

EcoLogic Memorandum

TO: Dave Snyder, OCDWEP
FROM: Liz Moran, EcoLogic, LLC
RE: Onondaga Lake 2009 Macrophyte Monitoring Results
DATE: January 12, 2010

This memorandum summarizes the 2009 Onondaga Lake macrophyte monitoring results. The annual macrophyte monitoring program consists of two elements: aerial photographs and ground truthing. The maps are collected at the end of this memorandum.

During the summer of 2009, the AMP field staff observed the formation of filamentous algae clouds (surface and subsurface) spreading throughout the littoral zone of the lake in both the north and south basins. These algae appeared to be metaphyton, described as "green cotton candy" that forms large billowing clouds that have little substance. The material is very slimy and almost gelatinous. Dr. Lars Rudstam of Cornell University tentatively identified the algae as *Ulothrix*, a filamentous green algae that form unicellular strands and tend to be free floating, although it is sometimes attached. These are not unusual in lakes.



Ulothrix cloud at Site 3.

Aerial Photographs Methodology

Aerial photographs were taken in August 2009 by Airphotographics Inc. Ten ground truthing sites were marked with large buoys prior to the flight, which are visible as orange dots in the photographs. The photographs were transferred to digital format, georeferenced and copied to a DVD that was sent to EcoLogic. The georeferenced photographs were imported into ArcGIS and the margins of the macrophyte beds were manually delineated.

Ground Truthing Methodology

Within one week of shooting the aerial photographs, a ground truth sampling effort was conducted. Onondaga County Department of Water Environment Protection (OCDWEP) staff visited each of the ten ground truthing sites ([Map 1](#)) and collected data on species composition and relative abundance. These data were used to verify that objects delineated in the air photographs were macrophyte beds.

Results – Aerial Photography Interpretation

A total of 382 acres of macrophytes were delineated from the 2009 aerial photographs (**Figure 1**). The overall coverage of macrophytes in 2009 was comparable to the highest delineated value – 378 acres in 2005 - since photographic interpretation began in 2000. However, it should also be noted that the aerial photographs were taken in June or early July for the period 2000 through 2005, and in August for the period 2006 through 2009. The drop in overall coverage observed between 2005 and 2006 may be the result of seasonal variability in plant growth between June and August. Despite the seasonal differences that may exist when comparing the June and August photographs, it is clear that coverage of macrophytes steadily increased over both periods.

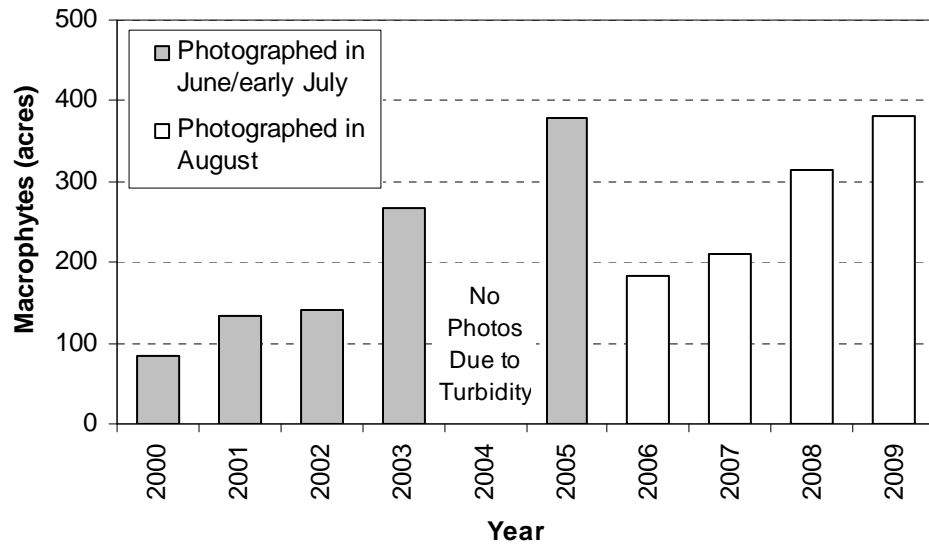


Figure 1. Total acreage of macrophytes in Onondaga Lake from 2000 to 2009 based on areas delineated as macrophytes from digitized aerial photographs.

Note: 2006 - 2009 photographs were taken in August, all others were taken in June or early July; this adds an unknown level of variability to the analysis.

In 2009, as in 2008, dense beds were evident along the northwest and entire east shores (**Maps 2 – 6**). As in the past, macrophyte growth appeared to be the least dense along the south and southwest shores. The northwest area (Maple and Willow Bays) and the east shore (Onondaga Lake Park) east toward the mouth of Ley Creek appears to have the most stable areas of macrophyte growth over time (**Figure 2**). The areas from the mouth of Ley Creek south to Harbor Brook, then north and west past the wastebeds to the mouth of Ninemile Creek seem to have the most variability in growth density.

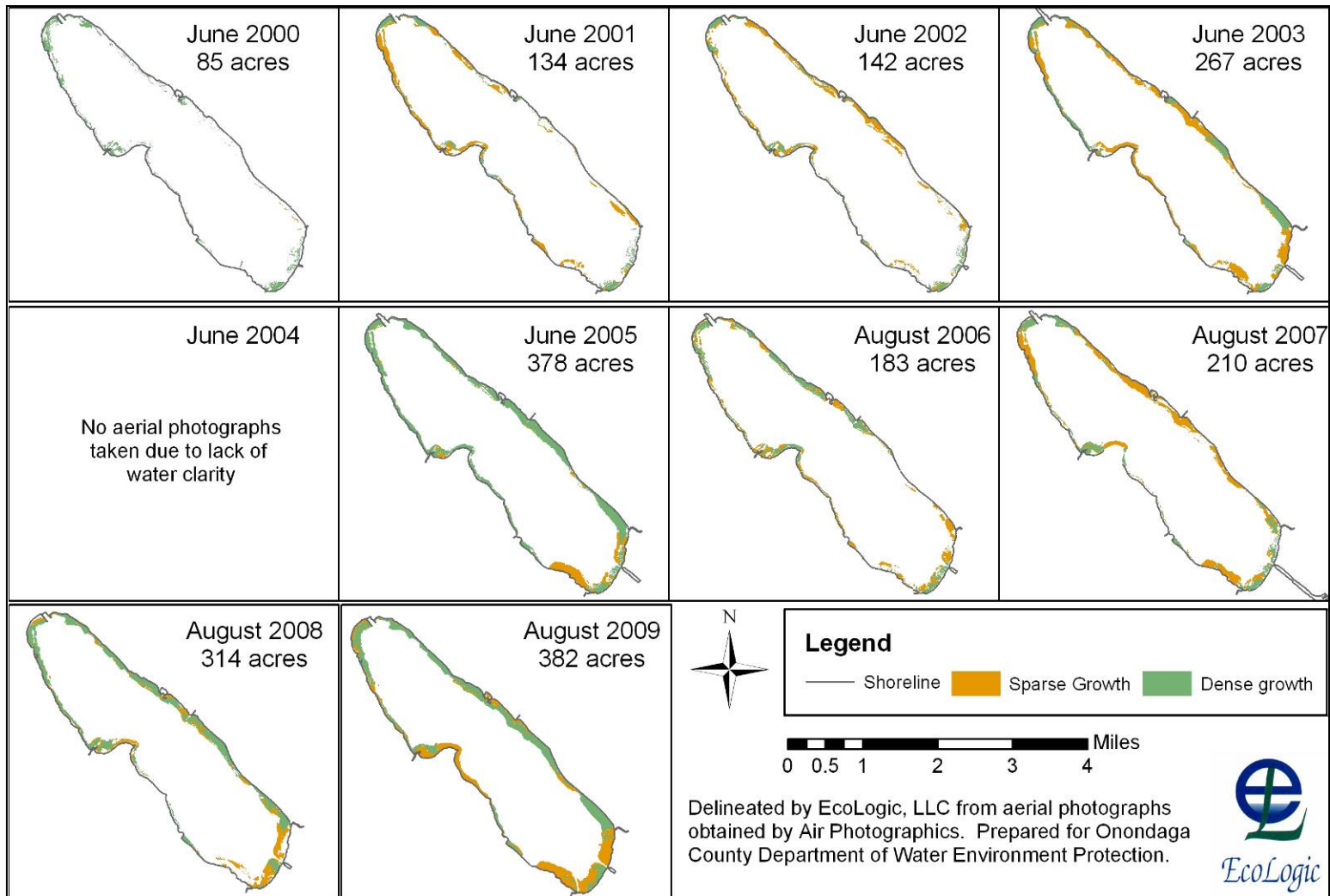


Figure 2. Onondaga Lake macrophyte aerial photograph interpretation over time.

