

Proračun bočnog preljeva

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UNIVERSITY OF SPLIT





SVEUČILIŠTE U SPLITU



FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I
GEODEZIJE

ZAVRŠNI RAD

SPLIT, 16.09.2020.

IVAN BARAĆ



SVEUČILIŠTE U SPLITU



FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I
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1. SAŽETAK

Tema završnog rada je projektiranje bočnog preljeva na kanalizacijskom kolektoru. Kanalizacijski sustav je mješovitog tipa. Zadani su dotoci za sušni period kao i maksimalni dotok koji se preljeva posebnim odvodnim kanalom u more. Proračun se radi tako da se osigura preljev u mirnome režimu.

Ključne riječi: bočni preljev, prigušnica, mirni režim, siloviti režim

2. ZADATAK

PREDMET: OSNOVE VODOGRADNJE

STUDENT: IVAN BARAĆ

ZADATAK ZA ZAVRŠNI RAD

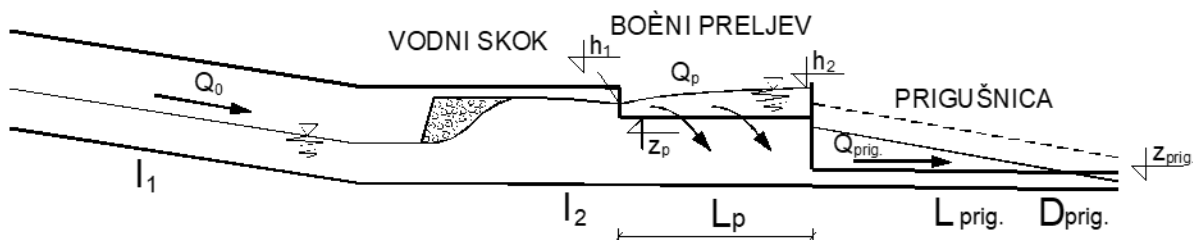
Potrebno je projektirati bočni preljev na kanalizacijskom kolektoru. Kanalizacijski sustav je mješovitog tipa.

Sušni dotok iznosi $Q_s=50$ (l/s). Preljev treba projektirati tako da se prelijevanje preko bočnog preljeva aktivira kod trostrukog protoka od Q_s , odnosno kod protoka od 150 (l/s). U tu svrhu treba projektirati prigušnicu odgovarajućeg promjera. Kroz prigušnicu se propušta protok prema uređaju za pročišćavanje, a višak vode (maksimalni dotok iznosi 3000 (l/s)), se prelijeva posebnim odvodnim kanalom u more.

Preljevanje treba biti u mirnom režimu. Kako bi se osiguralo prelijevanje u mirnom režimu, a dolazni dotok teče u silovitom režimu, potrebno je tako projektirati dio kolektora uz preljev da se vodni skok ostvaruje uzvodno od preljeva.

Izračun prelijevanja vode preko preljeva izvesti sljedeći način:

1. Preljevanje preko preljeva računati uz pretpostavku da je dubina ispred preljeva, duž cijelog preljeva, konstantna, te da se bočni preljev može računati kao čeonu oštrobridni preljev.



Slika 1. Shematski hidraulički uzdužni presjek

Zadano je:

$$I_1=0.04,$$

$$I_2=0.001,$$

$$D_1=1.4 \text{ (m)},$$

$$\varepsilon = 0.0015 \text{ (m)},$$

$$\nu = 0.00000131 \text{ (m}^2/\text{s)},$$

$m=0.4$ (za prelijevanje u varijanti 1)

$$L_p=?,$$

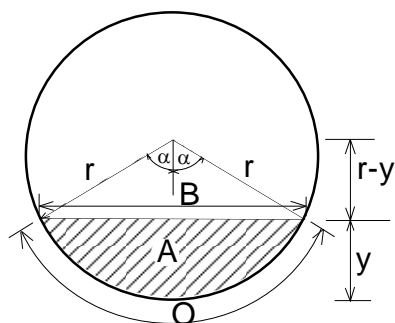
$$z_p=?,$$

$$z_{prig.} = 100 \text{ (m.n.m)}$$

$$D_{prig.}=?$$

$$L_{prig.}=?$$

Na slici 2. dat je poprečni presjek cijevi s osnovnim geometrijskim karakteristikama.



Slika 2. Poprečni presjek cijevi

$$\cos(\alpha) = \left(\frac{r-y}{r}\right) \rightarrow \alpha = \arccos\left(\frac{r-y}{r}\right) \quad (1)$$

$$B = 2 \cdot r \cdot \sin(\alpha) \quad (2)$$

$$A = r^2 \cdot \pi \cdot \frac{2\alpha}{2\pi} - B \cdot \frac{r-y}{2} = r^2 \cdot \left[\alpha - \sin(\alpha) \cdot \left(\frac{r-y}{r}\right)\right] = r^2 \cdot \alpha - r \cdot (r-y) \cdot \sin(\alpha) \quad (3)$$

Istjecanje kroz prigušnicu računati prema:

$$Q_{prig.} = \frac{1}{\sqrt{\xi_u + \lambda \cdot \frac{L_{prig.}}{D_{prig.}} + \alpha}} \sqrt{2g \cdot (h_2 - z_{prig.})} \cdot D_{prig.}^2 \cdot \frac{\pi}{4} \quad (4)$$

U varijanti 1 vodostaj duž preljeva je konstantan i iznosi h_2 , a preljevni protok treba računati prema:

$$\text{ako je } h_2 > z_p, \quad Q_p = m \cdot L_p \cdot \sqrt{2g} \cdot (h_2 - z_p)^{3/2} \quad (5)$$

$$\text{ako je } h_2 = z_p, \quad Q_p = 0.00 \quad (6)$$

$$\text{ako je } h_2 < z_p, \quad Q_{p2} = 0.00 \quad (7)$$

$$Q_0 = Q_{prig.} + Q_p. \quad (8)$$

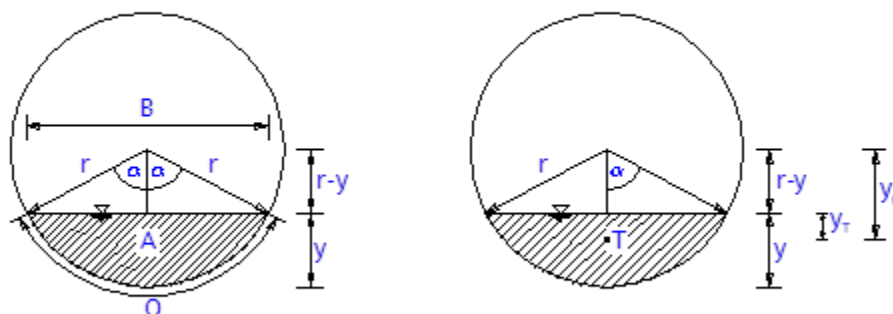
Split, 24.05.2020.

Doc. dr. sc. Davor Bojanić

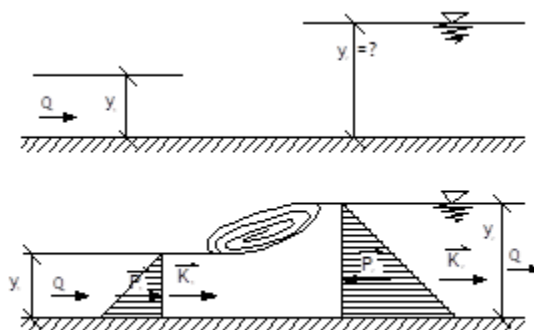
3. SADRŽAJ

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4. KORIŠTENE FORMULE I PRISTUP PUTEM IZRADE PRORAČUNA



Slika 1. Poprečni presjek kanala



Slika 2. Količine gibanja i tlačne sile u kanalu pri vodnom skoku

Rješenje:

Zadano je:

Q, y_1, R, ρ, g

Izračuna se:

$\rightarrow a_1, A_1, y_{01}, y_{T1}, P_1, K_1, P_1+K_1$

POSTUPAK:

$$\cos(\alpha) = \left(\frac{r-y}{r} \right) \Rightarrow \alpha = \arccos\left(\frac{r-y}{r} \right);$$

$$B = 2r \sin(\alpha)$$

$$A = r^2 \pi \frac{2\alpha}{2\pi} - B \frac{r-y}{2} = r^2 \left[\alpha - \sin(\alpha) \left(1 - \frac{y}{r} \right) \right] = r^2 \alpha - r \cdot (r-y) \cdot \sin(\alpha);$$

$$O = 2r\alpha$$

$$y_0 = \frac{2}{3} r \frac{\sin^3 \alpha}{\alpha - \sin \alpha \cdot \cos \alpha}$$

$$y_T = y_0 - (r-y) = y_0 + y - r$$

$$K = \rho \cdot Q \cdot v$$

$$P = \rho \cdot g \cdot y_T \cdot A$$

$$K_1 = \rho \cdot Q \cdot v_1$$

$$P_1 = \rho \cdot g \cdot y_{T1} \cdot A_1$$

| Q (m ³ /s) | y ₁ (m) | r (m) | ρ (kg/m ³) | g (m/s ²) | α (rad) | A ₁ (m ²) | v ₁ (m/s) | y ₀₁ (m) | y _{T1} (m) | K ₁ (N) | P ₁ (N) | K ₁ +P ₁ (N) |
|--------------------------|-----------------------|----------|---------------------------|--------------------------|------------|-------------------------------------|-------------------------|------------------------|------------------------|-----------------------|-----------------------|---------------------------------------|
| 30,000 | 1,000 | 4,000 | 1000 | 9,81 | 0,7227 | 3,626 | 8,272 | 3,405 | 0,405 | 248173,6 | 14394,8 | 262568,4 |

Tablica 1. Izračun hidrauličkih parametara u profilu prve konjugirane dubine

Pretpostavi se y₂ i izračuna:

$$\rightarrow a_2, A_2, y_{02}, y_{T2}, P_2, K_2, P_2+K_2$$

$$K_2 = \rho \cdot Q \cdot v_2$$

$$P_2 = \rho \cdot g \cdot y_{T2} \cdot A_2$$

| y _{2p} (m) | α ₂ (rad) | A ₂ (m ²) | v ₂ (m/s) | y ₀₂ (m) | y _{T2} (m) | K ₂ (N) | P ₂ (N) | K ₂ +P ₂ (N) | $\frac{\partial \alpha_2}{\partial y_2}$ | $\frac{\partial A_2}{\partial y_2}$ | $\frac{\partial K_2}{\partial y_2}$ | N | $\frac{\partial y_0}{\partial y_2}$ | $\frac{\partial y_{T2}}{\partial y_2}$ | $\frac{\partial P_2}{\partial y_2}$ | $\frac{\partial F}{\partial y_2}$ | F | y _{2novo} (m) |
|------------------------|-------------------------|-------------------------------------|-------------------------|------------------------|------------------------|-----------------------|-----------------------|---------------------------------------|--|-------------------------------------|-------------------------------------|--------|-------------------------------------|--|-------------------------------------|-----------------------------------|--------|---------------------------|
| 2,9948 | 1,3168 | 17,177 | 1,747 | 2,252 | 1,247 | 52395,8 | 210172,6 | 262568,4 | 0,2583 | 7,7433 | -23619,8 | 1,0736 | -0,6398 | 0,3602 | 155447,11 | 131827,312 | 0,0000 | 2,9948 |

