CHAPTER 4 RESULTS OF FIELD SURVEY ON ENVIRONMENTAL AND NATURAL CONDITIONS OF THE SITES

4.1 GROUND AND SURFACE WATER SURVEY

There are no natural water bodies and water reservoirs at the territory of the Karasai Disposal Site. However, between the existing two dam embankments, an artificial water body supplied by groundwater of the disposal site has been formed. Groundwater discharge at the downstream of the lower dam also was not found.

Currently, for household and industrial needs, water is supplied by water carrier from the Kaskelen River. This water is lightly mineralized by its macro-element content, biogenic and oxygenic condition and pH reaction complies with sanitary-hygienic requirements, while it is polluted with fluoride, copper, zinc and suspended matters. In this connection, the water for the disposal site will be supplied from the groundwater.

Due to the special features of activities, the Karasai Disposal Site does not generate organized sewage water discharge into the environmental components. Therefore, sewage water drainage is not regulated by the regulations on maximum permissible pollution discharges.

Hence, in the zone of potential negative impact caused by the disposal site activity, there is no natural water body that can be affected. For the disposal site, it is necessary to establish the order of permission on water use from the groundwater by using wells.

In hydro-geological aspect, the disposal site area belongs to the alluvial-prolluvial down-quaternary deposits of residual rocks. The particular feature of the deposits is vertical alteration of water permeable layers, impervious strata and lightly permeable layers. The sedimenthological structure of aquifers or water bearing layers changes from clay-loam and fine textured sand to gravel-pebble deposits. The thickness of aquifers varies from 1m to 24m.

Ground and pressure waters are widely spread at this area. The groundwater circulates in clay sand and in fine-textured sand with pebble inclusions. The flow intensity is not high. The groundwater occurs at the depth of 1.5-4.5m. According to the self-protection conditions of the groundwater, the territory belongs to Category I, practically wide-open for contamination. According to the results of laboratory analysis of water in the water body located between two dams and groundwater from the water well, the following contents of pollutants were identified:

- Content of coliforms (the end product of bacteria and parasite decomposition) in the water body is 100 units/dm^3; in the ground water it is 800 units/dm^3;
- Content of dry residue in the ground water exceeds the maximum allowable concentration factor (PDK) in 5.8 times; oxidability exceeds PDK in 1.5 times; cadmium exceeds PDK in 3.9 times; lead in 1.5-2.5 times; sulfates in 50 times; chlorine in 10-15 times; nitrates in 2 times; ammonia in 1.5-10 times; fluoride in 3 times, manganese and oil products match the PDK values; and
- Content of these elements in the water body is several times higher than in the groundwater.

The artesian (confined) water is spread in the bottom layers of down-quaternary deposits; artesian pressure surface is located at the depth of 20-35m from the ground surface. The abundance of water depends on the sedimenthological structure of water bearing rocks. The flow intensity in the wells is 5-8 l/sec at the depression of 8-10m. The water is sweet (0.3 g/dm^3) with hydro-carbonate-sulfate compound.

Resources of groundwater at the survey area were not evaluated. To the southeast from the disposal site, there is Kaskelen occurrence of groundwater. The groundwater resources in the quaternary deposits of Chemolgansky and Kaskelensky valley train were evaluated in 1965. To the southwest from the disposal site there is Uzun-Agash occurrence of groundwater at the Uzun-Kargalinsky site. Groundwater resources for water bearing system of middle-upper-quaternary alluvial-prolluvial deposits of Karakasteksky and Uzun-Kargalinsky valley train (slope wash) were evaluated in 1976.

The Karasai Disposal Site does not affect the mentioned occurrence of groundwater. It affects the groundwater located near the solid waste storage site.

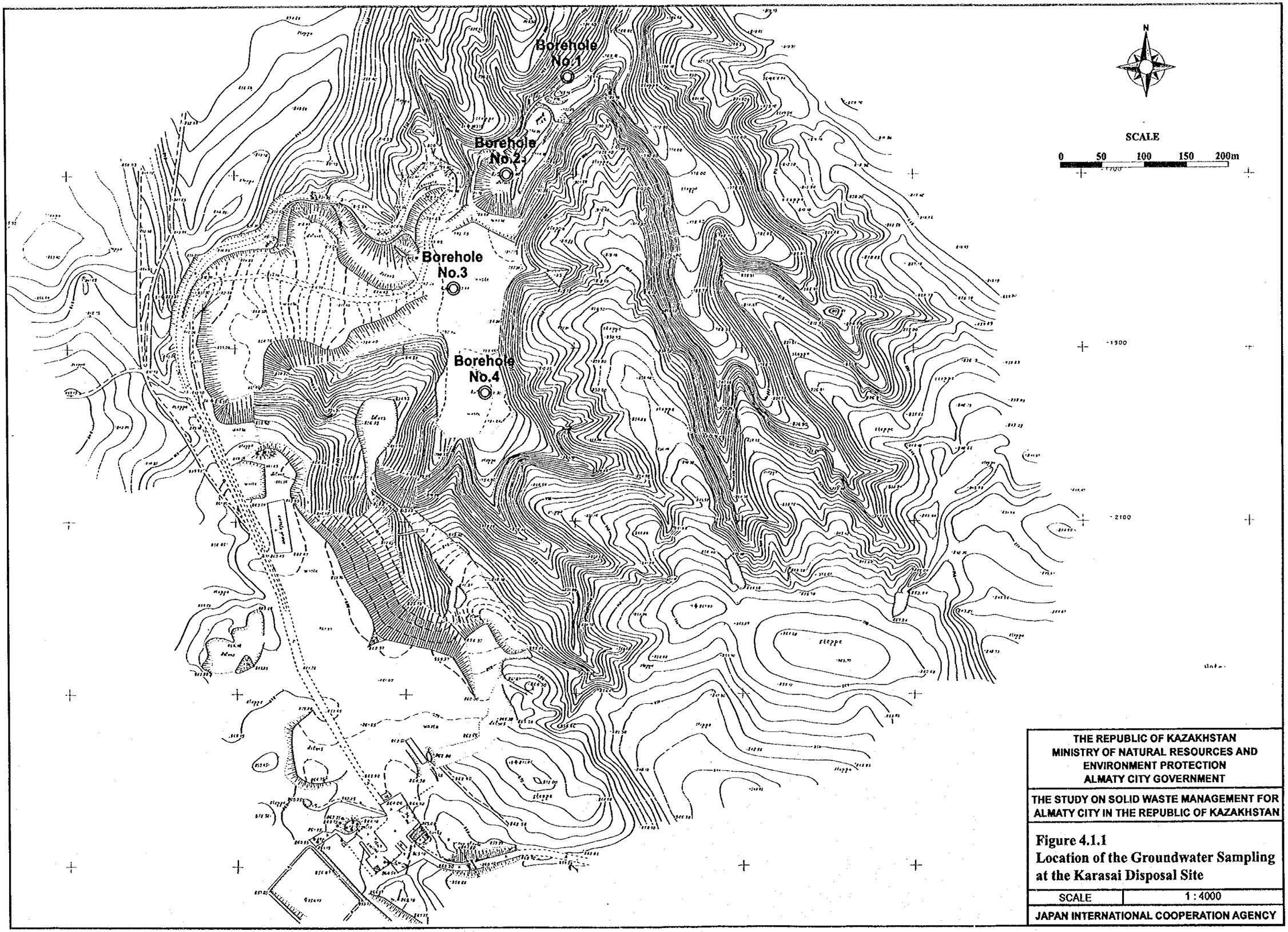
For assessment of the existing groundwater condition, four bore-holes were drilled (#1, 2, 3, and 4) and water samples were taken at the depth of 2 to 42 meters. The samples were analyzed for identification of parameters. The results are presented in Table 4.1.1, and location of the bore-holes is shown in Figure 4.1.1.

Table 4.1.1 Results of Analysis of Groundwater at the Karasai Disposal Site

Parameters to be analyzed	Sampling place									PDK
	Bore hole #1 Depth 2.0m	Bore hole #1 Depth 3.0m	Bore hole #2 Depth 2.0m	Bore hole #2 Depth 3.0m	Bore hole #3 Depth 28.0m	Bore hole #1 Depth 21.0m	Bore hole #4 Depth 20.0m	Bore hole #4 Depth 38.0m	Bore hole #3 Depth 42.0m	Sanitary-Hygienic
1	2	3	4	5	6	7	8	9	10	11
Nitrate (mg/dm^3)	6.2	9.0	2.0	3.0	157.0	8.8	165.0	216.0	59.0	45.0
Nitrite (mg/dm^3)	0.29	0.96	0.78	0.16	26.0	0.80	8.20	15.6	12.2	3.3
Chlorides (mg/dm^3)	2520.5	78.0	2378.5	3088.5	2840.0	63.9	2378.5	3088.5	1491.0	350
Quantity of intestinal Bacteria		>1100	>1100		>1100		>1100			Coliforms from 5000 up to 10000 in dm^3
Total microbial quantity		$7x10^3$	$5.7x10^3$		$7.3x10^3$		$5.4x10^3$			
Cyanide (mg/dm^3)	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	0.10
Mercury (mg/dm^3)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0005
Copper (mg/dm^3)	0.041	0.007	0.042	0.044	0.047	0.020	0.034	0.042	0.020	1.0
Iron (mg/dm^3)	1.36	0.90	0.66	1.04	0.90	0.75	0.61	1.02	0.90	0.5
Manganese (mg/dm^3)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
Zinc (mg/dm^3)	0.036	0.007	0.064	0.068	0.041	0.018	0.72	0.98	< 0.005	1.0
Lead (mg/dm^3)	0.018	0.051	0.075	0.095	0.078	0.019	0.096	0.041	0.085	0.03
Chrome VI-valence (mg/dm^3)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
Cadmium (mg/dm^3)	0.014	< 0.002	0.011	0.018	0.005	0.006	0.021	0.013	< 0.005	0.001
Arsenic (mg/dm^3)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
Fluorine (mg/dm^3)	4.4	4.0	4.0	4.1	2.0	4.4	3.6	4.0	3.6	1.5
Calcium (mg/dm^3)	120.2	22.0	34.0	150.3	100.2	10.0	136.3	86.2	148.3	180.0
Magnesium (mg/dm^3)	826.9	12.2	952.1	1027.1	766.1	12.2	622.6	956.9	457.2	20.0
Total hardness (mg/eq)	74.0	2.1	80.0	92.0	68.0	1.5	58.0	83.0	45.0	/
Distillation residue (mg/dm^3)	13484.0	543.0	15046.0	18912.0	11471.0	434.0	12504.0	16133.0	4944.0	/

