

**UPDATE TO THE STATUS REVIEW  
OF Howellia aquatilis  
FIELD SURVEYS, MONITORING STUDIES,  
AND TRANSPLANT EXPERIMENTS**

**1992**

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## SUMMARY

Howellia aquatilis Gray (Campanulaceae) is currently included on the sensitive (Montana) and watch (Idaho) species lists in Region 1 of the U.S. Forest Service (U.S. Department of Agriculture 1988; Reel *et al.* 1989), and the sensitive list in Region 5 (Shelly and Moseley 1988). It was recently designated as a Category 1 candidate species by the U.S. Department of Interior (1990). A proposal to list the species as threatened under the federal Endangered Species Act of 1973 is currently being reviewed by the U.S. Fish and Wildlife Service (Nordstrom 1992). Field inventories for this species have been ongoing in Montana since 1987, and a total of 59 occurrences, in nine locations within the Swan River drainage, have been documented. Ten ponds in the Lake Five area southwest of West Glacier, Montana, were surveyed in 1991. None of them contained H. aquatilis. Thus, a total of 437 potential habitats (ponds and other wetlands) have been surveyed to date in Montana, the species having been found in 13.5% of them. Results of population size estimates, and data obtained from transects utilizing line-intercept (1987, 1989, 1990) and frequency measures (1989, 1990, 1991), document the high annual variation in population sizes displayed by this species. These size fluctuations are related to annual variations in climatic factors, especially precipitation and temperature. Because the seeds of H. aquatilis germinate only when exposed to the atmosphere upon drying of the habitat in the fall (Lesica 1990), the populations are usually smaller in seasons following years when summer precipitation is above normal and/or temperatures are below normal (i.e., 1989, a year in which summer precipitation was above normal, was followed by reduced population sizes in 1990). These climatic factors, by their influence on the extent of autumn pond drawdown, directly influence subsequent population sizes via their effects on the required seed germination conditions.

Results of the 1989 transplant experiments have been mixed. Plants established themselves in two of the four transplant ponds in 1990 (A and B), and although reduced in number in pond A, were again observed in 1991. Transplant ponds C and D were resurveyed in 1991 and still did not contain H. aquatilis. While ponds A and B continued to successfully support plants in 1991, the reduction in population size could be detrimental. It remains to be seen whether or not these artificially established H. aquatilis populations will remain viable. Recommendations are made for continuing studies.

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## I. INTRODUCTION

This report summarizes the results of ongoing monitoring studies and field surveys conducted from 1988-1991. The principal goal of these studies has been to assess population trends and the conservation status of Howellia aquatilis Gray (Campanulaceae). This species occurs on the Flathead National Forest, in Region 1 of the U.S. Forest Service. Previous reports summarize research conducted prior to the 1991 field season (Shelly 1988, 1989; Shelly and Schassberger 1990; Schassberger and Shelly 1991).

The field work conducted in 1991 represented the third year of a three-year inventory and analysis project, conducted cooperatively by the Montana Natural Heritage Program and the Flathead National Forest. The purpose of the project was to collect information needed for the preparation of a U.S. Forest Service species conservation strategy. The 1991 goals were to:

- 1.) continue field surveys of potential habitat for H. aquatilis on the Flathead National Forest.
- 2.) resurvey 26 populations, emphasizing those found on Flathead National Forest lands, to obtain ongoing estimates of population size, condition, persistence, and response to management activities.
- 3.) monitor transplant experiments (soil plugs from ponds with high densities of H. aquatilis were placed in unoccupied potential habitats at four locations in September 1989 (Shelly and Schassberger 1990)).
- 4.) continue detailed quantitative monitoring studies, begun in 1988, for five populations; percent frequency measurements were used for this monitoring in 1991.

The 1991 field studies were conducted by the authors on 22-27 July.

## II. REVIEW OF PRESENT STATUS

Howellia aquatilis is currently included on the sensitive (Montana) and watch (Idaho) species lists in Region 1 of the U.S. Forest Service (U.S. Department of Agriculture 1988; Reel et al. 1989), and the sensitive list in Region 5 (Shelly and Moseley 1988). It was recently designated as a Category 1 candidate species by the U.S. Fish and Wildlife Service (U.S. Department of Interior 1990). In 1991, it was proposed for federal listing as threatened by the latter agency, and that proposal is currently in review (Nordstrom 1992). Also in 1991, the species was petitioned for federal listing as endangered by the Biodiversity Legal Foundation, P. Lesica, the Flathead Chapter of the Montana Native Plant Society, and the Swan View Coalition, for the following reasons:

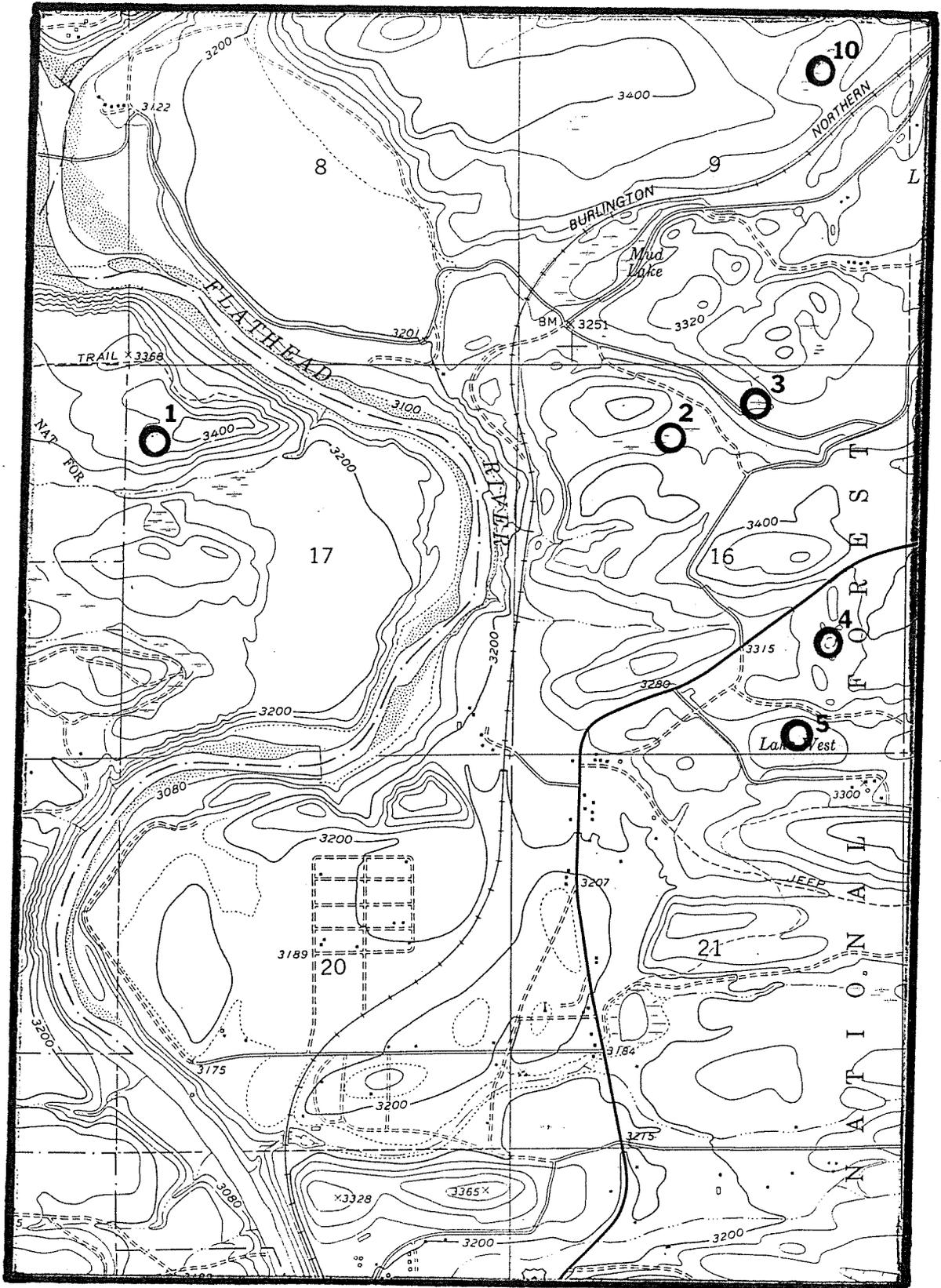
- (1) the species has been extirpated from a large portion of its previously known global range.
- (2) it has a narrow ecological amplitude.
- (3) it lacks detectable inter- and intrapopulation genetic variation.
- (4) it is currently known from only two areas that have potential long-term viability (the Swan River drainage, Montana, and in suitable habitats near Spokane, Washington).
- (5) threats from habitat alteration in major portions of its range, due to a.) invasion of its habitat by an aggressive grass species, Phalaris arundinacea, and b.) timber harvest and associated road construction.
- (6) a lack of regulations protecting this species in the states in which it is found.

A U.S. Forest Service conservation strategy, which addresses management of the populations on Flathead National Forest lands, has been drafted (Shelly 1992). This strategy is currently in review, and should be implemented by the Flathead National Forest in 1992.

### III. UPDATE OF GEOGRAPHIC DISTRIBUTION

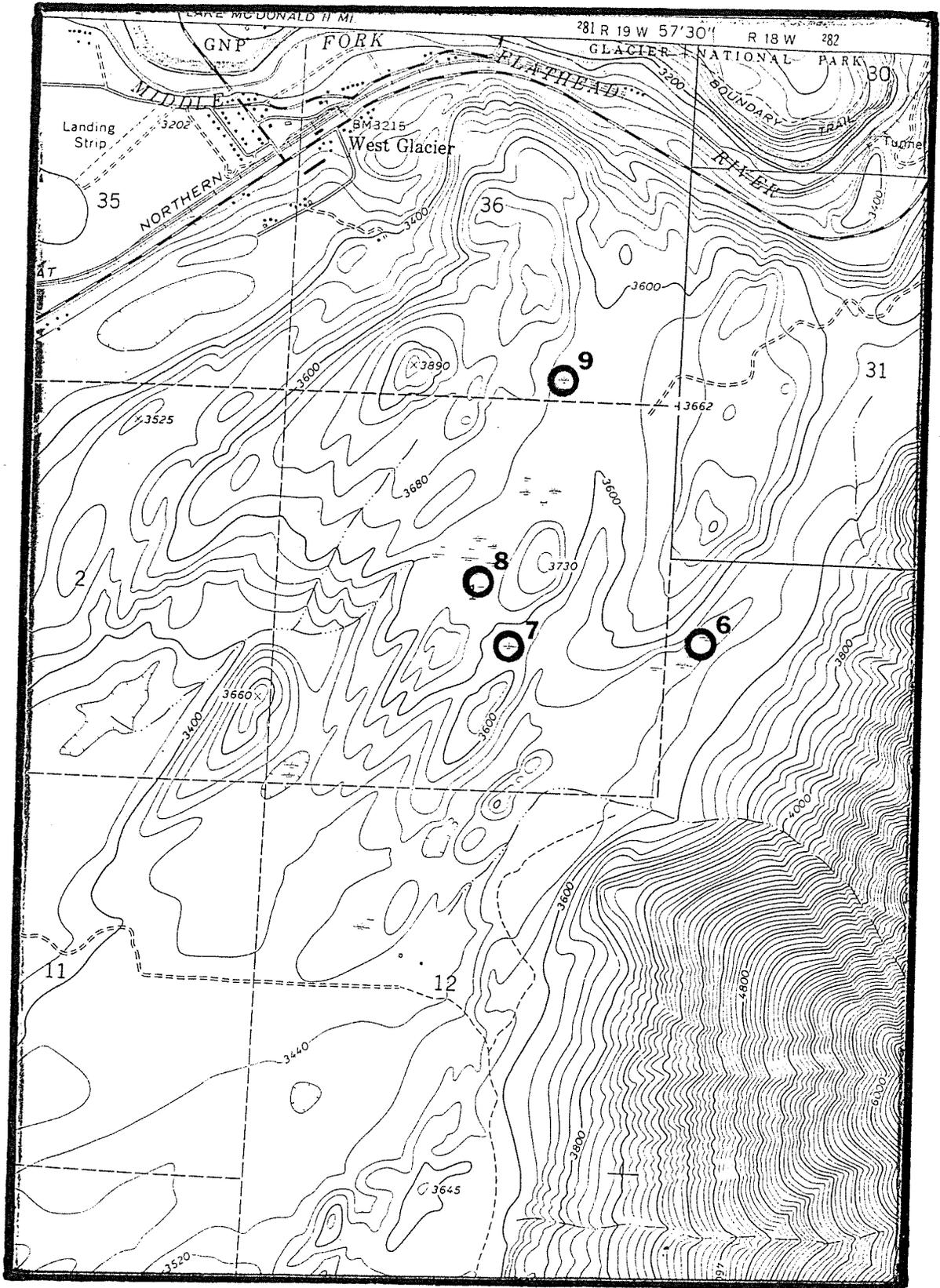
Howellia aquatilis continues to be known from a total of 76 extant populations worldwide: one in Idaho, 59 in Montana, and 16 in Washington. All known Montana populations are located in the Swan River drainage (Lake and Missoula counties), and constitute 77.6% of those known globally for the species. Thirty-eight populations (50% of those known globally) occur wholly or partially on Flathead National Forest lands. The land ownership status for the Montana populations is summarized by Schassberger and Shelly (1991).

