		1.735						
78	5	29	29-May-78											0.422	0.103			0.486		0.025		1.942						
78	6	28	28-Jun-78											0.149	0.01			0.293		0.025		1.655						
78	8	17	17-Aug-78											0.878	0.019			0.158		0.01		1.287						
78	10	4	04-Oct-78											0.104	0.012			0.181		0.01		1.728						
78	12	6	06-Dec-78											0.272	0.01			0.039		0.039		1.652						
78	12	28	28-Dec-78											0.685	0.019			0.073		0.01		1.674						
79	1	16	16-Jan-79											0.391	0.058			0.083		0.01		1.61						
79	2	7	07-Feb-79							0.01	4.35	0.01	0.01	0.235	0.109	0.01	0.914	0.08	0.01	0.01		1.79			6.69			
79	3	7	07-Mar-79								5.34			5.436	0.055		1.39	0.865										
79	4	9	09-Apr-79								6.927		0.056	14.28	0.197		0.88	1.01										
79	5	2	02-May-79								3.69		0.043	5.47	0.035		0.543	0.68										
79	6	6	06-Jun-79								4.94		0.059	8.951	0.048		1.221	0.857										
79	7	17	17-Jul-79								3.94			4.476	0.066		0.831	0.706				2.322			5.82			
79	8	14	14-Aug-79								4.06						0.42											
79	11	21	21-Nov-79								3.53						0.732											
80	2	11	11-Feb-80								6.85						2.55											
80	4	29	29-Apr-80								5.28						0.56											
80	7	24	24-Jul-80								5.03						1.27											
80	11	20	20-Nov-80								4.99		0.11	7.87	0.059		1.53	0.48				2.4			5.9			
81	4	1	01-Apr-81								5.18		0.23	10.7	0.39		1.5	0.48				1.37			6.33			
81	8	18	18-Aug-81								5.59		0.52	11.1	0.04		1.24	0.53				1.54			6.8			
81	11	9	09-Nov-81								6.94		0.25	13.6	0.045		1.84	0.422				4			7.12			
82	3	2	02-Mar-82								6.01		0.11	11	0.13		1.23	0.36				1.24			9.08			
82	5	10	10-May-82								6.18		0.01	8.94	0.01		1.09	0.34				1.25			5.8			
82	8	10	10-Aug-82			0.005				0.0003	6.05	0.001	0.014	13.6	0.035		1.13	0.32	0.001	0.01		0.88			5.89			
82	11	10	10-Nov-82								8.18						1.74											
83	1	26	26-Jan-83								10.5						2.26											
83	6	23	23-Jun-83								22.6			16.4			4.07					1.85			10			
83	9	7	07-Sep-83								26.8			17.5			4.53					1.63			11.8			
83	11	23	23-Nov-83								38.7			19.3			6.12					1.78			13.6			
84	2	29	29-Feb-84																									
84	5	18	18-May-84								55.7		0.174	29	0.06		9.72	1.46				2.19			16.5			
84	8	5	05-Aug-84								26		0.28	38.9	0.09		11.6	1.58				2.3			23			
85	2	15	15-Feb-85								100		0.12	38	0.007		18	2.98				2.7			35			
85	5	22	22-May-85								103			24.9			15.5	3.4				3.7			25			
85	8	6	06-Aug-85								110			27			19	2.9				3.1			30			
85	11	13	13-Nov-85																									
86	3	3	03-Mar-86																									
86	5	6	06-May-86								150			40			28	7.9				4			43			
86	8	13	13-Aug-86								160			38			32	13				3.4			47			
86	12	11	11-Dec-86								215			56.7			37.2	24.3				3.85			57.1			
87	2	23	23-Feb-87								206			5.49			4.8	3.3				0.37			63.8			
87	5	4	04-May-87	0.12		0.22	0.23	0.01	0.12	0.01	259.7	0.24	0.03	0.27	0.44	0.03	44.24	36.46		0.04		2.4	0.23		33.2	1.2	0.2	0.1
87	8	11	11-Aug-87	1.81		0.05	1.2	0.01	1.5	0.01	898.36	0.01	0.16	1.13	0.05	0.02	208.51	174.09		0.01	11.6	4.4	0.25		86.2	4.8	0.1	0.1
87	11	18	18-Nov-87	0.29		0.07	0.47	0.01	0.1	0.02	317.67	0.45	0.12	2.13	0.05	0.08	57.62	30.74		0.03	0.7	5.9	0.11		103	1.5	0.1	0.5
88	2	17	17-Feb-88	0.87		0.01	0.12	0.01	0.11	0.005	319	0.71	0.07	127	0.03	0.11	58.4	78.2		0.08	1.25	4.72	0.04	16.8	103	1.47	0.33	0.1
88	5	26	26-May-88	1.15		0.06	0.15	0.01	0.18	0.005	322	0.24	0.14	140	0.02	0.08	61.4	74.6		0.04	1.32	4.64	0.05	14.8	96.5	1.46	0.06	0.1
88	8	7	07-Aug-88	1		0.22	0.16	0.005	0.18	0.01	339	0.31	0.17	136	0.09	0.08	62.6	83		0.05	1.36	5.1	0.1		107	1.6	0.06	0.07
88	11	28	28-Nov-88	3.17		0.009	0.12	0.004	0.26	0.004	355.58	0.34	0.16	74.03	0.17	0.09	64.7	69.3		0.06	2.96	6.01	0.07	17.4	116	1.66	0.03	0.2
89	3	10	10-Mar-89	2.4	0.05		0.09	0.01	0.01	0.005	368	0.02	0.02	162	0.06	0.91	75	78.7		0.01		5.88	0.1		121		0.21	
89	5	23	23-May-89	3.2	0.05	0.027	0.117	0.005	0.17	0.005	376	0.05	0.04	141	0.18	0.57	68	80		0.03		5.71	0.1		116		0.1	
89	8	7	07-Aug-89	0.13	0.05	0.007	0.031	0.005	0.02	0.005	328	0.01	0.005	2.9	0.01	0.07	70	66.9		0.01		6.08	0.1		131		0.06	
89	12	13	13-Dec-89	4.96	0.05		0.109	0.006	0.02	0.011	340	0.07	0.04	178	0.11	0.67	73	74		0.02		11.3	0.1		148		0.32	
90	3	27	27-Mar-90	0.05	0.05		0.02	0.005	0.02	0.01	295	0.01	0.01	2.64	0.05	0.02	59	65		0.02		34.5	0.1		506		0.19	
90	6	1	01-Jun-90	18.4	0.05		0.276	0.007	0.15	0.08	320	0.32	0.02	128	0.54	0.89	14	71		0.07		5.5	0.1		166		0.03	
90	7	18	18-Jul-90	6.93	0.05		0.135	0.005	0.04	0.01	315	0.01	0.01	141	0.05	1	68	92		0.02		5.5	0.1		168		0.1	
90	11	13	13-Nov-90	2.08	0.001	0.005	0.5	0.05	0.94	0.0032	310	0.005	0.07	99	0.021	0.046	57	59		0.046		5.9	0.005		150		0.01	
92	8	17	17-Aug-92	17	0.001	0.005	0.5	0.05	0.47	0.0005	200	0.005	0.05	89	0.13	0.005	46	34		0.022		7.6	0.005		200		0.01	
94	7	13	13-Jul-94	3.1	0.005	0.005	0.5	0.05	0.2	0.007	120	0.005	0.03	33	0.036	0.005	33	19		0.005		7.1	0.005		200		0.01	
94	10	5	05-Oct-94	3.9	0.005	0.005	0.5	0.05	0.3	0.0056	94	0.005	0.005	55	0.025	0.005	26	19		0.005		5.8	0.005		160		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 2

continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDNE	Cond.	TURB.	pH	Alk.	Acidity	Li
77	7	20	20-Jul-77		17.927				0.476			0.087			0.53										25.35			7.15	43.8		
77	8	4	04-Aug-77		3.166				0.602			0.132			5.4													7.13	92.6		
77	9	5	05-Sep-77		18.71				0.648			0.075			3.6		7						108					7.09	39.8		
77	10	5	05-Oct-77		13.27				0.309			0.083			6.6							3.71						7.11	25.8		
77	10	24	24-Oct-77		15.695				0.445			0.234			6		11.3				14.28	2.83	79	200				6.54	36.4		
77	11	8	08-Nov-77		0.01				0.023			0.076			12.8		19.8				11.82		156	1			1.9	7.84	110		
77	11	23	23-Nov-77		18.165				0.385			0.148			0.8		4.2				9.75		76	14					28.6		
77	12	21	21-Dec-77		3.525				0.555			0.15																7.09	69.4		
78	2	22	22-Feb-78		5.132				0.41			0.106																	27.8		
78	3	20	20-Mar-78		4.653				0.374			0.057																	28		
78	4	18	18-Apr-78		3.44				0.51			0.047																	25.4		
78	5	29	29-May-78		2.704				0.327			0.071																7.43	23.4		
78	6	28	28-Jun-78		1.72				0.288			0.151																7.25	22.6		
78	8	17	17-Aug-78		5.112				0.218			0.083																7.15	23.4		
78	10	4	04-Oct-78		2.441				0.32			0.101																7.44	20.4		
78	12	6	06-Dec-78		3.53				0.262			0.198																9.03	23.4		
78	12	28	28-Dec-78		6.72				0.317			0.072																7.29	25.6		
79	1	16	16-Jan-79		4.19				0.255			0.096																8.43	27		
79	2	7	07-Feb-79		3.546		0.127		0.312			0.067					12				21		31	5				7.3	28.4		0.005
79	3	7	07-Mar-79		19.01	0.092	0.254	0.007	0.526						1		35				18				30.37	96.56		7.25	46.2		
79	4	9	09-Apr-79		35.08	0.408	0.005	0.216	0.86						1		7			2	49				48.41	88.17		7.03	125.6		
79	5	2	02-May-79		23.66	0.006	0.005	0.008	0.272						2		8			20	27		76		21.79	147.68		7.35	46		
79	6	6	06-Jun-79		21.51	0.138	0.468	0.057	2.37								13			39	35				34.96	107.45		7.22	56		
79	7	17	17-Jul-79		20.74		0.005		0.691						6		11				17				22.57	115.73		7.2	54.4		
79	8	14	14-Aug-79														16						76		13.92	83.33					
79	11	21	21-Nov-79														8						88		11.83	115.15					
80	2	11	11-Feb-80														7						87		27.8	95.44					
80	4	29	29-Apr-80														9						101		15.49	109.89					
80	7	24	24-Jul-80														8						85		17.79	127.14		8.56			
80	11	20	20-Nov-80		20.1		0.005		0.018			0.021			1		13			11	27		74		33.74	120		7.12	57		
81	4	1	01-Apr-81		21.7		0.027		0.318			0.471			100		4.2			1	13		67		39.2	100		6.93	51.1		
81	8	18	18-Aug-81		27.5		0.04		0.86						2		5.8				25		73		82	120		6.7	52		
81	11	9	09-Nov-81		13.5		0.019		0.5						2		4.4			2	11		44		70.7	70		6.33	39		
82	3	2	02-Mar-82		13.4		0.166		0.24						1.2		4			2	24		55		40.4	80		7.22	33		
82	5	10	10-May-82		25.5		0.006		0.12						0.8		4				14		86		77.4	110		6.33	52		
82	8	10	10-Aug-82		18.2		0.002					0.083			0.6		6.5			1	12		77		44.7	100		6.42	48		
82	11	10	10-Nov-82														8.7						93		27.6						
83	1	26	26-Jan-83														16.8						100		35.5						
83	6	23	23-Jun-83		28.6		0.038								0.8		37	0.015					181					6.84	74		
83	9	7	07-Sep-83		23.1		0.002								0.5		48	0.05					216			330		7.41	64.8		
83	11	23	23-Nov-83		43.1		0.002								0.8		78	0.05					327			485		7.94	61.4		
84	2	29	29-Feb-84																												
84	5	18	18-May-84		58.2		0.002		0.45			0.14			1.2		118	0.022			20		547			665		6.95	143.2		
84	8	5	05-Aug-84		65		0.002		0.47			0.277			0.69		100	0.04		7	48		691			740			150.7		
85	2	15	15-Feb-85		68		0.002		0.78			0.278			1.8		190	0.05		9.9	111		650			1000		6.62	197		
85	5	22	22-May-85		62												192						728								
85	8	6	06-Aug-85		110												200				28		764			1100		6.56	244		
85	11	13	13-Nov-85																												
86	3	3	03-Mar-86																												
86	5	6	06-May-86		36												273				57		897			1430			264		
86	8	13	13-Aug-86		39												340				57		963			1440		6.6	344		
86	12	11	11-Dec-86		30												320				75		1207			1660			351		
87	2	23	23-Feb-87		8.01												342				58		1180			1890			335		
87	5	4	04-May-87	0.11	24.88	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1			0.1				1235			2250			446		
87	8	11	11-Aug-87	0.01	109.84												486				114		1770			2500		6.3	539		
87	11	18	18-Nov-87	0.29	15.12								0.1	530.3			422						2090		1030.4	2750		6.3	435		
88	2	17	17-Feb-88	0.11	20.7								0.1	904			493						1960		1040	2750		8.18	742		
88	5	26	26-May-88	0.07	19.7												532						1790			2500			738		
88	8	7	07-Aug-88	0.09	16.5									970.3			435						1680		1104.1	2000		6.45	796		
88	11	28	28-Nov-88	0.1	64.2												433				406		2360			300		6.82	930		
89	3	10	10-Mar-89	0.01	58								0	1230			398				420		2110	808	1230	2020		6.98	1010		
89	5	23	23-May-89	0.06	40								0	1294.1			410						2060	698	1218.8	3500		6.5	1060		
89	8	7	07-Aug-89	0.01	29								0	1090.8			415				549		2340		1107.1	2750		6.96	895		
89	12	13	13-Dec-89	0.03	39												426				638		2260	2730	1150	1650		6.73	739		
90	3	27	27-Mar-90	0.01	13												384				538		338	3230	979	1650		6.73	928		
90	6	1	01-Jun-90	0.08	46								0.36	960			400						1810	1580	856	3000		6.6	960		
90	7	18	18-Jul-90	0.01	25								0.44	936			370						1860		1070	3080		6.7	936		
90	11	13	13-Nov-90	0.11	27												260				280		1830	562	1010	2030		6.56	906		
92	8	17	17-Aug-92	0.1	20				0.11			0.03					266	0.06			135		1190	578	689	1750		6.41	668		
94	7	13	13-Jul-94	0.05	23				1.1			0.02					267	0.09					1150	510	436	1590		7.21	544		2
94	10	5	05-Oct-94	0.05	20				1.7			0.02					192	0.08			58		1300	84	342	1520		7.02	643		

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 3

Yr	M	D	Date	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Ti
77	7	20	20-Jul-77			0.001				0.01	7.43	0.018	0.033	5.147	0.049		1.502	4.931		0.015		1.494			6.89			
77	8	4	04-Aug-77			0.001				0.01	6.453	0.007	0.017	5.03	0.042			3.506		0.014		0.608			4.461			
77	9	5	05-Sep-77			0.001				0.01	6.04	0.009	0.037	2.63	0.052			2.303		0.005		3.876			0.524			
77	10	5	05-Oct-77							0.01	3.48	0.005	0.018	0.734	0.028			1.497		0.005		0.8			5.01			
77	10	24	24-Oct-77							0.01	37.41	0.005	0.079	28.315	0.079		6.535	12.025		0.009		2.861			25.8			
77	11	8	08-Nov-77							0.005	60.56	0.005	0.005	0.038	0.01		7.901	0.008		0.008		0.942			9.875			
77	11	23	23-Nov-77							0.005	8.55	0.005	0.039	5.675	0.04		1.943	4.98		0.005		0.704			6.025			
77	12	21	21-Dec-77											2.211	0.01			1.603		0.005		0.376						
78	2	22	22-Feb-78											1.995	0.013			1.435		0.01		1.607						
78	3	20	20-Mar-78											0.495	0.01			0.926		0.01		0.401						
78	4	18	18-Apr-78											1.03	0.033			0.973		0.01		0.443						
78	5	29	29-May-78											21.766	0.016			9.296		0.025		5.177						
78	6	28	28-Jun-78											9.712	0.01			3.951		0.025		1.425						
78	8	17	17-Aug-78											7.464	0.019			1.931		0.011		0.992						
78	10	4	04-Oct-78											3.508	0.02			2.124		0.01		0.849						
78	12	6	06-Dec-78											0.247	0.016			1.161		0.041		0.731						
78	12	28	28-Dec-78											5.42	0.039			1.239		0.01		0.67						
79	1	16	16-Jan-79											2.805	0.027			0.862		0.01		0.5						
79	2	7	07-Feb-79							0.01	4.1	0.01	0.032	2.979	0.065	0.01	0.664	0.865	0.01	0.01		0.56			4.28			
79	3	7	07-Mar-79								7.67			9.224	0.177		2.274	0.98										
79	4	9	09-Apr-79								5.773		0.044	6.685	0.307		0.72	0.706										
79	5	2	02-May-79								5.16		0.086	4.58	0.058		0.549	0.592										
79	6	6	06-Jun-79								7.31		0.017	9.41	0.029		2.336	2.13										
79	7	17	17-Jul-79								5.78			6.197	0.085		1.125	1.875				1.687			4.96			
79	8	14	14-Aug-79								6.19			NA	NA		1.211											
79	11	21	21-Nov-79								4.42			NA	NA		0.714											
80	2	11	11-Feb-80								6.85			NA	NA		2.55											
80	4	29	29-Apr-80								4.01			NA	NA		0.62											
80	7	24	24-Jul-80								4.51			NA	NA		1.17											
80	11	20	20-Nov-80								3.61		0.06	6.96	0.023		1.54	1.69				2.39			4.8			
81	4	1	01-Apr-81								4.23		0.46	9.64	0.31		1.32	1.76				1.17			4.85			
81	8	18	18-Aug-81								5.78		3.06	10.2	0.46		1.16	2.12				0.86			5.73			
81	11	9	09-Nov-81								5.84		0.25	8.76	0.065		1.37	2.13				1.59			8.4			
82	3	2	02-Mar-82								11.6		0.04	16.1	0.19		1.36	2.23				2.2			9.08			
82	5	10	10-May-82								6.26		0.01	10.9	0.01		1.24	2.15				0.56			4.7			
82	8	10	10-Aug-82			0.005				0.01	6.97	0.01	0.05	18.3	0.185		3.4	2.12		0.01		2.96			5.12			
82	11	10	10-Nov-82								5.57						1.53											
83	1	26	26-Jan-83								4.92						1.44											
83	6	23	23-Jun-83								6.04			8.99			1.63					1.36			5.02			
83	9	7	07-Sep-83								5.16			11			0.92					1.24			4.64			
83	11	23	23-Nov-83								4.66			11			1.33					0.88			4.65			
84	5	18	18-May-84								5.5			10.5			1.19					1.08			5.35			
84	8	5	05-Aug-84								2.6			9.6	0.01		1.33					0.57			5.4			
85	5	22	22-May-85								2.9			4.6			1.47	2.23							5.7			
85	8	6	06-Aug-85								4.9			11			1.19	1.86				0.74			4.91			
85	11	13	13-Nov-85								5.8			8			1.44	1.66							7			
86	5	6	06-May-86								5.4			10	0.08		1.5	2.1							5.5			
86	8	13	13-Aug-86								5.3			7.5			1.6	2.3				1.14			6.3			
86	12	11	11-Dec-86								8.6			15.8			1.96	2.8							7.8			
87	2	23	23-Feb-87								8.7			13.2			2.5	2.7							8.4			
87	5	4	04-May-87	0.02		0.03	0.05	0.01	0.05	0.01	11.41	0.02	0.01	0.07	0.09	0.02	2.57	3.37		0.01		0.6	0.01		12.6	0.1	0.1	0.1
87	8	11	11-Aug-87	0.16		0.59	0.54	0.01	0.27	0.16	170.48	0.64	0.04	7.49	0.98	0.22	35.73	32.23		0.13	4.7	3.3	0.42		41.4	0.8	0.1	0.1
87	11	18	18-Nov-87	0.03		0.02	0.42	0.01	0.04	0.02	9.16	0.05	0.01	1.16	0.05	0.04	2.24	0.38		0.03	0.4	1	0.03		10.9	0.1	0.1	0.1
88	5	26	26-May-88	0.45		0.16	0.03	0.01	0.08	0.005	16.5	0.04	0.01	19.7	0.01	0.04	4.14	4.73		0.02	0.54	1.35	0.03	8.79	16.1	0.09	0.04	0.1
88	8	7	07-Aug-88	1.72		0.088	0.04	0.001	0.07	0.01	19.1	0.05	0.03	24	0.1	0.04	4.93	5.45		0.01	0.61	1.29	0.1		20.8	0.1	0.05	0.14
89	3	10	10-Mar-89	10			0.17	0.01	0.02	0.063	29	0.01	0.08	32	0.6	0.22	7.4	6.8		0.04		1.75	0.1		23.9		0.03	
89	5	23	23-May-89	81		0.041	0.825	0.035	0.18	0.11	49	0.09	0.35	109	2	0.8	27	8.6		0.13		3.98	0.1		29.6		0.03	
89	8	7	07-Aug-89	0.1		0.002	0.048	0.005	0.02	0.005	26	0.01	0.005	14	0.01	0.03	6.6	6.6		0.01		2.11	0.1		38		0.03	
89	11	28	28-Nov-89	12.5		0.021	0.13	0.002	0.23	0.092	24.17	0.09	0.09	35.76	0.59	0.09	8.33	8.56		0.06	3.51	5.06	0.05	23.6	24.4	0.13	0.03	0.98
89	12	13	13-Dec-89	4.16	0.05		0.115	0.007	0.02	0.079	38	0.1	0.03	30	0.57	0.01	8.75	8.86		0.04		9.35	0.1		42.8		0.12	
90	7	18	18-Jul-90	11	0.05		0.229	0.005	0.04	0.01	59	0.05	0.09	42	0.05	0.5	13	15		0.06		2.2	0.1		53.9		0.12	
90	11	13	13-Nov-90	2.34	0.01	0.005	0.5	0.05	0.42	0.0203	87	0.012	0.06	48	0.178	0.045	15	16		0.038		3.17	0.005		58		0.01	
92	8	17	17-Aug-92	16	0.001	0.005	0.5	0.05	0.39	0.0005	44	0.005	0.18	112	0.71	0.005	17	21		0.022		5.1	0.005		140		0.01	
94	5	13	13-May-94	12	0.005	0.005	0.5	0.05	0.2	0.035	45	0.005	0.03	64	0.41	0.005	12	12		0.005		4.9	0.005		150		0.01	
94	10	4	04-Oct-94	15	0.005	0.005	0.5	0.05	0.4	0.076	58	0.005	0.46	72	0.91	0.005	17	33		0.005		8.3	0.005		230		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 3
continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. NH.	T. NH.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDNE	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li
77	7	20	20-Jul-77		22.684				0.678			0.058			1.06										42.94				6.99	79.4		
77	8	4	04-Aug-77		3.277				0.439			0.097			2.7														6.98	111.4		
77	9	5	05-Sep-77		21.76				0.087			0.039			1.8		6						77						7.07	32.2		
77	10	5	05-Oct-77		34.56				0.215			0.07			4.2							2.18							7	67.2		
77	10	24	24-Oct-77		33.27				2.93			0.317			8.2		42.5				155.52	0.85	469	201					6.19	120.4		
77	11	8	08-Nov-77		0.01				0.005			0.078			72		24.1				13.61		258	1				0.82	7.6	98.4		
77	11	23	23-Nov-77		42.24				0.851			0.417			1		21.3				30.71		158	57					NA	76.8		
77	12	21	21-Dec-77		3.952				0.215			0.09																	7.04	145.6		
78	2	22	22-Feb-78		33.73				0.14			0.065																		68.6		
78	3	20	20-Mar-78		35.15				0.002			0.056																		57.6		
78	4	18	18-Apr-78		24.2				0.133			0.068																		47.2		
78	5	29	29-May-78		68.359				0.06			0.136																	7.1	16.48		
78	6	28	28-Jun-78		38.247				0.775			0.108																	7	64.4		
78	8	17	17-Aug-78		35.51				0.091			0.089																	6.97	58.4		
78	10	4	04-Oct-78		26.39				0.264			0.042																	7.16	60.8		
78	12	6	06-Dec-78		40				0.237			0.185																	6.89	62.4		
78	12	28	28-Dec-78		39.42				0.143			0.049																	6.74	68		
79	1	16	16-Jan-79		27.97				0.204			0.096																	6.89	56.2		
79	2	7	07-Feb-79		31.01		0.004		0.12			0.048					11				19		77	28					6.88	58.6		0.005
79	3	7	07-Mar-79		24.22	0.005	0.005	0.001	0.31						126		21				45				46.8	106.43			6.98	41.6		
79	4	9	09-Apr-79		31.68	0.01	0.005	0.005	0.429						3		6			2	11				30.67	78.27			7.44	57.7		
79	5	2	02-May-79		12.85	0.042	0.096	0.001	0.219						4		10			5	16		56		24.45	77.25			7	27.2		
79	6	6	06-Jun-79		14.61	0.005	0.005	0.008	0.528								14			22	28				48.61	113.47			7.01	47.8		
79	7	17	17-Jul-79		19.78		0.005		0.349						1		14				5				33.58	114.22			6.69	49		
79	8	14	14-Aug-79														15						63		20.44	85.6						
79	11	21	21-Nov-79														8						95		13.98	126.39						
80	2	11	11-Feb-80														9						87		12.56	113.96						
80	4	29	29-Apr-80														12						83		18.08				6.49			
80	7	24	24-Jul-80																													
80	11	20	20-Nov-80		22.68		0.005		0.005			0.005			2		13			9	8		77		30.9	110			6.62	49		
81	4	1	01-Apr-81		29.5		0.005		0.193			0.184			75		5.4			1	13		73		38.5	120			6.68	16.7		
81	8	18	18-Aug-81		30.5		0.009		0.68						2		7.2				13		83		88	130			6.56	61		
81	11	9	09-Nov-81		11.4		0.021		0.42						2		5.9			17	13		51		59	80			6.99	35		
82	3	2	02-Mar-82		20.9		0.054		0.18						1		7			1	19		68		67.5	110			7.45	33		
82	5	10	10-May-82		4.63		0.005		0.21						0.6		6.3				8		59		51.3	90			6.06	30		
82	8	10	10-Aug-82		7.92		0.002		0.36			2.8			1.2		41			1	13		63		68.1	90			8.05	35		
82	11	10	10-Nov-82														5.1						98		20.2							
83	1	26	26-Jan-83														6.1						107		18.2							
83	6	23	23-Jun-83		23.2		0.024								1.1		6.1	0.027					101						6.86	52		
83	9	7	07-Sep-83		10.2		0.044								1.4		55	0.05					62			85			7.52	41.4		
83	11	23	23-Nov-83		30.3				0.008						1.4		4.9	0.05					97			135			7.57	24.5		
84	5	18	18-May-84		26		0.056										5.3	0.068					78			130			6.94	50		
84	8	5	05-Aug-84		26		0.018										5.4	0.062					84			125				52.7		
85	5	22	22-May-85																				71									
85	8	6	06-Aug-85		26												13				9		48			130			6.32	44		
85	11	13	13-Nov-85														14						91			120				32.4		
86	5	6	06-May-86														16						99									
86	8	13	13-Aug-86		14												19				11		82			126			6.35	31.7		
86	12	11	11-Dec-86														25						103			153				37.5		
87	2	23	23-Feb-87														29						104			155				28.8		
87	5	4	04-May-87	0.02		0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1	25		0.1		NA		103			153				37.5		
87	8	11	11-Aug-87	0.02													29				NA		104			155				26.8		
87	11	18	18-Nov-87	0.02	4.07								0.1	19.5							NA		1			210				16		
88	5	26	26-May-88	0.03	46.94												295				99		1295		32.1	1975			6	368		
88	8	7	07-Aug-88	0.02	8.22									1.2			42.1						135			225			6.3	16		
89	3	10	10-Mar-89	0.03	8.78									134			59.7						225	1890	68	350				48		
89	5	23	23-May-89	0.26	7.43									107.5			70						155	17352	103	325			5.87	1		
89	8	7	07-Aug-89	0.01	63									477.8			98.8						540			550			6.43	88.2		
89	11	28	28-Nov-89	0.04	70												87.1				26		328		233.5	430			6.6	110		
89	12	13	13-Dec-89	0.04	39												152				37		1060	5740	131	500			6.33	138		
90	7	18	18-Jul-90	0.02	43								0	56			196						491		201	830			5.9	56		
90	11	13	13-Nov-90	0.17	16												144				190		793	881	229	805			5.94	112		
92	8	17	17-Aug-92	0.1	49				0.09			0.05					247	0.16			31		929	1870	180	1000			6.15	122		
94	5	13	13-May-94	0.05	25				0.7			0.02					157	0.2			31		670	654	162	0.02			6.42	116		
94	10	4	04-Oct-94	0.05	29				3.5			0.02					152	0.1			90		1110	116	215	1210			7.08	490		

TERRA NOVA LANDFILLL SITE - ANALYTICAL RESULTS - WELL No. 4

Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Ni	P	K	Se	Na	Sr	Sn	Tl
77	8	4	04-Aug-77		0.001				0.01	2.713	0.007	0.01	1.132	0.052			0.207	0.005		1.587		7.323			
77	9	5	05-Sep-77		0.001				0.019	3.76	0.007	0.01	0.46	0.043			0.106	0.005		7.545		1.651			
77	10	5	05-Oct-77						0.01	2.04	0.005	0.011	0.254	0.031			0.196	0.005		2.389		8.83			
77	11	8	08-Nov-77						0.005	16.49	0.005	0.005	0.038	0.01		4.268	0.014	0.005		0 641		8.575			
77	11	23	23-Nov-77						0.005	3	0.005	0.059	1.651	0.131		0.619	0.368	0.005		2.438		5.556			
77	12	21	21-Dec-77										0.251	0.02			0.332	0.005		1 92					
78	2	22	22-Feb-78										0.388	0.016			0.329	0.01		2 264					
78	3	20	20-Mar-78										0.183	0.01			0.296	0.01		2.359					
78	4	20	20-Apr-78										0.555	0.01			0.273	0.01		2.175					
78	5	29	29-May-78										0.471	0.039			0.202	0.025		2.477					
78	6	28	28-Jun-78										0.269	0.016			0.239	0.025		2.095					
78	8	17	17-Aug-78										0.394	0.03			0.062	0.01		2.254					
78	10	4	04-Oct-78										0.265	0.022			0.019	0.01		2.224					
79	4	9	09-Apr-79							70.72		0.01	18.145	0.064		17.31	24.62								
79	5	2	02-May-79							87.479		0.013	28.94	0.026		22.2	33.862								
79	6	6	06-Jun-79							99.1		0.017	26.987	0.021		21.69	37.8								
79	7	17	17-Jul-79							209.92			26.89	0.01		134.32	49.18			3.753		28.28			
79	8	14	14-Aug-79							155.51		0.167	83.55	0.08		33.95	58.32			14.55		43.01			
79	11	21	21-Nov-79							141.1		0.021	40.343			32.07	46.49			4.04		37.36			
80	2	11	11-Feb-80							166.2		0.055	27.44			37.3	55.01			5.041		36.35			
80	4	29	29-Apr-80							149.57		0.04	42.2			32.17	53.04			4.65		37.4			
80	7	24	24-Jul-80							167.6		0.04	38.6	0.01		31.28	55.7			3.78		31.1			
80	11	20	20-Nov-80							139.1		0.06	6.68	0.07		31.23	37.05			3,16		30.2			
81	4	1	01-Apr-81							131.6		0.02	30	0.18		29.6	37.9			5.09		36.8			
81	8	18	18-Aug-81							143		0.48	64.9	0.09		23.9	52.4			3.42		43.8			
81	11	9	09-Nov-81							154		0.21	54.3	0.04		26.7	53.95			4.38		5 35			
82	3	2	02-Mar-82							123		0.04	46.9	0.09		28.9	41.9			5.45		50.28			
82	5	10	10-May-82							149		0.03	51	0.02		11.6	47.7			3 63		34			
82	8	10	10-Aug-82		0.005				0.0049	135	0.001	0.03	59	0.026		26.8	40.8	0.01		3.63		30 5			
82	11	10	10-Nov-82							144		0.475	63 6	0.146		25.9	56.9			3.83		34.5			
83	1	26	26-Jan-83							128		0.04	53.9	0.095		23.8	49.9			4.54		33 8			
83	6	23	23-Jun-83							140		0.036	40.3	0.01		18.5	45			3.42		32			
83	9	7	07-Sep-83							100		0.02	55.2	0.034		19.2	39			3.55		30.4			
83	11	23	23-Nov-83							112		0.06	45.9	0.032		21.7	41.9			3.58		33.1			
85	8	6	06-Aug-85							150			85			26	69			3.8		36			
86	8	13	13-Aug-86							170			120			30	67			4.5		40			
87	8	11	11-Aug-87	0.15	0.36	0.92	0.01	0.21	0.02	228.17	0.86	0.1	88.34	0.74	0.28	38.95	43.13	0.07	2 8	6.1	0.52	93.5	1.7	0.1	0.1
88	8	7	07-Aug-88	4.84	0.224	0.25	0.005	0.38	0.01	218	0.36	0.8	363	0.32	0.3	38.6	129	0.11	3.3	8.27	0.1	139	2.31	0 09	0.33
89	8	7	07-Aug-89	0.17	0.002	0.086	0.005	0.06	0.005	156	0.01	0.005	121	0.01	0.38	31	89.9	0.01		9.69	0.1	167		0 03	0 01
90	7	18	18-Jul-90	16		0.197	0.005	0.04	0.02	144	0.01	0.15	153	0.05	2.33	35	103	0.02		8 8	0.1	202		0 23	
92	8	19	19-Aug-92	170	0.005	0.5	0.05	0.52	0.0005	42	0.005	0.17	189	0.29	0.005	26	49	0.013		15	0.005	210		0 01	
94	5	13	13-May-94	20	0.005	0.5	0.05	0.3	0.01	59	0.005	0.03	99	0.07	0.005	20	33	0.005		11	0.005	210		0.01	
94	10	4	04-Oct-94	4.8	0.005	0.5	0.05	0.3	0.0034	36	0.005	0.005	110	0.024	0.005	18	32	0.005		8.7	0.005	160		0.01	

TERRA NOVA LANDFILLL SITE - ANALYTICAL RESULTS - WELL No. 4

continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.
77	8	4	04-Aug-77		3.141				0.765			0.144			6.1	
77	9	5	05-Sep-77		11.03				0.465			0.065			4.7	
77	10	5	05-Oct-77		7.022				0.626			0.069			5.2	
77	11	8	08-Nov-77		0.01				0.005			0.08			12.8	
77	11	23	23-Nov-77		26.01				0.413			0.243			1	
77	12	21	21-Dec-77		3.272				0.325			0.057				
78	2	22	22-Feb-78		6.823				0.475			0.11				
78	3	20	20-Mar-78		2.84				0.256			0.07				
78	4	20	20-Apr-78		13.8				0.447			0.079				
78	5	29	29-May-78		9.323				0.463			0.09				
78	6	28	28-Jun-78		3.786				0.314			0.136				
78	8	17	17-Aug-78		6.345				0.062			0.086				
78	10	4	04-Oct-78		2.325				0.219			0.053				
79	4	9	09-Apr-79		156.8	0.04	0.709	0.037	1.34						1	
79	5	2	02-May-79		167.92	0.005	1.014	0.001	0.537						2	
79	6	6	06-Jun-79		117.92	0.017	0.468	0.007	1.065							
79	7	17	17-Jul-79		141.61		2.25		3.33						1	
79	8	14	14-Aug-79		255.48		1.59		0.812						2	
79	11	21	21-Nov-79		84.318				1						3.5	
80	2	11	11-Feb-80		126		1.324		1.95						5	
80	4	29	29-Apr-80		66.47		0.035		2.34			0.247			5	
80	7	24	24-Jul-80		70.59		0.474		0.794						3	
80	11	20	20-Nov-80		76.15		0.227		0.645			0.014			1	
81	4	1	01-Apr-81		82.9		0.005		0.45			0.231			1	
81	8	18	18-Aug-81		48.7		0.035		1.09						3	
81	11	9	09-Nov-81		33.7		0.005		0.76						2	
82	3	2	02-Mar-82		57.6		0.005		0.45						1	
82	5	10	10-May-82		82		0.006		0.23						0.8	
82	8	10	10-Aug-82		68.4		0.004		0.5			0.089			1.4	
82	11	10	10-Nov-82		65.8		0.005		0.617			0.13			0.1	
83	1	26	26-Jan-83		61.9		0.005		0.73			0.077			0.3	
83	6	23	23-Jun-83		38.7		0.018		0.66			0.114			1.3	
83	9	7	07-Sep-83		59.3		0.039		0.66			0.48			1	
83	11	23	23-Nov-83		47.4		0.044		0.27			0.108			0.8	
85	8	6	06-Aug-85		61											
86	8	13	13-Aug-86		38											
87	8	11	11-Aug-87	0.03	40.3											
88	8	7	07-Aug-88	0.09	46.1								0	570.5		
89	8	7	07-Aug-89		49								0	660.7		
90	7	18	18-Jul-90	0.03	0.15								0.06	532		
92	8	19	19-Aug-92	0.09	87				0.19			0.03				
94	5	13	13-May-94	0.05	35				3.1			0.02				
94	10	4	04-Oct-94	0.05	12				3.9			0.02				

Date	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S	HARDNE	Cond.	COLOR	TURB	pH	Alk.	Acidity	Li	Sb
04-Aug-77													7.2	61.4			
05-Sep-77	7												7.2	37.6			
05-Oct-77						4.84							7.4	23			
08-Nov-77	19.8				13.18		94	1				1.24	7.42	46.4			
23-Nov-77	5.8				14.36		60	52						45.4			
21-Dec-77																	
22-Feb-78														25			
20-Mar-78														20.4			
20-Apr-78														27.2			
29-May-78													7.63	20.2			
28-Jun-78													7.45	25.4			
17-Aug-78													7.27	21.4			
04-Oct-78													7.73	18.8			
09-Apr-79	104			15	160				325.6	836.35			7.6	401.4			
02-May-79	100				82		898		423.52	1115.8			7.05	371			
06-Jun-79	137			6	190				453.96	1146.1			6.87	401.8			
17-Jul-79	165				165				1214.82	1392.49			6.75	471			
14-Aug-79	187						1188		784.02	1494.62			7.04	530			
21-Nov-79	123						1173		841.3	1364.9			6.05				
11-Feb-80	121						753		717.93	1431.66			6.95	455.4			
29-Apr-80	84						107		678.15	1214.53			7.43	537.7			
24-Jul-80	76						1066		717.9	1458.93			6.58	609.8			
20-Nov-80	85			14	157		760		555.4	1100			7.46	386			
01-Apr-81	61			1	167		678		573.3	950			6.91	379			
18-Aug-81	50				167		863		742	1080			7.42	494			
09-Nov-81	42			8	124		605		742	800			6.35	357			
02-Mar-82	45			3	172		753		586	960			6.28	279			
10-May-82	40				200		874		724	1190			6.64	424			
10-Aug-82	36			1	149		958		627	1130			6.67	415			
10-Nov-82	34			2	176		931		584				6.94	447			
26-Jan-83	36			4	188		856		605				7.23	401			
23-Jun-83	32	0.06			97		755						6.54	394			
07-Sep-83	31	0.06			173		766			1000			7.38	424			
23-Nov-83	71	0.05			297		731			1000			6.36	405			
06-Aug-85	170				140		1114			1400			6.39	354			
13-Aug-86	350				166		1250			1640			6.66	303			
11-Aug-87	415				744		1980			2500			5.5	296			
07-Aug-88	436						1750		703.2	2000			5.79	468			
07-Aug-89	409				1100		2260		517.1	1950			6.16	542			
18-Jul-90	362						1420		503	2240			6.1	532			0.05
19-Aug-92	230	0.05			123		922	4280	212	1380			6.11	488			0.001
13-May-94	164	0.08					980	864	230	1450			6.78	564			0.006
04-Oct-94	141	0.08			57		1110	128	164	1250			7.02	555			0.005