1	2	3	4	5	6	7	8	9	10	11
Phenol (mg/dm^3)	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	0.001
Ammonia nitrogen (mg/dm^3)	4.50	1.24	23.0	31.0	23.0	1.34	<0.01	<0.01	1.80	
p	8.00	8.55	7.98	8.06	7.86	8.54	7.91	7.92	7.42	6.5-8.5
Taste	-	-	-	-	-	-	-	-	-	
Odor	odourless	Light odor of oil	Light odor of oil	Light odor of oil	Light odor of oil	odourless	Light odor of oil	Light odor of oil	odourless	
Color	colorless	colorless	colorless	colorless	colorless	colorless	colorless	colorless	colorless	
Turbidity (mg/dm^3)SiO_2	0.2	1.1	1.4	0.6	5.0	0.3	0.4	0.5	1.0	
Sulfides (mg/dm^3)	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Not found	Non-available
Sulfates (mg/dm^3)	2877.2	146.1	2563.2	2508.5	2757.5	104.1	2518.4	2677.2	1863.7	500.0
COD (mg/dm^3)	5.45	2.63	5.05	5.45	9.90	4.87	5.74	9.02	7.18	30.0
BOD (mg/dm^3)	4.39	1.73	2.54	2.54	6.81	2.50	3.25	6.30	5.17	11
Suspended Solids (mg/dm^3)	71.9	548.0	626.8	99.9	1442.8	56.3	166.8	76.2	200.6	6.0
Electric conductivity ($mCm.\ cm^{-1}$)	11.85	0.65	12.64	15.53	11.00	0.55	8.18	8.47	6.00	Background +25
Oxidation-reduction potential	120	200	120	110	114	194	116	106	120	/
Water Temperature (°C)	17.0	13.0	16.0	16.0	16.0	13.0	12.0	16.0	23.0	/
Temperature (°C)	25.0	28.0	31.0	23.0	24.0	26.0	22.0	27.0	18.0	

Note: PDK stands for "maximum allowable concentration factor. "



THE REPUBLIC OF KAZAKHSTAN MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT PROTECTION ALMATY CITY GOVERNMENT
THE STUDY ON SOLID WASTE MANAGEMENT FOR ALMATY CITY IN THE REPUBLIC OF KAZAKHSTAN
Figure 4.1.1 **Location of the Groundwater Sampling at the Karasai Disposal Site**
SCALE 1 : 4000
JAPAN INTERNATIONAL COOPERATION AGENCY

Analyzing the results, it is evident that all parameters exceed the maximum allowable concentration factor (PDK): Fe exceeds PDK in 2-4 times, Pb – in 3 times at the depth 20-40m, Cd – more than in 10 times, F – in 2-3 times, NO_3 – in 1.3-4.8 times (bore holes 3 and 4, depth from 20 up to 42m), NO_2 – in 8.2-26 times, NH_4 – more than in 10 times (bore hole #2, depth – 2-3m). There is irregularity in the temperature values of more than 23 °C, and pH reaction is weak alkaline – up to 8.54.

The presented data allows to make conclusion that analyzed groundwater is polluted by leachate products from the disposal site, which may spread in the direction of the two embankment dams and the ravine. Based on the result of soil investigation, although the soil layer on the site is categorized practically into impermeable layers, it is not perfectly impermeable and there might be some cracks in the layers. Therefore, the leachate can infiltrate into the groundwater especially in snow melting season and may pollute the groundwater. It is recommended to set a waterproof that can provide protection of the groundwater (not less than Category III).

In the process of disposal site improvement and operation, it is necessary to create a network of monitoring wells on the first aquifer and to carry out monitoring of the groundwater. The network of monitoring wells must be located in the downstream of the leachate retention pond, taking into account hydro-geological conditions of the disposal site.

4.2 Soil Survey

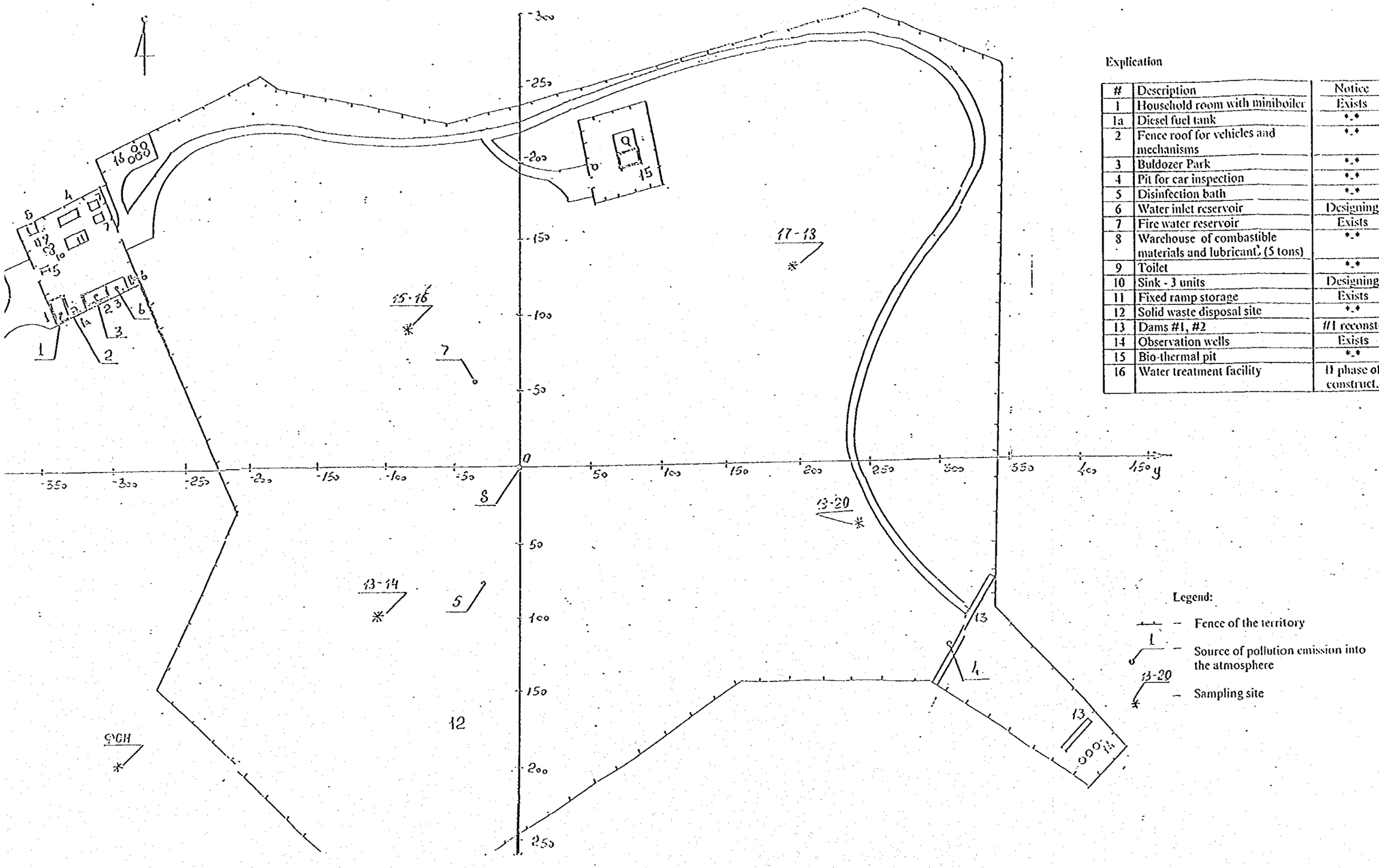
4.2.1 Soil Contamination Survey

The Karasai Disposal Site is located on the undulating and ridged foothills plain of the northern micro-slope of Zailisky Alatau within the desert-steppe vertical zone with light chestnut soils. Storage of solid domestic waste is performed upwards from a built earth dam in natural Y-type gully stretching from north to south. Total area of waste storage of the disposal site is 23 ha.

Conditionally, four sampling sites have been chosen. The first and the second sampling sites were located near gully edge, the third site was located at the middle of gully, and the fourth was located at the bottom of the gully. The location of each site is shown in Figures 4.2.1 and 4.2.2, and the sampling on vertical profile is shown in Figure 4.2.3.

The fifth site has been organized to determine level of pollution on the disposal site as a background. It is located to the northeast of the disposal site on a natural formation. Soil type is light chestnut and heavy loam.

Out of five sites, single samples from two depths, 0-5cm and 5-20cm have been taken by envelope method. All five single samples of the 0-5cm layer have been mixed and represented one compound. Similarly, mixing samples of the 5-20cm layer has been performed.



Explication

#	Description	Notice
1	Household room with miniboiler	Exists
1a	Diesel fuel tank	*-*
2	Fence roof for vehicles and mechanisms	*-*
3	Buldozer Park	*-*
4	Pit for car inspection	*-*
5	Disinfection bath	*-*
6	Water inlet reservoir	Designing
7	Fire water reservoir	Exists
8	Warehouse of combastible materials and lubricant (5 tons)	*-*
9	Toilet	*-*
10	Sink - 3 units	Designing
11	Fixed ramp storage	Exists
12	Solid waste disposal site	*-*
13	Dams #1, #2	#1 reconstr
14	Observation wells	Exists
15	Bio-thermal pit	*-*
16	Water treatment facility	II phase of construct.

