Noxon Rapids Reservoir and Cabinet Gorge Reservoir Herbicide Treatment Survey Report

2023 Season

Prepared for: The Sanders County Aquatic Invasive Plants Task Force

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THE **OUTSIDE** IS IN US ALL.

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Overview

Montana Fish, Wildlife, & Parks (FWP) partnered with The Sanders County Aquatic Invasive Plants Task Force to survey multiple plots within Noxon Rapids Reservoir and Cabinet Gorge Reservoir from 2018-2023. This effort guides annual treatment of Eurasian watermilfoil (EWM) within the reservoirs. In 2023, FWP staff surveyed 18 EWM plots under consideration for treatment and seven untreated, control plots July 11-14, 2023. Those locations, noted in Figure 1, cover the length of both reservoirs.

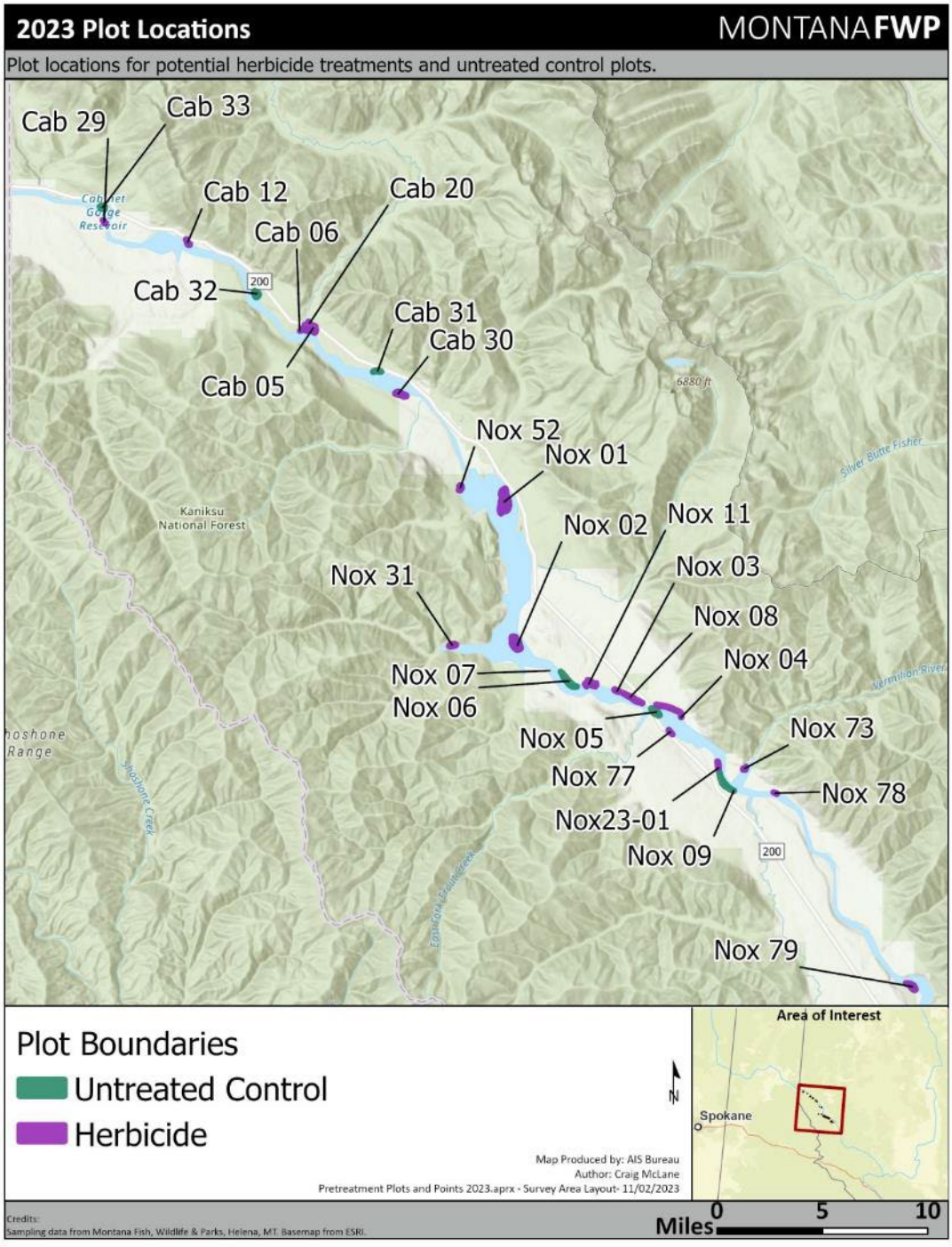


Figure 1. Locations of Survey Plots on Noxon Rapids and Cabinet Gorge Reservoirs, 2022.

Sampling Methods:

In each assigned area, FWP picked a certain number of random points. Table 1 shows the details of each area, its size, and the points sampled by FWP in 2023. The sizes of these areas were decided based on past surveys, and changes were made if more points were needed. The number of points in each area depended on its size, with bigger areas needing more points. If the shape was complicated, more points were used.

In 2020, three control areas were added for each reservoir to check for changes in abundance due to environmental changes like water temperature and clarity. FWP plans to keep sampling both control and treatment areas into the future.

The first task was to determine a suitable method to estimate the amount of plants at each plot. Density looks at the number of plants in a defined area (e.g., 2 plants/m^2). Density would be too labor intensive to determine so is not used since this would require intensive sampling methods such as scuba divers. Estimating plant abundances seemed easier to accomplish. Visual estimations of abundance at a plot level can be inaccurate (plants in plots are patchy with dense and sparse areas), so FWP used quantitative methods to reduce bias. Canopy cover is a useful estimating method to quantitatively determine plant abundances and is often used in terrestrial settings.

Canopy cover is amount (as a percentage) of area a plant species covers if looking at it from above or below (2-dimensional). A plant with a canopy cover value of 80% suggests that 80% of that area is covered by this plant species. Because plants can be under other plants, they are treated independent of other plants, so it is possible to have 100% coverage for more than one species. To complete canopy cover estimates the goal is to sample the same amount of area at each point to make the points comparable. A 1m^2 quadrat to estimate canopy cover is often used but seeing to the bottom of the lake is hard or impossible for technicians due to turbidity, plant growth on the surface, or wind/surface glare. Short of using divers to accomplish this, FWP decided to utilize rakes attached to long poles to collect plant samples from the lake bottom.

Table 1. List of plots surveyed and their approximate surveyed areas and number of sample points.

Plot	Potentially Treat/ Control	Approx. Plot Size (ac)	#Sample Points
C05	Potential Treat	21.4	28
C06	Potential Treat	7.8	21
C12	Potential Treat	3.7	27
C20	Potential Treat	3.2	14
C29	Potential Treat	1.9	16
C30	Potential Treat	16.1	52
C31	Control	4.4	20
C32	Control	9.6	18
C33	Control	8.0	19
N01	Potential Treat	98.3	104
N02	Potential Treat	50.9	59
N03	Potential Treat	3.3	34
N04	Potential Treat	8.7	55
N05	Control	16.8	12
N06	Control	22.4	33
N08	Potential Treat	14.4	56
N09	Control	16.8	20
N11	Potential Treat	21.1	67
N23-01	Control	3.3	15
N31	Potential Treat	7.7	34
N52	Potential Treat	5.4	19
N73	Potential Treat	1.3	15
N77	Potential Treat	1.6	23
N78	Potential Treat	0.65	13
N79	Potential Treat	15.3	38

Table 2. Cover class and range used during coverage sampling efforts for all years after 2019.

Cover Class	Range of Coverage	Midpoint of Range
0	0%	0.0%
1	1% to 2%	1.5%
2	3% to 5%	3.6%
3	6% to 15%	10.1%
4	16% to 25%	20.1%
5	26% to 40%	32.6%
6	41% to 60%	50.1%
7	61% to 75%	67.6%
8	76% to 85%	80.1%
9	86% to 95%	90.1%
10	96%-100%	97.6%

Technicians collected a sample on both sides the boat at each point using the rakes. This provides a consistent sample area at each point. After a 720-degree spin, technicians estimated the percentage of rake fullness for each species. This rake fullness was used to assign each species at each point a canopy cover by averaging both technicians' results. These canopy covers were then averaged within the whole plot to get a plot-level canopy cover for each species. Like the Daubenmire Method of estimating canopy cover, FWP used predetermined canopy cover classes and the associated midpoints for the coverage calculations (shown in Table 2) (Coulloudon et al, 1999). Treatment areas were then identified based on Eurasian watermilfoil plot-level canopy cover in the result maps. Results were also compared across different years to try to identify any trends.

Results:

Table 3 on the next page contains the survey results showing acreage of Eurasian watermilfoil and canopy cover abundances (in parentheses as a percent cover) within the potential treatment areas and untreated control plots in 2019-2023. Table 4 shows the estimated acreage and canopy cover of curlyleaf pondweed within each plot for 2020-2023.

Coulloudon, B. et al. 1999. Sampling Vegetation Attributes, Technical Reference 1734-4. Bureau of Land Management. Denver, CO.

Table 3. Pre-treatment acres and percent canopy cover of Eurasian watermilfoil within each plot (2019-2023).

Eurasian watermilfoil (*Myriophyllum spicatum*)											
Plot	2023		2022		2021		2020		2019		Plot Location
	Acres	*Canopy Cover (%)*	Acres	*Canopy Cover (%)*	Acres	*Canopy Cover (%)*	Acres	*Canopy Cover (%)*	Acres	*Canopy Cover (%)*	
Cab-05‡†	4.4	*7*	0	*2*	4.0	*11*	1.8	*0.1*	12.1	*7*	Southeast of Bull River Bridge on Hwy 200
Cab-06‡*†	5.7	*12*	0	*2*	0	*3*	3.7	*1*	4.2	*3*	Southwest of Bull River Bridge on Hwy 200
Cab-12*†	0.3	*1*	0	*2*	0	*1*	0.3	*1*	1.7	*5*	Big Eddy Campground
Cab-20	0.12	*2*	0	*0.3*	0	*2*	0.0	*0*	0.0	*0*	Bull River Campground
Cab-29†	1.1	*12*	0	*2*	0	*0.2*	1.2	*1*	0.5	*1*	Heron Boat Ramp
Cab-30‡*†	6.3	*7*	2.3	*2*	0	*0.1*	2.1	*1*	2.3	*2*	Noxon Community Park
Cab-31 (Untreated Control)	**2.7**	***10***	**0.7**	***1***	**1.9**	***10***	**1.9**	***4***	-	-	**Northwest of Noxon Bridge**
Cab-32 (Untreated Control)	**0.5**	***7***	**0**	***0***	**4.0**	***6***	**2.9**	***19***	-	-	**Downstream of Bull River at Power Lines**
Cab-33 (Untreated Control)	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	-	-	**North of Heron Boat Ramp**
Nox-01‡#^†	60.7	*14*	41.2	*9*	35.2	*10*	0	*0*	34.0	*33*	Near Rock Island - Mid Lake
Nox-02‡^†	37.5	*7*	0	*0*	32.2	*20*	25.6	*1*	21.3	*26*	Mid Lake at entrance to Marten Creek Bay
Nox-03‡#^*†	4.0	*7*	1.7	*2*	1.3	*15*	1.2	*3*	1.4	*1*	North Shore Campground
Nox-04‡#^*†	6.0	*7*	5.9	*18*	1.3	*3*	5.9	*5*	7.7	*5*	North Shore Shoreline East of Hwy 200 Bridge
Nox-05 (Untreated Control)	**9.2**	***41***	**12.4**	***37***	**3.6**	***15***	**1.2**	***5***	-	-	**South Shoreline E of Hwy 200 Bridge**
Nox-06 (Untreated Control)	**12.9**	***27***	**13.6**	***42***	**10.4**	***25***	**1**	***27***	-	-	**North Shoreline West of Train Bridge**
Nox-08‡#^†	13.3	*24*	0.9	*0.1*	8.5	*22*	0.3	*0.1*	8.2	*2*	North Shore Shoreline W of Hwy 200 Bridge
Nox-09 (Untreated Control)	**0**	***0***	**0**	***0.1***	-	-	**0**	***0***	-	-	**South Shoreline across from Vermillion Bay**
Nox-11#†	2.8	*3*	15.9	*44*	13.5	*19*	0.1	*0*	9.6	*26*	West of Train Bridge on N side
Nox-23-01 (Untreated Control)	**0**	***1***	-	-	-	-	-	-	-	-	**Private docks W side downstream of Vermillion Bay**
Nox-31‡#*†	3.6	*8*	2.5	*10*	0	*2*	2.1	*2*	3.7	*4*	Marten Creek Campground
Nox-52#†	0	*1*	2.8	*10*	0	*2*	0	*0*	0.8	*1*	South Shore Campground
Nox-73‡^†	1.4	*9*	0	*0.1*	.5	*7*	0.0	*0.1*	0.6	*26*	Vermillion Bay Boat Ramp
Nox-77#†	0.2	*2*	0.4	*19*	0	*3*	0.2	*3*	0.4	*3*	Trout Creek Boat Ramp
Nox-78†	0.1	*3*	0	*0.2*	0 (snorkel estimate)	-	0.0	*0*	0.1	*6*	Kirby Gulch Boat Ramp
Nox-79^†	0	*1*	0	*0*	-	-	0.0	*0.1*	0.7	*0.3*	Finley Flats Campground

Year treated for Eurasian watermilfoil: ‡ = 2023; #=2022; ^= 2021; * = 2020; † = 2019

Table 4. Pre-treatment acres and percent canopy cover of curlyleaf pondweed within each plot for 2020 - 2023. No treatments targeting curlyleaf pondweed have been conducted.

Curlyleaf pondweed (*Potamogeton crispus*)									
Plot	2023		2022		2021		2020		Plot Location
	Acres	*Canopy Cover (%)*	Acres	*Canopy Cover (%)*	Acres	*Canopy Cover (%)*	Acres	*Canopy Cover (%)*	
Cab-05‡†	6.3	*16*	8.9	*12*	9.0	*12*	8.1	*15*	SE of Bull River Bridge on Hwy 200
Cab-06‡*†	0	*0*	0	*0*	0.0	*0*	3.7	*1*	SW of Bull River Bridge on Hwy 200
Cab-12*†	0	*0*	0	*0.5*	0.0	*3*	1.1	*1*	Big Eddy Campground
Cab-20	0	*4*	0	*0*	0.0	*0*	0.4	*11*	Bull River Campground
Cab-29†	0	*0*	0	*0*	0.0	*0*	0	*0*	Heron Boat Ramp
Cab-30‡*†	0	*0*	0	*0*	0.0	*0.1*	0.4	*0*	Noxon Community Park
Cab-31 (Untreated Control)	**0**	***0***	**0.9**	***4***	**0.0**	***0***	**0.6**	***1***	**NW of Heron Bridge**
Cab-32 (Untreated Control)	**4.2**	***8***	**5.1**	***20***	**0.8**	***0***	**0.0**	***0***	**Downstream Bull River at Power Lines**
Cab-33 (Untreated Control)	**0**	***0***	**0.1**	***1***	**0.0**	***0***	**0.0**	***0***	**North of Heron Boat Ramp**
Nox-01‡#^†	10.8	*1*	0	*1*	11.5	*1*	17.8	*1*	Near Rock Island - Mid Lake
Nox-02‡^†	0.5	*0*	9.6	*1*	9.0	*0.4*	17.4	*2*	Mid Lake at entrance to Marten Creek Bay
Nox-03‡#^*†	0.6	*3*	1.7	*4*	0.2	*3*	1.2	*4*	North Shore Campground
Nox-04‡#^*†	3.6	*10*	3.3	*3*	4.9	*6*	5.9	*6*	North Shore Shoreline E of Hwy 200 Bridge
Nox-05 (Untreated Control)	**2.0**	***6***	**0.5**	***4***	**0.5**	***1***	**0**	***0***	**South Shoreline E of Hwy 200 Bridge**
Nox-06 (Untreated Control)	**14.6**	***9***	**7.4**	***18***	**4.9**	***10***	**1.4**	***1***	**North shoreline West of Train Bridge**
Nox-08‡#^†	5.4	*7*	5.4	*16*	7.9	*17*	7.9	*11*	North Shore Shoreline W of Hwy 200 Bridge
Nox-09 (Untreated Control)	**0**	***0***	**0**	***3***	**No Survey**	***No Survey***	**0**	***0***	**South Shoreline across from Vermillion Bay**
Nox-11#†	9.4	*4*	0	*3*	6.1	*19*	5.8	*9*	W of Train Bridge on N side
Nox23-01 (Untreated Control)	**0.2**	***1***	**-**	**-**	**-**	**-**	**-**	**-**	**Private docks W side downstream of Vermillion Bay**
Nox-31‡#*†	4.3	*6*	3.6	*13*	3.9	*27*	4.4	*21*	Marten Creek Campground
Nox-52#†	0	*1*	0	*0.3*	0.0	*1*	0.1	*1*	South Shore Campground
Nox-73‡^†	0.4	*8*	0.6	*17*	0.6	*4*	0.6	*4*	Vermillion Bay Boat Ramp
Nox-77#†	0	*1*	0	*0.3*	0.0	*0*	0.1	*0.2*	Trout Creek Boat Ramp
Nox-78†	0	*0*	0	*0*	-	-	0.0	*0*	Kirby Gulch Boat Ramp
Nox-79^†	0	*1*	0	*2*	No Survey	*No Survey*	0.1	*0.1*	Finley Flats Campground

Year treated for Eurasian watermilfoil: ‡ = 2023; #=2022; ^= 2021; * = 2020; † = 2019

Species level differences among plots in 2019 - 2023

The following five charts show the calculated percent canopy cover among each plot for each of the last 5 years. The grouped bar for each plot represents the cumulative native species, Eurasian watermilfoil, curlyleaf pondweed, and flowering rush. These graphs allow comparison among plots for each year. Plots where herbicide treatments occurred that year are outlined in light blue boxes.

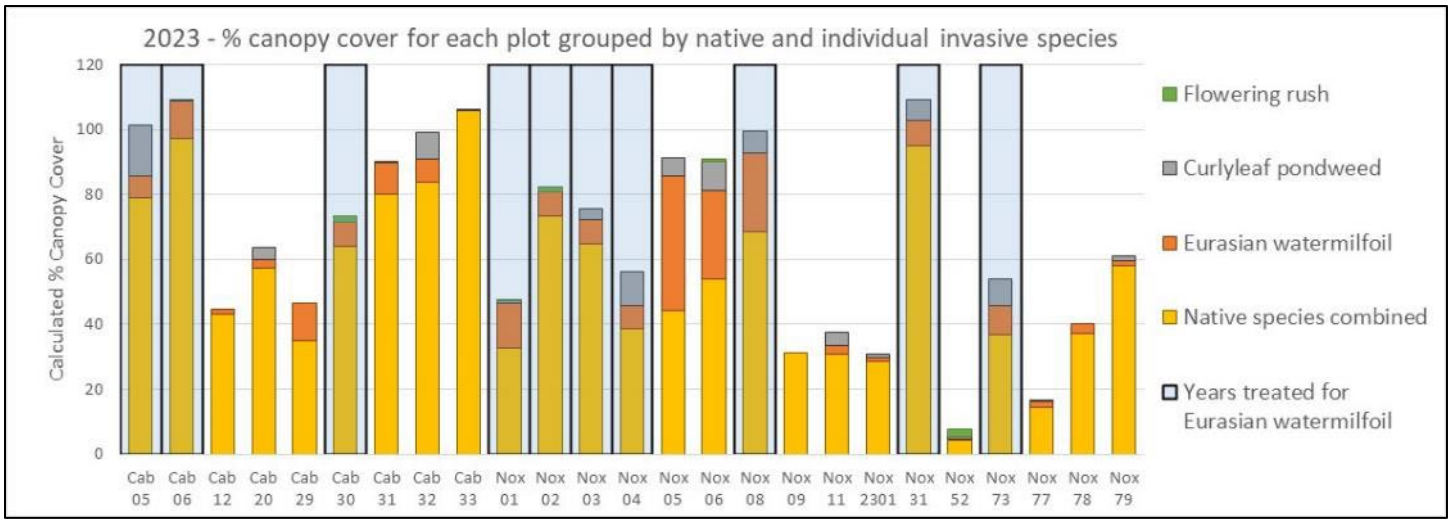


Figure 2. Calculated Canopy Cover (%) – 2023

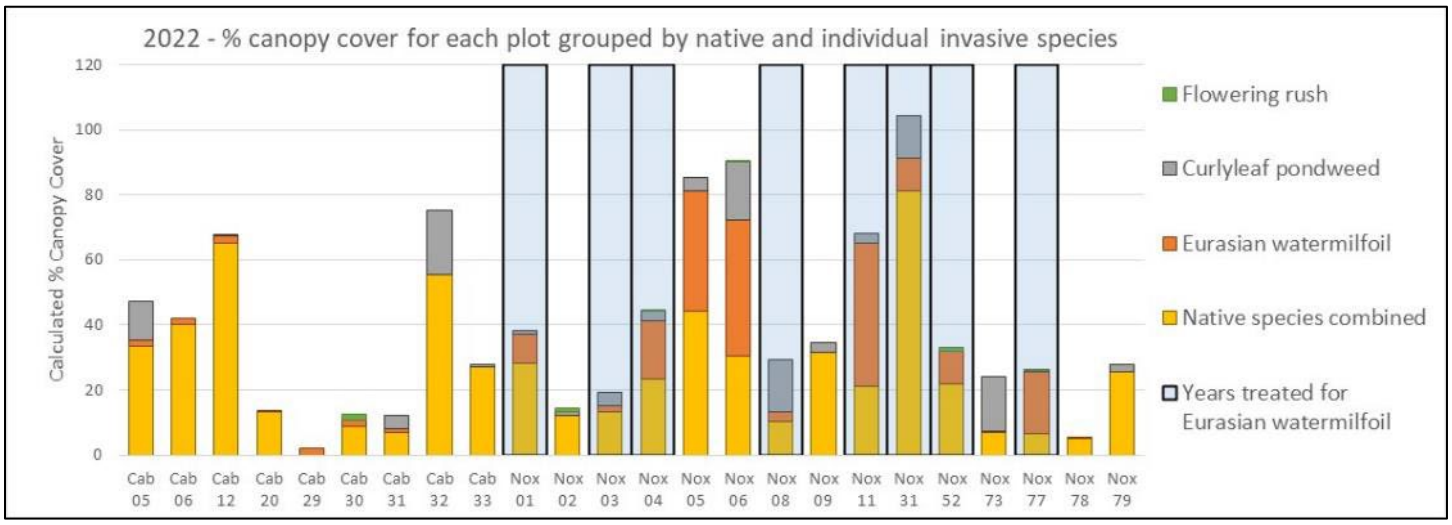


Figure 3. Calculated Canopy Cover (%) - 2022.

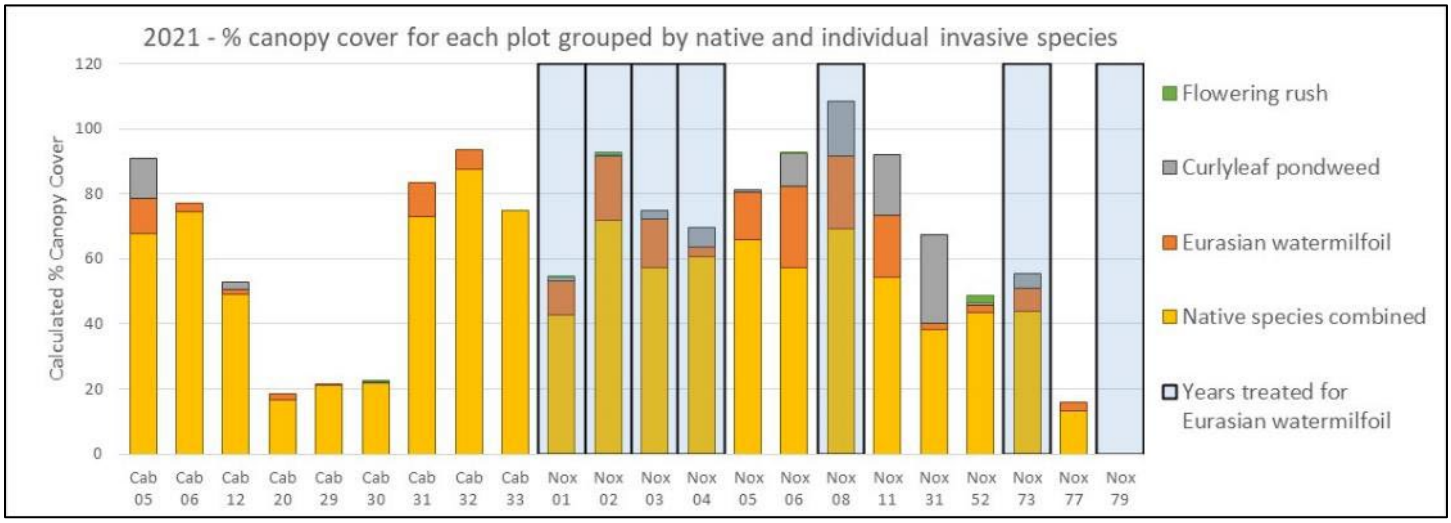


Figure 4. Calculated Canopy Cover (%) - 2021.

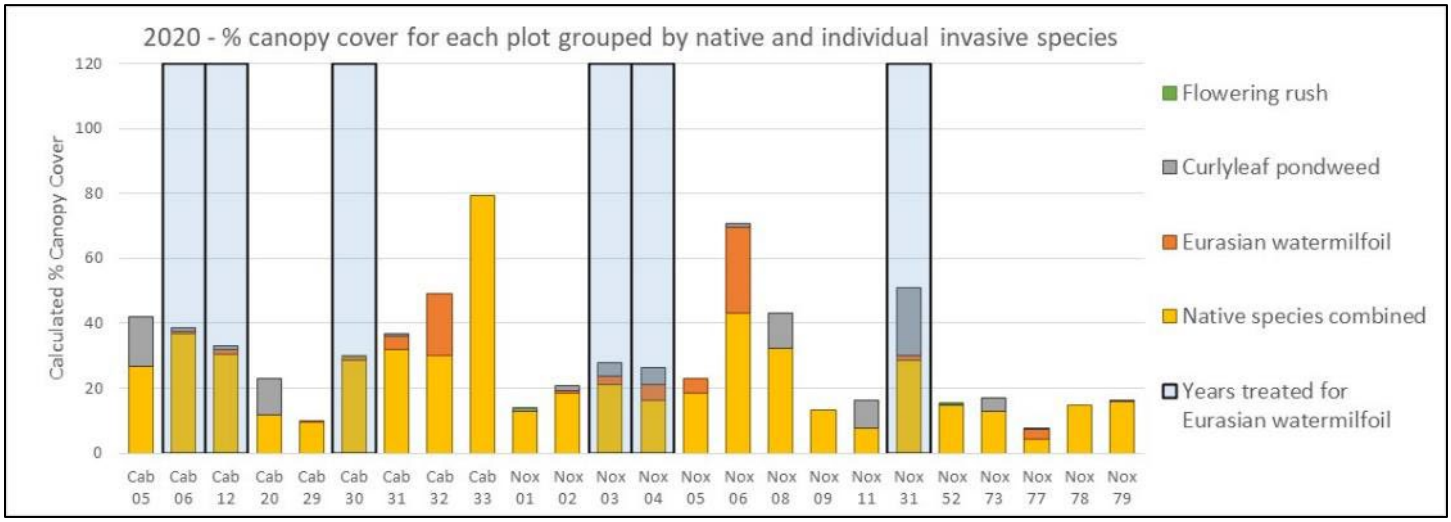


Figure 5. Calculated Canopy Cover (%) - 2020.

