Supplemental Material

A small-volume multiplexed pumping system for automated high resolution water chemistry measurements in volume-limited applications

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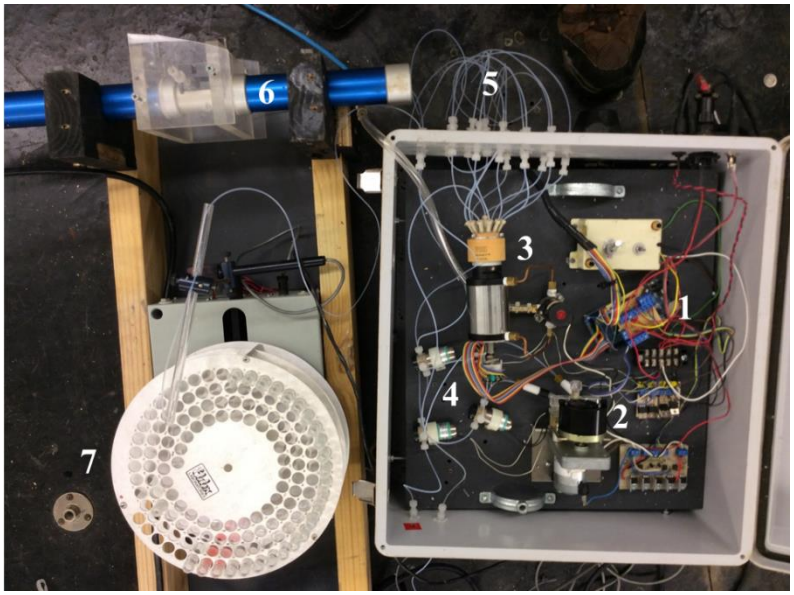
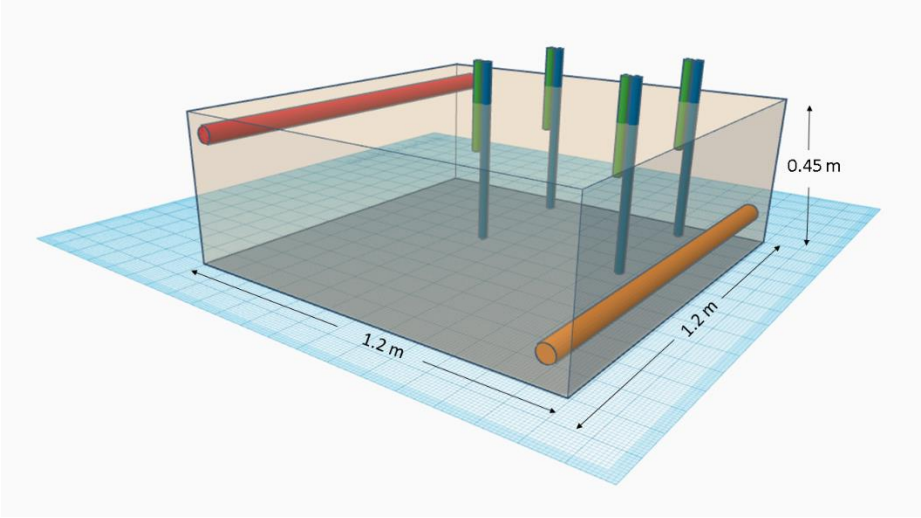
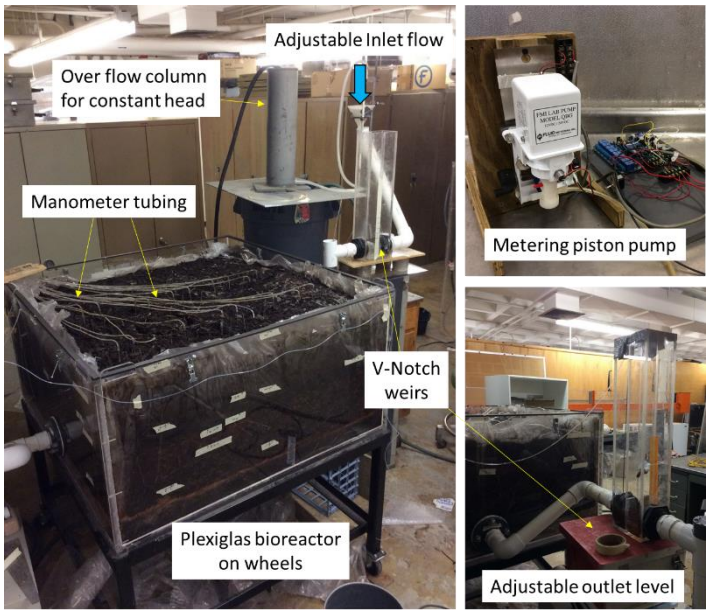


Supplemental Figure 1 – Photo of the small volume multiplexer with 1) Arduino control board, 2) bidirectional peristaltic pump, 3) 12 port air-actuated valve, 4) 3 way valve manifold, 5) 0.9 mm ID PFTE tubing, 6) s::can spectrophotometer with housing for 1.1 mL, 4 mm path length cuvette, and 7) fractional volume collector (optional).



Supplemental Figure 2 – Diagram of lab bioreactor at NCSU facility. Eight sampling wells were located in four well pairs placed at 20.9 and 41.9 cm depth, at 55.9 and 100.2 cm from the inlet, and in transects along the centerline of flow and 21.6 cm from left sidewall. Shallow and deep wells are shown in green and blue, respectively. Flow was diagonal downflow from the inlet header (red) to the outlet header (orange).



Supplemental Figure 3 – Photo of the lab bioreactor at the NCSU facility using V-notch weirs to measure flow, overflow constant head column for uniform flow, the metering piston pump for KNO_3 additions, and an adjustable outlet weir to stop flow or drain bioreactor.

Supplemental Figure 4 – Photo of the small volume MPS being deployed in the Sand section of Goldsboro stream. Four open-bottom Sediment mesocosms were inserted into the stream bottom and a fifth closed-bottom Control mesocosm was used as a baseline for nitrate fluxes occurring in the water column. The small volume MPS sampled each mesocosm every 6 min for a 36 min data interval on each mesocosm.

Supplemental Figure 5 – Photo of the small volume MPS being deployed in the Muck section of Goldsboro stream. Recirculating pumps were installed on the mesocosm sidewall to mimic advective flow of the stream.

Supplemental Figure 6 – Photo of the small volume MPS being deployed in the Muck section of Goldsboro stream. Emergent vegetation along the banks during March trials resulted in large variability in nitrate decreases over the 24 h experiment.