Supplementary Materials for

Seasonal Evaluation of Nutrient Removal from Simulated Wastewater Using Aquatic Plants in South Texas

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Figure S1: *Juncus effusus* (top left: in the wild, top right: in the small cup for floating test) and Three-square bulrush (bottom left: in the wild, bottom right: in the small cup for floating test).



Figure S2: a. Three-square bulrush before (left) and after (right) soil removal. **b.** *Juncus effusus* without soil.

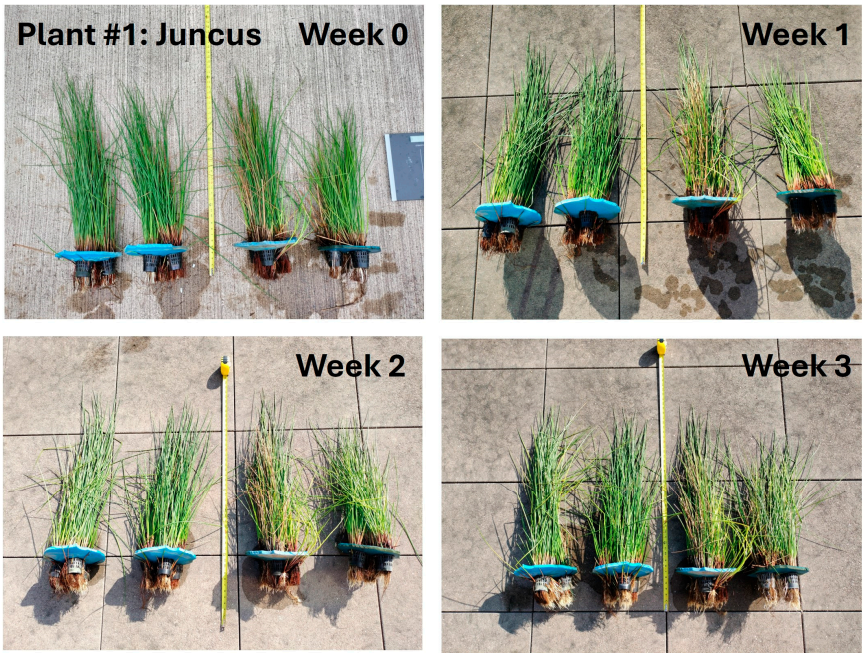


Figure S3. *Juncus effusus* (CR) growth images in different weeks.

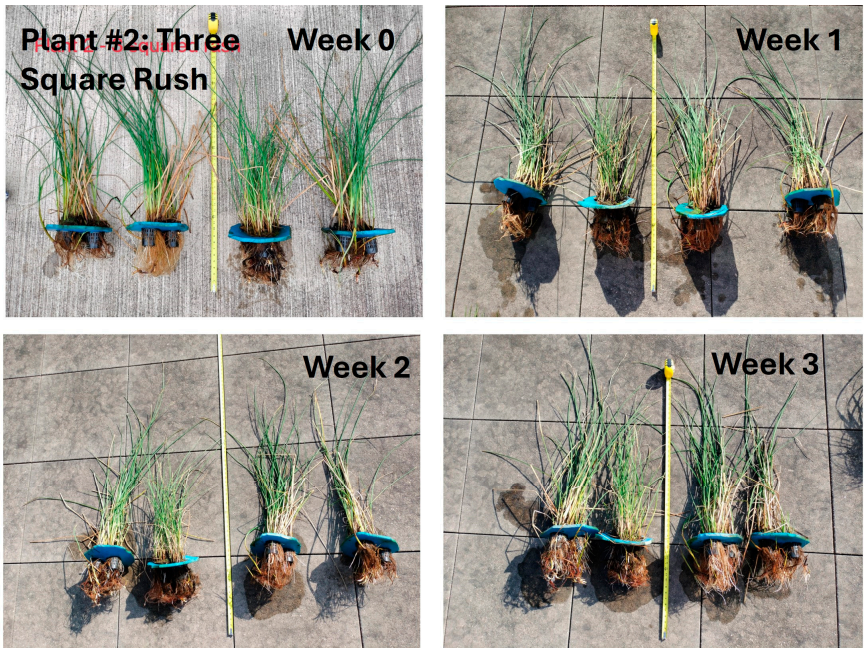


Figure S4. Three-square bulrush growth images in different weeks



Figure S5. *Centella asiatica* (TG) growth images in different weeks.

