

Figure 13-46: The Plan of the Proposed Disposal Site

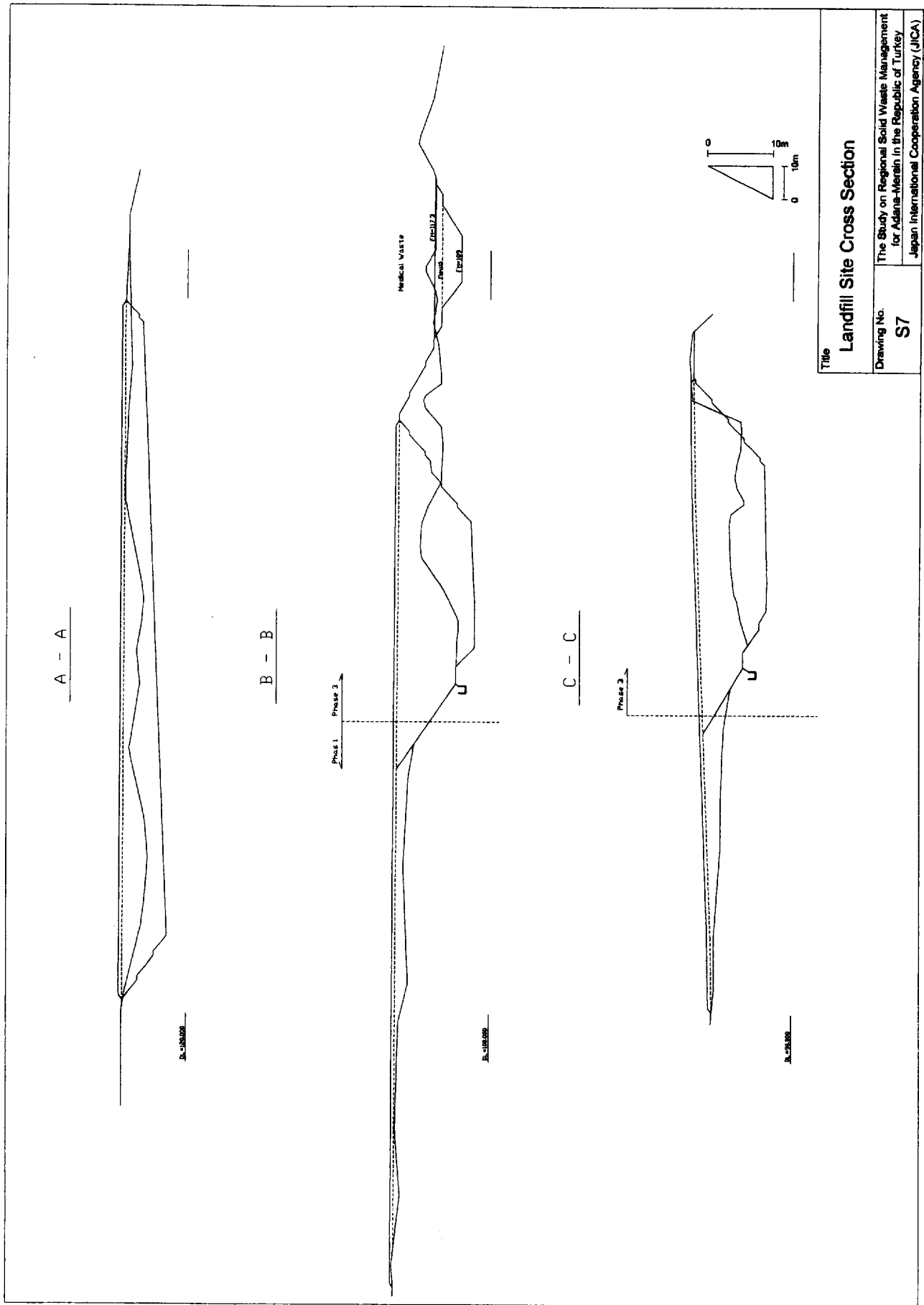


Figure 13-47: Cross Section of the Proposed Disposal Site

Before the commencement of operation at phase 1 site, the existing dumping site will be improved, i.e., the slope of waste is made gentle, gas ventilation system and leachate circulation system is installed, and the surface of the waste is covered with soil completely. The cover soil for phase 1 will provided from phase 2 site.

As the leachate from phase 1 site will be collected through the drain into the regulation pond located downstream of the site and circulated to the phase 1 site, most of leachate produced from phase 1 site will not be discharged out of the site.

Although it is impossible to install the impermeable sheet under the existing dumping site, there is more than 3m of impermeable clay/ marl layer at the bottom of the site of phase 2 and 3, and on impermeable sheet will be installed at the slide slope of the site to prevent the leachate from going into the ground and from polluting the groundwater. The leachate from the phase 2 and 3 site will be collected into the regulation pond and circulated without being discharged outside. Therefore, there will be no impact of leachate from the phase 2 and 3 on the surrounding area.