Tablica 2. Izračun druge konjugirane dubine na temelju pretpostavljene vrijednosti y₂

$$K_1 + P_1 = K_2 + P_2$$

Newton-ova metoda

$$F(y) = K_2 + P_2 - (K_1 + P_1) \equiv 0 \text{ (kod točnog rješenja).}$$

U iteraciji Newton-ovim postupkom, nova vrijednost dubine y₂ računa se na sljedeći način:

$$y_2^N = y_2^{\text{pretp}} - \frac{F(y_2^{\text{pretp}})}{\left. \frac{\partial F}{\partial y} \right|_{y=y_2}}$$

gdje je:

- y_2^{pretp} "pretpostavljena" vrijednost za y_2 ,

- y_2^{n} "nova" vrijednost za y_2 .

$$\frac{\partial F}{\partial y} = \frac{\partial K_2}{\partial y} + \frac{\partial P_2}{\partial y}$$

$$\frac{\partial K_2}{\partial y} = ?$$

$$K_2 = \rho \cdot Q \cdot v_2 = \rho \cdot \frac{Q^2}{A_2} = \rho \cdot Q^2 \cdot A_2^{-1}$$

$$\frac{\partial K_2}{\partial y} = -\rho \cdot \frac{Q^2}{A_2^2} \cdot \frac{\partial A_2}{\partial y}$$

$$\frac{\partial A}{\partial y} = r^2 \left[\frac{\partial \alpha}{\partial y} - \cos(\alpha) \frac{\partial \alpha}{\partial y} \left(1 - \frac{y}{r} \right) - \left(-\frac{1}{r} \right) \sin(\alpha) \right]$$

$$\frac{\partial \alpha}{\partial y} = \frac{d}{dy} \left[\arccos \left(\frac{r-y}{r} \right) \right] = -\frac{1}{\sqrt{1 - \left(\frac{r-y}{r} \right)^2}} \left(-\frac{1}{r} \right) = \frac{1}{r \sqrt{1 - \left(\frac{r-y}{r} \right)^2}}$$

$$\frac{\partial P_2}{\partial y} = ?$$

$$P_2 = \rho \cdot g \cdot y_{T2} \cdot A_2$$

$$\frac{\partial P_2}{\partial y} = \rho \cdot g \cdot \frac{\partial y_{T2}}{\partial y} \cdot A_2 + \rho \cdot g \cdot y_{T2} \cdot \frac{\partial A_2}{\partial y}$$

$$y_T = y_0 + y - r$$

$$\frac{\partial y_T}{\partial y} = \frac{\partial y_0}{\partial y} + 1$$

$$\frac{\partial y_0}{\partial y} = \frac{2}{3} \cdot r \cdot \frac{3 \sin^2 \alpha \cdot \cos \alpha \cdot \frac{\partial \alpha}{\partial y} \cdot (\alpha - \sin \alpha \cdot \cos \alpha) - \sin^3 \alpha \cdot \left(\frac{\partial \alpha}{\partial y} - (\cos^2 \alpha - \sin^2 \alpha) \cdot \frac{\partial \alpha}{\partial y} \right)}{(\alpha - \sin \alpha \cdot \cos \alpha)^2}$$

$$N = \alpha - \sin \alpha \cdot \cos \alpha$$

$$\frac{\partial y_0}{\partial y} = \frac{2}{3} \cdot r \cdot \sin^2 \alpha \cdot \frac{\partial \alpha}{\partial y} \cdot (3 \cos \alpha \cdot N - 2 \sin^3 \alpha) / N^2$$

$$F = K_2 + P_2 - (K_1 + P_1)$$

$$\frac{\partial F}{\partial y} = \frac{\partial K_2}{\partial y} + \frac{\partial P_2}{\partial y}$$

$$y_2^{\text{n}} = y_2^{\text{pretp}} - \frac{F(y_2^{\text{pretp}})}{\left. \frac{\partial F}{\partial y} \right|_{y=y_2^{\text{pretp}}}}$$

Koristeći iteraciju u Excel-u:

| y_{2p} (m) | α_2 (rad) | A_2 (m ²) | v_2 (m/s) | y_{02} (m) | y_{12} (m) | K_2 (N) | P_2 (N) | K_2+P_2 (N) | $\frac{\partial \alpha_2}{\partial y_2}$ | $\frac{\partial A_2}{\partial y_2}$ | $\frac{\partial K_2}{\partial y_2}$ | N | $\frac{\partial y_0}{\partial y_2}$ | $\frac{\partial y_{T2}}{\partial y_2}$ | $\frac{\partial P_2}{\partial y_2}$ | $\frac{\partial F}{\partial y_2}$ | F | y_{2novo} (m) |
|-----------------|---------------------|----------------------------|----------------|-----------------|-----------------|--------------|--------------|------------------|--|-------------------------------------|-------------------------------------|--------|-------------------------------------|--|-------------------------------------|-----------------------------------|------|--------------------|
| 2,9948 | 1,3168 | 17,177 | 1,747 | 2,252 | 1,247 | 52395,8 | 210172,6 | 262568,4 | 0,2583 | 7,7433 | -23619,8 | 1,0736 | -0,6398 | 0,3602 | 155447,11 | 131827,312 | 0,00 | 2,9948 |

Tablica 3. Izračun druge konjugirane dubine iteracijom na temelju pretpostavljene vrijednosti y_2

5. PRORAČUN

VARIJANTA 1 (NAJPOVOLJNIJI SLUČAJ): $Z_P = 101$ (m.n.m), $L_P = 3$ (m)

| Q_0 (m ³ /s) | h_2 izračunato | Q_p (m ³ /s) | $Q_{prig.}$ (m ³ /s) |
|---------------------------|------------------|---------------------------|---------------------------------|
| 0.100 | 100.44212 | 0 | 0.1 |
| 0.102 | 100.4599674 | 0 | 0.102 |
| 0.104 | 100.4781679 | 0 | 0.104 |
| 0.106 | 100.4967216 | 0 | 0.106 |
| 0.108 | 100.5156284 | 0 | 0.108 |
| 0.110 | 100.5348883 | 0 | 0.11 |
| 0.112 | 100.5545014 | 0 | 0.112 |
| 0.114 | 100.5744676 | 0 | 0.114 |
| 0.116 | 100.5947869 | 0 | 0.116 |
| 0.118 | 100.6154593 | 0 | 0.118 |
| 0.120 | 100.6364849 | 0 | 0.12 |
| 0.122 | 100.6578636 | 0 | 0.122 |
| 0.124 | 100.6795955 | 0 | 0.124 |
| 0.126 | 100.7016805 | 0 | 0.126 |
| 0.128 | 100.7241186 | 0 | 0.128 |
| 0.130 | 100.7469098 | 0 | 0.13 |
| 0.132 | 100.7700542 | 0 | 0.132 |
| 0.134 | 100.7935517 | 0 | 0.134 |
| 0.136 | 100.8174024 | 0 | 0.136 |
| 0.138 | 100.8416061 | 0 | 0.138 |
| 0.140 | 100.866163 | 0 | 0.14 |
| 0.142 | 100.8910731 | 0 | 0.142 |
| 0.144 | 100.9163362 | 0 | 0.144 |
| 0.146 | 100.9419525 | 0 | 0.146 |
| 0.148 | 100.9679219 | 0 | 0.148 |
| 0.150 | 100.9942445 | 0 | 0.15 |

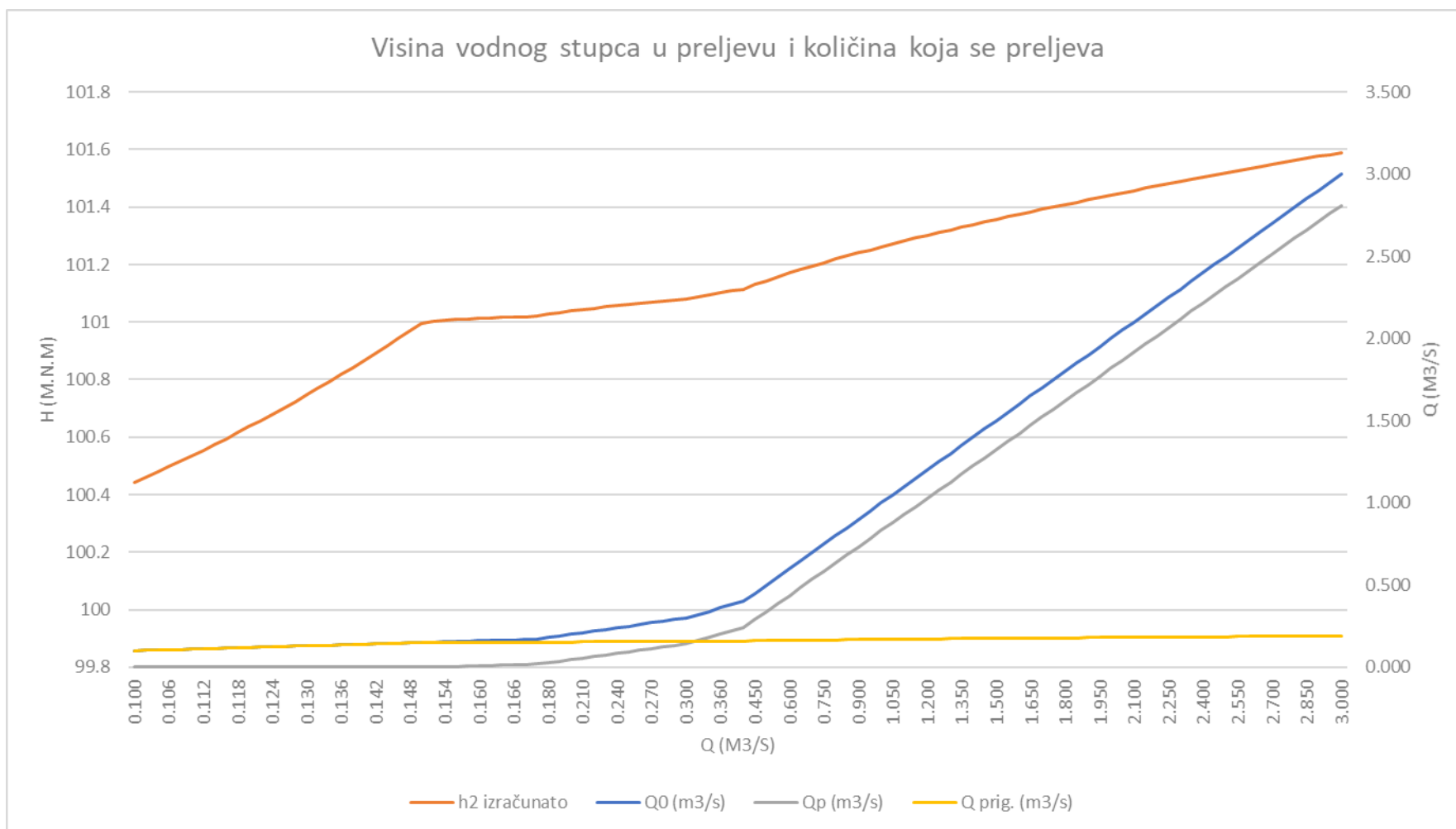
Tablica 1. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 0.152 | 101.0035304 | 0.001300786 | 0.150699214 |
| 0.154 | 101.0062901 | 0.003093604 | 0.150906396 |
| 0.156 | 101.008573 | 0.004922433 | 0.151077567 |
| 0.158 | 101.0106029 | 0.0067704 | 0.1512296 |
| 0.160 | 101.0124659 | 0.008631 | 0.151369 |
| 0.162 | 101.0142069 | 0.010500845 | 0.151499155 |
| 0.164 | 101.015853 | 0.012377879 | 0.151622121 |
| 0.166 | 101.0174225 | 0.014260739 | 0.151739261 |
| 0.168 | 101.0189279 | 0.016148461 | 0.151851539 |
| 0.170 | 101.0203788 | 0.01804033 | 0.15195967 |
| 0.180 | 101.0270223 | 0.02754618 | 0.15245382 |
| 0.190 | 101.0329592 | 0.037105939 | 0.152894061 |
| 0.200 | 101.0384213 | 0.046702026 | 0.153297974 |
| 0.210 | 101.0435327 | 0.056325005 | 0.153674995 |
| 0.220 | 101.0483699 | 0.065969061 | 0.154030939 |
| 0.230 | 101.0529841 | 0.07563029 | 0.15436971 |
| 0.240 | 101.0574118 | 0.085305908 | 0.154694092 |
| 0.250 | 101.0616801 | 0.094993843 | 0.155006157 |
| 0.260 | 101.06581 | 0.104692497 | 0.155307503 |
| 0.270 | 101.069818 | 0.114400607 | 0.155599393 |
| 0.280 | 101.0737173 | 0.12411715 | 0.15588285 |
| 0.290 | 101.077519 | 0.133841285 | 0.156158715 |
| 0.300 | 101.0812323 | 0.143572308 | 0.156427692 |
| 0.320 | 101.0884234 | 0.163052721 | 0.156947279 |
| 0.340 | 101.0953404 | 0.182554554 | 0.157445446 |
| 0.360 | 101.1020211 | 0.202074894 | 0.157925106 |
| 0.380 | 101.108495 | 0.221611465 | 0.158388535 |
| 0.400 | 101.1147858 | 0.241162444 | 0.158837556 |
| 0.450 | 101.1298297 | 0.290093755 | 0.159906245 |
| 0.500 | 101.1440647 | 0.339089057 | 0.160910943 |
| 0.550 | 101.1576418 | 0.388136601 | 0.161863399 |