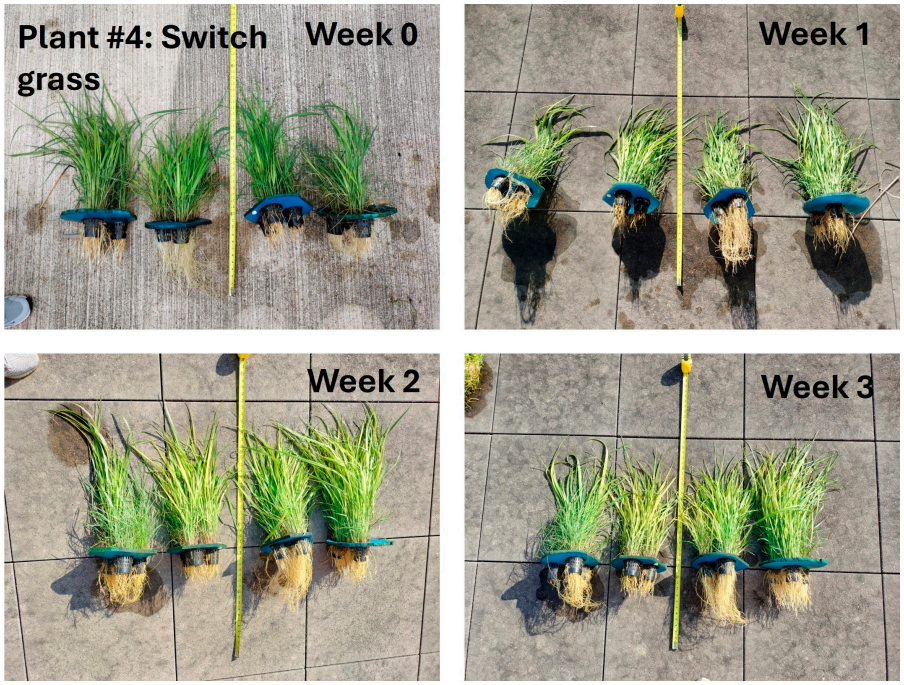


Figure S6. Switchgrass growth images in different weeks.

Regional temperature context

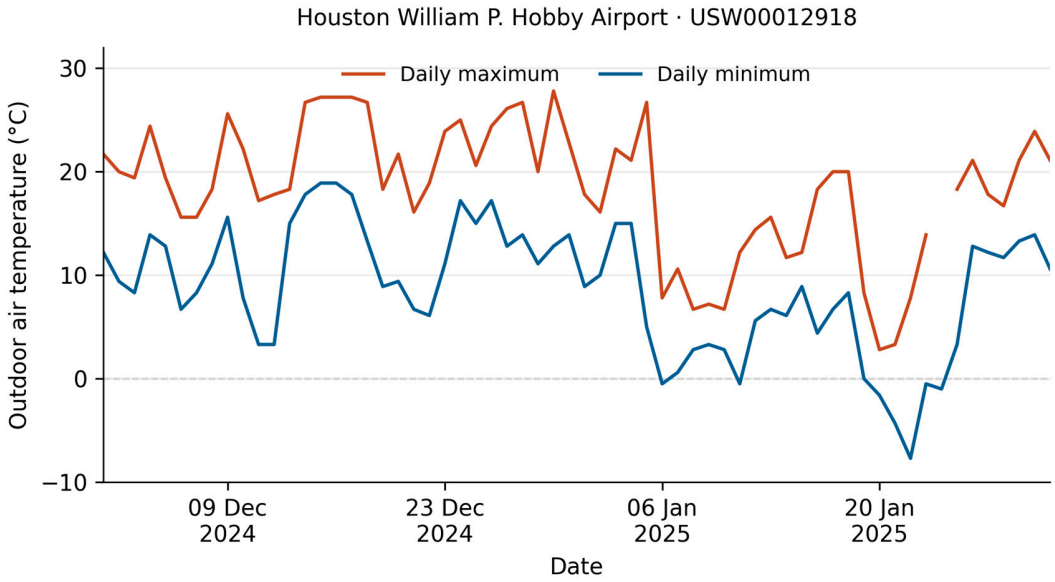


Figure S7. Regional outdoor air-temperature context for the winter experiment. Daily minimum and maximum air temperatures at Houston William P. Hobby Airport, Texas (NOAA GHCN-Daily station USW00012918), from December 1, 2024 to January 31, 2025. The dashed line marks 0 °C. The daily maximum for January 24, 2025 is omitted because it failed NOAA's spatial consistency check; the gap was not interpolated. These airport observations provide regional context and are not measurements at the experimental site or in the buckets. The reported indoor air temperature during temporary protection was approximately 25 °C. The plotted values are provided in Table S3. Source: Menne, M. J., I. Durre, B. Korzeniewski, et al. (2012). Global Historical Climatology Network–Daily (GHCN-Daily), Version 3.35. NOAA National Climatic Data Center. https://doi.org/10.7289/V5D21VHZ. Station USW00012918 (29.64586° N, 95.28212° W; elevation 13.2 m); accessed October 21, 2026.

