AQUATIC PLANT SURVEY METHODS

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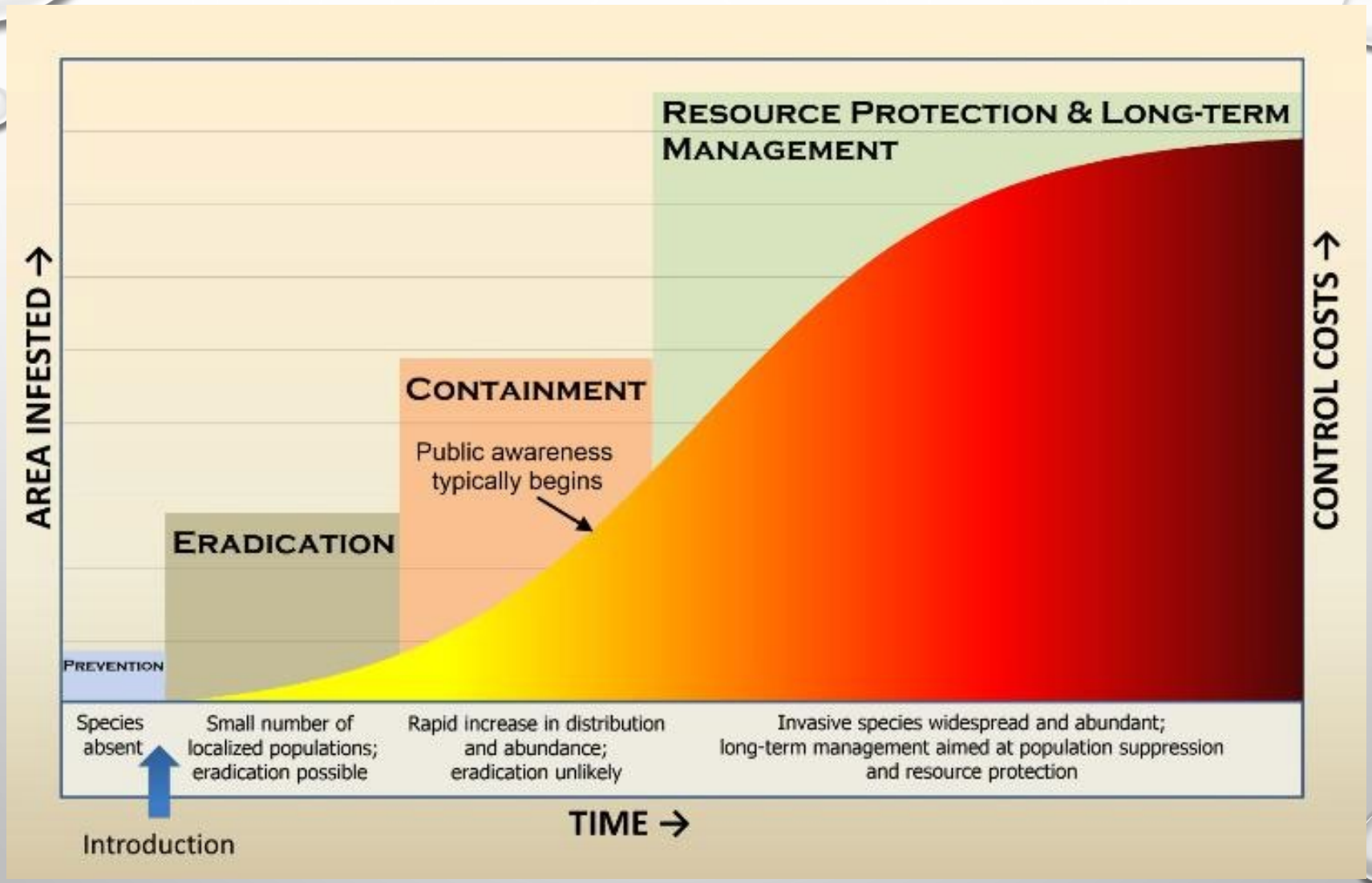
WHY CONDUCT A PLANT SURVEY?

- **CHECK STATUS OF GENERAL LAKE ECOSYSTEM HEALTH**
  - PRESENCE/ABSENCE INVASIVE SPECIES
  - INCREASED DIVERSITY INDICATES HEALTHY SYSTEM
- **TRACK CHANGES IN PLANT COMMUNITY**
- **PRESENCE OF RTE SPECIES**
- **PERMIT REQUIREMENTS**
  - I.E. NYSDEC PRIORITY WATERBODY LIST
- **PRE AQUATIC PLANT MANAGEMENT**
  - DETERMINE BEST METHOD
- **POST AQUATIC PLANT MANAGEMENT**
  - EFFICACY OF METHODS EMPLOYED

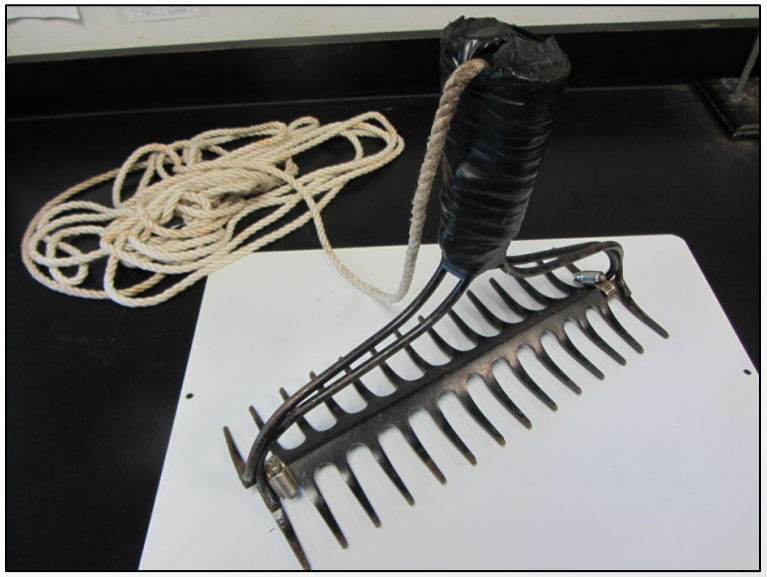

RESOURCE PROTECTION & LONG-TERM MANAGEMENT
CONTAINMENT
Public awareness typically begins
ERADICATION
PREVENTION
AREA INFESTED →
CONTROL COSTS →
Species absent
Small number of localized populations; eradication possible
Rapid increase in distribution and abundance; eradication unlikely
Invasive species widespread and abundant; long-term management aimed at population suppression and resource protection
Introduction
TIME →

