

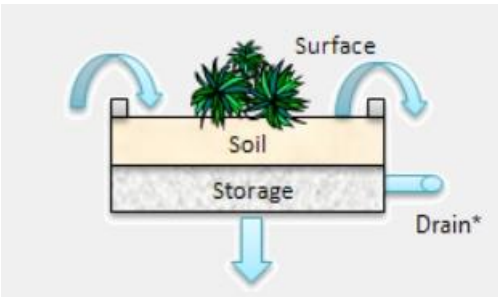
Supplementary material

Depollution of first flush urban runoff in a field-scale bioretention cell adapted to semi-arid climates

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1. SWMM parameters used in the modeling.

Bioretention cell 	Parameter	Value (SWMM) [units]
	Berm height	150 [mm]
	Vegetation volume fraction	0.2
	Surface roughness	0.4
	Surface slope (%)	1
	Soil thickness	500 [mm]
	Soil porosity (volume fraction)	0.39
	Field capacity (volume fraction)	0.24
	Wilting point (volume fraction)	0.15
	Conductivity	15 [mm/h]
	Conductivity slope	70
	Suction head	217.1 [mm]
	Storage thickness	300 [mm]
	Void ratio (voids/solids)	0.64
	Seepage rate	15 [mm/h]
	Clogging factor	0
	Drain flow coefficient	0
	Drain flow exponent	0.5
	Offset	6 [mm]

2. Analytical methods

Total suspended solids (TSS): TSS was determined gravimetrically according to the standard guideline 2540D by weighing the residues after membrane filtration of 50 mL–samples through a 0.45 μm –pore–size membrane and drying for 24 hours at 105 °C.

Chemical oxygen demand (COD): This parameter was determined according to the standard method 5220D. The filtered sample (2.5 mL) was added to 1.5 mL of the $\text{K}_2\text{Cr}_2\text{O}_7$ -digestion solution (prepared by mixing, on the one hand, 10.216 g $\text{K}_2\text{Cr}_2\text{O}_7$ in 500 mL of water and, in the other hand, 33.3 g of HgSO_4 in 167 mL of concentrated H_2SO_4 ; both solutions were mixed and diluted to 1 L with water) and to 3.5 mL of Ag_2SO_4 solution (10.142 g Ag_2SO_4 per L of concentrated H_2SO_4). Subsequently, the tubes were placed in a digestion block (COD Reactor, HACH) at 150°C for two hours. After digestion and cooling, the absorbance at 600 nm of the samples was measured and compared against a calibration curve prepared with potassium biphthalate solutions containing 100 to 600 mg COD/L.

