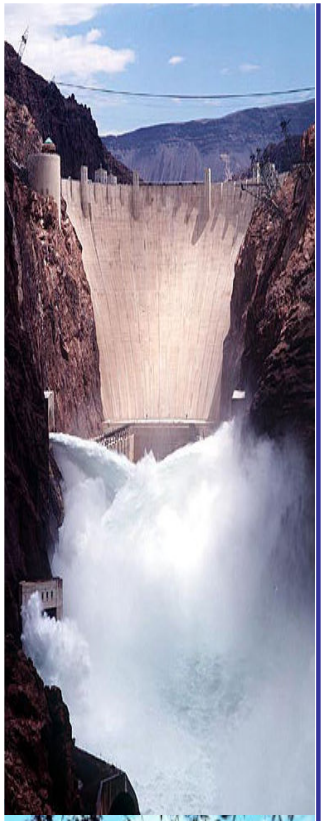
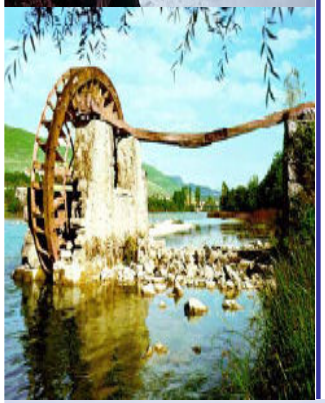




SVEUČILIŠTE U SPLITU
GRAĐEVINSKO-ARHITEKTONSKI FAKULTET
UNIVERSITY OF SPLIT
FACULTY OF CIVIL ENGINEERING AND ARCHITECTURE

VJEŽBE 2

-PRIMJENA DARCY-evog ZAKONA

Split, 04. travnja 2012.

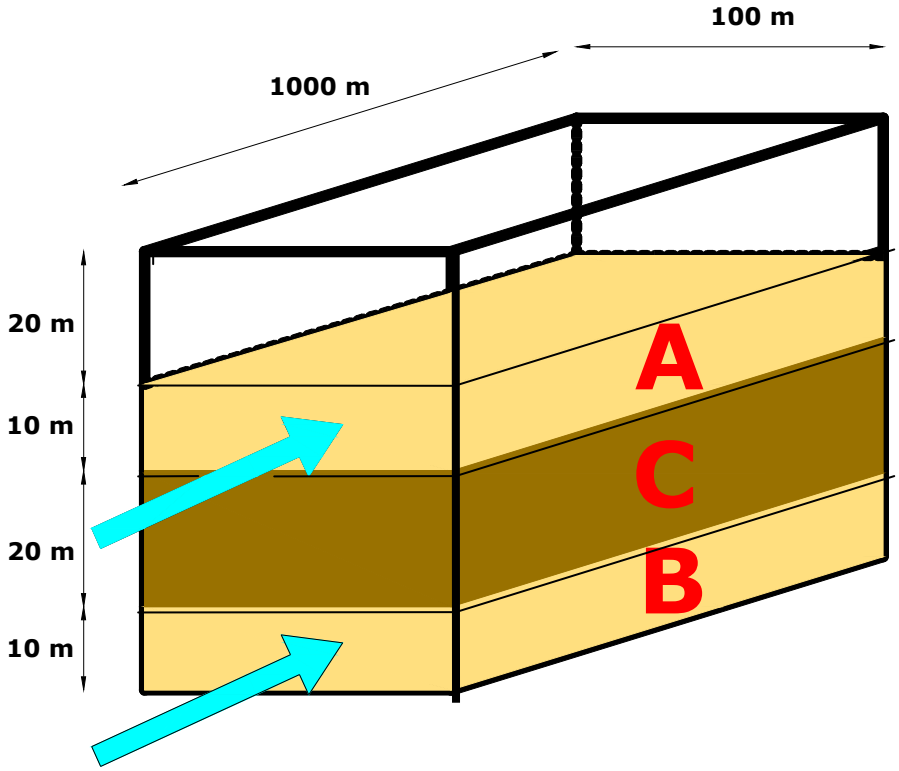
4. ZADATAK:

Postoje dva akvifera pod tlakom A i B debljine po 10 m svaki, međusobno odijeljeni slabo propusnim proslojkom gline C debljine 20 m. Nivo piezometarske linije je 10 m manji u gornjem akviferu.