TYPES OF AQUATIC PLANT SURVEYS

- **VISUAL SURVEYS**
  - COMMONLY USED, EASY TO PERFORM
  - DIFFICULT TO QUANTIFY RESULTS/REPEAT
- **BIOMASS SAMPLING**
  - 1-METER QUADRANT
- **TRANSECT SAMPLING**
- **REMOTE SENSING**
- **POINT INTERCEPT METHOD**
  - DEVELOPED BY ACOE (TECHNICAL NOTE MI-02: 1999)

"Adaptive Monitoring"

POINT INTERCEPT AQUATIC PLANT SURVEY (PIM)

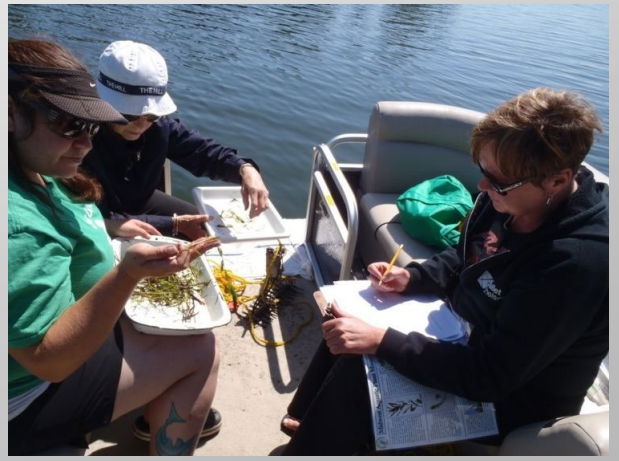


- **DEVELOPED BY ACOE**
  - MODIFIED BY CORNELL UNIVERSITY
  - TWEAKED BY BIOLOGISTS (CD/EM)
- **ACCEPTED METHODOLOGY BY REGULATORS/MANAGERS**
  - RECOMMEND ONE SURVEY LOCATION/HECTARE
  - I PREFER 1+ LOCATION PER LITTORAL ZONE ACRE (~100-125/DAY)
- **ASSIGN PLANT MASS DENSITIES**
  - NO PLANTS, TRACE, SPARSE, MEDIUM, DENSE
  - ASSIGNED TO OVERALL SUBMERSED PLANTS
    - THEN ASSIGNED TO EACH DIFFERENT PLANT SPECIES

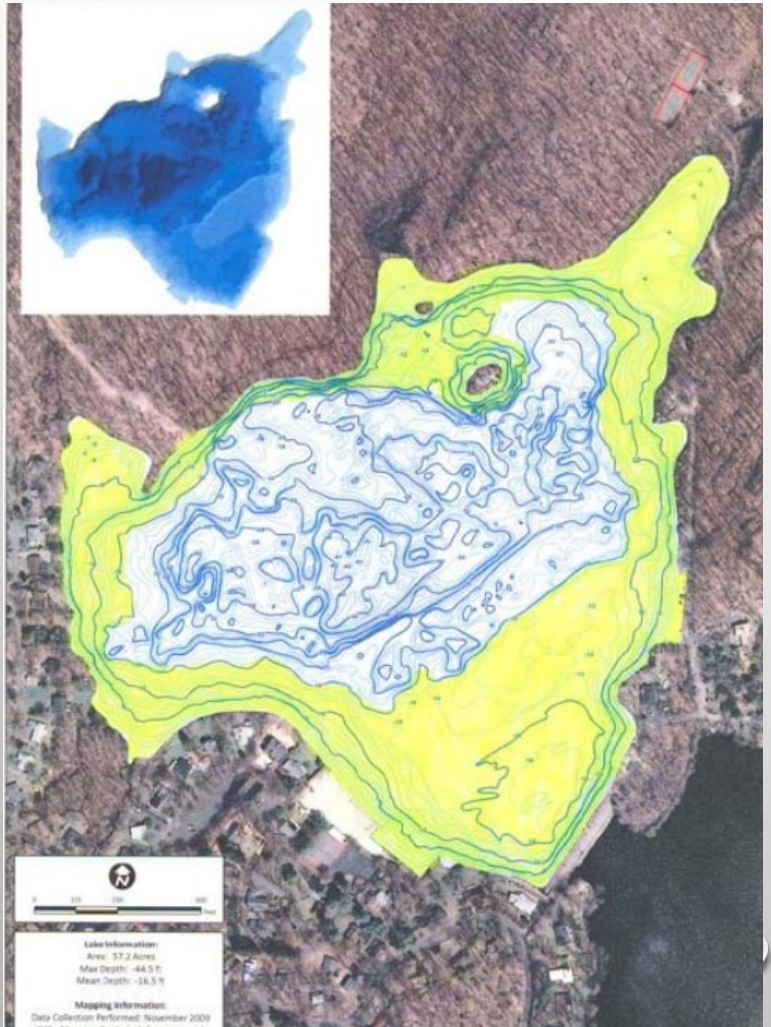
Abundance	Abundance #	Dry Weight (g/m^2)	Mean Weight ($g/m^{2)}$)	Description
No Plants (“0”)	0	0.0	0.0	Bare Rake
Trace (“T”)	1	~0.0001-0.9999	0.5	Finger-full
Sparse (“S”)	2	~1.0000-24.9999	13.0	Hand-full
Medium (“M”)	3	~25.0000-99.9999	62.5	Covers Rake
Dense (“D”)	4	~100.0000-400.0000+	250.0	Difficult to get plant mass into the boat

