Beemats

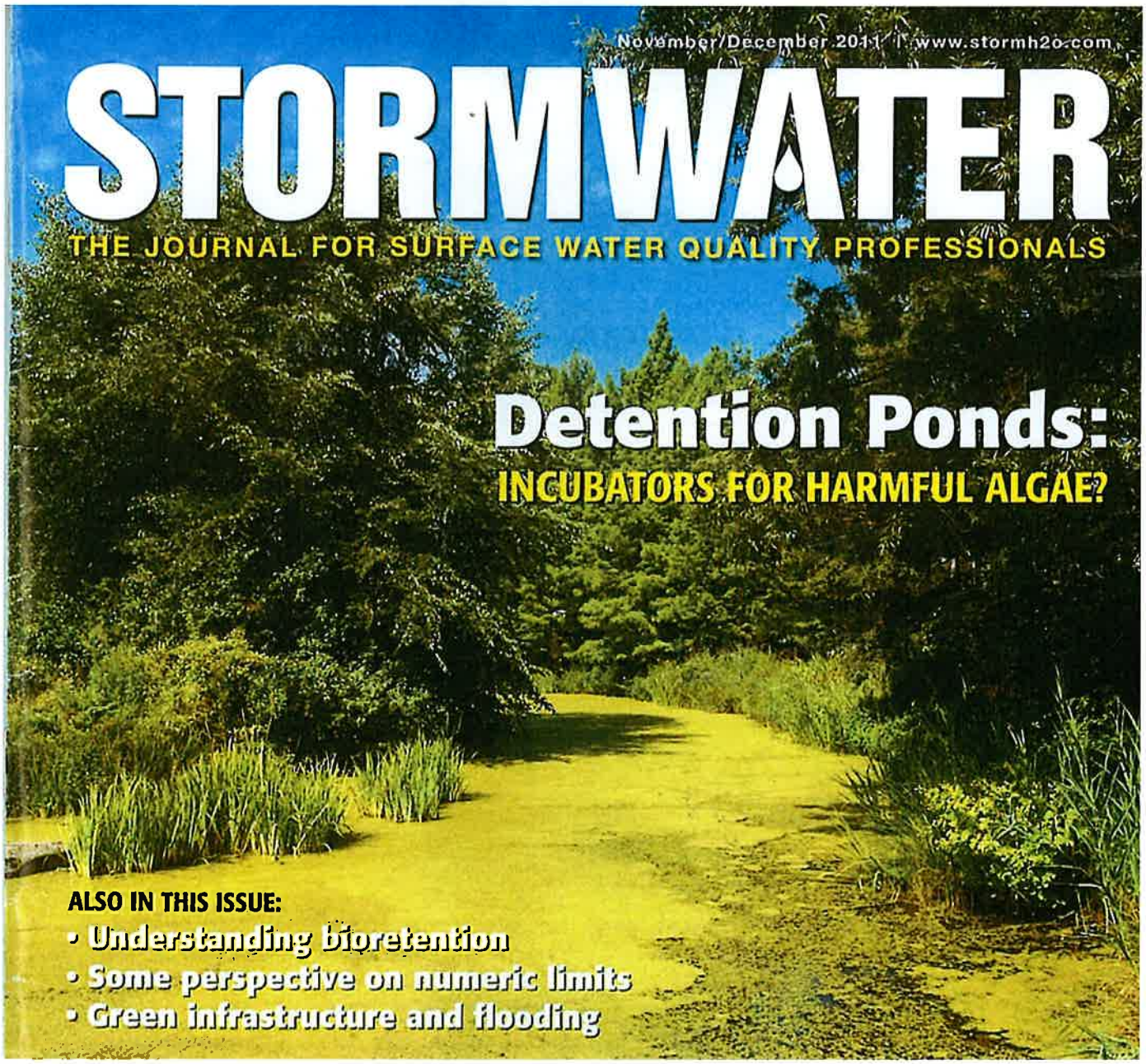
BEEMATS FLOATING TREATMENT WETLANDS

Managed Aquatic Plant Systems


We have algae problems...
WESH 2

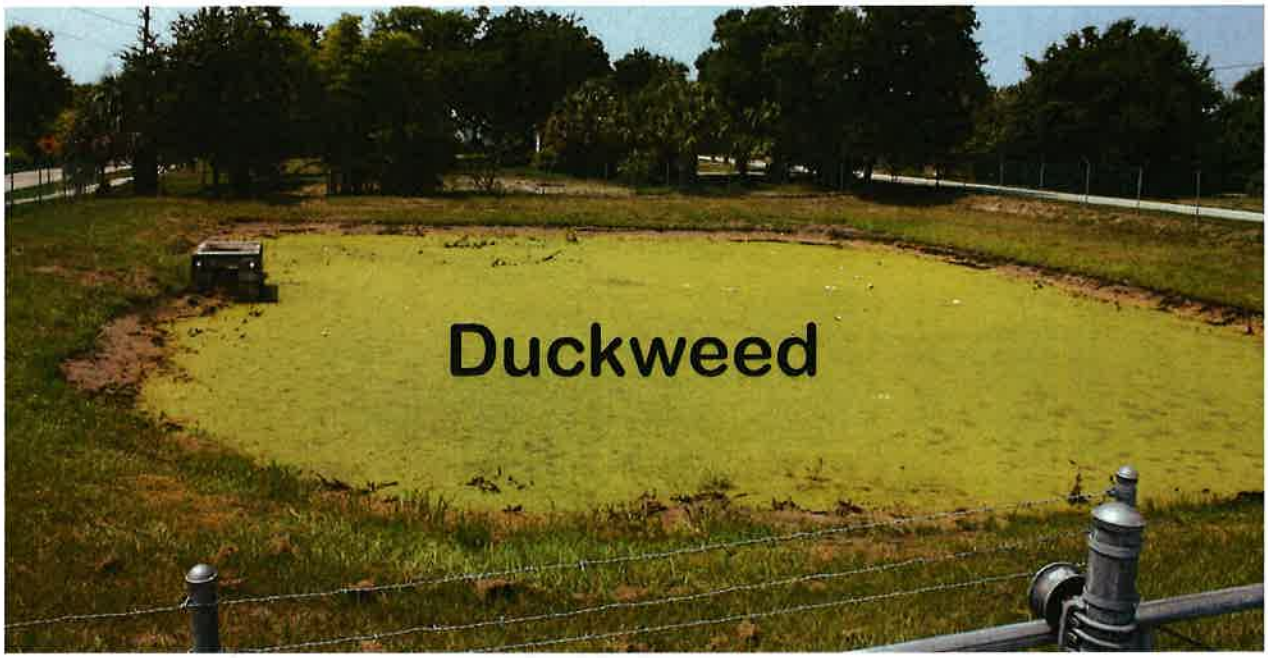

Aureoumbra lagunensis

.. primarily caused by nutrient pollution from upland runoff



The most common method for addressing nutrient pollution in storm water is through the detention of runoff in created ponds, called stormwater treatment areas (STAs).

Drescher, Sanger and Davis reported that storm water ponds in South Carolina frequently accumulated contaminants, sediments and nutrients at a higher rate than direct run off, before discharging to natural waters (1).



