

Tacis Project: Black Sea Investment Facility

Georgia

Project for Solid Household Waste Management in the Autonomous Republic of Adjara

Title	Project for SHWM in the AR of Adjara		
Code	Projet Rapport 1 E.doc	Date Redaction	08/06/05
Index of Revision		Emitter	
	Writing	Translation	Verification
Name	Philippe FICHAUX		Approbation
Quality	Key-expert		
Visa			

Warning

This report cannot pretend to be considered as a feasibility study. It's only a first description of the project. The figures want to be "realistic": they represent the reality and they are reliable at $\pm 5\%$ and sometimes $\pm 10\%$. But only the detailed studies would provide contractual figures. Nevertheless, we have wanted to situate the stakes and allow the preliminary decisions on a rationale base.

Table of contents

1. Existing situation	6
1.1. Geography and administration	6
1.2. Demography & Economy	8
1.2.1. Demography	8
1.2.2. Economy	9
1.2.2.1. Manufacturing	9
1.2.2.2. Agriculture	10
1.2.2.3. Tourism	10
1.2.2.4. Income of Population and Inflation	10
1.2.2.5. Unemployment	11
1.3. Legal Framework of Waste Management	11
1.3.1. Laws	11
1.3.2. Inspection of Environment	11
1.4. Organisation of the waste management	11
1.4.1. SHW Collection and Disposal Systems	11
1.4.2. SHW Accumulation Rate	12
1.4.3. SHW Generation Rate	13
1.4.4. Coverage by Mechanical SHW Collection Means	13
1.4.5. Engineering Issues	14
1.4.6. Tariffs	15
1.4.6.1. General framework of the tariff system	16
1.4.6.2. Organisation of relations between the enterprise, collecting SHW, and the clients	16
1.4.6.3. Tariffs and payment	16
1.4.6.4. Compensation of the losses	17
1.4.7. Investments	17
1.4.7.1. Decisions of investments	17
1.4.7.2. Funding of the investments	17
1.4.8. Dumps/Landfills	17
1.4.8.1. General Description	17
1.4.8.2. Service Areas	18
1.4.8.3. Unauthorised dumps	18
1.5. Landfill of Batumi	19
1.5.1. Situation	19
1.5.2. Remediation	20
1.6. Dumpsites of Kobuleti	20
1.6.1. Situation	20
1.6.2. Remediation	23
1.7. Collection	23
1.7.1. Mountain area	23
1.7.2. Coastal area	26
2. Summary of the Project	26
2.1. Construction of a new sanitary landfill	27
2.2. Closure of the Batumi landfill	27
2.3. Remediation of Kobuleti dumpsites	27
2.4. Creation of a Regional Waste Management Company	27
3. New Sanitary Landfill	28
3.1. The site	28
3.1.1. Location and state	28
3.1.2. Geology – hydrogeology	28
3.1.3. Climate	28

3.2. State of art and regulation.....	29
3.2.1. Admitted waste	29
3.2.2. Geotechnique.....	29
3.3. Design of the landfill.....	30
3.4. Equipment of the landfill.....	32
3.5. Estimated costs.....	33
3.5.1. Preliminary studies.....	33
3.5.2. Engineering.....	33
3.5.3. Construction.....	33
3.5.3.1. Infrastructures	34
3.5.3.2. Construction of a 2 ha row	34
3.5.3.3. Cover of a 2 ha row.....	34
3.5.3.4. Equipments	35
3.5.3.5. Operation.....	35
3.5.3.6. Financial charges	36
3.5.3.7. Provision for closure.....	36
3.5.3.8. Global cost	36
4. Closure of Batumi Landfill.....	37
4.1. Principle.....	37
4.2. Works	37
4.3. Cost.....	38
5. Remediation of Kobuleti dumpsites.....	38
5.1. Principles.....	38
5.2. Cost.....	38
6. Creation of a Regional Waste Management Company.....	38
6.1. Waste collection	38
6.2. Transfer stations	39
6.3. Status of the new company.....	40
7. Reforms of the Waste Management	40
7.1. Techniques.....	40
7.2. Regulation	40
7.3. Separation of the roles	41
8. Divers.....	41
8.1. Public awareness	41
8.2. Enhancement of the administration	42
9. Financial Planning.....	42
9.1. Budget.....	42
9.2. Affordability.....	42
9.3. Simulation.....	43
10. Annexes.....	45
10.1. Structure of the Government of Adjara	45
10.2. Drawings of the New Sanitary Landfill	45
10.2.1. Initial State	45

10.2.2. Step 1.....	45
10.2.3. Step 2.....	45
10.2.4. Step 3.....	45
10.2.5. Step 4.....	45
10.2.6. Step 5.....	45
10.2.7. Step 6.....	45
10.2.8. Step 7.....	45
10.2.9. Step 8.....	45
10.2.10.....	Step 9 45
10.2.11.....	Step 10 45
10.2.12.....	Step 11 45
10.2.13.....	Final State 45
10.2.14.....	Cut of the Final State 45
10.3. Standard Transfer Station.....	45

1. Existing situation

1.1. Geography and administration

The Autonomous Republic of Adjara (ARA) is located at the Southwest of the Republic of Georgia. It occupies about 2,900 km² and has an average population density of 132 inh/km².

Adjara is characterised by elongated and densely populated areas interlacing with sparsely populated and unoccupied territories. Mountainous terrain is dominant. Some peaks are over 2,500 m above the sea level.

The western part of the republic is washed by the Black Sea; here the major cities are located: Batumi and Kobuleti. The capital of the republic is the city of Batumi.

Adjara border on Turkey (the length of the border line is 132 km).

On the territory of the Autonomous Republic of Adjara, minor roads, connecting localities, mainly represent the transportation system. There are also some major roads, connecting the republic with the cities of Georgia.

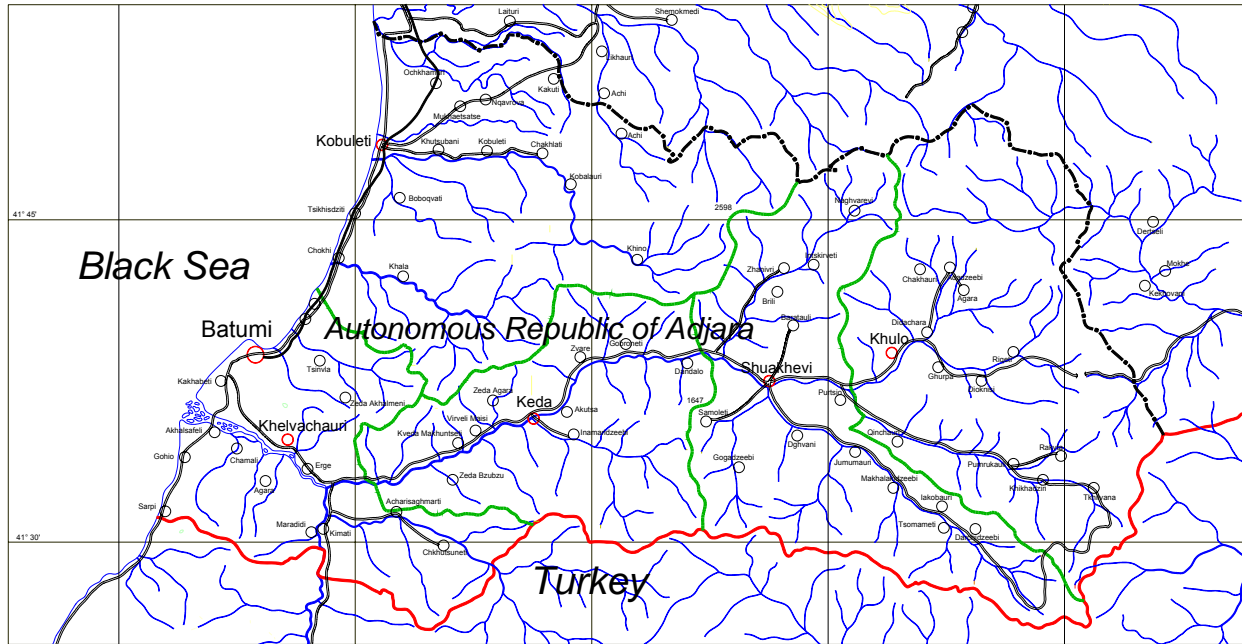
The railway network is highly developed. In the capital of Adjara, Batumi, there are a commercial sea port and an airport.



Map 1 Georgia

The Autonomous Republic of Adjara is divided in:

- 2 cities: Batumi, Kobuleti;
- 5 rayons: Kobuleti; Khelvachauri, Keda, Shuakhevi, Khulo.



Map 2 Administrative division of the Autonomous Republic of Adjara

These rayons include:

- 1 city of special importance;
- 7 small cities;
- 56 villages "sakrebulo",
- 333 villages.

1.2. Demography & Economy

1.2.1. DEMOGRAPHY

The official statistics are:

	1989	2002	2003	2004	2005
AR Adjara	392432	376016	378157	379899	381802
Rate of yearly growth			0.57%	0.46%	0.50%
• urban areas	181289	166398	167236	168000	168970
• rural areas	211143	209618	210921	211899	212832
City of Batumi	136930	121806	122440	122990	123604
Kobuleti District	88183	88063	88531	88879	89361
• Kobuleti	20637	18556	18610	18695	18828
• Chakve	5071	8100	8130	8167	8240
• Ochkhauri	7257	5026	5067	5085	5135
• rural areas	55218	56381	56724	56932	57158
Khelvachauri District	82243	90843	91429	91895	92398
• Khelvachauri	5121	6143	6196	6260	6312
• Makhindjauri	3009	3401	3411	3402	3419
• rural areas	74113	81299	81822	82233	82667
Keda District	20061	20024	20085	20104	20172
• Keda	1231	1244	1256	1262	1276
• rural areas	18830	18780	18829	18842	18896
Shuakhevi District	25386	21850	21922	21961	22042
• Shuakhevi	901	980	978	982	988
• rural areas	24485	20870	20944	20979	21054

Khulo District	39629	33430	33750	34070	34225
• Khulo	1132	1142	1148	1157	1168
• rural areas	38497	32288	32602	32913	33057

Table 1 Statistics of Population

As of 01.01.2005, the population of the Republic of Adjara is 381,800 people.

Out of which 43.6% is the urban population and 56.4% — rural population. The Autonomous Republic of Adjara consists of seven administrative-territorial units: 2 cities and 5 rayons.

By the present day, if compared to 1989 the total population of Adjara has reduced by 2.7%. Such a reduction is evident to have been caused by the emigration processes, because the birth rate exceeds the death rate almost by a factor of 2.

The rate of demographic process, if compared to 1989, stays within 86.6-112.4%.

Cities, rayons	Population, x1000		Including		Change (%)	Area occupied km ²	Population density inh/km ²
	1989	2004	Urban	Rural			
Total	392,4	381,8	166,5	215,3	97,3	2900	132
Cities:	157,5	142,4	139,4	3,1	90,4	28	5086
Batumi	136,9	123,6	121,1	2,5	90,3	17	7271
Kobuleti	20,6	18,8	18,3	0,6	91,3	11	1709
Rayons	234,9	239,4	27,1	212,3	101,9	2872	83
Kobuleti	67,6	70,5	13,9	56,6	104,3	709	99
Khelvachauri	82,2	92,4	9,7	82,7	112,4	413	224
Keda	20,1	20,2	1,3	18,9	100,5	452	45
Shuakhevi	25,4	22,0	1,0	21,0	86,6	588	37
Khulo	39,6	34,3	1,2	33,1	86,6	710	48

Table 2 Density of Population

It can be expected that the economical recovery will maintain a yearly growth rate of the population of 0.5%. So, in 20 years, the population could be 422,000 inh.

The ARA is a famous tourism area. From June to September, there's an additional population of officially around 65,000 but it can be expected 100,000.

1.2.2. ECONOMY

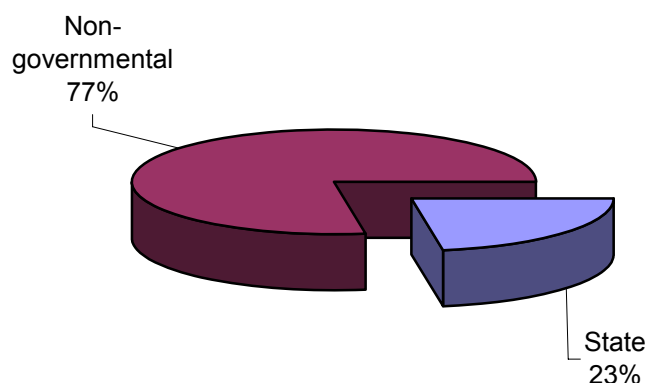
The national currency of the Autonomous Republic of Adjara is Georgian Lari (GEL): € 1 = GEL 2.15.

In 2004, the Gross Domestic Product of the Autonomous Republic of Adjara made GEL 490 mln. (which was 5% of the GDP of Georgia). Compared to 2003, this parameter has reduced by GEL 29 mln. or by 5.6%.

The main industries in the republic are agriculture, manufacturing, and tourism.

1.2.2.1. MANUFACTURING

As of 01.01.05, there are 515 industrial enterprises on the territory of Adjara: 34 state enterprises and 117 non-governmental enterprises.



Graph 1 Distribution of enterprises by the pattern of ownership

Manufacturing sector is represented by food, tobacco, and woodworking industries.

	2000	2001	2002	2003	2004
Industrial products, GEL x1000	21,849.4	22,238.2	29,213.6	38,941.7	32,869.8

Table 3 Industrial Production

The share of manufacturing in the GDP structure of Adjara is 5.9%.

1.2.2.2. AGRICULTURE

The agricultural sector is represented by such major industries as tobacco, citrus plants, potatoes, tea, and livestock farming. The share of agriculture in the GDP structure of Adjara is 18.7%.

Private farms occupy 63.8% of the agricultural lands. State and non-governmental agricultural farms occupy the rest, 46.2%.

There is no information on the distribution of farms by patterns of ownership.

	2000	2001	2002	2003	2004
Agricultural products, GEL x1000	48,300.0	60,400.0	137,590.2	114,690.0	91,520.6

Table 4 Agricultural Production

1.2.2.3. TOURISM

In 2004, the total cost of services rendered in the sphere of tourism was GEL 16.7 mln., which is 3.4% of the Adjara's GDP.

The tourist season lasts about 3 months, from late June till the end of September. On the average, by 2004, about 65-70 thousand people visited Adjara during the tourist season. Since 2005, the expected annual increase of the tourists inflow is 15% per year.

1.2.2.4. INCOME OF POPULATION AND INFLATION

The information on the income dynamics is unavailable. The average wage in 2004 was GEL 200. The inflation rate in 2004 made 50%.

1.2.2.5. UNEMPLOYMENT

The information on unemployment is unavailable. The unemployment rate in 2004 made 18.7%.

1.3. Legal Framework of Waste Management

1.3.1. LAWS

Today the solid domestic waste (SHW) management is carried out in compliance with the following normative and legal acts:

- Law "On Environmental Protection";
- Law "On Transit and Import of Waste from the territory of Georgia";
- Basel Convention "On Transborder Transportation and Disposal of Harmful Waste"; and
- Law "On Environmental Permits".

Pursuant to the Laws "On Health Protection" and "On Environmental Protection" the Ministry of Health developed, approved, and enforced "Sanitary and Hygienic Rules and Norms".

In 1997, the draft law "On Waste" was developed and submitted for consideration and approval to the Parliament. This law has not been approved yet.

1.3.2. INSPECTION OF ENVIRONMENT

We can say that there's, for the moment, neither Inspection of Environment nor ecological permitting in Georgia. Inside the Department of Environment of ARA, M. Nodar Koncelidze is in charge of the waste management, but the Dept has only a role of proposition in this matter.

1.4. Organisation of the waste management

The works in SHW disposal in each of the rayons of the republic are carried out by corresponding communal enterprises. Some of these enterprises also manage the SHW in Batumi and Kobuleti.

1.4.1. SHW COLLECTION AND DISPOSAL SYSTEMS

The enterprises, operating in the sphere of SHW management, use the following collection patterns:

- Bunker system (refuse chutes): Such a system is mainly used in multi-storey (9+) buildings. This is explained by the fact that the refuse chute and the bunker are integral parts of these buildings. The capacity of one bunker is 2-3 m³, which provides for 6-10 days of continuous operation (from dumping to dumping).

According to the sanitary service administration the bunkers are dumped once a week. All operations are done manually as follows: the bunker door is opened, the refuse is dumped on the ground, and then loaded on the vehicle.

All operations are done by one worker (sometimes by two workers). Dumping and loading on the vehicle takes 1-1.5 hours. The bunker system is serviced by open-top dump-trucks.

- Container system: The containers (capacity 0.75-1.5 m³) are located in the streets near buildings, schools, kindergartens, and other institutions. The refuse from the containers is collected by special vehicles. The containers are dumped on the average two times a day.
- "Ringling bell" system: This system is used in the areas, where there are no bunkers or containers: in the private sector and in rural areas. The system works as follows: early in the morning a sanitation truck enters the area and rings a bell; on hearing it the people bring refuse in plastic bags, bins or boxes and give it to the driver, which stands on the loading platform of the vehicle. SHW disposal, using this method, carried out every day.

8 large-scale enterprises collect themselves common industrial waste accumulated at their territory, deliver it to dump polygon and stow them. These 8 enterprises pay a fee to sanitary purification fleet for this last operation and fulfil significant function in the economic development of Georgia.

The sanitary purification service is obliged to:

- Clean the roads and pavements, collect, remove and stow the waste;
- Remove the sand from the street storm sewage
- Collect, remove, stow the solid domestic wastes of the population and enterprises
- Catch and secure against stray dogs and cats;
- Water the streets (cooling and washing them with water in summer period);
- Clean the streets from snow covering (in winter period)

Observation of sanitary and ecological requirements while collection, removal, stowing and processing of the solid domestic wastes is under control of the following two institutions: State Supervisory Sanitary Inspection of Ministry of Health and Administration of Protection of Environment and Natural Recourses.

Sanitary purification fleet has a staff of 317 employees, among them:

- Administration: 12
- Office workers: 47
- Fleet technical personnel: 26
- Drivers: 37
- Loaders: 36
- Street-cleaners: 144
- Brigade-leaders: 12
- Landfill personnel: 3

Technological line of collection and removal of the solid domestic waste does not provide separation of wastes by the personnel, although drivers, loaders and street-cleaners by their own select glass containers, metals, and other kinds of domestic waste.

According to our information glass containers (bottles, cans) are hand-washed and delivered to glass containers acceptance points. At present we have fixed 30 such commercial points. Population also separates glass containers and coloured metals, because such way, delivering them to acceptance points, they gain some additional profit to support their families. There are two parts of population: the first one separates the waste produced by itself, but the second part, much less than the first one – sorts it out in bunkers, containers and dumps.

