

„Soil water regime management“

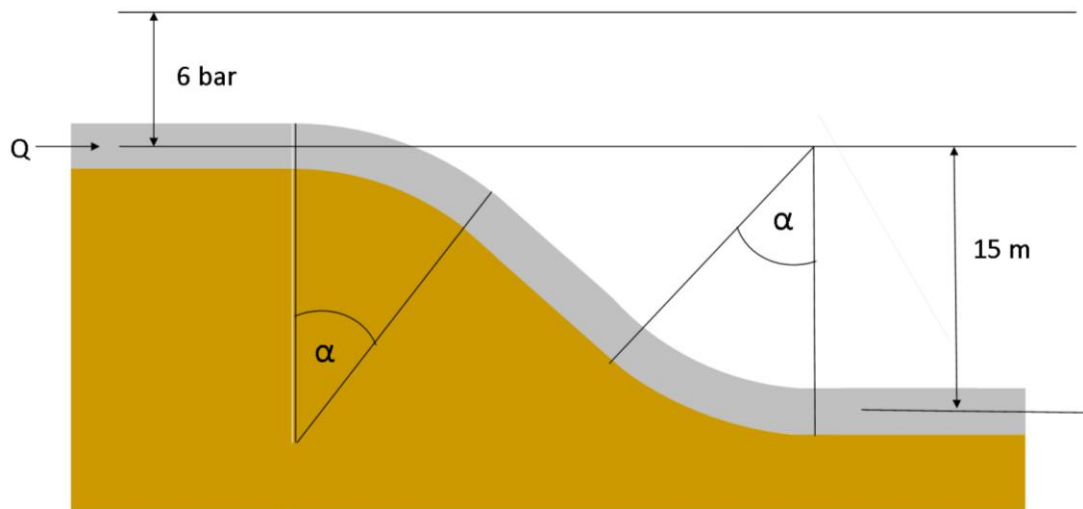
Assignment 5

IRRIGATION BY ASPERSION AND MICRO - IRRIGATION – Anchorages

(Due date: 5th of December 2012, please hand in on a sheet of paper)

Exercise 1

A pipe with an inner diameter of 110 mm is used to transport the water for irrigation from the reservoir to the fields. The pressure in the pipe is of 6 bar and the flow rate is 28 l/s. The reservoir is 15 meters higher than the fields and the angle α of the pipe is 50° .



You can make the following assumptions:

- The head losses are negligible
- At the first curve: $p_{\text{inflow}} = p_{\text{outflow}}$
- At the second curve: $p_{\text{outflow}} = p_{\text{inflow}}$

- a) Calculate the resulting force on the curves taking into account the conservation of momentum and make a drawing with the direction of the resulting force.

$$\text{Hint: } |F| = \sqrt{F_1^2 + F_2^2 - 2F_1F_2 \cos \alpha}$$

- b) Calculate the resulting force using the formula given in the lecture (F=KPS, polycopies lecture 8, p. IV-14) and make a drawing with the direction of the resulting force, discuss.

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Exercise 2

An underground drainage system is planned in the Haute-Broye region on a gently sloping perimeter (gradient of around 1 to 2%), consisting of a generally sandy-silty textured soil (saturation hydraulic conductivity $K_s = 8 \times 10^{-5}$ m/s and drainage porosity $\mu = 0.06$) overlying a clay layer ($K_s = 2 \times 10^{-8}$ m/s and $\mu = 0.01$) located at an average depth of 2.4 metres. The perimeter is expected to be cultivated mainly with cereals.

Determine the spacing of the drains, under steady-state conditions and under drying conditions, using rainfall data from the nearby Tour-de-Gourze station (Table 1). Drains with a diameter of 8 cm will be placed at a depth of 1 m. Under steady-state conditions, the critical depth of the water table between the drains should be around 50 cm; under drying conditions, to allow rapid access to the plots, the aim should be to be able to lower the water table, initially close to the surface of the ground, by 50 cm in 1 day.

Table 1 Pluies de 3 jours pour différents temps de retour à la Tour-de-Gourze

T (ans)	mm en 3 jours
2	72
5	90
10	102
20	114
50	128
100	139

Table 2 Valeurs indicatives du coefficient de restitution

Cond. hydraulique	Pente en %			
	< 1	1 à 5	5 à 10	10 à 15
Bonne	1	0.9	0.8	0.7
Moyenne	1	0.9	0.7	0.6
Faible	0.9	0.8	0.7	0.6

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Exercise 3

Consider the scheme in the figure 1 below. The foundations of a house are at risk of intercepting the water table of a freatic aquifer in the case the downstream water level reaches the height h_2 . The width b of the foundations is given. It is asked:

- 1) To calculate the flowrate reaching that would reach, under natural conditions, the downstream aquifer located at a distance L .
- 2) To calculate the total and the specific flowrate per unit length that should be depleted in the case a trench is dug at a distance $L/2$ with the purpose of nullify the flowrate reaching the downstream aquifer. Explain the result

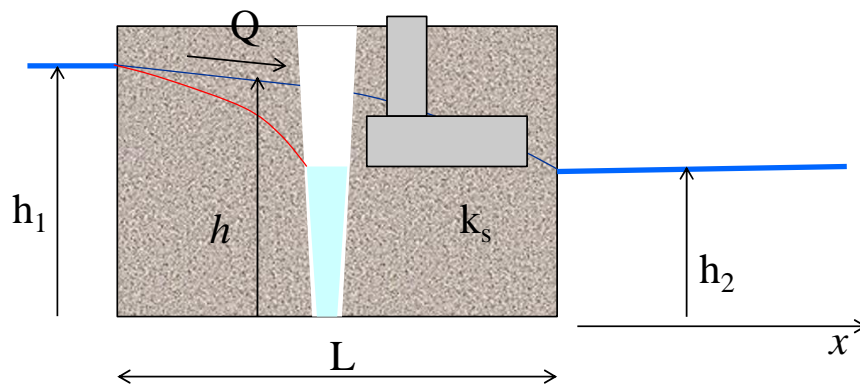


Figure 1

Data:

$h_1 = 10$ m; $h_2 = 8$ m; $L = 1000$ m; $b = 500$ m; $k_s = 0.002$ m/s