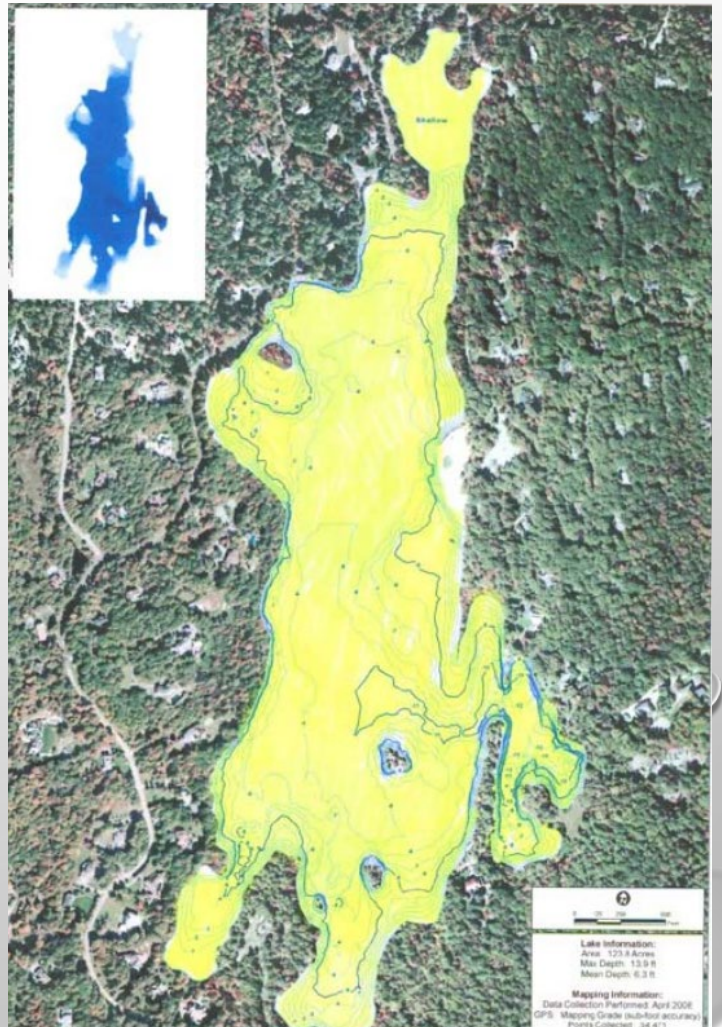
ADVANTAGES OF PIM PLANT MAPPING

- **STANDARD METHOD**
  - IMPORTANT PART OF MULTI-YEAR SAV CONTROL PROJECTS
- **REPEATABLE**
  - SUITABLE TO TRACK ABUNDANCE AND DISTRIBUTION CHANGES OF SPECIFIC PLANTS OVER TIME
    - PRE AND POST SAV CONTROL EFFICACY
  - SITE COMPARISONS
- **CAN BE CONDUCTED BY VOLUNTEER GROUPS**
  - **LIMITATIONS:** GPS CAPABILITIES AND PLANT ID SKILL



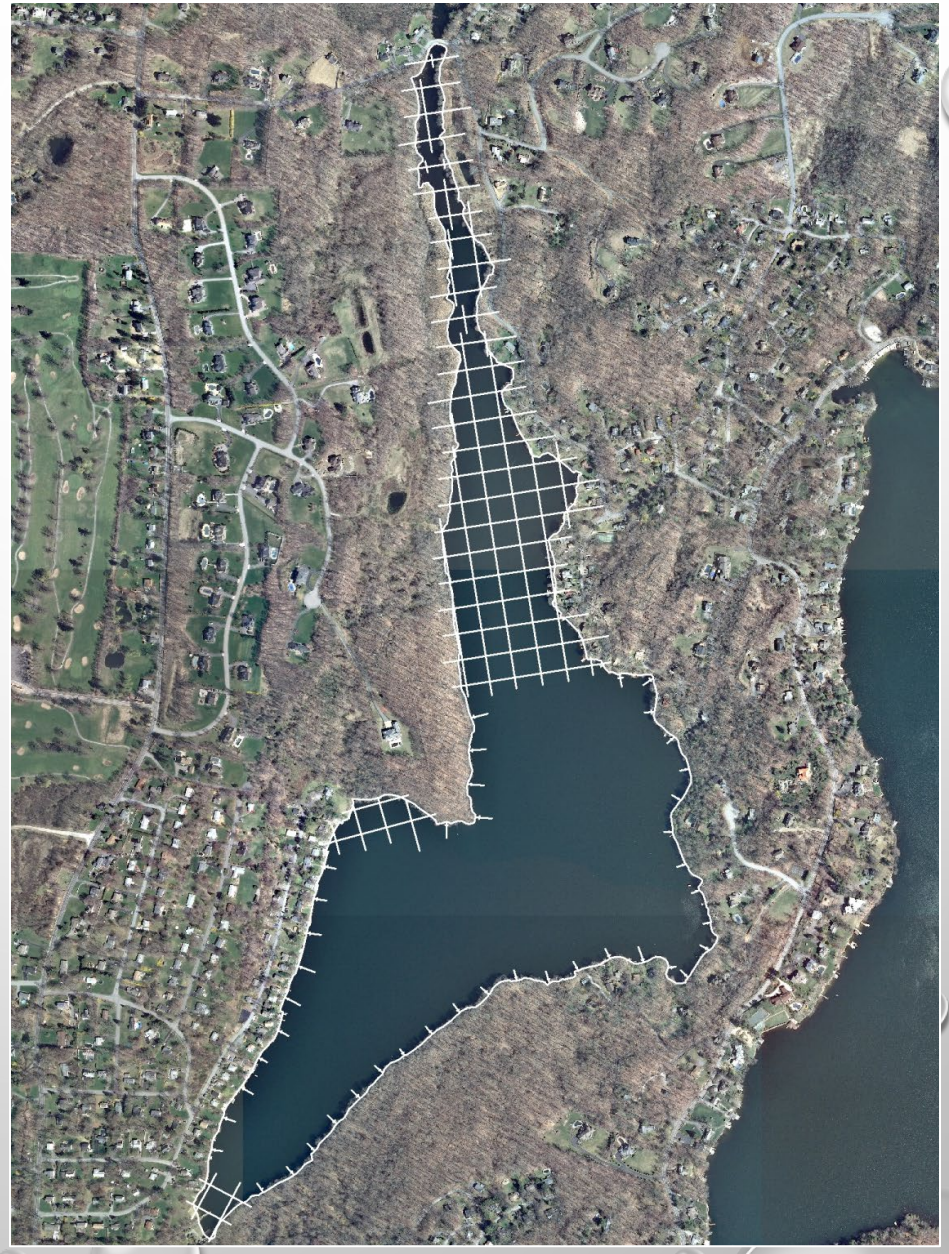
DETERMINE LITTORAL ZONE





Overlay Grid on the Littoral Zone

- **50-meter Grid**
  - Project Specific (Hydrilla)
  - Smaller = more sampling
  - Larger = less sampling
- **# of Weed Rake Tosses**
  - One, Two or Three
  - More Tosses = ↑ more Target or RTE species
  - But…..
    - ↑ more effort
    - ↓ overall abundance



