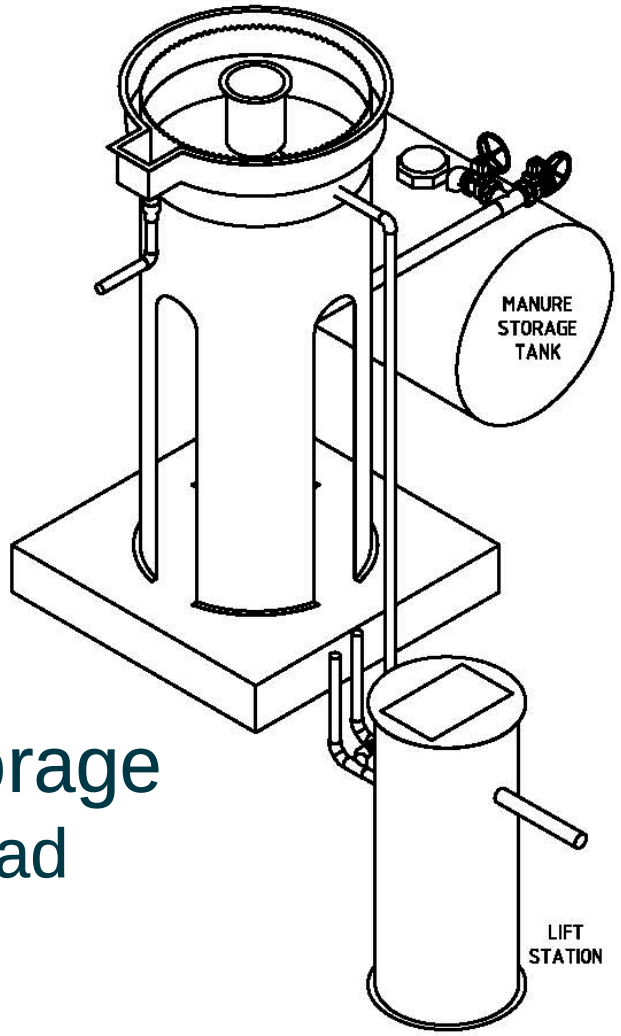
Gravity Thickening Settler

- Designed for solids collection, thickening and storage
- Intermittently loaded
  - microscreen filter backwash
  - 150 L/min (40 gpm)
- 2.7 m (8 ft) dia
  - 0.8 gpm/ft^2 surface loading rate
- Provides short-term biosolids storage
  - 11 m^3/wk (3000 gal/wk) at max load



Gravity Thickening Settler

Previous Research Suggests

- Solids capture efficiency
  - 30% TSS removal (3 data points)
  - 92% TSS removal (Sharrer et al., 2010)
- Thickened sludge concentration
  - 2% dry weight (3 data points)
  - 9% dry weight (Sharrer et al., 2010)
- No polymer

Woodchip Bioreactor Conceptual Design

- Design hydraulic retention time 24 hr
- Design flow rate 150 lpm (40 gpm)
- Woodchip bioreactor length 38 m
- Woodchip bioreactor width 7.5 m
- Woodchip bioreactor depth 1.2 m
- Woodchip bioreactor volume 342 m^3
- Length to Width ratio 5.1 : 1

Woodchip Bioreactor Conceptual Design

- Bioreactor to locate adjacent to RAS facility
- 1st conduct **pilot-scale research** to validate HRT assumption

THE CONSERVATION FUND

Woodchip Denitrification Bioreactors for Treatment of RAS Effluent

Laura Christianson and Steve Summerfelt
The Conservation Fund – Freshwater Institute

Aquaculture Innovation Workshop #6: "Assessing the Technical, Biological and Economic Feasibility of Closed Containment Aquaculture"
Vancouver, Canada
27-28 October2014

There is a new opportunity to try these for RAS effluent

- **Key design** and **operational issues** need to be resolved for woodchip bioreactor treatment of aquaculture effluent
  - **Hydraulic retention time**
  - **Clogging**