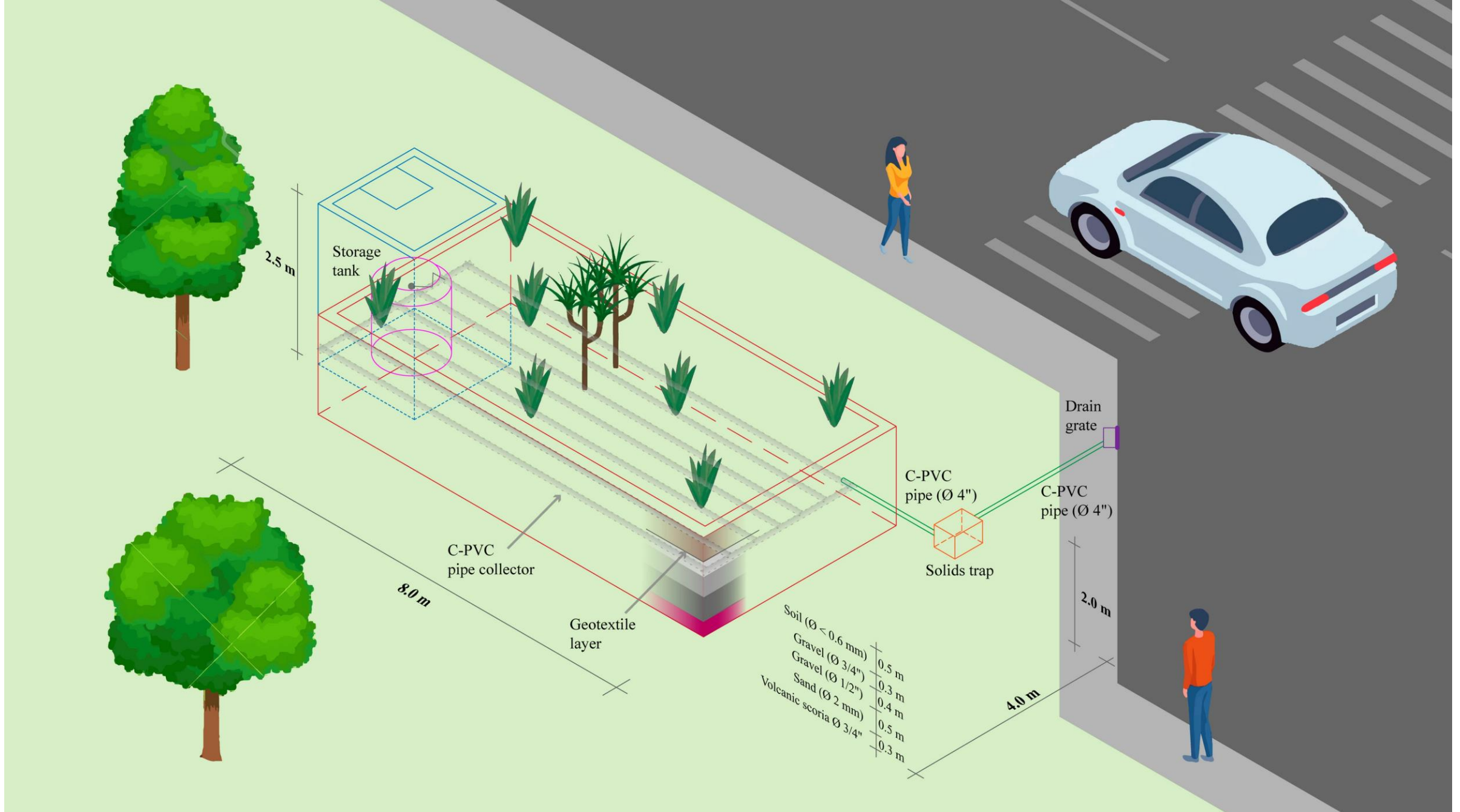
Ammonia nitrogen (N-NH_4^+): Ammonia nitrogen was measured through the standard phenate method (4500- NH_3 D). To 10 mL of the filtered sample, 50 μL of 0.003M MnSO_4 , 0.5 mL of 1% NaOCl , and 0.6 mL of phenate reagent (2.5 g NaOH and 10 g phenol in 100 mL distilled water) were added. The mixture was allowed to stand for 10 minutes before reading the absorbance at 600 nm. The N-NH_4^+ concentration was calculated from a calibration curve of 0 - 3 mg N-NH_4^+ /L prepared from a stock solution of NH_4Cl .

Nitrate nitrogen (N-NO_3^-): The method of Mubarak et al. (1977) was followed. A 10 mL aliquot of the filtered sample was evaporated to dryness. The residue was mixed with 2 mL phenyldisulphonic acid (25 g phenol in 150 mL concentrated H_2SO_4). This mixture was diluted with 20 mL of distilled water and then 7 mL of KOH 12N was added with stirring until maximum yellow color was developed. The solution was diluted to 50 mL with distilled water and the absorbance was read at 410 nm. The calibration curve (with concentrations from 0 to 2 mg/L N-NO_3^-) was made from a stock solution prepared with KNO_3 .

