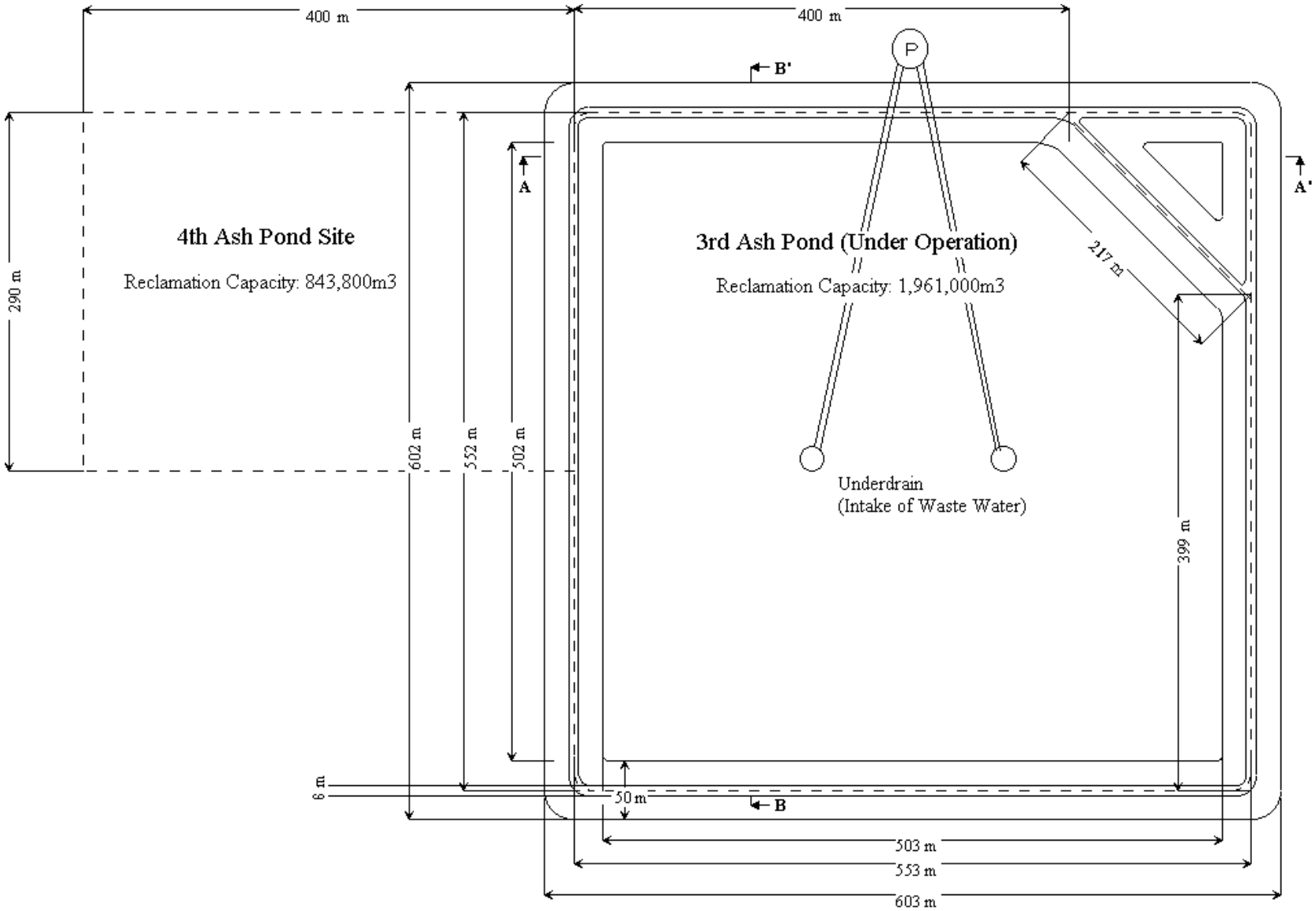

Fig. 6.3-11 Structure of the 3rd Ash Pond

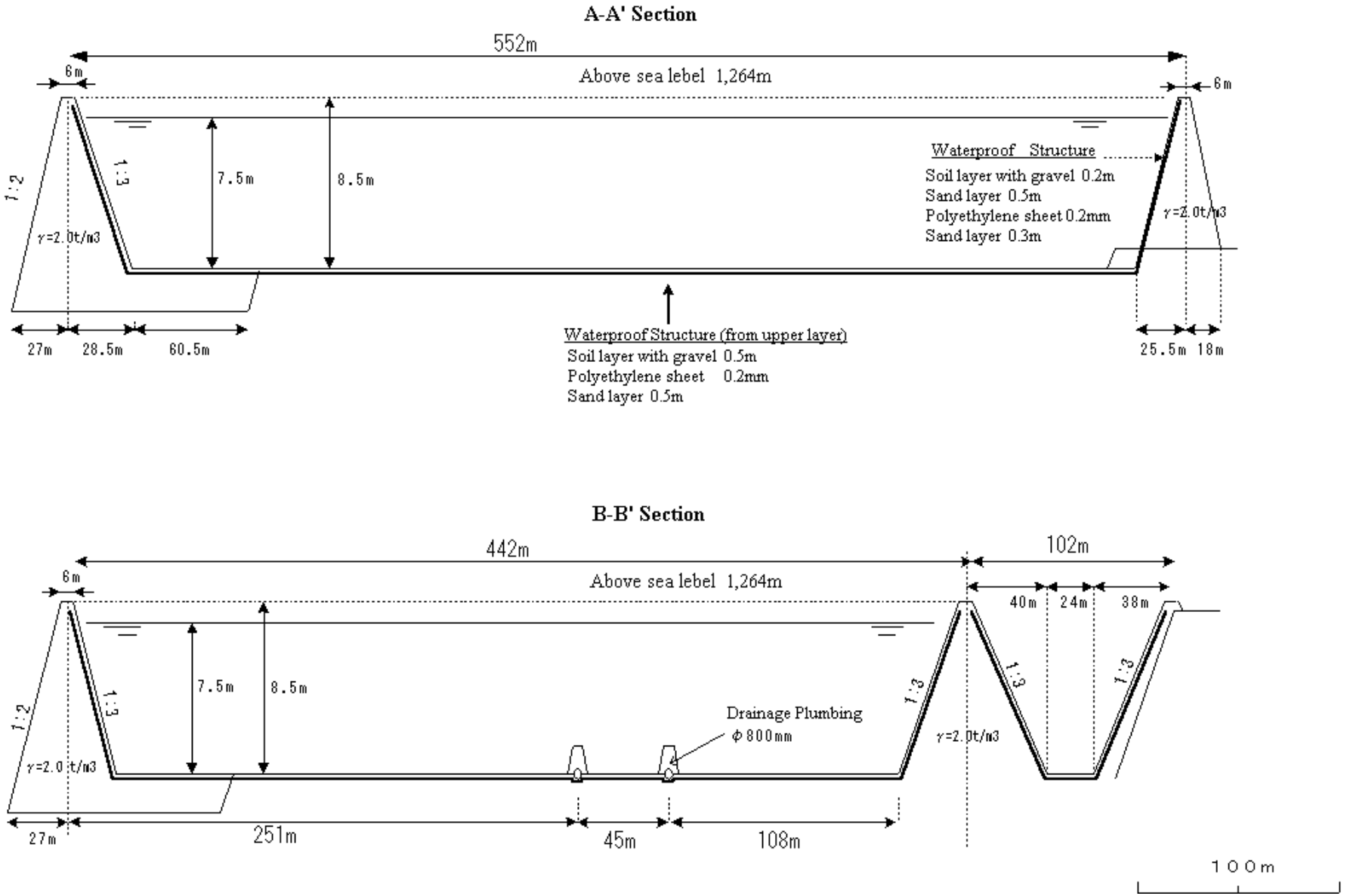

Fig. 6.3-12 Embankment Structure of the 3rd Ash Pond

Table 6.3-20 Embankment Stability of Ash Pond

The physical property value of gravel and sand used by TES4 as embankment materials is as follows.