Results – Ground Truthing

The ground truthing effort identified seven taxa at ten sites (**Table 1**). Coontail, *Elodea*, and Eurasian water milfoil were the most widely distributed species, found at most of the sites. The only other taxa found in 50% or more of the sites were southern naiad and water star grass. Coontail had the highest overall relative abundance (27%), two other taxa were present in nearly equivalent amounts: *Elodea* (25%) and water star grass (20%).



Macrophyte sample collected at Site 4.

Table 1. 2009 ground truthing results.

Species	Where Present		Overall Relative Abundance
	Percent of Sites	Relative Abundance	
Coontail (<i>Ceratophyllum demersum</i>)	90%	30%	27%
Common water weed (<i>Elodea canadensis</i>)	90%	28%	25%
Eurasian water milfoil (<i>Myriophyllum spicatum</i>)	80%	18%	15%
Southern naiad (<i>Najas quadalupensis</i>)	60%	23%	14%
Water star grass (<i>Zosterella dubia</i>)	50%	40%	20%
Curly leaf pondweed (<i>Potamogeton crispus</i>)	40%	<1%	<1%
Small pondweed (<i>Potamogeton pusillus</i>)	10%	<1%	<1%

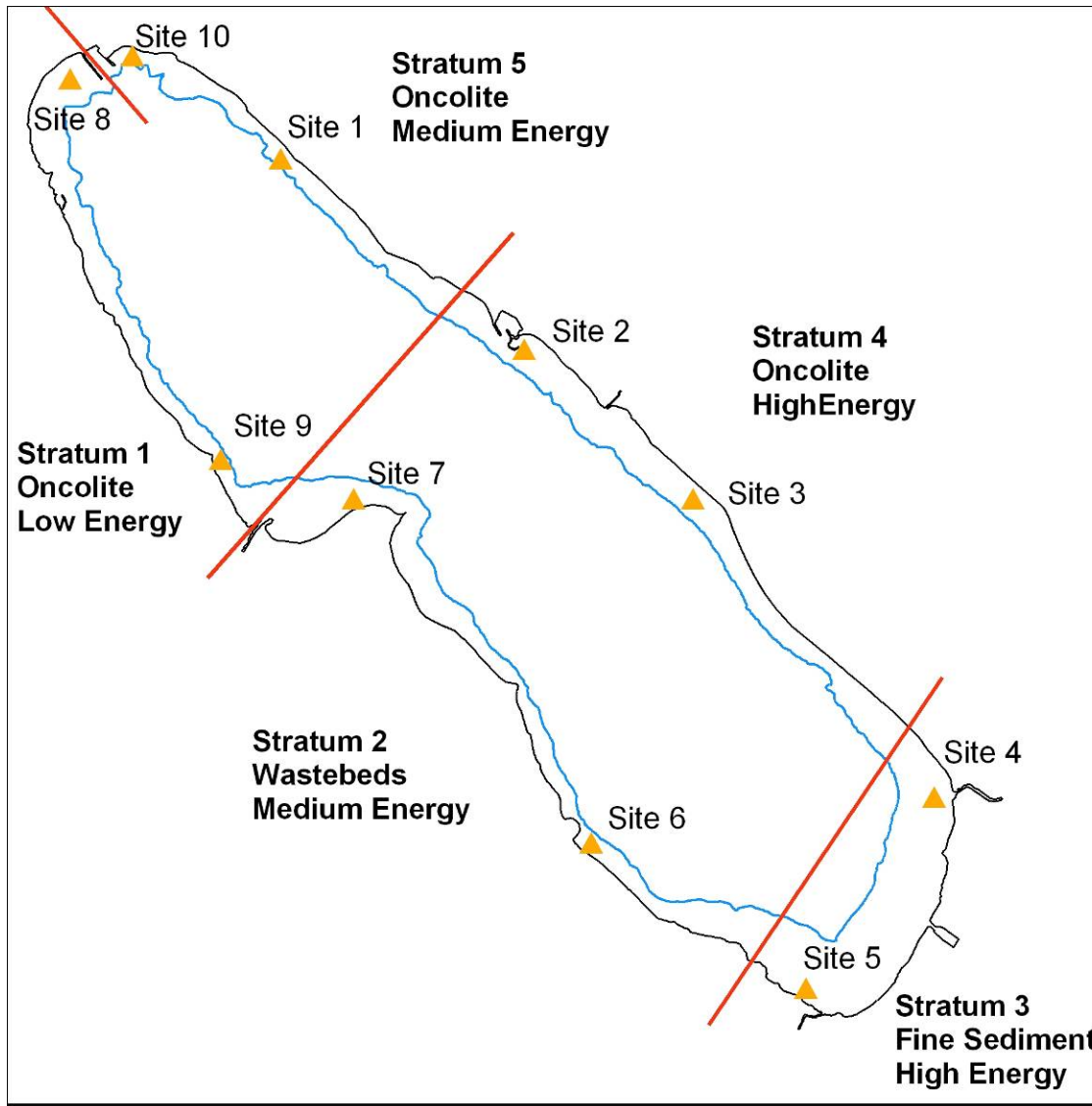
Verification – Aerial Photograph Interpretation and Ground Truthing

There was very good agreement between the results of the ground truthing compared to the digitized macrophytes (**Maps 7 through 16**). While some areas of metaphyton growing adjacent to macrophytes beds can be difficult to distinguish in the aerial photographs, it does not appear that these areas comprise a significant part of the delineations. Overall, the ground truthing seems to verify that the photo delineations are a reasonable interpretation of macrophyte distribution in the lake.

In addition to the plants identified at the ground truthing buoy sites, water chestnut was observed in the lake just north of Tributary 5A outlet (photograph at right), as in previous years.



Onondaga Lake Macrophyte Program
2009 Aerial Photograph Interpretation Maps



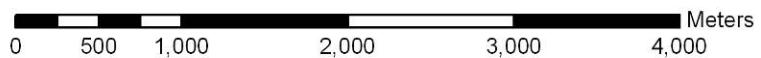
Map 1
Location of Ground Truth Buoys
Onondaga Lake, August 2009



