TAHOE KEYS LAGOONS
2024 AQUATIC MACROPHYTE SURVEY REPORT

PREPARED PURSUANT TO
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION BOARD ORDER NO. R6T-2014-0059

Tahoe Keys
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Prepared for
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ACRONYMS AND ABBREVIATIONS

2024 Survey	2024 Tahoe Keys Lagoons Aquatic Macrophyte Survey
AIP	Aquatic Invasive Plants
AIS	Aquatic Invasive Species
BrSc	*Brasenia schreberi* (watershield)
CeDe	*Ceratophyllum demersum* (coontail)
CMT	Tahoe Keys Lagoons Aquatic Weed Control Methods Test
ElCa	*Elodea canadensis* (elodea)
ESA	Environmental Science Associates
FA	Other Filamentous Algae
IDW	Inverse Distance Weighted
IMP	Integrated Management Plan
Lahontan	Lahontan Regional Water Quality Control Board
LFA	Laminar Flow Aeration
Keys Lagoons	Tahoe Keys lagoons
MyQu	*Myriophyllum quitense* (Andean watermilfoil)
MySp	*Myriophyllum spicatum* (Eurasian watermilfoil)
NiSp	*Nitella* sp. (filamentous algae)
NuPo	*Nuphar* polysepala (yellow pond-lily)
PeAm	*Persicaria amphibia* (water smartweed)
PoCr	*Potamogeton crispus* (curlyleaf pondweed)
PoFo	*Potamogeton foliosus* (leafy pondweed)
PoRi	*Potamogeton richardsonii* (Richardson's pondweed)
SEA	Sierra Ecosystem Associates
TKPOA	Tahoe Keys Property Owners Association
TRPA	Tahoe Regional Planning Agency
USGS	United States Geological Survey
UV-C	ultraviolet light at the "C" wavelength
WDR	Waste Discharge Requirements

1.0 INTRODUCTION

As required by the Waste Discharge Requirements (WDR) permit issued by the Lahontan Regional Water Quality Control Board (Lahontan), Order No. R6T-2014-0059 on July 18, 2014, this report summarizes the results of the annual aquatic macrophyte survey completed in the Tahoe Keys lagoons (lagoons or Keys lagoons) in 2024. The survey took place July 8 – July 12, 2024 and was conducted by Sierra Ecosystem Associates' (SEA) Senior Ecologist, Jeremy Waites, SEA Natural Resources Analyst Summer Abel, and Assistant Environmental Scientist Aria Pauling with the assistance of Tahoe Keys Property Owners Association's (TKPOA) Water Quality Manager (Kristine Lebo) and staff.

This report presents the sampling methodology (Section 2.0), results of the sampling activities in each of the lagoons (Section 3.0), and a narrative summary of the results compared to the previous nine years of data (Section 4.0). Section 4.0 also includes a discussion on the continued aggressive expansion of curlyleaf pondweed and the relationship of plant biovolume to water volume in response to TKPOA and stakeholder interest in these two topics.

Note that the aquatic plant data presented in this report does not separate or otherwise address the results of the 2022 through 2024 TKPOA Control Methods Test (CMT or CMT Project) that was performed in small-scale areas of the West Lagoon and the Tallac Lagoon. While some effects of the CMT can be seen in aquatic plant rake data and for the West Lagoon as a whole during this period, the CMT treatment methods were used within a relatively small percentage (roughly 20%) of the total area of the lagoons. Therefore, the seasonal effects of the different CMT treatments on the aquatic plant populations cannot be determined from the results of the mid-summer Lagoon-wide macrophyte surveys reported here. However, because several of the annual survey sampling points are within CMT Sites, the data from those samples may be useful in comparing AIP presences and abundance in those areas in the years prior to the CMT (before 2022). The data presented in this report summarize the aquatic plant conditions in the lagoons individually and collectively without analyzing specific areas within each lagoon. Results of the 2022 through 2024 CMT Project will be fully addressed in the CMT Draft Final Report that is scheduled for submittal to Lahontan April 30, 2025.

Lastly, presented for the first time in this year's annual report (Section 4.0) is a discussion of survey results relative to the May 2024 Tahoe Regional Planning Agency (TRPA) Board-adopted Threshold Standard regarding long-term goals for reducing aquatic invasive plant (AIP) biovolume in the Keys Lagoons by 75% from 2020 baseline levels. This and future annual reports will provide a mid-summer assessment of progress toward this new threshold standard specific to the Keys lagoons.

1.1 Overview of Site

The Tahoe Keys is a private housing, public marina, and commercial office development, created in the 1950s and 1960s, located at the south end of Lake Tahoe. It is comprised of a residential area, the largest Lake Tahoe commercial marina open to the public, and commercial business center covering an area of approximately 372 acres (including waterways). In addition to 1,529 private home lots and townhomes, several public and private entities own and manage land in and around the Tahoe Keys development including: Tahoe Keys Village, Tahoe Keys Marina (purchased by Suntex Marinas in 2022), the State of California, USDA Forest Service, and Tahoe Keys Beach and Harbor Association.

The water surface area encompassed by the 2024 Aquatic Macrophyte Survey (2024 Survey) was approximately 167 acres. This area includes the Marina (aka East) Lagoon, West Lagoon, Tallac Lagoon, and a portion of the dredged channels from the East Lagoon and West Lagoon into Lake Tahoe. The survey areas and the results described in this report are separately addressed for the East Lagoon, West Lagoon, and Tallac Lagoon (Figure 1). In response to ongoing studies on results of the CMT Project, certain areas in the West Lagoon and the Tallac Lagoon were sampled at a higher density than the rest of those lagoons. Figure 1 shows the locations of all macrophyte sample points for the 2024 Survey.

Figure 1. Point Sampling Locations 2024

1.2 Purpose of 2024 Survey

Beginning in 2014, in compliance with the WDR permit issued by Lahontan to TKPOA (Lahontan 2014), and in response to the increase of the Aquatic Invasive Species (AIS) infestation, TKPOA began preparing and updating an Integrated Management Plan (IMP) annually to develop and report on measures that may be more effective to control AIP than the historical weed harvesting program. The annual aquatic macrophyte survey supplies data that can identify yearly trends in species composition, and partially track the efficacy of IMP methods, and help identify successful approaches to achieve the IMP goals and objectives. However, since the surveys are only during a short 4-to 6-day period in mid-summer, the results do not inform seasonal changes in either biovolume or species composition (i.e. relative abundance or frequency of occurrence).

Past aquatic macrophyte surveys of the Keys lagoons were conducted in 2009, 2011, and annually from 2015 through 2024 to measure presence and absence of plant species (including percent occurrence and percent composition). Initial surveys were performed in 2014 in

portions of the lagoons, but data collection was limited and therefore not addressed in this report. The 2015-2023 annual surveys, as well as the 2024 Survey, also benefit from hydroacoustic scanning performed by TKPOA staff to determine the percent plant biovolumes within the water column.

1.3 Summary of 2024 Survey Results

The 2024 point-intercept survey was conducted over the course of five days: July 8 - July 12, 2024. During the survey, a total of 672 points were sampled throughout the Keys lagoons, including the East Lagoon (107 points), West Lagoon (489 points), and Tallac Lagoon (76 points). Appendix A presents the survey data with GPS coordinates taken in the Lagoons.

Hydroacoustic scans conducted around the time of the survey (June 26 – July 12, 2024) provided aquatic plant biomass information. The results of the 2024 survey were compared to the results of the prior annual surveys to determine whether there were any identified trends in growth of the aquatic macrophyte populations, including possible trends in species composition or abundance. Overall, species presence in 2024 for most areas of the Keys lagoons was found to be similar to previous years. Species identified during the survey were:

- *Myriophyllum spicatum* (Eurasian watermilfoil)
- *Ceratophyllum demersum* (coontail)
- *Potamogeton crispus* (curlyleaf pondweed)
- *Potamogeton richardsonii* (Richardson's pondweed)
- *Potamogeton foliosus* (leafy pondweed)
- *Elodea canadensis* (elodea)
- *Brasenia schreberi* (watershield)
- *Nuphar polysepala* (Yellow pond-lily)
- *Myriophyllum quitense* (Andean watermilfoil)
- *Persicaria amphibia* (water smartweed)
- *various species of Nitella, Chara, Spirogyra*, and other filamentous algae

Among these species, the non-native Eurasian watermilfoil and curlyleaf pondweed, along with the native nuisance coontail, have remained the most prevalent plant species in the waterways of the Keys lagoons since full surveys began in 2015. Species frequency of occurrence (Figures 2 through 4) has fluctuated from year to year. Curlyleaf pondweed has shown an aggressive increasing trend of occurrence in the lagoons since sampling began, especially in the West Lagoon. The exception to this was after the CMT Project 2022 treatments in the West Lagoon. Figures 2, 3 and 4 show the year-to-year general trends in AIP frequency of occurrence rates for the East, West, and Tallac lagoons.

Note that CMT treatments appeared to have a noticeable effect on both species occurrence rates and biovolume as reflected in the lagoon-wide data despite the relatively small footprint.

Herbicide and ultraviolet light at the "C" wavelength (UV-C) CMT treatments comprised approximately 27 acres (22%) of the West lagoon. The same CMT treatments comprised 2 acres (8%) of the Tallac Lagoon.

