Phragmites Mowing in the Great Marsh

(Northeast Massachusetts Mosquito Control and Wetlands District)

Igniting a large stand of dense *Phragmites australis* in the open marsh of the Newbury portion of the Great Marsh. Opening up the area will allow for access into the Phragmites stand for chemical application to control its growth in its juvenile stage.

Removing Phragmites Biomass

Post burn pilot site showing clear access into the stand for future treatment.

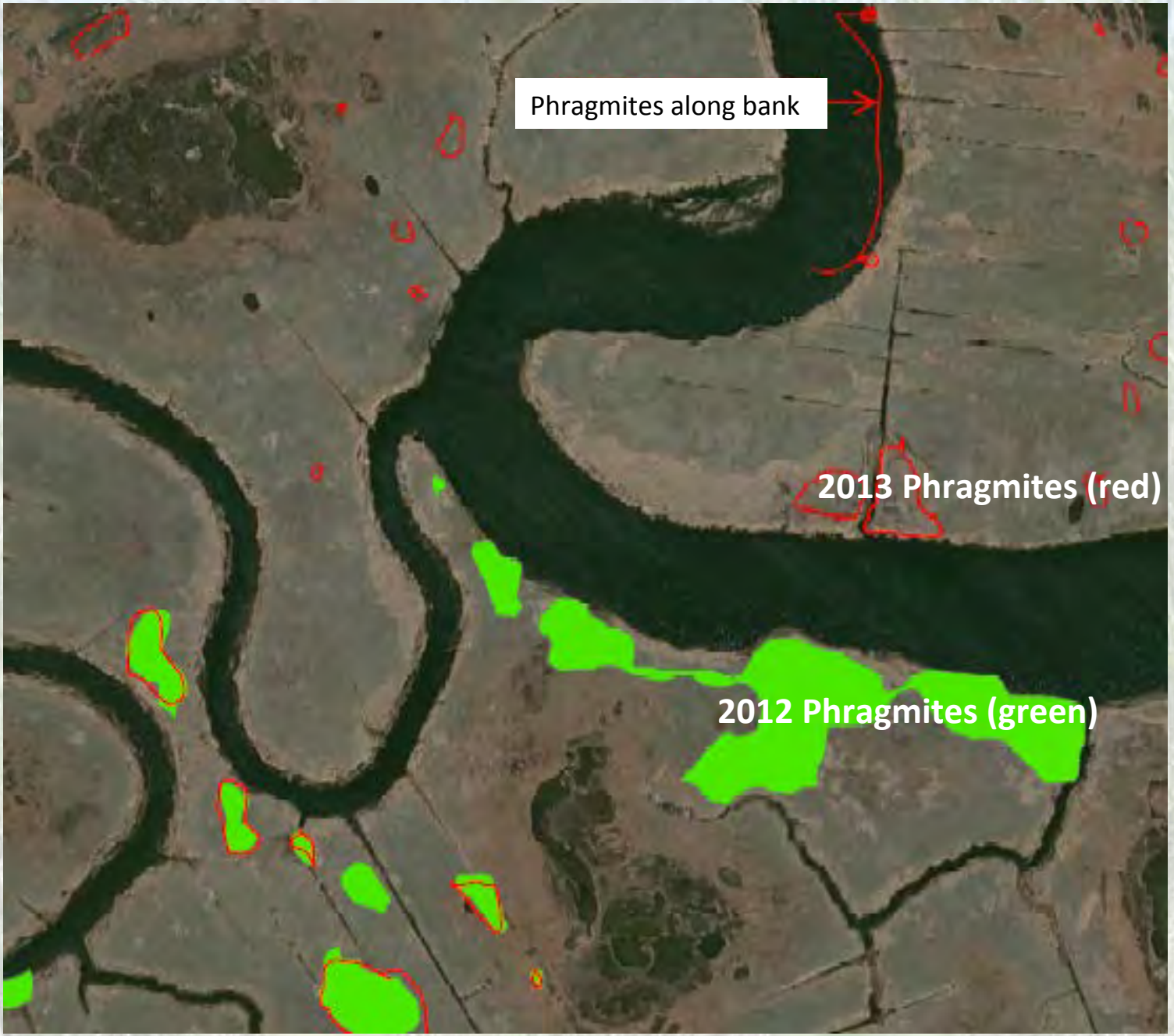
Regrowth from Previous Year Treatments

- Reduction in Stand Size
- Revegetation with Native Plants

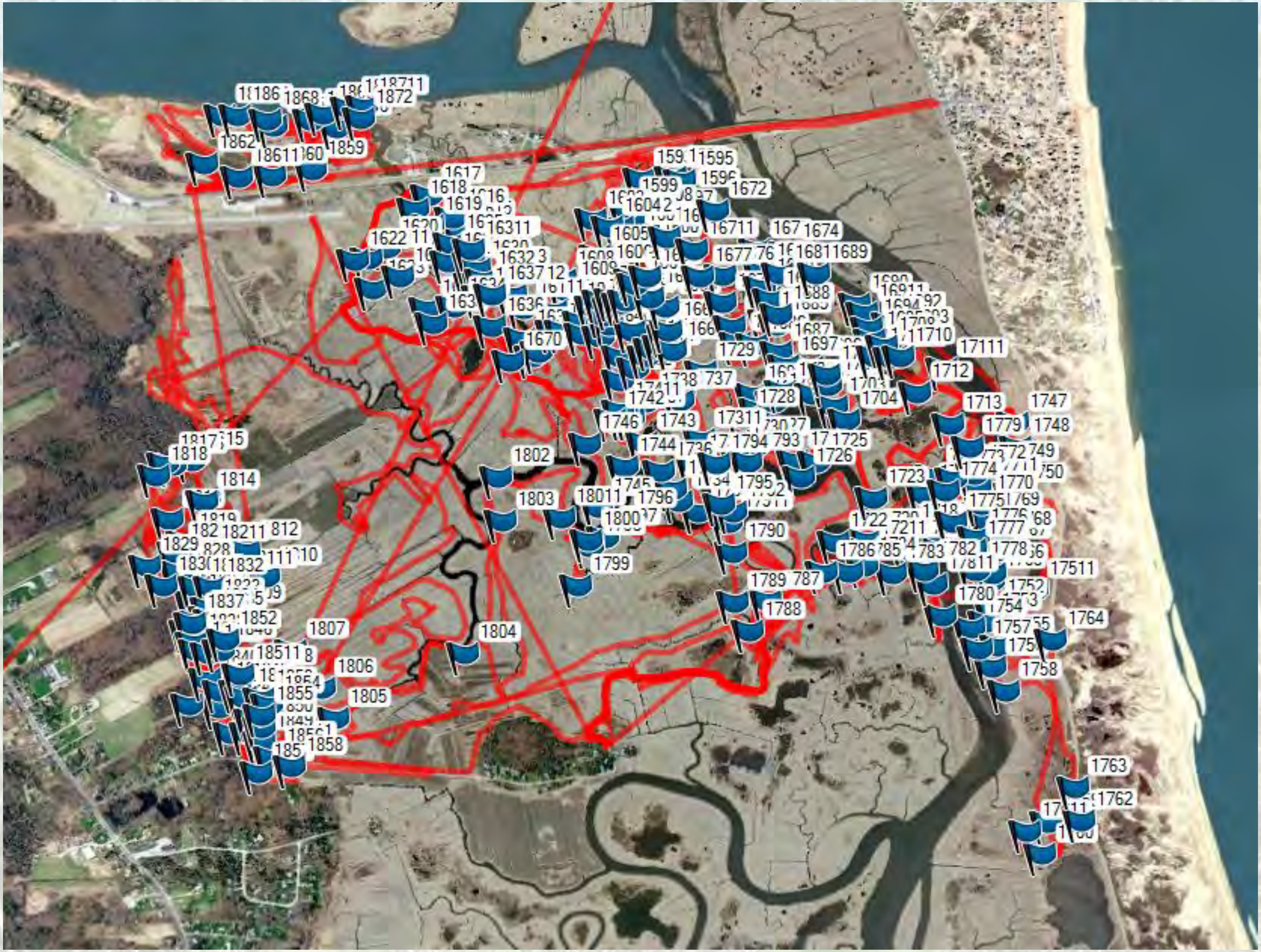

Early season, post-spray


Late season, post-spray


Controled Phragmites stands through 2009
N
W
E
S
Kilometers
0 0.125 0.25 0.5 0.75 1