Legend

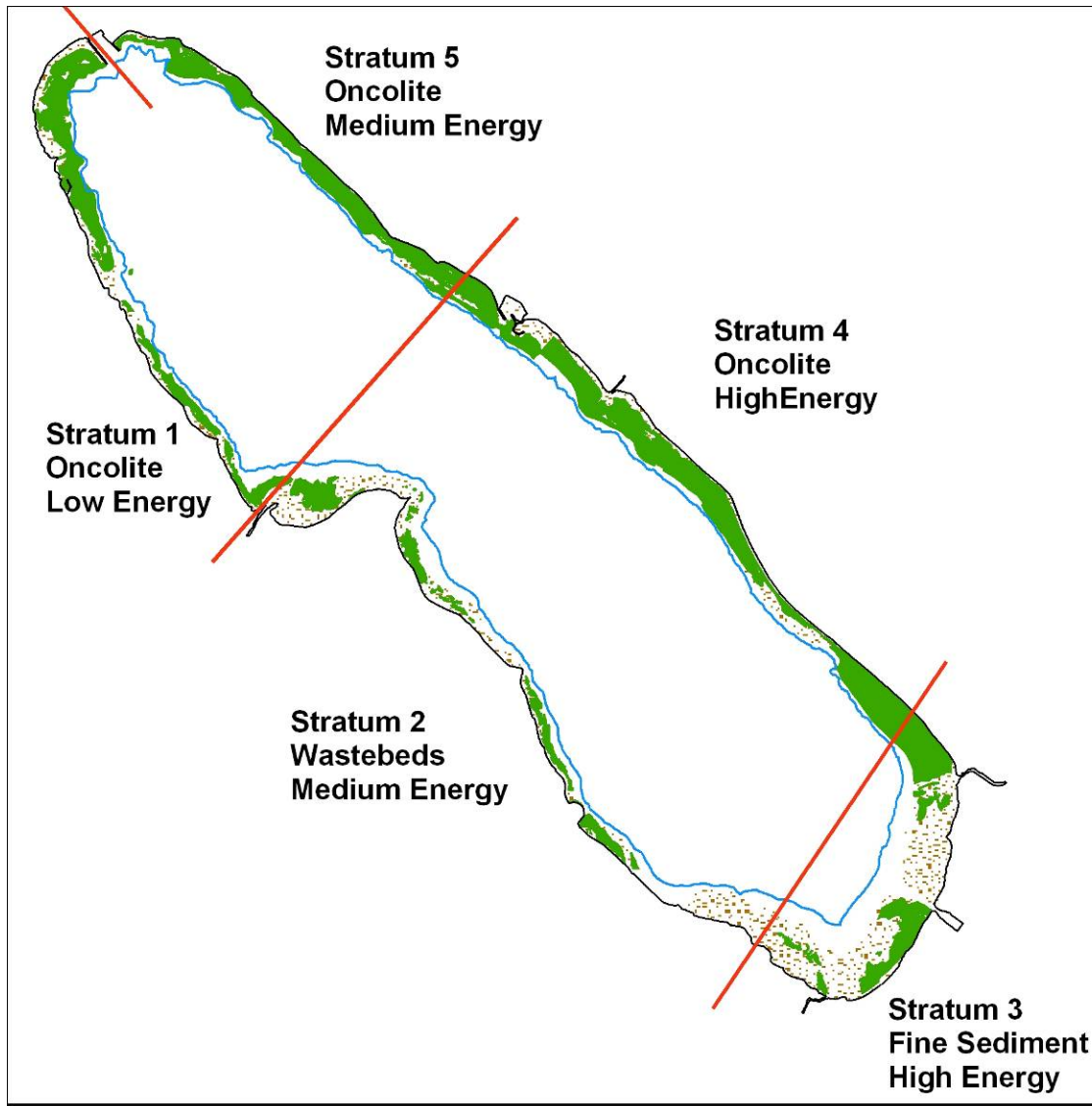
- Strata borders
- 6-meter depth
- ▲ Buoys

Source: Shoreline and buoys digitized from aerial photographs provided by Airphotographics.



Onondaga County Department Water Environment Protection
2009 Onondaga Lake Aquatic Macrophyte Survey





Map 2
Lakewide
Macrophyte Distribution
Onondaga Lake, August 2009

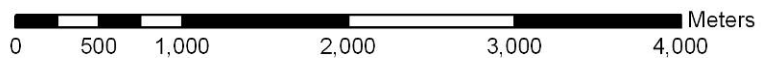


Legend

- Strata borders
- 6-meter depth
- Sparse macrophyte growth
- Dense macrophyte growth