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 5

Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Tl
77	8	4	04-Aug-77		0.001				0.029	25.184	0.015	0.015	7.305	0.127			1.009		0.03		2.882			8.073			
77	9	5	05-Sep-77		0.001				0.01	31.87	0.009	0.01	8.67	0.109			0.838		0.024		8.18			2.99			
77	10	5	05-Oct-77						0.01	26.84	0.005	0.012	5.292	0.085			0.947		0.006		3.44			8.44			
77	10	24	24-Oct-77						0.01	9.4	0.005	0.03	2.418	0.154		1.297	0.681		0.005		2.214			5.79			
77	11	8	08-Nov-77						0.005	18.64	0.005	0.005	0.106	0.01		5.522	0.021		0.005		0.746			10.09			
77	11	23	23-Nov-77						0.006	9.3	0.006	0.034	2.23	0.137		1.391	0.708		0.006		2.233			8.14			
77	12	21	21-Dec-77										0.472	0.038			0.678		0.005		2.17						
78	2	22	22-Feb-78										1.682	0.081			0.719		0.01		2.118						
78	3	20	20-Mar-78										0.545	0.017			0.698		0.01		2.157						
78	4	18	18-Apr-78										1.49	0.026			0.697		0.01		1.803						
78	5	29	29-May-78										1.15	0.031			0.622		0.025		2.262						
78	6	28	28-Jun-78										0.891	0.026			0.609		0.025		1.763						
78	8	17	17-Aug-78										1.882	0.026			0.568		0.017		1.821						
78	10	4	04-Oct-78										0.216	0.019			0.568		0.01		2.011						
78	12	6	06-Dec-78										0.454	0.02			0.48		0.048		1.68						
78	12	28	28-Dec-78										0.448	0.041			0.482		0.01		1.56						
79	1	16	16-Jan-79										0.951	0.012			0.485		0.01		1.02						
79	2	7	07-Feb-79						0.01	10.18	0.012	0.153	0.889	0.125		1.252	0.534		0.012		1.94			8.47			
79	3	7	07-Mar-79							9.01			2.987	0.118		1.155	0.544										
79	4	9	09-Apr-79							10.8		0.01	5.061	0.088		1.616	0.748										
79	5	2	02-May-79							13.39		0.044	53.971	0.054		1.99	0.902										
79	6	6	06-Jun-79							15.16		0.026	8.681	0.073		2.496	1.311										
79	7	17	17-Jul-79							17.72			8.48	0.104		2.619	1.353				1.735			7.44			
79	11	21	21-Nov-79							27.48						4.249											
80	4	29	29-Apr-80							39.57		0.19	28.9			7.22	3.29				4.7			32.6			
80	7	24	24-Jul-80							33.06		0.16	9.19	0.026		5.84	2.43				4.52			28.65			
80	11	20	20-Nov-80							37.67		0.13	36.71	0.055		9.05	3.08				12			36			
81	4	1	01-Apr-81							83.16		0.18	132	0.05		26.7	7.48				49.4			72.6			
81	8	18	18-Aug-81							63.9		0.27	80.6	0.11		10.5	4.68				34.8			60.3			
81	11	9	09-Nov-81							125		0.41	200.5	0.175		22.2	8.541				2.7			105			
82	3	2	02-Mar-82							62.4		0.18	116	0.32		12.7	4.2				5.62			56.85			
82	5	12	12-May-82							19.9		0.8	23.2	0.12		2.82	1.15				8.29			5			
82	8	10	10-Aug-82		0.006				0.0055	37.1	0.005	0.48	82.8	0.162		8.48	2.24		0.01		21.9			26			
82	11	10	10-Nov-82							20.1		0.214	20.2	0.042		3.32	1.19				4.61			9.31			
83	1	26	26-Jan-83							21.5		0.35	26.1	0.22		3.96	1.36				7.1			11.9			
83	6	23	23-Jun-83							28.1		0.2	38.7	0.054		4.71	1.56				12.6			17.2			
83	9	7	07-Sep-83							22.2		0.32	34.4	0.104		3.98	1.4				9.78			15			
83	11	23	23-Nov-83							20.2		0.27	19.1	0.086		3.47	1.12				3.82			9.81			
84	2	29	29-Feb-84							21.8		0.23	35.7	0.123		3.88	1.33				12.3			22			
84	8	5	05-Aug-84							10.7		0.56	12.9	0.37		3.2	1.04				2.65			10.2			
85	2	15	15-Feb-85																								
85	5	22	22-May-85							11.1			23.3			2.8	0.93							14			
85	5	23	23-May-85							18.8			38.8			8.4	1.98							28			
85	8	6	06-Aug-85							13			13			2.7	0.71				10			14			
85	11	13	13-Nov-85							19			26			4.9	0.97							30			
86	5	6	06-May-86							13			40	0.123		4.7	1.12							25			
86	8	13	13-Aug-86							12			18			4.3	0.9				15			14			
86	12	11	11-Dec-86							16.6			27.3			4.5	1							14.1			
87	2	23	23-Feb-87							20.5			51.2			8	1.38							18.3			
87	5	4	04-May-87	0.07	0.14	0.58	0.01	0.18	0.01	24.11	0.05	0.01	0.35	0.58	0.02	9.27	1.35		0.05		9.4	0.08		19.1	0.1	0.1	0.1
87	8	11	11-Aug-87	0.32	0.24	0.88	0.01	0.22	0.06	18.2	0.16	0.01	1.97	0.89	0.14	5.08	1.27		0.03	3.2	10.6	0.22		12.7	0.1	0.1	0.1
87	11	18	18-Nov-87	0.1	0.01	0.42	0.01	0.1	0.02	8	0.05	0.01	1.16	0.05	0.04	2.28	0.38		0.03	0.6	20.7	0.09		19.3	0.1	0.1	0.1
88	2	17	17-Feb-88	4.85	0.01	0.17	0.01	0.23	0.005	25.3	0.07	0.06	57.4	0.23	0.11	10.5	1.73		0.07	2.99	23.4	0.03	20.1	17.1	0.07	0.26	0.1
88	5	26	26-May-88	2.83	0.13	0.25	0.01	0.33	0.02	32.2	0.05	0.06	81.6	0.18	0.08	15	1.92		0.05	3.3	3.97	0.06	8.14	22.3	0.12	0.07	0.2
88	8	7	07-Aug-88	6.64	0.172	0.2	0.001	0.36	0.025	25.4	0.06	0.07	46.9	0.4	0.06	10.5	1.8		0.04	4.05	18.5	0.12		17.6	0.08	0.05	0.43
89	3	10	10-Mar-89	0.69		0.05	0.01	0.01	0.005	22.1	0.01	0.01	5.4	0.07	0.01	4.7	1.1		0.01		5.72	0.1		12.3		0.05	
89	5	23	23-May-89	2.3	0.002	0.051	0.005	0.02	0.005	24	0.01	0.01	11.5	0.11	0.05	5	1.4		0.01		2	0.1		8.24		0.03	
89	8	7	07-Aug-89	0.07	0.002	0.04	0.005	0.02	0.005	23	0.01	0.005	0.13	0.01	0.01	4.4	1.1		0.01		2.38	0.1		13.7		0.03	
89	11	28	28-Nov-89	5.27	0.005	0.13	0.001	0.25	0.034	22.34	0.05	0.06	17.18	0.68	0.05	5.92	1.31		0.04	3.22	7.69	0.06	10.5	11.5	0.05	0.03	0.32
89	12	15	15-Dec-89	2.03		0.133	0.005	0.05	0.026	35	0.04	0.03	45	0.13	0.01	8.09	0.7		0.02		21.3	0.1		27.5		0.12	
90	3	27	27-Mar-90	0.05		0.067	0.005	0.06	0.01	39	0.01	0.01	1.82	0.05	0.01	7.89	1.34		0.02		110	0.1		175		0.09	
90	6	1	01-Jun-90	1.68		0.116	0.005	0.05	0.01	33	0.01	0.01	33	0.05	0.01	6.4	1.3		0.02		13	0.1		21		0.03	
90	7	18	18-Jul-90	6.82		0.135	0.005	0.05	0.01	33	0.01	0.04	37	0.05	0.01	7.41	0.27		0.02		9.7	0.1		17.9		0.03	
90	11	13	13-Nov-90	1.74	0.005	0.5	0.05	0.1	0.0203	34	0.005	0.03	44	0.251	0.005	7	1.27		0.018		15	0.005		28		0.01	
92	8	17	17-Aug-92	12	0.005	0.5	0.05	0.39	0.0005	43	0.005	0.06	80	0.92	0.005	12	1.33		0.023		19	0.005		39		0.01	
94	5	13	13-May-94	5.8	0.005	0.5	0.05	0.2	0.024	50	0.005	0.02	61	0.2	0.005	9.6	1.01		0.005		18	0.005		40		0.01	
94	10	4	04-Oct-94	2.9	0.005	0.5	0.05	0.3	0.02	18	0.005	0.03	58	0.11	0.005	11	9.5		0.005		4.5	0.005		110		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 5

continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDNE	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	Sb
77	8	4	04-Aug-77		3.514				0.594			0.17			14.9														7.13	237.8			
77	9	5	05-Sep-77		75.45				0.203			0.136			9.6		9						200						7.32	116.8			
77	10	5	05-Oct-77		78.1				0.224			0.08			10.2							1.36							6.8	192.2			
77	10	24	24-Oct-77		14.27				0.15			0.158			5.6		7.1				4.46	1.79	84	70					6.45	60.8			
77	11	8	08-Nov-77		0.01				0.133			0.062			6		32.6				8.43		121	1					7.54	67			
77	11	23	23-Nov-77		29.387				0.421			0.144			2.9		8.5				12.14		108	10						63.2			
77	12	21	21-Dec-77		3.764				0.179			0.039																	7.2	128.8			
78	2	22	22-Feb-78		22.36				0.209			0.178																		65.4			
78	3	20	20-Mar-78		21.27				0.068			0.078																		71.4			
78	4	18	18-Apr-78		28.5				0.113			0.036																		63.6			
78	5	29	29-May-78		25.234				0.377			0.082																	7.09	69			
78	6	28	28-Jun-78		22.021				0.167			0.187																	7.34	60.8			
78	8	17	17-Aug-78		21.64				0.005			0.085																	7.25	50			
78	10	4	04-Oct-78		14.27				0.047			0.047																	7.53	51.4			
78	12	6	06-Dec-78		16.73				0.127			0.19																	7.14	40.6			
78	12	28	28-Dec-78		20.37				0.04			0.066																	7.03	54.8			
79	1	16	16-Jan-79		26.07				0.039			0.047																	7.36	62.8			
79	2	7	07-Feb-79		23.69		0.049		0.326			0.064					15				16		62	24					7.06	56.6			
79	3	7	07-Mar-79		38.92	0.005	0.258	0.001	0.206						5		19				30				33.61	166.4			7.04	63.2			
79	4	9	09-Apr-79		25.08	0.005	0.005	0.008	0.411						1		17			3	31				45.76	171.18			7.07	62.8			
79	5	2	02-May-79		33.44	0.013	0.067	0.001	0.264								18			7	13		124		140.2	201.25			7.09	76.2			
79	6	6	06-Jun-79		34.99	0.005	0.005	0.003	0.435						5		23			2	21				85.07	234.43			7.21	96			
79	7	17	17-Jul-79		67.07		0.103		0.501						1		32				13				89.1	389.01			6.92	128			
79	11	21	21-Nov-79														4						403		88.06	257.86							
80	4	29	29-Apr-80		129.52		0.013		4.2			0.316			5		48						525		166.31	641			7.07	256.3			
80	7	24	24-Jul-80		6.81		0.011		2.3						5		14						513		127.48	755.1			6.59	250.1			
80	11	20	20-Nov-80		113.7		0.005		7.49			0.016			10		66			10	106		200		212.7	870			6.96	216			
81	4	1	01-Apr-81		157		0.011		10.92			0.593			2		85			3	267		1179		568	1290			6.13				
81	8	18	18-Aug-81		108		0.006		44.8						3		51				195		607		521	870			7.56	167			
81	11	9	09-Nov-81		211		0.013		18.1						4		100			1	239		1402		1100	1590			5.66	223			
82	3	2	02-Mar-82		168		0.014		12						2.5		58			1	240		758		235	880			7.17	157			
82	5	12	12-May-82		75		0.014		2.12						0.7		16.7				58		203		220	340			6.33	38			
82	8	10	10-Aug-82		101		0.002		9			0.056			1.1		37			1	140		498		236	620			7.51	176			
82	11	10	10-Nov-82		77.5		0.014		1.7			0.167			0.4		19.1			2	24		215		102				7.19	121			
83	1	26	26-Jan-83		74.6		0.021		3.2			0.059			0.2		22.4			1	74		244		119				7.26	144			
83	6	23	23-Jun-83		66.3		0.02		5.9			0.225			0.8		35	0.035			63		303						6.44	182			
83	9	7	07-Sep-83		73.4		0.028		3.8			0.62			0.6		13.4	0.05			63		201			400			7.38	158			
83	11	23	23-Nov-83		62.3		0.014		1.3			0.33			0.4		24.6	0.05			25		239			345			6.28	73.8			
84	2	29	29-Feb-84		70.4		0.008		6			0.54			0.4		17.2	0.066			40		257			304			6.53	177			
84	8	5	05-Aug-84		55		0.031		2.8			0.104			0.3		9.6	0.047		7	42		144			310				122.8			
85	2	15	15-Feb-85																										6.3				
85	8	22	22-May-85																				196										
85	5	23	23-May-85																				370										
85	8	8	08-Aug-85		55												10				35		149			310			6.64	156			
85	11	13	13-Nov-85														20						384			720				336			
86	5	8	08-May-86														17						281										
86	8	13	13-Aug-86		66												15				99		197			370			7.21	202			
86	12	11	11-Dec-86														18						219			403				196			
87	2	23	23-Feb-87														31						282			532				216			
87	5	4	04-May-87	0.03	29.86	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1	166		0.1				290			805				280			
87	8	11	11-Aug-87	0.01	47.85												56.9				35		425			450			6.8	176			
87	11	18	18-Nov-87	0.02	19.1								0.1	185.3			25						340		24.4	600			6.8	152			
88	2	17	17-Feb-88	0.04	84.7								0.1	312			49						450		106	710			7.57	256			
88	5	26	26-May-88	0.05	105												59.3						205			650				258			
88	8	7	07-Aug-88	0.03	95.7									224.3			38.1						570		106.6	550			7.03	184			0.05
89	3	10	10-Mar-89	0.01	58									191			26.3				17			323	74.5	325			7.26	157			0.05
89	5	23	23-May-89	0.01	44									119.6			27.5						245	1140	80.5	400			6.96	98			
89	8	7	07-Aug-89	0.01	43									162.1			33.6				58		285		75.5	380			7.15	133			0.05
89	11	28	28-Nov-89	0.03	78.7												21.9				49.8		1100			425			7.25	83			0.05
89	12	15	15-Dec-89	0.02	86												52.2				71		395	416	121	600			6.85	234			0.05
90	3	27	27-Mar-90	0.01	54												68.6				123		1040	1970	130	600			6.38	205			0.05
90	6	1	01-Jun-90	0.01	70								0.11	190			59						317	295	117	539			6.8	190			0.05
90	7	18	18-Jul-90	0.02	85								0.16	153			60						284		113	470			7.1	153			0.05
90	11	13	13-Nov-90	0.12	82												63				66		350	515	114	505			6.7	222			0.001
92	8	17	17-Aug-92	0.09	115				5			0.02					77	0.05			64		408	1520	157	662			6.64	298			0.01
94	5	13	13-May-94	0.05	72				9.2			0.02					70	0.08						480	458	164	641			7.05	270			0.006
94	10	4	04-Oct-94	0.05	18				1.3			0.02					122	0.25			25		776	42	90.2	845			6.98	142			0.006

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 6

Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Ti
77	8	4	04-Aug-77		0.001				0.9	4.028	0.005	0.019	1.397	0.05			0.513		0.01		1.085			4.431			
77	9	5	05-Sep-77		0.001				0.01	4.93	0.011	0.01	0.58	0.059			0.261		0.023		3.978			1			
77	10	6	06-Oct-77						0.01	2.04	0.005	0.01	0.31	0.017			0.277		0.005		1.068			4.4			
77	10	24	24-Oct-77						0.01	4.4	0.289	0.019	1.199	0.077		0.976	0.262		0.006		1.375			4.375			
77	11	8	08-Nov-77						0.005	43.37	0.005	0.005	0.051	0.01		8.387	0.018		0.009		0.922			10.175			
77	11	23	23-Nov-77						0.005	3.67	0.005	0.023	0.59	0.044		0.552	0.228		0.008		1.1			4.07			
77	12	21	21-Dec-77										0.048	0.01			0.174		0.006		0.975						
78	3	20	20-Mar-78										0.114	0.01			0.12		0.01		0.987						
78	4	18	18-Apr-78										0.494	0.013			0.132		0.01		0.854						
78	5	29	29-May-78										0.286	0.013			0.29		0.025		3.477						
78	6	28	28-Jun-78										0.19	0.01			0.107		0.05		0.837						
78	8	17	17-Aug-78										0.343	0.01			0.092		0.01		0.951						
78	10	4	04-Oct-78										0.159	0.01			0.095		0.01		1						
78	12	6	06-Dec-78										0.194	0.014			0.065		0.015		0.856						
78	12	28	28-Dec-78										0.474	0.018			0.069		0.01		1.008						
79	1	16	16-Jan-79										0.334	0.019			0.073		0.01		0.89						
79	2	7	07-Feb-79						0.01	5.82	0.01	0.034	0.436	0.038	0.01	0.912	0.078	0.01	0.01		1.11			6.13			
79	3	7	07-Mar-79							1.58			0.802	0.027		1.262	0.085										
79	4	9	09-Apr-79							4.509		0.01	0.601	0.027		0.916	0.128										
79	5	2	02-May-79							5.16		0.028	0.848	0.028		0.811	0.169										
79	6	6	06-Jun-79							6.03		0.023	1.068	0.032		1.38	0.258										
79	7	17	17-Jul-79							7.57			5.954	0.052		1.536	0.756				0.745			5.45			
79	8	14	14-Aug-79							9.06						2.057											
79	11	21	21-Nov-79							9.19						2.112											
80	2	11	11-Feb-80							14.28		0.11	23.66			2.961	18.9				1.724			11.75			
80	4	29	29-Apr-80							13.41		0.06	31.24			3.14	20.46				1.37			11.64			
80	7	24	24-Jul-80							9.83		0.2	21.6	0.119		1.96	10.94				0.849			8.04			
80	11	20	20-Nov-80							11.23		0.06	21.22	0.021		2.45	10.71				0.98			7.1			
81	4	1	01-Apr-81							16.1		0.32	44.9	0.25		3.52	15.9				1.28			11.6			
81	8	16	16-Aug-81							20.2		0.17	43.6	0.06		3.44	19.1				1.4			14.3			
81	11	9	09-Nov-81							21.9		0.27	57.8	0.04		4.46	19.38				2.37			16.4			
82	3	2	02-Mar-82							21.5		0.1	65.6	0.12		4.46	14.6				2.58			25.19			
82	5	10	10-May-82							20.4		0.01	49.9			4.16	14				1.64			11			
82	8	10	10-Aug-82		0.005				0.007	19.7	0.001	0.01	46.3	0.02		3.95	11		0.01		1.5			10.8			
82	11	10	10-Nov-82							17.4		0.328	29.8	0.07		3.4	8.51				1.58			10.1			
83	1	26	26-Jan-83							15		0.168	25.1	0.04		2.97	6.83				1.47			8.92			
83	6	23	23-Jun-83							14.5		0.3	23.4	0.065		2.47	5.86				1.23			8.46			
83	9	7	07-Sep-83							11.7		0.19	22.2	0.063		2.12	5.49				1.53			8.58			
83	11	23	23-Nov-83							11.8		0.15	19.9	0.032		1.86	4.96				1.13			8.7			
84	2	29	29-Feb-84							9.9		0.18	20.5	0.283		1.83	4.65				1.11			9.03			
84	5	18	18-May-84							10.4		0.185	22.6	0.28		1.83	4.4				1.12			8.48			
84	8	5	05-Aug-84							4		0.24	17.4	0.18		1.64	4.2				1.01			8.3			
85	2	15	15-Feb-85							7.6		0.1	18	0.037		1.86	3.52				1.1			8.5			
85	5	22	22-May-85							6.3			14.4			1.48	4.5							7.7			
85	8	6	06-Aug-85							7			11			1.44	3.5				1.02			7.8			
85	11	13	13-Nov-85							6			12			1.46	3.3							9			
86	3	3	03-Mar-86							6.1			11			1.56	4.3							8.9			
86	5	6	06-May-86							7.2			14	0.014		1.57	4							7.6			
86	8	13	13-Aug-86							6.1			6.1			1.5	3.7				1.14			7.6			
86	12	11	11-Dec-86							8.2			8.5			1.66	4							8.8			
87	2	23	23-Feb-87							9.4			13.7			1.76	3.79							9.1			
87	5	4	04-May-87	0.02	0.07	0.08	0.01	0.05	0.01	9.66	0.03	0.01	0.11	0.19	0.02	1.9	4.45		0.01		0.5	0.05		12.4	0.1	0.1	0.1
87	8	11	11-Aug-87	0.01	0.17	0.14	0.01	0.07	0.02	9.68	0.13	0.01	4.38	0.27	0.06	2.14	4.79		0.01	0.9	1.1	0.12		8.4	0.1	0.1	0.1
87	11	18	18-Nov-87	0.03	0.06	0.17	0.01	0.07	0.02	9.14	0.09	0.01	1.57	0.05	0.05	1.98	4.54		0.02	0.5	1.2	0.12		9.2	0.1	0.1	0.1
88	2	17	17-Feb-88	0.2	0.03	0.01	0.01	0.07	0.005	9.17	0.05	0.02	15.6	0.02	0.05	2.01	3.89		0.02	0.67	0.99	0.02	8.58	9.08	0.04	0.17	0.1
88	5	26	26-May-88	0.3	0.15	0.02	0.01	0.1	0.01	8.44	0.04	0.01	18.4	0.01	0.04	1.93	3.85		0.02	0.73	1.27	0.01	7.2	9.6	0.05	0.05	0.1
88	8	7	07-Aug-88	0.22	0.081	0.02	0.001	0.09	0.01	8.51	0.04	0.01	16.6	0.04	0.03	1.88	3.89		0.01	0.71	0.93	0.1		10.2	0.05	0.06	0.05
88	11	28	28-Nov-88	2.27	0.014	0.03	0	0.19	0.04	9.27	0.07	0.07	17.35	0.76	0.06	2.3	4.14		0.04	2.04	1.59	0.05	9.9	10.4	0.06	0.04	0.12
89	3	10	10-Mar-89	0.24		0.01	0.01	0.01	0.011	7.2	0.01	0.03	15	0.28	0.06	1.4	3.3		0.01		1.26	0.1		9.43		0.05	
89	5	23	23-May-89	0.87	0.006	0.021	0.005	0.04	0.02	7.1	0.02	0.04	18	0.4	0.14	1.7	3.7		0.01	0.955	0.1			7.68		0.03	
89	8	7	07-Aug-89	0.05	0.002	0.005	0.005	0.02	0.005	6.3	0.01	0.005	2.3	0.01	0.02	2	2.7		0.01		1.35	0.1		14.9		0.03	
90	6	1	01-Jun-90	10.3		0.201	0.02	0.13	0.21	6.7	0.53	0.04	14	2.35	0.08	2.3	2.9		0.15		1	0.1		7.9		0.03	
90	7	18	18-Jul-90	2.13		0.031	0.005	0.03	0.04	8.52	0.01	0.05	18	0.31	0.01	1.73	2.27		0.02		1	0.1		7.7		0.13	
90	11	13	13-Nov-90	2.55	0.005	0.5	0.05	0.05	0.0766	6.8	0.01	0.09	20	0.748	0.017	0.97	2.83		0.016		1.51	0.005		8.3		0.01	
92	8	17	17-Aug-92	2.08	0.005	0.5	0.05	0.12	0.0005	42	0.005	0.02	13	0.51	0.005	0.88	2.07		0.014		1.21	0.005		9.4		0.01	
94	5	13	13-May-94	1.2	0.005	0.5	0.05	0.1	0.02	7	0.005	0.005	18	0.17	0.005	1.81	2.23		0.005		2.56	0.005		14		0.01	
94	10	4	04-Oct-94	3	0.005	0.5	0.05	0.1	0.012	4	0.005	0.005	21	0.09	0.005	1.47	2.92		0.005		1.16	0.005		21		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 6

continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDN	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	Sb
77	8	4	04-Aug-77		3.208				0.312			0.092			21.6														7.08	61.8			
77	9	5	05-Sep-77		20.78				0.309			0.043			25.6		7						44						7.06	24.4			
77	10	5	05-Oct-77		21.565				0.123			0.07			18.2							3.82							7	23.6			
77	10	24	24-Oct-77		20.876				0.064			0.118			1		6.5				4.82	8.64	77	51					6.62	29.4			
77	11	6	08-Nov-77		0.007				0.005			0.071			40		22.7				13.78		220	3				0.66	7.65	110.4			
77	11	23	23-Nov-77		23.925				0.239			0.105			15.4		17				6.07		79	26						31			
77	12	21	21-Dec-77		3.764				0.144			0.01																	7.03	105			
78	3	20	20-Mar-78		25.7				0.05			0.061																		27.8			
78	4	18	18-Apr-78		25.5				0.113			0.046																		34.4			
78	5	29	29-May-78		66.755				0.242			0.071																	6.64	1.1			
78	6	28	28-Jun-78		18.75				0.084			0.133																	7.09	19.8			
78	8	17	17-Aug-78		16.08				0.006			0.078																	6.96	19.6			
78	10	4	04-Oct-78		14.22				0.09			0.046																	7.1	14.6			
78	12	6	06-Dec-78		11.93				0.095			0.2																	7.06	22			
78	12	28	28-Dec-78		12.84				0.249			0.094																	6.89	22.6			
79	1	16	16-Jan-79		14.43				0.1			0.062																	7.22	26.2			
79	2	7	07-Feb-79		14.59		0.041		0.119			0.054					15				36		51	58					6.71	23.4		0.005	
79	3	7	07-Mar-79		37.11	0.005	0.049	0.001	0.215						1		15				16				10.37	149.3			7.12	50.8			
79	4	9	09-Apr-79		27.35	0.005	0.005	0.014	0.279						5		10			5	11				17.14	123.09			6.97	51			
79	5	2	02-May-79		43.34	0.005	0.005	0.001	0.32								12			1	5		97		18.05	155.93			7.12	66.6			
79	6	6	06-Jun-79		31.53	0.005	0.005	0.002	0.424						5		19			1	14				23.16	151.91			7.34	65.66			
79	7	17	17-Jul-79		49.02		0.112		0.458						1		25				30				37.27	246			6.99	102.4			
79	8	14	14-Aug-79														35						166		31.14	214							
79	11	21	21-Nov-79														21						180		31.64	243.74							
80	2	11	11-Feb-80		30.8		0.065		0.759						5		31						136		160.5	275.96			6.75	39.2			
80	4	29	29-Apr-80		27.06		0.008		0.381			0.224			5		23						181		139.67	254.96			7.38	88.8			
80	7	24	24-Jul-80		18.82		0.124		0.205						1		9						109		91.25	218.27			6.4	74.5			
80	11	20	20-Nov-80		26.44		0.005		0.091			0.006			1		28			11	47		100		95.67	230			6.95	90			
81	4	1	01-Apr-81		25.9		0.007		0.269			0.031			1		29			1	66		158		164.1	230			6.31				
81	8	18	18-Aug-81		29.8		0.006		3.2						2		40				61		197		223	340			6.63	98			
81	11	9	09-Nov-81		21.1		0.005		0.73						2		43			2	47		167		244	280			5.97	69			
82	3	2	02-Mar-82		24		0.057		0.68						0.5		52			4	48		200		216	300			7.53	84			
82	5	10	10-May-82		44		0.008		0.45						0.3		49				42		243		250	370			8.36	96			
82	8	10	10-Aug-82		37.8		0.002		0.42			0.022			0.5		77			4	40		224		166	60			6.97	173			
82	11	10	10-Nov-82		39		0.004		0.608			0.085			0.3		28			1	28		169		126				7.66	57			
83	1	26	26-Jan-83		29.8		0.011		0.8			0.149			0.2		48			1	29		220		107				7.49	66			
83	6	23	23-Jun-83		26.9		0.044		0.47			0.029			0.3		16.3	0.027			28		143						6.34	83.5			
83	9	7	07-Sep-83		18.1		0.079		0.47			0.098			0.2		11.5	0.06			48		108			190			7.32	155			
83	11	23	23-Nov-83		25.4		0.035		0.37			0.072			0.3		24.5	0.05			23		148			190			7.85	48.2			
84	2	29	29-Feb-84		18.2		0.021		0.52			0.083			0.3		11.1	0.058			12		110			113			6.36	67.7			
84	5	18	18-May-84		21.1		0.032		0.75			0.025			0.38		10.6	0.072			22		100			185			7.16	66.2			
84	8	5	05-Aug-84		22		0.031		0.62			0.081			0.1		8.9	0.052		4	13		91			170				63.4			
85	2	15	15-Feb-85		16		0.003		0.73			0.124			0.4		8.2	0.06		6.2	38		100			140			6.71	61.7			
85	5	22	22-May-85																				81										
85	8	6	06-Aug-85		24												8.3				10		44			140			6.78	62			
85	11	13	13-Nov-85														11						105			150				56.1			
86	3	3	03-Mar-86														14						80			156				50.2			
86	5	6	06-May-86														13						97										
86	8	13	13-Aug-86		12												13				10		75			134			6.75	49.4			
86	12	11	11-Dec-86														16						93			162				4.9			
87	2	23	23-Feb-87														17						94			153				48.5			
87	5	4	04-May-87	0.04	9.74	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1	163		0.1				15			190				46			
87	8	11	11-Aug-87	0.01	13.93												25.8				9.5		245			200			6.5	58			
87	11	18	18-Nov-87	0.03	12.24								0.1	42.7			14.7						120		30.9	185			6.3	35			
88	2	17	17-Feb-88	0.01	12.2								0.1	68.3			25.5						245		31.2	200			7.8	56			
88	5	26	26-May-88	0.03	11.6												15.3						100			155				52			
88	8	7	07-Aug-88	0.01	10.9								0	51.2			16						30		29	150			6.49	42			
88	11	28	28-Nov-88	0.01	32.2												14				13.8		540			200			6.89	80			
89	3	10	10-Mar-89	0.01	20								0	83.6			10.1				13		92	113	23.7	167			6.45	68.6			0.06
89	5	23	23-May-89	0.01	19								0	43.9			10.8						100	399	24.7	200			6.49	36			0.06
89	8	7	07-Aug-89	0.01	12								0	71.9			20.6				17		75		24	180			6.73	59			0.05
90	6	1	01-Jun-90	0.34	44								0.02	64			11						109	1540	26.2	154			6.6	64			0.06
90	7	18	18-Jul-90	0.01	24								0.03	55			12						84		23.4	142			6.8	55			0.06
90	11	13	13-Nov-90	0.04	32												16.8				180		118	791	21	132.5			6.56	68.1			0.001
92	8	17	17-Aug-92	0.09	20				0.33			0.02					9.1	0.05			6		85	296	108	113			6.28	54.2			0.001
94	5	13	13-May-94	0.05	18				0.35			0.03					13.3	0.05					105	78	24.1	154.1			6.91	78			0.006
94	10	4	04-Oct-94	0.05	15				0.8			0.02					7.7	0.05			29		130	30	16	190.2			6.84	100			0.006

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 7

Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Na	Sr	Sn	Tl
77	8	4	04-Aug-77		0.001				0.01	26.32	0.011	0.028	2.707	0.107			0.627		0.019		2.941		0.824			
77	9	5	05-Sep-77		0.001				0.01	48.4	0.016	0.01	2	0.078			0.498		0.015		7.038		2.172			
77	10	6	06-Oct-77						0.01	18.92	0.013	0.019	0.864	0.064			0.42		0.005		2.04		12.34			
77	10	24	24-Oct-77						0.011	16.96	0.102	0.054	8.427	0.18		1.746	0.262		0.012		6.77		7.425			
77	11	8	08-Nov-77						0.005	4.895	0.005	0.005	0.057	0.01		2.377	0.01		0.005		1.332		7.585			
77	11	23	23-Nov-77						0.005	8.2	0.013	0.092	2.467	0.141		1.001	0.336		0.006		1.21		6.37			
77	12	21	21-Dec-77										0.641	0.033			0.183		0.005		0.686					
78	2	22	22-Feb-78										1.246	0.04			0.096		0.01		1.157					
78	3	20	20-Mar-78										0.519	0.031			0.12		0.01		2.877					
78	4	18	18-Apr-78										2.94	0.194			0.171		0.01		1.4					
78	5	29	29-May-78										1.847	0.045			0.146		0.025		1.362					
78	6	28	28-Jun-78										1	0.031			0.125		0.025		1.349					
78	8	17	17-Aug-78										5.7	0.043			0.128		0.02		1.028					
78	10	4	04-Oct-78										1.069	0.051			0.097		0.01		1.096					
78	12	6	06-Dec-78										1.128	0.053			0.139		0.04		0.822					
78	12	28	28-Dec-78										1.323	0.037			0.137		0.01		0.585					
79	1	18	18-Jan-79										2.134	0.073			0.179		0.015		0.63					
79	6	6	06-Jun-79							8.71		0.025	4.096	0.054		0.9	0.511									
79	7	17	17-Jul-79							11.63			4.512	0.076		2.094	0.45				2.576		8.81			
79	8	14	14-Aug-79							12.75						2.491										
79	11	21	21-Nov-79							32.24						10.38										
80	4	29	29-Apr-80							54.78		0.07	25.66			22.69	1.89				52.97		161			
80	7	24	24-Jul-80							45.9		0.08	20.9	0.196		18.51	2.92				54.68		56.22			
80	11	20	20-Nov-80							30.7		0.08	8.04	0.099		8.29	1.07				28.4		35.6			
81	4	1	01-Apr-81							66.25		0.06	37.1	0.23		21.8	21.5				18		45.9			
81	8	18	18-Aug-81							65		0.08	41.6	0.19		17.3	42.3				4.31		12.3			
81	11	9	09-Nov-81							65		0.01	12.7	0.015		18.1	12.39				275		41.7			
82	3	2	02-Mar-82							80.9		0.04	78.4	0.2		19.4	33.5				3.4		43.23			
82	5	10	10-May-82							40.8		0.01	57.9	0.03		13	19.1				27.4		30			
82	8	10	10-Aug-82		0.005				0.144	19.7	0.005	0.03	56.8	0.243		8.74	2.65		0.01		40.2		62.8			
82	11	10	10-Nov-82							240		0.154	171	0.817		48.3	122				7.14		47.4			
83	1	26	26-Jan-83							194		0.14	158	0.86		41	99.5				10.3		49.1			
83	6	23	23-Jun-83							191		0.067	101	0.541		26	66.1				13.8		53.4			
83	9	7	07-Sep-83							138		0.11	145	1.02		26.7	50				26.2		68.4			
83	11	23	23-Nov-83							172		0.11	146	0.32		27.8	57.9				19.7		78			
84	2	29	29-Feb-84							181		0.037	15.7	0.019		32.9	75.7				5.61		84			
84	8	5	05-Aug-84							130		0.05	168	0.03		35.7	74				4.51		79			
86	8	13	13-Aug-86							110			81			17	24				3.5		82			
87	8	11	11-Aug-87	0.04	0.27	0.39	0.01	0.14	0.01	79.47	0.28	0.01	13.38	0.3	0.11	12.03	14.43		0.04	1	11.7	0.19	50	0.4	0.1	0.1
88	8	7	07-Aug-88	1.01	0.129	0.1	0.002	0.19	0.01	87.7	0.11	0.09	128	0.43	0.11	9.73	12.4		0.05	1.11	3.14	0.1	44.9	0.41	0.05	0.08
89	8	7	07-Aug-89	0.05	0.002	0.021	0.005	0.04	0.005	51	0.01	0.005	2.1	0.01	0.1	7.1	7.3		0.16		3.99	0.1	39.9		0.03	
90	7	18	18-Jul-90	1.94		0.187	0.013	0.13	0.2	55	0.07	0.55	83	2.04	1.77	8.31	11		0.16		8.2	0.1	41.1		0.9	
91	7	31	31-Jul-91	0.3	0.005			0.2	0.0005	27	0.005	0.02	0.25	0.006	0.005	7.6	7.6		0.315		9.9	0.005	53		0.01	
91	12	11	11-Dec-91	0.04	0.005	0.5	0.05	0.24	0.0005	50	0.005	0.03	30	0.002	0.005	8.6	11		0.164		5.2	0.005	25		0.01	
92	3	24	24-Mar-92	0.55	0.005	0.5	0.05	0.49	0.0005	6.3	0.005	0.03	0.17	0.001	0.005	1.78	0.005		0.005		2.38	0.005	24		0.01	
92	6	3	03-Jun-92	1.24	0.005	0.5	0.05	0.1	0.0005	64	0.005	0.005	11	0.004	0.005	9.8	12		0.103		6.3	0.005	5.4		0.01	
92	8	17	17-Aug-92	7.2	0.005	0.5	0.05	0.35	0.0005	65	0.005	0.3	165	0.63	0.005	13	16		0.03		5.8	0.005	45		0.01	
92	11	24	24-Nov-92	3.5	0.005	0.5	0.05	0.27	0.0005	67	0.026	0.31	157	0.48	0.005	11	13		0.145		5.8	0.005	36		0.01	
93	2	26	26-Feb-93	2.16	0.005	0.5	0.05	0.1	0.0005	59	0.005	0.01	39	0.04	0.005	11	14		0.005		4.8	0.005	42		0.01	
93	7	21	21-Jul-93	2.83	0.005	0.5	0.05	0.36	0.018	78	0.005	0.23	150	0.069	0.005	12	15		0.005		6.2	0.005	50		0.01	
94	5	13	13-May-94	1.5	0.005	0.5	0.05	0.1	0.0077	68	0.005	0.1	140	0.07	0.005	11	13		0.005		7.6	0.005	64		0.01	
94	10	4	04-Oct-94	3.8	0.005	0.5	0.05	0.3	0.0035	41	0.005	0.14	130	0.04	0.005	11	13		0.005		9	0.005	56		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 7
continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.
77	8	4	04-Aug-77		3.269				1.181			0.564			0.5	
77	9	5	05-Sep-77		24.97				0.549			0.082			8.9	
77	10	5	05-Oct-77		31.105				0.317			0.091			5.6	
77	10	24	24-Oct-77		22.566											
77	11	8	08-Nov-77		0.01				0.187			0.081			5.3	
77	11	23	23-Nov-77		48.36				0.434			0.252			1	
77	12	21	21-Dec-77		3.882				0.379			0.068				
78	2	22	22-Feb-78		13.02				0.704			0.252				
78	3	20	20-Mar-78		14.13				0.343			0.152				
78	4	18	18-Apr-78		25.2				0.974			0.208				
78	5	29	29-May-78		22.005				0.584			0.227				
78	6	28	28-Jun-78		24.188				0.601							
78	8	17	17-Aug-78		38.08				0.075			0.064				
78	10	4	04-Oct-78		26.25				0.72			0.218				
78	12	6	06-Dec-78		45.85				0.203			0.216				
78	12	28	28-Dec-78		44.02				0.249			0.09				
79	1	16	16-Jan-79		43.75				0.252			0.16				
79	6	6	06-Jun-79		45.38	0.026	0.005	0.013	0.553						5	
79	7	17	17-Jul-79		82.33		0.034		0.608						2	
79	8	14	14-Aug-79													
79	11	21	21-Nov-79													
80	4	29	29-Apr-80		107.64		0.013		28.14			0.754			12	
80	7	24	24-Jul-80		105.78		0.05		14.55						17	
80	11	20	20-Nov-80		9.22		0.005		11.1			0.067			100	
81	4	1	01-Apr-81		111		0.005		7.31			0.117			2	
81	8	18	18-Aug-81		59.6		0.005		3.25						6	
81	11	9	09-Nov-81		86.7		0.005		6.5						4	
82	3	2	02-Mar-82		85.9		0.005		6.8						1.9	
82	5	10	10-May-82		101		0.008		0.54						1	
82	8	10	10-Aug-82		143		0.002	4.1	21			0.095			4.1	
82	11	10	10-Nov-82		174		0.005		2.47			0.368			0.5	
83	1	26	26-Jan-83		112		0.005		3.5			0.67			0.4	
83	6	23	23-Jun-83		86.4		0.035		5.1			0.667			1.6	
83	9	7	07-Sep-83		78.5		0.014		7.5			0.36			32	
83	11	23	23-Nov-83		53.5		0.13		5.4			0.34			20	
84	2	29	29-Feb-84		62.4		0.02		2			0.32			3.4	
84	8	5	05-Aug-84		56		0.037		2.8			0.323			1.9	
86	8	13	13-Aug-86		17											
87	8	11	11-Aug-87	0.01	13.51											
88	8	7	07-Aug-88	0.03	13.6								0	299.9		
89	8	7	07-Aug-89	0.01	9								0	279.2		
90	7	18	18-Jul-90	0.11	44								0.07	192		
91	7	31	31-Jul-91	0.05	6.8											
91	12	11	11-Dec-91	0.05	4.3											
92	3	24	24-Mar-92	0.1	0.005											8
92	6	3	03-Jun-92	0.05	2.33											17
92	8	17	17-Aug-92	0.1	22				0.54							
92	11	24	24-Nov-92	0.15	22				2.6							8.4
93	2	26	26-Feb-93	0.05	3.31				2.5							40
93	7	21	21-Jul-93	0.05	9.5				2.4			1.2				3.3
94	5	13	13-May-94	0.05	3.8				2.3			0.02				
94	10	4	04-Oct-94	0.05	23				3.1			0.02				