Figure 2. East Lagoon AIP Occurrence Rates

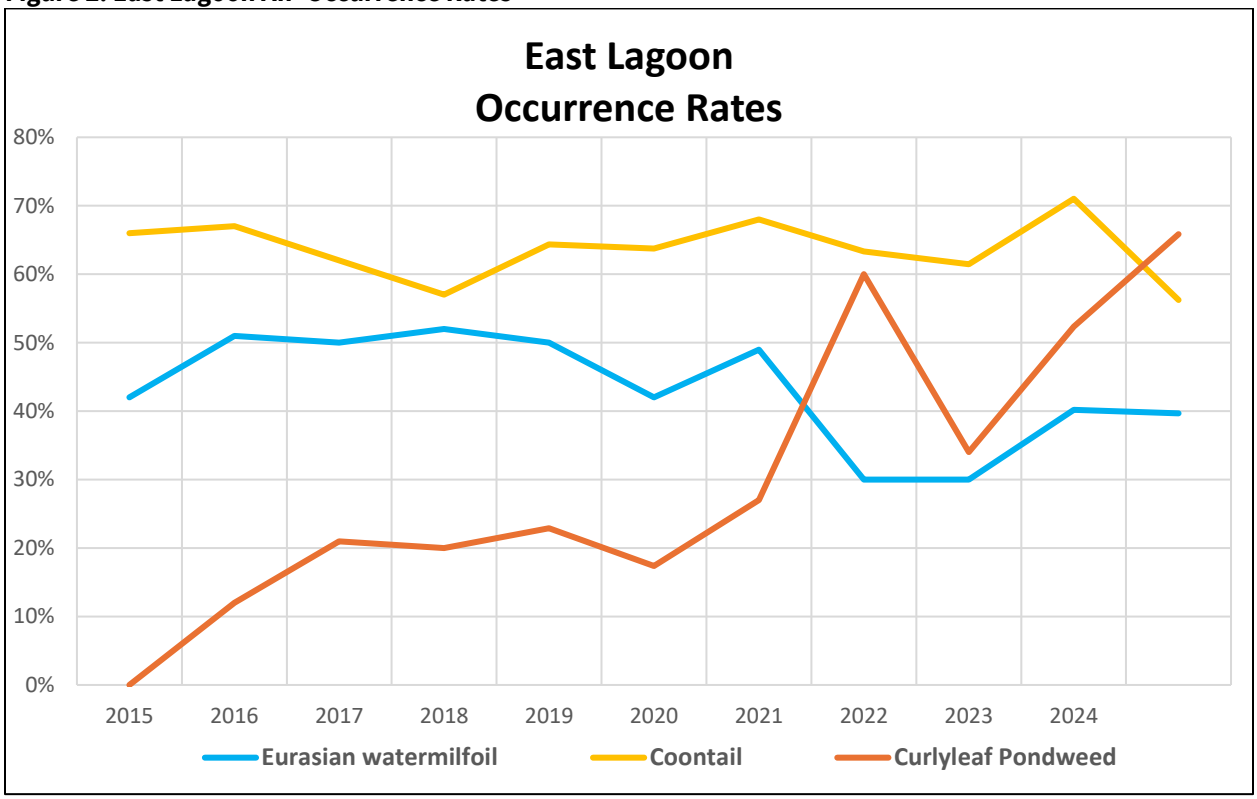


Figure 3. West Lagoon AIP Occurrence Rates

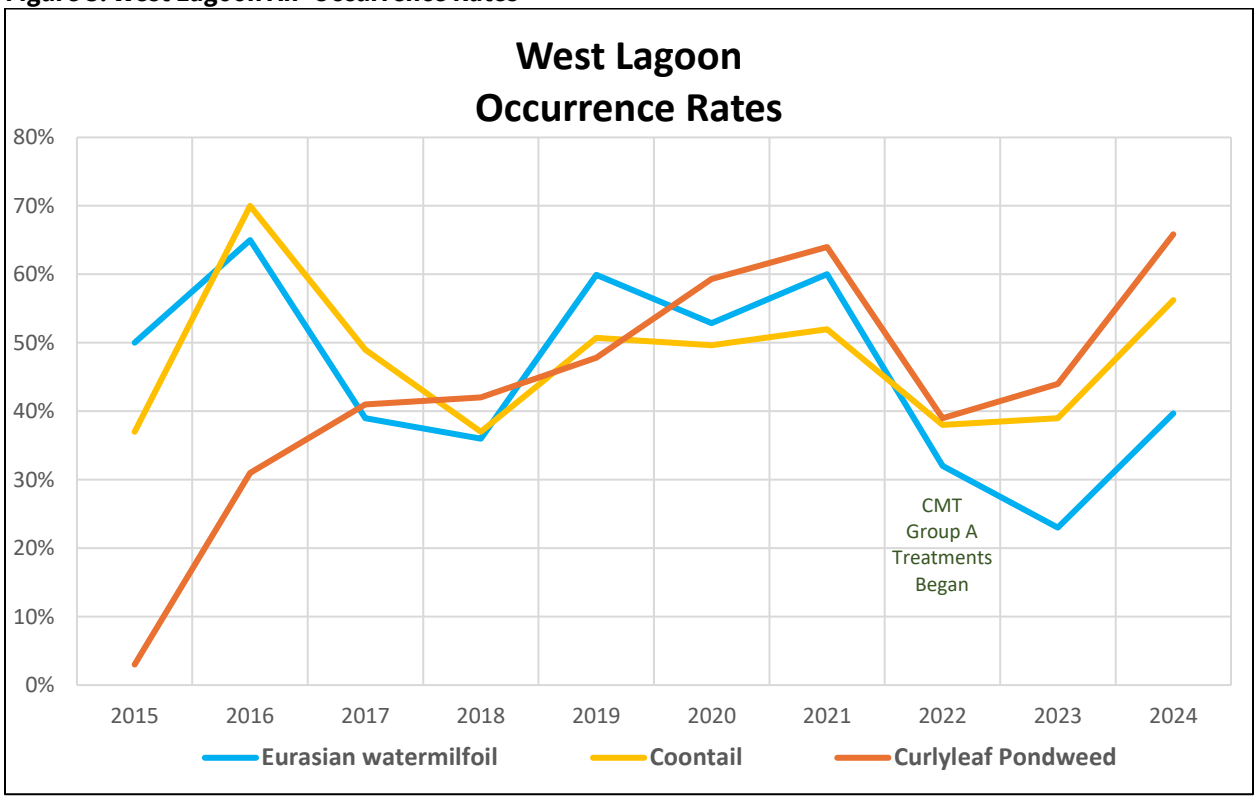
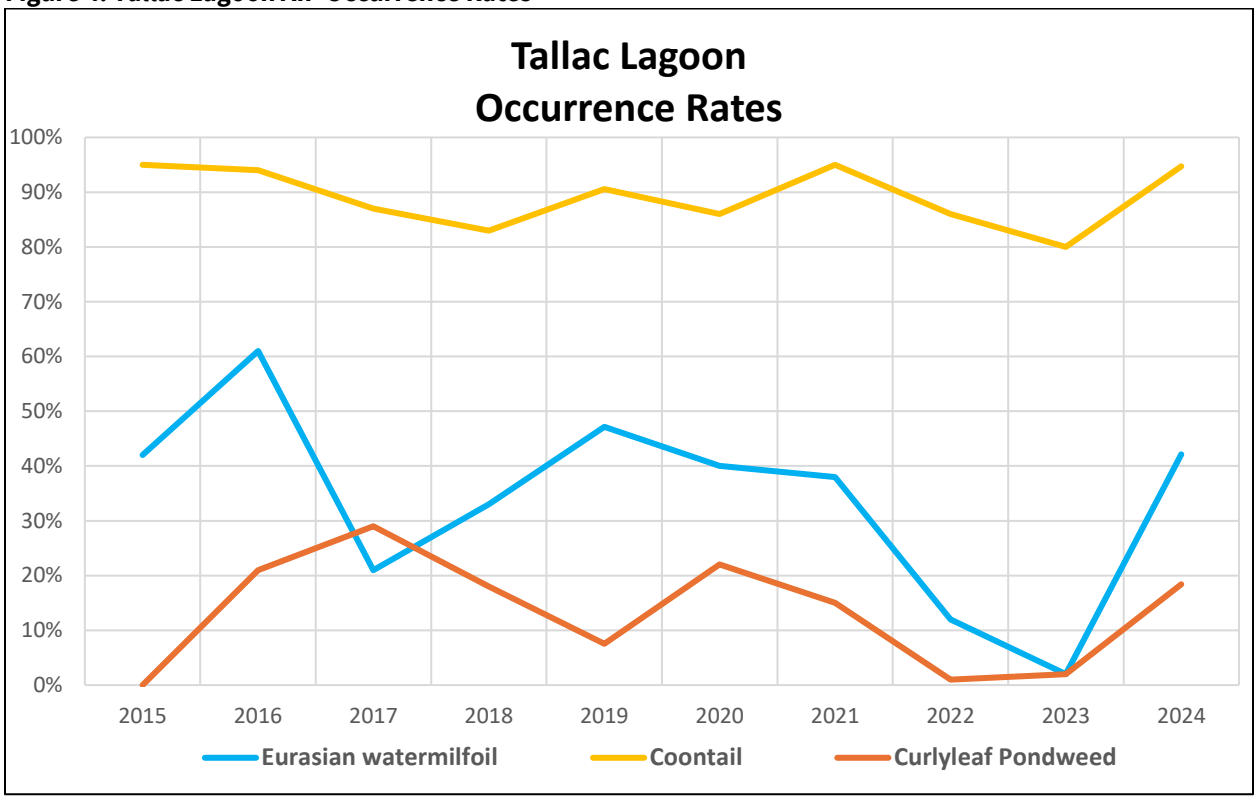


Figure 4. Tallac Lagoon AIP Occurrence Rates



*No CMT treatments were performed in the East Lagoon.

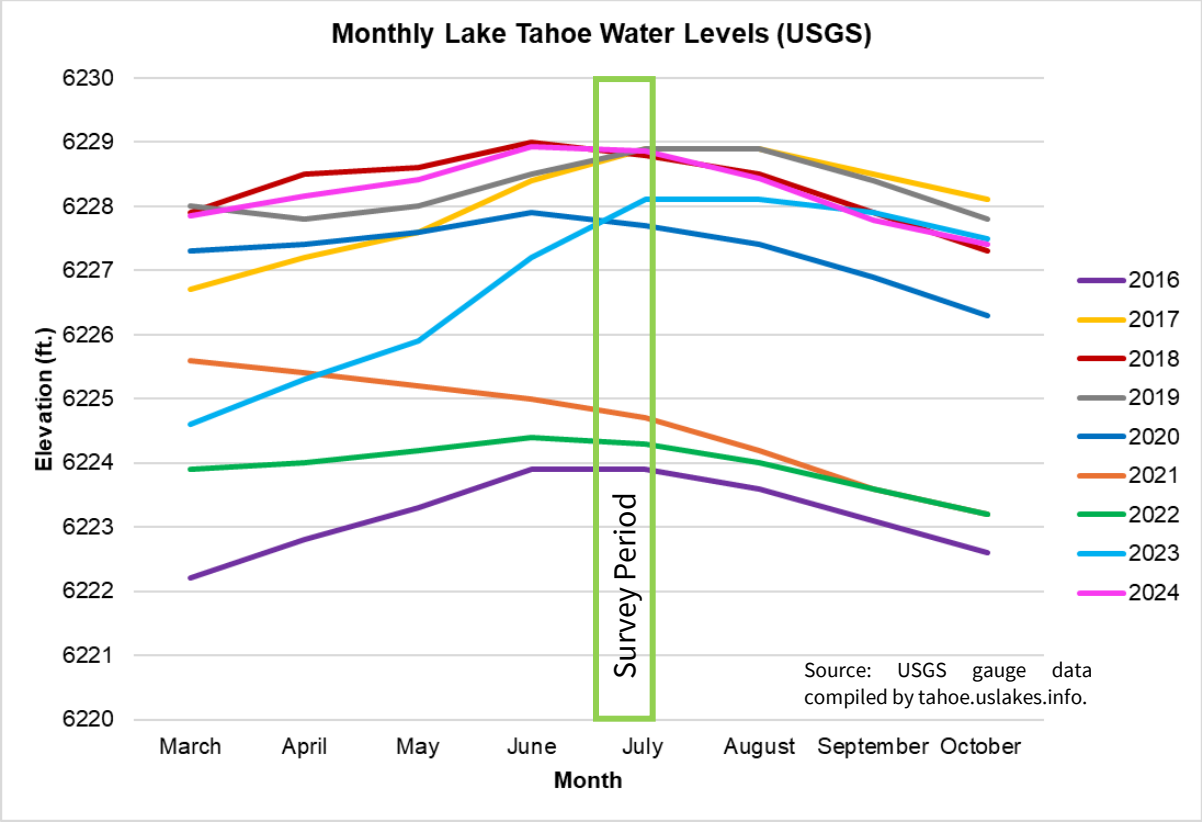
2.0 METHODOLOGY

The annual aquatic macrophyte surveys focus on submersed and floating-leaf aquatic plants in the littoral zones of the surveyed areas in the Keys lagoons. Fringe wetlands and emergent species were not sampled. As with previous years, the method used for the 2024 survey was point-intercept to determine composition and hydroacoustic scanning to determine plant biovolume.

2.1 Timing

The 2024 point-intercept survey was conducted over the course of five days: July 8-July 12. This time period was chosen to coincide with the evident and identifiable point in the growing season and with germinating, sprouting, flowering, or fruiting stages of the various species. Due to the short growing season in Lake Tahoe and the germination and sprouting timing of the aquatic plants of concern, one period of data collection is considered sufficient to assess presence, mid-summer relative abundance, and general year-to-year trends. The 2024 survey occurred during a period of unusually high water levels in Lake Tahoe, due primarily to the prior-year rainfall, which was far above average for South Lake Tahoe, with lake/lagoon levels far above average for the survey period. United States Geological Survey (USGS) gauge data for Lake Tahoe is seen in Figure 5.

Figure 5. Lake Tahoe Levels



Hydroacoustic scans were conducted June 26 and July 12, 2024. Scans are conducted on a regular basis by TKPOA Water Quality staff to track the growth of aquatic macrophytes throughout the season. The scans presented in this report (taken July 12, 2024) are those that most closely coincide with the timing of the point sampling survey. The June 26 hydroacoustic scan was used for the East Lagoon because no scan was performed for the East Lagoon on July 12.

2.2 Point Intercept Sampling

Point-intercept sampling involves plunging a double-tined, telescoping pole-mounted "thatch" rake into the water to the bottom, rotating the attached vertical pole when retrieving the rake, and then identifying the plant species retrieved on the rake sample (DiTomaso 2003). Georeferenced sample locations were accessed by boat, typically along regularly spaced and somewhat linear transects that represented the conditions of the area.

Percent species composition, percent species occurrence (aka presence/absence), abundance (biovolume percentage), health rating, rake fullness, and rake sample weight can be recorded and serve as indicators important to tracking changes over time in the amounts and distribution of AIP and desirable native species. Presented in the following sections are the metrics used in this report and what each metric represents.

2.2.1 Percent Species Composition

The percent species composition was determined visually and recorded, and then the sample was photographed. The composition is recorded for each species as a percentage of the total rake sample, with the sum of the species composition totaling 100% for each rake sample. Floating plants, such as watershield (*Brasenia schreberi*) and water smartweed (*Persicaria amphibia*) are not well sampled with the method used in this survey. Water smartweed was rare and was the only floating aquatic plant observed in the West and East lagoons, but it was prevalent along the north and south near-shore areas of the Tallac Lagoon. Additionally, the native emergent plant, yellow pond lily (*Nuphar polysepala*), was found in the stormwater inflow channel into the Tallac Lagoon between Lassen Drive and Whitney Drive. The analyses of percent composition for the 2024 survey are discussed in Section 2.4 (Data Analysis) below.

2.2.2 Percent Species Occurrence (aka Frequency of Occurrence)

Percent species occurrence is the frequency that a particular species appears (presence/absence) in any amount in a sample. A rake sample with one fragment or a rake sample completely full of a species is 100% frequency of occurrence for that sample. This metric is a measure relative to the total number of rake samples. This compares to Percent Species Composition, which is relative to each rake sample. As a result, Percent Species

Occurrences can total more than 100%, whereas Percent Species Composition does not exceed 100%.

2.2.3 Biovolume (Aquatic Plant) Percent of the Water Column

Biovolume Percent is a value that is produced by hydroacoustic scanning. It represents the percent of the water column occupied by plant matter at each sonar ping. It is plant height divided by water depth multiplied by 100 for each location along a traveled path. The biovolume range of values is from 0% (bare bottom with no plants in water column) to 100% (vegetation growth sonar 'returns' from the bottom to the surface). Biovolume percent can be used to estimate a volume of vegetation if the water volume of the water body is known. Section 2.3 further describes this measure.

2.2.4 Plant Health Rating

Rake samples were assigned a health rating based on the attributes in Table 1 below.

Table 1. Plant Condition Ranking System

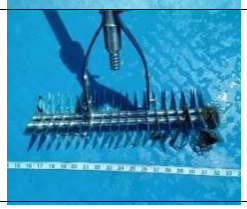
Score	Description
1	Plants are barely recognizable due to decomposed or disintegrating tissues including leaves, stems, roots and rhizomes, and any attached reproductive parts (flowers, fruit/seed/ turions)
2	Plants are defoliated, roots and stems are recognizable, intact but disintegrating. Plants easily come apart with minor physical force.
3	Plants are defoliated but stems are mostly intact; roots and rhizomes are mostly intact and firm; reproductive parts are intact (if present). Some plants may appear almost normal.
4	Some plants are partially defoliated or have "bleached" or pale leaves; most plant parts are otherwise intact and appear normal: stems, rhizomes, roots, reproductive parts are present.
5	Plants are consistently intact and appear normal with green tissues (leave/stems); rhizomes and roots are firm and intact and reproductive parts if present are normal.

Rake samples showing no plants were not assigned a health rating.

2.2.5 Rake Fullness

Rake samples were assigned a rake fullness rating based on the attributes in Table 2. Rake fullness ratings were based on CMT Project methodology developed by Environmental Science Associates (ESA) in 2023.

Table 2. Rake Fullness Rating

Rake Fullness Rating	Description	Example
0	0%; no plants (but filamentous/macro algae (e.g., Chara) may be present	
1	1-5%; handful of sprigs	
2	6-25%; less than one-fourth of the rake full	
3	26-50%; a fourth to half of the rake full; tines visible	
4	51-75%; more than half of the rake full; some tines still visible	
5	76%+; completely full rake; no tines visible	

Note: Rake Fullness Rating scale modified from Tahoe Keys Lagoons Macrophyte Control Efficacy Report: Year 2 (Table 5) prepared by ESA (March 2024).

2.2.6 Rake Sample Weight

Weight was collected for the first time in 2024 for a representative sample of each rake fullness rating. This was a parameter added in 2024 to contribute to CMT Project analyses and current/future AIP biovolume evaluations. Each rake sample that was weighed (81 total

samples) was allowed a 60-second drip time and then the plants from the rake were placed in a 5-gallon bucket. Samples were weighed in the bucket using UWE hanging scale (Mfr # AHS-60) accurate from 0.05 to 60 pounds.

2.3 Hydroacoustic Sampling

Hydroacoustic sampling uses sonar technology to scan a water body to determine and record the surface water temperature, depth to bottom, presence of plant matter, plant height, and plant biovolume. Scans are made using a Lowrance HDS Live 7 unit coupled to a transponder unit attached to the stern of boat. The system is fine-grained, collecting data at a frequency of 10 times per second. The digitized data is uploaded to BioBase, a third-party data processing subscription service company. Hydroacoustic scanning produces percent aquatic plant biovolume which represents the percent of the water column occupied by plant matter at each sonar ping. It is plant height divided by water depth multiplied by 100 for each location along a traveled path. The biovolume range of values is from 0% (bare bottom with no plants in water column) to 100% (vegetation growth sonar 'returns' from the bottom to the surface).

Hydroacoustic data is also used to determine the average vessel hull clearance, which is the distance between the water surface and the top of the aquatic plant canopy. Vessel hull clearance was also an efficacy measurement for CMT evaluations.

2.4 Data Analysis

Spatial data obtained from point sampling and hydroacoustic scan transect sampling for biovolume were analyzed using ArcGIS Pro with Spatial Analyst to create the thematic heat maps showing the composition and distribution of a species based on percent composition. The species composition data was interpolated into a raster surface from points using an Inverse Distance Weighted (IDW) technique. IDW uses data points to predict the values of un-sampled locations by weighing the surrounding values by distance. This method interpolates the composition percentage of the data points into a surface display representing the species composition and distribution within the Keys lagoons. Appendix A contains the survey data points from the study and Appendix B presents the species composition maps.

To compare the 2024 survey data with data from past surveys, the current data were normalized to show species presence or absence. This approach provided a means to reveal trends in the relative abundance and prevalence of the various aquatic plants over the past years.

3.0 RESULTS

A total of 672 points were sampled throughout the Keys lagoons, including the East Lagoon (107 points), West Lagoon (489 points), and Tallac Lagoon (76 points), as shown in Figure 1. Sections 3.1 through 3.3 below discuss the point-intercept data collection results. Section 3.4 discusses and compares the 2024 and 2023 hydroacoustic data sets.