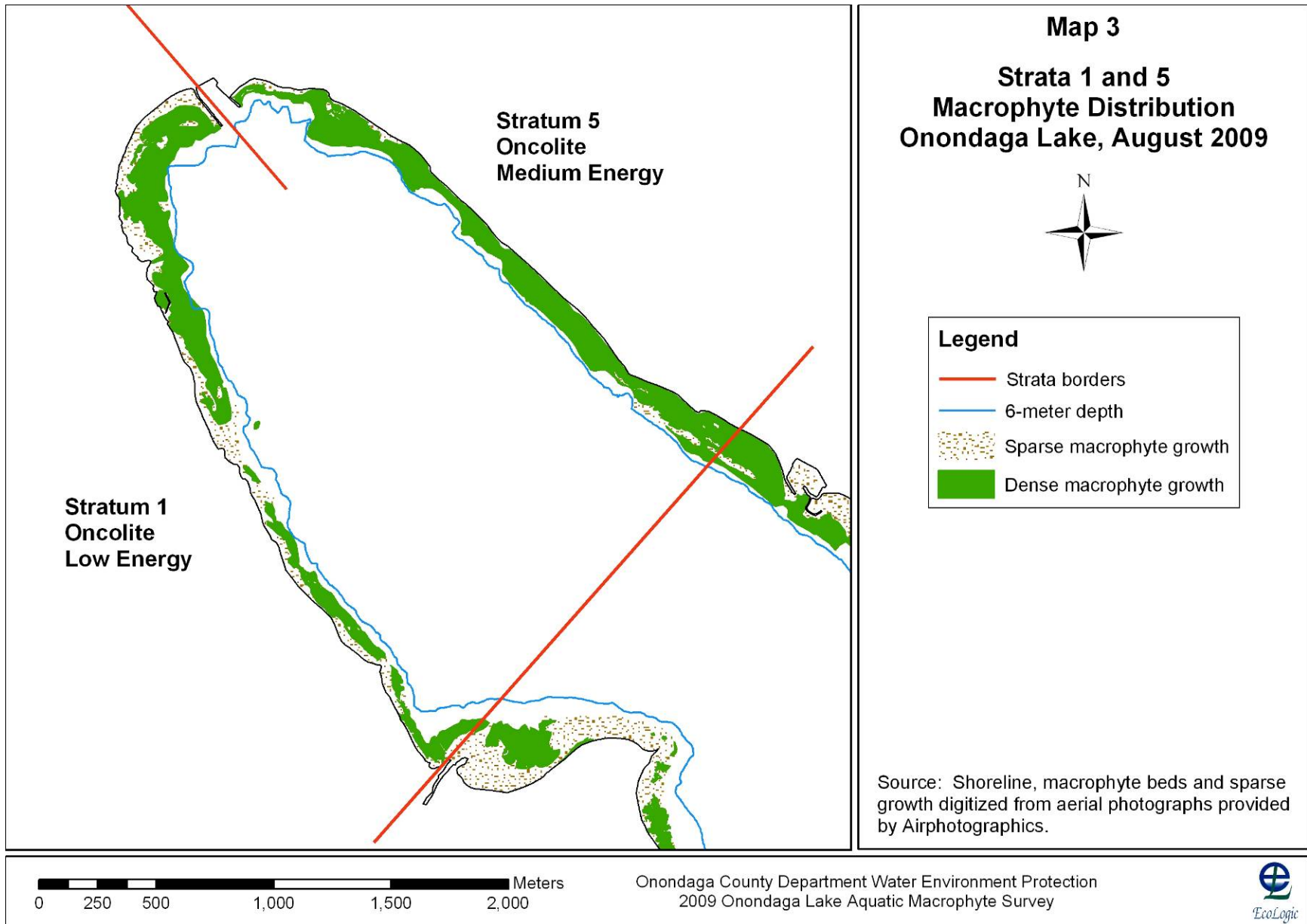
Estimated macrophyte area: 382 acres

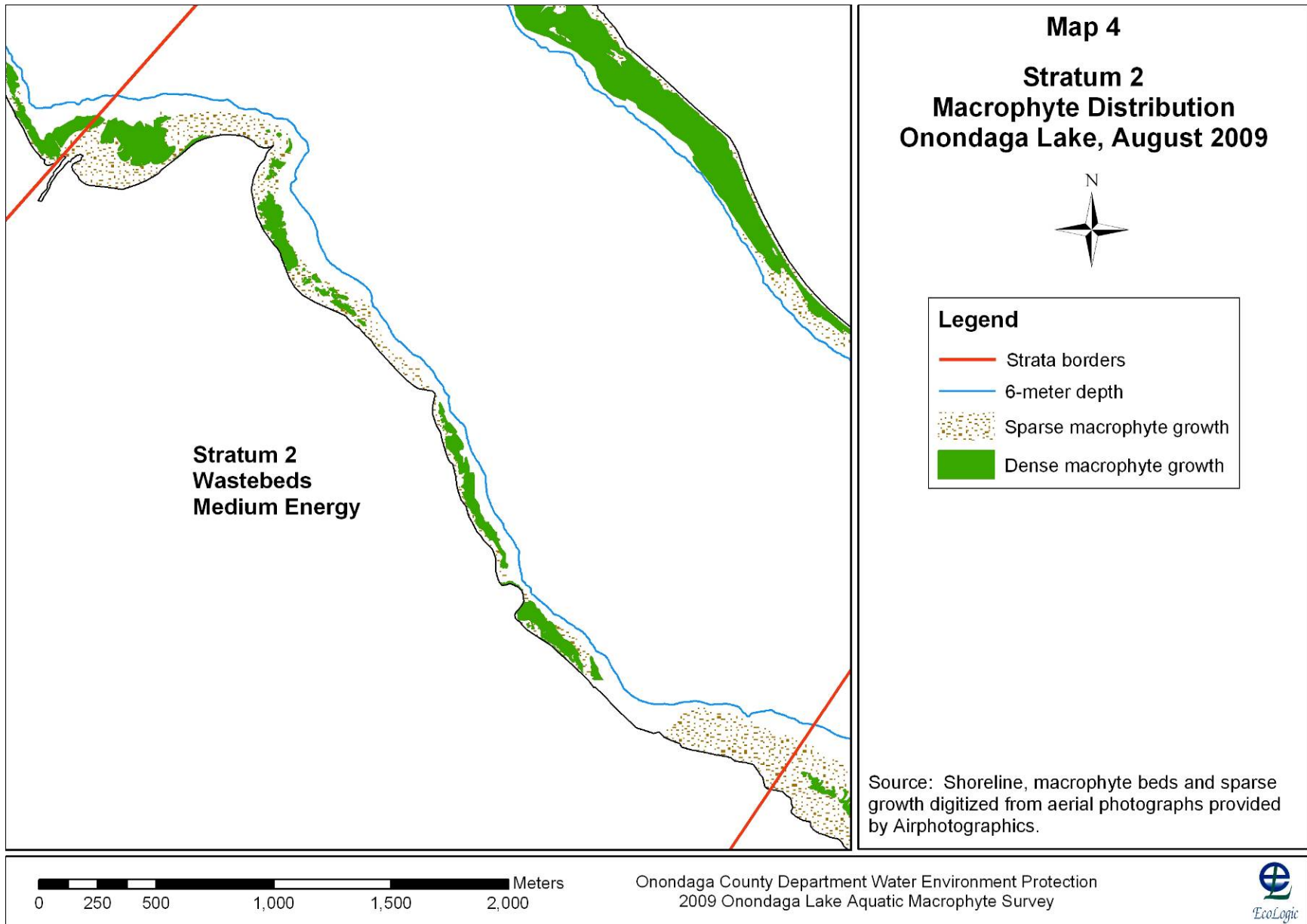
Source: Shoreline, macrophyte beds and sparse growth digitized from aerial photographs provided by Airphotographics.

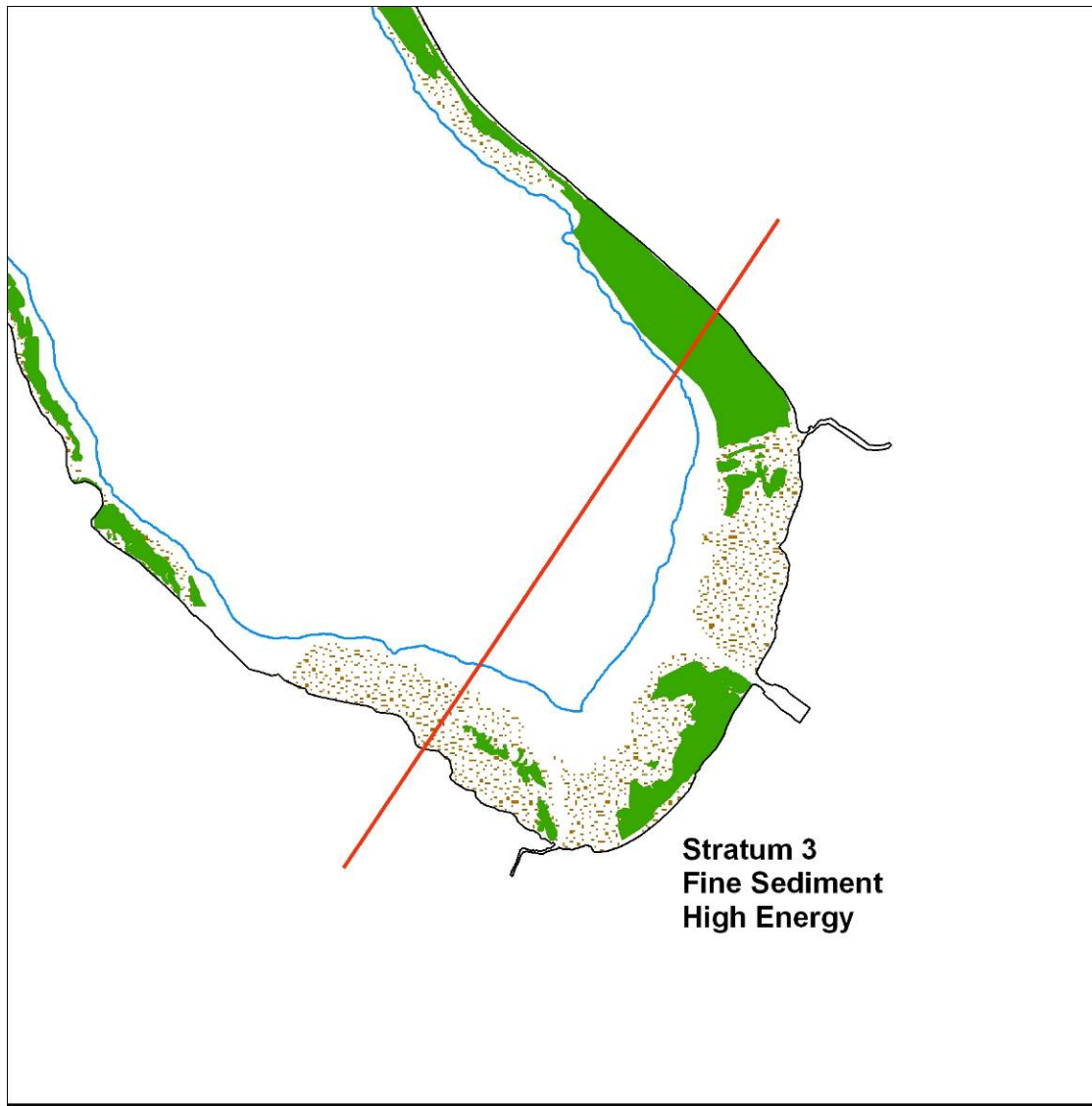


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 2009 Onondaga Lake Aquatic Macrophyte Survey













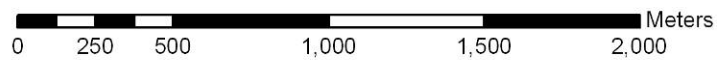
Map 5
Stratum 3
Macrophyte Distribution
Onondaga Lake, August 2009



