European Bank for Reconstruction and Development

REPUBLIC OF GEORGIA
ADJARA SOLID WASTE MANAGEMENT

FEASIBILITY STUDY AND
PROJECT PREPARATION

C17146REV/SODA-2007-12-01

Environmental Impact Assessment
Executive Summary for EIA

Environmental Impact Assessment
Stockholm 04-09-2008

Project No. 1989177
Anders Rydergren, Team Leader
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Executive Summary for EIA

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1. Project Description

The Adjara Solid Waste Management (SWM) Project contains a review of the existing practices in the SWM sector in the Autonomous Republic of Adjara (Adjara). Based on the findings a proposal has been identified for further implementation of further actions balanced against the available funding. This Environmental Impact Assessment (EIA) describes the environmental and social effects of implementation of the following proposed activities:

1. Construction of a new regional sanitary landfill at Chakvi (Figure 1) in accordance with the EC Directive on landfills 1999/31/EC. The site will, besides the landfill, include also relevant buildings, weigh-bridge, leachate collection and treatment system, sorting and storage facilities for recyclables and hazardous waste and vehicles necessary for the operation. A gas extraction system is planned for construction after 3-5 years of operation.

2. Closure of the existing non-compliant landfills in Batumi and Kobuleti (Figure 2).

In addition, to the above activities the project will also include establishment of a new entity to operate the landfill.

Improvements of the SWM in Adjara are proposed to be carried out in two stages; in this first stage the focus is on collection of municipal solid waste in the most densely populated area in Adjara, the coastline including municipalities of Batumi, Kobuleti and strips of Khelvachauri along the coast and main road and dispose the waste in the new landfill.
Figure 1 Location of new landfill in Chakvi (red contour line).

Figure 2 Non-compliant Landfills in Adjara
1.1 Project Owner

Georgia and the Autonomous Republic of Adjara will be the Borrower and Sub-borrower, respectively. At present, the loan will be up to EUR 3 millions, while the grant will be EUR 4 millions.

It is suggested that a separate landfill company will be created to own and operate the new sanitary landfill site and the associated assets at Chakvi and to provide landfill services. The Government of Adjara is planned to be the owner of the new landfill company initially.

Closure and covering of the existing landfills in Batumi and Kobuleti are tasks for the Adjara Government, but not for the new landfill company to be established in Chakvi.

1.2 Project Objectives

The overall objective for the project is to improve the Solid Waste Management (SWM) in focusing on the City of Batumi and the municipalities Kobuleti and Khelvachauri.

The main objectives are to:

- construct a sanitary landfill, compliant with the EC Directive 99/31/EC for landfill for non hazardous waste
- close down and remediate non-compliant landfills in Batumi and Kobuleti
- create a new waste management company for operation of the new landfill

2 Historical Development of the Project

2.1 Description of the Siting Process

A site selection study was carried out as part of the previous feasibility study (Solid Household Waste Management of the Autonomous Republic of Adjara, Georgia, Thalès et al, 2006). The objective was to select a possible site for a new sanitary landfill, compliant with the European Standard requirements. The site should cover the need for landfilling capacity for the coastal region, including City of Batumi, Kobuleti and Khelvachauri.

In the report from 2006 six possible sites were first pre-selected (Figure 3) and each of them were assessed from an environmental point of view, following 23 different criteria including natural conditions, proximity to dwellings and airports, surface and groundwater conditions, transportation conditions and possible volume of the landfill.

After this screening two of the sites were identified to be suitable for a more detailed examination. The final comparison followed a logic scheme including
assessment of six main environmental parameters or sources of potential conflicts if a landfill should be established. The conclusion and recommendation from the site selection study was that two of the sites met the requirements and could be used for a new landfill. A comparison of those two sites concluded that the Chakvi site was ranked as better regarding all six main environmental parameters. Therefore, it was recommended that the Chakvi site was chosen for establishing the new landfill (Figure 1 and Figure 4).

<table>
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<td>MicroRayon 7 (Chakvi), The region near the new road tunnel</td>
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Figure 3 Scheme of six potential landfill sites.

2.2 Government Decisions

Governmental Commission met on 22nd February 2005 to select a proper regional landfill site in Adjara. The decision was that among the analyzed
alternatives only Chakvi was suitable. Thus, the Chakvi site was chosen by the Adjara Government as the main alternative, where further investigations should be made to identify a suitable layout of a landfill including necessary environmental mitigation measures to be implemented.

Figure 4 Site for new landfill in Chakvi.

3 Laws and Regulations on Environment Protection

3.1 Georgian Regulations

Legislative requirements in the sphere of environmental protection are implemented through the Georgian framework law “Law on Environmental Protection” (1996 with amendments in 14 December of 2007) and a set of specific laws developed on its basis.

The laws on waste management exist only in the form of drafts and have no legal force yet. The same refers to “National Action Plan” on waste management. The only legislative act, which has legal force, is “Georgian Law on Transit and Import of Wastes in the Territory of Georgia”.

At present, the environmental permitting procedure in Georgia is set out in three laws:

(i) The Law on Licenses and Permits (2005);
(ii) The Law on Environmental Impact Permits (EIP), and


The Law on Licenses and Permits was adopted by Parliament of Georgia, on June 24, 2005. The new Law regulates legally organized activities posing certain threats to human life and health, and addresses specific state or public interests, including usage of state resources.

The Laws on Environmental Impact Permit and on Ecological Examination have been published on 14.12.2007 and entered in force on 01.01.2008. These new laws integrate all the amendments introduced in legislation of Georgia during recent years.

The Law of Georgia on Environmental Impact Permit determines the complete list of activities and projects subject to the ecological examination and the legal basis for public participation in the process of environmental assessment, ecological examination and decision making on issuance of an environmental impact permit.

According to Article 6, the developer is obliged to carry out public consultations on the EIA before submitting it to an administrative body responsible for issuing a permit.

3.2 EU Waste Management Legislation

The single-most important EU regulation relevant to this project is the Council Directive 1999/31/EC on the landfill of waste, where the environmental standards for landfilling within the EU member states are defined. The Directive includes both technical standards required for individual landfills of different classes and demands on the member states regarding reducing amounts of waste to be disposed at landfills and time schedules for implementing the directive.