Note that the values for percent occurrence rates represent the frequency that each species was detected. For example, in the East Lagoon *M. spicatum* could be detected in 40% of samples and *C. demersum* could be detected in 71% of the samples. Thus, these data are different from percent composition totaling 100%, but instead individually represent *frequency of occurrence* for the entire rake sample data set (see Section 2.2 above).

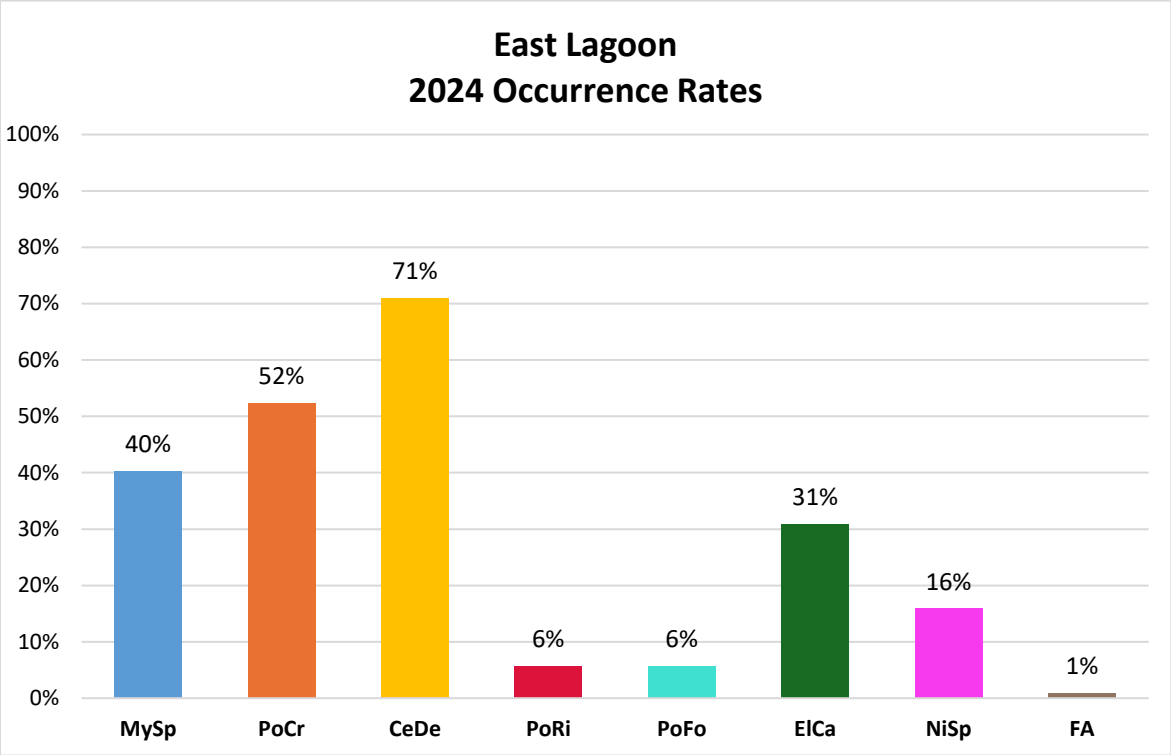
The abbreviations on the species occurrence charts are as follows:

Common Name	Scientific Name	Abbreviation
Eurasian watermilfoil	*Myriophyllum spicatum*	MySp
curlyleaf pondweed	*Potamogeton crispus*	PoCr
coontail	*Ceratophyllum demersum*	CeDe
Richardson's pondweed	*Potamogeton richardsonii*	PoRi
leafy pondweed	*Potamogeton foliosus*	PoFo
elodea	*Elodea canadensis*	ElCa
filamentous algae	*Nitella* sp.	NiSp
Other Filamentous Algae		FA
watershield	*Brasenia schreberi*	BrSc
yellow pond-lily	*Nuphar* polysepala	NuPo
Andean watermilfoil	*Myriophyllum quitense*	MyQu
water smartweed	*Persicaria amphibia*	PeAm

3.1 East Lagoon

In the East Lagoon, a presence/absence analysis (Figure 6) shows a frequency of occurrence of 40% for Eurasian watermilfoil - *M. spicatum* (MySp), 52% for curlyleaf pondweed - *P. crispus* (PoCr), and 71% for coontail - *C. demersum* (CeDe). Other species occurrences included: 6% Richardson's pondweed – Potamogeton richardsonii (PoRi), 6% leafy pondweed - *P. foliosus* (PoFo), 31% Elodea - *E. canadensis* (ElCa), 16% Nitella (NiSp), and 1% other filamentous algae (FA).

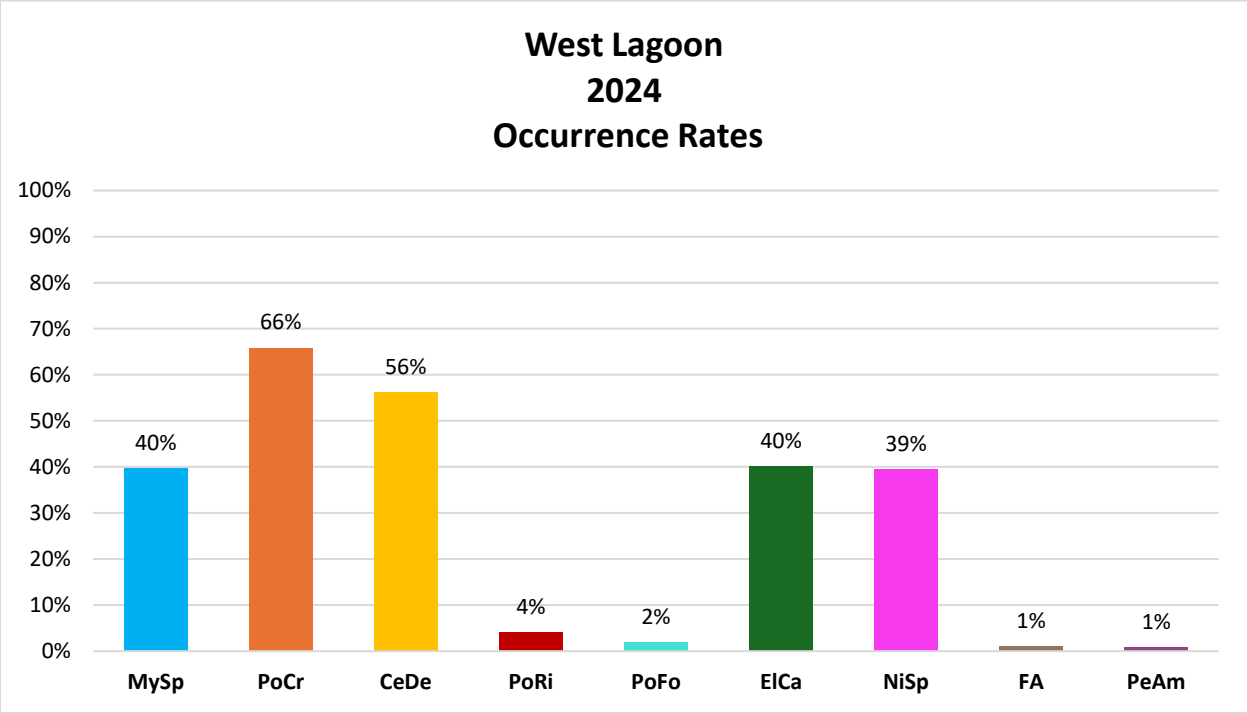
Figure 6. East Lagoon 2024 Frequency of Occurrence Rates



3.2 West Lagoon

In the West Lagoon, presence/absence analysis (Figure 7) shows a frequency of occurrence of 40% for Eurasian watermilfoil - *M. spicatum* (MySp), 66% for curlyleaf pondweed - P. Crispus (PoCr), and 56% for coontail - C. demersum (CeDe). Other species occurrences included: 4% Richardson's pondweed - P. richardsonii (PoRi), 2% leafy pondweed - *P. foliosus* (PoFo), 40% Elodea - E. canadensis (ElCa), 39% *Nitella* spp (NiSp), 1% other filamentous algae (FA), and 1% water smartweed - *P. amphibia* (PeAm).

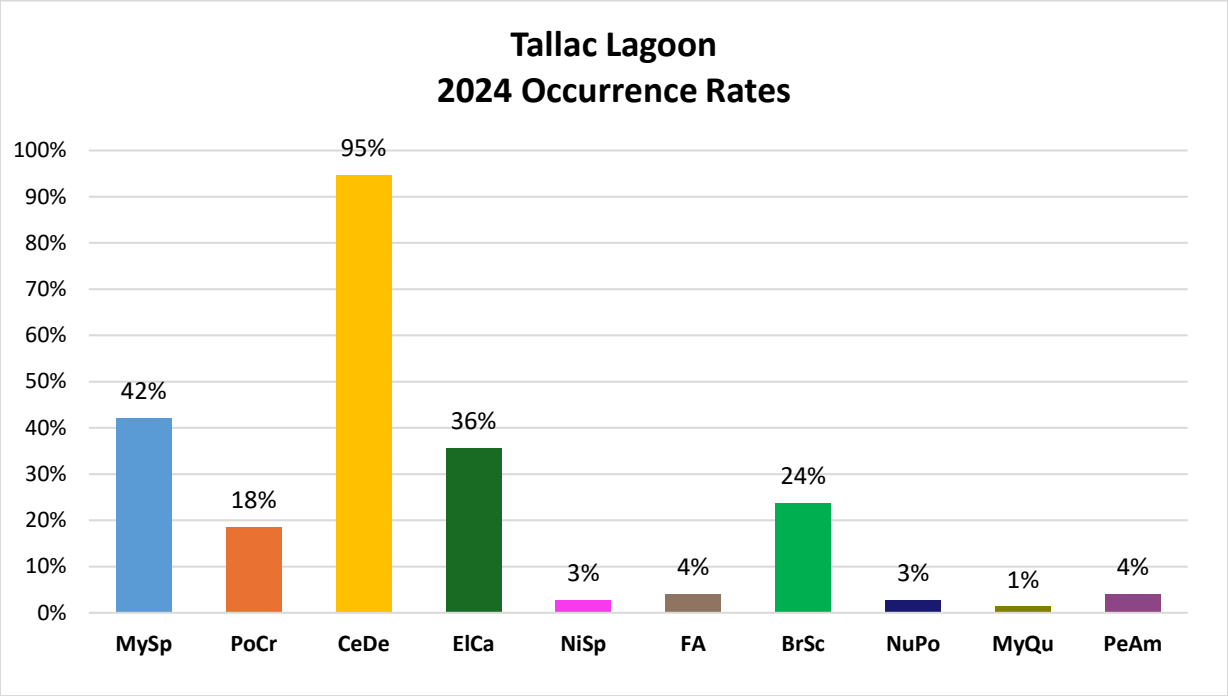
Figure 7. West Lagoon 2024 Frequency of Occurrence Rates



3.3 Tallac Lagoon

In the Tallac Lagoon, presence/absence analysis (Figure 8) showed a frequency of occurrence of 42% for Eurasian watermilfoil - *M. spicatum* (MySp), 18% curlyleaf pondweed - P. crispus (PoCr), and 95% for coontail - C. demersum (CeDe). Other species detected included: 36% Elodea – *E. canadensis* (ElCa), 24% watershield - B. schreberi (BrSc), (however, as noted earlier, this species dominates the stormwater inflow channel to the Tallac Lagoon), 3% yellow pond lily - N. polysepala (NuPo), 3% *Nitella* spp (NiSp), 4% other filamentous algae (FA), 1% Andean watermilfoil - *M. quitense* (MyQu), and 4% water smartweed - *P. amphibia* (PeAm).

Figure 8. Tallac Lagoon 2024 Frequency of Occurrence Rates



3.4 Hydroacoustic Sampling

The East Lagoon had a percent area plant coverage of approximately 99% and an average plant biovolume of approximately 27%, meaning that, on average, within the portion of the lagoon where plant cover existed (99% of the lagoon area), 27% of any given sample within a column of water would contain plant matter and the remaining 73% would be water.

The West Lagoon had a percent area plant coverage of approximately 92% and an average plant biovolume of approximately 40%, meaning that, on average, within the portion of the lagoon where plant cover existed (92% of the lagoon area), 40% of any given sample within a column of water would contain plant matter.

The Tallac Lagoon had a percentage area plant coverage of approximately 99% and an average plant biovolume of approximately 35%, meaning that, on average, within the portion of the lagoon where plant cover existed (99% of the lagoon area), 35% of any given sample within a column of water would contain plant matter. The hydroacoustic scan data did not extend far into the stormwater inflow channel due to vegetation obstruction.

Figure 9 presents the heat map of vegetation biomass in the East Lagoon for the hydroacoustic scan performed on June 26, 2024. Figure 10 shows the heat map of all aquatic vegetation for the West Lagoon and Tallac Lagoon from hydroacoustic scan data collected on July 12, 2024. Hydroacoustic scan data was not available for the East Lagoon for the July 12, 2024 scan event.

Figure 9. Heat Map of East Lagoon

Figure 10. Heat Map of West Lagoon and Tallac Lagoon

4.0 DISCUSSION AND ANALYSIS

The 2024 Survey showed some similarities to previous surveys. Many other species were observed in the waterways, but for the purpose of discussion, the primary focus is on Eurasian watermilfoil, coontail, and curlyleaf pondweed, which are the three invasive species highlighted for control in the IMP. Curlyleaf pondweed continues its aggressive spread throughout the three lagoons as displayed below in Table 3 through Table 5.

Tables 3 through 5 show the frequency of occurrence (presence/absence) for species recorded in the 2015 through 2024 macrophyte surveys broken down by East Lagoon, West Lagoon, and Tallac Lagoon(TKPOA 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023).