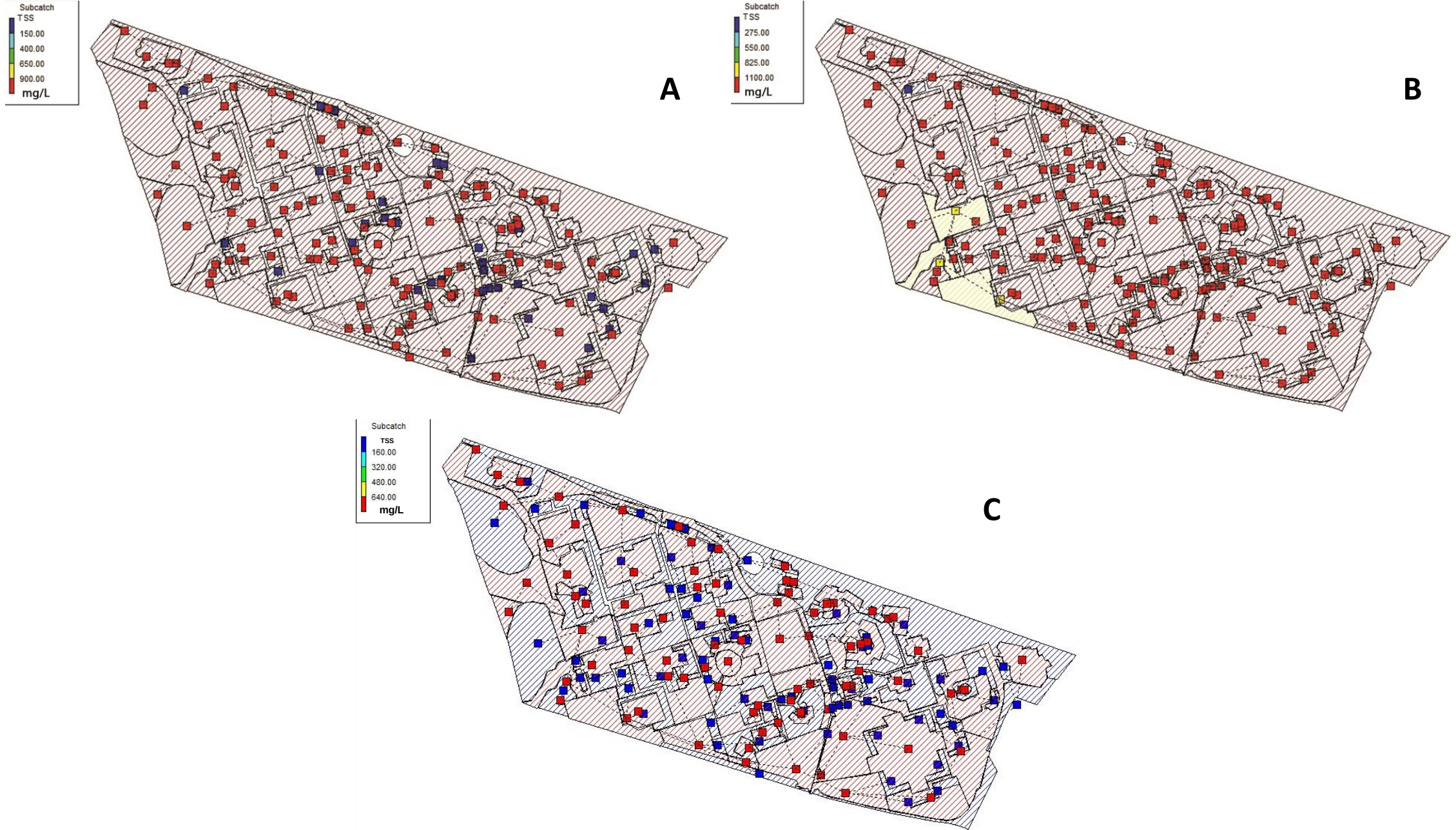
Total phosphates (PO_4^{3-} tot): Total phosphates were measured according to the standard method 4500-PF. 2.5 mL of potassium and antimony tartrate solution (1.877 g/L), 2.5 mL of ammonium molybdate solution (40 g/L), and 0.5 mL of ascorbic acid 0.1M were added to 25 mL of unfiltered and digested sample. The solution was allowed to stand for 10 to 30 minutes and the absorbance at 690 nm was measured. The data were compared against a calibration curve of 0.25 – 5 mg PO_4^{3-} /L prepared from KH_2PO_4 .

Total Mn and Pb: Samples were previously digested using a microwave oven (Mars X, U.S.A.). Metals were analyzed by atomic absorption spectrometry (AAS) in a Varian 800 spectrometer (Perkin Elmer, USA).