The Municipal SHWM Company is more precisely presented in Annex **Erreur ! Source du renvoi introuvable.**

1.4.2. SHW ACCUMULATION RATE

The per capita rate of accumulation of SHW is calculated individually by each of the administrative territorial units and applied on its territory.

The acting rates of accumulation, established for the population, are tabulated below.

City, rayon	SHW Accumulation Rate, m ³ /inh/y
the city of Batumi	0.8
the city of Kobuleti	0.6
Kobuleti rayon	0.6
Khelvachauri rayon	0.6
Keda rayon	1.3
Shuakhevi rayon	1.2
Khulo rayon	1.4

Table 5 SHW Rate of Accumulation

It must be noted that the applied rates of accumulation are not likely to reflect the actual situation, because they are applied to all categories of population of the locality, irrespectively of the place of living (city or village) and the standard of living.

The rates of accumulation, established for enterprises and institutions, depend on the type of activity.

1.4.3. SHW GENERATION RATE

Currently, it is difficult to determine the SHW generation rate, because there are no universal state statistic forms for reporting concerning waste generation, accumulation and disposal. We can only approximately assess the SHW generation rate, basing on the existing norms and the population of the localities and rayons.

The approximate estimate is set out in Table 6.

	Population, x1000	SHW Generation Rate, m ³ /inh/y	SHW Accumulation, m ³ /y
Total	381.8		308,760
Cities (total)	142.4		110,160
Batumi	123.6	0.8	98,880
Kobuleti	18.8	0.6	11,280
Rayons	239.4		198,600
Kobuleti	70.5	0.6	42,300
Khelvachauri	92.4	0.6	55,440
Keda	20.2	1.2	24,240
Shuakhevi	22.0	1.3	28,600
Khulo	34.3	1.4	48,020

Table 6 Approximate estimate of SHW generation rate in the residential sector

For the purpose of more precise assessment of the SHW generation rate we have sent questionnaires to the administrations of the corresponding territory units of the republic responsible for SHW management.

Along with the data on SHW generation in the residential sector the questionnaire covered the issues concerning SHW generation by commercial and state enterprises, and the municipal waste (street cleaning, removal of unauthorised dumps).

The data obtained by poll are tabulated below.

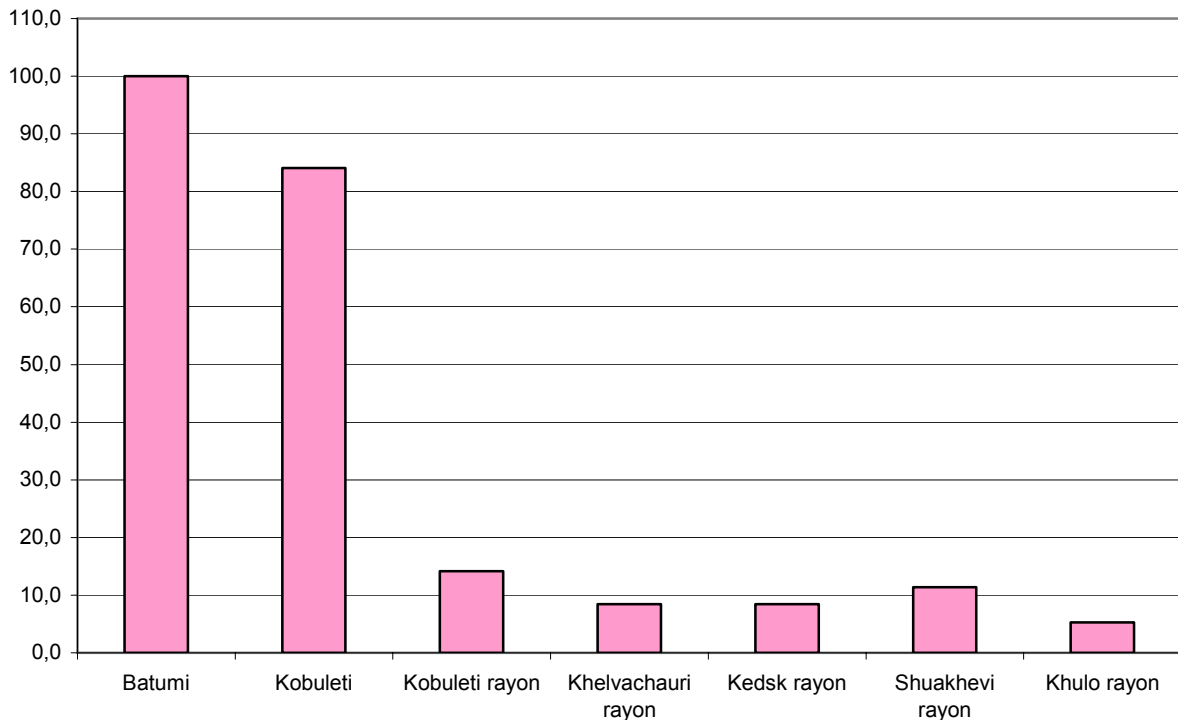
Cities, rayons	Population (as of 01.05.05)	Residential sector		Enter- prises (except residential sector)	Municipal waste	Total	SHW Density	Per capita Amount of SHW
		m ³	t					
Total	381.8	187,520	46,259	175,164	42,490	410,264	247	1.075
Cities (total)	142.4	169,800	40,075	161,000	41,500	372,300	236	2.614
Batumi	123.6	154,000	34,000	158,000	36,000	348,000	221	2.816
Kobuleti	18.8	15,800	6,075	3,000	5,500	24,300	384	1.293
Rayons	23.,2	17,720	6,184	14,164	990	37,964	349	0.159
Kobuleti	70.5	1,600	1,120	3,554	120	5,274	700	0.075
Khelvachauri	92.4	11,640	2,910	7,830	360	19,830	250	0.215
Keda	20.1	2,200	558	400	200	2,800	254	0.139
Shuakhevi	22.0	2,280	1,596	2,380	310	4,970	700	0.226
Khulo	34.2	2,340	585	1,500	1,250	5,090	250	0.149

Table 7 SHW Accumulation

1.4.4. COVERAGE BY MECHANICAL SHW COLLECTION MEANS

One of the major indicators of activities in the sphere of SHW management is the coverage of population by mechanical SHW collection means.

The coverage of population the mechanical means is shown in Figure below.



Graph 2 Number of people, covered by mechanical collection of waste, %

In the figure one can see that the best situation is in the cities of Batumi and Kobuleti. Such a situation is natural, because these cities are the tourist centres of the republic, and Batumi is also the administrative centre of the Autonomous Republic of Adjara.

In general, **43.5%** of the total population is covered by mechanical collection means.

The low coverage in the rayons is explained by the fact that the local communal services, as a rule, collect waste only in the localities they are based. The least serviced is the rural population.

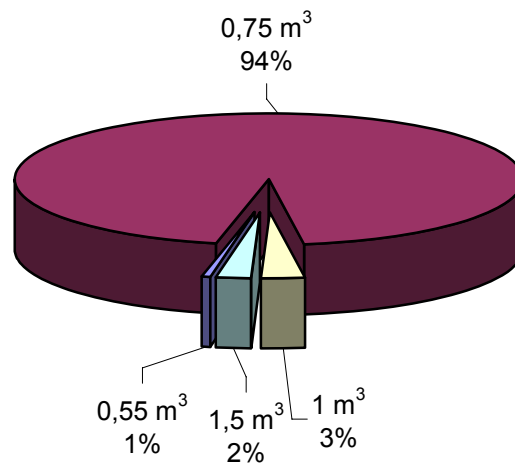
1.4.5. ENGINEERING ISSUES

The data on the number of containers and machines available are set out in the tables below.

Cities, rayons	Population, (as of 01.01.05) x1000	Number of containers by capacity				Total pcs	Capacity m ³
		0.55 m ³	0.75 m ³	1 m ³	2.5 m ³		
Total	381.8	3	536	15	13	567	451.2
Cities (total)	142.4	0	511	0	0	511	383.3
Batumi	123.6	0	487	0	0	487	365.3
Kobuleti	18.8	0	24	0	0	24	18.0
Rayons	239.2	3	25	15	13	56	67.9
Kobuleti rayon	70.5	0	0	0	0	0	0.0
Khelvachauri rayon	92.4	0	25	0	0	25	18.8
Keda rayon	20.1	0	0	0	12	12	30.0
Shuakhevi rayon	22.0	0	0	15	1	16	17.5
Khulo rayon	34.2	3	0	0	0	3	1.7

Table 8 Number of containers

Depending on the capacity the containers for SHW are distributed as follows:



Graph 3 Distribution of containers by capacity

As one can see in the figure the enterprises are mainly equipped with the 0.75 m³ containers, which make 94% of the total amount of containers used.

SHW disposal is done by special road transport. As of 01.01.05, the communal enterprises of Adjara operate 45 trucks with the total capacity of 409.8 m³.

The truck fleet is obsolete: some of the vehicles have need in operation for more than 20 years. 25% of the trucks are out of service. Another 25% are worn and need top be replaced.

Cities, Rayons	Population (as of 01.05.05)	Trucks				Capacity	Amount of SHW disposed (residential area)	Number of trips
		Total	Satisfact ory state	Under repair	Total capacity			
		x1000 pcs	pcs	pcs	m ³			
Total	381.8	45	34	11	409.8	1.07	187,520	458
Cities (total)	142.4	35	24	11	356.2	2.50	169,800	477
Batumi	123.6	25	18	7	285.0	2.31	154,000	540
Kobuleti	18.8	10	6	4	71.2	3.79	15,800	222
Rayons	239.2	10	10	0	53.6	0.22	17,720	331
Kobuleti rayon	70.5	2	2	0	8.8	0.12	1,600	182
Khelvachauri rayon	92.4	4	4	0	24.0	0.26	11,640	485
Keda rayon	20.1	1	1	0	6.0	0.30	2,200	367
Shuakhevi rayon	22.0	1	1	0	3.8	0.17	2,280	600
Khulo rayon	34.2	2	2	0	11.0	0.32	2,340	213

Table 9 Special vehicles

1.4.6. TARIFFS

The tariff system comprises several components:

1. general framework of the tariff system;
2. organisation of relations between the enterprise, collecting SHW, and the clients;

3. tariffs and payment.

1.4.6.1. GENERAL FRAMEWORK OF THE TARIFF SYSTEM

The current tariff system and the system of payments for SHW disposal is based on the two main principles, which regulate the relations between the enterprise, collecting waste, and the clients (population, organisations, institutions, and commercial bodies):

1. direct payment — the direct payments by the clients or their representatives to the enterprises, collecting waste, for the services rendered;
2. charges, based on the locally established SHW accumulation rates (in m³/year).

1.4.6.2. ORGANISATION OF RELATIONS BETWEEN THE ENTERPRISE, COLLECTING SHW, AND THE CLIENTS

In order to understand the system of relations between the enterprises, collecting SHW, and their clients, it is necessary to make difference between the two categories of clients:

1. residents of multi-storey buildings and private houses;
2. state and commercial bodies.

Relations with each of the categories are as follows:

- *Residents of multi-storey buildings and private houses:* Each resident, living within the service area, has a personal account, which is charged for the services rendered.
- *State and commercial bodies:* Relations with this category of clients are based on the service contracts. It should be noted that some of the enterprises dispose of waste themselves. In this case only the payments for disposal are made to the enterprise, which manages the receiving landfill.

The participation of local administrations in the development of tariff system is expressed in the decision-making on the following three issues:

- Approval of tariffs, applied by the enterprises, collecting waste, to the population and organisations of all patterns of ownership, including the tariffs for municipal waste disposal.
- Approval of the per capita accumulation rates for the residential sector and organisations of all patterns of ownership, depending on the type of their activity.
- Approval of standard form service contracts for enterprises and organisations.

1.4.6.3. TARIFFS AND PAYMENT

The tariffs, acting on the territory of the republic, are of two types:

1. Tariffs for the residential sector;
2. Tariffs for the institutions and enterprises of all patterns of ownership, depending on the type of activity.

As to the **residential sector**, the single tariff, applied within each administrative-territorial unit, is used irrespectively of the standard of living and the place of residence (city or village).

The tariffs for the **enterprises and institutions** are established for the whole administrative-territorial unit by the local administrations, depending on the type of activity. The tariffs are set out in Table 7.

In case an enterprise disposes of waste by itself, it pays the disposal fee of about GEL 2.3 per m³.

Consumers	Charge unit	Average accumulat ion rate	Average tariff	Annual payment	Average cost of waste disposal for the communal enterprises
		m ³ /year	GEL/month	GEL	GEL/m ³
Residential sector	person	1.00	0.30	3.60	5.80
Enterprises and organisations, including:					
Administrative institutions	person	0.41	0.20	2.40	5.80
Hotels, offices, pharmacies, shops	m ²	0.76	0.37	4.44	5.80
Markets and public catering enterprises	m ²	0.97	0.47	5.64	5.80
Production enterprises, warehouses and other objects of commercial purpose	m ²	0.97	0.47	5.64	5.80
Preschool institutions	child	0.26	0.12	1.44	5.80
Medical institutions	bed	1.16	0.56	6.72	5.80
Educational institutions	student	0.20	0.10	1.20	5.80
Cultural institutions	spectator	0.33	0.16	1.92	5.80
Sanatoria and rest houses	2 beds	0.93	0.45	5.40	5.80
Airports, bus depots, railway stations	m ²	0.52	0.25	3.00	5.80
Gambling-houses	m ²	0.52	0.25	3.00	5.80
Paid parking lots	place	0.50	0.24	2.88	5.80
Municipal waste	m ²	0.02	0.01	0.12	5.80

Table 10 Average tariffs for the residential sector, enterprises, and organisation

The calculation, based on the average tariff rate of GEL 0.3 and the average accumulation rate of 1 m³ of SHW per capita, shows that the payment for each resident is GEL 3.6 (=0.3x12) for 1 m³ of waste disposed, whereas the average tariff for enterprises is GEL 5.8. Thus, the client pays only about 60 % of the official cost of the services.

The tariffs, established for other types of clients, don't cover the expenses of the communal enterprises, associated with SHW collection and disposal.

The payments for the services rendered are made by bank transfers to the accounts of the corresponding communal enterprises.

1.4.6.4. COMPENSATION OF THE LOSSES

The low rate of recovery of the fees and the low level of the tariffs has obliged the Municipality of Batumi to compensate the losses of the Company with subsidies. **The amounts received by the company for 2002/2003/2004/2005 are:**

1.4.7. INVESTMENTS

1.4.7.1. DECISIONS OF INVESTMENTS

Description of the process of decision of the investments

1.4.7.2. FUNDING OF THE INVESTMENTS

Description of the process of decision of the financing of the investments

1.4.8. DUMPS/LANDFILLS

1.4.8.1. GENERAL DESCRIPTION

As of 01.06.2005r, there are 4 dumps/landfills on the territory of Adjara. The characteristics of the existing landfills are set out in Table 11.

1.4.8.2. SERVICE AREAS

Each of the four landfills service specific administrative units. The service areas are indicated in the following scheme:



Graph 4 Service areas of administrative units

1.4.8.3. UNAUTHORISED DUMPS

There are some unauthorized dumps in some parts of the territory of the republic. The data on the areas and amounts of waste are unavailable. There are 9 such unauthorized dumps.

Parameter	Location			
	Batumi	Kobuleti	Keda rayon	Khuloy rayon
Number of SHW dumps/landfills	1	1	1	1
Is the dump authorised?	Yes	Yes	Yes	Yes
Availability of authorising documents	No	No	No	No
Distance from the landfill border to the nearest locality, km	1.5	0.8	0.5	5
Distance from the centre of a large locality, km	10	4	10	15
Total area of the landfill, ha	18	1.6	0.15	0.15
Area, already under waste, ha	3	1.6	0.02	0.03
Average thickness of the waste layer, m	3,5	2	2	3
Year of opening	1967	1955	1998	1987
SHW inflow from the residential sector, m ³ /year	165,640	17,400	2,200	4,620
SHW inflow from the enterprises (under contracts), m ³ /year	129,000	6,554	400	3,880
Municipal waste inflow, m ³ /year	36,360	5620	200	1,560
Industrial and construction waste, received by the landfill	1,200	No	No	No
Total amount of accumulated waste, m ³	7,600,000	-	25,000	10,000
Operating reserve, m ³	-	-	20,000	30,000
Fence around the landfill	No	No	Yes	No
Landfill guard station	Yes	No	Yes	No
Availability of weighing facilities	No	No	No	No
Availability of telephone at the guard station	Yes	No	No	No
Number of bulldozers/tractors in service	1	1	1	1
Number of bulldozers/tractors out of service	-	1	-	-
Number of guard	3	-	2	-
Number of workers, handling waste	4	1	3	-
Number of bulldozer/tractor operators, handling waste	1	1	1	1

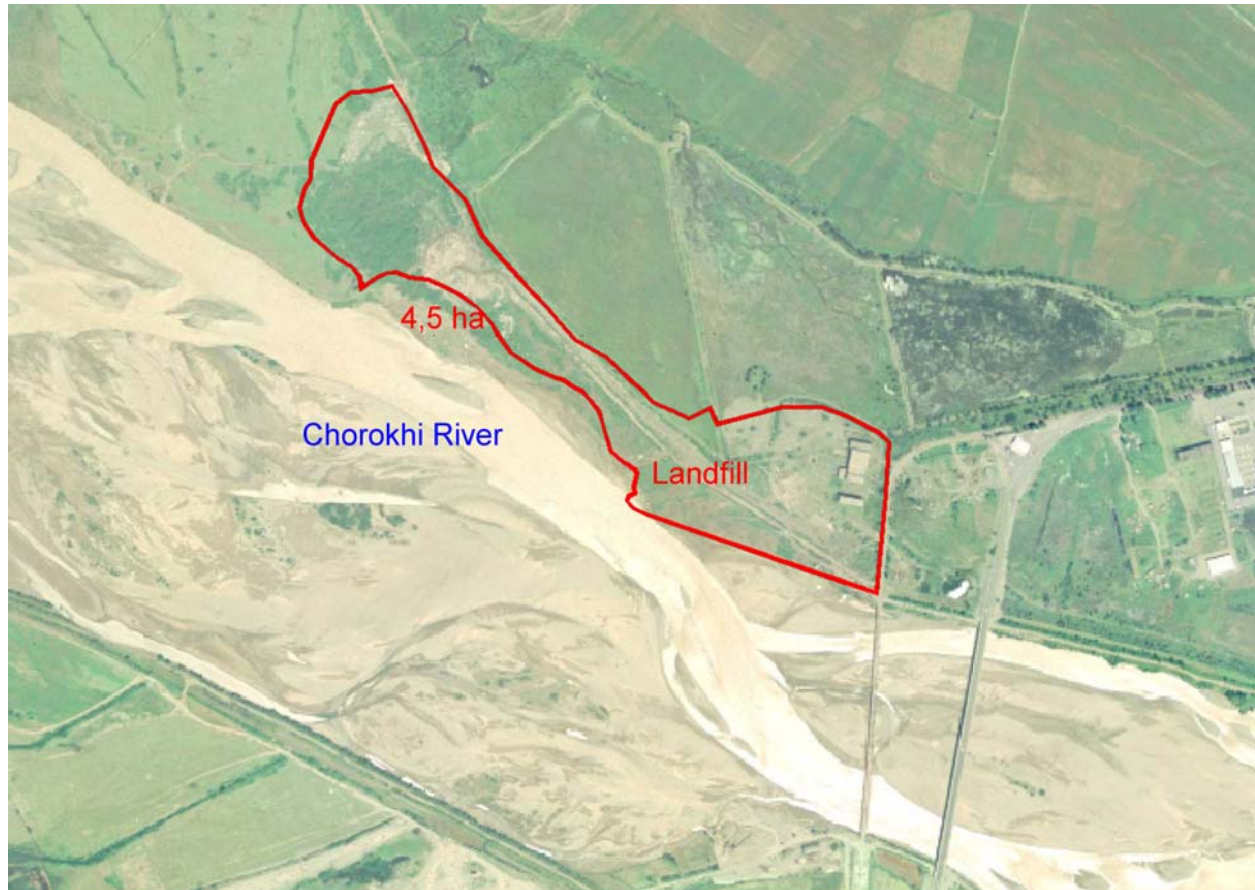
Approximate number of scavengers, practicing unauthorised collection of some components of waste	120	10	0	3
--	-----	----	---	---

Table 11 General description of the existing landfills

1.5. Landfill of Batumi

1.5.1. SITUATION

The landfill of Batumi is situated between the airport and the river, bordering the river. The next picture shows approximately the perimeter of the landfill. The occupied surface is today 19 ha.