Table 3. Frequency of Occurrence for Species Recorded from 2015 through 2024 (East Lagoon)

East Lagoon										
Species	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Eurasian watermilfoil (*M. spicatum*)	42%	51%	50%	52%	50%	42%	49%	30%	30%	40%
Curlyleaf Pondweed (*P. crispus*)	0%	12%	21%	20%	23%	17%	27%	60%	34%	52%
Coontail (*C.demersum*)	66%	67%	62%	57%	64%	64%	68%	63%	61%	71%
Richardson's Pondweed (*P.richardsonii)*	0%	2%	0%	2%	1%	1%	4%	2%	5%	6%
Leafy Pondweed (*P. foliosus*)	0%	11%	8%	4%	5%	9%	12%	7%	14%	6%
Elodea (*Elodea sp.*)	1%	21%	21%	10%	14%	10%	12%	3%	23%	31%
Nitella (*Nitella sp.*)	2%	10%	11%	18%	5%	4%	3%	0%	15%	16%
Watershield (*B. schreberi*)	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%

Table 4. Frequency of Occurrence for Species Recorded from 2015 through 2024 (West Lagoon)

West Lagoon										
Species	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Eurasian watermilfoil (*M. spicatum*)	50%	65%	39%	36%	60%	53%	60%	32%	23%	40%
Curlyleaf Pondweed (*P. crispus*) 3%	31%	41%	42%	48%	59%	64%	39%	44%	66%	
Coontail (*C.demersum*)	37%	70%	49%	37%	51%	50%	52%	38%	39%	56%
Richardson's Pondweed (P.richardsonii)	3%	5%	4%	4%	3%	2%	2%	2%	3%	4%
Leafy Pondweed (*P. foliosus*)	5%	28%	10%	9%	9%	4%	14%	10%	7%	2%
Elodea (*Elodea sp.*) 6%	48%	34%	24%	21%	19%	27%	42%	30%	40%	
Nitella (*Nitella sp.*)	7%	17%	19%	39%	11%	10%	9%	18%	21%	39%
Watershield (*B.schreberi*)	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%

Table 5. Frequency of Occurrence for Species Recorded from 2015 through 2024 (Tallac Lagoon)

Tallac Lagoon										
Species	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Eurasian watermilfoil (*M. spicatum*)	42%	61%	21%	33%	47%	40%	38%	12%	2%	42%
Curlyleaf Pondweed (*P. crispus*)	0%	21%	29%	18%	8%	22%	15%	1%	2%	18%
Coontail (*C.demersum*)	95%	94%	87%	83%	91%	86%	95%	86%	80%	95%
Richardson's Pondweed (*P.richardsonii)*	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
Leafy Pondweed (*P. foliosus*)	3%	12%	5%	1%	0%	0%	0%	0%	0%	0%
Elodea (*Elodea sp.*)	3%	6%	0%	0%	2%	4%	2%	2%	6%	36%
Nitella (*Nitella sp.*)	0%	3%	13%	6%	0%	0%	0%	1%	3%	3%
Watershield (*B. schreberi*)	8%	0%	32%	23%	6%	38%	35%	47%	53%	24%

4.1 Species Composition Based on Occurrence Rate

The following sections describe the species composition occurrence rates during the 2024 survey. 2024 occurrence rates are compared to the occurrence rates found during the preceding surveys for each lagoon.

4.1.1 East Lagoon

In past surveys, species frequency of occurrence in the East Lagoon was primarily dominated by Eurasian watermilfoil in the shallower areas and coontail in the deeper areas with a relatively low occurrence of other species such as leafy pondweed, curlyleaf pondweed, and Elodea. The 2024 survey found that curlyleaf pondweed increased in occurrence by 18% from 2023 with 52% of all samples containing curlyleaf pondweed. However, the increase from 2023 to 2024 was preceded by a larger decrease (60% to 34%) from 2022 to 2023. Prior to 2022, curlyleaf pondweed had less than 30% frequency of occurrence for all years. As in previous reports, coontail is still more dominant in the deeper lagoon areas. Eurasian watermilfoil is being gradually overtaken by curlyleaf pondweed in the shallower areas based on the years of survey data.

Eurasian watermilfoil and coontail percent composition are shown in Figures 11 and 12. The frequency of curlyleaf pondweed in the East Lagoon has shown an overall substantial increase, with a very large increase from 2021 to 2022. Curlyleaf pondweed occurrence rate was 27% in 2021, 10% higher than the 17% occurrence rate in 2020. The significant increase from 2021 to 2022 (60%) was followed by a substantial drop (to 34%) in 2023. The upwards trend resumed in 2024. The occurrence rate of coontail has remained relatively stable but trending upwards with a range from 57% in 2018 to 71% in 2024. Eurasian watermilfoil remained relatively constant throughout the years in the 40% and 50% range, with a decrease in 2022 and 2023 to 30%. 2024 saw an increase in Eurasian watermilfoil up to 40%.

4.1.2 West Lagoon

Species frequency of occurrence in the West Lagoon was dominated by curlyleaf pondweed and coontail. Eurasian watermilfoil broke from a decreasing occurrence trend and increased from 23% in 2023 to 40% in 2024. Coontail occurrence rate increased by 17% to 56% in 2024. Curlyleaf pondweed showed an increase from 44% in 2023 to 66% in 2024 following the 25% decrease in 2022 that coincided with the 2022 CMT treatments (although only about 20% of the acreage in the West and Tallac lagoons received herbicide and UV-C treatments). The increase from 2023 to 2024 marks the highest occurrence rate of curlyleaf pondweed since data collection began. Elodea maintained a high rate with 40% following a large percentage increase in 2022.

4.1.3 Tallac Lagoon

Species frequency of occurrence in the Tallac Lagoon continued to be mostly dominated by coontail, a consistent finding since 2015. This year coontail had a 95% occurrence rate in the Tallac Lagoon. This was the highest occurrence rate recorded since data collection began in the Tallac Lagoon in 2015. The occurrence rate of Eurasian watermilfoil increased slightly from 40% in 2023 to 42% in 2024. Similar variations in occurrence rates can be seen in prior years. The occurrence rate of curlyleaf pondweed peaked in 2017 at 29%, up from a 0% occurrence rate in 2015. This year the occurrence rate of curlyleaf pondweed was 18% with an increase of 16% from the 2% observed in 2023. Another species consistently present in the Tallac Lagoon is watershield, with yellow pond-lily dominating the stormwater inflow channel to the Tallac Lagoon. Watershield and yellow pond-lily are native to the area but, like coontail (also a native plant), can become a nuisance in certain habitats. Watershield decreased in occurrence in the Tallac Lagoon from 53% in 2023 to 24% in 2024. Watershield and water smartweed primarily occur on the near shore areas of the Tallac Lagoon.

Figure 11. Eurasian Watermilfoil Percent Composition Map Based on Rake Samples

Figure 12. Coontail Percent Composition Map Based on Rake Samples

4.2 Curlyleaf Pondweed

While sampling indicates that the occurrence of curlyleaf pondweed has varied somewhat since sampling began, overall, survey data indicates that this target invasive plant has become much more established in the Keys lagoons over the ten-year period. In 2015, the average total occurrence rate (combining samples pulled from the East Lagoon, West Lagoon and the Tallac Lagoon) was 4%. In 2019, the average occurrence rate was 39% for all three lagoons. In 2024, the increasing trend continued with an average total occurrence rate of 58%.

Figure 13 shows the relative changes in curlyleaf pondweed from 2015 to 2024 for all lagoons. As shown, the most dramatic increases took place from 2015 to 2016 and from 2023 to 2024, and the largest decrease from 2021 to 2022. Variations in water year types (e.g., drought, average or wet years), shifts in growing seasons (e.g., early spring v. late spring), and CMT Group A [herbicide, Laminar Flow Aeration (LFA), and UV-C] treatments in 2022 in about 27 acres of the 112-acre West Lagoon and 2 acres of the 25.2-acre Tallac Lagoon are believed to contribute to some of the variability observed in the sample data.

The threat to Lake Tahoe combined with the increase in spread and occurrence makes curlyleaf pondweed the highest priority aquatic invasive plant species of concern for the Tahoe Keys and the Tahoe Basin as a whole (UNR 2015). Curlyleaf pondweed is very adaptable to the climate and ecology of Lake Tahoe because it sprouts in the fall, over-winters under ice, and gets a head start growing in the spring while temperatures are still cool. Further, this invasive plant can grow to depths of 20 or more feet in clearer waters where competition is minimal with other aquatic plants. This give it competitive advantages over all native aquatic plants.

In addition to tolerating colder and deeper waters, this invasive plant also produces up to dozens of turions per plant during the growing season. Turions are vegetative propagules that break free from the parent plant and settle in the sediment where they can either sprout in the late summer to fall or remain dormant for several years until habitat conditions are adequate for growth (Sastroutomo 2003).

Increasing occurrence is not uncommon for aquatic invasive plant species. When a new species is introduced, a lag often exists between the first occurrence and a large, widespread presence of the species. A larger study of upper-Midwest plant invasions looked at a number of herbarium records and reported that lag times for species can be anywhere from three to 140 years. This wide range can be attributed to the vast differences in plant morphology. Curlyleaf pondweed was recorded as having a lag time of 8 to 35 years (Larkin 2012). Curlyleaf pondweed was first discovered in Lake Tahoe in 2003 (Anderson 2008).

Figure 13. Average Frequency of Curlyleaf Pondweed Occurrence for all the Tahoe Keys Lagoons

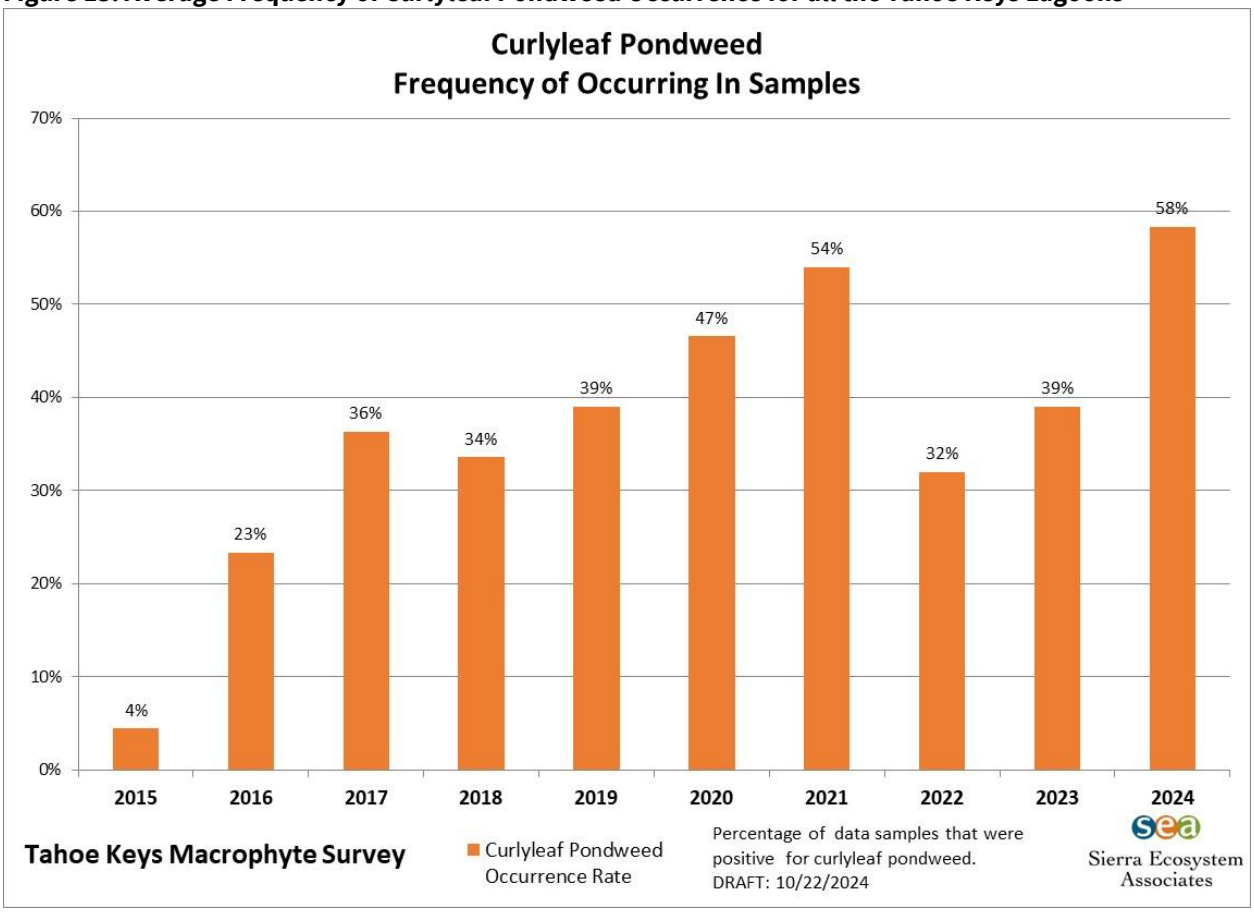
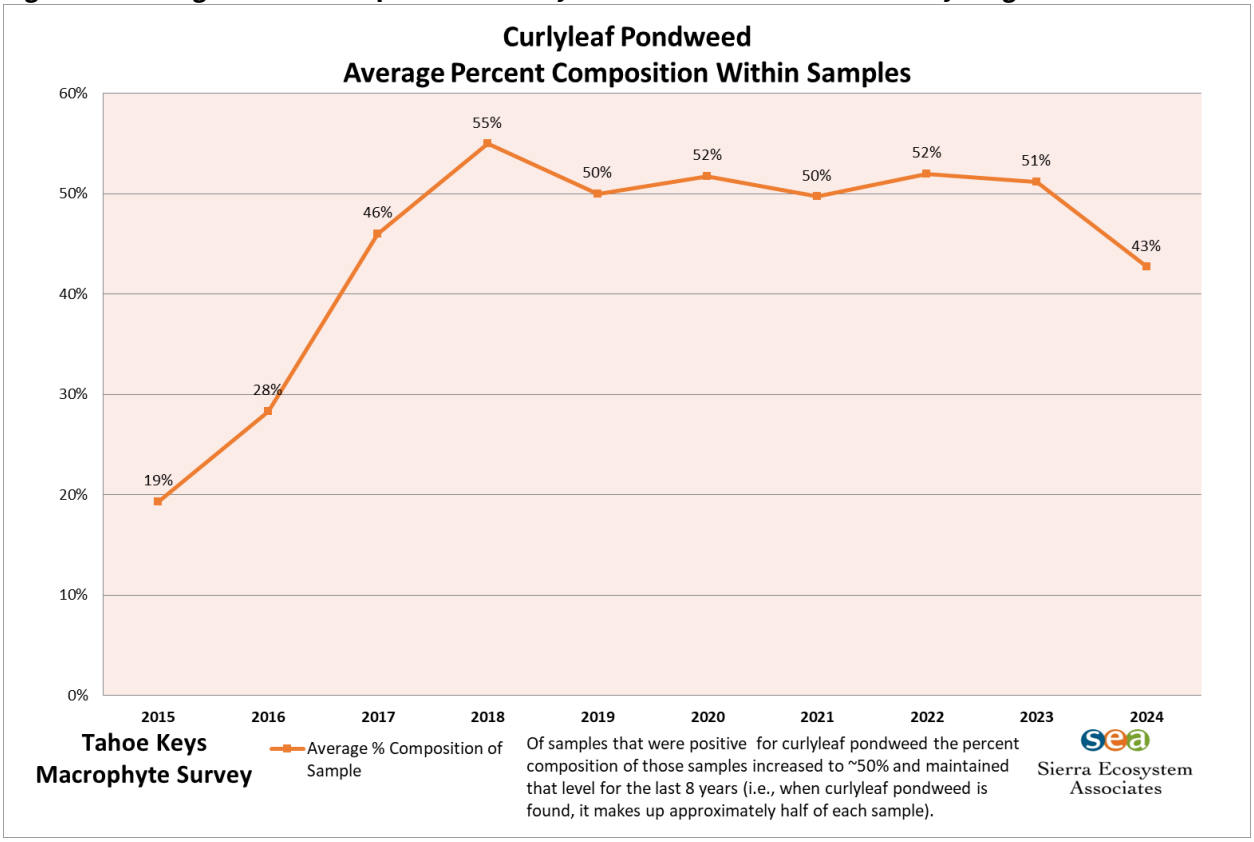


Figure 14 shows the average percent composition of curlyleaf pondweed collected in each sample. This averaged value means that, in each sample where curlyleaf pondweed was found, the sample was composed of this percent of curlyleaf pondweed. While the average percent composition of samples decreased by 8% for curlyleaf pondweed in 2024 (Figure 14), the overall average frequency of occurrence rate for curlyleaf pondweed increased 19% from 2023 to 2024 (Figure 13). This means that curlyleaf pondweed is maintaining an approximately 50% presence in each sample while occurring more frequently in all samples.

