Spatio-temporal variations of water sources and mixing spots in a riparian zone

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Fig.S1: Measured Cl⁻ concentrations on groundwater end-member well (Cl_{GW}), on stream water end-member (Cl_{SW}), and on other observation wells at the area (Cl_{obs}) alongside stream discharge (Q). Cl⁻ measurements were used to calculate the stream water fraction (F_{STR}) present on the riparian groundwater in the observation wells (Eq.3).



Fig.S2: Observed and simulated hydraulic heads (a) and stream discharge (Q) (b) for the simulated period. The inset scatter plot in (a) shows the observed versus simulated hydraulic heads alongside the mean coefficient of determination (R²) and mean Kling-Gupta Efficiency (KGE). Each observation well is presented with a different colour.



Fig.S3: Three snapshots showing conditions before, at the peak, and during the falling limb of the largest discharge event observed during the simulation period (2013-2016). **a-c**) SW-GW exchange fluxes in terms of gaining and losing conditions (the inverse relation between stream gaining conditions and stream discharge can be depicted); **d**-

f) geochemical hyporheic zone (HZ, $f_{SW} \ge 0.5$) around the stream channel coloured according to computed mixing degrees (*d*); and **g-i**) mixing degrees for the entire domain. Warmer colours indicate higher mixing degrees. Note the vertical exaggeration of the 3D plots (20x).



Fig.S4: Metrics of the stream discharge events and the resulting changes in d_h (Δd_h) from conditions immediately prior to the rising limb of the discharge event. The ΔQ represents the peak prominence of the different discharge events. Note that two set of simulations (2013-2016 and 2017-2019) were carried out for the analyses in order to comprise a large number of discharge events under evaluation.



Fig.S5: a) time-series of stream discharge (Q); and variation of water transit-times (τ) for floodplain (b) and for hyporheic flow paths (c). Hyporheic flow paths are defined as infiltrating SW that exfiltrates at streambed cells after subsurface transit. The grey bars indicate the interval between 0.25 and 0.75 quantiles of transit-times, whereas the large symbols indicate their median values.



Fig.S6: Location of the multilevel piezometers monitored in Gassen et al. (2017). They are located somewhat between the observation wells F2 and Fx1.