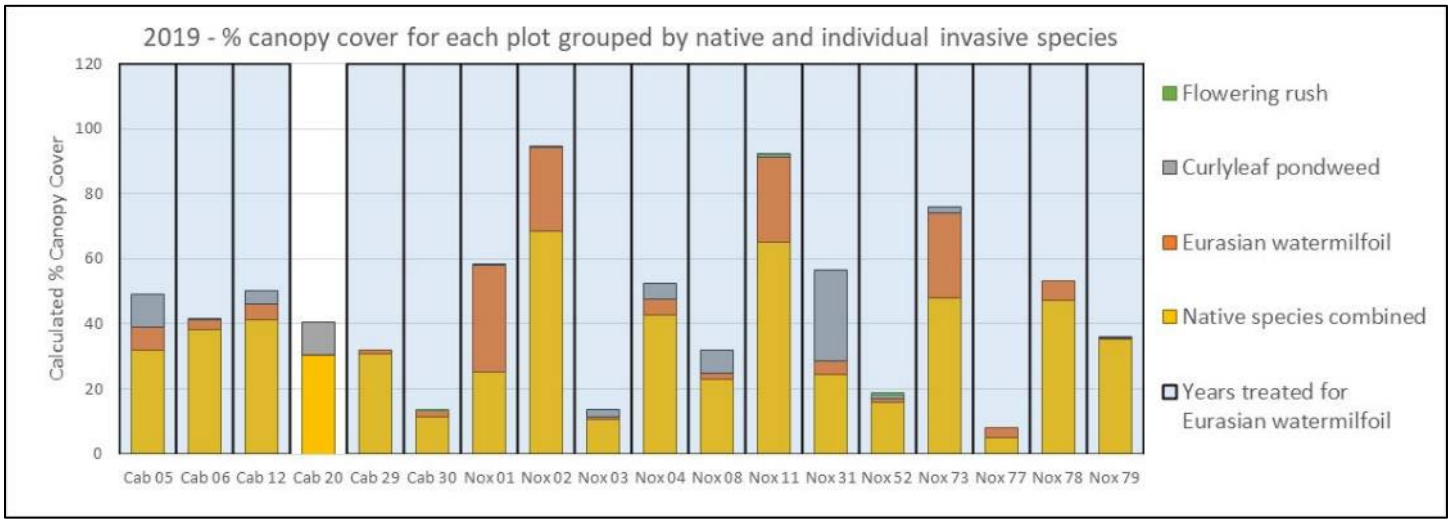


Figure 6. Calculated Canopy Cover (%) - 2019.

Percent change of canopy cover in last year (2022-2023) and five years (2019-2023)

Percent change of canopy cover among years were calculated and results are in the tables below for each species. Table 5 shows the percent change in 2023 compared to 2022 (1-year change) and Table 6 shows the percent change in 2023 compared to 2019 (5-year change). The cells are colored with a gradient of yellow (large decrease) to blue (large increase) depending on the percent change values. Appendix 2 shows tables with the % canopy cover for each species and corresponding 1-year and 5-year percent changes for each plot.

Table 5. Canopy cover percent change over last year (2022-2023).

Canopy cover percent change over last year (2022-2023)

	Plot ID	Flowering Rush	Curlyleaf Pondweed	Eurasian Watermilfoil	Coontail	Muskgrass species	Waterweed species	Northern watermilfoil	Naiad species	Native Pondweed species	White-stemmed pondweed	Richardson's pondweed	White water-buttercup
Cabinet Gorge	C05	0	33	247	102	-26	1714	0	0	0	0	0	101
	C06	0	Increase by 0.2	446	211	0	196	0	0	0	0	0	59
	C12	0	-100	-32	73	0	-88	-100	0	0	0	0	Increase by 0.6
	C20	0	Increase by 3.8	849	183	Increase by 0.3	371	0	0	Increase by 1.2	0	0	149
	C29	0	0	647	0	0	7479	0	0	0	0	0	0
	C30	-19	Increase by 0.3	298	432	208	743	-100	0	516	0	220	-100
	C31[c]	0	-96	801	631	0	1929	0	0	0	0	0	0
	C32[c]	0	-59	Increase by 7.2	64	0	300	0	0	0	0	-100	2
	C33[c]	0	-63	Increase by 0.2	276	0	322	0	0	0	0	0	0
Noxon Rapids Plots	N01	423	14	53	-23	77	176	-95	0	30	Increase by 0.4	1043	-50
	N02	71	-92	Increase by 7.4	243	1844	6515	Increase by 0.1	0	182	-100	640	Increase by 0.1
	N03	0	-4	198	332	371	553	Increase by 0.1	0	409	0	689	812
	N04	-100	236	-59	272	531	-33	-100	Increase by 0.4	245	0	-43	0
	N05[c]	0	31	12	21	Increase by 9.6	-79	0	0	836	0	0	Increase by 0.3
	N06[c]	139	-49	-34	113	0	8	0	0	-91	0	0	122
	N08	0	-58	802	1313	849	779	0	0	389	-100	0	402
	N09[c]	0	-100	0	60	3011	-88	0	0	43	0	0	-31
	N11	0	48	-93	47	289	-34	-100	0	140	0	Increase by 0.2	-47
	N2301												
	N31	0	-53	-20	77	0	-36	-100	0	Increase by 1.5	0	0	-100
	N52	219	162	-94	-86	-81	-100	-100	0	17	0	-100	-100
	N73	0	-53	Increase by 9.0	307	0	444	Increase by 0.5	0	Increase by 0.1	0	Increase by 0.5	92
	N77	-100	49	-92	162	257	-32	0	0	297	0	Increase by 4.8	-75
	N78	0	0	Increase by 3.2	847	-100	510	Increase by 0.4	0	770	0	0	Increase by 0.1
	N79	0	-36	Increase by 1.4	115	5678	1209	1668	0	-74	0	0	157

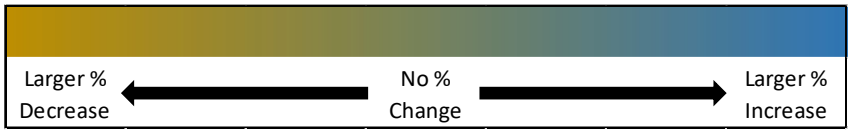
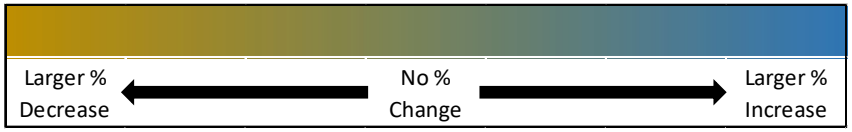


Table 6. Canopy cover percent change over 5 years (2019-2023).

Canopy cover percent change over 5 years (2019-2023)

	Plot ID	Flowering Rush	Curlyleaf Pondweed	Eurasian Watermilfoil	Coontail	Muskgrass species	Waterweed species	Northern watermilfoil	Naiad species	Native Pondweed species	White-stemmed pondweed	Richardson's pondweed	White water-buttercup
Cabinet Gorge	C05	0	56	-6	88	-73	117	0	0	-100	0	0	412
	C06	0	69	242	112	0	117	0	0	-100	0	0	449
	C12	0	-100	-73	116	-100	-78	0	0	0	0	0	578
	C20	0	-60	Increase by 2.4	379	Increase by 0.3	59	0	0	Increase by 1.2	0	-100	Increase by 7.4
	C29	0	0	1240	0	0	14	0	0	0	0	0	0
	C30	2209	Increase by 0.3	299	1014	163	443	0	-100	472	0	18	0
	C31[c]	0	-75	140	-3	0	1045	0	0	0	0	0	0
	C32[c]	0	Increase by 8.3	-63	491	0	-16	0	0	0	0	0	110
	C33[c]	0	Increase by 0.4	Increase by 0.2	-6	0	398	0	0	0	0	0	0
Noxon Rapids Plots	N01	Increase by 0.2	2547	-58	-21	12849	1	0	0	68	Increase by 0.4	933	-87
	N02	Increase by 1.3	-52	-72	-39	2580	-11	Increase by 0.1	0	805	-100	Increase by 0.7	-4
	N03	0	120	1282	311	Increase by 1.3	9642	0	0	762	0	Increase by 1.5	Increase by 1.7
	N04	0	114	55	-28	741	-69	0	Increase by 0.4	9671	0	Increase by 0.4	2239
	N05[c]	0	Increase by 5.6	820	86	Increase by 9.6	175	-100	0	65	-100	0	Increase by 0.3
	N06[c]	Increase by 0.7	952	3	59	0	-38	0	0	-87	-100	0	Increase by 0.6
	N08	0	2	1195	52	5300	389	0	0	1116	-100	-100	206
	N09[c]	0	0	0	-41	Increase of 13.1	419	0	0	407	0	0	Increase by 0.6
	N11	-100	409	-89	-60	856	-72	-100	0	83	0	77	-36
	N2301	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N31	0	-78	94	428	0	138	0	0	277	0	0	0
	N52	110	-29	-30	-84	-51	-100	0	0	-10	0	-100	0
	N73	0	296	-65	-8	Increase by 0.1	-75	Increase by 0.5	0	Increase by 0.1	0	Increase by 0.5	80
	N77	0	Increase by 0.5	-54	237	Increase by 1.5	11	0	0	Increase by 1.1	0	3110	-81
	N78	0	0	-42	337	0	-37	Increase by 0.4	0	866	0	0	-94
	N79	0	985	377	73	1488	34	Increase by 3.1	0	-75	0	-100	419



Percent canopy cover over 5 years (2019-2023)

The following collection of graphs include canopy cover abundances of Eurasian watermilfoil, curlyleaf pondweed, and native species over the last five years for each reservoir divided into untreated control plots and treated control plots. Within each plot's graph, years with herbicide treatment are outlined with black boxes. Trendlines and the respective R^2 values are included for each group within each graph. The R^2 values closer to a value of one suggest a strong correlation with time. Overall, the R^2 values show no or weak correlations with time. This suggests that in many plots there is no clear increase or decrease in abundances that can be explained by time.

Appendix 1 includes canopy cover abundance graphs for each plot, as well as maps showing individual sample points with their respective abundance of Eurasian watermilfoil in 2023. Red polygons with hatch marks suggest the approximate area with higher canopy cover abundance of Eurasian watermilfoil that could be considered for treatment that year if treated. Green polygons represent untreated control plots; purple polygons respresent plots being considered for herbicide treatements and any orange polygons are plots that were evaluated in 2022 for a harvester control project. Additional details of canopy cover for each species within each plot for each of the last 5 years can be found in Appendix 3.

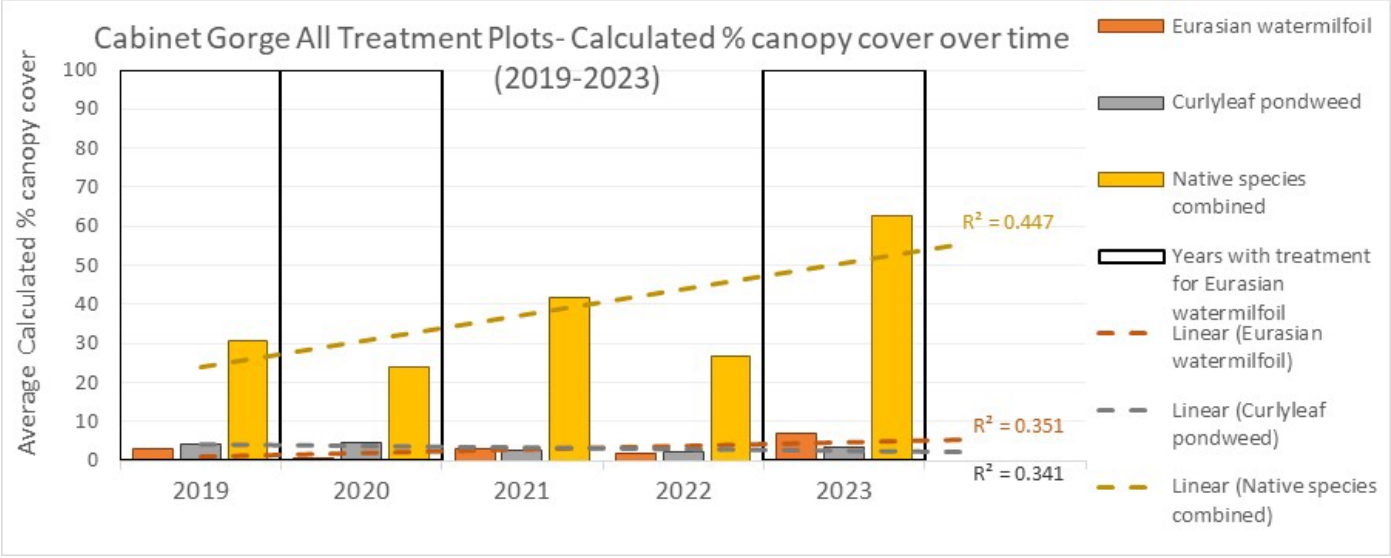


Figure 7. Calculated % canopy cover over time (2019-2023) for all treatment plots on Cabinet Gorge Reservoir.

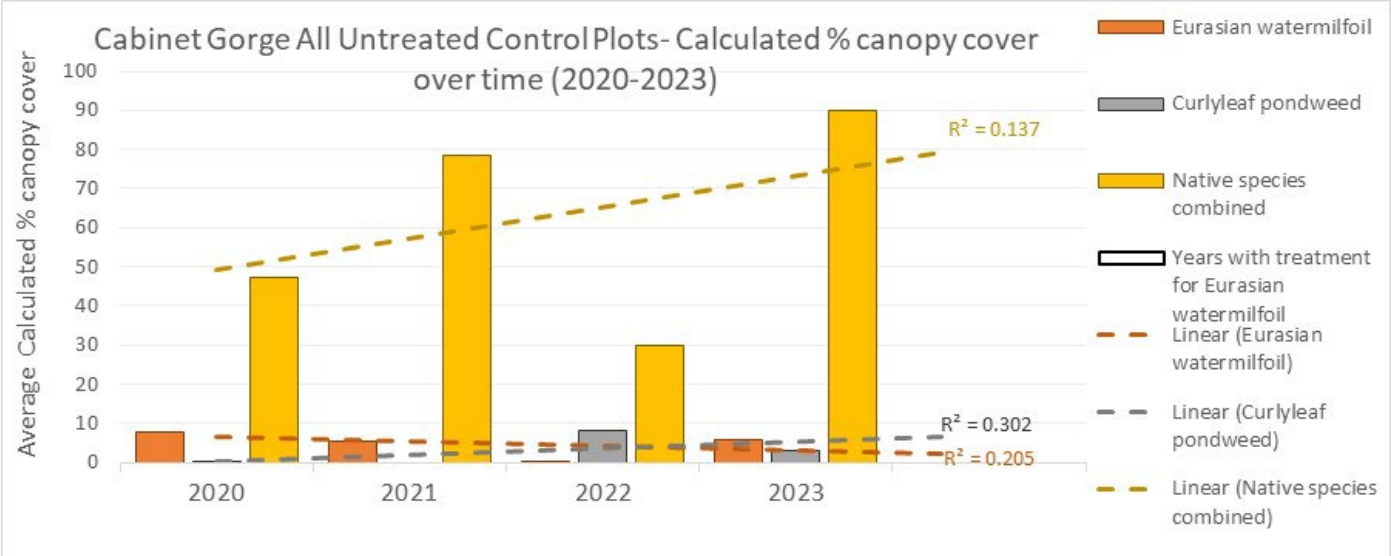


Figure 8. Calculated % canopy cover over time (2019-2023) for all untreated control plots on Cabinet Gorge Reservoir.

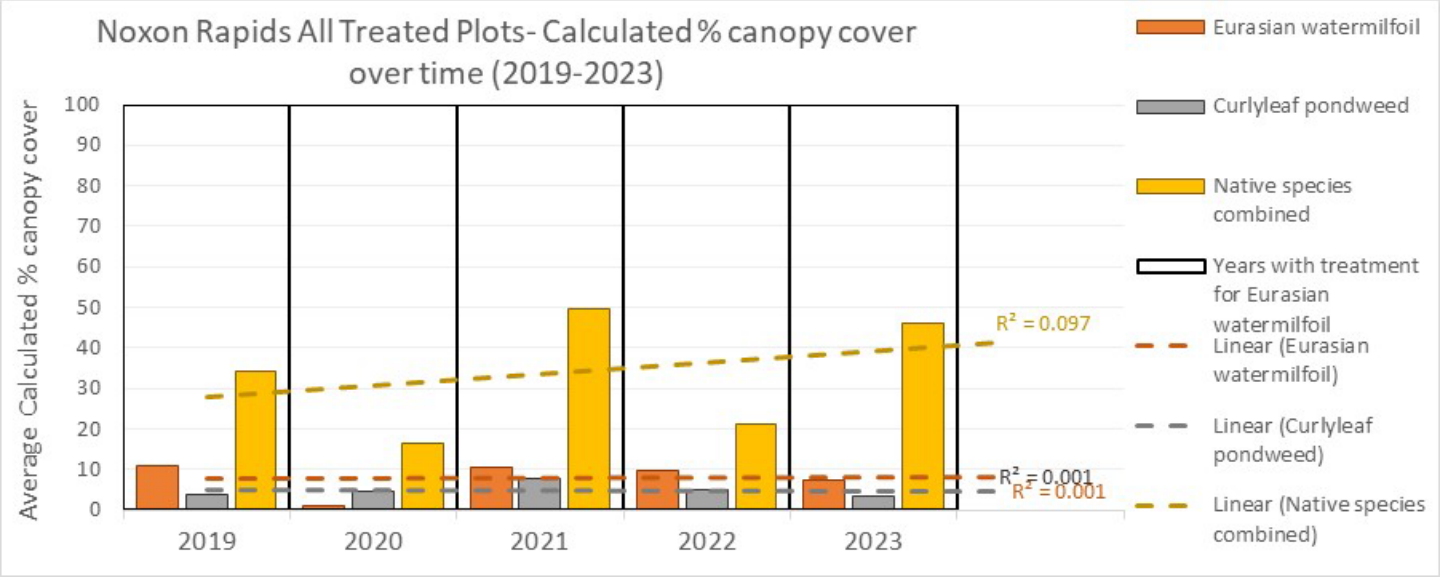


Figure 9. Calculated % canopy cover over time (2019-2023) for all treatment plots on Noxon Rapids Reservoir.

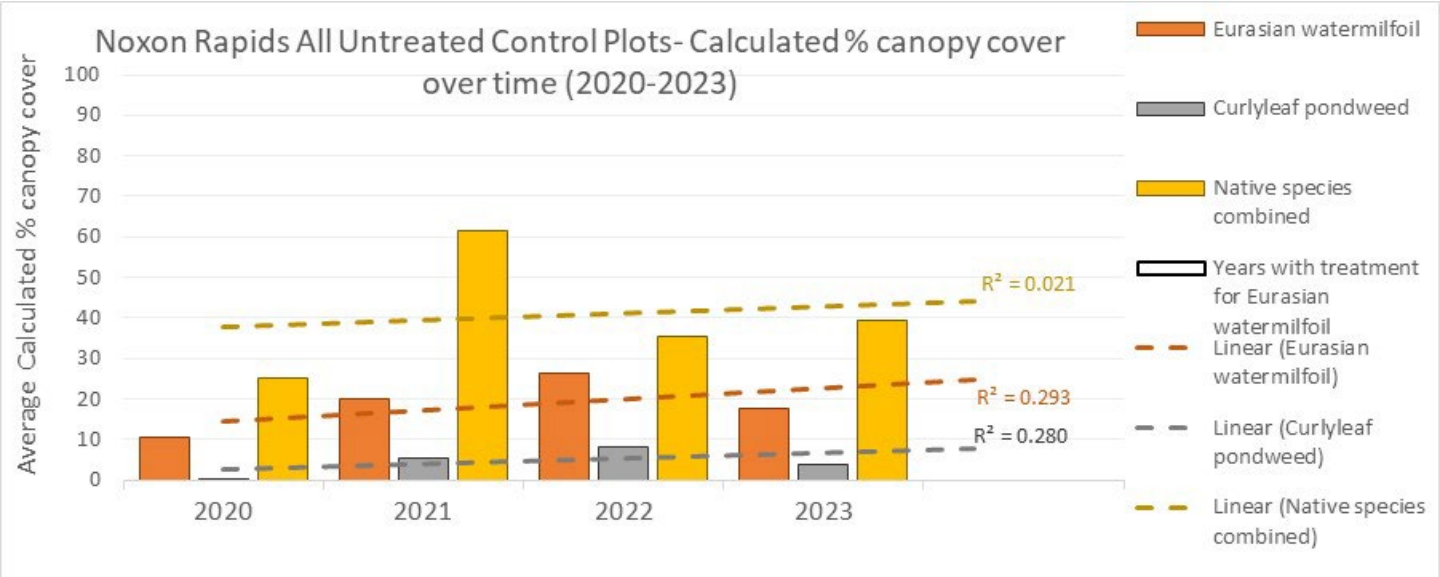


Figure 10. Calculated % canopy cover over time (2019-2023) for all untreated control plots on Noxon Rapids Reservoir.

Conclusion

Sample Method

Using the pole-attached rake seems to reduce bias in sampling but may provide underestimations. This method allows a consistent sampled area for each sample. The pole-attached rake implemented in 2019 helped improve repeatability of sample area. A rope attached rake can have variations in sampled area due to distance the rake was tossed, the depth of the water (thus changing the angle of retrieval), and the rate of retrieval. In general, the pole-attached method appears more precise, but anecdotal evidence suggests it underestimates plant cover at the plot level. Subsequent consistent sampling among years will improve the overall sampling effort's precision but accuracy needs to be further evaluated. Even if the rake-pole sampling method underestimates cover, current years' canopy cover and inference of variations among years can still be made in the future. In 2024, FWP hopes to implement aquatic habitat maps using sonar to help determine

the relationship of our canopy cover results and the total vegetation abundance within a plot. This should help make decisions on plot treatment in the future.

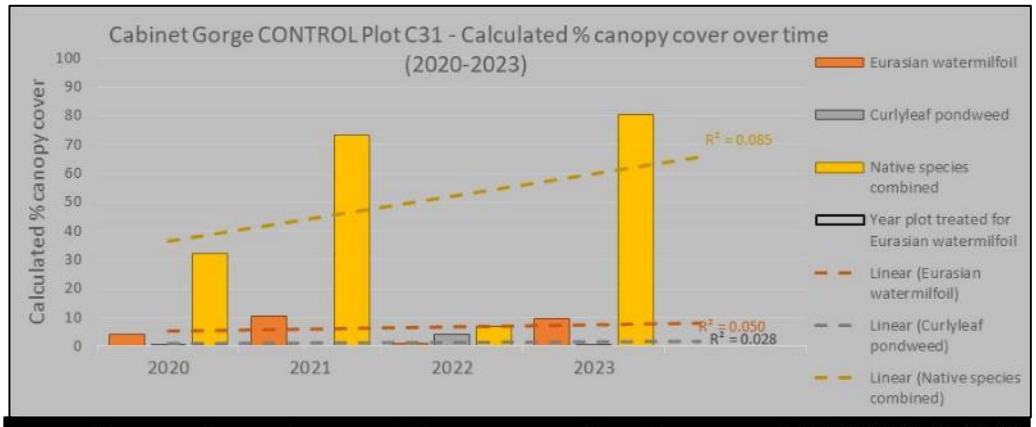
Change in Canopy Cover

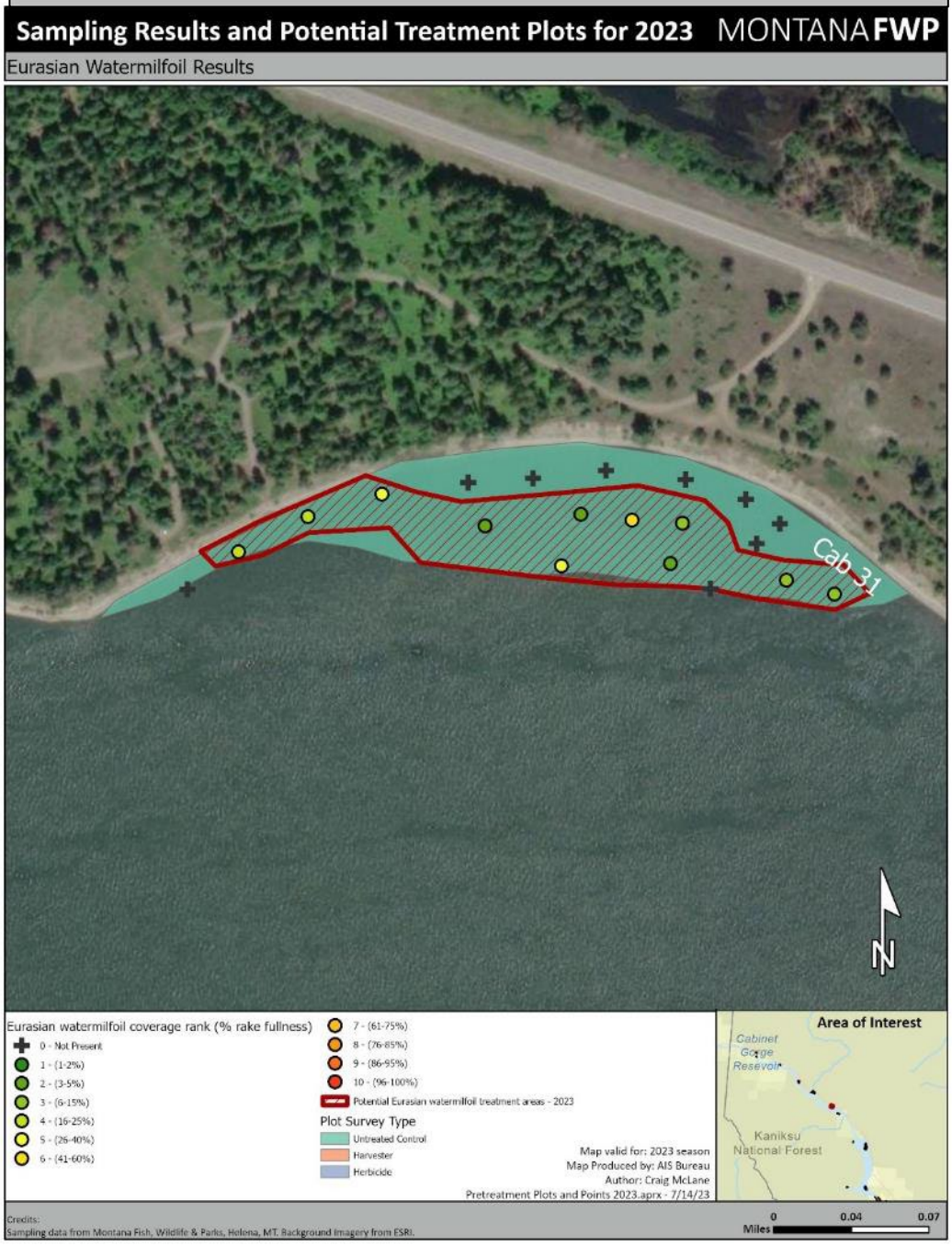
It is difficult to make much inference of canopy cover change due to herbicide treatments alone as multiple factors could contribute to said changes. Natural environmental variations such as water flows, temperatures, and hybridization strains could cause significant localized macrophyte community variations or responses to herbicide among years.