Date	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDN	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	Sb
04-Aug-77													7.4	203			
05-Sep-77	9						121						7.4	91.4			
05-Oct-77						2.86							7.3	88.8			
24-Oct-77						2.22											
08-Nov-77	32.6				11.39		52	2				1.08	6.46	9.2			
23-Nov-77	7.1				32.07		119	79						73			
21-Dec-77													6.99	131.6			
22-Feb-78														22			
20-Mar-78														38			
18-Apr-78														40.2			
29-May-78													6.79	41.8			
28-Jun-78													7.22	49.6			
17-Aug-78													7.34	67.4			
04-Oct-78													7.17	44.2			
06-Dec-78													7.35	81.8			
28-Dec-78													6.99	65.6			
16-Jan-79													7.07	75			
06-Jun-79	23			1	48				33.73	234.43			7.14	87			
17-Jul-79	29				32				46.56	309.49			7.01	132.8			
14-Aug-79	40						205		42.09	269.03							
21-Nov-79	7						802		123.23	890.19							
29-Apr-80	186						1084		279.22	1420.07			6.46	123			
24-Jul-80	9						841		236.07	1484.12			6.42	240.9			
20-Nov-80	93			4	59		250		128.9	550			6.39	59			
01-Apr-81	90			4	65		463		361	810			6.61	326			
18-Aug-81	66				22		487		580	340			7.25	294			
09-Nov-81	86			1	83		349		415	840			6.51	341			
02-Mar-82	89			3	126		496		433	800			7.75	245			
10-May-82	72.5				114		549		449	910			6.79	320			
10-Aug-82	6.9			2	111		617		1.92	900			6.63	69			
10-Nov-82	162			3	141		1853		1330				7.35	564			
26-Jan-83	6.8			4	307		1503		1120				6.34	417			
23-Jun-83	112	0.035			198		1280						6.24	348			
07-Sep-83	96	0.05			277		1350			1640			6.43	418			
23-Nov-83	130	0.05			251		1470			1640			7.91	407			
29-Feb-84	115	0.062			230		1820			135			6.26	442			
05-Aug-84	98	0.069		3	357		1720			1840				364.4			
13-Aug-86	70				260		955			971			6.26	262			
11-Aug-87	299				359		740			900			6.2	175			
07-Aug-88	39.2						270		209.1	800			6.7	246			
07-Aug-89	46.4				95		295		156.6	550			6.77	229			0.05
18-Jul-90	65						320		171	570			6.8	192			0.15
31-Jul-91	90				50		365	5	98.7	418			6.8	144			0.001
11-Dec-91	108				45		397	14	180	548			6.77	174			0.001
24-Mar-92	58				21		138	4	23.1	219			6.63	12			0.001
03-Jun-92	137				41		513	68	200	668			6.4	203			0.001
17-Aug-92	143	0.09			40		612	786	216	749			6.15	224			0.001
24-Nov-92	157	0.06			21		549	621	213	823			6.47	180			0.001
26-Feb-93	171	0.15					542	627	193	813			6.23	146			0.001
21-Jul-93	181	0.18			19		743	616	239	1001			6.61	300			0.001
13-May-94	191	0.11					724	390	215	925			6.37	252			0.005
04-Oct-94	142	0.14			6		885	60	148	1020			6.88	338			0.005

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 8

Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Tl
77	8	4	04-Aug-77		0.001				0.01	4.854	0.005	0.01	0.403	0.021			0.171		0.005		1.769			5.112			
77	9	5	05-Sep-77		0.001				0.01	6.32	0.005	0.048	0.56	0.044			0.091		0.008		5.304			1.704			
77	10	5	05-Oct-77						0.01	3.87	0.005	0.01	0.033	0.01			0.129		0.006		1.717			5.62			
77	10	24	24-Oct-77						0.01	2.98	0.08	0.031	0.722	0.04		0.474	0.103		0.005		0.993			4.09			
77	11	8	08-Nov-77						0.005	15.291	0.005	0.006	0.03	0.01		3.491	0.01		0.006		0.551			8.005			
77	11	23	23-Nov-77						0.005	3.64	0.016	0.07	0.801	0.083		0.389	0.071		0.006		0.875			4.15			
77	12	21	21-Dec-77										0.045	0.021			0.043		0.006		0.854						
78	2	22	22-Feb-78										1.246	0.04			0.096		0.01		1.157						
78	3	20	20-Mar-78										0.519	0.031			0.12		0.01		2.877						
78	4	18	18-Apr-78										2.94	0.194			0.171		0.01		1.4						
78	5	29	29-May-78										0.542	0.031			0.035		0.025		0.482						
78	6	28	28-Jun-78										0.202	0.01			0.019		0.025		0.582						
78	8	17	17-Aug-78										0.266	0.013			0.026		0.01		0.652						
78	10	4	04-Oct-78										0.133	0.016			0.029		0.01		0.801						
78	12	6	06-Dec-78										0.401	0.016			0.028		0.033		0.643						
78	12	28	28-Dec-78										0.314	0.02			0.037		0.01					0.82			
79	1	16	16-Jan-79										0.199	0.012			0.047		0.01		0.65						
79	5	2	02-May-79							8.74		0.068	0.931	0.046		0.961	0.208										
79	6	6	06-Jun-79							6.65		0.011	0.656	0.03		1.309	0.119										
79	7	17	17-Jul-79							6.71			0.378	0.07		1.051	0.215				0.709			5.54			
80	11	20	20-Nov-80							5.93		0.09	2.57	0.056		1.37	0.2				1.74			6.4			
81	4	1	01-Apr-81							7.81		0.01	0.13	0.01		1.29	0.22				0.75			7.03			
81	8	18	18-Aug-81							8.37		0.16	2.36	0.06		1.15	0.18				0.63			8.05			
81	11	9	09-Nov-81							5.4		0.37	2.58	0.125		1.25	0.155				1.69			8.61			
82	3	2	02-Mar-82							7.09		0.06	3.04	0.01		1.14	0.1				1.38			6.05			
82	5	10	10-May-82							8.11		0.01	2.93	0.01		1.22	0.05				0.87			5			
82	8	10	10-Aug-82		0.005				0.123	7.39	0.001	0.03	4.36	0.11		1.5	0.07		0.01		1.02			6.15			
82	11	10	10-Nov-82							6.52						1.01											
83	1	26	26-Jan-83							8.5						1.09											
83	6	23	23-Jun-83							7.45			2.31			1.16					0.68			5.44			
83	9	7	07-Sep-83							7.57			3.03			1.01					1.18			5.77			
83	11	23	23-Nov-83							8.21			2.66			1.19					0.74			7.14			
84	5	18	18-May-84							11			4.2			1.59					0.83			7.4			
84	8	9	09-Aug-84							6.8			2.8	0.01		1.47					0.86			7.5			
85	2	15	15-Feb-85							13			2.9	0.056		2.2					0.89			10.8			
85	8	6	06-Aug-85							14			2.2			2.1	0.07				1.06			8.9			
85	11	13	13-Nov-85							15			4.3			2.7	0.13							11			
86	3	3	03-Mar-86							14			4			2.9	0.2							16			
86	5	6	06-May-86							15			3.5	0.127		2.8	0.12							11			
86	8	13	13-Aug-86							17			2.7			3.3	0.13				1.42			11			
86	12	11	11-Dec-86							21.6			4.1			3.4	0.15							12.2			
87	2	23	23-Feb-87							22.2			4.73			4.2	0.14							13.7			
87	5	4	04-May-87	0.03	0.11	0.08	0.01	0.1	0.01	32.07	0.03	0.01	0.12	0.55	0.01	6.03	0.2		0.04		0.5	0.1		18.2	0.1	0.1	0.1
87	8	11	11-Aug-87	0.05	0.26	0.19	0.01	0.17	0.04	35.11	0.12	0.01	1.98	0.62	0.13	5.59	0.27		0.04		1.3	0.24		18.9	0.2	0.1	0.1
87	11	18	18-Nov-87	0.03	0.04	0.12	0.01	0.07	0.02	11.09	0.05	0.01	0.45	0.05	0.03	1.85	0.13		0.03	0.6	1.6	0.09		18.4	0.1	0.1	0.1
88	2	17	17-Feb-88	1.32	0.1	0.02	0.01	0.15	0.006	25.3	0.06	0.04	7.18	0.17	0.09	4.36	0.23		0.07	1.97	1.41	0.05	15.9	16.4	0.1	0.23	0.1
88	5	26	26-May-88	0.47	0.18	0.02	0.01	0.19	0.02	21.1	0.03	0.03	6.74	0.11	0.03	3.52	0.02		0.04	1.51	1.46	0.03	8.53	16	0.1	0.05	0.1
88	8	7	07-Aug-88	1.88	0.108	0.02	0.001	0.2	0.023	18.7	0.03	0.04	7.79	0.35	0.03	3.38	0.27		0.03	1.77	1.19	0.1		16.7	0.09	0.05	0.09
88	11	28	28-Nov-88	0.86	0.006	0.01	0.001	0.21	0.031	12.96	0.04	0.03	6.91	0.83	0.06	2.2	0.17		0.04	2.06	1.23	0.05	9.64	14.1	0.07	0.02	0.08
89	3	10	10-Mar-89	1.1		0.02	0.01	0.01	0.022	11.7	0.01	0.02	8.1	0.55	0.01	1.9	0.12		0.01		1.22	0.1		14.2		0.03	
89	5	23	23-May-89	2.2	0.002	0.021	0.005	0.02	0.02	12.8	0.01	0.02	10	0.6	0.02	2.6	0.23		0.01		0.95	0.1		14.2		0.03	
89	8	7	07-Aug-89	0.05	0.002	0.006	0.005	0.02	0.006	12	0.01	0.005	0.64	0.01	0.01	2.3	0.24		0.01		1.34	0.1		19		0.03	
89	12	13	13-Dec-89	0.26		0.007	0.006	0.02	0.015	10	0.01	0.02	6.52	0.53	0.01	1.63	0.01		0.02		1.49	0.1		16		0.03	
90	6	1	01-Jun-90	0.93		0.013	0.005	0.02	0.02	11	0.01	0.02	9	0.68	0.01	2.7	0.16		0.02		1	0.1		16		0.03	
90	7	18	18-Jul-90	1.37		0.019	0.005	0.02	0.01	8.96	0.01	0.04	14	0.67	0.01	1.9	0.01		0.02		1	0.1		15.8		0.08	
90	11	13	13-Nov-90	2.16	0.005	0.5	0.05	0.05	0.0208	6.8	0.006	0.06	14	0.762	0.005	1.19	0.19		0.019		1.14	0.005		16		0.01	
92	8	17	17-Aug-92	1.69	0.005	0.5	0.05	0.08	0.0005	10	0.005	0.05	16	0.81	0.005	1.73	0.22		0.012		1.23	0.005		24		0.01	
94	7	13	13-Jul-94	1.3	0.005	0.5	0.05	0.1	0.014	2.26	0.005	0.005	12	0.29	0.005	1.34	0.15		0.005		1.06	0.005		19		0.01	
94	10	4	04-Oct-94	1.3	0.005	0.5	0.05	0.1	0.0086	1.5	0.005	0.008	16	0.25	0.005	0.74	0.22		0.005		0.87	0.005		23		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 8
continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C	Cl	F	I	B.O.D	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDN	Cond	COLOR	TURB	pH	Alk	Acidity	Li	Sb
77	8	4	04-Aug-77		3.099				0.234			0.09			19.6														7.2	58.6			
77	9	5	05-Sep-77		12.41				0.782			0.078			5.8		6						74						7.27	34.8			
77	10	5	05-Oct-77		9.624				0.562			0.09			2.4							4.95							7.22	31.2			
77	10	24	24-Oct-77		15.9				0.242			0.114			1		7.1				2.5	5.57	81	34					6.48	40.4			
77	11	8	08-Nov-77		0.01				0.005			0.109			7.8		1.4				6.46		95	2				0.35	7.41	43.4			
77	11	23	23-Nov-77		22.335				0.348			0.158			4.8		8.5				6.07		92	16						38.8			
77	12	21	21-Dec-77		3.899				0.11			0.025																	7.17	78.8			
78	2	22	22-Feb-78		13.02				0.704			0.252																		22			
78	3	20	20-Mar-78		14.13				0.343			0.152																		38			
78	4	18	18-Apr-78		25.2				0.974			0.206																		40.2			
78	5	29	29-May-78		22.865				0.264			0.129																	7.11	41.8			
78	6	28	28-Jun-78		25.756				0.316			0.204																	7.06	35.4			
78	8	17	17-Aug-78		15.63				0.083			0.087																	7.22	41			
78	10	4	04-Oct-78		12.65				0.114			0.051																	7.27	29			
78	12	6	06-Dec-78		29.21				0.109			0.218																	7.1	42.8			
78	12	28	28-Dec-78		23.14				0.218			0.119																	7.06	35.2			
79	1	16	16-Jan-79		63.3				0.224			0.066																	7.44	52.8			
79	5	2	02-May-79		41.57	0.005	0.005	0.001	0.598								18			2	9		108		22.84	162.62			7.06	59			
79	6	6	06-Jun-79		34.61	0.005	0.005	0.001	0.379						5		20			1	16				23.39	165.3			7.46	72.8			
79	7	17	17-Jul-79		32.62		0.034		0.518						1		34				13				22.15	165.13			7.05	73.8			
80	11	20	20-Nov-80		22.9		0.014		0.257			0.023			4		20			1	27		81		25.42	150			7.28	59			
81	4	1	01-Apr-81		41.8		0.021		0.215			0.037			3		18			3	16		82		25.4	150			7.02	62			
81	8	18	18-Aug-81		45.7		0.012		0.91						2		18.3				11		84		100	200			6.52	38			
81	11	9	09-Nov-81		31.8		0.005		0.46						3		13.6			2	7		81		79.7	620			6.34	61			
82	3	2	02-Mar-82		32.8		0.006		0.26						0.9		10			4	16		62		29.5	100			6.99	32			
82	5	10	10-May-82		37.1		0.003		0.27						0.4		9.8				26		120		87.4	190			6.24	76			
82	8	10	10-Aug-82		40.7		0.002		0.46			0.76			0.3		14	0.21		1	16		114		32.8	170			7.81	236			
82	11	10	10-Nov-82														8.4						111		20.4								
83	1	28	28-Jan-83														9.4						112		20.7								
83	6	23	23-Jun-83		38.9		0.008								1		10.8						77						6.46	68.3			
83	9	7	07-Sep-83		26.8		0.003								0.8		8	0.05					100			155			7.08	99.7			
83	11	23	23-Nov-83		45.5		0.002								1.1		25.9	0.05					133			230			7.7	140			
84	5	18	18-May-84		46.2		0.005										17.8	0.04					142			230			7.27	81.2			
84	8	5	05-Aug-84		41		0.014										17	0.04					158			225				70.9			
85	2	15	15-Feb-85		39		0.006								0.8		30	0.05					186			240			6.82	66.8			
85	8	8	08-Aug-85		44												36				13		140			230			6.74	131			
85	11	13	13-Nov-85														37						164			260				54.4			
86	3	3	03-Mar-86														43						181			269				51.3			
86	5	6	06-May-86														48						221										
86	8	13	13-Aug-86		36												61				18		209			289			6.86	64.2			
86	12	11	11-Dec-86														55						192			339				54.2			
87	2	23	23-Feb-87														66						215			385				53			
87	5	4	04-May-87	0.03	28.7	0.05	0.06	0.05	0.1	0.1	0.05				0.1	0.1	88.1		0.1				140			445				61			
87	8	11	11-Aug-87	0.01	44.82												90.1				19		575			500			6.5	84			
87	11	18	18-Nov-87	0.05	14.88								0.1	58.5			72.6						325		35.3	450			6.2	48			
88	2	17	17-Feb-88	0.02	37								0.1	92.6			82.4						350		81.1	440			7.51	76			
88	5	26	26-May-88	0.03	31												68.4						190			350				62			
88	8	7	07-Aug-88	0.01	28.2									43.9			48.1						140		80.5	325			6.81	36			
88	11	28	28-Nov-88	0.01	38.1												30.8				15.6		295			250			6.9	65.8			
89	3	10	10-Mar-89	0.01	36									89.5			24.5				15		160	381	37	230			6.67	73.4			0.05
89	5	23	23-May-89	0.01	40									73.6			35						125	875	42.7	300			6.41	60.4			0.05
89	8	7	07-Aug-89	0.01	26									81.7			40.9				16		185		39.4	230			6.67	67			0.05
89	12	13	13-Dec-89	0.01	29												33.8				15		215	125	31.7	200			7.08	44.4			0.05
90	6	1	01-Jun-90	0.01	32								0.02	65			34						156	187	36.6	225			6.6	65			0.05
90	7	18	18-Jul-90	0.01	36								0.04	59			33						148		32.7	225			6.8	59			0.05
90	11	13	13-Nov-90	0.04	29												20				92		139	256	26.4	169.2			6.57	67.1			0.001
92	8	17	17-Aug-92	0.09	10				0.04			0.02					30	0.05			10		139	183	32.1	199.2			6.16	56			0.001
94	7	13	13-Jul-94	0.05	9.9				0.1			0.02					22	0.05					107	111	11.2	153.1			6.73	50			0.005
94	10	4	04-Oct-94	0.05	13				0.35			0.02					13.4	0.05			43		114	40	6.8	166.3			6.99	67.8			0.005

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 9

Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Tl
77	8	4	04-Aug-77		0.001				0.01	7.065	0.061	0.072	8.256	0.114			0.376		0.027		3.996			7.284			
77	9	5	05-Sep-77		0.001				0.01	7.56	0.033	0.065	4.08	0.115			0.278		0.028		6.936			3.852			
77	10	5	05-Oct-77						0.01	2.71	0.005	0.024	0.726	0.078			0.235		0.005		2.397			8.165			
77	10	24	24-Oct-77						0.01	17.19	0.238	0.172	10.27	0.178		4.14	1.485		0.072		48.525			32.55			
77	11	8	08-Nov-77						0.005	35.029	0.005	0.006	0.094	0.01		8.312	0.008		0.007		0.911			10.405			
77	11	23	23-Nov-77						0.005	8.8	0.013	0.052	5.139	0.076		2.068	0.872		0.018		5.33			8.97			
77	12	21	21-Dec-77										2.5	0.059			0.581		0.007		3.3						
78	2	22	22-Feb-78										2.146	0.052			0.614		0.013		2.606						
78	3	20	20-Mar-78										1.635	0.029			0.662		0.024		1.665						
78	4	18	18-Apr-78										2.25	0.045			0.612		0.01		1.793						
78	5	29	29-May-78										1.072	0.032			0.534		0.025		3.163						
78	6	28	28-Jun-78										0.638	0.114			0.534		0.025		1.396						
78	8	17	17-Aug-78										0.929	0.028			0.578		0.01		1.434						
78	10	4	04-Oct-78										0.459	0.02			0.491		0.01		1.567						
78	12	6	06-Dec-78										0.941	0.015			0.322		0.011		1.569						
78	12	28	28-Dec-78										0.72	0.02			0.385		0.01		1.539						
79	1	16	16-Jan-79										0.644	0.023			0.358		0.01		2.19						
79	2	7	07-Feb-79						0.01	7.11	0.01	0.025	1.042	0.055	0.01	1.401	0.419	0.01	0.01		1.48			7.77			
79	4	9	09-Apr-79							6.941		0.042	10.54	0.091		0.898	0.409										
79	5	2	02-May-79							6.37		0.043	8.44	0.048		0.854	0.345										
79	6	6	06-Jun-79							4.82		0.019	4.038	0.047		1.251	0.398										
79	7	17	17-Jul-79							4.73			2.418	0.138		0.902	0.355				1.856			5.72			
80	2	11	11-Feb-80							6.68						1.308											
80	4	29	29-Apr-80							5.34						0.56											
80	7	24	24-Jul-80							5.21						1.24											
80	11	20	20-Nov-80							6.2		0.08	3.09	0.049		1.03	0.3				1.95			6.9			
81	4	1	01-Apr-81							6.58		0.71	4.2	0.41		1.82	0.4				1.34			7.8			
81	8	18	18-Aug-81																								
81	11	9	09-Nov-81							9.12		0.37	3.61	0.15		2.09	0.462				2.15			9.1			
82	3	2	02-Mar-82							10.3		0.09	4	0.13		2.27	0.45				1.89			13.31			
82	5	10	10-May-82							14.9		0.04	5.15	0.05		2.79	0.64				1.32			9.1			
82	8	10	10-Aug-82		0.006				0.0126	15.3	0.001	0.03	6.1	0.012		3.14	0.68		0.01		1.33			10.1			
82	11	10	10-Nov-82							13.9						3.09											
83	1	26	26-Jan-83							15.5						3.51											
83	6	23	23-Jun-83							24.5			4.16			4.7					1.42			10.6			
83	9	7	07-Sep-83							22.6			6.59			4.56					1.67			11.7			
83	11	23	23-Nov-83							23.2			7.42			5.25					1.79			13.1			
84	5	18	18-May-84							30.9		0.183	9.4	0.11		6.66	1.42				1.83			13.1			
84	8	5	05-Aug-84							26.3		0.45	7.4	0.25		6.3	1.56				1.8			14.3			
85	2	15	15-Feb-85							48		0.09	10	0.075		13	2.18				1.96			17			
85	5	22	22-May-85							57.6			6.3			14.5	3.4				3			17			
85	5	23	23-May-85							57.9			4.2			14.5	3.3				2.05			18			
85	8	6	06-Aug-85							82			11			20	3.7				2.7			19			
85	11	13	13-Nov-85							91			7.7			21	3.9				3.3			21			
86	3	3	03-Mar-86							110			6.9			28	6.2				2.1			23			
86	5	8	08-May-86							120			6.7			28	7.4				2.7			19			
86	8	13	13-Aug-86							140			24			33	11				2.4			19			
86	12	11	11-Dec-86							176			36.6			36.6	13.1				2.75			17			
87	2	23	23-Feb-87							168			41.1			44.8	11				2.33			16.8			
87	5	4	04-May-87	0.06	0.09	0.04	0.01	0.03	0.01	185.74	0.07	0.02	0.13	0.09	0.03	40.06	12.12		0.02	1.3	0.07			17.3	0.4	0.1	0.1
87	8	11	11-Aug-87	0.52	0.06	0.14	0.01	0.17	0.08	801.97	0.01	0.06	3.19	0.06	0.07	148.31	48.63		0.01	0.1	2.7	0.59		21.3	1.5	0.1	0.1
87	11	18	18-Nov-87	0.17	0.07	0.14	0.01	0.04	0.02	165.96	0.15	0.07	0.52	0.05	0.06	35.71	11.57		0.02	0.3	2.9	0.09		18.8	0.4	0.1	0.2
88	2	17	17-Feb-88	0.62	0.02	0.03	0.01	0.07	0.005	158	0.14	0.05	51.1	0.12	0.07	32.9	11		0.04	0.76	2.37	0.02	17.4	15.4	0.3	0.25	0.1
88	5	26	26-May-88	0.4	0.09	0.03	0.01	0.07	0.005	140	0.07	0.12	44.5	0.04	0.04	28.3	10.4		0.02	0.52	1.86	0.01	14.4	17.2	0.26	0.03	0.1
88	8	7	07-Aug-88	0.44	0.137	0.04	0.003	0.07	0.01	139	0.08	0.11	46.7	0.1	0.05	27.8	11		0.02	0.65	2.11	0.1		19	0.3	0.05	0.06
88	11	28	28-Nov-88	1.6	0.033	0.04	0.002	0.16	0.052	138.2	0.12	0.12	49.21	0.47	0.07	25.9	11.4		0.03	1.72	3	0.05	18.4	18.8	0.3	0.03	0.13
89	3	10	10-Mar-89	0.13		0.02	0.01	0.01	0.005	126	0.01	0.01	55	0.1	0.17	21.5	10		0.01		2.1	0.1		17.7		0.11	
89	5	23	23-May-89	1.5	0.025	0.053	0.01	0.08	0.04	114	0.02	0.07	52	0.4	0.37	27	11.4		0.01		2.04	0.1		19.2		0.05	
89	8	7	07-Aug-89	0.07	0.003	0.008	0.005	0.02	0.005	105	0.01	0.005	0.87	0.01	0.03	18	8.6		0.01		2.36	0.1		20.8		0.03	
89	12	13	13-Dec-89	0.09		0.017	0.005	0.02	0.02	93	0.04	0.02	41	0.09	0.01	17	8.21		0.02		2.66	0.1		18.1		0.14	
90	6	1	01-Jun-90	1.25		0.037	0.005	0.03	0.03	97	0.01	0.03	33	0.33	0.01	16	9.6		0.02		2.2	0.1		19		0.17	
90	7	18	18-Jul-90	1.56		0.038	0.005	0.02	0.04	92	0.01	0.1	56	0.34	0.18	16	8.84		0.02		2.2	0.1		18.8		0.29	
90	11	13	13-Nov-90	1.88	0.005	0.5	0.05	0.35	0.0188	68	0.005	0.04	51	0.15	0.021	15	8.8		0.008		2.49	0.005		18		0.01	
91	7	31	31-Jul-91	0.15	0.005			0.14	0.0005	43	0.005	0.02	0.11	0.002	0.005	13	7.7		0.01		2.28	0.005		31		0.01	
91	12	11	11-Dec-91	0.04	0.005	0.5	0.05	0.47	0.0005	54	0.005	0.005	9.7	0.001	0.005	12	7		0.16		2.3	0.005		18		0.01	
92	3	19	19-Mar-92	0.23	0.005	0.5	0.05	0.79	0.0005	38	0.005	0.005	0.92	0.002	0.005	13	6.6		0.068		2.06	0.005		19		0.01	
92	6	3	03-Jun-92	0.24	0.005	0.5	0.05	0.1	0.0005	70	0.005	0.005	1.93	0.005	0.05	13	7.2		0.041		3.02	0.005		21		0.01	
92	8	17	17-Aug-92	0.76	0.005	0.5	0.05	0.23	0.0005	63	0.005	0.02	47	0.29	0.005	15	8.1		0.01		1.94	0.005		27		0.01	
92	11	23	23-Nov-92	5.9	0.005	0.5	0.05	0.46	0.0005	67	0.013	0.12	43	0.41	0.005	13	7.8		0.055		2.77	0.005		20		0.01	
93	3	2	02-Mar-93	1.01	0.005	0.5	0.05	0.1	0.0005	58	0.005	0.01	15	0.082	0.05	12	7.2		0.005		2.17	0.005		26		0.01	
93	5	20	20-May-93	1.85	0.005	0.5	0.05	0.36	0.013	76	0.005	0.04	48	0.153	0.005	14	7.8		0.005		2.67	0.005		28		0.01	
94	5	13	13-May-94	5.6	0.005	0.5	0.05	0.1	0.084	69	0.005	0.02	63	0.2	0.005	16	6.7		0.005		3.9	0.005		35		0.01	
94	10	4	04-Oct-94	1.5	0.005	0.5	0.05	0.2	0.053	50	0.005	0.04	56	0.13	0.005	14	8.3		0.005		3.11	0.005		34		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 9

continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.
77	8	4	04-Aug-77		3.201				3.15			1.195			0.5	
77	9	5	05-Sep-77		41.27				2.178			0.429			3.6	
77	10	5	05-Oct-77		37.78				0.859			0.158			7.4	
77	10	24	24-Oct-77		58.365				1.177			2.47			4.5	
77	11	8	08-Nov-77		0.024				0.083			0.065			23	
77	11	23	23-Nov-77		32.96				0.131			0.071			3.9	
77	12	21	21-Dec-77		3.852				0.611			0.422				
78	2	22	22-Feb-78		25.95				0.75			0.385				
78	3	20	20-Mar-78		20.82				0.25			0.238				
78	4	18	18-Apr-78		30.9				0.517			0.104				
78	5	29	29-May-78		28.255				0.289			0.093				
78	6	28	28-Jun-78		28.537				0.219			0.181				
78	8	17	17-Aug-78		28.92				0.1			0.074				
78	10	4	04-Oct-78		28.81				0.236			0.049				
78	12	8	08-Dec-78		21.09				0.124			0.2				
78	12	28	28-Dec-78		41.25				0.291			0.074				
79	1	18	18-Jan-79		24.82				0.173			0.084				
79	2	7	07-Feb-79		30.34		0.021		0.183			0.068				
79	4	9	09-Apr-79		30.75	0.395	4.24	0.382	1.17						80	
79	5	2	02-May-79		32.47	0.185	0.005	0.005	0.748						1	
79	6	8	08-Jun-79		33.9	0.008	0.005	0.018	0.66						5	
79	7	17	17-Jul-79		20.82		0.005		0.727						1	
80	2	11	11-Feb-80													
80	4	29	29-Apr-80													
80	7	24	24-Jul-80													
80	11	20	20-Nov-80		25		0.005		0.019			0.007			2	
81	4	1	01-Apr-81		28.9		0.013		0.099			0.142			10	
81	8	18	18-Aug-81													
81	11	9	09-Nov-81		20.4		0.006		0.62						3	
82	3	2	02-Mar-82		17.1		0.005		0.18						0.9	
82	5	10	10-May-82		56		0.009		0.27						0.5	
82	8	10	10-Aug-82		51.7		0.002		0.65			0.112			0.1	
82	11	10	10-Nov-82													
83	1	26	26-Jan-83													
83	6	23	23-Jun-83		69.3		0.005								0.9	
83	9	7	07-Sep-83		35		0.11								0.7	
83	11	23	23-Nov-83		107		0.003								1.2	
84	5	18	18-May-84		135		0.002		0.56			0.058			1.2	
84	8	5	05-Aug-84		131		0.169		0.77			0.409			1.1	
85	2	15	15-Feb-85		110		0.006		0.52			0.213			2	
85	5	22	22-May-85		54											
85	5	23	23-May-85		114											
85	8	6	06-Aug-85		96											
85	11	13	13-Nov-85		43											
86	3	3	03-Mar-86		17											
86	5	6	06-May-86		29											
86	8	13	13-Aug-86		14											
86	12	11	11-Dec-86		16											
87	2	23	23-Feb-87		7.18											
87	5	4	04-May-87	0.06	4.25	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1
87	8	11	11-Aug-87	0.01	34.5											
87	11	18	18-Nov-87	0.14	8.29								0.1	493.7		
88	2	17	17-Feb-88	0.05	11.8								0.1	541		
88	5	26	26-May-88	0.07	6.85											
88	8	7	07-Aug-88	0.06	7.63									463.2		
88	11	28	28-Nov-88	0.05	25.4											
89	3	10	10-Mar-89	0.01	8.4									531		
89	5	23	23-May-89	0.02	25									460.3		
89	8	7	07-Aug-89	0.01	4.1									427.9		
89	12	13	13-Dec-89	0.02	14											
90	6	1	01-Jun-90	0.01	18								0.15	320		
90	7	18	18-Jul-90	0.03	25								0.45	300		
90	11	13	13-Nov-90	0.11	16											
91	7	31	31-Jul-91	0.05	12											
91	12	11	11-Dec-91	0.06	5.4											
92	3	19	19-Mar-92	0.07	1.88											
92	6	3	03-Jun-92	0.05	8.6											
92	8	17	17-Aug-92	0.07	17							0.02				
92	11	23	23-Nov-92	0.13	28				0.25			3.4				10
93	3	2	02-Mar-93	0.05	8.7				0.28			2.6				47
93	5	20	20-May-93	0.05	18				0.25			1.3				2
94	5	13	13-May-94	0.06	28				0.04			0.02				
94	10	4	04-Oct-94	0.05	25				0.47			0.02				

Date	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDN	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	Sb
04-Aug-77													6.79	68.8			
05-Sep-77	11						152						7.1	61.8			
05-Oct-77													7.11	54.8			
24-Oct-77	21.3				143.34	2.18	62	3860					8.49	44.4			
08-Nov-77	22.7				4.04		191	5				0.21	7.84	118			
23-Nov-77	7.1				5.36		107	5						84.2			
21-Dec-77													7.21	138.6			
22-Feb-78														70.4			
20-Mar-78														70.2			
18-Apr-78														71.2			
29-May-78													7.05	68.6			
28-Jun-78													7.52	68.6			
17-Aug-78													7.29	64.8			
04-Oct-78													7.34	61.2			
08-Dec-78													7.41	67.4			
28-Dec-78													7.39	62.8			
18-Jan-79													7.45	68.4			
07-Feb-79	13				19		74	48					7.3	64.2		0.005	
09-Apr-79	6			3	45				40.89	111.45			7.06	62.4			
02-May-79	9			21	15		79		34.38	122.77			7.05	62.6			
08-Jun-79	11			3	22				25.14	106.34			7.34	54.6			
17-Jul-79	11				15				20.5	123			7	58.8			
11-Feb-80	8						80		22.06	87.26							
29-Apr-80	8						85		15.64	108.59							
24-Jul-80	13						91		18.11	134.65			6.48				
20-Nov-80	14				12		73		25.8	180			6.92	79			
01-Apr-81	8.7			1	13		64		32.2	140			7.02	63			
18-Aug-81	12.5									170							
09-Nov-81	12			28	15		64		69.9	100			6.61	52			
02-Mar-82	16			9	15		91		43	130			7.23	42			
10-May-82	14.2				8		175		145	280			6.63	117			
10-Aug-82	14.1	0.02		1	22		172		63.3	240			6.71	29			
10-Nov-82	18						203		47.4								
26-Jan-83	11.7						174		53.2								
23-Jun-83	37	0.02					176						6.79	126			
07-Sep-83	36	0.06					202			305			7.36	97			
23-Nov-83	41.7	0.05					361			255			8.1	57.2			
18-May-84	51.6	0.059			45		388			650			7.1	249			
05-Aug-84	46	0.054		7	56		364			590				214.4			
15-Feb-85	66	0.07		6.6	86		377			650			6.78	255			
22-May-85	76						409										
23-May-85	76						526										
06-Aug-85	72				29		493			830			6.78	348			
13-Nov-85	21				28		476			860				300			
03-Mar-86	95				22		560			848				331			
06-May-86	88				35		668			1030				421			
13-Aug-86	95				45		691			1040			7.36	477			
11-Dec-86	82				53		747			1220				457			
23-Feb-87	80				55		732			1130				512			
04-May-87	97		0.1				600			1300				280			
11-Aug-87	59				114		840			1300			6.8	480			
18-Nov-87	64.1						820		561.4	1075			6.8	405			
17-Feb-88	106						885		630	1180			6.28	444			
26-May-88	67						840			1500				420			
07-Aug-88	48.8						130		461.6	950			6.91	380			
28-Nov-88	47.8				84		780			800			7.11	364			
10-Mar-89	36.2				64		571	158	403	780			7.11	436			0.05
23-May-89	43.3						720	5080	395.8	900			6.58	378			0.06
07-Aug-89	41.8				58		535		338.3	720			7.3	361			0.06
13-Dec-89	35.8				43		578	392	302				6.85	346			0.03
01-Jun-90	38						443	342	308	706			6.7	320			0.08
18-Jul-90	36						408		295	690			7.2	300			0.08
13-Nov-90	28				102		398	302	277	534			6.5	318			0.001
31-Jul-91	33				42		373	4	161	434			6.90	270			0.001
11-Dec-91	42				35		350	14	184	471			7.08	242			0.001
19-Mar-92	53				20		368	4	148	615			7.24	220			0.001
03-Jun-92	46				35		380	10	229	549			6.88	220			0.001
17-Aug-92	36	0.15			40		378	220	219	533			6.35	232			0.001
23-Nov-92	64	0.05			26		397	647	221	295			6.73	242			0.001
02-Mar-93	57	0.17					383	908	194	674			6.56	218			0.001
20-May-93	70	0.18			14		484	384	247	643			7.24	230			0.001
13-May-94	91	0.16					470	432	238	698			6.83	262			0.008
04-Oct-94	101	0.17			5		630	232	193	709			7.28	247			0.008