Legend

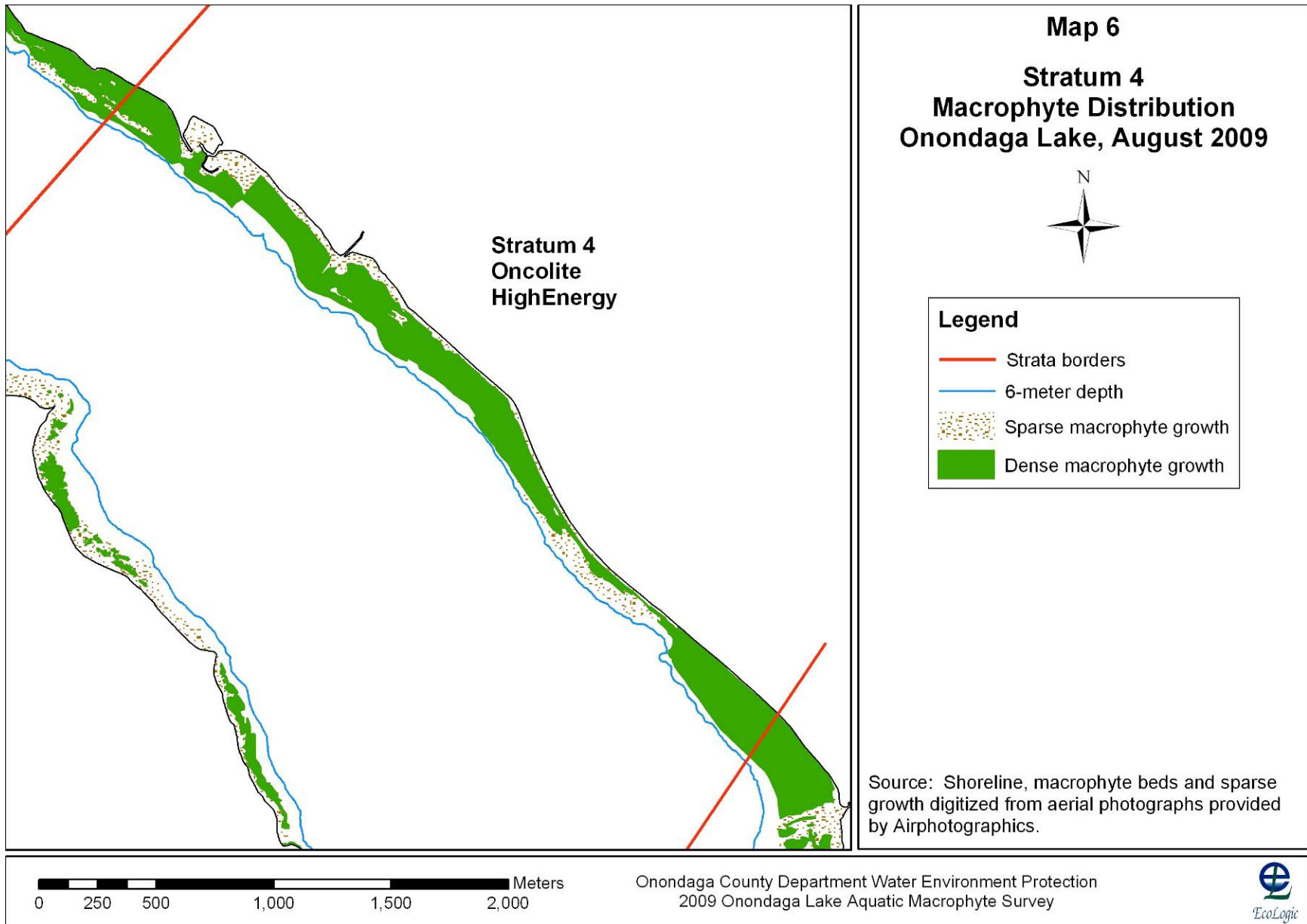
-  Strata borders
-  6-meter depth
-  Sparse macrophyte growth
-  Dense macrophyte growth

Source: Shoreline, macrophyte beds and sparse growth digitized from aerial photographs provided by Airphotographics.



Onondaga County Department Water Environment Protection
 2009 Onondaga Lake Aquatic Macrophyte Survey

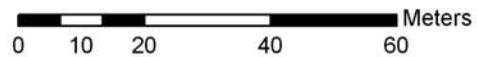
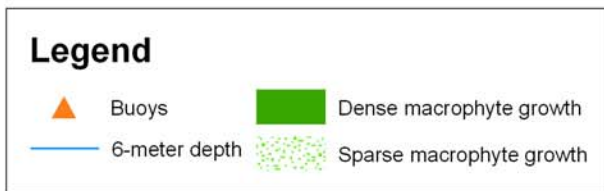




Map 7

Ground Truth Buoy Site 1

August 2009, Onondaga Lake



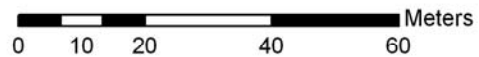
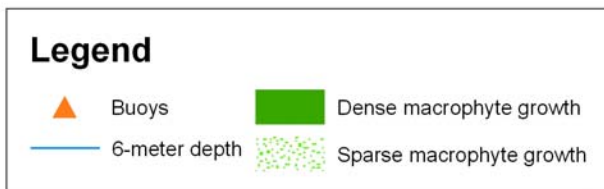
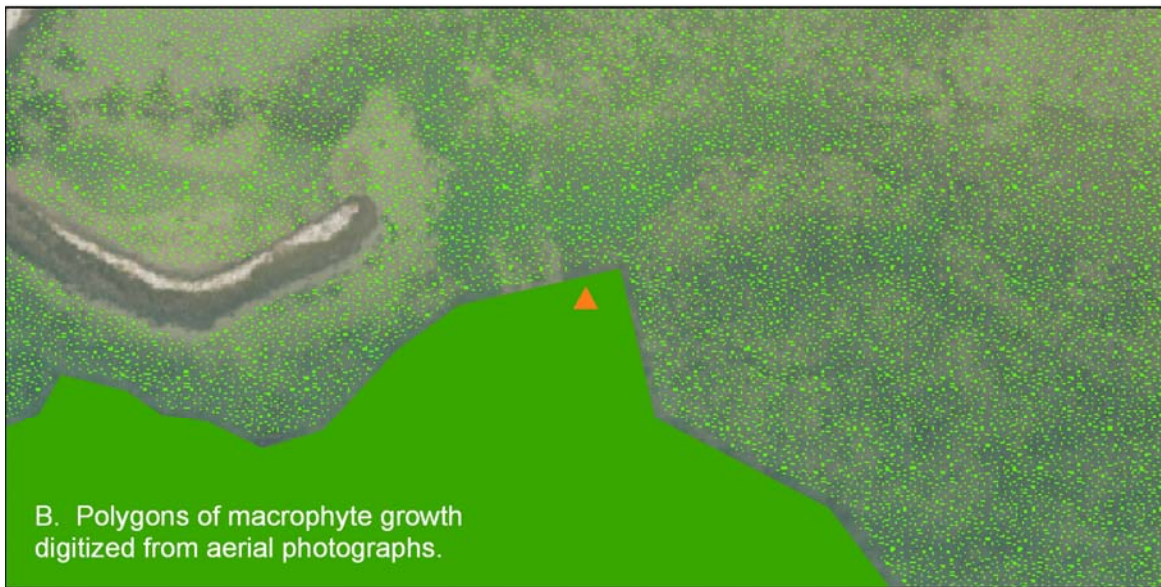
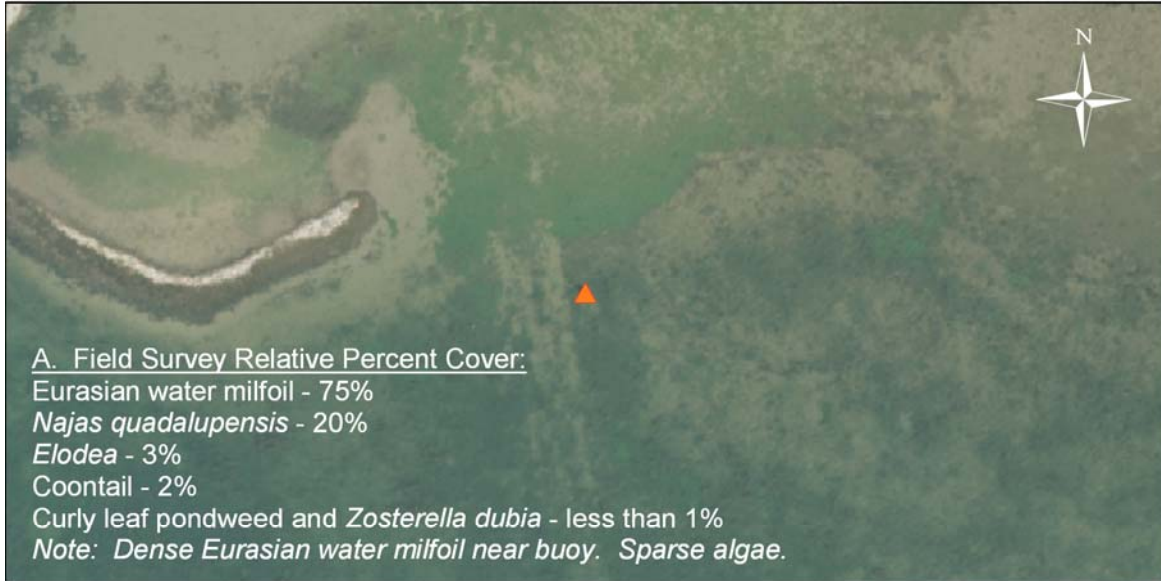
Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