On the contrary the amount of surface water will increase. On the stage of phase 2 and 3, the phase site is divided into some sections by embankment and operation will be conducted in one section in order to minimise the production of leachate. The rainwater on the section will be collected into the regulation pond, but the rainwater on the other sections will be discharged directly because it is not polluted. Thus, in this project, the waterway will be improved to prevent flooding downstream.

The land for intermediate treatment facilities like a sorting plant and a compost plant will be cut several meters and made flat. The location of the plants and ground plane are as shown in Figure 13-48.

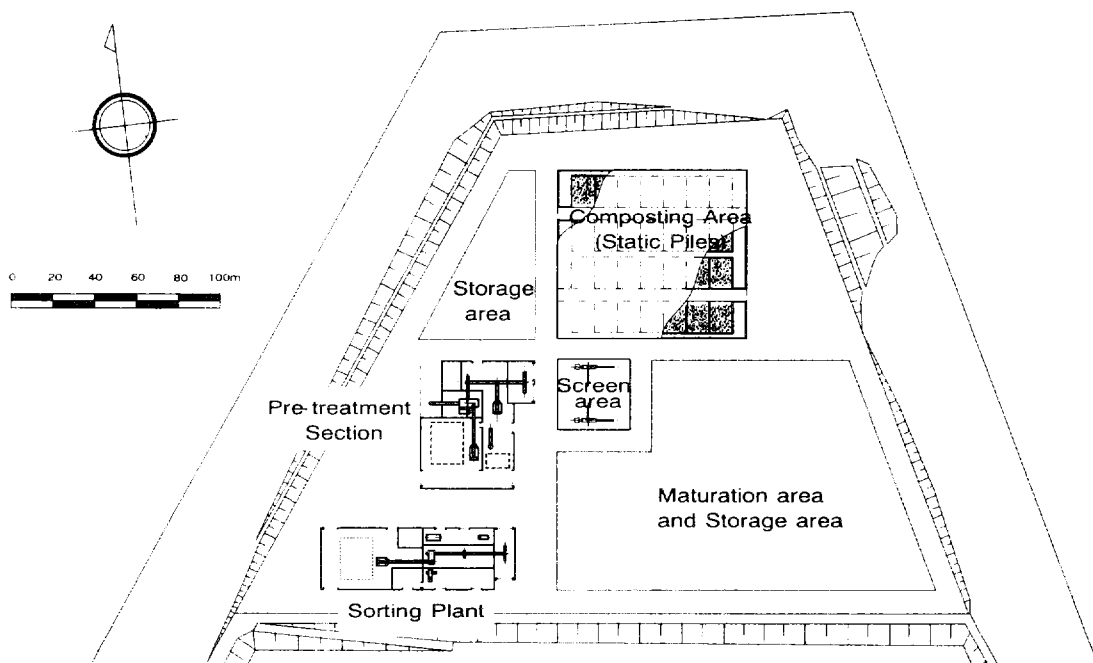


Figure 13-48: Location of Sorting Plant and Compost Plant

The proposed site is used for agriculture, grazing, quarrying activities and others. There is no big tree in the proposed site. In this project the great deal of green trees will be planted in the buffer zone surrounding the whole area of the project to prevent the disposal operation from being viewed.

There is no precise information of the land use. However, apparently 50% of the proposed site is used for agriculture and most farmers grow wheat and barley there. The grain field lost owing to this project will be approximately 37ha.

On the stage of construction of disposal site for municipal waste and medical waste, a few heavy machines like bulldozers, backhoes and dump trucks will operate for earthworks. There may be probability of impact on the environment by noise. The noise owing to construction of sorting plant and compost plant will also occur. The noise and vibration from large trucks, which transport the materials for construction, may impact on the surrounding area. However, there are very few houses within 1,000m radius of the proposed site.

There are few big trees in the proposed site. In this project the great deal of green trees will be planted in the buffer zone surrounding the whole area of the project to prevent the disposal operation from being viewed.

13.5.2 Activities during Operation Stage

The detailed information can be obtained in “ **Operation Plan of Sofulu Site Development of Annex 10 in Volume III** ”.

Activities during operation stage consist of municipal waste disposal, medical waste disposal, and operation of sorting plant and compost plant.

a. Municipal Waste Disposal Site

At disposal site, waste is disposed of every day. In 2005 the amount of waste hauled to the site will be 1,192 t/day. Among this 148 t/day is transported to the sorting plant and 199 t/day is to the compost plant. The final amount of waste to be treated at disposal site will be 965 t/day, including other waste. The equipment for sanitary landfill consists of three bulldozers, one excavator, three dump trucks and one water tank truck.