$K_A = K_B = 10^{-6}$ (m/s)
$K_C = 10^{-9}$ (m/s)
$\Delta H = 10$ (m)

$$I_{ULAZ}^{A,B} = 0.1$$

A) Nađi ulazni protok u oba akvifera?
B) Nađi izlazni protok iz oba akvifera?
C) Nađi gradijent u oba akvifera na izlaznom presjeku?



A)

$$Q_{ULAZ}^{A,B} = -K \cdot I \cdot A = 10^{-6} \cdot 10^{-1} \cdot 100 \cdot 10 =$$

$$10^{-4}(m^3 / s) = 8.64(m^3 / dan)$$

B)

$$Q_{A,B} = 10^{-9}(m / s) \cdot \frac{10m}{20m} \cdot 1000m \cdot 100m =$$

$$0.5 \cdot 10^{-4}(m^3 / s) = 4.32(m^3 / dan)$$

$$Q_{IZLAZ}^{A} = Q_{ULAZ}^{A} + Q_{A,B} = 12.97(m^3 / dan)$$

$$Q_{IZLAZ}^{B} = Q_{ULAZ}^{B} - Q_{A,B} = 4.32(m^3 / dan)$$

C)

$$Q = -K \cdot I \cdot A \Rightarrow I = \frac{-Q}{K \cdot A}$$

$$I_A = \frac{1.5 \cdot 10^{-4}}{10^{-6} \cdot 10^{2} \cdot 10} = 0.15 \qquad I_B = \frac{0.5 \cdot 10^{-4}}{10^{-6} \cdot 10^{2} \cdot 10} = 0.05$$

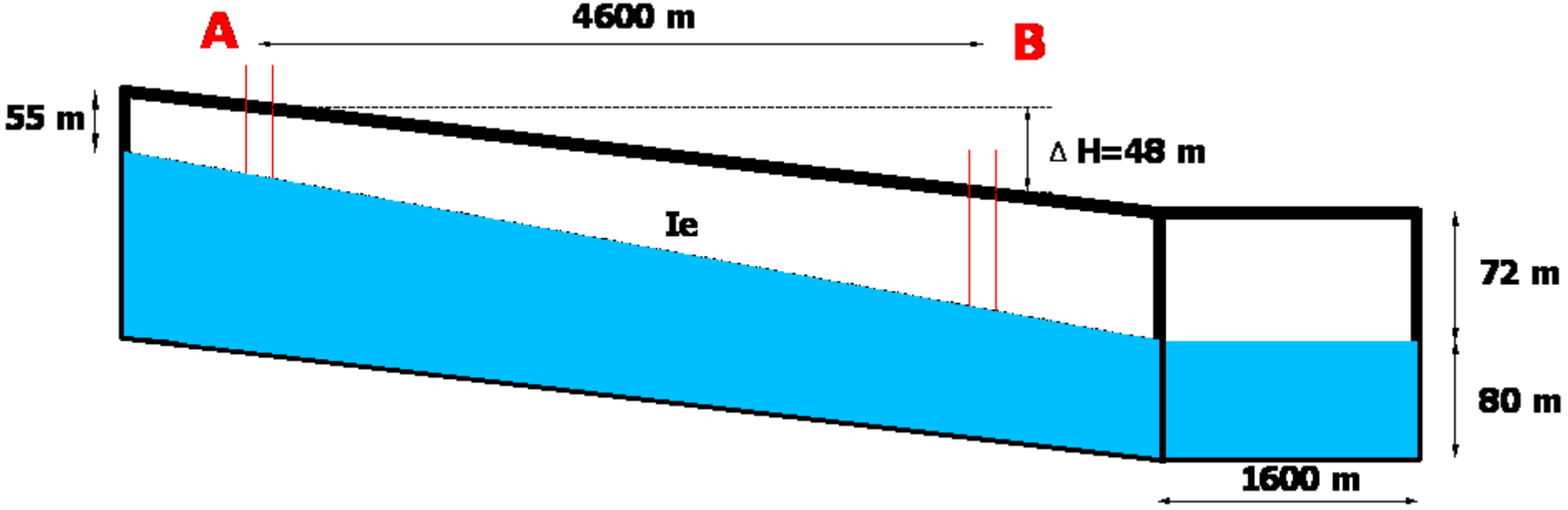
5. ZADATAK:

Za zadane parametre potrebno je izračunati vrijeme za koje voda u vodonosniku prijeđe put od A do B, protok kroz vodonosnik u najnizvodnijem poprečnom presjeku i volumen povezanih pora iznad vodnog lica!