Map 8

Ground Truth Buoy Site 2

August 2009, Onondaga Lake



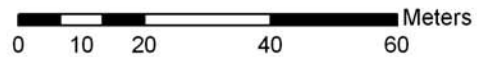
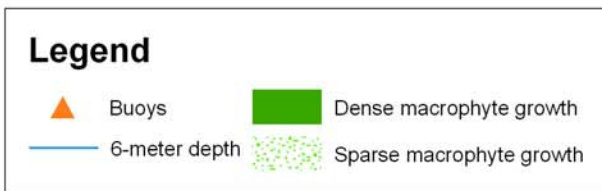
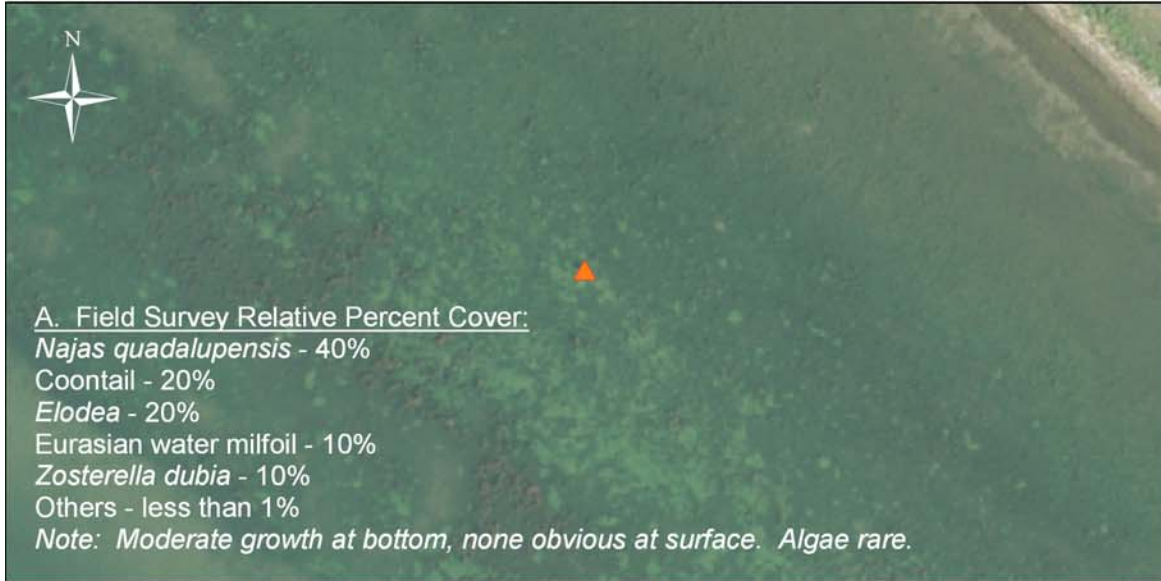
Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



Map 9

Ground Truth Buoy Site 3

August 2009, Onondaga Lake



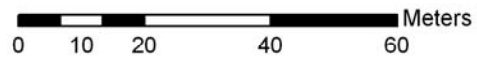
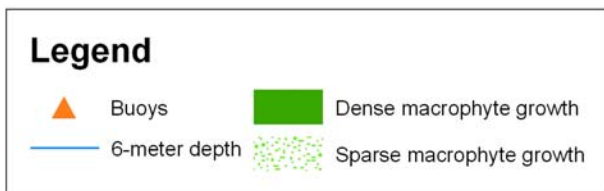
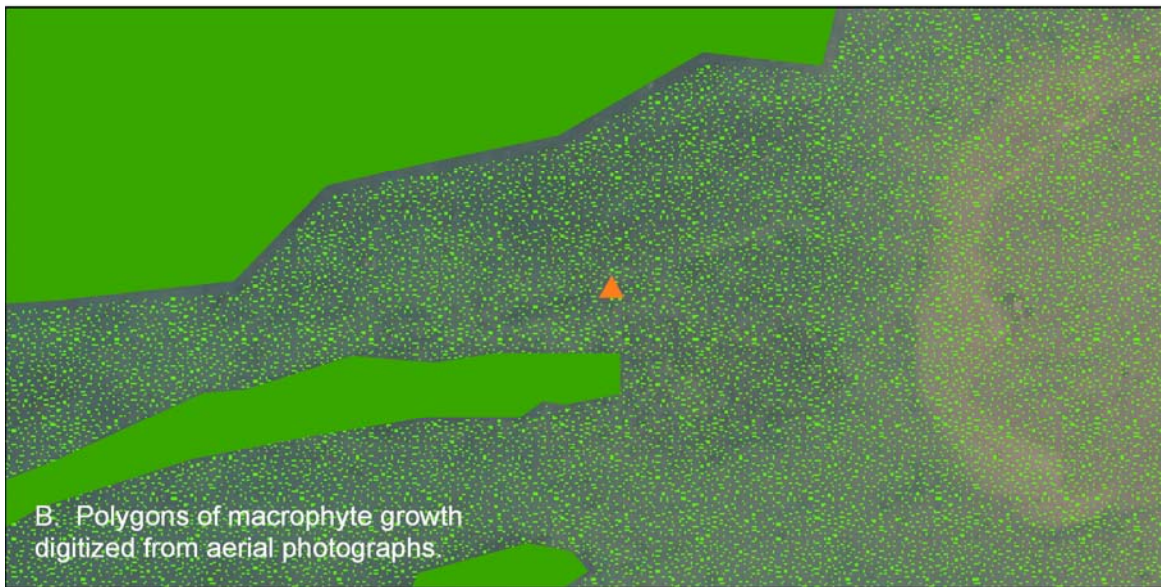
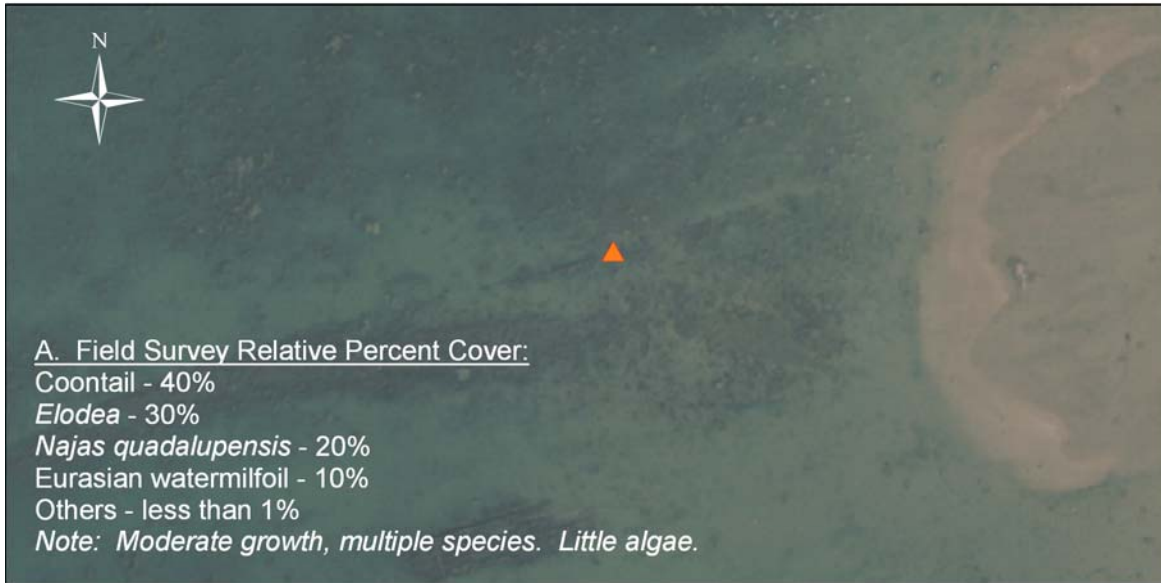
Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