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 10

Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Tl
77	8	4	04-Aug-77		0.001				0.01	12.987	0.009	0.015	0.65	0.064			0.412		0.006		1.897			9.07			
77	9	5	05-Sep-77		0.001				0.01	16.73	0.011	0.059	0.46	0.058			0.446		0.019		8.056			1.975			
77	10	5	05-Oct-77						0.01	13.64	0.005	0.015	0.248	0.023			0.562		0.006		2.435			9.17			
77	10	24	24-Oct-77						0.01	32.55	0.005	0.034	0.63	0.087		3.139	0.945		0.005		2.294			7.92			
77	11	8	08-Nov-77						0.005	62.96	0.006	0.006	0.09	0.01		8.911	0.035		0.006		0.941			11.37			
77	11	23	23-Nov-77						0.005	20.45	0.005	0.029	0.301	0.06		3.084	0.845		0.005		1.835			7.97			
77	12	21	21-Dec-77										0.348	0.048			0.665		0.005		1.85						
78	2	22	22-Feb-78										0.27	0.01			0.611		0.01		1.617						
78	3	20	20-Mar-78										0.088	0.01			0.644		0.01		1.804						
78	4	18	18-Apr-78										0.241	0.01			0.577		0.01		1.407						
78	5	29	29-May-78										0.266	0.013			0.558		0.025		0.591						
78	6	28	28-Jun-78										0.184	0.01			0.545		0.025		1.407						
78	8	17	17-Aug-78										0.177	0.01			0.526		0.01		1.412						
78	10	4	04-Oct-78										0.149	0.01			0.503		0.01		1.645						
78	12	8	08-Dec-78										0.285	0.024			0.48		0.02		1.378						
78	12	28	28-Dec-78										0.166	0.021			0.446		0.015		1.533						
79	1	18	18-Jan-79										0.082	0.018			0.432		0.027		1.43						
79	2	7	07-Feb-79						0.01	24.06	0.01	0.032	0.301	0.025	0.01	3.051	0.433	0.014	0.019		1.53			9.27			
79	3	7	07-Mar-79							1.7			0.78	0.01		3.041	0.486										
79	4	9	09-Apr-79							25.16		0.01	2.96	0.096		3.087	0.542										
79	5	2	02-May-79							20.03		0.025	1.14	0.059		2.91	0.453										
79	6	8	08-Jun-79							19.72		0.01	1.608	0.048		3.096	0.497										
79	7	17	17-Jul-79							19.1			0.723	0.062		2.7	0.451				1.653			7.71			
80	11	20	20-Nov-80							21.32		0.07	1.15	0.037		3.1	0.46				2.86			9.5			
81	8	18	18-Aug-81																								
81	11	9	09-Nov-81							24.9		0.19	2.39	0.095		3.55	0.479				3.04			9.48			
82	3	2	02-Mar-82							24.7		0.15	9.54	0.13		3.48	0.55				5.07			11.44			
82	5	10	10-May-82							26.7		0.01	0.83	0.02		2.8	0.38				1.63			6.9			
82	8	10	10-Aug-82		0.006				0.0008	25.2	0.001	0.02	0.65	0.018		3.15	0.39		0.01		1.41			8.81			
82	11	10	10-Nov-82																								
83	6	23	23-Jun-83							26.5			0.62			3.23								8.35			
83	9	7	07-Sep-83							32.2			1.17			2.98								7.94			
83	11	23	23-Nov-83							24.5			0.62			2.98								8.27			
84	2	29	29-Feb-84							20			1.4			2.91								8.39			
84	5	18	18-May-84							25.3			0.98			3.24								8.74			
84	8	5	05-Aug-84							20.3			0.51			3.4								8.9			
85	2	15	15-Feb-85							29			0.81			4.6								11			
85	5	22	22-May-85							28.1			1.84			4.2	0.84							9.6			
85	8	8	08-Aug-85							23			0.26			2.8	0.37				1.29			8.8			
85	11	13	13-Nov-85							31			1.55			4.5	0.52							11			
86	3	3	03-Mar-86							27			0.26			4.5	0.52							22			
86	5	6	06-May-86							26			0.46	0.013		4	0.52							9.4			
86	8	13	13-Aug-86							27			0.49			4.3	0.53				1.81			9.6			
86	12	11	11-Dec-86							36.6			0.55			4.8	0.58							10.6			
87	2	23	23-Feb-87							33.1			0.52			5.1	0.52							10.1			
87	5	4	04-May-87	0.01	0.04	0.05	0.01	0.05	0.01	42.4	0.01	0.01	0.05	0.2	0.01	5.51	0.65		0.01		0.8	0.01		12	0.1	0.1	0.1
87	8	11	11-Aug-87	0.05	0.23	0.1	0.01	0.04	0.01	43.77	0.06	0.01	0.12	0.25	0.04	5.72	0.69		0.01	0.8	0.6	0.06		9.3	0.1	0.1	0.1
87	11	18	18-Nov-87	0.1	0.02	0.12	0.01	0.07	0.02	48.66	0.05	0.03	0.06	0.05	0.03	6.4	0.75		0.02	0.8	1.9	0.06		10.2	0.1	0.1	0.2
88	2	17	17-Feb-88	0.23	0.06	0.01	0.01	0.07	0.005	48.5	0.02	0.03	0.81	0.05	0.04	6.56	0.74		0.03	0.84	1.57	0.02	11.5	98	0.06	0.19	0.1
88	5	26	26-May-88	0.23	0.11	0.01	0.01	0.09	0.01	44.6	0.02	0.04	0.33	0.01	0.02	6.16	0.66		0.01	0.73	1.98	0.01	9.56	11.4	0.07	0.02	0.1
88	8	7	07-Aug-88	0.42	0.105	0.01	0.001	0.11	0.01	46.4	0.02	0.05	1.24	0.1	0.02	6.46	0.7		0.01	0.98	1.528	0.1		12.6	0.06	0.06	0.05
88	11	28	28-Nov-88	1.47	0.005	0.03	0.001	0.2	0.021	80.53	0.05	0.06	2.27	0.21	0.04	12.1	1.24		0.03	2.69	2.57	0.07	14.3	15.1	0.15	0.01	0.1
89	3	10	10-Mar-89	0.05		0.01	0.01	0.01	0.005	72	0.01	0.01	0.14	0.01	0.01	9.3	0.86		0.01		1.79	0.1		13.3		0.06	
89	5	23	23-May-89	0.8	0.003	0.019	0.005	0.01	0.02	45	0.02	0.02	2.7	0.29	0.01	6.9	0.69		0.01		1.47	0.1		9.13		0.03	
89	8	7	07-Aug-89	0.05	0.002	0.01	0.005	0.02	0.006	44	0.01	0.005	0.03	0.01	0.01	8.4	0.79		0.01		2	0.01		13.4		0.03	
89	12	13	13-Dec-89	0.28		0.025	0.005	0.02	0.019	114	0.02	0.01	2.68	0.28	0.01	18	3.98		0.02		3.1	0.1		18		0.1	
90	3	27	27-Mar-90	0.05		0.013	0.005	0.02	0.01	102	0.01	0.01	0.33	0.06	0.01	15	1.99		0.02		14.3	0.1		80		0.06	
90	6	1	01-Jun-90	1.93		0.047	0.005	0.02	0.02	89	0.01	0.02	2.1	0.49	0.01	14	1.5		0.02		2.3	0.1		13		0.04	
90	7	18	18-Jul-90	3.18		0.053	0.005	0.02	0.03	110	0.03	0.04	6.89	0.33	0.01	19	2.36		0.02		2.4	0.1		13.7		0.21	
90	11	13	13-Nov-90	0.28	0.005	0.5	0.05	0.06	0.0022	217	0.005	0.005	3.46	0.04	0.005	33	4.8		0.012		3.15	0.005		24		0.01	
91	7	31	31-Jul-91	0.33	0.005			0.14	0.0005	70	0.005	0.01	0.03	0.019	0.005	15	1.56		0.01		2.33	0.005		24		0.01	
91	12	11	11-Dec-91	0.01	0.005	0.5	0.05	0.2	0.0005	103	0.005	0.005	0.05	0.017	0.005	21	4.7		0.018		2.47	0.005		18		0.01	
92	3	19	19-Mar-92	0.17	0.005	0.5	0.05	0.17	0.0005	48	0.005	0.005	0.02	0.016	0.005	15	1.76		0.045		2.26	0.005		15		0.01	
92	6	3	03-Jun-92	0.03	0.005	0.5	0.05	0.1	0.0005	110	0.005	0.005	0.01	0.004	0.005	24	0.24		0.043		4	0.005		17		0.01	
92	8	13	13-Aug-92	22	0.005	0.5	0.05	0.23	0.0005	120	0.005	0.03	4.7	0.46	0.005	27	6.9		0.021		2.77	0.005		20		0	
92	11	23	23-Nov-92	7.8	0.005	0.5	0.05	0.1	0.0005	88	0.012	0.04	3.4	0.59	0.005	16	3.18		0.028		2.89	0.005		15		0.01	
93	2	26	26-Feb-93	29	0.005	0.5	0.05	0.3	0.0005	61	0.005	0.04	3.91	0.392	0.005	11	2.81		0.005		4.8	0.005		19		0.01	
93	5	21	21-May-93	37	0.005	0.5	0.05	0.82	0.037	110	0.005	0.06	9.5	0.46	0.005	20	6.6		0.005		4.8	0.005		40		0.01	
94	5	13	13-May-94	9.9	0.005	0.5	0.05	0.1	0.063	80	0.005	0.02	4	0.54	0.005	18	4.2		0.005		4.2	0.005		20		0.01	
94	10	5	05-Oct-94	3.4	0.005	0.5	0.05	0.2	0.037	79	0.005	0.04	5	0.4	0.005	21	7.8		0.005		4.9	0.005		65		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 10
continued

Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.	Cl	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDNE	Cond.	TURB.	pH	Alk.	Acidity	Li	Sb	ORGAN. N
77	8	4	04-Aug-77		3.077				0.429			0.084			7.4												7.33	148.4				
77	9	6	06-Sep-77		12.31				0.133			0.069			7.4		9					108					7.7	81.8				
77	10	5	05-Oct-77		8.094				0.186			0.078			2.4						4.08						7.58	79.8				
77	10	24	24-Oct-77		7.01				0.243			0.15			1.9		7.1			8.86	3.97	111	57				7.28	79.2				
77	11	8	08-Nov-77		0.013				0.079			0.09			138.1		38.3			13.5		304	3			0.8	8.05	105.2				
77	11	23	23-Nov-77		8.576				0.922			0.727			1		7.1			57.21		172	34					76.4				
77	12	21	21-Dec-77		3.333				0.106			0.024															7.88	172.6				
78	2	22	22-Feb-78		5.902				0.127			0.123																74.4				
78	3	20	20-Mar-78		5.591				0.032			0.125																85.2				
78	4	18	18-Apr-78		6.33				0.053			0.078																87				
78	5	29	29-May-78		5.365				0.19			0.131															7.6	87.2				
78	6	28	28-Jun-78		5.574				0.075			0.127															7.85	83.6				
78	8	17	17-Aug-78		5.875				0.005			0.081															7.61	79.2				
78	10	4	04-Oct-78		5.153				0.011			0.048															7.64	79.2				
78	12	6	06-Dec-78		5.74				0.223			0.205															7.98	82.2				
78	12	28	28-Dec-78		5.79				0.177			0.063															7.94	81				
79	1	16	16-Jan-79		5.406				0.06			0.062															7.89	87.8				
79	2	7	07-Feb-79		7.47		0.053		0.177			0.074					14			10		96	14				7.49	80		0.005		
79	3	7	07-Mar-79		10.31	0.097	0.005	0.003	0.389						3		9			20				19.07	184.9		7.29	85.2				
79	4	9	09-Apr-79		9.66	0.11	0.005	0.07	0.31						30		8		13	17					169.2		7.92	88				0.2
79	5	2	02-May-79		5.06	0.005	0.005	0.003	0.363						3		7		3	4		150		64.87	169.7		7.21	81.5				
79	6	6	06-Jun-79		6.75	0.005	0.005	0.008	0.256						5		14		1	20				68.01	172.2		7.73	83.4				
79	7	17	17-Jul-79		8.55		0.005		0.354						1		13			5				60.92	171.33		7.58	84.8				
80	11	20	20-Nov-80		6.06		0.006		0.005			0.023			3		9		2	17		98		68.89	170		7.73	88				
81	8	18	18-Aug-81														5.4								180							
81	11	9	09-Nov-81		7.01		0.005		0.36						4		4.2		2	9		99		92.7	180		7.06	73				
82	3	2	02-Mar-82		14.4		0.02		0.24						6.4		6		1	19		100		94.1	180		7.85	82				
82	5	10	10-May-82		4.49		0.006		0.2						1.8		3.9			7		90		87.7	190		7.6	86				
82	8	10	10-Aug-82		4.99		0.002		0.34			0.24			0.9		3.9			5		110		77.8	180		6.96	85				
82	11	10	10-Nov-82														3.8															
83	6	23	23-Jun-83									0.269			1.5		4					112					7.12	95.8				
83	9	7	07-Sep-83									0.45			1.4		4.2					128			175		8.3	92.3				
83	11	23	23-Nov-83									0.059			1.4		4.3					133			205		8.29	88.1				
84	2	29	29-Feb-84									0.45			1.6		4.8					168			114		7.09	86.9				
84	5	18	18-May-84									0.215			1.7		5.1					131			205		7.94	86.5				
84	8	5	05-Aug-84												1.6		5.3					140			200			86.9				
85	2	15	15-Feb-85												1.7		8.4					129			230		7.7	101				
85	5	22	22-May-85																			126										
85	8	6	06-Aug-85		5.8												4.5			7		64			190		7.3	91				
85	11	13	13-Nov-85														12					154			270			114				
86	3	3	03-Mar-86														13					151			288			114				
86	5	6	06-May-86														11					158										
86	8	13	13-Aug-86		9.9												12			6		156			249		7.49	118				
86	12	11	11-Dec-86														15					168			311			111				
87	2	23	23-Feb-87														13					175			302			124				
87	5	4	04-May-87	0.01	11.53	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1	47.3	0.1				35			350			1				
87	8	11	11-Aug-87	0.01	12.36												18.2			6.2		370			370		7.2	140				
87	11	18	18-Nov-87	0.05	13.77								0.1	167			15.1					275		142.9	375		8.6	137				
88	2	17	17-Feb-88	0.01	16								0.1	173			87					305		148	410		7.81	142				
88	5	26	26-May-88	0.03	13.8												17.1					175			400			120				
88	8	7	07-Aug-88	0.02	14.8									109.7			13.9					175		142.5	400		7.89	90				
88	11	28	28-Nov-88	0.03	41.8												28			15.6		370			500		8.26	50				
89	3	10	10-Mar-89	0.01	26									329			21.7			8.4		327	51	218	510		8.12	270			0.06	
89	5	23	23-May-89	0.01	28									183.1			14					280	721	140.8	425		8.85	150			0.06	
89	8	7	07-Aug-89	0.01	15									212.1			17.5			17		200		138.2	350		7.21	174			0.08	
89	12	13	13-Dec-89	0.01	48												42.7			42		2400	378	358	650		7.04	415			0.08	
90	3	27	27-Mar-90	0.01	32												37.7			59		958	337		800		7.04	302			0.06	
90	6	1	01-Jun-90	0.01	47								0.54	289			34					390	415	280	818		7.3	290			0.06	
90	7	18	18-Jul-90	0.02	58								1	338			39					462		353	780		7.5	337			0.08	
90	11	13	13-Nov-90	0.14	29												51			95		750	118	678	965		6.93	802			0.001	
91	7	31	31-Jul-91	0.05	18												24			42		410	9	237	486		7.68	310			0.001	
91	12	11	11-Dec-91	0.05	22												34			45		542	4	344	758		7.58	440			0.001	
92	3	19	19-Mar-92	0.05	1.01											4	38			11		390	4	182	582		7.77	291			0.001	
92	6	3	03-Jun-92	0.05	0.44											15	40			38		571	9	374	842		7.21	438			0.001	
92	8	13	13-Aug-92	0.09	40				0.04			0.03					36			43		537	414	411	764		6.96	424			0.001	
92	11	23	23-Nov-92	0.09	28				0.1			1.4				7.4	36			18		404	388	266	808		7.28	312			0.001	
93	2	26	26-Feb-93	0.05	27				0.27			2.5				23	21					345	1157	198	518		7.55	278			0.001	
93	5	21	21-May-93	0.05	39				0.25			3.2				1.1	38			15		528	1190	357	885		7.31	342			0.001	
94	6	13	13-May-94	0.05	30				0.04			0.02					38					416	472	268	617		7.41	320			0.006	
94	10	5	05-Oct-94	0.05	29				0.37			0.02					50			5		480	114	284	785		7.98	418			0.006	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 11

continued

Date	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	SO4	T.O.C.	Cl	F	I
04-Aug-77				0.699			0.13	31.8				
05-Sep-77				0.225			0.072	2.9		14		
05-Oct-77				0.486			0.074	1				
24-Oct-77				0.741			0.114	1		14.2		
08-Nov-77				0.038			0.067	17.4		1.4		
23-Nov-77				0.779			0.089	2.5		14.2		
18-Apr-78				0.619			0.056					
29-May-78				1.269			0.104					
28-Jun-78				0.643			0.105					
17-Aug-78				0.481			0.271					
04-Oct-78				0.226			0.062					
21-Nov-78				0.442			0.315					
06-Dec-78				0.259			0.23					
28-Dec-78				0.67			0.113					
16-Jan-79				0.301			0.088					
07-Feb-79		0.005		0.674			0.061			12		
07-Mar-79	0.043	0.005	0.001	0.155				1		10		
09-Apr-79	0.416	0.005	0.025	0.774				5		10		
02-May-79	0.143	0.005	0.004	0.665				1		8		
06-Jun-79	1.612	0.005	20.001	1.91				5		32		
17-Jul-79		0.005		0.547				7		19		

Date	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDNES	Cond.	COLOR	TURB.	pH	Alk.	Acidity	LI	EPM BAL.	ORGAN.
04-Aug-77										4.62	0.2			39.576	
05-Sep-77				164						6.6	5.4			22.310	
05-Oct-77			4.11							5.38	1.8			25.400	
24-Oct-77		58.96	4.52	69	21					7.12	78.4			40.133	
08-Nov-77		3.14		130	2				0.23	7.96	74.2			52.422	
23-Nov-77		41.42		89	4						9.4			23.922	
18-Apr-78											11			20.867	
29-May-78										7.05	19			13.059	
28-Jun-78										8.32	4.8			29.285	
17-Aug-78										8.57	11.2			28.678	
04-Oct-78										5.31	1			31.566	
21-Nov-78										5.64	2.6			28.716	
06-Dec-78										5.89	4.8			29.496	
28-Dec-78										8.62	5.2			35.020	
16-Jan-79										5.59	4.2			27.252	
07-Feb-79		41		33	13					8.14	5		0.005	28.904	
07-Mar-79							23.27			5.45	1.2			43.684	
09-Apr-79	13	49					54.25			8.44	6.2			69.663	0.358
02-May-79	1	52		92		8.08	35.54			5.66	16			31.746	
06-Jun-79	1	47				25.65	130.57			8.56	17.2			35.104	
17-Jul-79		0.46				15.64	68.53			6.75	13.2			23.551	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 11

Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Na	Sr	Sn	Ti	V	Zn
04-Aug-77		0.001				0.01	3.42	0.005	0.01	0.797	0.01			0.284		0.005		1.557		8.113					0.134
05-Sep-77		0.001				0.01	3.56	0.009	0.025	1.1	0.024			0.139		0.005		4.998		1.21					0.311
05-Oct-77						0.01	2.24	0.005	0.01	0.853	0.01			0.118		0.005		1.371		4.93					0.068
24-Oct-77						0.01	2.89	0.005	0.01	1.318	0.002		1.02	0.258		0.005		2.858		6.21					0.07
08-Nov-77						0.005	24.35	0.005	0.008	0.073	0.01		5.448	0.01		0.005		0.736		8.16					0.019
23-Nov-77						0.005	2.91	0.005	0.014	1.24	0.015		0.898	0.463		0.005		2.938		5.34					0.034
18-Apr-78										1.75	0.01			0.914		0.01		1.338							0.821
29-May-78										3.179	0.01			1.601		0.025		4.498							0.01
28-Jun-78										1.021	0.01			0.52		0.025		2.05							0.644
17-Aug-78										1.467	0.01			0.425		0.01		1.105							0.041
04-Oct-78										0.57	0.01			0.231		0.01		1.213							0.03
21-Nov-78										2.327	0.016			0.111		0.01		1.532							0.056
06-Dec-78										1.79	0.012			0.133		0.01		1.148							0.031
28-Dec-78										0.463	0.01			0.109		0.01		1.589							0.032
16-Jan-79										0.25	0.01			0.095		0.01		0.98							0.01
07-Feb-79						0.01	2.03	0.01	0.01	0.45	0.01	0.01	0.738	0.387	0.01	0.01		1.36		4.74					0.918
07-Mar-79							2.1			0.707	0.01		0.334	0.117											11.73
09-Apr-79							1.891		0.01	1.076	0.01		0.849	0.495											0.107
02-May-79							1.36		0.01	0.979	0.01		0.645	0.15											0.014
06-Jun-79							4.55		0.01	2.514	0.01		1.782	1.343											0.02
17-Jul-79							3.57			1.029	0.01		0.993	0.435				1.163		8.14					0.018

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 12

Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Ti	V	Zn
04 Aug 77		0.003				0.01	3.339	0.006	0.025	0.779	0.01			0.151		0.005		1.763			5.981					0.038
05 Sep 77		0.001				0.01	4.24	0.007	0.028	0.95	0.021			0.01		0.005		5.61			1.644					0.015
05 Oct 77						0.01	2.11	0.005	0.01	0.674	0.01			0.024		0.005		1.603			5.685					0.236
24 Oct 77						0.01	3.04	0.005	0.01	0.568	0.009		0.792	0.042		0.005		2.442			5.9					0.305
23 Nov 77						0.005	2.39	0.005	0.019	0.628	0.01		0.642	0.005		0.005		2.486			6.205					0.019
21 Dec 77										0.479	0.01			0.012		0.005		1.86								0.01
22 Feb 78										0.558	0.01			0.158		0.01		1.54								0.361
20 Mar 78										0.511	0.01			0.078		0.01		0.978								0.016
18 Apr 78										0.519	0.01			0.084		0.01		1.985								0.02
29 May 78										0.689	0.01			0.044		0.025		2.075								0.01
28 Jun 78										1.005	0.01			0.038		0.025		1.702								0.033
17 Aug 78										2.101	0.01			0.166		0.018		2.342								0.065
04 Oct 78										0.873	0.01			0.02		0.01		1.997								0.135
21 Nov 78										0.854	0.011			0.014		0.01		2.264								0.032
06 Dec 78										0.767	0.02			0.014		0.011		2.129								0.092
28 Dec 78										0.382	0.01			0.017		0.01		2.864								0.03
07 Feb 79						0.01	3.77	0.01	0.1	0.218	0.01	0.01	0.851	0.039	0.01	0.038		3.23			10.02					0.133
07 Mar 79							3.84			0.994	0.01		0.581	0.091												5.97
09 Apr 79							5.329		0.01	0.269	0.01		1.48	0.04												0.015
02 May 79							2.07		0.01	0.556	0.01		0.725	0.046												0.044
06 Jun 79							3.94		0.01	1.916	0.01		1.566	0.943												0.023
17 Jul 79							4.06			0.388	0.01		1.602	0.055				3.145			8.95					0.01
14 Aug 79							2.73		0.01	0.366	0.01		1.18	0.035				1.804			6.14					0.025
21 Nov 79							9.95		0.01	2.686			3.216	0.877				9.23			17.051					0.021
29 Apr 80							5.4		0.04	1.32			2.05	1				6.05			12.21					0.01
24 Jul 80							4.16		0.01	1.25	0.01		1.21	0.063				3.23			7.61					0.016
20 Nov 80							5.22		0.05	0.62	0.01		1.42	0.18				5.83			11.2					0.01
01 Apr 81							8.04		0.01	1.05	0.01		1.99	0.91				6.1			11.6					0.01
18 Aug 81							11.8		0.03	3.22	0.01		2.09	0.84				5.05			15.7					0.01
09 Nov 81							17.2		0.01	5.43	0.005		3.4	3.162				9.33			22.11					0.01
10 May 82							9.48		0.01	3.07	0.01		2	1.32				4.34			8					0.01
10 Aug 82							15	0.001	0.01	4.81	0.015		3.55	1.11		0.01		7.05			16.3					0.01
10 Nov 82							11		0.089	1.81	0.023		2.58	1.05				4.52			12.8					0.01
26 Jan 83							6.95		0.01	1.22	0.005		1.67	0.57				3.16			7.84					0.01
23 Jun 83							17.4						4.02								16.1					
07 Sep 83							11.6		0.01	1.82	0.004		2.73	0.37				4.29			12.8					0.01
23 Nov 83							7.23		0.016	1.12	0.001		1.7	0.3				3.8			11.2					0.039
29 Feb 84							8.97		0.014	1.07	0.001		2.06	0.85				3.61			10.3					0.25
18 May 84							12.5		0.005	1.51	0.004		2.91	0.32				9.26			18.8					0.029
03 Aug 84							13.1		0.01	1.26	0.002		3.2	0.93				5.13			16.6					0.02
22 May 85							8.66			0.76			2.9	0.19							15					
06 Aug 85							11			0.31			3.1	0.07				5.1			15					0.02
13 Nov 85							11			0.2			3.1	0.05							18					
03 Mar 86							8.6			0.51			2.8	0.11							15					
06 May 86							7.5			0.3	0.002		2.4	0.11							15					
13 Aug 86							12			0.18			3.7	0.29				6.2			19					0.01
11 Dec 86							9.9			0.18			3.3	0.05							17					
23 Feb 87							10.9			0.14			3.9	0.02							18.1					
04 May 87	0.04	0.01	0.02	0.01	0.04	0.01	11.57	0.01	0.01	0.09	0.03	0.01	3.15	0.02		0.01		3	0.01		18.5	0.1	0.1	0.1	0.01	0.28
18 Nov 87	0.07	0.01	0.07	0.01	0.06	0.01	18.33	0.01	0.01	0.05	0.05	0.01	5.04	0.03		0.01	0.1	20.7	0.06		47.8	0.1	0.1	0.1	0.01	0.32
17 Feb 88	0.07	0.07	0.01	0.01	0.06	0.005	11.6	0.01	0.01	0.33	0.01	0.01	3.32	0.1		0.01	0.1	8.66	0.01	4.01	17.6	0.02	0.17	0.1	0.01	0.07
26 May 88	0.17	0.07	0.01	0.01	0.05	0.005	13.8	0.01	0.01	0.39	0.01	0.01	3.62	0.08		0.01	0.01	8.52	0.01	3.07	18.8	0.08	0.01	0.1	0.02	0.02
07 Aug 88	0.08	0.01	0.01	0.001	0.02	0.01	19.9	0.01	0.02	0.11	0.01	0.01	5.31	0.03		0.01	0.1	6.26	0.1		17.9	0.07	0.05	0.05	0.01	0.01
28 Nov 88	0.12	0.005	0.01		0.06		21.26	0.01	0.02	0.01	0.01		5.06	0.02			0.01	14.1	0.05	3.5	29.5	0.08	0.01	0.02	0.01	0.03
10 Mar 89	0.05		0.01	0.01	0.03	0.005	17	0.01	0.01	0.07	0.01	0.01	3.9	0.02		0.01		11.8	0.1		24.9		0.03		0.01	0.02
23 May 89	0.09	0.002	0.005	0.005	0.03	0.005	11.9	0.01	0.01	0.54	0.01	0.01	3.1	0.17		0.01					13.8		0.03		0.01	0.05
07 Aug 89	0.06	0.002	0.005	0.005	0.02	0.005	17	0.01	0.005	0.05	0.01	0.01	4.4	0.08		0.01		5.78	0.1		17.2		0.03		0.01	0.16
13 Dec 89	0.05		0.012	0.005	0.05	0.005	28	0.01	0.01	0.1	0.02	0.01	6.61	0.04		0.02		15.5	0.1		33.7		0.03		0.01	0.02
01 Jun 90	0.05		0.005	0.005	0.06	0.01	27	0.01	0.01	0.02	0.05	0.01	5.4	0.01		0.02		12	0.1		21		0.03		0.01	0.01
16 Jul 90	0.06		0.007	0.005	0.04	0.01	19	0.01	0.01	0.19	0.05	0.01	4.22	0.07		0.02		7.4	0.1		17.3		0.03		0.01	0.03
13 Nov 90	0.05	0.005	0.5	0.05	0.21	0.0005	30	0.005	0.005	0.1	0.001	0.005	5.7	0.005		0.005		14	0.005		22		0.01		0.18	0.005

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 12

continued

Date	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.	Cl
04-Aug-77				0.739			0.121			4.7		
05-Sep-77				0.381			0.791			1		17
05-Oct-77				0.543			0.09			1		
24-Oct-77				0.364			0.14			1		21.3
23-Nov-77				0.524			0.081			1.2		12.8
21-Dec-77				0.474			0.023					
22-Feb-78				0.265			0.12					
20-Mar-78				0.295			0.051					
18-Apr-78				0.389			0.089					
29-May-78				0.702			0.076					
28-Jun-78				0.548			0.108					
17-Aug-78				0.292			0.326					
04-Oct-78				0.301			0.086					
21-Nov-78				0.697			0.275					
06-Dec-78				0.223			0.233					
28-Dec-78				0.483			0.139					
07-Feb-79		0.005		0.3			0.05					21
07-Mar-79	0.125	0.005	0.002	0.158						5		14
09-Apr-79	0.311	0.095	0.04	0.541						3		21
02-May-79	0.397	0.005	0.008	0.706						4		13
06-Jun-79	0.542	1.29	0.006	0.947						5		19
17-Jul-79		0.6		0.421						7		22
14-Aug-79		0.207		0.158						5		173
21-Nov-79		0.005		3.46						9.2		9
29-Apr-80		0.051		3.21			0.168			7		17
24-Jul-80		0.308		0.864						3		9
20-Nov-80		0.187		0.929			0.005			4		23
01-Apr-81		0.094		1.05			0.074			3		
18-Aug-81		0.005		1.25						24		28
09-Nov-81		0.008		0.95						6		30
10-May-82		0.267		0.14						2.9		18.8
10-Aug-82		3.9		1.01			0.24			3.9		25
10-Nov-82		0.186		1.45			0.025			2.5		22
26-Jan-83		0.42		1.06			0.025			2.5		14.6
23-Jun-83										1.8		33
07-Sep-83		0.2		1.04			0.039			4.1		19
23-Nov-83		1.17		0.87			0.026			5.3		26.7
29-Feb-84		0.26		0.89			0.023			5.2		17.1
18-May-84		0.554		1.2			0.007			2.4		31.9
05-Aug-84		1.87		5.3			0.323			9.5		25
22-May-85												
06-Aug-85												24
13-Nov-85												23
03-Mar-86												33
06-May-86												33
13-Aug-86												37
11-Dec-86												41
23-Feb-87												34
04-May-87	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1	149
18-Nov-87								0.1	26.9			73.2
17-Feb-88								0.1	30.5			46.1
26-May-88												25.5
07-Aug-88									51.2			21.1
28-Nov-88												51.4
10-Mar-89									56.1			36.9
23-May-89									43.6			227
07-Aug-89									81.7			22.6
13-Dec-89												71
01-Jun-90								0.15	39.8			34
18-Jul-90								0.28	58.7			28
13-Nov-90												31

Date	F	I	B.O.D.	C.O.D.	D.O	T.D.S.	T.S.S.	HARDNESS	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	Sb	ORGAN. N
04-Aug-77												6.23	12				
05-Sep-77						135						6.5	3.4				
05-Oct-77					5.18							5.12	0.8				
24-Oct-77				50.39	7.06	73	17					4.93	0.6				
23-Nov-77						65	2						4				
21-Dec-77												6.01	9.2				
22-Feb-78													22.4				
20-Mar-78													6				
18-Apr-78													4.2				
29-May-78												7.01	6.4				
28-Jun-78												6.44	7.8				
17-Aug-78									0.326			5.93	6.8				
04-Oct-78												5.89	2.4				
21-Nov-78												6.31	4.4				
06-Dec-78												6.42	3				
28-Dec-78												6.24	3.2				
07-Feb-79				43		59	14					6.16	2.2		0.005		
07-Mar-79								13.93	64.13			5.96	1.2				
09-Apr-79			5	37					125.97			6.76	4.6				0.23
02-May-79			5	60		116		17.32	60.47			6.87	28				
06-Jun-79			4	51				21.44	91.28			6.97	16.6				
17-Jul-79				30				17.52	99.94			6.32	16.8				
14-Aug-79						101		12.39	62.77			6.52	8.2				
21-Nov-79						183		44.5	227.49			7.44	38.7				
29-Apr-80						99		26.11	113.96			7.32	24.7				
24-Jul-80						123		17.72	100.95			6.91	10.4				
20-Nov-80			5	45		83		20.32	100			6.35	14				
01-Apr-81			1	33		84		31.8	130			0.3	30				
18-Aug-81				65		149		45.4	190			6.92	9				
09-Nov-81			3	48		123		72.4	220			7.04	50				
10-May-82				45		102		39.8	130			6.5	29				
10-Aug-82			3	50		120		62.7	200			6.54	35				
10-Nov-82			1	31		117		43.2				7.7	29				
26-Jan-83				32		74		27.5				7.37	18.3				
23-Jun-83													43.3				
07-Sep-83	0.05			59		134			125	70	2.23	6.83	36.8				
23-Nov-83	0.05			32		105			89	70	2.8	6.5	25.8				
29-Feb-84	0.04			25		97			79			6.66	27.7				
18-May-84	0.028			53		150			210			7.39	27.2				
05-Aug-84	0.04		5	77		147			200				16.6				
22-May-85						125											
06-Aug-85				30		90			1700			6.99	32				
13-Nov-85						115			190				24.9				
03-Mar-86						99			158				16.8				
06-May-86						123											
13-Aug-86				40		107			208			7.67	48				
11-Dec-86						102			201				24.3				
23-Feb-87						121			211				29.4				
04-May-87	0.1					25			210				28				
18-Nov-87						345		66.5	575			7.1	22				
17-Feb-88						190		42.6	225			7.59	25				
26-May-88						115			250				37				
07-Aug-88						115		71.5	200			7.46	42				
28-Nov-88				33.6		290			150			7.01	60				
10-Mar-89				19		186	4	58.5	310			7.44	46			0.08	
23-May-89						150	1050	42.5	205			7.29	35.8			0.06	
07-Aug-89				28		110		60.6	225			7.52	67			0.06	
13-Dec-89				20		783	60	97.1	400			6.79	20			0.06	
01-Jun-90						227	1.3	89.6	324			7.6	40			0.06	
18-Jul-90						172		64.8	239			7.7	58			0.06	
13-Nov-90				50		257	9	98.4	323			7.34	68.8			0.001	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 13

Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Na	Sr	Sn	Tl
04-Aug-77		0.001				0.01	2.326	0.005	0.018	0.637	0.01			0.035		0.025		0.478		5.191			
05-Sep-77		0.001				0.01	2.55	0.005	0.023	0.66	0.01			0.035		0.005		5.101		0.448			
05-Oct-77						0.01	2.64	0.005	0.01	1.049	0.01			0.046		0.005		0.638		7.735			
24-Oct-77						0.01	2.83	0.005	0.023	0.853	0.012		0.842	0.061		0.005		0.799		7.21			
23-Nov-77						0.005	3.22	0.005	0.024	0.739	0.01		0.802	0.014		0.005		0.924		9.03			
21-Dec-77										0.599	0.01			0.038		0.005		0.72					
22-Feb-78										0.546	0.01			0.012		0.01		0.747					
20-Mar-78										0.609	0.01			0.047		0.01		0.991					
18-Apr-78										0.365	0.01			0.057		0.01		0.653					
29-May-78										0.249	0.01			0.043		0.025		0.597					
28-Jun-78										1.727	0.01			0.116		0.025		1.154					
17-Aug-78										1.084	0.01			0.231		0.01		1.128					
04-Oct-78										1.504	0.01			0.072		0.017		0.835					
21-Nov-78										0.881	0.01			0.029		0.01		0.962					
06-Dec-78										0.943	0.01			0.033		0.01		0.837					
28-Dec-78										0.794	0.011			0.053		0.01		0.965					
16-Jan-79										0.462	0.01			0.04		0.01		1.06					
07-Feb-79						0.01	4.2	0.01	0.079	0.295	0.01		0.846	0.076		0.064		1.13		12.1			
07-Mar-79							2.7			1.081	0.01		0.516	0.063									
09-Apr-79							4.411		0.01	0.266	0.01		0.978	0.011									
06-Jun-79							7.12		0.01	0.575	0.01		1.722	0.043									
17-Jul-79							7.08			0.866	0.01		1.668	0.064				1.389		26.66			
12-May-82							5.58		0.01	0.55	0.01		1	0.02				1.41		12			
12-Aug-82		0.005					11.5	0.001	0.04	0.64	0.002		2.31	0.12		0.01		1.75		32.9			

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 13

continued

Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	SO4
04-Aug-77		0.014				0.368			0.055	0.5
05-Sep-77		0.01				0.243			0.056	1
05-Oct-77		0.035				0.853			0.08	1
24-Oct-77		0.244				0.376			0.129	1
23-Nov-77		0.022				0.318			0.1	2.1
21-Dec-77		0.01				0.351			0.023	
22-Feb-78		0.013				0.382			0.064	
20-Mar-78		0.014				0.277			0.063	
18-Apr-78		0.014				0.537			0.059	
29-May-78		0.01				0.293			0.074	
28-Jun-78		0.024				0.601			0.125	
17-Aug-78		0.096				0.069			0.139	
04-Oct-78		0.017				0.265			0.081	
21-Nov-78		0.023				0.439			0.22	
06-Dec-78		0.01				0.366			0.224	
28-Dec-78		0.019				0.382			0.082	
16-Jan-79		0.014				0.142			0.074	
07-Feb-79		0.073		0.005		0.432			0.089	
07-Mar-79		0.168	0.006	0.005	0.001	0.197				3
09-Apr-79		0.003	0.044	0.005	0.014	0.291				3
06-Jun-79		0.017	0.005	0.005	0.001	0.331				5
17-Jul-79		0.06		0.005		0.446				6
12-May-82		0.01				0.17				
12-Aug-82		0.01		0.149		0.57			0.047	1.5

Date	T.O.C.	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDNESS	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	EPM BAL.	Sb	ORGAN. N
04-Aug-77														5.79	6			39.368		
05-Sep-77		16						103						5.91	2.2			22.913		
05-Oct-77							4.64							4.8	1			22.921		
24-Oct-77		14.2				59.49	6.02	78	15					6.27	10			40.190		
23-Nov-77		22.7						79	1						1.2			46.959		
21-Dec-77														5.21	2.2			45.331		
22-Feb-78															0.4			32.971		
20-Mar-78															4.6			33.596		
18-Apr-78															1.8			20.868		
29-May-78														6.14	1.2			13.248		
28-Jun-78														5.48	1.2			29.229		
17-Aug-78														5.2	1			28.322		
04-Oct-78														5.48	1.8			31.092		
21-Nov-78														5.79	1.4			28.480		
06-Dec-78														5.88	2.6			29.235		
28-Dec-78														6.38	3.2			33.966		
16-Jan-79														5.66	2			13.940		
07-Feb-79		27				39		82	48					5.78	4			41.314		
07-Mar-79		22								10.92	74.94			5.43	1			49.511		
09-Apr-79		27			1	43					121.78			6	1.6			80.682		0.247
06-Jun-79		63			2	45				25.98	210.51			6.22	3.2			37.211		
17-Jul-79		60				38				26.21	208.57			4.84	1			24.216		
12-May-82										19.1								20.567		
12-Aug-82		54			1	20		140		39.6	200			6.59	13			17.897		