W=1.60 (km)

n_e=0.290

K = 83.0 m/dan = $9.6*10^{-4}$ (m/s)



$$Ie = i = \frac{65m}{4600m} = \frac{\Delta H}{\Delta L} = 0.0141$$

$$v_{DARCY} = K \cdot Ie = 83(m/dan) \cdot 0.0141 = 1.173(m/dan)$$

$$v = \frac{v_{DARCY}}{n_e} = \frac{1.173(m/dan)}{0.29} = 4.044(m/dan)$$

$$v = \frac{L}{t_{AB}} \Rightarrow t_{AB} = \frac{L}{v} = \frac{4600m}{4.044(m/dan)} = 1137.487dana = 3.11godina$$

$$Q = v \cdot A = v \cdot w \cdot h = 1.173(m/dan) \cdot 1600(m) \cdot 80(m) =$$

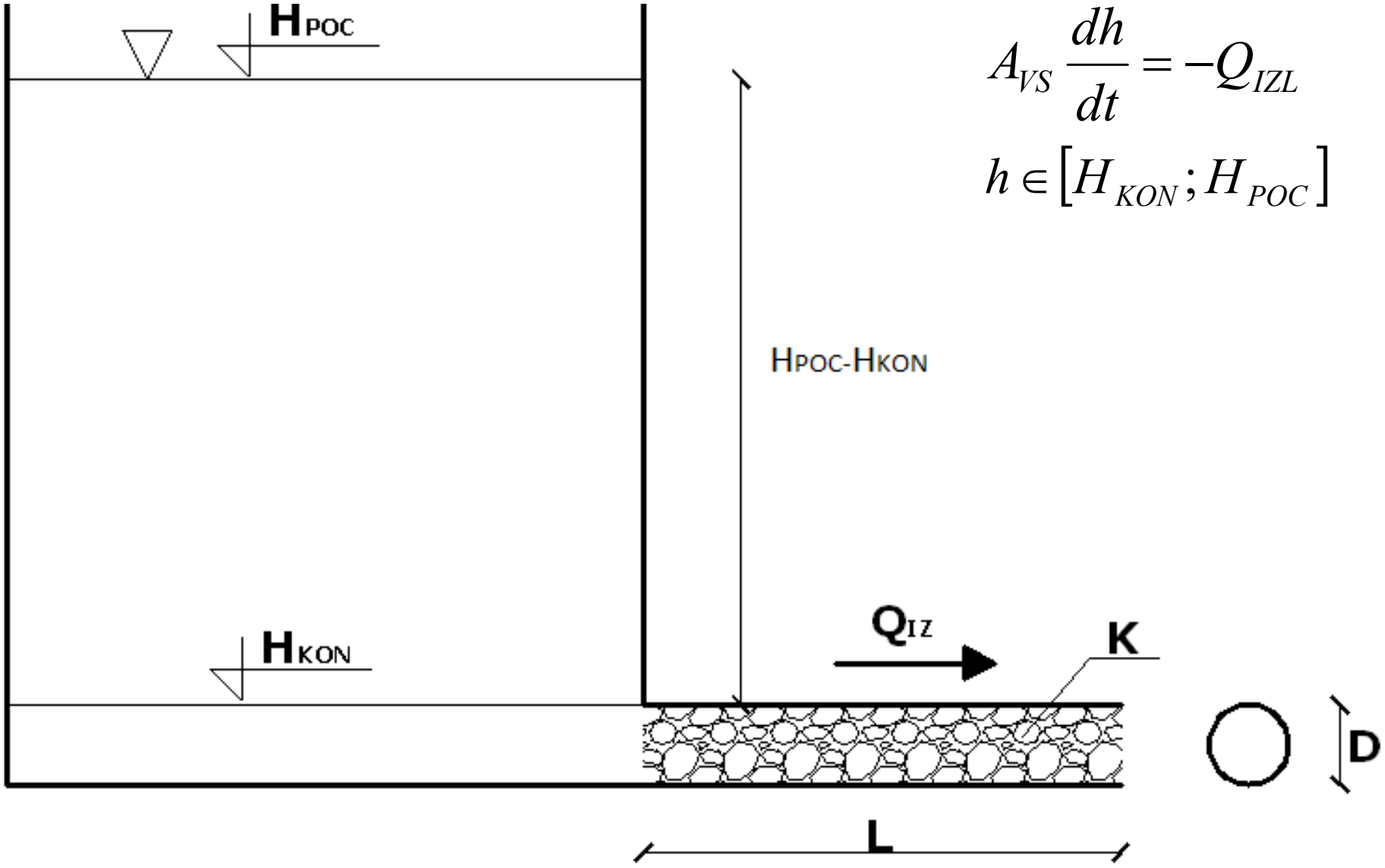
$$150144(m^3/dan)$$

$$V = n_e \cdot \frac{55+72}{2} \cdot 4600(m) \cdot 1600(m) = 1.3553 \cdot 10^8(m^3)$$

PRIMJENA DARCY-evog ZAKONA

$$A_{VS}\frac{dh}{dt} = -Q_{IZL}$$

$$h \in [H_{KON}; H_{POC}]$$



$$Q_{IZL} = v \cdot A_{CJ} = -\left(-K \cdot \frac{\Delta h}{\Delta L}\right) \cdot \frac{D^2 \pi}{4}$$

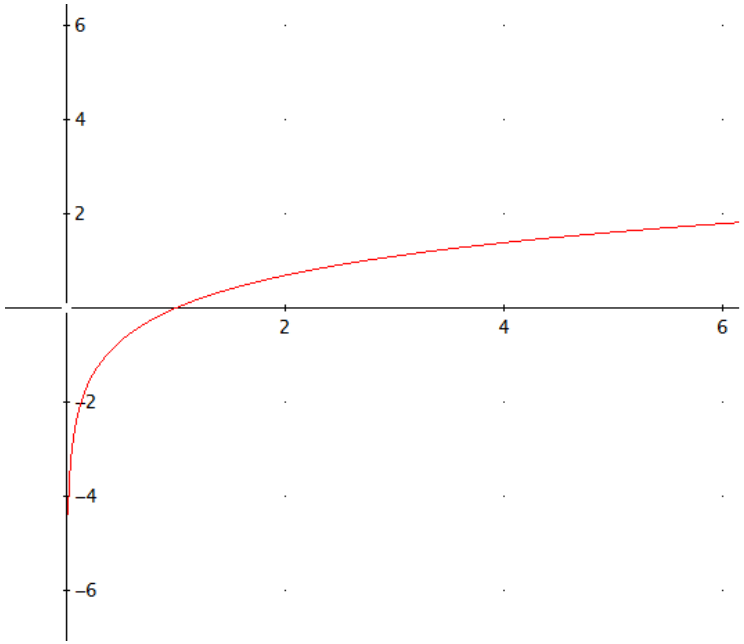
$$A_{VS} \frac{dh}{dt} = K \frac{h}{L} \frac{D^2 \pi}{4} = K \frac{h}{L} A_{CJ}$$