Figure 4.2.1 Location of Soil Sampling at the Karasai Disposal Site

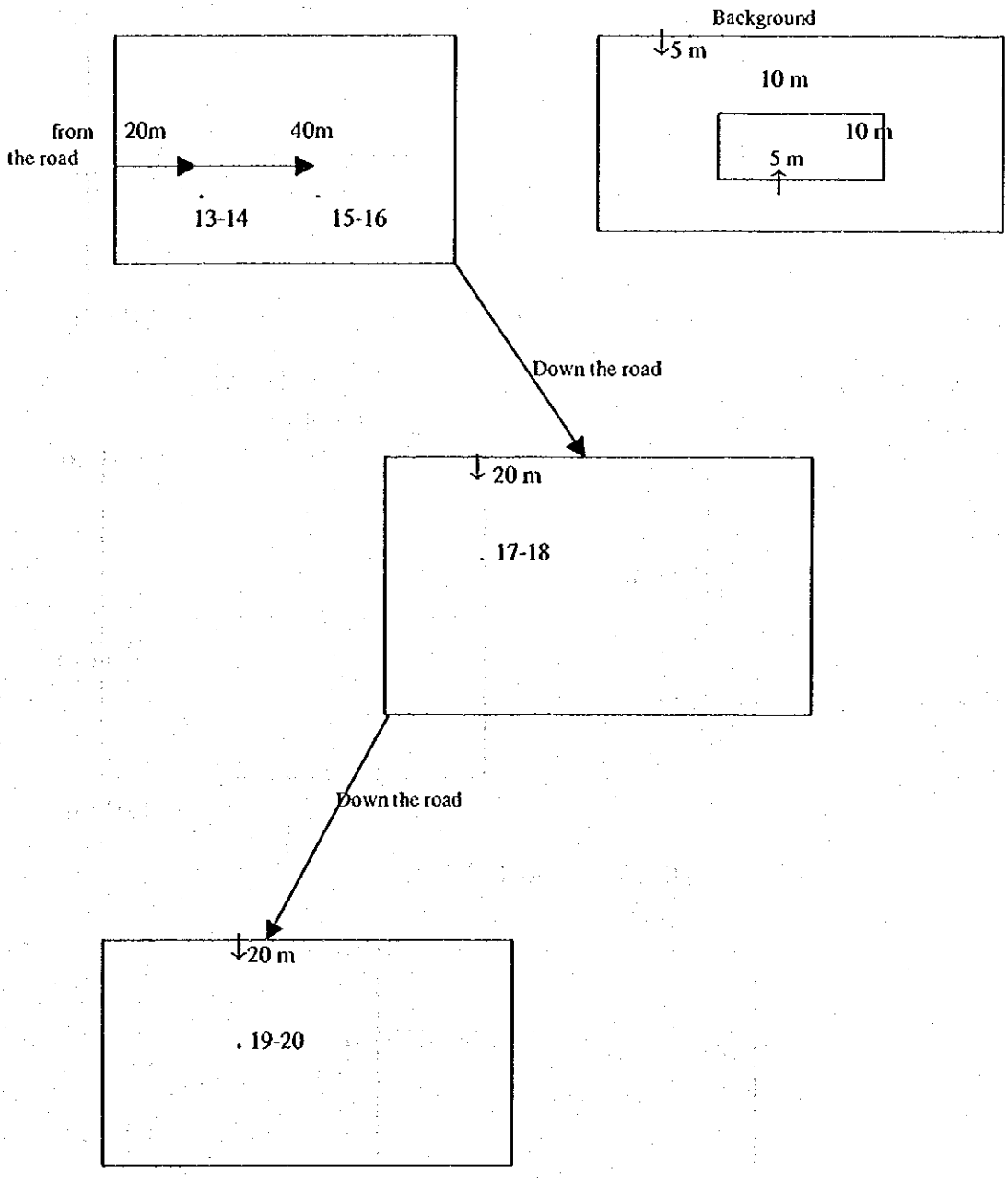


Figure 4.2.2 Schematic Location of Soil Sampling Sites

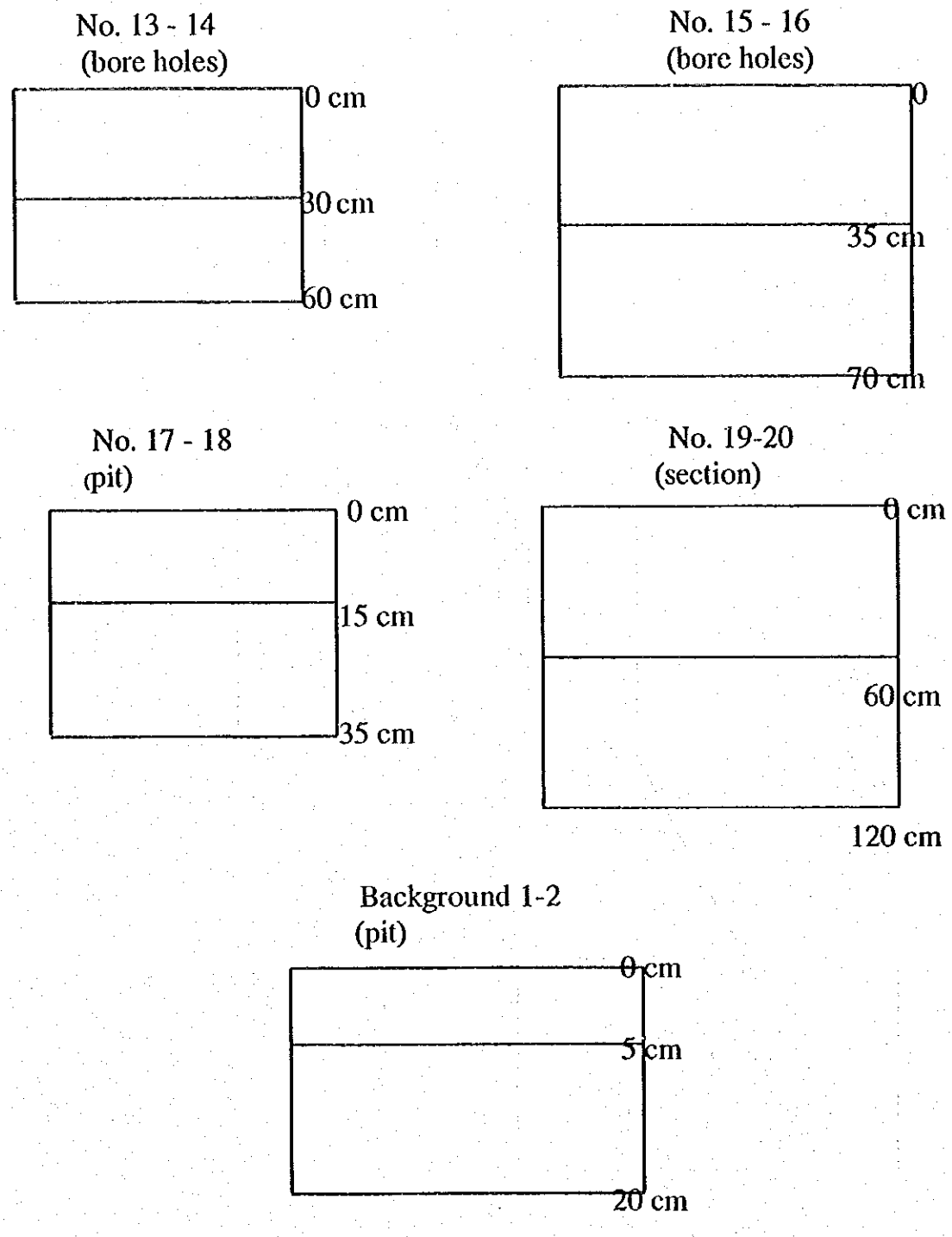


Figure 4.2.3 Scheme of Sampling on Vertical Profile

No. 13 - 20: Number of sample taken
No. 1 - 2 : Number of sample taken at the background

Soil sampling used in this survey included several meteorological conditioned devices as follows:

(1) Layer-wise sampling from bore holes: the 1st site (0-30cm and 30-60cm); and the 2nd sites (0-35cm and 35-70cm);

(2) Layer-wise sampling from diggings: the 3rd site (0-5cm and 5-35cm); and

(3) Layer-wise sampling from cuts: the 4th site (0-60cm and 60-120cm).

Such sampling allows developing of representative samples to determine motley of pollution along vertical direction and their migration due to mechanical mixture with isolated layer or physical and chemical properties of pollutants. Information on the soil sampling is given in Table 4.2.1.

Table 4.2.1 Characteristic of Soil Sampling for the Karasai Disposal Site

Object #	Site #	Sample #	Sampling depth (cm)	Sampling time	Sampling date (day, month, year)
1	2	3	4	5	6
3 Karasai Disposal Site	1	13	30-60	10:45	16.08.99
		14	0-30	10:55	-"-
	2	15	35-70	11:00	-"-
		16	0-35	11:05	-"-
	3	17	15-35	11:30	-"-
		18	0-15	11:40	-"-
	4	19	60-120	13:50	-"-
		20	0-60	11:55	-"-
	Background	1	0-5	09:30	17.08.99
		2	5-20	09:50	-"-

The main criteria of soil pollution evaluation were the maximum allowable concentration factor (PDK) and own "background". Characteristics of Table 4.2.2 certify that soil pollution of the Karasai Disposal Site currently occurs at the expense of chemical substances of the first and second class danger, namely:

a) under chemical substances of the first class danger, i.e., maximal plumbum (Pb) content reaches 134.9 mg/kg, it exceeds PDK in 4.2 times and background – in 6.7; mass parts of zinc (Zn) exceeds PDK from 3.6 up to 8.8 times, and background - from 4.0 up to 9.9 times; cadmium (Cd) pollution has been observed in two samples: N16 – 1.1 PDK and N20 – 2.6 PDK; arsenic (As) and mercury (Hg) pollution has not been observed;

b) under chemical substances of the second class danger, i.e., content of copper exceeds PDK from 1.4 times up to 214, and background - from1.2 times up to 164.7 (it should be mentioned that content of the specified element is approximately equal to PDK or exceeds it in 1.3 times in background samples); chrome pollution (Cr^{+6}) has not been observed.

Two composite soil samples of background and eight single samples were taken at the project site.

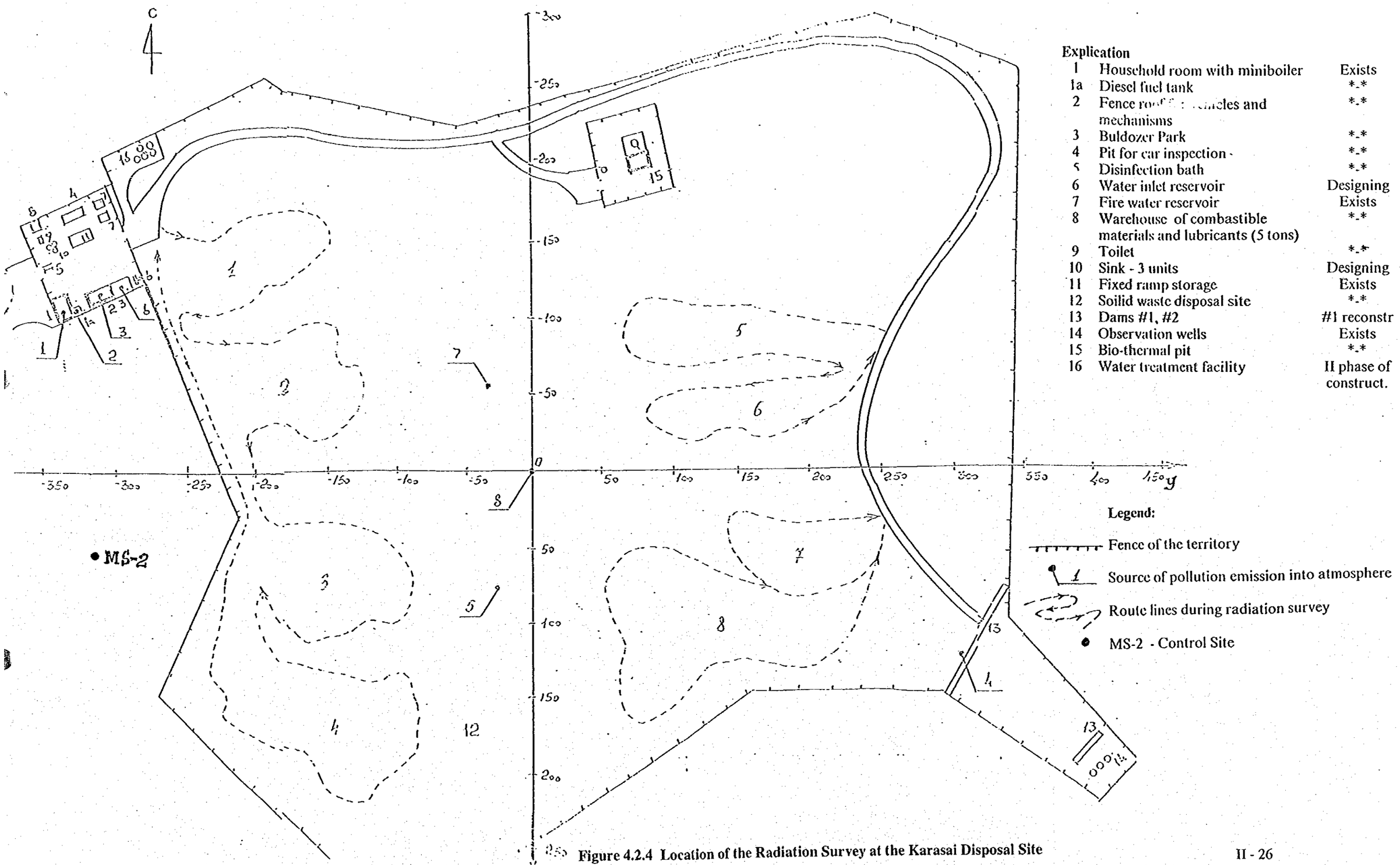
The photographs of soil sampling are attached to this report. The results of chemical analysis of soil samples are presented in Table 4.2.2.

