

Part IV. Plant Assessment Form

For use with “Criteria for Categorizing Invasive Non-Native Plants that Threaten Colorado’s Wildlands and Agriculture”

By the Colorado Noxious Weed Advisory Committee

Electronic version: December 4, 2008

Table 1. Species and Evaluator Information

Species name (Latin binomial):	Butomus umbellatus L.
Synonyms:	None
Common names:	Flowering rush
Evaluation date (mm/dd/yy):	4/8/2010
Evaluator #1 Name/Title:	Cameron Douglass, PhD Candidate
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Address:	114 Weed Research Lab, CSU, Ft. Collins, CO 80523-1179
Evaluator #2 Name/Title:	Dr. Scott Nissen, Professor
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Section below for list committee use—please leave blank

List committee members:	enter text here
Committee review date:	enter text here
List date:	enter text here
Re-evaluation date(s):	enter text here

General comments on this assessment:

Flowering rush is a regulated species in the following states: Connecticut ("Potentially invasive" and "Banned"), Minnesota ("Prohibited"), Michigan ("Restricted"), Vermont (Class B Noxious Weed) and Washington ("Secondary Species of Concern" and "Wetland and Aquatic Weed Quarantine").

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	D	Other Pub. Mat'l	<p>Impact</p> <p><i>Enter four characters from Q1.1-1.4 below:</i></p> <p>DBDD</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>C</p>	<p>Wildlands Plant Score</p> <p><i>Using matrix, determine Overall Score and Alert Status from the first, second, and third section scores and enter below:</i></p> <p>Limited</p> <p>No Alert</p>
1.2	Impact on plant community	B	Rev'd, Sci. Pub'n		
1.3	Impact on higher trophic levels	D	Other Pub. Mat'l		
1.4	Impact on genetic integrity	D	Other Pub. Mat'l		
2.1	Role of anthropogenic and natural disturbance	A (3 pts)	Rev'd, Sci. Pub'n	<p>Invasiveness</p> <p><i>Enter the sum total of all points for Q2.1-2.7 below:</i></p> <p>18</p> <p><i>Use matrix to determine score and enter below:</i></p> <p>A</p>	
2.2	Local rate of spread with no management	A (3 pts)	Rev'd, Sci. Pub'n		
2.3	Recent trend in total area infested within state	U (0 pts)	No Information		
2.4	Innate reproductive potential Wksht A	A (3 pts)	Rev'd, Sci. Pub'n		
2.5	Potential for human-caused dispersal	A (3 pts)	Rev'd, Sci. Pub'n		
2.6	Potential for natural long-distance dispersal	A (3 pts)	Rev'd, Sci. Pub'n		
2.7	Other regions invaded	A (3 pts)	Rev'd, Sci. Pub'n		
3.1	Ecological amplitude/Range	U	Rev'd, Sci. Pub'n	<p>Distribution</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>U</p>	
3.2	Distribution/Peak frequency Wrksht B	U	No Information		

4.1	Poisonous to livestock	D (0 pts)	Other Pub. Mat'l
4.2	Detrimental to economic crops	D (0 pts)	No Information
4.3	Detrimental to management of agricultural system, rangeland and pasture	D (0 pts)	Rev'd, Sci. Pub'n
4.4	Human impacts Wrksht C	C (1 pt)	Rev'd, Sci. Pub'n