MULTIPLE RAKE TOSS CALCULATIONS

- ASSIGN AN ABUNDANCE NUMBER TO EACH DENSITY
- NO PLANTS =0, TRACE=1, SPARSE=2, MEDIUM=3, DENSE=4
- TO DETERMINE THE PLANT DENSITY AT A GIVEN SITE, SUM AND CALCULATE THE MEAN OF THE ABUNDANCE NUMBERS
- EXAMPLES:

Rake Toss	Abundance	Abundance #
1	D	4
2	S	2
3	D	4
Mean	M	3.33

Rake Toss	Abundance	Abundance #
1	D	4
2	T	1
3	T	1
Mean	S	2.0

DATA MANAGEMENT

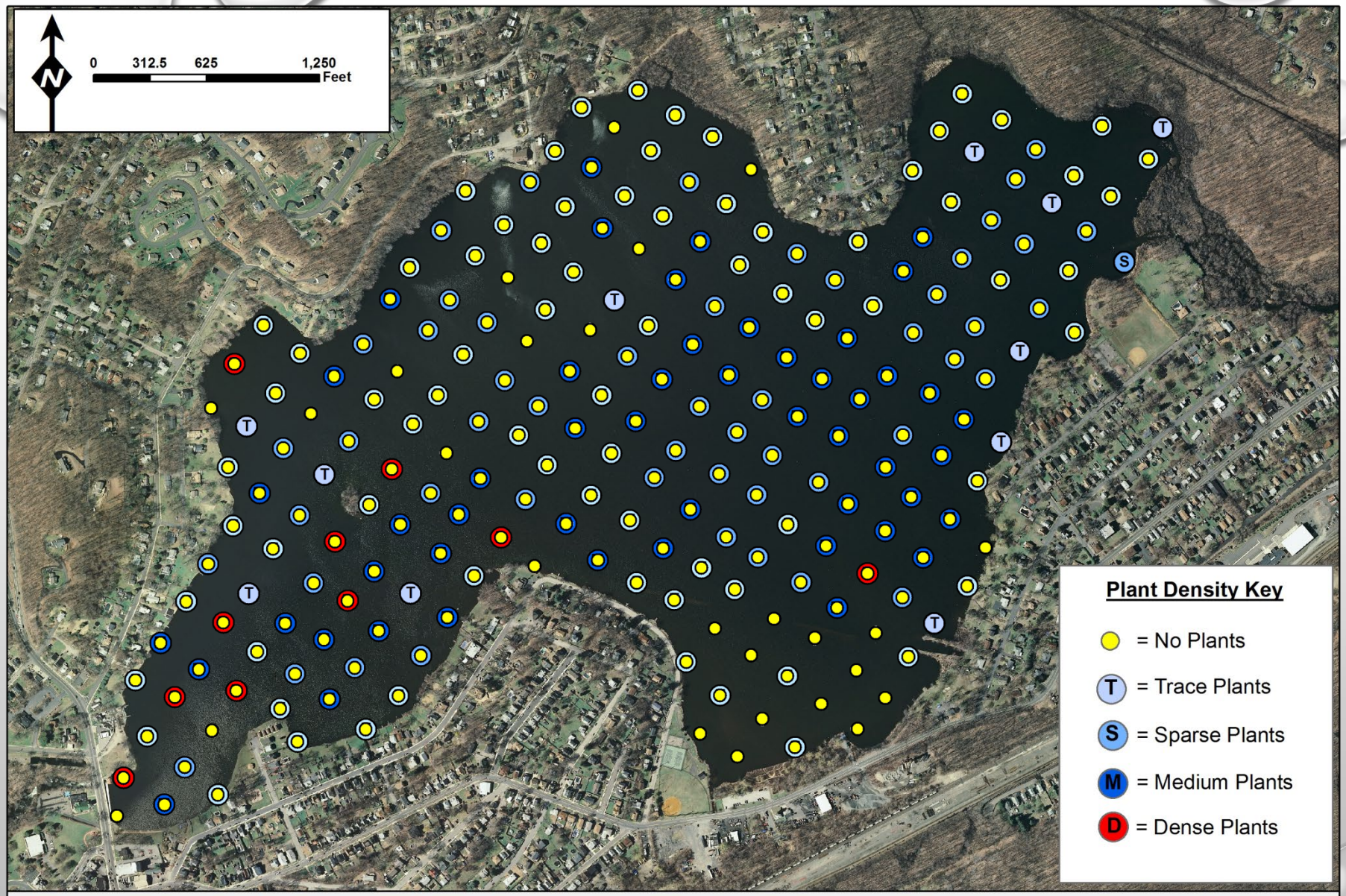
- **QA/QC AND DEFINING CODES**
- **OVERALL ABUNDANCE & DISTRIBUTION**
- **OCCURRENCE AT SITES**
- **HOW TO QUANTIFY YOUR DATA?**
  - **FQI (FLORISTIC QUALITY INDEX)** CONSERVATION VALUE (VARIES BASED ON STATE)
  - **SHANNON DIVERSITY MODEL** - NUMBER OF SPECIES LIVING IN A HABITAT (RICHNESS) AND THEIR RELATIVE ABUNDANCE (EVENNESS)