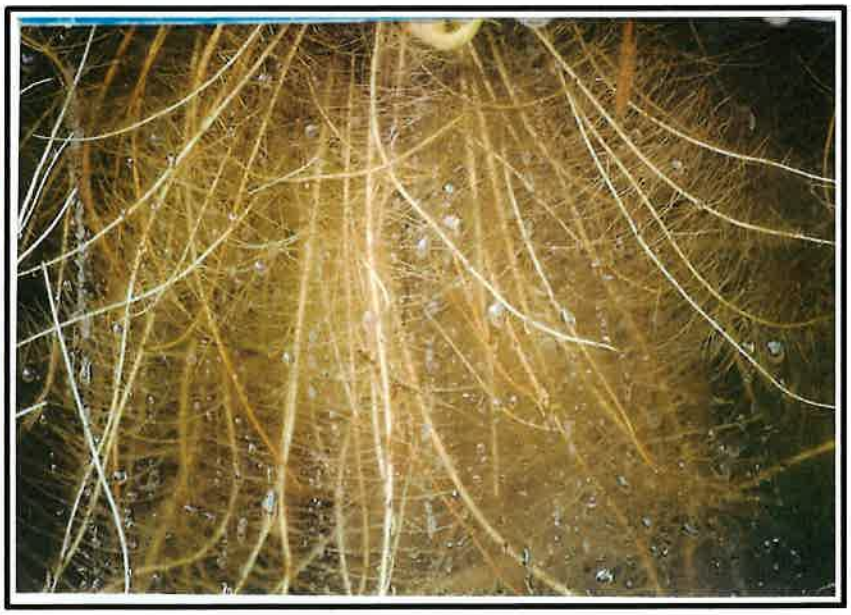
Stewart notes that the inherent flaw in passive storm water systems (STAs), is that while they may retain nutrients through precipitation, adsorption and sedimentation, most of the stored nutrients are still present (7).

Herbicide application is the standard method for dealing with nuisance vegetation in water. Dying plants can cause oxygen depletion. The dead biomass accumulates on the pond bottom, replacing sandy sediments with organic muck.

In a study of the Indian River Lagoon, Trefrey (8) reports that about 20% of the bioavailable forms of nitrogen and phosphorus enter the water column as upland run off and 22% comes in as base flow seepage through the substrate.

Over 40% of the nitrate and phosphate in the water comes from "muck flux", released by decomposing organic matter stored in the sediments, as a result of erosion and herbicide treated biomass.

Beemats are active biological treatment systems that utilize macrophyte plants to remove nitrogen and phosphorus from water, the same way terrestrial plants deplete those nutrients from soil. The roots and attached biofilm are suspended in the water below the mats where they accumulate and store soluble nutrients. The plants and biofilm are periodically harvested so the nutrients that have been sequestered in the biomass can be recovered. The removal rates can be directly measured as a percentage of the collected biomass.



The philosophy behind Beemats Harvestable Floating Treatment Wetlands is different from any other system on the market. Our goal is to extract excess nutrients from stormwater and prevent them from fueling algae blooms in lakes, streams, rivers or estuaries.
The vehicle for nutrient removal is actively growing plants.

Beemats are HARVESTABLE floating treatment wetlands.

It's not rocket science. We simply allow plants to feed on dissolved nutrients and sequester them in expanding biomass as they grow from small shoots to mature sizes. Then we remove them from the floating wetlands before they start to degrade and release nutrients back into the water. By measuring the net weight of the harvested biomass and analyzing the nitrogen and phosphorus content, we can provide accurate nutrient removal accountability.

Clemson University Pond Studies

SJRWMD Study - Deep Creek

Titusville Senior Center Pond

Titusville Senior Center Park

Fresh Water

Project for the City of Titusville – planted in 2015
Two harvests / year
55.42 g P/m^2/year (494.45 lbs. P/acre/year)
401.14 g N/m^2/year (3,578.97 lbs. N/acre /year)

Titusville - Coleman Pond

Fresh Water

City of Titusville - Planted April 2019

Two Harvests per year

65.08 g P / m^2 / year (580.64 lbs. P / ac. / year)

245.74 g N / m2 / year (2,192.48 lbs. N / acre / year)

Indian Hills Recreation Area

Fresh Water / Saline

Project for the City of Ft. Pierce – planted in 2014

34.96 g P/m^2/year (311.91 lbs. P/acre /year)

451.41 g N/m^2/year (4,027.46 lbs. N/ac/year)

Brevard County – Merritt Ridge

Saline

35.17 g P/m^2 /year (313.79 lbs. P /acre / year)
222.13 g N/ m^2/year (1,981.83 lbs. N/acre / year)

Brevard County – Flounder Creek Rd.