The project is planned to comply with this Directive.

3.3 EBRD Environmental Policy

EBRD is considering financing the project and therefore, the project has been structured to comply with the requirements in EBRD’s Environmental and Social Policy 2003. According to this policy an Environmental Impact Assessment (EIA) is required to be carried out for projects classified as Category A projects. This project is classified as “A” according to the policy’s Annex 1 article 19, which refers to “municipal solid waste processing and disposal facilities."
4 Baseline Data – Waste Amounts

The total population 2006 in the Autonomous Republic of Adjara was 383,737 and around 80 percent of the total population lives within the project area, which includes municipalities of Batumi, Kobuleti and Khelvachauri (Table #1).

Tabell 1 Population with SWM Services from Sandasuptaveba Ltd.

<table>
<thead>
<tr>
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<th>Population 2006</th>
<th>Population with SWM services 2006</th>
<th>Assumed future extension of waste collection</th>
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<tr>
<td>Batumi</td>
<td>125,671</td>
<td>125,671</td>
<td>125,671</td>
</tr>
<tr>
<td>Kobuleti District</td>
<td>90,834</td>
<td>30,000</td>
<td>40,000 +</td>
</tr>
<tr>
<td>Khelvachauri District</td>
<td>93,974</td>
<td>20,000</td>
<td>30,000 +</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>310,479</strong></td>
<td><strong>175,671</strong></td>
<td><strong>195,671 +</strong></td>
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The population increase has been estimated at 2000 persons per year.

All existing statistics on waste is presented in m³. In order to allow more correct figures on waste amounts a weighing campaign was carried out in March 2008. By using the obtained relation between weight and volume the following amounts disposed at the landfills in Batumi and Kobuleti 2007 was calculated (Figure #5). The average density of the waste (at the vehicle) was calculated at 300 kg/m³, based on the prevailing distribution between compacting and non-compacting vehicles. The future density of the waste in the landfill is estimated to become 700-800 kg/m³ after compaction and some years of degradation and settlements, based on experience from other landfills.
The peak months for waste generation are the summer period, mainly July-August, due to the tourist season.

The indicated increase of the population above in combination with possible improved living standards the waste amounts may be estimated to increase by some 3% per year over the next 30 years.

Taking the assumed increased waste collection into consideration the waste amount incoming to the new landfill is estimated to increase up to 47 000 tons per year.

The household waste is the dominating waste type by far, over 95% of the total amount. Only minor amounts of construction waste are disposed at the non-compliant landfills, less than 1%. In addition, the City Cleaning of Sandasuptaveba disposes street sweepings, beach cleaning waste, snow, and liquidated animals, but this is estimated at a few percent of the total amount only.

5 New Sanitary Landfill in Chakvi

5.1 Conditions at the Site

Two field surveys of the proposed Chakvi landfill site have been carried out as part of this feasibility study: a topographical and a geological/geotechnical survey.

A topographic survey was made in March 2008 and in parallel, a survey was made including drillings and sampling to identify the local geotechnical conditions.
as well as geological and groundwater conditions. In addition, a description of the geomorphology, geology, hydrogeology and geotechnical aspects has been prepared putting the local conditions into a regional context, which is necessary to obtain the full understanding of those important features of the site. Below an extract from those reports are provided.

The total area of the site is 27 ha and the area planned for landfilling is 17 ha. The coordinates for the entrance of the site are: N 41º 42’ 15.8” and E 41º 44’ 09.9”.

### 5.1.1 Climate

The proposed site for the new landfill belongs to the so called First Climatic zone. The First Zone is defined as a seaside damp subtropical climatic zone, which comprises the whole West Georgia. The climate of this zone is influenced by its location on the border between subtropical and moderate latitudes, circulation processes in the atmosphere and the orographic patterns. Due to the influence of the mountain ridges bordering from three sides, the damp, unstable air masses coming from the Black Sea, converge and ascend up along the west slopes of the mountains. This causes a damp climate, with large amounts of precipitation almost any time of the year.

The strong, warm stream of the Mediterranean Sea, which is passing through Bosporus towards the east coast of the Black Sea, warms up the Adjara coast considerably in the winter period.

The average temperature of the coldest month (January) is 4.8-6.7 ºC, and the average temperature in the warmest month (August) is 22.2-23.1 ºC. Summer is not too hot in the region (especially in Kobuleti) due to breezes, rich vegetation and the large of precipitation. Autumn is considerably warmer than spring.

The Adjara coast is protected from easterly winds by the mountain ridges covered by dense forests. Despite this fact there is an obvious seasonal variation of wind directions. The western winds (from the sea) dominate over the eastern (continental) winds everywhere, almost in every season. Chakvi is an exception as south-east winds are prevailing in the area due to local orographic reasons.

The wind speed reaches its maximum value at the end of winter and in the early spring. The average wind speed in Kobuleti is 3.1 m/s in February. The number of days with strong winds is relatively large, 16-24 days per year.

Due to the high thermal regime of the place, precipitation on Adjara coast is mainly falling as rain. Snow occurs very seldom, approximately once in 20-30 years. The annual amount of precipitation varies between 2,320 and 2,621 mm. On the flat lowland, where mountains are at some distance from the sea shores the level of precipitation is lower (for example, in Kobuleti 2,320 mm). Spring is a comparatively dry season, while large amounts of precipitation occur during the autumn, especially in September.

In Batumi the daily precipitation has been observed as high as 231 mm in one day. Similar conditions prevail for Chakvi. Such extreme events do not take place
often, but they have a great influence on the ground water regime and may cause a substantial rising of the groundwater table. These events must be taken into account in Chakvi, where the groundwater table is shallow.

5.1.2 Topography

A topographic survey has been made for this project and a base map in shown in Figure 6.

![Figure 6 Topographic map of Chakvi landfill site.](image)

The proposed new landfill site is located in a valley with a well defined water divider and is furthermore divided into two major valleys. The ground slopes are generally steeper closer to the water divider and the steepest slopes are approximately 1:2.5 (vertical/horizontal).

