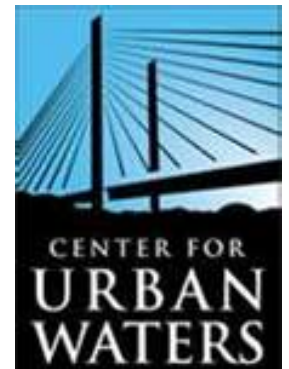


Can Denitrification Occur in Salinity Influenced Groundwater ?

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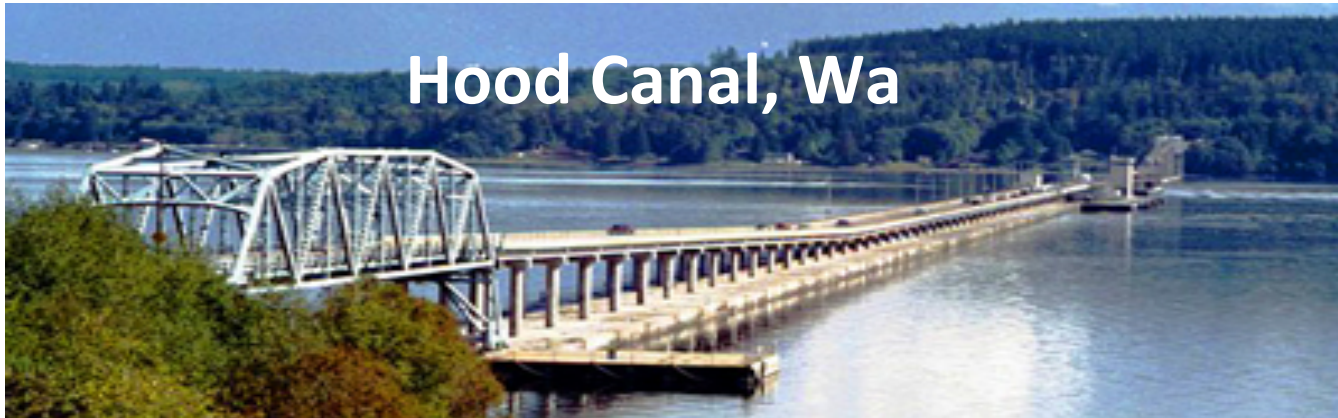


Presentation Outline

- Problem: Nutrient contamination and Eutrophication
- Denitrification walls as a solution
- Project design and methodology
- Results
- Conclusions
- Questions

Nutrient Contamination

- Nitrogen and phosphorus from storm and waste water
 - Point Source, waste water treatment plants
 - Non-Point Source, fertilizer run off
- leach into ground water and surface waters
- harmful effects where contamination is concentrated



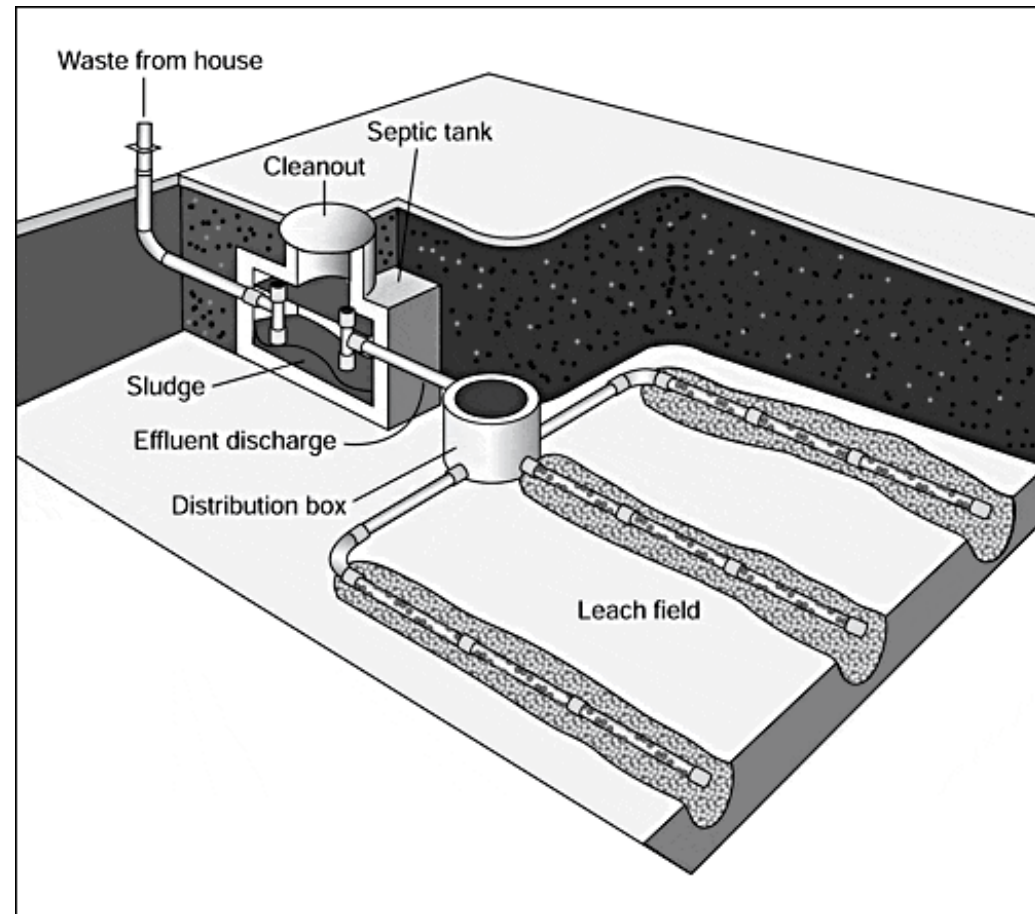
Eutrophication

- Caused by excess nutrients in surface waters.
 - >0.2 mg/L nitrogen in marine waters
- “Bloom” of primary producers
- Reduction in dissolved oxygen
 - Decrease biodiversity
 - Community composition
 - Toxic affect