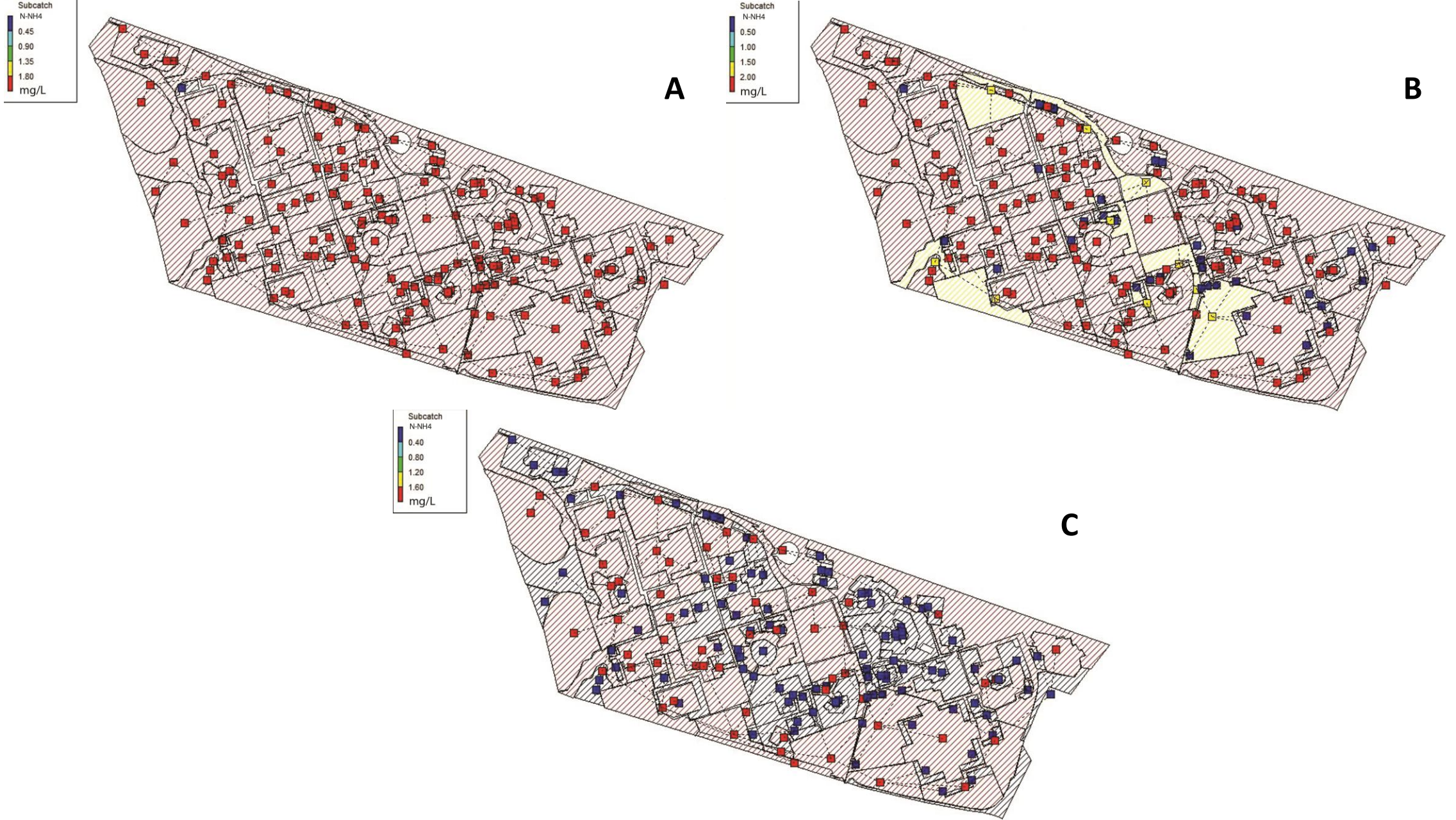
Mubarak A., Howald R.A., Woodriff R. (1977) Elimination of chloride interferences with mercuric ions in the determination of nitrates by the phenoldisulfonic acid method. *Anal. Chem.*, 49(6), 857-860. doi: <https://doi.org/10.1021/ac50014a047>.



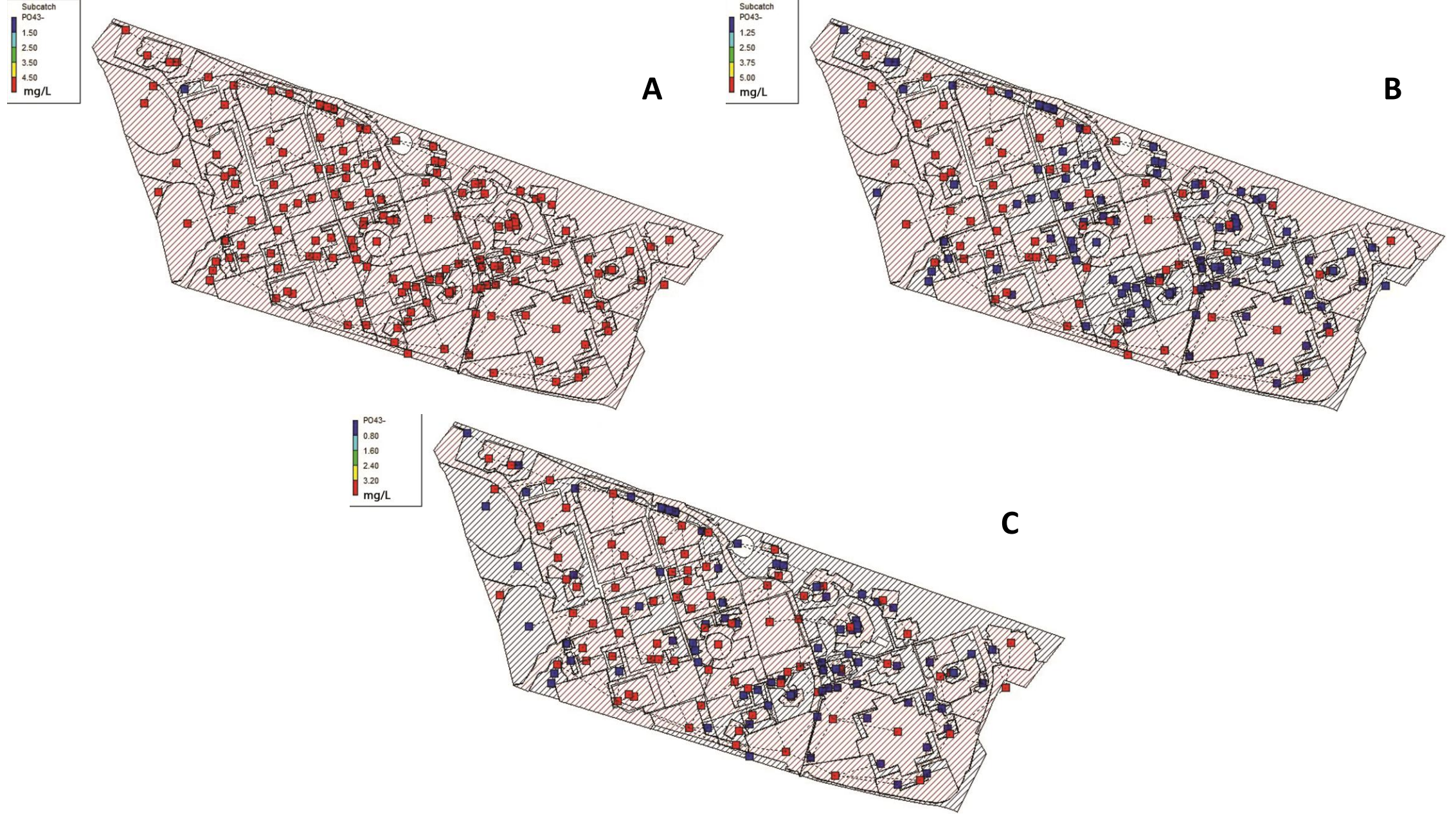
Supplementary Figure S1. Representation of the bioretention cell and its dimensions.