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 14

Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Na	Sr	Sn	Tl
24-Oct-77						0.01	3.25	0.005	0.01	0.502	0.01		0.775	0.03		0.005		0.537		4.115			
23-Nov-77						0.005	2.92	0.005	0.01	0.413	0.01		0.667	0.013		0.005		0.506		3.895			
29-May-78										0.225	0.01			0.054		0.025		0.569					
28-Jun-78										0.544	0.01			0.017		0.025		0.705					
04-Oct-78										0.414	0.01			0.01		0.01		0.676					
21-Nov-78										0.579	0.013			0.073		0.01		0.7					
16-Jan-79										0.22	0.018			0.01		0.01		0.58					
07-Feb-79						0.01	2.63	0.01	0.01	0.195	0.01	0.01	0.639	0.092	0.01	0.019		0.69		3.66			
07-Mar-79							1.77			0.2	0.01		0.426	0.027									
09-Apr-79							2.752		1.685	0.495	0.081		0.672	0.025									
17-Jul-79							3.72			0.549	0.01		1.022	0.142				0.749		4.62			
10-May-82							2.23		0.01	0.29	0.01		0.52	0.01				0.5		2.9			
10-Aug-82		0.005					5.13	0.001	0.01	0.33	0.003		1	0.02		0.01		0.72		5.17			
07-Sep-83							5.46						1.2							14.3			
05-Aug-84							4.7						1.78							24			
06-May-86							5.6			0.18	0.002		1.43	0.01						20			
13-Aug-86							9			0.56			2.4	0.02				1.82		31			
11-Dec-86							6.7			0.29			1.56	0.05						19.5			
23-Feb-87							6.4			0.28			1.62	0.02						21.4			
04-May-87	0.13	0.03	0.03	0.01	0.01	0.01	6.94	0.01	0.01	0.16	0.05	0.01	1.5	0.01		0.01		1	0.01	18.4	0.1	0.1	0.1
11-Aug-87	0.01	0.05	0.01	0.01	0.36	0.02	55.1	0.43	0.01	0.34	0.05	0.01	11.3	0.17		0.01	0.1	1.6	0.72	8.6	0.2	0.1	0.1
18-Nov-87	0.24	0.02	0.11	0.01	0.01	0.01	11.17	0.01	0.01	0.26	0.05	0.01	2.94	0.03		0.01	0.1	4.1	0.02	25.1	0.1	0.1	0.1
26-May-88	0.21	0.09	0.01	0.01	0.02	0.005	7.47	0.01	0.01	0.37	0.01	0.01	1.73	0.03		0.01	0.1	3.06	0.02	22.1	0.03	0.03	0.1
08-Aug-88	0.08	0.032	0.01	0.001	0.01	0.01	12.2	0.01	0.02	0.72	0.01	0.01	2.63	0.04		0.01	0.1	1.58	0.1	33.5	0.05	0.05	0.05
28-Nov-88	0.33	0.005	0.01		0.01		7.91		0.01	0.01	0.01		1.74	0.02			0.01	2.39	0.05	20	0.03	0.01	0.02
23-May-89	0.05	0.002	0.005	0.005	0.01	0.005	8.8	0.01	0.01	0.22	0.01	0.01	1.9	0.01		0.01		1.5	0.1	23.6		0.03	
07-Aug-89	0.05	0.002	0.005	0.005	0.02	0.005	3	0.01	0.005	0.34	0.01	0.01	0.04	0.05		0.01		2.06	0.1	42.2		0.03	
13-Dec-89	0.08		0.009	0.005	0.02	0.005	11	0.01	0.01	0.36	0.02	0.01	2.54	0.02		0.02		2.71	0.1	24.5		0.03	
27-Mar-90	0.18		0.006	0.005	0.02	0.01	8.91	0.01	0.01	0.29	0.05	0.01	1.75	0.01		0.02		23.4	0.1	147		0.03	
01-Jun-90	0.12		0.005	0.005	0.02	0.01	9.4	0.01	0.01	0.07	0.05	0.01	2.2	0.02		0.02		3.3	0.1	22		0.03	
18-Jul-90	0.11		0.015	0.005	0.02	0.01	14	0.01	0.01	0.51	0.05	0.01	2.88	0.08		0.02		2.6	0.1	38		0.03	
13-Nov-90	0.05	0.005	0.5	0.05	0.45	0.0005	8.9	0.005	0.005	0.41	0.001	0.005	1.69	0.005		0.005		2.95	0.005	16		0.01	
31-July-91	0.2	0.005			0.2	0.0005	8.6	0.005	0.01	0.19	0.002	0.005	2.68	0.03		0.01		2.4	0.005	45		0.01	
11-Dec-91	0.2	0.005	0.5	0.05	0.26	0.0005	8.6	0.005	0.005	0.22	0.002	0.005	21	0.01		0.005		2.06	0.005	20		0.01	
24-Mar-92	0.3	0.005	0.5	0.05	1.59	0.0005	37	0.005	0.005	6.7	0.005	0.005	8.9	10		0.246		5.5	0.005	44		0.01	
03-Jun-92	0.11	0.005	0.5	0.05	0.87	0.0005	11	0.005	0.005	0.2	0.003	0.005	2.01	0.005		0.043		3.83	0.005	21		0.01	
19-Aug-92	0.06	0.005	0.5	0.05	0.59	0.0005	12	0.005	0.005	0.54	0.003	0.005	2.48	0.06		0.01		2.13	0.005	39		0.01	
23-Nov-92	0.12	0.005	0.5	0.05	0.58	0.0005	10	0.005	0.005	0.22	0.004	0.005	2.42	0.03		0.005		2.45	0.005	23		0.01	
26-Feb-93	0.13	0.005	0.5	0.05	0.7	0.0005	7.4	0.005	0.005	0.22	0.001	0.005	1.53	0.02		0.005		2.28	0.005	34		0.01	
20-May-93	0.35	0.005	0.5	0.05	0.22	0.0005	8.7	0.005	0.005	0.24	0.001	0.005	1.57	0.005		0.005		2.67	0.005	23		0.01	
13-May-94	0.2	0.005	0.5	0.05	0.3	0.0027	4	0.005	0.02	0.12	0.005	0.005	0.96	0.01		0.005		2.04	0.005	16		0.01	
04-Oct-94	0.22	0.005	0.5	0.05	0.3	0.0005	5.9	0.005	0.005	0.59	0.001	0.005	1.58	0.005		0.005		1.57	0.005	24		0.01	

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - SURFACE SITE No. 14

continued

Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos	CO3	HCO3	SO4	T.O.C.	Cl	F
24-Oct-77		0.015				0.485			0.125			1.9		14.2	
23-Nov-77		0.01				0.236			0.082			1.2		9.9	
29-May-78		0.031				0.291			0.113						
28-Jun-78		0.028				0.472			0.125						
04-Oct-78		0.037				0.224			0.074						
21-Nov-78		0.015				0.426			0.298						
18-Jan-79		0.174				0.15			0.073						
07-Feb-79		0.086		0.005		0.513			0.301					10	
07-Mar-79		0.015	0.005	0.02	0.001	0.268						3		10	
09-Apr-79		0.043	0.005	0.005	0.014	0.435						1		6	
17-Jul-79		0.01		0.005		2.56						6		14	
10-May-82		0.01		0.026		0.54						3.3		6.9	
10-Aug-82		0.01		0.058		0.56			0.051			2.7		4.8	
07-Sep-83												4.7		26	
05-Aug-84									0.051			5.6		30	
06-May-86														44	
13-Aug-86		0.01												71	
11-Dec-86														47	
23-Feb-87														41	
04-May-87	0.01	0.14	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1	317	
11-Aug-87	0.01	2.67												90.8	
18-Nov-87	0.03	0.13								0.1	7.3			37.9	
26-May-88	0.01	0.01												42.9	
08-Aug-88	0.01	0.01									24.4			60.5	
28-Nov-88	0.01	0.01												32.5	
23-May-89	0.01	0.01									7.3			51	
07-Aug-89	0.01	0.06									48.8			79.7	
13-Dec-89	0.01	0.01												44.8	
27-Mar-90	0.01	0.02												44.5	
01-Jun-90	0.01	0.01								0.01	7.59			42	
18-Jul-90	0.01	0.02								0.02	16			71	
13-Nov-90	0.02	0.005												21	
31-July-91	0.05	0.04												60	
11-Dec-91	0.05	0.02												51	
24-Mar-92	0.06	1.78											7	124	
03-Jun-92	0.05	0.05											11	35	
18-Aug-92	0.06	0.1				0.03			0.02					53	0.13
23-Nov-92	0.07	0.02				0.17			0.02				8	50	0.13
26-Feb-93	0.05	0.04				0.26			0.02				19	41	0.12
20-May-93	0.05	0.02				0.21			0.02				1	32	0.12
13-May-94	0.05	0.02				0.3			0.02					24	0.1
04-Oct-94	0.05	0.005				0.49			0.06					33	0.22

Date	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDNESS	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	Sb
24-Oct-77			54.42	5.1	51	12					5.15	1.8			
23-Nov-77					56	6						6.2			
29-May-78											6.76	6.4			
28-Jun-78											6.43	12.2			
04-Oct-78											6.16	6			
21-Nov-78											6.6	10.8			
18-Jan-79											6.3	6.8			
07-Feb-79			40		25	14					6.14	3.2		0.005	
07-Mar-79							6.58	26.19			5.92	2.2			
09-Apr-79		3	54					45.77			6.14	5			
17-Jul-79			76				14.74	56.44			6.75	14			
10-May-82			46		34		8.25	30			5.94	3			
10-Aug-82		2	19		44		17.6	60			6.53	14			
07-Sep-83								90	70	1.08	6.21	8.3			
05-Aug-84								190				11.4			
06-May-86					121										
13-Aug-86			45		157			243			7.01	12.3			
11-Dec-86					118			173				7.1			
23-Feb-87					101			177				7.6			
04-May-87	0.1				70			187				6			
11-Aug-87			16		405			390			7.6	21			
18-Nov-87					160		40	240			7.2	6			
26-May-88					120			200				12			
08-Aug-88					110		41.3	275			7.17	20			
28-Nov-88			49.2		170			2000			7.3	36			
23-May-89					150	24	29.8	250			6.92	6			0.05
07-Aug-89			21		240		7.7	320			7.04	40			0.05
13-Dec-89			28		222	3	37.9	225			6.75	4			0.05
27-Mar-90			25.5		2860	3		200			5.91	11.2			0.05
01-Jun-90					143	2	32.5	193			6.8	7.6			0.05
18-Jul-90					202		46.8	290			7.1	18			0.05
13-Nov-90			74		136	6	29.2	128.3			6.52	14			0.001
31-July-91			20		230	5	32.5	223			7.13	20.8			0.001
11-Dec-91			10		136	4	108	217			6.84	15.5			0.001
24-Mar-92			17		526	4	129	675			6.54	175			0.001
03-Jun-92			27		130	4	35.7	184.4			6.82	14.2			0.001
18-Aug-92			28		175	11	40.2	245			6.9	22.4			0.001
23-Nov-92			20		148	12	34.9	222			6.81	22			0.001
26-Feb-93					145	19	24.8	218			6.68	12.2			0.001
20-May-93			8		106	12	28.2	158.5			6.77	13			0.001
13-May-94					80	4	13.9	108.9			6.72	9.8			0.006
04-Oct-94			46		95	4	21.2	139.9			7.19	17.4			0.006

TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 15

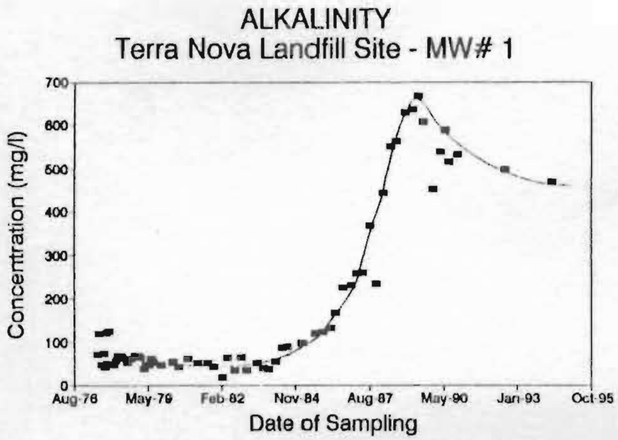
Yr	M	D	Date	Al	As	Ba	Be	B	Cd	Ca	Cr	Cu	Fe	Pb	Co	Mg	Mn	Mo	Ni	P	K	Se	Si	Na	Sr	Sn	Ti
81	11	9	09-Nov-81							4.64		0.17	2.72	0.13		2.22	2.838				28.4			12.76			
82	3	2	02-Mar-82							4.56		0.17	1.86	0.03			5.59				2.19			12.65			
82	5	10	10-May-82							5.49		0.04	2.49	0.05		2.78	6.63				1.85			3.8			
82	8	10	10-Aug-82						0.0006	3.78	0.001	0.03	0.81	0.123		2.5	2.3		0.01		2.02			9.38			
82	11	10	10-Nov-82							5.03		0.254	0.63	0.213		2.29	9.05				1.72			6.04			
83	1	26	26-Jan-83							4.63		0.166	1.37	0.04		1.95	8.79				1.53			4.86			
83	6	23	23-Jun-83							5.18		0.2	0.87	0.066		1.64	6.85				1.7			4.93			
83	9	7	07-Sep-83							6.42		0.34	2.72	0.141		1.22	4.74				2.35			4.58			
83	11	23	23-Nov-83							4.25		0.32	0.75	0.19		1.16	4.44				2.02			5.44			
84	2	29	29-Feb-84							4.25		0.047	0.01	0.002		1	2.72				1.75			5.04			
84	5	18	18-May-84							5.76		0.236	0.76	0.061		1.18	0.66				1.94			6.32			
84	8	5	05-Aug-84							24.2		0.13	1.35	0.02		9.6	15.6				4.18			29			
85	2	15	15-Feb-85							82		0.21	300	0.128		20	110				9.3			92			
85	5	22	22-May-85							86			230			21.1	133				13.2			109			
85	8	6	06-Aug-85							81			230			25	110				17			130			
85	11	13	13-Nov-85							120			210			49	70				29			210			
86	3	3	03-Mar-86							110			250			50	79				37			240			
86	5	4	04-May-86	0.06	0.14	1.01	0.01	0.31	0.01	118.12	0.16	0.01	0.09	0.13	0.14	46.23	32.04		0.01		13.3	0.12		46.8	0.5	0.1	0.1
86	5	8	08-May-86							98			220			42	83				45			170			
86	8	13	13-Aug-86							80			180			35	43				49			160			
86	12	11	11-Dec-86							96			169			36.7	35.7				11.5			281			
87	11	18	18-Nov-87	0.19	0.06	0.01	0.01	0.45	0.02	130.48	0.44	0.06	2.5	0.05	0.29	53.44	30.82		0.05	0.9	94.6	0.12		185	0.6	0.1	0.3
88	3	28	28-May-88	10.1	0.11	1	0.01	0.64	0.005	121	0.23	0.23	163	0.22	0.23	50.7	35.5		0.09	3.83	102	0.1	23.3	226	0.55	0.15	0.6
88	8	7	07-Aug-88	6.51	0.213	0.07	0.003	0.69	0.01	94.4	0.18	0.15	97	0.25	0.18	40.3	21.8		0.09	3.2	94.9	0.11		192	0.44	0.09	0.41
88	11	28	28-Nov-88	2.72	0.017	0.89	0.002	0.71	0.003	104.07	0.17	0.1	117.39	0.14	0.23	43.5	24.9		0.08	2.55	101	0.05	14.7	176	0.51	0.07	0.16
89	3	10	10-Mar-89	1.2		0.5	0.01	0.25	0.005	85	0.01	0.03	90	0.12	0.01	42	24.5		0.01		108	0.1		169		0.14	
89	5	23	23-May-89	0.89	0.006	0.664	0.005	0.4	0.005	48	0.01	0.02	49	0.09	1.1	22	10.9		0.01		90.5	0.1		158		0.07	
89	8	7	07-Aug-89	0.05		0.292	0.005	0.26	0.005	80	0.01	0.005	0.03	0.01	0.01	28	8.3		0.01	91	0.1	0.1		140		0.03	
89	12	13	13-Dec-89	0.35		0.478	0.005	0.27	0.005	79	0.03	0.05	78	0.06	0.25	29	13		0.02		109	0.1		133		0.18	
90	3	27	27-Mar-90	0.05		0.15	0.005	0.27	0.01	79	0.01	0.01	2.97	0.05	0.06	25	9.77		0.02		522	0.1		714		0.18	
90	6	1	01-Jun-90	2.13		0.79	0.005	0.39	0.03	78	0.01	0.03	67	0.28	0.19	24	13		0.03		82	0.1		136		0.41	
90	7	18	18-Jul-90	1		0.53	0.005	0.45	0.01	51	0.01	0.02	66	0.05	0.01	25	7.98		0.02		81.3	0.1		136		0.03	
90	11	13	13-Nov-90	4.4	0.005	0.5	0.05	0.89	0.002	69	0.005	0.03	63	0.031	0.064	29	9.1		0.009		90	0.005		100		0.01	

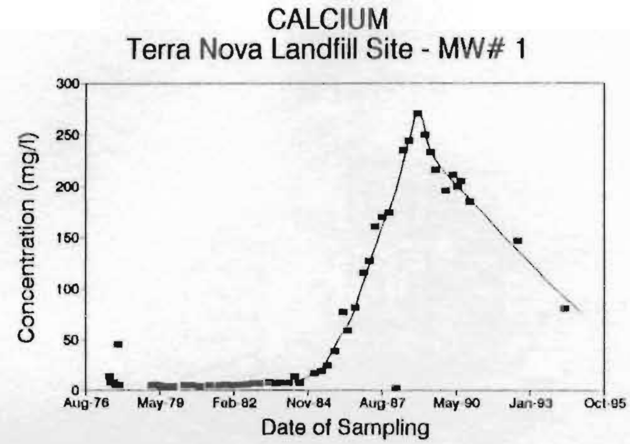
TERRA NOVA LANDFILL SITE - ANALYTICAL RESULTS - WELL No. 15

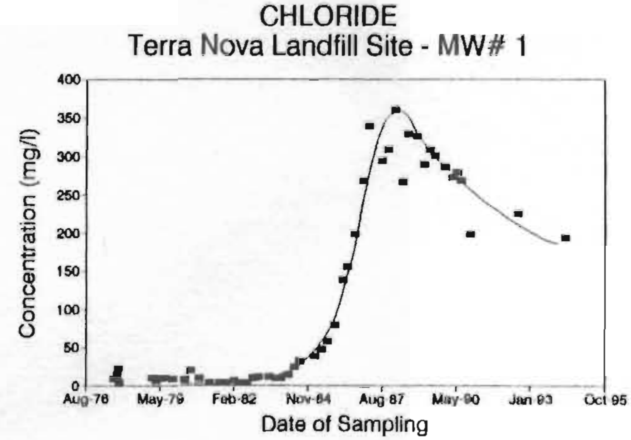
continued

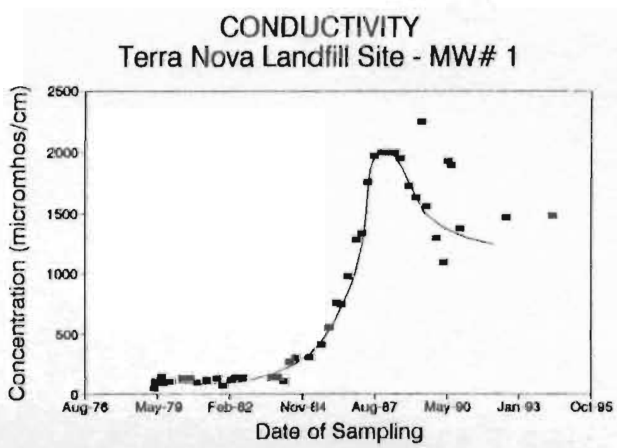
Yr	M	D	Date	V	Zn	NH4	NO3	NO2	Kj. Nit.	T. Nit.	PO4	T. Phos.	CO3	HCO3	SO4	T.O.C.
81	11	9	09-Nov-81		8.38		0.176		0.48						9	
82	3	2	02-Mar-82		11.5		0.12		0.33							
82	5	10	10-May-82		11.4		0.001		0.55						0.9	
82	8	10	10-Aug-82		10.9		0.002		0.28			0.121			1	
82	11	10	10-Nov-82		15.4		0.006		0.207			0.047			0.7	
83	1	26	26-Jan-83		14.4		0.002		0.22			0.035			0.9	
83	6	23	23-Jun-83		16		0.022		0.43			0.047			1.2	
83	9	7	07-Sep-83		18.8		0.068		0.31			0.25			1.9	
83	11	23	23-Nov-83		26.7		0.043		0.03			0.042			1.7	
84	2	29	29-Feb-84		18.9		0.056		0.17			0.082			1.1	
84	5	16	16-May-84		27.6		0.063		0.4			0.005			1.4	
84	8	5	05-Aug-84		73		0.016		0.85			0.099			1.6	
85	2	15	15-Feb-85		85		0.005		9.8			0.247			1.6	
85	5	22	22-May-85		83											
85	8	8	08-Aug-85		90											
85	11	13	13-Nov-85		93											
86	3	3	03-Mar-86		86											
86	5	4	04-May-86	0.08	5.97	0.05	0.05	0.05	0.1	0.1	0.05				0.1	0.1
86	5	6	06-May-86		62											
86	8	13	13-Aug-86		34											
86	12	11	11-Dec-86		28											
87	11	18	18-Nov-87	0.19	19.79								0.1	727.7		
88	5	26	26-May-88	0.09	93											
88	8	7	07-Aug-88	0.06	49.1									768		
88	11	28	28-Nov-88	0.06	48.6											
89	3	10	10-Mar-89	0.01	42									960		
89	5	23	23-May-89	0.02	30									821.4		
89	8	7	07-Aug-89	0.01	13											
89	12	13	13-Dec-89	0.02	53											
90	3	27	27-Mar-90	0.01	20											
90	6	1	01-Jun-90	0.01	38								0.38	640		
90	7	18	18-Jul-90	0.01	39								0.91	610		
90	11	13	13-Nov-90	0.05	19											

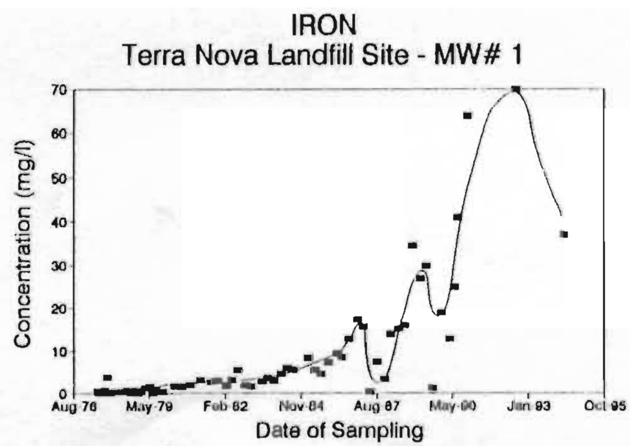
Date	Cl	F	I	B.O.D.	C.O.D.	D.O.	T.D.S.	T.S.S.	HARDN	Cond.	COLOR	TURB.	pH	Alk.	Acidity	Li	Sb
09-Nov-81	7.2			6	28		58		43.6	110			6.68	30			
02-Mar-82	8			9	69												
10-May-82	4.5				29		83		62.8	130			6.96	56			
10-Aug-82	3.5			1	13		54		25	90			7.12	41			
10-Nov-82	4			1	16		83		39.8				7.82	53			
26-Jan-83	4.2				36		83		38.8				7.48	5.7			
23-Jun-83	5.5				32		88						8.62	47.2			
07-Sep-83	6	0.05			11		86			115			8.49	46.2			
23-Nov-83	7	0.05			10		137					155	7.66	26.9			
29-Feb-84	7.4	0.04			17		88			83			8.42	50.5			
16-May-84	7.9	0.045			8		82			150			7.47	53.5			
05-Aug-84	80	0.04		1	213		447			670				63.3			
15-Feb-85	190	0.08		16	751		1140			1400			5.66	239			
22-May-85	268						1519										
08-Aug-85	302				170		1479			2000			3.36	169			
13-Nov-85	350				250		1659			2400				388			
03-Mar-86	330				206		1609			2250				458			
04-May-86	204		0.1				1180			2500				593			
06-May-86					172		1430			2120				479			
13-Aug-86	280				131		1130			1670			7.11	412			
11-Dec-86	220				144		1193			1960				454			
18-Nov-87	319						1610		545.7	2400			6.7	597			
26-May-88	376						1420			2606				665			
07-Aug-88	258						1210		401.8	2000			7.22	630			
28-Nov-88	241				468		1280			200			7.42	718			
10-Mar-89	172				342		1100	350	410	1740			7.3	788			
23-May-89	180						1320	404	210.4	2000			6.71	874			
07-Aug-89	155				240		1020		265.1								0.05
13-Dec-89	205				234		1060	483	316	1250			7.48	274			0.05
27-Mar-90	190				190		125	357		1400			8.05	850			0.05
01-Jun-90	150						924	392	288	1740			[illegible]	640			0.05
18-Jul-90	136						429		230	1690			7.2	811			0.05
13-Nov-90	100				160		741	200	292	1220			6.63	597			0.06

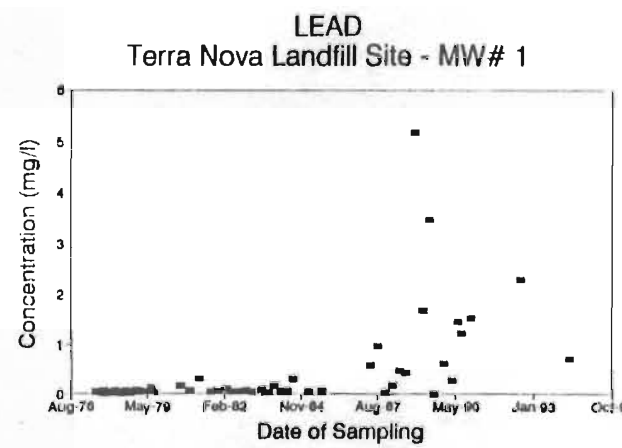

ALKALINITY
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
0
100
200
300
400
500
600
700
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

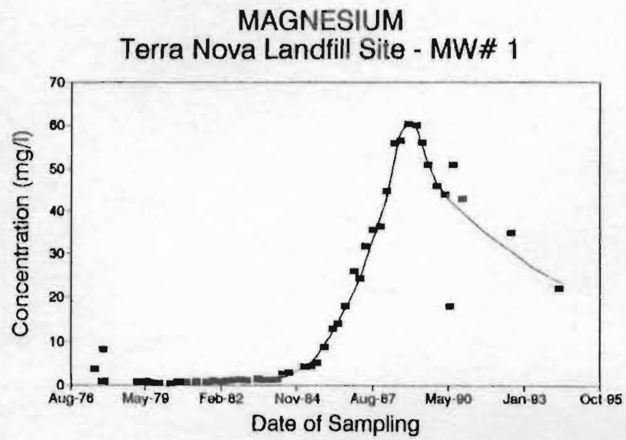

CALCIUM
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
0
50
100
150
200
250
300
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

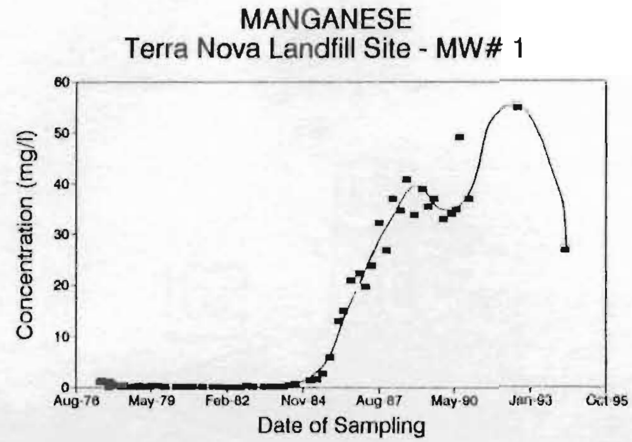

CHLORIDE
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
0
50
100
150
200
250
300
350
400
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

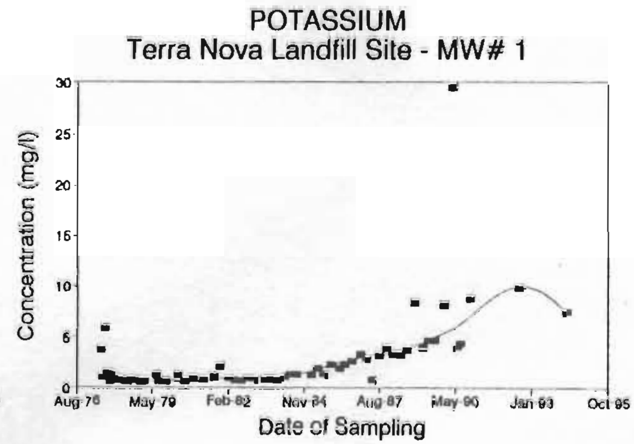

CONDUCTIVITY
Terra Nova Landfill Site - MW# 1
Concentration (micromhos/cm)
0
500
1000
1500
2000
2500
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

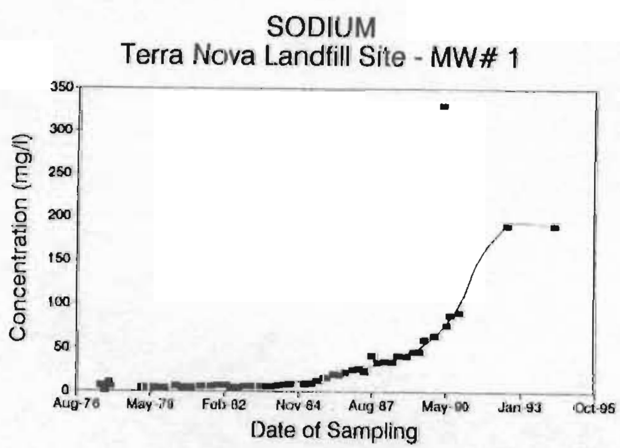

IRON
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
0
10
20
30
40
50
60
70
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

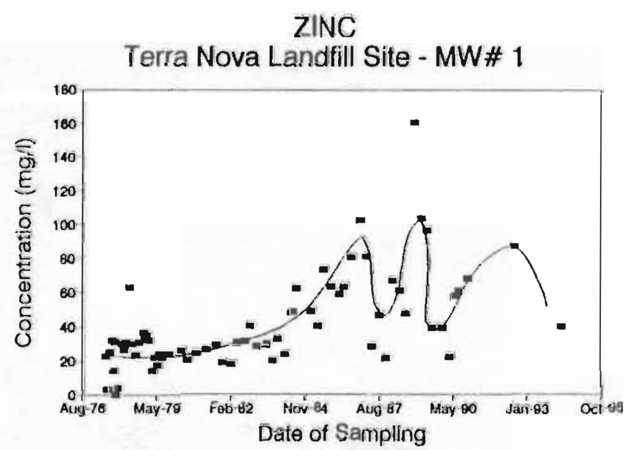

LEAD
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
0
1
2
3
4
5
6
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

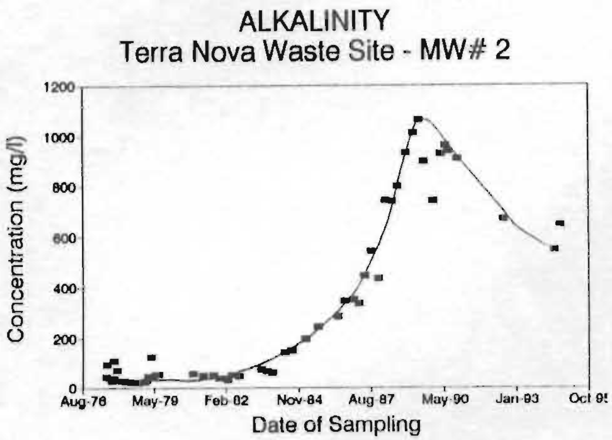

MAGNESIUM
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

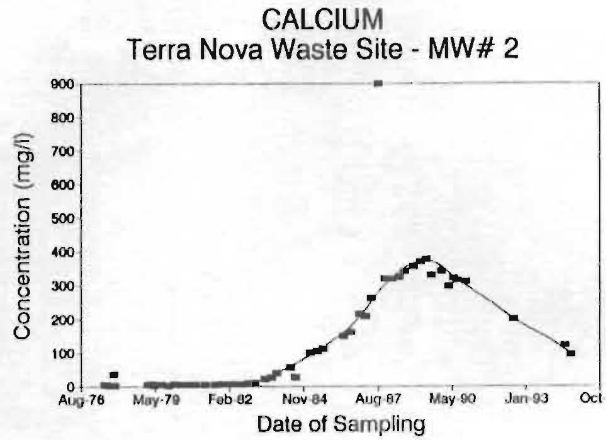

MANGANESE
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

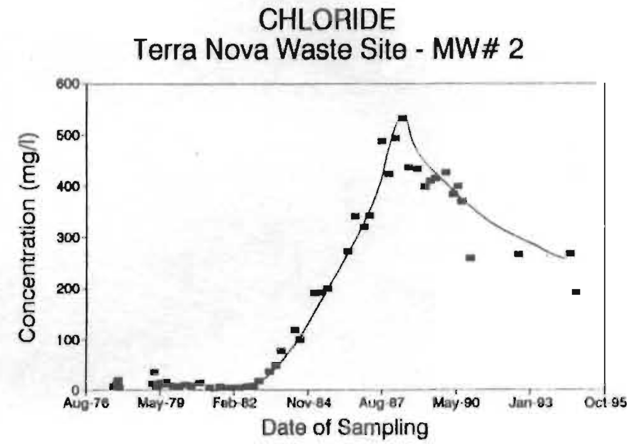

POTASSIUM
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

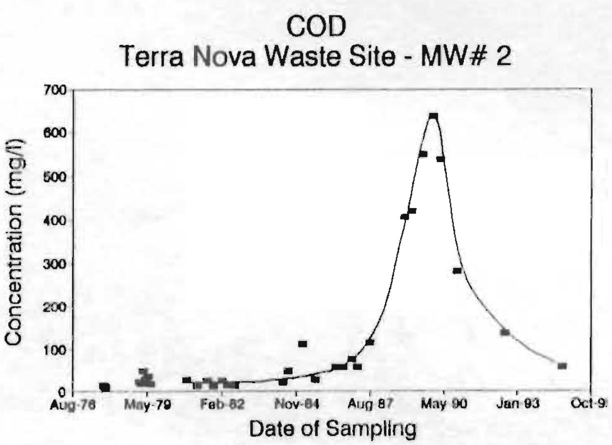

SODIUM
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

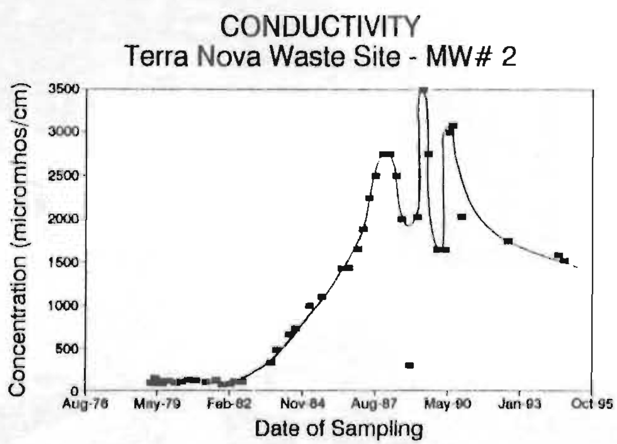

ZINC
Terra Nova Landfill Site - MW# 1
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

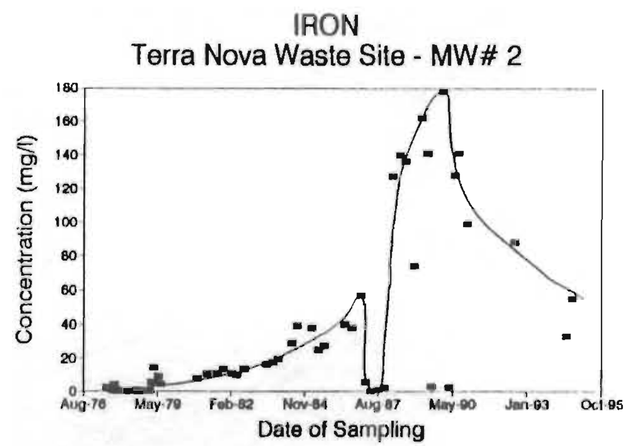

ALKALINITY
Terra Nova Waste Site - MW# 2
Concentration (mg/l)
0
200
400
600
800
1000
1200
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Date of Sampling


CALCIUM
Terra Nova Waste Site - MW# 2
Concentration (mg/l)
0
100
200
300
400
500
600
700
800
900
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Date of Sampling

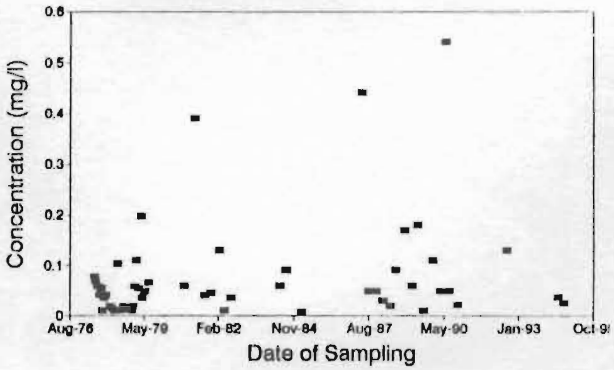

CHLORIDE
Terra Nova Waste Site - MW# 2
Concentration (mg/l)
0
100
200
300
400
500
600
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


COD
Terra Nova Waste Site - MW# 2
Concentration (mg/l)
0
100
200
300
400
500
600
700
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Date of Sampling

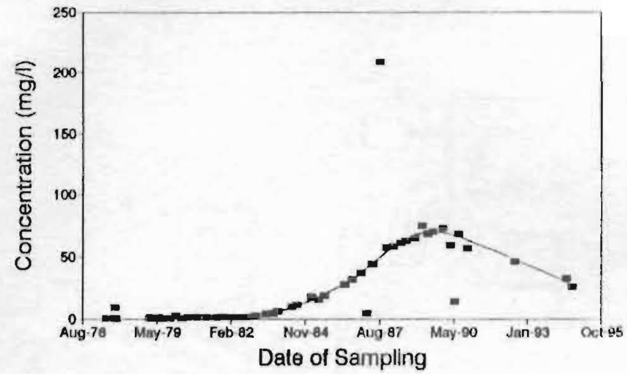

CONDUCTIVITY
Terra Nova Waste Site - MW# 2
Concentration (micromhos/cm)
0
500
1000
1500
2000
2500
3000
3500
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


IRON
Terra Nova Waste Site - MW# 2
Concentration (mg/l)
0
20
40
60
80
100
120
140
160
180
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