Tablica 2. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 0.600 | 101.1706686 | 0.437227987 | 0.162772013 |
| 0.650 | 101.1832251 | 0.486356946 | 0.163643054 |
| 0.700 | 101.1953731 | 0.535518638 | 0.164481362 |
| 0.750 | 101.2071611 | 0.584709227 | 0.165290773 |
| 0.800 | 101.2186287 | 0.633925605 | 0.166074395 |
| 0.850 | 101.2298082 | 0.683165211 | 0.166834789 |
| 0.900 | 101.2407266 | 0.732425901 | 0.167574099 |
| 0.950 | 101.2514069 | 0.781705857 | 0.168294143 |
| 1.000 | 101.2618687 | 0.831003519 | 0.168996481 |
| 1.050 | 101.2721288 | 0.880317538 | 0.169682462 |
| 1.100 | 101.2822021 | 0.929646736 | 0.170353264 |
| 1.150 | 101.2921015 | 0.978990076 | 0.171009924 |
| 1.200 | 101.3018385 | 1.028346639 | 0.171653361 |
| 1.250 | 101.3114233 | 1.077715607 | 0.172284393 |
| 1.300 | 101.320865 | 1.127096245 | 0.172903755 |
| 1.350 | 101.3301718 | 1.176487895 | 0.173512105 |
| 1.400 | 101.3393511 | 1.225889956 | 0.174110044 |
| 1.450 | 101.3484098 | 1.275301887 | 0.174698113 |
| 1.500 | 101.3573538 | 1.324723192 | 0.175276808 |
| 1.550 | 101.3661889 | 1.374153417 | 0.175846583 |
| 1.600 | 101.3749201 | 1.423592146 | 0.176407854 |
| 1.650 | 101.3835522 | 1.473038994 | 0.176961006 |
| 1.700 | 101.3920896 | 1.522493608 | 0.177506392 |
| 1.750 | 101.4005363 | 1.571955659 | 0.178044341 |
| 1.800 | 101.408896 | 1.621424842 | 0.178575158 |
| 1.850 | 101.4171723 | 1.670900875 | 0.179099125 |
| 1.900 | 101.4253683 | 1.720383491 | 0.179616509 |
| 1.950 | 101.4334872 | 1.769872443 | 0.180127557 |
| 2.000 | 101.4415317 | 1.819367501 | 0.180632499 |
| 2.050 | 101.4495046 | 1.868868447 | 0.181131553 |
| 2.100 | 101.4574082 | 1.918375077 | 0.181624923 |
| 2.150 | 101.4652451 | 1.967887197 | 0.182112803 |
| 2.200 | 101.4730173 | 2.017404629 | 0.182595371 |
| 2.250 | 101.4807269 | 2.066927199 | 0.183072801 |
| 2.300 | 101.488376 | 2.116454747 | 0.183545253 |
| 2.350 | 101.4959664 | 2.16598712 | 0.18401288 |
| 2.400 | 101.5034998 | 2.215524171 | 0.184475829 |
| 2.450 | 101.510978 | 2.265065765 | 0.184934235 |
| 2.500 | 101.5184025 | 2.314611769 | 0.185388231 |
| 2.550 | 101.5257748 | 2.364162059 | 0.185837941 |
| 2.600 | 101.5330965 | 2.413716517 | 0.186283483 |
| 2.650 | 101.5403688 | 2.46327503 | 0.18672497 |
| 2.700 | 101.547593 | 2.51283749 | 0.18716251 |
| 2.750 | 101.5547705 | 2.562403793 | 0.187596207 |
| 2.800 | 101.5619024 | 2.611973842 | 0.188026158 |
| 2.850 | 101.5689898 | 2.661547543 | 0.188452457 |
| 2.900 | 101.5760338 | 2.711124805 | 0.188875195 |
| 2.950 | 101.5830355 | 2.760705542 | 0.189294458 |
| 3.000 | 101.589996 | 2.810289671 | 0.189710329 |

Tablica 3. Proračun visine vodnog stupca u preljevu i količine koja se preljeva



Grafikon 1. Visina vodnog stupca u preljevu i količina koja se preljeva

VARIJANTA 2 : $Z_P = 101.2$ (m.n.m), $L_P = 3$ (m)

| Q_0 (m ³ /s) | h_2 izračunato | Q_p (m ³ /s) | $Q_{prig.}$ (m ³ /s) |
|---------------------------|------------------|---------------------------|---------------------------------|
| 0.100 | 100.44212 | 0 | 0.1 |
| 0.102 | 100.4599674 | 0 | 0.102 |
| 0.104 | 100.4781679 | 0 | 0.104 |
| 0.106 | 100.4967216 | 0 | 0.106 |
| 0.108 | 100.5156284 | 0 | 0.108 |
| 0.110 | 100.5348883 | 0 | 0.11 |
| 0.112 | 100.5545014 | 0 | 0.112 |
| 0.114 | 100.5744676 | 0 | 0.114 |
| 0.116 | 100.5947869 | 0 | 0.116 |
| 0.118 | 100.6154593 | 0 | 0.118 |
| 0.120 | 100.6364849 | 0 | 0.12 |
| 0.122 | 100.6578636 | 0 | 0.122 |
| 0.124 | 100.6795955 | 0 | 0.124 |
| 0.126 | 100.7016805 | 0 | 0.126 |
| 0.128 | 100.7241186 | 0 | 0.128 |
| 0.130 | 100.7469098 | 0 | 0.13 |
| 0.132 | 100.7700542 | 0 | 0.132 |
| 0.134 | 100.7935517 | 0 | 0.134 |
| 0.136 | 100.8174024 | 0 | 0.136 |
| 0.138 | 100.8416061 | 0 | 0.138 |
| 0.140 | 100.866163 | 0 | 0.14 |
| 0.142 | 100.8910731 | 0 | 0.142 |
| 0.144 | 100.9163362 | 0 | 0.144 |
| 0.146 | 100.9419525 | 0 | 0.146 |
| 0.148 | 100.9679219 | 0 | 0.148 |
| 0.150 | 100.9942445 | 0 | 0.15 |
| 0.152 | 101.0209202 | 0 | 0.152 |
| 0.154 | 101.047949 | 0 | 0.154 |
| 0.156 | 101.0753309 | 0 | 0.156 |
| 0.158 | 101.103066 | 0 | 0.158 |
| 0.160 | 101.1311542 | 0 | 0.16 |
| 0.162 | 101.1595956 | 0 | 0.162 |
| 0.164 | 101.1883901 | 0 | 0.164 |