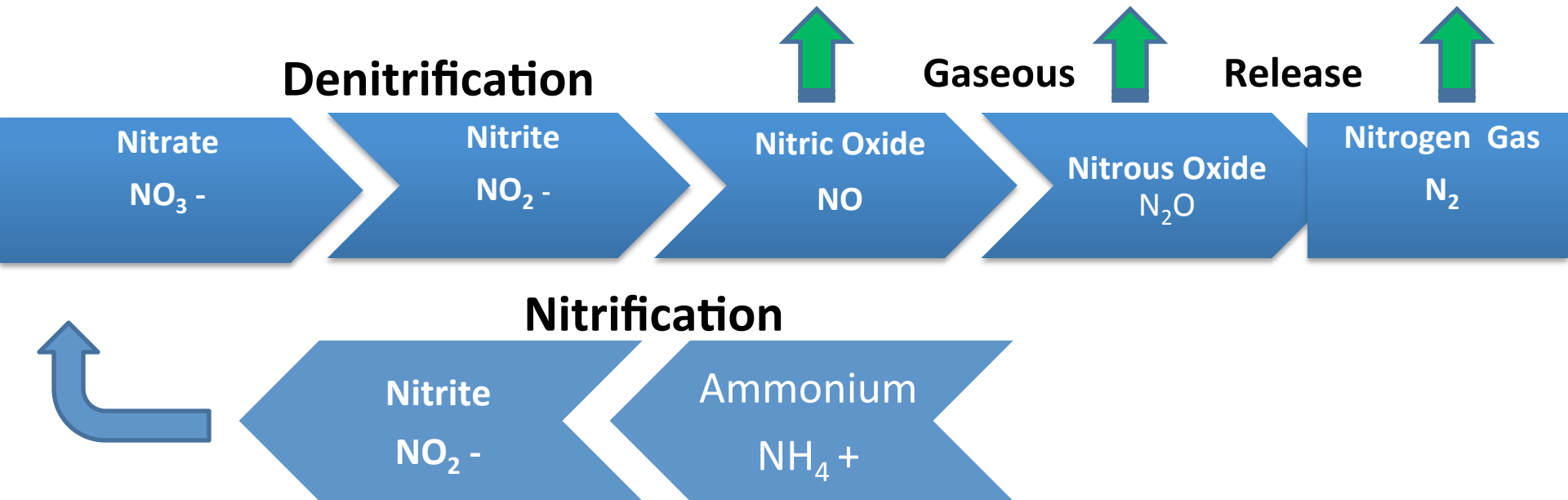


Nutrient Contamination from Septic Systems

- Tank - anoxic environment for anaerobic bacteria
- Septic effluent defused through the leach field
- Does little to remove nutrients



Denitrification as a solution

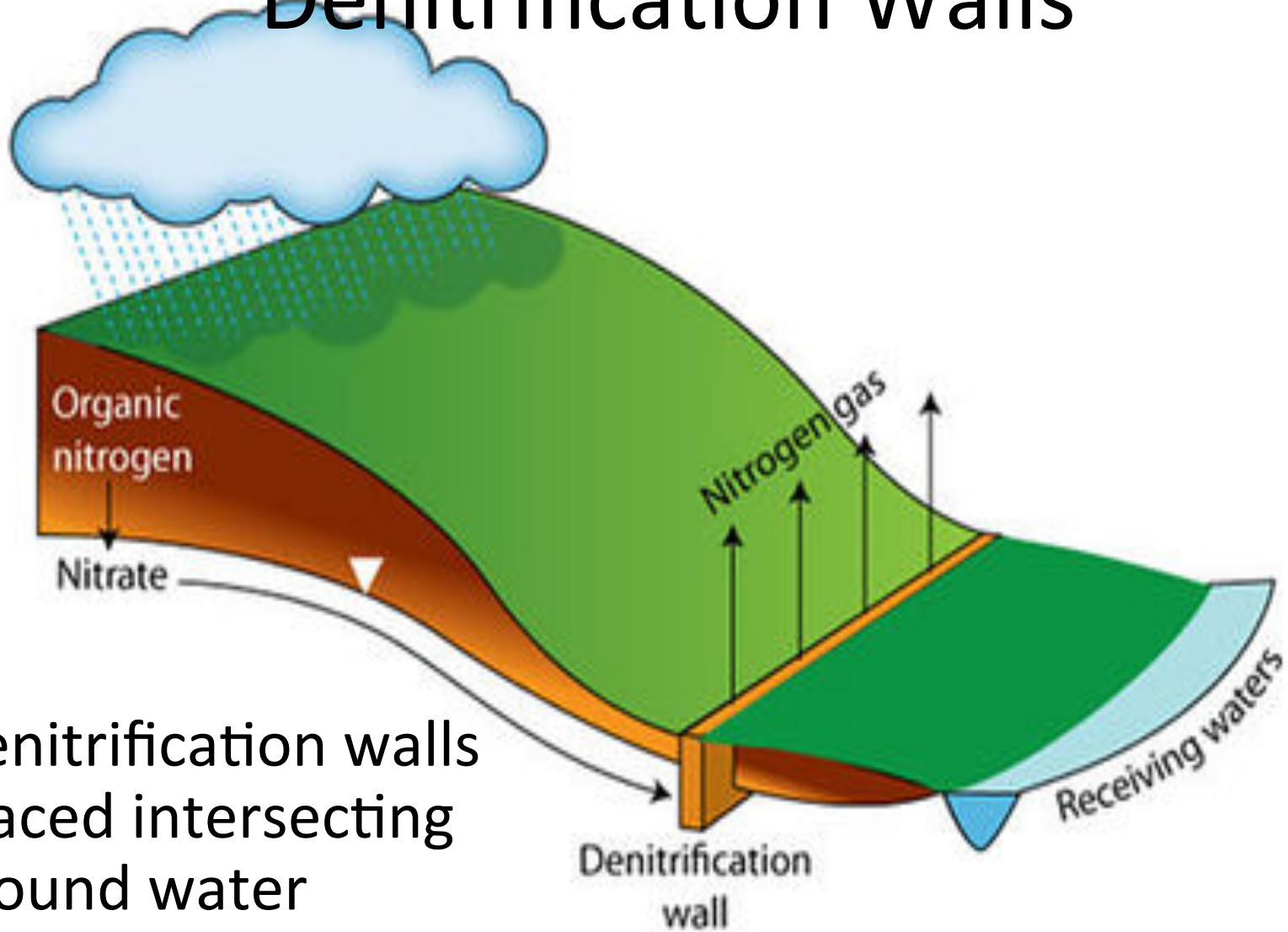


- Nitrate reduction facilitated by bacteria
- Reduced through process of respiration
- Requires specific environmental conditions

Environmental Conditions for Denitrification

- Anoxic environment
- pH of 5.5 - 8.0
- Temperature 2 – 50 °C
- Salinity < 20 ppt
- Source of organic carbon (major limiting factor)