$$\frac{dh}{dt} = K \frac{h}{L} \frac{A_{CJ}}{A_{VS}}$$

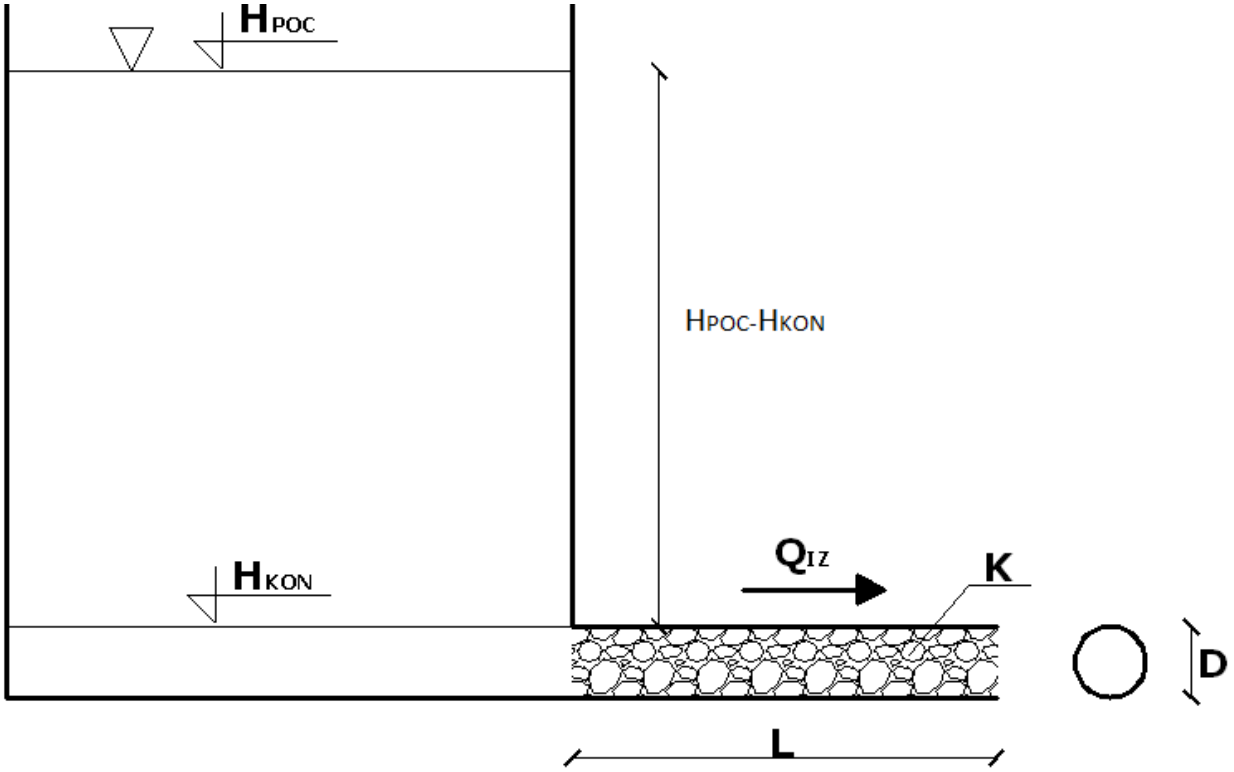
$$dt = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \frac{dh}{h}$$

$$\int_0^T dt = -\frac{L}{K} \frac{A_{VS}}{A_{CJ}} \int_{H_{KON}}^{H_{POC}} \frac{dh}{h} = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \int_{H_{KON}}^{H_{POC}} \frac{dh}{h}$$

