CHAPTER VII

RECOMMENDATION AND SUGGESTION FOR FURTHER WORKS

According to the work-plan of the mine, the rocks of Overburden Claystone in the northwestern part of the existing mine pit will be excavated for the exploitation of Lignite K Seam which locates at a depth of about 70 to 100 meters from the original ground surface. This means that the height of the northwestern flank slope will be approximately 70 to 100 meters and thus with a rather steep slope angle. The slope stability generally decrease with the increasing of slope height and slope angle.

Higher factor of safety is needed to reduce the risk of landslide which may damage the existing electric power plants located nearby. Remedial and preventive measures can be done by reducing the presence of the surface water or prevent it from penetrating this area, and by lowering the groundwater table, and if possible reducing the slope angle.

In the working area where the excavation has to be toward the up-dip direction, the stripping height should also be reduced. Changing of the approached direction of the excavation to be along the strike of bedding plane is also recommended.

To predict a slope failure and to judge the effectiveness of remedial measures, the monitoring system should be installed to continuously

measure the ground movement and groundwater pressure and their rate of change.

Some more - important geologic - and engineering properties await the understanding here. The further study should be done to fulfill the knowledge so, to refine a better conclusion and recommendation on slope stability improvement. The further detailed studies are listed below.

1) A nature of highly weathered claystone and its process of weathering, especially for chemical weathering is needed to be known. The weathered claystone is known to be less competent but the factors controlling the less competency is yet to be found.

2) A further study of claystone specimens aiming to find the homogeneity of clay mineral content throughout the concession area is recommended. The absence of the expansive clay should also be re-confirmed while the swelling pressure of these rocks be tested. The rock specimens should be collected from Overburden -, Interburden - and upper part of Lower Claystone, the last two groups will play a greater role when Lignite Q Seam is to be exploited.

3) The effect of lignite combustion is suspected to relate to the strength reduction of adjacent claystone. This idea should be tested.

4) A further study on the nature of the materials along the slip planes and other fractures, on their shear strength parameters, and on the detailed features on the fracture furface is suggested. The materials allow the groundwater to flow through the fractures and may

themselves be the least competent hence causing the problem in the slope stability while the surface features of the fractures give the understanding of the nature of slip. The roughness of the surface of fractures as controlled by these features may resist the planar slip to a certain degree.

5) Piezometric study of the areas where the future critical slopes will locate, is recommended. As the excavation approaches these areas the piezometric change should be recorded. The study should be aimed at the groundwater flowage through the primary porosity of rocks, along fractures and other secondary porosity e.g. that created during the weathering process.

In addition, the quantitative resistivity data presented in chapter III should be tried to correlate with the further detaited subsurface-geologic data.

The recommendation of the chemical reaction caused by the groundwater flowage is also included here.

6) The further detailed discontinuity survey is still needed to locate the concealed major structures and other planes of weakness which are the potential of instability. The study should be done in parallel with the further mine pit excavation.

7) The other methods of slope stability analyses, i.e., Janbu's non-circular failure method, two-dimensional wedge failure method, finite element method, etc. are also needed to be tested in this

area since there are already a lot of information here. The most-proper analysis method will help eliminate the uncertainly about the risk of failure.

8) Finally, the techniques of excavation and an appropriate preventive and remedial measures for improving the stability of slope should be developed with the more - collected information. The better technique will increase the safety for mining operation. These mining techniques should be modified according to the geologic nature and of the allowable investment.