Denitrification Walls

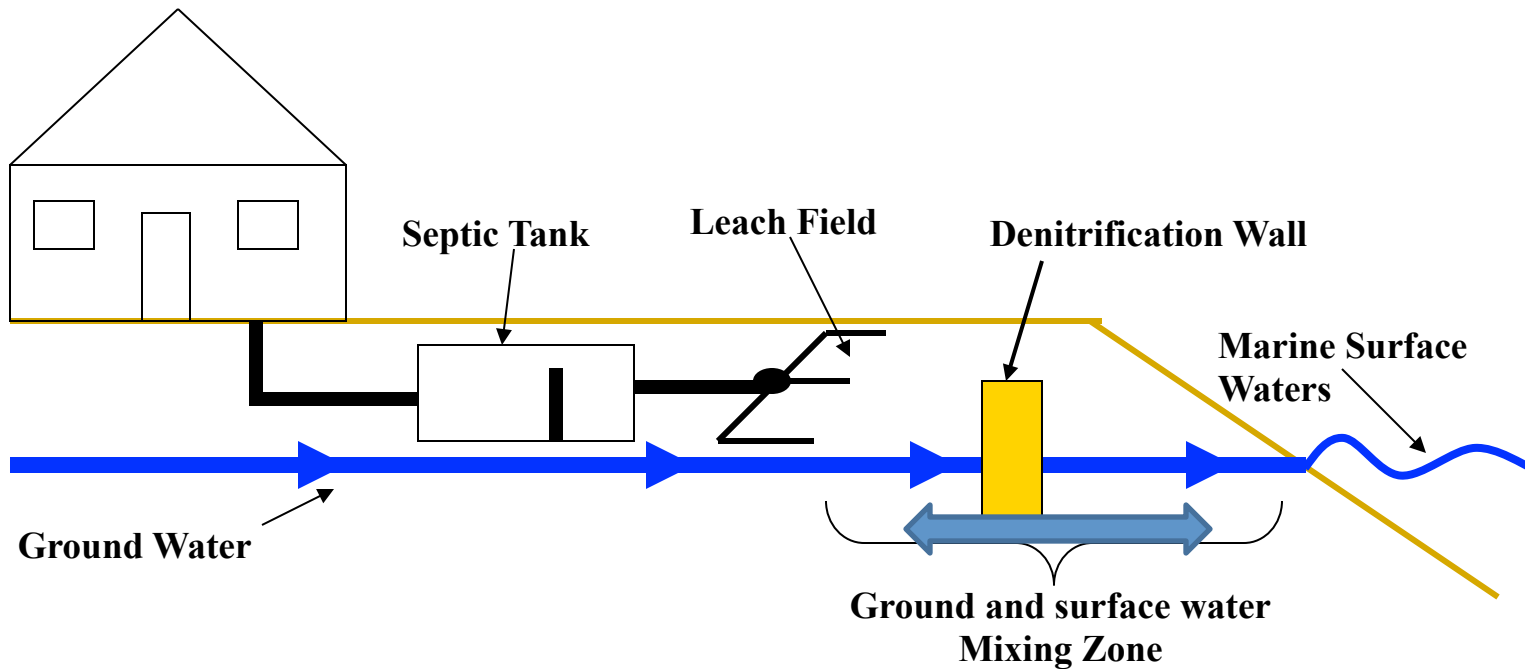


- Denitrification walls placed intersecting ground water
- Reduces ground water nitrate levels



Marine Surface Waters

**Leach
Field**



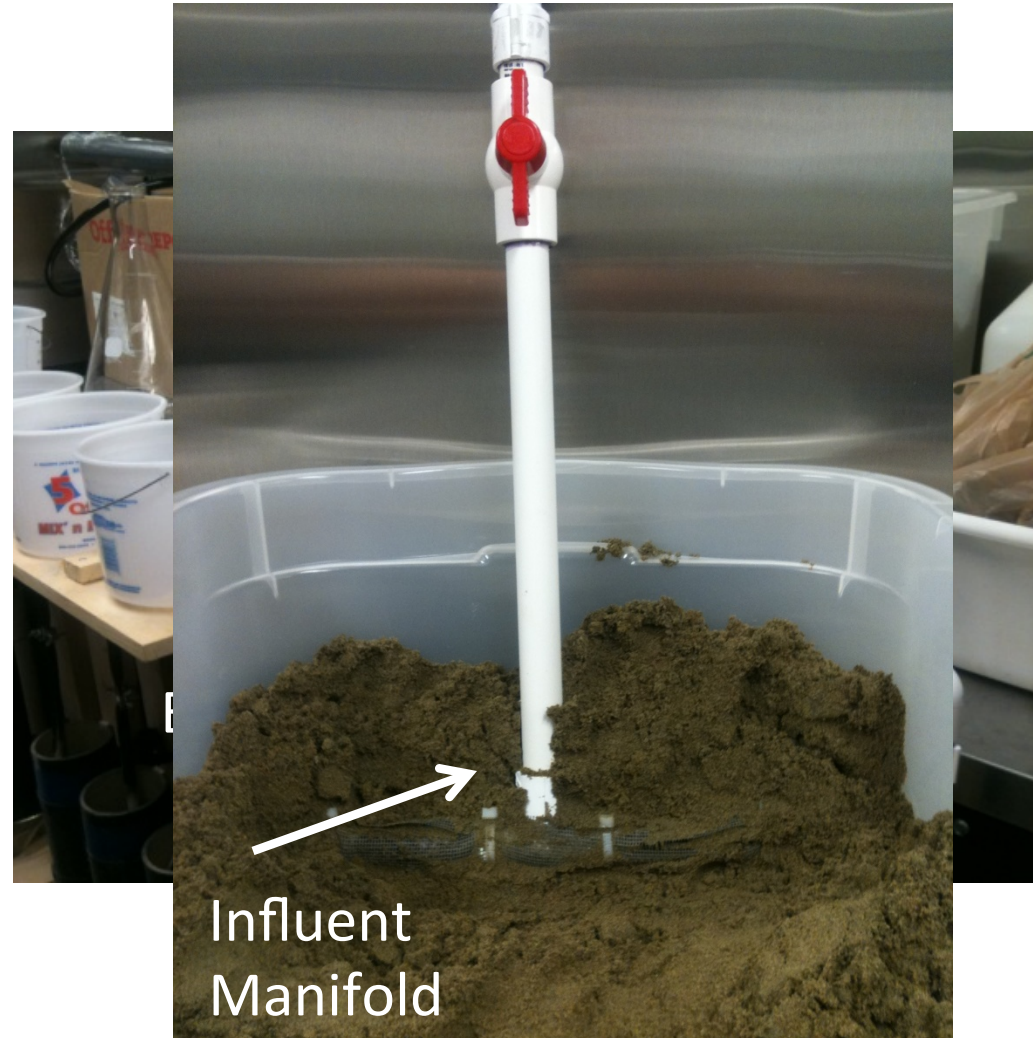
- Effluent water from leach field mixes with ground and salt water
- Water passes through denitrification wall and is treated before reaching surface waters
- Salinity influence may inhibit denitrification