Ag/ Human Impacts
Total Points:
1
Score:
D

Agriculture
Plant Score
Overall Score:
Moderate
Alert Status:
No Alert

Table 3. Documentation

<p>Question 1.1 Impact on abiotic ecosystem processes</p>	<p>D Other Pub. Mat'l back</p>
<p>Identify ecosystem processes impacted: None reported.</p>	
<p>Rationale: None.</p>	
<p>Sources of information: None.</p>	
<p>Question 1.2 Impact on plant community composition, structure, and interactions</p>	<p>B Rev'd, Sci. Pub'n back</p>
<p>Identify type of impact or alteration: Displaces native riparian and wetland vegetation, particularly native emergent species typical of shallower waters and shoreline plants.</p>	
<p>Rationale: Flowering rush thrives in a wide variety of aquatic and riparian habitats - establishing where there is at least enough standing water to submerge rhizomes, but also growing well in very deep waters (can survive in water 6.5 feet or deeper - though such populations often do not flower). This habitat range is much greater than that of similar native aquatic and riparian bulrushes or cattail species. Though the species is not thought to move rapidly over large distances, once established the plant quickly becomes dominant at the site - one study in the St. Lawrence River found flowering rush to be much more dominant (normally representing >50% of absolute plant cover) than over aquatic invasives such as purple loosestrife and phragmites. Despite its abundance, the authors actually found that flowering rush had less of an impact on the native plant community than did the other aquatic invaders.</p>	
<p>Sources of information: Cao, L. 2010. <i>Butomus umbellatus</i>. US Geological Survey (USGS) Non-indigenous Aquatic Species Database (Online). Last updated 11 August 2008. Available at: http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100. Gainesville, FL: US Department of the Interior, USGS.</p> <p>Indiana Department of Natural Resources (IDNR). 2010. Aquatic Invasive Species: Flowering rush. Last updated April 2009. Available at: http://www.in.gov/dnr/files/ FLOWERING_RUSH.pdf. Accessed 6:12 PM 5 April 2010.</p> <p>Lavoie, C., M. Jean, F. Delisle and G. Letourneau. 2003. Exotic plant species of the St. Lawrence River wetlands: a spatial and historical analysis. <i>Journal of Biogeography</i> 30: 537-549.</p> <p>US Department of Agriculture, Forest Service (USFS). 2010. Weed of the Week: Flowering rush (<i>Butomus umbellatus</i> L.). Last updated 22 January 2007. Available at: http://na.fs.fed.us/fhp/invasive_plants/weeds/flowering-rush.pdf. Accessed 6:21 PM 5 April 2010. Newton Square, PA: USFS, Forest Health Staff.</p> <p>Washington State Noxious Weed Control Board. 2008. Written Findings: <i>Butomus umbellatus</i> L, 2 November 2008. Available at: http://www.nwcb.wa.gov/ weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf. Accessed 6:27 PM 5 April 2010.</p>	
<p>Question 1.3 Impact on higher trophic levels</p>	<p>D Other Pub. Mat'l back</p>
<p>Identify type of impact or alteration: <i>B. umbellatus</i> rhizomes and flowerheads are known to be consumed by numerous waterfowl as well as muskrats.</p>	
<p>Rationale: Beyond providing resources for wildlife, the species is not reported to have any negative impacts on</p>	

higher trophic levels.	
Sources of information: Washington State Noxious Weed Control Board. 2008. Written Findings: <i>Butomus umbellatus</i> L, 2 November 2008. Available at: http://www.nwcb.wa.gov/weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf . Accessed 6:27 PM 5 April 2010.	
Question 1.4 Impact on genetic integrity	D Other Pub. Mat'l back
Identify impacts: None.	
Rationale: <i>B. umbellatus</i> is the only member of Butomaceae family; members of two related families (<i>Alisma</i> spp and <i>Sagittaria</i> spp) in the order Alismatales are reported to occur in Colorado.	
Sources of information: Ackerfield, J. 2009. <i>The Flora of Colorado</i> . Ft. Collins, CO: Colorado State University Herbarium. 407 pp.	
US Department of Agriculture, Natural Resources Conservation Service (NRCS). 2010. The PLANTS Database (Online). Baton Rouge, LA: National Plant Data Center. Available at http://plants.usda.gov . Accessed 5:19 PM 5 April 2010.	
Question 2.1 Role of anthropogenic and natural disturbance in establishment	A Rev'd, Sci. Pub'n back
Describe role of disturbance: Disturbances that result in fragmentation of rhizomes or dispersal of bulbils will further spread the species. Also, it is reported that warmer, newly exposed substrates facilitate the establishment and sprouting of rhizome fragments, bulbils and viable seeds. In particular, deliberate or unintentional draw-downs of water levels in water bodies already infested will expose sediment that is ideal for the establishment of seeds or vegetative propagules.	
Rationale: While disturbances can play an important role in increasing the rate of invasion, populations of flowering rush are also very capable of establishing and becoming dominant at a site independent of disturbances.	
Sources of information: Global Invasive Species Database (GISD). 2010. <i>Butomus umbellatus</i> (aquatic plant). Last updated 8 July 2005. Available at: http://www.issg.org/database/species/ecology.asp?si=610&fr=1&sts= . Accessed 5:31 PM 5 April 2010.	
Lavoie, C., M. Jean, F. Delisle and G. Letourneau. 2003. Exotic plant species of the St. Lawrence River wetlands: a spatial and historical analysis. <i>Journal of Biogeography</i> 30: 537-549.	
Washington State Noxious Weed Control Board. 2008. Written Findings: <i>Butomus umbellatus</i> L, 2 November 2008. Available at: http://www.nwcb.wa.gov/weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf . Accessed 6:27 PM 5 April 2010.	
Question 2.2 Local rate of spread with no management	A Rev'd, Sci. Pub'n back
Describe rate of spread: Once populations are established they can very quickly (5-10 years) become locally dominant and represent 50-75% of the absolute plant cover at infested sites.	
Rationale: Throughout its range flowering rush populations can variably be either mainly fertile plants that	