Map 3 Batumi landfill

A wall of concrete has been built along the river at the level of the bridge as on the next pictures.



Further, the river has a curve and the flow is progressively eroding the landfill as on the next pictures.



The superposition of the air photo of 1999 and the today's contour shows that about 4,5 ha of landfill disappeared.

The main effects on environment are:

- the leachates are polluting the river;
- a lot of plastic bags and other waste are carried by the stream until the beaches.

1.5.2. REMEDIATION

The landfill must be used until a new sanitary landfill will enter in operation, which can be expected within one or two years.

The objective of the remediation is to protect the landfill from the erosion by the river, to protect the environment of the flying of plastics and papers, and eventually to protect the river from the leachates.

1.6. Dumpsites of Kobuleti

1.6.1. SITUATION

The term of landfill is not proper. Along the road from the city of Kobuleti to the former aerodrome the solid household waste of the city have been disposed directly in the wetland, so forming a dozen of dumpsites. So this street could be called Dumpsites Avenue !



Map 4 Kobuleti dumpsites







1.6.2. REMEDIATION

All this wetland area can be considered as seriously contaminated by the leachate of the waste. It may be hoped it's only domestic waste!

The waste is literally bathing in the water. This wetland is of a great interest, ecologically if not economically (tourism, market gardening). There's no solution able to contain the pollution of the waste and to insulate them from the environment. So the only one realistic solution should be to pick back these waste and to dispose them in the future sanitary landfill. A visual estimation is a size order of 200,000 m³ accumulated.

1.7. Collection

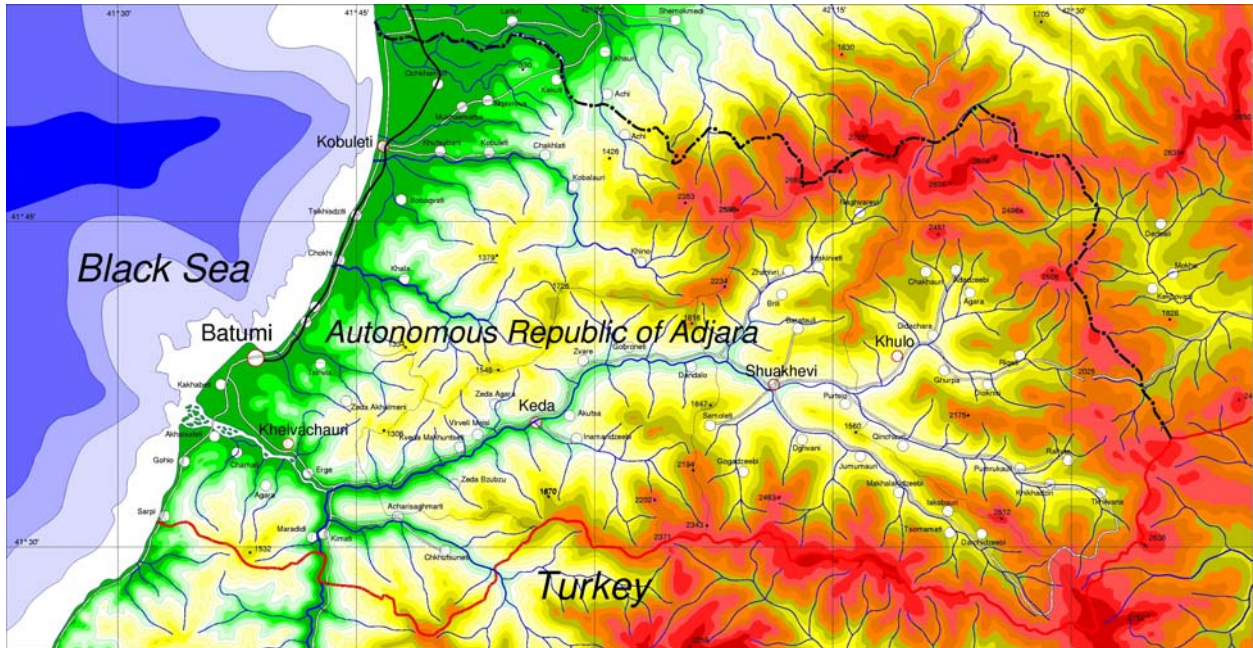
Today the solid household waste are collected in the coastal area and principally in the cities of Batumi and Kobuleti. The same cannot be said about the mountain area.

1.7.1. MOUNTAIN AREA

This area, which constitutes the main part of the territory of ARA, is characterized by:

- strong relief with summits > 2500 m and deep valleys steeply sloping;
- few roads and in a bad state (often including portions without revetment);
- very dispersed housing.

This area includes principally the rayons of Keda, Shuakhevi and Khulo. We have visited these three cities and met the people in charge of the waste management. As to say, there's no waste collection in this area.



Map 5 Relief of Adjara

These three cities use an ordinary truck and several waste containers and in fact they deserve only a part of the administrative centre of the rayon:

City	Inhabitants		Park Containers
	City	Rayon	
Keda	1,276	20,172	25
Shuakhevi	988	22,042	15
Khulo	1,168	34,225	4
TOTAL	3,432	76,439	

Table 12 Waste collection in the mountain area



With such an equipment, the method of collection is inefficient as on the following pictures. Two workers transfer the waste from the container to the truck with a shovel, at the beginning directly, then they rock the container and take the waste on the ground. The containers are waterproof so with the local rainfall (between 2 and 4 m per year) they are often full of water which run on the ground when the container is rocked.



It must be noted there's in Shuakhevi an original equipement for a housing zone: a hopper.



The cities of Shuakhevi and Khulo use a common dumpsite located half-way between them in a bottom of the valley just close the road.



It's very easy to access for the trucks but there's not any protection of the environment. The waste are disposed and are supposed to fill progressively this valley until they fall in the river with the rainfalls. In the meantime, the leachates go directly to the river.

The city of Keda uses a dumpsite in the bed of the river, in a liable to flooding zone. This dumpsite is built with concrete walls. We were told it was used for more than six years but the few quantity of accumulated waste indicates that the dumpsite is regularly clean out by the spring floods.



Out of that, people are creating and using a lot of little convenient dumpsites as close as possible of the housings, as this one in Khulo.



1.7.2. COASTAL AREA

Despite to the difficult economical situation, the City of Batumi is noticeably clean. The city is equipped with containers and trucks and the waste are regularly collected. It's not the same for the rest of the coastal area which is also characterized by few roads in the rural zone. An other important point is the impact of tourism. During the four months of summer there's an additional population of 100,000 tourists with an other way of life and so producing different waste in terms of quantity (more kg/inh/day) and quality (packaging waste).

2. Summary of the Project

The Project aims to be a whole and complete programme of solid household waste management on the territory of the ARA. The concrete objectives are to reach:

- 100% waste collected;
- 100% fees paid;
- 100% waste disposed in safe conditions (sanitary landfill or recycling).

A conditional objective is to create a true Inspection of Environment with the means to control all the waste management.

The Project includes the following main parts:

- construction of a new sanitary landfill in aim to have a safe way to dispose the waste;

- closure and "safetyzation" of the landfill of Batumi;
- remediation of the dumpsites of Kobuleti;
- creation of a regional waste management company able to progressively ensure a good level of service on the whole territory;
- development of new schemes of waste management in the mountain area;
- public awareness;
- Inspection of Environment.

The key parts are the following.

2.1. Construction of a new sanitary landfill

The local authorities have selected a site for the construction of a sanitary landfill. At a first glance, the site is particularly convenient for a sanitary landfill. It is located very close the main road between Batumi and Kobuleti. It has the shape of a natural basin. It seems to be located on a thick layer of good clay. It's far from the neighbour inhabitants.

The land is supposed to be for agricultural use even if today it's a fallow land covered of fern. According to the Georgian law, there's a huge tax to pay when an agricultural land is used for other purposes. The question is: should local authorities use state subsidies to pay a state tax?

2.2. Closure of the Batumi landfill

The landfill must be used until the new sanitary landfill will enter in operation, which can be expected within one to three years.

The objective of the remediation is to protect the landfill from the erosion by the river, to protect the river from the leachates, to protect the environment of the flying of plastics and papers.

2.3. Remediation of Kobuleti dumpsites

All this wetland area can be considered as seriously contaminated by the leachate of the waste. It may be hoped it's only domestic waste!

The waste is literally bathing in the water. This wetland is of a great interest, ecologically if not economically (tourism, market gardening). There's no solution able to contain the pollution of the waste and to insulate them from the environment. So the only one realistic solution should be to pick back these waste and to dispose them in the future sanitary landfill. A visual estimation is a size order of 200 000 m³ accumulated.

2.4. Creation of a Regional Waste Management Company

Let's be clear. Until now, there's an efficient SHWM company in Batumi and quite nothing else. If the SHW are regularly collected in Batumi, the target is that some day all the SHW on the territory of the ARA will be collected and safely disposed. At the size of the ARA, one company is surely the best way to provide efficiently the service.

It can be estimated that only 1/3 of SHW are today collected and disposed within the territory of ARA. The rest is burned or put in dumpsites. The RWMC will aim to provide progressively a solution for waste collection and disposal all over the territory of the ARA. New schemes of waste collection must be experimented and applied because the main factor is the difficulty to carry the waste. So this programme will be linked to the improvement of the roads: the problem is not so to collect the waste than to carry it to a sanitary landfill. It must be added that the winter conditions are not favourable.

3. New Sanitary Landfill

3.1. The site

3.1.1. LOCATION AND STATE

The site for the new sanitary landfill is a wild area close (about 200 m) the main road Batumi-Kobuleti. At this place there's a bus stop which can be considered as the "entrance" of the site. The coordinates of this point are: N41° 42' 15.8" and E41° 44' 09.9". The local authorities have defined a perimeter for this new landfill which contains a surface of 56 ha as it is showed on the next picture.



Map 6 New landfill site

It has a shape of a natural basin, made by a loop of the hills. At the level of the road, the altitude is 16 m and on the site, the hill culminates at 108 m. This area is not cultivated. It is covered of fern and it can be seen some cows looking for food. The closest neighbour is a farm at the South-West of the site which is located at 200 m from the perimeter and 500 m from the limit of landfilling which is envisaged in the project. On the previous picture, only the main road (NW of the picture) is really a road. All the rest are dirt tracks only usable by local minibuses ("marchoudka") and AWD cars.

3.1.2. GEOLOGY – HYDROGEOLOGY

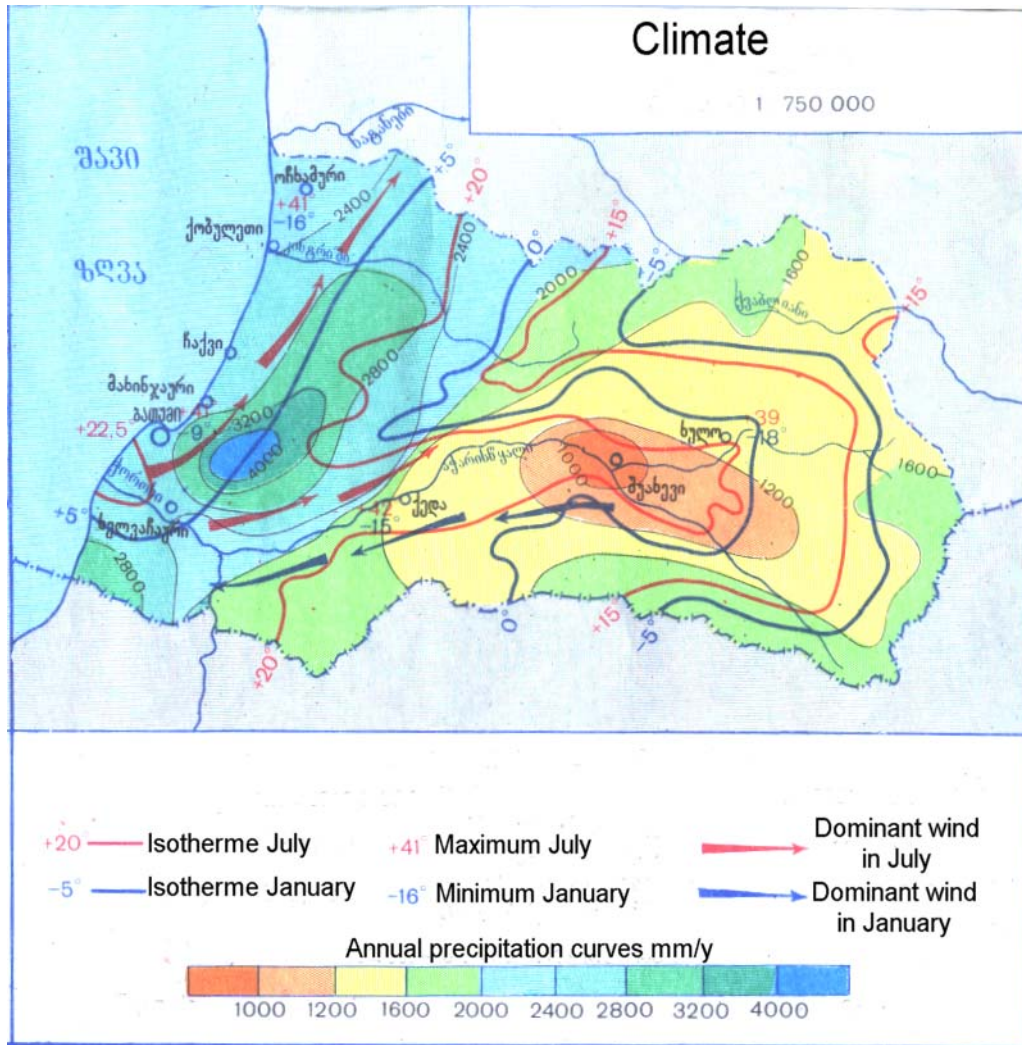
The regional service of geology indicates that the underground is made of a layer of clay of sedimentation originated in the decomposition of the eruptive rocks of the mountains. The average thickness of the clay should be around 16 m. Several hundreds meters far from the site, a tunnel has been recently burrowed so it's possible to see this clay. It seems that the permittivity of the clay is as size order 10^{-7} m/s.

On the site, there's a source feeding a very little brook after the rains (several litres/second).

Under the clay, it may be a watertable of underground water but there's no such indication.

3.1.3. CLIMATE

It's a key point for a project of sanitary landfill. The annual average rainfall at this place is 2000 mm/y. It means that a particular attention should be paid to the management of the running waters and the rainwater on the landfill in aim to avoid the production of leachates.



Map 7 Climate

3.2. State of art and regulation

Today there's no particular Georgian regulation about sanitary landfills if not the willingness to approach the European Directive. From our part, we consider that the European Directive should be applied excepted for the nature and the composition of the admitted waste.

3.2.1. ADMITTED WASTE

The today's objective is to take all the existing waste under control, what we call 100% collected and 100% safely disposed. It's clear that it includes today a large part of organic waste that the Directive wants to forbid. But the sanitary landfill is a very good process of treatment of organic waste specifically with the biogas collection and valuation. So should be forbidden only the waste offering a risk for the protection of the environment as chemical waste and toxic waste. The decision of landfilling industrial waste should be taken case by case by the Department of Environment of the ARA.

3.2.2. GEOTECHNIQUE

The protection of the environment is focused on the protection of underground waters. It includes a passive barrier and an active barrier.