After the waste is dumped from the collection vehicle, the bulldozer levels the waste and covers it with soil to prevent the landfill fire and offensive odour from breaking out. Daily covering with soil also prevents feeding dogs or birds and growth of vectors and vermin.

Leachate will not be discharged from the site of phase 2 and 3. As the impermeable clay/ marl layer is kept at the bottom of the site, leachate is collected through the pipe into the regulation pond and circulated to the area in operation. It is expected that the volume of leachate will be reduced by the evaporation and concentration of pollutant will decrease.

Landfill gases will be dispersed into the open air through the ventilation system. It can prevent the landfill fire and explosion.

a.1 Landfill Method

The landfill methods are divided into three types; open dumping, sandwich and cell method. The open dumping method can not abate offensive odours, generation of disease vectors and noxious insects, and also does not make well compaction.

- With the sandwich method, soil is spread to cover solid wastes filled horizontally. Where the landfill site is narrow, this method is effective, but if the site is wide, solid wastes are left uncovered for a couple days, resulting in generation of offensive odours etc.
- With the cell method, soil is spread daily to cover solid wastes dumped. Through this method a highly compacted landfill can be obtained and this prevents scattering of solid waste, generation of offensive odour and the breeding of disease vectors and noxious insects. Therefore, the cell method should be applied.

a.2 Cover Soil

Cover soil is to be placed as in the method shown above and the thickness of each layer is as follows.

- daily covering soil: 20 cm
- final covering soil: 100 cm (depending on the ultimate use)

Accordingly, the ratio of cover soil to the disposal volume of waste will be 20 %, excluding final covering soil.

a.3 Landfill Procedure

a.3.1 Basic Plan

JICA study team has proposed phased development that Sofulu landfill area under operation now shall be planned as Phase 1. Construction for Phase 2 will commence in 2001 and landfill operation will commence in 2002. At that time, Phase 1 site will be full and landfill operation will be ceased. Phase 2 landfill operation will be ceased in 2006. Then construction for Phase 3 will commence and landfill operation will start.

a.3.2 Landfill Procedure

Area and volume of Phase 2 landfill site shall be 13 ha and 2,325,000m³ respectively. Municipal Solid Waste can be filled for the period of 5 years at this phase. Area and volume of Phase 3 landfill site shall be 17 ha and 2,351,000m³ respectively. Municipal Solid Waste can be filled for the period of 3 years at this phase.

- In Phase 2 and Phase 3, landfill area shall be divided into some sections by the embankment and area of each section shall cover for one year operation. Landfill operation shall be executed from downstream towards upstream in order to connect leachate collection pipe easier. Rainfall drainage pipe shall be provided from upstream section adjacent to the landfill area in order not to mix the rainfall water and leachate. This rainfall drainage pipe shall be extended according to the progress of landfill operations.

- Gas removal equipment shall be installed according to the progress of landfill operation.
- Municipal solid waste shall be covered by soil everyday in order to keep environmental conditions in the landfill area and its surroundings.
- Municipal solid waste shall be compacted by heavy vehicle in order to secure the landfill volume and stabilise the landfill waste.
- Heavy vehicle used for covering and compaction shall be inspected and maintained regularly.

The landform after the termination of operation will be as shown in Figure 13-49.

b. Medical Waste Disposal Site

In 2005, the amount of medical waste hauled to the disposal site will be 6 t/day. The collection vehicles with capacity 2t will be prepared. The medical waste disposal site is strictly controlled. The entrance is usually locked and nobody except the relevant staff can enter the site. At the site, the special collection vehicle hauls medical waste three times per day and medium type of bulldozer levels the waste and covers it with soil immediately. The leachate is not discharged outside and circulated and treated within the medical waste disposal site.

b.1 Landfill Implementation

Landfill implementation of the medical landfill is shown in Table 13-33.

Table 13-33: Landfill Implementation of the Medical Landfill

Item	Sub-Item	During Operation
Landfill Implementation	landfill method	-cover soil immediately after dumping of medical waste - landfill division by divider(1 year / divider) - cover soil from quarry site in landfill site
	final disposal foundation	article 34 of design standard
	Disposal site floor	article 35 of design standard
	drainage system	article 36 of design standard
	deposition of waste	article 37 of design standard
	top cover	article 38 of design standard
	gas removal	Every 50 meters(vertically and horizontally)
	vegetation of disposal site	article 39 of design standard
Leachate	system	-recirculation system -gravity fall from slope surface
Rain water	drainage system	-individual collection and direct discharge

b.2 Landfill Procedure

The area and the volume of medical waste landfill site are 3 ha and 48,000m³ respectively. Medical waste can be filled for the period of 8 years at this site

- Medical waste landfill area shall be divided into sections by the embankment and area of each section shall be covered for one year operation. Landfill operation shall be executed from downstream towards upstream in order to prevent leachate amount to be increased due to rainfall water flowing from upstream. Therefore temporary drainage shall be constructed at upstream

section adjacent to the landfill area in order not to mix the rainfall water and leachate. This temporary drainage shall be abolished and changed to the leachate drainage system according to the progress of landfill operations.