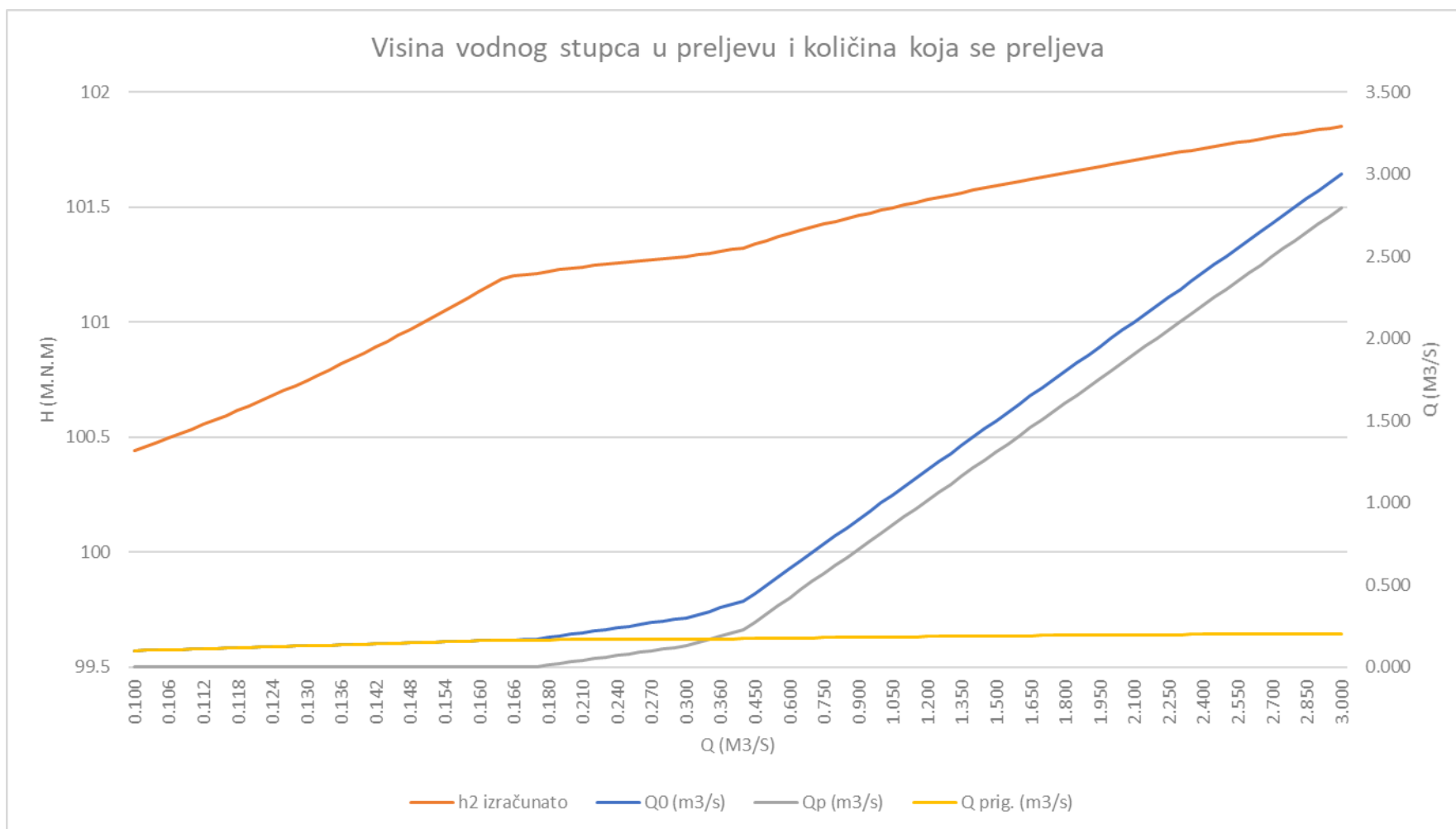
Tablica 4. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 0.166 | 101.2032357 | 0.000978321 | 0.165021679 |
| 0.168 | 101.2064564 | 0.002757505 | 0.165242495 |
| 0.170 | 101.2090545 | 0.004579591 | 0.165420409 |
| 0.180 | 101.2189825 | 0.013901487 | 0.166098513 |
| 0.190 | 101.2268358 | 0.023367041 | 0.166632959 |
| 0.200 | 101.2337118 | 0.032900517 | 0.167099483 |
| 0.210 | 101.2399713 | 0.04247694 | 0.16752306 |
| 0.220 | 101.2457913 | 0.052084067 | 0.167915933 |
| 0.230 | 101.251275 | 0.061714734 | 0.168285266 |
| 0.240 | 101.2564894 | 0.071364287 | 0.168635713 |
| 0.250 | 101.2614811 | 0.081029487 | 0.168970513 |
| 0.260 | 101.2662842 | 0.090707964 | 0.169292036 |
| 0.270 | 101.2709244 | 0.100397917 | 0.169602083 |
| 0.280 | 101.2754222 | 0.110097937 | 0.169902063 |
| 0.290 | 101.2797935 | 0.119806893 | 0.170193107 |
| 0.300 | 101.2840516 | 0.129523861 | 0.170476139 |
| 0.320 | 101.2922705 | 0.148978892 | 0.171021108 |
| 0.340 | 101.3001477 | 0.168458199 | 0.171541801 |
| 0.360 | 101.3077342 | 0.187958209 | 0.172041791 |
| 0.380 | 101.315069 | 0.20747619 | 0.17252381 |
| 0.400 | 101.3221826 | 0.227009985 | 0.172990015 |
| 0.450 | 101.3391502 | 0.275903024 | 0.174096976 |
| 0.500 | 101.3551606 | 0.324864921 | 0.175135079 |
| 0.550 | 101.3704 | 0.373882488 | 0.176117512 |
| 0.600 | 101.3849992 | 0.422946441 | 0.177053559 |
| 0.650 | 101.3990543 | 0.472049927 | 0.177950073 |
| 0.700 | 101.4126387 | 0.521187704 | 0.178812296 |
| 0.750 | 101.4258101 | 0.570355647 | 0.179644353 |
| 0.800 | 101.4386147 | 0.619550433 | 0.180449567 |
| 0.850 | 101.4510906 | 0.668769338 | 0.181230662 |
| 0.900 | 101.4632691 | 0.718010088 | 0.181989912 |
| 0.950 | 101.4751769 | 0.767270766 | 0.182729234 |
| 1.000 | 101.4868366 | 0.81654973 | 0.18345027 |
| 1.050 | 101.4982679 | 0.865845564 | 0.184154436 |
| 1.100 | 101.5094876 | 0.915157034 | 0.184842966 |
| 1.150 | 101.5205107 | 0.964483056 | 0.185516944 |

Tablica 5. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 1.200 | 101.5313504 | 1.013822674 | 0.186177326 |
| 1.250 | 101.5420183 | 1.063175035 | 0.186824965 |
| 1.300 | 101.5525249 | 1.112539377 | 0.187460623 |
| 1.350 | 101.5628795 | 1.161915013 | 0.188084987 |
| 1.400 | 101.5730906 | 1.211301323 | 0.188698677 |
| 1.450 | 101.5831659 | 1.260697747 | 0.189302253 |
| 1.500 | 101.5931123 | 1.310103771 | 0.189896229 |
| 1.550 | 101.6029362 | 1.359518926 | 0.190481074 |
| 1.600 | 101.6126436 | 1.408942782 | 0.191057218 |
| 1.650 | 101.6222396 | 1.458374945 | 0.191625055 |
| 1.700 | 101.6317293 | 1.507815048 | 0.192184952 |
| 1.750 | 101.6411173 | 1.557262753 | 0.192737247 |
| 1.800 | 101.6504078 | 1.606717747 | 0.193282253 |
| 1.850 | 101.6596047 | 1.656179739 | 0.193820261 |
| 1.900 | 101.6687118 | 1.705648455 | 0.194351545 |
| 1.950 | 101.6777323 | 1.755123643 | 0.194876357 |
| 2.000 | 101.6866697 | 1.804605064 | 0.195394936 |
| 2.050 | 101.6955267 | 1.854092495 | 0.195907505 |
| 2.100 | 101.7043064 | 1.903585728 | 0.196414272 |
| 2.150 | 101.7130112 | 1.953084564 | 0.196915436 |
| 2.200 | 101.7216438 | 2.002588819 | 0.197411181 |
| 2.250 | 101.7302064 | 2.052098317 | 0.197901683 |
| 2.300 | 101.7387013 | 2.101612892 | 0.198387108 |
| 2.350 | 101.7471305 | 2.151132388 | 0.198867612 |
| 2.400 | 101.7554961 | 2.200656656 | 0.199343344 |
| 2.450 | 101.7638 | 2.250185556 | 0.199814444 |
| 2.500 | 101.7720439 | 2.299718953 | 0.200281047 |
| 2.550 | 101.7802295 | 2.34925672 | 0.20074328 |
| 2.600 | 101.7883585 | 2.398798737 | 0.201201263 |
| 2.650 | 101.7964324 | 2.448344887 | 0.201655113 |
| 2.700 | 101.8044527 | 2.497895061 | 0.202104939 |
| 2.750 | 101.8124207 | 2.547449153 | 0.202550847 |
| 2.800 | 101.8203378 | 2.597007063 | 0.202992937 |
| 2.850 | 101.8282053 | 2.646568695 | 0.203431305 |
| 2.900 | 101.8360245 | 2.696133956 | 0.203866044 |
| 2.950 | 101.8437964 | 2.74570276 | 0.20429724 |
| 3.000 | 101.8515222 | 2.79527502 | 0.20472498 |

Tablica 6. Proračun visine vodnog stupca u preljevu i količine koja se preljeva



Grafikon 2. Visina vodnog stupca u preljevu i količina koja se preljeva

VARIJANTA 3 : $Z_P = 101.2$ (m.n.m), $L_P = 6$ (m)

| Q_0 (m ³ /s) | h_2 izračunato | Q_p (m ³ /s) | $Q_{prig.}$ (m ³ /s) |
|---------------------------|------------------|---------------------------|---------------------------------|
| 0.100 | 100.44212 | 0 | 0.1 |
| 0.102 | 100.4599674 | 0 | 0.102 |
| 0.104 | 100.4781679 | 0 | 0.104 |
| 0.106 | 100.4967216 | 0 | 0.106 |
| 0.108 | 100.5156284 | 0 | 0.108 |
| 0.110 | 100.5348883 | 0 | 0.11 |
| 0.112 | 100.5545014 | 0 | 0.112 |
| 0.114 | 100.5744676 | 0 | 0.114 |
| 0.116 | 100.5947869 | 0 | 0.116 |
| 0.118 | 100.6154593 | 0 | 0.118 |
| 0.120 | 100.6364849 | 0 | 0.12 |
| 0.122 | 100.6578636 | 0 | 0.122 |
| 0.124 | 100.6795955 | 0 | 0.124 |
| 0.126 | 100.7016805 | 0 | 0.126 |
| 0.128 | 100.7241186 | 0 | 0.128 |
| 0.130 | 100.7469098 | 0 | 0.13 |
| 0.132 | 100.7700542 | 0 | 0.132 |
| 0.134 | 100.7935517 | 0 | 0.134 |
| 0.136 | 100.8174024 | 0 | 0.136 |
| 0.138 | 100.8416061 | 0 | 0.138 |
| 0.140 | 100.866163 | 0 | 0.14 |
| 0.142 | 100.8910731 | 0 | 0.142 |
| 0.144 | 100.9163362 | 0 | 0.144 |
| 0.146 | 100.9419525 | 0 | 0.146 |
| 0.148 | 100.9679219 | 0 | 0.148 |
| 0.150 | 100.9942445 | 0 | 0.15 |
| 0.152 | 101.0209202 | 0 | 0.152 |
| 0.154 | 101.047949 | 0 | 0.154 |
| 0.156 | 101.0753309 | 0 | 0.156 |
| 0.158 | 101.103066 | 0 | 0.158 |
| 0.160 | 101.1311542 | 0 | 0.16 |
| 0.162 | 101.1595956 | 0 | 0.162 |
| 0.164 | 101.1883901 | 0 | 0.164 |
| 0.166 | 101.2021414 | 0.001053416 | 0.164946584 |