Figure 14. Average Percent Composition of Curlyleaf Pondweed for the Tahoe Keys Lagoons



4.3 Biovolume

Analysis of TKPOA hydroacoustic data from surveys in 2015, 2016, 2018, 2019, 2020, 2021, 2022, 2023, and 2024 is presented in Table 6 (below). The table shows the percentage (spatial) area covered by plants in each lagoon, along with average biovolume percentages (within the water column) for each lagoon. Based on the data referenced above, the average biovolume percentages (average biovolume of all lagoons) have fluctuated between 30% and 72% over the nine years of displayed data (Table 6). The fluctuations are likely due to annual differences in year-to-year growing season water temperatures (relative to the dates of the annual aquatic plant surveys, e.g., early v. late summer warm-up of lagoon water temperatures) and differences in water levels during the collection of the hydroacoustic data. Hydroacoustic scan data for 2024 was collected June 26 and July 12.

Table 6. Average Biovolume Percentages

Percent Area Covered									
	2015	**2016**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
East Lagoon	85%	90%	78%	87%	41%	93%	93%	92%	99%
West Lagoon	89%	92%	90%	80%	79%	83%	89%	74%	92%
Tallac Lagoon	N/A	89%	78%	91%	65%	79%	97%	95%	99%
Average Biovolume									
	2015	**2016**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
East Lagoon	51%	44%	28%	27%	20%	21%	24%	25%	27%
West Lagoon	63%	53%	72%	59%	67%	40%	31%	33%	40%
Tallac Lagoon	N/A	50%	66%	57%	51%	30%	45%	37%	35%

[1]Data from 2017 was not included in the table as equipment challenges led to incomplete hydroacoustic data collection at the time of the 2017 Macrophyte Survey (BioBase 2015a, 2015b, 2016a, 2016b, 2016c, 2018a, 2018b, 2018c, 2019a, 2019b, 2019c, 2020, 2021,2022, 2023, 2024).

Table 7 below shows the biovolume expressed as cubic yards for some of the predominant species in the Keys lagoons. Both invasive nuisance and native desirable species had a large increase in the East Lagoon from 2020 to 2024. Nuisance species in the West Lagoon had a minor increase from 2020 to 2024 while the native desirable species increased by over 120,000 cubic yards. In the Tallac Lagoon, both Eurasian watermilfoil and curlyleaf pondweed decreased by approximately 75% but coontail increased substantially, more than making up the difference. The Tallac Lagoon is dominated by coontail which leaves little habitat for other species. Elodea was not found in the Tallac Lagoon in 2020 but was found sporadically in 2024.

Table 7. Biovolume by Aquatic Plant Species: 2020 and 2024

Biovolume in Cubic Yards		Eurasian Watermilfoil	Coontail	Curlyleaf Pondweed	**Invasive Nuisance Species**	Nitella	Elodea	Richardson's Pondweed	Leafy Pondweed	**Native Desirable Species**
East Lagoon	2020	9,036	15,770	15,770	**40,576**	285	594	-	2,120	**3,000**
	2024	39,042	65,358	15,873	**120,273**	3,094	1,778	4,817	4,343	**14,032**
West Lagoon	2020	110,196	117,870	168,844	**396,910**	10,005	10,543	2,578	4,127	**27,253**
	2024	89,478	174,798	209,612	**473,888**	91,083	45,229	10,481	2,460	**149,253**
Tallac Lagoon	2020	12,497	48,079	4,050	**64,626**	-	-	-	-	**-**
	2024	3,972	67,210	1,980	**73,162**	-	881	-	-	**881**

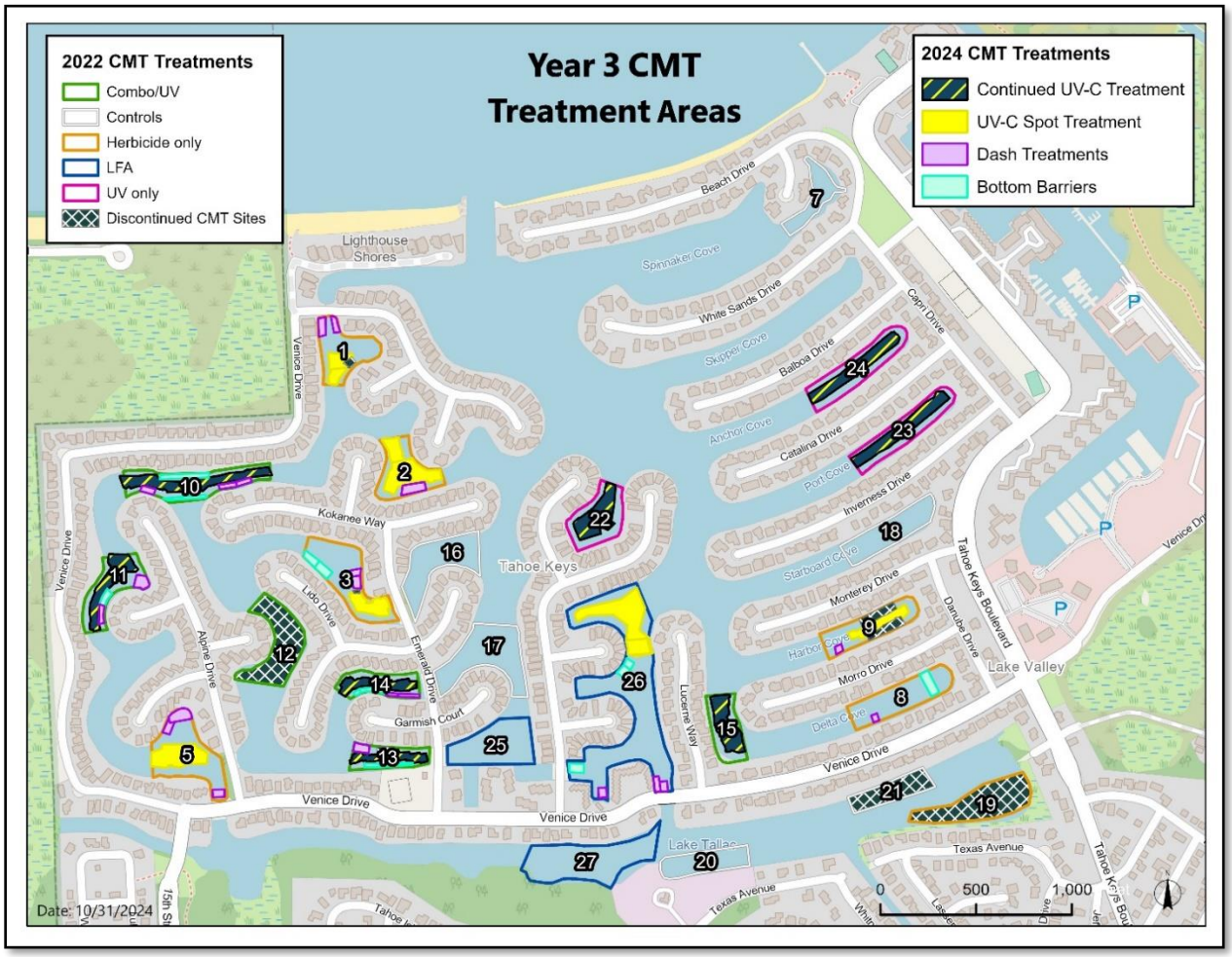
4.4 Control Methods Test (CMT)

Species composition and biovolume results have varied over the past 10 years of the annual macrophyte studies due to changing environmental conditions and cultural practices, as well as the CMT activities in 2022 through 2024. Environmental variables include plant population dynamics and morphology, year-to-year growing season water temperatures and water (lake) levels (e.g., lower water levels reduce total 'space' for the plants to grow, thereby resulting in higher biovolume percentages), and seasonal weather patterns which can alter species growth, timing, composition and biovolume. Cultural practices such as aquatic weed harvesting and bottom barriers could also impact composition and biovolume if sampling occurred within or adjacent to these weed management practices.

In 2022, the CMT treatments began with a prescribed set of "Group A" control methods: UV-C, LFA, and two types of aquatic herbicides. These treatments introduced additional effects on conditions in the lagoons. Figure 15 shows the 2024 CMT treatment types and locations. In 2022, herbicide and UV-C CMT treatments comprised approximately 27 acres (22%) of the West Lagoon, while herbicide and UV-C treatments in the Tallac Lagoon comprised 2 acres (8%) of that lagoon. No herbicides were applied in 2023 or 2024, but UV-C and other non-herbicide methods were tested in 2023 and 2024.

Site, lagoon, and aquatic species-specific results of the CMT Project on AIP for the three years of testing will be described in the CMT Draft Final Report that is scheduled for completion in Spring 2025.

Figure 15. CMT Treatment Areas in 2022 and 2024



4.5 Other Observations

An interesting finding of the 2023 and 2024 surveys is the number of rake samples in all lagoons that came up with no AIP. Many of the samples in the 2022 and 2023 surveys of the West Lagoon and the Tallac Lagoon disintegrated upon retrieval or were unrecognizable, primarily in the CMT Project test areas. The number of survey rake samples that included no AIP for these lagoons increased from 40 points in 2021 to 174 points in 2022. In 2023, the number of samples with no vegetation further increased to 188 points. In 2024, the number of samples with no AIP dropped to 49.

Another interesting result of the 2024 survey was that water smartweed (*Persicaria amphibia)* is now appearing in the West Lagoon and East Lagoon (based on observations during field survey). In past surveys (prior to 2023), smartweed only occurred sporadically in the Tallac Lagoon. Occurrences of smartweed for 2024 can be seen in the Figure B-7 composition map in Appendix B. This species, like coontail, is native, but can become a nuisance plant very quickly

if left unimpeded and unmanaged. The composition maps in Appendix B don't accurately reflect the species occurrence due to difficulties in accessing near shore areas and collecting strongly rooted vegetation such as watershield and water smartweed.

5.0 CONCLUSIONS

Non-native Eurasian watermilfoil, along with the native (but nuisance) coontail, are no longer the only dominant species throughout the Tahoe Keys. Coontail is still the dominant species in the deeper areas of the lagoons, while the dominant species in the shallow areas has changed. Past surveys found that Eurasian watermilfoil was dominant in the shallow areas, but it is now becoming displaced by curlyleaf pondweed. Eurasian watermilfoil's historical dominance in the shallow areas has waned in response to various factors including recent high lake water levels, increased competition from curlyleaf pondweed, and effects from the CMT treatments in certain areas.

Based on this 2024 Survey Report and TRPA's recently adopted Threshold Standard to reduce AIP in the Keys lagoons by 75% below 2020 baseline levels, a dedicated effort is needed to update the Integrated Management Plan for the Tahoe Keys. The update needs to take the findings of the CMT Project and design an implementation/action plan that addresses near and long-term actions that will be required to reduce the expanding presence of the AIP species. Such actions would need to consider the aggressive continued expansion of curlyleaf pondweed, and lagoons' management practices to improve containment and collection of AIP fragments to minimize movement into Lake Tahoe proper.

6.0 LIST OF PREPARERS

The following individuals prepared the text presented in this report.

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TKPOA Staff including Kristine Lebo, Meghan Hoffmann, Moire Breslin, and Katie Terwilliger provided equipment, boat transportation, and assisted in plant identification and data collection.