With the current management strategy there is no expectation that herbicide control with contact herbicides will have any long-term reductions of Eurasian watermilfoil with the plots. The goal is to maintain access and reduce the risk of boat moving the invasive species to another waterbody. There seems to be clear evidence that is there is no large upswings in Eurasian watermilfoil cover in any of the treatment plots overtime. This suggests that there is success of treatments looking to keep these Eurasian watermilfoil infestations at bay. With many of the treatment plots there is anecdotal evidence that the following year after treatment Eurasian watermilfoil abundances drop to much lower levels. This may suggest that there are some residual effects of treatments into the following year, though populations appear to rebound at some point during the growing season.

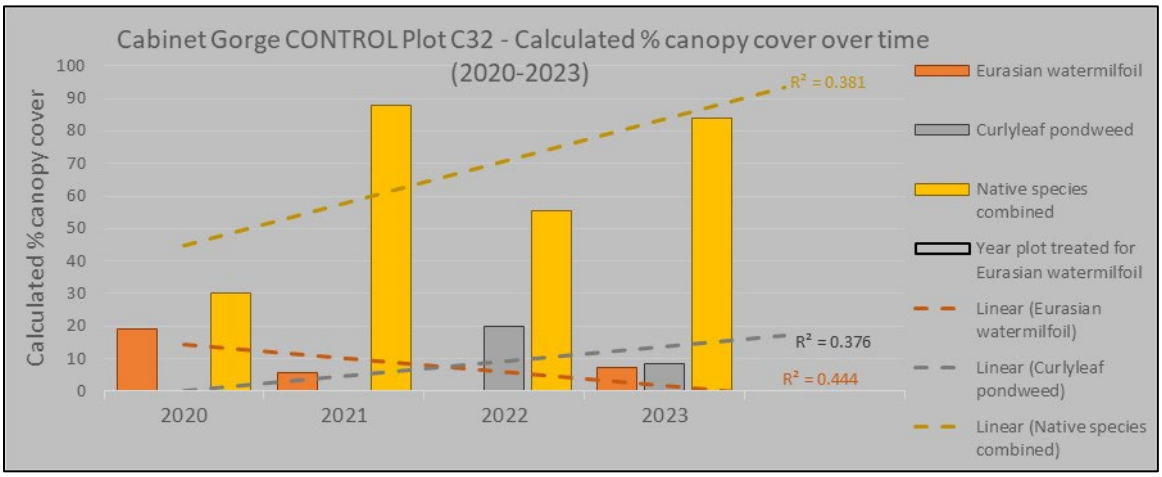
Appendix 1. Individual plot maps and graphs (% canopy cover over 5 years).

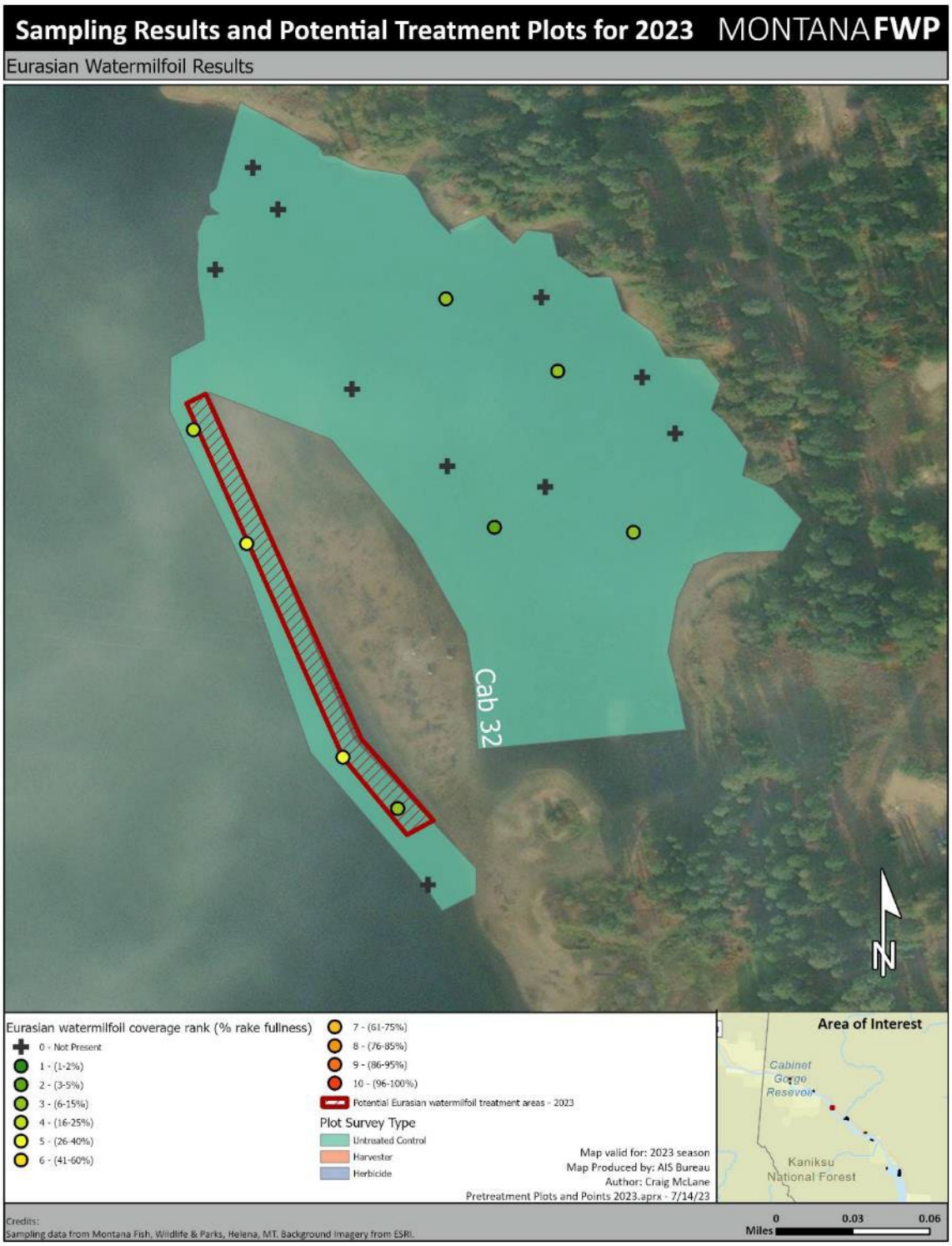
Cab-31



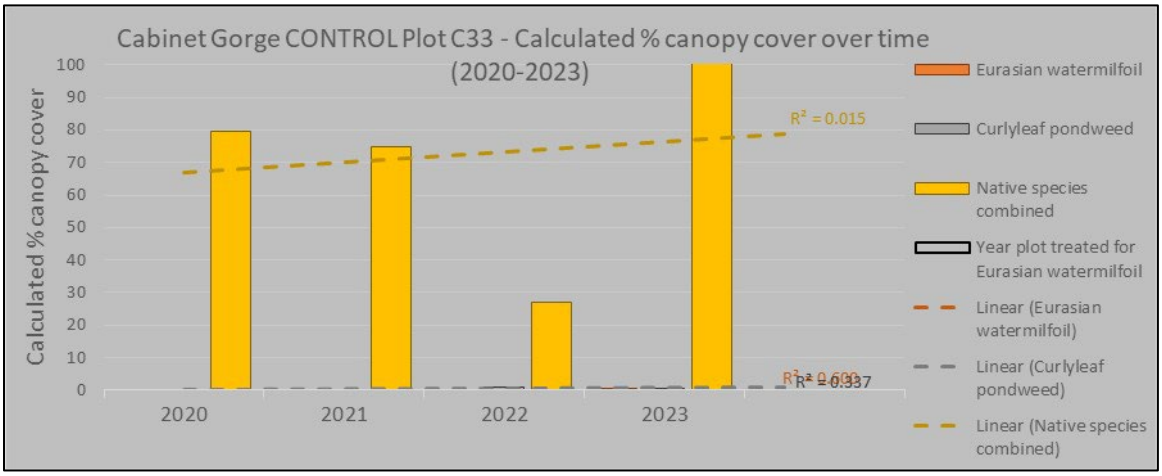


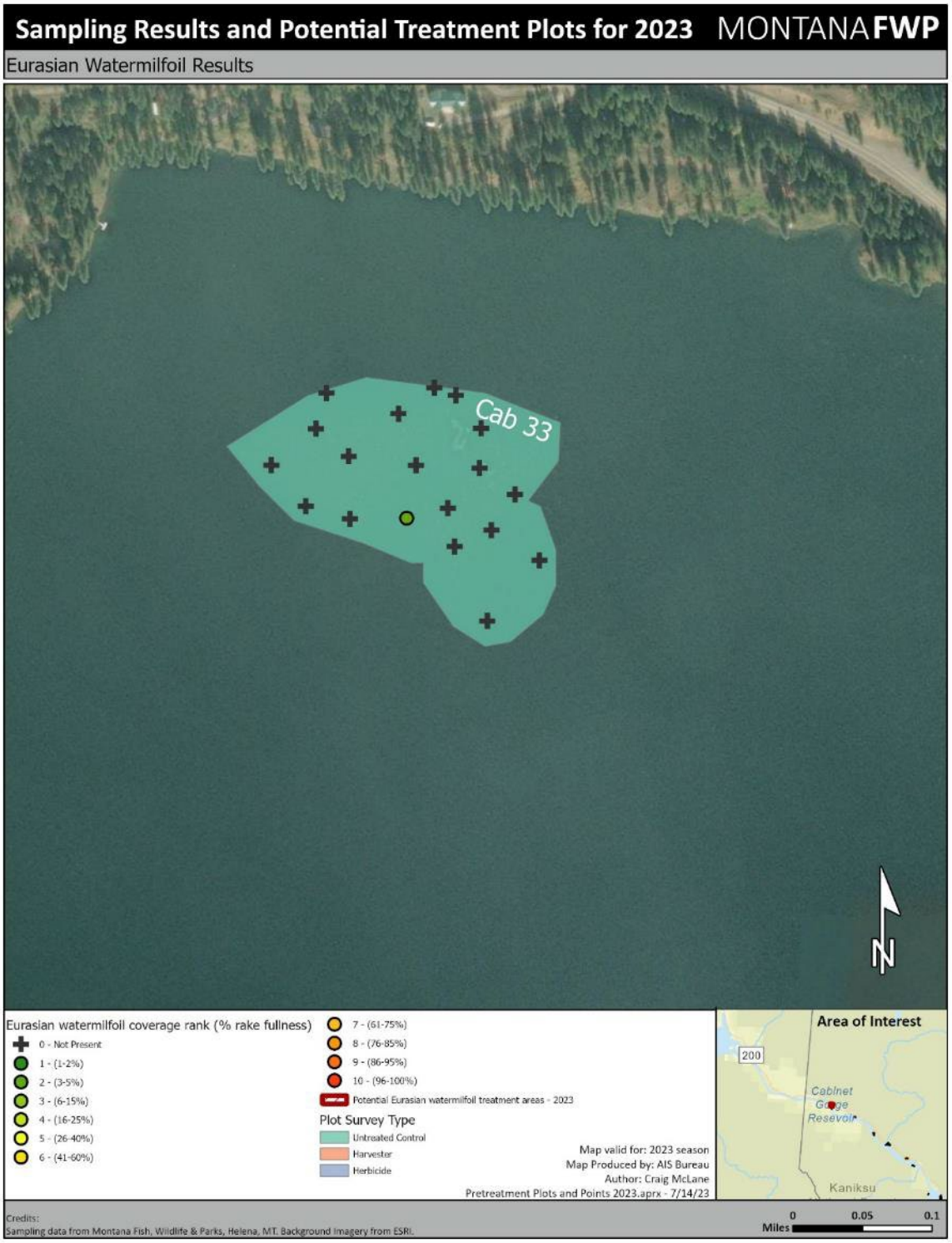
Cab-32


Cabinet Gorge CONTROL Plot C32 - Calculated % canopy cover over time (2020-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2020
2021
2022
2023
R² = 0.381
R² = 0.376
R² = 0.444
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

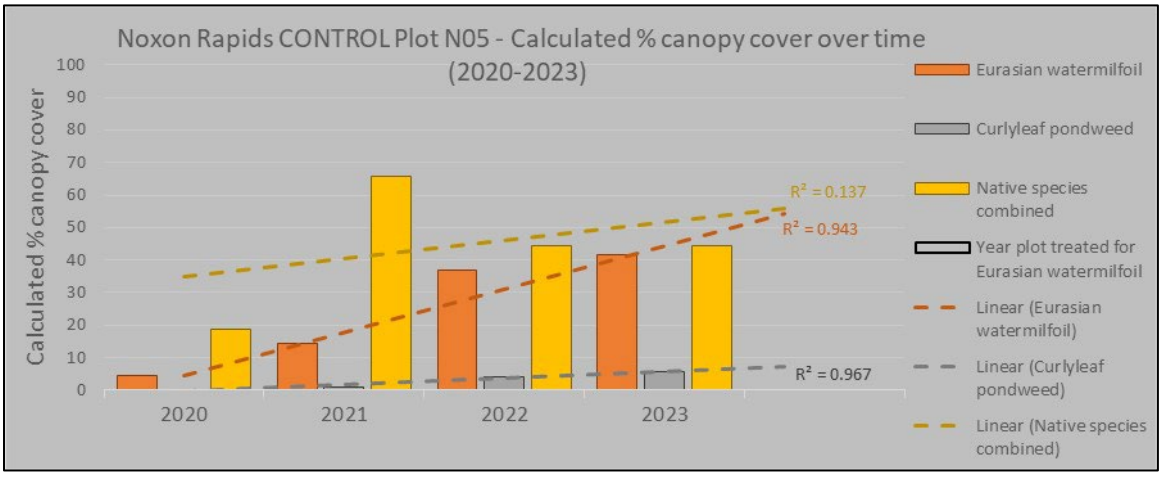

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 32
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Cabinet Gorge Reservoir
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.03
0.06
Miles

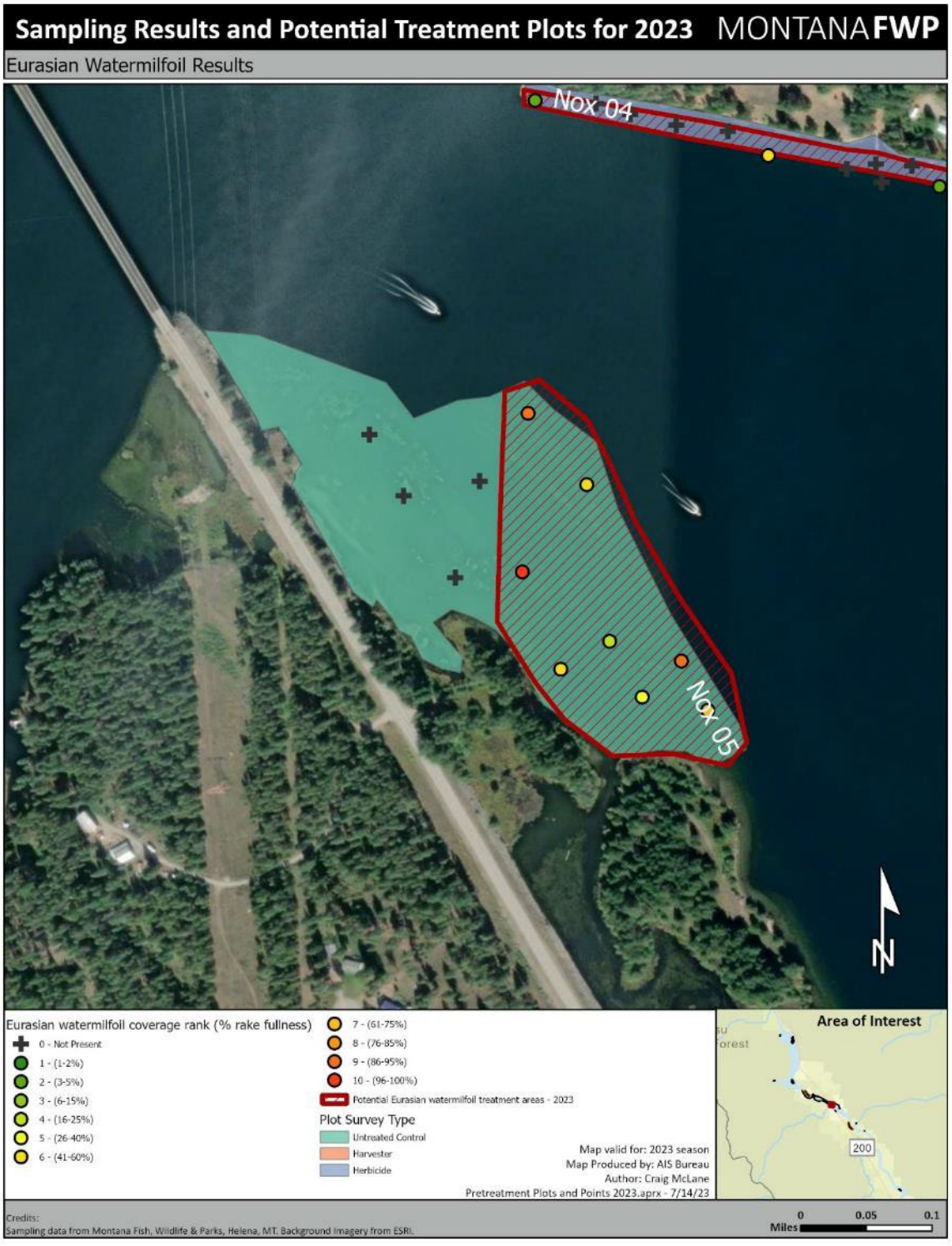
Cab-33


Cabinet Gorge CONTROL Plot C33 - Calculated % canopy cover over time (2020-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2020
2021
2022
2023
R² = 0.015
R² = 0.337
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

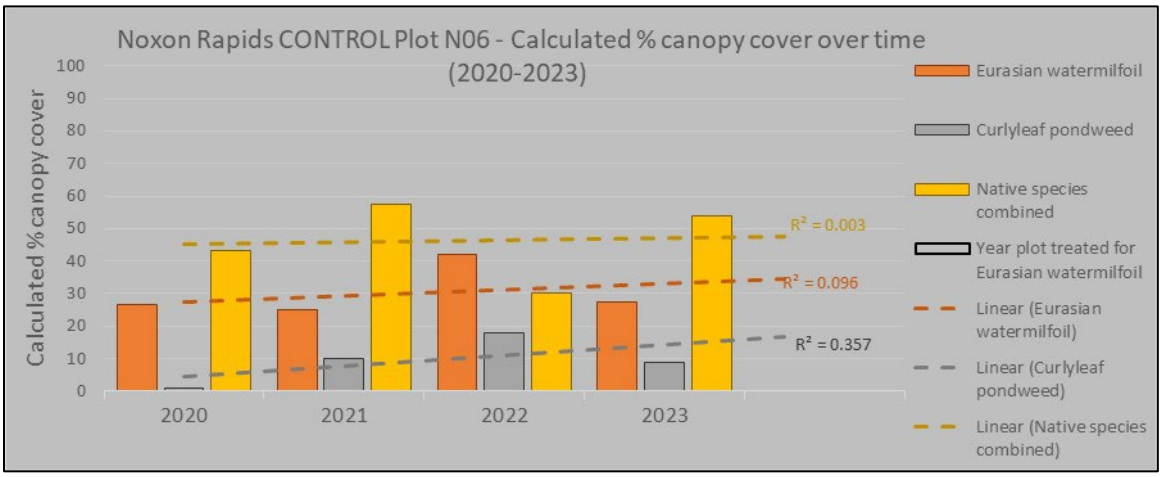

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 33
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Cabinet Gorge Reservoir
Kaniksu
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.05
0.1
Miles

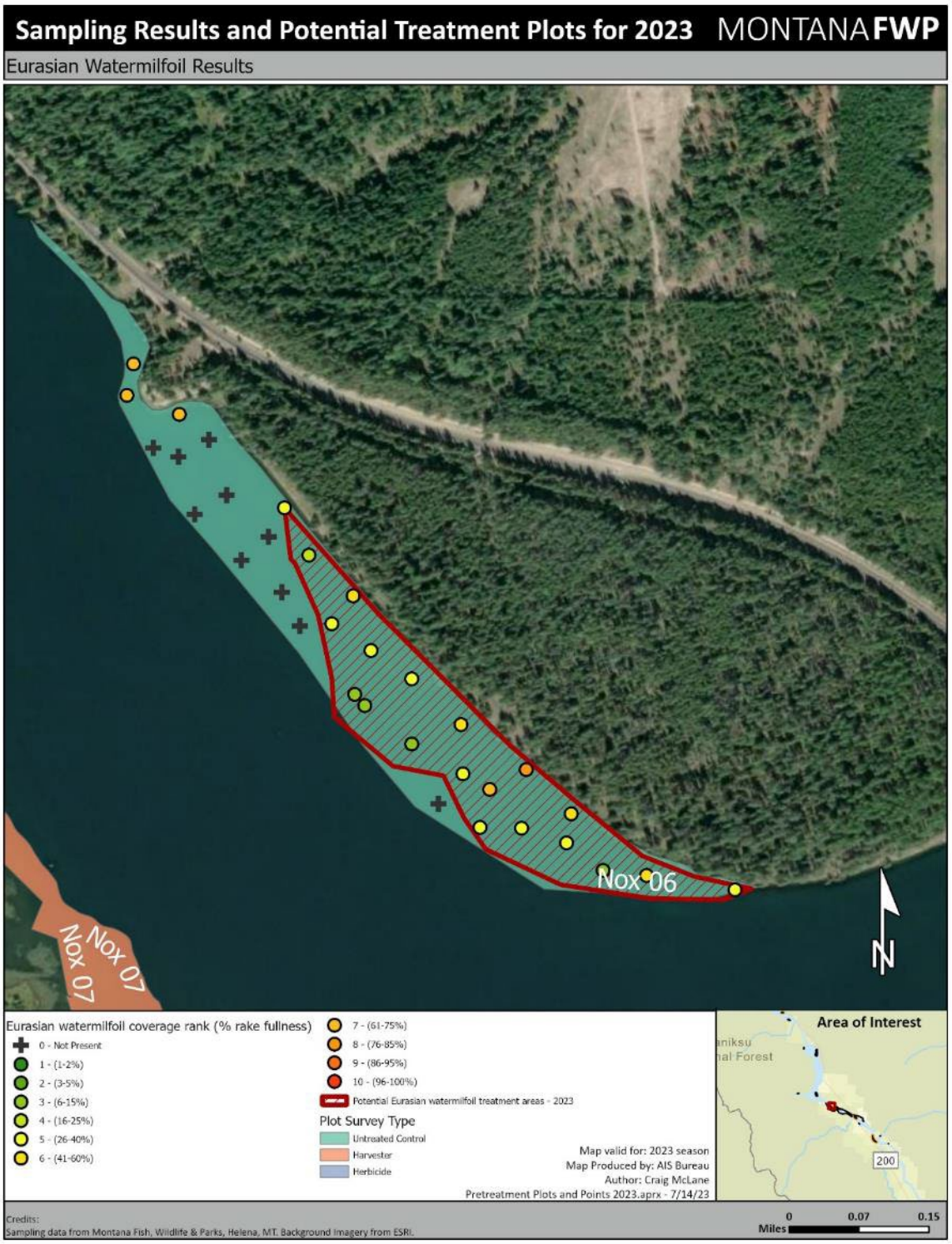
Nox-05


Noxon Rapids CONTROL Plot N05 - Calculated % canopy cover over time (2020-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2020
2021
2022
2023
R² = 0.137
R² = 0.943
R² = 0.967
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

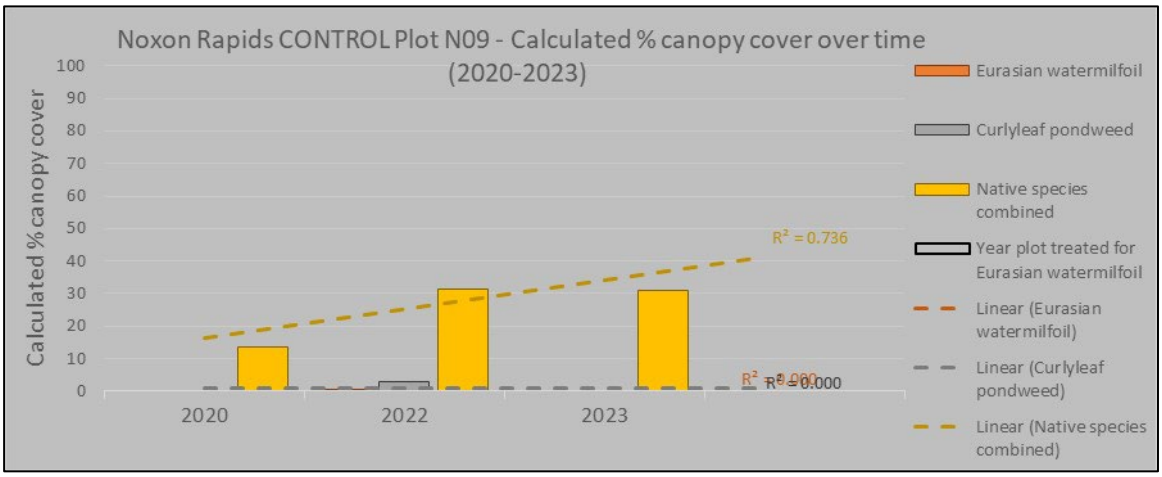

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 04
Nox 05
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.05
0.1
Miles