Surveys of ten sites suspected to contain potential habitat were conducted in 1991, in the Lake Five area southwest of West Glacier, Montana. None of these sites appeared to support populations of H. aquatilis. Thus, a total of 437 ponds and other wetland habitats have been surveyed to date, in Montana, for the presence of H. aquatilis. The locations of the sites surveyed in 1991 are indicated on pp. 3-4. The results of these field surveys are summarized below.



Howellia aquatilis

○ = areas unsuccessfully searched



Howellia aquatilis

○ = areas unsuccessfully searched

**1991 FIELD SURVEY RESULTS: Lake Five Area, Flathead County,  
Montana**  
24-25 July 1991

None of the following ten sites were observed to contain Howellia aquatilis in 1991 (site numbers correspond to those shown on pp. \*\*-\*\*). Site 9 was very interesting, and should be surveyed earlier in the season for the presence of rare orchid species (i.e., Cypripedium calceolus).

- Site 1: small pond (dry on date of survey), with Carex vesicaria, Sium suave; margin surrounded by Populus balsamifera. The riparian corridor to the south contains Alnus sinuata, Salix drummondiana, Betula papyrifera, Picea engelmannii, Larix occidentalis, Pinus contorta, Cornus stolonifera, Carex vesicaria, and Adenocaulon bicolor.
- Site 2 wetland: Typha latifolia (dominant on south end), Sium suave, Carex vesicaria (dominant on west end), Carex rostrata, Potentilla palustris, Equisetum fluviatile (dominant in central portion), Carex lanuginosa; surrounded by Betula papyrifera, Populus balsamifera, Alnus sinuata. Clear cut just north of wetland.
- Site 3 pond: muddy bottom, with Potentilla palustris, Carex vesicaria; surrounded by Pinus contorta, Populus balsamifera, Salix drummondiana.
- Site 4 pond: deep, with sparse Carex rostrata; surrounded by Pinus contorta, with a few Populus balsamifera, Shepherdia canadensis.
- Site 5 lake: deep, with Carex lasiocarpa (dominates shoreline), Typha latifolia, Equisetum arvense, Nuphar polysepalum (in protected areas); surrounded by Pinus contorta forest, with Betula papyrifera, Cornus stolonifera, Betula occidentalis and Shepherdia canadensis.
- Site 6 Rhamnus alnifolia, Populus balsamifera, Salix drummondiana.
- Site 7 pond, nearly dry, with Carex rostrata, Populus balsamifera, Alnus sinuata, Cornus stolonifera.
- Site 8 small dammed area, with ponded portion containing Chara and Typha latifolia.

- Site 9 spruce bottom, with Taxus brevifolia, Betula papyrifera, Rhamnus alnifolia, Alnus sinuata, Habenaria dilatata, Listera convallarioides, Adenocaulon bicolor, Gymnocarpium dryopteris. This site needs further survey work, as it may support other plant species of special concern.
- Site 10 wetland, with Carex lasiocarpa, Carex vesicaria, Populus tremuloides, Populus balsamifera, Alnus sinuata, Salix candida.

#### IV. MONITORING STUDIES

During 1991, 26 previously documented populations were resurveyed, and estimates of population size, and the percentage of each pond occupied by H. aquatilis, were recorded. Updated element occurrence records for these populations are provided in Section VIII, p. 23. Quantitative monitoring of five occurrences (008, 009, 013, 020, and 027) was also continued. The locations of the resurveyed ponds are provided in an earlier status review (Shelly 1988). The locations of the long-term monitoring sites, and the study methods used, are described by Shelly (1989). In 1991, after an evaluation of the methods used to monitor H. aquatilis, the line-intercept method of population monitoring was omitted. We felt that this method was too time-consuming in relation to the type of information obtained, and that similar information can be gained by recording percent frequency along the study transects, and by making estimates of total population size and percentage of the ponds occupied by H. aquatilis. Percent frequency was recorded again in 1991, and the line-intercept transects were used for this purpose. Percent frequency was measured by presence/absence in 20x50 cm quadrats placed at one-meter intervals along the transects.

**RESULTS:** The results of the population size surveys are presented in Table 1, p. 7. As stated in previous reports (Shelly and Schassberger 1990, Schassberger and Shelly 1991), these figures are to be strictly regarded as estimates. Nonetheless, they do indicate that populations remained fairly stable in size from 1987 to 1989; however, between 1989 and 1990, 20 populations were reduced in size by at least 50 percent, and 14 were reduced by more than 75 percent from the previous years' estimates. In 1991, fourteen populations showed a ten percent or greater increase in size, while nine populations remained nearly the same size and three were reduced in size. Of the nine ponds that remained approximately the same size, two were ponds where H. aquatilis populations were reduced to zero individuals in 1990, and which again did not contain plants in 1991.

The four ponds for which water depth measurements were taken in both 1988 and 1989 were all deeper during the second year, with

Table 1. Population size estimates (number of individuals), and percentage of pond occupied, for 26 Howellia aquatilis occurrences, Swan River Valley, Montana (1987, 1989-1991).

OCCURRENCE NUMBER	1987	1989	EST. % OF POND OCCUPIED (1989)	1990	EST. % OF POND OCCUPIED (1990)	1991	EST. % OF POND OCCUPIED (1991)
001*	75-100+	300-400	60	27	<5	25	<5
006	1000-2000	1000-2000	50	500-1000	20	800-1000	30
007	3000-4000	1000-2000	95	500-600	30	1000-2000	70
008	2000-3000	1000-1500	50	40+	10	1000-2000	45
009*	500-600	500-1000	30	220+	20	40	5
012*	400-500	16	<5	35	<5	260	15
013*	1000-1500	500-1000	50	33	5	310	10
014*	300-400	500+	50	150-250	30	80-100	5
016	400+	1000-1500	85	300-500	30 (c/lumped)	70	10
017	10-12	10-20	<5	0	(# <sup>1</sup> )	0	0
020	1000	1000-1500	60	190+	20	210	20
022	200	500-1000	70	60-100	25	100	15
023	3	400-500	55	20	<5	110	20
025*	25	100-125	<5	0	(# <sup>2</sup> )	15	<5 (# <sup>2</sup> )
026	200-300	500-1000	70	1000-1500	50	1000-2000	70
027*	300	300-400	40	200+	30	195	15
029*	200-300	500-1000	30	100-200	10	165	10
030*	1000	1000	55	0	(# <sup>3</sup> )	15	<5
032	101-1000 (1983)	750-1000	40	3-10	5	25	5
035	51-1000 (1983)	500-750	40	0	(# <sup>4</sup> )	15	5
044	275-400	90-120	60	0	(# <sup>4</sup> )	0	0 (# <sup>4</sup> )
045	300	300-400	20	0	<5 (# <sup>5</sup> )	500	20
046*	50	30-50	<5	3	<5	25	<5
047*	200	200-300	20	150	15	200	15
048*	250	200	10	0	(# <sup>6</sup> )	20	5
049	1500-2000	2000+	65	200-300	15 (# <sup>7</sup> )	1000	40

\* - Ponds whose margins or immediate surroundings have been physically impacted by timber harvesting.

Observations at selected sites (1990-1991).

#<sup>1</sup> - High cover of Carex vesicaria.

#<sup>2</sup> - High cover of Nuphar variegatum and Carex vesicaria.

#<sup>3</sup> - No apparent cause for lack of plants.

#<sup>4</sup> - Oily scum on surface, water deep reddish-yellow to brown, possible dumping from road or decaying leaves.

#<sup>5</sup> - Heavy algal bloom.

#<sup>6</sup> - Dead sedges and cat-tails, water level appears high.

#<sup>7</sup> - High cover of Lemna minor.

pond numbers 020 and 027 significantly deeper in 1989. In 1990, pond number 008 was only slightly less deep than in 1989, the depth of pond 013 remained the same, and the rest were slightly deeper. In 1991, the two ponds in the Condon area (020 and 027) were substantially deeper than in 1990, whereas the three ponds closer to Swan Lake (008, 009, and 013) were all less deep. The water depth measurements are given in Table 2, p. 9, and summarized in Figures 1-6, pp. 10-15.

The results from the monitoring transects are also presented in Table 2, and summarized in Figures 1-6. Figure 1 is based on averages of pond depth and percent frequency from all five transect ponds. Figures 2-6 indicate pond depth and percent frequency from each individual transect pond, for the three two-year intervals from 1988-1991. **NOTE:** Depth measurements were not recorded for pond 008 in 1988; average pond depth for all five ponds is thus based on the remaining four ponds only for that year.

**DISCUSSION:** Populations were observed to be greatly reduced again in 1990, as shown by the results of line-transect, frequency and population size estimate studies. In 1991, most of the populations either increased in size, or remained approximately the same size, in comparison to 1990 observations. However, compared to original 1987 population estimates, all populations, except 023, remain reduced in size. As noted by Lesica (1990), one possible reason for the fluctuating population sizes could be the date of pond drying each year (see discussion below); this date is undoubtedly influenced by annual patterns of precipitation and temperature (Schassberger and Shelly 1991). The observed decline in population sizes in nearly all of the surveyed ponds in 1990, and the small increases in population size in 1991, may reflect the suboptimal drying regimes in 1989 and 1990 (i.e., late, and/or inconsequential, drying resulting from prevailing climatic conditions).