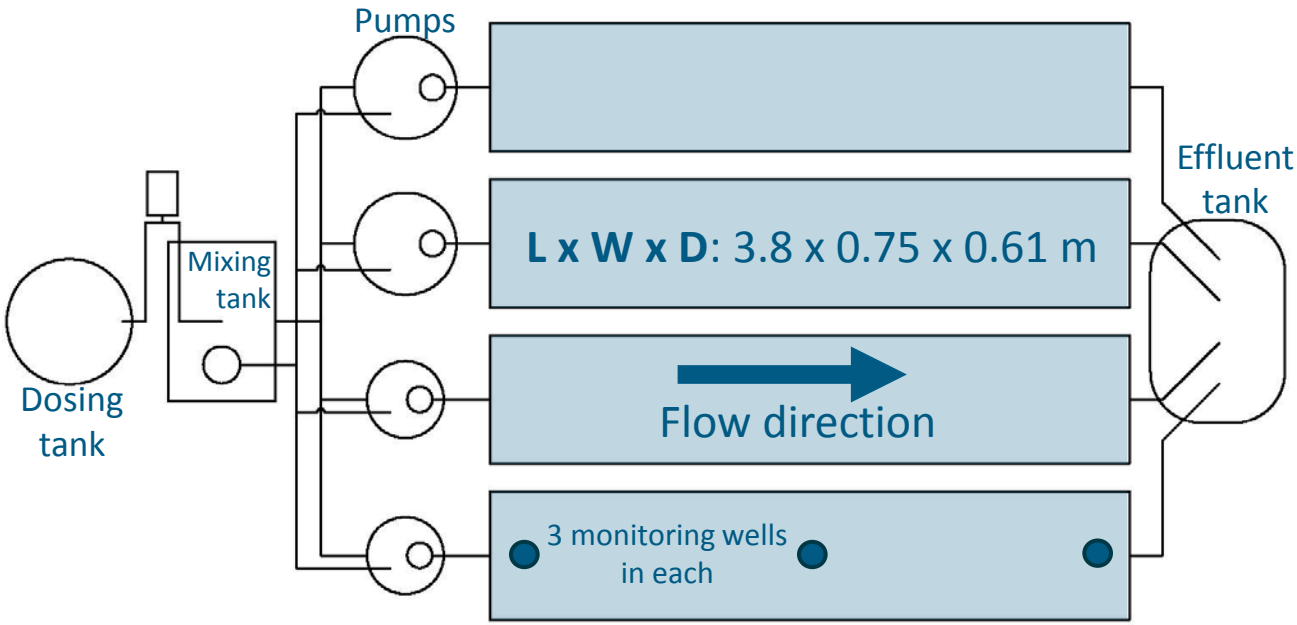
Woodchip bioreactors work well for nitrate-laden waters

Agricultural drainage water treatment

Images: Iowa Soybean Association; http://biogeochemistry.nres.illinois.edu/Embarras/bioreactor.html

