

Interactive comment on “Hydraulic modelling of drinking water treatment plant operations” by G. I. M. Worm et al.

Anonymous Referee #2

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I coincide with the anonymous referee #1 almost in everything. Even so, I would like to point out some additional comments regarding this paper.

In page 157, line 19 I find some confusion with the terms “head” and pressure, and their relation with the PSV usage. The authors say that “[...] a PSV maintains a fixed pressure at the upstream junction [...] by adding a specific head difference to the elevation [...]” and it is not really in that way. If we name head as H and pressure as p , the relation between both magnitudes in a junction is given by the more scientific equation:

$$H = \frac{p}{\gamma} + z$$

In this expression, z is the elevation of the junction, and p/γ is the pressure term,

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expressed as water column meters, no an additional head due to the PSV. I would substitute the line 19 (page 157) by the equation shown above.

The usage of the PSV is as described by the authors in their reply to referee 1 (pages S82 and S83). I must disagree with referee #1 at this point, but must also state that the original explanation of PSV was poor. It is better explained in the reply mentioned above.

I don't share the model the authors propose for wells. The authors model the drawdown in the well through a general purpose valve (GPV) with a linear relationship. There are 16 wells which supposedly are very close one to each other. The linear relation between flow and drawdown, as proposed by Thiem, corresponds to an isolated well with constant extracted flow. For the situation described for this paper, a second non-linear term must be added, obtaining the following equation, due to Rorabaugh (1953):

$$\Delta z = \frac{Q}{2\pi T} \ln \frac{R}{r_w} + kQ^n$$

In the equation above, Q is the extracted flow, T is the soil conductivity, R the influence well radius, r_w the distance to well, k a coefficient to be determined, and n an exponent ranging between 1 and 2.

Anyway, the description of this model for wells is unnecessary since it is not used. Finally, as described in page 160, lines 10 to 12, “[...] the water level measurement inside the well has been used instead of the groundwater level minus the groundwater estimation [...]”.

Furthermore, it is mentioned a range for speed of the pumps when the model is run under steady state conditions and, hence, there is no speed variation during the simulation. Also, “[...] the speeds [...] were set manually to match the flow of the historic data [...]” (page 162, lines 3 to 5), which is like including a constant negative demand (interpreted as a constant inflow by EPANET solver).

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The model layout shown in Figure 1 is redundant and unclear. The model of each element in the plant was described in the text and in Table 1. So, a simpler sketch of plant's layout with the elements (wells, cascades, rapid sand filters, tower aerators, and clear water reservoirs) is easy to understand.

In the *Results and Discussion* section there are several comments to be done. First, independently from scale, the plots in Figures 2 and 5 show some obvious deviations. In Figure 2, measured flows from wells are mainly bigger than calculated. On the other hand, in Figure 5 almost all measured effluent flows in the rapid sand filters seem to be smaller than the calculated ones. In fact, only 3 measures are bigger than calculated flows.

The updated figures shown in the reply by authors seem to be mistaken, since the three figures are the same.

Conclusion:

The paper is really interesting and solves a very common problem when modelling a water distribution system, as is the inclusion of the water treatment plant. The modelling of each element is exhaustive, and probably effective with smaller changes. However, some revision has to be done in both description of the model and validation and calibration process.

Interactive comment on Drink. Water Eng. Sci. Discuss., 1, 155, 2008.