The monitoring transect data support the hypothesis that the extent and timing of pond drawdown, as influenced by climatic factors, directly influence the annual population dynamics of *H. aquatilis*. A review of precipitation patterns, based on data from stations at Bigfork and Seeley Lake, Montana (Tables 3-4, pp. 16-17), is revealing. Data indicate that total precipitation at Bigfork and Seeley Lake was below normal in summer 1988, but above normal in summer 1989 (Tables 3-4). In 1990, total precipitation was near normal from June to August at Seeley Lake and Bigfork. As a result, depths in the five monitoring ponds were shallower in 1988, but deeper in 1989 and 1990 (except for pond 008; Table 2, and Figures 2-6). In 1991, June precipitation was above normal at both stations, and the water depth again increased in ponds 020 and 027, but decreased in the other 3 ponds (Table 2, p. 9). Thus, significant increases in water depths occurred in all of the ponds in 1989 and 1990, and for two of the ponds in 1991. The subsequent population sizes, as estimated by percent frequency, inversely

Table 2. Monitoring transect data, Howellia aquatilis, Swan Valley, Montana, 1988-91.

		<u>Occurrence number</u>				
		<u>008</u>	<u>009</u>	<u>013</u>	<u>020</u>	<u>027</u>
Date read	1988:	21 JUL	21 JUL	21 JUL	22 JUL	22 JUL
	1989:	12 JUL	12 JUL	11 JUL	14 JUL	13 JUL
	1990:	18 JUL	19 JUL	19 JUL	18 JUL	17 JUL
	1991:	23 JUL	23 JUL	23 JUL	22 JUL	22 JUL
Transect length (m)		48.95	50.0	46.0	42.9	50.0
Water depth (cm)						
Tape point (m):		20.0 40.0	20.0 40.0	15.0 30.0	10.0 23.0	15.0 30.0
1988		not measured	3.1 3.2	1.7 1.8	2.72 2.64	1.96 1.50
1989		3.4 4.95	3.45 3.55	2.4 2.2	4.45 4.35	4.5 4.0
1990		3.1 4.06	3.6 3.81	2.4 2.1	4.8 4.75	4.7 4.5
1991		2.3 3.6	2.7 2.9	2.0 2.0	5.5 5.4	5.7 5.2
Estimated % cover:						
		1988				
		1989				
		1990				
		1991				
<u>Howellia aquatilis</u>		8.21 27.40 2.01 8.48	7.06 7.24 2.95 3.7	6.44 4.87 0.83 6.1	26.29 59.21 6.13 20.3	1.80 5.86 3.28 28.3
% frequency						
1989:		56	36	69	95	40
1990:		25	18	16	19	8
1991:		56	18	31	26	6

FIGURE 1.

### HOWELLIA AQUATILIS MONITORING, 1988-91 Pond Depths & % Frequency (All 5 ponds)

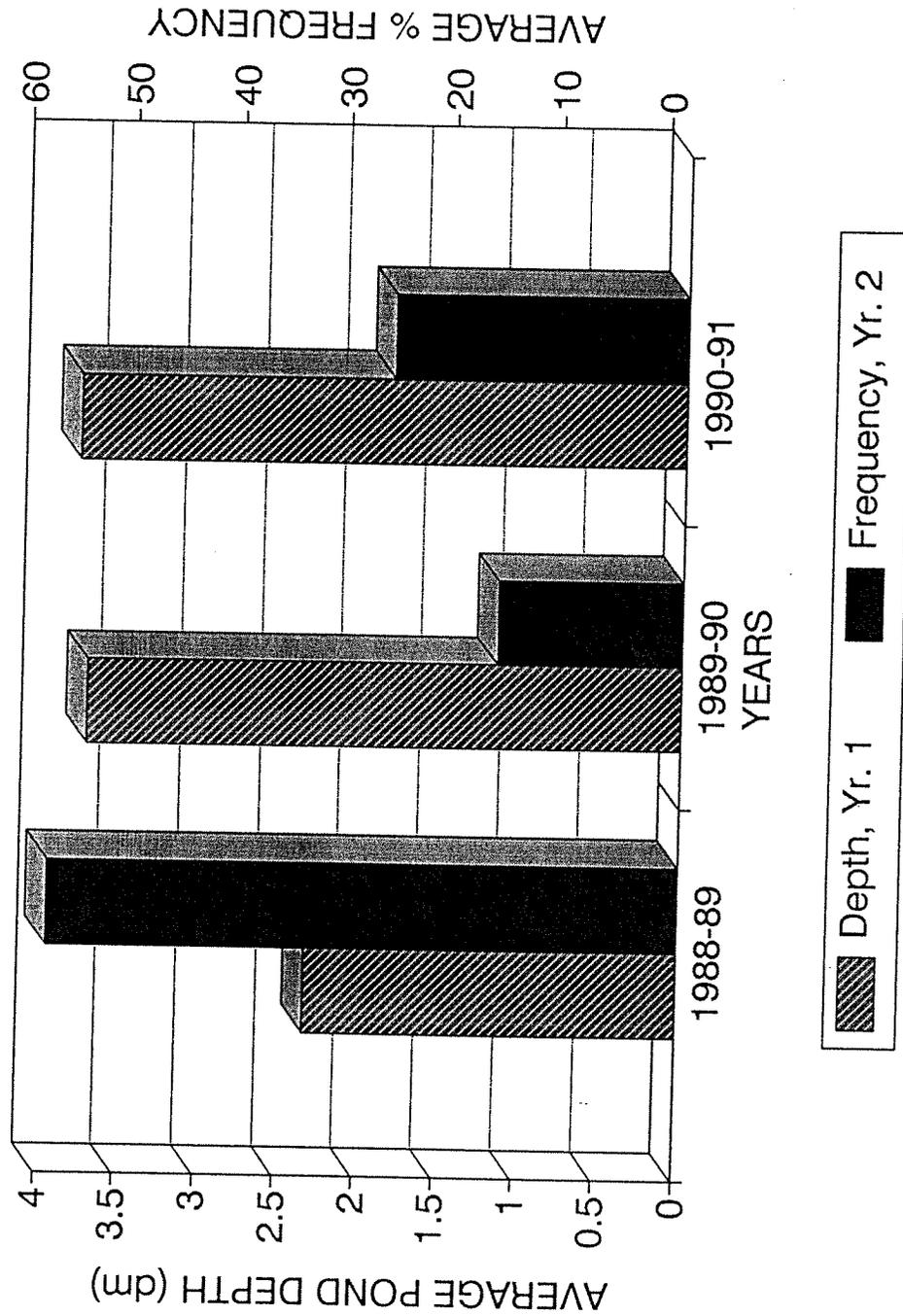


FIGURE 2.

**HOWELLIA AQUATILIS, 1988-91**  
Occurrence 008, Lost-Cilly Cr. (Forest)

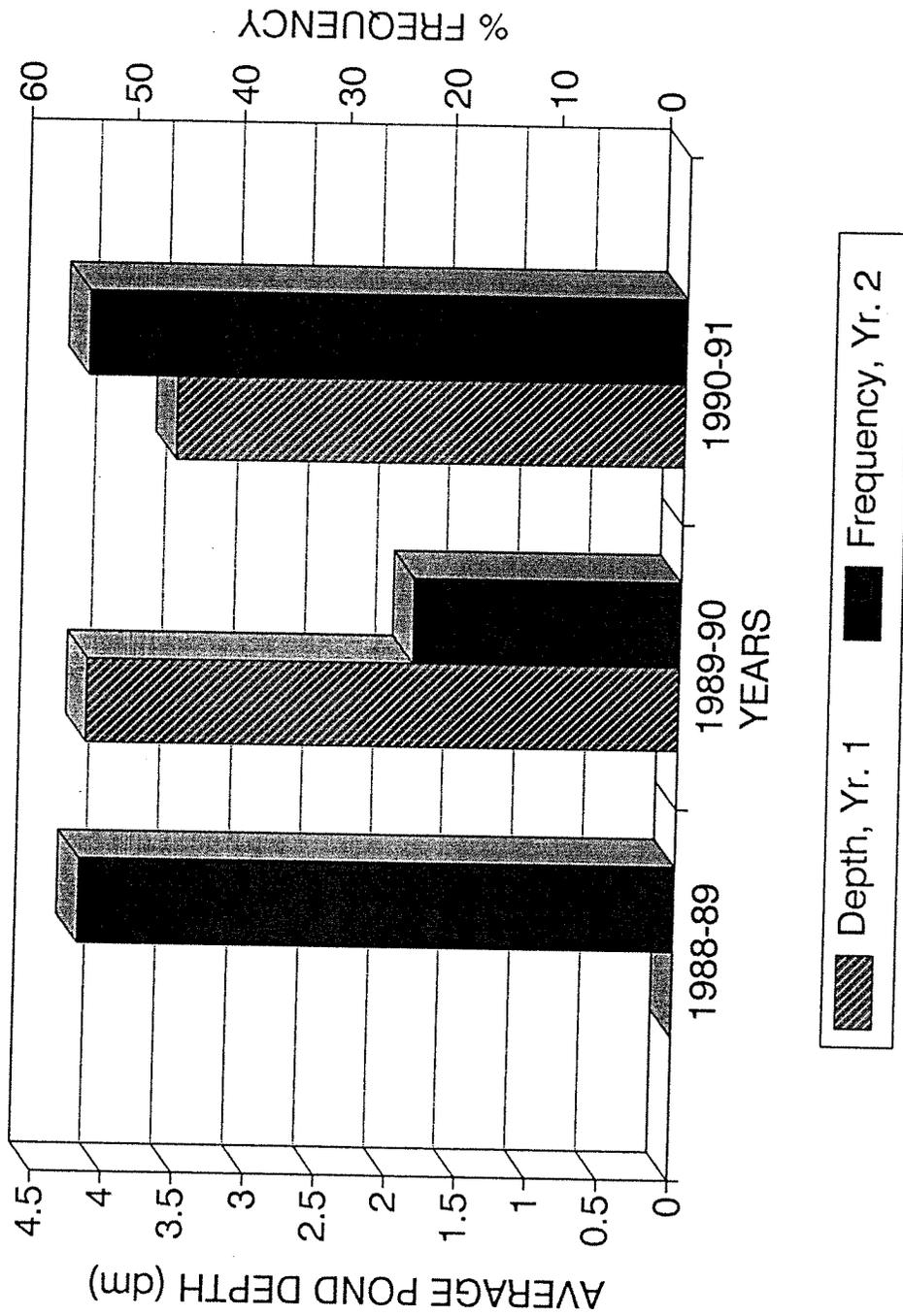


FIGURE 3.