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Appendix A

Tahoe Keys Lagoons 2024 Aquatic Macrophyte Survey Data Points

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
1	5	4	1.03	0	50	0	50	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	5	4	1.63	40	60	0	2	2	0	0	0	0	0	0
4	5	4	0.99	10	60	5	20	5	0	0	0	0	0	0
5	5	3	0.47	25	5	20	50	0	0	0	0	0	0	0
6	5	2	0.49	25	25	25	25	0	0	0	0	0	0	0
7	5	5	4.63	0	3	2	95	0	0	0	0	0	0	0
8	5	3	0.85	40	20	30	10	0	0	0	0	0	0	0
9	5	3	0.74	0	90	0	10	0	0	0	0	0	0	0
10	5	2	0.61	30	30	40	0	0	0	0	0	0	0	0
11	5	4	2.41	0	98	0	2	0	0	0	0	0	0	0
12	5	3	0.47	10	0	80	10	0	0	0	0	0	0	0
13	5	4	1.69	0	0	0	100	0	0	0	0	0	0	0
14	5	3	0.47	0	5	0	95	0	0	0	0	0	0	0
15	5	4	2.67	0	2	0	98	0	0	0	0	0	0	0
16	5	1	0.11	3	0	2	95	0	0	0	0	0	0	0
17	4	3	0.89	5	40	0	50	0	0	0	0	0	0	0
18	5	4	1.05	0	40	10	50	0	0	0	0	0	0	0
19	5	3	1.2	30	20	20	40	0	0	0	0	0	0	0
20	5	3	1.16	80	5	0	15	0	0	0	0	0	0	0
21	5	4	1.49	10	20	20	45	5	0	0	0	0	0	0
22	5	1	0.2	30	0	0	40	30	0	0	0	0	0	0
23	5	2	0.67	80	10	0	5	5	0	0	0	0	0	0
24	5	3	2.27	5	0	5	90	0	0	0	0	0	0	0
25	5	4	2.42	20	25	10	40	5	0	0	0	0	0	0
26	5	3	1.09	0	80	0	15	5	0	0	0	0	0	0
27	4	2	0.45	5	0	70	0	30	0	0	0	0	0	0
28	5	3	1.91	0	3	3	94	0	0	0	0	0	0	0
29	5	3	1.2	0	60	0	40	0	0	0	0	0	0	0
30	5	2	0.41	0	0	0	100	0	0	0	0	0	0	0
31	5	3	1.58	30	35	0	30	5	0	0	0	0	0	0
32	5	5	6	0	98	0	2	0	0	0	0	0	0	0
33	5	5	6	0	0	100	0	0	0	0	0	0	0	0
34	5	5	6	10	40	0	50	0	0	0	0	0	0	0
35	5	4	2.01	10	20	0	70	0	0	0	0	0	0	0
36	5	2	0.84	40	50	0	10	0	0	0	0	0	0	0
37	5	1	0.17	5	0	95	0	0	0	0	0	0	0	0
38	5	2	1.01	70	10	10	10	0	0	0	0	0	0	0
39	5	2	0.69	30	60	10	0	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
40	5	2	0.66	0	0	0	100	0	0	0	0	0	0	0
41	5	5	6	0	90	0	5	5	0	0	0	0	0	0
42	5	4	0	0	95	0	2	3	0	0	0	0	0	0
43	5	3	0	95	0	0	2	3	0	0	0	0	0	0
44	5	3	0	30	0	40	30	0	0	0	0	0	0	0
45	5	4	0	40	30	0	10	0	0	0	20	0	0	0
46	5	3	0	30	0	15	50	5	0	0	0	0	0	0
47	5	4	0	5	5	0	90	0	0	0	0	0	0	0
48	5	4	0	0	90	0	10	0	0	0	0	0	0	0
49	5	3	0	90	0	0	5	5	0	0	0	0	0	0
50	5	2	0	50	0	0	50	0	0	0	0	0	0	0
51	5	2	0	5	0	5	90	0	0	0	0	0	0	0
52	5	4	0	0	100	0	0	0	0	0	0	0	0	0
53	5	3	0	80	0	0	20	0	0	0	0	0	0	0
54	4	2	0.31	0	0	0	100	0	0	0	0	0	0	0
55	5	2	0	0	99	0	1	0	0	0	0	0	0	0
56	5	3	0	20	0	40	40	0	0	0	0	0	0	0
57	5	3	0	0	100	0	0	0	0	0	0	0	0	0
58	5	3	0	40	50	0	0	10	0	0	0	0	0	0
59	5	4	0	35	60	0	0	5	0	0	0	0	0	0
60	5	3	0	90	0	5	0	5	0	0	0	0	0	0
61	5	3	0	80	5	0	15	0	0	0	0	0	0	0
62	5	1	0.17	30	0	50	20	0	0	0	0	0	0	0
63	5	4	0	20	0	30	30	20	0	0	0	0	0	0
64	5	3	0	50	0	40	10	0	0	0	0	0	0	0
65	5	4	0	10	30	0	60	0	0	0	0	0	0	0
66	5	3	0	0	40	0	60	0	0	0	0	0	0	0
67	5	4	0	0	0	10	60	20	0	0	0	0	0	0
68	5	2	0	0	0	10	50	40	0	0	0	0	0	0
69	5	4	0	20	0	0	70	10	0	0	0	0	0	0
70	5	4	0	0	0	20	70	10	0	0	0	0	0	0
71	5	3	0	0	0	1	99	0	0	0	0	0	0	0
72	5	4	0	20	0	0	70	10	0	0	0	0	0	0
73	5	5	0	0	0	0	99	1	0	0	0	0	0	0
74	5	4	0	0	0	15	85	0	0	0	0	0	0	0
75	5	5	0	10	0	80	10	0	0	0	0	0	0	0
76	4	3	0	0	0	10	90	0	0	0	0	0	0	0
77	5	2	0	95	0	0	0	5	0	0	0	0	0	0
78	5	3	0	10	40	50	0	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
79	5	5	0	0	0	2	95	3	0	0	0	0	0	0
80	5	2	0	50	0	20	30	0	0	0	0	0	0	0
81	5	3	0	5	0	0	90	5	0	0	0	0	0	0
82	4	3	0	90	0	5	0	5	0	0	0	0	0	0
83	3	3	0	0	75	0	25	0	0	0	0	0	0	0
84	5	2	0	95	5	0	0	0	0	0	0	0	0	0
85	4	4	0	0	5	5	90	0	0	0	0	0	0	0
86	5	3	0	50	45	0	5	0	0	0	0	0	0	0
87	5	3	0	0	5	0	95	0	0	0	0	0	0	0
88	5	1	0.13	5	0	0	95	0	0	0	0	0	0	0
89	5	1	0	100	0	0	0	0	0	0	0	0	0	0
90	5	2	0	0	0	0	100	0	0	0	0	0	0	0
91	5	1	0	0	5	0	95	0	0	0	0	0	0	0
92	5	3	0	25	25	25	0	25	0	0	0	0	0	0
93	4	4	0	0	0	50	40	10	0	0	0	0	0	0
94	5	1	0	0	0	0	100	0	0	0	0	0	0	0
95	5	1	0	0	0	50	50	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	5	2	0	0	0	60	40	0	0	0	0	0	0	0
98	5	1	0	0	0	50	50	0	0	0	0	0	0	0
99	5	4	0	10	0	5	60	25	0	0	0	0	0	0
100	5	3	0	50	0	0	30	20	0	0	0	0	0	0
101	5	3	0	0	0	0	100	0	0	0	0	0	0	0
102	5	4	0	0	95	5	0	0	0	0	0	0	0	0
103	5	1	0	0	0	20	0	30	0	50	0	0	0	0
104	5	3	0	0	100	0	0	0	0	0	0	0	0	0
105	5	3	0	0	0	80	20	0	0	0	0	0	0	0
106	5	2	0	0	0	0	100	0	0	0	0	0	0	0
107	5	5	0	0	0	5	95	0	0	0	0	0	0	0
108	5	4	0	0	0	0	100	0	0	0	0	0	0	0
109	5	3	0	2	0	0	98	0	0	0	0	0	0	0
110	5	5	0	1	0	1	98	0	0	0	0	0	0	0
111	5	3	0	0	0	0	100	0	0	0	0	0	0	0
112	5	2	0	30	0	60	0	10	0	0	0	0	0	0
113	5	3	0	0	0	10	80	10	0	0	0	0	0	0
114	5	4	0	0	0	95	5	0	0	0	0	0	0	0
115	5	1	0	0	0	0	100	0	0	0	0	0	0	0
116	3	3	0	0	0	40	40	20	0	0	0	0	0	0
117	5	3	0	0	0	20	75	5	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
118	5	3	0	0	0	1	99	0	0	0	0	0	0	0
119	5	3	0	0	0	60	20	20	0	0	0	0	0	0
120	5	2	0	0	0	0	95	5	0	0	0	0	0	0
121	5	3	0	0	0	30	70	0	0	0	0	0	0	0
122	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	5	3	0	0	70	0	10	20	0	0	0	0	0	0
124	5	3	0	0	0	10	80	10	0	0	0	0	0	0
125	5	2	0	10	10	0	0	80	0	0	0	0	0	0
126	5	2	0	0	0	0	100	0	0	0	0	0	0	0
127	5	4	0	0	40	50	0	10	0	0	0	0	0	0
128	4	4	0	0	0	100	0	0	0	0	0	0	0	0
129	5	2	0	0	0	0	0	0	100	0	0	0	0	0
130	5	3	0	0	0	0	10	0	90	0	0	0	0	0
131	5	1	0	0	0	5	95	0	0	0	0	0	0	0
132	5	3	0	0	0	0	0	0	100	0	0	0	0	0
133	5	2	0	0	0	0	20	0	60	20	0	0	0	0
134	5	4	0	0	0	0	30	0	0	70	0	0	0	0
135	5	3	0	0	0	20	0	20	60	0	0	0	0	0
136	5	3	0	0	0	40	10	30	40	0	0	0	0	0
137	5	2	0	5	0	20	5	0	0	70	0	0	0	0
138	5	2	0	60	0	0	40	0	0	0	0	0	0	0
139	5	2	0	20	0	0	50	30	0	0	0	0	0	0
140	5	3	0	0	98	0	0	2	0	0	0	0	0	0
141	5	4	0	0	100	0	0	0	0	0	0	0	0	0
142	5	3	0	0	60	20	20	5	0	0	0	0	0	0
143	5	3	0	0	70	0	25	5	0	0	0	0	0	0
144	5	3	0	5	5	0	40	50	0	0	0	0	0	0
145	5	2	0	0	0	95	0	5	0	0	0	0	0	0
146	5	3	0	10	60	0	10	15	0	5	0	0	0	0
147	5	1	0	5	95	0	0	5	0	0	0	0	0	0
148	4	1	0	0	95	0	0	5	0	0	0	0	0	0
149	5	5	0	0	100	0	0	0	0	0	0	0	0	0
150	5	3	0	0	100	0	0	0	0	0	0	0	0	0
151	5	3	0	20	30	0	40	0	0	10	0	0	0	0
152	5	5	0	0	100	0	0	0	0	0	0	0	0	0
153	5	5	0	0	100	0	0	0	0	0	0	0	0	0
154	5	4	0	0	100	0	0	0	0	0	0	0	0	0
155	5	4	0	0	100	0	0	0	0	0	0	0	0	0
156	5	1	0	10	0	0	90	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
157	5	4	0	0	94	0	5	1	0	0	0	0	0	0
158	5	5	0	0	100	0	0	0	0	0	0	0	0	0
159	5	4	0	0	100	0	0	0	0	0	0	0	0	0
160	5	5	0	0	100	0	0	0	0	0	0	0	0	0
161	5	5	0	0	100	0	0	0	0	0	0	0	0	0
162	5	5	0	0	100	0	0	0	0	0	0	0	0	0
163	5	5	0	0	100	0	0	0	0	0	0	0	0	0
164	5	5	0	0	100	0	0	0	0	0	0	0	0	0
165	5	3	0	5	0	0	90	5	0	0	0	0	0	0
166	5	2	0	0	0	5	90	5	0	0	0	0	0	0
167	5	2	0.58	5	0	0	90	5	0	0	0	0	0	0
168	5	1	0.25	100	0	0	0	0	0	0	0	0	0	0
169	5	2	0.57	0	95	0	0	5	0	0	0	0	0	0
170	5	3	1.22	90	5	0	2	5	0	0	0	0	0	0
171	5	1	0.16	0	0	0	100	0	0	0	0	0	0	0
172	5	3	0	5	5	85	5	0	0	0	0	0	0	0
173	5	3	1.3	5	60	0	35	0	0	0	0	0	0	0
174	5	2	1.08	5	60	0	0	40	0	0	0	0	0	0
175	5	2	0.81	10	50	0	10	30	0	0	0	0	0	0
176	5	1	0.39	1	0	95	5	1	0	0	0	0	0	0
177	5	1	0.12	10	80	0	10	0	0	0	0	0	0	0
178	5	3	0.86	0	95	0	5	0	0	0	0	0	0	0
179	5	3	1.02	10	0	30	30	30	0	0	0	0	0	0
180	5	3	0.97	20	10	0	30	40	0	0	0	0	0	0
181	5	1	0.26	10	40	0	50	0	0	0	0	0	0	0
182	5	2	0.65	80	0	10	10	0	0	0	0	0	0	0
183	5	4	1.61	0	95	0	0	5	0	0	0	0	0	0
184	5	2	0.44	0	0	60	30	10	0	0	0	0	0	0
185	5	3	0	0	100	0	0	0	0	0	0	0	0	0
186	5	3	0	10	65	0	25	0	0	0	0	0	0	0
187	5	3	0	0	100	0	0	0	0	0	0	0	0	0
188	5	4	0	0	100	0	0	0	0	0	0	0	0	0
189	5	2	0	30	50	0	20	0	0	0	0	0	0	0
190	5	2	0	0	95	0	5	0	0	0	0	0	0	0
191	5	1	0	0	90	0	10	0	0	0	0	0	0	0
192	5	5	0	0	100	0	0	0	0	0	0	0	0	0
193	5	1	0	5	95	0	0	0	0	0	0	0	0	0
194	5	2	0	0	50	0	50	0	0	0	0	0	0	0
195	5	3	0	0	5	0	95	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
196	5	3	0	70	95	0	0	5	0	0	0	0	0	0
197	5	4	0	75	13	0	10	2	0	0	0	0	0	0
198	5	2	0	5	95	0	0	0	0	0	0	0	0	0
199	4	1	0	0	95	0	5	0	0	0	0	0	0	0
200	5	4	0	0	100	0	0	0	0	0	0	0	0	0
201	5	5	0	0	95	0	2	0	0	0	0	0	0	0
202	5	2	0	100	0	0	0	0	0	0	0	0	0	0
203	5	2	0	5	30	0	65	0	0	0	0	0	0	0
204	5	3	0	0	95	0	5	0	0	0	0	0	0	0
205	5	2	0	20	75	0	0	5	0	0	0	0	0	0
206	5	3	0	0	100	0	0	0	0	0	0	0	0	0
207	5	3	0	30	30	0	40	0	0	0	0	0	0	0
208	5	4	0	10	90	0	0	0	0	0	0	0	0	0
209	5	5	0	0	100	0	0	0	0	0	0	0	0	0
210	5	2	0	15	5	0	80	0	0	0	0	0	0	0
211	5	1	0	0	0	0	100	0	0	0	0	0	0	0
212	5	3	0	5	80	0	5	5	0	0	0	0	0	0
213	5	3	0	20	75	0	5	0	0	0	0	0	0	0
214	5	3	0	20	40	0	40	0	0	0	0	0	0	0
215	5	4	0	0	95	0	5	0	0	0	0	0	0	0
216	5	5	0	0	100	0	0	0	0	0	0	0	0	0
217	5	3	0	0	100	0	0	0	0	0	0	0	0	0
218	5	5	0	0	100	0	0	0	0	0	0	0	0	0
219	5	3	0	0	100	0	0	0	0	0	0	0	0	0
220	5	2	0	75	0	10	10	5	0	0	0	0	0	0
221	5	3	0	0	0	0	30	0	0	0	70	0	0	0
222	5	3	0	75	0	0	20	5	0	0	0	0	0	0
223	5	1	0	95	0	5	0	0	0	0	0	0	0	0
224	5	2	0	30	5	0	65	0	0	0	0	0	0	0
225	5	2	0	85	5	0	5	5	0	0	0	0	0	0
226	5	2	0	0	95	0	5	0	0	0	0	0	0	0
227	5	2	0	5	90	0	0	5	0	0	0	0	0	0
228	5	1	0	0	80	0	0	20	0	0	0	0	0	0
229	5	2	0	0	0	100	0	0	0	0	0	0	0	0
230	5	2	0	0	0	100	0	0	0	0	0	0	0	0
231	5	3	0	0	100	0	0	0	0	0	0	0	0	0
232	5	2	0	0	0	75	20	0	0	5	0	0	0	0
233	5	2	0	0	100	0	0	0	0	0	0	0	0	0
234	5	3	0	0	100	0	0	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
235	5	1	0	0	100	0	0	0	0	0	0	0	0	0
236	5	2	0	15	0	0	80	5	0	0	0	0	0	0
237	5	3	0	40	20	0	30	10	0	0	0	0	0	0
238	5	3	0	0	0	90	10	0	0	0	0	0	0	0
239	5	2	0	10	0	0	90	0	0	0	0	0	0	0
240	5	2	0	0	25	0	50	25	0	0	0	0	0	0
241	4	3	0	5	40	50	0	5	0	0	0	0	0	0
242	4	3	0	90	0	0	100	0	0	0	0	0	0	0
243	4	1	0	0	40	0	60	0	0	0	0	0	0	0
244	5	1	0	0	0	80	20	0	0	0	0	0	0	0
245	2	2	0	0	0	40	60	0	0	0	0	0	0	0
246	0	0	0	0	0	0	0	0	0	0	0	0	0	0
247	4	2	0	0	40	0	60	0	0	0	0	0	0	0
248	3	2	0	0	0	0	90	10	0	0	0	0	0	0
249	4	1	0	0	100	0	0	0	0	0	0	0	0	0
250	3	3	0	0	0	95	5	0	0	0	0	0	0	0
251	3	3	0	5	5	0	90	0	0	0	0	0	0	0
252	3	2	0	5	5	0	90	0	0	0	0	0	0	0
253	3	3	0	30	0	30	40	0	0	0	0	0	0	0
254	5	2	0	60	10	0	30	0	0	0	0	0	0	0
255	5	3	0	95	5	0	0	0	0	0	0	0	0	0
256	5	4	0	60	0	25	0	15	0	0	0	0	0	0
257	5	3	0	95	0	0	0	0	0	0	0	0	0	5
258	5	3	0	90	0	10	0	0	0	0	0	0	0	0
259	5	2	0	0	0	0	95	5	0	0	0	0	0	0
260	5	3	0	40	30	0	20	10	0	0	0	0	0	0
261	5	2	0	30	20	0	0	50	0	0	0	0	0	0
262	5	2	0	0	5	0	90	0	0	0	0	0	0	5
263	5	3	0	0	90	0	10	0	0	0	0	0	0	0
264	5	1	0	5	85	0	5	5	0	0	0	0	0	0
265	5	2	0	0	100	0	0	0	0	0	0	0	0	0
266	5	3	0	0	20	70	0	10	0	0	0	0	0	0
267	5	3	0	15	55	0	10	20	0	0	0	0	0	0
268	5	5	0	0	95	0	0	5	0	0	0	0	0	0
269	5	1	0	10	0	20	70	0	0	0	0	0	0	0
270	5	5	0	0	95	0	2	3	0	0	0	0	0	0
271	5	1	0	0	100	0	0	0	0	0	0	0	0	0
272	5	2	0	95	5	0	0	0	0	0	0	0	0	0
273	5	2	0	0	75	0	20	5	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
274	5	5	0	0	100	0	0	0	0	0	0	0	0	0
275	5	3	0	0	10	0	90	0	0	0	0	0	0	0
276	4	2	0	0	5	5	90	0	0	0	0	0	0	0
277	5	3	0	0	10	5	85	0	0	0	0	0	0	0
278	5	2	0	0	0	95	5	0	0	0	0	0	0	0
279	5	2	0	0	5	90	5	0	0	0	0	0	0	0
280	5	3	0	0	70	0	0	30	0	0	0	0	0	0
281	5	5	0	10	65	0	0	25	0	0	0	0	0	0
282	5	3	0	10	70	0	10	10	0	0	0	0	0	0
283	5	3	0	5	90	0	5	0	0	0	0	0	0	0
284	5	3	0	0	50	0	50	0	0	0	0	0	0	0
285	5	4	0	0	95	0	5	0	0	0	0	0	0	0
286	5	2	0	0	60	0	0	40	0	0	0	0	0	0
287	5	2	0	0	80	0	20	0	0	0	0	0	0	0
288	5	3	0	0	20	40	20	20	0	0	0	0	0	0
289	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	5	3	0	0	30	35	35	0	0	0	0	0	0	0
291	5	1	0	0	50	10	40	0	0	0	0	0	0	0
292	5	3	0	0	20	0	80	0	0	0	0	0	0	0
293	0	0	0	0	0	0	0	0	0	0	0	0	0	0
294	0	0	0	0	0	0	0	0	0	0	0	0	0	0
295	4	1	0	0	90	0	0	10	0	0	0	0	0	0
296	5	4	0	0	90	0	0	10	0	0	0	0	0	0
297	5	1	0	0	5	90	0	5	0	0	0	0	0	0
298	5	3	0	0	0	5	5	10	0	0	0	0	0	0
299	5	2	0	0	90	5	5	0	0	0	0	0	0	0
300	5	3	0	0	80	0	0	20	0	0	0	0	0	0
301	4	5	0	0	100	0	0	0	0	0	0	0	0	0
302	5	3	0	0	50	10	40	0	0	0	0	0	0	0
303	5	3	0	0	20	0	75	5	0	0	0	0	0	0
304	5	3	0	0	70	0	30	0	0	0	0	0	0	0
305	5	2	0	0	100	0	0	0	0	0	0	0	0	0
306	5	1	0	0	50	0	50	0	0	0	0	0	0	0
307	5	2	0	0	90	0	10	0	0	0	0	0	0	0
308	5	1	0	0	100	0	0	0	0	0	0	0	0	0
309	5	3	0	0	10	0	90	0	0	0	0	0	0	0
310	5	3	0	0	65	25	10	0	0	0	0	0	0	0
311	5	2	0	0	85	0	5	0	0	0	0	0	0	10
312	5	2	0	0	2	50	40	8	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
313	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314	5	5	0	0	95	0	3	2	0	0	0	0	0	0
315	5	2	0	0	20	0	80	0	0	0	0	0	0	0
316	5	1	0	0	90	0	0	10	0	0	0	0	0	0
317	5	2	0	0	95	0	5	0	0	0	0	0	0	0
318	5	3	0	0	95	0	0	5	0	0	0	0	0	0
319	5	3	0	0	75	0	20	5	0	0	0	0	0	0
320	5	2	0	15	40	30	15	0	0	0	0	0	0	0
321	5	1	0	0	100	0	0	0	0	0	0	0	0	0
322	5	1	0	0	0	100	0	0	0	0	0	0	0	0
323	4	2	0	0	0	0	85	15	0	0	0	0	0	0
324	5	1	0	0	0	0	100	0	0	0	0	0	0	0
325	5	2	0	0	0	40	20	40	0	0	0	0	0	0
326	5	2	0	0	0	2	98	0	0	0	0	0	0	0
327	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328	5	2	0	60	40	0	0	0	0	0	0	0	0	0
329	5	4	0	0	0	0	70	30	0	0	0	0	0	0