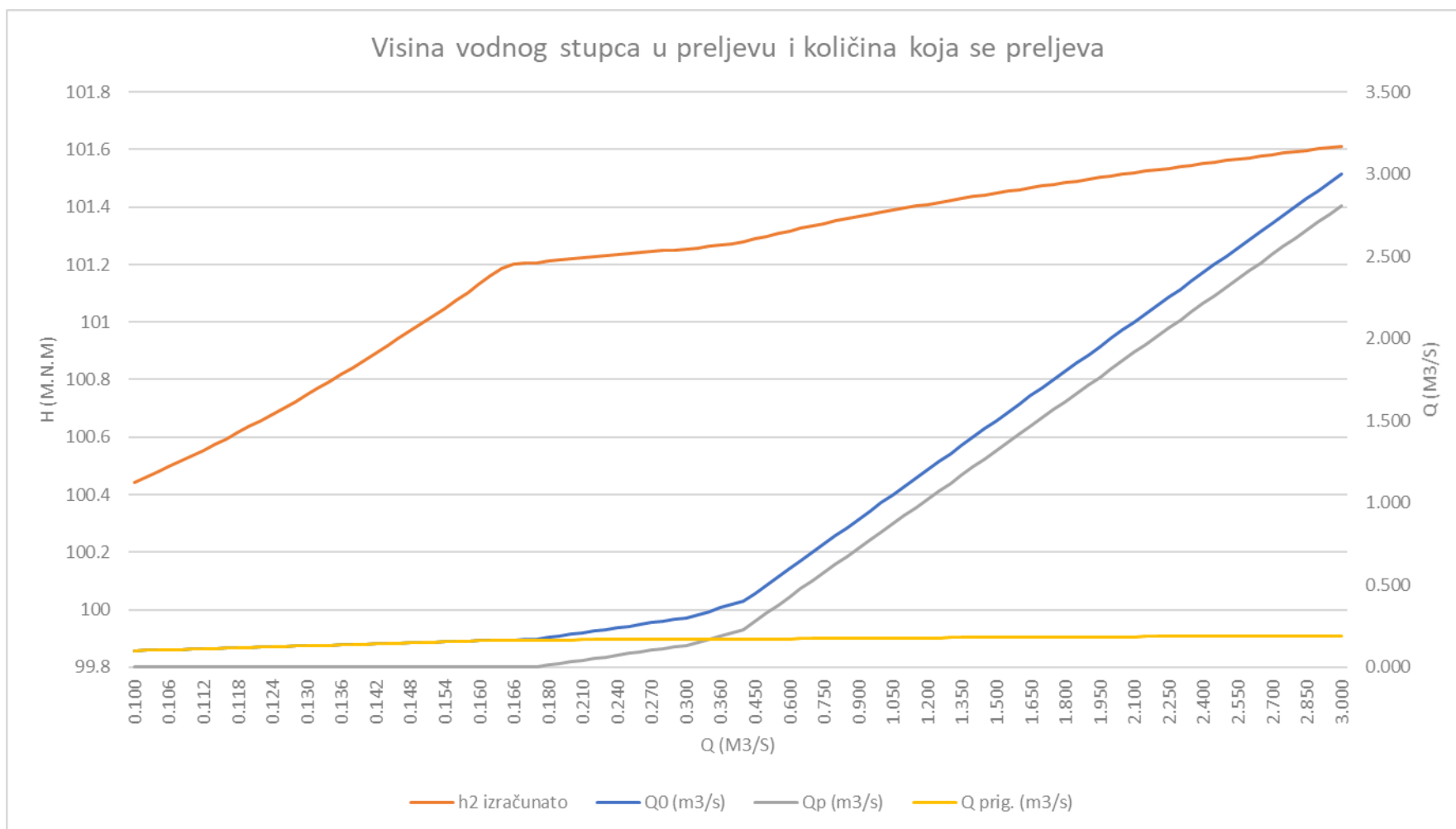
Tablica 7. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 0.168 | 101.2042169 | 0.002911019 | 0.165088981 |
| 0.170 | 101.2058829 | 0.004796801 | 0.165203199 |
| 0.180 | 101.2122214 | 0.01436298 | 0.16563702 |
| 0.190 | 101.2172198 | 0.02402168 | 0.16597832 |
| 0.200 | 101.2215899 | 0.033723854 | 0.166276146 |
| 0.210 | 101.2255648 | 0.043453425 | 0.166546575 |
| 0.220 | 101.2292582 | 0.053202537 | 0.166797463 |
| 0.230 | 101.2327366 | 0.062966603 | 0.167033397 |
| 0.240 | 101.2360428 | 0.07274265 | 0.16725735 |
| 0.250 | 101.2392069 | 0.082528609 | 0.167471391 |
| 0.260 | 101.2422506 | 0.092322969 | 0.167677031 |
| 0.270 | 101.2451904 | 0.102124585 | 0.167875415 |
| 0.280 | 101.2480394 | 0.111932558 | 0.168067442 |
| 0.290 | 101.2508077 | 0.121746172 | 0.168253828 |
| 0.300 | 101.253504 | 0.131564838 | 0.168435162 |
| 0.320 | 101.2587071 | 0.151215462 | 0.168784538 |
| 0.340 | 101.2636926 | 0.170881367 | 0.169118633 |
| 0.360 | 101.2684933 | 0.19056029 | 0.16943971 |
| 0.380 | 101.2731337 | 0.210250502 | 0.169749498 |
| 0.400 | 101.2776335 | 0.229950641 | 0.170049359 |
| 0.450 | 101.288364 | 0.279237699 | 0.170762301 |
| 0.500 | 101.2984864 | 0.32856788 | 0.17143212 |
| 0.550 | 101.3081191 | 0.37793288 | 0.17206712 |
| 0.600 | 101.3173455 | 0.427326861 | 0.172673139 |
| 0.650 | 101.3262265 | 0.476745521 | 0.173254479 |
| 0.700 | 101.334809 | 0.526185573 | 0.173814427 |
| 0.750 | 101.3431295 | 0.575644433 | 0.174355567 |
| 0.800 | 101.3512174 | 0.625120022 | 0.174879978 |
| 0.850 | 101.3590969 | 0.674610635 | 0.175389365 |
| 0.900 | 101.3667879 | 0.724114853 | 0.175885147 |
| 0.950 | 101.3743073 | 0.773631478 | 0.176368522 |
| 1.000 | 101.3816696 | 0.823159487 | 0.176840513 |
| 1.050 | 101.388887 | 0.872697996 | 0.177302004 |
| 1.100 | 101.3959705 | 0.922246237 | 0.177753763 |
| 1.150 | 101.4029295 | 0.971803535 | 0.178196465 |

Tablica 8. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 1.200 | 101.4097722 | 1.021369294 | 0.178630706 |
| 1.250 | 101.4165062 | 1.070942984 | 0.179057016 |
| 1.300 | 101.4231381 | 1.120524131 | 0.179475869 |
| 1.350 | 101.4296737 | 1.170112308 | 0.179887692 |
| 1.400 | 101.4361184 | 1.219707131 | 0.180292869 |
| 1.450 | 101.4424772 | 1.269308249 | 0.180691751 |
| 1.500 | 101.4487544 | 1.318915345 | 0.181084655 |
| 1.550 | 101.4549541 | 1.368528129 | 0.181471871 |
| 1.600 | 101.46108 | 1.418146332 | 0.181853668 |
| 1.650 | 101.4671354 | 1.46776971 | 0.18223029 |
| 1.700 | 101.4731236 | 1.517398036 | 0.182601964 |
| 1.750 | 101.4790474 | 1.567031101 | 0.182968899 |
| 1.800 | 101.4849095 | 1.61666871 | 0.18333129 |
| 1.850 | 101.4907124 | 1.666310681 | 0.183689319 |
| 1.900 | 101.4964584 | 1.715956848 | 0.184043152 |
| 1.950 | 101.5021497 | 1.765607051 | 0.184392949 |
| 2.000 | 101.5077884 | 1.815261145 | 0.184738855 |
| 2.050 | 101.5133763 | 1.86491899 | 0.18508101 |
| 2.100 | 101.5189152 | 1.914580457 | 0.185419543 |
| 2.150 | 101.5244068 | 1.964245424 | 0.185754576 |
| 2.200 | 101.5298527 | 2.013913777 | 0.186086223 |
| 2.250 | 101.5352544 | 2.063585406 | 0.186414594 |
| 2.300 | 101.5406132 | 2.113260209 | 0.186739791 |
| 2.350 | 101.5459305 | 2.162938089 | 0.187061911 |
| 2.400 | 101.5512076 | 2.212618954 | 0.187381046 |
| 2.450 | 101.5564456 | 2.262302717 | 0.187697283 |
| 2.500 | 101.5616458 | 2.311989295 | 0.188010705 |
| 2.550 | 101.566809 | 2.361678609 | 0.188321391 |
| 2.600 | 101.5719365 | 2.411370584 | 0.188629416 |
| 2.650 | 101.5770291 | 2.461065149 | 0.188934851 |
| 2.700 | 101.5820879 | 2.510762236 | 0.189237764 |
| 2.750 | 101.5871135 | 2.560461779 | 0.189538221 |
| 2.800 | 101.5921071 | 2.610163716 | 0.189836284 |
| 2.850 | 101.5970692 | 2.659867988 | 0.190132012 |
| 2.900 | 101.6020008 | 2.709574539 | 0.190425461 |
| 2.950 | 101.6069025 | 2.759283312 | 0.190716688 |
| 3.000 | 101.6117751 | 2.808994256 | 0.191005744 |

Tablica 9. Proračun visine vodnog stupca u preljevu i količine koja se preljeva



Grafikon 3. Visina vodnog stupca u preljevu i količina koja se preljeva

VARIJANTA 4 : $Z_P = 101$ (m.n.m), $L_P = 2$ (m)

| Q_0 (m ³ /s) | h_2 izračunato | Q_p (m ³ /s) | $Q_{prig.}$ (m ³ /s) |
|---------------------------|------------------|---------------------------|---------------------------------|
| 0.100 | 100.44212 | 0 | 0.1 |
| 0.102 | 100.4599674 | 0 | 0.102 |
| 0.104 | 100.4781679 | 0 | 0.104 |
| 0.106 | 100.4967216 | 0 | 0.106 |
| 0.108 | 100.5156284 | 0 | 0.108 |
| 0.110 | 100.5348883 | 0 | 0.11 |
| 0.112 | 100.5545014 | 0 | 0.112 |
| 0.114 | 100.5744676 | 0 | 0.114 |
| 0.116 | 100.5947869 | 0 | 0.116 |
| 0.118 | 100.6154593 | 0 | 0.118 |
| 0.120 | 100.6364849 | 0 | 0.12 |
| 0.122 | 100.6578636 | 0 | 0.122 |
| 0.124 | 100.6795955 | 0 | 0.124 |
| 0.126 | 100.7016805 | 0 | 0.126 |
| 0.128 | 100.7241186 | 0 | 0.128 |
| 0.130 | 100.7469098 | 0 | 0.13 |
| 0.132 | 100.7700542 | 0 | 0.132 |
| 0.134 | 100.7935517 | 0 | 0.134 |
| 0.136 | 100.8174024 | 0 | 0.136 |
| 0.138 | 100.8416061 | 0 | 0.138 |
| 0.140 | 100.866163 | 0 | 0.14 |
| 0.142 | 100.8910731 | 0 | 0.142 |
| 0.144 | 100.9163362 | 0 | 0.144 |
| 0.146 | 100.9419525 | 0 | 0.146 |
| 0.148 | 100.9679219 | 0 | 0.148 |
| 0.150 | 100.9942445 | 0 | 0.15 |
| 0.152 | 101.0048608 | 0.001200873 | 0.150799127 |
| 0.154 | 101.0087654 | 0.002908019 | 0.151091981 |
| 0.156 | 101.0120117 | 0.004664969 | 0.151335031 |
| 0.158 | 101.0149057 | 0.006448631 | 0.151551369 |
| 0.160 | 101.0175662 | 0.008250018 | 0.151749982 |
| 0.162 | 101.0200555 | 0.010064419 | 0.151935581 |
| 0.164 | 101.0224114 | 0.011888969 | 0.152111031 |
| 0.166 | 101.0246593 | 0.013721761 | 0.152278239 |