HOWELLIA AQUATILIS, 1988-91  
Occurrence 009, Lost-Cilly Cr. (Logged)

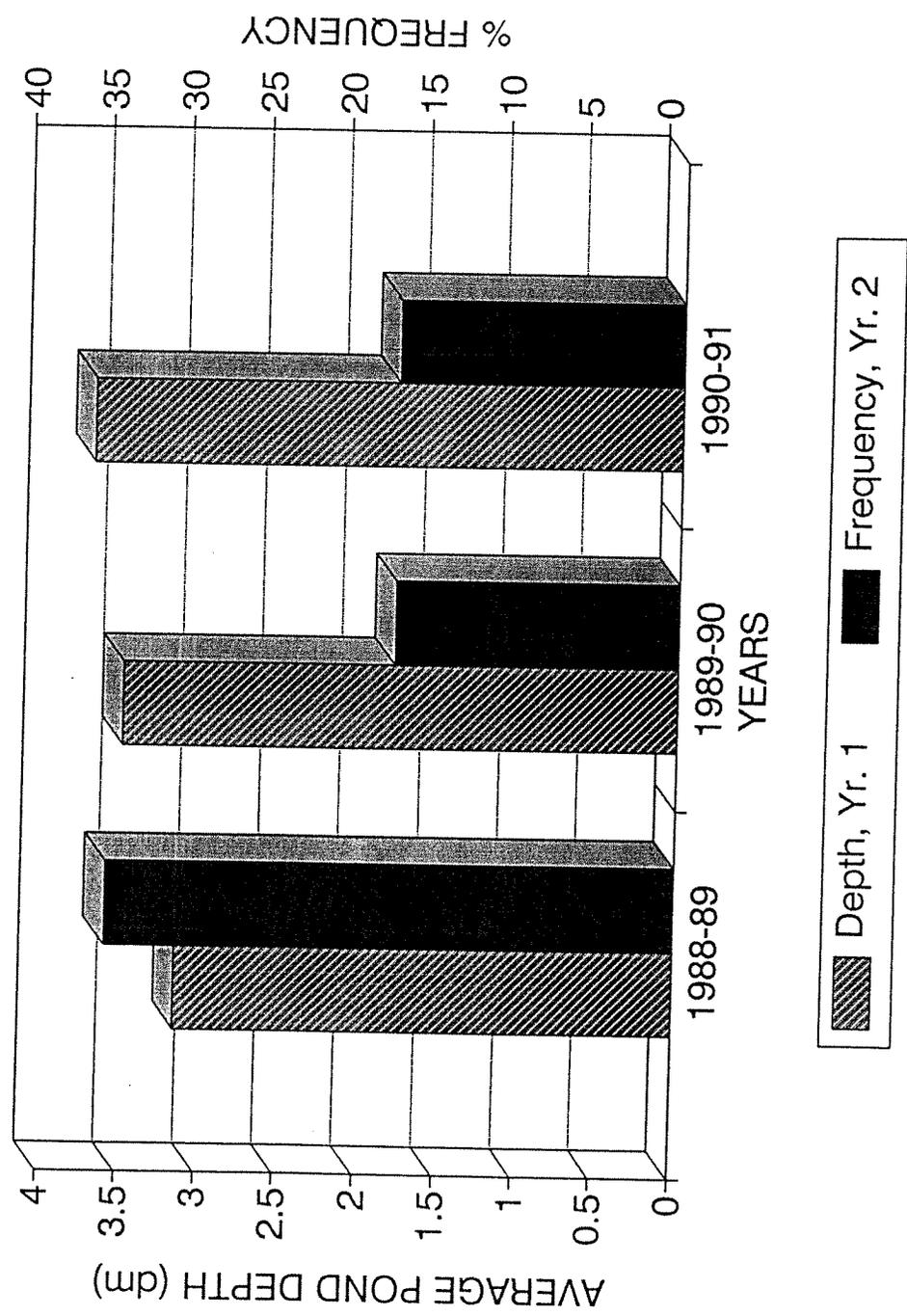
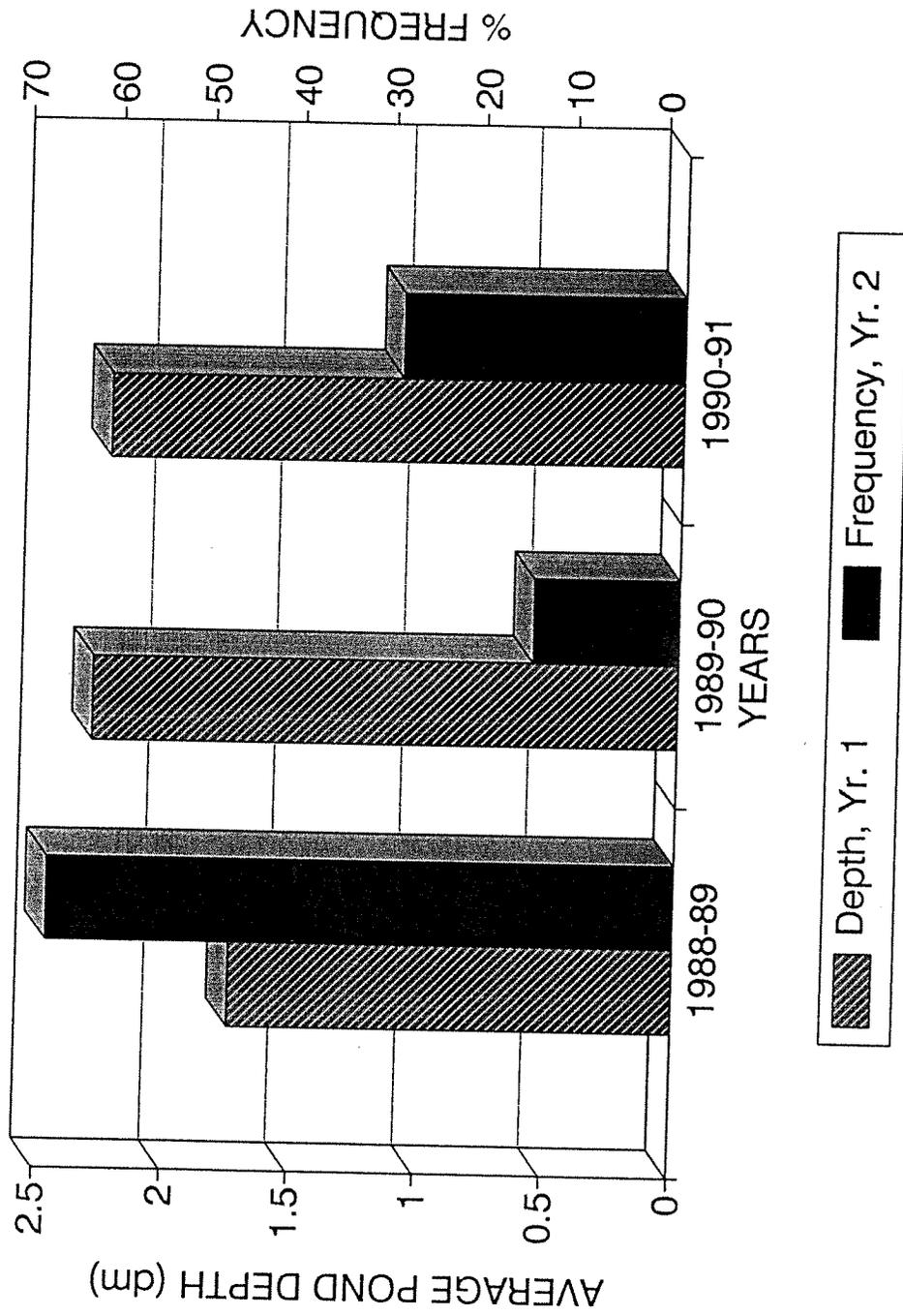


FIGURE 4.

**HOWELLIA AQUATILIS, 1988-91**  
Occurrence 013, Lost-Cilly Cr. (Logged)



HOWELLIA AQUATILIS, 1988-91  
Occurrence 020, Condon Creek (Forest)

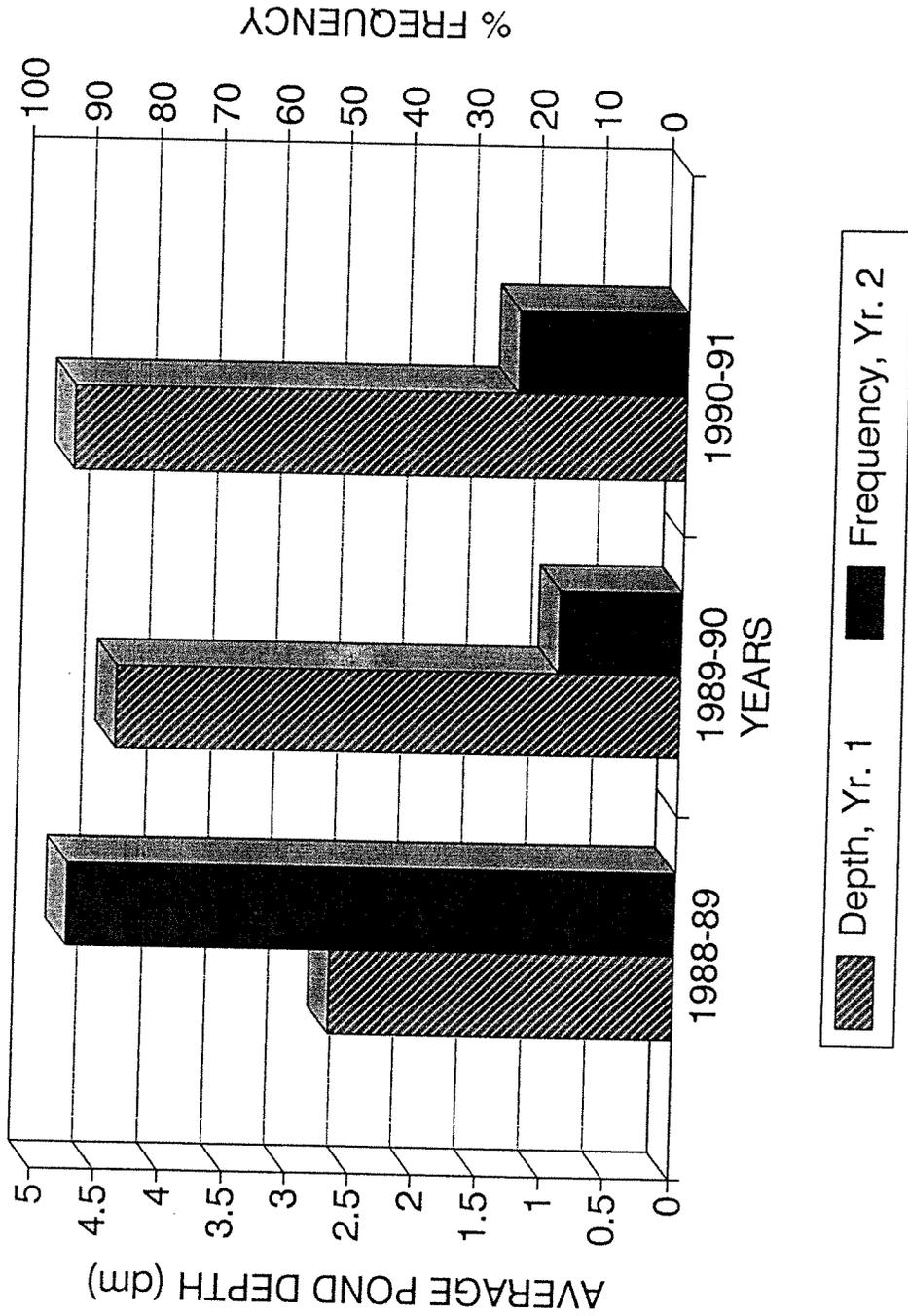


FIGURE 5.

FIGURE 6.

