Keys to Algae Control in Stormwater Management Ponds

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Overview

- Revisiting a wet pond design
  - Post construction maintenance
- Intro to Algae
- Plants sometimes mistaken for algae
- Issues with algae blooms
- Causes of algae blooms
- Algae control (short and long term)
  - Algaecides
  - Nutrient management
Wet Pond

• Permanent pool
  – Contains water year round
  – Management is difficult due to water quality issues within the pond
    • algae
  – Public safety issues (require bench shelf)
• Vegetative Buffers
  – Embankments, vegetative buffer 25’ outward from the high water level
• Proactive Management Opportunities
Wet Pond Standard Design

Drawings from DNREC Division of Watershed Stewardship
Post Construction (focus on Wet ponds)

- Compliance and functionality
  - Operation and Management Plan
- Aesthetics and vegetation management
  - Can vary greatly from one landowner to the next
- Water Quality
  - Algae, turbidity, and macroinvertebrates are great indicators
- Opportunities
  - Habitat
  - Pollinator forage
Compliance and Functionality

- Preventative maintenance
  - Inspect structures: inlets, outfalls, rip-rap, pipes etc.
  - Unclog structures
    - Trash
    - Organic debris
    - Sediment
  - Basic Vegetation management
    - Mow access areas around inlets and outfalls
    - Prevent establishment of invasive plant species
Permanent Pool

- Water quality Issues
  - Nutrient load and sedimentation
    - Algae growth
    - Turbidity
  - Dissolved Oxygen deficiency
    - Fish kills
What are algae?

- Unicellular
- No roots
- Gathers nutrients as a food source directly from the water column
- Most types are healthy for an aquatic ecosystem at normal levels
- Quickly populates slow moving water bodies which are loaded with nutrients
- Most grow aggressively in warmer temperatures
Types of Algae

• Green Algae
  – Filamentous
  – stoneworts
• Blue-green algae
  – cyanobacteria
• Other problematic floating species
  – Duckweed
  – watermeal
Green Algae

- Filamentous
- mat forming
- Most are green although some can seem brown or blackish green
- This group of algae provides a food source for aquatic life but quickly becomes a detriment to the ecosystem during aggressive growth periods
- Most species grow on the bottom of aquatic systems
- Gases are formed which allow the algae to float to the surface creating massive mats
Green Algae

• Pithophora
  – Horsehair algae, tends to grow heavier in mid-late summer
  – Very difficult to control when established
• Spirogyra
  – Bright green, slimy mats, easy to control chemically
• Hydrodictyon
  – Mat forming, spongy, net like
  – Hexagonal or pentagonal patterns are visible
Green algae

• Chara
  – Green filamentous algae which anchors self to substrate
  – Can form dense stands in eutrophic waters
  – Resembles pondweeds, chara “pops” when squeezed to help with identification
  – Highly beneficial algae which creates habitat for macroinvertebrates and fish
Green algae

- **Hydrodictyon**
  - Photo by Pondpros

- **Chara**
- **Spirogyra**
  - Photo by ASAP Aquatics

- **Pithophora**

Photo by nathistoc
Blue-green algae

- Cyanobacteria
- forms what looks like pond scum, some species creates a “pea soup” look to a waterbody
- This type of algae is almost always detrimental to overall aquatic health
- Very quickly lowers dissolved oxygen levels to critical levels
- Main culprit in DO related fish kills
- Some species are able to fix nitrogen
- Some species excrete toxins which can cause incontinence in livestock and people. Can also create kidney or liver problems if ingested
- Some species excrete neurotoxins as well, tainted drinking water can cause mortality in livestock
Blue-green algae

- **Microsystis**
  - Pea soup appearance
  - Contains the hepatotoxin microsystin
- **Lyngbya**
  - Mat forming cyanobacteria
  - May cause irritate the skin but poses no long term issues
  - May appear black or dark green
- **Anabena**
  - Another pea soup colony forming cyanobacteria
  - Contains neurotoxin (anatoxin) and microsystin
Blue-green algae

- Micrystis
- Anabena
- Lyngbya
Plants mistaken for algae

• Common duckweed
  – Small floating plant with roots
  – 1 to 3 fronds/leaves per plant
  – Reproduces by seed and asexual budding
  – Beneficial in small amounts for waterfowl and other aquatic inhabitants
  – Becomes a management issue in slow moving, eutrophic waters
  – Quickly covers surface waters in the right conditions
Plants mistaken for algae

- Watermeal
  - Very small seed bearing, free floating, plant
  - Reproduces by seed and budding
  - Budding in eutrophic waters create massive infestations quickly
  - Very hard to control once established
Plants mistaken for algae

photo by Mike Kieron
Plants mistaken for algae

Photo by Solitude Lake Management
Issues with algae blooms

- Unsightly water quality
- Unpleasant smells
- Clogging of outfall structures
- Reduced water storage capacity
- Reduced diversity
- Reduced dissolved oxygen
  - Common cause of fish kills
Causes of algae blooms

• Stagnant waters
• Shallow water
• High nutrient load
  – Nitrogen and phosphorus
    • Sheet runoff
    • Stormwater runoff
    • Fertilizer runoff
    • Canada goose excrement
    • Sedimentation
Sources of nitrogen
Sources of Nitrogen
Sources of nitrogen

• According to National Geographic 50 Canada geese can produce two and a half TONS of excrement per year
Sources of phosphorus
Sources of phosphorus
Sources of phosphorus

- Fertilization practices
- Sedimentation
- Yard waste being dumped near drainage sites or leaf litter washing into pond
- Microbial activity releasing phosphorus from pond bottom
Now what?

