Groundwater Flow Modeling Based on the Site Descriptive Model Around KURT

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1. Introduction

Korea Atomic Energy Research Institute Underground Research Tunnel (here after KURT) is a research tunnel for high level radioactive waste disposal in Korea. Several geo-environmental studies related to the site characterization such as geological, hydro-geological and geochemical investigations had been carried out around KURT site since 2007 [1]. Recently, the site description model for KURT was finally built from the results of various geo-environment studies [2, 3]. In this study, we would like to introduce the site descriptive model of KURT area such as the geological model and the hydrogeological model, and the groundwater flow modeling results based on the site descriptive model.

2. Site descriptive model around KURT

2.1 Geological model

We synthesized the site characteristics obtained by various types of site investigations to construct the geological model around KURT site. From the geological investigations at the surface and boreholes, four geological components such as subsurface weathered rock, upper fractured rock, lower fractured rock and fracture zones were defined for the construction of geological model. In addition, the three-dimensional geometries of these geological components were analyzed for the model (Fig. 1).

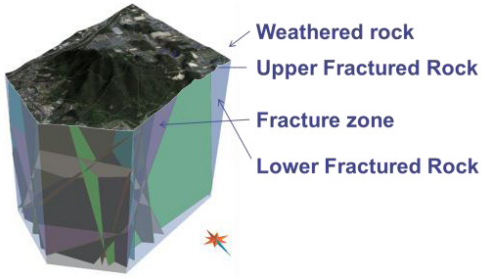

Fig. 1. Geological model around KURT.

2.2 Hydro-geological model

The geological model was used to construct the hydro-geological model (hear after HG model) around KURT site. Hundreds of in-situ hydraulic field tests had been carried out to obtain the hydrogeological properties of geological components around KURT site.

As a result, four geological components such as weathered rock, upper fractured rock, lower fractured rock and fracture zones were identified Hydraulic Soil Domain (HSD), Upper Hydraulic Rock Domain (UHRD), Lower Hydraulic Rock Domain (LHRD) and Hydraulic Conductor Domain (HCD) of the HG model, respectively (Fig. 2).

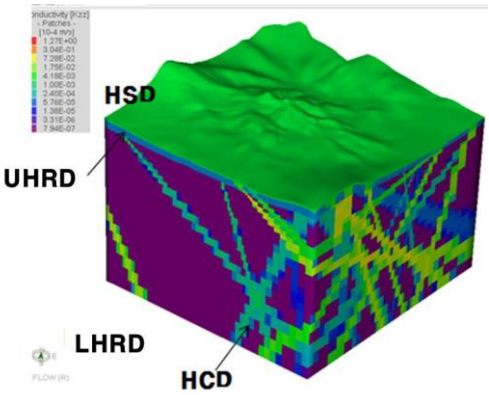

Fig. 2. Hydrogeological model around KURT.

2.3 Groundwater(GW) flow modeling

The model domain for groundwater flow modeling was constructed based on the HG model. The domain for modeling had total 30 layers, which the 1st layer was for HSD, the 2nd and 3rd layer were for UHRD and the below layers of the 3rd layer were for LHRD. The HCDs were located inside the LHRD with the estimated hydraulic conductivities from in-situ hydraulic tests.

The boundary conditions used in groundwater flow modeling were the constant head boundaries for side walls of the domain, which was obtained from lager scale model (local scale model), and the flux boundary was assigned to the upper surface as recharge boundary (Fig. 3). The groundwater flow model was calibrated by adjusting the recharge rate to minimize the difference between the observed and simulated hydraulic heads, and the calibrated recharge rate was 12.7% of annual precipitation around KURT area.

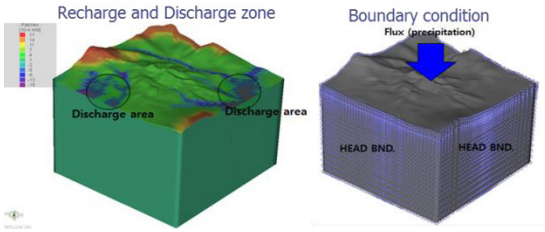

Fig. 3. Recharge rate and boundary condition used in groundwater flow modeling.

3. Results of GW flow modeling

The results of groundwater flow model could explain the artesian condition of southern area of KURT, which was one of the most important hydrogeological properties around KURT site. Also, we could understand that the groundwater flow of the deep environment of KURT was mainly affected by HCDs. To validate groundwater flow modeling around KURT area, the results from modeling are compared with the results of in-situ hydraulic tests (i.e. long term interference test). The validation results show that our groundwater flow model described the long term interference tests well.

4. Conclusion

Groundwater flow modeling was carried out around KURT area. Before the groundwater flow modeling, the geological model was constructed after geological investigation. Then, in-situ hydraulic tests to characterize the hydrogeological properties of the geological components around KURT were conducted, and the HG model was constructed. In the geological model, there were four model units, which were weathered rock, upper fractured rock, lower fractured rock and fracture zone in the geological model although HSD, UHRD, LHRD and HCDs in the HG model. The HG model was used for the input parameters for groundwater flow modeling, and the results indicated that the fracture zones were very influential on deep groundwater flow around KURT area.

Acknowledgement

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