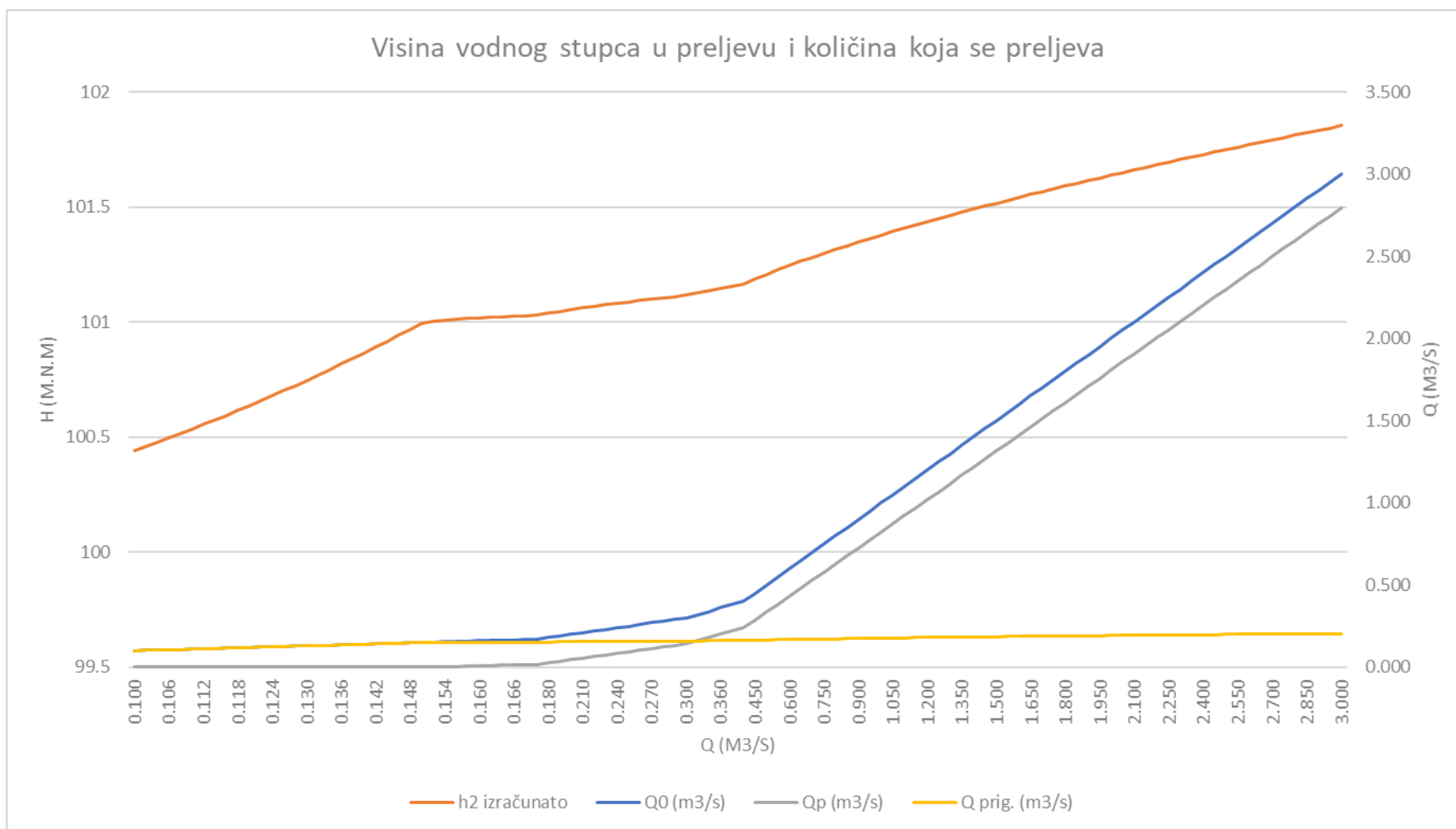
Tablica 10. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 0.168 | 101.0268168 | 0.015561443 | 0.152438557 |
| 0.170 | 101.0288972 | 0.017407011 | 0.152592989 |
| 0.180 | 101.0384349 | 0.026701023 | 0.153298977 |
| 0.190 | 101.04697 | 0.036071989 | 0.153928011 |
| 0.200 | 101.0548297 | 0.045494992 | 0.154505008 |
| 0.210 | 101.06219 | 0.05495661 | 0.15504339 |
| 0.220 | 101.0691591 | 0.064448556 | 0.155551444 |
| 0.230 | 101.0758098 | 0.073965251 | 0.156034749 |
| 0.240 | 101.0821941 | 0.083502713 | 0.156497287 |
| 0.250 | 101.0883506 | 0.093057971 | 0.156942029 |
| 0.260 | 101.094309 | 0.102628735 | 0.157371265 |
| 0.270 | 101.1000928 | 0.112213188 | 0.157786812 |
| 0.280 | 101.1057212 | 0.121809861 | 0.158190139 |
| 0.290 | 101.1112097 | 0.131417543 | 0.158582457 |
| 0.300 | 101.1165714 | 0.14103522 | 0.15896478 |
| 0.320 | 101.1269573 | 0.160297249 | 0.159702751 |
| 0.340 | 101.1369501 | 0.179590411 | 0.160409589 |
| 0.360 | 101.1466039 | 0.1989105 | 0.1610895 |
| 0.380 | 101.1559608 | 0.218254222 | 0.161745778 |
| 0.400 | 101.1650546 | 0.237618936 | 0.162381064 |
| 0.450 | 101.1868078 | 0.286109268 | 0.163890732 |
| 0.500 | 101.2073981 | 0.334692997 | 0.165307003 |
| 0.550 | 101.227042 | 0.383353033 | 0.166646967 |
| 0.600 | 101.245894 | 0.432077143 | 0.167922857 |
| 0.650 | 101.2640688 | 0.480856185 | 0.169143815 |
| 0.700 | 101.2816552 | 0.52968309 | 0.17031691 |
| 0.750 | 101.298723 | 0.578552252 | 0.171447748 |
| 0.800 | 101.315329 | 0.627459125 | 0.172540875 |
| 0.850 | 101.3315197 | 0.67639996 | 0.17360004 |
| 0.900 | 101.3473341 | 0.725371616 | 0.174628384 |
| 0.950 | 101.362805 | 0.774371427 | 0.175628573 |
| 1.000 | 101.3779606 | 0.823397107 | 0.176602893 |
| 1.050 | 101.3928254 | 0.872446678 | 0.177553322 |
| 1.100 | 101.4074206 | 0.921518409 | 0.178481591 |
| 1.150 | 101.4217649 | 0.970610778 | 0.179389222 |

Tablica 11. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 1.200 | 101.4358747 | 1.019722437 | 0.180277563 |
| 1.250 | 101.4497648 | 1.068852184 | 0.181147816 |
| 1.300 | 101.4634483 | 1.117998941 | 0.182001059 |
| 1.350 | 101.476937 | 1.167161737 | 0.182838263 |
| 1.400 | 101.4902417 | 1.216339693 | 0.183660307 |
| 1.450 | 101.5033721 | 1.265532012 | 0.184467988 |
| 1.500 | 101.5163369 | 1.314737966 | 0.185262034 |
| 1.550 | 101.5291443 | 1.363956887 | 0.186043113 |
| 1.600 | 101.5418017 | 1.413188165 | 0.186811835 |
| 1.650 | 101.5543159 | 1.462431234 | 0.187568766 |
| 1.700 | 101.5666932 | 1.511685575 | 0.188314425 |
| 1.750 | 101.5789394 | 1.560950704 | 0.189049296 |
| 1.800 | 101.59106 | 1.610226175 | 0.189773825 |
| 1.850 | 101.60306 | 1.659511569 | 0.190488431 |
| 1.900 | 101.614944 | 1.708806499 | 0.191193501 |
| 1.950 | 101.6267165 | 1.758110602 | 0.191889398 |
| 2.000 | 101.6383815 | 1.807423537 | 0.192576463 |
| 2.050 | 101.6499429 | 1.856744985 | 0.193255015 |
| 2.100 | 101.6614042 | 1.906074646 | 0.193925354 |
| 2.150 | 101.6727689 | 1.95541224 | 0.19458776 |
| 2.200 | 101.6840401 | 2.004757498 | 0.195242502 |
| 2.250 | 101.6952209 | 2.054110172 | 0.195889828 |
| 2.300 | 101.7063141 | 2.103470023 | 0.196529977 |
| 2.350 | 101.7173224 | 2.152836826 | 0.197163174 |
| 2.400 | 101.7282484 | 2.20221037 | 0.19778963 |
| 2.450 | 101.7390944 | 2.251590452 | 0.198409548 |
| 2.500 | 101.7498629 | 2.30097688 | 0.19902312 |
| 2.550 | 101.7605558 | 2.350369473 | 0.199630527 |
| 2.600 | 101.7711754 | 2.399768055 | 0.200231945 |
| 2.650 | 101.7817237 | 2.449172463 | 0.200827537 |
| 2.700 | 101.7922024 | 2.498582538 | 0.201417462 |
| 2.750 | 101.8026134 | 2.547998129 | 0.202001871 |
| 2.800 | 101.8129585 | 2.597419092 | 0.202580908 |
| 2.850 | 101.8232392 | 2.646845291 | 0.203154709 |
| 2.900 | 101.8334572 | 2.696276592 | 0.203723408 |
| 2.950 | 101.843614 | 2.745712869 | 0.204287131 |
| 3.000 | 101.8537109 | 2.795154002 | 0.204845998 |

Tablica 12. Proračun visine vodnog stupca u preljevu i količine koja se preljeva



Grafikon 4. Visina vodnog stupca u preljevu i količina koja se preljeva

VARIJANTA 5 : $Z_P = 101$ (m.n.m), $L_P = 2.5$ (m)

| Q_0 (m ³ /s) | h_2 izračunato | Q_p (m ³ /s) | $Q_{prig.}$ (m ³ /s) |
|---------------------------|------------------|---------------------------|---------------------------------|
| 0.100 | 100.44212 | 0 | 0.1 |
| 0.102 | 100.4599674 | 0 | 0.102 |
| 0.104 | 100.4781679 | 0 | 0.104 |
| 0.106 | 100.4967216 | 0 | 0.106 |
| 0.108 | 100.5156284 | 0 | 0.108 |
| 0.110 | 100.5348883 | 0 | 0.11 |
| 0.112 | 100.5545014 | 0 | 0.112 |
| 0.114 | 100.5744676 | 0 | 0.114 |
| 0.116 | 100.5947869 | 0 | 0.116 |
| 0.118 | 100.6154593 | 0 | 0.118 |
| 0.120 | 100.6364849 | 0 | 0.12 |
| 0.122 | 100.6578636 | 0 | 0.122 |
| 0.124 | 100.6795955 | 0 | 0.124 |
| 0.126 | 100.7016805 | 0 | 0.126 |
| 0.128 | 100.7241186 | 0 | 0.128 |
| 0.130 | 100.7469098 | 0 | 0.13 |
| 0.132 | 100.7700542 | 0 | 0.132 |
| 0.134 | 100.7935517 | 0 | 0.134 |
| 0.136 | 100.8174024 | 0 | 0.136 |
| 0.138 | 100.8416061 | 0 | 0.138 |
| 0.140 | 100.866163 | 0 | 0.14 |
| 0.142 | 100.8910731 | 0 | 0.142 |
| 0.144 | 100.9163362 | 0 | 0.144 |
| 0.146 | 100.9419525 | 0 | 0.146 |
| 0.148 | 100.9679219 | 0 | 0.148 |
| 0.150 | 100.9942445 | 0 | 0.15 |
| 0.152 | 101.0042883 | 0.001243859 | 0.150756141 |
| 0.154 | 101.0076924 | 0.002988437 | 0.151011563 |
| 0.156 | 101.0105163 | 0.004776882 | 0.151223118 |
| 0.158 | 101.0130307 | 0.006588758 | 0.151411242 |
| 0.160 | 101.0153406 | 0.008416145 | 0.151583855 |
| 0.162 | 101.0175007 | 0.010254904 | 0.151745096 |
| 0.164 | 101.0195442 | 0.012102521 | 0.151897479 |
| 0.166 | 101.0214932 | 0.013957324 | 0.152042676 |