Project design

- **Goal: Determine if denitrification can reduce nitrate concentration in salinity influenced ground water**
- Influent comprised of waste and salt water mix
- Influent water passes through control or denitrification wall cells
- Influent & effluent water tested for nitrate & ammonia concentrations

Methodology

- Control & Denitrification Wall Cells built from plastic tubs, PVC tubing and connections
- Effluent tubing creates 3" saturated layer
 - Simulates ground water
 - Provides anoxic environment
- filled with sand to 7" then capped with plastic
- Influent manifold placed above saturated layer



Denitrification Wall

- Sawdust(carbon source) was mixed with sand (1:1) to create fill for denitrification wall
- 4" wide trench was dug into the denitrification cell
- filled with 6 L mix to create
- Wall was located close to influent manifold

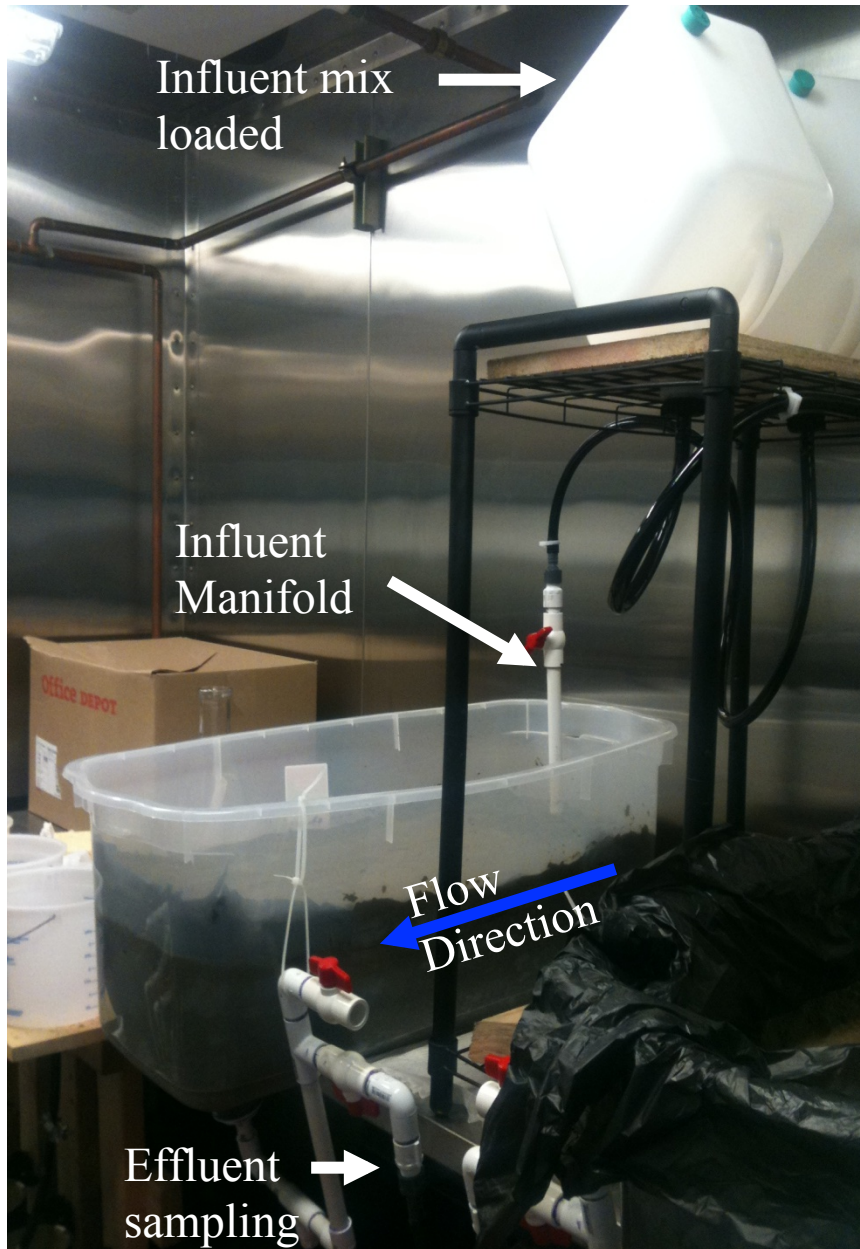


Influent Mix

- Cells first primed with 100% thea foss salt water to acclimatize bacteria
- Influent water comprised of 1:1 ratio of salt water (Thea Foss) to secondary effluent waste water (Tacoma WWTP)



Sampling



- Sampling took place Mon.- Fri. for four consecutive weeks
- 1 liter of influent mix/ cell/day
 - Flow limited to avoid pooling
- Effluent captured for analysis

