



## Rare Plant Survey of the Lake Terrell Wildlife Area

Prepared for  
Washington Department of Fish and Wildlife

Prepared by  
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**ON THE COVER:** Southeast arm of Lake Terrell with habitat of *Cicuta bulbifera* along the lakeshore and small islands.

Photographs by: Walter Fertig

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## Introduction

The Lake Terrell Unit of the Whatcom Wildlife Area is located ten miles northwest of Bellingham, Washington and was purchased by the Washington Department of Fish and Wildlife (WDFW) in the late 1940s to promote fishing, waterfowl hunting, boating, and other recreational pursuits (WDFW 2006). The area was formerly managed as a dairy farm that included a small natural lake and two peatland marshes (Heimer 2017). In 1950, a dam was constructed on Terrell Creek that increased the size of the original lake and blocked a natural coho salmon run. Other developments included dredging and constructing artificial islands in the peat marsh areas of the southwest and southeast arms of Lake Terrell, cultivating introduced grasses for waterfowl, and building a fishing pier and boat ramp. In 2012 the original dam was replaced to allow access for salmon and to better manage water levels in the lake to promote growth of aquatic and emergent plants that provide waterfowl habitat (WDFW 2006).

Nearly 200 plant species have been documented from Lake Terrell (Heimer 2017; Consortium of Pacific Northwest Herbaria 2018 [<http://www.pnwherbaria.org>]). Notable among these species are three rare plant taxa currently or formerly tracked as state Threatened or Sensitive by the Washington Natural Heritage Program (WNHP) (Table 1) (Camp and Gamon 2011; WNHP 2018). Lake Terrell also contains at least three state noxious weed species: Eurasian milfoil (*Myriophyllum spicatum*), purple loosestrife (*Lythrum salicaria*), and invasive knotweed (*Fallopia japonica* and other *Fallopia* taxa formerly included in *Polygonum*) (Heimer 2017). Active control and eradication measures are being undertaken for these noxious weeds at Lake Terrell, including the application of the herbicide 2,4-D at the south end of the lake near the boat ramp and fishing pier for Eurasian milfoil and spot applications of herbicide for scattered patches of purple loosestrife (Heimer 2017, Dave Heimer personal communication, Laurel Baldwin personal communication).

In 2017, WDFW contracted with WNHP to conduct a botanical survey of Lake Terrell in order to relocate historical populations of rare plant species and to document any potential deleterious impacts of herbicide treatment. The following report summarizes the results of this survey.

## Methods

Surveys were conducted at Lake Terrell on 15-16 August, 2018. Daniel Zimmerman of WDFW piloted an airboat that allowed us access to the entire perimeter of the main body of Lake Terrell and its shallow, marshy, southeast and southwest arms. These latter areas would not have been readily accessible without the airboat. We systematically followed the shoreline at idle-speed and from an approximate distance of 0.5 to 1 m which allowed us to observe individual plants close-up. If we could not safely approach the shore we used binoculars to survey the vegetation. When we observed one of the target plant species we approached as closely as possible to record the latitude and longitude with a Garmin GPSmap 60CSX, count the number of individuals and their reproductive condition (flowering, fruiting, or vegetative), describe habitat conditions (including associated plant species, soil type and moisture, landscape position), and assess potential threats or management issues. Each population was also photographed and a set of

**Table 1. Rare plant species reported for Lake Terrell.**

Species	Natural Heritage Rank	State Status	Current Status at Lake Terrell
<i>Carex comosa</i> (bristly sedge)	G5/S3	None (formerly Sensitive)	Last observed in 2004 (4 clumps at N end of lake). Second population by boat landing at S end of lake was last observed in 1989. No populations found in 2018 survey.
<i>Cicuta bulbifera</i> (bulb-bearing water-hemlock)	G5/S2S3	Sensitive	Documented along NW shore of lake in 1972; relocated at 13 subpopulations in 3 main areas (N end of lake and marshy areas in SE and SW arms of lake) in 2018.
<i>Rotala ramosior</i> (lowland toothcup)	G5/S2	Sensitive (formerly Threatened)	Falsely reported (1948 collection from Lake Terrell is misidentified <i>Ludwigia palustris</i> ); no populations found in 2018 survey and suitable habitat probably lacking.

herbarium vouchers of target species and other taxa of interest were collected for the University of Washington and Western Washington University herbaria.