There is hardly any flat area within the site and the differences in height are seen in Figure 6.

The site is crossed with several gullies with varying depths, in some place up to 6-8 meters. However, most of the gullies are much shallower.

5.1.3 Geotechnical Conditions

The whole Georgian territory is located in an area with occasional seismic activities up to grade 8-9 earthquake intensity zone. However, it should be noted that the landfill itself is regarded less sensitive to seismic activities compared to more complex structures.
The landfill site is located in an area where land slides have occurred historically, which is evident from the morphology of the site. The landslide direction is towards west-north west. At present, the landslide body is in a stable state. However, proper considerations to this factor shall be made in detailed design work.

Two types of geotechnical investigations were made: (i) drillings (Figure 7) along with a laboratory survey of the soil samples and (ii) an assessment of the regional geotechnical conditions. Based on the recommendations from the geotechnical investigations in the site the landfill should first be established in the lower parts of the terrain to avoid the risk for landslides, the maximum slope should not exceed 1:3 (vertical:horizontal) and the total load should not exceed 30 tons per m².

5.1.4 Geology

The soils in the site consist of laterite clay and loam, originating from an intense weathering of volcanic rocks. The thickness of the clay and loam bed is in the magnitude of some 20 m according to the drillings made in the area. The bed thickness increases gradually from the western parts towards the higher elevations in the east.
The permeability of the soil samples was determined in the laboratory and the results varied between $8 \times 10^{-7}$ to $1 \times 10^{-9}$ m/s.

5.1.5 Hydrology

The site is located between the rivers Chakvistskali and Korolistskali.

The site is located within a well defined watershed and there are no surface waters flowing into the site. All surface water originating from the site, including discharging water from the springs, crosses the central part of the planned landfill area from east to west and is finally collected into one creek in the low western part of the site. The creek is then feeding the left tributary of the Chakvistskali River, which has its outflow in the sea.

In the low western part of the site where the ground is rather flat occasional bogging may occur after heavy rainfalls. However, the flow is not permanent over the year.

5.1.6 Groundwater

Some springs discharging groundwater to the gullies have been observed inside the site. The discharge from those springs is rather low and not permanent over the year.

The groundwater table is generally close to the ground surface within the site. In the lower parts in the west the depth to the groundwater table varied between 0.3 to 1.6 m in March 2008. In the boreholes located higher up in the valley the depth was between 3.0 to 4.0 meters.

5.1.7 Flora and Landscape

For many years the site was used as tea plantation. After the collapse of the USSR the tea plantation has been abandoned. Now the dominating plants on the site are degraded tea bushes, fern and blackberry bushes (*Rubus caesius*). No red data species of flora have been observed at the site.

Along the crest there are *Cryptomeria japonica* trees planted as wind-breakers. Many of them have recently been cut down for heating purposes but they should be re-planted to minimize the view on the new landfill.

The site is not sensitive from a biodiversity point of view.

5.1.8 Fauna

Usually the similar sites covered by bushes, which is typical for the Adjara piedmont hilly landscape, are inhabited by small mammal species, as jackal (*Canis aureus*), fox (*Vulpes vulpes*), badger (*Meles meles*), hare (*Lepus europeus*), squirrel (*Sciurus vulgaris*), as well as reptiles and amphibians. The landscape at the site is strongly transformed and anthropogenized, however
there is evidence that some of the mentioned species may occur at the site. Regarding birds, common species like crows, seagulls, blackbirds can be observed at the site. The site is not used as a usual stop-over for migrating birds, although occasional appearance of such species can not be excluded. This may be more probable for the short periods when some parts of the site may get flooded and temporary ponds and swamps exist for several weeks or days, providing stop-over sites for waterfowls.

The area is strongly anthropogenized and no valuable and endangered population of animals requiring urgent conservation measures occur at the site. The site is not sensitive from a biodiversity viewpoint.

5.1.9 Other Information

There are some minor walking paths inside the area, but no roads possible for driving cars. The paths were probably used at the time the tea plantation was in operation.

Along the southern crest there is a track road of rather poor condition leading to settlements further east.

There is a gas pipeline crossing the watershed in the south-eastern part of the site. This will not be affected by the operations of the landfill.

5.2 Chqvi Site – Proposed Facilities and Operation

An operation manual shall be prepared during the design stage of the project. This document will provide detailed information of the future operation. The basic concept for operation activities is provided below.

5.2.1 Entrance Road

The entrance road to the landfill will be separated from other roads and the existing road on the edge of the watershed will be improved and re-routed to avoid potential future conflicts in traffic streams. Waste trucks waiting for registration at the weigh-bridge shall be parked inside the fenced area.

5.2.2 Control of Incoming Waste

Only waste types eligible for disposal in a landfill for non-hazardous waste will be accepted at the site.

A weigh-bridge will be installed at the entrance and all waste and other material, e.g. for covering shall be registered. A system shall be established where all drivers submit a signed certificate of the waste type and the origin of the waste.

The registration system will form the base for the invoicing.
5.2.3 Buildings

In addition to the weigh-bridge and registration office described above the site will also include the following buildings:

- Administration building incl. office space and washing facilities
- Workshop
- Hazardous waste storage
- Guard house

5.2.4 Sorting and Recycling

An area will be allocated for introduction of sorting of recyclable waste. The area shall include one part for sorting and one part for temporary storage of recyclables until transported to the end-user.

The fractions potentially available for recycling are mainly:

- Metals
- Glass
- Papers
- Wood
- Other materials of economic interest

In addition, hazardous waste that may appear in the waste should also be separated and placed in the hazardous waste storage temporarily.

The sorting will at least initially, be made manually and the labour force should be informed about health risks and provided with proper protection. In first hand employment should be provided for the scavengers at the existing non-compliant landfills.
5.2.5 Hazardous Waste

There is no existing facility for destruction of other types of hazardous waste in Georgia today. Thus, eventual incoming hazardous waste can only be sorted out and stored at site until a final solution has been found. A ventilated building for storage of hazardous waste is included at the site.

There is one small facility for incineration of infectious hospital waste at the non-compliant landfill in Batumi and there is also a special vehicle for collection of such waste.