Table 4.2.2 Content of Heavy Metals in Soil

Number of sample	Sampling depth (cm)	Elements, mg/kg						
		Lead	Cadmium	Copper	Zinc	Chrome	Arsenic	Mercury
1	2	3	4	5	6	7	8	9
3/13	30 - 60	131.3	2.7	4.2	159.4	Not found	Not found	Not found
3/14	0 - 30	80.6	2.0	5.7	168.2	Not found	0.23	Not found
3/15	35 - 70	87.8	1.4	2.8	119.4	0.010	0.13	Not found
3/16	0 - 35	107.4	3.3	5.8	160.4	Not found	Not found	Not found
3/17	15 - 35	134.9	2.3	2.3	148.4	Not found	Not found	Not found
3/18	0 - 15	20.7	1.1	4.7	22.8	Not found	Not found	Not found
3/19	60 - 120	41.2	2.3	7.0	82.5	Not found	Not found	Not found
3/20	0 - 60	39.2	7.9	642.3	203.4	Not found	Not found	0.84
Background 1	0 - 5	20.0	2.3	3.9	20.6	Not found	Not found	Not found
Background 2	5 - 20	15.2	2.5	2.9	2.3	0.010	Not found	Not found
PDK		**32.0**	**3.0**	**3.0**	**23.0**	**0.05**	**2.0**	**2.1**

4.2.2 Radiation Survey

Gamma activity has been evaluated by following route lines, "loop" method, on the surface of the Karasai Disposal Site. The selected method was conditioned by relief complexity of the disposal site. The whole investigated area was divided on separate sites-sectors, quantity and location of which were determined by the complexity level of the route specified on Figure 4.2.3 by dotted line. Each of such contours ("loops") is given a number, and altered gamma-activity values are represented in Table 4.2.3, accordingly. Simultaneously, control site CS-2 was selected, which is located on the even site nearby the disposal site (See Figure 4.2.4), and CS-1, for comparison, is on the SRAIE "Kazmekhanobr" area.



Explication

1	Household room with miniboiler	Exists
1a	Diesel fuel tank	*-*
2	Fence roof[illegible]hicles and mechanisms	*-*
3	Buldozer Park	*-*
4	Pit for car inspection	*-*
5	Disinfection bath	*-*
6	Water inlet reservoir	Designing
7	Fire water reservoir	Exists
8	Warehouse of combastible materials and lubricants (5 tons)	*-*
9	Toilet	*-*
10	Sink - 3 units	Designing
11	Fixed ramp storage	Exists
12	Soilid waste disposal site	*-*
13	Dams #1, #2	#1 reconstr
14	Observation wells	Exists
15	Bio-thermal pit	*-*
16	Water treatment facility	II phase of construct.

Legend:

- Fence of the territory
- 1 — Source of pollution emission into atmosphere
- Route lines during radiation survey
- MS-2 - Control Site

Figure 4.2.4 Location of the Radiation Survey at the Karasai Disposal Site

Table 4.2.3 Results of Measurements of Soil Gamma-activity at the Routes

Routes (pointed at the map)	The results of measurements, mcR/hour
1	11.5 - 12.0
2	12.5 - 13.0
3	11.0 - 11.5
4	11.5 - 12.0
5	13.5 - 14.0
6	12.5 - 13.0
7	13.5 - 14.5
8	12.0 - 13.5
CS-1	19.0
CS-2	15.0

Note: CS-1; Territory of "Kazmekhanobr"
CS-2; Control site (150 km to the south-west from the assess road of household zone of the Karasai Disposal Site)

The results of investigation showed, that gamma-radioactivity over surface of measured layer varied within the limits of 11.0 up to 14.5 mcR/hour, and in control site CS-2 was 15 mcR/hour. Therefore, it can be stated, that anomaly has not been observed on the specified area.

4.3 WIND SURVEY

The Karasai Disposal Site is located to the west from Almaty City and to the north from the 34-km section of the Almaty-Bishkek road and occupies an area of 23 ha. The nearest populated localities are: Kaskelen City located 3 km to the south-east from the disposal site and Chemolgan village located 4.5 km to the south-west from the disposal site. The climatic data of the area of the disposal site location were obtained by the nearest meteorological station Uzun-Agach.

The average annual multiyear periodicity (%) of wind directions for eight points, calms and prevalent wind direction are characterized by the following parameters:

Table 4.3.1 Periodicity of Wind Directions

N	NE	E	SE	S	SW	W	NW	Calm
13	10	12	9	26	13	8	9	27

The maximum wind force with periodicity of 5% is 4m/sec.

Table 4.3.2 Average Monthly and Annual Wind Force

Unit: m/sec

I	II	III	IV	V	VI	VII	VII I	IX	X	XI	XII	Year
0.9	1.1	1.3	1.6	1.5	1.5	1.4	1.4	1.2	1.2	1.0	0.8	1.2

Table 4.3.3 Average Number of Days When Wind Force > 15 m/sec

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1.2	0.9	1.7	2.6	3.3	4.2	3.6	1.8	1.1	1.4	0.6	0.4	22.8

Table 4.3.4 Average Number of Days with Dust Storm

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
0	0	0.4	0.8	1.0	1.2	1.3	0.9	0.5	0.5	0	0	6.6

4.4 AIR SURVEY

Climate of the Karasai Disposal Site location is characterized as moderate-continental, with dry air and many sunny days. The average multiyear temperature of the coldest month (January) is 9.9 degrees below zero, the average multiyear temperature of the hottest month (July) is 29 degrees above zero. Precipitation at this territory reaches 509 mm and average annual evaporation is 452.2 mm.

Air condition of the disposal site may be determined by technological processes of waste storage and disposal. The impact of the nearest populated localities (Kaskelen, Chemolgan and Aitey) on the air condition will not be considered, because there are not large sources of pollution on their territory.

At the waste storage site and at the disposal site in the process of decomposition of wastes the following compounds are generated: methane, organic acids and their derivatives, ammonia, hydrogen sulfide, nitric oxide, carbon oxide, amines, closed-chain compound and aromatic. On the basis of analysis of research and special literature, the list of harmful substances generated in the process of anaerobic decomposition of wastes at the disposal site was made.

Table 4.4.1 List of Harmful Substances Generated in the Process of Anaerobic Decomposition of Wastes at the Karasai Disposal Site

#	Harmful substances	PDK_{ms} mg/m³	PDK_{sd} mg/m³	Hazardous class	Emission	
					g/sec	t/year
1	Ethylamine*	0.03	-	-	0.0025	0.0788
2	Carbon oxide	5	3	4	0.0045	0.14
3	Ammonia	0.2	0.04	4	0.0048	0.151
4	Hydrogen sulfide	0.008		2	0.0095	0.03
5	Acetic acid	0.2	0.06	3	0.00378	0.12
6	Methane	50	-	-	0.82	25.8
7	Bivinul	0.01	-	4	0.0023	0.07
8	Acetone	0.35	0.35	4	0.0028	0.088
9	n-chlorphenole	0.0015	0.003	2	0.0047	0.148
10	Butyric acid	0.015	0.010	3	0.00344	0.108
11	Succinic acid *	0.10	-	-	0.0056	0.176
12	Triethylamine	0.14	0.14	3	0.0026	0.082
13	Phenole	0.010	0.003	2	0.00385	0.12
14	Diethylamine	0.05	0.05	4	0.0025	0.0788
15	Dimethilftalat	0.01	-	2	0.00428	0.134
16	n-hexane	60	-	4	0.0023	0.0725
17	Ethylbenzol	0.02	0.02	3	0.0032	0.1
18	Scathole *	0.010	-	2	0.00468	0.147
19	Valeric acid *	0.03	0.01	3	0.0033	0.104
20	Diallyl sulfide *	0.01	-	-	0.00468	0.147
21	Thiophene	0.6	-	4	0.0033	0.12
22	Formaldehyde	0.35	0.35		0.0029	0.09
23	Benzol	1.5	0.1	2	0.00316	0.1
24	Naphthalene	0.003	0.003	4	0.0041	0.129
25	Propilamine *	0.15	-	-	0.00468	0.147
26	Nitric dioxide	0.085	0.04	2	0.00536	0.168
27	Phenylacetic acid *	0.010	0.003	2	0.0044	0.138
28	Toluene	0.6	0.6	3	0.00312	0.098
29	Xylene	0.2	0.2	3	0.00313	0.098
30	Cresol	0.02	-	-	0.00374	0.117
31	Acetic aldehyde	0.010	0.010	3	0.0028	0.088
32	Allyl aldehyde	0.03	0.03	2	0.003	0.094

Note: *Evaluation of toxicity was made by comparison analysis of toxic action of considered substance and toxic action of substance with similar chemical composition with known value of maximum allowable concentration factor (PDK) and safety level of impact;

PDK_{ms} – maximum allowable maximum single concentration, mg/m³

PDK_{sd} – maximum allowable average daily concentration, mg/m³

4.5 FLORA AND FAUNA SURVEY

4.5.1 Flora

Geo-botanical investigations have been performed on the area of the Karasai Disposal Site in accordance with the *"Instructions on Implementation of Large Scale (1:1,000-1:100,000) Geo-Botanical Survey of RK Natural Fodder Lands "* approved by the State Committee of the Republic of Kazakhstan on Land Relations and Land Development in 1995.

Works were performed in 2 stages. Field investigation within 1 km radius from the disposal site was carried out by route method in 1:25 000 scale. Distance between routes accepted was equal to 500m. A vegetation map of the site is shown in Figure 4.5.1.

Fifteen (15) geo-botanical contours have been specified and 5 flora descriptions have been developed with yield and floristic structure specification. Flora map has been developed with colored contours, according to dominants of flora cover in cameral period. Contour numbers, share numbers and yield of eaten dry mass in c/ha have been shown by numerals; types of lands and their cultural and technical state have been marked by symbols. Besides, list of plants of investigated area has been developed, contour areas under types of lands have been calculated. Land resources evaluation and soil quality determination have been performed as a result of investigation.

Flora of investigated area is of desert-steppe character (See Subsection 2.5.1). Types of plants grown there form numerous associations on light chestnut, sometimes washed, loamy soils, forming on tops and slopes of undulating ridged foothills separated by channels of dry currents and brooks.