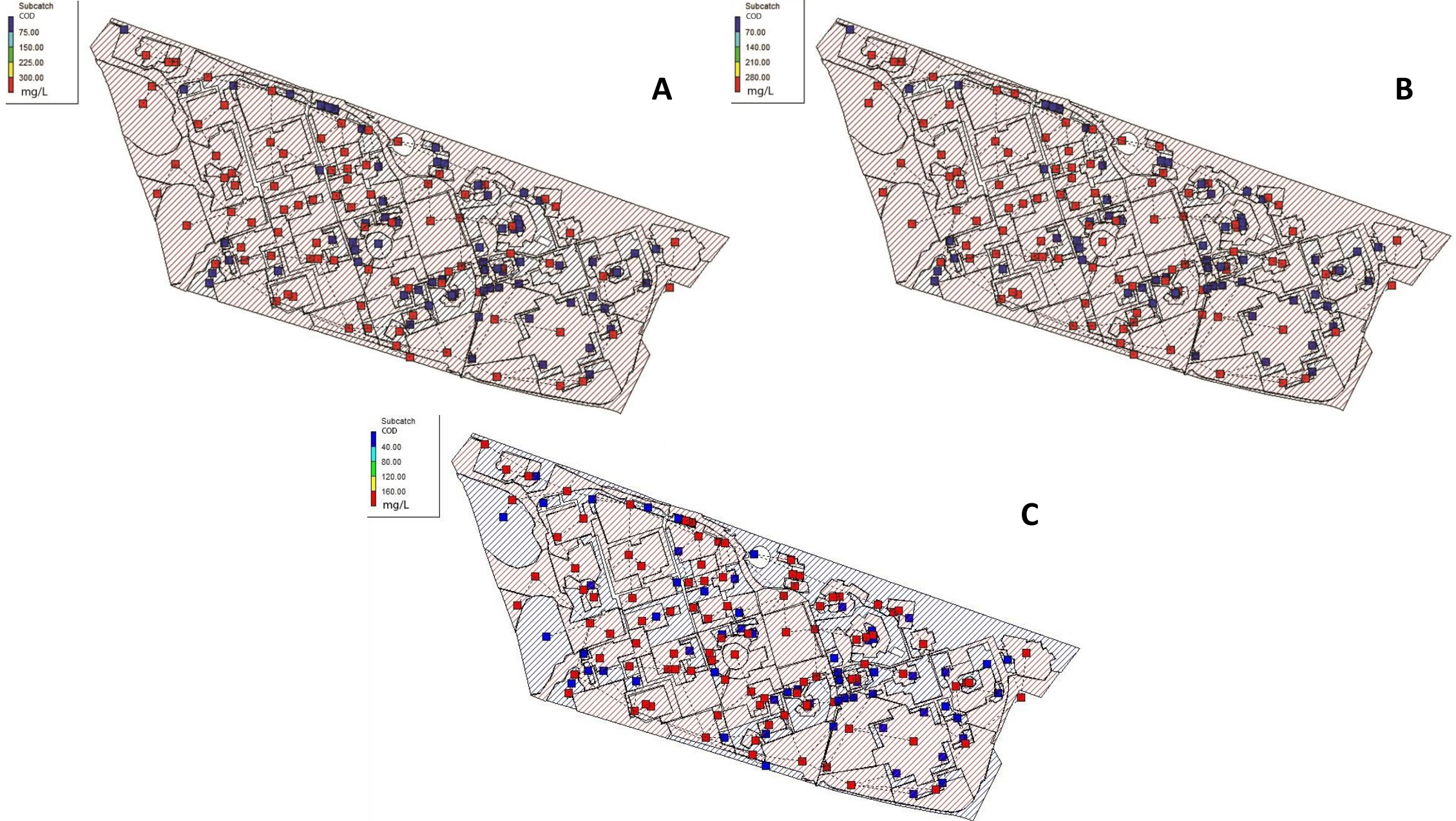
Supplementary Figure S2. Concentrations of total suspended solids in the runoff generated in the study zone after one hour of the following storm events: A) 51 mm; B) 30 mm; C) 9 mm.