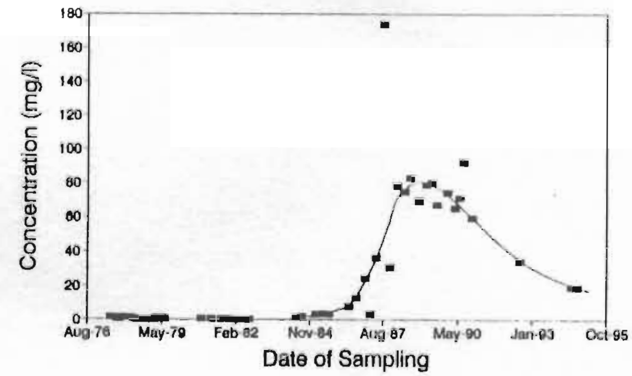
LEAD
Terra Nova Waste Site - MW# 2



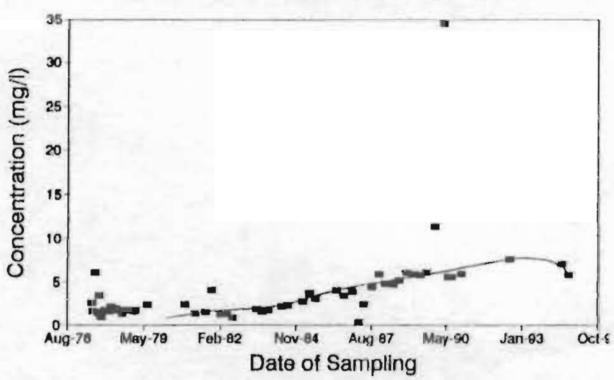
MAGNESIUM
Terra Nova Waste Site - MW# 2



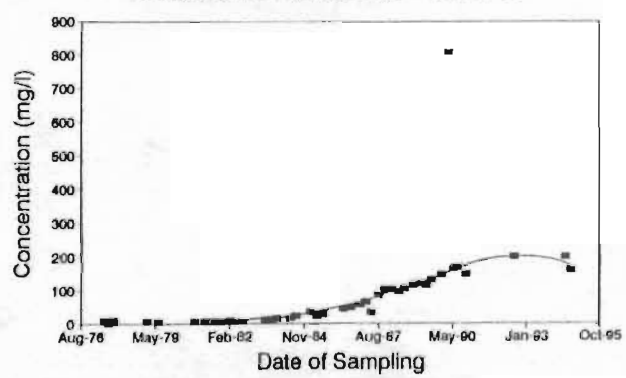
MANGANESE
Terra Nova Waste Site - MW# 2



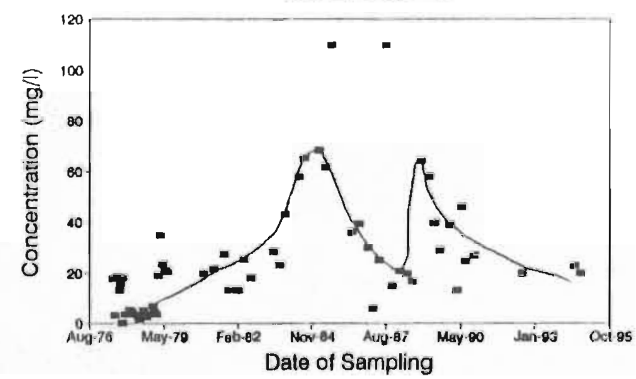
POTASSIUM
Terra Nova Waste Site - MW# 2

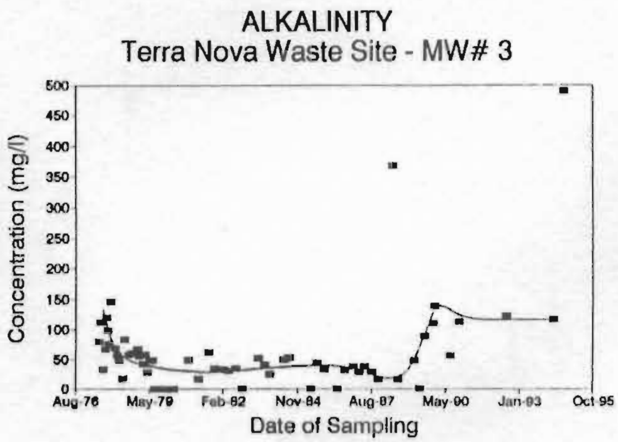


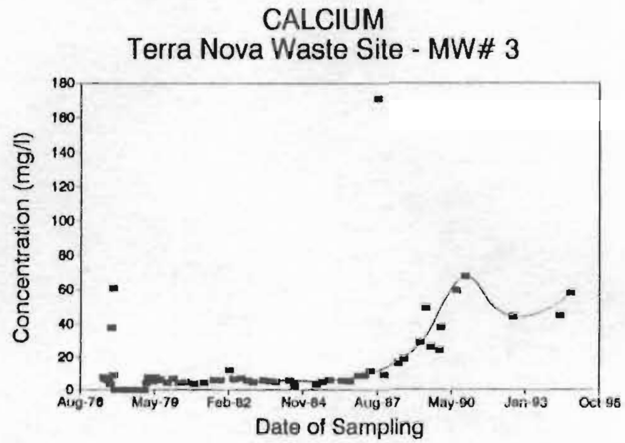
SODIUM
Terra Nova Waste Site - MW# 2

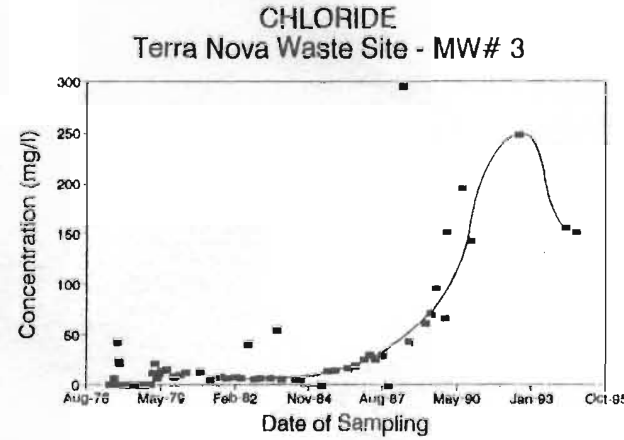


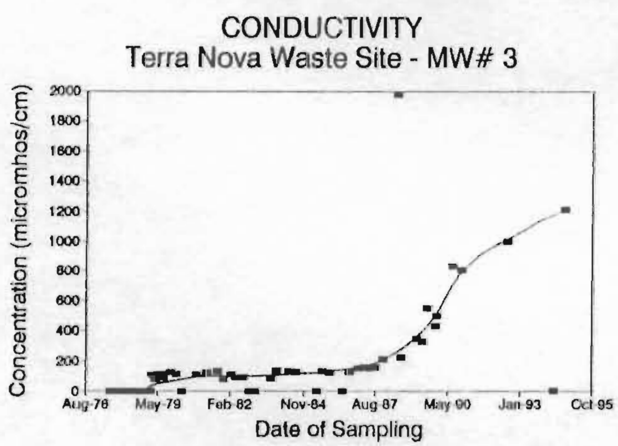
ZINC
Terra Nova Waste Site - MW# 2

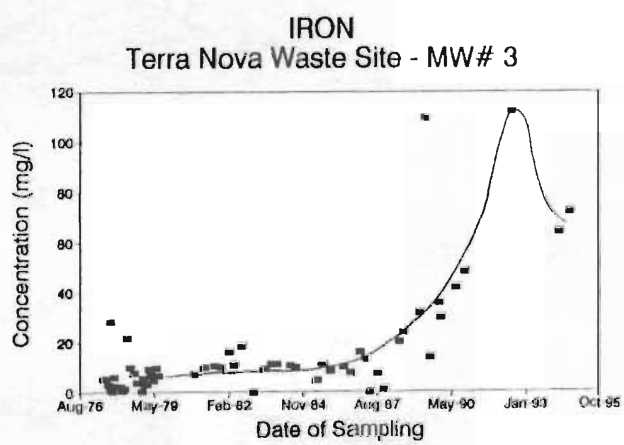


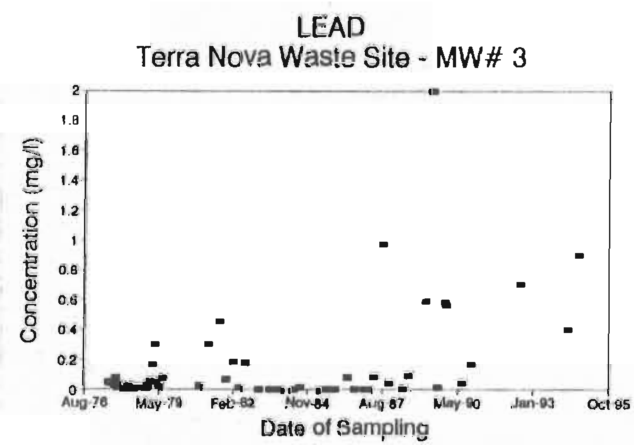

ALKALINITY
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
0
50
100
150
200
250
300
350
400
450
500
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

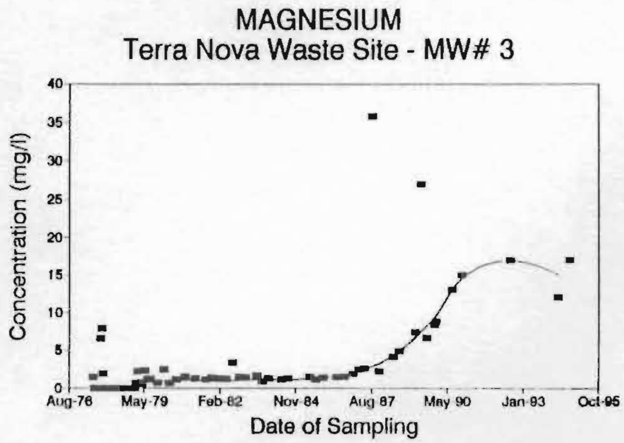

CALCIUM
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
0
20
40
60
80
100
120
140
160
180
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

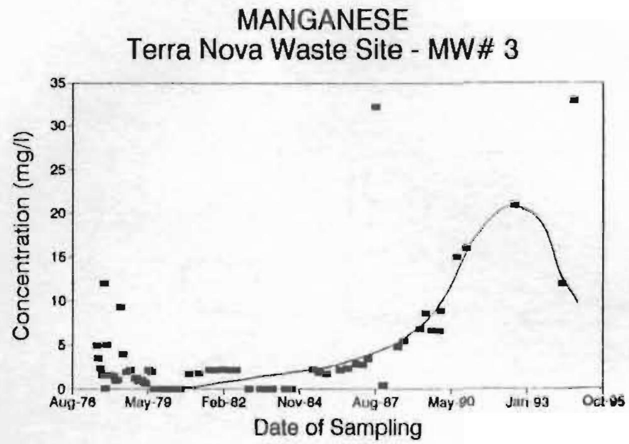

CHLORIDE
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
0
50
100
150
200
250
300
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

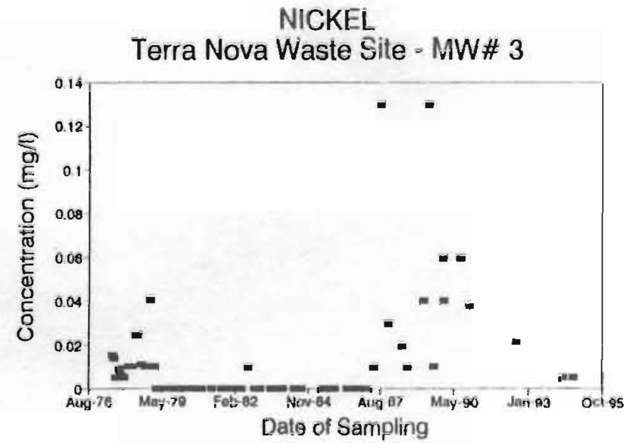

CONDUCTIVITY
Terra Nova Waste Site - MW# 3
Concentration (micromhos/cm)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

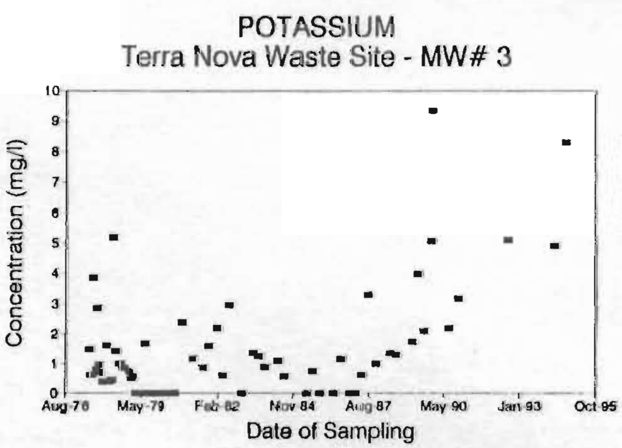

IRON
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
0
20
40
60
80
100
120
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

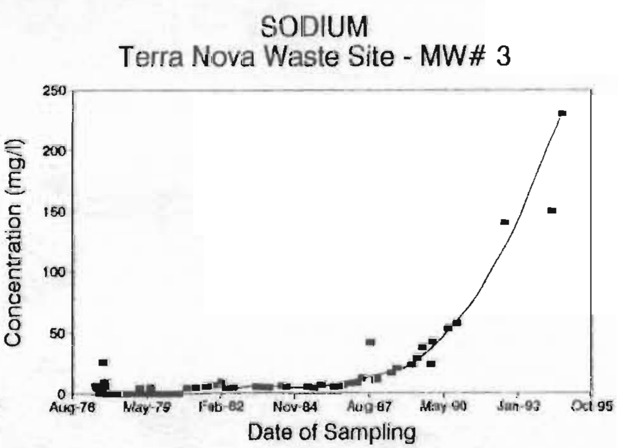

LEAD
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

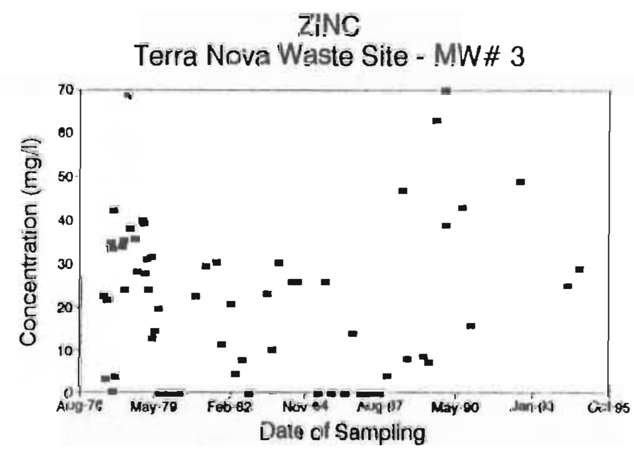

MAGNESIUM
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

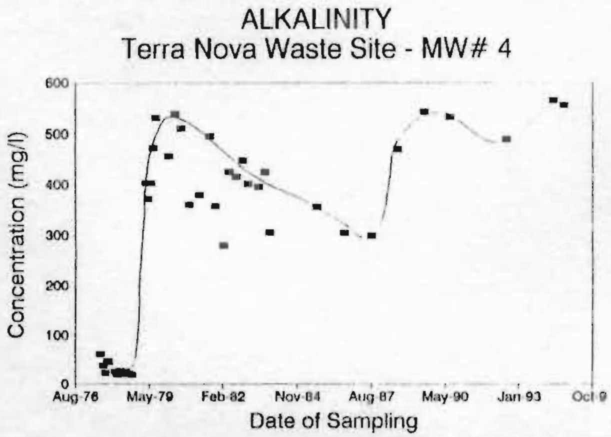

MANGANESE
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

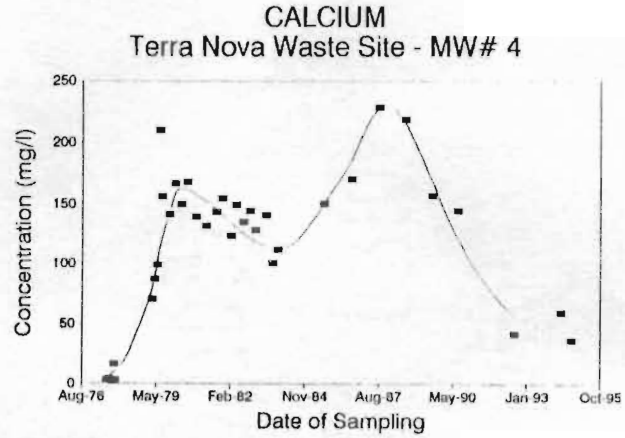

NICKEL
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

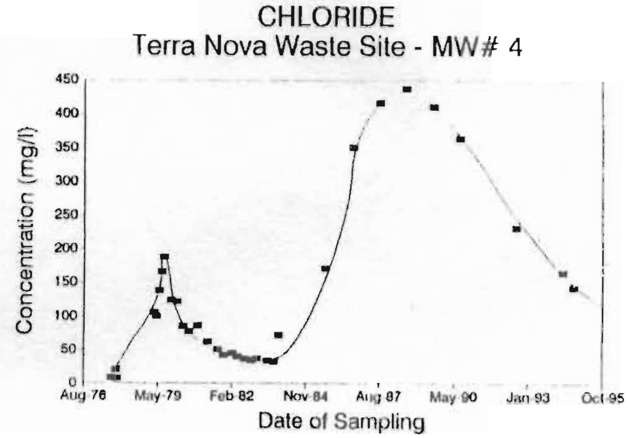

POTASSIUM
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

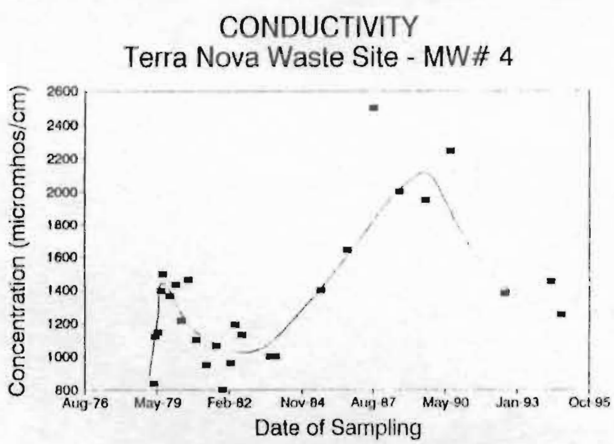

SODIUM
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

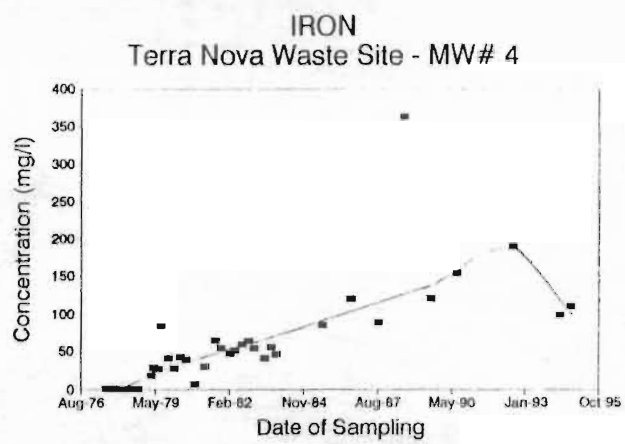

ZINC
Terra Nova Waste Site - MW# 3
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

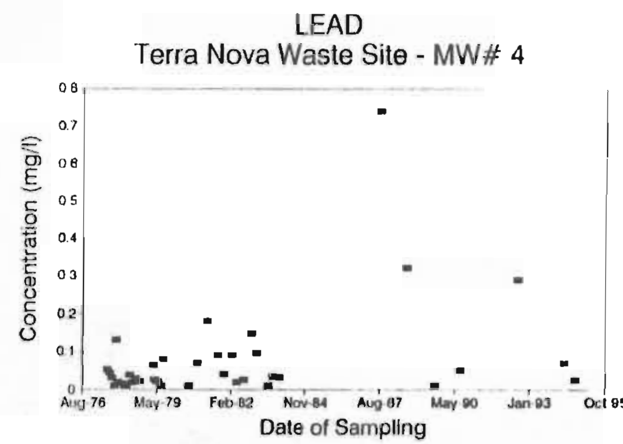

ALKALINITY
Terra Nova Waste Site - MW# 4
Concentration (mg/l)
0
100
200
300
400
500
600
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-9
Date of Sampling


CALCIUM
Terra Nova Waste Site - MW# 4
Concentration (mg/l)
0
50
100
150
200
250
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

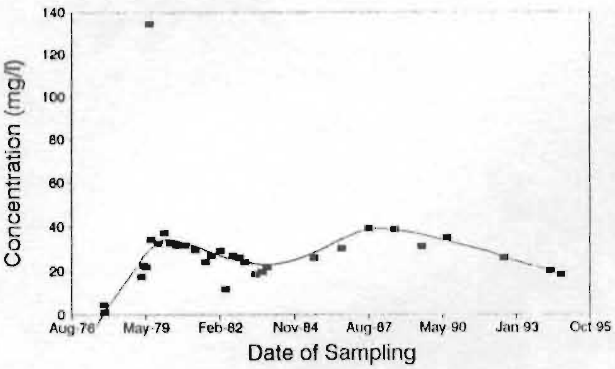

CHLORIDE
Terra Nova Waste Site - MW# 4
Concentration (mg/l)
0
50
100
150
200
250
300
350
400
450
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


CONDUCTIVITY
Terra Nova Waste Site - MW# 4
Concentration (micromhos/cm)
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

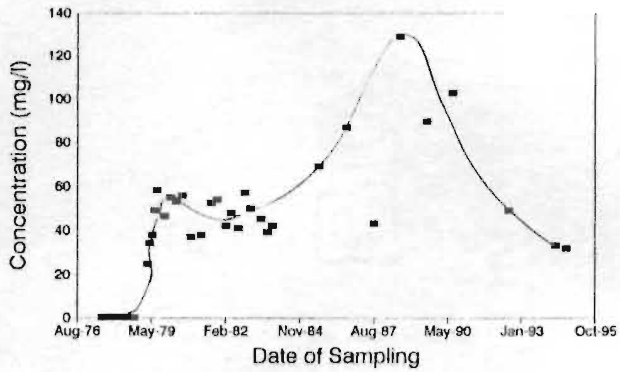

IRON
Terra Nova Waste Site - MW# 4
Concentration (mg/l)
0
50
100
150
200
250
300
350
400
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


LEAD
Terra Nova Waste Site - MW# 4
Concentration (mg/l)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

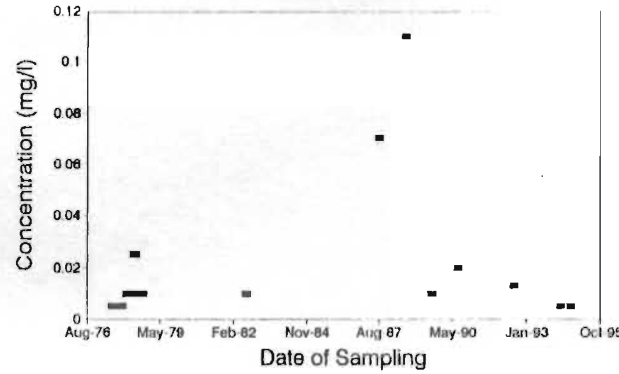
MAGNESIUM
Terra Nova Waste Site - MW# 4



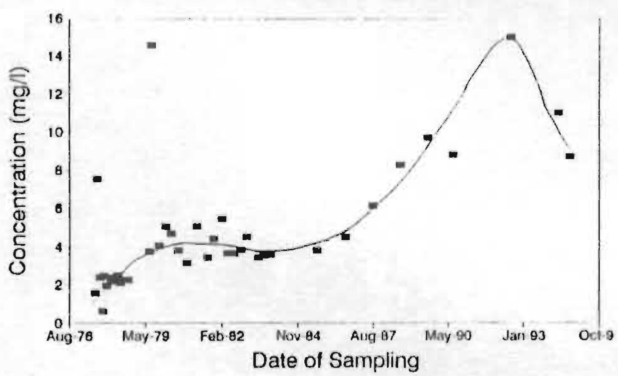
MANGANESE
Terra Nova Waste Site - MW# 4



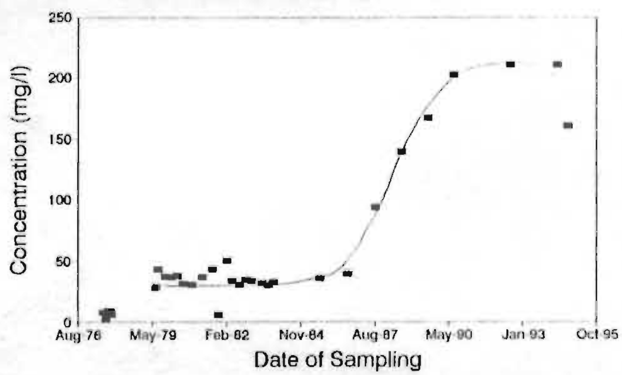
NICKEL
Terra Nova Waste Site - MW# 4



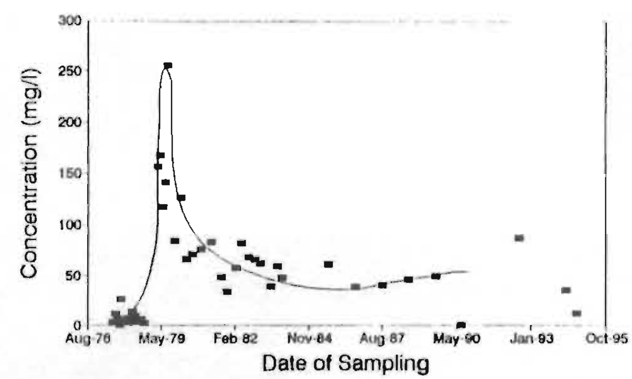
POTASSIUM
Terra Nova Waste Site - MW# 4

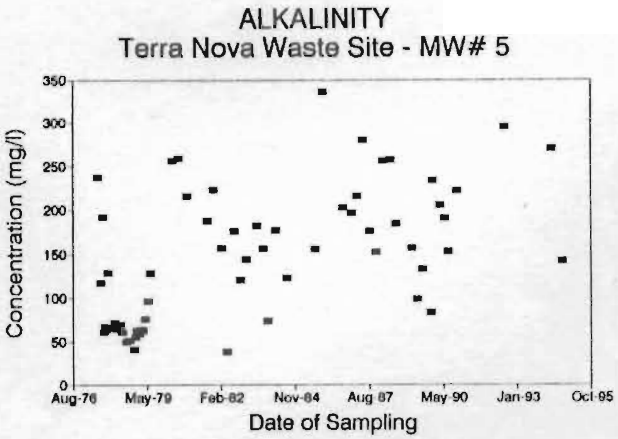


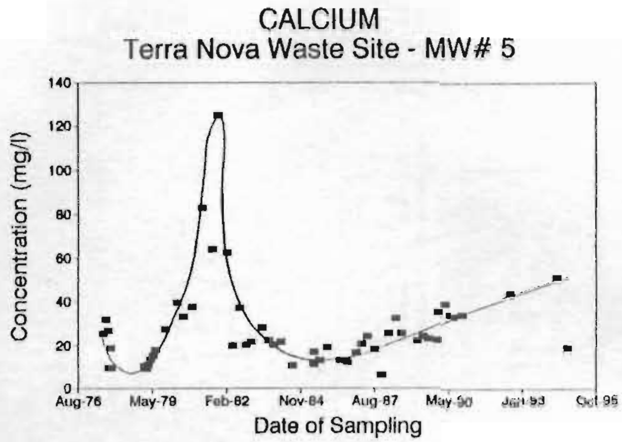
SODIUM
Terra Nova Waste Site - MW# 4

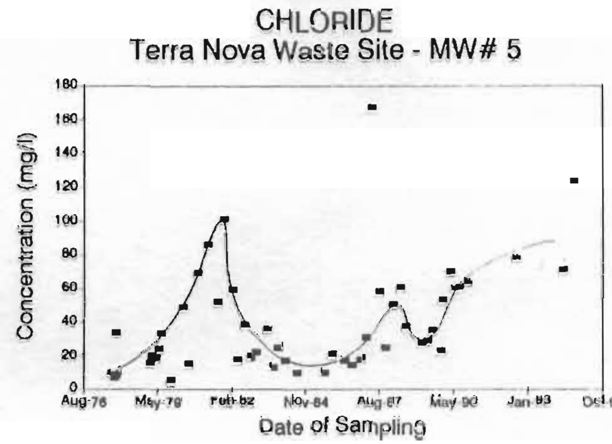


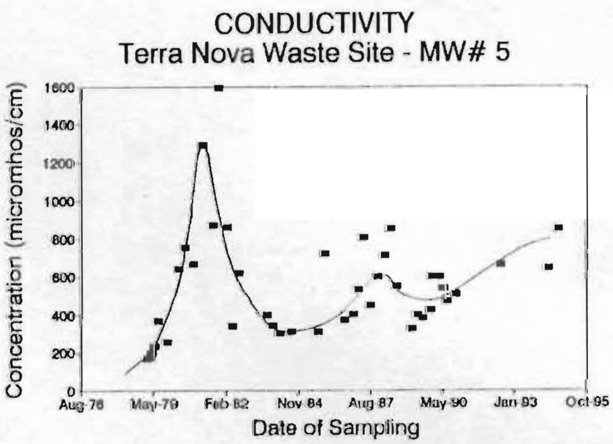
ZINC
Terra Nova Waste Site - MW# 4

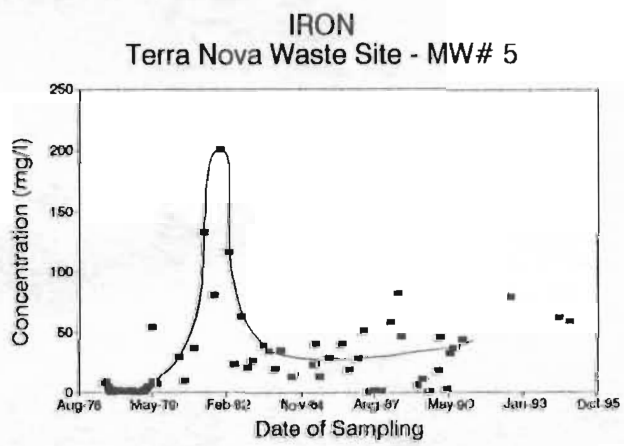


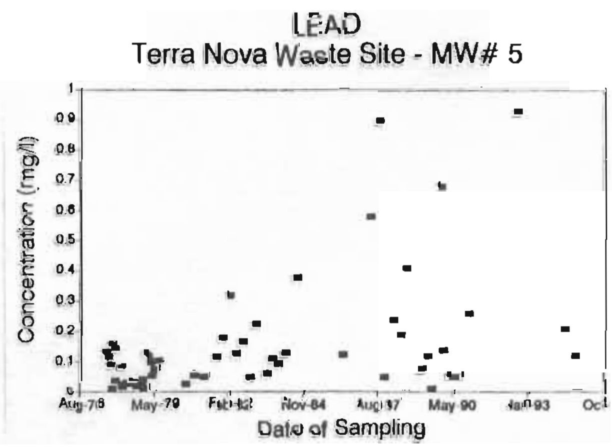

ALKALINITY
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

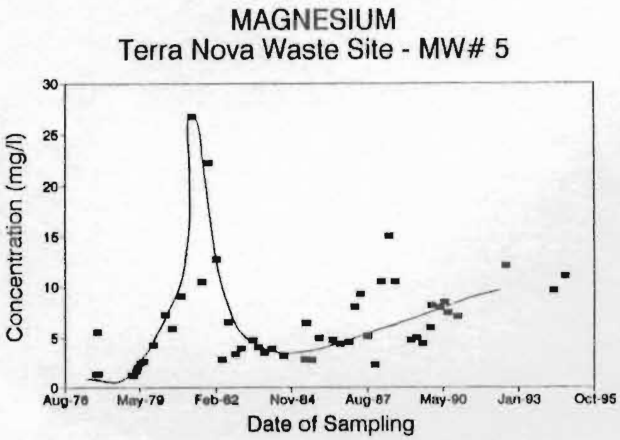

CALCIUM
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

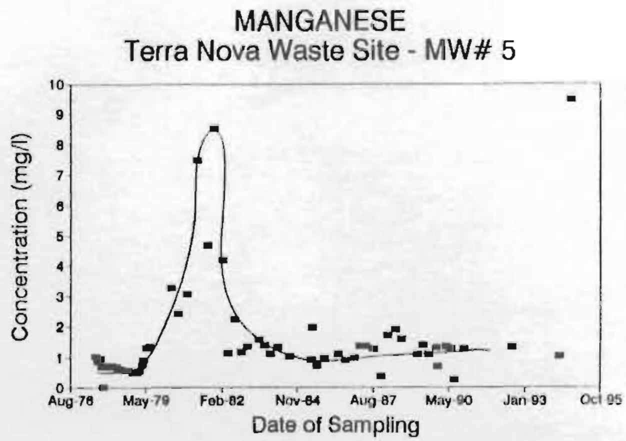

CHLORIDE
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
Date of Sampling

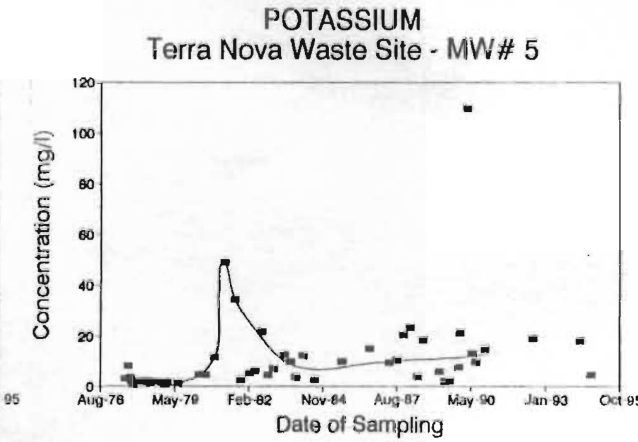

CONDUCTIVITY
Terra Nova Waste Site - MW# 5
Concentration (micromhos/cm)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

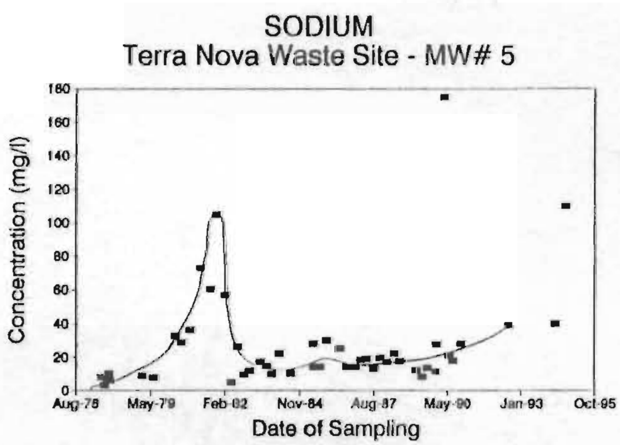

IRON
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
Date of Sampling

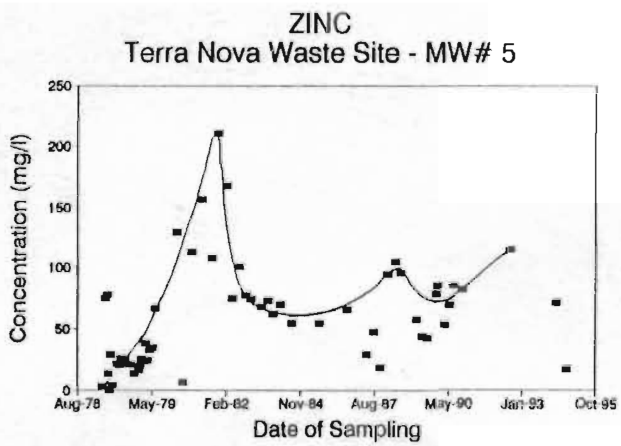

LEAD
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
Date of Sampling


MAGNESIUM
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
0
5
10
15
20
25
30
Aug-78
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

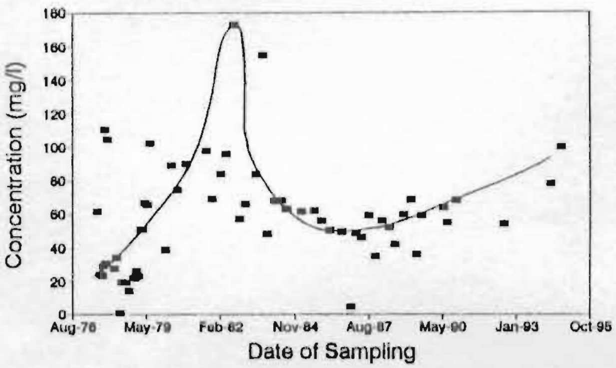

MANGANESE
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
0
1
2
3
4
5
6
7
8
9
10
Aug-78
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


POTASSIUM
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
0
20
40
60
80
100
120
Aug-78
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

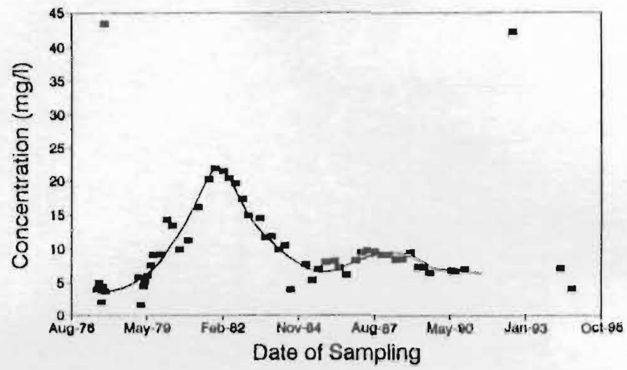

SODIUM
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
0
20
40
60
80
100
120
140
160
180
Aug-78
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


ZINC
Terra Nova Waste Site - MW# 5
Concentration (mg/l)
0
50
100
150
200
250
Aug-78
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

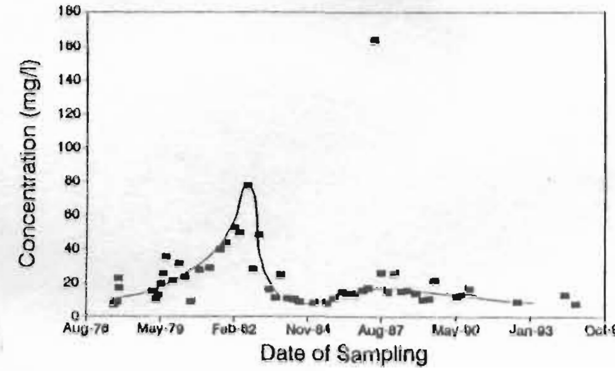
ALKALINITY
Terra Nova Waste Site - MW# 6



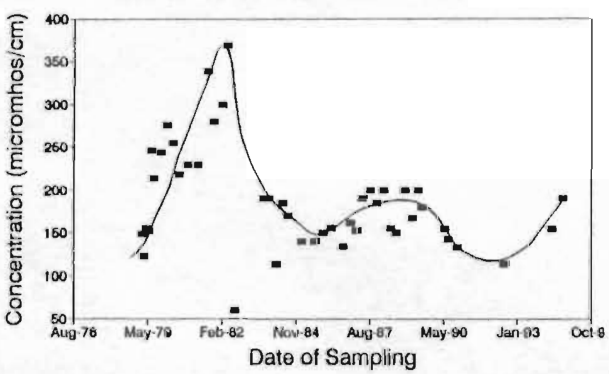
CALCIUM
Terra Nova Waste Site - MW# 6



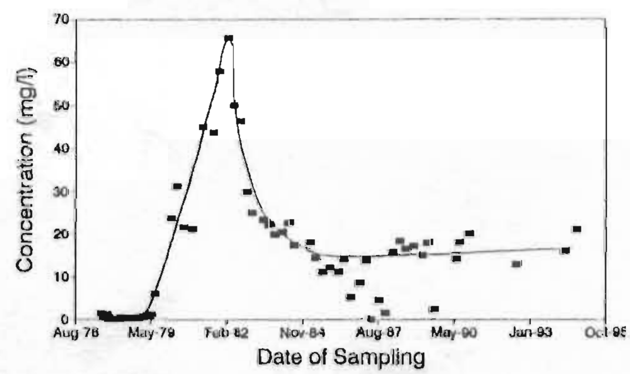
CHLORIDE
Terra Nova Waste Site - MW# 6



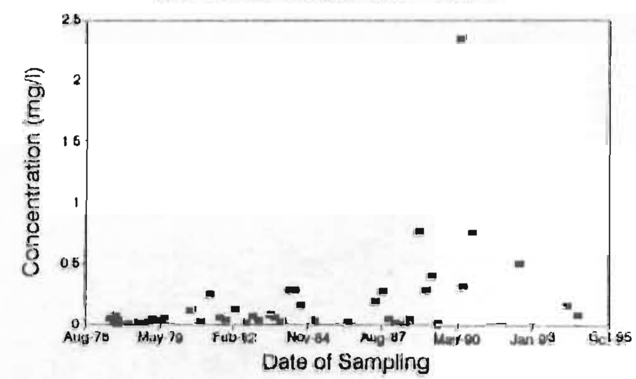
CONDUCTIVITY
Terra Nova Waste Site - MW# 6