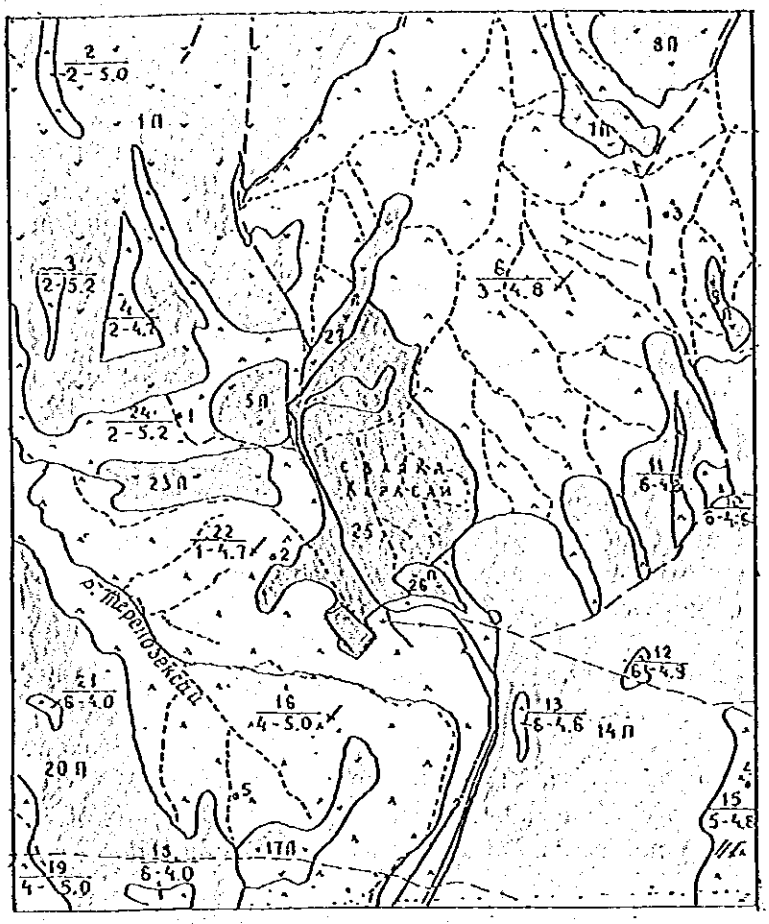
Tyrsa-sedge-grass and tyrsa-ephemera-grass dominate among plant associations (sharp teeth brome and bulbous meadow grass are subdominants in last case). Annual, often cop grass (small-podded gold-of-pleasure, starry scabious, family stick seed, desert alyssum, arched trigonella) finishing its vegetation to the end of June and many perennial grass like ordinary mullein, moth mullein, milfoil, desert sage, gay mallow and others are always present in both associations.

Autumn-wormwood-ephemera association is observed on steep hillsides of ridges, and tyrsa-ephemera-grass association is met near relief distinct elements and, especially, near the disposal site. The second association is characterised by an almost complete lack of plants with long vegetation period, except some types of grass (mulleins, wavy lettuce, Canadian fleabane).

Absolute heights rise on the South-West of the investigated area, so autumn wormwood is partially or completely replaced by narrow-segment wormwood in grass in contours located to the South of Terenozeksay; scratched fescue (typchuk) is met often; separate bushes and associations of meadow sweet with St. John's wort leaves appear in ravines.

Liquorice- and cop-cereal-grass associations with domination of such types of weeds as cop hemp, thistle, bristling cornflower, burweed, mugwort and sweet wormwood spread along bottoms of numerous deep cut depressions on meadow light chestnut loam soils. Mesophyll meadow cereals, generally scoured up to basis – couch, awnless brome, meadow-grass - also grow there. East-Indian bluestem grass is found on slopes of depression.

Scale 1: 25000



Keys

п - plowed land, virgin land

- pastures

Figure 4.5.1 Vegetation Map of the Karasai Disposal Site

Investigated area around the Karasai Disposal Site is strongly cut by gullies with ridged slopes and temporary currents, i.e., subjected to water erosion. Besides, presence of rather large faded areas should be mentioned from the North-East side of the disposal site, on which, mainly, tyrsa-ephemera-grass has faded.

4.5.2 Fauna

Special routes were made on August 20, 1999 to acquaint with fauna of vertebral origin on the area of the current disposal site. Thus, 150m of Route (A) along the upper and southern part of the disposal site let to reveal only a variety synanthropic birds, feeding on the vast areas stored with isolation waste. Sparrows, lanes, magpies, rooks and a large group of migrating black kites (9,2,3,12 = 26) were mentioned. Further, 5 doves, 2 jackdaws, 6 gold bee-eaters were marked on Route (A). Four exits of closed burrows of yellow gophers and 9 burrows of small mouth-like rodents were visually observed on Route (B) i.e., 250m coming along the western part of the disposal site on the boundary with cultural fields. Traces of partridge (gray or keklik were not observed) were specified on fields of steppe vegetation. Presence of 3 field larks and one kestrel were also mentioned.

Route (B) passed along the west extremity of the east micro-slope of the disposal site, to the East up to the low part of logged depression. One steppe lark, 3 blackcap wagtails, 1 gray warbler and 2 magpies were met on the 150-200m route.

Among mammalians, only traces of small mouth-like rodents (holes, paths, etc.) were observed.

It should be mentioned that terms of investigation of the disposal site were not enough to make a complete picture of the quantitative and qualitative structure of vertebrate animals in connection with the small activity of a majority of the animals during this period of the year (end of August).

CHAPTER 5 RESULTS OF FIELD SURVEY ON SOCIOECONOMIC CONDITIONS OF THE SITE

5.1 TRAFFIC SURVEY

Length of the access road 34 km from the Almaty-Bishkek road to the household site of the Karasai Disposal Site is 2.3 km. The access road and the disposal site were put into operation in December 1989. By technical characteristics, this road belongs to Class IV, the width of the roadway is 6m, and the width of the roadbed is 10m. The traffic intensity is 500 cars/day.

In connection with the construction of two transfer stations in Almaty (the West Transfer Station is in Auezovsky and the Spasskaya Transfer Station is in Turksibsky) where it is planned to separate secondary raw materials from the total volume of wastes, the traffic intensity at the access road will decrease and in 2010 the traffic intensity will be 210 cars/day (refuse trucks – 20 trips; heavy vehicles 40 m^3 – 84 trips). Therefore, the expected traffic intensity in 2010 will decrease by 2.4 times.

The impact on the air condition of the existing Karasai Disposal Site and adjacent territories can be caused by vehicles passing through the 34 km section of the Almaty-Bishkek road located 2 km to the south from the disposal site. This road belongs to Class I and traffic intensity is 20575 car/day (the data from June 17, 1999). The width of the roadway is 21.5 m, it has asphalt-concrete pavement, the total width of road bed is 27.5m, the width of way sides 3.75m × 2m, asphalt-concrete reinforcement of way sides is 3.0m × 2m.

The traffic intensity of the Almaty-Bishkek road changes depending on the season and it significantly increases in summer and autumn. According to the data from June 1999, at the section 34 –100 km the total traffic intensity was 12037 cars/day,i.e., forward direction – 5869 cars/day and backward direction – 6168 cars/day. Analyzing the types of vehicles passing through the road, it is seen that cars make more than 53%, trucks – 32%, trailers – 7.3%, buses – 5.8%, tractors and motorcycle – 1%.

5.2 SURVEY OF PUBLIC AWARENESS IN THE SETTLEMENT ADJACENT TO THE KARASAI DISPOSAL SITE

The public opinion survey was conducted in the Aitey Village of Karasaisky located 3 km from the disposal site in order to find out population attitude to the existing environmental situation at the Karasai Disposal Site. In the process, fifty householders in this village were asked the question:

"What is your attitude to the prospect of reconstruction of the Karasai Disposal Site?"

The householders were suggested to take into consideration the fact that in the process of improvement, new waste disposal technology reducing negative impact on the environment will be applied, traffic intensity will decrease, and the total volume of storage wastes will decrease by recycling. The interviewees were suggested three possible variants of answer: "positive", "negative", and "difficult to answer".

Most of the householders (44 persons – 88%) gave a positive answer to the prospect of reconstruction of the Karasai Disposal Site. Negative answers were given by 6 people (12%). The negative attitude to the project is connected with the fact that currently these people work at the existing disposal site. Since it is planned to apply a new waste treatment technology at two transfer stations, they are afraid to loose their places.

The positive answers prevail over the negative answers. It is connected with the fact that currently the Karasai Disposal Site has an adverse impact on the environment and health of population of the adjacent villages. When wind blows in a specific direction the combustion materials generated by spontaneous combustion of wastes reach the Aitei village and Kaskelen City.

In this connection, they were asked the second question "How do you evaluate the present condition of the environment at the existing Karasai Disposal Site?", and they evaluated the environmental situation at the existing disposal site negatively. Only one person gave an undetermined answer.

CHAPTER 6 IDENTIFICATION OF ENVIRONMENTAL IMPACT OF THE SITE

The identification of environmental impacts caused by the Karasai Disposal Site activity was made on the basis of structure of natural and anthropogenic landscapes. At the area of Karasai Disposal site the dry steppe is suitable for agriculture. The nearest residential area is located 3 km from the disposal site borders. The existing sanitary-protection zone of the disposal site is occupied by contaminated agricultural land, the width of the zone is 1 km. The landscape of the disposal site has changed insignificantly, so it can be said that there is a potential impact on the environment during operation of the disposal site.

Depending on the type of impact, landscapes are divided into surface, soil and underground layers. The surface layer includes the atmospheric bottom layer 30-35 m height of wood plants in the existing and projected woodland. The main adverse impact on this layer is emission of dust and aerosols from the disposal site caused by blowing pollutants from the surface of contaminated ground and waste storage, and by wind transferring emissions generated by vehicles and machines. Transferring of pollutants by vehicles passing from the disposal site is not possible because the vehicles are disinfected. Transferring of infection by animals such as birds and rodents was not inspected at this stage.

The soil layer includes rooted layer of soil-ground at the depth of 3m. It is polluted by the surface layer during rains, by falling leaves, and also by groundwater. Quick snow melting and big amounts of rainfall favor transferring pollutants into the depressions like ravines, gullies and rivers. Owing to this, the pollutants do not accumulate in the soil. This layer is polluted by contaminated ground and surface water near the disposal site water reservoirs. Negative impact of the disposal site on the underground layers is caused by groundwater contaminated by leachate.

The following impact types should be considered:

- chemical and biological pollutions;
- physical impact (noise, electro-magnetic radiation, etc.);
- heat impact (fires, evaporation, fogs);
- complex impact on landscape and population; and
- withdrawal and depletion of resources

The prognosis and assessment of impact on the environment are presented in Chapter 8 of this report.

CHAPTER 7 INVENTORY OF SOURCES OF IMPACTS ON THE ENVIRONMENT

The main sources of pollutant emissions into the atmosphere are:

- boiler for heating office, generating fuel soot, sulfur dioxide, carbon oxide and nitric oxide during operation;
- digging machines, generating carbohydrates, carbon oxide, fuel soot, nitric oxide, sulfur dioxide and benzapyrene;
- bulldozers providing waste storage and compaction generate the same substances as the digging machines;
- works on waste compaction generate suspended matters, dust and ammonia;
- vehicles transporting wastes generate carbohydrates, carbon oxide, fuel soot, nitric oxide, sulfur dioxide and benzapyrene;
- vehicle passing through the adjacent Alamty-Bishkek road of Class 1 with traffic intensity of 12,000 cars/day. The level of impact of this road on the disposal site located 3 km from it should be evaluated additionally; and
- combustible materials and lubricants for filling vehicles generate carbohydrates.

Pollutants discharged into the surface and ground water are caused by:

- Drainage of rainwater and snow water from the household zone contaminated by suspended matters, oil products and organic compounds;
- Drainage of industrial sewage and household sewage from the filling station, boiler, office and shower rooms; and
- Leachate from the waste storage site and from the disposal site.

These sources and types of impact presented in Chapter 6 allow preliminary prognosis and evaluate the impact of the Karasai Disposal Site on the environment.