Sample Analysis



pH/Conductivity Probe



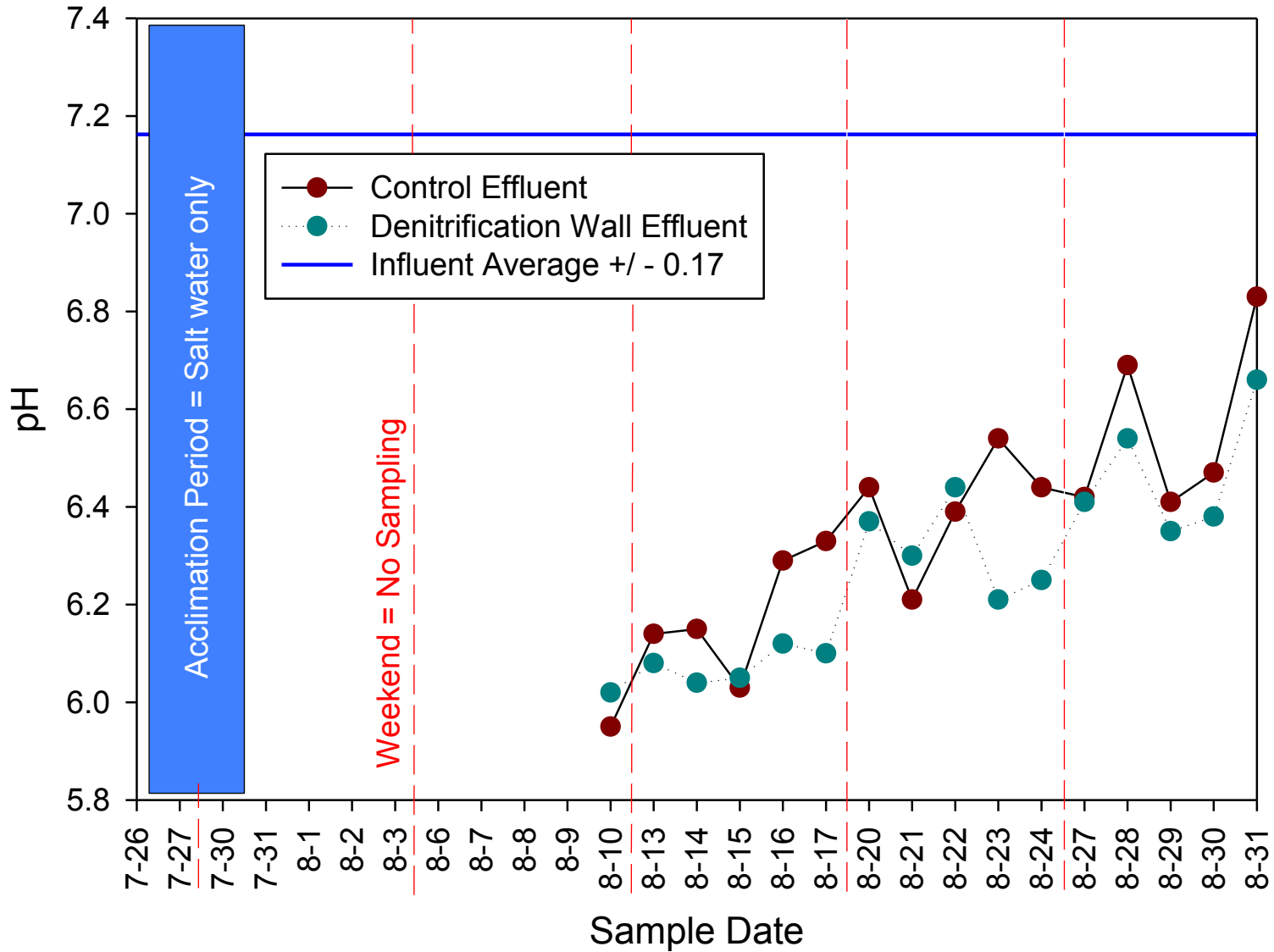
Discrete Analyzer

- pH and Salinity were measured by a pH/conductivity probe
- Samples filtered through .45 micron filter
- Influent & Effluent samples analyzed for nitrate and ammonia concentrations by spectrophotometry on UWT's Discrete Analyzer