**HOWELLIA AQUATILIS, 1988-91**  
Occurrence 027, Condon Creek (Logged)

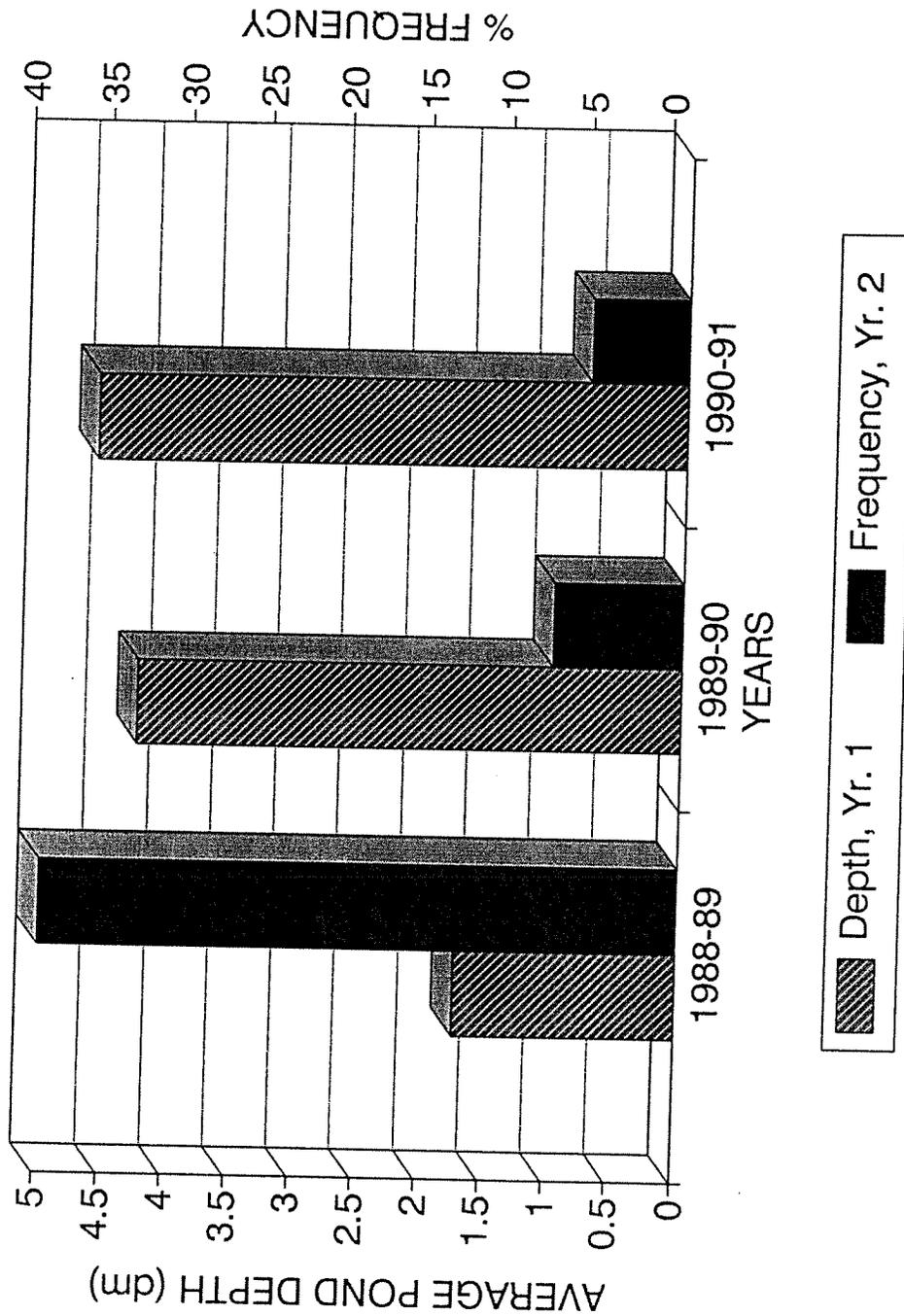


TABLE 3.

## Bigfork 13 S Precipitation Data \*\*

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1986	2.81 0.74	2.09 0.81	1.03 -0.38	1.51 0.02	2.61 0.05	3.00 -0.08	1.24 -0.11	0.85 -0.97	3.75 1.74	0.87 -0.62	2.07 0.42	0.64 -1.56
1987	0.26 -1.81	0.50 -0.78	3.46 2.05	1.10 -0.39	2.47 -0.09	1.85 -1.23	5.50 4.15	2.18 0.36	0.96 -1.05	1.10 -0.39	2.77 1.12	0.69 -1.51
1988	0.99 -1.08	0.63 -0.65	1.38 -0.03	1.77 0.28	4.07 1.51	2.60 -0.48	1.07 -0.28	0.40 -1.42	3.29 1.28	0.30 -1.19	0.83 -0.82	1.40 -0.8
1989	1.93 -0.14	1.33 0.05	2.03 0.62	2.08 0.59	3.69 1.13	1.09 -1.99	1.44 0.09	4.60 2.78	1.89 -0.12	0.76 -0.73	1.63 -0.02	2.16 -0.04
1990	0.56 -1.51	0.51 -0.77	1.72 0.31	1.12 -0.37	4.43 1.87	2.03 -1.05	2.37 1.02	2.13 0.31	0.00 -2.01	2.15 0.66	2.78 1.13	2.03 -0.17
1991	1.03 -1.04	0.55 -0.73	1.15 -0.26	1.13 -0.36	3.02 0.46	4.24 1.16	0.16 -1.19	1.49 -0.33	0.58 -1.43	2.80 1.31	1.00 -0.65	3.09 0.89

\*\*

FIRST LINE CONTAINS TOTALS, SECOND LINE CONTAINS DEPARTURES FROM NORMAL (1961-1983)

TABLE 4.

Seeley Lake Precipitation Data \*\*

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1986	3.14 -0.05	3.64 1.97	0.39 -1.18	0.47 -0.87	1.62 -0.36	2.07 -0.15	0.83 -0.21	1.76 0.51	2.52 0.97	1.20 0	2.38 0.4	0.74 -2.24
1987	0.91 -2.28	0.49 -1.18	2.08 0.51	0.59 -0.75	1.52 -0.46	1.85 -0.37	1.39 0.35	1.16 -0.09	0.07 -1.48	0.60 -0.6	2.27 0.29	1.22 -1.76
1988	1.72 -1.47	2.86 1.19	2.60 1.03	0.47 -0.87	2.90 0.92	1.35 -0.87	0.25 -0.79	0.51 -0.74	0.81 -0.74	0.04 -1.16	0.63 -1.35	1.16 -1.82
1989	2.14 -1.05	2.07 0.4	2.80 1.23	3.17 1.83	1.17 -0.81	1.26 -0.96	2.57 1.53	2.77 1.52	0.89 -0.66	3.03 1.83	3.32 1.34	2.00 -0.98
1990	1.45 -1.74	0.66 -1.01	0.95 -0.62	0.63 -0.71	2.52 0.54	2.27 0.05	0.65 -0.39	1.66 0.41	0.01 -1.54	1.79 0.59	2.26 0.28	2.44 -0.54
1991	1.87 -1.32	1.68 0.01	2.00 0.43	0.27 -1.07	2.78 0.8	3.30 1.08	0.75 -0.29	0.88 -0.37	1.37 -0.18	3.28 2.08	3.81 1.83	0.91 -2.07

\*\*

FIRST LINE CONTAINS TOTALS, SECOND LINE CONTAINS DEPARTURES FROM NORMAL (1961-1983)

these changes in depth, at least in ponds 009, 013, 020, and 027 (Figures 2-6).

In summary, pond depth, which has been measured during the second half of July, appears to be a reliable predictor of population levels during the following growing season. Deeper pond depths in year one are usually followed by reduced population sizes in year two, presumably as a result of reduced fall drawdown in year one, a resultant low percentage of seed germination, and low numbers of plants in year two. The climate patterns and population levels observed in 1990 and 1991 indicate that suboptimal drying regimes occurred in 1989 and 1990.

Pond 044 continued to be deep yellow-red in color, and had what appeared to be an oily slick on the surface of the water, in 1991. This pond did not contain plants in 1990 or 1991, and the H. aquatilis population may have been extirpated. The causes of this reddish color and the oily slick are still unknown. However, the resultant reduction in incoming light due to discoloration may be a factor in the apparent loss of this population.

Additional studies, focused on the actual dates and amounts of autumn pond drawdown, and coupled with population size data from the following growing season, are needed to more closely determine the relationship of population size to annual climatic patterns.

## V. TRANSPLANT EXPERIMENTS

**METHODS:** During September 1989, transplant experiments were initiated by obtaining soil plugs from two ponds containing dense populations of H. aquatilis. The transplants were placed in four ponds that appeared to contain suitable habitat for H. aquatilis, but that had not been observed to support the species. Exact locations of transplant ponds, and methods for the transplant study, are described in Shelly and Schassberger (1990).

Transects at ponds A and B were read on 23 July 1991, and at ponds C and D on 22 July 1991. Transects were read by carefully wading out into the pond and visually searching along the length of the tape for H. aquatilis plants, and then searching the rest of the ponds in case seeds had been dispersed away from the transects.

**RESULTS:** In 1991, as in 1990, Howellia aquatilis was present in ponds A and B, and not present in ponds C or D. The two-year results for ponds A and B are shown in Table 5, p. 19, and Table 6, p. 20, respectively. No plants were found away from the transects in ponds A or B in 1991.

**DISCUSSION:** As described by Schassberger and Shelly (1991), ponds C and D still contained water on the original transplant date, and it is unlikely that these ponds dried much further prior to freezing. Similar conditions existed in 1991. The failure of Howellia aquatilis to become established in these ponds is probably a result of incorrect conditions for seed germination (i.e.,

**Table 5.** Number, location, and presence and type of flowers for Howellia aquatilis plants in transplant Pond A, 1990-1991 (s = plant(s) with submergent flowers, e = plant(s) with emergent flowers, se = plant(s) with both submergent and emergent flowers, v = vegetative plant(s)).

POND A		
Tape Point (m)	Date Read	
1.6	18 July 1990	23 July 1991
	3 plants: 2s, 1se	No plants observed
3.1	2 plants: 1s, 1se	No plants observed
6.0	4 plants: 3e, 1v	No plants observed
8.4	No plants observed	No plants observed
10	1 plant: e	1 plant: e
12	No plants observed	1 plant: se
14	1 plant: se	No plants observed
16	No plants observed.	No plants observed
18	4 plants: all s	1 plant: e
20	3 plants: large, all se	No plants observed
22	2 plants: both se	1 plant: s
24	6 plants: 3 uprooted, 3 se	No plants observed
26	1 plant: e	No plants observed
28	2 plants: both se	No plants observed
30	3 plants: 2s, 1se	No plants observed
<u>32 plants total</u>		<u>4 plants total</u>
17	se	1 se
9	s	1 s
5	e	2 e
1	v	

**Table 6.** Number, location, and presence and type of flowers for Howellia aquatilis plants in transplant Pond B, 1990-1991 (s = plant(s) with submergent flowers, e = plant(s) with emergent flowers, se = plant(s) with both submergent and emergent flowers, v = vegetative plant(s)).

Tape Point (m)		Date Read	
18	July 1990	23 July 1991	
2	1 plant: s	No plants observed	
4	1 plant: s	No plants observed	
6	No plants observed	No plants observed	
8	No plants observed	No plants observed	
10	No plants observed	1 plant: s	
12	1 plant: detached, s	No plants observed	
13	No plants observed	No plants observed	
14	1 plant: s	No plants observed	
15	No plants observed	1 plant: detached, s	
16	No plants observed	No plants observed	
17	1 plant: s	1 plant: s	
20	No plants observed	2 plants: both s	
22	No plants observed	No plants observed	
24	No plants observed	No plants observed	
<u>5 plants total</u>		<u>5 plants total</u>	
5 s		5 s	

insufficient fall drawdown, and lack of exposure of the seeds to the atmosphere). Seeds and/or root systems of other aquatic plant species were, however, successfully transplanted, as demonstrated by the presence of Sium suave and Potamogeton gramineus, both of which were observed along the transects where the soil plugs had been placed. This was especially apparent in Pond D.

A small number of H. aquatilis plants were again present in ponds A and B in 1991. Both ponds contained plants that were reproductive. The population size of Pond A was significantly reduced (by 85%) from 1990 levels, but continued to have plants with submergent and/or emergent flowers. Pond B contained five plants in 1991, all of them again having only submergent flowers.