## Results

### *Carex comosa*

*Carex comosa* (Figure 1) is known from two sites along Lake Terrell. In 1989, Binda Colebrook documented three plants along the south shore of the lake near the boat landing. RareCare volunteers Barry Wendling and Ellen Kuhlmann were unable to relocate this population in 2004, but did find a new subpopulation consisting of four clumps at the north end of Lake Terrell near the outlet of Terrell Creek. We were unable to relocate either of these populations in 2018, or find any additional populations along the lake. Development around the boat landing may have eliminated this subpopulation, although some unsurveyed habitat may still occur on the banks immediately west of the ramp where we were unable to access the shore from the airboat. The area at the north end of the lake has a dense population of reed canary grass (*Phalaris arundinacea*) which made it difficult to relocate that subpopulation. All sedge species were surprisingly uncommon along the shores of Lake Terrell, perhaps due to displacement by reed canary grass. We did find several small patches of beaked sedge (*Carex utriculata*) in marshy, low lying areas with little or no *Phalaris* in the southwest and southeast arms of Lake Terrell. *Carex utriculata* is a widespread species that superficially resembles *C. comosa*, but has a straight, rather than deeply forked, beak at the tip of the perigynia, and erect, rather than drooping, fruiting spikes.

While the Lake Terrell population is small and possibly declining, the species as a whole seems to be doing better across Washington. Since 2004, 13 new populations of *Carex comosa* have been discovered in the state, raising the number of extant occurrences to 24 (another 11 populations are historical). *Carex comosa* is now known to occur from Whatcom to Thurston County west of the Cascades and from Chelan to Pend Oreille and Spokane counties east of the Cascades, with additional historical populations in Kittitas and Walla Walla counties. At least

five extant populations are found in protected areas (Fish Lake Bog Research Natural Area, Whatcom Wildlife Area, and Elbow Lake, Flaming Geysers, and Millersylvania state parks). Based on these changes in its status, the rank of *Carex comosa* was downgraded from S2 (imperiled) to S3 (vulnerable) by WNHP in 2017 and it was dropped as a State Sensitive species.



Figure 1. *Carex comosa*. Photo by Ben Legler, provided with permission. 2004. Burke Herbarium Image Collection (<http://biology.burke.washington.edu>)

### ***Cicuta bulbifera***

At Lake Terrell, *Cicuta bulbifera* (Figures 2 and 3) was known from a single historical collection made by R.J. Taylor in the “moist flood zone” on the northwest side of the lake in 1972. Barry Wendling attempted to relocate this population in 2004 but was unsuccessful. In 2018, Daniel Zimmerman and I found 13 small patches of *C. bulbifera* in three main locations on Lake Terrell (Figures 4 and 5). The largest population consisted of three patches and 28 plants at the far north end of the lake, just east of the outlet of Terrell Creek. Five scattered patches with a total of 20 plants were observed along the shore of the southeast arm of the lake and on scattered islands within this bay, and another five patches and 12 plants were observed in the southwest arm (Figure 4). In total, we found only 60 flowering, fruiting, and vegetative individuals (Table 2). *Cicuta bulbifera* was found almost exclusively along the edge of dense thickets of cattail (*Typha latifolia*) and reed canarygrass on muddy organic-rich soil. It was notably absent from stands of





Figure 2 (Above left): Flowering stem of *Cicuta bulbifera* with pale, nut-like asexual bulblets in whorls in leaf axils.

Figure 3 (Above, right): Leaf of *Cicuta bulbifera* with narrowly linear leaflet segments. Both photos by Walter Fertig, 15 August 2018.

bulrush (*Schoenoplectus acutus* and *S. tabernaemontani*) that occur along most of the eastern and western shores of the main body of Lake Terrell.

This species is difficult to observe when growing amid dense vegetation and could be present from more sites along the lake, especially in the southwest and southeast inlets. It is consistently found at low densities, however, and so the total population at Lake Terrell is probably not significantly greater.

The area on the northwest shore of Lake Terrell where Taylor collected *Cicuta bulbifera* in 1972 may be within a private inholding. This site has been impacted in the past by livestock grazing and suitable habitat for *C. bulbifera* may no longer be present. This species is highly toxic to livestock (and humans) and is not likely to be extensively grazed.





Figure 4. Orthophoto image of the distribution of *Cicuta bulbifera* at Lake Terrell based on August 2018 survey. Individual patches of *C. bulbifera* indicated in red. Note the congregation of these patches in 3 main subpopulations at the north end of the lake near the outlet of Terrell Creek and in the shallow, densely vegetated southwest and southeast lobes of the lake.