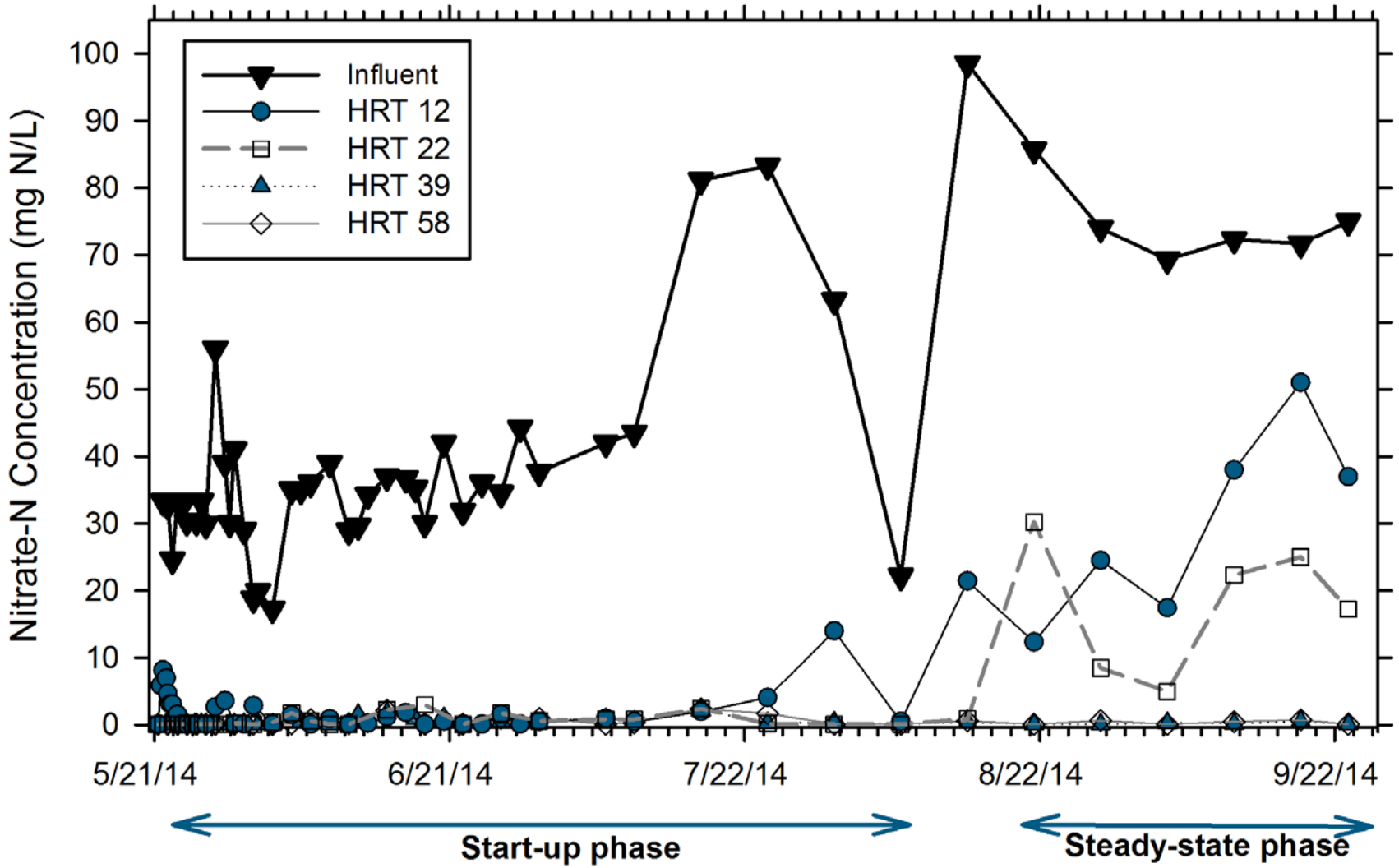
Case Study: Pilot-scale woodchip bioreactors

- **1:10 scale** based on surface
- Receive settling cone supernatant plus a concentrated nitrate solution
- Treatments: **12, 24, 36, and 48 hr** hydraulic retention time

