# Management Options for Aquatic Plants

Updated Oct 2006

| Option | Permit Needed? | How it Works | PROS | CONS |
|---|---|---|---|---|
| **No management** | N | Do not actively manage plants | Minimizing disturbance can protect native species that provide habitat for aquatic fauna, reduce shoreline erosion, may improve water clarity, and may limit spread of invasive species | May allow small population of invasive plants to become larger, more difficult to control later |
| | | | No financial cost | Excessive plant growth can hamper navigation and recreational lake use |
| | | | No system disturbance | May require modification of lake users' behavior and perception |
| | | | No unintended effects of chemicals | |
| | | | Permit not required | |
| **Mechanical Control** | May be required under NR 109 | Plants reduced by mechanical means | Flexible control | Must be repeated, often more than once per season |
| | | Wide range of techniques, from manual to highly mechanized | Can balance habitat and recreational needs | Can suspend sediments and increase turbidity and nutrient release |
| a. Handpulling/Manual raking | Y/N | SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake | Little to no damage done to lake or to native plant species | Very labor intensive |
| | | Works best in soft sediments | Can be highly selective | Needs to be carefully monitored |
| | | | Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing exotics | Roots, runners, and even fragments of some species, particularly Eurasian watermilfoil (EWM) will start new plants, so all of plant must be removed |
| | | | Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species | Small-scale control only |

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| b. Harvesting | Y | Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore | Immediate results | Not selective in species removed |
| | | Harvest invasives only if invasive is already present throughout the lake | EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting | Fragments of vegetation can re-root |
| | | | Usually minimal impact to lake ecology | Can remove some small fish and reptiles from lake |
| | | | Harvested lanes through dense weed beds can increase growth and survival of some fish | Initial cost of harvester expensive |
| | | | Can remove some nutrients from lake | |
| **Biological Control** | Y | Living organisms (e.g. insects or fungi) eat or infect plants | Self-sustaining; organism will over-winter, resume eating its host the next year | Effectiveness will vary as control agent's population fluctates |
| | | | Lowers density of problem plant to allow growth of natives | Provides moderate control - complete control unlikely |
| | | | | Control response may be slow |
| | | | | Must have enough control agent to be effective |
| a. Weevils on EWM | Y | Native weevil prefers EWM to other native water-milfoil | Native to Wisconsin: weevil cannot "escape" and become a problem | Need to stock large numbers, even if some already present |
| | | | Selective control of target species | Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines |
| | | | Longer-term control with limited management | Bluegill populations decrease densities through predation |

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| b. | Pathogens | Y | Fungal, bacterial, or viral pathogen introduced to target species to induce mortalitiy | May be species specific<br><br>May provide long-term control<br><br>Few dangers to humans or animals | Largely experimental; effectiveness and longevity unknown<br><br>Possible side effects not understood |
| c. | Allelopathy | Y | Aquatic plants release chemical compounds that inhibit other plants from growing | May provide long-term, maintenance-free control<br><br>Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermilfoil growth | Initial transplanting slow and labor-intensive<br><br>Spikerushes native to WI, and have not effectively limited EWM growth<br><br>Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water |
| d. | Native plantings | Y | Diverse native plant community established to compete with invasive species | Native plants provide food and habitat for aquatic fauna<br><br>Diverse native community more repellant to invasive species | Initial transplanting slow and labor-intensive<br><br>Nuisance invasive plants may outcompete plantings<br><br>Transplants from another lake or nursery may unintentionally introduce invasive species<br>Largely experimental; few well-documented cases |

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| **Physical Control** | Required under Ch. 30 / NR 107 | Plants are reduced by altering variables that affect growth, such as water depth or light levels | | |
| a. Fabrics/ Bottom Barriers | Y | Prevents light from getting to lake bottom | Reduces turbidity in soft-substrate areas | Eliminates all plants, including native plants important for a healthy lake ecosystem |
| | | | Useful for small areas | May inhibit spawning by some fish |
| | | | | Need maintenance or will become covered in sediment and ineffective |
| | | | | Gas accumulation under blankets can cause them to dislodge from the bottom |
| | | | | Affects benthic invertebrates |
| | | | | Anaerobic environment forms that can release excessive nutrients from sediment |
| b. Drawdown | Y, May require Environmental Assessment | Lake water lowered with siphon or water level control device; plants killed when sediment dries, compacts or freezes | Winter drawdown can be effective at restoration, provided drying and freezing occur. Sediment compaction is possible over winter | Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling |
| | | Season or duration of drawdown can change effects | Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction | May impact attached wetlands and shallow wells near shore |
| | | | Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality | Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced |
| | | | Success demonstrated for reducing EWM, variable success for curly-leaf pondweed (CLP) | Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning |
| | | | Restores natural water fluctuation important for all aquatic ecosystems | Winter drawdawn must start in early fall or will kill hibernating reptiles and amphibians |
| | | | | Navigation and use of lake is limited during drawdown |