Tap water and floating mat control.

We also tested the floating water's ion concentration. Figure S8b shows the tap water's IC test results, which shows small amount of sulfate and chloride ions. The amount of Nitrate ions is very limited comparing with other ions. In addition, we have soaked a floating mat in tap water for 3 weeks and measure the ion concentration difference to see whether the floating mat will release any ions. The results in Figure S8a shows there is no obvious ion release from the floating mat.

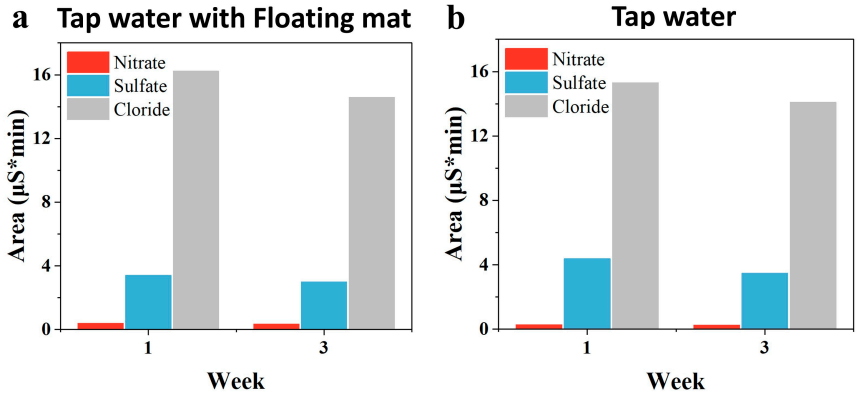


Figure S8: Floating mat and tap water control experiment. a. Ion concentration change after 3 weeks of soaking floating mat in the tap water. **b.** Tap water ion concentration change after 3 weeks.

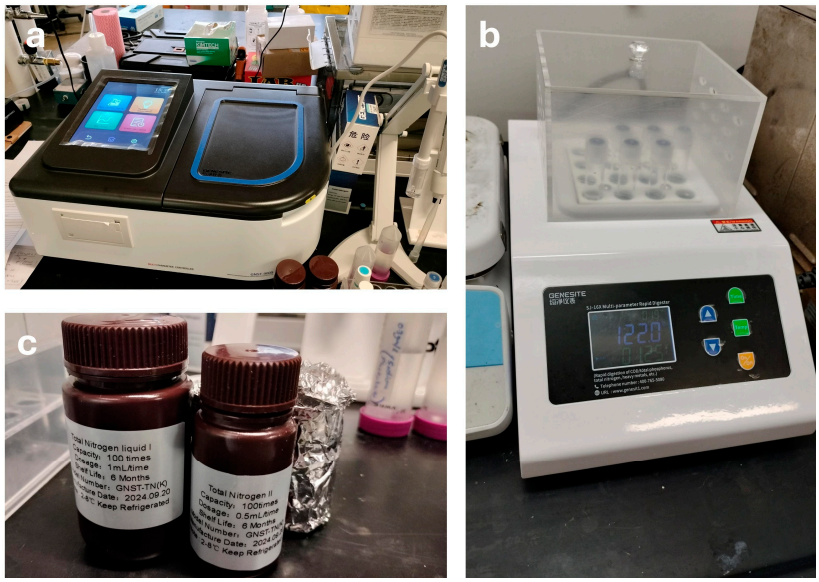


Figure S9. Equipment and reagents for TN and TP analysis: GNST-900S Multi-Parameter Analyzer (a), Genesite SJ-16X Rapid Digester (b), and TN and TP reagents (c).

