11 Dam with Unconfined Groundwater Flow (Muskat's Problem)

11.1 Problem Description

This verification considers the groundwater flow in a uniform dam. The results from this model are compared to the analytical results from reference [1]. Figure 11-1 illustrates the geometry of the model and Figure 11-2 shows the mesh and the boundary conditions of the studied model.

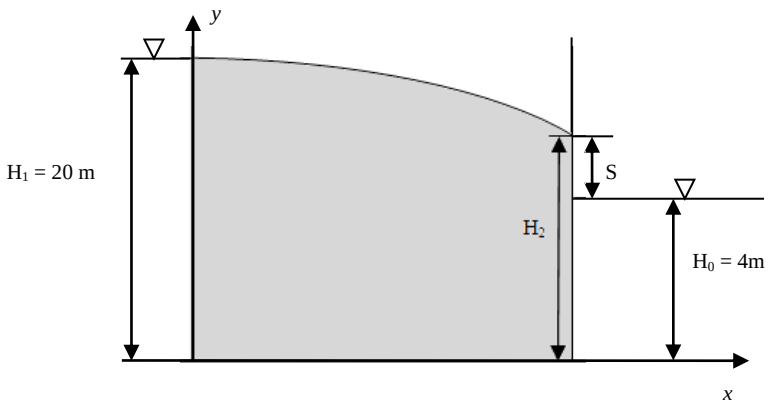

Figure 11-1: Geometry of the dam

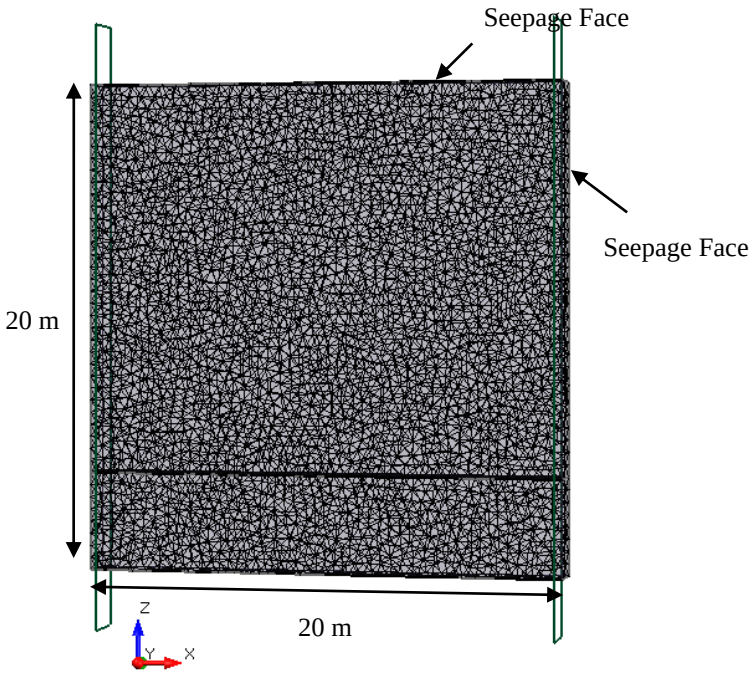

Figure 11-2 : Mesh and boundary conditions of the model

Table 1 shows permeability function used for the analysis.

Table 11-1 : Permeability data

Matric Suction (kPa)	*Permeability(m/s)*
0	0.0057
1	0.0000057

11.2 Model Properties

The model consists of a 20 m × 20 m square with thickness of 1m as shown in Figure 11-2. The groundwater boundary condition on the left side of the model is assigned as "Total Head" with the value of 20 m (H_t=*20 m*). On the right-hand side, the total head value is assigned to be 4 m (H_0=*4 m*). Field stress is assigned as gravity only and the hydraulic properties are isotropic. Two discharge sections are added at the left and right side of the model shown by green lines in Figure 11-3.

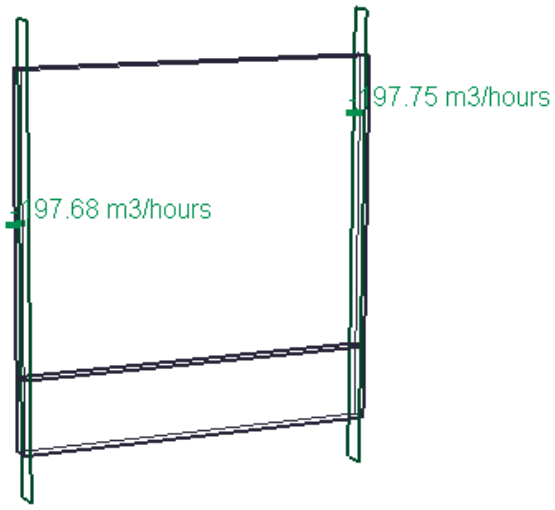

Figure 11-3 : Discharge quantities

11.3 Results

The results for the model are summarized in Table 11-2.