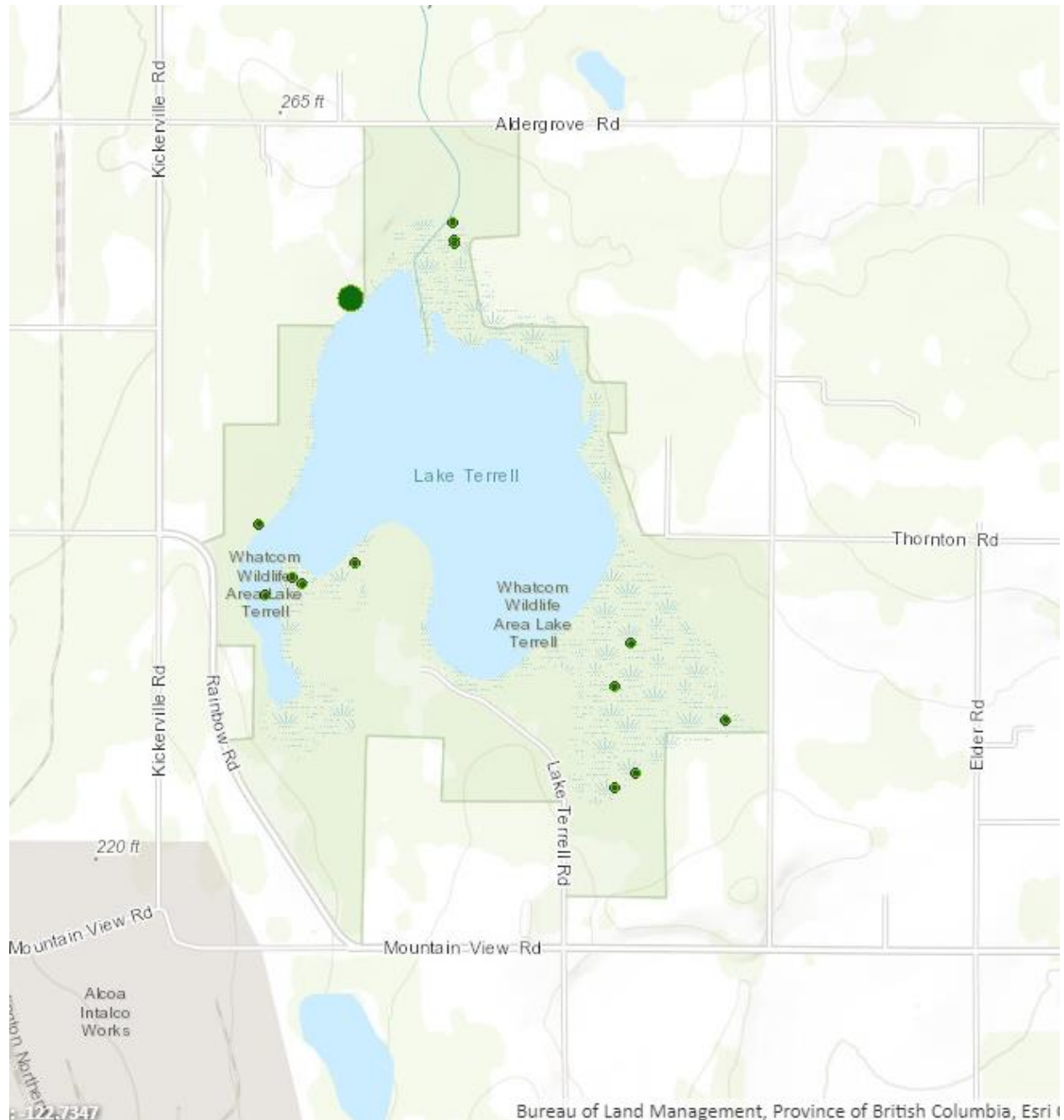


Figure 5. Map of the distribution of *Cicuta bulbifera* at Lake Terrell. Individual patches of *C. bulbifera* indicated in green. Note the congregation of these patches in 3 main subpopulations at the north end of the lake near the outlet of Terrell Creek and in the shallow, densely vegetated southwest and southeast lobes of the lake. The larger circle along the NW shore indicates the approximate location of the 1972 collection by R.J. Taylor.

