APPENDIX 4 : SAT & MAR monitoring, and model for performance evaluation from EviBAN D2.1, June 2023

5. Tool for SAT & MAR monitoring, and model for performance evaluation

The objective of this chapter is to present three approaches useful to assess and optimise a MAR system 1) System Monitoring Device (developed ImaGeau), 2) NORRMAN tool (developed by ANTEA) and 3) an intrinsic tracer test and transport modelling study (conducted by Brgm).

The last approach concerns the work developed during PhD study in EVIBAN project (Quentin Guillemoto). It is about simplified preliminary assessments of residence time and the fate and transport of contaminants in Soil Aquifer Treatment (SAT) systems (include non-reactive solutes, nutrients, pesticides, fertilizers, heavy metals, pharmaceuticals, and personal care products). Travel time from the area of recharge to the point of abstraction during SAT is a critical parameter to ensure sufficient attenuation for undesired substances when water containing contaminants is recharged in the unsaturated zone of an aquifer via infiltration ponds (Figure 1). The proposed approach uses existing analytical solution, and the concentration of contaminants is calculated after specified pore water velocity (residence time), distance and time from infiltration point. This chapter summarizes the sources of data and established parameters needed for model building before applying modelling on the SAT scheme of Agon-Coutainville case as example applied on specific trace organic compounds (TrOCs) and published in 2022 in the journal Science Total Environment[1].

This approach already exist through applets deliver by the FRAME Decision Support System (DSS) http://www.frame-project.eu/previous-news/dss/index.html , http://www.geo-hyd.net/install/Frame_DSS/), the INOWAS Platform (T13. Travel Time Through Unconfined Aquifer: https://inowas.com/tools/t13-travel-time-through-unconfined-aquifer/ and T08. One-Dimensional Transport Equation: https://inowas.com/tools/t08-one-dimensional-transport-equation/ and T19. Groundwater residence time: https://inowas.com/tools/t19-groundwater-residence-time/) and the AQUANES DSS (http://dss.aquanes.eu/Default.aspx?t=1756). Analytical equations and the nonlinear parametric estimation are available on the package CXTFIT[2].

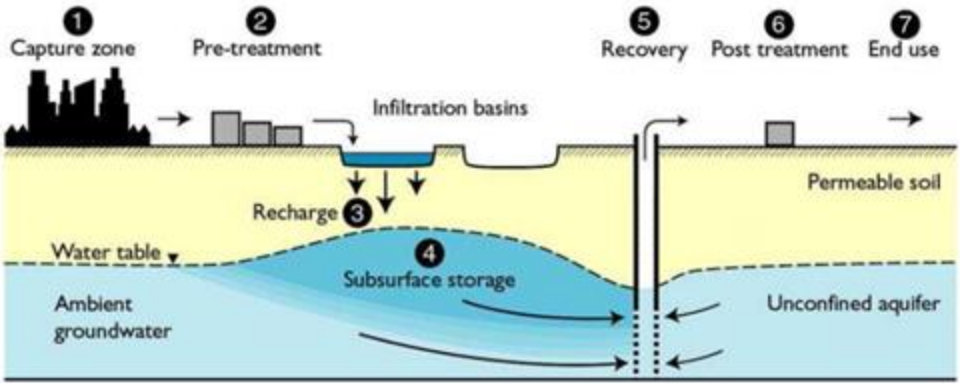

Figure 1: SAT scheme[3]

[1] Q. Guillemoto, G. Picot-Colbeaux, D. Valdes, N. Devau, F.A. Mathurin, M. Pettenati, W. Kloppmann, J.-M. Mouchel, Transfer of trace organic compounds in an operational soil-aquifer treatment system assessed through an intrinsic tracer test and transport modelling. Science of The Total Environment, Volume 836, 25 August 2022, 155643. https://doi.org/10.1016/j.scitotenv.2022.155643

[2] Toride, N., Leij, F., Van Genuchten, M., 1995. The CXTFIT Code for Estimating Transport Parameters from Laboratory or Field Tracer Experiments. Salin. Lab. 137.

[3] Miotliński K., Barry K., Dillon P. and Breton M.,2010. Alice Springs SAT Project - Hydrological and Water Quality Monitoring Report 2008-2009. CSIRO: Water for a Healthy Country National Research Flagship. https://sswm.info/sites/default/files/reference_attachments/MIOTLINSKI%20et%20al%202010%20Alice%20Springs%20SAT%20Project.pdf