WRITTEN FINDINGS OF THE
WASHINGTON STATE NOXIOUS WEED CONTROL BOARD
(September 2005)

Scientific Name: *Glyceria maxima* (C. Hartm.) Holmb.

Synonyms: *Glyceriaspectabilis* Mert. & Koch
Molinia maxima Hartman
Glyceriaaquatica (L.) Wahlb., non J. & C.Presl
Poa aquatica L.

Common Name: reed sweetgrass, tall manna grass, reed grass

Family: Poaceae

Legal Status: Proposed for 2006 Noxious Weed Status as Class A weed

Description and Variation: *Glyceria maxima* is a perennial, rhizomatous wetland grass, sometimes sold as an ornamental plant. The unbranched stems are often reddish at the base and can reach a height of 2.5 meters. Leaf blades are flat, shiny, glabrous (smooth and hairless), lightly grooved by prominent midribs, and are typically 22-29 cm long and 0.7–2.0 cm wide. In the variegated variety (*G. maxima* var. *variegata*), the leaf blades are longitudinally striped with green and creamy white. The leaf tip is pointed and the leaf margins (edges) are rough to the touch when rubbed from the tip towards the leaf base. Leaf sheaths have prominent midribs, visible transverse veins, and are rough to the touch and closed near the top. Ligules (appendage on the adaxial side of the leaf at the junction of the blade and sheath) are unlobed, membranous, smooth and 5-7mm long.

The flowerhead is paniculate (arranged in a branching indeterminate flower cluster widest at the base), between 150-450 mm in length, and can be either open or symmetrically contracted. It is typically produced during the spring and summer and consists of narrow spikelets, 5-12mm long, that range from yellow to green and are tinged with a purplish hue. The inflorescence branches have short, stiff hairs.

G. maxima produces an extensive network of underground roots and rhizomes, which can comprise around 50% (fresh weight) of the grass's total biomass during the peak of the growing season (Westlake, 1966). The root system can reach one meter deep underground (DPIWE, 2002).

G. maxima looks similar to the native American mannagrass, *Glyceria grandis* Wats.; however, they can be differentiated by overall height and floral features (Mehrhoff *et al*., 2004). *G. maxima* can attain a height of 2.5 meters, has upright panicle branches, and the panicle sheaths are rough to the touch. Additionally, the glumes (one of a pair of bracts at the base of a grass flowerhead) are 2-3 mm long. *G. grandis* does not grow as tall (1.5m), has drooping panicle branches, and the panicle sheaths are smooth. Glumes are smaller, typically 1.2-1.5mm long.

Economic Importance:
Detrimental: *Glyceria maxima* requires high levels of nutrients, and under such conditions forms dense monotypic stands (Sundblad, 1989). These monocultures outcompete native plants,

thereby decreasing plant diversity (Burgess *et al*., 1990, as cited in Clarke *et al*., 2004) and reducing habitat quality, as the grass is an inferior food and nesting source for waterfowl (Burgess *et al*., 1990, as cited in Anderson and Reznicek, 1994). For example, in New Zealand *G. maxima* does not provide suitable spawning habitat for the jollytail fish (*Galaxias maculates*), compared to the native flora it displaces (Taylor, 2002). Macroinvertebrate community structure differs significantly between stream samples collected either in the presence or absence of *G. maxima*, with respect to morphospecies composition, functional feeding groups, and sample heterogeneity (Clarke et al., 2004). The macroinvertebrate communities sampled from the *G. maxima* stands were more uniform in composition, *i.e*., less diverse. This study also found that the volume of rhizomes and the sediment trapped therein was fifteen times greater in stands of *G. maxima*, and that this accumulation transformed portions of the stream into slow-flowing, anaerobic zones. In some instances, stands of *G. maxima* have completely filled in shallow dams in Tasmania (DPIWE, 2002).

Although *G. maxima* has been cultivated for wetland forage, the grass is cyanogenic, producing cyanide in its vegetative tillers but not in its seeds or flowerheads (Barton et al., 1983). Cyanide concentrations are highest in the young shoots (Sunblad, 1989) that occur during the spring and again in autumn (Barton et al., 1983).

Beneficial: The same characteristics that make *Glyceria maxima* a formidable weed also make it a candidate for wastewater nutrient removal (Sundblad and Wittgren, 1989). Despite the risk of cattle poisoning, this flood-tolerant grass has also been cultivated as forage material in wetland areas in North America, New Zealand, and Australia (Willis, 1978, as cited in Barton *et al*., 1983).

Habitat: *Glyceria maxima is* a wetland obligate species (plant that has occurred in wetland habitat 99% of the time it was sampled), which typically grows in rivers, streams, dams, and ponds. Aerenchyma (spongy tissue whose air spaces facilitate atmospheric gaseous exchange and increase buoyancy in aquatic plants) in the roots allows it to withstand periods of anoxic flooding (Sundblad and Wittgren, 1989). Although *G. maxima* can tolerate water depths up to two meters, it also appears to be capable of establishing on dry roadsides (DPIWE, 2002).

Geographic Distribution: *Glyceria maxima* is native in temperate climates of Europe and Asia.