2 layers of clay provide the passive barrier: 5 m of clay with a permittivity $<10^{-6}$ m/s topped by 1 m of clay with a permittivity $<10^{-9}$ m/s. The laboratory tests on the existing underground clay will show what can be realistically done. It's not sure that a deposit of clay $<10^{-9}$ m/s can be found at a reasonable distance from

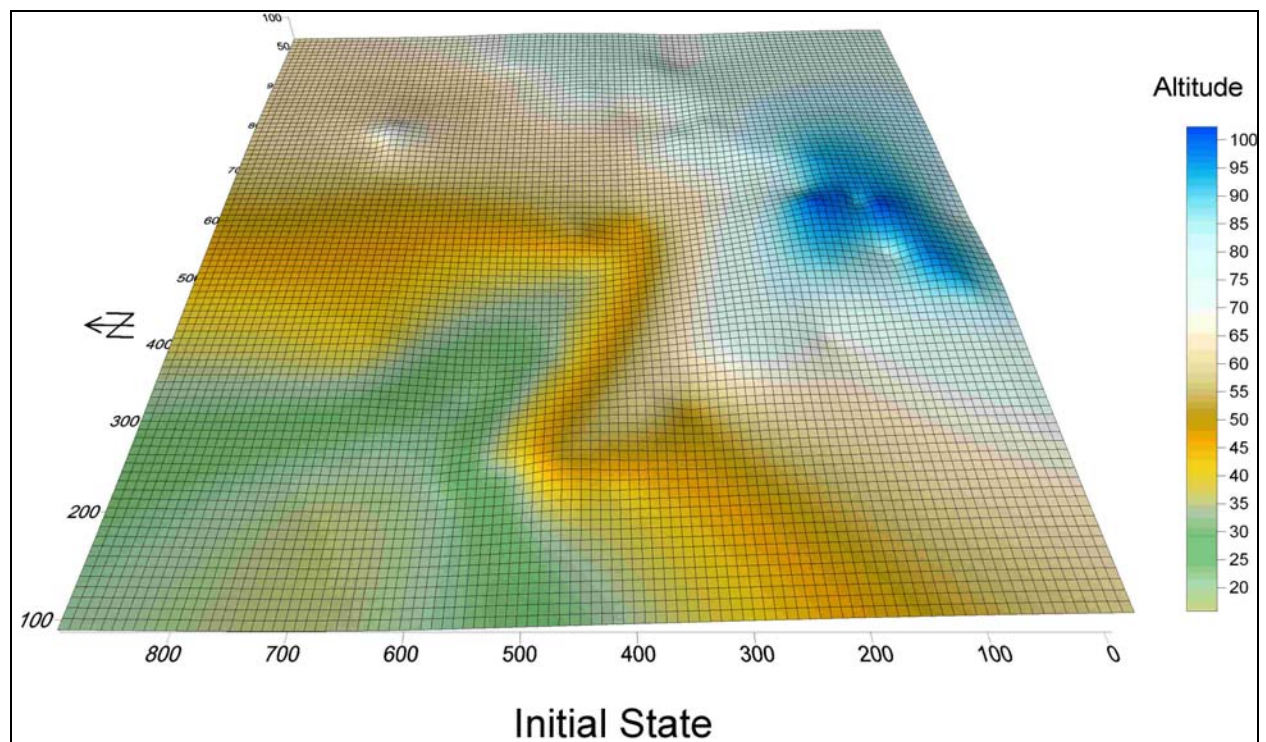
the site. On the other hand, if the permittivity of the natural material in place is close to 10^{-8} m/s or 10^{-9} m/s and the thickness really 16 m, it can be admitted that the natural materials will provide an efficient passive barrier. So the studies will pay a particular attention to this question.

The active barrier is a draining system including a relatively waterproof layer (made of a geomembrane) and a relatively permeable layer (made of gravels). The layer of gravels includes draining pipes collecting the leachates by gravity and evacuating them toward the purification station. It's better if that entire network can operate only by gravity and the existing slopes of the site are very favourable.

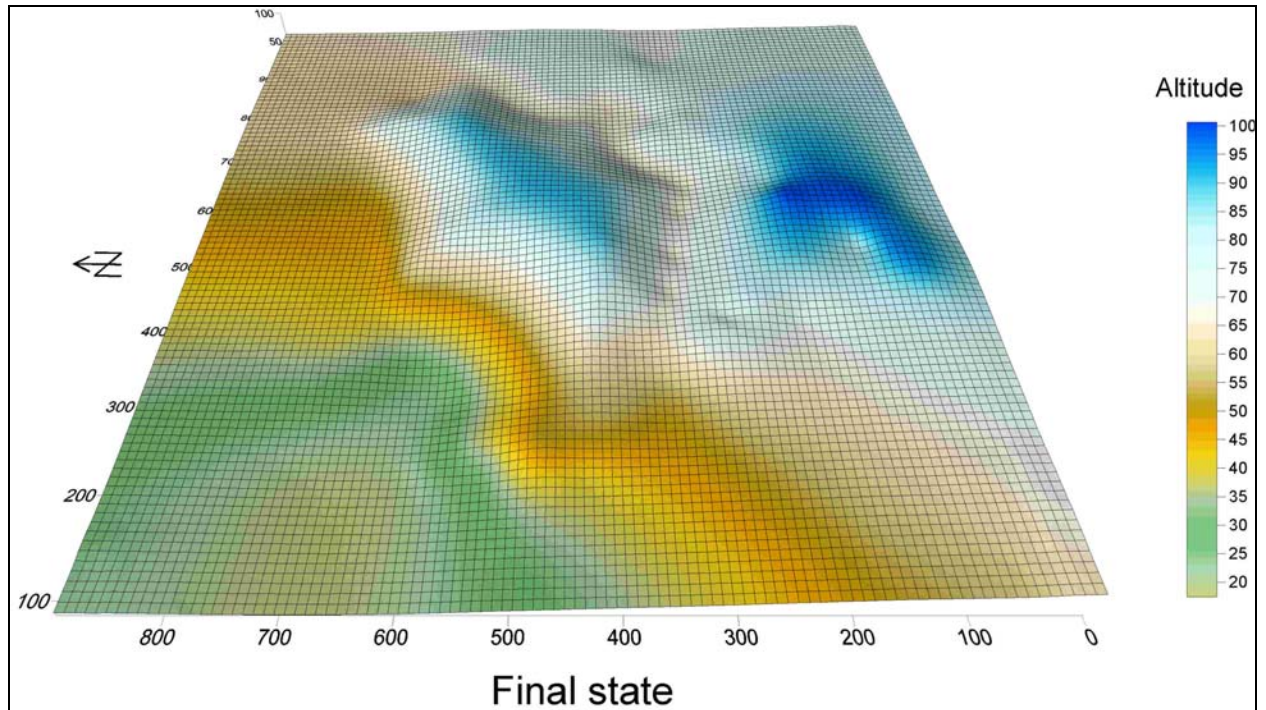
There are a lot of international standards for the works required for the construction of a sanitary landfill. It covers the fields of the application of geomembranes, the tests of geotechnique, etc. They are defined in ASTM, ISO, CEN, or national standards. They don't exist in the Georgian standards. So the international standards will be applied for the construction of the landfill.

3.3. Design of the landfill

The design aims to return to the landscape a natural aspect after the operations as it can be shown on the next pictures.

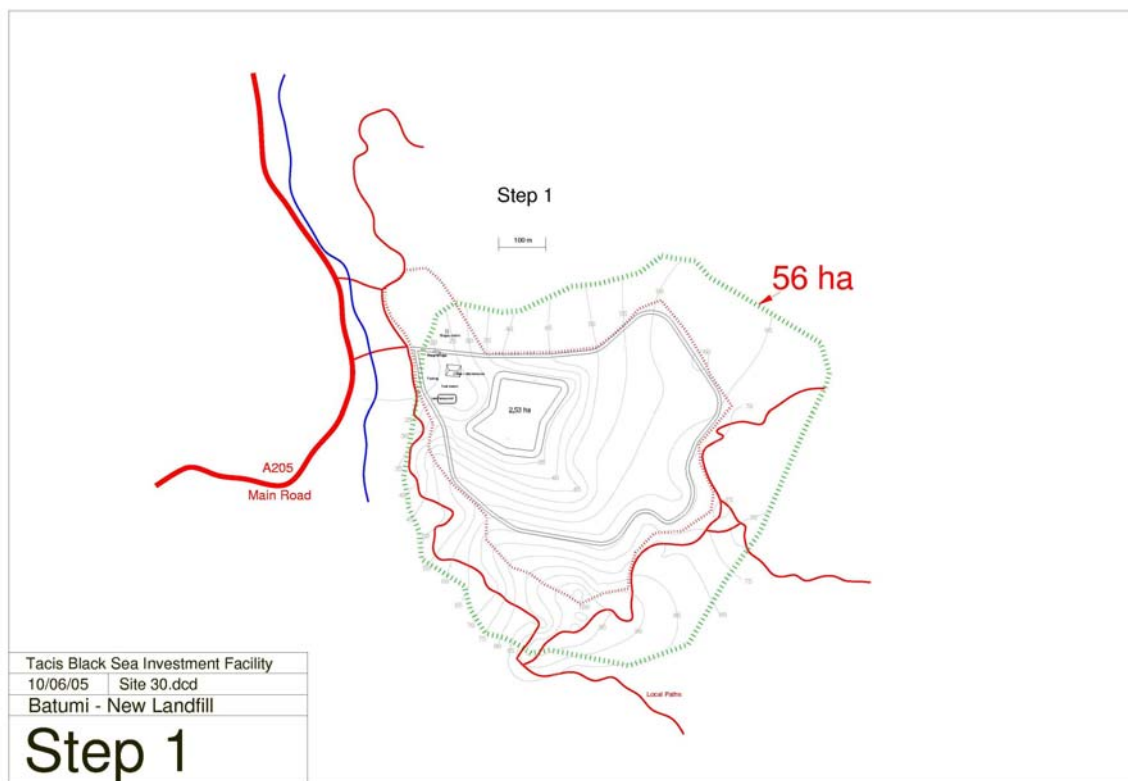


Drawing 1 Perspective of the initial state



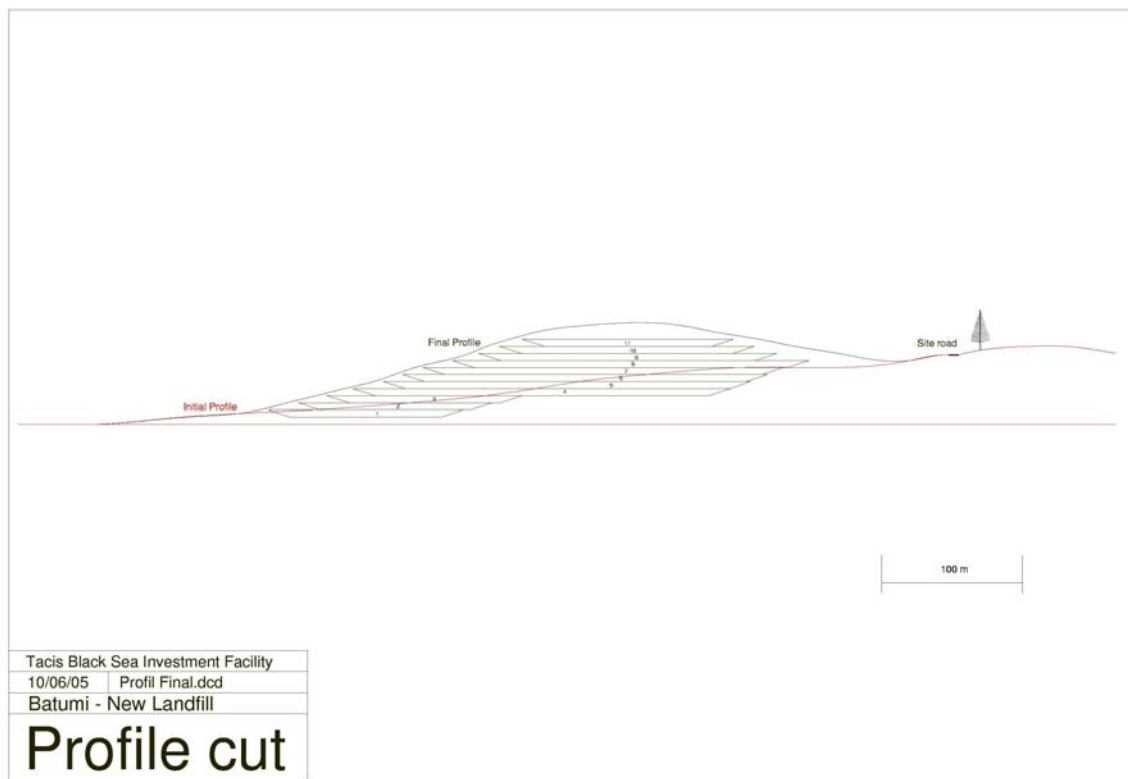
Drawing 2 Perspective of the final state

So starting from the bottom of the site, the rows will be built by levels of 5 m and superposed. The shape of the row is deliberately non geometric for the final natural aspect. The first row should be implemented as on the next picture. In annex are the successive rows.



Drawing 3 Design of the first row

The cut of the final state should be like the next picture.



Drawing 4 General cut of the landfill in final state

This design of the landfill provides a capacity of 3.5 – 4 million m³.

The design includes a peripheral road which will provide an access to the successive rows for the trucks. This peripheral road will include ditches disconnecting the running waters from the rows. Along this road the facilities networks can be implemented as the electrical power line. In fact, the necessary surface of the landfill could be limited to this road, so around 25 ha. Along the road, a fence of 2 m height must forbid the entrance of any people on the landfill but also the entrance of any animal.

A dirt track must be implemented deservng the successive rows for the circulation of the compactors between the rows and the maintenance workshop.

3.4. Equipment of the landfill

The landfill will be equipped with:

- Gate and guardians post
- Weighbridge
- Equipment for the cleaning of the wheels of the trucks after downloading on the landfill
- Office, laboratory and sanitary premises
- Meteorological station
- Maintenance workshop
- Fuel station
- Leachates treatment station

- Storm rain pond
- Biogas pumping station (with flare, then with electricity power generators)

The landfill must be connected to:

- Drinkable water network
- Electricity (Medium voltage) network
- Phone network

The wastewaters of the site (sanitary, office) must be treated on place.

The means of fighting against fires must be carefully provided.

3.5. Estimated costs

The objective of this part is to estimate the amount of the first investment for its funding and the cost of landfilling in €/ton as the price to pay for the disposal of waste.

3.5.1. PRELIMINARY STUDIES

These studies include the geological study which is always costly with the borings and the laboratory analysis. The objectives of the preliminary studies are:

- to forecast any potential impact on environment;
- to adjust the preliminary design with the results of the geological and hydro geological results;
- to define all the measures allowing to control the impact on the environment.

A team of specialists must do these studies. It needs usually 6 months. Associating EU and local consultants, the cost will be around 200,000 €.

3.5.2. ENGINEERING

Before to start the construction of the landfill, it's necessary to study in details all the operations that must be done and to produce all the dossiers of drawings and instructions for the enterprises that will make the construction. It's also to produce all the dossiers for the tenders. There will be imported equipments, so the operations of custom clearance must be prepared.

In parallel a Quality Assurance Plan (QAP) must be conceived and written. This QAP will define all the key-points that will allow to certify that the landfill has been correctly built and so to guarantee the protection of the environment.

At least, the management of the safety of the works must be prepared.

The budget for the engineering will be between 100,000 to 250,000 € according to the team will include more or less EU and local skills.

3.5.3. CONSTRUCTION

We'll distinguish several parts.

The **infrastructures** are the works that will be done once for ever and that will not evolve all along the life length of the landfill. Of course, there will be some maintenance. The cost of these infrastructures is amortized on the total tonnage that will be received by the landfill.

Each row will be built before its operation. At the beginning, the first row will be built. One year before it's full, the second will be built, and so on. So there's a budget of investment per row. The construction of the row is amortized on the tonnage buried in the row.

At the end of the operations, the row is closed and so there's a budget of **final cover**. The cost of the cover of the row is amortized on the tonnage buried in the row.

With the general design of this particular landfill, the successive rows will partially cover the previous one, so the cost and the amortization of the construction and the final cover must be appreciated globally.

3.5.3.1. INFRASTRUCTURES

Designation	Amounts k€	
Civil Works		
Earthworks		50
Main access		150
Office building		90
Maintenance building		140
Ponds and waste water treatment		150
Internal road		230
Fence and gate		150
Total Civil works	960	
Utilities		
Connection to High Voltage Line		75
Substation High Voltage		125
Connection to water network		10
Fuel station		30
External lighting		20
Total Utilities	260	
Equipments for the process		
Leachates network		50
Leachates treatment		150
Storage of materials		15
Biogas network		50
Treatment of the biogas		300
1° Electrical power group		400
Weighbridge		40
Vehicles washing unit		10
Total process	1015	
TOTAL	2235	

Table 13 Cost of infrastructures

3.5.3.2. CONSTRUCTION OF A 2 HA ROW

Designation	Amounts k€	
Civil Works		
Earthworks		250
Main access		30
Base of gravel		120
Base HDPE		165
Total Civil works	565	
Utilities		
Draining of leachates		50
Draining of biogas		60
Total Utilities	110	
TOTAL	675	

Table 14 Cost of construction of the first row

3.5.3.3. COVER OF A 2 HA ROW

Designation	Amounts k€	
Civil Works		
Earthworks		100
Ceiling gravels		115
Cover HDPE		130
Vegetable soil		30
Plantations		30
TOTAL	405	

Table 15 Cost of the cover of the first row

3.5.3.4. EQUIPMENTS

Designation	Amounts k€	
Equipments landfilling		
Compactors		600
Excavator		80
Tractor		20
Bulldozer		60
Truck 10 t		30
2 vehicles 4x4		20
Minibus		15
Individual equipments		20
Tools		25
Total	870	
Equipments services		
Laboratory		50
Outside sensors		50
Furniture		15
Computers		15
Total	130	
TOTAL	1000	

Table 16 Cost of the equipments

The equipment should be renewed each 7-8 years. So they will be amortized on the third of the capacity of the landfill.

3.5.3.5. OPERATION

- Manpower

On the base de 100 000 t/y buried waste:

- 1 engineer, Manager of the landfill
- 1 accountant, in charge of the weighbridge
- 1 secretary
- 1 chief of quay (responsible of the downloading of the trucks on the site)
- 2 conductors of compactor
- 4 sorters, cleaners
- 1 environment monitor
- 4 guardians (presence 24/24 7/7)

- Budget

Designation	Amounts k€
Maintenance of equipments 8%/y	55
Wages	75
Electricity	15
Fuel expl.500 l/d	40
Telephone - fax	2
Analyses	8
Repairs of tracks	25
Supplies for office	2
Supplies for wastewater treatment	15
Supplies for measures	3
Taxes	45
Divers	10
Charges of exploitation	295

Table 17 Budget of operation costs

3.5.3.6. FINANCIAL CHARGES

The construction and the cover of the rows cannot be considered as perennial investments. All along the life of the landfill, it will be necessary to build and to close rows. In these conditions, it's difficult, in full financial orthodoxy, to propose to amortize investments which will have a life length of 1 or 2 years.

For the rest, either is considered the frozen capital or the financing of this investment with a credit, it's good to estimate financial charges. As a first approach, the amount of the cumulated interests is calculated for a financing at 5 % on 20 years. It aims only to give a size order of the use of a financial resource.

3.5.3.7. PROVISION FOR CLOSURE

After the end of the operations, the biological activity of the waste will continue for 25 years. The cost of the following and the maintenance that will be necessary for 25 years must be provisioned. It also may happen an accident of pollution and the financial means to remedy it must be disposed. So it's usual to provision 1 €/t of incoming waste.

3.5.3.8. GLOBAL COST

Item	Investment	Amortiz. /4 Mt	Amortiz. /1,3 Mt	Amortiz. /300 kt	Direct costs
Studies	200000	0.050			
Engineering	250,000	0.063			
Infrastructures	2,235,000	0.559			
Construction of rows	675,000			2.250	
Cover of rows	405,000			1.350	
Equipments	1,000,000		0.769		
Training	100,000	0.025			
TOTAL Investment	4,865,000	1.274	0.769	3.600	
Operation	295,000				2.950
Provision for closure					1.000
Financial charges	2,297,622	0.574			
TOTAL cost /ton	9,59				3.950

Table 18 Global costs

The final result is that the sanitary landfill:

- is an investment of an order of 5 M€;
- has a global cost, all included, of an order of 10 €/t.

