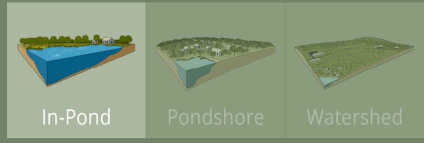
NUTRIENT MANAGEMENT

Oxygenation



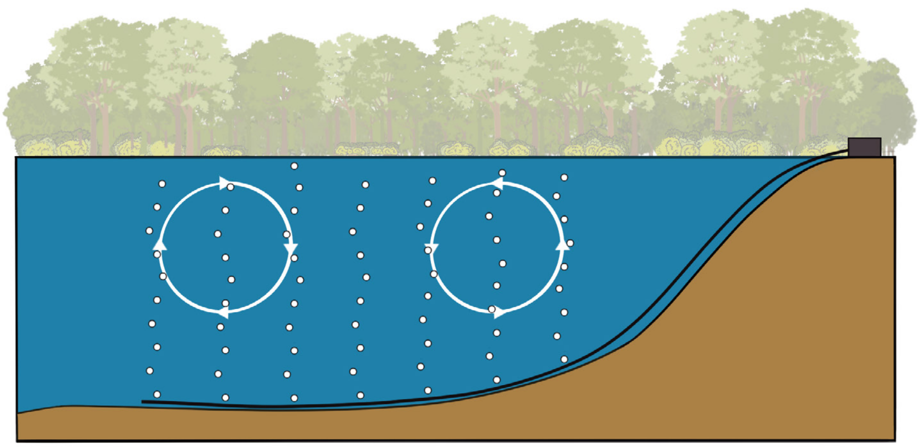
STRATEGY SCALE

THREATS ADDRESSED

- ✓ Excess Nutrients
- ✗ Pollutant Inputs
- ✓ Algal Blooms
- ✗ Erosion
- ✗ Invasive/Nuisance Species

STRATEGY GOALS	Protect	Manage	Rehabilitate
	○	●	●

STRATEGY CO-BENEFITS	Habitat	Aesthetics	Recreation
	Neutral	*Neutral*	*Neutral*



✓ **Permittable in Massachusetts**
Local review through the Conservation Commission required. List of potential permits available here.

✓ **Implemented on Cape Cod**
See examples of pond projects implemented on Cape Cod here.

✓ **Listed in 208 Plan Technologies Matrix**
Learn more about the nutrient management strategies in the Tech Matrix here.

✓ **Can be Performed at Homeowner Scale**
In small, private ponds. Local review and permitting may be required.

✗ **Nature-based Solution**

DURATION OF BENEFITS	Less than one month	One season or year	Multiple seasons or years
	●	○	○

MAINTENANCE REQUIREMENTS	Monthly	Annually	Infrequent
	●	○	○

DESCRIPTION

Oxygenation describes any process that adds concentrated oxygen to target waters. Oxygenation is intended to increase oxygen levels thereby avoiding anoxia and reducing conditions, providing deep water habitat with sufficient oxygen. Oxygenation is a subset of aeration that delivers a gas stream with high oxygen concentration to pond water, improving aquatic habitat conditions and limiting internal phosphorus recycling. There are various methods of transferring oxygen gas into a water body including: sub surface; bottom up; submersed; hypolimnion aeration; and bottom diffused aeration. Generally oxygen is pumped into the pond from delivery equipment located on the bottom of the pond to promote exchange of oxygen from air bubbles to the surrounding water. By using concentrated oxygen, less air volume must be delivered which can maintain natural stratification. The details of an oxygenation system should be designed specific to the characteristics of the pond.

ADVANTAGES

- May promote conditions less favorable to cyanobacteria blooms
- May prevent internal phosphorus release and reduce nuisance algae
- Few negative impacts expected to non-target species
- Duration of benefits extended with ongoing operations and maintenance
- Creates an aerobic environment for fish and other aquatic biota through improving dissolved oxygen levels

CONSTRAINTS

- System must be sized appropriately to accommodate volume of water being managed
- Reliance on systems in constant operation creates potential for failure during unplanned system outages
- Less cost effective than other treatments for phosphorus control, such as alum
- Best to provide more than enough oxygen - target > 5 mg/L (more like 10, 15, or 20 mg/L) - to handle potential shutdown periods
- Biggest challenge is induced oxygen demand, created by movement of water in contact with sediment, which increases the rate of oxygen consumption - action taken to satisfy oxygen demand causes increased demand
- Likely requires winterization
- Compressor often needs to be sited within the pond buffer and makes some noise

IMPLEMENTATION

POTENTIAL ACTORS

Towns: Towns may propose oxygenation in town-managed ponds

Pond Groups: May propose oxygenation in public or private ponds and provide a supportive role through education

Private Landowners: May propose oxygenation in private ponds

Land Trusts: Land trusts may provide a supportive role through education

SITING REQUIREMENTS

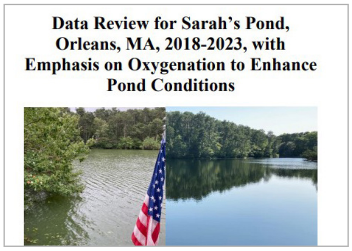
- Ponds with internal phosphorus loading and where enough natural phosphorus binders (e.g. iron and manganese) are present
- Most effective for deep lakes with anoxic bottom waters that experience sustained nutrient and sediment loading
- Onshore site for compressor, hoses, distribution system

INFORMATION NEEDS

- Watershed size, land use, waterbody size and depth, stratification, and lake trophic type need to be understood prior to assessing whether aeration is an appropriate tool or what type of aeration system design may be suitable to meet a particular management goal
- Water quality profiles (temp, DO, nutrients)
- Sediment oxygen demand
- Thermal structure
- Sediment composition

IMPLEMENTATION EXAMPLES

The Orleans Pond Coalition chose Sarah's Pond to test an *oxygen saturation technology system* as a preventive means for controlling nutrients and problem algae.


Data Review for Sarah's Pond, Orleans, MA, 2018-2023, with Emphasis on Oxygenation to Enhance Pond Conditions

RESOURCES

- For more information on aeration and oxygenation techniques, see the *Spring 2015 Lakeline article "Aeration and Oxygenation Methods for Stratified Lakes and Reservoirs"*
- The Massachusetts' Department of Conservation and Recreation's *Lakes and Ponds Program* provides related resources.

COST ESTIMATE

**$$$**$

Relative to other in-pond strategies

For all aeration/circulation strategies, costs vary substantially by pond volume and technology, as well as oxygen demand

ADDITIONAL FINANCIAL CONSIDERATIONS

Assessment: Planning, design, permitting, including required studies (e.g., water quality and oxygen studies)

Implementation: Equipment (pumps, pipes, compressor), and installation

Maintenance: Annual operating and maintenance including power and oxygen supplies, and real time data collection, if applicable

POTENTIAL FUNDING SOURCES

- **Community Preservation Act**
- **Capital Budget**
- **Grants**
- **Private Funding**

Additional information regarding potential funding sources is available ***here***.