Sample Point	Sample	Latitude (NAD83)	Longitude (NAD83)	Depth (feet)	Overall Abundance	Arrowhead Rosette	Benthic Filamentous Algae	Brittle Naiad	Common Bladderwort	Common Waterweed	Coontail
1	A										
1	B										
1	M	40.36539°	-74.94594°	7							
2	A										
2	B										
2	M	40.36497°	-74.94578°	7							
3	A										
3	B				S					S	
3	M	40.36453°	-74.94558°	4.5	T					T	
4	A										
4	B				M					M	
4	M	40.36408°	-74.94538°	5.5	S					S	

Frequency of Occurrence Table

Aquatic Macrophyte Abundance Distribution
September 22, 2015

Aquatic Macrophytes	Total		Trace		Sparse		Medium		Dense	
	Sites	%	Sites	%	Sites	%	Sites	%	Sites	%
Total Sites	50	100%								
Overall Plant Abundance	40	80%	8	20%	5	13%	13	33%	14	35%
Small Duckweed	33	66%	19	58%	10	30%	2	6%	2	6%
Brittle Naiad	31	62%	5	16%	9	29%	9	29%	8	26%
Eurasian Water Milfoil	29	58%	13	45%	10	34%	5	17%	1	3%
Coontail	18	36%	16	89%	1	6%	1	6%	0	0%
Great Duckweed	16	32%	14	88%	2	13%	0	0%	0	0%
Northern Naiad	16	32%	8	50%	6	38%	2	13%	0	0%
Water Chestnut	15	30%	8	53%	5	33%	1	7%	1	7%
Spatterdock	6	12%	4	67%	2	33%	0	0%	0	0%
Wild Celery	4	8%	3	75%	1	25%	0	0%	0	0%
Water Stargrass	4	8%	4	100%	0	0%	0	0%	0	0%
Benthic Filamentous Algae	3	6%	2	67%	1	33%	0	0%	0	0%
Common Waterweed	2	4%	1	50%	0	0%	1	50%	0	0%



Eurasian Water Milfoil (*Myriophyllum spicatum*) Distribution
Lake Musconetcong Aquatic Vegetation Survey
September 2, 2010

WATERSHED MONITORING

- MONITORING YOUR LOCAL WATERSHED
- MODIFIED SURVEY METHODS (DR CANAL)
- STREAM MONITORING PROGRAM
  - PLANT ID WORKSHOPS
- EDUCATING THE PUBLIC AND VOLUNTEERS