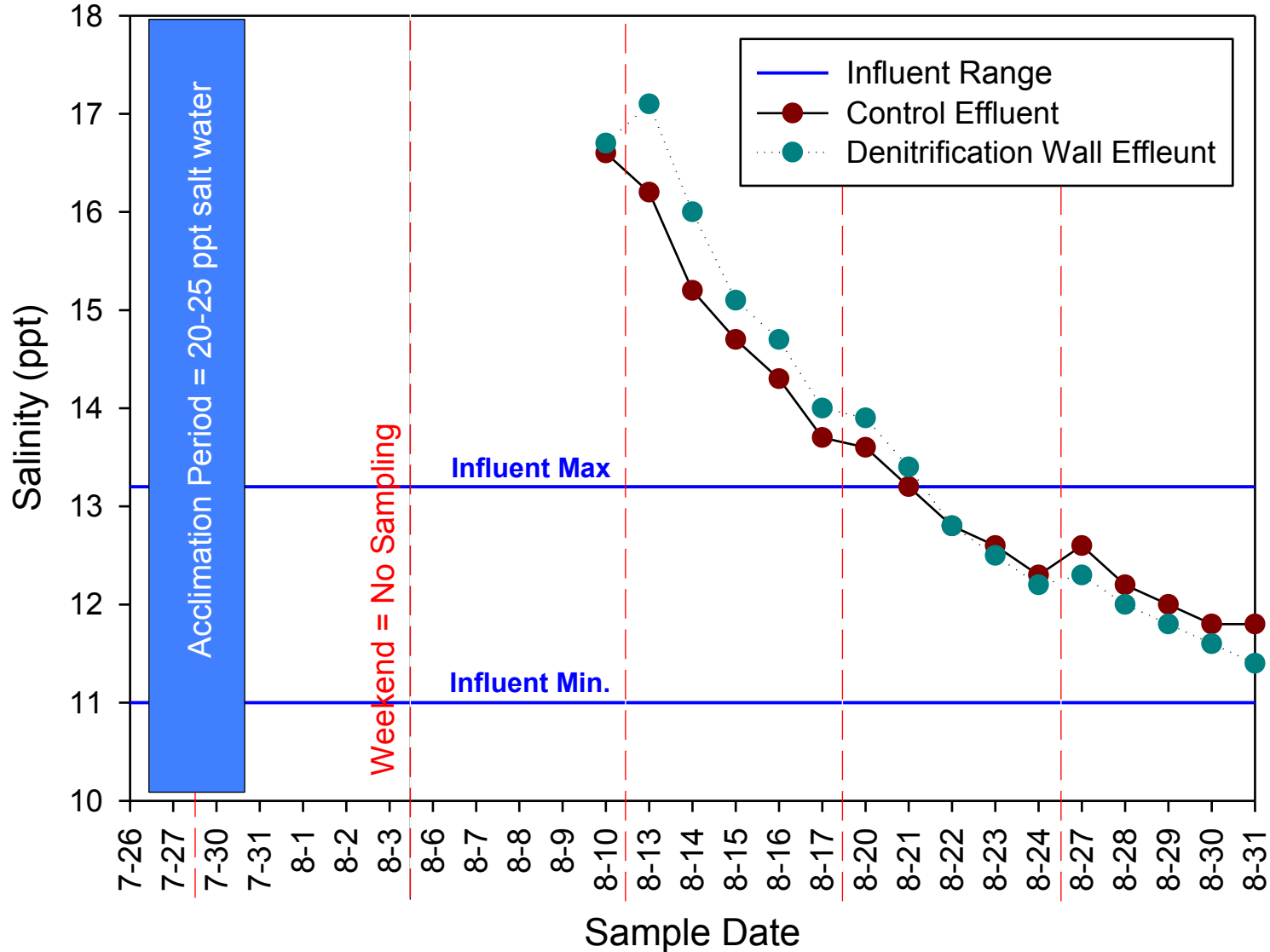
Results

- pH
- Salinity
- Nitrate
- Ammonia
- Total inorganic nitrogen

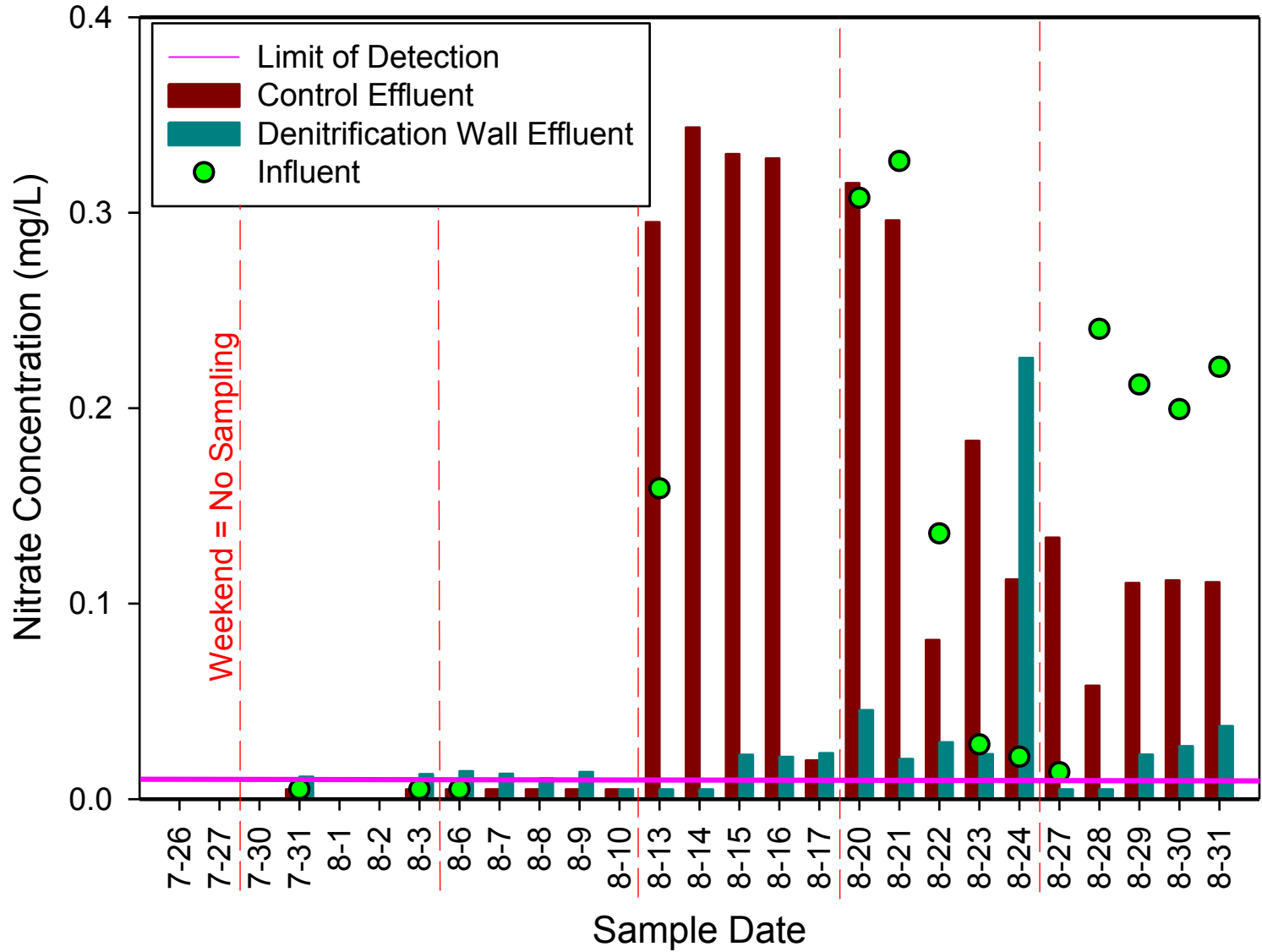
Influent and Effluent pH



