Effects of three floating treatment wetland arrangements on the flow field of a channel

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Introduction



Treatment processes performed by a FTW. Source: International Institute for Sustainable Development (floating-wetlands-brochure.pdf (iisd.org)). FTWs can have the potential to affect the flow field, inducing preferential paths and short-circuit, for instance, which may be controlled by how the FTWs are arranged on the water surface.

The goal of the study was to numerically simulate the flow field of three different FTW arrangements displayed in a channel reach, in order to assess the hydrodynamic differences between each arrangement.



Methods



Arrangement 1: three FTWs in series, centered in the channelArrangement 2: three FTWs in series, spanning the channel widthArrangement 3: two FTWs at each margin of the channel

The FTWs covered 45% of the channel surface area and occupied half of the channel depth

Steady-state solution:

- Discretization of the domain (grid with approx. 500,000 elements)
- Initial bulk flow velocity U₀ entering the channel
- Root zone represented as porous media
- CFD solver (FLUENT® v. 19.5)
- RANS equations + Transition SST model for flow and turbulence

Results: top view (half the root length)



Results: side view (channel midwidth)





Conclusions

- When there is an open space at the sides of the wetland, the flow is diverted toward this path.
- When the wetland spans the channel width, the flow will be mainly diverted beneath the wetland.

Acknowledgments

Work supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), process nº 88882.458516/2019-01.