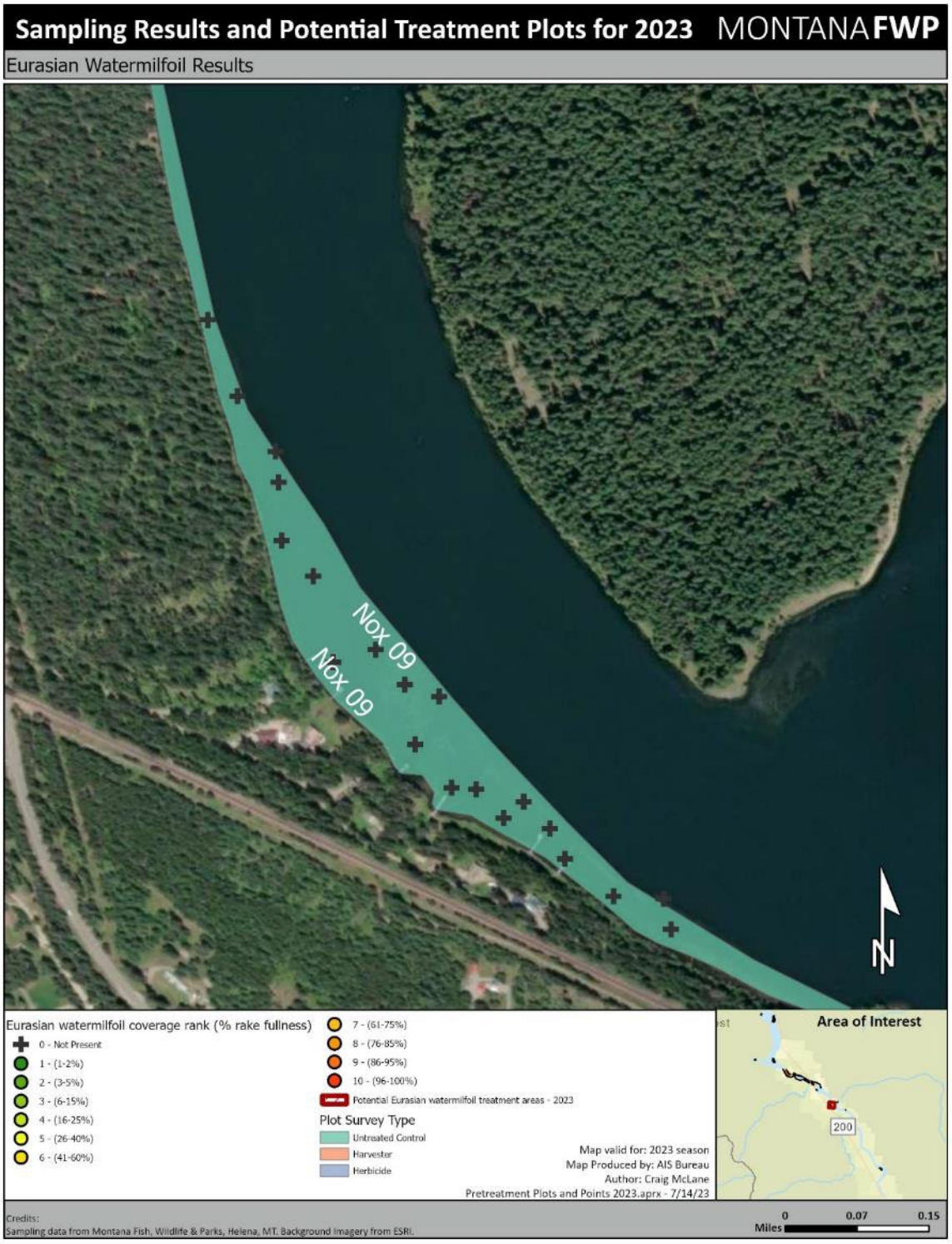
Nox-06


Noxon Rapids CONTROL Plot N06 - Calculated % canopy cover over time (2020-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2020
2021
2022
2023
R² = 0.003
R² = 0.096
R² = 0.357
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

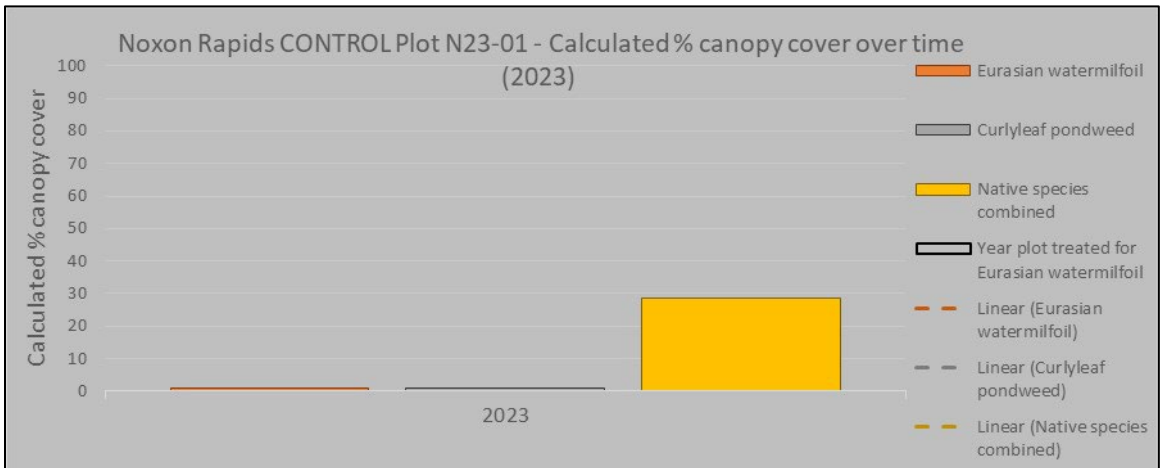

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 06
Nox 07
Nox 07
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.07
0.15
Miles

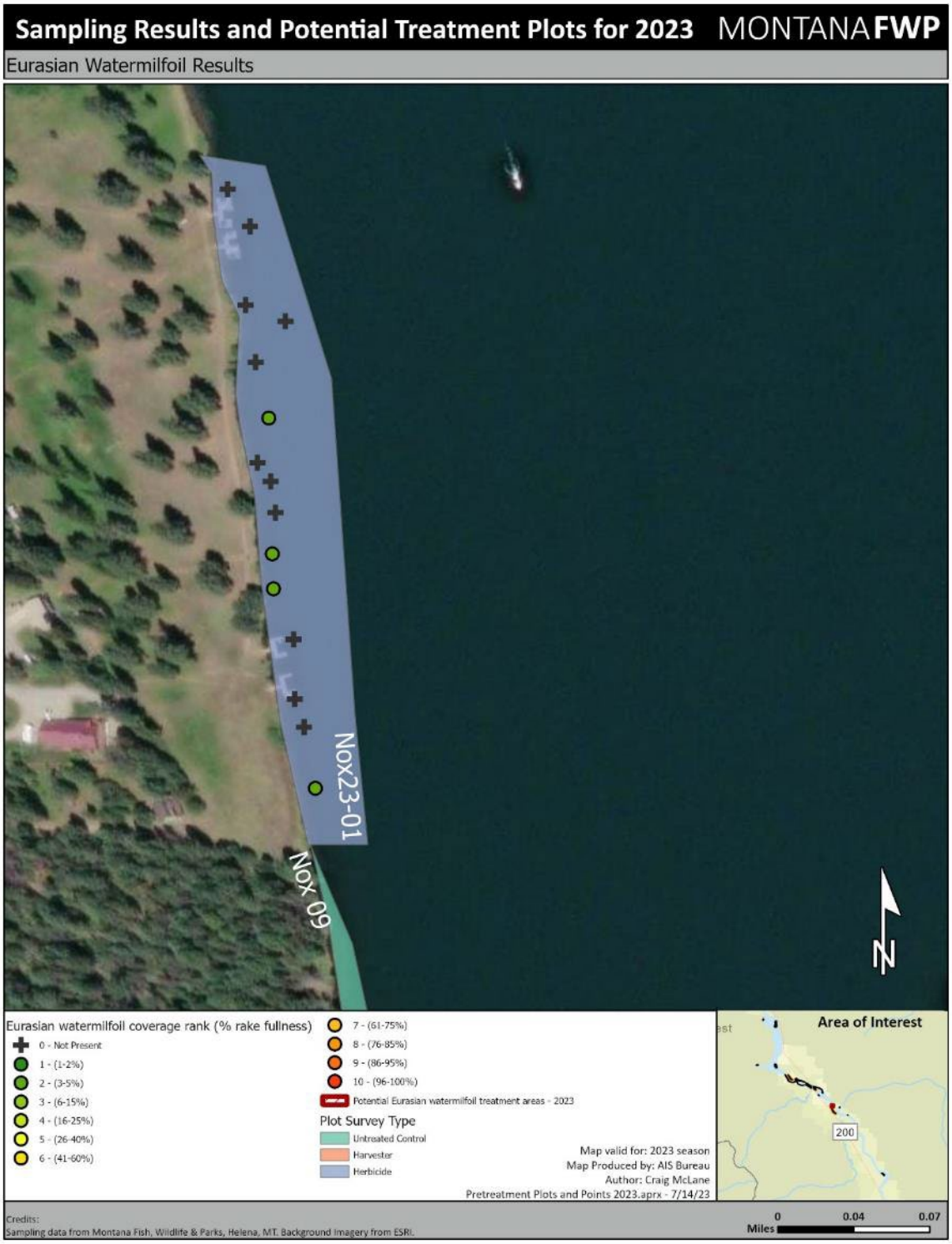
Nox-09


Noxon Rapids CONTROL Plot N09 - Calculated % canopy cover over time (2020-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2020
2022
2023
R² = 0.736
R² = 0.000
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

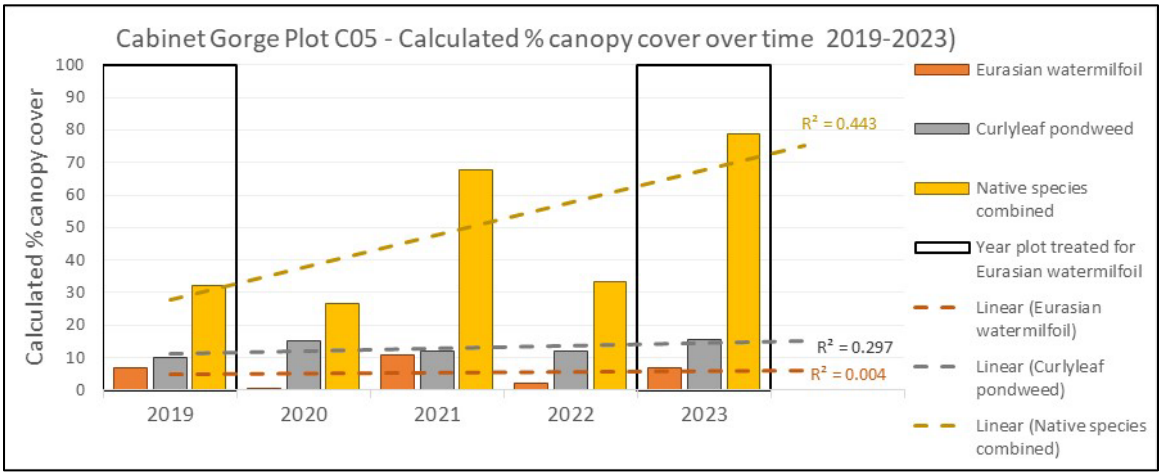

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 09
Nox 09
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.07
0.15
Miles

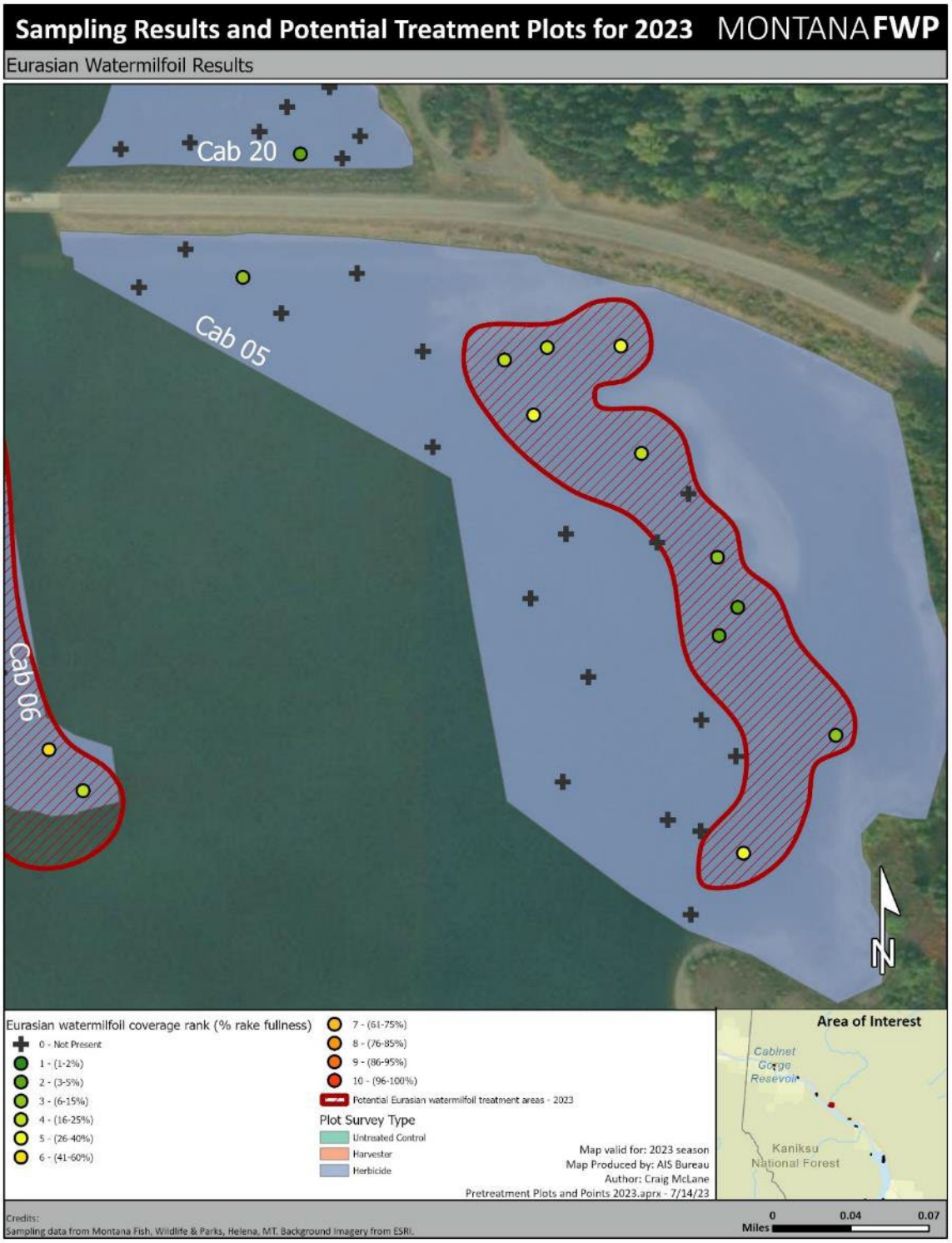
Nox-2301


Noxon Rapids CONTROL Plot N23-01 - Calculated % canopy cover over time (2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2023
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

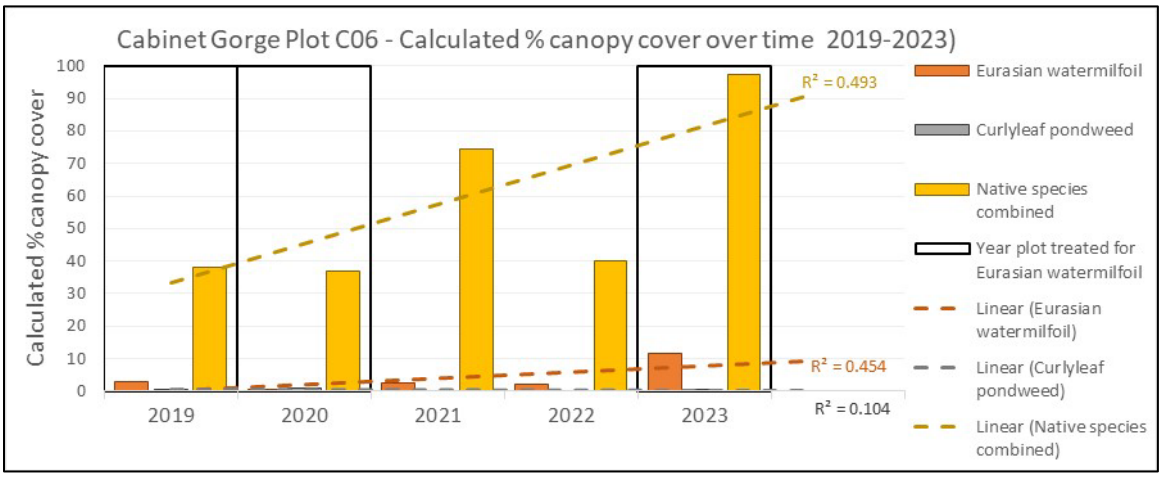

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox23-01
Nox 09
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.04
0.07
Miles

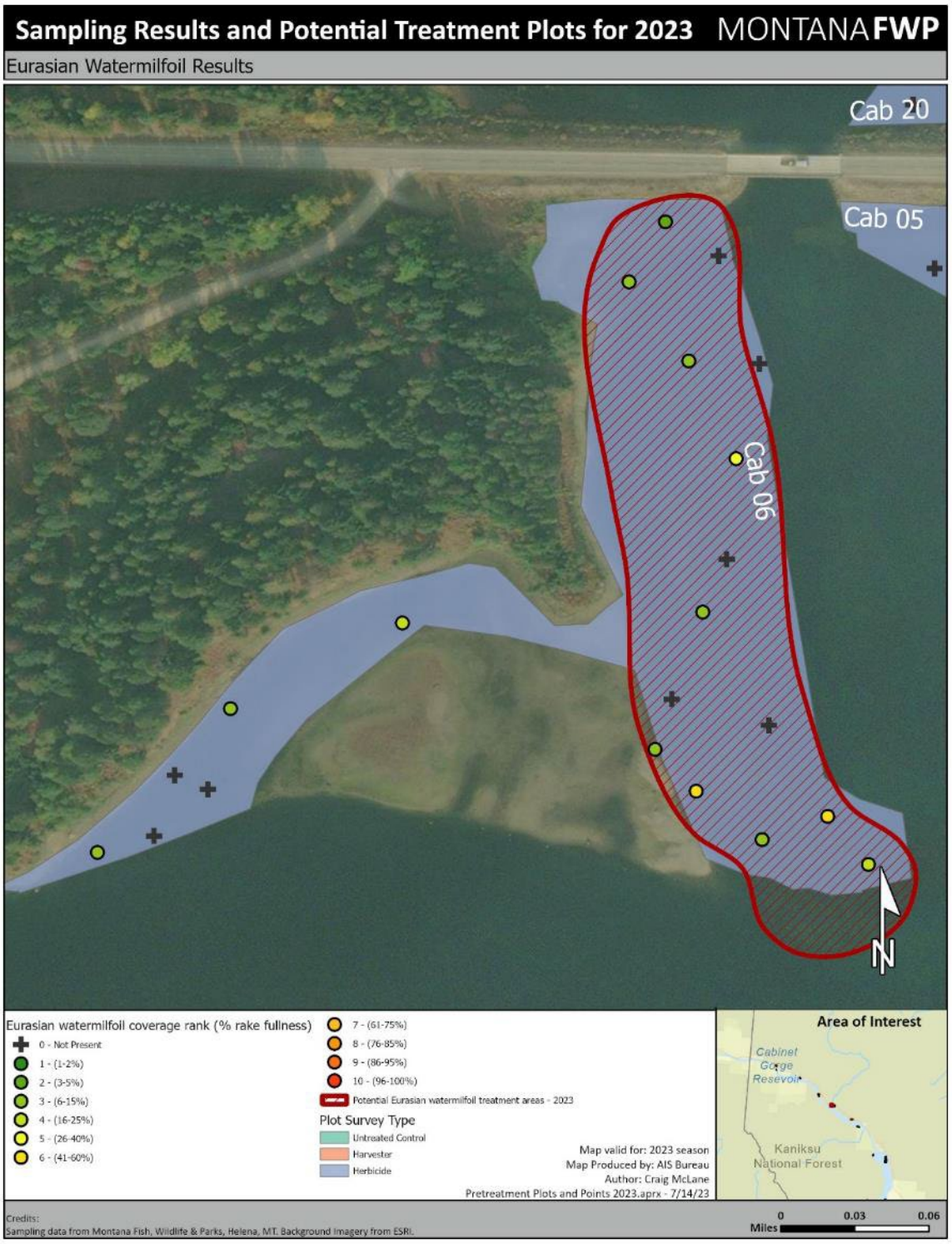
Cab-05


Cabinet Gorge Plot C05 - Calculated % canopy cover over time 2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.443
R² = 0.297
R² = 0.004
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

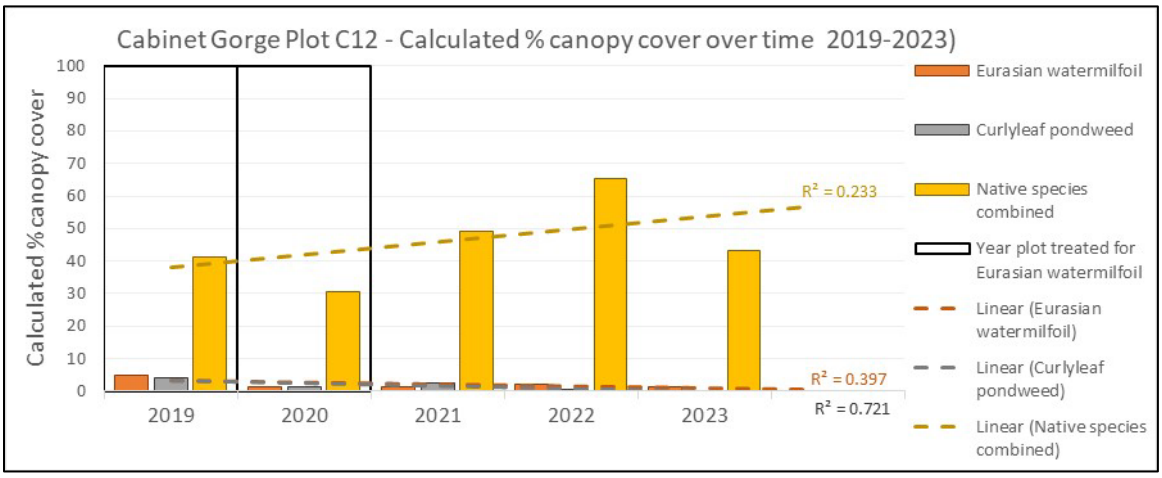

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 20
Cab 05
Cab 06
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Cabinet Gorge Reservoir
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.04
0.07
Miles

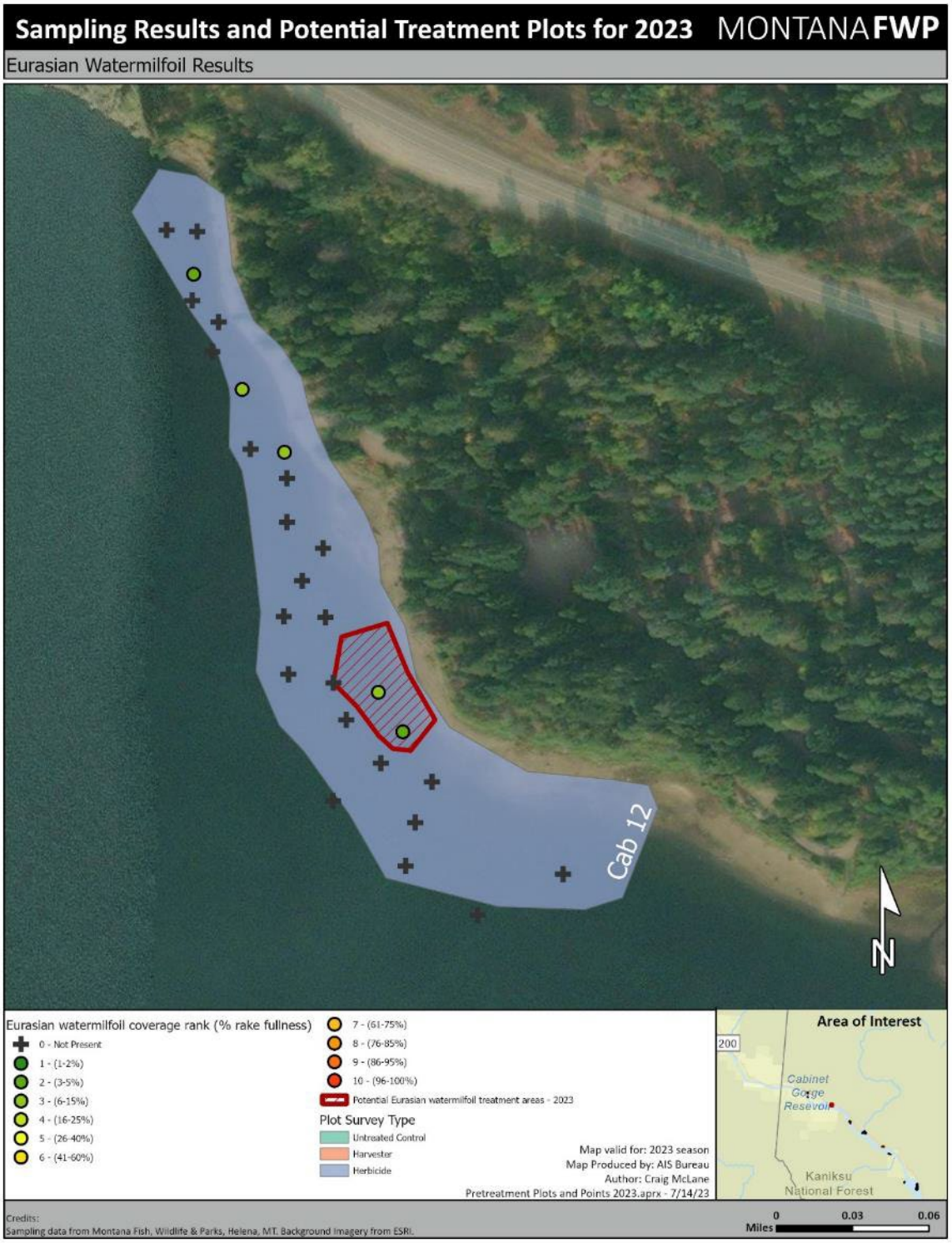
Cab-06


Cabinet Gorge Plot C06 - Calculated % canopy cover over time 2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.493
R² = 0.454
R² = 0.104
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

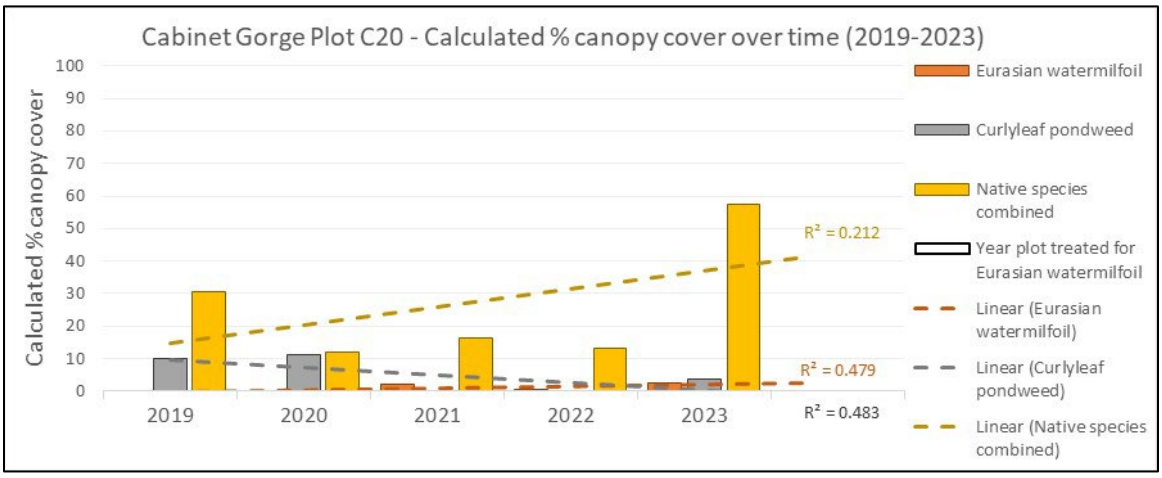

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 20
Cab 05
Cab 06
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Cabinet Gorge Reservoir
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.03
0.06
Miles