Physical property	Unit	Gravel	Sand	(Reference) Coal ash
γ value	t/m^3	2～2.2	1.8～2.0	0.85
σ value *1	kgf/cm^3	> 2.5	> 2.0	0.5～1.0
Φ value *2	°	40	38	31
C value *3	mPa	1	2	

*1 : Effective stress of sliding face and vertical direction
*2 : Angle of internal friction
*3 : Adhesive power of the ground based on total stress

By comparing the physical properties value of above gravel/sand with following soil constant number of Japanese landfill standard, it is examined what kind of landfill the embankment of ash pond corresponds to.

Soil constant number (Design point of Japan Highway Public Corporation)

Sort		Status		Weight per unit volume (tf/m^3)	Internal friction power (°)	Adhesion (tf/m^2)
Landfill	Stones, Mixture of stones & sand	Compacted		2.0	40	0
	Sand	Compacted	Good particle size Rough particle size	2.0 1.9	35 30	0 0
	Sand soil	Compacted		1.9	25	< 3
	Viscous soil	〃		1.8	15	< 5
	Kanto loam	〃		1.4	20	< 1

Consequently, the gravel and sand currently used for the embankment of ash pond were considered to be the compact sand with rough particle and the slope of embankment was compared with the standard gradient of Japanese landfill slope.

Landfill material and Japanese standard of slope gradient for landfill height is shown in following table (Source: Japan Road Association).

Standard of the slope gradient for road landfill

Landfill material	Landfill Height (m)	Gradient	Summary
Sand with good particle size, Gravel and gravel mixing sand	Less than 5m	1:1.5～1:1.8	It is applied to the landfill with sufficient support power of basic foundation and without influence of flood.
	5～15m	1:1.8～1:2.0	
Sand with rough particle size	Less than 10m	1:1.8～1:2.0	
Rock lump	Less than 10m	1:1.5～1:1.8	
	10～20m	1:1.8～1:2.0	
Sand soil, hard clay (hard clay of diluvial layer, Kanto loam, etc.)	Less than 5m	1:1.5～1:1.8	
	5～10m	1:1.8～1:2.0	
Soft viscous soil	Less than 5m	1:1.8～1:2.0	

According to the standard slop gradient of road landfill, the stability of a landfill with height 10m or less using sand with rough particle size is kept enough, when the slope gradient is designed by 1:1.8 to 1:2.0.

Since the embankment of 3rd ash pond is designed in the height of 10m or less with outside slope gradient 1:2 (reclamation side 1:3), the stability of embankment seems to be sufficient by considering Japanese gradient standard of the landfill slope

2) Management Problems of the 3rd Ash Pond

(a) Exudation Water Leakage generated in 2000 and Measures

a) Wastewater leakage occurred once from the embankment of the 3rd ash pond in the past. As for the part of the embankment that leaked wastewater, the protection sheet was set up only to half the height of the inner side. The site of poor enforcement is a few sections of the western and southern embankment.

For this reason, exudation water leaked from the embankment and flowed out like a stream.

b) As measure against wastewater leakage, reclamation of the ash slurry volume was increased near the leakage area. Furthermore, the ground peak to the embankment outside was taken out due to the reinforcement. By these measures, the leakage of wastewater has so far not occurred.

c) The occurrence period of wastewater leakage was early spring of 2000. At that time, waves were generated by strong winds on the water surface that exceeded the sheet height. Moreover, this period overlapped with the ash scattering generation time. This wastewater leakage was also considered to have been promoted by the raising of the water level for ash scattering measures.

Fig. 6.3-13 shows the present status of the southern embankment where measures against wastewater leakage were taken.

(b) Status of Ash Reclamation

The calculation result of TES4 regarding the ash reclamation amount after 1995 is shown below. The total amount of coal ashes from the power station has been reclaimed from the ash pond without effective use.