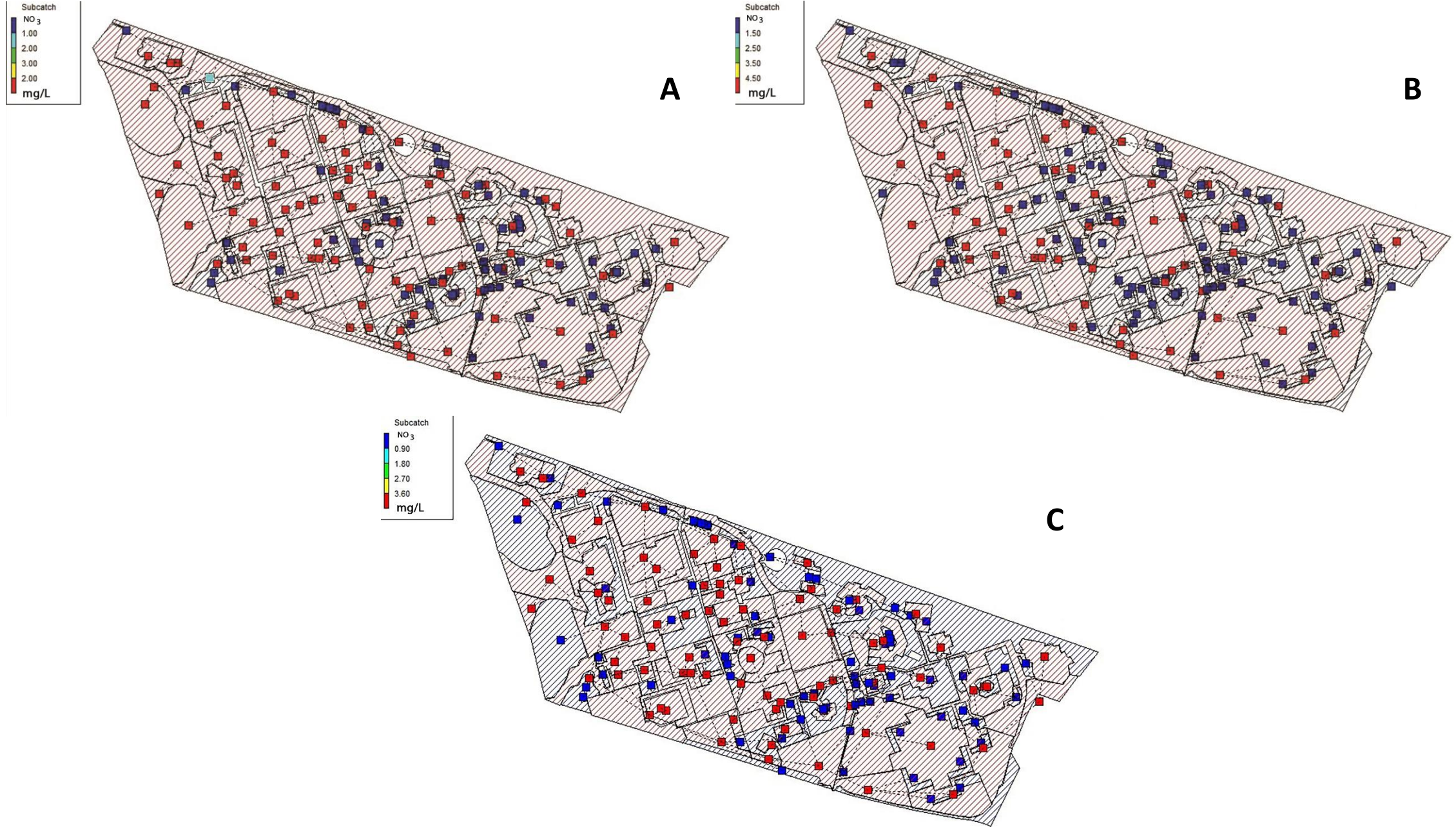
Supplementary Figure S3. Concentrations of N-NH₄⁺ in the runoff generated in the study zone after one hour of the following storm events: A) 51 mm; B) 30 mm; C) 9 mm.