330	5	2	0	0	5	15	80	0	0	0	0	0	0	0
331	5	3	0	0	30	10	60	0	0	0	0	0	0	0
332	5	1	0	0	30	0	70	0	0	0	0	0	0	0
333	5	1	0	0	100	0	0	0	0	0	0	0	0	0
334	5	1	0	90	5	5	0	0	0	0	0	0	0	0
335	5	3	0	0	80	20	0	0	0	0	0	0	0	0
336	5	2	0	0	38	0	60	2	0	0	0	0	0	0
337	5	2	0	5	20	40	0	5	0	0	0	0	0	0
338	5	1	0	0	0	10	0	90	0	0	0	0	0	0
339	5	1	0	0	0	0	0	100	0	0	0	0	0	0
340	5	3	0	10	45	30	10	15	0	0	0	0	0	0
341	4	2	0	0	0	5	90	5	0	0	0	0	0	0
342	5	3	0	0	0	40	45	15	0	0	0	0	0	0
343	5	2	0	0	0	80	20	0	0	0	0	0	0	0
344	5	1	0	0	10	0	90	0	0	0	0	0	0	0
345	4	1	0	0	95	0	5	0	0	0	0	0	0	0
346	4	1	0	5	55	30	10	0	0	0	0	0	0	0
347	5	3	0	10	0	70	17	3	0	0	0	0	0	0
348	4	3	0.9	5	85	0	0	10	0	0	0	0	0	0
349	5	2	0.35	1	0	0	84	15	0	0	0	0	0	0
350	5	5	3.68	0	60	0	40	0	0	0	0	0	0	0
351	4	4	2.24	0	80	0	10	10	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
352	0	0	0	0	0	0	0	0	0	0	0	0	0	0
353	5	4	1.45	0	100	0	0	0	0	0	0	0	0	0
354	5	1	0.25	0	55	30	50	10	0	0	0	0	0	0
355	5	5	6	0	60	0	35	5	0	0	0	0	0	0
356	5	3	2.31	0	5	5	95	0	0	0	0	0	0	0
357	5	4	1.98	0	0	40	90	2	0	0	0	0	0	0
358	5	2	0.71	0	10	20	60	10	0	0	0	0	0	0
359	5	2	0.82	5	70	0	20	5	0	0	0	0	0	0
360	4	2	0.76	10	30	0	20	2	0	0	0	0	0	0
361	5	5	6	0	100	0	0	0	0	0	0	0	0	0
362	5	2	0.54	0	20	0	75	5	0	0	0	0	0	0
363	5	3	2.11	0	0	50	50	0	0	0	0	0	0	0
364	5	2	0.41	2	0	0	96	2	0	0	0	0	0	0
365	5	1	0.29	0	45	0	55	0	0	0	0	0	0	0
366	4	1	0.2	5	0	80	10	5	0	0	0	0	0	0
367	5	4	2.66	5	85	0	0	10	0	0	0	0	0	0
368	5	4	1.71	0	70	0	30	0	0	0	0	0	0	0
369	4	3	1.21	0	100	0	0	0	0	0	0	0	0	0
370	5	2	0	0	80	0	20	0	0	0	0	0	0	0
371	0	0	0	0	0	0	0	0	0	0	0	0	0	0
372	5	1	0.08	0	20	60	0	20	0	0	0	0	0	0
373	5	5	3.32	0	100	0	0	0	0	0	0	0	0	0
374	5	5	3.04	10	80	0	10	0	0	0	0	0	0	0
375	5	1	0.07	70	0	30	0	0	0	0	0	0	0	0
376	4	5	3.44	0	100	0	0	0	0	0	0	0	0	0
377	4	5	6	0	100	0	0	0	0	0	0	0	0	0
378	3	3	0	0	0	80	15	5	0	0	0	0	0	0
379	5	3	0	0	0	30	30	40	0	0	0	0	0	0
380	5	3	0	10	70	0	5	15	0	0	0	0	0	0
381	5	2	0	75	0	0	20	5	0	0	0	0	0	0
382	5	3	0	20	30	0	20	30	0	0	0	0	0	0
383	5	3	0	85	0	0	10	5	0	0	0	0	0	0
384	5	2	0	80	5	0	0	15	0	0	0	0	0	0
385	5	2	0	10	0	20	70	0	0	0	0	0	0	0
386	5	3	0	50	45	0	5	5	0	0	0	0	0	0
387	5	3	0	30	0	0	70	0	0	0	0	0	0	0
388	5	3	0	20	60	0	0	20	0	0	0	0	0	0
389	5	3	0	40	5	30	0	25	0	0	0	0	0	0
390	5	2	0	60	0	30	10	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
391	5	1	0	30	0	0	70	0	0	0	0	0	0	0
392	5	3	0	60	0	0	40	0	0	0	0	0	0	0
393	5	1	0	70	0	0	20	5	5	0	0	0	0	0
394	5	3	0	0	50	5	40	5	0	0	0	0	0	0
395	5	3	0	50	5	0	40	5	0	0	0	0	0	0
396	5	4	0	20	60	0	15	5	0	0	0	0	0	0
397	5	3	0	70	0	10	20	10	0	0	0	0	0	0
398	5	1	0	90	0	0	0	10	0	0	0	0	0	0
399	5	2	0	60	0	10	30	0	0	0	0	0	0	0
400	5	3	0	70	0	5	15	10	0	0	0	0	0	0
401	5	1	0	25	0	0	25	25	25	0	0	0	0	0
402	5	3	0	60	20	0	20	0	0	0	0	0	0	0
403	0	0	0	0	0	0	0	0	0	0	0	0	0	0
404	5	1	0	0	0	0	10	0	40	0	0	0	50	0
405	5	1	0	0	0	0	0	0	100	0	0	0	0	0
406	5	4	0	5	0	0	5	20	60	10	0	0	0	0
407	5	4	0	2	0	10	5	10	60	20	0	0	0	0
408	5	1	0	0	0	0	0	0	100	0	0	0	0	0
409	5	2	0	90	0	0	5	5	0	0	0	0	0	0
410	2	1	0	5	0	90	5	0	0	0	0	0	0	0
411	3	2	0	0	60	0	40	0	0	0	0	0	0	0
412	0	0	0	0	0	0	0	0	0	0	0	0	0	0
413	5	4	0	40	0	0	40	20	0	0	0	0	0	0
414	4	3	0	0	40	0	60	0	0	0	0	0	0	0
415	4	3	0	0	0	30	70	0	0	0	0	0	0	0
416	2	1	0	0	25	0	45	30	0	0	0	0	0	0
417	4	3	0	0	5	5	75	15	0	0	0	0	0	0
418	4	3	0	0	0	40	50	10	0	0	0	0	0	0
419	2	1	0	0	5	0	95	0	0	0	0	0	0	0
420	3	2	0	5	10	45	0	40	0	0	0	0	0	0
421	4	3	0	0	30	20	20	30	0	0	0	0	0	0
422	1	1	0	0	0	5	85	10	0	0	0	0	0	0
423	4	3	0	15	40	0	40	5	0	0	0	0	0	0
424	4	3	0	0	30	5	60	5	0	0	0	0	0	0
425	4	3	0	75	0	0	20	5	0	0	0	0	0	0
426	1	1	0	0	0	0	25	75	0	0	0	0	0	0
427	3	2	0	20	0	0	75	5	0	0	0	0	0	0
428	2	2	0	5	5	0	5	85	0	0	0	0	0	0
429	4	1	0	0	5	0	0	95	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
430	1	1	0	0	0	95	0	5	0	0	0	0	0	0
431	1	1	0	5	10	40	50	0	0	0	0	0	0	0
432	5	1	0	0	75	0	5	10	0	15	0	0	0	0
433	5	2	0	0	50	0	0	0	0	50	0	0	0	0
434	5	1	0	100	0	0	0	0	0	0	0	0	0	0
435	5	2	0	0	100	0	0	0	0	0	0	0	0	0
436	4	1	0	0	95	0	0	5	0	0	0	0	0	0
437	1	1	0	0	100	0	0	0	0	0	0	0	0	0
438	4	3	0	10	10	25	20	15	0	0	0	0	0	0
439	5	4	0	0	100	0	0	0	0	0	0	0	0	0
440	5	4	0	0	100	0	0	0	0	0	0	0	0	0
441	5	2	0	0	100	0	0	0	0	0	0	0	0	0
442	4	3	0	15	30	10	30	15	0	0	0	0	0	0
443	0	0	0	0	0	0	0	0	0	0	0	0	0	0
444	3	1	0	5	65	5	0	25	0	0	0	0	0	0
445	3	1	0	0	30	30	0	40	0	0	0	0	0	0
446	4	3	0	0	90	0	10	0	0	0	0	0	0	0
447	4	3	0	5	40	5	0	60	0	0	0	0	0	0
448	1	1	0	0	0	100	0	0	0	0	0	0	0	0
449	4	2	0	0	0	40	5	15	20	0	0	0	0	0
450	4	3	0	0	90	0	0	10	0	0	0	0	0	0
451	5	2	0	0	70	25	5	0	0	0	0	0	0	0
452	2	1	0	0	0	100	0	0	0	0	0	0	0	0
453	3	1	0	10	80	0	0	5	10	0	0	0	0	0
454	4	1	0	0	20	0	80	0	0	0	0	0	0	0
455	5	5	0	0	100	0	0	0	0	0	0	0	0	0
456	4	3	0	0	30	0	0	60	0	0	0	0	0	0
457	0	0	0	0	0	0	0	0	0	0	0	0	0	0
458	0	0	0	0	0	0	0	0	0	0	0	0	0	0
459	5	2	0	0	40	0	0	60	0	0	0	0	0	0
460	3	2	0	0	25	0	0	75	0	0	0	0	0	0
461	4	2	0	0	75	0	15	10	0	0	0	0	0	0
462	5	4	0	0	100	0	0	0	0	0	0	0	0	0
463	2	1	0	50	0	25	0	25	0	0	0	0	0	0
464	4	4	0	0	100	0	0	0	0	0	0	0	0	0
465	5	1	0	0	0	50	0	50	0	0	0	0	0	0
466	5	4	0	0	100	0	0	0	0	0	0	0	0	0
467	4	2	0	50	0	25	0	25	0	0	0	0	0	0
468	5	2	0	45	0	5	50	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
469	4	2	0	75	0	5	20	0	0	0	0	0	0	0
470	3	3	0	60	10	10	10	0	10	0	0	0	0	0
471	2	2	0	0	10	60	20	5	0	0	5	0	0	0
472	0	0	0	0	0	0	0	0	0	0	0	0	0	0
473	3	3	0	40	0	10	40	10	0	0	0	0	0	0
474	3	2	0	30	25	15	25	5	0	0	0	0	0	0
475	4	3	0	45	10	0	45	0	0	0	0	0	0	0
476	5	3	0	10	0	70	0	10	0	0	10	0	0	0
477	5	2	0	0	10	0	90	0	0	0	0	0	0	0
478	3	4	0	15	0	0	85	0	0	0	0	0	0	0
479	3	2	0	50	0	0	50	0	0	0	0	0	0	0
480	3	1	0	0	15	0	80	5	0	0	0	0	0	0
481	3	2	0	5	0	0	95	0	0	0	0	0	0	0
482	3	2	0	95	0	0	0	5	0	0	0	0	0	0
483	4	5	0	0	90	0	10	0	0	0	0	0	0	0
484	3	3	0	0	40	0	60	0	0	0	0	0	0	0
485	3	2	0	0	0	0	100	0	0	0	0	0	0	0
486	3	2	0	10	0	70	20	0	0	0	0	0	0	0
487	4	4	0	20	70	0	0	10	0	0	0	0	0	0
488	4	2	0	5	0	75	20	0	0	0	0	0	0	0
489	4	2	0	30	10	60	0	0	0	0	0	0	0	0
490	4	3	0	30	10	50	20	0	0	0	0	0	0	0
491	3	2	0	5	0	50	0	45	0	0	0	0	0	0
492	4	1	0	0	0	80	20	0	0	0	0	0	0	0
493	4	4	0	5	0	65	20	10	0	0	0	0	0	0
494	5	2	0	70	0	0	0	5	0	0	0	30	0	0
495	5	5	0	5	75	0	10	0	10	0	0	0	0	0
496	5	1	0	5	0	0	85	0	0	10	0	0	0	0
497	4	3	0	0	10	60	20	5	0	0	0	0	0	0
498	4	1	0	20	5	5	60	0	5	0	0	0	0	0
499	4	3	0	0	50	0	40	0	10	0	0	0	0	0
500	4	2	0	10	0	50	15	5	15	0	0	0	0	0
501	5	2	0	0	0	5	5	5	85	0	0	0	0	0
502	4	1	0	0	0	50	30	15	0	0	0	0	0	0
503	0	0	0	0	0	0	0	0	0	0	0	0	0	0
504	4	1	0	10	30	0	55	5	0	0	0	0	0	0
505	4	1	0	0	60	40	0	0	0	0	0	0	0	0
506	0	0	0	0	0	0	0	0	0	0	0	0	0	0
507	5	1	0	0	100	0	0	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
508	0	0	0	0	0	0	0	0	0	0	0	0	0	0
509	5	2	0	10	0	20	60	10	0	0	0	0	0	0
510	5	1	0	0	0	0	100	0	0	0	0	0	0	0
511	5	2	0	0	15	0	80	5	0	0	0	0	0	0
512	5	3	0	0	10	0	50	40	0	0	0	0	0	0
513	5	4	0	0	15	0	70	15	0	0	0	0	0	0
514	4	4	0	0	100	0	0	0	0	0	0	0	0	0
515	3	1	0	0	0	0	0	100	0	0	0	0	0	0
516	4	5	0	0	95	0	0	5	0	0	0	0	0	0
517	4	4	0	0	75	5	10	0	0	0	0	0	0	0
518	5	3	0	0	95	0	5	0	0	0	0	0	0	0
519	5	1	0	25	0	0	50	25	0	0	0	0	0	0
520	0	0	0	0	0	0	0	0	0	0	0	0	0	0
521	0	0	0	0	0	0	0	0	0	0	0	0	0	0
522	5	2	0	50	0	0	0	10	0	0	0	0	0	40
523	0	0	0	0	0	0	0	0	0	0	0	0	0	0
524	5	3	0	0	30	30	10	30	0	0	0	0	0	0
525	5	2	0	0	80	0	5	10	5	0	0	0	0	0
526	5	3	0	0	0	0	100	0	0	0	0	0	0	0
527	5	2	0	25	25	0	50	0	0	0	0	0	0	0
528	5	3	0	0	0	0	100	0	0	0	0	0	0	0
529	5	3	0	25	0	25	25	0	25	0	0	0	0	0
530	5	2	0	0	30	0	40	30	0	0	0	0	0	0
531	5	1	0	0	0	0	100	0	0	0	0	0	0	0
532	5	2	0	0	15	0	70	15	0	0	0	0	0	0
533	5	4	0	0	100	0	0	0	0	0	0	0	0	0
534	5	1	0	0	5	0	95	0	0	0	0	0	0	0
535	5	1	0	0	95	0	5	0	0	0	0	0	0	0
536	5	1	0	20	20	0	50	10	0	0	0	0	0	0
537	5	2	0	0	5	0	90	5	0	0	0	0	0	0
538	5	3	0	5	0	0	80	10	0	5	0	0	0	0
539	4	4	0	0	40	40	20	0	0	0	0	0	0	0
540	5	2	0	10	80	0	10	0	0	0	0	0	0	0
541	3	3	0	0	0	0	0	100	0	0	0	0	0	0
542	4	3	0	40	0	5	0	5	50	0	0	0	0	0
543	5	2	0	20	0	0	20	60	0	0	0	0	0	0
544	4	2	0	5	20	5	70	0	0	0	0	0	0	0
545	5	1	0	0	100	0	0	0	0	0	0	0	0	0
546	5	3	0	0	100	0	0	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
547	5	1	0	0	100	0	0	0	0	0	0	0	0	0
548	3	1	0	0	100	0	0	0	0	0	0	0	0	0
549	0	0	0	0	0	0	0	0	0	0	0	0	0	0
550	5	2	0	0	100	0	0	0	0	0	0	0	0	0
551	5	1	0	0	0	40	30	0	30	0	0	0	0	0
552	5	4	0	90	0	0	0	10	0	0	0	0	0	0
553	4	2	0	10	0	0	60	30	0	0	0	0	0	0
554	5	3	0	20	50	30	0	0	0	0	0	0	0	0
555	4	3	0	10	0	10	80	0	0	0	0	0	0	0
556	5	3	0	80	0	10	0	10	0	0	0	0	0	0
557	4	3	0	0	5	50	40	5	0	0	0	0	0	0
558	5	3	0	20	10	55	5	10	0	0	0	0	0	0
559	5	3	0	0	40	45	5	0	0	5	5	0	0	0
560	4	1	0	0	50	50	0	0	0	0	0	0	0	0
561	3	1	0	0	100	0	0	0	0	0	0	0	0	0
562	0	0	0	0	0	0	0	0	0	0	0	0	0	0
563	4	1	0	0	100	0	0	0	0	0	0	0	0	0
564	5	2	0	50	20	0	20	10	0	0	0	0	0	0
565	5	3	0	0	40	5	50	0	0	0	5	0	0	0
566	5	2	0	5	0	50	40	5	0	0	0	0	0	0
567	5	3	0	0	20	40	0	0	0	0	0	0	0	0
568	5	1	0	0	100	0	0	0	0	0	0	0	0	0
569	5	2	0	0	100	0	0	0	0	0	0	0	0	0
570	5	3	0	45	0	10	50	0	0	0	0	0	0	0
571	4	3	0	0	100	0	0	0	0	0	0	0	0	0
572	3	1	0	0	100	0	0	0	0	0	0	0	0	0
573	5	1	0	0	90	10	0	0	0	0	0	0	0	0
574	0	0	0	0	0	0	0	0	0	0	0	0	0	0
576	5	1	0	0	100	0	0	0	0	0	0	0	0	0
577	5	3	0	0	99	1	0	0	0	0	0	0	0	0
578	5	2	0	0	95	0	5	0	0	0	0	0	0	0
579	5	1	0	5	0	5	90	0	0	0	0	0	0	0
580	4	1	0	0	0	50	50	0	0	0	0	0	0	0
581	4	1	0	0	0	100	0	0	0	0	0	0	0	0
582	3	1	0	0	0	100	0	0	0	0	0	0	0	0
583	4	3	0	20	30	0	20	30	0	0	0	0	0	0
584	4	3	0	0	70	0	30	0	0	0	0	0	0	0
585	5	3	0	25	50	0	25	0	0	0	0	0	0	0
586	4	2	0	50	0	10	0	40	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
587	5	2	0	0	0	50	50	0	0	0	0	0	0	0
588	5	2	0	5	0	5	50	0	40	0	0	0	0	0
589	4	1	0	25	0	75	0	0	0	0	0	0	0	0
590	5	1	0	0	25	0	75	0	0	0	0	0	0	0
591	4	2	0	10	5	10	75	0	0	0	0	0	0	0
592	5	3	0	25	25	25	25	0	0	0	0	0	0	0
593	5	3	0	0	95	0	5	0	0	0	0	0	0	0
594	5	1	0	0	100	0	0	0	0	0	0	0	0	0
595	5	3	0	0	10	40	50	0	0	0	0	0	0	0
596	5	2	0	5	5	0	85	5	0	0	0	0	0	0
597	1	1	0	0	100	0	0	0	0	0	0	0	0	0
598	5	1	0	0	100	0	0	0	0	0	0	0	0	0
599	5	3	0	0	20	0	0	0	0	0	0	80	0	0
600	4	3	0	0	100	0	0	0	0	0	0	0	0	0
601	5	4	0	50	20	0	0	0	0	0	0	30	0	0
602	3	3	0	15	80	0	0	10	0	0	0	5	0	0
603	4	4	0	0	100	0	0	0	0	0	0	0	0	0
604	5	5	0	0	100	0	0	0	0	0	0	0	0	0
605	3	2	0	0	100	0	0	0	0	0	0	0	0	0
606	5	4	0	0	100	0	0	0	0	0	0	0	0	0
607	5	3	0	0	60	0	0	0	0	0	0	40	0	0
608	4	3	0	0	100	0	0	0	0	0	0	0	0	0
609	5	1	0	100	0	0	0	0	0	0	0	0	0	0
610	0	0	0	0	0	0	0	0	0	0	0	0	0	0
611	5	2	0	0	100	0	0	0	0	0	0	0	0	0
612	5	3	0	10	0	0	0	0	0	0	0	60	30	0
613	5	2	0	0	100	0	0	0	0	0	0	0	0	0
614	3	2	0	10	90	0	0	0	0	0	0	0	0	0
615	5	3	0	10	75	0	10	5	0	0	0	0	0	0
616	4	4	0	0	100	0	0	0	0	0	0	0	0	0
617	5	2	0	10	80	0	10	0	0	0	0	0	0	0
618	5	5	0	0	100	0	0	0	0	0	0	0	0	0
619	4	2	0	0	100	0	0	0	0	0	0	0	0	0
620	5	3	0	0	100	0	0	0	0	0	0	0	0	0
621	5	2	0	0	100	0	0	0	0	0	0	0	0	0
622	5	2	0	0	50	0	0	15	0	0	0	35	0	0
623	5	3	0	0	100	0	0	0	0	0	0	0	0	0
624	5	4	0	0	10	0	0	0	0	0	0	90	0	0
625	4	1	0	0	100	0	0	0	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
626	5	4	0	5	80	0	5	10	0	0	0	0	0	0
627	3	3	0	0	95	5	0	0	0	0	0	0	0	0
628	5	4	0	0	70	0	5	5	0	0	20	0	0	0
629	4	5	0	0	75	0	10	5	0	0	0	0	0	0
630	5	4	0	0	40	0	10	0	0	0	10	20	0	0
631	5	5	0	30	50	0	5	5	0	0	0	10	0	0
632	3	1	0	0	100	0	0	0	0	0	0	0	0	0
633	5	2	0	20	30	0	5	0	0	0	15	10	0	0
634	4	4	0	0	70	0	30	0	0	0	0	0	0	0
635	4	5	0	0	100	0	0	0	0	0	0	0	0	0
636	5	2	0	0	60	0	0	0	0	0	0	40	0	0
637	5	1	0	0	100	0	0	0	0	0	0	0	0	0
638	5	5	0	0	70	0	0	0	0	0	0	30	0	0
639	5	4	0	0	100	0	0	0	0	0	0	0	0	0
640	5	5	0	10	85	0	0	5	0	0	0	0	0	0
641	5	5	0	0	100	0	0	0	0	0	0	0	0	0
642	5	5	0	0	100	0	0	0	0	0	0	0	0	0
643	5	4	0	50	40	0	10	0	0	0	0	0	0	0
644	5	2	0	25	25	0	0	25	0	0	0	0	0	25
645	5	3	0	50	25	0	0	25	0	0	0	0	0	0
646	5	4	0	0	75	10	10	5	0	0	0	0	0	0
647	5	1	0	0	25	0	0	0	0	0	0	25	0	0
648	5	2	0	5	80	0	0	15	0	0	0	0	0	0
649	5	3	0	4	90	0	0	5	0	0	0	0	0	0
650	5	5	0	0	99	0	1	0	0	0	0	0	0	0
651	5	4	0	10	80	0	0	0	0	0	0	10	0	0
652	5	4	0	0	100	0	0	0	0	0	0	0	0	0
653	5	3	0	40	50	0	0	10	0	0	0	0	0	0
654	5	5	0	0	60	0	0	40	0	0	0	0	0	0
655	5	4	0	25	30	0	0	10	0	0	0	0	0	5
656	5	3	0	5	60	0	0	35	0	0	0	0	0	0
657	5	2	0	40	50	0	0	10	0	0	0	0	0	0
658	5	3	0	40	50	0	0	10	0	0	0	0	0	0
659	5	5	0	40	20	0	0	40	0	0	0	0	0	0
660	5	1	0	75	10	0	0	0	0	0	0	0	0	15
661	5	3	0	25	40	0	0	25	0	0	0	10	0	0
662	5	5	0	0	95	0	0	5	0	0	0	0	0	0
663	5	4	0	25	60	0	0	15	0	0	0	10	0	0
664	5	4	0	0	95	0	0	5	0	0	0	0	0	0