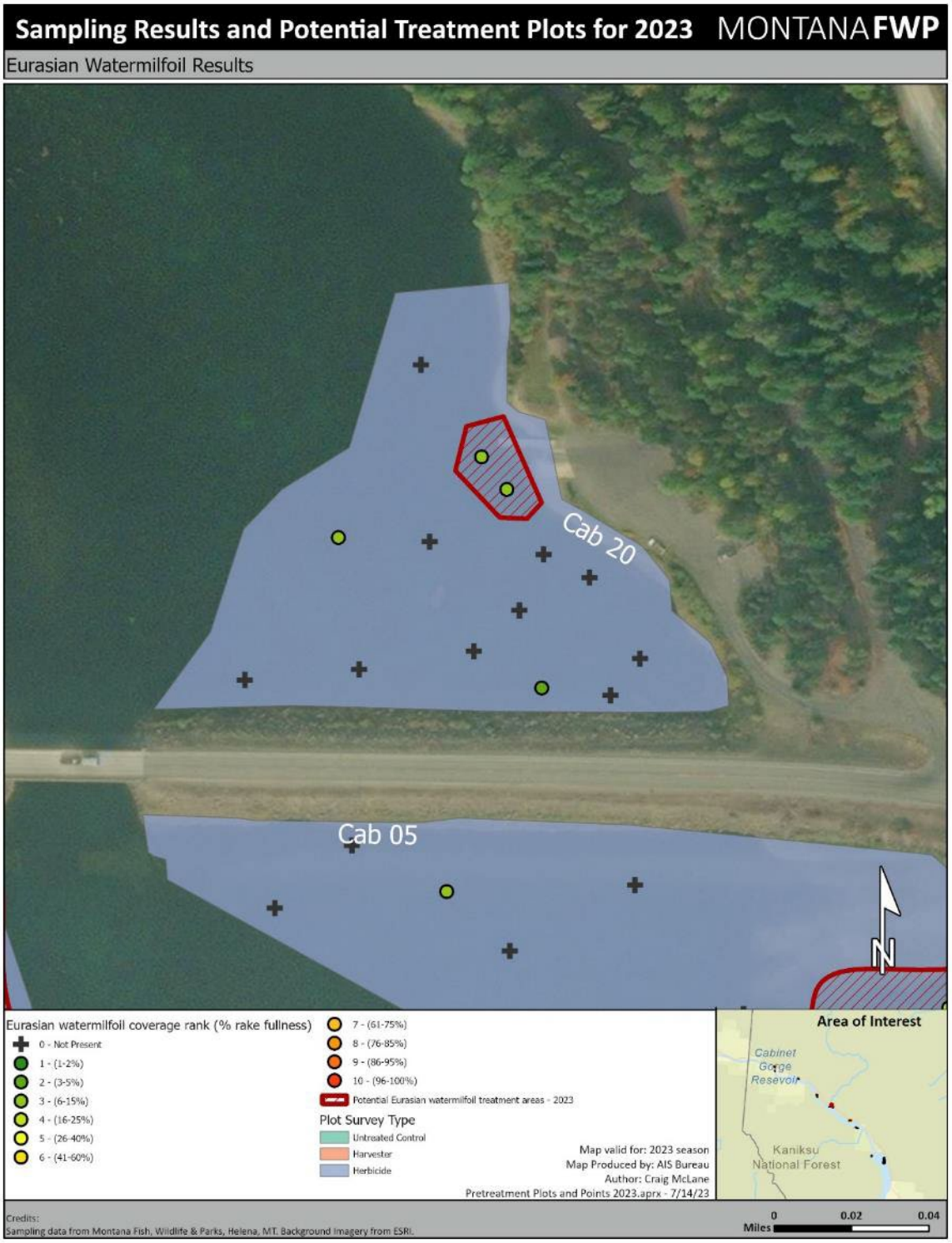
Cab-12


Cabinet Gorge Plot C12 - Calculated % canopy cover over time 2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.233
R² = 0.397
R² = 0.721
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

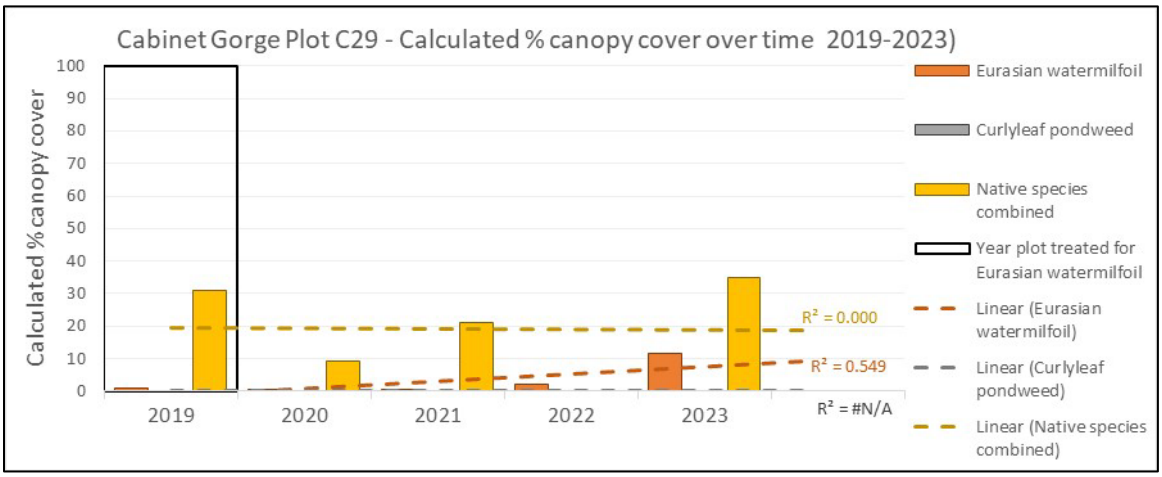

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 12
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Cabinet Gorge Reservoir
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.03
0.06
Miles

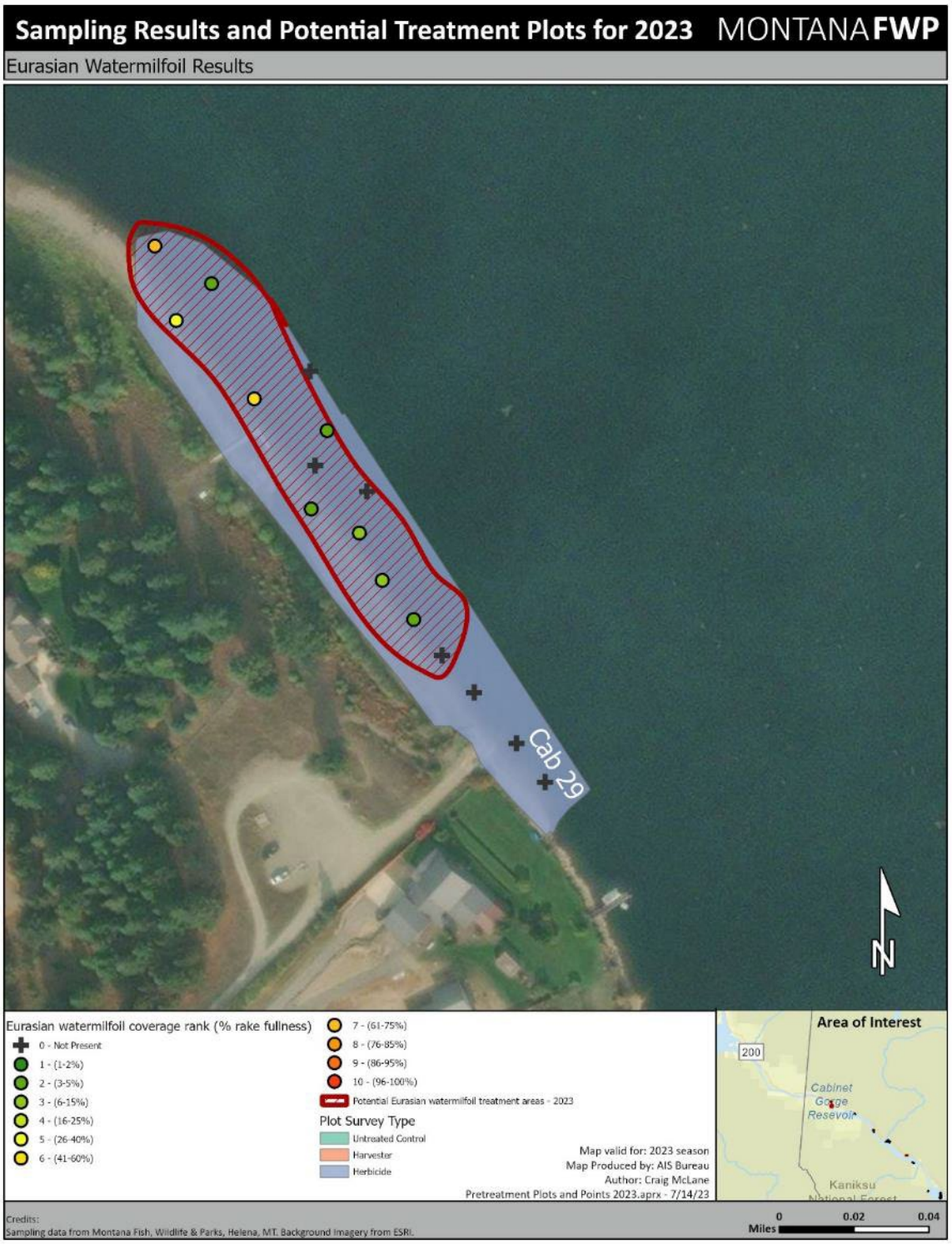
Cab-20


Cabinet Gorge Plot C20 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.212
R² = 0.479
R² = 0.483
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

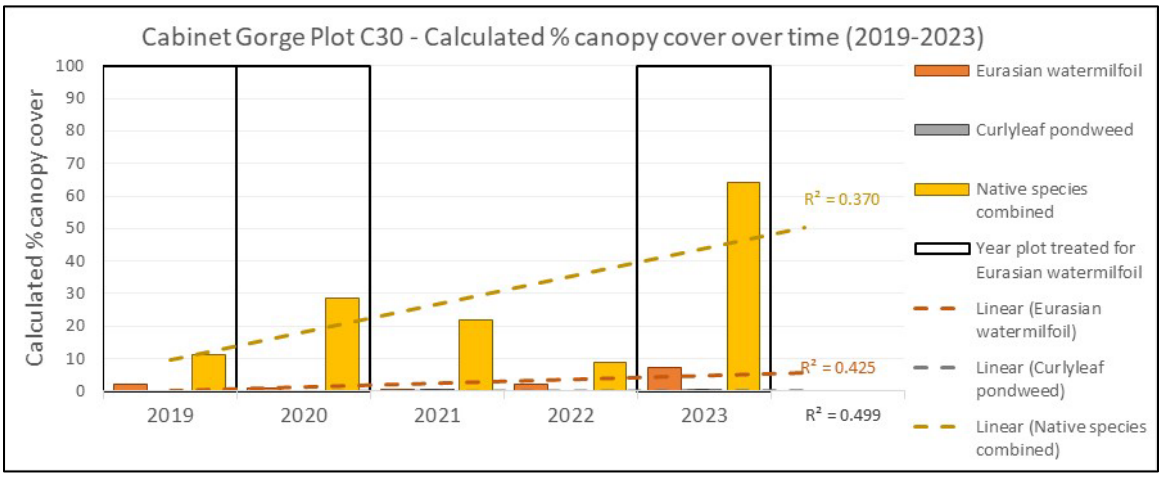

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 20
Cab 05
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Cabinet Gorge Reservoir
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.02
0.04
Miles

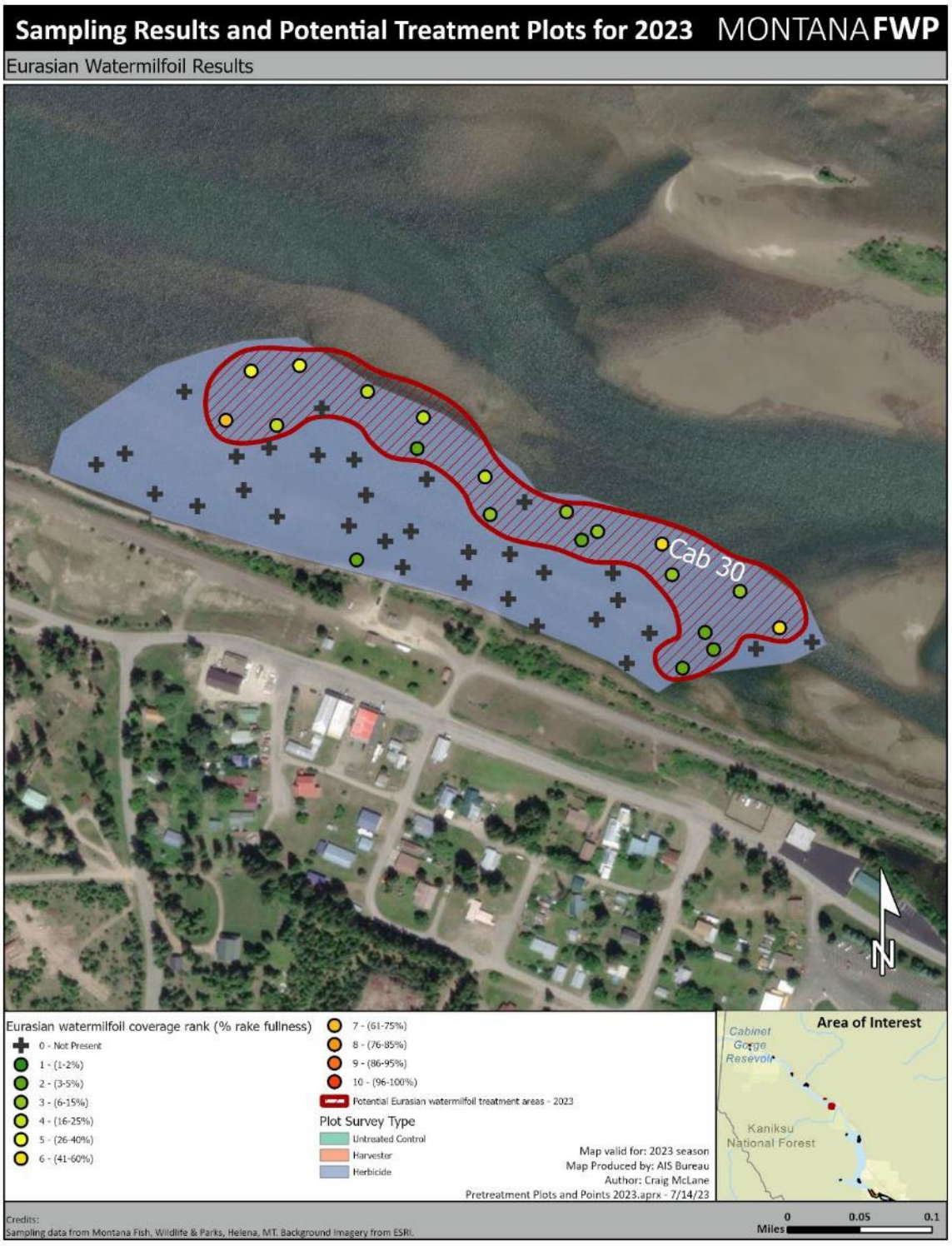
Cab-29


Cabinet Gorge Plot C29 - Calculated % canopy cover over time 2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.000
R² = 0.549
R² = #N/A
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

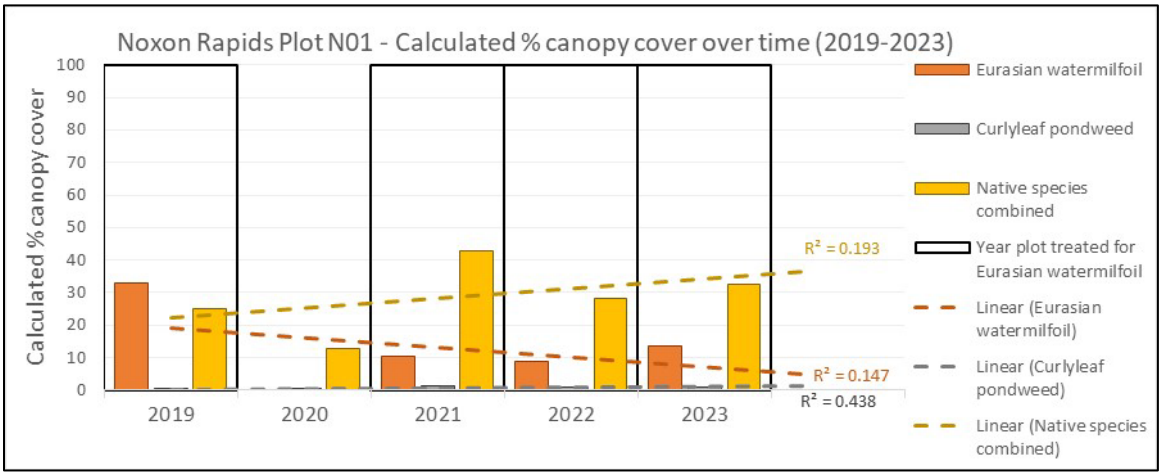

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 29
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Cabinet Gorge Reservoir
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.02
0.04
Miles

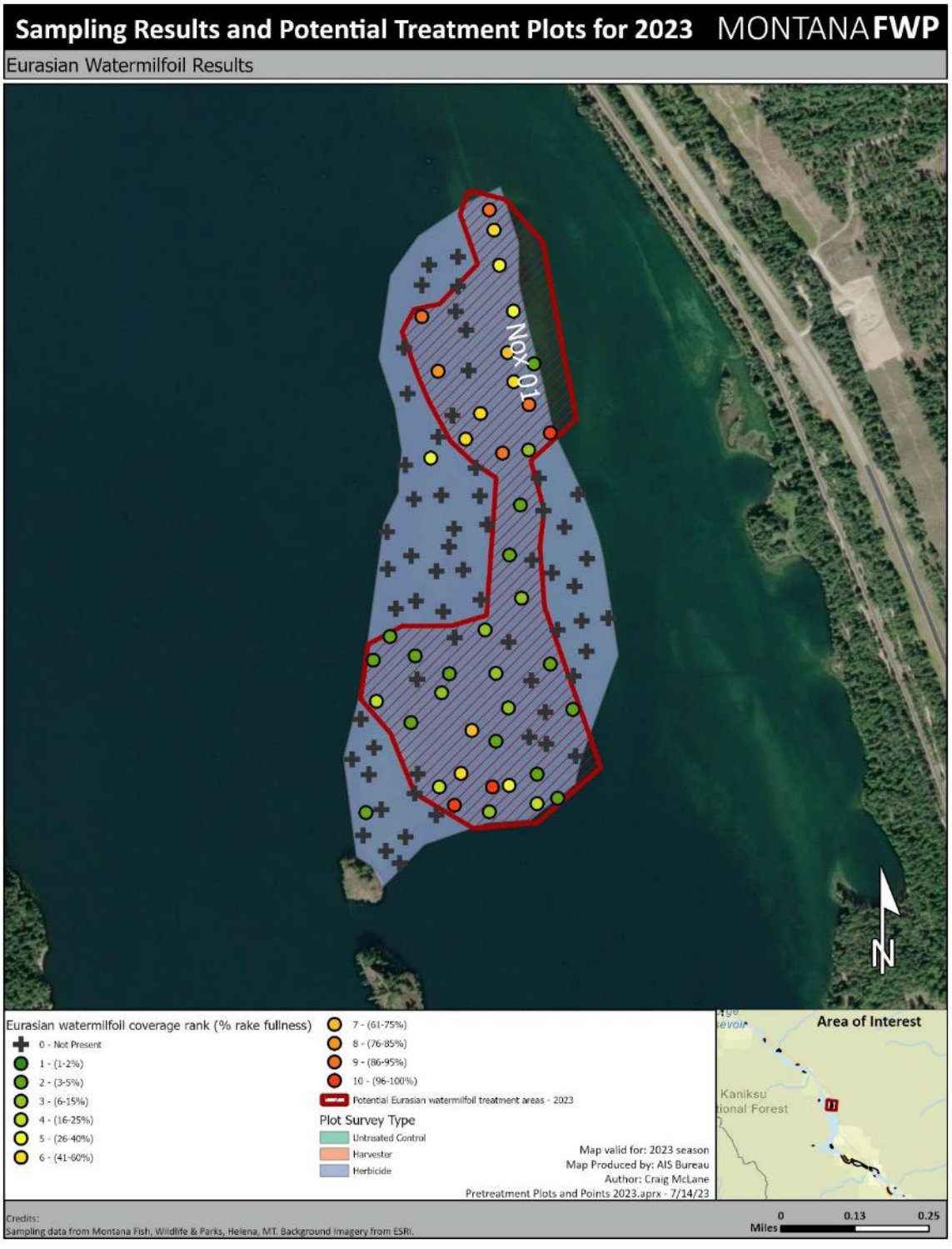
Cab-30


Cabinet Gorge Plot C30 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.370
R² = 0.425
R² = 0.499
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

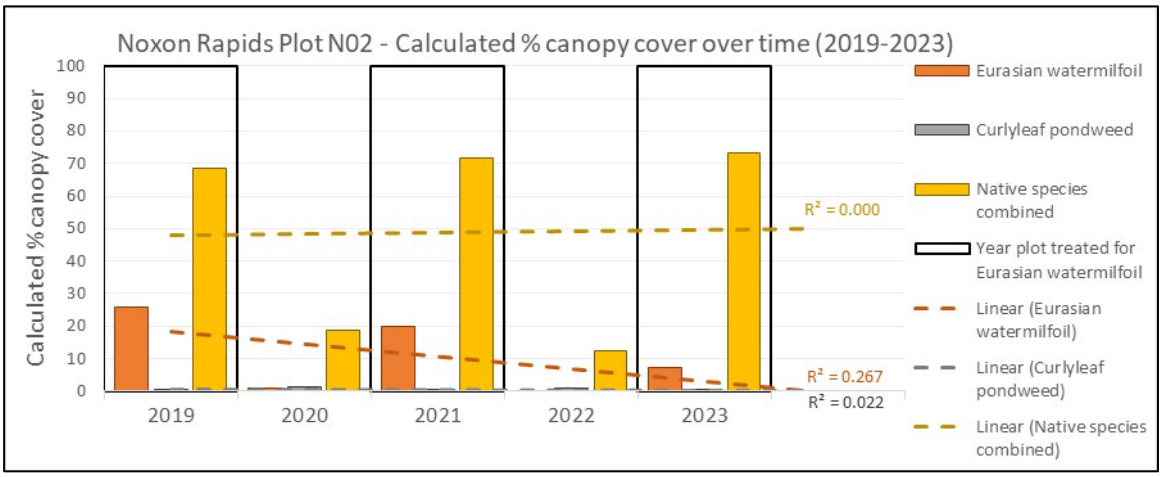

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Cab 30
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Cabinet Gorge Reservoir
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.05
0.1
Miles

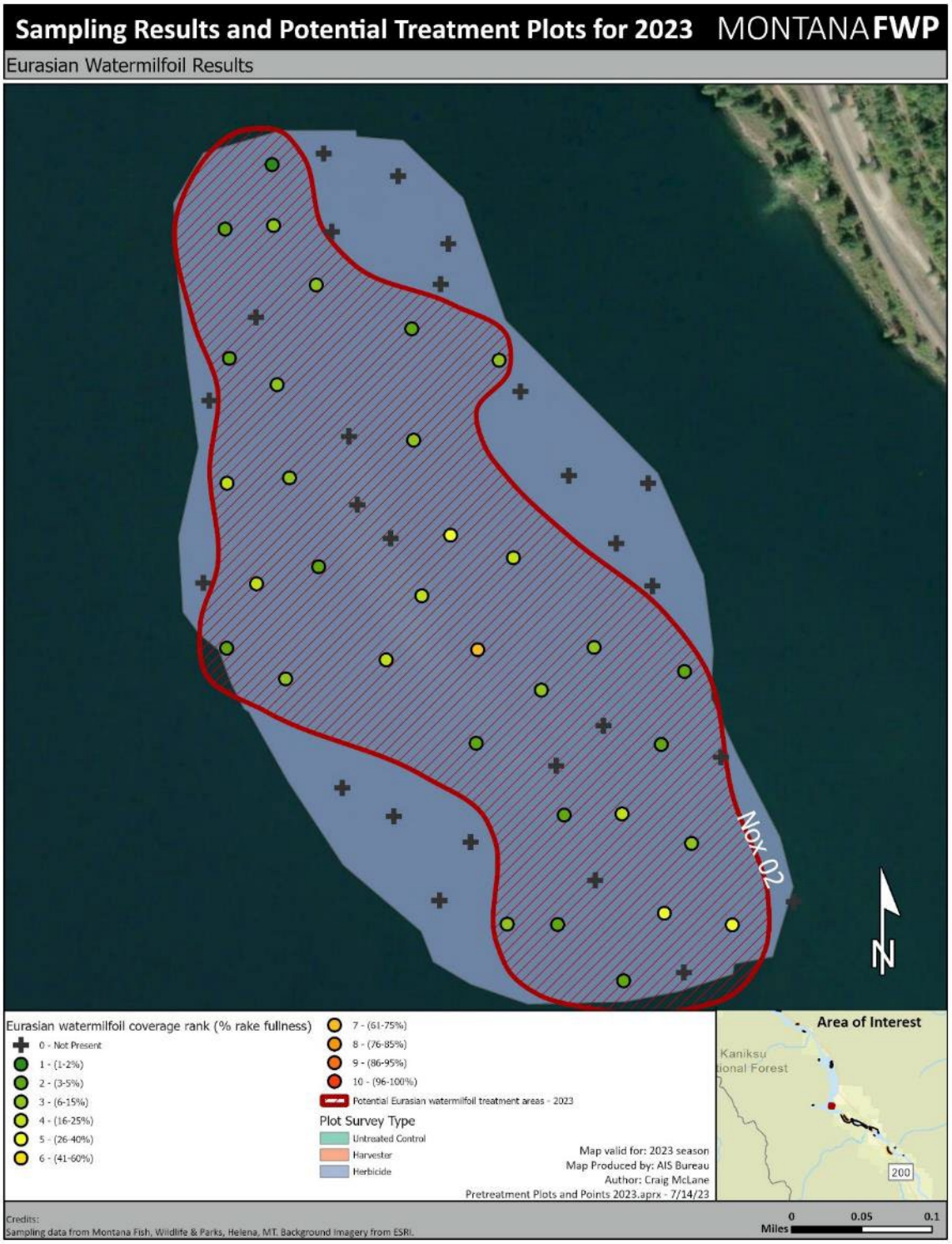
Nox-01


Noxon Rapids Plot N01 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.193
R² = 0.147
R² = 0.438
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