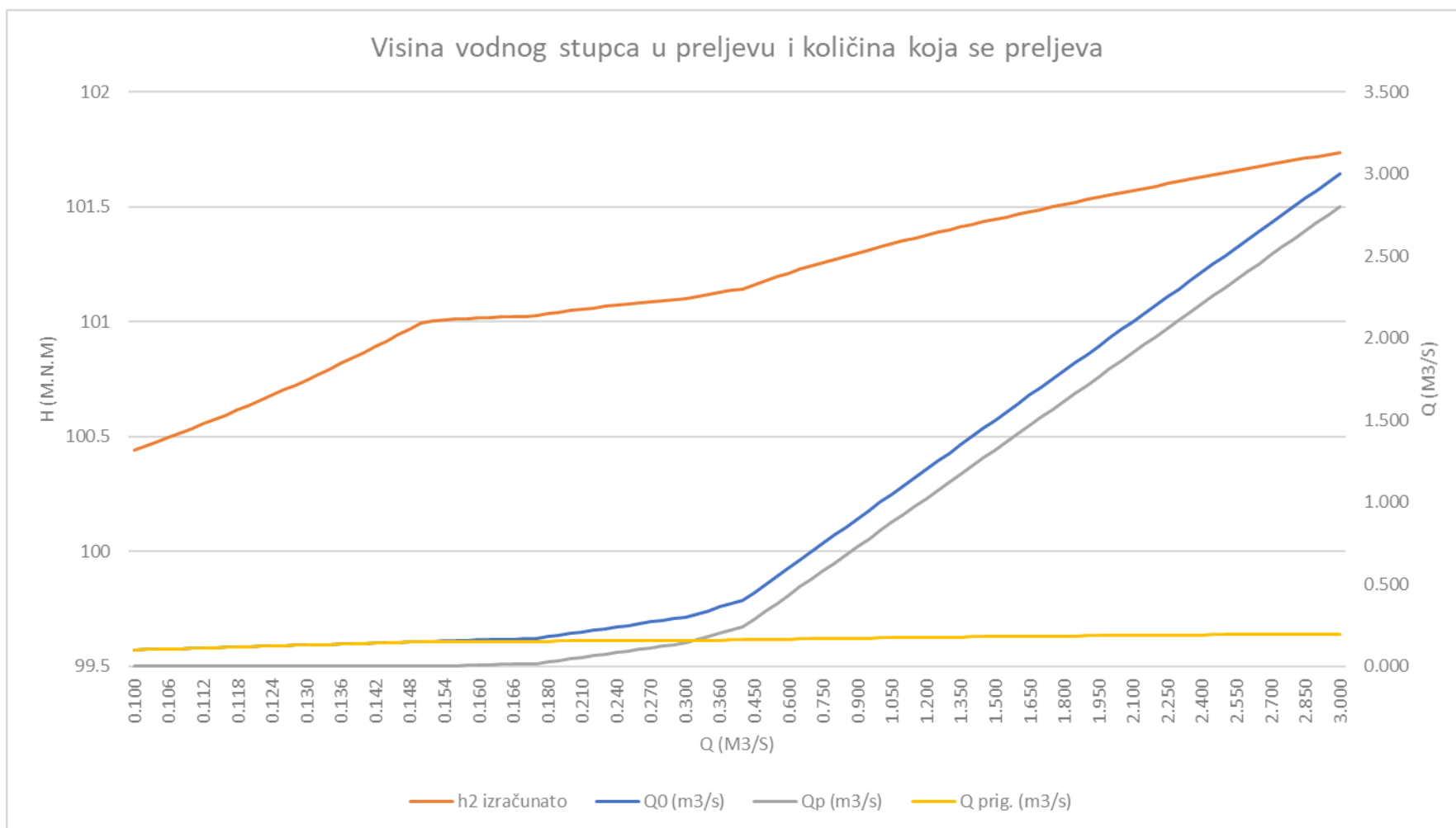
Tablica 13. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 0.168 | 101.0233635 | 0.01581813 | 0.15218187 |
| 0.170 | 101.0251664 | 0.01768406 | 0.15231594 |
| 0.180 | 101.0334277 | 0.027071258 | 0.152928742 |
| 0.190 | 101.0408159 | 0.036525284 | 0.153474716 |
| 0.200 | 101.0476167 | 0.046024431 | 0.153975569 |
| 0.210 | 101.0539833 | 0.055557024 | 0.154442976 |
| 0.220 | 101.0600102 | 0.065115861 | 0.154884139 |
| 0.230 | 101.0657606 | 0.074696101 | 0.155303899 |
| 0.240 | 101.0712797 | 0.084294289 | 0.155705711 |
| 0.250 | 101.0766011 | 0.09390785 | 0.15609215 |
| 0.260 | 101.0817507 | 0.103534797 | 0.156465203 |
| 0.270 | 101.0867488 | 0.11317356 | 0.15682644 |
| 0.280 | 101.0916122 | 0.122822865 | 0.157177135 |
| 0.290 | 101.0963542 | 0.132481665 | 0.157518335 |
| 0.300 | 101.1009864 | 0.142149083 | 0.157850917 |
| 0.320 | 101.1099582 | 0.161506911 | 0.158493089 |
| 0.340 | 101.1185894 | 0.180891564 | 0.159108436 |
| 0.360 | 101.1269268 | 0.200299409 | 0.159700591 |
| 0.380 | 101.1350071 | 0.219727603 | 0.160272397 |
| 0.400 | 101.1428596 | 0.239173866 | 0.160826134 |
| 0.450 | 101.161641 | 0.287857114 | 0.162142886 |
| 0.500 | 101.1794159 | 0.336620702 | 0.163379298 |
| 0.550 | 101.1963717 | 0.385449912 | 0.164550088 |
| 0.600 | 101.2126423 | 0.434334215 | 0.165665785 |
| 0.650 | 101.2283272 | 0.483265743 | 0.166734257 |
| 0.700 | 101.2435031 | 0.53223842 | 0.16776158 |
| 0.750 | 101.2582306 | 0.581247426 | 0.168752574 |
| 0.800 | 101.2725587 | 0.630288856 | 0.169711144 |
| 0.850 | 101.2865278 | 0.679359489 | 0.170640511 |
| 0.900 | 101.3001715 | 0.728456627 | 0.171543373 |
| 0.950 | 101.3135184 | 0.777577981 | 0.172422019 |
| 1.000 | 101.3265927 | 0.826721591 | 0.173278409 |
| 1.050 | 101.3394157 | 0.875885755 | 0.174114245 |
| 1.100 | 101.3520057 | 0.925068991 | 0.174931009 |
| 1.150 | 101.3643789 | 0.974269991 | 0.175730009 |

Tablica 14. Proračun visine vodnog stupca u preljevu i količine koja se preljeva

| | | | |
|-------|-------------|-------------|-------------|
| 1.200 | 101.3765495 | 1.023487599 | 0.176512401 |
| 1.250 | 101.3885302 | 1.072720784 | 0.177279216 |
| 1.300 | 101.4003325 | 1.121968619 | 0.178031381 |
| 1.350 | 101.4119665 | 1.171230273 | 0.178769727 |
| 1.400 | 101.4234415 | 1.220504992 | 0.179495008 |
| 1.450 | 101.4347658 | 1.269792091 | 0.180207909 |
| 1.500 | 101.4459473 | 1.319090946 | 0.180909054 |
| 1.550 | 101.4569927 | 1.368400984 | 0.181599016 |
| 1.600 | 101.4679086 | 1.41772168 | 0.18227832 |
| 1.650 | 101.4787008 | 1.46705255 | 0.18294745 |
| 1.700 | 101.4893747 | 1.516393148 | 0.183606852 |
| 1.750 | 101.4999355 | 1.56574306 | 0.18425694 |
| 1.800 | 101.5103878 | 1.615101901 | 0.184898099 |
| 1.850 | 101.5207359 | 1.664469314 | 0.185530686 |
| 1.900 | 101.5309839 | 1.713844964 | 0.186155036 |
| 1.950 | 101.5411356 | 1.763228541 | 0.186771459 |
| 2.000 | 101.5511944 | 1.812619752 | 0.187380248 |
| 2.050 | 101.5611638 | 1.862018323 | 0.187981677 |
| 2.100 | 101.5710468 | 1.911423997 | 0.188576003 |
| 2.150 | 101.5808463 | 1.960836532 | 0.189163468 |
| 2.200 | 101.5905652 | 2.010255699 | 0.189744301 |
| 2.250 | 101.600206 | 2.059681283 | 0.190318717 |
| 2.300 | 101.6097712 | 2.10911308 | 0.19088692 |
| 2.350 | 101.6192631 | 2.158550897 | 0.191449103 |
| 2.400 | 101.6286839 | 2.207994552 | 0.192005448 |
| 2.450 | 101.6380357 | 2.25744387 | 0.19255613 |
| 2.500 | 101.6473205 | 2.306898687 | 0.193101313 |
| 2.550 | 101.6565401 | 2.356358847 | 0.193641153 |
| 2.600 | 101.6656965 | 2.405824199 | 0.194175801 |
| 2.650 | 101.6747912 | 2.455294602 | 0.194705398 |
| 2.700 | 101.6838259 | 2.50476992 | 0.19523008 |
| 2.750 | 101.6928022 | 2.554250024 | 0.195749976 |
| 2.800 | 101.7017216 | 2.603734789 | 0.196265211 |
| 2.850 | 101.7105854 | 2.653224097 | 0.196775903 |
| 2.900 | 101.7193951 | 2.702717835 | 0.197282165 |
| 2.950 | 101.7281519 | 2.752215894 | 0.197784106 |
| 3.000 | 101.7368571 | 2.801718169 | 0.198281831 |

Tablica 15. Proračun visine vodnog stupca u preljevu i količine koja se preljeva



Grafikon 5. Visina vodnog stupca u preljevu i količina koja se preljeva

PRORAČUN KONJUGIRANIH DUBINA ZA $r = 1\text{m}$

| Q_0 (m ³ /s) ▾ | y_1 (m.v.s) ▾ | y_2 (m.v.s) ▾ |
|-----------------------------|-----------------|-----------------|
| 0.100 | 0.075842811 | 0.249712961 |
| 0.105 | 0.077615975 | 0.25621371 |
| 0.110 | 0.079346022 | 0.262570057 |
| 0.115 | 0.081035917 | 0.268791623 |
| 0.120 | 0.082688302 | 0.274887 |
| 0.125 | 0.084305542 | 0.280863903 |
| 0.130 | 0.085889767 | 0.286729289 |
| 0.135 | 0.087442899 | 0.292489454 |
| 0.140 | 0.088966685 | 0.298150124 |
| 0.145 | 0.090462712 | 0.303716521 |
| 0.150 | 0.091932432 | 0.309193425 |
| 0.155 | 0.093377175 | 0.314585223 |
| 0.160 | 0.094798163 | 0.319895953 |
| 0.165 | 0.096196522 | 0.325129344 |
| 0.170 | 0.097573294 | 0.330288846 |
| 0.175 | 0.098929441 | 0.335377658 |
| 0.180 | 0.100265859 | 0.340398757 |
| 0.185 | 0.101583379 | 0.345354913 |
| 0.190 | 0.102882778 | 0.350248712 |
| 0.195 | 0.104164779 | 0.355082575 |
| 0.200 | 0.105430061 | 0.359858767 |
| 0.210 | 0.107912968 | 0.369246515 |
| 0.220 | 0.11033613 | 0.378427495 |
| 0.230 | 0.112703655 | 0.387415512 |
| 0.240 | 0.115019202 | 0.396222895 |
| 0.250 | 0.117286047 | 0.404860714 |
| 0.260 | 0.11950714 | 0.413338946 |
| 0.270 | 0.121685147 | 0.421666628 |
| 0.280 | 0.123822484 | 0.429851972 |
| 0.290 | 0.125921353 | 0.437902469 |
| 0.300 | 0.127983765 | 0.445824973 |
| 0.320 | 0.132006439 | 0.461310672 |
| 0.340 | 0.135903555 | 0.476353726 |
| 0.360 | 0.139686245 | 0.490992355 |
| 0.380 | 0.1433641 | 0.505259575 |
| 0.400 | 0.146945451 | 0.519184137 |
| 0.420 | 0.150437586 | 0.532791265 |
| 0.440 | 0.153846928 | 0.546103231 |
| 0.460 | 0.157179167 | 0.559139824 |