Fresh Water

55.03 g P/m^2/year (490.98 lbs. P/acre /year)
270.17 g N/m^2/year (2,410.45 lbs. N/acre/year)

Brevard County – Huntington Blvd.

Saline

40.62 g P/m^2/year (362.42 lbs. P/acre/year)
212.78 g N/m^2/year (1,898.41 lbs. N/acre/year)

Brevard County – Lake George

Saline

24.90 g P/m^2/year (222.16 lbs. P/acre/year)
195.65 g N/m^2/year (1,745.00 lbs. N/acre/year)

Martin County – Old Palm City

Saline

Two Harvests per year

43.58 g P/m^2/year (388.82 lbs. P/acre /year)
257.21 g N/m^2/year (2,294.82 lbs. N/acre /year)

Ormond Beach – Central Lakes Park

Fresh Water

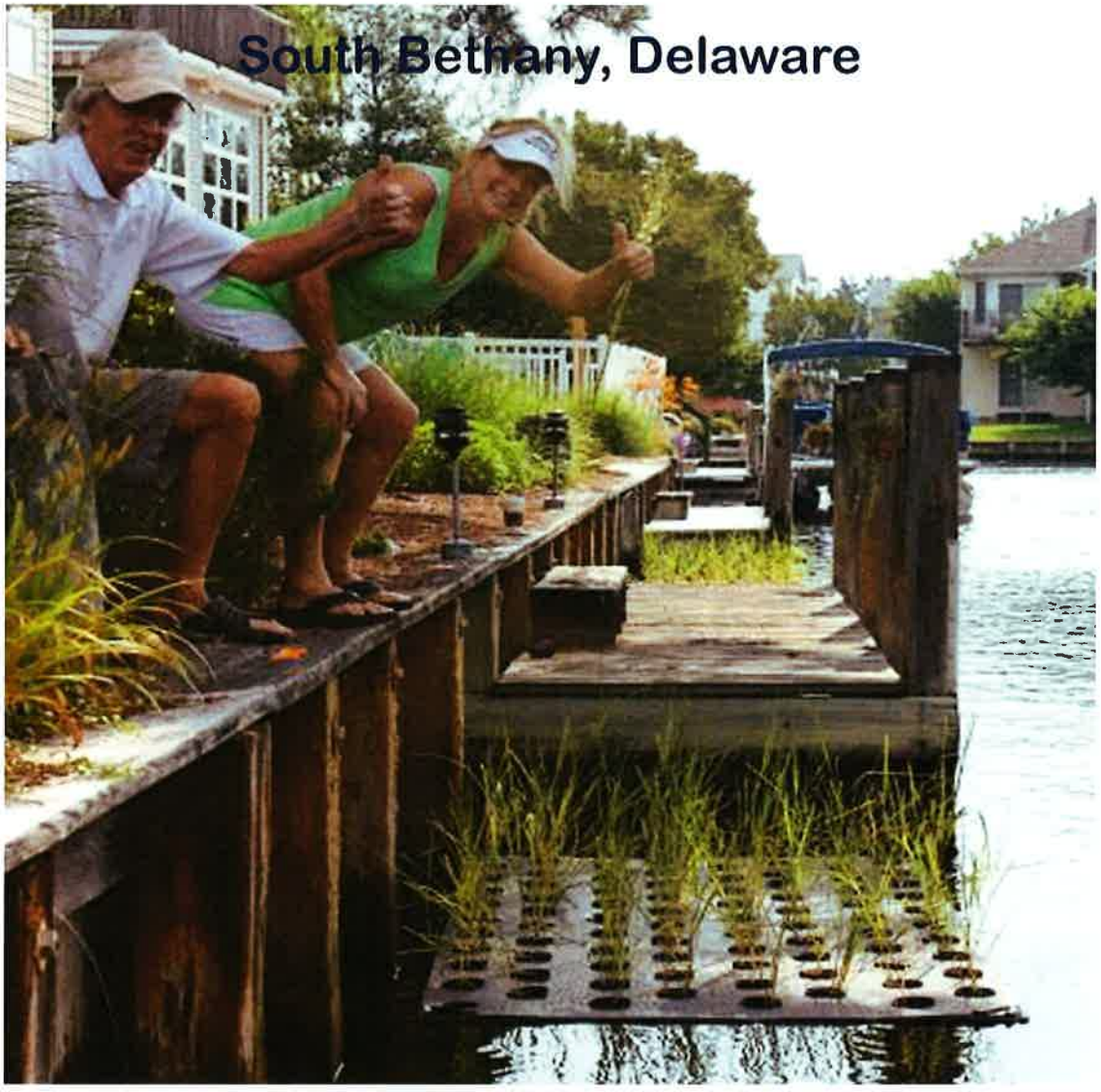
16.59 g P/m^2/year (148.02 lbs. P/acre /year)
586.29 g N/m^2/year (5,230.85 lbs. N/acre /year)