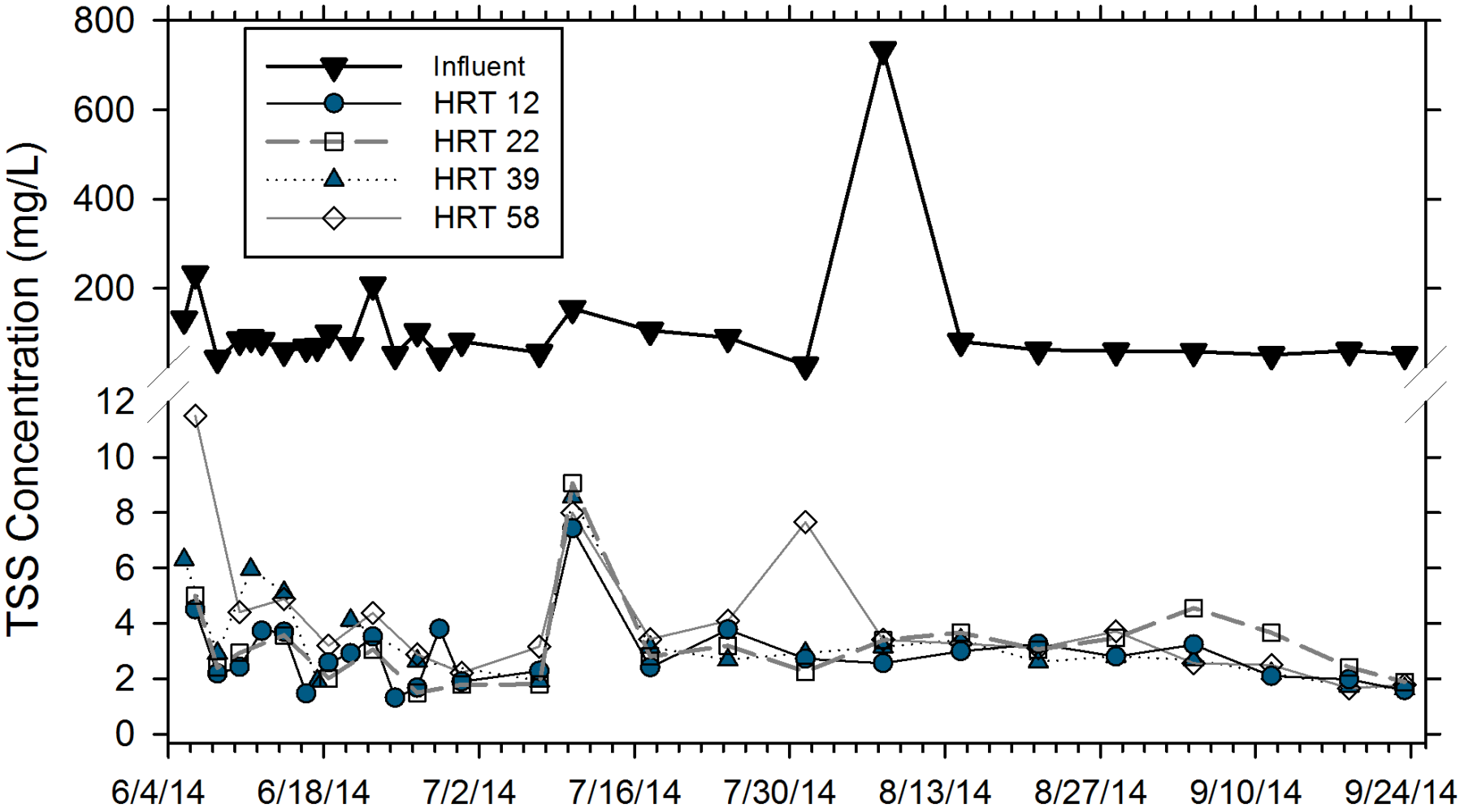


Drawing Courtesy: Kata Sharrer, TCFFI

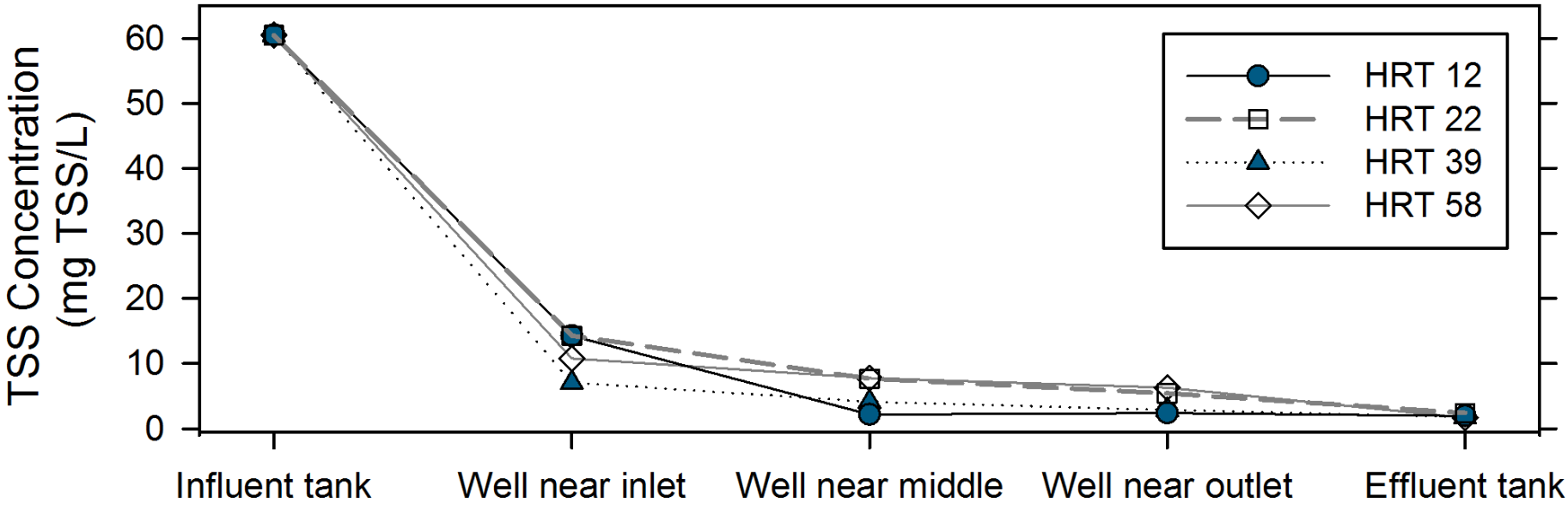
Optimizing Hydraulic Retention Time: NO_3^- Removal