Table 11-2 : Results

H_1 (m)	*H_0 (m)*	*S (m)*		*Discharge quantity (m^2/h)* *	
		Ref [1]	RS3	Ref [1]	RS3
20	4	4	4.0	198.5	197.7

* A 1m section is considered for the model.

Figure 11-4 shows the contours for pore water pressure.

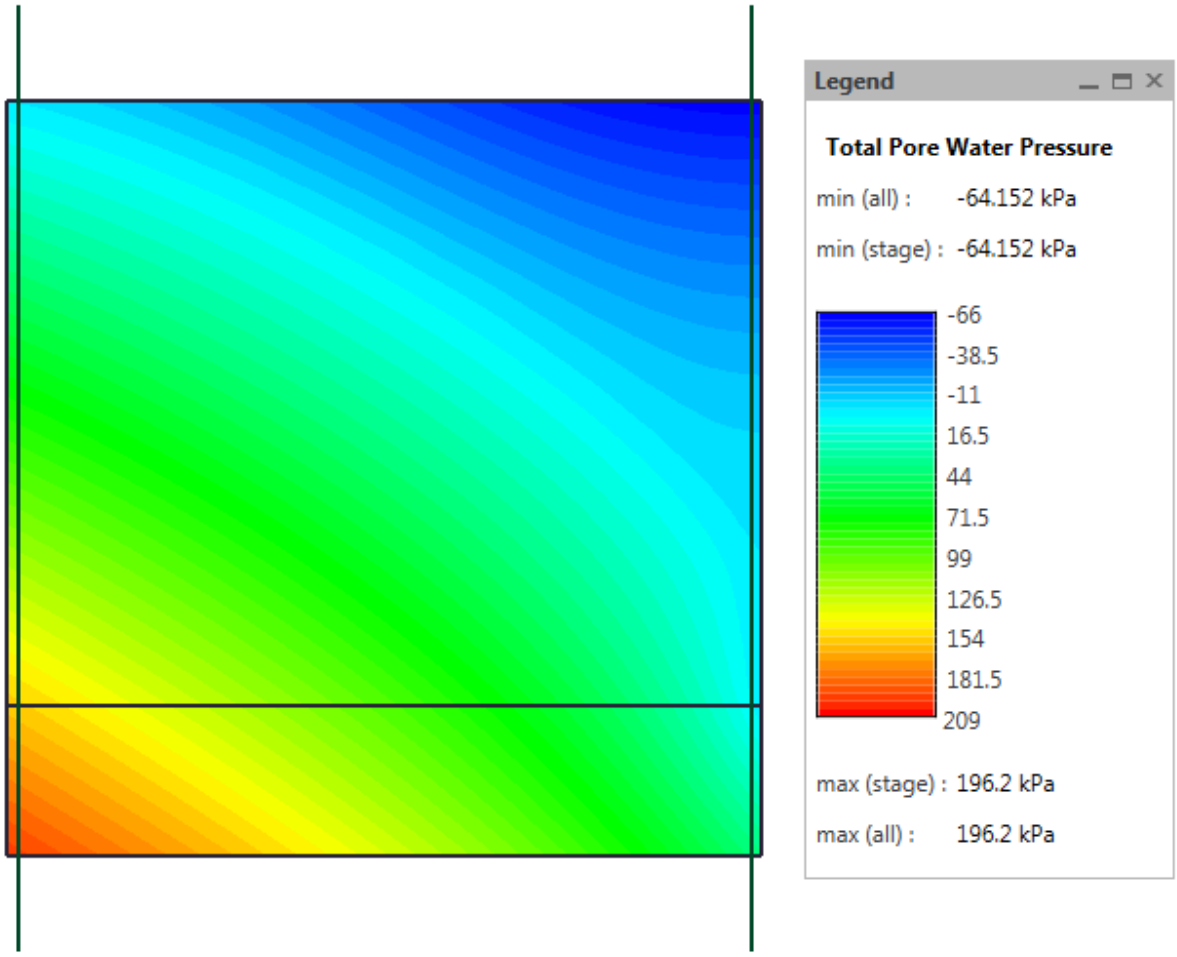

Figure 11-4 : Pore water pressure contours

11.4 References

1. Lee, K. -K, and D. I. Leap. "Simulation of a Free-Surface and Seepage Face using Boundary-Fitted Coordinate System Method." *Journal of Hydrology* 196.1-4 (1997): 297-309.

11.5 Files

The input data file **V011.rs3model** can be found in the ***RS3*** installation folder.