Table S1. Statistical summary of the experimental data of water samples.

Parameters	Unit	Initial	Infiltration Distances															
			10 cm				30 cm				50 cm				80 cm			
			Min.	Max.	Avg.	SD	Min.	Max.	Avg.	SD	Min.	Max.	Avg.	SD	Min.	Max.	Avg.	SD
RHC *	-	100%	33.0%	60.4%	39.6%	8.5%	22.0%	50.96%	31.0%	9.2%	14.1%	42.9%	23.4%	9.1%	11.8%	37.1%	19.9%	8.1%
Turbidity	NTU	38.73	8.30	15.73	11.28	2.54	5.82	10.64	7.82	1.64	1.96	8.82	4.50	2.31	1.21	7.91	3.44	2.27
COD	mg L^{-1}	33.65	20.50	26.27	22.90	2.05	17.16	24.40	19.93	2.55	13.86	22.38	16.90	2.82	11.44	19.35	13.95	3.91
NH_4^+	mg L^{-1}	52.55	34.46	46.80	38.05	2.95	31.33	42.55	34.59	2.49	27.21	38.42	30.95	0.06	25.91	36.59	29.22	2.49
Mn(IV)	mg L^{-1}	0.54	0.32	0.45	0.37	0.05	0.30	0.43	0.35	0.04	0.20	0.39	0.25	0.06	0.16	0.37	0.24	0.06
Mn^{2+}	mg L^{-1}	0.27	0.19	0.25	0.21	0.03	0.18	0.23	0.20	0.03	0.12	0.19	0.15	0.03	0.12	0.18	0.14	0.03
Total Fe	mg L^{-1}	38.37	29.54	35.03	31.51	2.07	28.94	33.58	30.82	1.77	26.56	31.60	28.36	2.07	21.07	28.83	23.45	2.83
Fe^{3+}	mg L^{-1}	20.09	15.26	18.36	16.56	1.30	14.98	17.35	16.11	1.16	13.98	16.18	14.98	0.86	10.93	14.88	12.20	1.42
Fe^{2+}	mg L^{-1}	12.50	9.80	11.51	10.33	0.81	9.63	11.19	10.16	0.73	8.70	10.63	9.26	0.55	6.95	9.62	7.76	0.99

* RHC: denotes to relative hydraulic conductivities, which are quotient of the real-time monitoring data (K_t) dividing by the initial hydraulic conductivity (K_0) of the medium.

Table S2. Statistical summary of removal rate of the target water quality parameters during RBF simulation experiment.

Parameters	Infiltration Distances															
	10 cm				30 cm				50 cm				80 cm			
	Min.	Max.	Avg.	SD	Min.	Max.	Avg.	SD	Min.	Max.	Avg.	SD	Min.	Max.	Avg.	SD
RHC *	39.6%	66.7%	60.4%	0.085	48.7%	78.3%	69.0%	0.092	56.4%	85.8%	76.6%	0.091	63.0%	88.2%	80.1%	0.081
Turbidity	59.4%	78.6%	70.9%	0.066	72.5%	85.0%	79.8%	0.038	77.2%	94.9%	88.4%	0.062	79.6%	96.9%	91.1%	0.060
COD	21.9%	39.1%	31.9%	0.061	27.5%	49.0%	40.8%	0.076	33.5%	58.8%	49.8%	0.084	42.5%	66.0%	58.5%	0.116
NH_4^+	10.9%	34.4%	27.6%	0.056	19.0%	40.4%	34.2%	0.047	26.9%	48.2%	41.1%	0.048	30.4%	50.7%	44.4%	0.047
Mn(IV)	16.8%	41.1%	33.0%	0.084	21.6%	44.3%	36.2%	0.075	27.8%	63.3%	53.8%	0.111	31.6%	70.0%	56.3%	0.106
Mn^{2+}	9.8%	28.7%	23.4%	0.098	14.6%	32.8%	27.2%	0.100	28.8%	55.8%	46.8%	0.116	32.8%	56.6%	47.8%	0.113
Total Fe	8.7%	23.0%	17.9%	0.054	12.5%	24.6%	19.7%	0.046	17.6%	30.8%	26.1%	0.050	24.9%	45.1%	38.9%	0.074
Fe^{3+}	8.6%	24.1%	17.6%	0.065	13.6%	25.4%	19.8%	0.058	19.5%	30.4%	25.5%	0.043	25.9%	45.6%	39.3%	0.071
Fe^{2+}	7.9%	21.6%	17.4%	0.065	10.5%	22.9%	18.7%	0.058	15.0%	30.4%	26.0%	0.044	23.1%	44.4%	37.9%	0.079

* RHC: denotes to relative hydraulic conductivities, which are quotient of the real-time monitoring data (K_t) dividing by the initial hydraulic conductivity (K_0) of the medium.

Table S3. Correlation matrix of the target water quality parameters.