Calculation Result of Ash Disposing Quantity in the 3rd Ash Pond （Unit: 1,000 t）

Year	1995	1996	1997	1998	1999	2000
Baganuur coal consumption	1806.8	2072.1	1958.6	1982.3	1787.4	1792.2
Shivee-Ovoo coal consumption	161.7	17.2	20.4	62.7	288.1	398.2
Total	1968.5	2089.3	1979.0	2045.0	2075.5	2190.4
Ave. Ash Content *1	12%	12%	12%	12%	12%	12%
Ash quantity	236.2	250.7	237.5	245.4	249.1	262.8
Ash volume 1000 m^3 *2	277.9	294.9	279.4	288.7	293.0	309.2
Ash disposal total volume	1743100 m^3 （Approx. 90% of ash pond capacity of 1,961,000 m^3）					

**1: Value considering ESP efficiency *2: Revised by specific gravity 0.85*

According to this calculation result of the ash disposing amount, the 3rd ash pond is almost full now and reclamation will become difficult in 2002 and beyond.

The problem of wastewater exuding from an embankment exceeding the limit is creating concern in the circumference environment.

As a measure, TES4 has been constructing the 4th ash pond for about two years for urgent reclamation, but it has a small-scale capacity, since securing a sufficient budget was difficult.

Therefore, to maintain stable operation of the power plant, it is judged necessary to construct an optimum ash pond for long-term reclamation.

(c) Environmental Impact of Ash Scattering

In the present operation, there is neither wastewater leakage from the ash transportation system nor water exudation from the ash pond. Moreover, the influence of the ash pond on the water quality of the Tuul River has not been seen.

However, the ash scattering occurs from the ash reclaimed surface by the strong winds that occur every spring. Especially in April 2000, ash scattering from the 3rd ash pond occurred frequently by the drying surface and comparatively strong northwestern wind. At that time, TES4 received complain from surrounding resident, etc, when a lot of ash scattered and reached to the residential area in southwest of Tuul River.

As ash scattering mitigation, TES4 takes measure to wet the dry surface by increasing ash slurry volume from the transportation pipe near the ash scattering place. However, as for the mitigation of ash scattering a sufficient effect is not obtained. Therefore, due to mitigate ash scattering from dry surface reclaimed with ash partially, certain measures have to be taken in hereafter, such as covering with soil, periodical sprinkling with pond water, etc.

3) The 4th Ash Pond (Under construction)

TES4 is constructing the 4th ash pond as urgent reclamation to the western side of the 3rd pond since 2001. A Mongolian design company (TTC) designed the 4th pond based on the Russian design of the 1st to 3rd ash pond and two companies are engaging the construction work. The construction work process is being delayed, although development is completed to the embankment height of 5.8m in October 2001.

In addition, inside construction of the pond including pond bottom, adjustment facility of the water level, waterproofing layer of embankment, etc. is planed in 2002.

- Construction term: 2001 to October 2002 (planed schedule)
- Scale: reclamation capacity 843,800m3 (about 290m x 400m)
- Embankment scale: upper width about 5m, bottom width about 60m, height 9 to 10m, inner side gradient 1:3, outside gradient 1:2
- Waterproofing structure: the same as the 3rd ash pond
- Ash reclamation period: about 2 years
- Construction cost: amount 4 billion Tug

Figure 6.3-14 shows a construction status of the 4th ash pond.

Fig. 6.3-13　Southern Embankment Outside Status of the 3rd Ash Pond (On October 5, 2001 shooting)

Measure marks Status of the waste water leakage occurred in 2000

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Fig. 6.3-13　Southern Embankment Outside Status of the 3rd Ash Pond (On October 5, 2001 shooting)

Measure marks Status of the waste water leakage occurred in 2000

Fig. 6.3-14 Construction Status of the 4th Ash Pond (On October 5, 2001 shooting)

4th Ash Pond under Construction on the West Side of the 3rd Ash Pond