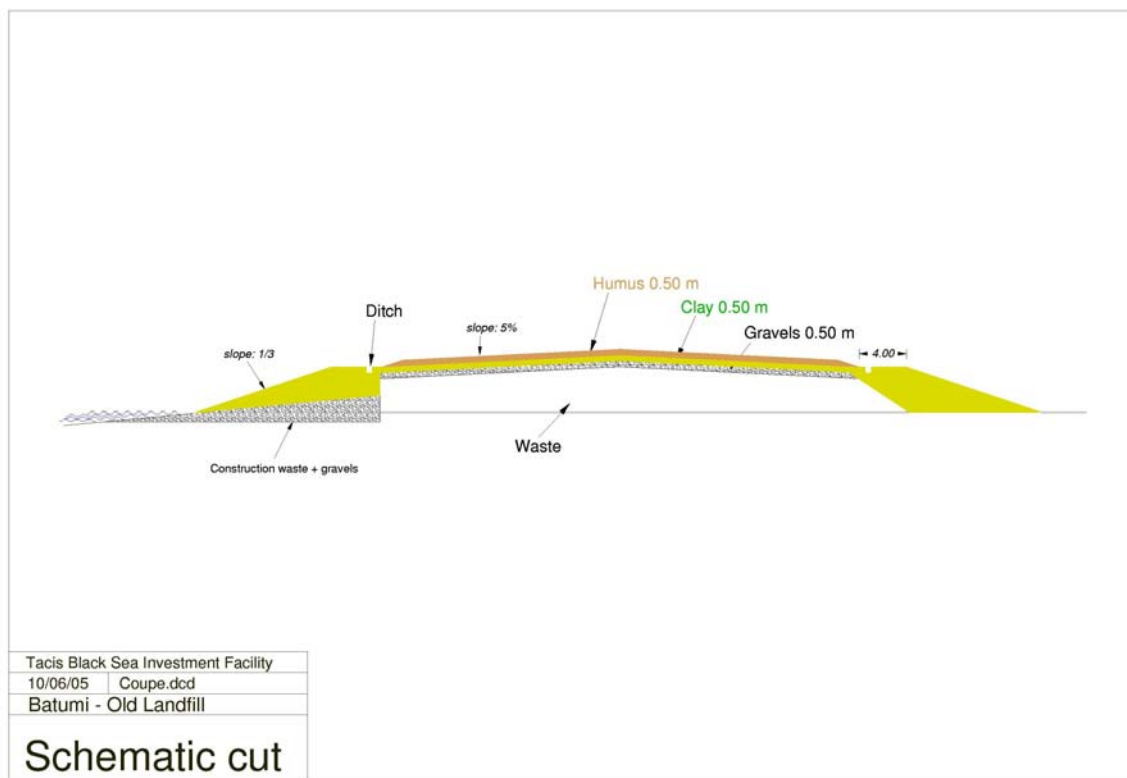
4. Closure of Batumi Landfill

4.1. Principle

The principle is to enclose completely the waste with a barrier of clay. The biodegradation will continue to produce leachates and they cannot be collected because the landfill is implemented on the gravels of the former beds of the Chokhoki Estuary. This soil is very permeable and it's not economically affordable to create a waterproof layer under the waste. But as it's household waste, the pollution of the leachates is only made of organic carbon and the impact on environment (estuary and sea) should be negligible in the measure the production of leachates should be limited by an efficient cover of clay.

The second key-point is to definitively avoid the erosion of the landfill by the river. So a study must define the works allowing to create an effect of deposit of silt along the landfill.

4.2. Works



Drawing 5 Scheme of the works for the closure of Batumi landfill

As soon as possible, the waste close the river must be moved with a bulldozer and a dyke built of clay (mix of clay and sand with a permeability between 10^{-6} and 10^{-7} m/s). This dyke must be implemented on a mix of construction waste (big blocks of concrete) and gravels able to resist to the stream of the river. On the side of the river, the slope must be $< 1/3$. On the top, a lane of 4 m width, including a ditch on the side of the waste. This ditch will collect the running water and discharge them in a pond. On the side of the waste, the slope can be around from 1/1 to vertical. It must be disposed by layers of 50 cm carefully compacted.

The existing waste and the new waste until the closure of the landfill must be disposed in aim to obtain a final top slope of 5 %.

On the land side, the same dyke must be progressively built.

At the end of the operation of the landfill, the waste must be covered. The minimum is to dispose a layer of 50 cm of clay. The best is to dispose 50 cm of gravels, a geotextile, 50 cm of clay, 50 cm of top soil for the recultivation. Vertical drain pipes can be implemented for the exhaust of the biogas, and even, if there's enough flow, to implement a flare and a generating unit.

But the length of this dyke is about 2.5 km and the surface to cover is 19 ha and it may be expensive. So a variant must be studied. It is based on the idea to push the waste in aim to make a 6 m thick layer. It should seriously reduce the length of dyke and the area to cover.

4.3. Cost

A detailed study must value the two variants. On the base of the volume of the dyke and of the cover, a first estimation of the budget is around 500,000 €.

5. Remediation of Kobuleti dumpsites

5.1. Principles

The Government of the Autonomous Republic of Adjara must decide immediately to forbid the disposal of waste in this area and to put the means to apply this decision. It may be to carry the waste of Kobuleti to the landfill of Batumi.

When the new sanitary landfill will be in operation, the removal of the waste can be easily organised with a bulldozer, an excavator and three trucks, considering 1 h to load the truck and 2 h for the round trip. The necessary time will be estimated after the estimation of the volume.

5.2. Cost

The City and/or the Rayon of Kobuleti have not paid for the wild disposal of this waste during the past years and the question of the responsibility and of the expenses for this ecological catastrophe can be put.

On the base of 100,000 m³ accumulated, it's possible to move with one crew of a bulldozer, an excavator and three trucks:

- 12 m³ per truck round
- 3 rounds per truck and per day, so 100 m³ per day

On this base, the budget should be as size order:

Amortization of the equipment	150,000 €
Fuel	100,000 €
Maintenance	20,000 €
Wages	30,000 €
TOTAL	300,000 €

6. Creation of a Regional Waste Management Company

6.1. Waste collection

It must be considered that within a short term the existing equipment of waste collection must be renewed.

According to the figures of the existing equipment, the existing park of trucks and containers must be progressively completely renewed and an additional park is necessary for the extension of the collection

to the today's non-deserved areas. The capacity of collection of 1 truck is estimated as 6,000 m³/y. The needs in containers are calculated on the base of:

- Urban areas: density of 0.25 and a daily collection; for the containers, the figures are minored because the refuse chutes;
- Rural areas: density of 0.41 2 weekly collections; the figures are majored for Kobuleti rayon because the tourism.

So it can be scheduled the following investments:

Cities, Rayons	N inh (as of 01.05.05)	Trucks			Containers		
		To be changed	Extension of collection	Total needs	To be changed	Extension of collection	Total needs
	x1000	pcs	pcs	pcs	pcs	pcs	pcs
Cities (total)	142.4	24	2	26			2,400
Batumi	123.6	18	2	20			2,000
Kobuleti	18.8	6*		6			400
Rayons	239.2	10	30	40			7,600
Kobuleti rayon	70.5	2	10	12			2,300
Khelvachauri rayon	92.4	4	11	15			3,000
Keda rayon	20.1	1	2	3	25		600
Shuakhevi rayon	22.0	1	3	4	15		700
Khulo rayon	34.2	2	4	6	4		1,000
Total	381.8	34	32	56			10,000
Unit price €				15,000			40
Amount €				840,000			400,000

Table 19 Investment in containers and collection trucks

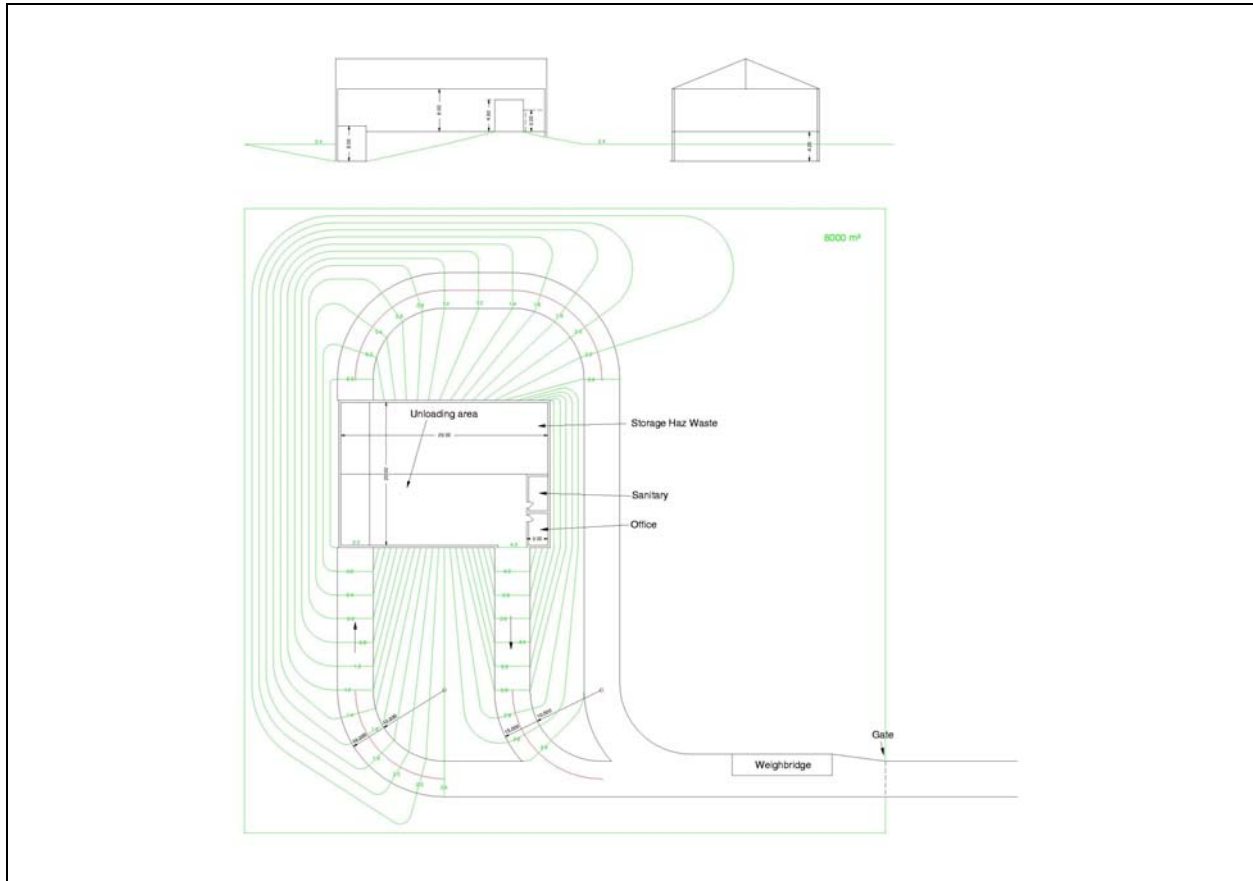
6.2. Transfer stations

The collection trucks are not made to carry the waste between the housings and the landfill: they pass more time for the trip between the collection area and the landfill than for the collection by itself. So it's better to implement in the cities transfer stations.

In a transfer station, the collection trucks which have a capacity of 10-12 m³ download the waste which are reloaded in semi-trailers of 80 m³. The semi-trailers carry the waste to the landfill.

The standard transfer station, as on the following picture, cost 500,000 € and has a capacity corresponding only to the city of Batumi. For the other cities, a solution must be searched, for example with removable trailers, for the transport of the waste to the landfill.

The cost of a standard transfer station is estimated 200,000 €.



Drawing 6 Scheme of a transfer station

6.3. Status of the new company

The last news is that the status of the new company is not yet defined. The Property management department of the Ministry of Finances said that this process can take another month and should be done for the end of July. The inventory of the assets and debts of the Municipal Company of Batumi has been done.

7. Reforms of the Waste Management

7.1. Techniques

The system of collection with refuse chutes and bunkers must be progressively abandoned and replaced by containers because: the efficiency of the picking and loading is very low (1.5 hour for 1 bunker); the bunkers are a source of infection; and it doesn't promote the public awareness about household waste.

New schemes for the collection in the mountain area must be experienced, and then implemented.

7.2. Regulation

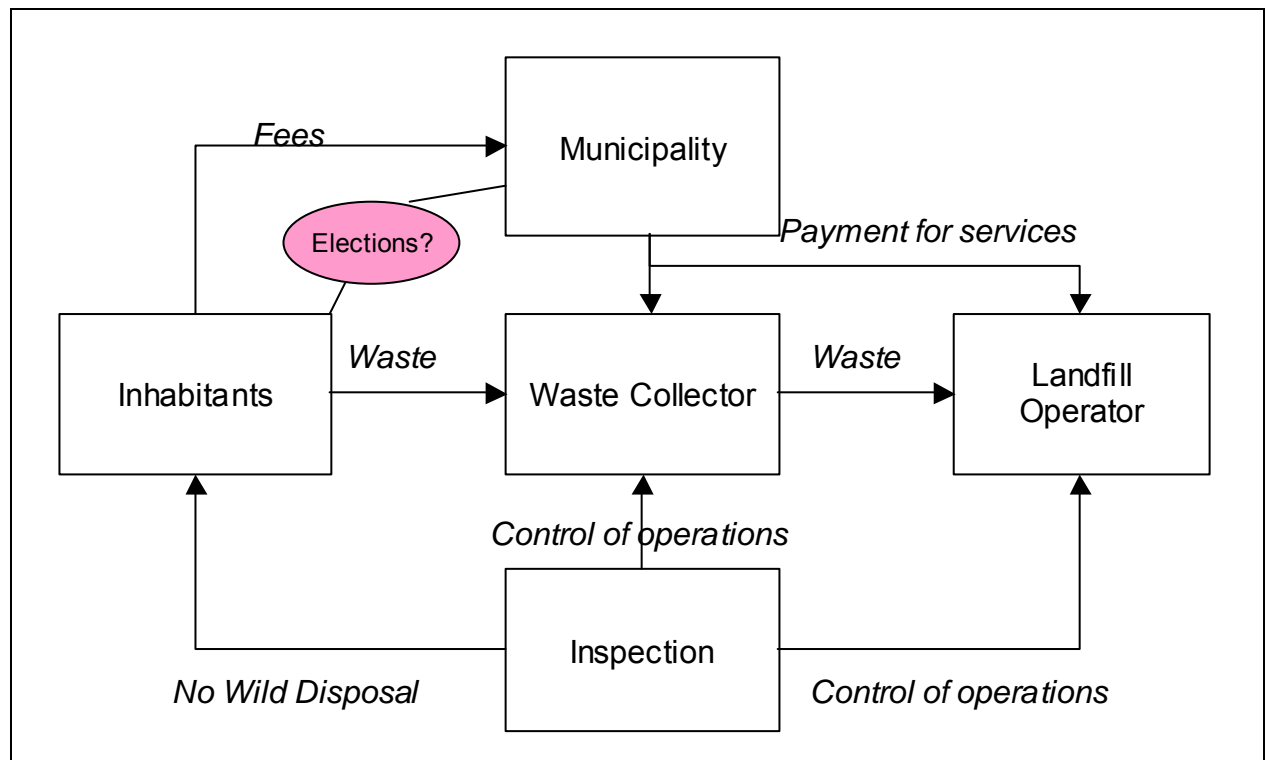
The regulation about waste must be enhanced. The main texts must define:

- The categories of waste with standardized methods for the measure of the hazard and the toxicity of the waste (it exists international standardized methods).
- The duties of the inhabitants, the organisations producing waste, the local self-government bodies, and the obligation to dispose the waste in legal conditions. It must also forbid all unauthorized waste disposal or behaviour as the wild burning. It must fix the fines in case of infringement.
- The creation and the role of a state inspection of the environment.

- The system of sampling, analyses, counter-analyses, norms and standards, for the measure of the state of the environment and of the toxicity of waste.
- The writing and the enforcement of "state of art rules" for the permitting of the waste treatment facilities.

7.3. Separation of the roles

The SHWM involves several actors and their roles must be clearly separated.



Drawing 7 Actors of the SHWM

The inhabitants have to pay the fees to the Municipality and their waste are collected. Never forget that the inhabitants are also the voters.

The Waste collector has to ensure a high level service of waste collection and cleanness of the collection points (containers or others). It is paid by the Municipality on a contract base, including criteria of efficiency and quality, the way to measure these criteria, the penalties or premiums.

The landfill operator has to dispose the waste in regular conditions, including the control of the quality of the waste it accepts. It is paid by the Municipality on a contract base of tons landfilled.

The Inspection controls there's no illegal waste disposal and controls that the operations of the waste collector and the landfill operator are in keeping with the regulations.

8. Divers

8.1. Public awareness

The inhabitants must be involved in this reform of the solid household waste management. The key point is always the behaviour of the inhabitants. The waste is a decision: somebody decides that this object or this material has finished to be useful for him and it becomes a waste. The more often this decision is an automatism and the target is that it becomes conscious.

So the programme will include:

- public opinion poll, in aim to understand the expectations of the population;
- mass-media campaigns;
- sensitization campaigns in schools;
- involvement of the NGOs and specifically the retired people associations.

8.2. Enhancement of the administration

It cannot be a good waste management without a strong control by the administration. For that, a service of Inspection of the Environment must be created and equipped with a small laboratory for the analyses of the leachates and the exhaust of the wastewater treatment. It must include a training of the future inspectors.

9. Financial Planning

9.1. Budget

The global project requires an investment of:

Part of the project	K€
New sanitary landfill	5,000
Closure of Batumi landfill	500
Remediation of Kobuleti dumpsites	300
Regional Waste management Company Transfer station of Batumi	200
Other transfer stations	100
Semi-trailers	300
Collection trucks	840
Containers	400
Public Awareness	100
Administration	160
TOTAL	7,900

Table 20 Global budget of the project

9.2. Affordability

We have calculated the cost of the landfilling in the new sanitary landfill as 10 €/t.

The remediation of the existing landfills and dumpsites cannot be charged on the future waste management. It should be funded by grants or on the local budget.

The cost of the collection could be 8.5 €/t.

So the total cost for the solid household waste collection and disposal should be 18.5 €/t, so ~5 €/m³, so ~11 GEL/m³. The today's cost in Batumi is estimated 5.8 GEL/m³. Today, this cost is not covered by the level of the tariffs, which are 3.60 GEL/year for the inhabitants, and the rate of recovery of the fees. So this project requires a strong effort on the recovery of the fees and a progressive effort of growth of the tariffs.

It's usually scheduled a 5-year transition period.