New Smyrna Beach – D.O.T. Pond

Saline


Isleworth Country Club

South Bethany, Delaware



Chesapeake Basin – Hanover County, Virginia

L – 5 Pond - Mechanicsville

Chesapeake Basin - Hanover County, Virginia

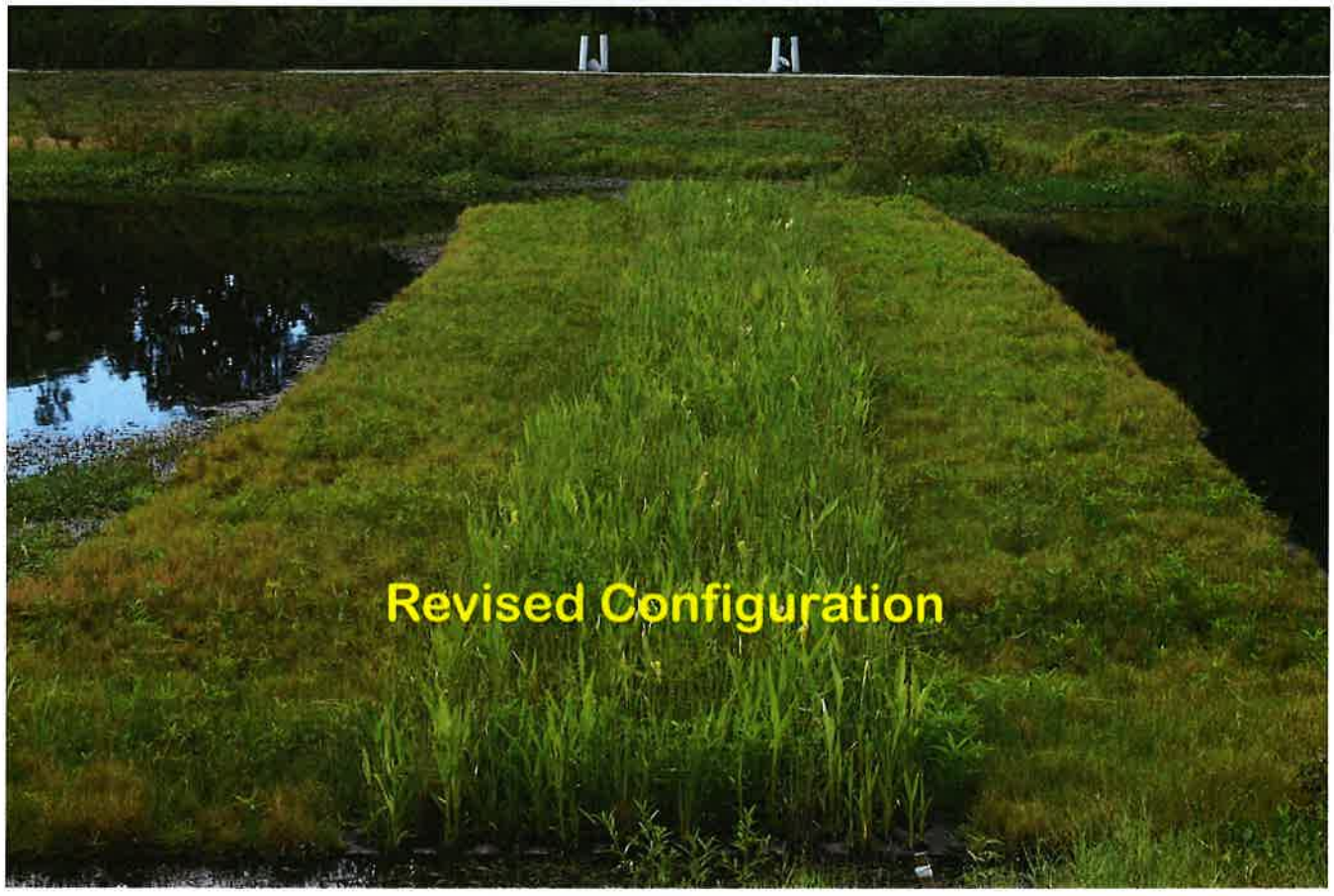
Covenant Woods Pond

Rose Hill Pond

Pensacola – Chico Bayou Drainage Basin

Wickham Park – Water Flows and Beemat Placements


Original Installation – 19 Islands


Revised Configuration


Solar Bee


Control


Solar Bee Circulator


Island #2
Island #1

WICKHAM PARK POND

NUTRIENT UPTAKE INCREASES WITH SOLAR BEE

April 2017 - April 2018:

Nitrogen - 371.12 g N / m^2 / year
(3,308.76 lb. N / acre / year)

Phosphorus - 32.83 g P / m^2 / year
(292.68 lb. P / acre / year)

April 2018 - April 2019:

Nitrogen - 418.33 g N / m^2 / year
(3,732.32 lb. N / acre / year)

Phosphorus - 107.77 g P / m^2 / year
961.52 lb. P / acre / year)

Total Pond (Solar Bee and Control) Increases

Nitrogen - 13% increase

Phosphorus - 228% increase

SOLAR BEE – Islands 1 & 2

NITROGEN = 433.10 pounds
= 440.38 g N / m^2 / year
= 3,929.05 lbs. N / acre / year

PHOSPHORUS = 116.75 pounds
= 118.71 g P / m^2 / year
= 1,059.13 lbs. P / acre / year

CONTROL - Islands 3 & 4

NITROGEN = 389.72 pounds
= 396.27 g N / m^2 / year
= 3,535.50 lbs. N / acre / year

PHOSPHORUS = 95.22 pounds
= 96.82 g P / m^2 / year
= 863.82 lbs. P / acre / year

The storage of phosphorus in the sediments of storm water detention ponds does not equal removal from the system (7).

Accumulation of phosphorus within STAs or in the biomass of rooted shoreline vegetation and non-harvestable floating wetlands does not equal removed phosphorus (6), (7).

Phosphorus storage in those systems averages 7 to 10 lb./acre /year (2), while phosphorus removal rates in harvestable floating treatment wetlands are 200 - 900 lb./acre /year (3) (4) (5) (9)

Beemats are portable and adaptable. It is easy to deploy them in any water body, from small ponds to canals or ditches within STAs, to natural lakes, estuaries or rivers.

They are designed for easy harvesting and replanting. All of the plants and materials are re-useable or recyclable. The patented aerator pots are made of re-useable plastic, and the harvested plants can be used to create living shorelines after they have performed their water cleaning duties.

Some plants are broken down to small pieces and re-grown for future floating wetlands, while the rest of the biomass is trimmed and composted. We recycle much of the compost by screening to mix it with peat for potting soil at our native plant nursery.

Literature cited:

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