A significant phenomenon in the successful transplant ponds has been the appearance of plants at soil plug sites, in the second year following transplanting, where none had appeared during the first year. This suggests that some seeds can retain viability for at least two years, and that H. aquatilis may be capable of forming at least short-lived seed banks. Such seed banks may serve as a buffer against unfavorable drying regimes in certain years, although the longer-term longevity of such seed banks remains unknown.

Both of the successful transplant ponds appear to have suitable bottom substrates and drying regimes for seed germination, but mid-season water levels along the transect in Pond B have been too high for the plants to reach the water surface and produce emergent flowers. Only cleistogamous (self-pollinated) submerged flowers were produced by these plants.

In summary, results of the transplant studies have been mixed. Although plants were still present in ponds A and B, the great reduction in population size of Pond A means that fewer seeds would be produced in 1991. The possibility of further declines, followed by "extirpation," is high for both ponds. Also, plants continued to be located only along the transect lines, with none being observed elsewhere in the ponds. Continued monitoring will be necessary to fully evaluate these transplant experiments. Again, if these transplant populations remain viable, it might be hypothesized that limited dispersal events keep H. aquatilis from being established in currently uninhabited but suitable ponds. If the transplant populations do not persist, then it is possible that the transplant ponds were unsuitable for H. aquatilis over the longer term, perhaps due to one or more unknown environmental factors aside from those influenced by climate.

## VI. STUDY RECOMMENDATIONS

Population size and percent cover estimates of H. aquatilis appear to be adequate for detecting fluctuations experienced by this

species over time. The relationship of these fluctuations to climatic patterns, especially precipitation, is important, and examination of this relationship should be continued. If possible, information on pond drying should be obtained from several marked locations within occupied ponds, in areas that contain a high density of H. aquatilis, and in areas that have no plants present. This would entail evaluating these selected sites at frequent intervals (i.e., weekly) for the months of August and September, and possibly October. Valuable data to collect include the date of drying, length of dry period prior to seed germination, date of seedling emergence, and date of subsequent submergence or burial by snowfall. Finally, it is imperative that monitoring of the transplant ponds be continued to ascertain the long-term success of those experiments.

For long-term monitoring of H. aquatilis, population size estimation is the recommended method of study. Frequency measurements can also be used to quantitatively track population shifts from year to year. However, this method requires repeated wading along the transect lines, and the disruption to the bottom substrates and vegetation may be such that it alters the occurrence of H. aquatilis along the transects.

All ponds on the Flathead National Forest should continue to be monitored, in order to assess long-term population trends and response to adjacent management activities.

## VII. MANAGEMENT RECOMMENDATIONS

Because of the extremely dynamic relationship of population levels to macroclimatic factors, it is difficult to determine, from the monitoring results to date, whether disturbance adjacent to the ponds is also influencing population size or persistence. Nonetheless, in areas that are managed for timber harvesting, it will be important to maintain undisturbed buffers around the margins of ponds that support H. aquatilis, as described by Shelly (1992). Such protective buffers would best insure the maintenance of the physical environment of the ponds, and is especially important for ponds that have remained undisturbed. Also, to the extent possible, consideration should be given to maintaining landscape-level corridors among occupied, as well as suitable but unoccupied, pond habitats within the Swan River drainage. The goal of these corridors will be to allow for movement of mammal and bird species that may be serving as seed dispersal agents for H. aquatilis.

**VIII. ELEMENT OCCURRENCE PRINT-OUTS: RESURVEYED SITES**

Element Occurrence Record  
Howellia aquatilis

24

Occurrence number: 001

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: D  
EO rank comments: SMALL POPULATION; NORTH MARGIN OF POND  
IMPACTED BY LOGGING.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 017W Section: 12 Precision: S  
Township-range comments: NE4SE4NW4

Survey date: 1984-07-15      Elevation: 4230  
First observation: 1984      Slope/aspect: LEVEL  
Last observation: 1991-07-22      Size (acres): 2

Location:

SWAN VALLEY, 0.68 AIR MILES NNE. FROM THE FIRST FORK ON LINDBERGH LAKE  
ROAD, CA. 2.5 MILES WEST FROM ST. HWY. 83.

Element occurrence data:

1991: CA. 25 PLANTS; 1990: 27 PLANTS; 1989: 300-400 PLANTS; 1987: EST.  
75-100+ PLANTS; NORTH END OF POND IMPACTED BY LOGGING, WITH SOME SLASH  
PILED INTO THE WATER.

General site description:

GLACIAL POTHOLE; WITH CAREX VESICARIA, SIUM SUAVE, RANUNCULUS  
GMELINII; POPULUS TRICHOCARPA, PINUS CONTORTA, LARIX OCCIDENTALIS,  
SALIX SP. AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

25

Occurrence number: 006

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: LARGE POPULATION; AREA THREATENED BY  
LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 18 Precision: S  
Township-range comments: NE4NW4SW4

Survey date: 1986-07-14      Elevation: 3740  
First observation: 1986      Slope/aspect: LEVEL  
Last observation: 1991-07-25      Size (acres): 1

Location:

SWAN VALLEY, WEST BASE OF SWAN RANGE UPLIFT, 3.5 AIR MILES NORTH OF  
CONDON, 2.1 AIR MILES EAST OF ST. HWY. 83, 0.1 AIR MILES SOUTH OF  
CONDON CREEK.

Element occurrence data:

1991: CA. 800-1000 PLANTS; 1990: 500-1000 PLANTS; 1989 AND 1987: EST.  
1000-2000 PLANTS (MANY PLANTS DISTURBED BY MOOSE AND/OR WATERFOWL  
ACTIVITY); AREA IS ACTIVELY THREATENED BY LOGGING ROAD CONSTRUCTION  
AND TIMBER HARVESTING.

General site description:

VERNAL POND, IN PINUS PONDEROSA/LARIX OCCIDENTALIS FOREST; WITH SIUM  
SUAVE, CAREX VESICARIA, RANUNCULUS AQUATILIS, VERONICA CATENATA,  
CALLITRICHE HETEROPHYLLA.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-LESICA, P. (3965), 1986, SPECIMEN #104450 (MONTU).

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

26

Occurrence number: 007

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: SWAN RIVER WEST  
EO rank: AB  
EO rank comments: VERY LARGE POPULATION; NEARBY STATE LAND  
IS LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 018W Section: 14 Precision: S  
Township-range comments: SW4SE4SE4

Survey date: 1987-07-01      Elevation: 3190  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-25      Size (acres): 1

Location:

WEST SIDE OF SWAN VALLEY, 1.4 AIR MILES WEST OF ST. HWY. 83; 0.57 AIR  
MILE WEST OF SWAN RIVER; CA. 6.5 AIR MILES SOUTH OF SWAN LAKE (TOWN).

Element occurrence data:

1991: CA. 1000-2000 PLANTS; 1990: 500-1000 PLANTS; 1989: 1000-2000  
PLANTS; 1987: ABOUT 3000-4000 PLANTS, POSSIBLY MORE PLANTS; VERY  
DENSE, AND FORMING MATS, IN WEST POND; THE TWO PONDS, WHICH ARE  
SEPARATED BY A SALIX BORDER, ARE JOINED BY HIGHER WATER IN THE SPRING.

General site description:

IN TWO SMALL, ADJACENT GLACIAL POTHOLE, IN 1-2 FEET OF WATER; WITH  
CAREX VESICARIA, EQUISETUM FLUVIATILE, SIUM SUAVE; POPULUS  
TRICHOCARPA, BETULA PAPYRIFERA AROUND PONDS.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-SHELLY, J.S. (1356), 1987, MONTU. pH = 7.20 IN WEST POND.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

27

Occurrence number: 008

Global rank: G2            Forest Service status: SENSITIVE  
State rank: S2            Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: B  
EO rank comments: LARGE, VIGOROUS POPULATION; IN GOOD  
CONDITION HABITAT.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 017W Section: 06            Precision: S  
Township-range comments: N2SE4

Survey date: 1987-07-07            Elevation: 3190  
First observation: 1987            Slope/aspect: LEVEL  
Last observation: 1991-07-23        Size (acres): 2

Location:

SWAN VALLEY, CA. 4.5 AIR MILES SSE. OF SWAN LAKE (TOWN); 0.5 AIR MILES  
EAST OF ST. HWY. 83; 0.5 AIR MILES SSE. OF CONFLUENCE OF NORTH AND  
SOUTH FORKS LOST CREEK.

Element occurrence data:

1991: CA. 1000-2000 PLANTS; 1990: 40+ PLANTS; 1989: 1000-1500 PLANTS;  
1987: EST. 2000-3000 PLANTS, IN A SINGLE POND; SURROUNDED BY A  
RELATIVELY UNDISTURBED FOREST, WHICH WAS REPORTEDLY LIGHTLY  
SELECTIVELY LOGGED IN ABOUT 1910.

General site description:

THROUGHOUT A GLACIAL POTHOLE POND, BOTTOM SOIL OF CONSOLIDATED CLAY  
MUCK; WITH SIUM SUAVE, RANUNCULUS AQUATILIS, GLYCERIA BOREALIS, CAREX  
VESICARIA, POTAMOGETON, ELEOCHARIS.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-SHELLY, J.S. (1358) AND ANNE MORLEY, 1987, MONTU. pH=7.57.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

28

Occurrence number: 009

Global rank: G2            Forest Service status: SENSITIVE  
State rank: S2            Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION, ADJACENT FOREST  
PREVIOUSLY LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 017W Section: 07            Precision: S  
Township-range comments: NE4NE4NE4

Survey date: 1987-07-01            Elevation: 3250  
First observation: 1987            Slope/aspect: LEVEL  
Last observation: 1991-07-23        Size (acres): 3

Location:

SWAN VALLEY, 0.6 AIR MILES EAST OF ST. HWY. 83, 0.6 AIR MILES SOUTH OF  
SOUTH FORK LOST CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1991: CA. 40 PLANTS; 1990: 220+ PLANTS (SEVERAL AREAS HIGH COVER OF  
Lemna minor); 1989: 500-1000 PLANTS (SPECIES DOES NOT OCCUPY ALL OF  
THE AVAILABLE, SUITABLE HABITAT AT THIS SITE); 1987: EST. 500-600  
PLANTS; AREAS AROUND SOUTH AND EAST SIDES OF POND, CLEARCUT CA. 15  
YEARS AGO.

General site description:

IN SHALLOW WATER OF A GLACIAL POND, ORGANIC CLAY BOTTOM; WITH  
EQUISETUM FLUVIATILE, CAREX VESICARIA, SIUM SUAVE; POPULUS TRICHOCARPA  
BORDERING POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-SHELLY, J.S. (1357) AND ANNE MORLEY, 1987, MONTU.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

29

Occurrence number: 012

Global rank: G2            Forest Service status: SENSITIVE  
State rank: S2            Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MODERATE-SIZED POPULATION; SURROUNDING  
FOREST LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 017W Section: 08 Precision: S  
Township-range comments: NE4SW4NW4,SE4NW4NW4

Survey date: 1987-07-07            Elevation: 3235  
First observation: 1987            Slope/aspect: LEVEL  
Last observation: 1991-07-23        Size (acres): 2

Location:

SWAN VALLEY, 0.83 AIR MILES EAST OF ST. HWY 83, 0.37 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1991: CA. 260 PLANTS; 1990: EST. 35 PLANTS (Nuphar VERY ABUNDANT, H.  
aquatilis SCATTERED AMONG Sium suave); 1989: 16 PLANTS; 1987: EST.  
400-500 PLANTS; MUCH OF POND HAS NO VEGETATION; LOGGING HAS OCCURRED  
AROUND POND.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION, SOILS FAIRLY UNCONSOLIDATED;  
WITH NUPHAR VARIEGATUM, SIUM SUAVE, POTAMOGETON SP., POPULUS  
TRICHOCARPA, BETULA PAPYRIFERA AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT).