Map 10

Ground Truth Buoy Site 4

August 2009, Onondaga Lake



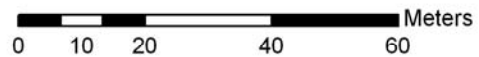
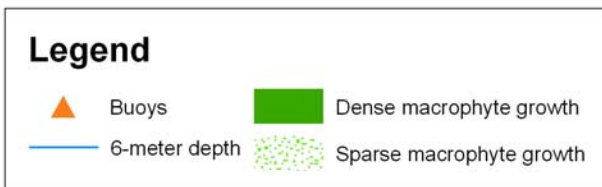
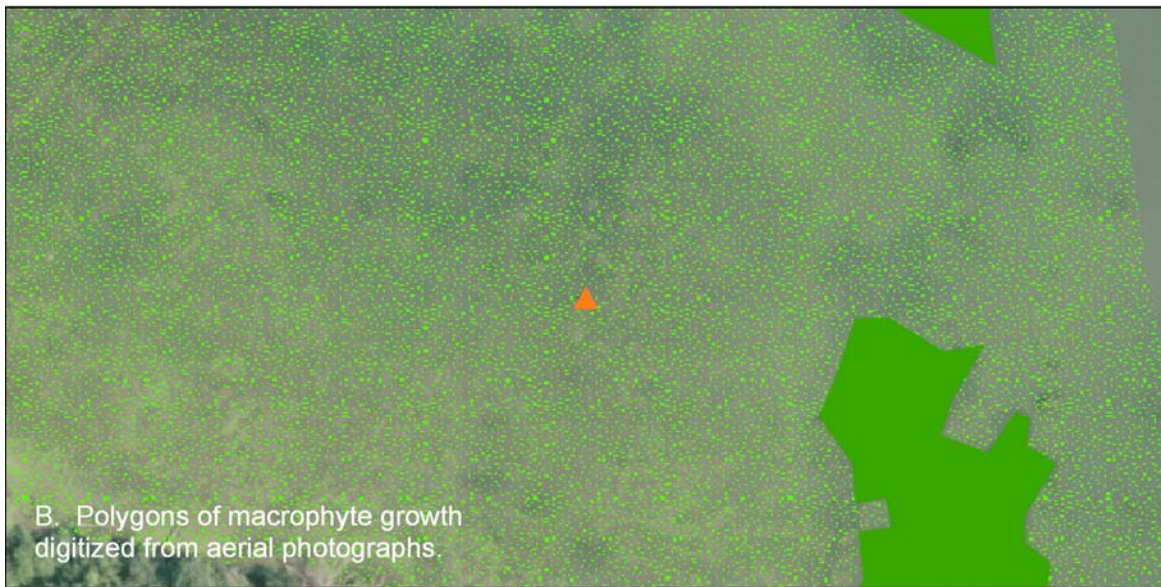
Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



Map 11

Ground Truth Buoy Site 5

August 2009, Onondaga Lake



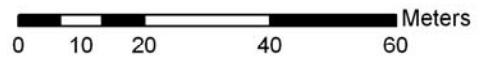
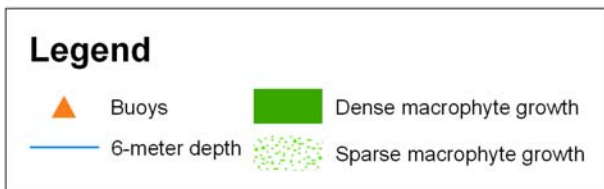
Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



Map 12

Ground Truth Buoy Site 6

August 2009, Onondaga Lake



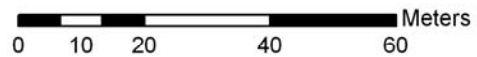
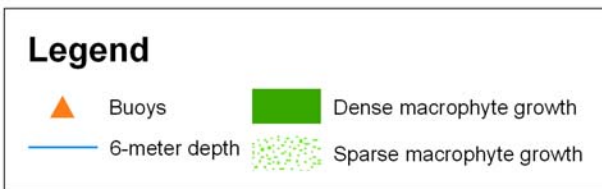
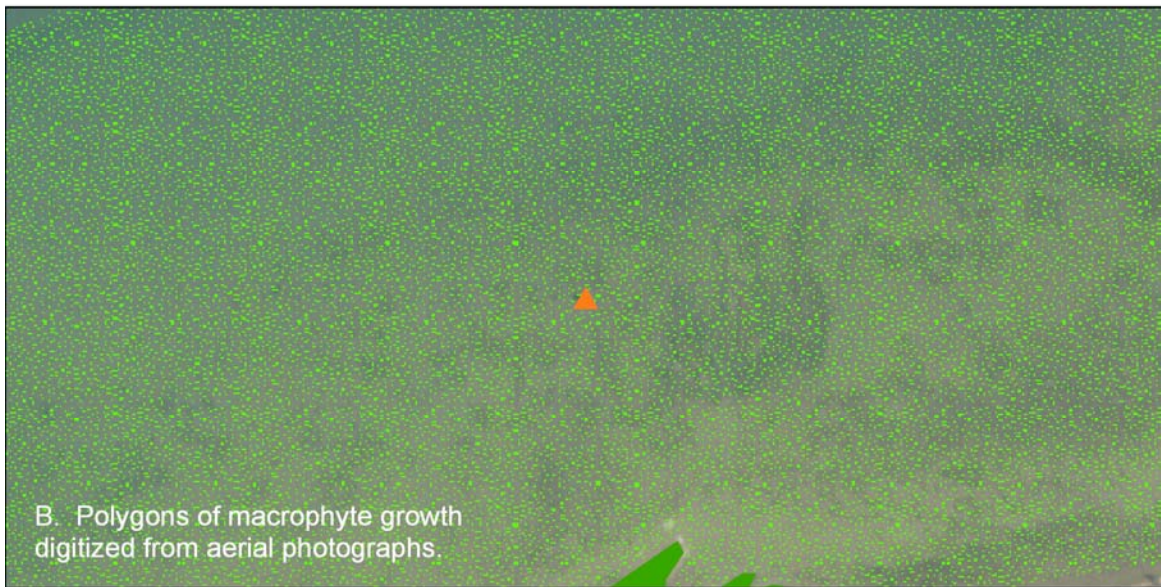
Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



Map 13

Ground Truth Buoy Site 7

August 2009, Onondaga Lake



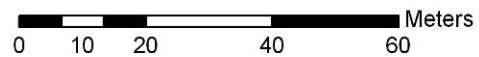
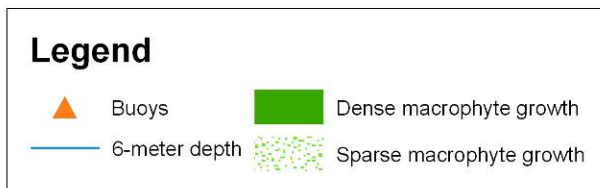
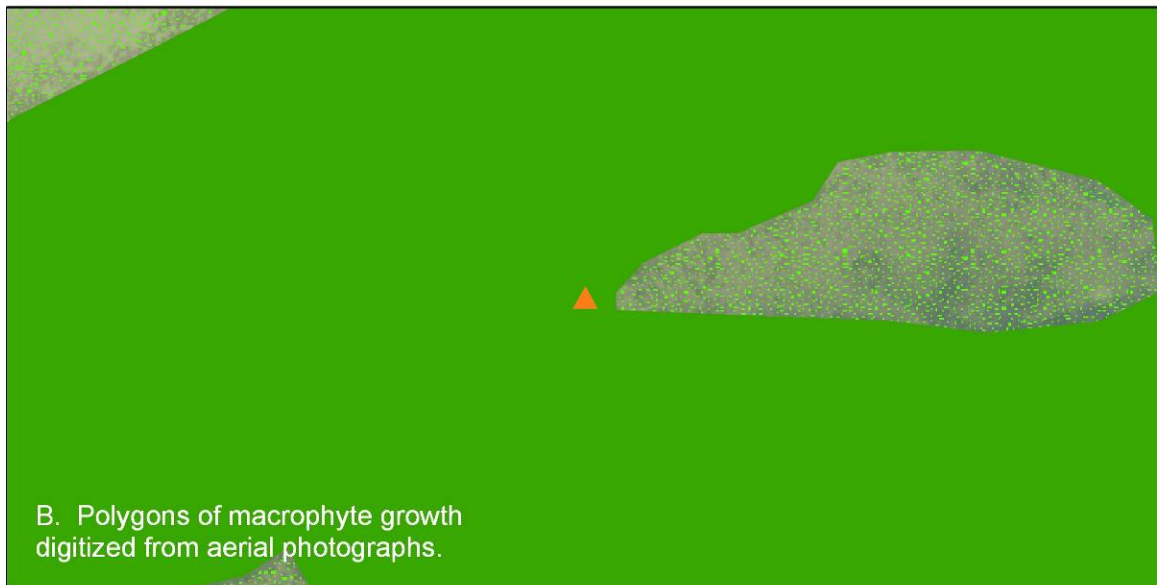
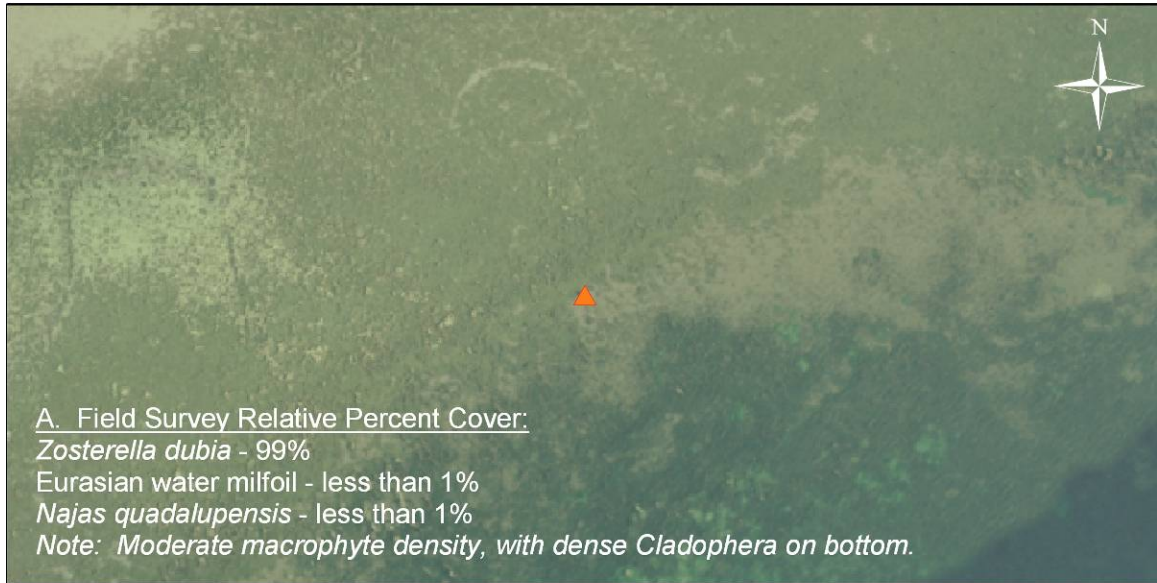
Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