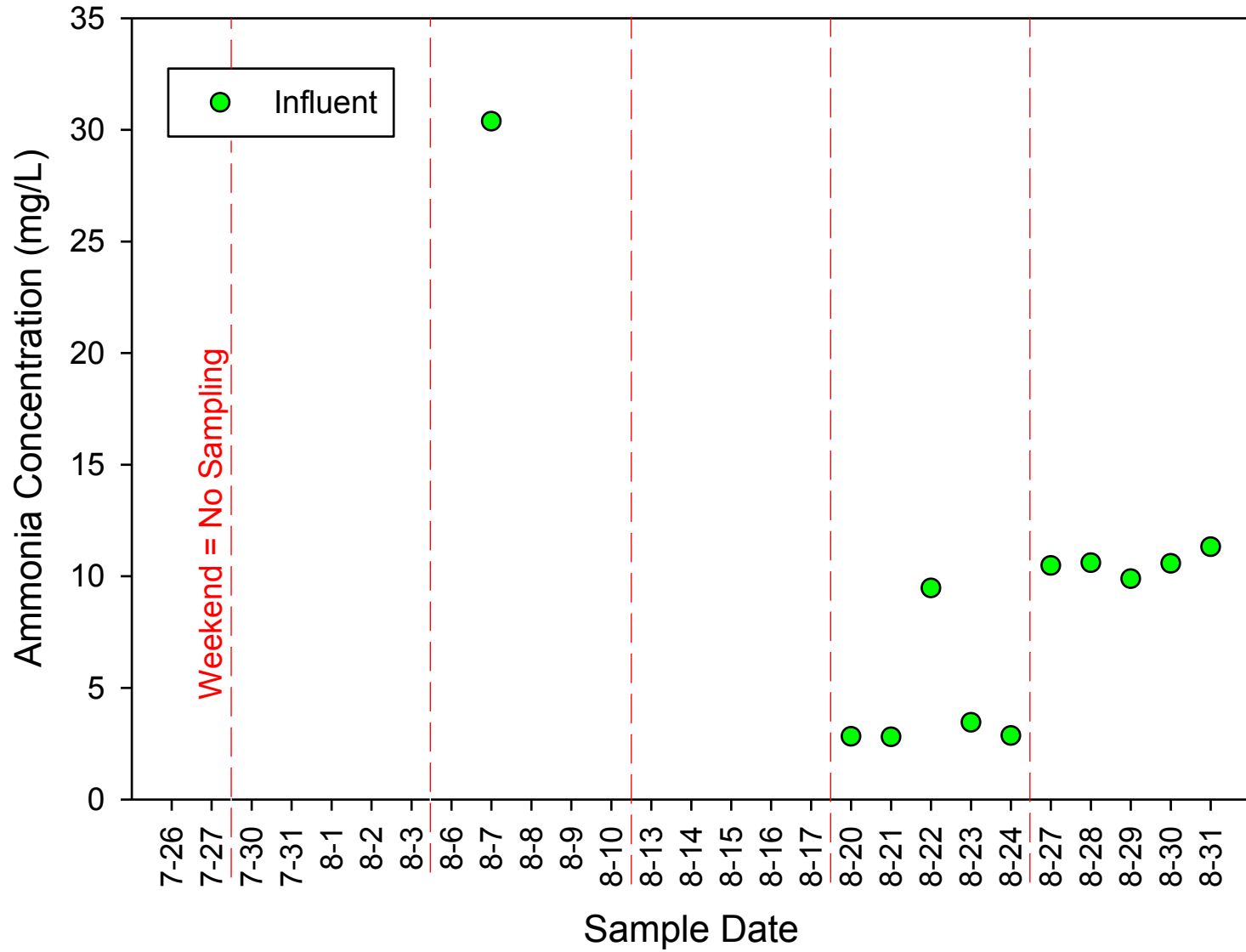
Influent and Effluent Salinity



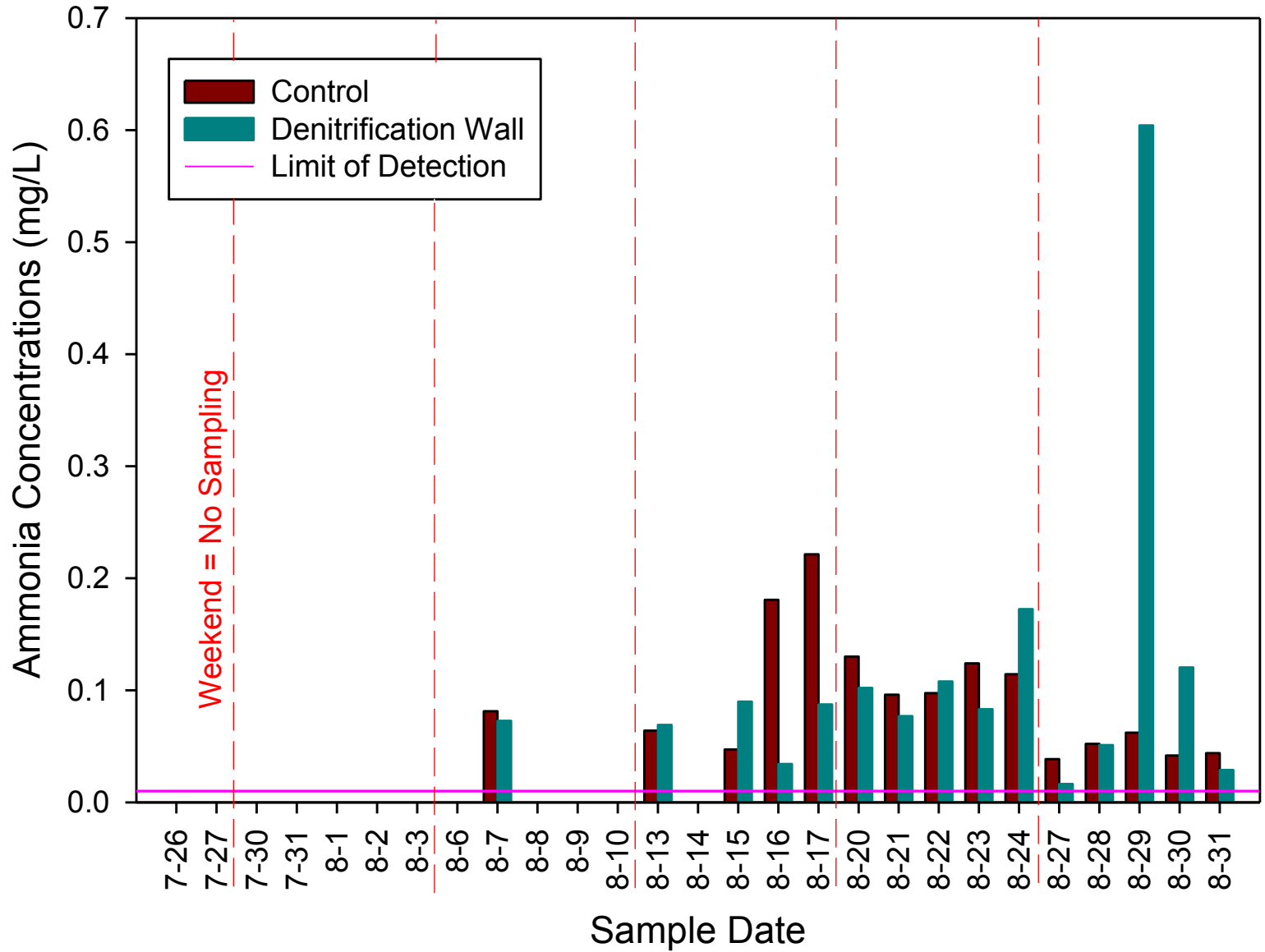
Influent and Effluent Nitrate Concentrations