	Infiltration Distance	**Time**	**Turbidity**	**NH_4^+**	**Fe^{3+}**	**Fe^{2+}**	**Total Fe**	**Mn(IV)**	**Mn^{2+}**	**COD**	**Permeability**
Infiltration distance	1.000										
Time	0.082	1.000									
Turbidity	−0.850 **	−0.444 *	1.000								
NH_4^+	−0.547 *	−0.511 *	0.098	1.000							
Fe^{3+}	−0.806 **	−0.454 *	0.337 *	0.10	1.000						
Fe^{2+}	−0.806 **	−0.438 *	0.408 *	0.708	−0595 *	1.000					
Total Fe	−0.826 **	−0.428 *	0.460 *	0.702	0.994 **	0.987 **	1.000				
Mn(IV)	−0.699 *	−0.541 *	0.375 *	0.768	0.393 *	0.276 *	0.307 *	1.000			
Mn^{2+}	−0.686 *	−0.496 *	0.328 *	0.744	0.309 *	0.294 *	0.219 *	−0.673 *	1.000		
COD	−0.791 **	−0.516 *	0.553 *	0.799 **	0.882 **	−0.760 **	0.696 **	0.919 **	−0.789 **	1.000	
RHC ***	−0.812 **	−0.484 *	0.953 **	0.755 **	0.803 **	0.769 **	0.826 **	0.882 **	0.843 **	0.962 **	1.000

*: $p \leq 0.05$; **: $p \leq 0.01$; *** RHC: denotes to relative hydraulic conductivities, which are quotient of the real-time monitoring data (K_t) dividing by the initial hydraulic conductivity (K_0) of the medium.

Table S4. Principal component loadings of the target water quality parameters.

	PC1	**PC2**
Infiltration distance	−0.795	−0.590
Time	−0.596	−0.748
Turbidity	0.883	−0.004
NH_4^+	0.862	−0.219
Fe^{3+}	0.957	0.156
Fe^{2+}	0.95	0.177
Total Fe	0.961	0.171
Mn(IV)	0.955	−0.156
Mn^{2+}	0.952	−0.175
COD	0.072	0.972
Eigenvalue	8.014	1.061
% Total variance	80.145	10.610
Cumulative %	80.145	90.755

Table S5. Statistical summary of removal rate of the target water quality parameters during RBF simulation experiment.

Parameters	Time Period for Decreasing	Time for Reaching Steady State	Time Period for Increasing	Occurring Position for Parameters Concentration Variation	Interpretation for Concentration Variation	Clogging Type
Turbidity	0–96 h	96–120 h	120–168 h	0–10 cm	Physical clogging occurs in whole depth, and mainly in 0–12.5% of infiltration pathway	Physical clogging
NH_4^+	0–96 h	96–120 h	96–144 h	10–30 cm	Mainly occur in 12.5–37.5% of the infiltration pathway	Chemical clogging
COD	0–120 h	120–144 h	144–168 h	10–80 cm	Mainly occur in 12.5–37.5% of the infiltration pathway	Chemical clogging
Mn(IV) and Mn^{2+}	0–120 h	120–144 h	120–144 h, 192–216h	30–50 cm	Under the impacts of chemical clogging (redox processes) and dilution at 37.5–62.5% of infiltration pathway	Chemical clogging
Fe^{3+}, Fe^{2+}, and total Fe	0–120 h	120–144 h	120–144 h, 192–216h	50–80 cm	Under the impacts of chemical clogging (redox processes) and dilution at 62.5–100% of infiltration pathway	Chemical clogging

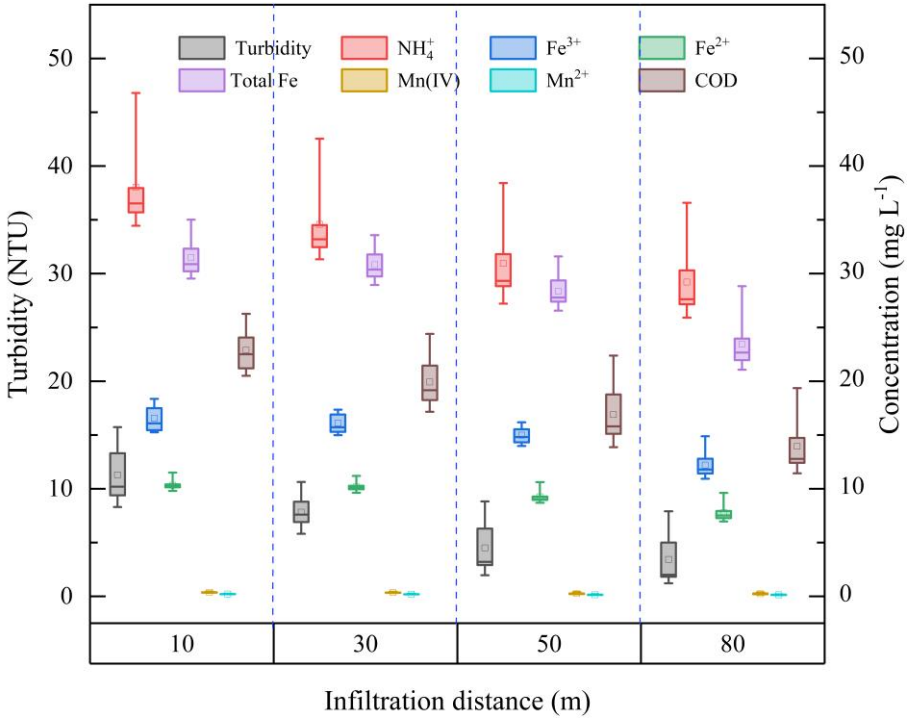

Figure S1. The box plot of concentration of target water quality parameters.