reproduce via seeds as well as vegetative means, or infertile plants that reproduce and spread equally rapidly via the production of bulbils and rhizome fragmentation.

Sources of information: Cao, L. 2010. *Butomus umbellatus*. US Geological Survey (USGS) Non-indigenous Aquatic Species Database (Online). Last updated 11 August 2008. Available at: <http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100>. Gainesville, FL: US Department of the Interior, USGS.

Eckert, C.G., B. Massonnet and J.J. Thomas. 2000. Variation in sexual and clonal reproduction among introduced populations of flowering rush, *Butomus umbellatus* (Butomaceae). *Canadian Journal of Botany* 78: 437-446.

King County, WA. 2010. Flowering-rush (*Butomus umbellatus*). Last updated 24 March 2010. Available at: <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/flowering-rush.aspx>. Accessed 6:24 PM 5 April 2010.

Lavoie, C., M. Jean, F. Delisle and G. Letourneau. 2003. Exotic plant species of the St. Lawrence River wetlands: a spatial and historical analysis. *Journal of Biogeography* 30: 537-549.

Question 2.3 Recent trend in total area infested within state

U No Information [back](#)

Describe trend: There is no reliable information on the current (or historical) distribution of flowering rush in Colorado.

Rationale: Flowering rush is not yet reported to occur in Colorado; a survey of available and authoritative flora and checklists for Colorado did not find a single reported occurrence in the state.

Sources of information: None.

Question 2.4 Innate reproductive potential

A Rev'd, Sci. Pub'n [back](#)

Describe key reproductive characteristics: Hundreds of flowers - which are perfect and primarily insect-pollinated (though plants are also self-compatible) - are produced on individual plants from July to September, with seeds ripening in August and September. Seeds can disperse over large distances, and plants also have the capacity to spread via fragmentation of fleshy rhizomes. Bulbils also form along the surface of both rhizomes and umbels, and these structures can easily detach and will quickly germinate once they reach the water surface or land on soil.

Rationale: Plants may be either sexually fertile, self-compatible diploids ($2n = 26$) or sterile triploids ($3n = 36$); the former spread vigorously via the production of seeds as well as hundreds of clonal bulbils per plant, while the later propagate only through bilbil production and rhizome fragmentation. Populations closer to the species initial locations of introduction near Montreal and Quebec City (i.e. NY, Michigan, Ohio, and Ontario) appear to have a great proportion of fertile plants than do newer locations farther north and west - although this variation has no effect on overall population size or density.

B. umbellatus seeds will float for up to two days, have a dormancy requirement, and can remain viable after five years of storage in cold water. Seed viability can be 65% under ideal conditions, and individual umbels can produce upwards of 6,000 seeds. Seed viability appears to be strongly tied to the length and quality of the stratification period, with an increase of 51% in viability seen with an additional 8 weeks of cold stratification (from 20 to 28 weeks). Bilbil production in some Canadian populations was estimated at up to 60% of all plants, with plants producing an average of 300 bulbils per growing season.