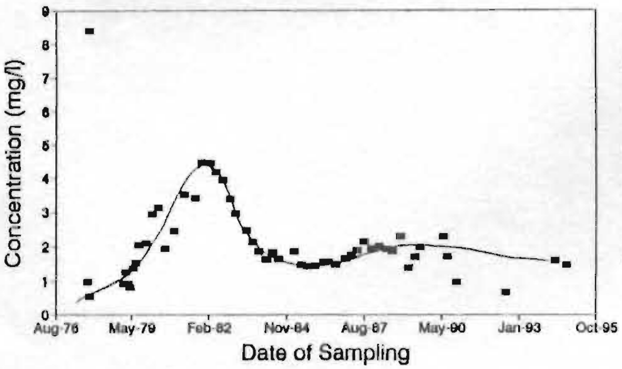
IRON
Terra Nova Waste Site - MW# 6



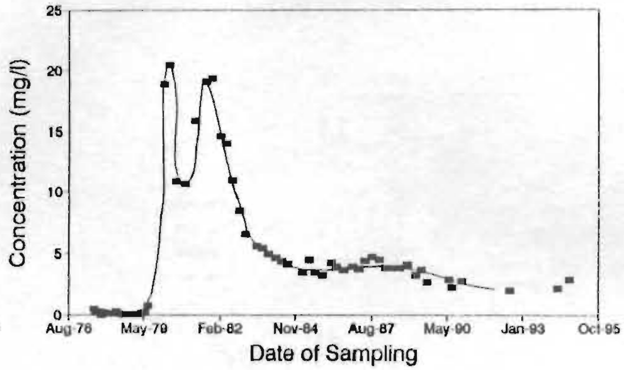
LEAD
Terra Nova Waste Site - MW# 6



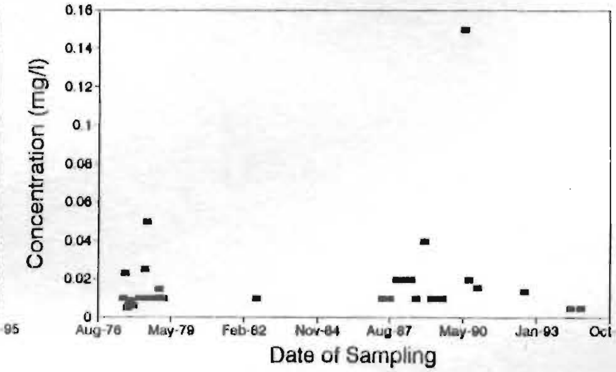
MAGNESIUM
Terra Nova Waste Site - MW# 6



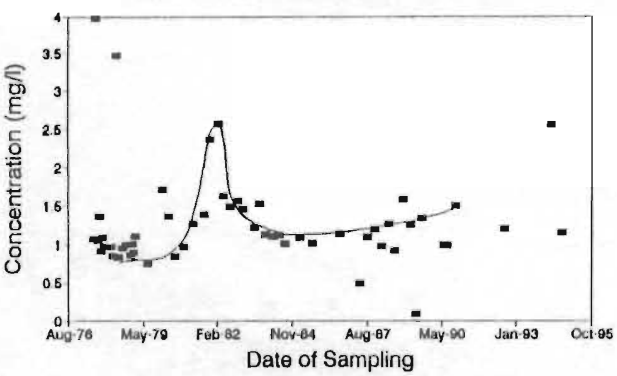
MANGANESE
Terra Nova Waste Site - MW# 6



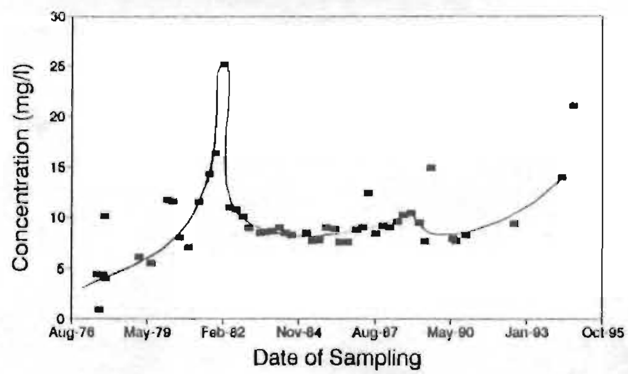
NICKEL
Terra Nova Waste Site - MW# 6



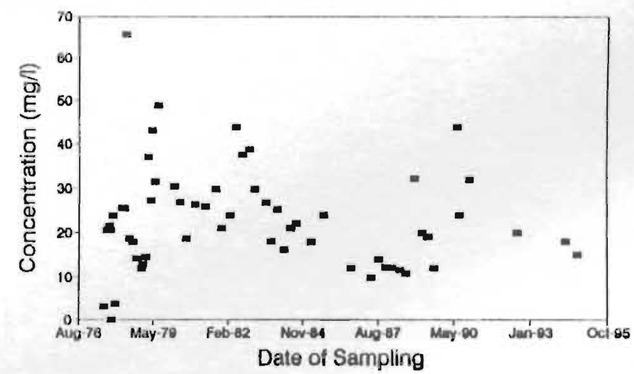
POTASSIUM
Terra Nova Waste Site - MW# 6

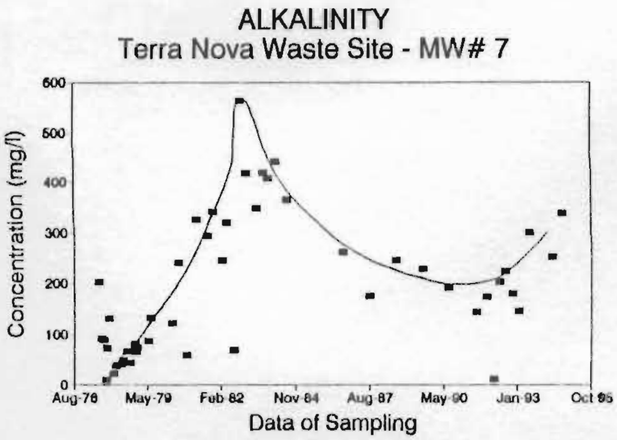


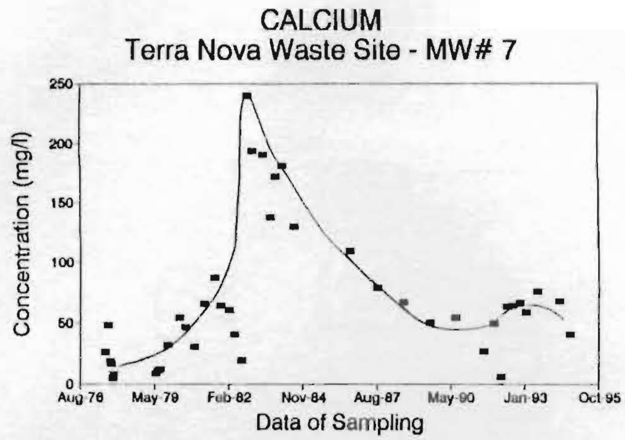
SODIUM
Terra Nova Waste Site - MW# 6

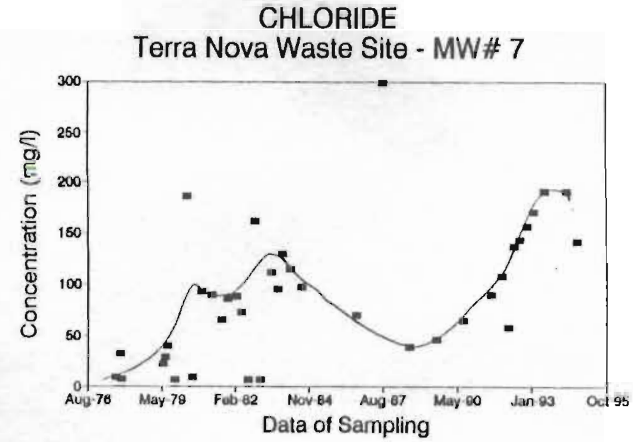


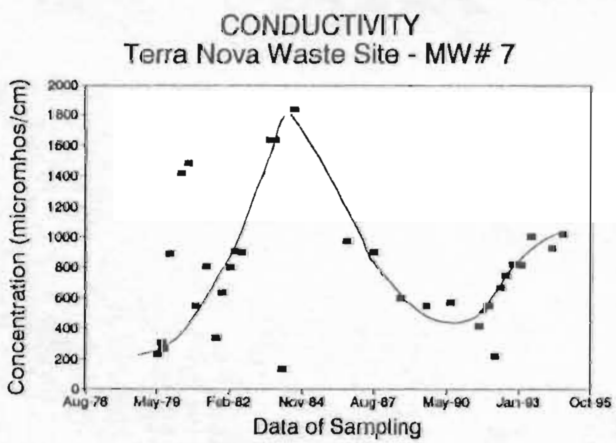
ZINC
Terra Nova Waste Site - MW# 6

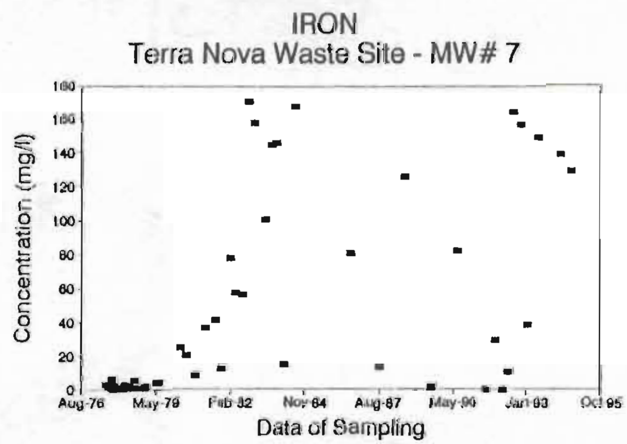


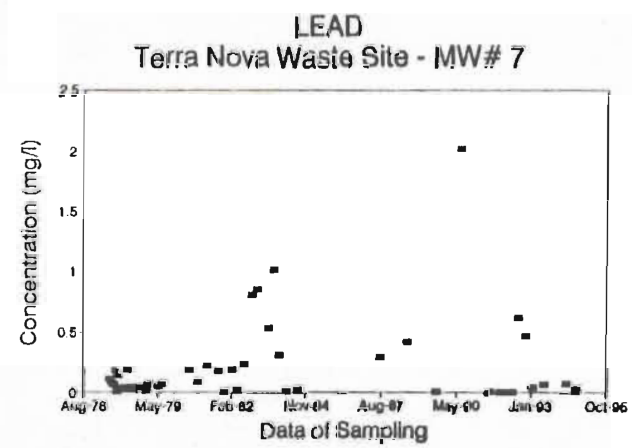

ALKALINITY
Terra Nova Waste Site - MW# 7
Concentration (mg/l)
Data of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95


CALCIUM
Terra Nova Waste Site - MW# 7
Concentration (mg/l)
Data of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

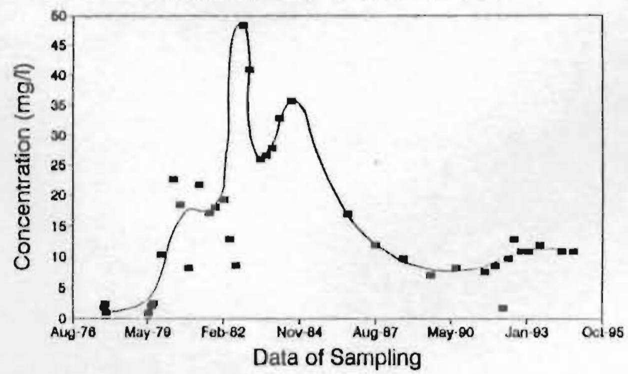

CHLORIDE
Terra Nova Waste Site - MW# 7
Concentration (mg/l)
Data of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95


CONDUCTIVITY
Terra Nova Waste Site - MW# 7
Concentration (micromhos/cm)
Data of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

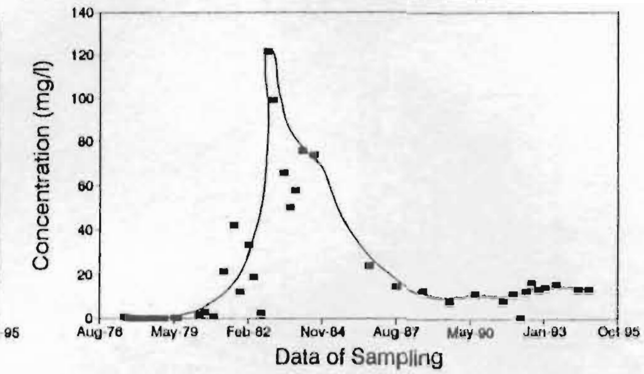

IRON
Terra Nova Waste Site - MW# 7
Concentration (mg/l)
Data of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95


LEAD
Terra Nova Waste Site - MW# 7
Concentration (mg/l)
Data of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-96

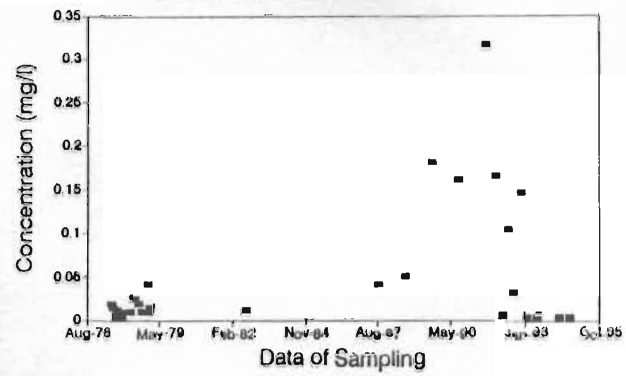
MAGNESIUM
Terra Nova Waste Site - MW# 7



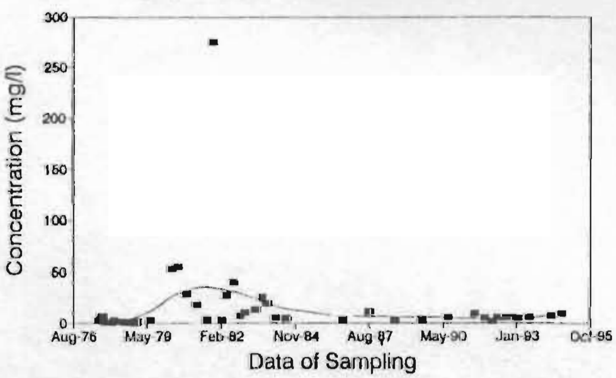
MANGANESE
Terra Nova Waste Site - MW# 7



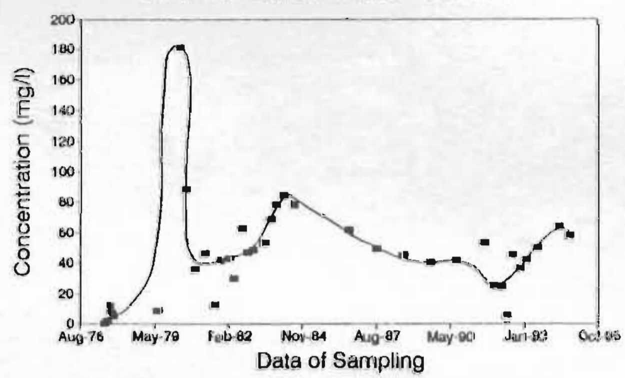
NICKEL
Terra Nova Waste Site - MW# 7



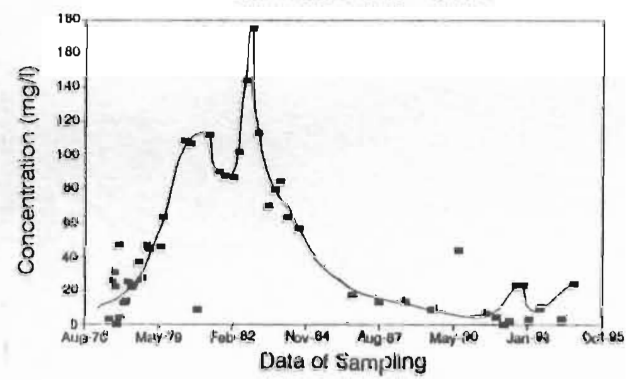
POTASSIUM
Terra Nova Waste Site - MW# 7

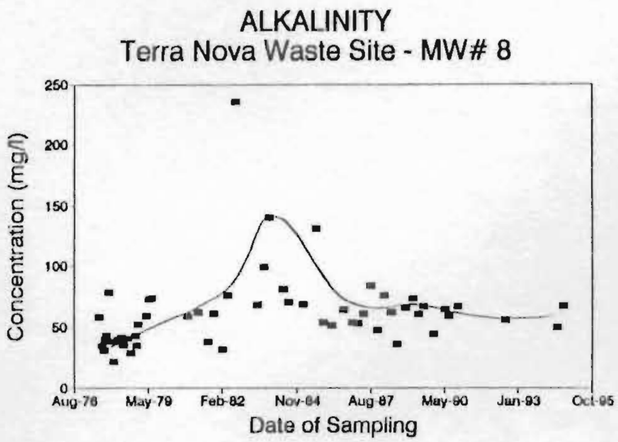


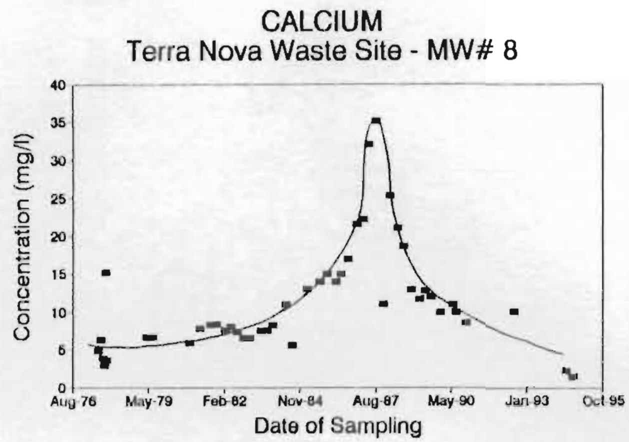
SODIUM
Terra Nova Waste Site - MW# 7

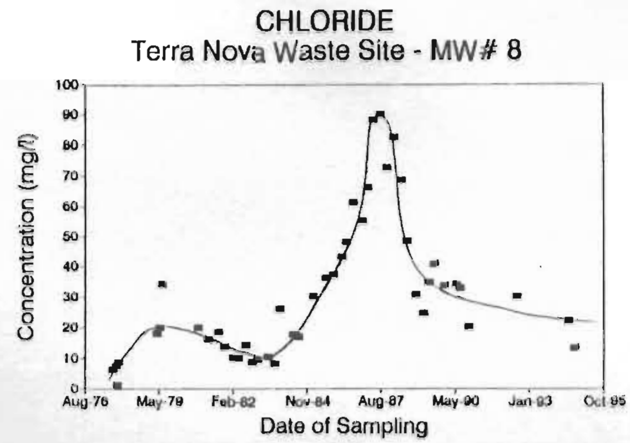


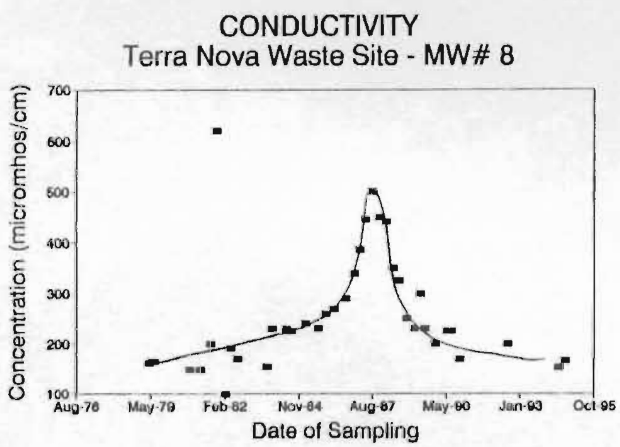
ZINC
Terra Nova Waste Site - MW# 7

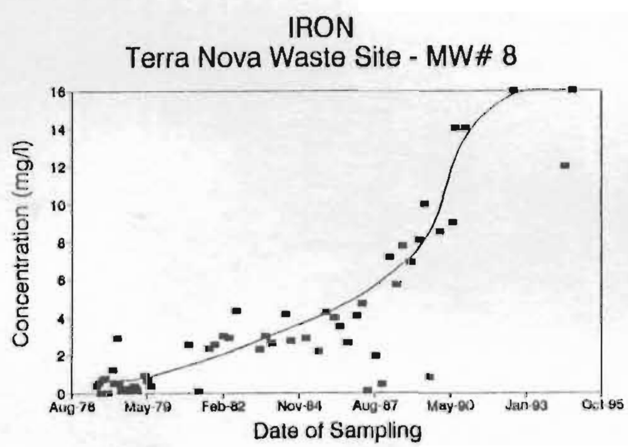


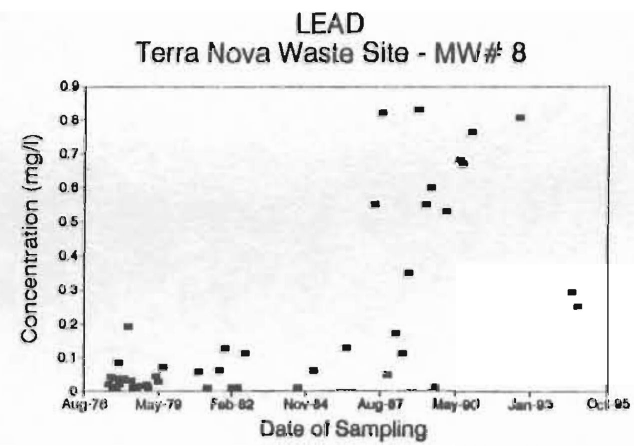

ALKALINITY
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling

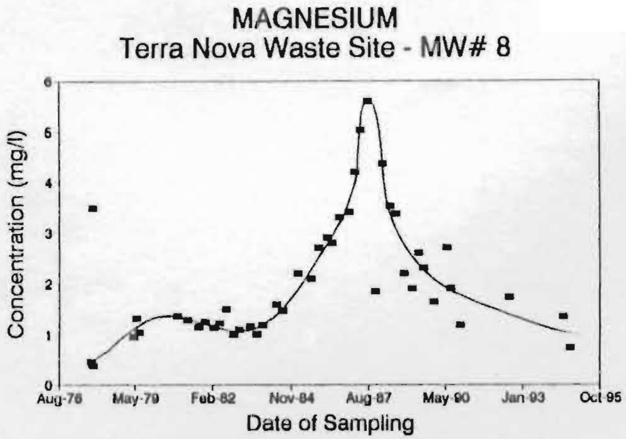

CALCIUM
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling

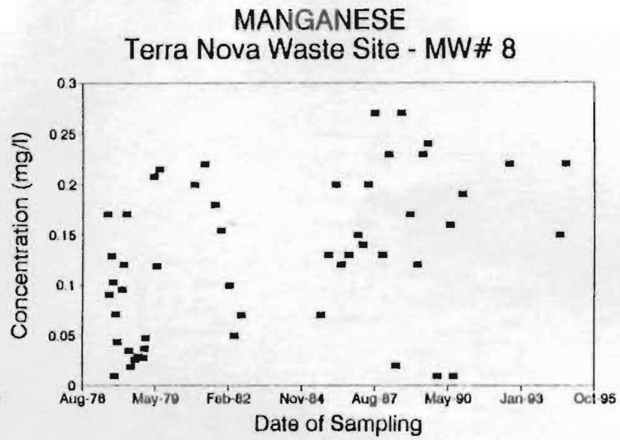

CHLORIDE
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling

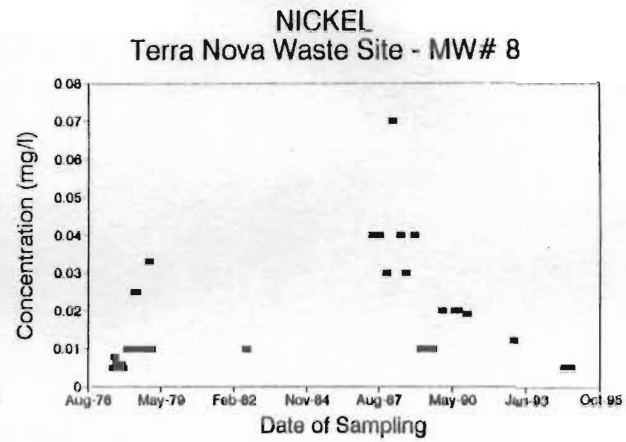

CONDUCTIVITY
Terra Nova Waste Site - MW# 8
Concentration (micromhos/cm)
Date of Sampling

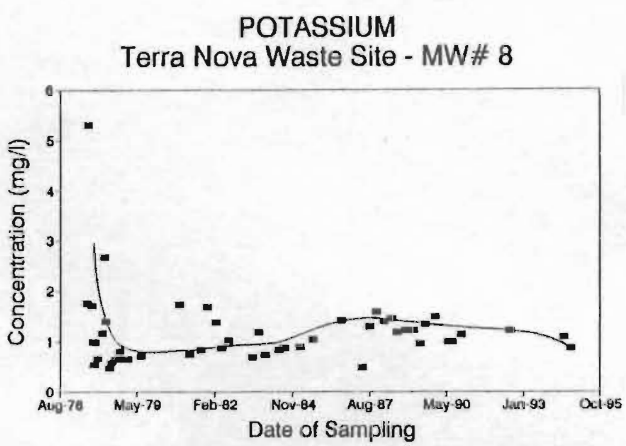

IRON
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling

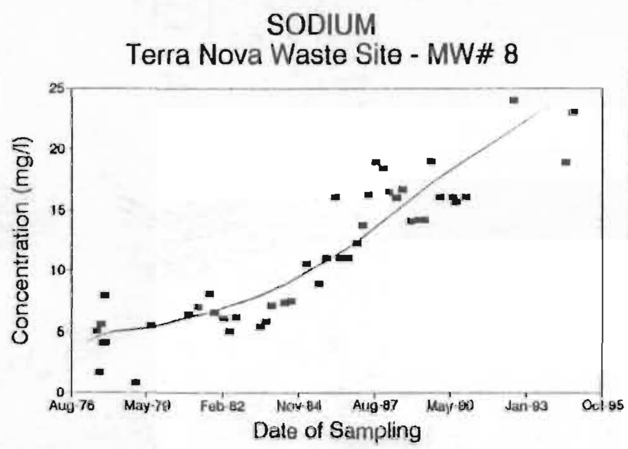

LEAD
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling

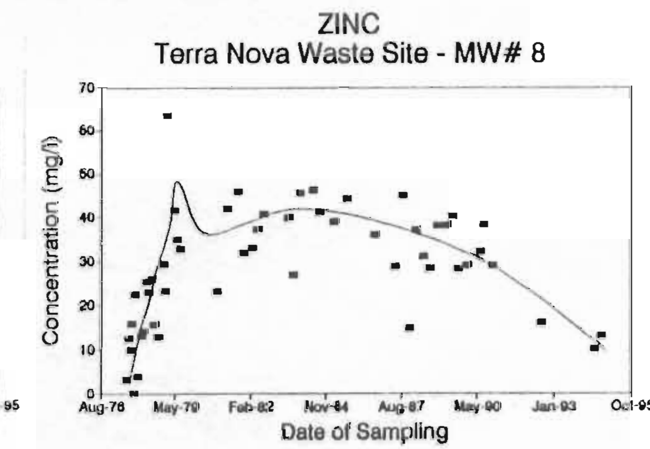

MAGNESIUM
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95


MANGANESE
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

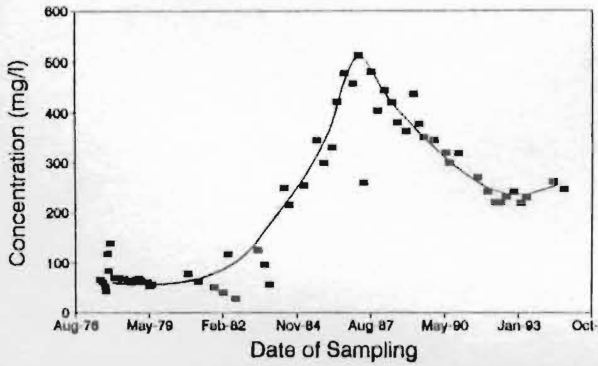

NICKEL
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95


POTASSIUM
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

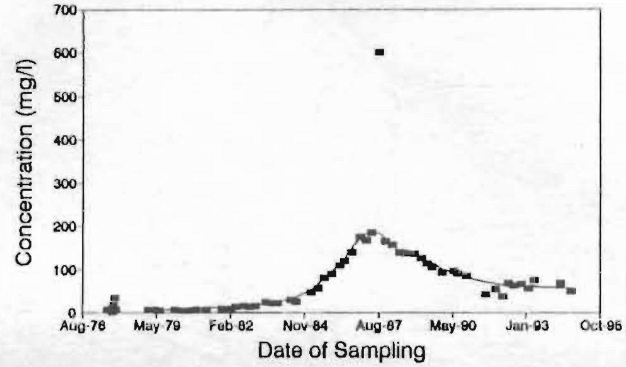

SODIUM
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95


ZINC
Terra Nova Waste Site - MW# 8
Concentration (mg/l)
Date of Sampling
Aug-76 May-79 Feb-82 Nov-84 Aug-87 May-90 Jan-93 Oct-95

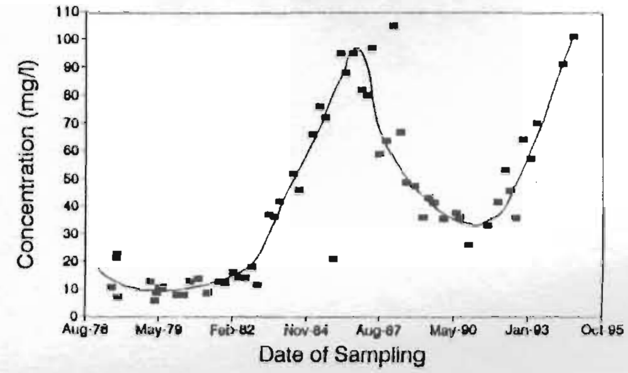
ALKALINITY
Terra Nova Waste Site - MW# 9



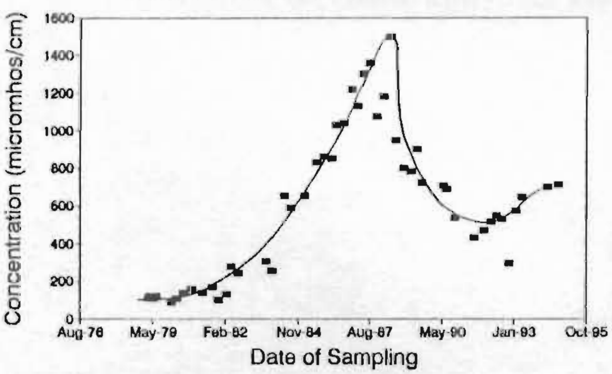
CALCIUM
Terra Nova Waste Site - MW# 9



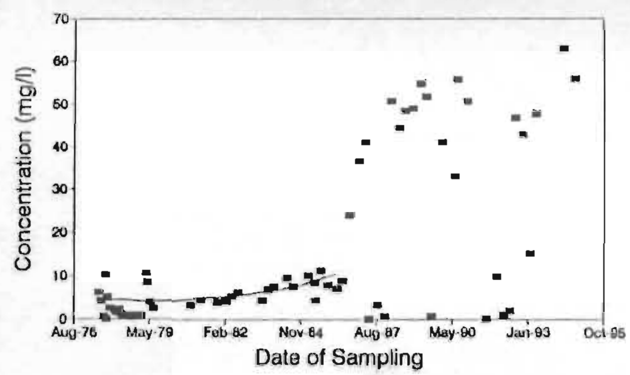
CHLORIDE
Terra Nova Waste Site - MW# 9



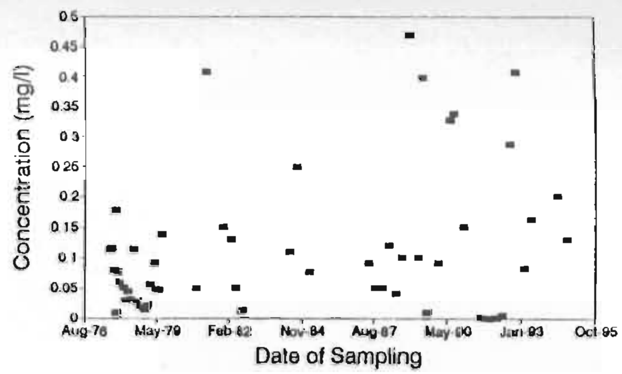
CONDUCTIVITY
Terra Nova Waste Site - MW# 9

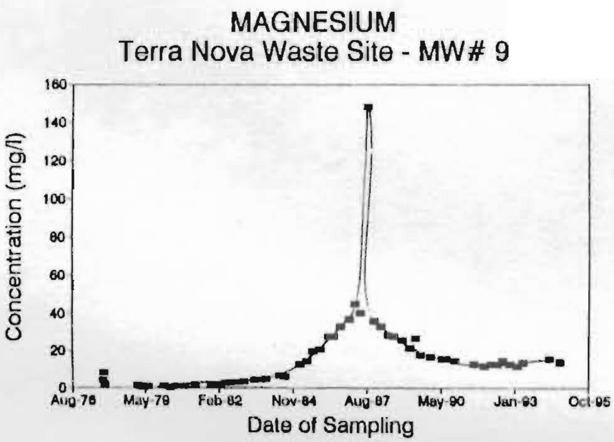


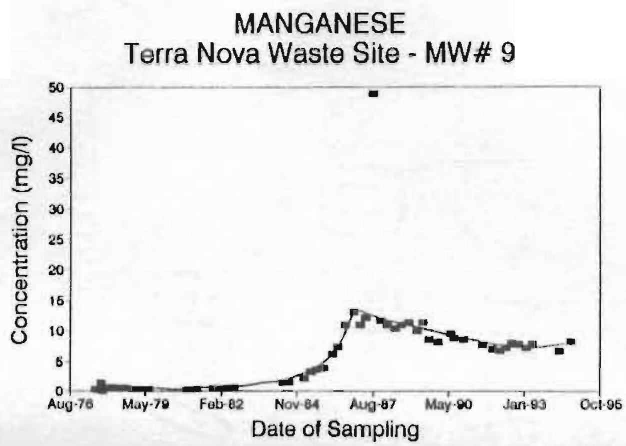
IRON
Terra Nova Waste Site - MW# 9

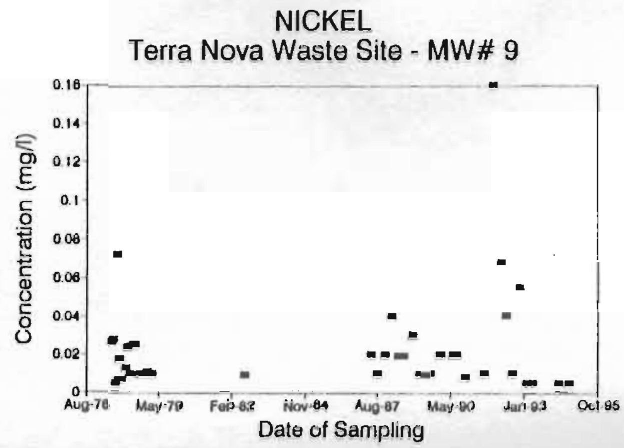


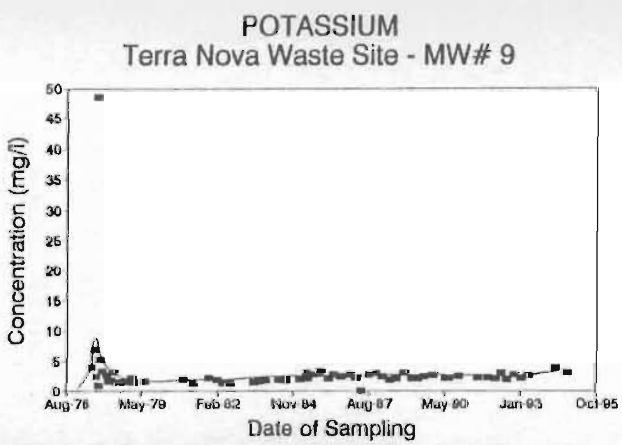
LEAD
Terra Nova Waste Site - MW# 9

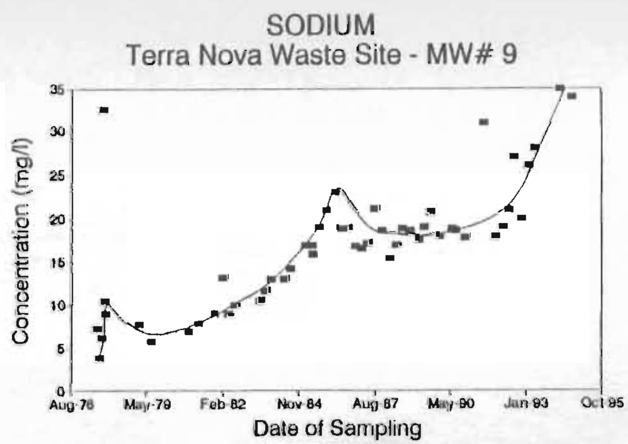


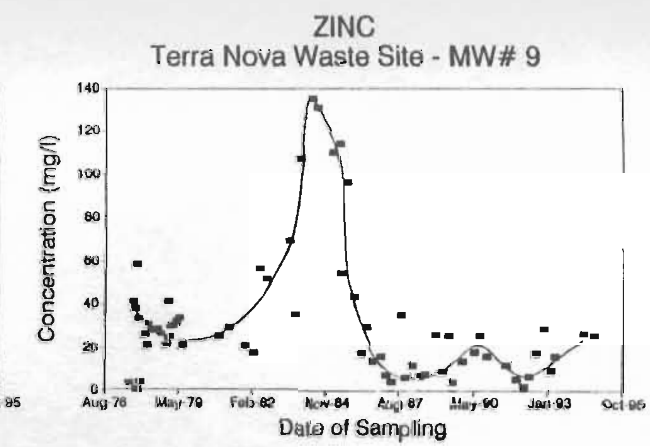

MAGNESIUM
Terra Nova Waste Site - MW# 9
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

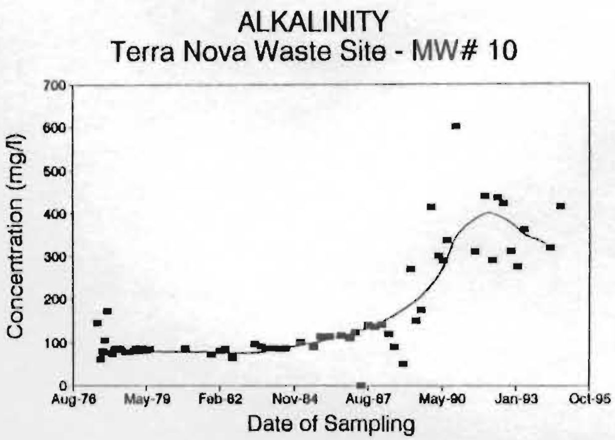

MANGANESE
Terra Nova Waste Site - MW# 9
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

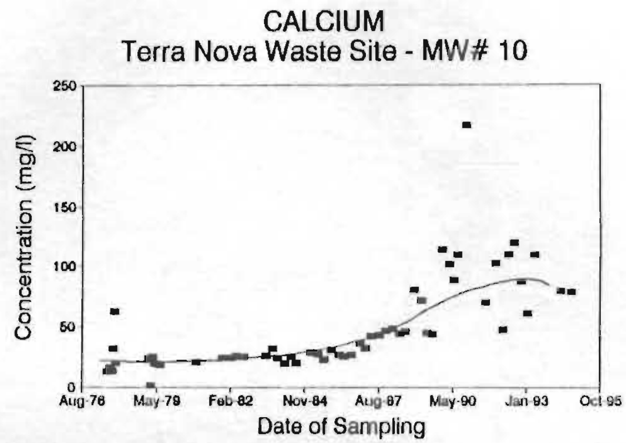

NICKEL
Terra Nova Waste Site - MW# 9
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

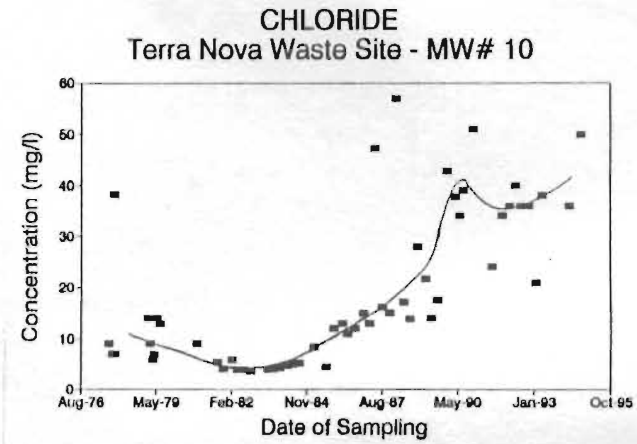

POTASSIUM
Terra Nova Waste Site - MW# 9
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

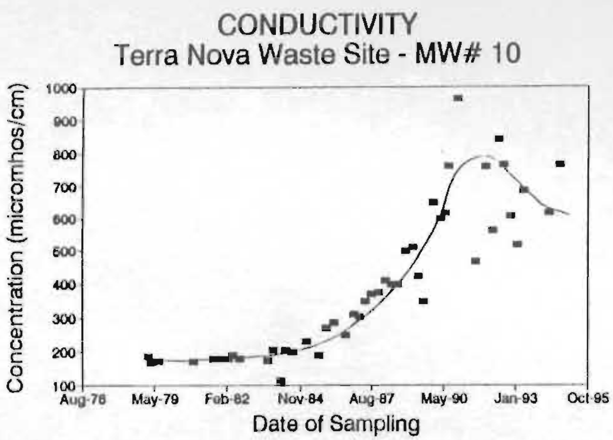

SODIUM
Terra Nova Waste Site - MW# 9
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