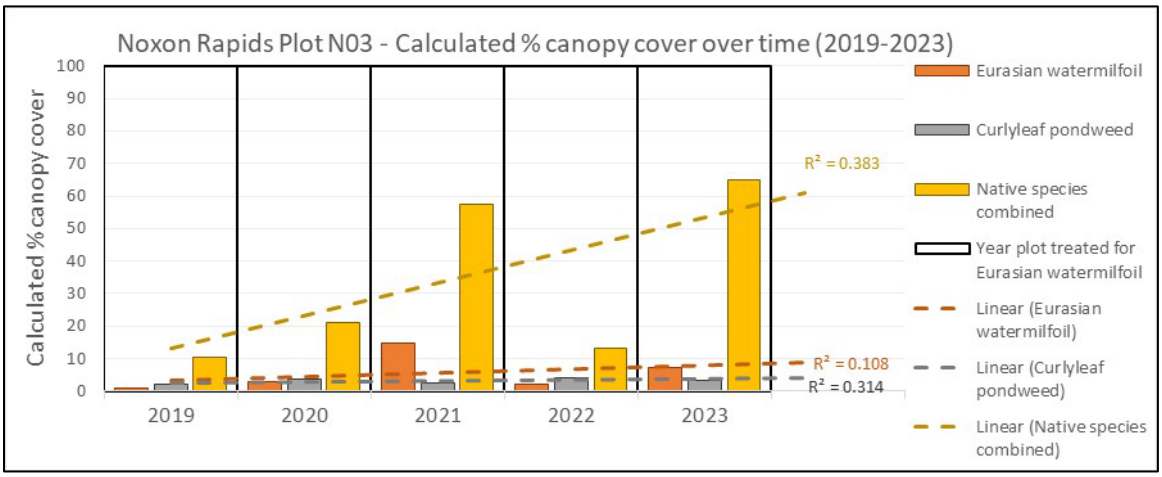

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 01
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Kaniksu
tional Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.13
0.25
Miles

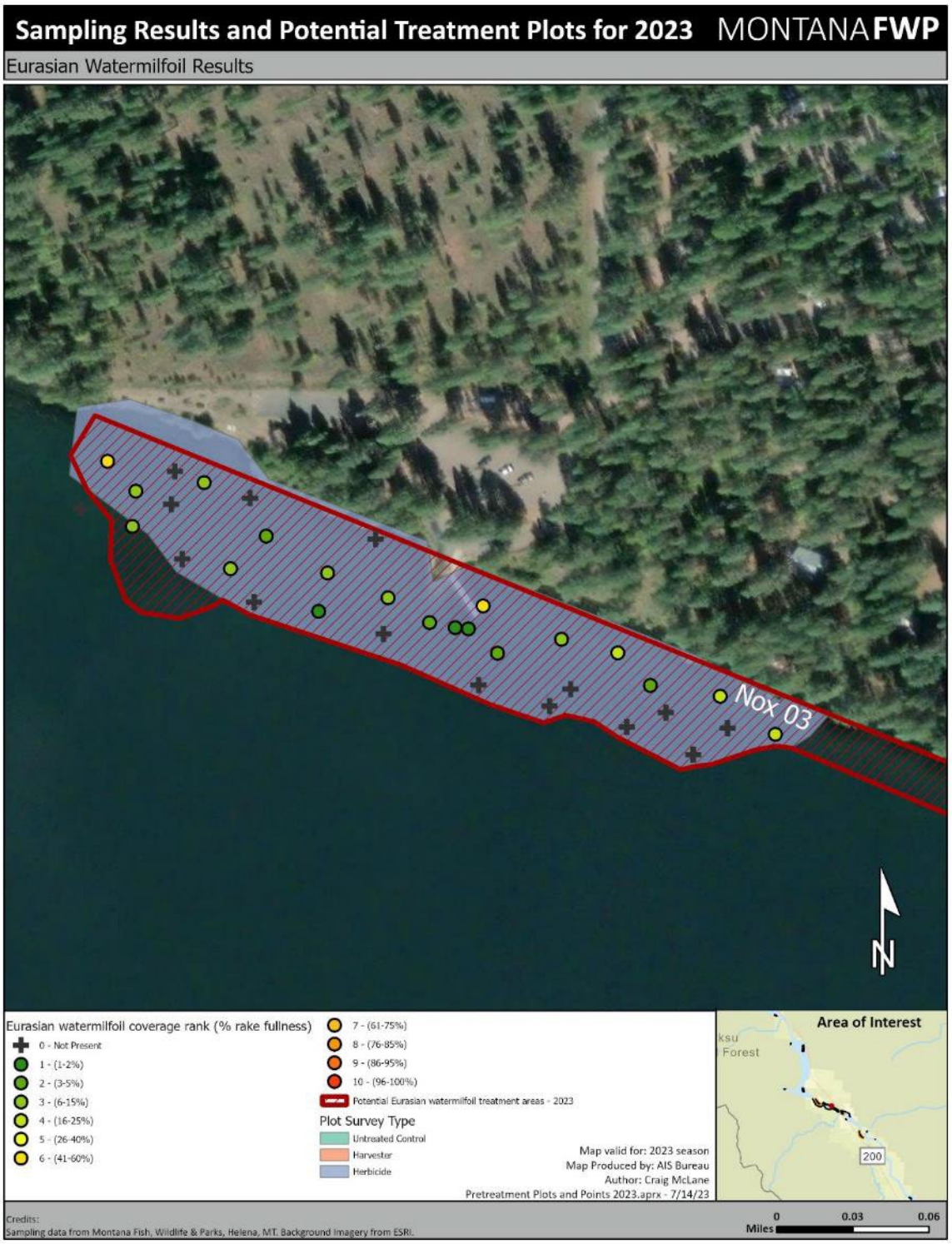
Nox-02


Noxon Rapids Plot N02 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.000
R² = 0.267
R² = 0.022
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

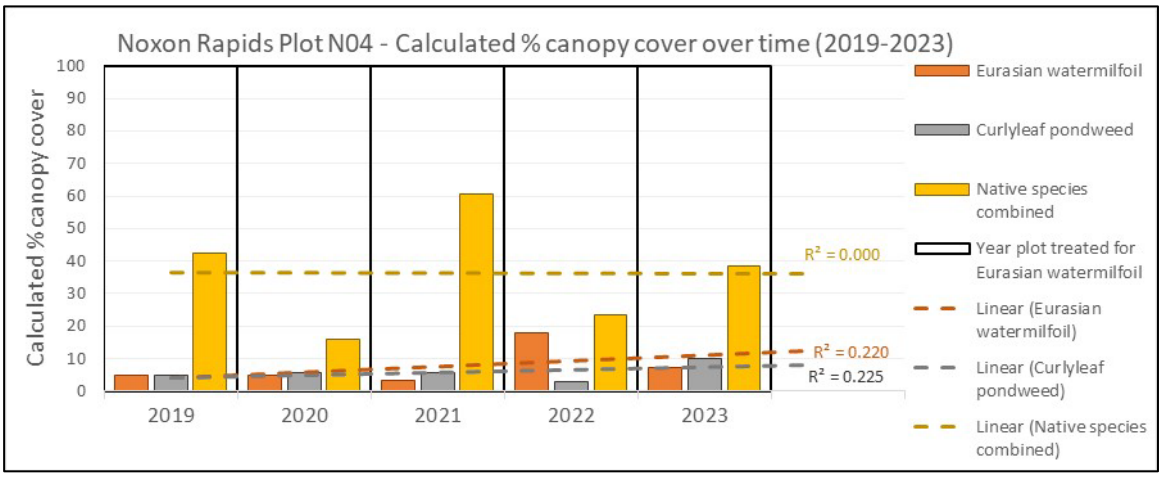

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox-02
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Kaniksu
tional Forest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.05
0.1
Miles

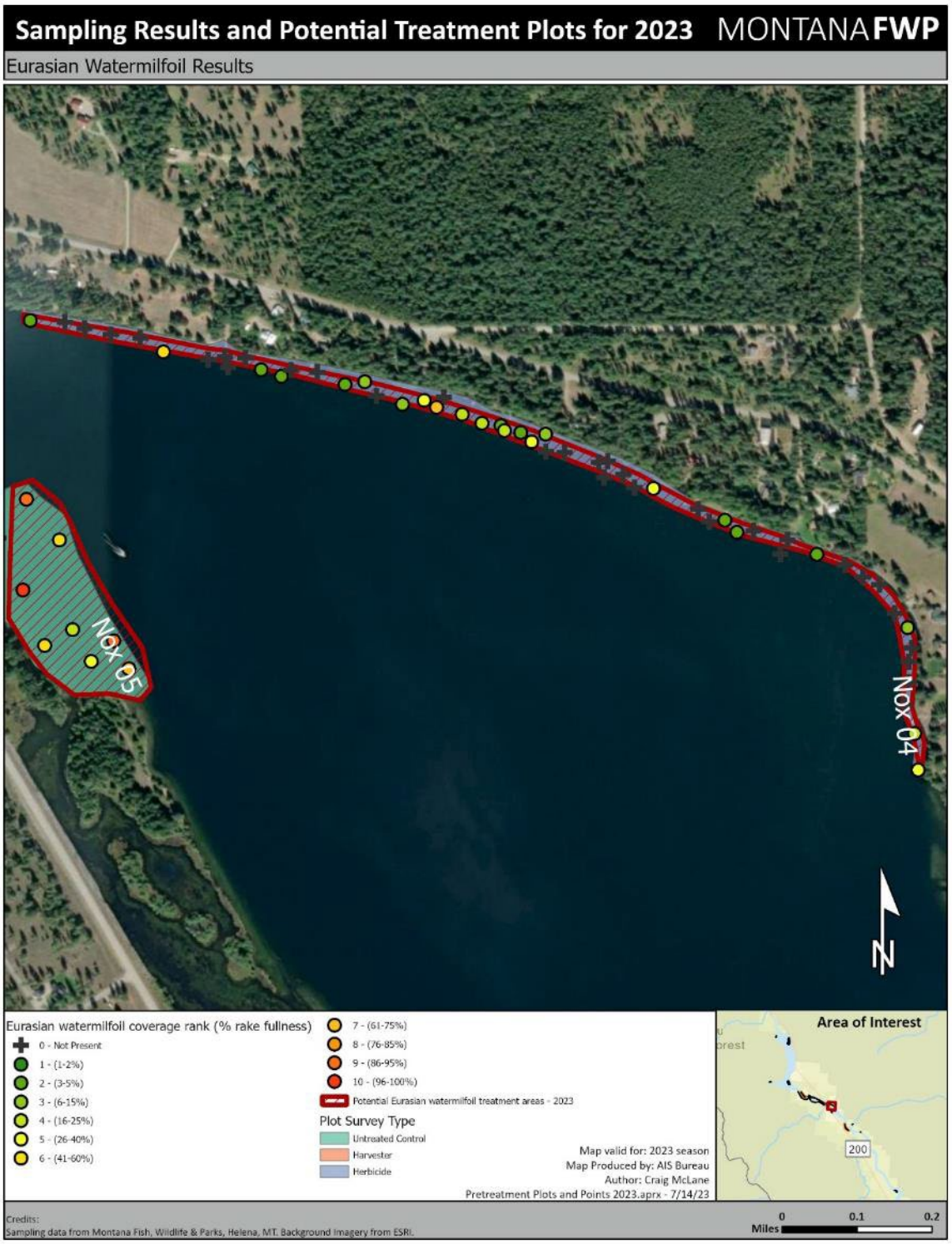
Nox-03


Noxon Rapids Plot N03 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.383
R² = 0.108
R² = 0.314
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

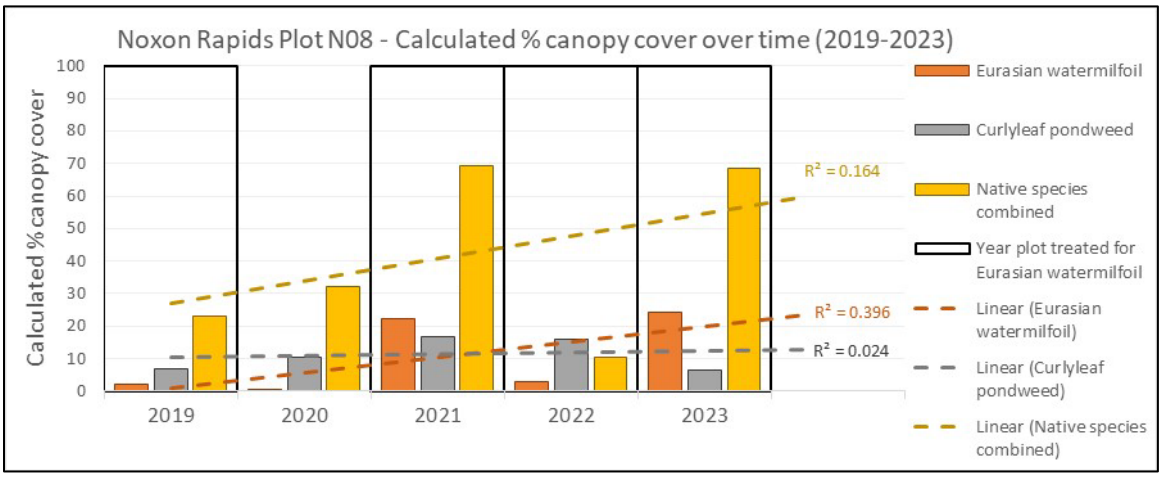

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 03
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
ksu
Forest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.03
0.06
Miles

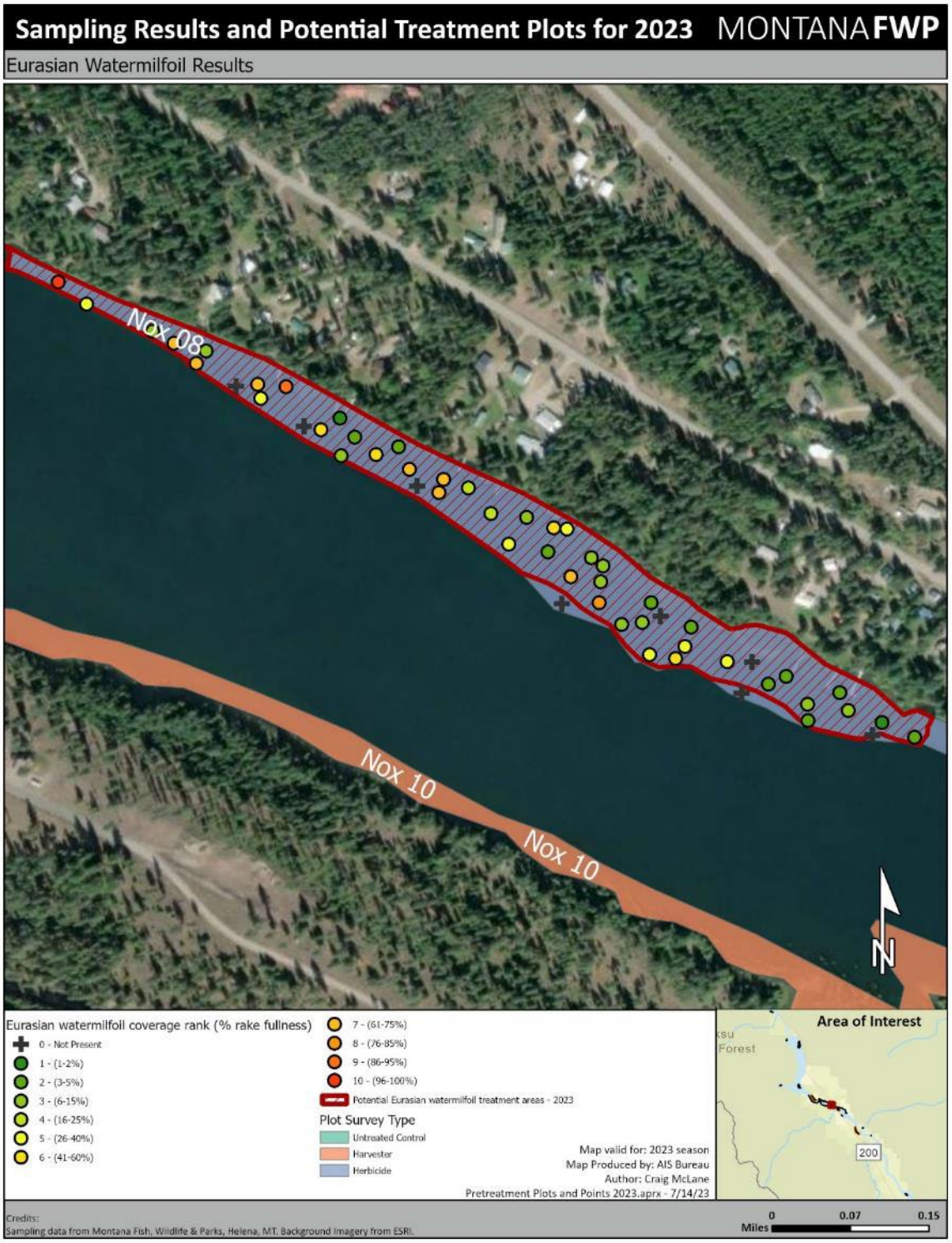
Nox-04


Noxon Rapids Plot N04 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.000
R² = 0.220
R² = 0.225
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

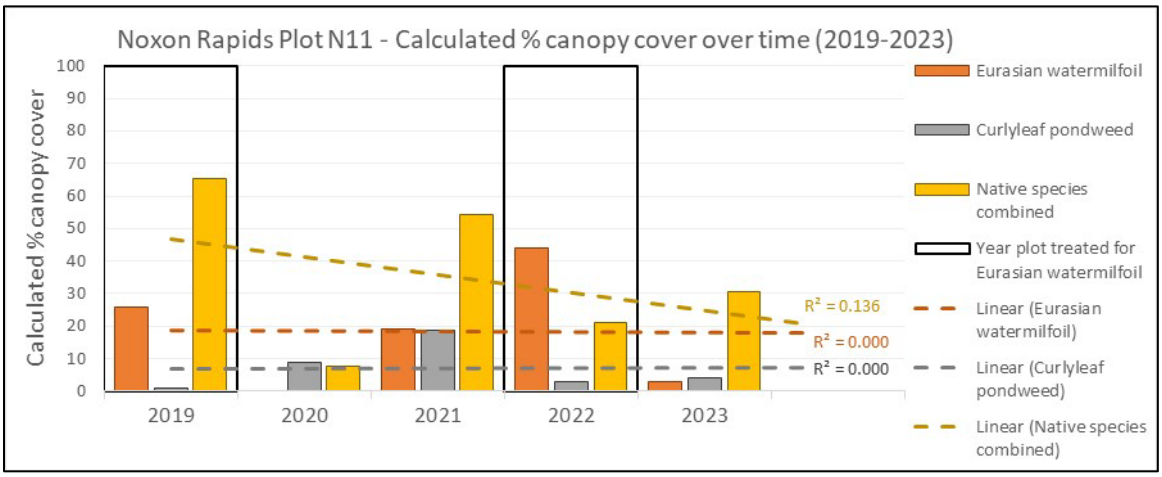

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 05
Nox 04
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.1
0.2
Miles

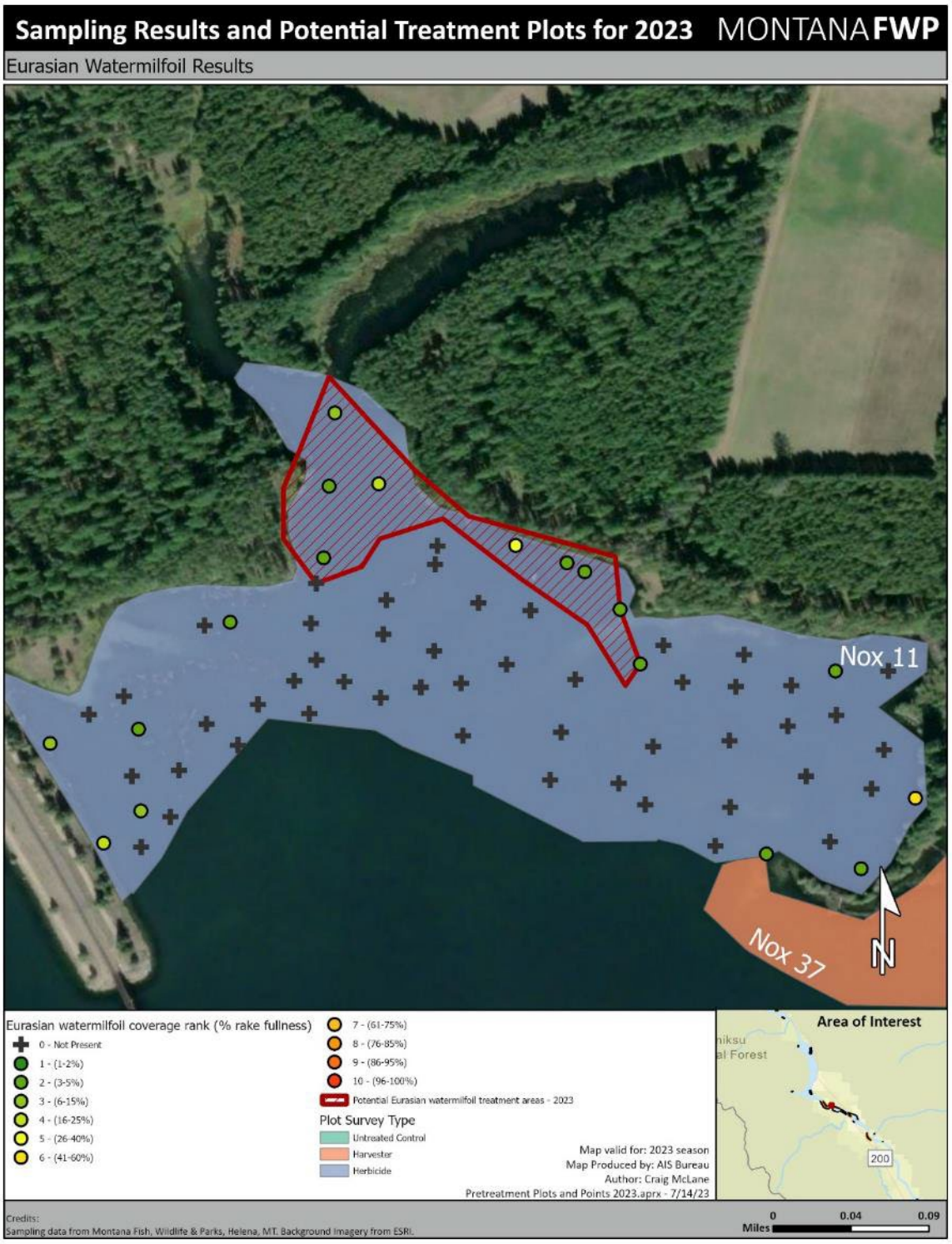
Nox-08


Noxon Rapids Plot N08 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.164
R² = 0.396
R² = 0.024
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

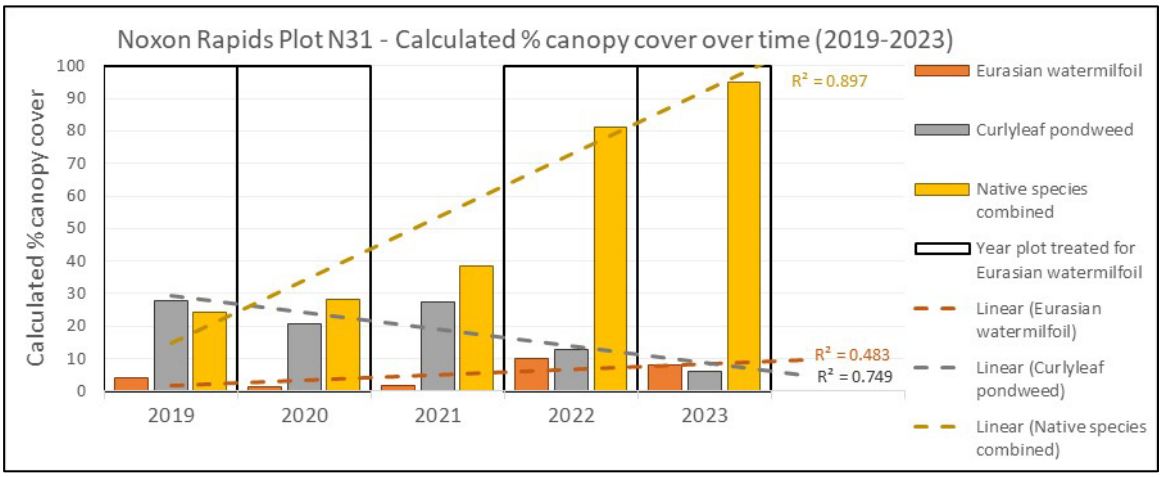

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 08
Nox 10
Nox 10
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Forest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.07
0.15
Miles

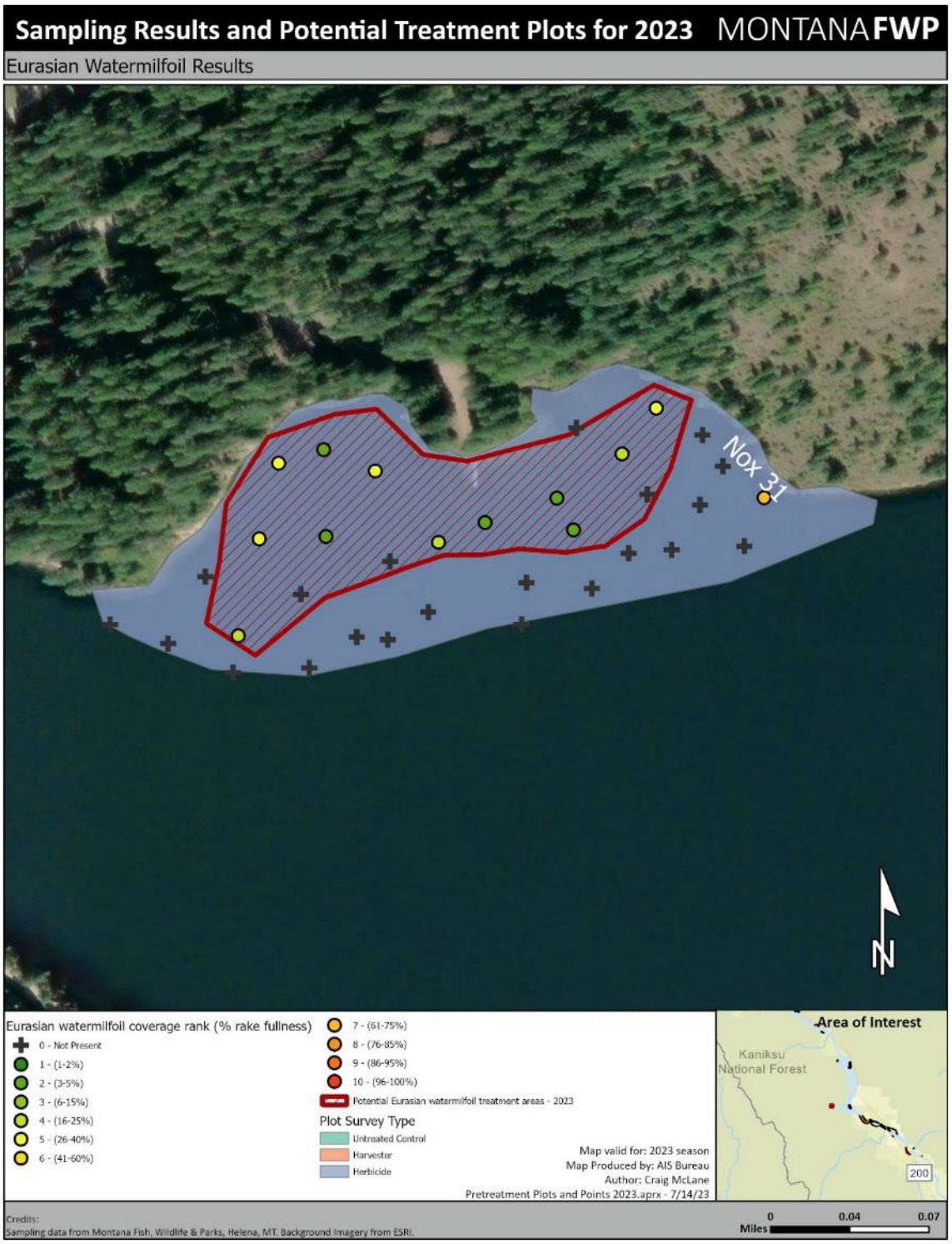
Nox-11


Noxon Rapids Plot N11 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.136
R² = 0.000
R² = 0.000
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