Sources of information: Cao, L. 2010. *Butomus umbellatus*. US Geological Survey (USGS) Non-indigenous Aquatic Species Database (Online). Last updated 11 August 2008. Available at: <http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100>. Gainesville, FL: US Department of the Interior, USGS.

Eckert, C.G., B. Massonnet and J.J. Thomas. 2000. Variation in sexual and clonal reproduction among introduced populations of flowering rush, *Butomus umbellatus* (Butomaceae). *Canadian Journal of Botany* 78: 437-446.

Eckert, C.G., K. Lui, K. Bronson, P. Corradini and A. Bruneau. 2003. Population genetic consequences of extreme variation in sexual and clonal reproduction in an aquatic plant. *Molecular Ecology* 12: 331-344.

Global Invasive Species Database (GISD). 2010. *Butomus umbellatus* (aquatic plant). Last updated 8 July 2005. Available at: <http://www.issg.org/database/species/ecology.asp?si=610&fr=1&sts=>. Accessed 5:31 PM 5 April 2010.

Indiana Department of Natural Resources (IDNR). 2010. Aquatic Invasive Species: Flowering rush. Last updated April 2009. Available at: [http://www.in.gov/dnr/files/ FLOWERING_RUSH.pdf](http://www.in.gov/dnr/files/FLOWERING_RUSH.pdf). Accessed 6:12 PM 5 April 2010.

King County, WA. 2010. Flowering-rush (*Butomus umbellatus*). Last updated 24 March 2010. Available at: <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/flowering-rush.aspx>. Accessed 6:24 PM 5 April 2010.

Lui, K., F.L. Thompson and C.G. Eckert. 2005. Causes and consequences of extreme variation in reproductive strategy and vegetative growth among invasive populations of a clonal aquatic plant, *Butomus umbellatus* L. (Butomaceae). *Biological Invasions* 7: 427-444.

Washington State Noxious Weed Control Board. 2008. Written Findings: *Butomus umbellatus* L, 2 November 2008. Available at: http://www.nwcb.wa.gov/weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf. Accessed 6:27 PM 5 April 2010.

Watson, L. and M.J. Dallwitz. 1992. Butomaceae Rich. in *The Families of Flowering Plants: Descriptions, Illustrations, Identification, and Information Retrieval* (Online). Last updated 21 March 2010. Available at: <http://delta-intkey.com>. Accessed 6:17 PM 5 April 2010.

Question 2.5 Potential for human-caused dispersal

A Rev'd, Sci. Pub'n [back](#)

Identify dispersal mechanisms: Though intentionally introduced for its horticultural value, flowering rush is also commonly spread in ballast water, and transported by ice or on boating equipment. There are also numerous reports of the plant being spread for use in gardens, and consequently it is widely available in the aquatic nursery trade.

Rationale: Flowering rush was likely first introduced in or near Montreal, most likely for its value in water gardens, and it then spread down the St. Lawrence River and into the Great Lakes in large part through dispersal in ballast tanks and on boats themselves.

Sources of information: Cao, L. 2010. *Butomus umbellatus*. US Geological Survey (USGS) Non-indigenous Aquatic Species Database (Online). Last updated 11 August 2008. Available at: <http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100>. Gainesville, FL: US Department of the Interior, USGS.

Global Invasive Species Database (GISD). 2010. *Butomus umbellatus* (aquatic plant). Last updated 8 July 2005. Available at: <http://www.issg.org/database/species/ecology.asp?si=610&fr=1&sts=>. Accessed 5:31 PM 5 April 2010.

Indiana Department of Natural Resources (IDNR). 2010. Aquatic Invasive Species: Flowering rush. Last updated April 2009. Available at: [http://www.in.gov/dnr/files/ FLOWERING_RUSH.pdf](http://www.in.gov/dnr/files/FLOWERING_RUSH.pdf). Accessed 6:12 PM 5 April 2010.