5.2.6 Sanitary Landfill

The landfill will be constructed according to EU directive on landfills for a non-hazardous waste landfill, i.e. mainly household waste.

The available volume is estimated at 3.4 Mm$^3$ and the lifetime for the landfill until it has been fully filled up is estimated at 35 years (Figure 8). The area for the landfill is 17 ha and the height of the waste will be maximum 35-40 m.

![Figure 8 Estimated lifetime for the proposed Chakvi landfill.](image)

In first hand the vegetation will be removed and existing gullies will be filled with gravel or similar course material to allow eventual discharging groundwater to be drained below the bottom of the landfill and not mix with the leachate.

The landfill bottom will consist of an impermeable sealing layer below a drainage layer for collection of leachate. A proposed design of the landfill bottom is shown in Figure 9.
Figure 9 Proposed bottom sealing for the landfill.

The waste will be disposed in cells to minimise the working face at all times (Figure 10). Daily cover shall be applied to minimise wind-blown waste and bad odour to the surroundings. In addition, the exposure of organic material will be minimised and this will in turn reduce the amount of flies, birds, rats etc.

Step by step as the waste pile reach the final height an intermediate cover will be applied to allow diversion of the surface runoff and reduce the generation of leachate.

A gas extraction system shall be installed along with the cell construction stepwise as full height has been reached and the intermediate cover has been applied. By this measure the risk for explosions and fires will be substantially reduced. The gas may initially be flared off for environmental reasons. However, it is assumed that there will be a market for utilising the energy content for heating or for other industrial purposes. Thus, a feasibility study should be made to assess the optimum final solution.

The gas system can obviously not be installed immediately and it is estimated that such system may be considered after some 3-5 years.

Each cell of the waste pile shall gradually be filled up to the planned final elevation. The surface shall be given a maximum slope of 1:3 (vertical:horizontal) to allow reasonable working conditions during operation as well as for applying the final cover during the closure of the site. The maximum slope is also adapted to reduce the risk for erosion.

The maximum slope will be applied as high as possible to utilise the available volume at an optimum. After reaching a certain elevation the surface will be given a gentle slope up to a ridge in the middle of the landfill allowing surface water
runoff. The minimum slope shall be 1:20 to avoid future ponding of water on the top.

Surface waters flowing towards the waste pile shall be diverted around the waste and thus, kept unpolluted. However, in the lower portions of the valleys inside the site diversion of surface water around the waste pile is not possible without extensive pumping. Thus, it is proposed to construct ponds for temporary storage of surface water up-stream of the waste pile discharging to drainage channels below the lining. Under any circumstance it is necessary to allow discharge of shallow groundwater in drainage channels below the lining to avoid the potential risk for groundwater to accumulate underneath the landfill.

Once the whole volume has been completely filled up a final cover will be applied according to valid regulations at that time.

Figure 10 Cells and section in the new landfill in Chakvi.
Figure 11 Surface and bottom profiles of the section.
6 Potential Environmental Impact of the Project

6.1 Impact on Surface Water

The localization of the proposed landfill close to local water divider will minimize the inflow of surface water that may be polluted by the leachate.

The leachate will be collected and treated to meet required standards before discharged to the recipient, the Black Sea via the Chakvistskali River. Dominating pollutants in the leachate from the landfill will be organic matter (BOD, COD) and nitrogen in the form of ammonia.

6.2 Impact on Soil and Groundwater

Leakage discharge to the ground and to the groundwater will be minimized through a bottom construction, meeting the requirements in the EC directive for a landfilling of non-hazardous waste. This will be achieved by construction of a bottom liner on top of the natural soil as well as a drainage layer on top of the liner to divert the leachate to collection and treatment plant.

6.3 Impact on the Atmosphere

Landfilling of organic, or partly organic waste, always results in a degradation of the waste and consequently a production of landfill gas, consisting mainly of methane and carbon dioxide. If not collected and burnt the gas can cause odour problems in the neighbourhood and also globally contribute to the increased level of greenhouse gases in the atmosphere.

The landfill will generate landfill gas starting some few months after disposal and during the whole active lifetime as well as during a long period after landfilling has ended. The whole period of landfill gas generation form the site can be estimated at about 70 years.

When mixed with oxygen the landfill gas poses a risk for explosions and the occurrence of landfill gas also increases the risk for fires at the landfill.

Aerosols from the leachate treatment facility may also be emitted and windblown.

There are two main sources of odour at the site: odour from the degradation of the organic waste (landfill gas) and odour from the leachate ponds.
6.4 Impact on Waste Transports

The effects of transportation are normally not a dominating environmental parameter in a waste management system, but from the side of cost effectiveness short transportation distances are vital.

The location of the proposed landfill between the main waste generating areas Batumi and Kobuleti and close to the existing main road makes provides an excellent basis for an efficient and safe waste collection system.

At present (2007) around 25 rounds of transports dispose their waste at the Batumi and Kobuleti non-compliant landfills (9,200 transports on a yearly basis). The major part of the waste, some 80 percent, is transported by compacting vehicles, but also smaller vehicles are in operation, even some motorcycles.

To reach the site the waste trucks will use the main road Batumi-Kobuleti. In the future the amount of transports is estimated to increase due to increased waste amounts. However, even after an increase the relative effect of waste transports is insignificant compared to the normal traffic load on the main road.

An access road will be constructed from the main road to the landfill site. The planned access road is at present the existing public road leading to the settlement Mikrorayon 7. This road is in poor condition and in order to separate the traffic streams a new alignment with improved standard for this local road will be constructed as part of the project.

6.5 Impact on Present Land Use

The proposed area for the new landfill is a former tea plantation, but is today fallow land. The entire area is registered as Government land and there are today no residents (private or business) occupying parts of the area, neither legally nor illegally. There is some grazing in the valley of the future landfill, which can be easily done in the other places because there large similar areas in the neighbourhood.