It can be expected the continuation of the economical recovery of Georgia and ARA. So, if we take into account it's necessary to increase the average fee (for inhabitants) from 3.60 GEL/year to 11 GEL/year, or 0.30 GEL/month to 0.90 GEL/month. The main question remains: is it affordable to ask 0.90 GEL/month/inh for the waste management within 5 years? Today this amount is < 2 tickets of microbus.

It has been said that in 2004 the fees recovered from the population were <10% for the City of Batumi. The new computerized system has been implemented in March 2005 and is giving progressively good results. A particular attention must be paid to reach 100% as soon as possible for the City of Batumi. A part of the population with very low incomes cannot pay at all, so a social welfare system must compensate this part of the fees.

Grants can greatly help the management of this transition period. The structure of the costs of the new solid household waste management includes a big part of amortization of the investments and interests of the loans. So the grants that could fund the project should help to manage the transition by postponing the truth of costs.

9.3. Simulation

The following simulation lays on several hypotheses:

- The tariffs are progressively raised, specifically for the enterprises and the municipal waste;
- The new landfill and the transfer station are operational for 2007;
- The salaries and costs of fuel are estimated on the 2005 base.

	Unit	2005	2006	2007	2008	2009
INCOMES						
Tariff Inhabitants	GEL/inh/y	3,60	5,80	7,20	9,00	11,00
Tariff Enterprises & Municipal	€/t	6,00	9,00	12,00	15,00	18,00
Base 300 kg/inh/year 1 € = 2,10 GEL	€/t	5,71	9,21	11,43	14,29	17,46
N inhabitants paying	inh	123 000	170 000	200 000	220 000	240 000
Incomes -Inhabitants	€/y	210 900	469 500	685 700	942 900	1 257 100
Incomes -Enterprises	€/y	262 800	394 200	525 600	657 000	788 400
Incomes -Municipal waste	€/y	63 000	94 500	126 000	157 500	189 000
TOTAL INCOMES	€/y	536 700	958 200	1 337 300	1 757 400	2 234 500
COSTS						
Collection						
Households						
N inhabitants deserved	inh	123 000	170 000	200 000	220 000	240 000
Waste collected -tons/year	t/y	36 900	51 000	60 000	66 000	72 000
Waste collected -m3/year	m3/y	147 600	204 000	240 000	264 000	288 000
Park of trucks		26	30	34	38	42
Park of containers		2 300	2 900	3 500	4 100	4 700
Amortization of the trucks	€/y	78 000	90 000	102 000	114 000	126 000
Amortization of the containers	€/y	18 400	23 200	28 000	32 800	37 600
Fuel	€/y	156 000	180 000	204 000	228 000	252 000
Salaries /p/month	€	100	110	121	132	145
Salaries Amount	€/y	62 400	79 200	98 700	120 400	146 200
Others	€/y	100 000	100 000	100 000	100 000	100 000
Total	€/y	414 800	472 400	532 700	595 200	661 800
Enterprises						
Waste collected -tons/year	t/y	43 800	43 800	43 800	43 800	43 800
Waste collected -m3/year	m3/y	175 000	175 000	175 000	175 000	175 000
Park of trucks		20	20	20	20	20
Amortization of the trucks	€/y	60 000	60 000	60 000	60 000	60 000
Fuel	€/y	120 000	120 000	120 000	120 000	120 000
Salaries /p/month	€	100	110	121	132	145
Salaries Amount	€/y	24 000	26 400	29 000	31 700	34 800
Others	€/y	50 000	50 000	50 000	50 000	50 000

Total	€/y	254 000	256 400	259 000	261 700	264 800
Municipal waste						
Waste collected -tons/year	t/y	10 500	10 500	10 500	10 500	10 500
Waste collected -m3/year	m3/y	42 000	42 000	42 000	42 000	42 000
Park of trucks		5	5	5	5	5
Amortization of the trucks	€/y	15 000	15 000	15 000	15 000	15 000
Fuel	€/y	30 000	30 000	30 000	30 000	30 000
Salaries /p/month	€	100	110	121	132	145
Salaries Amount	€/y	6 000	6 600	7 300	7 900	8 700
Others	€/y	20 000	20 000	20 000	20 000	20 000
Total	€/y	71 000	71 600	72 300	72 900	73 700
TOTAL Collection		739 800	800 400	864 000	929 800	1 000 300
Transfer						
Amortization of the transfer station	€/y			20 000	20 000	20 000
Park of semi-trailers				3	3	4
Amortization of the semi-trailers	€/y			90 000	90 000	120 000
Fuel	€/y			18 800	18 800	25 000
Amortization of the loader	€/y			3 000	3 000	3 000
Salaries /p/month	€			121	132	145
Salaries Amount	€/y			8 700	9 500	12 200
Others	€/y			5 000	5 000	5 000
Total				145 500	146 300	185 200
Landfilling						
Compactor Amortization	€/y	50 000	50 000			
Fuel	€/y	25 000	25 000			
Salaries	€/y	4 800	5 300			
Landfilling in Batumi	€/t	0,88	0,76			
Operation costs of New Landfill	€/t			2,95	2,95	2,95
Cost of landfilling	€/y	79 800	80 300	337 200	354 900	372 600
TOTAL COSTS	€/y	819 600	880 700	1 346 700	1 431 000	1 558 100
Rough margin	€/y	-282 900	77 500	-9 400	326 400	676 400

Table 21 Financial Simulation

It's a simulation. That means that it's possible to test different values of each parameter. We have taken the realistic values we can estimate today for this first test.

So this simulation doesn't take into account the amortization of the investment of the new landfill nor the interests of loans. It means that a balance must be searched between loans and grants in aim the reimbursements stays affordable for the Company and the criteria of risk management of the lender stay in the usual brackets.