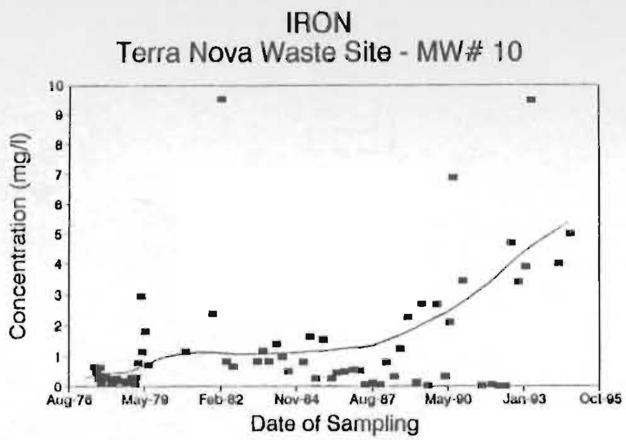

ZINC
Terra Nova Waste Site - MW# 9
Concentration (mg/l)
Date of Sampling
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95

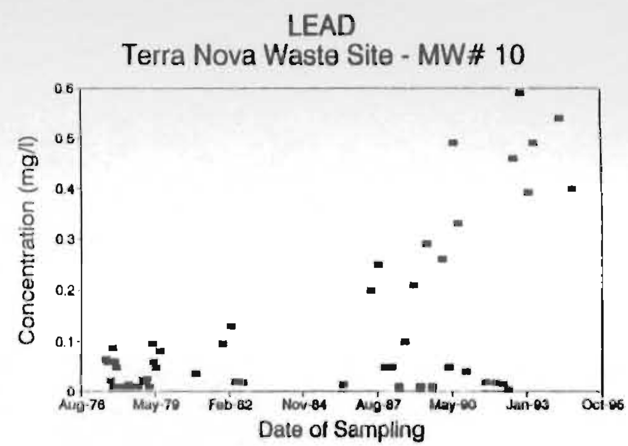

ALKALINITY
Terra Nova Waste Site - MW# 10
Concentration (mg/l)
0
100
200
300
400
500
600
700
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


CALCIUM
Terra Nova Waste Site - MW# 10
Concentration (mg/l)
0
50
100
150
200
250
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

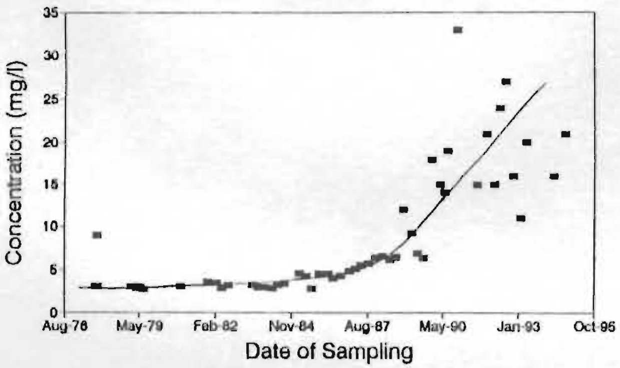

CHLORIDE
Terra Nova Waste Site - MW# 10
Concentration (mg/l)
0
10
20
30
40
50
60
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


CONDUCTIVITY
Terra Nova Waste Site - MW# 10
Concentration (micromhos/cm)
100
200
300
400
500
600
700
800
900
1000
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

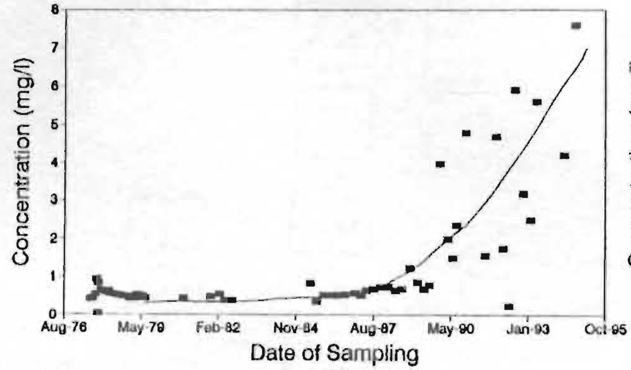

IRON
Terra Nova Waste Site - MW# 10
Concentration (mg/l)
0
1
2
3
4
5
6
7
8
9
10
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


LEAD
Terra Nova Waste Site - MW# 10
Concentration (mg/l)
0
0.1
0.2
0.3
0.4
0.5
0.6
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

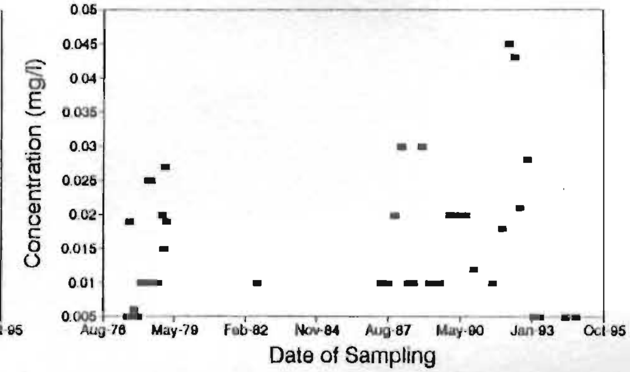
MAGNESIUM
Terra Nova Waste Site - MW# 10



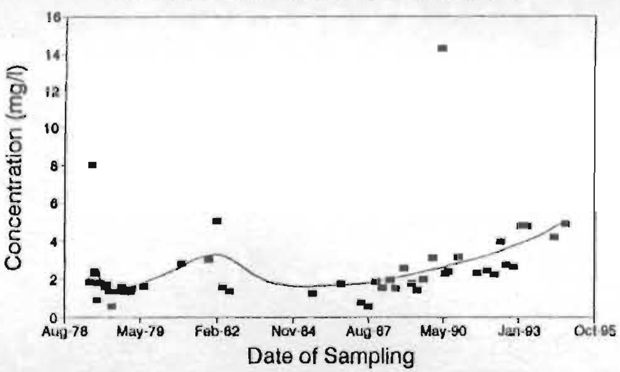
MANGANESE
Terra Nova Waste Site - MW# 10



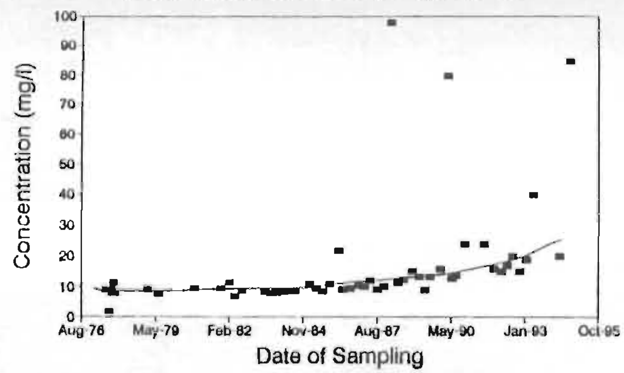
NICKEL
Terra Nova Waste Site - MW# 10



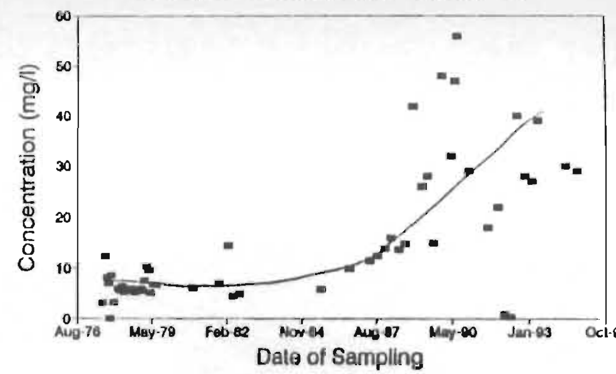
POTASSIUM
Terra Nova Waste Site - MW# 10



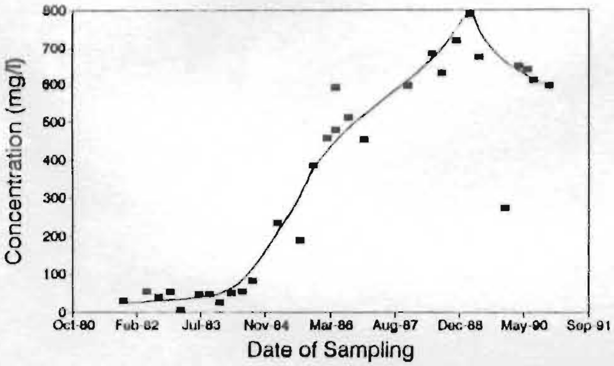
SODIUM
Terra Nova Waste Site - MW# 10



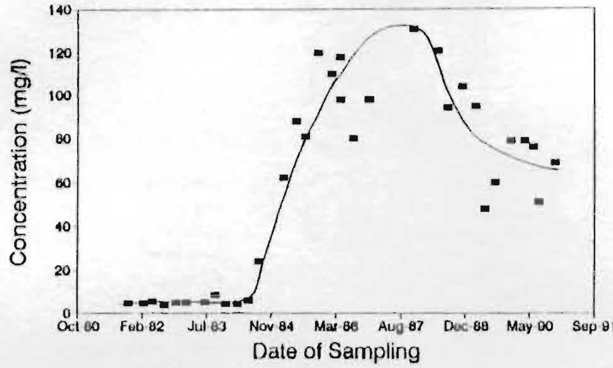
ZINC
Terra Nova Waste Site - MW# 10



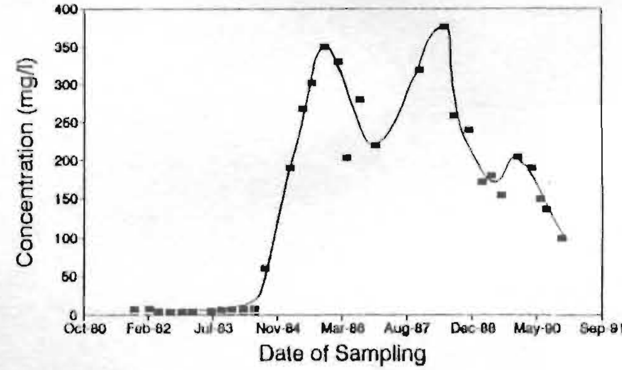
ALKALINITY
Terra Nova Waste Site - MW# 15



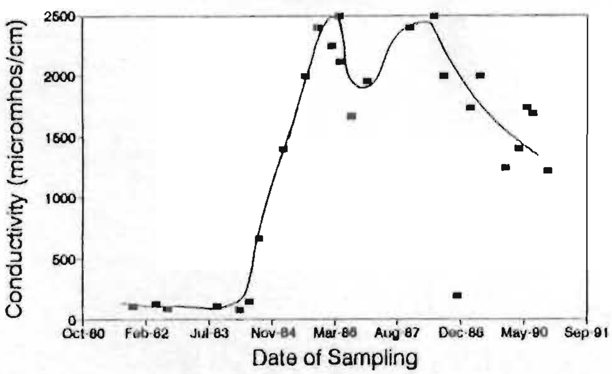
CALCIUM
Terra Nova Waste Site - MW# 15



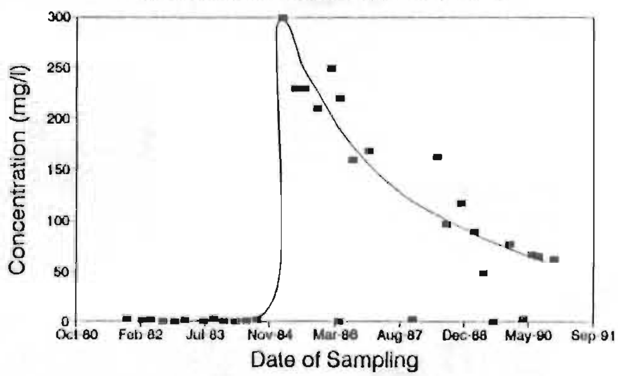
CHLORIDE
Terra Nova Waste Site - MW# 15



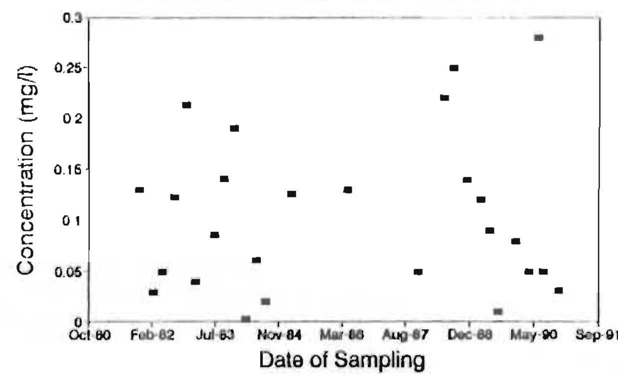
CONDUCTIVITY
Terra Nova Waste Site - MW# 15



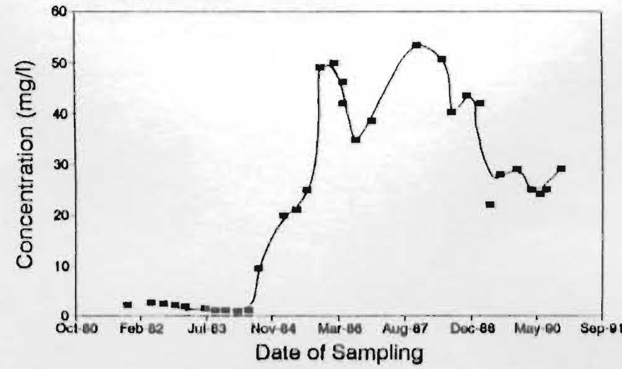
IRON
Terra Nova Waste Site - MW# 15



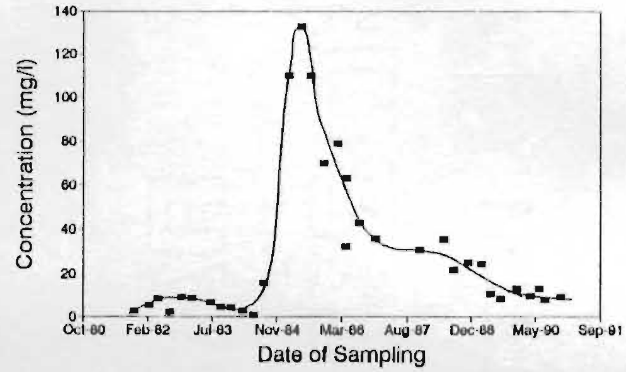
LEAD
Terra Nova Waste Site - MW# 15



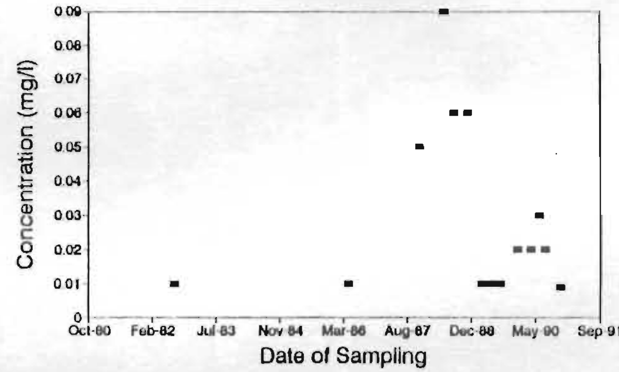
MAGNESIUM
Terra Nova Waste Site - MW# 15



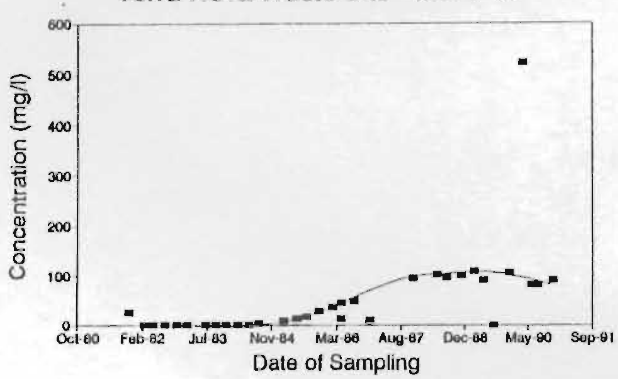
MANGANESE
Terra Nova Waste Site - MW# 15



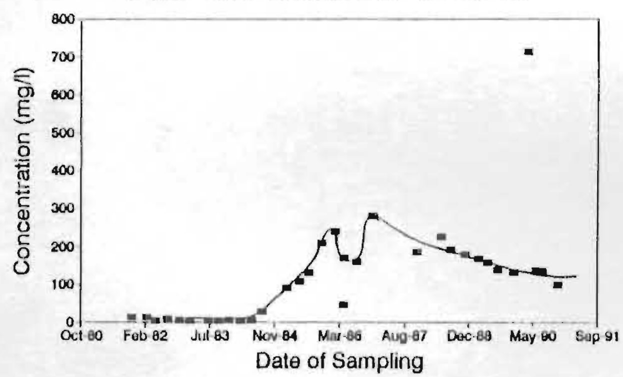
NICKEL
Terra Nova Waste Site - MW# 15



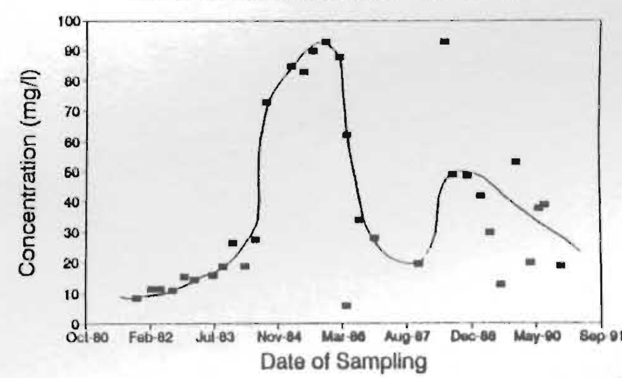
POTASSIUM
Terra Nova Waste Site - MW# 15



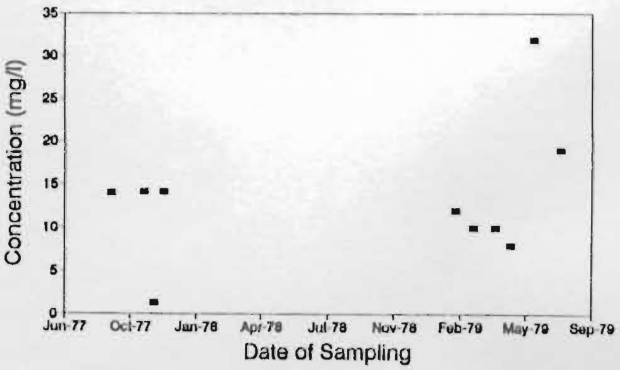
SODIUM
Terra Nova Waste Site - MW# 15



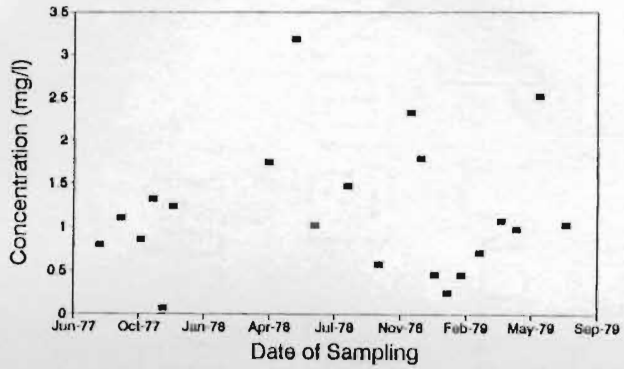
ZINC
Terra Nova Waste Site - MW# 15



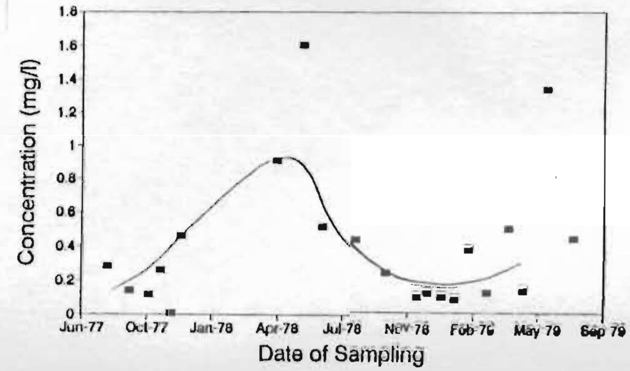
CHLORIDE
Terra Nova Waste Site - Site #11



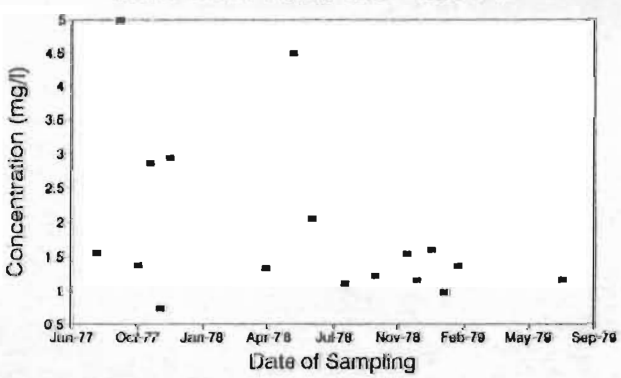
IRON
Terra Nova Waste Site - Site #11



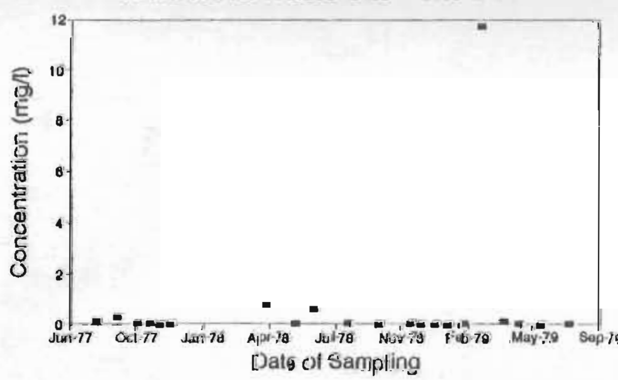
MANGANESE
Terra Nova Waste Site - Site #11



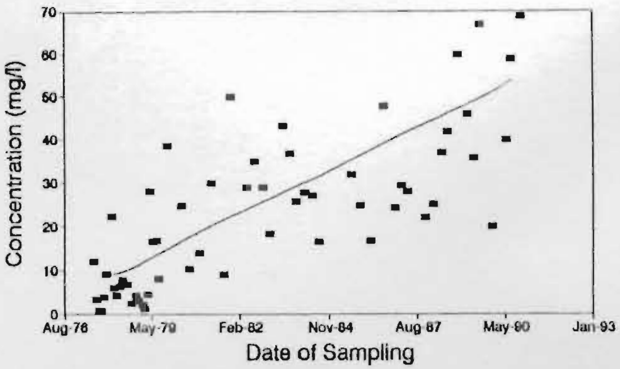
POTASSIUM
Terra Nova Waste Site - Site #11



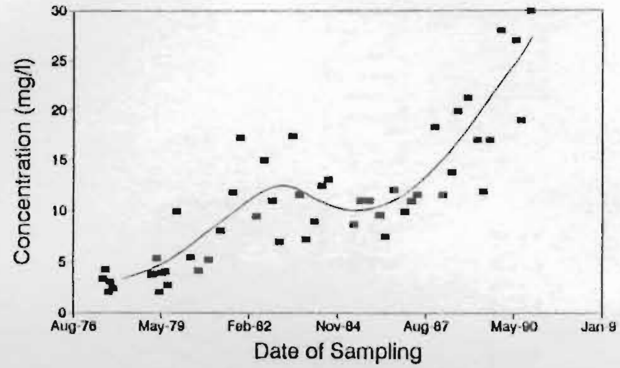
ZINC
Terra Nova Waste Site - Site #11



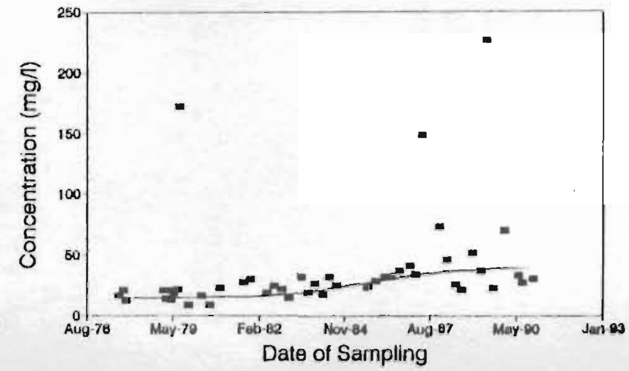
ALKALINITY
Terra Nova Waste Site - Site #12



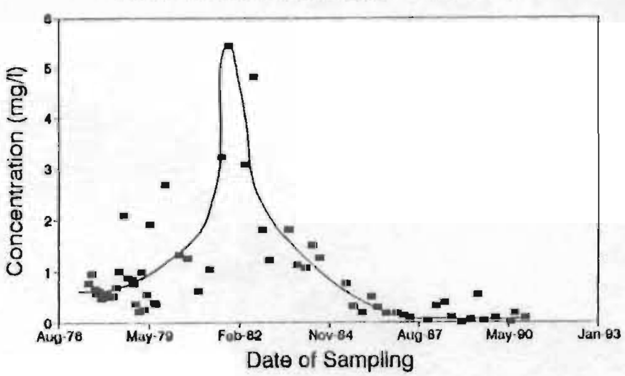
CALCIUM
Terra Nova Waste Site - Site #12



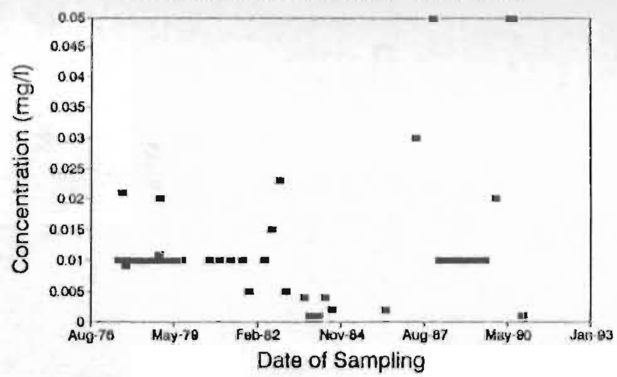
CHLORIDE
Terra Nova Waste Site - Site #12



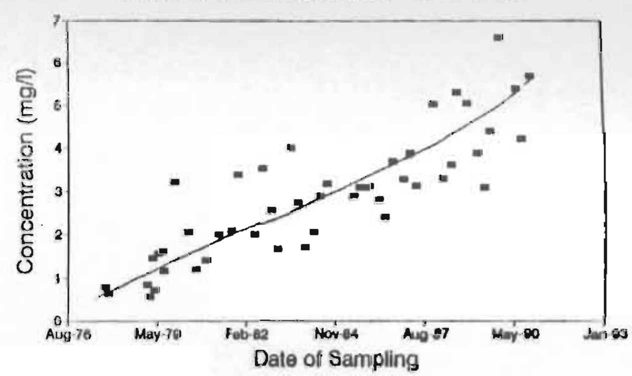
IRON
Terra Nova Waste Site - Site #12



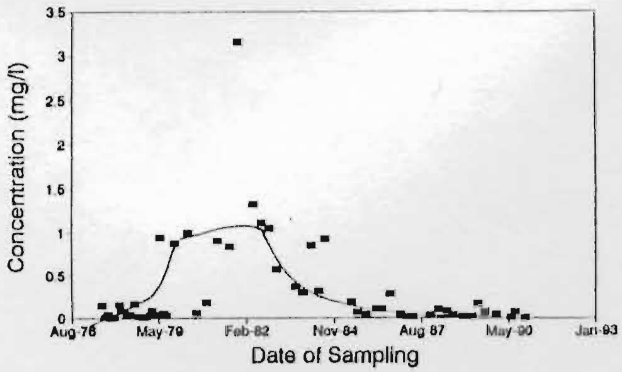
LEAD
Terra Nova Waste Site - Site #12



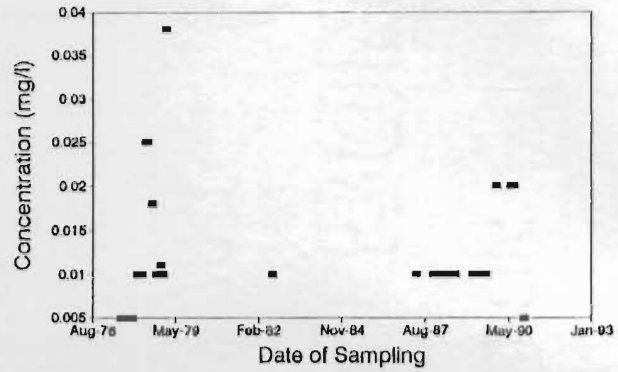
MAGNESIUM
Terra Nova Waste Site - Site #12



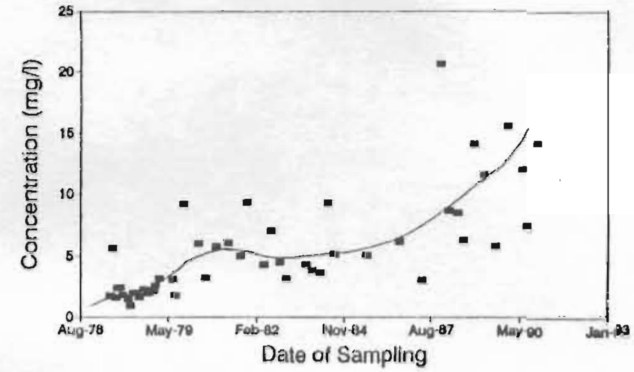
MANGANESE
Terra Nova Waste Site - Site #12



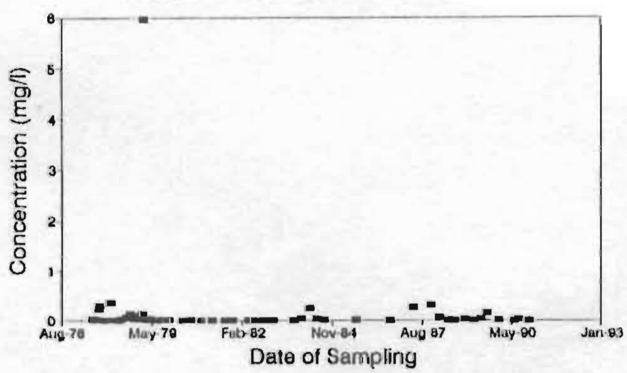
NICKEL
Terra Nova Waste Site - Site #12

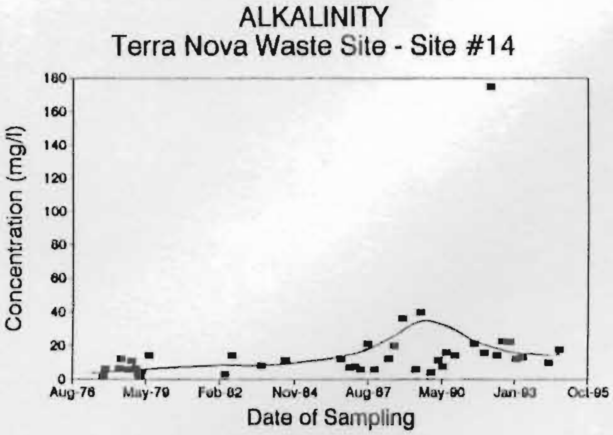


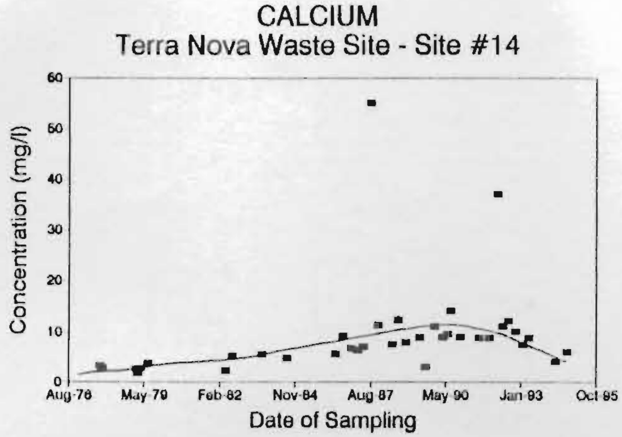
POTASSIUM
Terra Nova Waste Site - Site #12

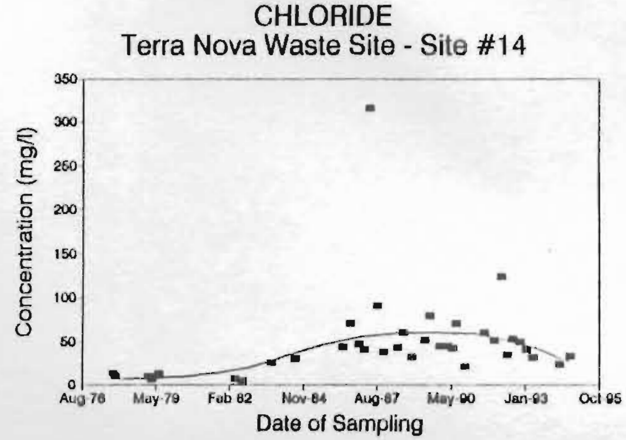


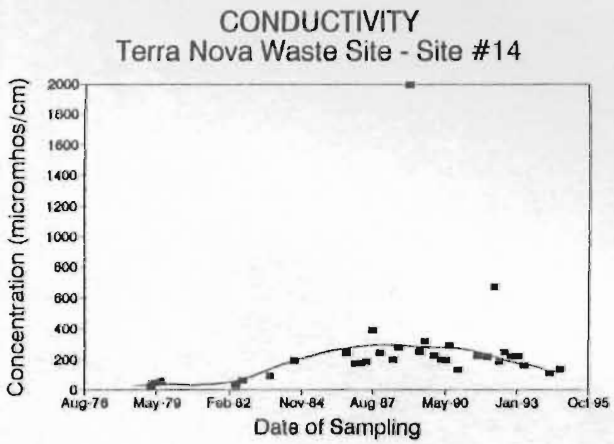
ZINC
Terra Nova Waste Site - Site #12

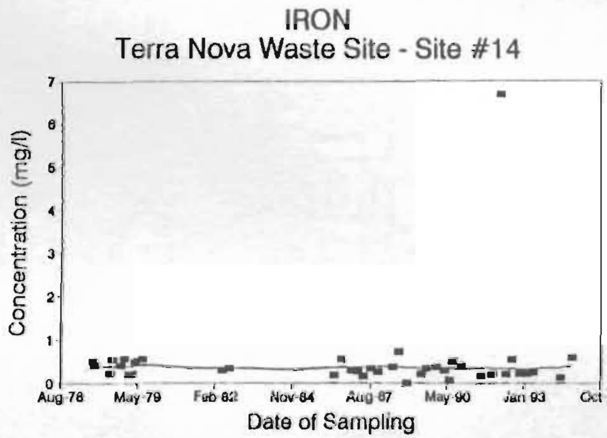


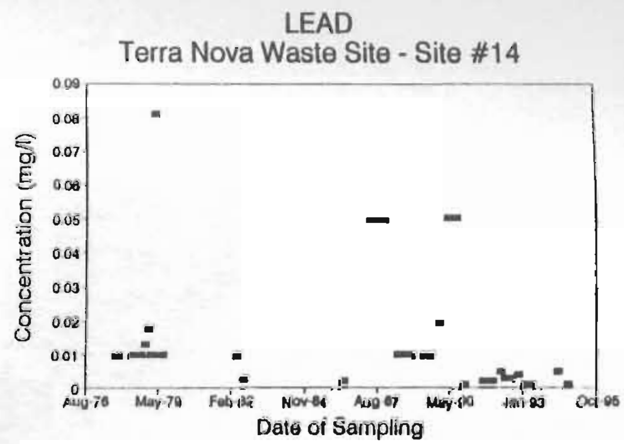

ALKALINITY
Terra Nova Waste Site - Site #14
Concentration (mg/l)
0
20
40
60
80
100
120
140
160
180
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


CALCIUM
Terra Nova Waste Site - Site #14
Concentration (mg/l)
0
10
20
30
40
50
60
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

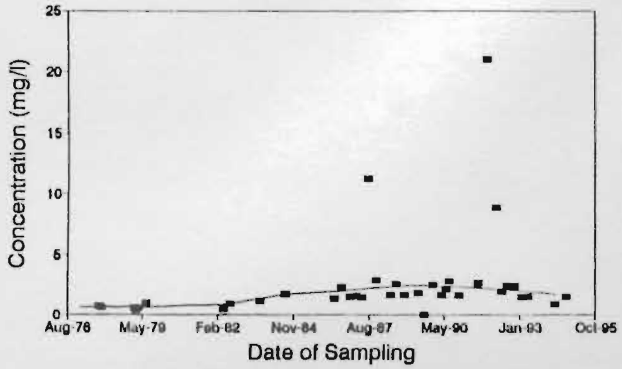

CHLORIDE
Terra Nova Waste Site - Site #14
Concentration (mg/l)
0
50
100
150
200
250
300
350
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling


CONDUCTIVITY
Terra Nova Waste Site - Site #14
Concentration (micromhos/cm)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Date of Sampling

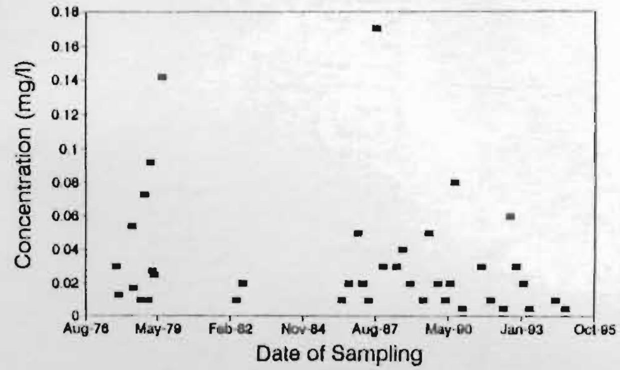

IRON
Terra Nova Waste Site - Site #14
Concentration (mg/l)
0
1
2
3
4
5
6
7
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Date of Sampling


LEAD
Terra Nova Waste Site - Site #14
Concentration (mg/l)
0
0.01
0.02
0.03
0.04
0.05
0.07
0.08
0.09
Aug-76
May-79
Nov-84
Aug-87
Jan-93
Oct-95
Date of Sampling

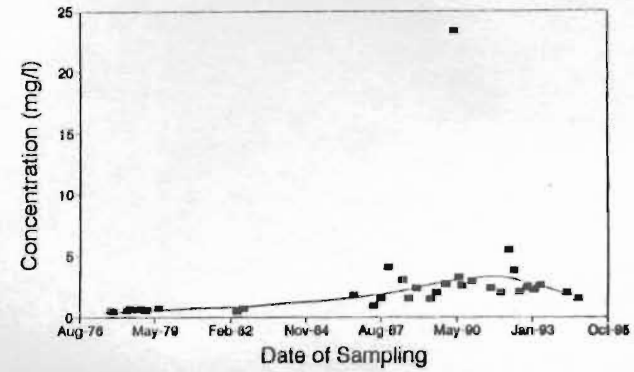
MAGNESIUM
Terra Nova Waste Site - Site #14



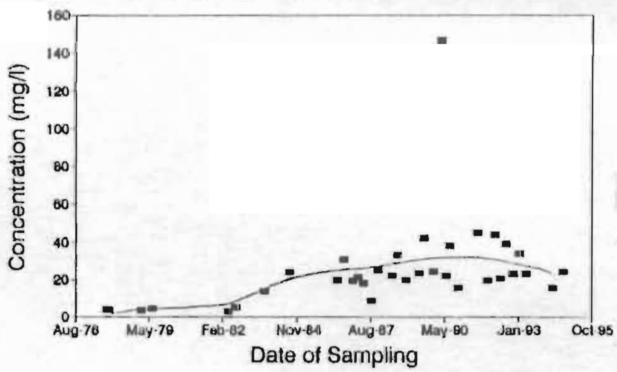
MANGANESE
Terra Nova Waste Site - Site #14



POTASSIUM
Terra Nova Waste Site - Site #14



SODIUM
Terra Nova Waste Site - Site #14



ZINC
Terra Nova Waste Site - Site #14