$$T = \frac{L}{K} \frac{A_{VS}}{A_{CJ}} \left[LN(H_{POC}) - LN(H_{KON})\right]$$



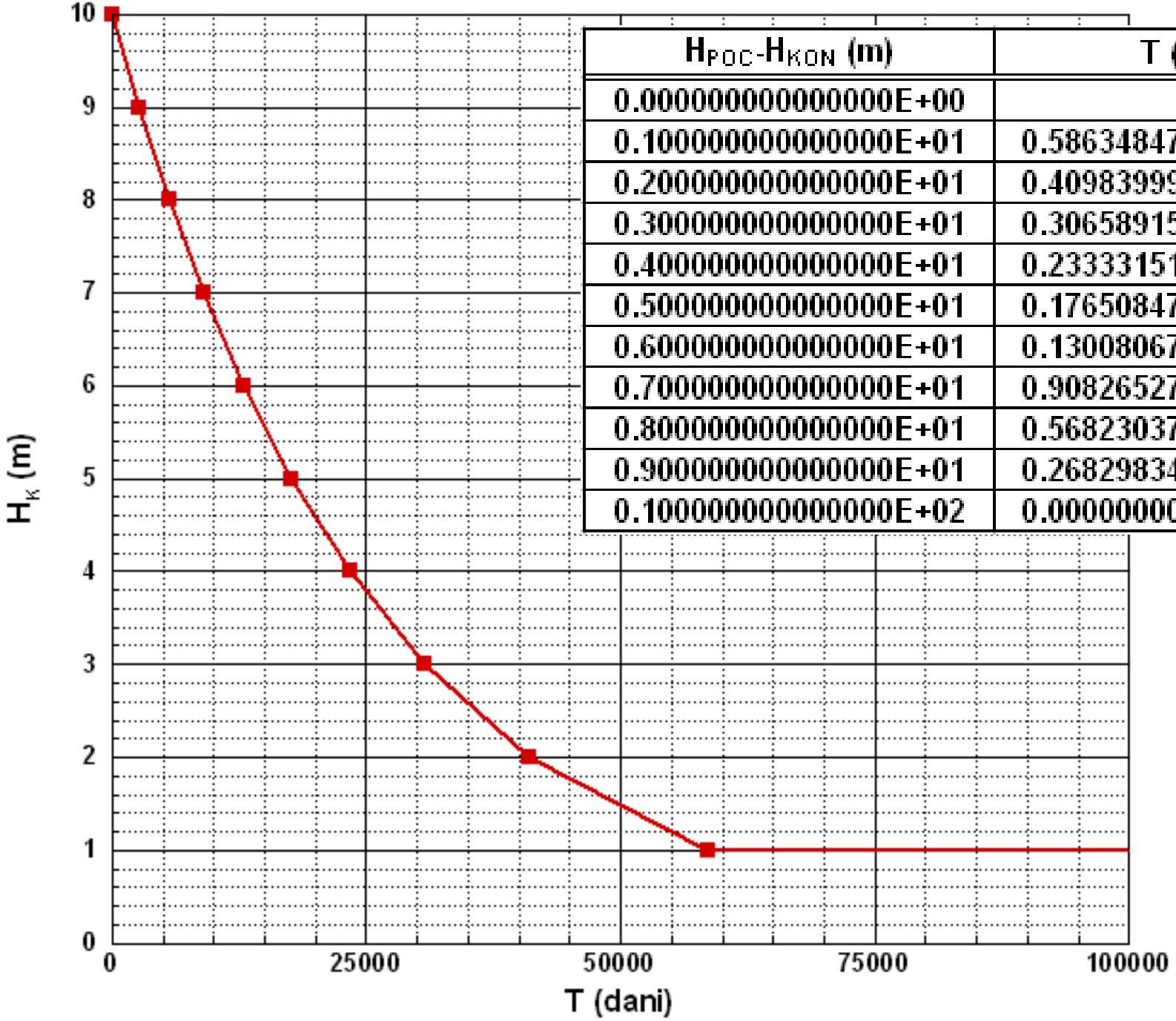
6. ZADATAK: Izračunati vrijeme pražnjenja vodospremišta na slici?



H_{POC} (m)	10,00