10. Annexes

10.1. Structure of the Government of Adjara

10.2. Drawings of the New Sanitary Landfill

10.2.1. INITIAL STATE

10.2.2. STEP 1

10.2.3. STEP 2

10.2.4. STEP 3

10.2.5. STEP 4

10.2.6. STEP 5

10.2.7. STEP 6

10.2.8. STEP 7

10.2.9. STEP 8

10.2.10. STEP 9

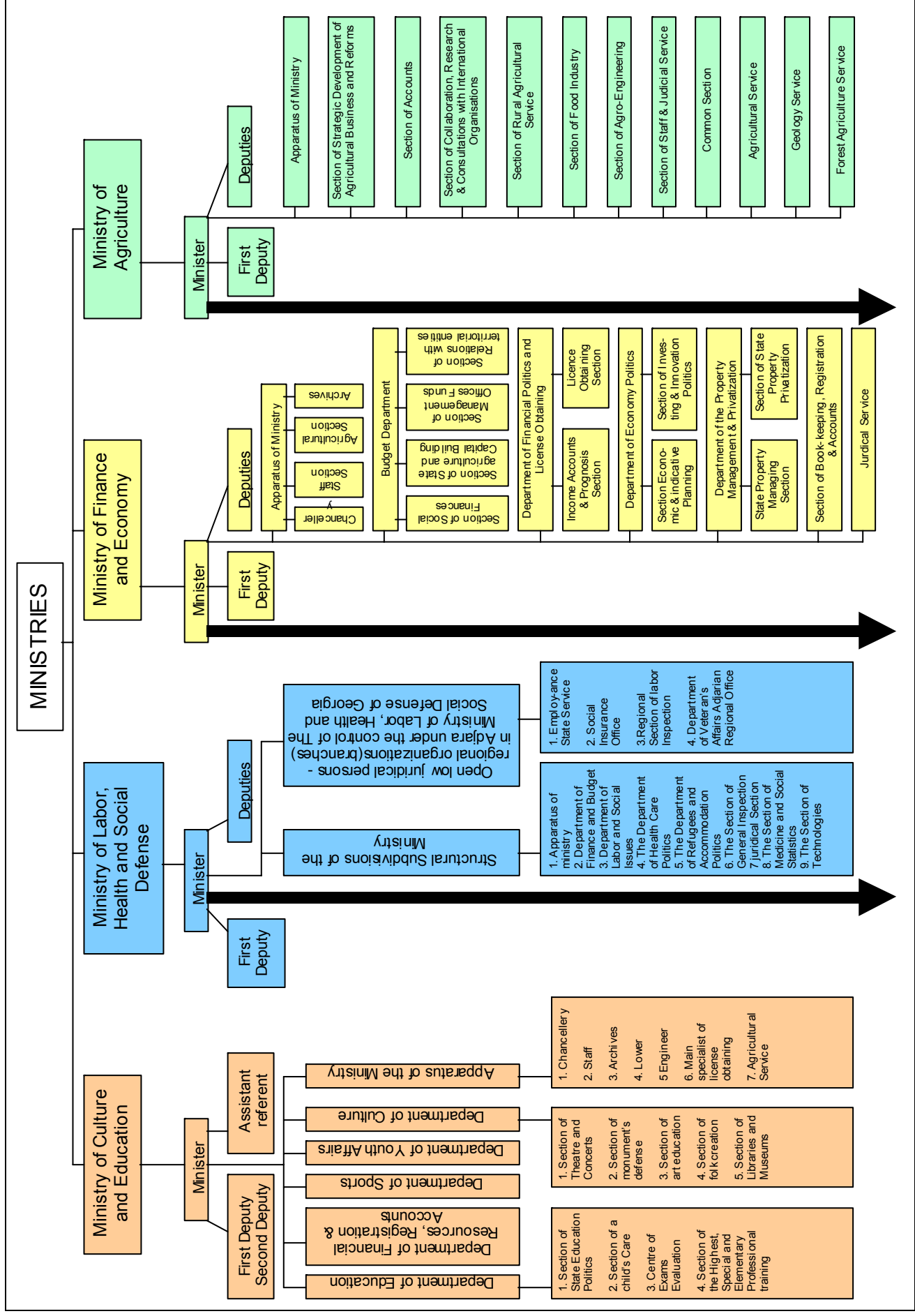
10.2.11. STEP 10

10.2.12. STEP 11

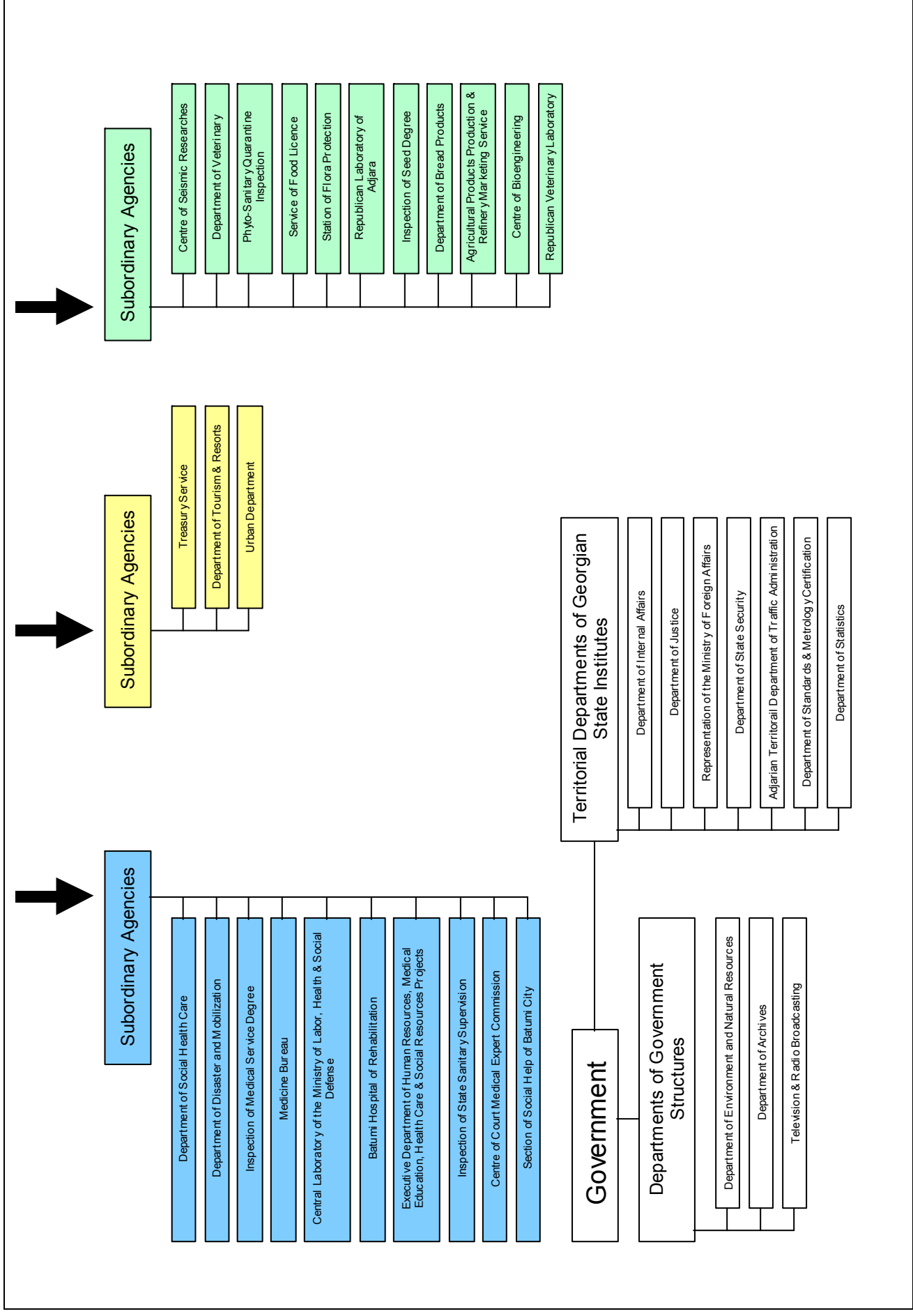
10.2.13. FINAL STATE

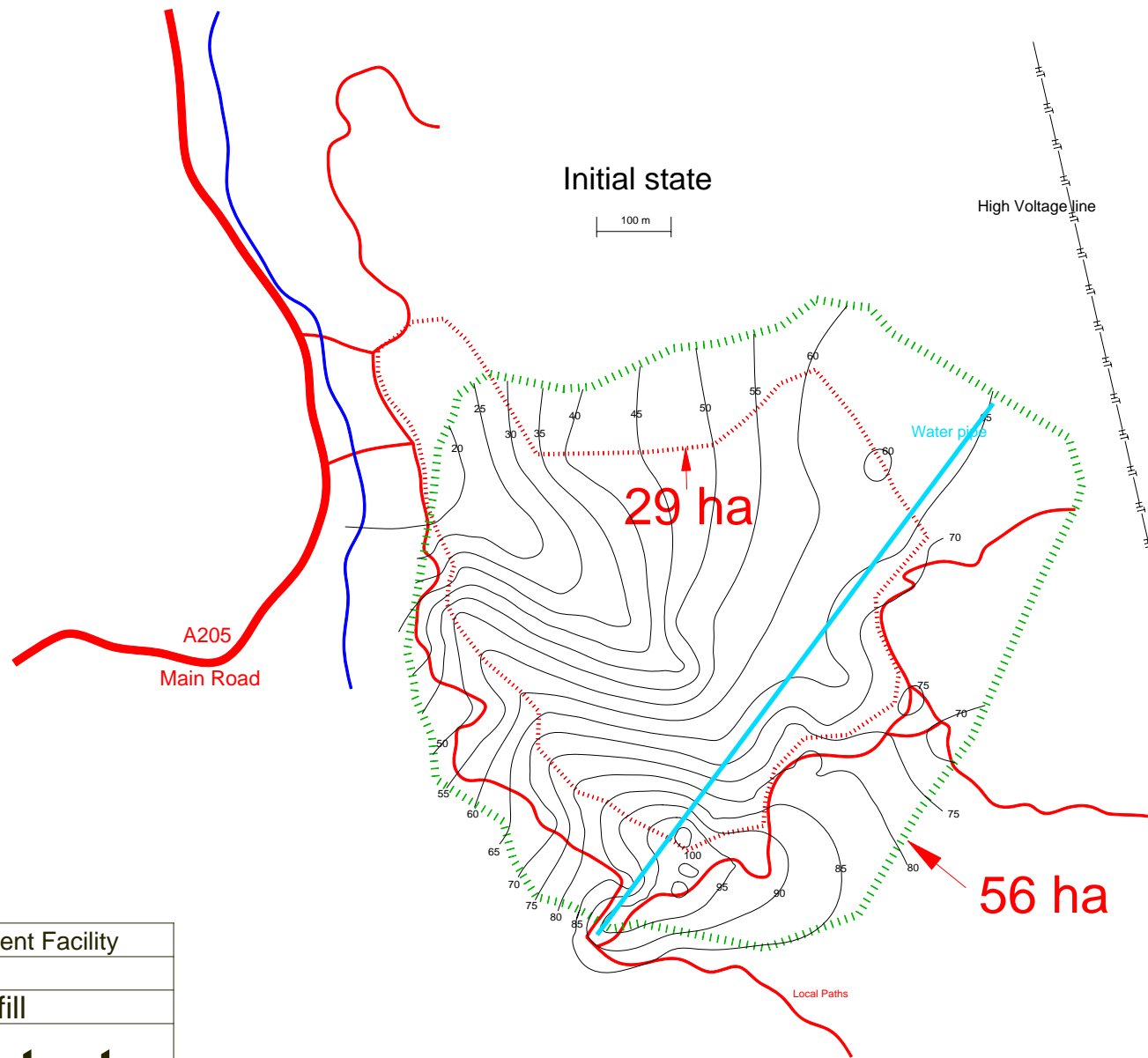
10.2.14. CUT OF THE FINAL STATE

10.3. Standard Transfer Station



Structure of the Government of the Autonomous Republic of Adjara



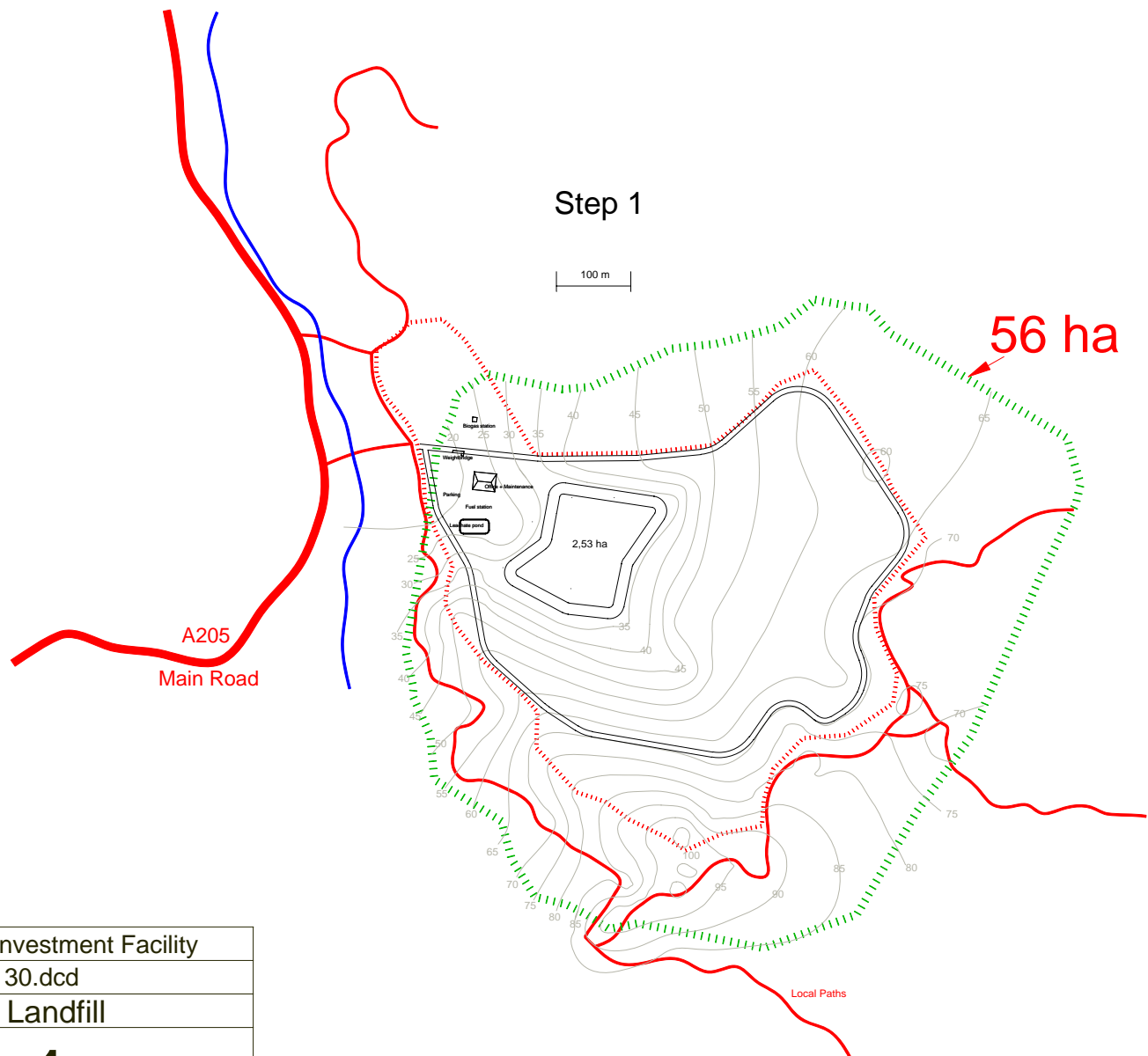


Tacis Black Sea Investment Facility

10/06/05 | Site 02.dcd

Batumi - New Landfill

Initial state



Step 1

100 m

56 ha

A205
Main Road

2.53 ha

Local Paths

Tacis Black Sea Investment Facility

10/06/05 | Site 30.dcd

Batumi - New Landfill

Step 1

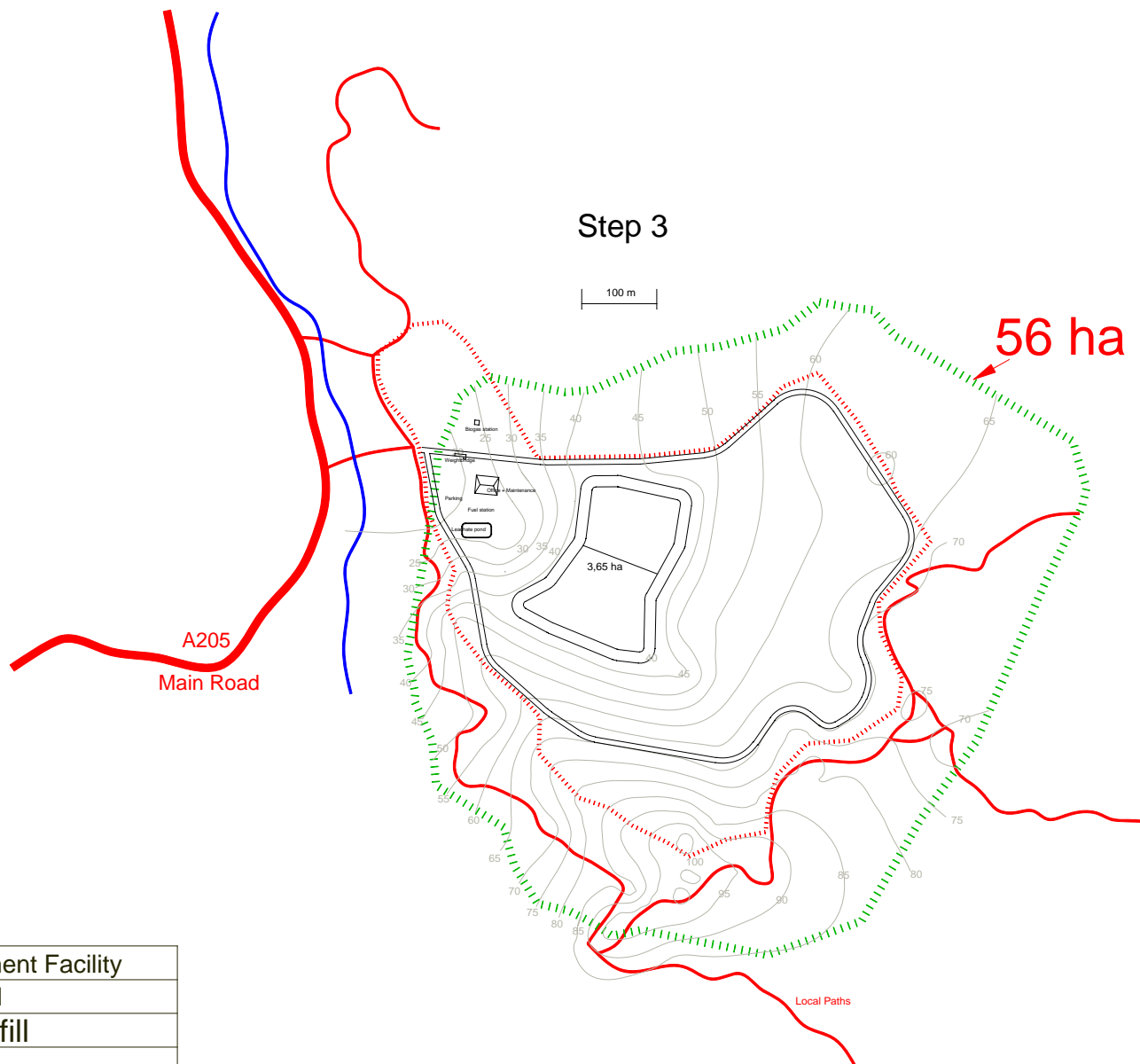


Tacis Black Sea Investment Facility

10/06/05 | Site 31.dcd

Batumi - New Landfill

Step 2

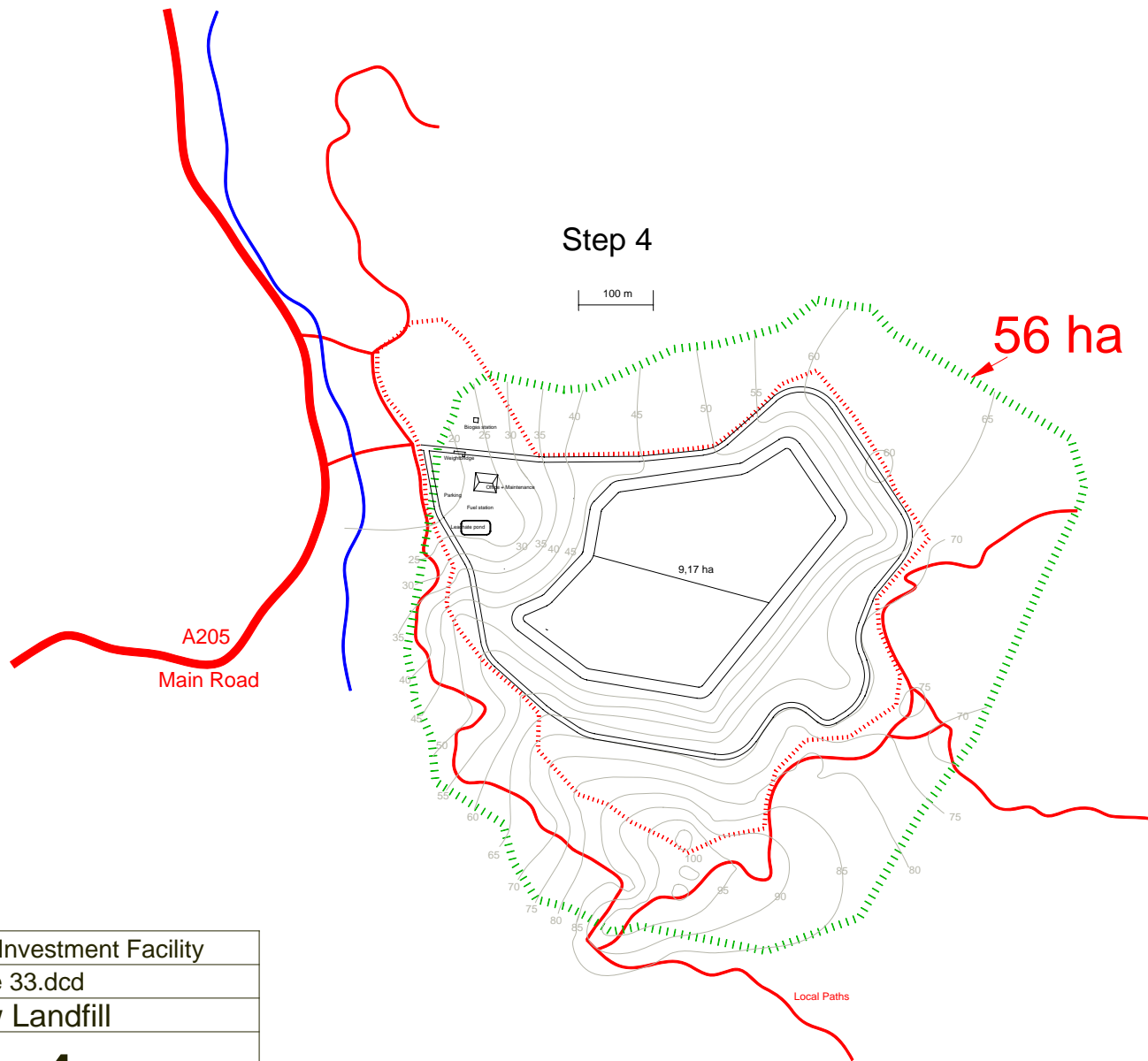


Tacis Black Sea Investment Facility

10/06/05 | Site 32.dcd

Batumi - New Landfill

Step 3

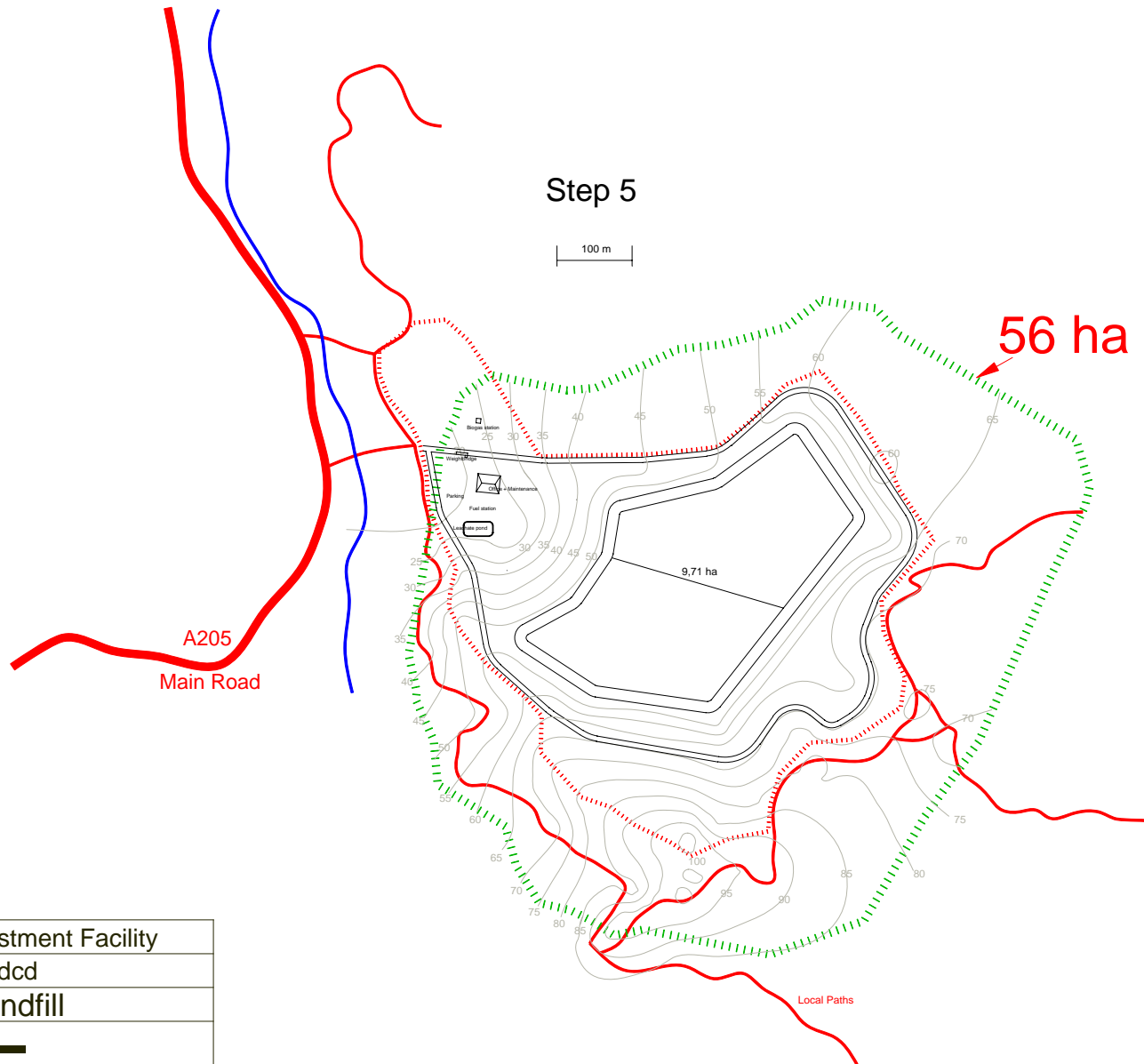