CHAPTER 8 PREDICTION AND EVALUATION AND COUNTERMEASURES FOR THE IMPACT

8.1 AIR

The pollution emissions generated by the Karasai Disposal Site are not significant, so to calculate spread of pollutants is beside the purpose, because the ratio of maximum allowable maximum-point concentration to the normal maximum allowable concentration is less than 1. The factor of air quality is a value of maximum point concentration less than 1.

Table 8.1.1 Meteorological Characteristics and Coefficients, Specifying the Conditions of Pollutant Spread in the Atmosphere

Characteristics	Value
Coefficient depending on stratification of atmosphere, A	200
Coefficient of relief, η	1
Average maximum temperature of the hottest month, °C	29.5
Average minimum temperature of the coldest month, °C	- 9.9
Average wind rose, %	
N	13
NE	10
E	12
SE	9
S	26
SW	13
W	8
NW	9
Calm	27
Wind force (u^*) according to the average multiyear data, wind force periodicity – 5%, m/sec	4

Analysis of surface concentration of the harmful gaseous pollutants emitted on the disposal site in the process of anaerobic decomposition of solid wastes was made on the assumption that:

- It is not possible to carry out full qualitative and quantitative analysis of pollutants emitted, and there is no one-valued data in the research literature. Therefore, from the data frequently met in the literature (paraffin, cyclic and aromatic compounds, amine, fatty acid, aldehyde, hydrogen sulfide, ammonia), the most frequently mentioned substances as well as smelling substances were also chosen;
- The data on gaseous pollutant emissions are perhaps overstated; the proposed range of substances is limited to 32 elements;
- Analysis of surface concentrations was not made on the border of the sanitary-protective zone where the concentrations are very low and are not registered; it was made according to the wind directions in the territory;
- Evaluation of toxicity of substances that have no reference data on PDK was made by comparison, analyzing toxic action of considered substance and toxic action of substance with similar chemical composition and with known value of maximum allowable concentration factor (PDK); and

- The analysis shows that the surface concentrations of all elements during spreading reached tenth or hundredth parts of PDK even on the assumption that determination area is decreased 100 times. Therefore, the conclusion is that the pollutants reached the maximum permissible concentrations in the "operation zone" of the Karasai Disposal Site with the area of 23 ha. Also, the standard quality of the air (the ratio $C_m < 1$) is reached at the border of the sanitary-protection zone (1000m) – at an area of 625 ha occupied by the disposal site with the sanitary-protection zone.

Table 8.1.2 presents values of maximum surface concentrations by PDK values for eight wind directions.

Table 8.1.2 Pollutant Spreading in the Atmosphere

Pollutant	PDK_{MS} mg/m³	Wind directions of the sanitary-protection zone							
		N	NE	E	SE	S	SW	W	NW
1	2	3	4	5	6	7	8	9	10
Methane	50	0.00685	0.00449	0.00683	0.00472	0.00739	0.00345	0.00406	0.00346
n-hexane	60	Calculation is not necessary to carry out, because Q< 0.1							
Butyric acid	0.015	0.0957	0.0628	0.0956	0.066	0.103	0.0482	0.0567	0.0484
Valeric acid	0.03	0.0459	0.0301	0.0458	0.0316	0.0495	0.0231	0.0272	0.0232
Acetic acid	0.2	0.0789	0.00518	0.00788	0.00544	0.00851	0.00397	0.00467	0.00399
Succinic acid	0.1	0.0234	0.0153	0.0233	0.0161	0.0252	0.0119	0.0139	0.0118
Acetic aldehyde	0.01	0.117	0.0767	0.117	0.0805	0.126	0.0589	0.117	0.0591
Benzol	1.5	Calculation is not necessary to carry out, because Q< 0.1							
Ethyl Benzol	0.02	0.0668	0.0438	0.0667	0.046	0.0721	0.0336	0.0396	0.0338
Xylene	1	0.00653	0.00429	0.00652	0.0045	0.00705	0.00329	0.00387	0.0033
Toluene	0.6	0.00217	0.00142	0.00217	0.0015	0.00234	0.00109	0.00129	0.0011
Cresol	0.02	0.0781	0.0512	0.0779	0.0538	0.0842	0.0393	0.0463	0.0395
Hydrogen sulfide	0.008	0.496	0.325	0.495	0.342	0.535	0.250	0.294	0.251
Ammonia	0.2	0.01	0.00657	0.01	0.069	0.0108	0.00505	0.00594	0.00506
Formaldehyde	0.035	0.0346	0.0227	0.0345	0.0238	0.0373	0.0174	0.0205	0.0175
Bivinul	0.01	0.096	0.063	0.0958	0.0662	0.104	0.0484	0.0569	0.0485
Acetone	0.35	0.00334	0.00219	0.00333	0.0023	0.0036	0.00168	0.00198	0.00169
Diethyamine	0.05	Calculation is not necessary to carry out, because Q< 0.1							
Ethylamine	0.003	0.348	0.228	0.347	0.24	0.375	0.175	0.206	0.176
n-chlorphenol	0.01	0.196	0.129	0.196	0.135	0.212	0.0988	0.116	0.0992
Naphtaline	0.003	0.571	0.374	0.57	0.393	0.616	0.287	0.338	0.288
Propilamine	0.15	0.013	0.00856	0.0013	0.00897	0.0141	0.00656	0.00772	0.00658
Nitric dioxide	0.085	0.0263	0.0173	0.0263	0.0181	0.0284	0.0181	0.0156	0.0133
Carbon oxide	5	Calculation is not necessary to carry out, because Q< 0.1							
Scathole	0.01	0.195	0.128	0.195	0.135	0.211	0.0984	0.116	0.0987
Phenylacetic acid	0.01	0.184	0.121	0.183	0.127	0.198	0.0925	0.109	0.0928
Phenol	0.01	0.161	0.105	0.16	0.111	0.173	0.0809	0.0952	0.0812
Tiophen	0.6	0.00264	0.00173	0.00264	0.00182	0.00285	0.00133	0.00157	0.00134

Allyl aldehyde	0.03	0.0418	0.0274	0.0417	0.0288	0.045	0.021	0.0274	0.0211
Dimethilftalat	0.01	0.179	0.117	0.178	0.123	0.193	0.09	0.106	0.0903
Diallyl sulfide	0.01	0.195	0.123	0.195	0.135	0.211	0.0984	0.116	0.0987
Triethylamine	0.14	0.00775	0.00509	0.00774	0.00534	0.00936	0.0039	0.00459	0.00392
X - coordinate		6550	7050	7050	7050	6550	6050	6050	6050
Y - coordinate		10500	10500	10200	9900	9900	9900	10200	10500

In accordance with the standard documents, it is not required to calculate pollutant spread for other sources of atmospheric pollution (oven, emissions of hydrocarbon in the process of oil product storage and pouring) of the Karasai Disposal Site.

Emissions generated by internal combustion engines during operation of mobile facilities are not controlled but are taken into account during calculation of total emission from the disposal site.

On the north border of the sanitary-protection zone, it is advisable that a monitoring site for controlling air condition would be established. The monitoring site should be equipped with modern equipment for analyzing specific harmful substances. In addition, it is necessary to identify the harmful substances necessary for observation.

8.2 Surface and Ground Water

In Subsection 4.2 of this report, it was noted that there are no natural water bodies and water streams at the territory of the existing Karasai Disposal Site.

During periods of snow melting and rainfalls at the considered territory, observed is short-term surface runoff, which humidifies turf-covered slopes and periodically washes out part of pollutants emitted from the atmosphere.

The results of laboratory analyses of water from the leachate treatment lagoon in front of the upstream embankment dam and from the water body down the leachate treatment lagoon at the existing Karasai Disposal Site are presented in Table 8.2.1. Reconnaissance survey was carried out by the "Kazmekhanobr" in March 1999. According to the table data, the leachate treatment lagoon between both upstream and downstream dams plays an important and positive role, because it significantly decreases concentration of organic compounds and suspended matters in water. Their content is decreased in 35% on chemical oxygen demand (COD) parameters and in 32% on bio-chemical oxygen demand (BOD) parameters. Water quality in the water body is better on color, pH reaction, organic and biogenic compositions than in the sewage treatment lagoon. However, the content of Coliforms is high and exceeds the maximum allowable concentration factor (PDK) in 2-2.5 times. Electric conductivity in the water body is 1.8 times higher than in the sewage treatment lagoon. It means that the exchange hydraulic processes proceed very actively at the ravine and, because of these processes, the water body is replenished with highly mineralized ground water.

Table 8.2.1 Results of Analyses of Leachate Retention Ponds at the Karasai disposal site

#	Parameter	Water sampling place				PDK
		Leachate treatment lagoon in front of the upstream dam		Water body down the leachate treatment lagoon		
		25.03.99	30.03.99	25.03.99	30.03.99	
1	2	3	4	5	6	7
1	Color	Light-brown	Light-brown	Light-Yellow	Light-yellow	Water must not be of strange color
2	Turbidity	63.0	96.0	53.0	60.0	
3	pH reaction	7.97	7.78	7.70	7.75	6.5-8.5
4	Electric conductivity m.cm./cm	7.5	9.2	13.5	13.1	Not found
5	Dissolved oxygen, O_2 mg/dm^3	5.08	5.43	3.47	3.20	Must not be less than 4.0 mg/dm^3 in any season
6	COD, O_2, mg/dm^3	39.60	39.78	26.40	25.50	30.0
7	BOD, O_2, mg/dm^3	33.70	33.41	23.84	21.34	6.0
8	Suspended matters	42.80	72.95	41.10	69.30	Background + 0.75
9	Total content of nitrogen, mg/dm^3	38.77	44.28	0.87	1.56	On nitrate nitrogen – 45.0
10	Total content of phosphorus, mg/dm^3	<0.01	<0.01	<0.01	<0.01	On phosphates 3.5
11	Content of Coliforms	90	23000	90	23800	Coliforms 5000 10000, pfu/dm^3

The Kaskelen River is the river nearest to the disposal site and currently it serves as water source to meet household and production needs of closely located settlements and the existing Karasai Disposal Site. The last data on river water quality obtained by the hydro-meteorological station of the Republic in 1996 is presented in Table 8.2.2.

Implementation of activities specified in the *"Work Project on Improvement of the Disposal Site of Almaty City"* (was developed by public company "Parasat" in 1999) – drainage of rainfall water and snow water, disposal of wastes, daily covering of wastes with loam layer, and other activities will allow to eliminate negative impact of the disposal site on the water bodies and the environment as a whole. Under current conditions the negative impact on the ground water caused by the disposal site operation is limited by contour of the disposal site and ravine, where filtration ground flow is discharged.

Specified in the *"Work Project ..."* artificial water-proofing to be placed on the ground of the waste disposal site (insulation film, loam or clay layer) will allow to prevent potential pollution of ground water in the process of Karasai Disposal Site operation after its improvement. Strict performance proposed by the *"Work Project..."* technical, technological and organizational decisions on improvement of the Karasai Disposal Site

will provide elimination of negative impact on the condition of existing water bodies located at the considered territory.