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| c. | Dredging | Y | Plants are removed along with sediment | Increases water depth | Severe impact on lake ecosystem |
| | | | Most effective when soft sediments overlay harder substrate | Removes nutrient rich sediments | Increases turbidity and releases nutrients |
| | | | For extremely impacted systems | Removes soft bottom sediments that may have high oxygen demand | Exposed sediments may be recolonized by invasive species |
| | | | Extensive planning required | | Sediment testing may be necessary |
| | | | | | Removes benthic organisms |
| | | | | | Dredged materials must be disposed of |
| d. | Dyes | Y | Colors water, reducing light and reducing plant and algal growth | Impairs plant growth without increasing turbidity | Appropriate for very small water bodies |
| | | | | Usually non-toxic, degrades naturally over a few weeks. | Should not be used in pond or lake with outflow |
| | | | | | Impairs aesthetics |
| | | | | | Effects to microscopic organisms unknown |
| e. | Non-point source nutrient control | N | Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use) thereby providing fewer nutrients available for plant growth | Attempts to correct source of problem, not treat symptoms | Results can take years to be evident due to internal recycling of already-present lake nutrients |
| | | | | Could improve water clarity and reduce occurrences of algal blooms | Requires landowner cooperation and regulation |
| | | | | Native plants may be able to better compete with invasive species in low-nutrient conditions | Improved water clarity may increase plant growth |

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| **Chemical Control** | Required under NR 107 | Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae | Some flexibility for different situations | Possible toxicity to aquatic animals or humans, especially applicators |
| | | Results usually within 10 days of treatment, but repeat treatments usually needed | Some can be selective if applied correctly | Often affect desirable plant species that are important to lake ecology and compete with invasive species |
| | | Chemicals must be used in accordance with label guidelines and restrictions | Can be used for restoration activities | Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration |
| | | | | May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape |
| | | | | Often controversial |
| a. 2,4-D (e.g. Weedar, Navigate) | Y | Systemic[1] herbicide selective to broadleaf[2] plants that inhibits cell division in new tissue | Moderately to highly effective, especially on EWM | May cause oxygen depletion after plants die and decompose |
| | | Applied as liquid or granules during early growth phase | Monocots, such as pondweeds (e.g. CLP) and many other native species not affected. | May affect native dicots such as water lilies and coontail |
| | | | Can be used in synergy with endotholl for early season CLP and EWM treatments | Cannot be used in combination with copper herbicides (used for algae) |
| | | | Can be selective depending on concentration and seasonal timing | Toxic to fish |
| | | | Widely used aquatic herbicide | |

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| b. | Endothall (e.g. Aquathol) | Y | Broad-spectrum[3], contact[4] herbicide that inhibits protein synthesis | Especially effective on CLP and also effective on EWM | Affects many native pondweeds |
| | | | Applied as liquid or granules | May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring | Not as effective in dense plant beds; heavy vegetation requires multiple treatments |
| | | | | Can be selective depending on concentration and seasonal timing | Not to be used in water supplies; post-treatment restriction on irrigation |
| | | | | Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds | Toxic to aquatic fauna (to varying degrees) |
| | | | | Limited off-site drift | |
| c. | Diquat (e.g. Reward) | Y | Broad-spectrum, contact herbicide that disrupts cellular functioning | Mostly used for water-milfoil and duckweed | May affect non-target plants, especially native pondweeds, coontail, elodea, naiads |
| | | | Applied as liquid, can be combined with copper treatment | Rapid action | Toxic to aquatic invertebrates |
| | | | | Limited direct toxicity on fish and other animals | Must be reapplied several years in a row |
| | | | | | Ineffective in muddy or cold water (<50°F) |

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| d. | Fluridone (e.g. Sonar or Avast) | Y; special permit and Environmental Assessment may be required | Broad-spectrum, systemic herbicide that inhibits photosynthesis | Effective on EWM for 1 to 4 years with aggressive follow-up treatments | Affects native milfoils, coontails, elodea, and naiads, even at low concentrations |
| | | | Must be applied during early growth stage | Some reduction in non-target effects can be achieved by lowering dosage | Requires long contact time: 60-90 days |
| | | | Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107 | Slow decomposition of plants may limit decreases in dissolved oxygen | Often decreases water clarity, particularly in shallow eutrophic systems |
| | | | Applied at very low concentration at whole lake scale | Low toxicity to aquatic animals | Demonstrated herbicide resistance in hydrilla subjected to repeat treatments |
| | | | | | Unknown effect of repeat whole-lake treatments on lake ecology |
| e. | Glyphosate (e.g. Rodeo) | Y | Broad-spectrum, systemic herbicide that disrupts enzyme formation and function | Effective on floating and emergent plants | RoundUp is often illegally substituted for Rodeo; surfactants in RoundUp believed to be toxic to reptiles and amphibians |
| | | | Usually used for purple loosestrife stems or cattails | Selective if carefully applied to individual plants | Cannot be used near potable water intakes |
| | | | Applied as liquid spray or painted on loosestrife stems | Non-toxic to most aquatic animals at recommended dosages | Ineffective in muddy water |
| | | | | Effective control for 1-5 years | No control of submerged plants |