**Table 2. *Cicuta bulbifera* subpopulations at Lake Terrell.**

Location	Latitude/Longitude	TRS	# of Plants in 2018
NW shore of lake	48° 52' 16.7" N -122° 41' 37.3" W	T39N R1E S16 SE4 NW4	0 (last found in 1972)
N end of lake E of Terrell Creek	48° 52' 23.9" N -122° 41' 18.3" W	T39N R1E S16 NE4 NE4 SW4 NE4	7
N end of lake E of Terrell Creek	48° 52' 26.2" N -122° 41' 18.7" W	T39N R1E S16 SE4 SE4 NW4 NE4	3
N end of lake E of Terrell Creek	48° 52' 23.5" N -122° 41' 18.4" W	T39N R1E S16 NE4 NE4 SW4 NE4	18
SE arm of lake	48° 51' 14.6" N -122° 40' 47.4" W	T39N R1E S22 NE4 SW4 NW4 SW4	5
SE arm of lake	48° 51' 16.4" N -122° 40' 43.3" W	T39N R1E S22 SE4 NE4 NW4 SW4	2
SE arm of lake	48° 51' 23.2" N -122° 40' 26.0" W	T39N R1E S22 SW4 SE4 SE4 NW4	2
SE arm of lake	48° 51' 27.3" N -122° 40' 47.5" W	T39N R1E S22 SE4 NW4 SW4 NW4	1
SE arm of lake	48° 51' 32.8" N -122° 40' 44.2" W	T39N R1E S22 NW4 NE4 SW4 NW4	10
SW arm of lake	48° 51' 48.0" N -122° 41' 55.9" W	T39N R1E S16 SE4 SE4 SW4 SW4	1
SW arm of lake	48° 51' 43.0" N -122° 41' 37.5" W	T39N R1E S21 SE4 NE4 NE4 NW4	6
SW arm of lake	48° 51' 40.3" N -122° 41' 47.6" W	T39N R1E S21 SE4 NW4 NE4 NW4	1
SW arm of lake	48° 51' 41.3" N -122° 41' 49.6" W	T39N R1E S21 SW4 NW4 NE4 NW4	2
SW arm of lake	48° 51' 38.9" N -122° 41' 54.7" W	T39N R1E S21 NE4 SE4 NW4 NW4	2
<b>Total</b>			<b>60</b>

***Rotala ramosior***

*Rotala ramosior* was known from Lake Terrell based on a specimen collected by R.G. Jeffrey on 1 August 1948 and deposited at the Marion Ownbey Herbarium at Washington State University. Initially, I thought we had relocated this species amid the floating mat vegetation and muddy shores of small islands throughout the southeast arm of Lake Terrell. On further inspection, I realized that these plants were actually *Ludwigia palustris*, a distantly related species in the evening-primrose family. Vegetatively and in fruit, *Rotala ramosior* and *Ludwigia palustris* are remarkably similar. Both have reddish stems with opposite, slender leaves with short petioles and paired 4-merous fruits with short calyx lobes enclosing a rounded capsule (Figures 6 and 7). *Rotala* differs in having white petals (*L. palustris* lacks petals), a rounded (rather than 4-sided) calyx, and proportionally longer and narrower leaf blades (Camp and Gamon 2011). Once we learned this distinction, Daniel Zimmerman and I found *Ludwigia palustris* to be locally abundant in suitable sites throughout the shallow southeastern and southwestern lobes of Lake Terrell. It was less frequent at scattered locations along the north and west shore of the main body of the lake. We did not encounter any populations of *Rotala ramosior*.

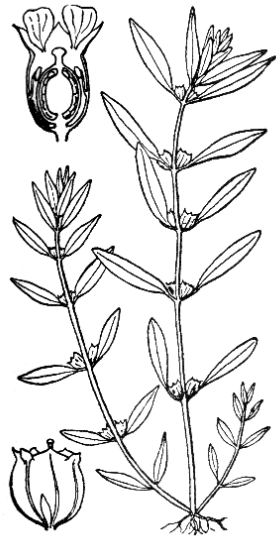


Figure 6 above, left: *Rotala ramosior* from Britton and Brown (1913). Note the slender leaf blades and the presence of petals on the flowers (inset in upper left).

Figure 7 above, right: *Ludwigia palustris* in fruit from Lake Terrell, 15 August 2018. Photo by Walter Fertig.

Figure 8, below: Close up of *Jeffrey 48-21* (WS: 189644), the specimen originally identified as *Rotala ramosior* from Lake Terrell. This specimen was misidentified and is actually *Ludwigia palustris*. Photo by Kimberly Hanson, Collections Manager, Marion Ownbey herbarium (WS) at Washington State University.