- Most encounters with algae require immediate attention
  - Physical removal
  - Chemical treatment
  - Combination of the two

- Once immediate actions are complete/successful, move to long term nutrient management
Physical removal

- Algae harvesters
- Sein netting
- Raking
Chemical treatments

• All pesticides used in aquatic sites must be labelled for use in those systems to include adjuvants.
• Copper sulfate, chelated copper sulfate etc
  – Granular
  – Liquid
  – Potentially toxic to koi and trout
  – Has activity on some pondweeds including Hydrilla
• Sodium carbonate peroxyhydrate
  – Granular
  – Safe for use around koi, goldfish and trout
  – Breaks down into safe byproducts
• Algae should be treated above 60 degrees F for best results
Long term management

• Take actions to reduce the amount of available nutrients in the water column
  – Phosphorus precipitation (Lanthanum and clay or aluminum sulfate applications)
  – Removal of accumulated sediment from forebays and pond bottoms
  – Riparian buffers
  – Bench shelf plantings with native beneficial
  – Winter organic material removal
  – Aeration
  – Rain gardens
  – Rain barrels
Phosphorus precipitation

- Lanthanum and clay
  - Permanently locks free reactive phosphorus from the water column
  - Costly but safe and effective tool for phosphorus removal
- Aluminum sulfate
  - Binds phosphorus and suspended sediment for clarification and phosphorus removal solutions
Sediment removal

- Forebays must be cleaned out regularly
- Full pond dredges may be required
- Stabilize areas at risk of eroding
Riparian Buffers

- Maintain a vegetative riparian buffer around any stormwater management system
- Select for native beneficial grasses, forbs, shrubs, and trees
- Buffers should cover all slopes surrounding stormwater systems but at a minimum, maintain 3’ buffers
Bench shelf plantings

- Bench shelf is a safety measure installed in most stormwater ponds and are generally 6” to 12” deep
- Plant native beneficial aquatic plants to stabilize bench shelf and for nutrient removal
- Plantings also create habitat and diversity
Vegetated Perimeter

- Operate within the Operation and management plan
  - Plantings may include: trees, shrubs, grasses, forbs
  - Helps slow sheet runoff, capture nutrients, protect embankments, and may provide wildlife habitat and pollinator forage

- Management Issues
  - Invasive species
  - Differing opinions on what looks aesthetically pleasing
  - Time consuming
Embarkment

• Plantings may only be herbaceous
  – Grasses and forbs
  – Provides stabilization of embankment
  – Opportunity for wildlife habitat and pollinator forage

• Management issues
  – Invasive species management
  – Potential for erosion
  – Sloped terrain
  – Muskrats
Invasive Plant Species

- Delaware Invasive Species Council
- The Delaware Wetland Plant Field Guide

photo by Chris Evans University of Illinois
Desirable Upland Native Plants

• https://www.dnlaonline.org/resources/purchasing-native-plants
Desirable Wetland Native Plants

- The Delaware Wetland Plant Field Guide
  - DNREC Wetland Monitoring and Assessment Program
Winter organic removal

- Removal of dormant vegetation or leaves
- Decomposing organic material releases nutrients back into the water column
- To go along with removal, take measures to avoid introducing clippings or yard wastes into ponds and swales
Aeration

- Diffused air systems supply dissolved oxygen to entire water column
  - Also moves water enough to deter algae growth
  - Prevents stratification and fish kills
- Surface aeration supplies dissolved oxygen to top portion of the water column
  - Not as efficient at supplying DO to entire water column
  - Moves more water than diffused air
  - Aesthetically pleasing
- Water movers
  - Systems designed to create flow in low flow areas such as fingers in a pond
At home nutrient removal

• Rain gardens can be planted in areas that receive runoff at home
  – Slowly filters out nutrients
  – Creates habitat
  – Aesthetically pleasing
• Rain Barrels
  – Reduces amount of stormwater runoff
  – Recycle rainwater for use around the home
At Home Stormwater Management

• Rain barrels
• Rain gardens
• Turf conversion to meadow, trees, shrubs, etc
  – Opportunities to diversify services
• Buffers
• Direct gutters away from impervious surface
• Pervious hardscapes
At Home Stormwater Management
Stormwater Management Resources

• DNREC Division of Watershed Stewardship

• Conservation Districts
  – Sussex - https://www.sussexconservation.org/
  – Kent - http://kentcd.org/
  – New Castle - http://newcastleconservationdistrict.org/

• Private Consultants
Permitting

• NPDES Permit Required in Delaware to apply aquatic pesticides

• Pesticide Discharge Management Plan for services to populations over 10,000
  – Does not need to be submitted, but must be kept on record at the business
  – https://www3.epa.gov › npdes › pubs › pgp_pdmp_template
Certified Pesticide Applicator

• Must be certified with the Delaware Department of Agriculture
  – 5A – Aquatic
  – 5C – Mosquito Control
  – 06 – Right of Way
  – 03 – turf and ornamental
In Summary

• Looking at the big picture when managing stormwater management systems is key
• Due to human activity, all stormwater management systems must be monitored and managed over time to create static, healthy, functional, and aesthetically pleasing systems.
• Managing your environmental footprint at home helps reduce the amount of stress to community wide drainage systems
Questions?

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