Table 8.2.2 Qualitative Water Content in the Kaskelen River Near and Farther on Kaskelen City

#	Parameter	Concentration, mg/l
1	Dissolved oxygen, mg/l /%	10.5/92
2	Carbon oxide (CO_2)	0.82
3	PH reaction	7.68
4	Mineralization	143.5
5	Calcium	23.95
6	Magnesium	4.44
7	Sodium + Potassium	10.2
8	Bicarbonate (HCO_3)	79.8
9	Sulfates	19.18
10	Chlorides	4.15
11	Ammonia nitrogen	0.07
12	Nitrites	0.01
13	Nitrates	0.69
14	Total nitrogen	0.78
15	Total phosphorus	0.017
16	Silicon	1.2
17	Iron	0.24
18	Hardness	1.56
19	BOD	2.35
20	COD	28.58
21	Phenols	0.001
22	Oil products	0.10
23	Specific surface active matters	0.015
24	Fluorine	1.05
25	Copper	0.5
26	Zinc	2.25
27	Suspended matters	97.23

Analysis of data presented in the table shows that all parameters of Kaskelen river water comply with sanitary and hygienic requirements, but also it is necessary to treat water from fluorine, copper, zinc and suspended matters.

8.3 Soil

The impact of disposal site operations on the soil of adjacent territories is determined by the level of pollutant emissions and by the landscape improvement of the sanitary-protection zone of the project site.

Maximum permissible concentrations of pollutants were observed within the disposal site. Concentrations decrease and are about zero at further distances away from the site. This means that transfer of pollutants by air to the soil of the adjacent territories is practically impossible. Reduction of negative impact could take place by covering the waste with soil everyday and by improvement of the household zone of the disposal site and the sanitary-protection zone where agricultural use is going on. The sanitary-protection zone will then be planted with trees and shrubs.

At the territory near the existing ponds the ground water impounds (underflows) the rooted soil. As the result, the meadow soil formed at this territory is more fertile than the light-brown soil around it. Plants growing at this territory should be mowed and provided with earth together with wastes at the disposal site. The soil cover along the access road leading to the disposal site will be polluted by transport fuel combustion products at the distance of 10m from the roadbed. For reducing pollutant content, it is recommended to use clean burn fuel and to maintain vehicles in an ecologically safe condition. In the condition of washing pollutants by surface flows and transferring them by wind, the contamination of road by vehicles may not be considered.

8.4 FLORA AND FAUNA

8.4.1 Flora

The improvement of the Karasai Disposal Site will be executed at the existing site. Therefore, the improvement will not have significant impact on the vegetation of the adjacent territory.

In the process of improvement, it is planned to implement a new waste disposal technology minimizing negative impacts on the environment. This will improve conditions for plant growth at this region.

8.4.2 Fauna

Any change of landscape may impact on the fauna of the affected territories. For synathropic animals, human activity is favorable. It allows expansion of habitat for them. For other animals this activity may destroy their habitation and displace them to the outlying landscapes.

The Karasai Disposal Site occupies a large territory whose area is 23 ha and its operation will have significant impact on the animals inhabiting this territory. During filling the bottom levels of the disposal site the habitats of water-marsh animals will be eliminated. Toads, frogs, snakes and small mammalians such as voles, muskrats, shrews, and mice will be displaced. Water-marsh and meadow birds (mallard, moorhen, little crake, pheasant, common partridge) will also perish. Most of the rodents except synatrophic animals will move to the disposal site periphery.

For a more objective and detailed assessment of the impact of the Karasai Disposal Site on vertebrates, it is necessary to perform an annual survey. This survey will allow assessment of any change in fauna and evaluate the dynamics of changes. In addition, it is necessary to do more detailed research by specialists, such as zoologists.

Analysis of presented data shows, that water of the Kaskelen River corresponds to the sanitary-hygienic requirements; however, it is necessary to carry out water treatment to remove excessive substances like fluoride, copper, zinc and suspended matters.

CHAPTER 9 CONCLUSION

Results of predicted impacts caused by the Karasai Disposal Site on the atmospheric air, surface and ground water, soil, and flora and fauna show that the disposal site will have insignificant impact on the environment. In this connection, the site operation will not cause any changes in social and economic conditions of population living in adjacent territories.

The planned change in the solid waste management system of Almaty including waste treatment on the West and Spasskaya transfer stations, transferring wastes into heavy duty vehicle, and recycling will lead to decrease in traffic flow to the Karasai Disposal Site. As the result of this, the traffic intensity through the Almaty-Bishkek road and the access road to the Karasai Disposal Site (see, Subsection 5.1) will be reduced.

Improvement of the Karasai Disposal Site would not change the landscape of its territory because the operation of the improved disposal site will be made within the borders of the existing disposal site.

As for this draft environmental impact assessment (EIA) for the Karasai Disposal Site, the present review was performed in accordance with the requirements stated in the Republican Standard Document dated from December 30, 1993 intended for use during preparation of preliminary EIA.

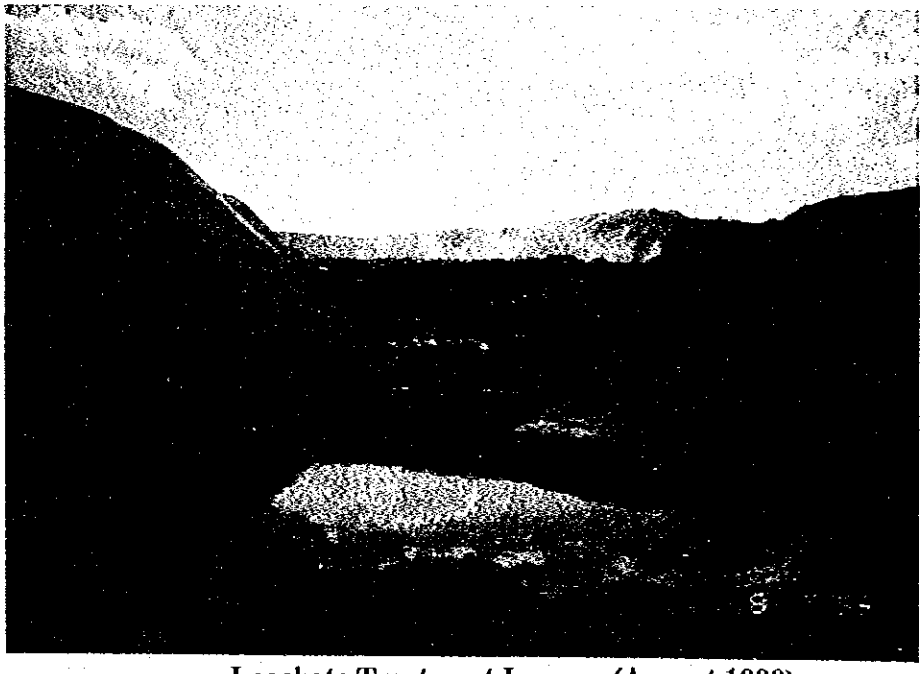
For more detailed assessment and specification of levels of impact caused by the improvement of the Karasai Disposal Site on the environment, it is necessary to perform full-scale EIA, which should be carried out under the special conditions of financing and in accordance with the appropriate terms based on the coordinated work schedule.

PHOTOGRAPHS
OF
THE SURVEY SITE

General View of the Karasai Disposal Site (April 1999)

General View of the Karasai Disposal Site (July 1999)

Leachate Treatment Lagoon (April 1999)

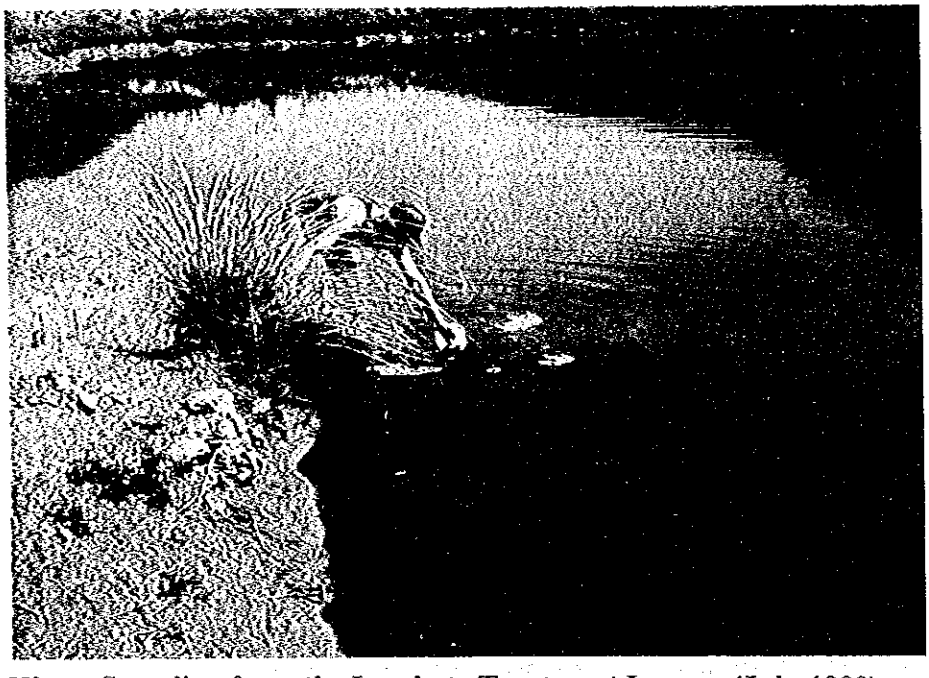


Leachate Treatment Lagoon (August 1999)

Administrative Office (March 1999)

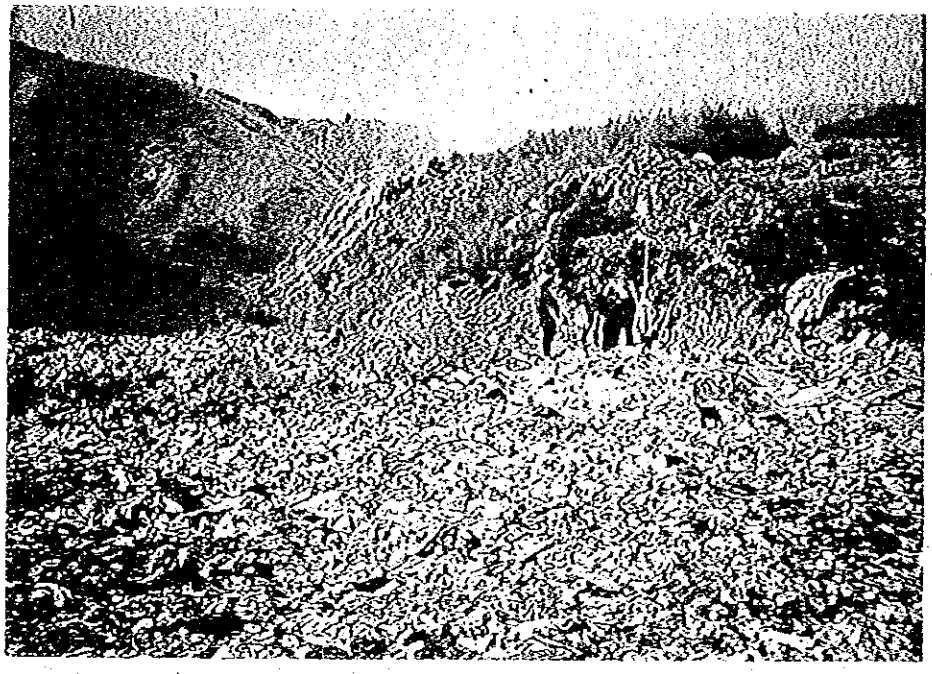
Soil Investigation (August 1999)

