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Determination of Pore Pressure Distribution and Its Control for Slope Stability in an Active Mine Site

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Prediction of pore water pressure distribution in large excavations such as open pit mines is an important issue since unfavorable groundwater regime is one of the main causes of slope instability. This paper presents pore water pressure distribution and groundwater flow along North-South and East-West cross sections in an open pit mine mainly in metasediments located in Eastern Turkey. Representative hydrogeological conceptual model was developed based on the field studies and then the conceptual model was transferred to numerical model through SEEP/W of GeoStudio. 2D model was used for this work since it can incorporate geometrical and material heterogeneities in vertical planes quite effectively and easily. After construction of model grid and assignment of hydraulic properties, calibration of the model was conducted under steady-state conditions by trial-and-error for the selected sections. After several trials of calibration runs the RMSE was calculated as 6.93 meter, 92.01 kPa and 9.40 meter for total head, pore water pressure and pressure head values, respectively for North-South cross section. RMSE for East-West cross-section was calculated as 6.54 meter, 93.56 kPa and 9.57 meter for total head, pore water pressure and pressure head values, respectively. Steady state calibrations are followed by transient analyses for twenty years to confirm the steady state values at both sections. Results show that transient run in the long term reaches a steady-state condition which is not significantly different than the generated steady-state solution and can be used for designing of horizontal drainage systems. Finally, horizontal drains were simulated at different critical slopes and performance of these systems in terms of depressurization of the excess pore water pressure were evaluated.

Keywords: SEEP/W, Drain, Slope Stability, Turkey