<p>Lavoie, C., M. Jean, F. Delisle and G. Letourneau. 2003. Exotic plant species of the St. Lawrence River wetlands: a spatial and historical analysis. <i>Journal of Biogeography</i> 30: 537-549.</p> <p>Les, D.H. and L.J. Mehrhoff. 1999. Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. <i>Biological Invasions</i> 1: 281-300.</p>	
<p>Question 2.6 Potential for natural long-distance dispersal</p>	<p>A Rev'd, Sci. Pub'n back</p>
<p>Identify dispersal mechanisms: Flowering rush can disperse over long distances by the production of floating seeds, bulbils, or rhizome fragmentation.</p>	
<p>Rationale: In addition to water transport of seeds and plant material, muskrats and waterfowl use and transport plant parts, contributing to its spread.</p>	
<p>Sources of information: Cao, L. 2010. <i>Butomus umbellatus</i>. US Geological Survey (USGS) Non-indigenous Aquatic Species Database (Online). Last updated 11 August 2008. Available at: http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100. Gainesville, FL: US Department of the Interior, USGS.</p> <p>Lavoie, C., M. Jean, F. Delisle and G. Letourneau. 2003. Exotic plant species of the St. Lawrence River wetlands: a spatial and historical analysis. <i>Journal of Biogeography</i> 30: 537-549.</p> <p>Les, D.H. and L.J. Mehrhoff. 1999. Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. <i>Biological Invasions</i> 1: 281-300.</p> <p>Washington State Noxious Weed Control Board. 2008. Written Findings: <i>Butomus umbellatus</i> L, 2 November 2008. Available at: http://www.nwcb.wa.gov/weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf. Accessed 6:27 PM 5 April 2010.</p>	
<p>Question 2.7 Other regions invaded</p>	<p>A Rev'd, Sci. Pub'n back</p>
<p>Identify other regions: Common in the northeastern US, and widespread though only locally invasive in regions of the northern and midwestern US and neighboring regions of Canada - mainly surrounding the Great Lakes. Flowering rush has also been reported to occur at a few locations (Silver Lake in Whatcom County and the Yakima River in Benton County) in Washington State, and in Flathead Lake and River in Montana.</p>	
<p>Rationale: Flowering rush was first widely reported as naturalized in the region surrounding Montreal in 1905/6, but French missionaries reported its introduction in that region as early as 1897. In invaded regions the species in a variety of aquatic and riparian habitats, from deep standing water to newly exposed substrate on the banks of slower moving rivers.</p>	
<p>Sources of information: Cao, L. 2010. <i>Butomus umbellatus</i>. US Geological Survey (USGS) Non-indigenous Aquatic Species Database (Online). Last updated 11 August 2008. Available at: http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100. Gainesville, FL: US Department of the Interior, USGS.</p> <p>Core, E.L. 1941. <i>Butomus umbellatus</i> in America. <i>Ohio Journal of Science</i> 41(2): 79-85. Available at: http://hdl.handle.net/1811/3136. Accessed 5:58 PM 5 April 2010.</p> <p>Indiana Department of Natural Resources (IDNR). 2010. Aquatic Invasive Species: Flowering rush. Last updated April 2009. Available at: http://www.in.gov/dnr/files/ FLOWERING_RUSH.pdf. Accessed 6:12 PM 5 April 2010.</p> <p>King County, WA. 2010. Flowering-rush (<i>Butomus umbellatus</i>). Last updated 24 March 2010. Available at: http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/flowering-</p>	

rush.aspx. Accessed 6:24 PM 5 April 2010.

Washington State Noxious Weed Control Board. 2008. Written Findings: *Butomus umbellatus* L, 2 November 2008. Available at: http://www.nwcb.wa.gov/weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf. Accessed 6:27 PM 5 April 2010.

Question 3.1 Ecological amplitude/Range

U Rev'd, Sci. Pub'n [back](#)

Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: There is no reliable information on the introduction or distribution of flowering rush in Colorado. Information is given in the following section that describes the species general preferred habitat. Given its hardiness and ability to disperse (through both natural and anthropogenic means) it would not be surprising that the species has already been introduced to Colorado, though is clearly not yet widespread.