Case Study#1: New Croton Reservoir

1. Aquatic Plant Bio-volume Mapping

- Hydroacoustic mapping
- Assumed Littoral Zone

2. PIM Aquatic Plant Mapping

- Select areas from Phase 1
- Coves and Shorelines

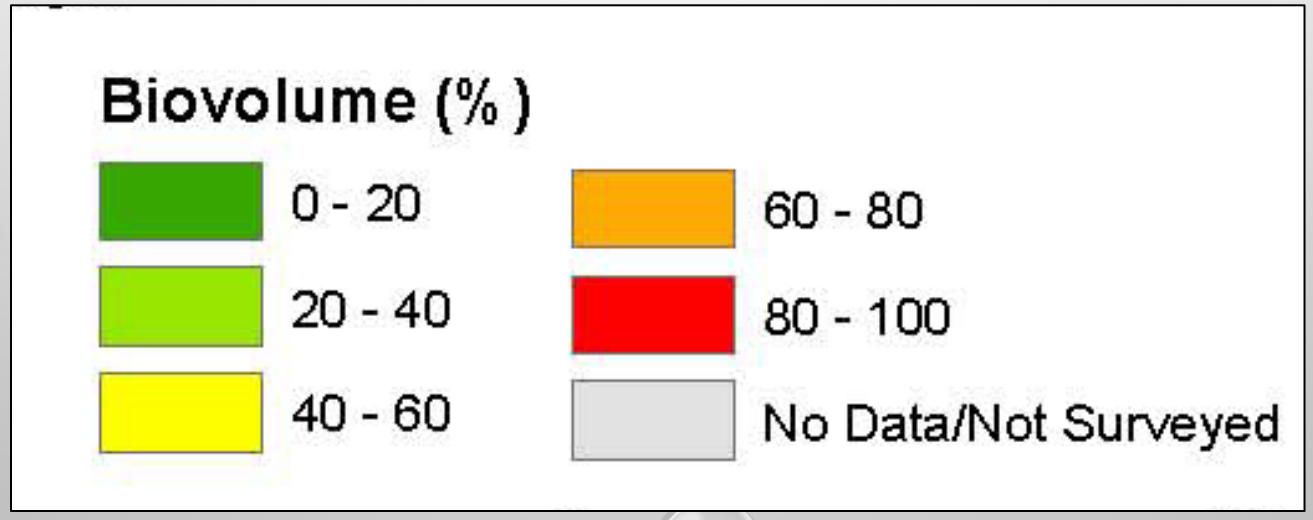
Phase 1: Hydroacoustic Plant Mapping

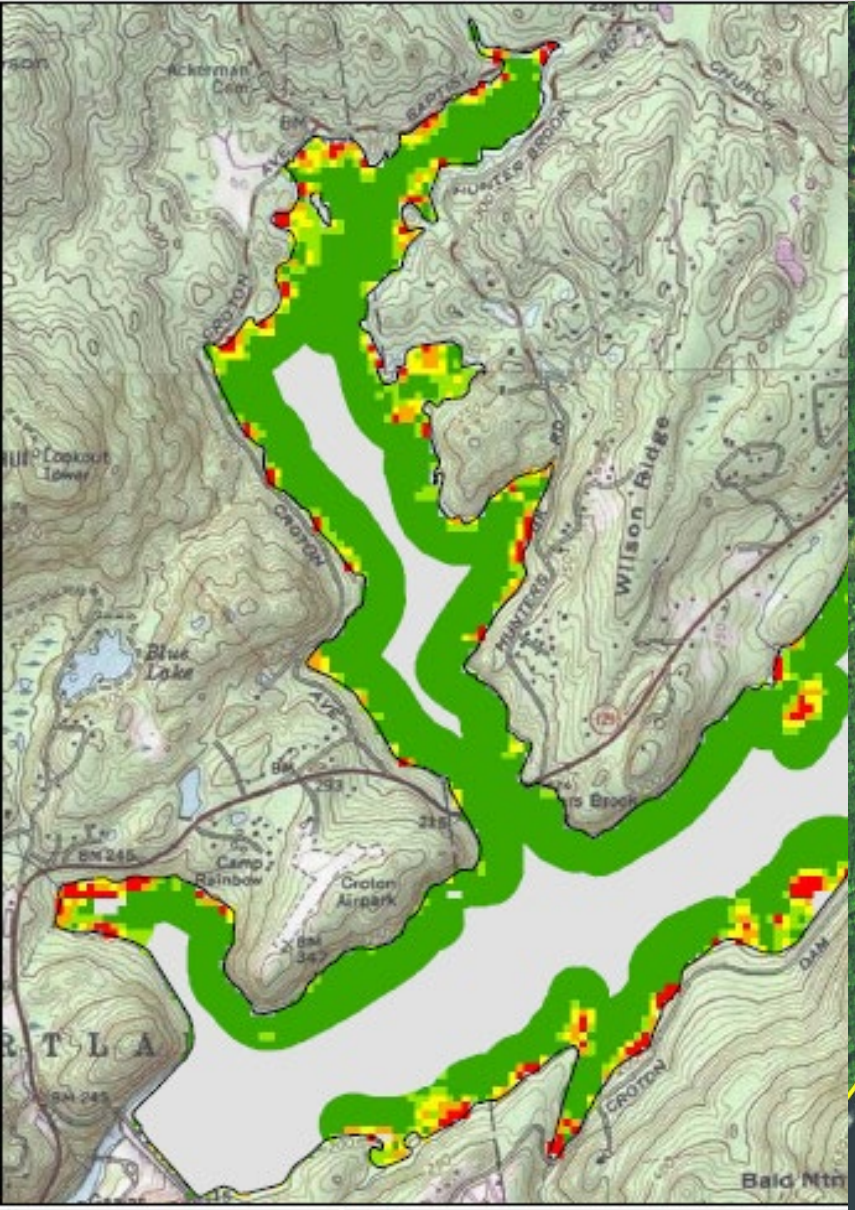
1. **Side Scan Fathometer**
2. **Data Collection**
   - Late August
   - Boat Speed: < 8 mph
   - Shorelines, coves and littoral zone
   - 18 hours on water data collection
   - 20-minute runs (file size)

3. **Data Outputs**
   - Uploaded to Manufacturer Server (QC/Interpolation)
   - Reprocessed with Spatial Analyst
   - ArcMap 10.3
   - Bathymetry and Bio-volume Maps

Submersed Aquatic Plant Bio-volume

1. **% of SAV in Water Column**
   - Ex. Plants at Surface = 100%
   - Ex. Water Depth 10 ft.; Plant Height 5 ft. = 50%
2. **Displayed in a Color Array**
3. **Doesn't Differentiate Species**