5-6 households live very close to the landfill site. Distance from these land plots to the landfill site varies from 120 to 200 m. Within the 500 m buffer zone a minimum of 40 land plots are cultivated and buildings are situated on 11 of these plots. More dense settlement is represented by the village, which is situated east side of the landfill site at a distance about 1 km.
6.6 Landfill Operation Impacts

The main potential nuisances for the neighbourhood are odour and smoke from the site (in case of fire), littering, and noise both from vehicles operating at the site and waste collection vehicles as well as aesthetic disturbances if the site is visible from the settlements.

Figure 12 Houses on the nearest hill east of the proposed site.
6.7 Health Risks

Health risks at landfills are normally associated with exposure to sharp, infected or toxic material at the site, contact with leachate and emissions of hazardous smoke from fires.

Other risks are the hazards for explosions and fires caused by improper management of the landfill gas.

Risk for suffocation in manholes or deep excavations in the waste body is evident whenever there is a risk for landfill gas to enter.

6.8 Impact on Valuable Natural Reserves

The proposed location of the landfill is not affecting any protected, natural reserves.

6.9 Impact on Cultural Heritage

The proposed location of the landfill has no historical assets or buildings, according to information from the Archaeological Authorities.

6.10 Noise and Littering

During construction noise from excavators, wheel loaders and all other vehicles will occur.

During the operation the noise from the site is mainly coming from the vehicles operating at the site and the vehicles transporting waste to the site.

Littering from wind-blown light wastes like papers and plastics may occur, especially after strong winds.

6.11 View of the Site

During the first years of operation the landfill will only be visible from the main road. Gradually the height of the waste pile will increase and the intermediate cover will be applied as the volume has been filled up, minimising the view from the road. After a number of years the waste pile will reach a height where the visibility will increase also from other directions. However, the views from the settlements are of remote character (Figure 12Figure 13).
7 Environmental Protection Measures

7.1 Control and Separation of Hazardous Waste

One of the major environmental concerns is the risk for contamination of waters and soil caused by the leachate leaking from the site. In order to reduce the hazards from leachate the content of hazardous substances disposed at the landfill shall be minimised. The basic approach to achieve this is to ascertain that only the eligible types of waste are disposed. For example no hazardous waste shall be disposed on the new landfill in Chakvi.

An initial screening of waste types will be carried out at the entrance as part of the registration procedure. In addition, the personnel, the bulldozer driver and others, at the working face will also make a visual inspection of the waste when it is un-loaded as a second control.

Enforcement mechanisms shall be established for drivers violating those rules.

7.2 Landfill Lining

The bottom of the landfill will be constructed in accordance with the EU directive for landfills. An impermeable lining underneath a drainage layer will be established to minimise contamination of waters and soil (Figure 9).

In order to eliminate potential inflow of groundwater from the surroundings all existing creeks in the landfill area will be filled with gravel to allow diversion of such non-polluted water underneath the lining.

7.3 Leachate Collection and Treatment

The proposed leachate treatment will include the following flows:

- Leachate from the landfill
- Surface run-off water from the sorting platform

The estimated average flow of leachate to treatment at the end of the operation period is estimated at 200 m$^3$ day$^{-1}$, while the design value has been set at 470 m$^3$ day$^{-1}$.

The quality of the leachate will vary over the years and the description below is based on experience from landfills with similar conditions.

Leachate generated from municipal solid waste (MSW) landfills generally contains high concentrations of dissolved substances (usually measured as BOD and COD) and nitrogen (mainly in the form of ammonium), rather high concentrations of chloride, iron and manganese, but usually low concentrations of phosphorus and heavy metals. The leachate may be toxic, due to the presence of ammonium-nitrogen ($\text{NH}_4$-N) and of heavy metals. The latter is
usually not a big problem in leachate, while the ammonium content can be significant.

The proposed leachate treatment is basically an aerobic biological treatment, with the main purpose of reducing the content of organic material and ammonium nitrogen (\(\text{NH}_4\text{-N}\)).

The basic treatment process is proposed to include an equalization pond (low aerated), a SBR process (SBR = sequencing biological reactor, which is a batch-wise operating activated sludge process), and a polishing pond.