After completing the field work at Lake Terrell, I contacted Kimberly Hanson, Collections Manager of the Washington State University herbarium, to ask her to send me a digital photograph of the Jeffrey specimen from Lake Terrell (Figure 8). This specimen has the same oblanceolate leaf shape and 4-angled calyx characters of *Ludwigia palustris* (Figure 7) and is clearly a misidentification of *Rotala ramosior*. The Jeffrey collection was the only record of *Rotala ramosior* west of the Cascade Range in Washington and the only specimen from bog-like lakeshores (the species is otherwise known from fine sand, silt, or mudflats of free-flowing reaches of the Columbia River and tributaries). It is likely that *Rotala ramosior* was never found at Lake Terrell or west of the Cascades, and so should be dropped from the species list for the Lake Terrell area.

## Discussion and Management Recommendations

Presently, *Cicuta bulbifera* is the only Washington plant species of special concern known to occur at Lake Terrell. *Carex comosa* has been documented at the lake as recently as 2004, but was dropped as a state Sensitive species in 2017 following the discovery of more than a dozen new occurrences in the past 18 years. *Rotala ramosior* was previously reported for Lake Terrell based on a 1948 specimen that has been shown to be misidentified. Lake Terrell does not contain suitable habitat for *Rotala ramosior* and it no longer needs to be a target of conservation attention in the area (though it remains a state Sensitive species in eastern Washington).

The populations of *Cicuta bulbifera* at Lake Terrell are relatively small and scattered, but are restricted to three primary areas (Figures 4 and 5). Most of these populations are confined to the shallow, heavily vegetated marshy shores and islands in the southeast and southwest arms of Lake Terrell in areas managed primarily for waterfowl nesting habitat and sport hunting. These areas are not infested with Eurasian water milfoil and are not being targeted for herbicide treatment of this aquatic pest. These areas might be subject to some diffusion of 2,4-D unless the inlets are physically buffered. The small populations of *C. bulbifera* at the north end of Lake Terrell are more vulnerable to herbicide treatments because they are located directly on the main shore of the lake. Impacts to these plants could be reduced if herbicide treatments were applied in the fall when lake levels are drawn down, exposing mudflats that would restrict the spread of 2,4-D. Milfoil populations in this area could also be treated by other methods, such as mechanical removal.

The marsh populations of *Cicuta bulbifera* in the southeast and southwest arms of Lake Terrell could be vulnerable to herbicides used to control infestations of purple loosestrife. Both plants often co-occur in the same microsites, but loosestrife is much more obvious because of its showy purple-pink flowers. Spot applications of herbicide on individual loosestrife plants would reduce the deleterious effects of herbicide drift on surrounding plants, but weed crews would need to be careful to avoid the less showy *Cicuta* plants growing with them. Appendix A contains a non-technical summary of the field characteristics and status of *C. bulbifera* which could be used to educate weed crews about this species.

In the long-term, the spread of reed canarygrass may be the most significant threat to *Cicuta bulbifera* and other native wetland plants at Lake Terrell. The populations of *C. bulbifera* should be revisited every 5 years to ensure that they continue to persist. If these populations show a decline, more intensive and frequent monitoring should be undertaken to assess potential causes. Such monitoring might include measuring the density of reed canarygrass or other competing species. Periodic monitoring might also uncover additional patches of *C. bulbifera* that we overlooked, especially in the southeast and southwest arms of the lake. Additional surveys and monitoring could be done using a canoe or kayak, although we found the WDFW airboat to be a most conducive means of transportation in these shallow waters!

## Acknowledgments

Thanks to Dave Heimer of the Washington Department of Fish and Wildlife (WDFW) for many helpful suggestions on the manuscript and for initiating this project. Richard Kessler of WDFW shared his knowledge of Lake Terrell and places to survey. Laurel Baldwin, Whatcom County Weed Control Coordinator, helped with surveys. Daniel Zimmerman of WDFW capably piloted the airboat and quickly developed a good eye for *Cicuta bulbifera*, helping the survey immensely.