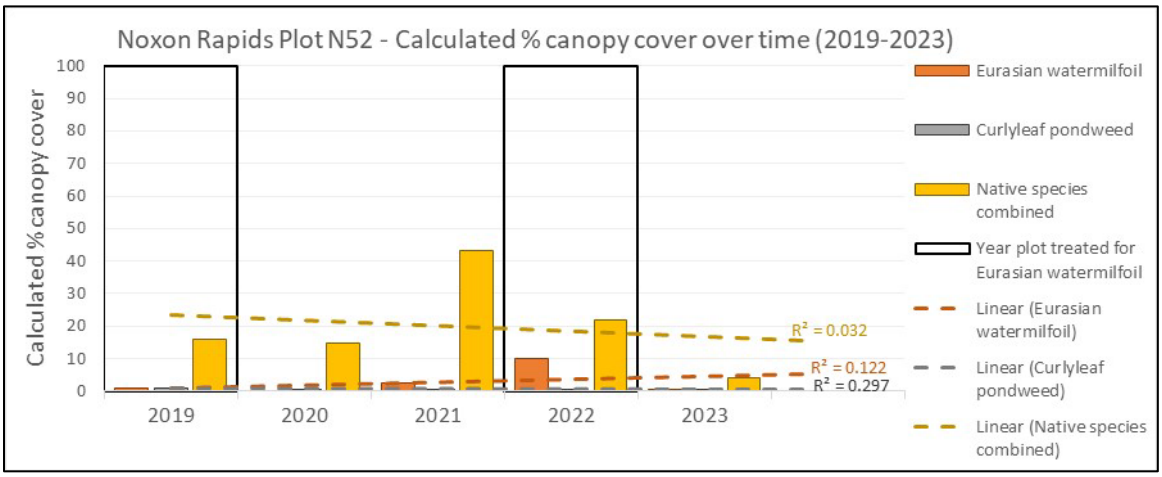

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 11
Nox 37
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.04
0.09
Miles

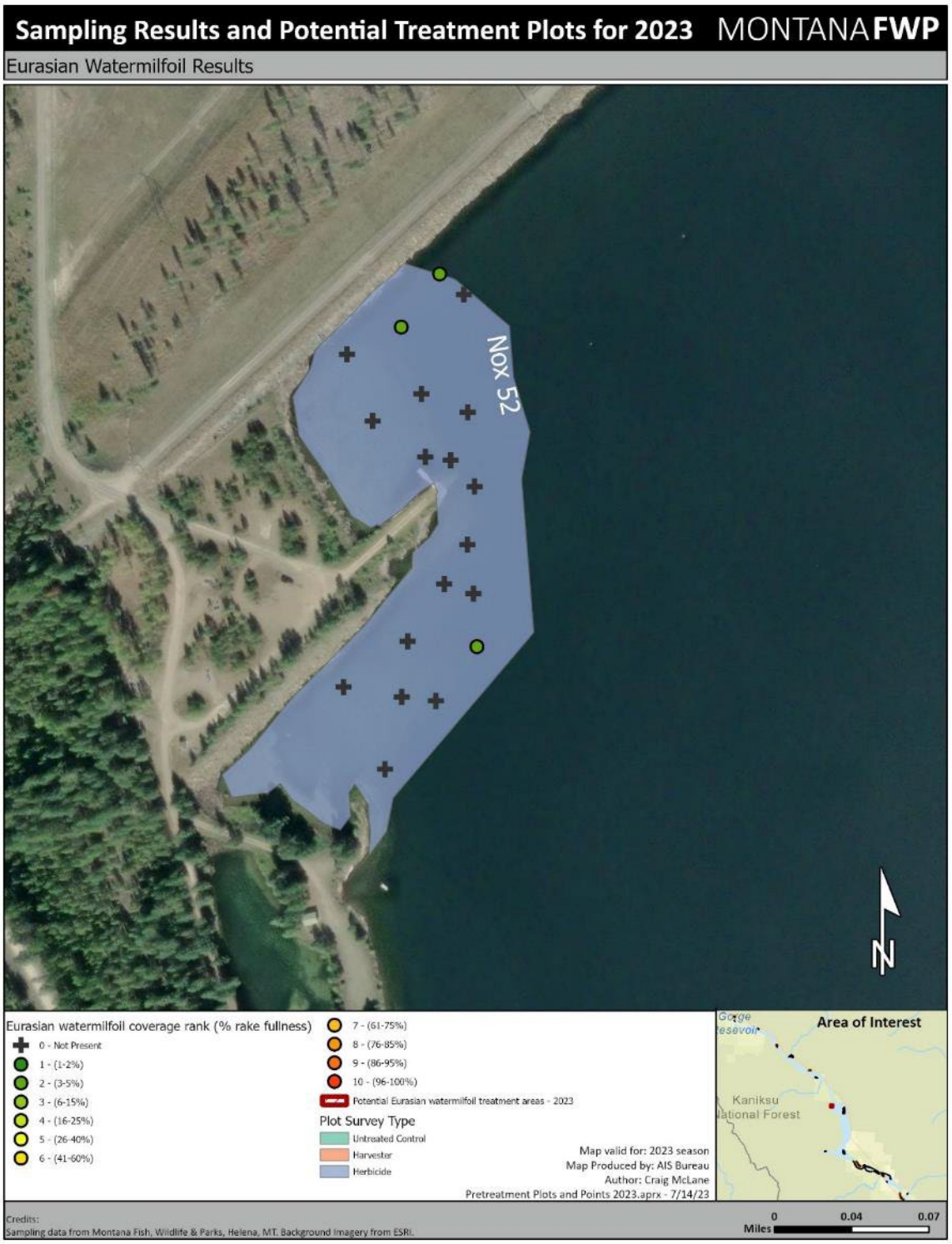
Nox-31


Noxon Rapids Plot N31 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.897
R² = 0.483
R² = 0.749
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

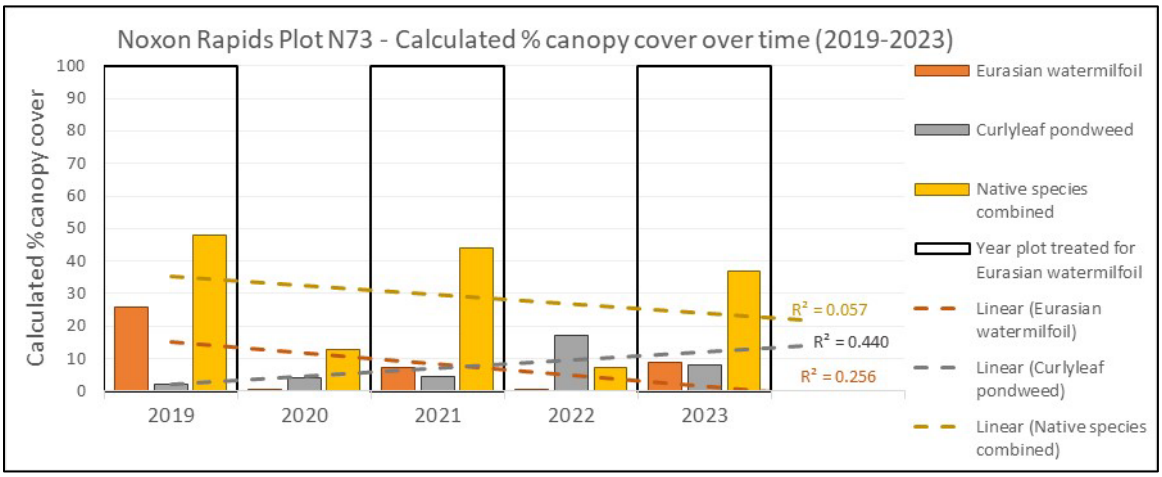

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 31
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Kaniksu National Forest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.04
0.07
Miles

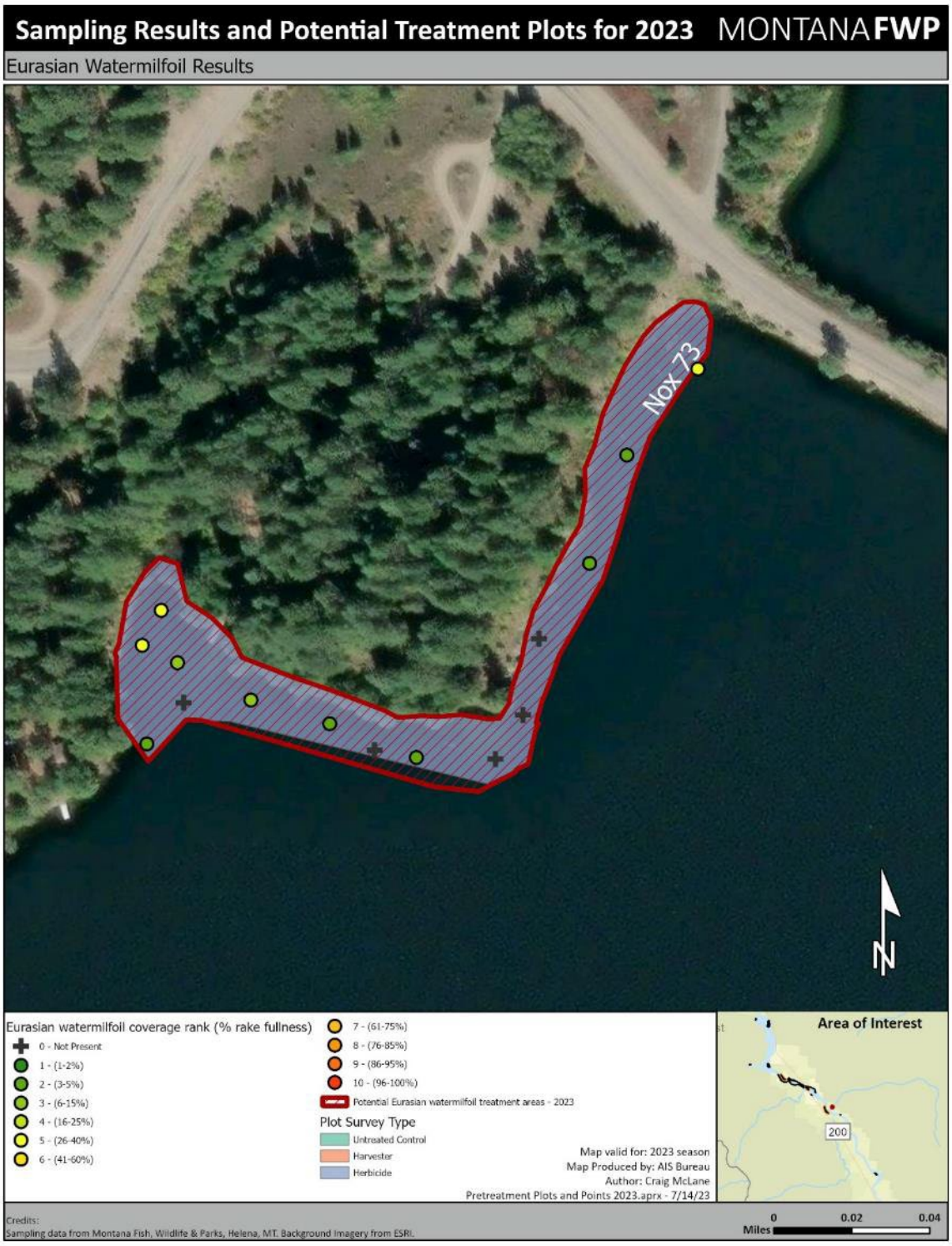
Nox-52


Noxon Rapids Plot N52 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.032
R² = 0.122
R² = 0.297
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

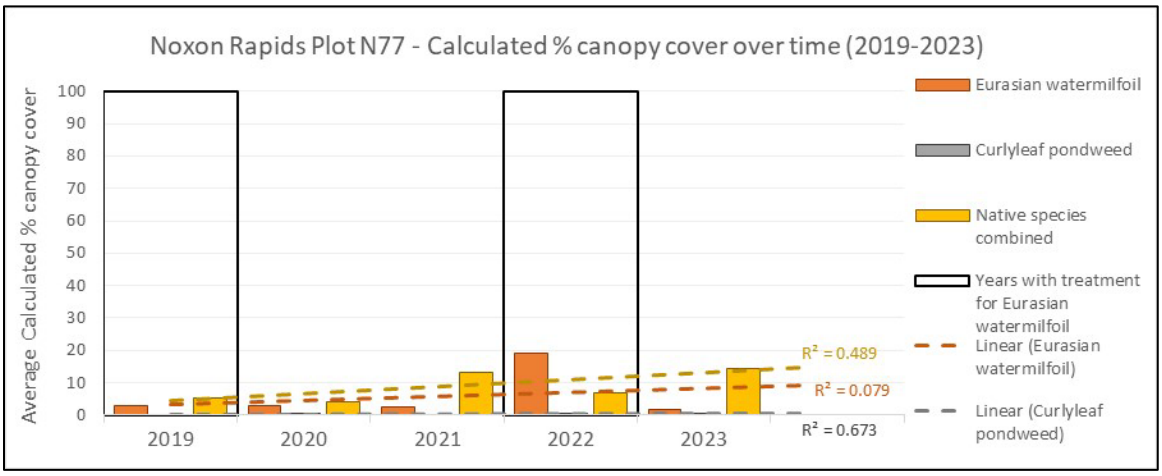

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 52
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
Kaniksu National Forest
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.04
0.07
Miles

Nox-73


Noxon Rapids Plot N73 - Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.057
R² = 0.440
R² = 0.256
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)

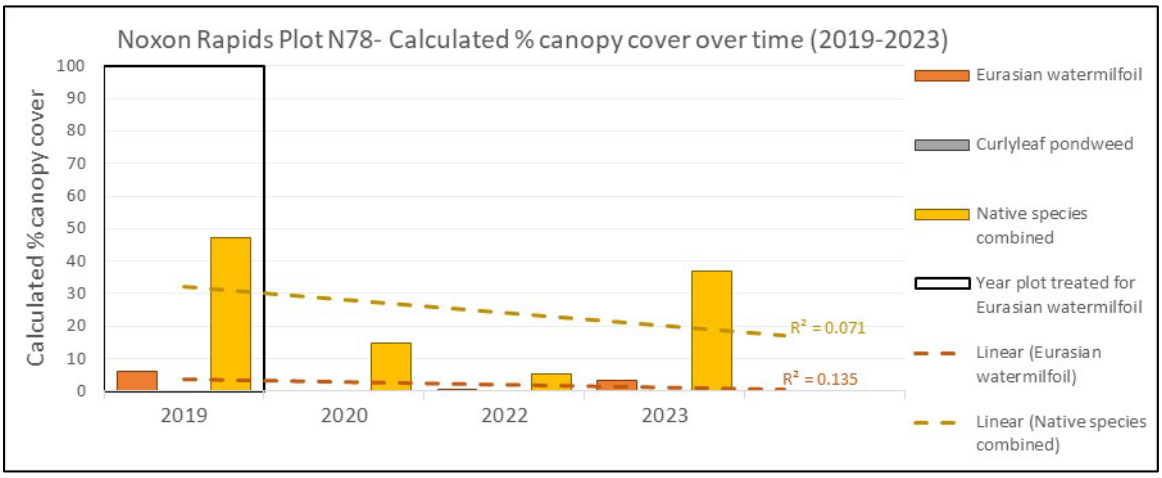

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 73
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.02
0.04
Miles

Nox-77


Noxon Rapids Plot N77 - Calculated % canopy cover over time (2019-2023)
Average Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.489
R² = 0.079
R² = 0.673
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Years with treatment for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)

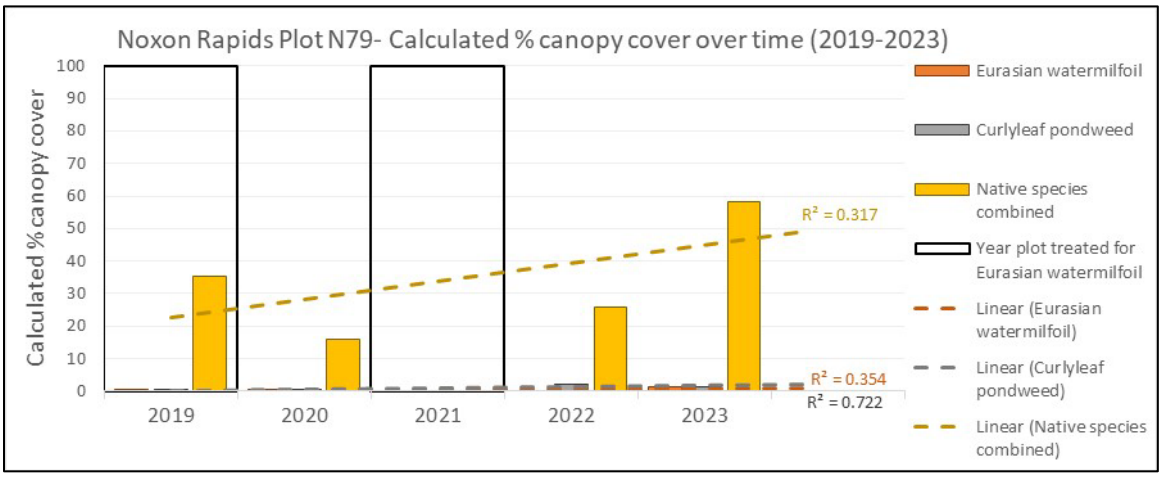

Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 77
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.02
0.04
Miles

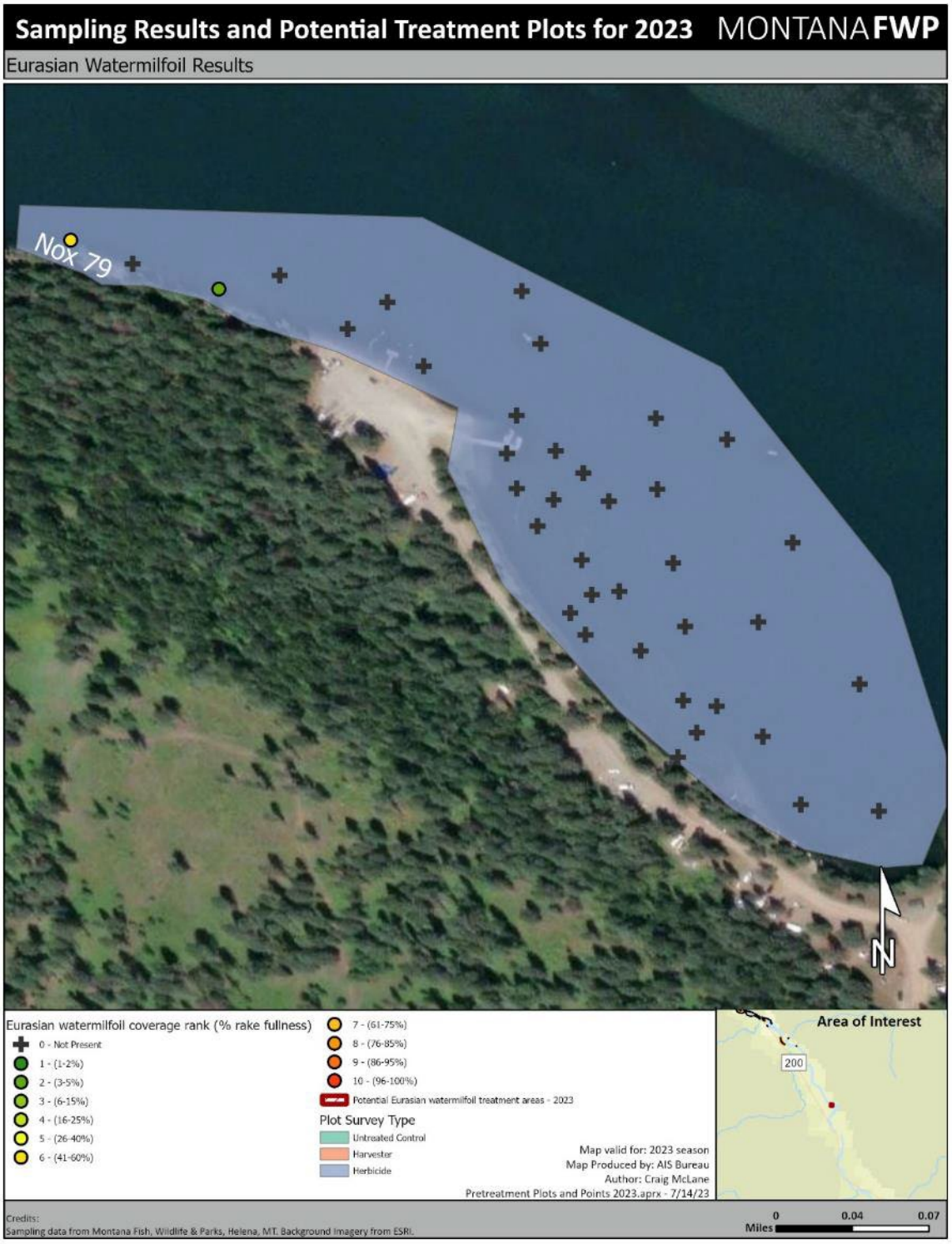
Nox-78


Noxon Rapids Plot N78- Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2022
2023
R² = 0.071
R² = 0.135
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Native species combined)


Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 78
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.
0
0.01
0.03
Miles

Nox-79


Noxon Rapids Plot N79- Calculated % canopy cover over time (2019-2023)
Calculated % canopy cover
100
90
80
70
60
50
40
30
20
10
0
2019
2020
2021
2022
2023
R² = 0.317
R² = 0.354
R² = 0.722
Eurasian watermilfoil
Curlyleaf pondweed
Native species combined
Year plot treated for Eurasian watermilfoil
Linear (Eurasian watermilfoil)
Linear (Curlyleaf pondweed)
Linear (Native species combined)


Sampling Results and Potential Treatment Plots for 2023
MONTANA FWP
Eurasian Watermilfoil Results
Nox 79
N
Eurasian watermilfoil coverage rank (% rake fullness)
0 - Not Present
1 - (1-2%)
2 - (3-5%)
3 - (6-15%)
4 - (16-25%)
5 - (26-40%)
6 - (41-60%)
7 - (61-75%)
8 - (76-85%)
9 - (86-95%)
10 - (96-100%)
Potential Eurasian watermilfoil treatment areas - 2023
Plot Survey Type
Untreated Control
Harvester
Herbicide
Map valid for: 2023 season
Map Produced by: AIS Bureau
Author: Craig McLane
Pretreatment Plots and Points 2023.aprx - 7/14/23
Area of Interest
200
Credits:
Sampling data from Montana Fish, Wildlife & Parks, Helena, MT. Background imagery from ESRI.
0
0.04
0.07
Miles

Appendix 2 – Canopy cover abundances among years for each plot for different species. Percent changes represent those differences between 2022 and 2023 as well as between 2019 and 2023.