H_{KON} (m)	0,00
K (m/dan)	0,0050
L (m)	10,00
A_{VS} (m^2)	10,00
D (m)	1,00

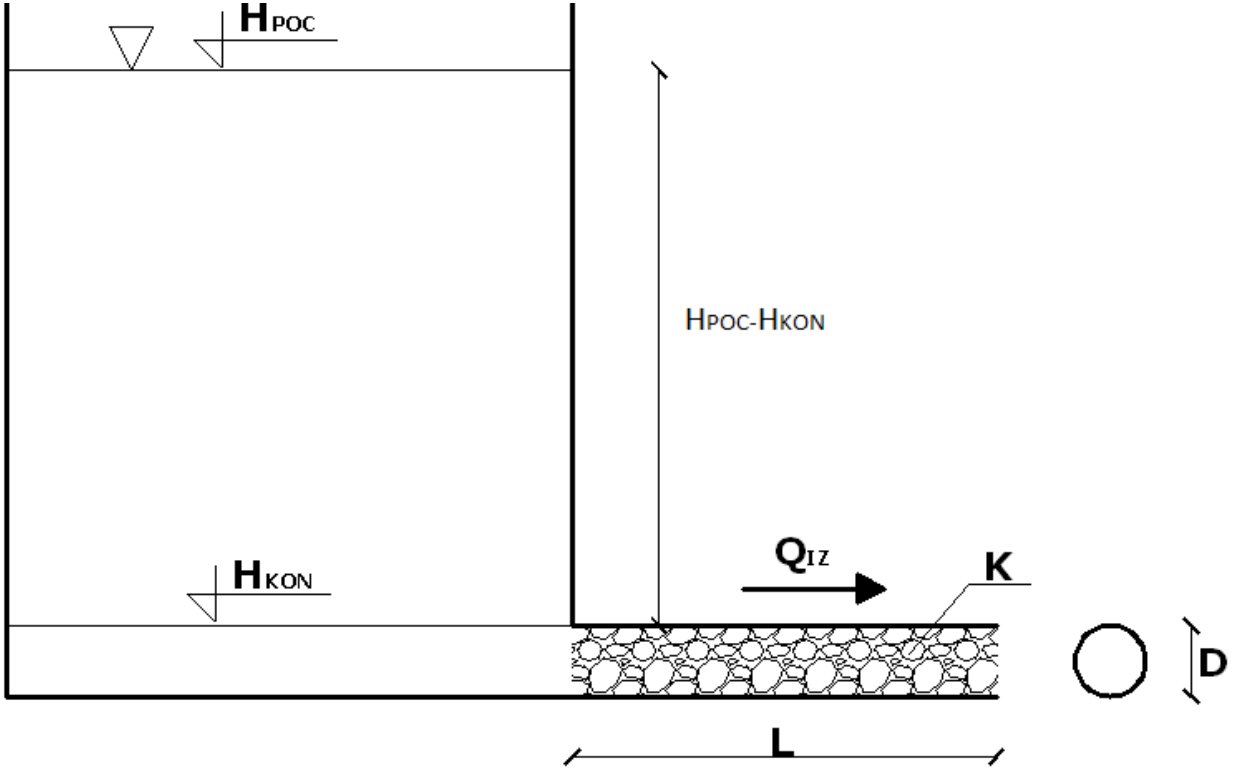
$$T = \frac{L}{K}\frac{A_{VS}}{A_{CJ}}\left[LN(H_{POC}) - LN(H_{KON})\right]$$