Map 14

Ground Truth Buoy Site 8

August 2009, Onondaga Lake



Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.

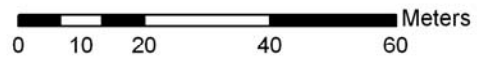
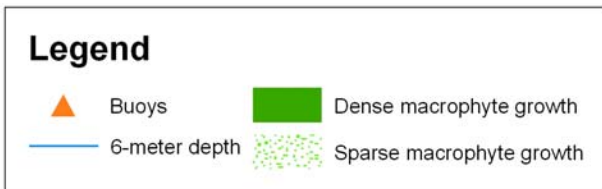
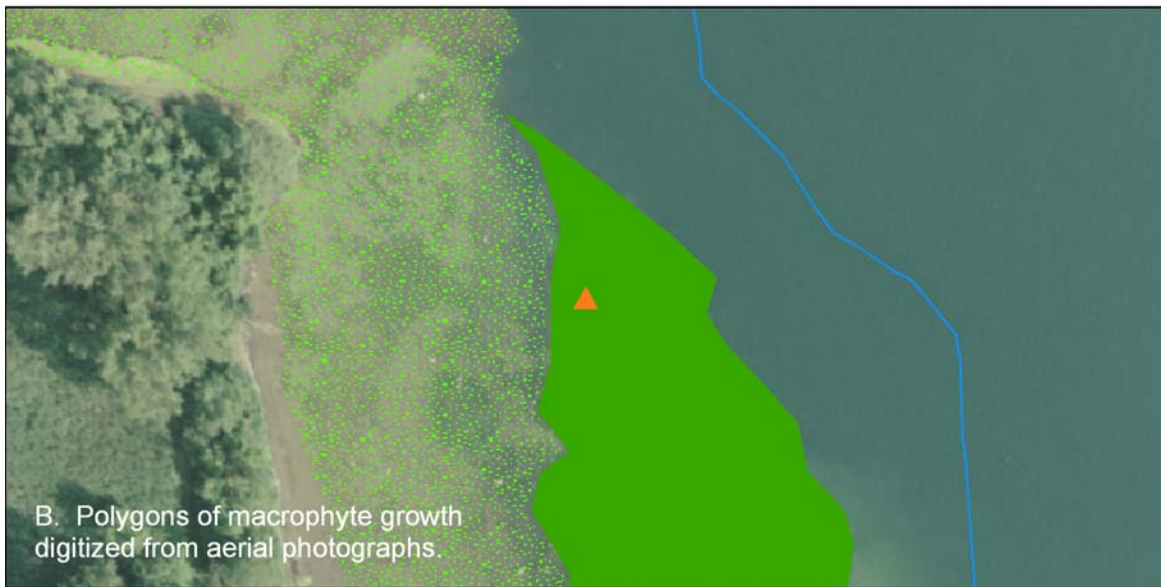


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Map 15

Ground Truth Buoy Site 9

August 2009, Onondaga Lake



Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.

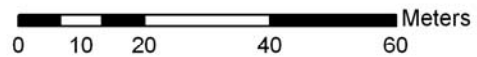
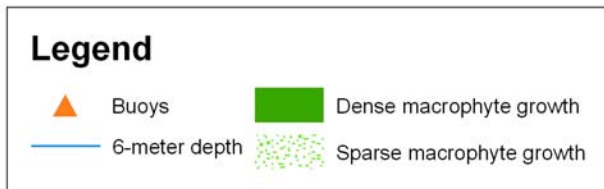
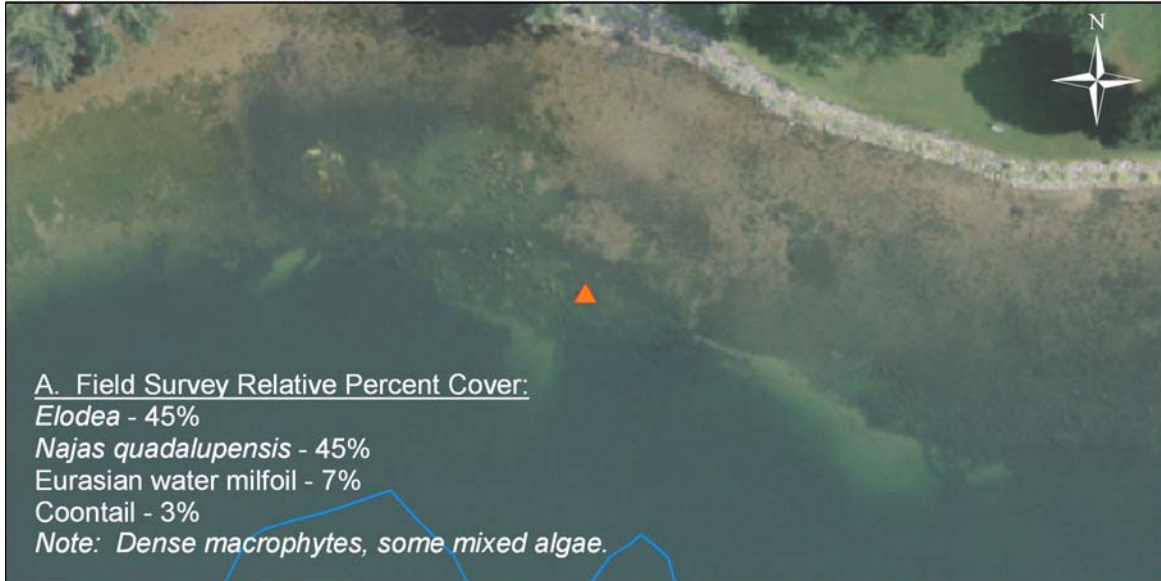


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Map 16

Ground Truth Buoy Site 10

August 2009, Onondaga Lake



Source: Buoy locations and macrophyte polygons digitized from aerial photographs provided by Airphotographics.



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