Tacis Black Sea Investment Facility

10/06/05 | Site 33.dcd

Batumi - New Landfill

Step 4

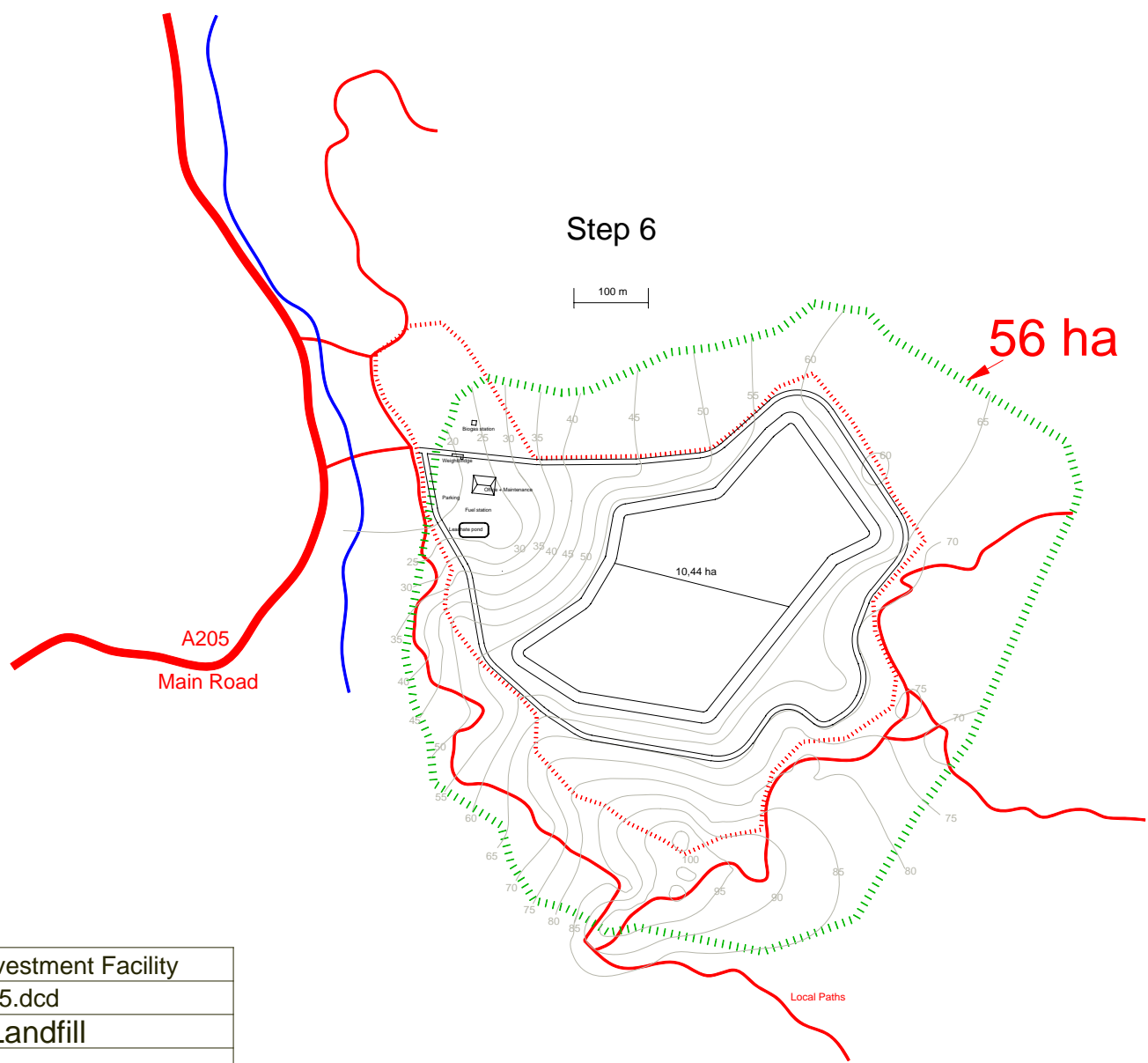


Tacis Black Sea Investment Facility

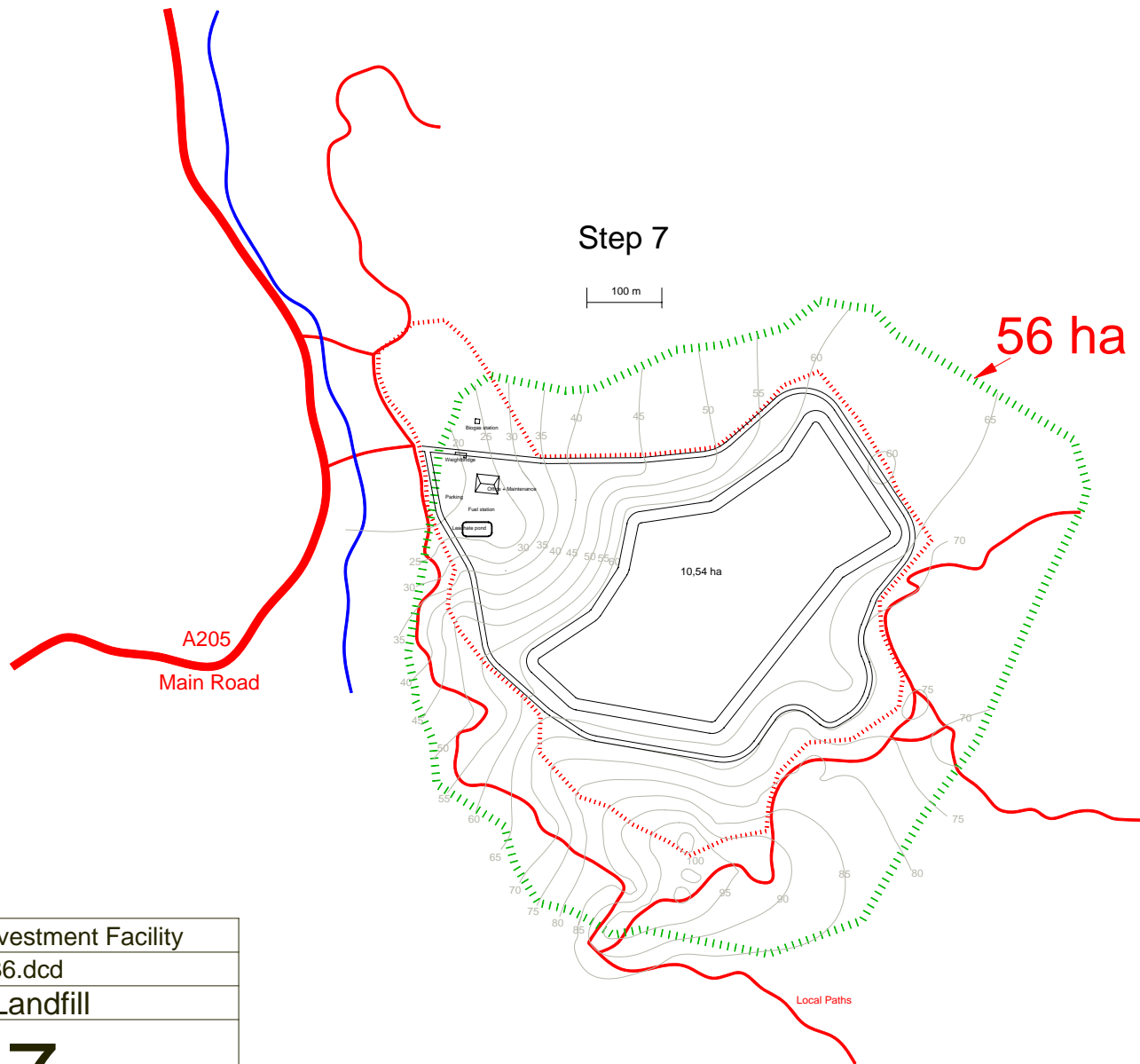
10/06/05 | Site 34.dcd

Batumi - New Landfill

Step 5



Tacis Black Sea Investment Facility	
10/06/05	Site 35.dcd
Batumi - New Landfill	
Step 6	



Tacis Black Sea Investment Facility

10/06/05 | Site 36.dcd

Batumi - New Landfill

Step 7



Tacis Black Sea Investment Facility	
10/06/05	Site 37.dcd
Batumi - New Landfill	

Step 8

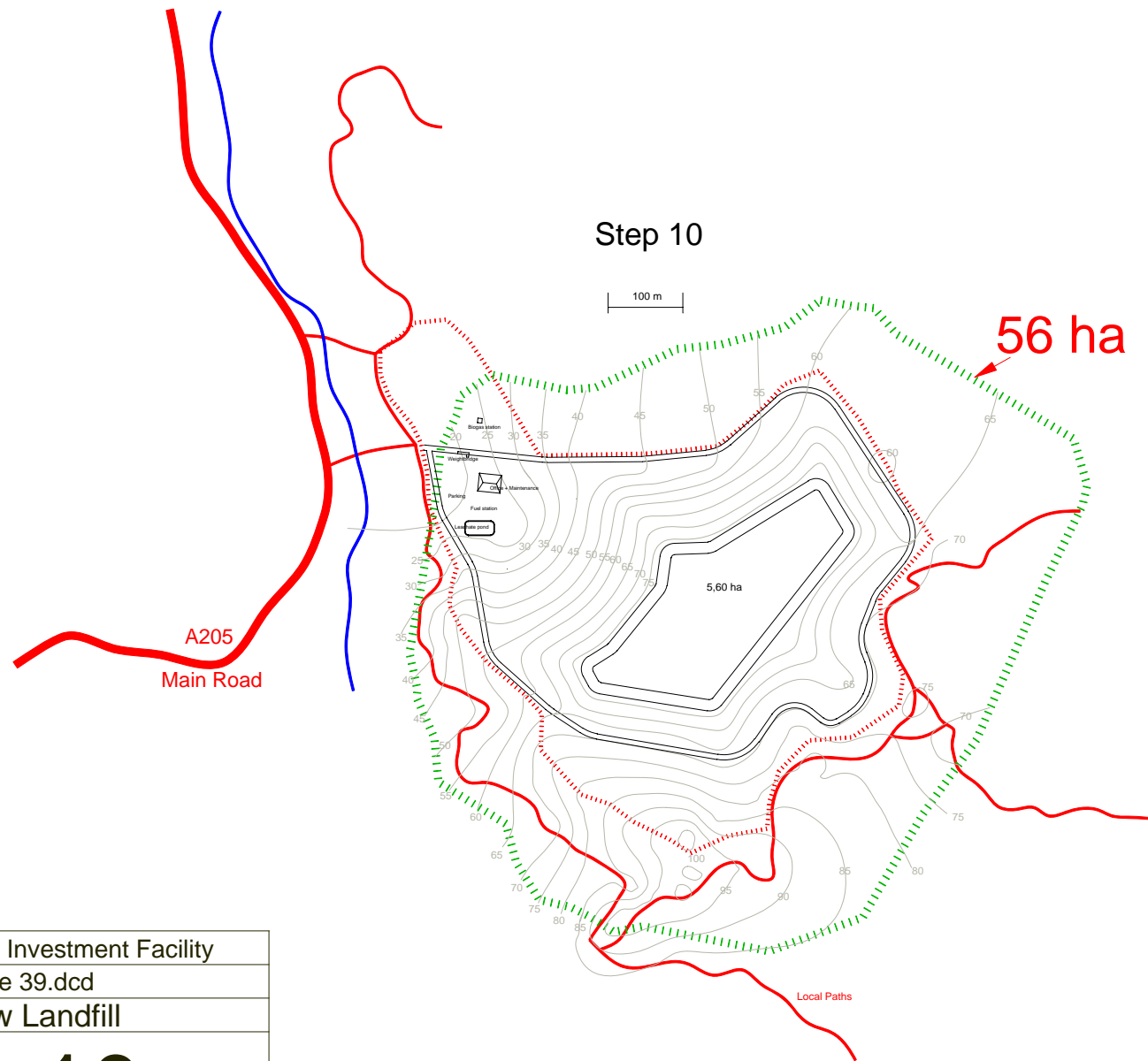


Tacis Black Sea Investment Facility

10/06/05 | Site 38.dcd

Batumi - New Landfill

Step 9

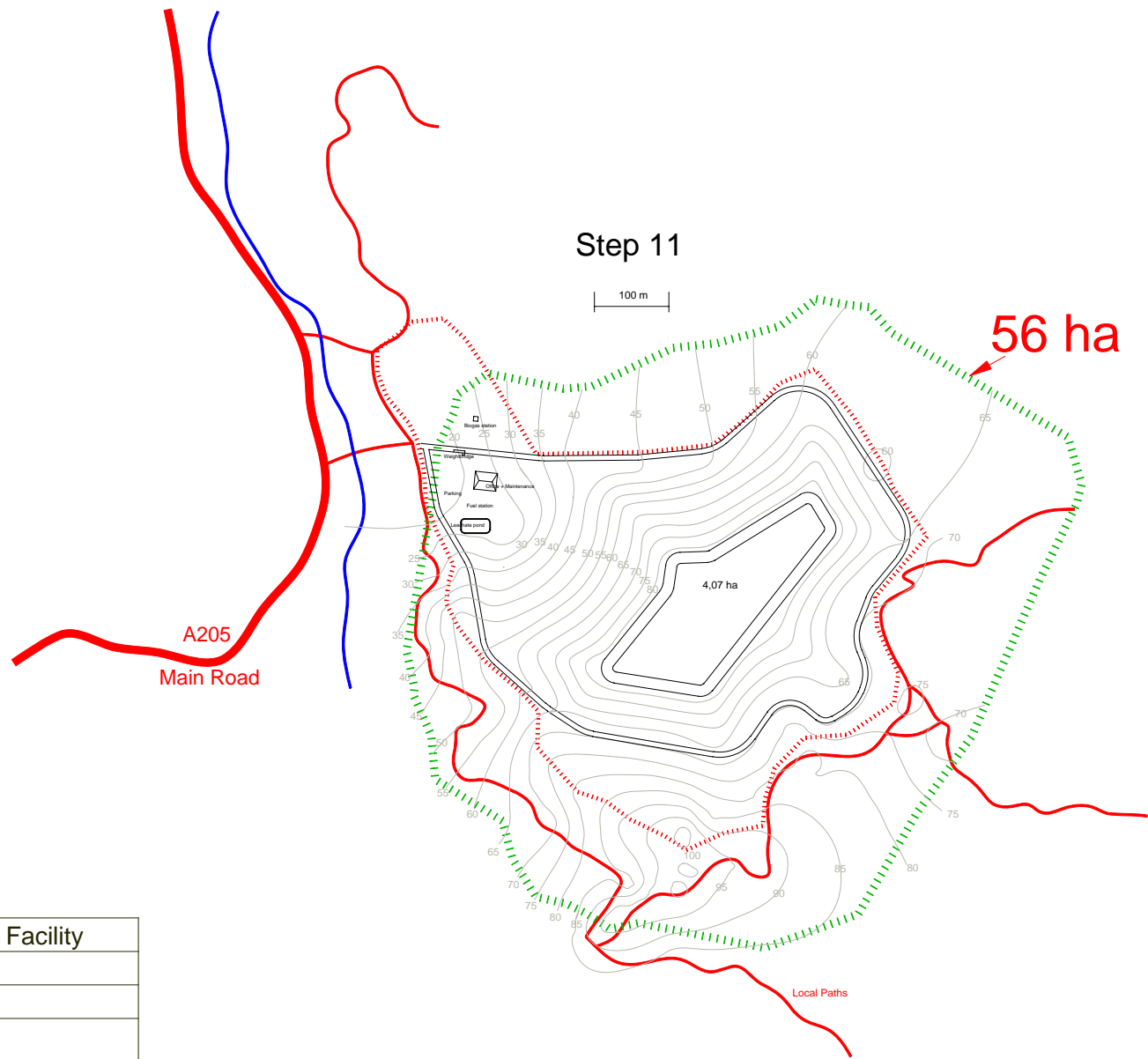


Tacis Black Sea Investment Facility

10/06/05 | Site 39.dcd

Batumi - New Landfill

Step 10

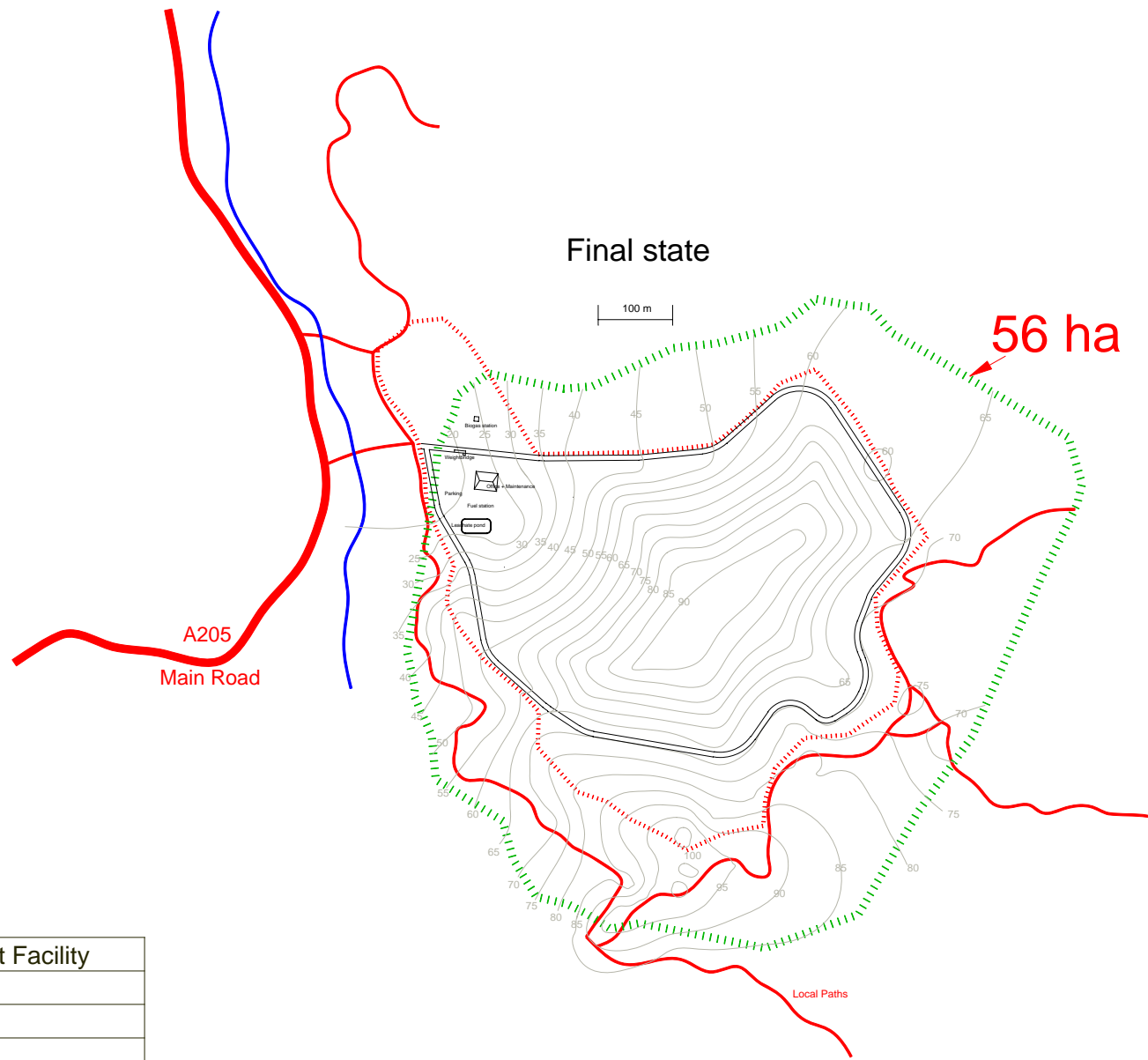


Tacis Black Sea Investment Facility

10/06/05 | Site 40.dcd

Batumi - New Landfill

Step 11

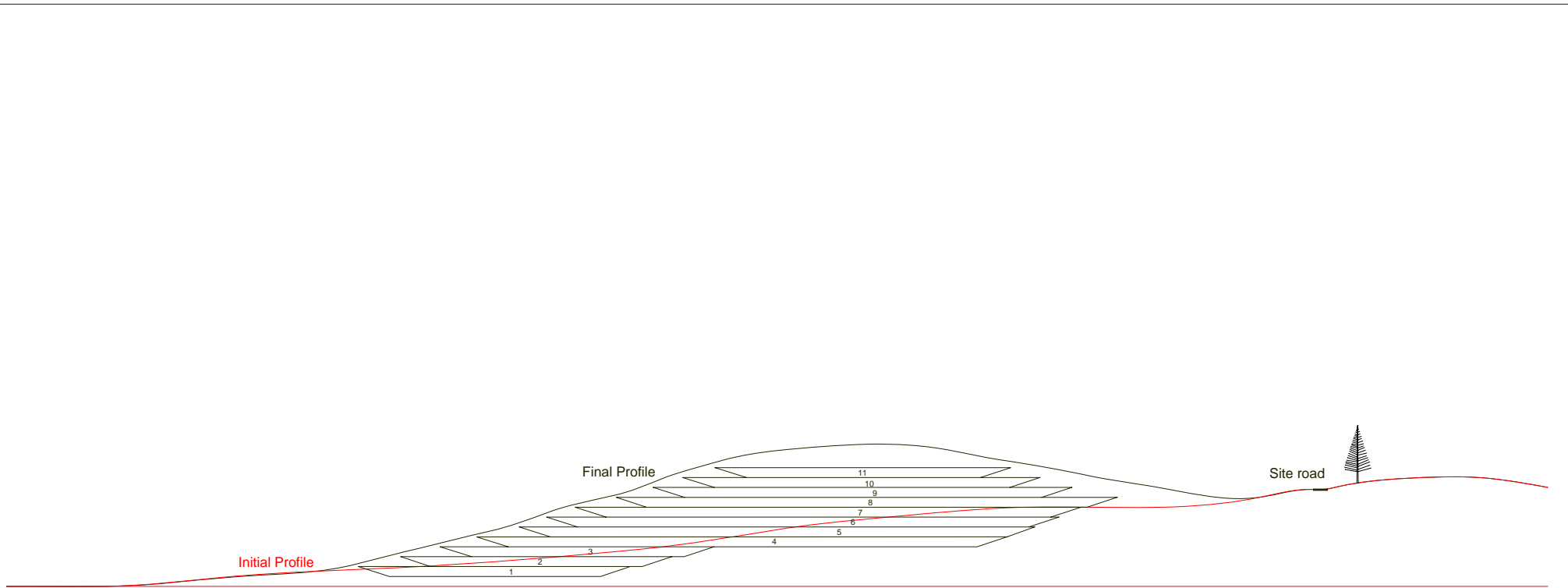


Tacis Black Sea Investment Facility

10/06/05 | Site 41.dcd

Batumi - New Landfill

Final state



Tacis Black Sea Investment Facility

10/06/05 | Profil Final.dcd

Batumi - New Landfill

Profile cut