$$T_{PRAZNJENJA} = \frac{10m}{0.005m/dan}\frac{10m^2}{0.785398m^2}\left[LN(10) - LN(0)\right] = \infty$$



H_{POC}-H_{KON} (m)	T (dani)
0.00000000000000E+00	∞
0.10000000000000E+01	0.586348470441517E+05
0.20000000000000E+01	0.409839992926925E+05
0.30000000000000E+01	0.306589152521506E+05
0.40000000000000E+01	0.233331515412334E+05
0.50000000000000E+01	0.176508477514592E+05
0.60000000000000E+01	0.130080675006914E+05
0.70000000000000E+01	0.908265273060337E+04
0.80000000000000E+01	0.568230378977415E+04
0.90000000000000E+01	0.268298346014940E+04
0.10000000000000E+02	0.00000000000000E+00

7. ZADATAK: **Izračunati i grafički prikazati odnos promjena razine vode u vodospremištu za vremensko razdoblje od 300 dana za dva različita materijala u cijevi.**



H_{POC} (m)	10,00
H_{KON} (m)	?
K_2 (m/dan)	0,0864
K_1 (m/dan)	0,8640
L (m)	10,00
A_{VS} (m^2)	10,00
D (m)	1,00

$$T = \frac{L}{K}\frac{A_{VS}}{A_{CJ}}\left[LN(H_{POC}) - LN(H_{KON})\right]$$

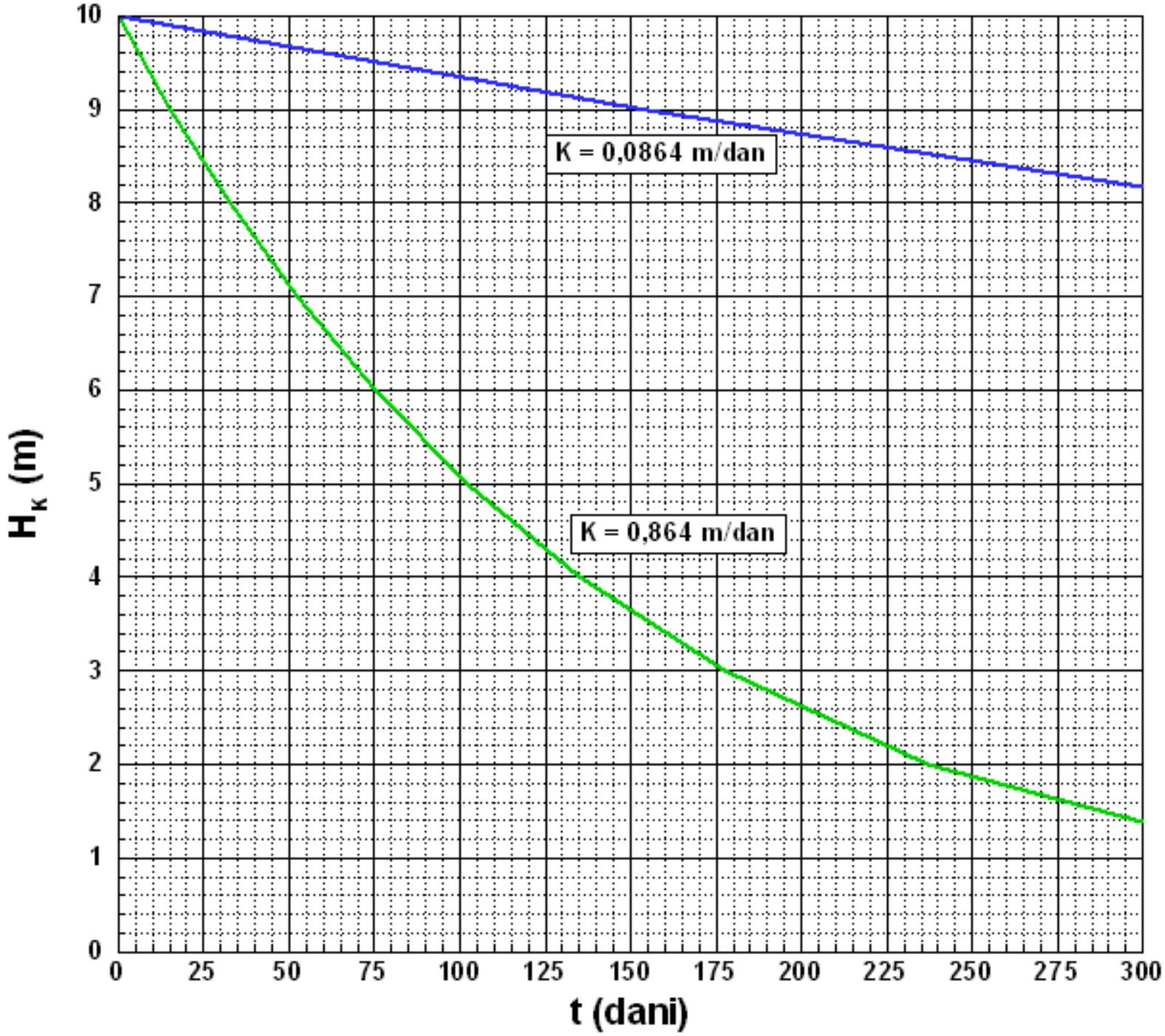
$$LN(H_{KON}) = LN(H_{POC}) - \frac{TK}{L}\frac{A_{CJ}}{A_{VS}}$$

$$LN(H_{KON}) = LN(10) - \frac{300dana \cdot 0.0864m/dan}{10m} \frac{0.785398m^2}{10m^2}$$

$$LN(H_{KON}) = X \Rightarrow H_{KON} = e^X$$

$$H_{KON}{}^2 = 8.158m \qquad H_{KON}{}^1 = 1.306m$$

H_{KON} (m)	T_1 (dani)	T_2 (dani)
0.00000000000000E+00	∞	∞
0.10000000000000E+01	0.339322031505508E+03	0.339322031505508E+04
0.20000000000000E+01	0.237175921832711E+03	0.237175921832711E+04
0.30000000000000E+01	0.177424278079575E+03	0.177424278079575E+04
0.40000000000000E+01	0.135029812159915E+03	0.135029812159915E+04
0.50000000000000E+01	0.102146109672796E+03	0.102146109672796E+04
0.60000000000000E+01	0.752781684067788E+02	0.752781684067788E+03
0.70000000000000E+01	0.525616477465473E+02	0.525616477465473E+03
0.80000000000000E+01	0.328837024871189E+02	0.328837024871189E+03
0.90000000000000E+01	0.155265246536424E+02	0.155265246536424E+03
0.10000000000000E+02	0.00000000000000E+00	0.00000000000000E+00


10
9
8
7
6
5
4
3
2
1
0
H_K (m)
K = 0,0864 m/dan
K = 0,864 m/dan
0
25
50
75
100
125
150
175
200
225
250
275
300
t (dani)