The basic treatment scheme is proposed as follows:

```
Equalization/Aeration pond    SBR process    Polishing pond
                           |                    |
                           |                    |  Sludge to drying beds
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The SBR process operates batch-wise, i.e. the reactor is filled up with a certain volume of leachate, then treatment is run for a certain time, finally the reactor is emptied down to a pre-determined level.

In addition, the following units will be installed:

- Holding tank/Pumping station between the equalization pond and the SBR, for feeding the SBR
- Sludge drying beds for the dewatering of excess biological sludge from the process. The dried sludge will be landfilled, or composted for production of a soil product.
- Effluent discharge chamber, to be used primarily for flow measurement and sampling of the finally treated leachate.

The proposed treatment is a biological treatment, which has the main purpose of reducing the leachate's content of organic matter. The treatment efficiency for BOD (biochemical oxygen demand) will be high, about 80 – 90 % or higher. The efficiency for COD (chemical oxygen demand) will be more moderate, estimated at about 50 – 70 %, possibly towards 80 %. The efficiency for TOC (total organic carbon) is expected to be of the same order as for COD.

A typical component of leachate is ammonium nitrogen, which may occur in high concentrations. This substance is toxic to water-living organisms, and one purpose of leachate treatment is often to oxidize this component to the less toxic nitrate nitrogen (\(\text{NO}_3\text{-N}\)). An oxidation of the ammonium to nitrate of approximately 90 % or higher can be expected, and thus a significant toxicity reduction will be reached. If a reduction of the total content of nitrogen in the leachate is required, the process in the SBR reactor can be adapted for total nitrogen removal. If the polishing pond is designed as a wetland, a further nitrogen
removal can be expected there. About 50 – 80 % reduction of total nitrogen can then be expected.

The area, required for the leachate treatment, is roughly about 8000 m², or about 11 000 m², if a wetland design is applied for the polishing pond.

The two ponds will be constructed as earth ponds. The SBR reactor will be a concrete tank. Additional smaller constructions, such as the holding tank/pumping station ahead of the SBR, and the sludge holding tank, will also be in concrete.

The ponds, the SBR and other parts of the plant need to be accessible, preferably by vehicles, for service. Such service will concern, for instance, maintenance of pumps and aeration equipment, drainage of accumulated sludge and maintenance of the pond constructions. Therefore, the ponds should ideally be furnished with roads alongside, drivable for suitable vehicles.

7.4 Landfill Gas Collection and Utilisation

![Diagram of Landfill Gas Collection System]

*Figure 14 Principles for a gas collection system.*

A landfill gas extraction system will be installed in the waste pile some 3-5 years after start of operation. The main components of the gas extraction system are (*Figure 14*):

- gas wells
- gas collection pipes
- gas pumping station
- condensate traps
- gas motors
- gas torch

The basic concept is that perforated gas wells are installed into the waste pile after the corresponding area has been sealed with an impermeable intermediate
cover. A sub-pressure to extract the gas will be arranged by blowing machines in the gas pumping station. From an environmental point of view the final step is destruction of the landfill gas by incineration in an environmental-friendly torch allowing a high incineration temperature. However, one additional concept commonly applied is to utilise the energy content in the gas for e.g. heating purposes or in other industrial processes. For this project it is proposed to convert the energy to electrical power by adding gas motors to the system.

The total amount of landfill gas during the full cycle is estimated at about 700 Mm³ landfill gas. The efficiency of a gas extraction system varies from site to site within a rather wide range. Based on experience from other landfills one can assume that around 80-90 can be collected by the gas extraction system and thus, for this project it is estimated that 20% may be emitted to the atmosphere.

By implementation of this project the reduction of landfill gas to the atmosphere can be estimated at about 550 Mm³.

7.5 Covering of Waste Cells

Covering of the waste will be made at three different levels with somewhat different methods:

- Daily cover
- Intermediate cover
- Final cover

The daily cover shall be applied at the end of each day and consist of minimum 5 cm of sand or other suitable material. The concept is to reduce the open exposure of the organic matter causing bad odour and risk for littering of light waste, such as plastics or papers. Another important aspect is to minimise flies, birds, rats etc. feeding from the waste.

The intermediate cover will consist of 50 cm of low permeable soil to divert the non-polluted surface water runoff outside the waste cell. This type of cover shall be applied for surface not used for disposal for some six months. It shall specifically be applied in areas before the gas wells are installed. By application of this impermeable layer it will be possible to introduce a sub-pressure system for extraction of the landfill gas without intrusion of oxygen into the waste body.

The final cover will be applied after the landfill volume has been completely filled up. The cover shall follow the existing regulations at the prevailing time, but should as a minimum be planned according the EU directives.

The cost for daily and intermediate cover will be apparent during the operation phase. However, costs for final cover will occur when no more tipping fees can be obtained and thus, in order to assure that funding is available for closure activities an amount for such investments shall be deposited on an annual basis during operation.
7.6 Odour

The minimisation of odours spreading to the surroundings is crucial for the social acceptance of the landfill. The combined effect of the mitigating measures described above, leachate collection and treatment, gas collection and covering of the waste is the most efficient method to reduce the odour to a minimum.

7.7 Noise Abatement

All vehicles operating at the site shall be equipped with silencers. The busiest operating hours will be during normal working hours when the waste trucks have collected the first round of waste. No transports or operation are planned during nighttimes.

The topography is favourable to minimise noise to the surroundings. The distance to nearby residential areas is also favourable as the nearest houses are located at a distance exceeding of 500 m from the new landfill site.

7.8 Hidden from View

During the first years of operation the landfill will only be visible from the main road. During the first phase of operation disposal of waste will be made behind a wall starting from the western side of the site. Gradually the height of the waste pile will increase and the intermediate cover will be applied as the volume has been filled up, minimising the view from the road.

There will be several buildings in the area between the landfill and the road and the impression by passing vehicles will be like any other type of industrial activity.

From other directions than from the west the landfill will be hidden from view in first hand by the natural surrounding hills. After a number of years the waste pile will reach a height where the visibility will increase. This view shall be minimised by planting trees and bushes on the crest around the site.

7.9 Labour and Working Conditions

All personnel working at the site shall be properly vaccinated and informed about the safety regulations. Such regulations shall be prepared by the Site Manager and especially focus on risks associated with the gas extraction system besides more common safety aspects on clothing, sanitary aspects, traffic etc.

The personnel working at the sorting area shall be equipped with proper protection gears, such as gloves, boots, masks, protection clothing etc.

All personnel shall have access to regular health examinations.
7.10 Occupational Health and Safety Management

The site will be fenced and guarded and the public will not be allowed to enter the site, due to health and security reasons. By minimizing the emissions to air and water, through waste control, lining, top covering, leachate treatment and gas collection the sources for health risks will be kept at a minimum, both inside and outside the landfill site.