- Gas removal equipment shall be installed according to the progress of landfill operation.
- Medical waste shall be covered by soil immediately after dumping in order to keep environmental conditions in the landfill area and its surroundings according to the Regulation on Control of Medical Wastes
- Medical waste shall be compacted by heavy vehicle in order to secure the landfill volume and stabilise the landfill waste.
- Heavy vehicle for covering and compaction shall be fixed for medical waste use only.
- Operators, drivers and workers for medical waste landfill operation shall be fixed. They have to take a shower after daily operation and have to take a periodical medical examination.
- It must be fenced and forbidden entering at Medical landfill site and must be locked at gate.

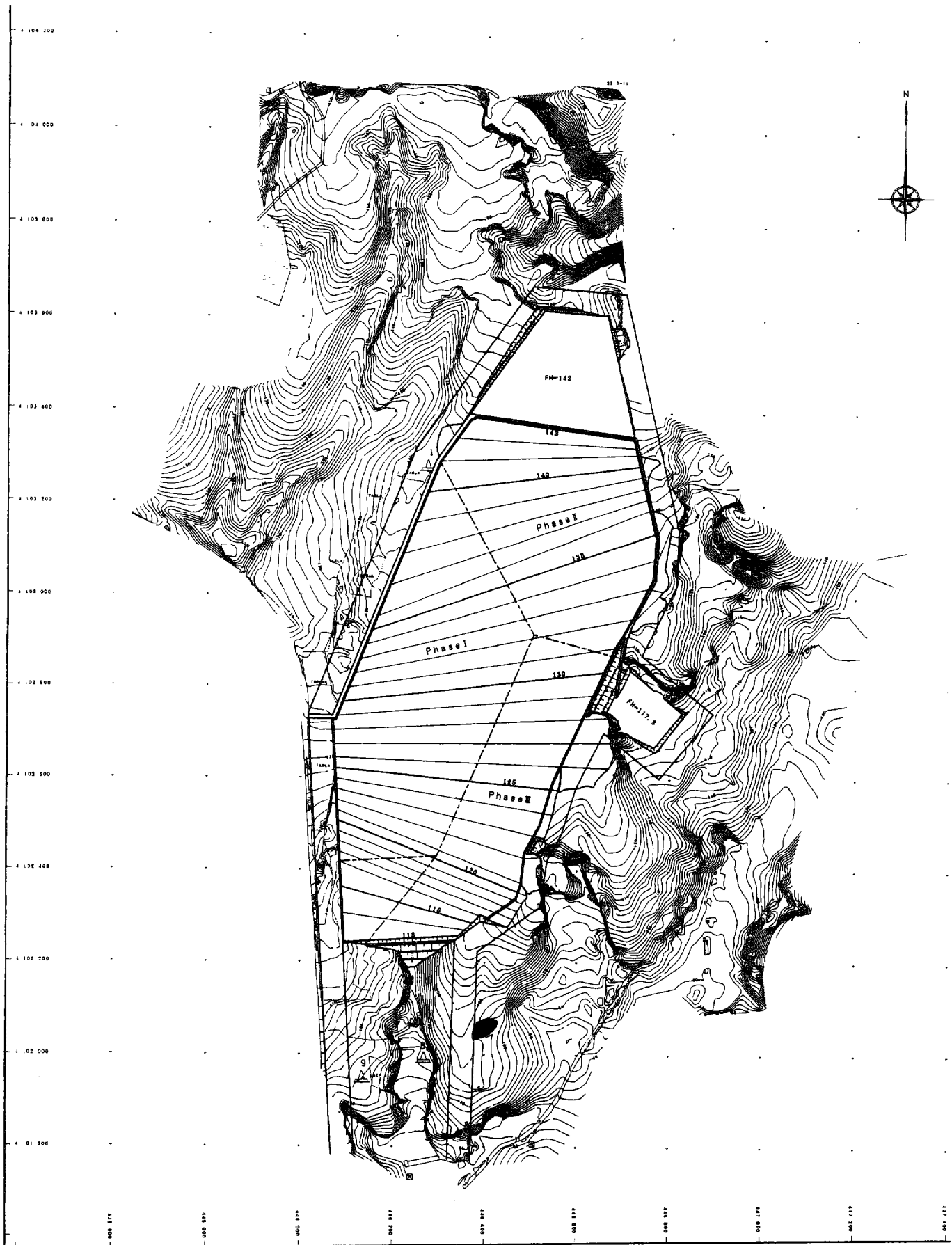


Figure 13-49: The Land Shape after the Termination of Operation