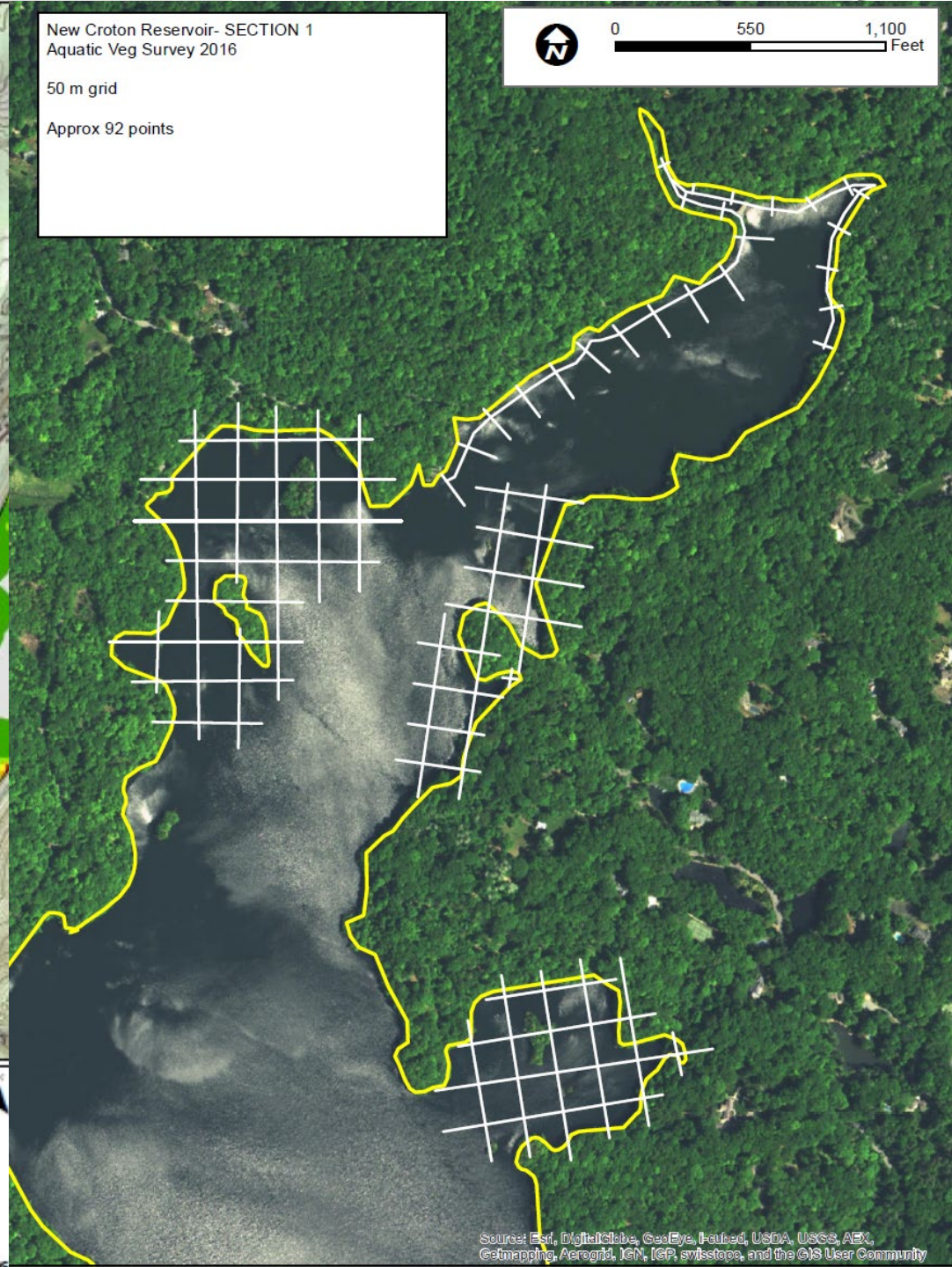


New Croton Reservoir- SECTION 1
Aquatic Veg Survey 2016

50 m grid

Approx 92 points

0 550 1,100 Feet



New Croton Reservoir

Westchester County, NY

Biovolume

FIGURE	SURVEY DATE	MAP DATE
2a	8/30-9/1/16	11/30/16

Legend:

Biovolume (%)

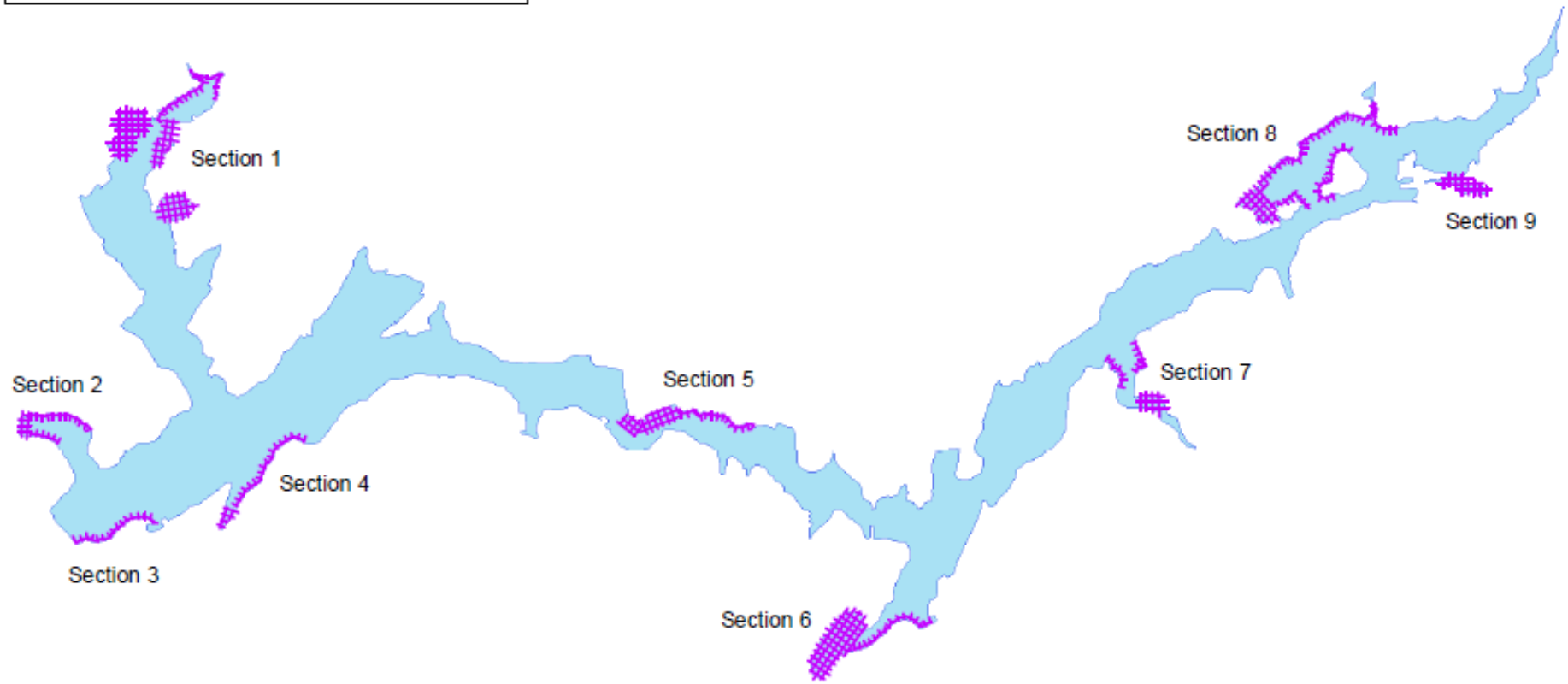
- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100
- No Data/Not Surveyed