Table 7. Eurasian watermilfoil (Myriophyllum spicatum)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	7.4	3.4	5.2	0.0	0.9	1.9	N/A	N/A	N/A	33.1	26.0	0.5	4.7	N/A	N/A	1.9	N/A	26.0	N/A	4.2	0.8	25.9	3.4	5.6	0.3
2020	0.1	0.6	1.2	0.0	0.7	1.1	4.1	19.1	0.0	0.0	0.8	2.8	4.9	4.5	26.7	0.1	0.0	0.0	N/A	1.5	0.0	0.1	3.0	0.0	0.1
2021	11.0	2.5	1.3	2.0	0.2	0.1	10.3	5.6	0.0	10.3	19.8	14.9	3.2	14.5	25.2	22.4	-	19.0	N/A	1.8	2.4	7.1	2.6	N/A	N/A
2022	2.0	2.2	2.0	0.3	1.5	1.9	1.1	0.0	0.0	9.0	0.0	2.5	17.7	36.9	41.7	2.7	0.0	43.8	N/A	10.1	9.6	0.0	19.2	0.0	0.0
2023	7.0	11.7	1.4	2.4	11.5	7.4	9.8	7.2	0.2	13.7	7.4	7.3	7.3	41.5	27.4	24.2	0.0	2.9	0.9	8.1	0.6	9.0	1.6	3.2	1.4
2022-2023 % Change	247	446	-32	849	647	298	801	Up 7.2	Up 0.2	53	Up 7.4	198	-59	12	-34	802	0	-93	N/A	-20	-94	Up 9.0	-92	Up 3.2	Up 1.4
2019-2023 % Change	-6	242	-73	Up 2.4	1240	299	140	-63	Up 0.2	-58	-72	1282	55	820	3	1195	0	-89	N/A	94	-30	-65	-54	-42	377

Table 8. Curlyleaf pondweed (Potamogeton crispus)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	10.1	0.1	4.3	9.7	0.0	0.0	N/A	N/A	N/A	0.0	0.1	1.5	4.8	N/A	N/A	6.5	N/A	0.8	N/A	28.2	1.0	2.0	0.0	0.0	0.1
2020	15.2	1.0	1.2	11.2	0.0	0.0	0.7	0.0	0.0	0.6	1.5	3.8	5.5	0.0	0.9	10.6	0.0	8.7	N/A	20.9	0.6	4.0	0.2	0.0	0.1
2021	12.2	0.0	2.5	0.0	0.0	0.1	0.0	0.0		1.3	0.4	2.6	5.7	1.0	10.1	16.6	N/A	18.7	N/A	27.3	0.7	4.4	0.0	N/A	N/A
2022	11.8	0.0	0.5	0.0	0.0	0.0	4.4	20.1	1.0	0.7	0.7	3.5	3.0	4.3	17.6	15.6	2.7	2.8	N/A	13.4	0.3	16.8	0.3	0.0	2.1
2023	15.7	0.2	0.0	3.8	0.0	0.3	0.2	8.3	0.4	0.8	0.1	3.4	10.2	5.6	9.0	6.6	0.0	4.1	1.1	6.3	0.7	8.0	0.5	0.0	1.4
2022-2023 % Change	33	Up 0.2	-100	Up 3.8	0	Up 0.3	-96	-59	-63	14	-92	-4	236	31	-49	-58	-100	48	N/A	-53	162	-53	49	0	-36
2019-2023 % Change	56	69	-100	-60	0	Up 0.3	-75	Up 8.3	Up 0.4	2547	-52	120	114	Up 5.6	952	2	0	409	N/A	-78	-29	296	Up 0.5	0	985

Table 9. Flowering rush (Butomus umbellatus)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	0.0	0.0	0.0	0.0	0.0	0.08	N/A	N/A	N/A	0.0	0.0	0.0	0.0	N/A	N/A	0.0	N/A	0.05	N/A	0.0	1.0	0.0	0.0	0.0	0.0
2020	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.2	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.4	0.0	N/A	0.0	N/A	0.0	2.3	0.0	0.0	N/A	N/A
2022	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.8	0.0	0.2	0.0	0.3	0.0	0.0	0.0	N/A	0.0	0.7	0.0	0.1	0.0	0.0
2023	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.2	1.3	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0
2022-2023 % Change	0	0	0	0	0	-19	0	0	0	423	71	0	-100	0	139	0	0	0		0	219	0	-100	0	0
2019-2023 % Change	0	0	0	0	0	2209	0	0	0	Up 0.2	Up 1.3	0	0	0	Up 0.7	0	0	-100		0	110	0	0	0	0

[c] = Control Plots (First surveyed in 2020)

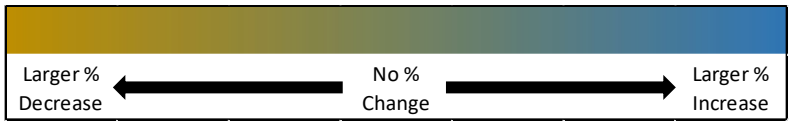


Table 10. Coontail (*Ceratophyllum demersum*)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	18.2	14.5	17.3	0.2	0.0	1.6	N/A	N/A	N/A	17.4	27.0	10.2	22.7	N/A	N/A	18.3	N/A	53.1	N/A	12.4	12.2	26.7	1.5	0.3	20.9
2020	12.9	13.8	11.8	0.0	0.0	2.3	27.4	9.1	71.8	6.2	13.3	6.5	7.7	14.5	28.4	9.5	11.3	4.1	N/A	12.4	11.3	11.6	3.3	0.0	12.1
2021	33.0	19.2	28.9	0.0	0.0	3.3	46.6	43.6	62.1	5.6	24.5	29.8	9.7	26.3	44.6	14.9	-	9.7	N/A	4.4	18.8	25.3	0.0	N/A	N/A
2022	17.0	9.9	21.6	0.3	0.0	3.4	3.6	32.8	18.0	17.9	4.8	9.8	4.4	22.3	21.3	2.0	4.2	14.2	N/A	37.0	13.9	6.0	1.9	0.1	16.8
2023	34.2	30.6	37.4	0.7	0.0	18.1	26.7	53.7	67.9	13.8	16.4	42.1	16.4	27.1	45.3	27.9	6.7	21.0	9.3	65.7	2.0	24.5	5.1	1.1	36.1
2022-2023 % Change	102	211	73	183	0	432	631	64	276	-23	243	332	272	21	113	1313	60	47	N/A	77	-86	307	162	847	115
2019-2023 % Change	88	112	116	379	0	1014	-3	491	-6	-21	-39	311	-28	86	59	52	-41	-60	N/A	428	-84	-8	237	337	73

Table 11. Muskgrass species (*Chara* species)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	0.9	0.0	0.1	0.0	0.0	0.2	N/A	N/A	N/A	0.1	0.1	0.0	0.1	N/A	N/A	0.2	N/A	0.3	N/A	0.0	1.5	0.0	0.0	0.0	0.5
2020	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.3	0.0	0.2	0.0	0.0	0.1	0.0	0.0	N/A	0.1	2.7	0.0	0.1	0.0	0.6
2021	1.6	0.0	0.1	0.0	0.2	0.8	0.0	0.0	0.0	18.9	2.4	5.1	6.1	10.6	0.0	6.6	-	18.3	N/A	1.3	11.9	0.1	5.3	N/A	N/A
2022	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	5.5	0.2	0.3	0.2	0.0	0.0	1.0	0.4	0.8	N/A	0.0	3.8	0.1	0.4	0.1	0.2
2023	0.3	0.0	0.0	0.3	0.0	0.6	0.0	0.0	0.0	9.8	3.4	1.3	1.0	9.6	0.0	9.1	13.1	3.1	0.0	0.0	0.7	0.1	1.5	0.0	8.7
2022-2023 % Change	-26	0	0	Up 0.3	0	208	0	0	0	77	1844	371	531	Up 9.6	0	849	3011	289	N/A	0	-81	0	257	-100	5678
2019-2023 % Change	-73	0	-100	Up 0.3	0	163	0	0	0	12849	2580	Up 1.3	741	Up 9.6	0	5300	Up 13.1	856	N/A	0	-51	Up 0.1	Up 1.5	0	1488

Table 12. Waterweed species (*Elodea species*)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	6.6	18.7	24.3	30.0	30.6	5.3	N/A	N/A	N/A	5.8	39.6	0.2	18.5	N/A	N/A	3.0	N/A	9.4	N/A	11.6	0.5	20.0	1.7	43.6	5.9
2020	3.6	7.8	18.1	11.9	9.4	23.8	4.7	11.0	7.6	1.1	3.6	12.4	5.8	1.6	12.5	13.2	0.5	0.5	N/A	13.3	0.0	0.1	0.6	5.3	1.8
2021	12.3	31.9	19.9	12.9	21.0	13.0	26.4	18.6	12.9	4.5	41.9	18.1	23.0	28.3	8.2	14.2	-	19.3	N/A	30.4	4.3	8.9	2.8	N/A	N/A
2022	0.8	13.7	43.2	10.2	0.5	3.4	2.6	2.3	9.0	2.1	0.5	2.5	8.5	21.6	7.1	1.7	20.3	4.1	N/A	43.0	1.9	0.9	2.7	4.5	0.6
2023	14.4	40.6	5.3	47.9	35.0	28.6	53.5	9.3	37.9	5.8	35.1	16.2	5.7	4.5	7.7	14.5	2.4	2.7	18.3	27.6	0.0	5.0	1.8	27.3	8.0
2022-2023 % Change	1714	196	-88	371	7479	743	1929	300	322	176	6515	553	-33	-79	8	779	-88	-34	N/A	-36	-100	444	-32	510	1209
2019-2023 % Change	117	117	-78	59	14	443	1045	-16	398	1	-11	9642	-69	175	-38	389	419	-72	N/A	138	-100	-75	11	-37	34

[c] = Control Plots (First surveyed in 2020)

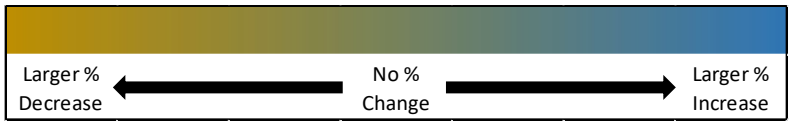


Table 13. Northern watermilfoil (*Myriophyllum sibiricum*)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	0.0	0.0	0.0	0.0	0.0	0.0	N/A	N/A	N/A	0.0	0.0	0.0	0.0	N/A	N/A	0.0	N/A	0.2	N/A	0.0	0.0	0.0	0.0	0.0	0.0
2020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.6	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.1	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	-	0.0	N/A	0.0	0.0	0.0	0.0	N/A	N/A
2022	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.7	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	N/A	0.2	0.8	0.0	0.0	0.0	0.2
2023	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.4	3.1
2022-2023 % Change	0	0	-100	0	0	-100	0	0	0	-95	Up 0.1	Up 0.1	-100	0	0	0	0	-100	N/A	-100	-100	Up 0.5	0	Up 0.4	1668
2019-2023 % Change	0	0	0	0	0	0	0	0	0	0	Up 0.1	0	0	-100	0	0	0	-100	N/A	0	0	Up 0.5	0	Up 0.4	Up 3.1

Table 14. Waternymph species (*Najas* species)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	0.0	0.0	0.0	0.0	0.0	0.1	N/A	N/A	N/A	0.0	0.0	0.0	0.0	N/A	N/A	0.0	N/A	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0
2020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	N/A	N/A
2022	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0
2023	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2022-2023 % Change	0	0	0	0	0	0	0	0	0	0	0	0	Up 0.4	0	0	0	0	0	N/A	0	0	0	0	0	0
2019-2023 % Change	0	0	0	0	0	-100	0	0	0	0	0	0	Up 0.4	0	0	0	0	0	N/A	0	0	0	0	0	0

Table 15. Narrow leaved Potamogeton species (*Potamogeton/Stuckenia* species)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	0.1	0.2	0.0	0.0	0.0	2.7	N/A	N/A	N/A	1.0	1.4	0.3	0.1	N/A	N/A	0.8	N/A	1.8	N/A	0.4	0.5	0.0	0.0	0.8	6.8
2020	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.9	1.4	0.1	0.0	1.7	1.2	4.6	1.6	2.8	N/A	0.3	0.5	0.0	0.2	9.4	1.2
2021	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	2.1	1.8	2.2	4.3	0.4	3.4	19.3	-	4.4	N/A	1.9	0.2	1.4	2.7	N/A	N/A
2022	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	1.3	4.5	0.4	1.4	0.3	1.7	2.0	5.8	1.4	N/A	0.0	0.4	0.0	0.3	0.9	6.6
2023	0.0	0.0	0.0	1.2	0.0	15.4	0.0	0.0	0.0	1.7	12.7	2.2	4.9	2.8	0.2	9.9	8.3	3.4	0.7	1.5	0.5	0.1	1.1	8.1	1.7
2022-2023 % Change	0	0	0	Up 1.2	0	516	0	0	0	30	182	409	245	836	-91	389	43	140	N/A	Up 1.5	17	Up 0.1	297	770	-74
2019-2023 % Change	-100	-100	0	Up 1.2	0	472	0	0	0	68	805	762	9671	65	-87	1116	407	83	N/A	277	-10	Up 0.1	Up 1.1	866	-75

[c] = Control Plots (First surveyed in 2020)

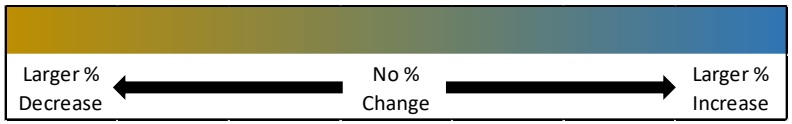


Table 16. White-stemmed pondweed (*Potamogeton praelongus*)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	0.0	0.0	0.0	0.0	0.0	0.0	N/A	N/A	N/A	0.0	0.1	0.0	0.0	N/A	N/A	0.2	N/A	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0
2020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.2	1.0	0.8	0.0	0.0	N/A	1.5	0.2	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	1.0	0.6	-	0.0	N/A	0.0	8.0	0.0	0.0	N/A	N/A
2022	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	2.5	0.0	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0
2023	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2022-2023 % Change	0	0	0	0	0	0	0	0	0	Up 0.4	-100	0	0	0	0	-100	0	0	N/A	0	0	0	0	0	0
2019-2023 % Change	0	0	0	0	0	0	0	0	0	Up 0.4	-100	0	0	-100	-100	-100	0	0	N/A	0	0	0	0	0	0

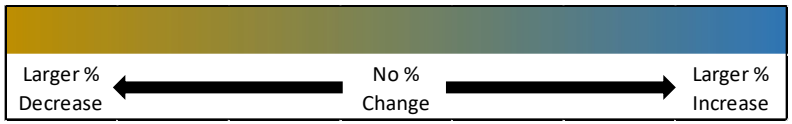
Table 17. Richardson's pondweed (*Potamogeton richardsonii*)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	0.0	0.0	0.0	0.2	0.0	1.2	N/A	N/A	N/A	0.0	0.0	0.0	0.0	N/A	N/A	0.1	N/A	0.1	N/A	0.0	1.0	0.0	0.2	0.0	0.1
2020	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.1
2021	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.3	0.0	0.0	0.0	N/A	0.0	N/A	0.3	0.0	2.2	2.5	N/A	N/A
2022	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.3	0.0	0.0	0.1	0.2	0.7	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.1	0.0	0.0	0.0	0.0
2023	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.3	0.7	1.5	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	5.0	4.8	0.0	0.0
2022-2023 % Change	0	0	0	0	0	220	0	-100	0	1043	640	689	-43	0	0	0	0	Up 0.2	N/A	0	-100	Up 0.5	Up 4.8	0	0
2019-2023 % Change	0	0	0	-100	0	18	0	0	0	933	Up 0.7	Up 1.5	Up 0.4	0	0	-100	0	77	N/A	0	-100	Up 0.5	3110	0	-100

Table 18. White waterbuttercup (Ranunculus aquatilis)

	C05	C06	C12	C20	C29	C30	C31[c]	C32[c]	C33[c]	N01	N02	N03	N04	N05[c]	N06[c]	N08	N09[c]	N11	N2301	N31	N52	N73	N77	N78	N79
2019	5.9	4.7	0.1	0.0	0.0	0.0	N/A	N/A	N/A	0.9	0.1	0.0	0.4	N/A	N/A	0.5	N/A	0.6	N/A	0.0	0.0	0.5	1.2	1.9	0.1
2020	10.1	15.3	0.7	0.0	0.0	0.3	0.0	9.9	0.0	4.3	0.0	2.0	1.8	0.0	0.0	4.0	0.0	0.1	N/A	0.8	0.0	1.0	0.0	0.0	0.1
2021	20.8	23.4	0.4	0.4	0.0	0.4	0.0	25.5	0.0	11.6	0.1	0.5	16.1	0.4	0.2	13.7	N/A	2.6	N/A	0.0	0.2	6.2	0.0	N/A	N/A
2022	14.9	16.4	0.0	3.0	0.0	0.0	0.0	20.4	0.0	0.2	0.0	0.2	8.7	0.0	0.3	0.3	0.8	0.7	N/A	1.4	0.3	0.5	0.9	0.0	0.3
2023	30.0	26.0	0.6	7.4	0.0	0.0	0.0	20.8	0.0	0.1	0.1	1.7	8.6	0.3	0.6	1.4	0.6	0.4	0.3	0.0	0.0	0.9	0.2	0.1	0.6
2022-2023 % Change	101	59	Up 0.6	149	0	-100	0	2	0	-50	Up 0.1	812	0	Up 0.3	122	402	-31	-47	N/A	-100	-100	92	-75	Up 0.1	157
2019-2023 % Change	412	449	578	Up 7.4	0	0	0	110	0	-87	-4	Up 1.7	2239	Up 0.3	Up 0.6	206	Up 0.6	-36	N/A	0	0	80	-81	-94	419

[c] = Control Plots (First surveyed in 2020)



Appendix 3 – Canopy cover abundances (%) grouped by year (2019-2023.)

Table 19. 2023 Treatment Plots	C05‡	C06‡	C12	C20	C29	C30‡	N01‡	N02‡	N03‡	N04‡	N08‡	N11	N31‡	N52	N73‡	N77	N78	N79
Elodea spp.	14	41	5	48	35	29	6	35	16	6	15	3	28	0	5	2	27	8
Coontail	34	31	37	1	0	18	14	16	42	16	28	21	66	2	25	5	1	36
Eurasian watermilfoil	7	12	1	2	12	7	14	7	7	7	24	3	8	1	9	2	3	1
Curlyleaf pondweed	16	0	0	4	0	0	1	0	3	10	7	4	6	1	8	1	0	1
Native narrow-leaved pondweed spp.	0	0	0	1	0	15	2	13	2	5	10	3	1	0	0	1	8	2
White water buttercup	30	26	1	7	0	0	0	0	2	9	1	0	0	0	1	0	0	1
Chara/Nitella spp.	0	0	0	0	0	1	10	3	1	1	9	3	0	1	0	1	0	9
Richardson's pondweed	0	0	0	0	0	1	0	1	1	0	0	0	0	0	5	5	0	0
Flowering rush	0	0	0	0	0	2	0	1	0	0	0	0	0	2	0	0	0	0
White-stemmed pondweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern watermilfoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Water stargrass	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Slender Naiad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Illinois pondweed	0	0	0	0	0	0	0	5	0	2	6	0	0	1	0	0	0	0

‡ = Treated in 2023

Table 20. 2023 Control Plots	Untreated Control Plots						
	C 31	C 32	C 33	N 05	N 06	N 09	N 2301
Elodea spp.	54	9	38	4	8	2	18
Coontail	27	54	68	27	45	7	9
Eurasian watermilfoil	10	7	0	41	27	0	1
Curlyleaf pondweed	0	8	0	6	9	0	1
Native narrow-leaved pondweed spp.	0	0	0	3	0	8	1
White water buttercup	0	21	0	0	1	1	0
Chara/Nitella spp.	0	0	0	10	0	13	0
Richardson's pondweed	0	0	0	0	0	0	0
Flowering rush	0	0	0	0	1	0	0
White-stemmed pondweed	0	0	0	0	0	0	0
Northern watermilfoil	0	0	0	0	0	0	0
Water stargrass	0	0	0	0	0	0	0
Slender Naiad	0	0	0	0	0	0	0
Illinois pondweed	0	0	0	0	0	0	0

Table 21. Potential Treatment Plots																		
2022	C05	C06	C12	C20	C29	C30	N01#	N02	N03#	N04#	N08#	N11#	N31#	N52#	N73	N77#	N78	N79
Elodea spp.	1	14	43	10	0	3	2	1	2	8	2	4	43	2	1	3	4	1
Coontail	17	10	22	0.3	0	3	18	5	10	4	2	14	37	14	6	2	0.1	17
Eurasian watermilfoil	2	2	2	0.3	2	2	9	0	2	18	3	44	10	10	0.1	19	0.2	0.0
Curlyleaf pondweed	12	0	0.5	0	0	0	1	1	4	3	16	3	13	0.3	17	0.3	0	2
Native narrow-leaved pondweed spp.	0	0	0	0	0	2	1	5	0.4	1	2	1	0	0.4	0	0.3	1	7
White water buttercup	15	16	0	3	0	0	0.2	0	0.2	9	0.3	1	1	0.3	0	1	0	0.3
Chara/Nitella spp.	0.3	0	0	0	0	0.2	6	0.2	0.3	0.2	1	1	0	4	0.1	0.4	0.1	0.2
Richardson's pondweed	0	0	0	0	0	0.4	0	0.1	0.2	1	0	0	0	0.1	0	0	0	0
Flowering rush	0	0	0	0	0	2	0	1	0	0.2	0	0	0	1	0	0.1	0	0
White-stemmed pondweed	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0
Northern watermilfoil	0	0	0.3	0	0	0.1	1	0	0	0.2	0	0.2	0.2	1	0	0	0	0.2

#=Plots treated in 2022

Table 22. 2022 Control Plots	Untreated Control Plots						Potential Harvester Plots				
	C32	C31	C33	N05	N06	N09	N07	N10	N30	N37	N88
Elodea spp.	2	3	9	22	7	20	-	15	8	3	10
Coontail	33	4	18	22	21	4	-	16	12	5	20
Eurasian watermilfoil	0	1	0	37	42	0.1	-	30	20	5	10
Curlyleaf pondweed	20	4	1	4	18	3	-	26	30	9	41
Native narrow-leaved pondweed spp.	0	0	0	0.3	2	6	-	10	1	1	0.4
White water buttercup	20	0	0	0	0.3	1	-	1	7	6	2
Chara/Nitella spp.	0	0	0	0	0	0.4	-	0	0	1	0
Richardson's pondweed	0.3	0	0	0	0	0	-	0	0	0	0
Flowering rush	0	0	0	0	0.3	0	-	0	0.2	0	0
White-stemmed pondweed	0	0	0	0	0	0	-	0	0	0	4
Northern watermilfoil	0	0	0	0	0	0	-	0.1	1	0.1	1

Table 23. Potential Treatment Plots 2021	C05	C06	C12	C20	C29	C30	N01^	N02^	N03^	N04^	N08^	N11	N31	N52	N73^	N77	N78	N79^
Elodea spp.	12.3	31.9	19.9	12.9	21.0	13.0	4.5	41.9	18.1	23.0	14.2	19.3	30.4	4.3	8.9	2.8	-	-
Coontail	33.0	19.2	28.9	0	0	3.3	5.6	24.5	29.8	9.7	14.9	9.7	4.4	18.8	25.3	0	-	-
Eurasian watermilfoil	11.0	2.5	1.3	2.0	0.2	0.1	10.3	19.8	14.9	3.2	22.4	19.0	1.8	2.4	7.1	2.6	-	-
Curlyleaf pondweed	12.2	0	2.5	0	0	0.1	1.3	0.4	2.6	5.7	16.6	18.7	27.3	0.7	4.4	0	-	-
Native narrow-leaved pondweed spp.	0	0	0	0	0	4.4	2.1	1.8	2.2	4.3	19.3	4.4	1.9	0.2	1.4	2.7	-	-
White water buttercup	20.8	23.4	0.4	0.4	0	0.4	11.6	0.1	0.5	16.1	13.7	2.6	0	0.2	6.2	0	-	-
Chara spp.	1.6	0	0.1	0	0.2	0.8	18.9	2.4	5.1	6.1	6.6	18.3	1.3	11.9	0.1	5.3	-	-
Richardson's pondweed	0	0	0	3.3	0	0	0	0	1.7	1.3	0	0	0.3	0.0	2.2	2.5	-	-
Flowering rush	0	0	0	0	0	0.1	0	0.6	0	0	0	0	0	2.3	0	0	-	-
White-stemmed pondweed	0	0	0	0	0	0	0	0.8	0	0	0.6	0	0	8.0	0	0	-	-
Northern watermilfoil	0	0	0	0	0	0	0.1	0.3	0	0	0	0	0	0	0	0	-	-

^=Plots treated in 2021; Unable to sample N78 and N79 due to boat troubles

Table 24. 2021 Untreated Control Plots	C31	C32	C33	N05	N06	N09
Elodea spp.	26.4	18.6	12.9	28.3	8.2	-
Coontail	46.6	43.6	62.1	26.3	44.6	-
Eurasian watermilfoil	10.3	5.6	0	14.5	25.2	-
Curlyleaf pondweed	0	0	0	1.0	10.1	-
Native narrow-leaved pondweed spp.	0	0	0	0.4	3.4	-
White water buttercup	0	25.5	0	0.4	0.2	-
Chara spp.	0	0	0.0	10.6	0	-
Richardson's pondweed	0	0	0	0	0	-
Flowering rush	0	0	0	0	0.4	-
White-stemmed pondweed	0	0	0	0	1.0	-
Northern watermilfoil	0	0	0	0	0	-

Unable to sample N09 due to boat troubles

Table 25. Potential Treatment Plots 2020	C05	C06*	C12*	C20	C29	C30*	N01	N02	N03*	N04*	N08	N11	N31*	N52	N61	N73	N77	N78	N79
Elodea spp.	3.6	7.8	18.1	11.9	9.4	23.8	1.1	3.6	12.4	5.8	13.2	0.5	13.3	0	NA	0.1	0.6	5.3	1.8
Coontail	12.9	13.8	11.8	0	0	2.3	6.2	13.3	6.5	7.7	9.5	4.1	12.4	11.3	NA	11.6	3.3	0	12.1
Eurasian watermilfoil	0.1	0.6	1.2	0	0.7	1.1	0	0.8	2.8	4.9	0.1	0	1.5	0	NA	0.1	3.0	0	0.1
Curlyleaf pondweed	15.2	1.0	1.2	11.2	0	0	0.6	1.5	3.8	5.5	10.6	8.7	20.9	0.6	NA	4.0	0.2	0	0.1
Native narrow-leaved pondweed spp.	0	0	0	0	0	1.7	0.9	1.4	0.1	0	4.6	2.8	0.3	0.5	NA	0	0.2	9.4	1.2
White water buttercup	10.1	15.3	0.7	0	0	0.3	4.3	0	2.0	1.8	4.0	0.1	0.8	0	NA	1.0	0.0	0	0.1
Chara spp.	0.2	0	0	0	0	0.4	0.2	0.3	0	0.2	0.1	0	0.1	2.7	NA	0	0.1	0	0.6
Richardson's pondweed	0	0	0	0	0	0.1	0.1	0	0	0	0.1	0	0	0	NA	0	0.0	0	0.1
Flowering rush	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0.2	NA	0	0.0	0	0
White-stemmed pondweed	0	0	0	0	0	0	0	0	0	0.6	0.8	0	1.5	0.2	NA	0	0.0	0	0
Northern watermilfoil	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0	NA	0.1	0.0	0	0

* = plots treated in 2020

Untreated Controls - First Surveyed in 2020

Table 26. Control Plots 2020	C31	C32	C33	N05	N06	N09
Elodea spp.	4.7	11.0	7.6	1.6	12.5	0.5
Coontail	27.4	9.1	71.8	14.5	28.4	11.3
Eurasian watermilfoil	4.1	19.1	0	4.5	26.7	0
Curlyleaf pondweed	0.7	0	0	0	0.9	0
Native narrow-leaved pondweed spp.	0	0	0	1.7	1.2	1.6
White water buttercup	0	9.9	0	0	0	0
Chara spp.	0	0	0	0	0	0
Richardson's pondweed	0	0	0	0	0	0
Flowering rush	0	0	0	0	0	0
White-stemmed pondweed	0	0	0	0.2	1.0	0
Northern watermilfoil	0	0	0	0.6	0	0

Table 27. Potential Treatment Plots 2019	C05†	C06†	C12†	C20	C29†	C30†	N01	N02†	N03†	N04†	N08†	N11†	N31†	N52†	N61	N73†	N77†	N78†	N79†
Elodea spp.	7	19	24	30	31	5	6	40	0.2	19	3	9	12	1	NA	20	2	44	6
Coontail	18	14	17	0.2	0	2	17	27	10	23	18	53	12	12	NA	27	2	0.25	21
Eurasian watermilfoil	7	3	5	0	1	2	33	26	1	5	2	26	4	1	NA	26	3	6	0.3
Curlyleaf pondweed	10	0.1	4	10	0	0	0.03	0.1	2	5	7	1	28	1	NA	2	0	0	0.1
Native narrow-leaved pondweed spp.	0.1	0.2	0	0	0	3	1	1	0.3	0.1	1	2	0.4	1	NA	0	0	1	7
White water buttercup	6	5	0.1	0	0	0	1	0.1	0	0.4	0.5	0.6	0	0	NA	1	1	2	0.1
Chara spp.	1	0	0.1	0	0	0.2	0.1	0.1	0	0.1	0.2	0.3	0	1	NA	0	0	0	1
Richardson's pondweed	0	0	0	0.2	0	1	0.03	0	0	0	0.1	0.1	0	1	NA	0	0.2	0	0.1
Flowering rush	0	0	0	0	0	0.1	0	0	0	0	0	0.05	0	1	NA	0	0	0	0
White-stemmed pondweed	0	0	0	0	0	0	0	0.1	0	0	0.2	0	0	0	NA	0	0	0	0
Northern watermilfoil	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	NA	0	0	0	0
Grass leaved pondweed	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	NA	0	0	0	0
Waternymph spp.	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	NA	0	0	0	0

† = plots treated in 2019