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| f. | Triclopyr (e.g. Renovate) | Y | Systemic herbicide selective to broadleaf plants that disrupts enzyme function | Effective on many emergent and floating plants | Impacts may occur to some native plants at higher doses (e.g. coontail) |
| | | | Applied as liquid spray or liquid | Most effective on dicots, such as purple loosestrife; may be more effective than glyphosate | May be toxic to sensitive invertebrates at higher concentrations |
| | | | | Control of target plants occurs in 3-5 weeks | Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm) |
| | | | | Low toxicity to aquatic animals | Sensitive to UV light; sunlight can break herbicide down prematurely |
| | | | | No recreational use restrictions following treatment | Relatively new management option for aquatic plants (since 2003) |
| g. | Copper compounds (e.g. Cutrine Plus) | Y | Broad-spectrum, systemic herbicide that prevents photosynthesis | Reduces algal growth and increases water clarity | Elemental copper accumulates and persists in sediments |
| | | | Used to control planktonic and filamentous algae | No recreational or agricultural restrictions on water use following treatment | Short-term results |
| | | | Wisconsin allows small-scale control only | Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin | Long-term effects of repeat treatments to benthic organisms unknown |
| | | | | | Toxic to invertebrates, trout and other fish, depending on the hardness of the water |
| | | | | | Clear water may increase plant growth |

[1]Systemic herbicide - Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.

[2]Broadleaf herbicide - Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.

[3]Broad-spectrum herbicide - Affects both monocots and dicots.

[4]Contact herbicide - Unable to move within the plant; kills only plant tissue it contacts directly.

**This document is intended to be a guide to available aquatic plant control techniques, and is not necessarily an exhaustive list.**
**References to registered products are for your convenience and not intended as an endorsement or criticism of that product versus other similar products.**
**Specific effects of herbicide treatment contingent on usage within label guidelines and in accordance with all applicable laws.**
**Please contact your local Aquatic Plant Management Specialist when considering a permit.**

# Aquatic Plant Control Techniques Not Allowed in Wisconsin

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| | Option | How it Works | PROS | CONS |
|---|---|---|---|---|
| **Biological Control** | | | | |
| a. | Carp | Plants eaten by stocked carp | Effective at removing aquatic plants | Illegal to transport or stock carp in Wisconsin |
| | | | Involves species already present in Madison lakes | Carp cause resuspension of sediments, increased water temperature, lower dissolved oxygen levels, and reduction of light penetration |
| | | | | Widespread plant removal deteriorates habitat for other fish and aquatic organisms |
| | | | | Complete alteration of fish assemblage possible |
| | | | | Dislodging of plants such as EWM or CLP turions can lead to accelerated spreading of plants |
| b. | Crayfish | Plants eaten by stocked crayfish | Reduces macrophyte biomass | Illegal to transport or stock crayfish in Wisconsin |
| | | | | Control not selective and may decimate plant community |
| | | | | Not successful in productive, soft-bottom lakes with many fish predators |
| | | | | Complete alteration of fish assemblage possible |
| **Mechanical Control** | | | | |
| a. | Cutting (no removal) | Plants are "mowed" with underwater cutter | Creates open water areas rapidly | Root system remains for regrowth |
| | | | Works in water up to 25 ft | Fragments of vegetation can re-root and spread infestation throughout the lake |
| | | | | Nutrient release can cause increased algae and bacteria and be a nuisance to riparian property owners |
| | | | | Not selective in species removed |
| | | | | Small-scale control only |
| b. | Rototilling | Sediment is tilled to uproot plant roots and stems | Decreases stem density, can affect entire plant | Creates turbidity |
| | | Works in deep water (17 ft) | Small-scale control | Not selective in species removed |
| | | | May provide long-term control | Fragments of vegetation can re-root |
| | | | | Complete elimination of fish habitat |
| | | | | Releases nutrients |
| | | | | Increased likelihood of invasive species recolonization |
| c. | Hydroraking | Mechanical rake removes plants from lake | Creates open water areas rapidly | Fragments of vegetation can re-root |
| | | Works in deep water (14 ft) | | May impact lake fauna |
| | | | | Creates turbidity |
| | | | | Plants regrow quickly |
| | | | | Requires plant disposal |