Other risks are the hazards for explosions and fires caused by improper management of the landfill gas. A risk zone map shall be prepared during the design to minimise those risks. A person responsible for all management of the gas extraction system shall be specifically assigned once the system is installed. “No smoking” signs shall e.g. be placed at the entrance and specifically sensitive areas, such as classified areas of the gas extraction system.

All personnel shall be informed about the safety regulation at start of their employment and such information shall also be repeated at regular intervals.

8. Environmental Monitoring

An environmental monitoring programme shall be established during the design phase and necessary infrastructure, e.g. monitoring wells for groundwater, shall be part of the construction works. The programme shall follow the stipulated criteria in the EC directive. Some general descriptions of minimum requirements are made below.

A programme shall include information on what type of monitoring shall take place, the frequency for sampling and the locations of sampling points as well as procedures for reporting.

8.1 Incoming Waste Control

All incoming waste and other materials as well as outgoing recycled material shall be registered.

8.2 Leachate

The quantity of leachate shall be recorded as well as the quality of the leachate before and after treatment.

8.3 Surface and Groundwater Monitoring

The programme shall include monitoring of both surface and groundwater. Minimum two wells for groundwater shall be installed, one to serve as a reference for non-polluted groundwater and one downstream of the landfill.

As there is no surface water flowing into the site it is deemed that one surface water collection point downstream the site is sufficient.
8.4 Landfill Gas Control

Relevant data for the operation of the gas extraction system shall be recorded on a daily basis. Such information is e.g. amount of gas generated and the composition of the gas, especially the methane content. In case any irregularities occur the reason shall be identified and corrected. It is e.g. important to assure that the sub-pressure in the landfill is maintained to minimise the risks for gas leaking to the atmosphere.

8.5 Environmental Reporting

The results of the monitoring activities shall be reported annually. It is proposed the report is submitted by March each year to allow some time for compilation of all information.

The report shall be submitted to the relevant Adjara authority.

8.6 Construction Supervision

The construction works shall be supervised according to local regulations. However, it is necessary to add international experience for some special features of the project, mainly the construction of the bottom lining, leachate collection and treatment system and at a later stage also the installation and trimming of the gas extraction system.
9 Social Impact

9.1 Living Conditions for Neighbours

5-6 households live very close to the landfill site. Distance from these landplots to the landfill site varies from 120 to 200 m. Within the 500 m buffer zone a minimum of 40 land plots are cultivated and buildings are situated on 11 of these plots. More dense settlement is represented by the village, which is situated east side of the landfill site at a distance about 1 km.

Due to the distance to the nearest residents and the possibilities to plan the activities from the very start, including immediate construction of all necessary protective measures (landfill cell constructions, covering of waste, fences etc) the negative effects on the neighborhood can be mitigated. At a longer distance the new facility might inevitably be visible from some directions, but it will probably be seen as an industrial construction, not necessarily connected to waste management. In the site selection study the Chakvi site is assessed to have favorable conditions to be well integrated in the surrounding landscape.

There will be some working opportunities at the site for both skilled and unskilled labor and a portion of those employments can well be managed by local people.

9.2 Involuntary Resettlements

certain amount of dwelling houses and cultivated land plots are located within the 500 m buffer zone. The exact amount of affected land plots and households will be clarified after final agreement with MoE on acceptable safety radius and boarders of the sanitary protection zone. The scale of resettlement and required compensations will be defined after verification of the status of the land plots and entitlement. However, it is possible to make conclusions at this stage, that the project implementation will require physical relocation of several (minimum 6) households. Distance from the land plots, occupied by the mentioned households, to the landfill site varies from 120 to 200 m. These land plots are occupied before 2003. Therefore, we may conclude that preparation of the Resettlement Action Plan is necessary. According to the EBRD social safeguards the affected persons should be rehabilitated even if their entitlement on land and assets is not confirmed legally. Legally owned land and assets should be compensated to full replacement costs.

9.3 Diversion of Traffic Flow

The existing road to the settlement Mikrorayon 7 is today in a poor condition. It will be given a new alignment around the new site to avoid mixing with the transports to the landfill.

The new road will be constructed as part of this project and provided with modern Georgian standards.

9.4 Sanitary Risks

Sanitary risks are mainly caused by direct contact with harmful substances in the
waste. The site will be fenced and guarded to keep unauthorised persons out of the site. Thus, sanitary risks for local residents will be minimised.

**9.5 Scavengers**

Although unofficially there are a number of people scavenging from the waste at the existing landfills in Batumi (20-25 people) and Kobuleti (maximum 5). In order to provide them with an alternative source of income they may be offered an employment at the site at the planned sorting facility.
10 Closure of Non-compliant Landfills

10.1 Batumi Non-compliant Landfill

The landfill should be terminated and further disposal of wastes at the site should be prohibited. Rehabilitation of the river bank protection is a separate project, but a necessary element for the final closure of the landfill. It is proposed that the waste is relocated into two waste piles to reduce the area for covering and as well reduce the volume by applying proper compaction layer by layer. Those waste piles shall be re-profiled to obtain suitable slopes to facilitate the surface runoff and thus, minimize the leachate generation. Gas emissions will be reduced by introduction of a passive methane gas oxidising filter in the upper part of the surface. Summary of proposed measures:

- Re-location of waste into one higher waste pile
- Cleaning the surfaces formerly filled by waste
- Compaction of the new waste pile layer by layer
- Re-profiling the waste pile to obtain efficient surface water runoff
- Covering with 0.5 m low permeable soil
- Spreading of seeds to allow a quick vegetation cover
- Diversion of surface water by construction of ditches around the waste pile
- Construction of a methane oxidising filter in the upper part of the waste pile

By those measures there is only a minor need for supervision of the site after termination.

10.2 Kobuleti Non-compliant Landfills

The old landfill, as well as the temporary dumping site should be closed and further disposal of wastes at the site should be prohibited after the new landfill is in operation.

The same measures as proposed for Batumi are also relevant for the two landfills in Kobuleti. However, it is proposed that the smaller waste areas along the road shall be excavated and transported to the old landfill in order to reduce the risk for continued pollution and as well provide a visual improvement of the ground.

Existing groundwater pollution at each of those smaller sites is not deemed possible to rehabilitate at a reasonable cost. It is proposed to apply a robust procedure by excavating the waste down to a depth of 2 m and afterwards backfill with soil. Any additional excavation below the groundwater table in the peat layer will be very costly and the environmental benefit rather uncertain.
11 Project Alternative - Conclusion on Environmental and Social Impact

The new site will be provided with environmental mitigation measures compliant to the EC directive for landfills to minimize potential negative impact on the environment.

In order to put the impact from the new site into its proper context, a description of the no-project alternative is provided below. The no-project scenario means that the project will not be implemented and the negative impact from the existing non-compliant landfills will continue.