Water Sampling from the Leachate Treatment Lagoon (March 1999)

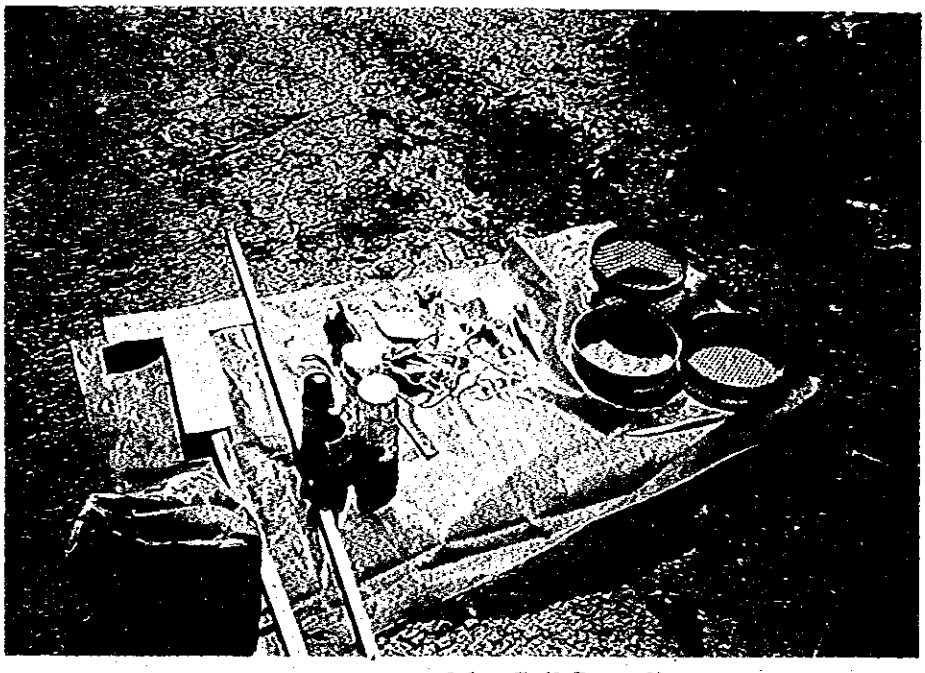


Water Sampling from the Leachate Treatment Lagoon (July 1999)

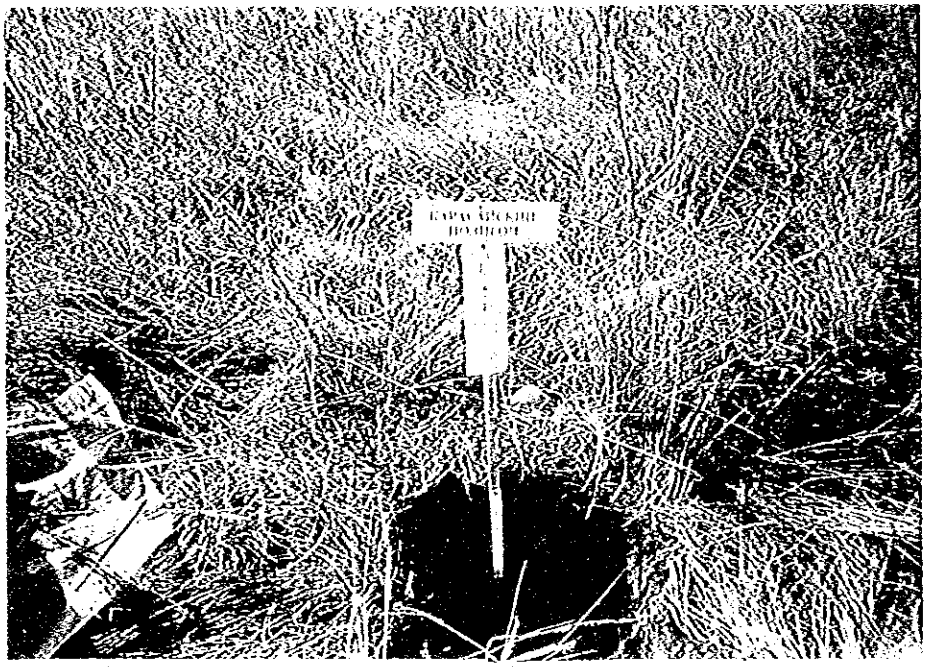
PHOTOGRAPHS
OF
SOIL SAMPLES AND SAMPLING PLACES



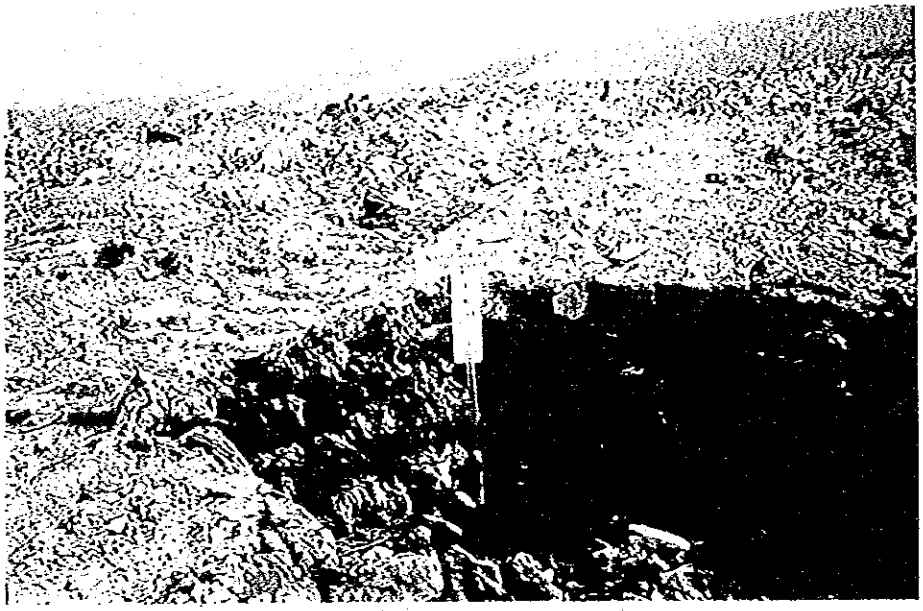
General View



Tools used for Soil Sampling



The Karasai Disposal Site Background (0.5; 5-20cm)



The Karasai Disposal Site, Soil Sample 13 (30-60cm)

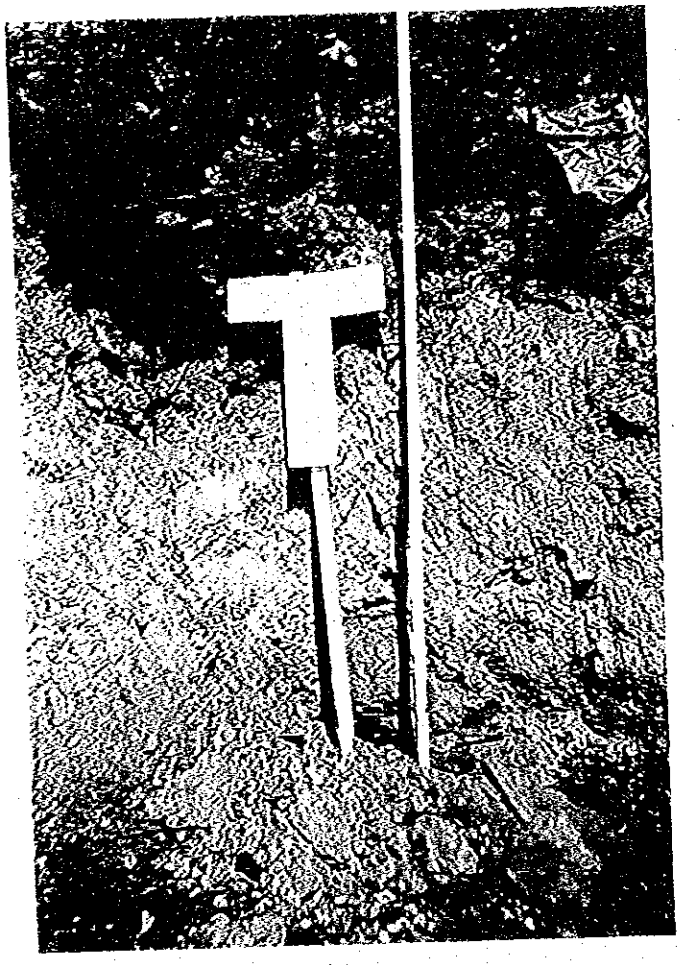
The Karasai Disposal Site, Soil Sample 14 (0-30cm)

The Karasai Disposal Site, Soil Sample 15 (35-70cm)

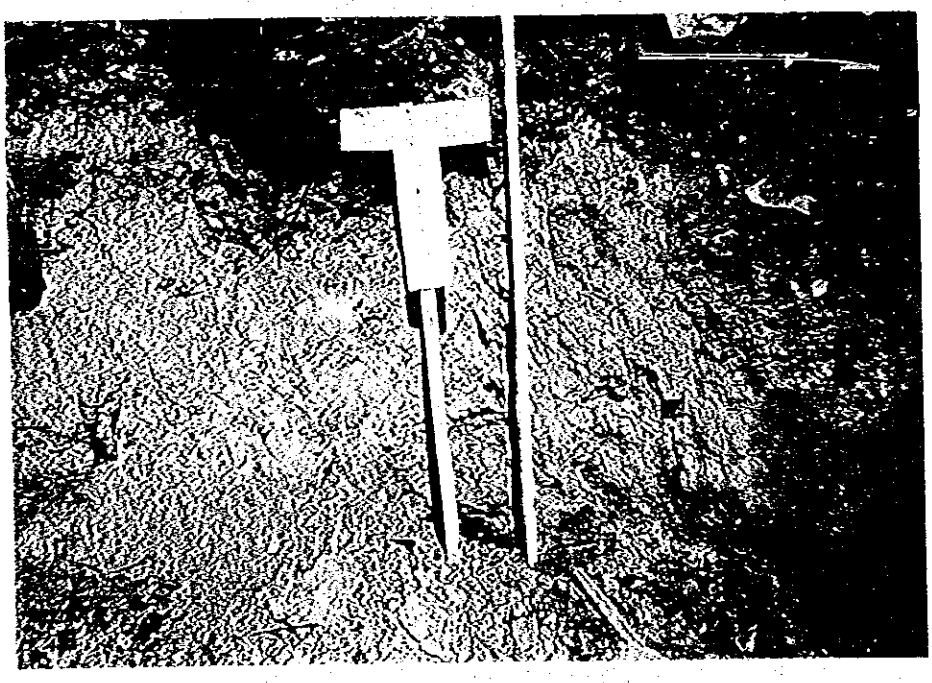
The Karasai Disposal Site, Soil Sample 16 (0-35cm)

The Karasai Disposal Site, Soil Sample 17 (15-35cm)

The Karasai Disposal Site, Soil Sample 18 (0-15cm)



The Karasai Disposal Site, Soil Sample 19 (60-120cm)



The Karasai Disposal Site, Soil Sample 20 (0-60cm)

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