Table S1. Procedure to Measure Total Nitrogen with the GNST-900S

Step	Item	Procedure
1	Reagent I	Dissolve Total Nitrogen Reagent powder I in Reagent liquid I; heat to 40 degrees C if necessary.
2	Reagent II	Dissolve powder in 50 mL distilled water.
3	Reagent III	Mix Reagent III concentrate with 320 mL of 10:1 sulfuric acid prepared separately.
4	Sample preparation	For a sample range of 0-20 mg/L, take 2 mL of the sample. For 20-100 mg/L, take 0.4 mL of the sample and add 1.6 mL of distilled water.
5	Digestion	Add 1 mL of Reagent I to each sample tube and shake, then heat tubes to 125 degrees C for 30 minutes.
6	Cooling and Reagent II addition	Cool to room temperature, then add 0.5 mL of Reagent II and shake.
7	Color development	Add 4 mL of Reagent III, shake, and allow color to develop for 15 minutes.
8	Analysis	Analyze color with the GNST-900S.

Table S2: Procedure to Measure Total Phosphorus with the GNST-900S

Step	Item	Procedure / Details
1	Reagent I	Dissolve the entire bottle of Total Phosphorus Reagent I powder in 100 mL of distilled water.
2	Reagent II	Dissolve the entire bottle of Total Phosphorus Reagent II powder in 20 mL of distilled water.
3	Reagent III	Provided by the manufacturer.
4	Sample volume	For a sample range of 0-2 mg/L, take 5 mL of the sample. For 2-20 mg/L, take 0.5 mL of sample and 4.5 mL of distilled water.
5	Add Reagent I	Add 1 mL of Reagent I to each sample tube and shake.
6	Heating and cooling	Heat tubes to 125°C in a reactor for 30 minutes, then cool to room temperature.
7	Color development	Add 4 drops of Reagent II and 6 drops of Reagent III, shake well, and let stand for 10 minutes.
8	Analysis	Use the GNST-900S to measure and analyze color development.

Table S3. Daily outdoor air temperatures at Houston William P. Hobby Airport (USW00012918), December 1, 2024–January 31, 2025.

All temperatures are in °C and were obtained from NOAA GHCN-Daily, Version 3.35 (source given with Figure S7). Only observations with blank NOAA quality flags are reported. The dash for January 24 denotes an excluded maximum temperature (raw value 29.4 °C; quality flag S, failed spatial consistency check); no value was substituted. These records provide regional context, not experimental site or bucket-water temperatures.

Date	Daily minimum (°C)	Daily maximum (°C)
2024-12-01	12.2	21.7
2024-12-02	9.4	20.0
2024-12-03	8.3	19.4
2024-12-04	13.9	24.4
2024-12-05	12.8	19.4
2024-12-06	6.7	15.6
2024-12-07	8.3	15.6
2024-12-08	11.1	18.3
2024-12-09	15.6	25.6
2024-12-10	7.8	22.2
2024-12-11	3.3	17.2
2024-12-12	3.3	17.8
2024-12-13	15.0	18.3
2024-12-14	17.8	26.7
2024-12-15	18.9	27.2
2024-12-16	18.9	27.2
2024-12-17	17.8	27.2
2024-12-18	13.3	26.7
2024-12-19	8.9	18.3
2024-12-20	9.4	21.7
2024-12-21	6.7	16.1
2024-12-22	6.1	18.9
2024-12-23	11.1	23.9
2024-12-24	17.2	25.0
2024-12-25	15.0	20.6
2024-12-26	17.2	24.4
2024-12-27	12.8	26.1
2024-12-28	13.9	26.7
2024-12-29	11.1	20.0

Date	Daily minimum (°C)	Daily maximum (°C)
2024-12-30	12.8	27.8
2024-12-31	13.9	22.8
2025-01-01	8.9	17.8
2025-01-02	10.0	16.1
2025-01-03	15.0	22.2
2025-01-04	15.0	21.1
2025-01-05	5.0	26.7
2025-01-06	-0.5	7.8
2025-01-07	0.6	10.6
2025-01-08	2.8	6.7
2025-01-09	3.3	7.2
2025-01-10	2.8	6.7
2025-01-11	-0.5	12.2
2025-01-12	5.6	14.4
2025-01-13	6.7	15.6
2025-01-14	6.1	11.7
2025-01-15	8.9	12.2
2025-01-16	4.4	18.3
2025-01-17	6.7	20.0
2025-01-18	8.3	20.0
2025-01-19	0.0	8.3
2025-01-20	-1.6	2.8
2025-01-21	-4.3	3.3
2025-01-22	-7.7	7.8
2025-01-23	-0.5	13.9
2025-01-24	-1.0	—
2025-01-25	3.3	18.3
2025-01-26	12.8	21.1
2025-01-27	12.2	17.8
2025-01-28	11.7	16.7
2025-01-29	13.3	21.1
2025-01-30	13.9	23.9
2025-01-31	10.6	21.1