Below a description of the environmental improvements foreseen for the Batumi and Kobuleti non-compliant landfills at local, regional and global levels are provided as well as certain social aspects.

Locally the closing down of Batumi (Figure 15) and Kobuleti (Figure 16) noncompliant landfills will contribute to a substantial improvement of the neighbourhood. Covering the landfills will reduce leachate production, littering, odour and other emissions to the air. Stop of incoming vehicles for delivery of waste will diminish the risks of traffic accidents.

Regionally especially closing of Batumi landfill will have a positive impact on lowering the discharge of leachate to the Chorokhi River and stop the ongoing erosion of the landfill along the river.

Globally closing of the landfills and diverting the waste to a sanitary landfill, equipped with efficient means for collecting and use of the landfill gas produced during anaerobic degradation of the organic waste, will reduce the emissions of methane. Thus, closing of the landfills is one measure to reduce the adverse climate impact from waste management.

Figure 15 Non-compliant Landfill in Batumi (Chorokvi River eroding the landfill)
Social effects of closing the landfills include a better neighbourhood environment. Today the open non-compliant landfills represent a constant risk to children and others that may enter the sites. Covering the waste will reduce both safety risks and health hazards.

By terminating the activities at the non-compliant landfills the risk for accidents at unloading due to the occurrence of people scavenging from the waste will be avoided.

Nevertheless waste dumps also are a place for informal recovery of material and recycling activities. A number of informal recyclers are today dependent on sorting out recyclables from the waste being dumped at the sites. By closing and covering the sites these recyclers will not be able to continue. The Project will include measures aiming at formalising the waste recycling activities in a way that can include also people depending on the landfills as a source of their livelihood.

Figure 16 Non-compliant landfill in Kobuleti

Thus, by implementation of the project, including termination of the existing noncompliant landfills and replacing those with a landfill compliant with the EC directive there will be a significant improvement of the environmental impact at all levels.
12 Public Participation Process

The public consultation and disclosure process have been prepared to comply with the Georgian legal requirements, the European Union directive as well as to EBRD’s requirements. Therefore, the Consultant, in close cooperation with the Project Owner (Government of ARA) and Environmental and Natural Resources Department of ARA, has prepared a Public Consultation and Disclosure Plan (PCDP).

The following paragraphs give a brief overview of the basic principles of the PCDP, which were used for developing such a document.

12.1 Georgian Regulations on Public Consultation

The law of Georgia on Environmental Impact Permit (2008) describes the procedure of public consultation/review in the process of EIA and defines a timeline for public review and consulting.

According to the Georgian regulations one public hearing is required to be held in Batumi, in Kobuleti and in Chakvi.

According to the article 7 of the law, during 5 days after conducting the public disclosure meeting, the minutes of the meeting should be prepared to reflect all the questions and comments raised and explanations, provided by the project proponents.

Appropriate corrections should be incorporated into the main text of the EIA, if required. If the comments and proposals of stakeholders are not accepted a letter of explanation should be sent to the authors. The minutes of the meeting, as well as response letters, explanations and corrections should be submitted to the MoE or the administrative body responsible for issuing the Permit as supplementary materials to the EIA. The mentioned documents should be considered as an essential part of the EIA.

12.2 European Regulations on Public Consultation

European regulations regarding public consultation includes:

- The Aarhus convention, adopted on 25 June 1998 at Aarhus, Denmark, "Convention on access to information, public participation in decision-making and access to justice in environmental matters". Adopted by Georgia in April 2000.
12.3 EBRD’s Public Information Requirements

On all projects, EBRD is committed to provide information, within the requirements of the Public Information Policy and the Environmental and Social Policy. In particular, for significant “green field” projects and projects involving a major expansion or transformation-conversion, the Bank is committed to meaningful consultation.

The current project is categorized as “green-field” investments (construction of a new sanitary landfill), which means that according to Georgian law and EBRD’s

Environmental and Social Policies 2003 an environmental impact assessment has to be carried out and discussed and amended on public consultations.

According to EBRD’s public information policy a 120 days public consultation period is required.

12.4 Public Information and Consultation Procedures

The procedure for how the notification is undertaken depends on local political, legal and cultural practices. The project owner needs to provide the potentially affected public and interested non-governmental organizations (NGOs) with information about the nature of the project for which financing is sought from the EBRD. In this project, the Environmental and Natural Resources Department of ARA invited the people living of the potentially affected municipalities, i.e. Batumi and Kobuleti as well NGOs and other organizations interested in the issue (the PCDP includes a full stakeholder list). The sessions were chaired by representatives from Environmental and Natural Resources Department of ARA while the

Consultant’s representatives facilitated the discussion. Grievances, suggestions and amendments were collected, processed and recorded. The final version of the EIA has been completed based on the outcomes of public hearings as well as on considerations of received written notes.

12.5 Public Consultations and Disclosure Plan for the Project

In order to conduct meaningful public consultations the Public Consultation and Disclosure Plan (PCDP) has been elaborated and agreed with EBRD (see annex 3). The PCDP has been publicly disclosed using the web-site of the Directorate of Environmental Protection and Natural Resources of Adjara AR.

At present the following activities have been implemented:

- Publication of draft Scoping Report in central (electronic version: web-site of the DEPNR of Adjara AR; hard copies: offices of DEPNR of Adjara AR and municipalities of Khelvachauri and Kobuleti regions of Adjara)

- 14.09.2008 – Door to door meetings were organized with the local inhabitants living in the vicinity of the Chakvi new landfill. The objective was to inform briefly about the project and the upcoming public hearings.
• 22/23.09.2008 – Public hearings, related to Scoping Report, in Batumi and Kobuleti. The aim was to present the project “Adjara Waste Management Project”, Scoping Report and the Public Consultation and Disclosure Plan (PCDP). The meetings were attended by the local population, NGOs and representatives of the local authority (in all 50 people attended the meeting).

• 24.09.2008 – First consultation meetings with the owners of houses and land plots situated close to the new landfill site. Distribution of brief information regarding the project. Agreement on further meetings.

• 23/24.11.2008 – Before the Public Consultations of the first draft of the Environmental Impact Assessment (EIA), PR/Communications expert and Environmental experts of the Project team conducted door-to-door meetings in Chakvi, with the objective to inform residents living within a 100 – 150 m radius from the new landfill. During the meetings, both local residents and representatives of the villages, received copies of the Executive Summaries of EIA and information about the upcoming EIA Public Hearings.

• 22/23.01.2009 - Public hearings regarding the first draft of the Environmental Impact Assessment (EIA) in Batumi, Kobuleti and Chakvi. The meetings were attended by the local inhabitants, NGOs and representatives of the local authority (in all 85 people).

• 13.03.2009 - Consultations with local residents have continued after the public hearing regarding the first draft of the EIA. Door-to-door meetings have been conducted in Chakvi. The residents have received information regarding the project, its goals and objectives, as well as their rights and interests.

The protocols from the meetings can be found in Addendum 2.