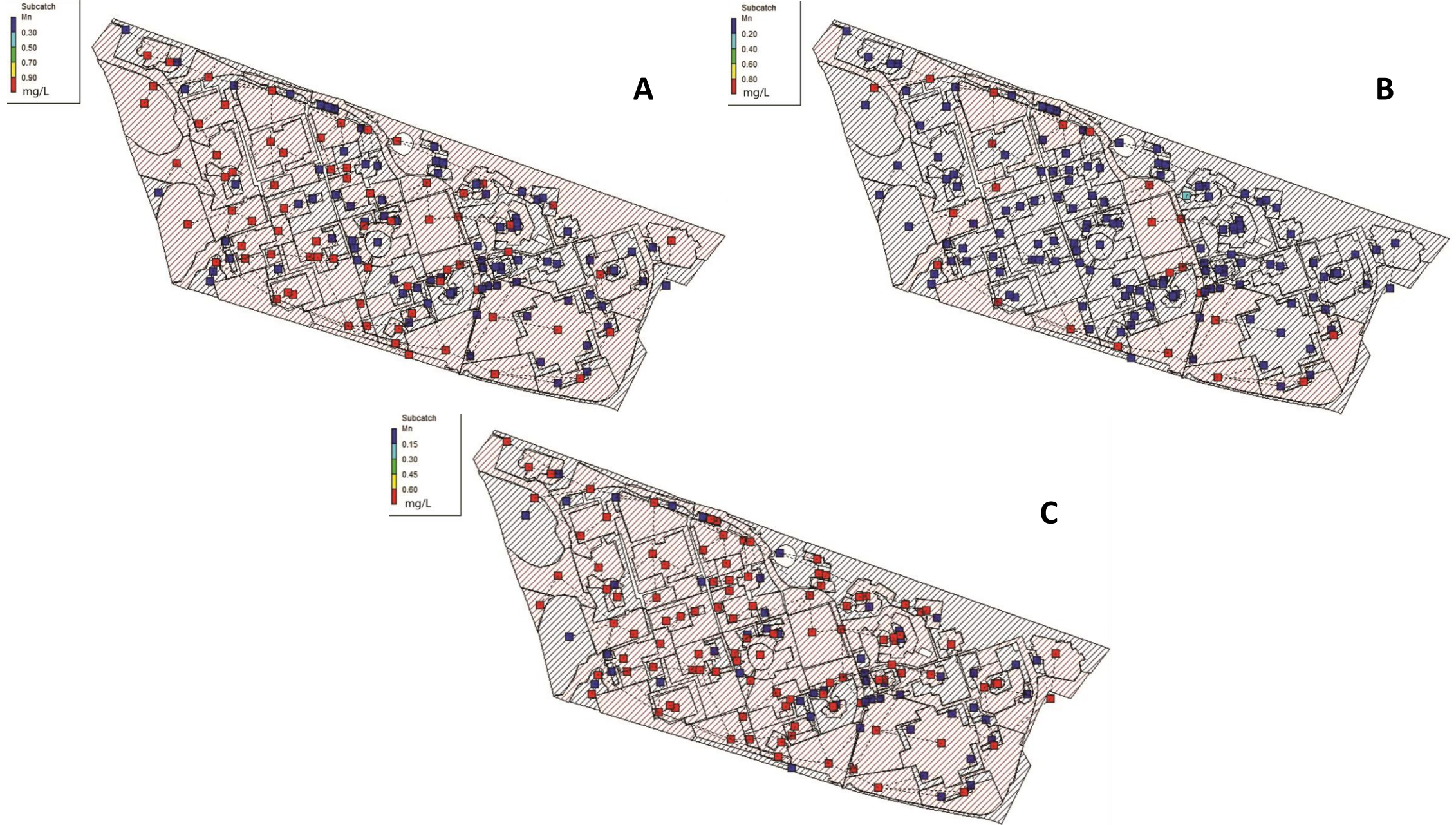
Supplementary Figure S4. Concentrations of PO_4^{3-} tot in the runoff generated in the study zone after one hour of the following storm events: A) 51 mm; B) 30 mm; C) 9 mm.