Rationale: Flowering rush is an obligate wetland species, and is generally found in shallower portions of lakes, riparian zones along slower-moving rivers and streams, and in wetlands and marshes. However, the plant can survive and spread in deeper water, with reports infestations floating in water nine feet deep. Species does not tolerate salt or brackish waters. Has a very wide range (zones 3-10) of hardiness; rhizomes in particular are known to be very cold-hardy. Flowering rush can tolerate a wide range of soil conditions, though it appears to prefer those that are neutral to alkaline. Plants are completely intolerant of shade.

Sources of information: Cao, L. 2010. *Butomus umbellatus*. US Geological Survey (USGS) Non-indigenous Aquatic Species Database (Online). Last updated 11 August 2008. Available at: <http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100>. Gainesville, FL: US Department of the Interior, USGS.

Lavoie, C., M. Jean, F. Delisle and G. Letourneau. 2003. Exotic plant species of the St. Lawrence River wetlands: a spatial and historical analysis. *Journal of Biogeography* 30: 537-549.

US Department of Agriculture, Forest Service (USFS). 2010. Weed of the Week: Flowering rush (*Butomus umbellatus* L.). Last updated 22 January 2007. Available at: http://na.fs.fed.us/fhp/invasive_plants/weeds/flowering-rush.pdf. Accessed 6:21 PM 5 April 2010. Newton Square, PA: USFS, Forest Health Staff.

Washington State Noxious Weed Control Board. 2008. Written Findings: *Butomus umbellatus* L, 2 November 2008. Available at: http://www.nwcb.wa.gov/weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf. Accessed 6:27 PM 5 April 2010.

Wisconsin Department of Natural Resources (WDNR). 2010. Flowering rush (*Butomus umbellatus*). Last updated 3 September 2004. Available at: http://www.dnr.state.wi.us/invasives/fact/rush_flowering.htm.

Question 3.2 Distribution/Peak frequency

U No Information [back](#)

Describe distribution: There is no reliable information on the current distribution of *B. umbellatus* in Colorado.

Rationale: None.

Sources of information: None.

Question 4.1 Poisonous to Livestock

D Other Pub. Mat'l [back](#)

Describe impacts in terms of high probability of death, long-term health impacts, or short-term health impacts: Flowering rushes do not contain compounds that are known to be toxic to livestock, in fact the rhizomes and

flowerheads are edible and known to be foraged by waterfowl and muskrats.	
Rationale: None.	
Sources of information: Washington State Noxious Weed Control Board. 2008. Written Findings: <i>Butomus umbellatus</i> L, 2 November 2008. Available at: http://www.nwcb.wa.gov/weed_info/written_findings/CLASS%20A%20PDFs/Flowering_rush%20wf,%2011-02-08.pdf . Accessed 6:27 PM 5 April 2010. Watson, L. and M.J. Dallwitz. 1992. <i>Butomaceae</i> Rich. in <i>The Families of Flowering Plants: Descriptions, Illustrations, Identification, and Information Retrieval (Online)</i> . Last updated 21 March 2010. Available at: http://delta-intkey.com . Accessed 6:17 PM 5 April 2010.	
Question 4.2 Detrimental to Economic Crops	D No Information back
Describe impacts to all aspects of cropping systems (see guidelines): None reported.	
Rationale: None.	
Sources of information: None.	
Question 4.3 Detrimental to Mgmt of Agricultural System, Rangeland and Pasture	D Rev'd, Sci. Pub'n back
Describe impacts to water diversion systems, increased water use, reduced forage for livestock: Flowering rush will only establish in standing or very slowly moving waters, so it would not pose a threat to irrigation or water diversion systems.	
Rationale: See above.	
Sources of information: Lavoie, C., M. Jean, F. Delisle and G. Letourneau. 2003. Exotic plant species of the St. Lawrence River wetlands: a spatial and historical analysis. <i>Journal of Biogeography</i> 30: 537-549. Les, D.H. and L.J. Mehrhoff. 1999. Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. <i>Biological Invasions</i> 1: 281-300.	
Question 4.4 Human Health Impacts	C Rev'd, Sci. Pub'n back
Describe key human impacts such as; irritants, property values, recreational values, and industry impacts: Can serve as an obstacle to boat traffic and the use of lake shores and stream/river banks.	
Rationale: Flowering rush is very difficult to control, and very dense and widespread populations could be expected to affect the value of water-front properties. The species is known and has been reported to be widespread in the nursery industry, though the negative impact of its listing on the industry is difficult to assess given available information.	
Sources of information: Cao, L. 2010. <i>Butomus umbellatus</i> . US Geological Survey (USGS) Non-indigenous	

Aquatic Species Database (Online). Last updated 11 August 2008. Available at: <http://nas.er.usgs.gov:80/queries/FactSheet.aspx?speciesID=1100>. Gainesville, FL: US Department of the Interior, USGS.