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

30

Occurrence number: 013

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: LARGE POPULATION; SURROUNDING FOREST  
LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 017W Section: 08 Precision: S  
Township-range comments: N2SW4NW4

Survey date: 1987-07-07      Elevation: 3240  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-23      Size (acres): 2

Location:

SWAN VALLEY, 0.79 AIR MILES EAST OF ST. HWY 83, 0.36 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1991: CA. 310 PLANTS; 1990: 33 PLANTS; 1989: 500-1000 PLANTS; 1987:  
EST. 1000-1500 PLANTS; LOGGING HAS OCCURRED AROUND POND.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; OPENINGS AMONG CAREX  
VESICARIA, WITH SIUM SUAVE, ELEOCHARIS PALUSTRIS, CAREX ROSTRATA;  
POPULUS TRICHOCARPA, BETULA PAPYRIFERA AROUND POND

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1359) AND ANNE MORLEY, 1987, MONTU.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

31

Occurrence number: 014

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MODERATE-SIZED POPULATION; SURROUNDING  
FOREST LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 017W Section: 08 Precision: S  
Township-range comments: NW4SW4NW4

Survey date: 1987-07-07      Elevation: 3245  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-23      Size (acres): 2

Location:

SWAN VALLEY, 0.68 AIR MILES EAST OF ST. HWY 83, 0.44 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1991: CA. 80-100 PLANTS; 1990: 150-250 PLANTS (SEVERAL AREAS OF DENSE  
Potamogeton); 1989: 500+ PLANTS; 1987: EST. 300-400 PLANTS; LOGGING  
HAS OCCURRED IN ADJACENT FORESTS.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; AROUND LOGS & IN OPENINGS  
AMONG CAREX VESICARIA, WITH SIUM SUAVE, POTAMOGETON SPP; POPULUS  
TRICHOCARPA, P. TREMULOIDES, BETULA PAPYRIFERA.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT); pH = 7.00.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

32

Occurrence number: 016

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MODERATE-SIZED POPULATION; ADJACENT TO  
LOGGING ROAD.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 017W Section: 07 Precision: S  
Township-range comments: SE4SE4NE4, NE4NE4SE4

Survey date: 1987-07-07      Elevation: 3235  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-23      Size (acres): 2

Location:

SWAN VALLEY, 0.61 AIR MILES EAST OF ST. HWY 83, 0.18 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1991: CA. 70 PLANTS; 1990: 300-500 PLANTS (Carex vesicaria VERY DENSE;  
H. aquatilis ONLY IN SHALLOW OPEN WATER AT EDGES OF POND, EMERGENT  
FLOWERS); 1989: 1000-1500 PLANTS; 1987: EST. 400+ PLANTS; ADJACENT TO  
LOGGING ROAD.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH CAREX VESICARIA, SIUM  
SUAVE; POPULUS TRICHOCARPA BORDERING POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT).

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

33

Occurrence number: 017

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: D  
EO rank comments: SMALL POPULATION; ADJACENT TO LOGGING  
ROAD.

County: LAKE

USGS quadrangle: CILLY CREEK

Township: 024N Range: 017W Section: 08 Precision: S  
Township-range comments: SW4SW4NW4

Survey date: 1987-07-07      Elevation: 3245  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-23      Size (acres): 3

Location:

SWAN VALLEY, 0.71 AIR MILES EAST OF ST. HWY 83, 0.25 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1991: 0 PLANTS; 1990: 0 PLANTS (WATER POSSIBLY TOO DEEP, *Carex  
vesicaria* DENSE); 1989: 10-20; 1987: EST. 10-12 PLANTS; ADJACENT TO  
LOGGING ROAD; THIS DEPRESSION WAS MUCH DRYER THAN THE OTHERS, *HOWELLIA  
AQUATILIS* PRESENT IN A FEW PUDDLES; HABITAT MAY BE MORE ADVANCED  
SUCCESIONALLY THAN NEARBY PONDS.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH *CAREX VESICARIA*, *SIUM  
SUAVE*, *POTAMOGETON*, *CAREX ROSTRATA*, *POTENTILLA PALUSTRIS*; *POPULUS  
TREMULOIDES* AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD; NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT).

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

34

Occurrence number: 020

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: LARGE POPULATION; AREA BEING LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 18 Precision: S  
Township-range comments: SW4NE4SW4

Survey date: 1987-07-02      Elevation: 3740  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-22      Size (acres): 2

Location:

SWAN VALLEY, 3.3 AIR MILES NORTH OF CONDON, 2.13 AIR MILES EAST OF ST.  
HWY 83, 0.25 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 210 PLANTS; 1990: 190+ PLANTS; 1989: 1000-1500 PLANTS; 1987:  
EST. 1000 PLANTS; NEARBY FORESTS RECENTLY LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED. pH=7.28.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

35

Occurrence number: 022

Global rank: G2            Forest Service status: SENSITIVE  
State rank: S2            Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION; AREA BEING  
LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 18            Precision: S  
Township-range comments: SW4NE4SW4

Survey date: 1987-07-02            Elevation: 3750  
First observation: 1987            Slope/aspect: LEVEL  
Last observation: 1991-07-25        Size (acres): 1

Location:

SWAN VALLEY, 3.28 AIR MILES NORTH OF CONDON, 2.18 AIR MILES EAST OF  
ST. HWY 83, 0.27 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 100 PLANTS; 1990: 60-100 PLANTS (WATER DEEP RED-YELLOW, *Sium*  
*suave* SPARSE); 1989: 500-1000 PLANTS; 1987: EST. 200 PLANTS; NEARBY  
FORESTS RECENTLY LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH *SIUM SUAVE*, *CAREX*  
*VESICARIA*; *POPULUS TRICHOCARPA*, *PINUS PONDEROSA*, *LARIX OCCIDENTALIS* IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

36

Occurrence number: 023

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION; AREA BEING  
LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 18 Precision: S  
Township-range comments: NW4SE4SW4

Survey date: 1987-07-02      Elevation: 3740  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-25      Size (acres): 1

Location:

SWAN VALLEY, 3.2 AIR MILES NORTH OF CONDON, 2.10 AIR MILES EAST OF ST.  
HWY 83, 0.35 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 110 PLANTS; 1990: 20 PLANTS; 1989: 400-500 PLANTS; 1987: 3  
PLANTS (1987); SEVERAL HUNDRED PLANTS OBSERVED IN 1986 BY P. LESICA;  
NEARBY FORESTS RECENTLY LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

37

Occurrence number: 025

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: SMALL POPULATION; POND MARGIN IMPACTED  
BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 18      Precision: S  
Township-range comments: S2SE4SW4

Survey date: 1987-07-02      Elevation: 3750  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-25      Size (acres): 2

Location:

SWAN VALLEY, 3.08 AIR MILES NORTH OF CONDON, 2.18 AIR MILES EAST OF  
ST. HWY 83, 0.45 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 15 PLANTS; 1990: 0 PLANTS (Carex AND Nuphar VERY EXTENSIVE);  
1989: 100-125 PLANTS; 1987: EST. 25 PLANTS; POND MARGINS RECENTLY  
DISTURBED BY LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

38

Occurrence number: 026

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION; AREA BEING  
LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 18      Precision: S  
Township-range comments: SE4NW4SW4

Survey date: 1987-07-02      Elevation: 3710  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-26      Size (acres): 1

Location:

SWAN VALLEY, 3.29 AIR MILES NORTH OF CONDON, 1.97 AIR MILES EAST OF  
ST. HWY 83, 0.28 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 1000-2000 PLANTS; 1990: 1000-1500 (VERY DENSE WITH MANY  
EMERGENT FLOWERING STEMS, ONLY MISSING FROM SHALLOW EDGES OF NORTHERN  
END OF POND); 1989: 500-1000 PLANTS; 1987: EST. 200-300 PLANTS; NEARBY  
FORESTS RECENTLY LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

Occurrence number: 027

Global rank: G2            Forest Service status: SENSITIVE  
State rank: S2            Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: MEDIUM-SIZED POPULATION; POND MARGIN  
IMPACTED BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 18            Precision: S  
Township-range comments: NW4SW4SW4

Survey date: 1987-07-02            Elevation: 3690  
First observation: 1987            Slope/aspect: LEVEL  
Last observation: 1991-07-22            Size (acres): 2

Location:

SWAN VALLEY, 3.18 AIR MILES NORTH OF CONDON, 1.84 AIR MILES EAST OF  
ST. HWY 83, 0.40 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 195 PLANTS; 1990: 200+ PLANTS; 1989: 300-400 PLANTS; 1987:  
EST. 300 PLANTS; SOUTH MARGIN OF POND RECENTLY DISTURBED BY LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED. pH=7.66.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

40

Occurrence number: 029

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: MEDIUM-SIZED POPULATION; POND MARGINS  
IMPACTED BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 19 Precision: S  
Township-range comments: NW4NW4NW4

Survey date: 1987-07-02      Elevation: 3690  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-26      Size (acres): 2

Location:

SWAN VALLEY, 2.97 AIR MILES NORTH OF CONDON, 1.88 AIR MILES EAST OF  
ST. HWY 83, 0.59 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 165 PLANTS; 1990: 100-200 PLANTS (ONLY IN VERY SHALLOW EDGE  
WATERS); 1989: 500-1000 PLANTS; 1987: EST. 200-300 PLANTS; POND  
MARGINS RECENTLY DISTURBED BY LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

BURLINGTON NORTHERN LAND

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

41

Occurrence number: 030

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: LARGE POPULATION; POND MARGINS IMPACTED  
BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township: 021N Range: 016W Section: 19 Precision: S  
Township-range comments: NE4NE4NW4

Survey date: 1987-07-02      Elevation: 3740  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-26      Size (acres): 1

Location:

SWAN VALLEY, 2.99 AIR MILES NORTH OF CONDON, 2.19 AIR MILES EAST OF  
ST. HWY 83, 0.55 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1991: CA. 15 PLANTS; 1990: 0 PLANTS; 1989 AND 1987: EST. 1000 PLANTS;  
POND MARGINS RECENTLY DISTURBED BY LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

BURLINGTON NORTHERN LAND

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

42

Occurrence number: 032

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: B  
EO rank comments: MEDIUM-SIZED POPULATION; HABITAT  
RELATIVELY UNDISTURBED.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 016W Section: 07      Precision: S  
Township-range comments: SE4SW4NW4

Survey date: 1983-07-24      Elevation: 4165  
First observation: 1983      Slope/aspect: LEVEL  
Last observation: 1991-07-26      Size (acres): 2

Location:

SWAN VALLEY, 0.16 AIR MILES SOUTH OF LINDBERGH LAKE RD., CA. 1.75 AIR  
MILES WEST OF ST. HWY 83.

Element occurrence data:

1991: CA. 25 PLANTS; 1990: 3-10 PLANTS (PLANTS INTERTWINED, DIFFICULT  
TO ESTIMATE; FEW *Sium suave* PRESENT); 1989: 750-1000 PLANTS; 1983:  
EST. 101-1000 PLANTS.