History: *Glyceria maxima* has been introduced to southern Australia, New Zealand, the British Isles, and North America (DPIWE, 2002). It was first recorded in North America in a Lake Ontario marsh in 1940, although settlers may have introduced the forage grass as early as the late eighteenth century (Mills et al., 1993, and references therein). The cultivar *G. maxima* var. *variegata* has been used as an ornamental in North America (Martin, 2005). Its distribution in the United States has been limited to Wisconsin and Massachusetts (USDA, NRCS, 2005), but it has recently been detected in two Snohomish County ponds in Washington State.

Growth and Development: *Glyceria maxima* overwinters as small green shoots connected to short-lived rhizomes (Buttery and Lambert, 1965) that can resume growth under the flooded conditions typical of spring, so long as the water depth does not exceed 10 cm (Studer-Ehrensberger et al., 1993). This ability to begin growing in the early spring before other plants gives *G. maxima* a strong competitive advantage. Furthermore, its leaves are positioned to maximize photosynthetic activity (Sundblad, 1989). The grass is equally productive when grown in different substrate types; however, the addition of nutrients to sediment substrate significantly increases its growth rate and also increases belowground production (Van der Putten et al, 1997). *G. maxima* will continue growing year round in areas where winters are mild (Sundblad, 1990).

Reproduction: The first overwintering shoots of spring are typically reproductive, after which shoots are vegetative (Buttery and Lambert, 1965). The use of both reproductive and vegetative reproduction allows the grass to quickly dominate regions where it has already established since it continuously produces tillers throughout the growing season (Sundblad, 1989; Buttery and Lambert, 1965) while dispersing seeds to colonize new areas (DPIWE, 2002).

Seeds are dark brown, between 1.5-2.0 mm in length, and while most can germinate immediately, some can remain dormant for years (DPIWE, 2002). *G. maxima* seeds can be germinated under artificial conditions (see Van der Putten *et al.*, 1997); however it has been reported that 1-9% of the florets develop into viable seed (Dore, 1953, in Anderson and Reznicek, 1994.) Seeds germinate in early spring and young plants quickly produce network of rhizomes from which vegetative shoots arise. Flowering culms are produced after the first year, in addition to vegetative shoots. *G. maxima* can also vegetatively reproduce through fragmentation of the rhizome (DIPWE, 2002). Seeds dispersal vectors include water, machinery and vehicles carried seed-containing mud, footwear, and livestock (DIPWE, 2002).

Response to Herbicide: Because herbicide availability and regulation differ between States, as well as between countries, we recommend the Washington Department of Ecology web site for information on aquatic weed management and herbicides, available at:
http://www.ecy.wa.gov/programs/wq/links/plants.html

DIPWE (2002) provides some useful information regarding herbicide use on *G. maxima*. The most effective period to use herbicides, at least in Tasmania, is between late summer and early fall. If more than one third of the stems are in standing water, herbicide application may be ineffective. Therefore, flooding should be minimized before – and at least 12 hours following – herbicide application. Decomposition following the treatment of a large infested area can cause a drop in dissolved oxygen, so a plan to remove dead plant material should be considered.

Response to Cultural Methods: Although *Glyceria maxima* is more productive in waterlogged soil than in drained soil (Van der Putten *et al*., 1997), it can be substantially damaged when recently mowed stubble is flooded (Sundblad and Wittgren, 1989). Another option is to till the affected soil in autumn, provided that the winter is cold enough to kill the roots and rhizomes through desiccation (DIPWE, 2002). Small populations can be effectively controlled by tarping with black plastic (Rawinski, as cited in Martin, 2005).

Response to Mechanical Methods: If an infestation is detected early enough, before seeds have been produced, the prognosis for complete control is good; however, eradication of an established population will take 2-3 years of follow-up treatment (DIPWE, 2002). A large infestation can be excavated; however, follow-up treatment to destroy shoots emerging from broken rhizomes and seeds is necessary (DIPWE, 2002). Hand-pulling smaller infestations is an option so long as all pieces of stems and rhizomes are removed. *G. maxima*, after being harvested 2-3 times within a year will still have the same stem density; however, the stems are thinner and thus biomass will be lower (Sundblad 1990). Furthermore, repeated aboveground harvesting can reduce belowground rhizome biomass up to 60% (Sundblad, 1990). Once aboveground biomass has been removed, more sunlight is available to surrounding species that may then outcompete the noxious grass (Sundblad and Wittgren, 1989).

Biocontrol Potentials: No information has been found.

Rationale for Listing: *Glyceria maxima* is an aggressive grass that is a serious threat to wetlands (Anderson and Reznicek, 1994). It is already banned in Connecticut (USDA, NRCS, 2005), listed as a Category 1 (aggressive invasive exotic species whose control is a top priority) in Southern Ontario (Urban Forest Associates, 2002), prohibited in Tasmania, and will be listed as a prohibited plant in Massachusetts, effective January 1, 2006. (Interestingly, *G. maxima* var. *variegata* is recommended for ornamental ponds in South Carolina [Whetstone, et al., 2000].) In Washington State, the variegated variety has been detected in two private ponds in Snohomish County, where it is already starting to dominate. Because *G. maxima* has the potential to alter aquatic water regimes and habitat - making them difficult if not impossible to fully restore - it is critical to eradicate the species as early as possible. This grass is already on the Washington State Plant Quarantine List.

Glyceria maxima growing in Snohomish County pond, early spring.
Pictures courtesy of the Snohomish County Noxious Weed Control Board

G. maxima flowerhead. Photo by Les Mehrhoff, courtesy of IPANE
http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=54

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