Appendix I (Flow Calculations):

Volumetric Flow Rate Equation: $Q = \frac{V}{T}[G/H]$
General Area Formula: $A = \pi r^2$
Let $x[GPH]$ my volumetric flow rate, converting from

$$Q = \frac{x[G]}{[H]} \cdot \frac{1\ [\mathrm{H}]}{60\ [\mathrm{M}]} \cdot \frac{1[M]}{60[s]} \cdot \frac{0.00378541\ [m^3]}{1\ [G]} = x \cdot \frac{0.00378541[m^3]}{3600[s]} \quad (1)$$

From the flow rate equation, we can expand and derive the velocity: $\frac{V}{t} = \frac{A \cdot d}{t} = v \cdot A$

$$\Rightarrow v \cdot A = \frac{Q[m^3]}{951022[s]} \rightarrow v = \frac{Q}{951022 \cdot A} \quad (2)$$

Bernoulli's equation: $P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$
Our condition: 1) The pipe's diameter does not change throughout the pipe.
2) The atmosphere pressure acts on both intake and outtake.
3) Friction is negligible, and we are not considering it.
$\therefore \rho g h_1 = \rho g h_2$
Speed is independent of height.
And if we consider the external energy of the pump from $\Delta E = W$,
$\Delta P = \rho g\, \Delta h$
The height only influences the pressure of our water.
This is used to verify that the pump can support the lift height of our traveling height if needed.
The flow rate Q assumes that the pump can maintain the exit velocity at a certain height which is provided in the listing.

This tells me that the change of pressure is related to the change of height.
So, I know the speed stays the same from the intake to outtake which means:

$$Q = \frac{V}{t}\left[\frac{m^3}{s}\right] = \frac{A \cdot d}{t} = A \cdot v$$

$$\Rightarrow v_f = \frac{Q}{A} = \frac{Q}{\pi \cdot \frac{\mathrm{d}^2}{4}}$$

Note: Absolute value comes from the fact that the water's output is at the bottom of the bending tube. We are taking the average of the top to the faucet bottom height.
Q – Flow Rate in (GPH); D – Diameter of pipe;

Q[G/H] **D Q[G/s]· 10^4**	**32** **0.034**	**80** **0.084**	**120** **1.26**	**160** **1.68**	**320** **3.36**	**<u>410</u>** **4.31**	**480** **5.04**	**900** **9.46**
0.5" (1.27 cm)	0.266	0.664	0.996	1.328	2.656	3.403	3.984	7.471
0.65" (1.651 cm)	0.157	0.393	0.589	0.786	1.572	2.014	2.358	4.421
<u>0.75</u>" (1.905 cm)	0.118	0.295	0.443	0.590	1.181	**1.513**	1.771	3.320
0.85" (2.159 cm)	0.092	0.230	0.345	0.460	0.919	1.178	1.379	2.585
1.00" (2.54 cm)	0.066	0.166	0.249	0.332	0.664	0.851	0.996	1.868