Point Sample ID	Health Rating	Rake Fullness	Weight	MySp	CeDe	NiSp	PoCr	ElCa	PoRi	PoFo	FiAl	BrSc	MyQu	PeAm
665	5	1	0	90	0	0	0	10	0	0	0	0	0	0
666	5	5	0	0	100	0	0	0	0	0	0	0	0	0
667	5	1	0	25	75	0	0	0	0	0	0	0	0	0
668	5	4	0	0	100	0	0	0	0	0	0	0	0	0
669	5	2	0	25	50	0	0	0	0	0	0	25	0	0
670	5	5	0	10	90	0	0	0	0	0	0	0	0	0
671	5	5	0	10	30	0	10	10	0	0	0	40	0	0
672	5	2	0	25	50	0	20	5	0	0	0	0	0	0

Appendix B

Species Composition Maps Based on Rake Samples

Figure B-1. 2024 Eurasian watermilfoil Composition Map Based on Rake Samples

Figure B-2. 2024 Curlyleaf Pondweed Composition Map Based on Rake Samples

Figure B-3. 2024 Coontail Composition Map Based on Rake Samples

Figure B-4. 2024 Leafy Pondweed Composition Map Based on Rake Samples

Figure B-5. 2024 Elodea Composition Map Based on Rake Samples

Figure B-6. 2024 Nitella Composition Map Based on Rake Samples

Figure B-7. 2024 Water Smartweed Composition Map Based on Rake Samples