General site description:

GLACIAL POTHOLE, IN ONE TO TWO FEET OF WATER; WITH *EQUISETUM*  
*FLUVIATILE*, *SIUM SUAVE*, *TYPHA*, *CAREX ROSTRATA*; *POPULUS TRICHOCARPA*, *P.*  
*TREMULOIDES* AROUND POND.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

43

Occurrence number: 035

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: B  
EO rank comments: MEDIUM-SIZED POPULATION; HABITAT  
RELATIVELY UNDISTURBED.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 016W Section: 07 Precision: S  
Township-range comments: E2NE4SW4

Survey date: 1983-07-24      Elevation: 4150  
First observation: 1983      Slope/aspect: LEVEL  
Last observation: 1991-07-26      Size (acres): 2

Location:

SWAN VALLEY, 0.38 AIR MILES SOUTH OF LINDBERGH LAKE RD., CA. 1.5 AIR  
MILES WEST OF ST. HWY 83.

Element occurrence data:

1991: CA. 15 PLANTS; 1990: 0 PLANTS (NO *Sium suave* PRESENT, WATER DEEP  
YELLOW RED, OILY SCUM AT SURFACE (POSSIBLY DUE TO HIGH LEAF CONTENT));  
1989: 500-750 PLANTS; 1983: EST. 51-1000 PLANTS.

General site description:

GLACIAL POTHOLE, IN 0.5-1.5 FEET OF WATER; WITH *SIUM SUAVE*, *CAREX*  
*ROSTRATA*.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

44

Occurrence number: 044

Global rank: G2            Forest Service status: SENSITIVE  
State rank: S2            Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: LARGE POPULATION; ADJACENT TO A GRAVEL  
ROAD.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 017W Section: 12 Precision: S  
Township-range comments: S2SE4NE4, N2NE4SE4

Survey date: 1987-07-29            Elevation: 4215  
First observation: 1987            Slope/aspect: LEVEL  
Last observation: 1991-07-22        Size (acres): 1

Location:

SWAN VALLEY, SOUTHEAST OF LINDBERGH LAKE RD., 2.0 AIR MILES WEST OF  
ST. HWY 83.

Element occurrence data:

1991: 0 PLANTS (RED-YELLOW COLOR AND OILY SLICK PRESENT); 1990: 0  
PLANTS (POND HAD OILY SLICK ON SURFACE, DEEP RUST COLORED WATER, VERY  
LITTLE *Sium suave* PRESENT); 1989: 90-120 PLANTS; 1987: EST. 275-400  
PLANTS; POND IS ALONGSIDE A HEAVILY USED GRAVEL ROAD, AND IS UNDER A  
POWER LINE.

General site description:

GLACIAL POTHOLE DEPRESSION; WITH *CAREX VESICARIA*, *SIUM SUAVE*,  
*RANUNCULUS AQUATILIS*; *POPULUS TRICHOCARPA*, *P. TREMULOIDES* *PINUS*  
*CONTORTA*, *LARIX OCCIDENTALIS* AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

45

Occurrence number: 045

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: FAIRLY SMALL POPULATION, NEARBY AREAS  
LOGGED.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 016W Section: 18      Precision: S  
Township-range comments: SE4SW4SE4

Survey date: 1987-07-10      Elevation: 4250  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-26      Size (acres): 2

Location:

SWAN VALLEY, 1.83 AIR MILES ESE OF NORTH END OF LINDBERGH LAKE, 1.08  
AIR MILES SOUTH OF SWAN RIVER, CA. 2.0 AIR MILES WEST OF ST. HWY 83.

Element occurrence data:

1991: 500 PLANTS; 1990: 10 PLANTS (HEAVY ALGAL BLOOMS, WATER RUST  
COLORED, WATER APPEARED DEEPER); 1989: 300-400 PLANTS; 1987: EST. 300  
PLANTS.

General site description:

GLACIAL POTHOLE POND, SURROUNDED BY PINUS CONTORTA FOREST, POPULUS  
TREMULOIDES NEAR MARGIN; WITH CAREX VESICARIA, EQUISETUM FLUVIATILE,  
POTAMOGETON GRAMINEUS, SIUM SUAVE.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1364) AND L. CAMPBELL, 1987, MONTU.

Information source:

ROE, LISA S., MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

46

Occurrence number: 046

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: D  
EO rank comments: SMALL POPULATION; SURROUNDING HABITAT  
DISTURBED BY LOGGING.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 016W Section: 18 Precision: S  
Township-range comments: SW4NW4NW4

Survey date: 1987-07-10      Elevation: 4230  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-27      Size (acres): 1

Location:

SWAN VALLEY, 0.58 AIR MILES SOUTH OF SWAN RIVER, 2.13 AIR MILES WEST  
OF ST. HWY 83.

Element occurrence data:

1991: CA. 25 PLANTS; 1990: 3 PLANTS (NEAR AREA OF *Sium suave*); 1989:  
30-50 PLANTS; 1987: EST. 50 PLANTS; ADJACENT AREAS DISTURBED BY  
CLEARCUT LOGGING.

General site description:

GLACIAL POTHOLE POND; WITH *SIUM SUAVE*, *CAREX VESICARIA*, *TYPHA*,  
*RANUNCULUS GMELINII*, *POTAMOGETON GRAMINEUS*.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1368) AND L. CAMPBELL, 1987, MONTU.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

47

Occurrence number: 047

Global rank: G2            Forest Service status: SENSITIVE  
State rank: S2            Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: MED.-SIZED POPULATION; SURROUNDING AREA  
DISTURBED BY LOGGING

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 016W Section: 18            Precision: S  
Township-range comments: SW4NE4NW4

Survey date: 1987-07-10	Elevation: 4215
First observation: 1987	Slope/aspect: LEVEL
Last observation: 1991-07-27	Size (acres): 1

Location:

SWAN VALLEY, 0.5 AIR MILES SOUTH OF SWAN RIVER, 1.95 AIR MILES WEST OF  
ST. HWY 83.

Element occurrence data:

1991: CA. 200 PLANTS; 1990: 150 PLANTS; 1989: 200-300 PLANTS; 1987:  
EST. 200 PLANTS; POND LOCATED ON EDGE OF A CLEARCUT.

General site description:

GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX VESICARIA, TYPHA LATIFOLIA,  
NUPHAR VARIEGATUM, ELEOCHARIS PALUSTRIS, SPARGANIUM MINIMUM; ALNUS ON  
EDGES, NO POPULUS.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1365) AND L. CAMPBELL, 1987, MONTU.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

48

Occurrence number: 048

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: MED.-SIZED POPULATION; SURROUNDING AREA  
DISTURBED BY LOGGING

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 016W Section: 18 Precision: S  
Township-range comments: SW4NE4NW4

Survey date: 1987-07-10      Elevation: 4215  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1991-07-27      Size (acres): 1

Location:

SWAN VALLEY, 0.5 AIR MILES SOUTH OF SWAN RIVER, 1.89 AIR MILES WEST OF  
ST. HWY 83.

Element occurrence data:

1991: CA. 20 PLANTS; 1990: 0 PLANTS OBSERVED (MANY DEAD SEDGE PLANTS  
SOUTH END OF POND, DEAD Typha IN NORTH END, WATER APPEARED DEEPER THEN  
IN 1989); 1989: CA. 200 PLANTS; 1987: EST. 250 PLANTS; ADJACENT AREAS  
DISTURBED BY CLEARCUT LOGGING.

General site description:

GLACIAL POTHOLE POND; WITH CAREX VESICARIA, SIUM SUAVE, EQUISETUM  
FLUVIATILE, TYPHA LATIFOLIA.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1366) AND L. CAMPBELL, 1987, MONTU.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

Element Occurrence Record  
Howellia aquatilis

49

Occurrence number: 049

Global rank: G2      Forest Service status: SENSITIVE  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: LARGE POPULATION; ADJACENT TO NEW  
LOGGING ROAD.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township: 019N Range: 016W Section: 07      Precision: S  
Township-range comments: SW4SW4SE4

Survey date: 1987-07-10	Elevation: 4150
First observation: 1987	Slope/aspect: LEVEL
Last observation: 1991-07-27	Size (acres): 1

Location:

SWAN VALLEY, 0.16 AIR MILES SOUTH OF SWAN RIVER, 1.60 AIR MILES WEST  
OF ST. HWY 83.

Element occurrence data:

1991: CA. 1000 PLANTS; 1990: 200-300 PLANTS (HIGH COVER OF Lemna minor  
IN SOME AREAS); 1989: 2000+ PLANTS; 1987: EST. 1500-2000 PLANTS; POND  
IS ON NORTH SIDE OF A NEWLY CONSTRUCTED LOGGING ROAD, JUST NORTH OF  
USFS BOUNDARY.

General site description:

GLACIAL POTHOLE POND; WITH CAREX ROSTRATA, C. VESICARIA, RANUNCULUS  
GMELINII, R. AQUATILIS, ALOPECURUS AEQUALIS; POPULUS SPP., ALNUS  
INCANA, SALIX SPP. AROUND EDGE.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

VOUCHER - SHELLY, J.S. (1369) AND L. CAMPBELL, 1987, MONTU. pH=7.29.

Information source:

ROE, LISA S. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. 6TH AVE.,  
HELENA, MT.

## IX. LITERATURE CITED

- Lesica, P. 1990. Habitat requirements, germination behavior and seed bank dynamics of Howellia aquatilis in the Swan Valley, Montana. Unpublished report to USDA Forest Service, Flathead National Forest, Kalispell, Montana. Conservation Biology Research, Helena, Montana. 44 pp. + appendix.
- Nordstrom, L. 1992. U.S. Fish and Wildlife Service, Helena, MT. Phone conversation of 8 January 1992, on the current federal listing status of Howellia aquatilis.
- Schassberger, L.A. and J.S. Shelly. 1991. Update to the status review of Howellia aquatilis: field surveys, monitoring studies and transplant experiments. Unpublished report to USDA Forest Service, Flathead National Forest, Kalispell, Montana. Montana Natural Heritage Program, Helena. 57 pp.
- Shelly, J.S. 1988. Status review of Howellia aquatilis, U.S. Forest Service - Region 1, Flathead National Forest, Montana. Unpublished report to USDA Forest Service, Flathead National Forest, Kalispell, Montana. Montana Natural Heritage Program, Helena. 120 pp.
- Shelly, J.S. 1989. Addendum to the status review of Howellia aquatilis, U.S. Forest Service - Region 1, Flathead National Forest, Montana. Unpublished report to USDA Forest Service, Flathead National Forest, Kalispell, Montana. Montana Natural Heritage Program, Helena. 17 pp.
- Shelly, J.S. 1992. Conservation strategy: Howellia aquatilis (DRAFT). U.S. Forest Service, Northern Region, Missoula, Montana.
- Shelly, J.S. and R. Moseley. 1988. Report on the conservation status of Howellia aquatilis, a candidate threatened species. Unpublished report to U.S. Fish and Wildlife Service, Denver, Colorado. Montana Natural Heritage Program, Helena. 166 pp.
- Shelly, J.S. and L.A. Schassberger. 1990. Update to the status review of Howellia aquatilis: field surveys, monitoring studies and transplant experiments. Unpublished report to USDA Forest Service, Flathead National Forest, Kalispell, Montana. Montana Natural Heritage Program, Helena. 50 pp.
- Reel, S., L. Schassberger and W. Ruediger. 1989. Caring for Our Natural Community: Region 1 - Threatened, Endangered and Sensitive Species Program. U.S.D.A. Forest Service, Northern Region, Wildlife and Fisheries Unit, Missoula, Montana. 309 pp. + appendices.

- U.S. Department of Agriculture. 1988. Sensitive Plant Field Guide (Montana), Northern Region. U.S.D.A. Forest Service, Missoula, Montana.
- U.S. Department of Interior, Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants: Review of plant taxa for listing as endangered or threatened species. Federal Register 50: 6184-6229.