Clogging Potential: TSS Removal

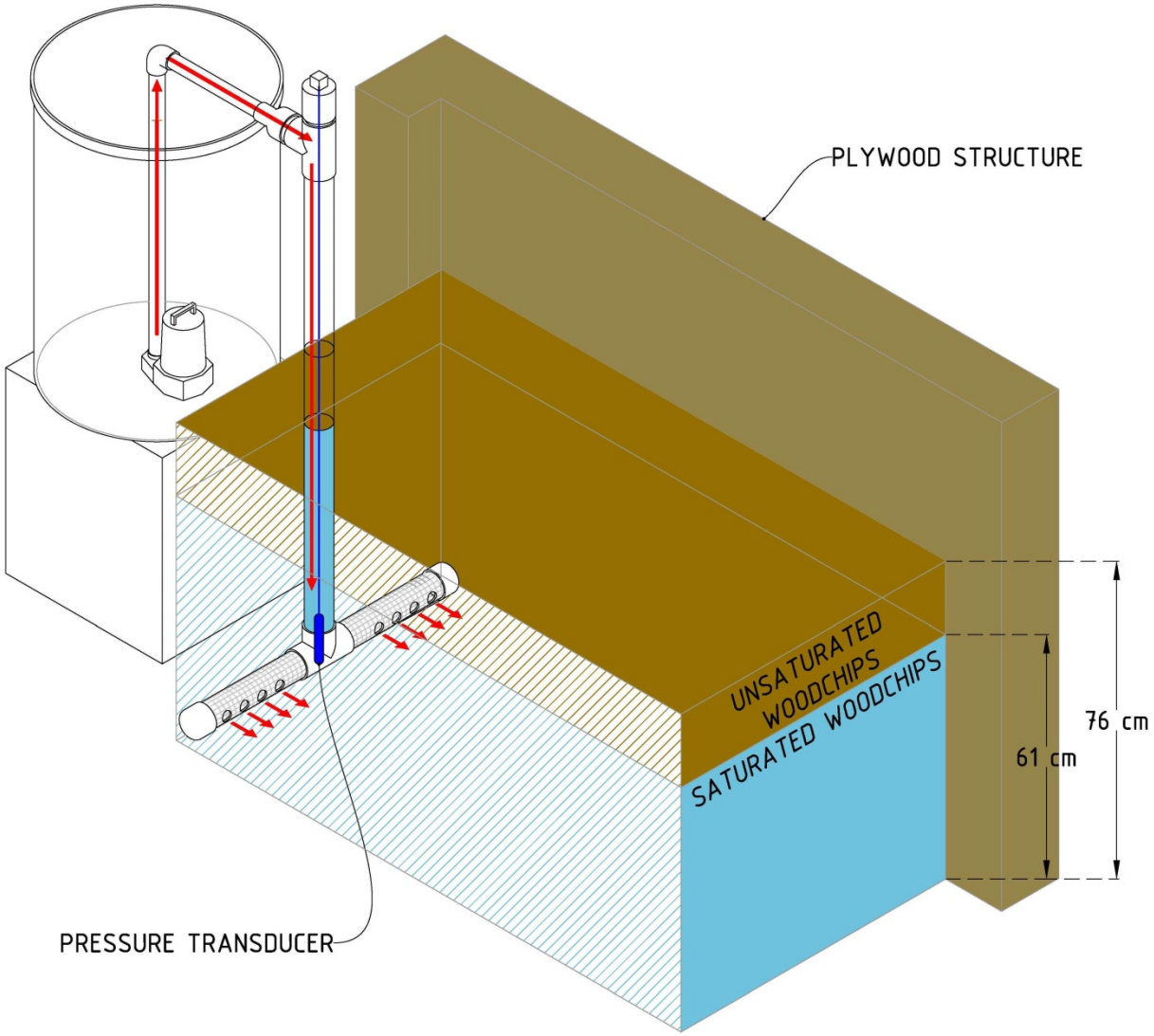


Clogging Potential: TSS Removal

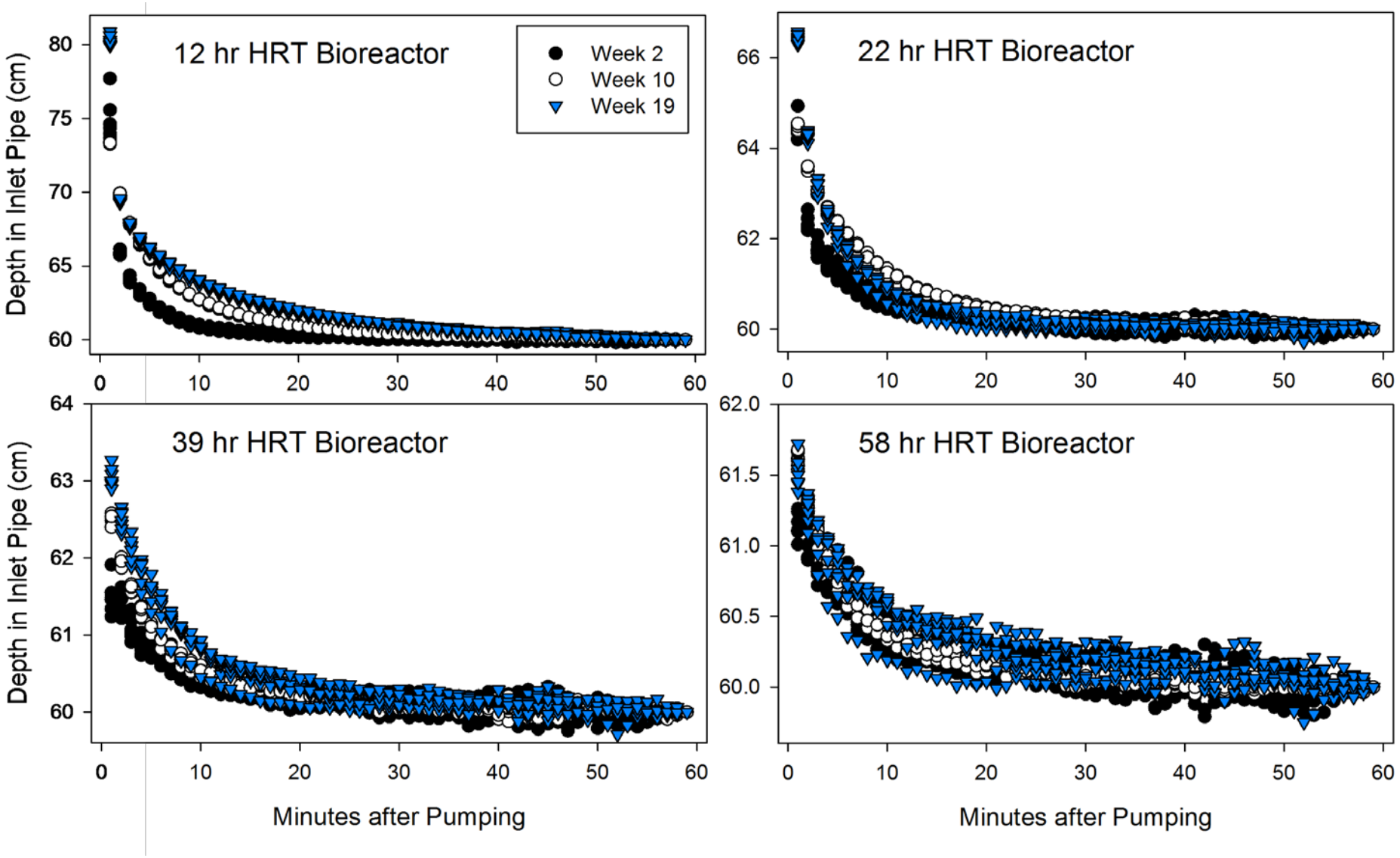


Clogging Potential: Changes in Hydraulics

- Pressure transducers in the inlet manifolds
- Continuously log length of time required for water to flow into chips
- Bioreactors dosed once hourly



Clogging Potential: Changes in Hydraulics



Conclusion: Viable RAS technology, needs refining

- **24 hr HRT** is appropriate in this application
- Pulsed pump flow from the supernatant lift station must be applied in smaller, more frequent pulses.
- Clogging near the inlet is possible, but impacts on design life cannot be made based on this short-term study

- Acknowledgements
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