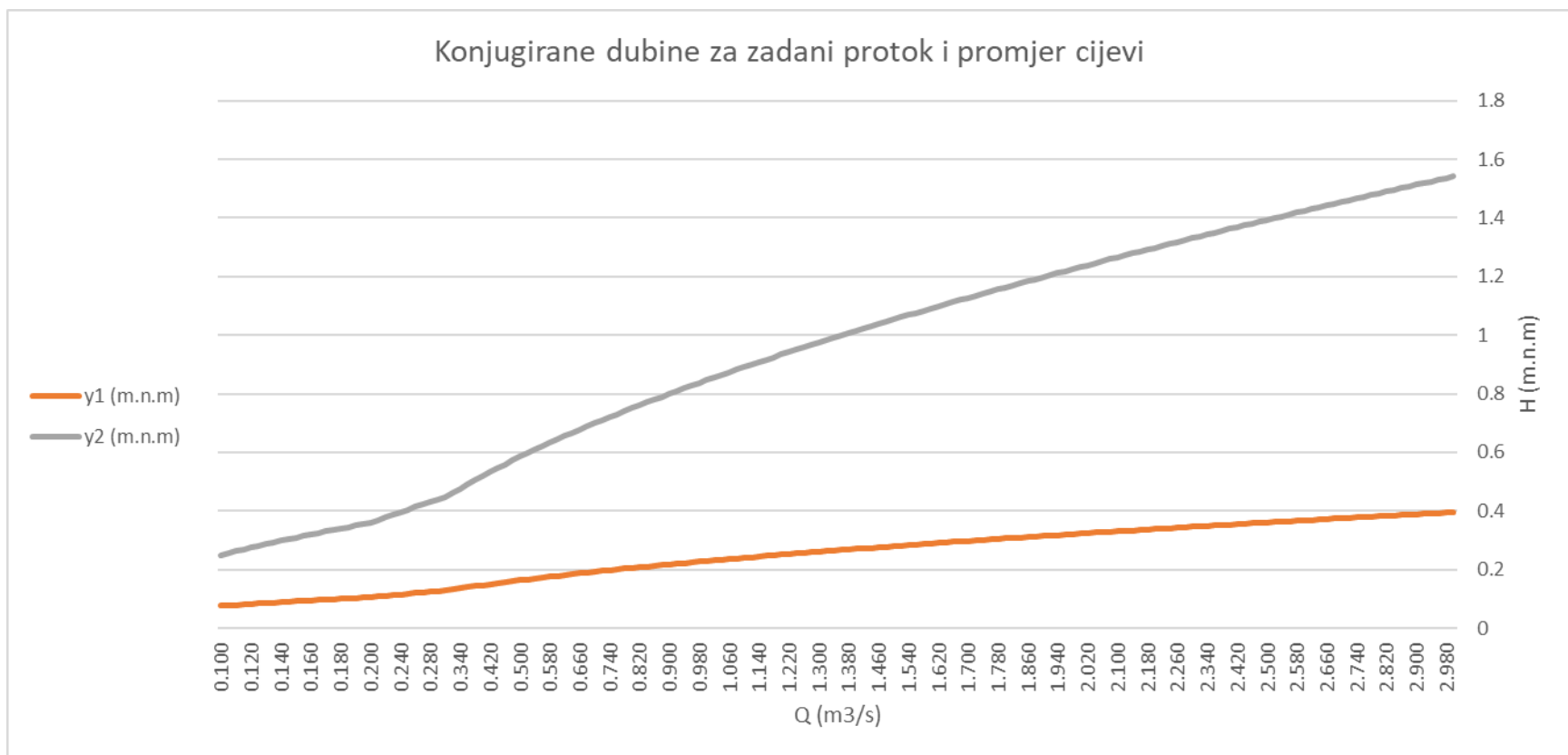
Tablica 16. Proračun konjugiranih dubina za odabrane protoke

| | | |
|-------|-------------|-------------|
| 0.480 | 0.160439377 | 0.571918713 |
| 0.500 | 0.1636321 | 0.584455761 |
| 0.520 | 0.166761426 | 0.596765268 |
| 0.540 | 0.16983105 | 0.608860182 |
| 0.560 | 0.172844323 | 0.620752268 |
| 0.580 | 0.175804297 | 0.63245226 |
| 0.600 | 0.17871376 | 0.643969977 |
| 0.620 | 0.181575268 | 0.655314434 |
| 0.640 | 0.184391169 | 0.666493929 |
| 0.660 | 0.187163626 | 0.677516119 |
| 0.680 | 0.189894641 | 0.688388092 |
| 0.700 | 0.192586065 | 0.69911642 |
| 0.720 | 0.195239618 | 0.709707211 |
| 0.740 | 0.197856898 | 0.720166157 |
| 0.760 | 0.200439398 | 0.730498569 |
| 0.780 | 0.202988508 | 0.740709414 |
| 0.800 | 0.205505533 | 0.750803342 |
| 0.820 | 0.207991692 | 0.76078472 |
| 0.840 | 0.210448133 | 0.770657649 |
| 0.860 | 0.212875932 | 0.78042599 |
| 0.880 | 0.215276105 | 0.790093383 |
| 0.900 | 0.217649607 | 0.799663262 |
| 0.920 | 0.219997342 | 0.809138875 |
| 0.940 | 0.222320164 | 0.818523292 |
| 0.960 | 0.224618881 | 0.827819425 |
| 0.980 | 0.226894259 | 0.837030035 |
| 1.000 | 0.229147024 | 0.846157743 |
| 1.020 | 0.231377867 | 0.855205042 |
| 1.040 | 0.233587443 | 0.864174302 |
| 1.060 | 0.235776376 | 0.873067782 |
| 1.080 | 0.237945261 | 0.881887635 |
| 1.100 | 0.240094666 | 0.890635917 |
| 1.120 | 0.24222513 | 0.899314589 |
| 1.140 | 0.244337171 | 0.907925527 |
| 1.160 | 0.246431283 | 0.916470526 |
| 1.180 | 0.248507937 | 0.924951303 |
| 1.200 | 0.250567587 | 0.933369504 |
| 1.220 | 0.252610665 | 0.941726707 |
| 1.240 | 0.254637588 | 0.950024427 |
| 1.260 | 0.256648753 | 0.958264117 |

Tablica 17. Proračun konjugiranih dubina za odabrane protoke

| | | |
|-------|-------------|-------------|
| 2.160 | 0.335207541 | 1.28501113 |
| 2.180 | 0.336754626 | 1.291540069 |
| 2.200 | 0.338295108 | 1.298044737 |
| 2.220 | 0.339829079 | 1.30452548 |
| 2.240 | 0.341356631 | 1.310982638 |
| 2.260 | 0.342877851 | 1.317416541 |
| 2.280 | 0.344392827 | 1.323827513 |
| 2.300 | 0.345901643 | 1.33021587 |
| 2.320 | 0.347404382 | 1.336581923 |
| 2.340 | 0.348901125 | 1.342925974 |
| 2.360 | 0.350391951 | 1.34924832 |
| 2.380 | 0.351876939 | 1.355549252 |
| 2.400 | 0.353356163 | 1.361829052 |
| 2.420 | 0.354829698 | 1.368088 |
| 2.440 | 0.356297618 | 1.374326368 |
| 2.460 | 0.357759993 | 1.380544422 |
| 2.480 | 0.359216894 | 1.386742424 |
| 2.500 | 0.360668388 | 1.392920629 |
| 2.520 | 0.362114543 | 1.399079288 |
| 2.540 | 0.363555424 | 1.405218647 |
| 2.560 | 0.364991096 | 1.411338947 |
| 2.580 | 0.366421623 | 1.417440422 |
| 2.600 | 0.367847065 | 1.423523305 |
| 2.620 | 0.369267484 | 1.429587823 |
| 2.640 | 0.37068294 | 1.435634196 |
| 2.660 | 0.37209349 | 1.441662644 |
| 2.680 | 0.373499192 | 1.447673379 |
| 2.700 | 0.374900102 | 1.453666612 |
| 2.720 | 0.376296275 | 1.459642548 |
| 2.740 | 0.377687766 | 1.465601388 |
| 2.760 | 0.379074627 | 1.47154333 |
| 2.780 | 0.380456912 | 1.477468569 |
| 2.800 | 0.38183467 | 1.483377293 |
| 2.820 | 0.383207953 | 1.48926969 |
| 2.840 | 0.384576809 | 1.495145944 |
| 2.860 | 0.385941288 | 1.501006233 |
| 2.880 | 0.387301437 | 1.506850734 |
| 2.900 | 0.388657302 | 1.512679621 |
| 2.920 | 0.39000893 | 1.518493062 |
| 2.940 | 0.391356367 | 1.524291225 |
| 2.960 | 0.392699656 | 1.530074274 |
| 2.980 | 0.394038841 | 1.535842367 |
| 3.000 | 0.395373966 | 1.541595664 |

Tablica 18. Proračun konjugiranih dubina za odabrane protoke



Grafikon 6. Visina konjugiranih dubina u dovodnoj cijevi

6. ZAKLJUČAK

Proračunima za visinu preljeva kao i količinu vode koja se preljeva kod određenih dotoka dokazali smo da je najpovoljnija varijanta izvedbe ovoga preljeva ta da dužina preljeva bude $L_p = 3 \text{ m}$ te da se gornja kota prije nego li dođe do preljeva nalazi na $Z_p = 101 \text{ m.n.m.}$

Kod prigušnice smo dokazali da je najpovoljnija situacija kojom se zadovolji uvjet, gdje joj je protok 150 l/s , ta u kojoj je promjer prigušnice $D_{\text{prig.}} = 25 \text{ cm}$, te joj je dužina $L_{\text{prig.}} = 5.5 \text{ m}$.

Prilikom proračuna konjugiranih dubina u dovodu da bi dobili siloviti režim prije preljeva odredili smo da promjer dovodne cijevi mora biti $D = 2 \text{ m}$ da bih se osigurala dovoljna visina sustava da dođe do silovitog režima tečenja prije preljeva.

7. LITERATURA

„Osnove vodogradnje“ skripta – autor Doc. Dr. Sc. Davor Bojanić