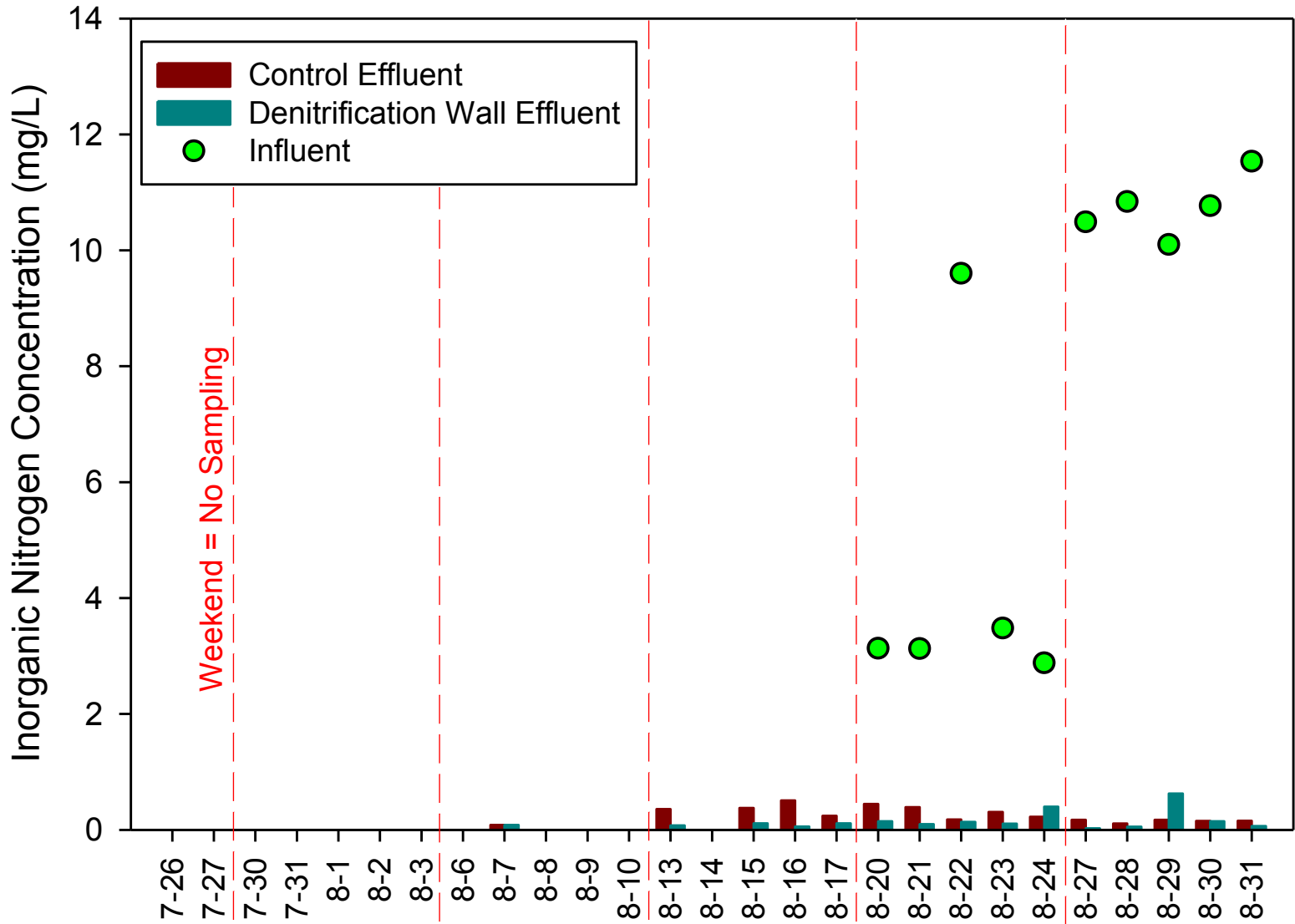
Influent Ammonia Concentration



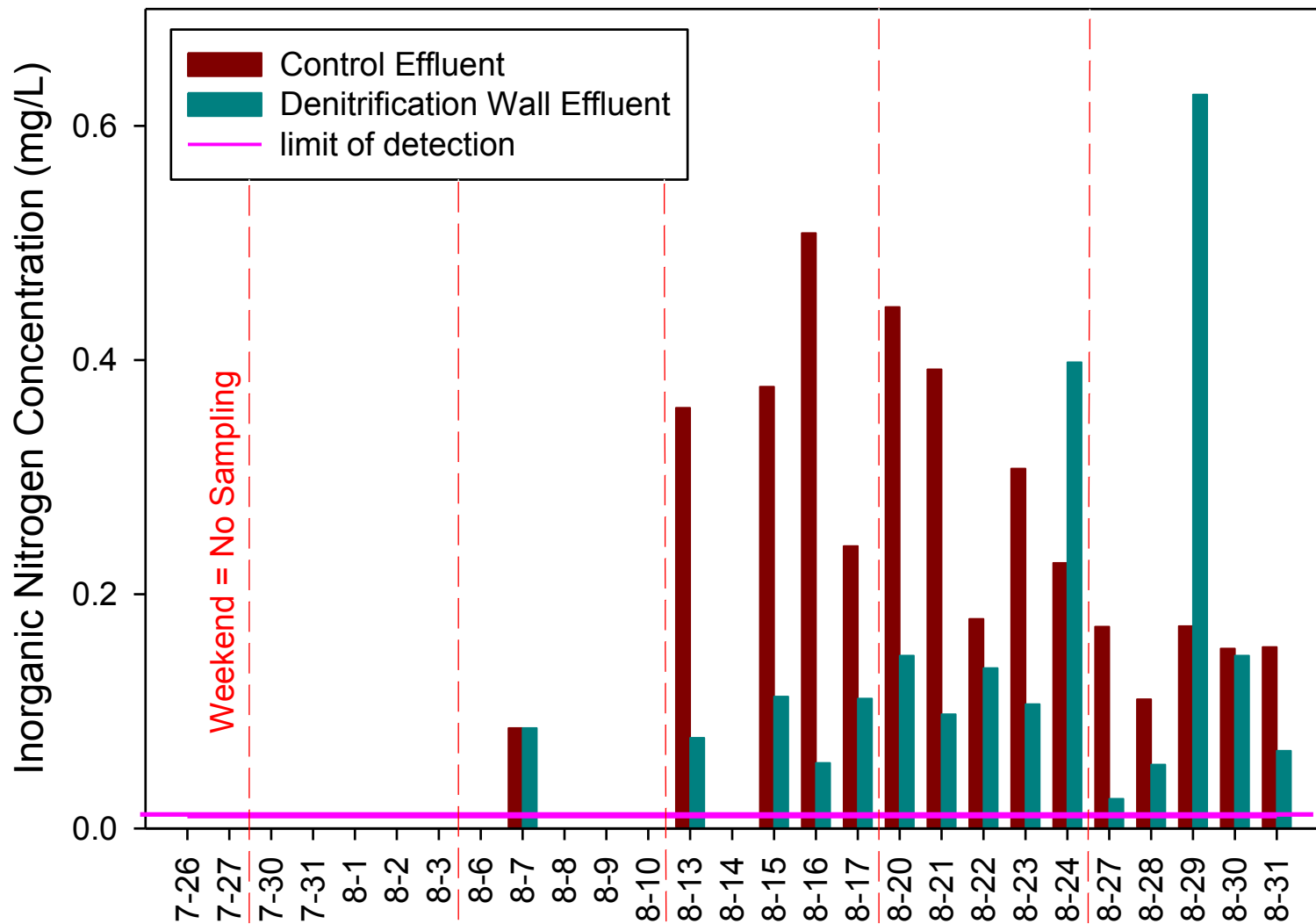
Effluent Ammonia Concentrations



Influent and Effluent Total Inorganic Nitrogen



Effluent Total Inorganic Nitrogen



Conclusions

- Preliminary results indicate lower nitrate concentrations in Denitrification wall effluent
- Larger data set is needed to conclude this definitely
- Experimental design shows proof of concept with minor changes
 - Constant influent nitrate and ammonia concentrations
 - Effluent Dissolved Oxygen measurements

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