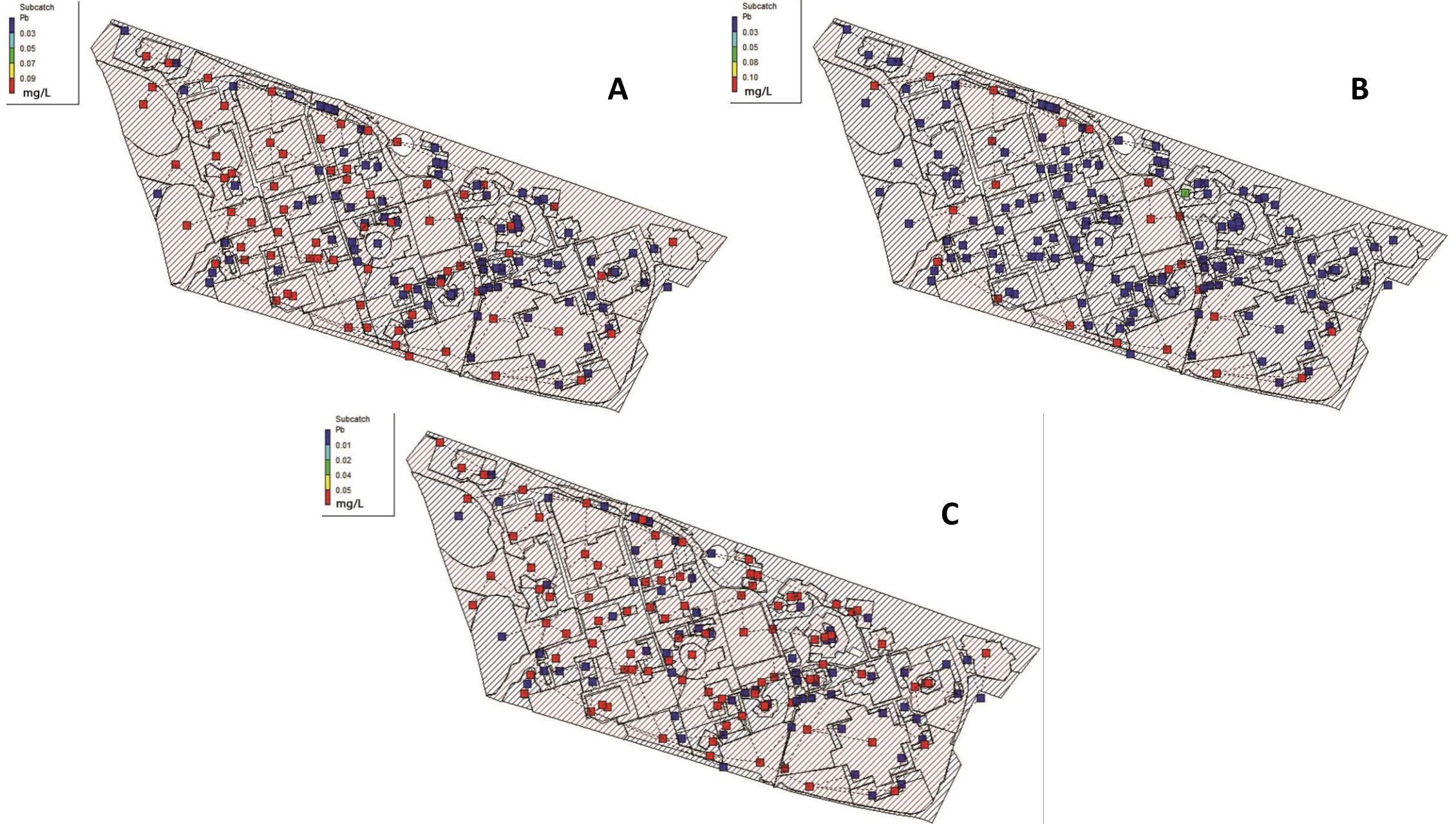
Supplementary Figure S5. Concentrations of chemical oxygen demand in the runoff generated in the study zone after one hour of the following storm events: A) 51 mm; B) 30 mm; C) 9 mm.



Supplementary Figure S6. Concentrations of N-NO₃⁻ in the runoff generated in the study zone after one hour of the following storm events: A) 51 mm; B) 30 mm; C) 9 mm.



Supplementary Figure S7. Concentrations of Mn tot in the runoff generated in the study zone after one hour of the following storm events: A) 51 mm; B) 30 mm; C) 9 mm.



Supplementary Figure S8. Concentrations of Pb tot in the runoff generated in the study zone after one hour of the following storm events: A) 51 mm; B) 30 mm; C) 9 mm.