NUTRIENT MANAGEMENT

Hydraulic Control

STRATEGY SCALE

THREATS ADDRESSED

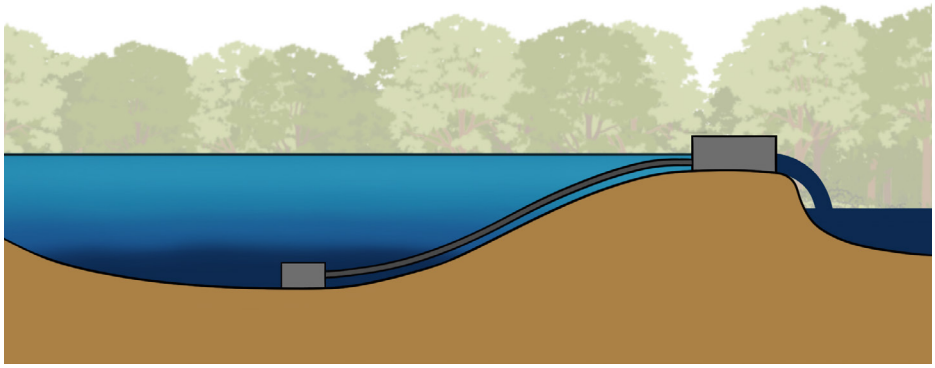
- ✓ Excess Nutrients
- ✓ Pollutant Inputs
- ✓ Algal Blooms
- ✗ Erosion
- ✗ Invasive/Nuisance Species

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

Hydraulic control involves adding and/or withdrawing water from a pond to dilute or flush nutrients and reduce loading of phosphorus. Pond hydrology and residence time can be manipulated through diversion of a nutrient-rich inflow, adding low nutrient water to dilute nutrient concentrations, or flushing of nutrient-rich water from a pond. Through hydraulic control, the concentration of nutrients (typically phosphorus) within a pond is lowered by decreasing the load of nutrients entering (diversion) or present (withdrawal) in the pond, or by adding sufficient volumes of nutrient-poor water (dilution) from an external source. In an ideal scenario, a small amount of water containing a large amount of nutrients is diverted.

ADVANTAGES

- Can be an effective means of reducing nutrient inputs to lakes with the right characteristics
- May help improve low dissolved oxygen levels
- Withdrawn nutrient rich waters may be usable as irrigation water – subject to other water chemistry considerations (e.g. hydrogen sulfide)

CONSTRAINTS

- Requires a substantial external water source and/or means for water level control which are rare on Cape Cod
- Kettle ponds not good candidates based on hydrology
- Where it has been used, phosphorus levels have dropped, but still support algal blooms
- Sends contaminated water elsewhere without addressing the source of nutrients
- Dilution / flushing water may introduce undesirable taxa

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CAPE COD COMMISSION

IMPLEMENTATION

POTENTIAL ACTORS

- **Towns:** Towns may propose hydraulic control in town-managed ponds
- **Pond Groups:** May propose hydraulic control in public or private ponds and provide a supportive role through education
- **Private Landowners:** May propose hydraulic control in private ponds
- **Land Trusts:** Land trusts may provide a supportive role through education

SITING REQUIREMENTS

- For dilution and flushing, ponds with surface water inflows and outflows where the nutrient load is undesirable and the loss of the hydrologic load will not have undue negative impacts
- For selective withrdrawal, deeper, stratified ponds with considerable internal loading of phosphorus in pond bottom sediments and anoxic conditions
- Ponds with water level control
- Ponds with short residence time (2-5 years)

INFORMATION NEEDS

- Nutrient load analysis
- Pond depth and residence time
- Detailed hydrologic budget
- Fishery assessment

IMPLEMENTATION EXAMPLES

A well-known example of dilution is the *Clean Lakes Project* at Moses Lake in Washington State. Low-phosphorus water from the Columbia River was introduced to Moses Lake over time through existing infrastructure. The addition of water with very low phosphorus has diluted phosphorus in the lake. The lake's quality improved over the course of the Clean Lakes Project from being hypereutrophic to eutrophic through the 1980s to near-mesotrophic through the 2000s.

RESOURCES

- The Massachusetts' Department of Conservation and Recreation's *Lakes and Ponds Program* provides related resources.

COST ESTIMATE

**$$-$$$**$

Relative to other in-pond strategies

Varies with technique, volume and availability of water, distance for transport, and water treatment (if needed)

ADDITIONAL FINANCIAL CONSIDERATIONS

Assessment: Hydrological, nutrient and fisheries studies; planning, design, and permitting

Implementation: Materials (pipes and pumps), equipment and installation

Maintenance: Monitoring and maintenance of materials and equipment

POTENTIAL FUNDING SOURCES

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

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