Indiana Department of Natural Resources (IDNR). 2010. Aquatic Invasive Species: Flowering rush. Last updated April 2009. Available at: [http://www.in.gov/dnr/files/ FLOWERING_RUSH.pdf](http://www.in.gov/dnr/files/FLOWERING_RUSH.pdf). Accessed 6:12 PM 5 April 2010.

Les, D.H. and L.J. Mehrhoff. 1999. Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. *Biological Invasions* 1: 281-300.

Wisconsin Department of Natural Resources (WDNR). 2010. Flowering rush (*Butomus umbellatus*). Last updated 3 September 2004. Available at: http://www.dnr.state.wi.us/invasives/fact/rush_flowering.htm.

Worksheet A

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Reaches reproductive maturity in 2 years or less	Yes: 1 pt
Dense infestations produce >1,000 viable seed per square meter	Yes: 2 pts
Populations of this species produce seeds every year.	Yes: 1 pt
Seed production sustained over 3 or more months within a population annually	Yes: 1 pt
Seeds remain viable in soil for three or more years	Yes: 2 pts
Viable seed produced with <i>both</i> self-pollination and cross-pollination	Yes: 1 pt
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	Yes: 1 pt
Fragments easily and fragments can become established elsewhere	Yes: 2 pts
Resprouts readily when cut, grazed, or burned	Yes: 1 pt
	12 pts Total Unknowns
	A (6+ pts)

Note any related traits: None

Worksheet B - Colorado Ecological Types and Land Use

[back](#)

Major Ecological and Land Use Types	Minor Ecological and Land Use Types	Code*
Freshwater and Aquatic Systems	lakes, ponds, reservoirs	Unknown
	rivers, streams, canals	Unknown
Riparian and wetlands	Riparian forest	Unknown
	Riparian shrublands	Unknown
	Wet meadows	Unknown
Grasslands	Shortgrass prairie	score
	Tallgrass prairie	score
	Sandsage prairie	score
	Montane meadows	score
Irrigated Agriculture	Hay meadows	score
	Irrigated crops (alfalfa, corn, sugar beets)	score
Dryland Agriculture	Dryland crops (wheat, corn, millet, dryland grass hay, sunflowers, mustard for biodiesel)	score
Developed Lands	Urban, exurban, industrial	score
Arid Shrublands	Sagebrush shrublands	score
	Foothills shrublands	score
	Gambel oak shrublands	score
Woodlands	Pinyon - juniper	score
	Ponderosa pine	score
	Limber pine	score
Forest	Lodgepole pine	score
	Spruce-fir	score
Alpine	Boulder and rock fields	score
	Dwarf shrublands	score
	Tundra	score
Barrens (lower elevation)	Dunes	score
	Rock outcrops	score
	Canyonlands	score

* A. means >50% of type occurrences are invaded; B means >20% to 50%; C. means >5% to 20%; D. means present but ≤5%; U. means unknown (unable to estimate percentage of occurrences invaded).

Worksheet C – Human Impacts

Human health impacts; irritants (sap), spines, poisonous, and/or smoke impacts	No: 0 pt
Property values are decreased due to increased risk of fire	No: 0 pts
Decreased property value due to moderate to heavy infestations	Unknown: 0 pts
Decreased land value for recreational use; boating, fishing, camping, etc.	Yes: 1 pt
Impact of listing detrimental to industry; agriculture, horticulture, nursery, and/or seed	Unknown: 0 pts
	1 pt 2 unknowns
	C (1-2)
Note any related traits: enter text here	