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## Appendix A Species Abstract for *Cicuta bulbifera*

*Cicuta bulbifera* (Bulb-bearing water-hemlock)  
Apiaceae (Umbelliferae)

### Status:

US Fish and Wildlife Service: none

US Forest Service and Bureau of Land Management: Sensitive

State of Washington: State Sensitive

WA Natural Heritage Rank: G5/S2S3

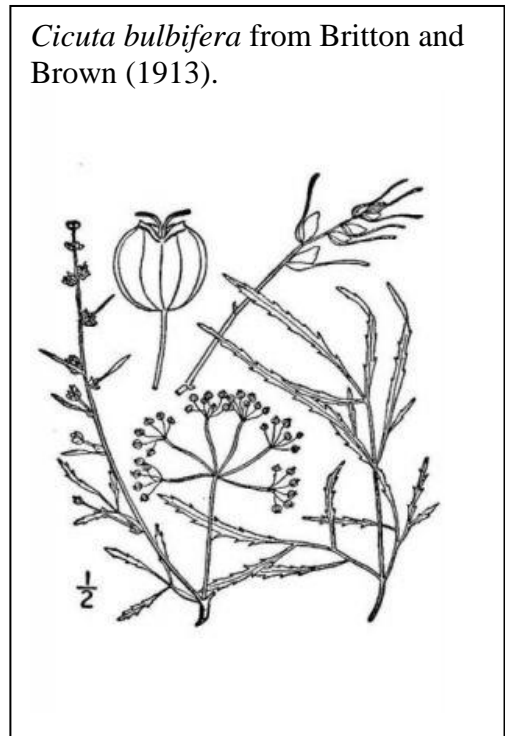
Description: *Cicuta bulbifera* is a poisonous, perennial herb with single stems 30-100 cm tall from slender fibrous roots or thickened clusters of roots (but is not taprooted). Leaves are found only along the stem and are alternate. The middle to lower leaves are pinnately dissected into narrowly linear, entire or few-toothed leaflets mostly less than 0.5-1.5 mm wide and 4 cm long. Upper leaves are smaller, with entire or few-lobed blades that may contain bulbils (small, bulb-like asexual propagules) in the axils. The inflorescence is a simple umbel (or often lacking, in which case plants reproduce entirely by leaf bulbils). Flowers are white or greenish, small, and borne on slender stalks 1-2.5 cm long. Fruits are round and appear vertically striped from the broad ribs alternating with narrow spaces (Camp and Gamon 2011; Hitchcock and Cronquist 1961).

Similar Species: *Cicuta maculata* and *C. douglasii* lack bulbils in the leaf axils and have lance-shaped to ovate leaflets 5-35 mm wide with prominent teeth and veins ending in the sinus of the teeth. *Conium maculatum* has thrice-compound, fern-like leaves, lacks bulbils, and has a taproot.

Flowering/Fruiting Period: Late July-September.

Distribution: Ranges from Newfoundland to British Columbia, south to Oregon, Idaho, Nebraska, and Virginia (Hitchcock and Cronquist 1961). In Washington, known from Chelan, Island, Pend Oreille, Stevens, Thurston, and Whatcom counties in the Canadian Rockies, East Cascades, and Puget Trough ecoregions.

Habitat: Across its range, found in marshes, bogs, and wet meadows (often in standing water) in valley bottoms and lowlands (Hitchcock and Cronquist 1961). In Washington, found primarily in marshes, lake margins, bogs, and wet meadows with shallow, standing water at 70-1130 m (240-3700 ft). Some populations are associated with beaver activity (Camp and Gamon 2011).





Occurrences in Washington: Known from 21 extant and one historical occurrences. Sixteen populations have been discovered or relocated since 2000.

Abundance: Populations range from one or two plants to about 2000. The total state population contains at least 6700 individuals. The species is very difficult to observe if it is not in flower or if bulblets are not present and so populations may be under-counted.

Trends: Few populations have been resurveyed to determine trends. Those that have been revisited tend to have stable to increasing numbers.

Protection status: Although most populations are on private or National Forests managed for multiple use, at least five occurrences in Washington are on protected lands, including Elbow Lake State Park, Fish Lake Bog Research Natural Area, Little Pend Oreille River Natural Area Preserve, Pend Oreille National Wildlife Refuge, and Whatcom Wildlife Area (Lake Terrell Unit).

Threats: Primary threats are competition from reed canarygrass (*Phalaris arundinacea*), changes in hydrology, residential development along shoreline habitat, and herbicide spraying for purple loosestrife (*Lythrum salicaria*) or other wetland broadleaf weeds. Livestock grazing has been cited as a potential threat, but this species is highly toxic to wildlife (and humans) and unlikely to be browsed.

Managed Areas: Colville National Forest, Elbow Lake State Park, Little Pend Oreille River Natural Area Preserve, Okanogan-Wenatchee National Forest, Pend Oreille National Wildlife Refuge, Whatcom Wildlife Area – Lake Terrell Unit.