0 0.5 Miles

New Croton Reservoir- Overview
Aquatic Veg Survey 2016

Sections 1-9

50 meters grid



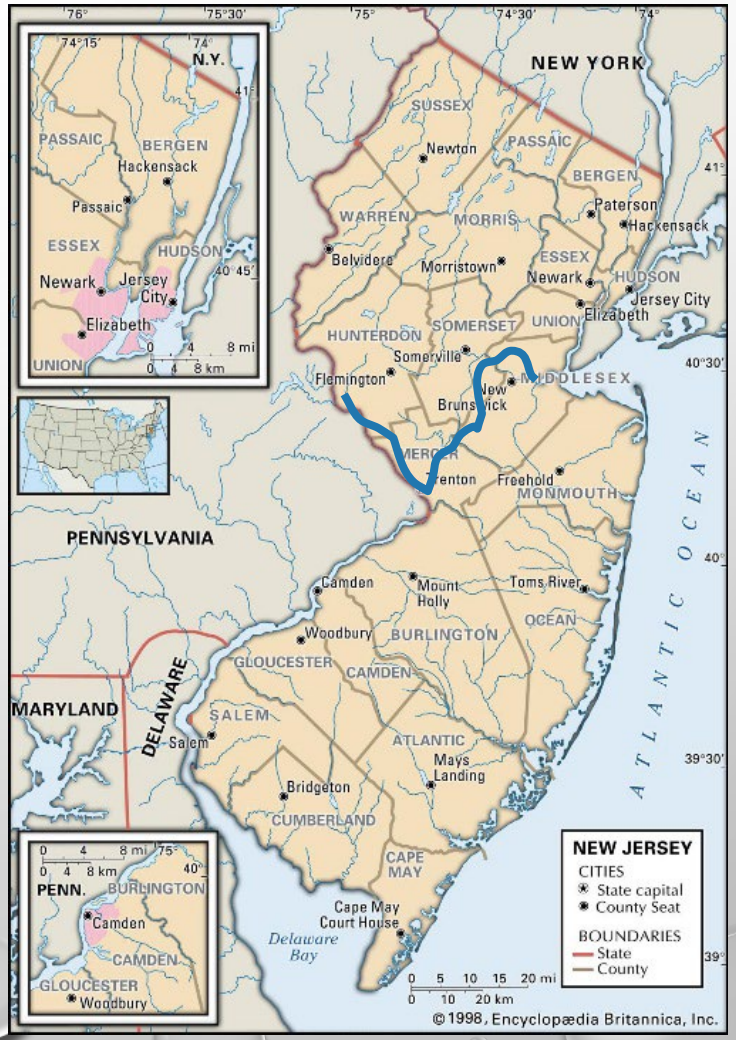
N

0 4,600 9,200 Feet

CASE STUDY #2: D&R CANAL

- DELAWARE AND RARITAN RIVERS
- CONSTRUCTED IN 1830'S
  - MOSTLY HAND DUG
  - ANTHRACITE: PA TO NJ
- LENGTH: 66 MILES
- Primary Goal: Suitable Water Flow
- 2016: Flow Decrease
  - July discovered hydrilla

For more information on the Project:
http://www.njwsa.org/hydrilla.html

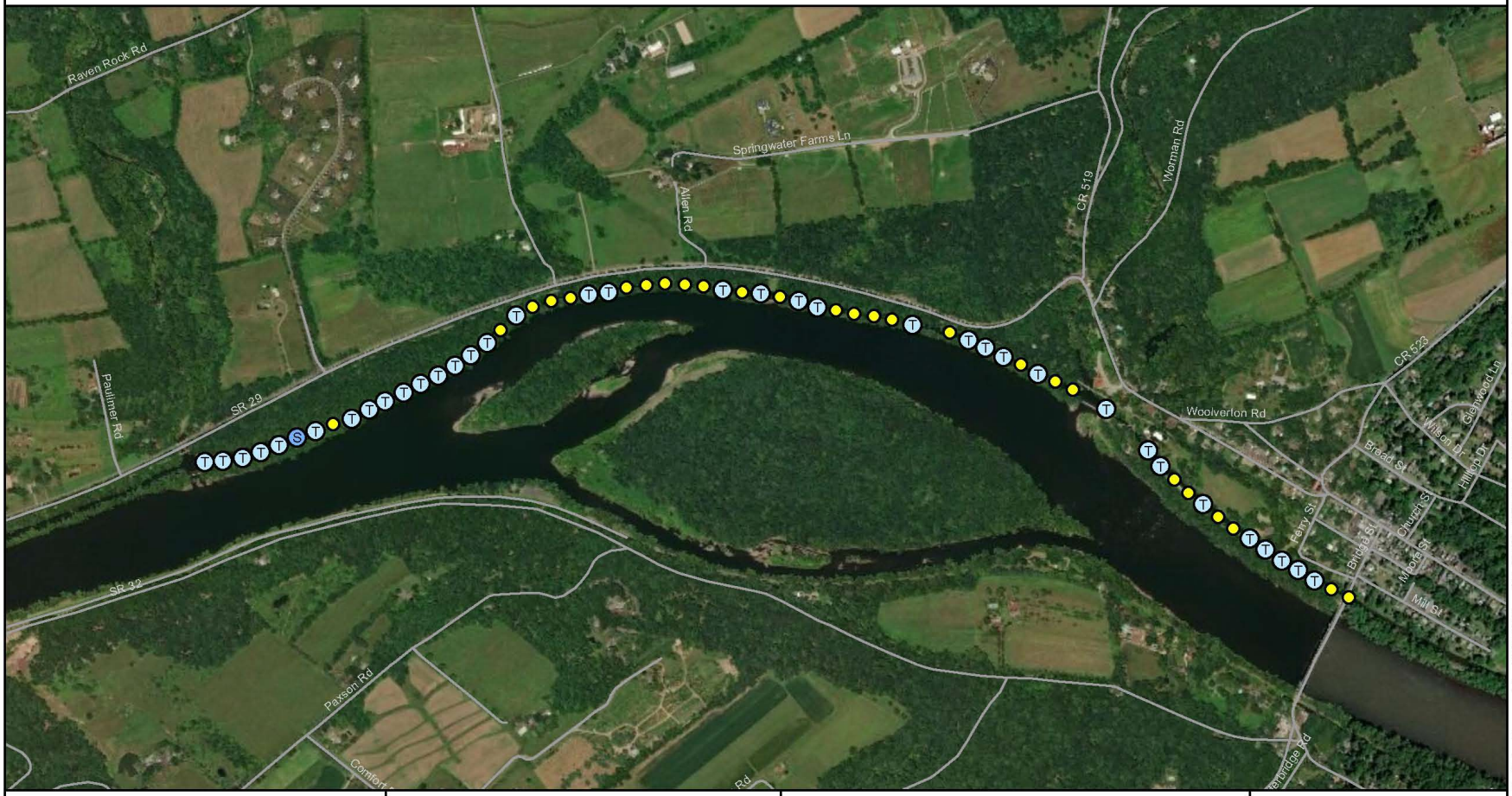



50-75 ft.


A
B

NON-TREATMENT AREA
OVERALL AQUATIC PLANT ABUNDANCE
SEPTEMBER 21, 2018

SŌLITUDE LAKE MANAGEMENT



DELAWARE & RARITAN CANAL
Non-Treatment Area
Aquatic Vegetation Survey
September 21, 2018

Total Sample Sites: 63

Plant Density

- = No Plants
- T = Trace Plants
- S = Sparse Plants
- M = Medium Plants
- D = Dense Plants

Percent Distribution

Abundance	Sites	Percent
Total	37	59%
Trace	36	97%
Sparse	1	3%
Medium	0	0%
Dense	0	0%

N

0 280 560 1,120 Feet

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

THANK YOU!

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