Edits back in the office

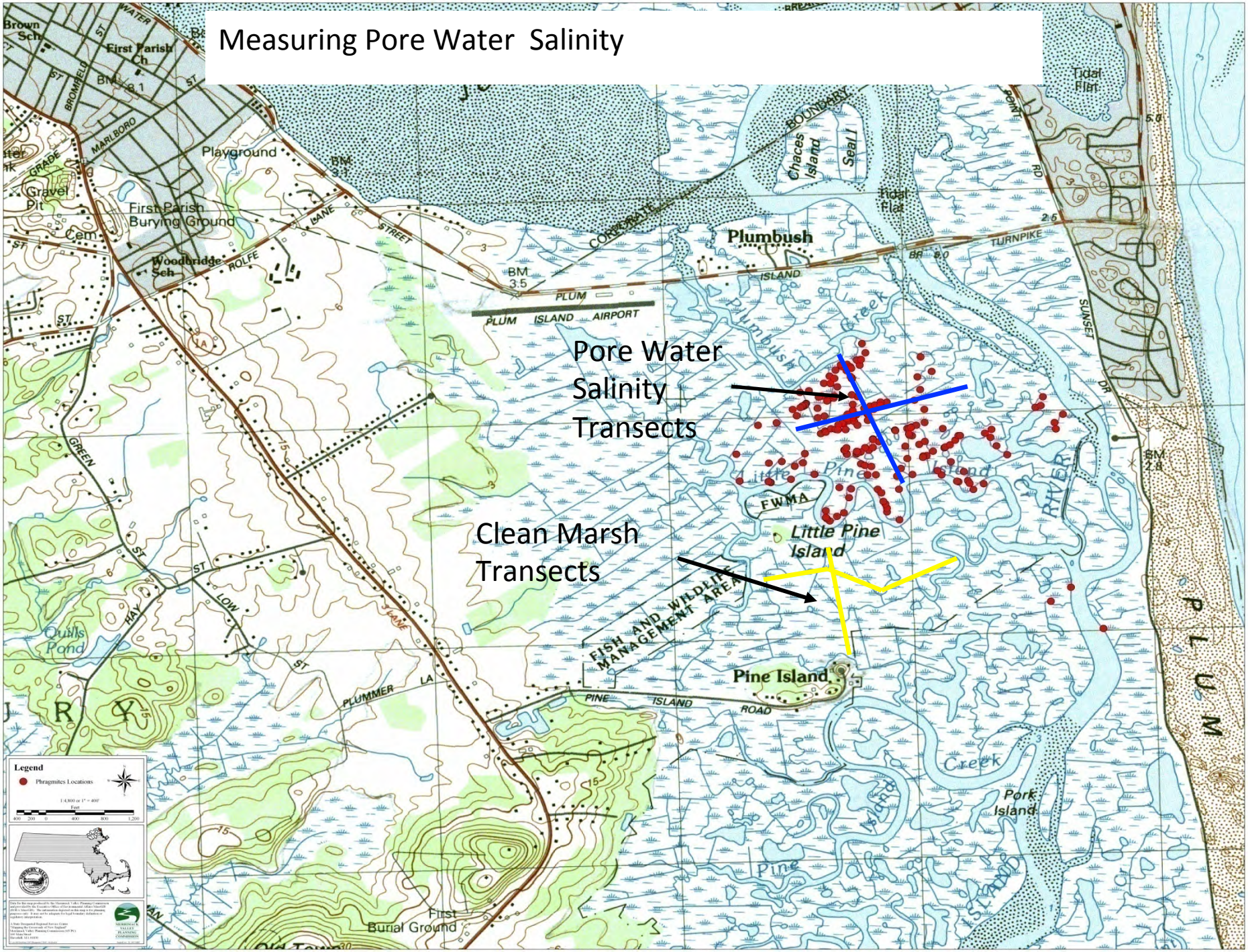


2013 Treat Stands

2014 Mapped stands

Step 3: Research Causes of Phragmites Growth in the Open Marsh

Measuring Pore Water Salinity




Phragmites Survey 7/17/2008

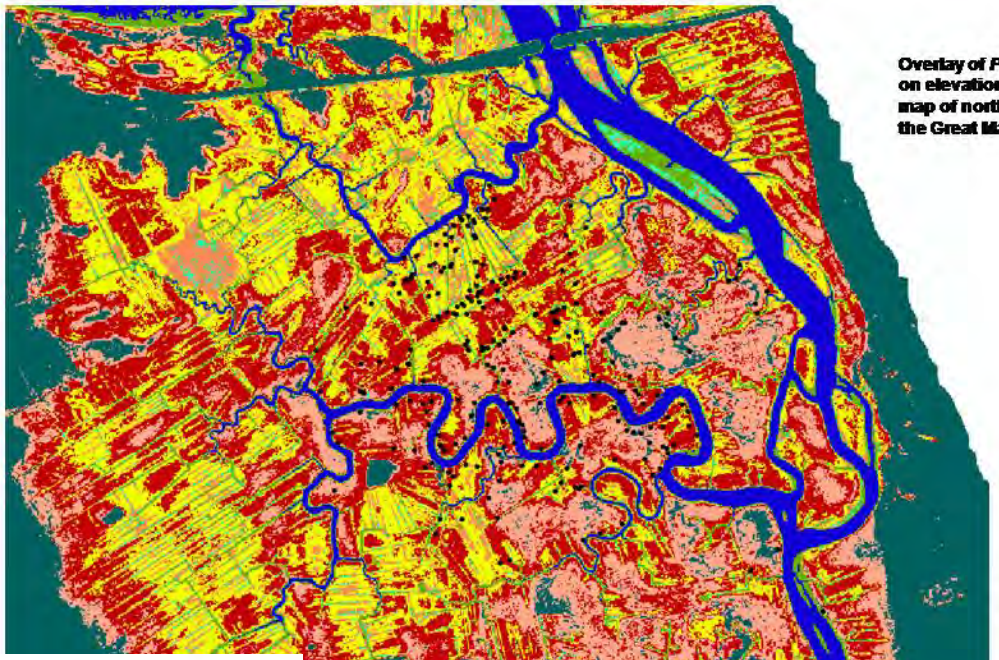

Phragmites Survey 7/28/2008

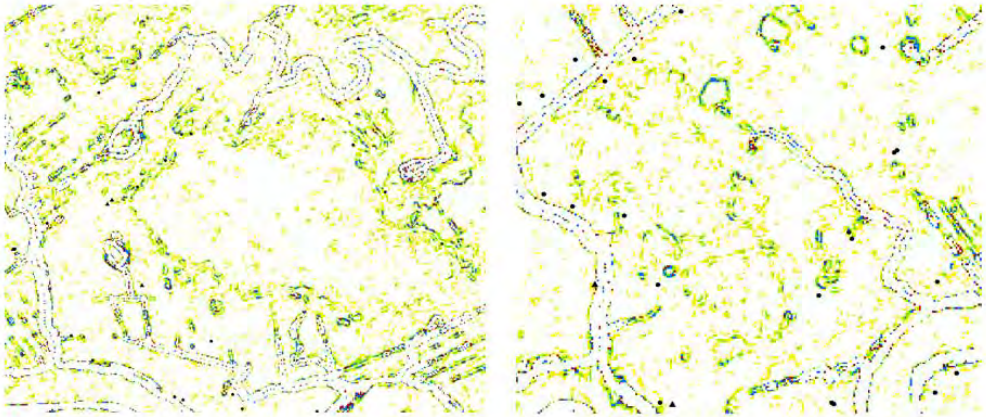
Emergent Phragmites Locations - Orthophoto
Town of Newbury

Pore water salinity: infested marsh/clean marsh

Great Marsh Salinity Data								
(Average)								
Station #	Salinity Value	Color	Type	Dominant Vegetation / %		Clean Marsh Salinity	Value	
1NS	15.6	yellow	mix	Dts 80		CM1	21	
1NS	17.4	orange	emergent	Dts 70		CM2	21	
3NS	18.4	yellow	mix	Dts 50		CM3	21	
4NS	17.8	yellow	mix	Dts 70		CM4	20	
5NS	15.4	yellow	mix	Dts 50		CM5	21	
6NS	16.2	green	clean marsh	Glx 30		CM6	26	
7NS	15.8	red	dense	Phrag 70		CM7	25	
8NS	15.4	orange	emergent	Jcs 50		CM8	19	
9NS	15.8	yellow	mix	Glx 50		CM10	14	
10NS	18.6	yellow	mix	Jcs 50		CM11	19	
11NS	15.6	orange	emergent	Jcs 60		CM12	19	
12NS	14.6	yellow	mix	Jcs 40		CM13	19	
13NS	13	yellow	mix	Glx 50		CM14	14	
14NS	13.2	green	clean marsh	Pat 80		CM15	xx	
15NS	15.6	yellow	mix	Dts 20		CM16	20	
16NS	14.4	yellow	mix	Dts 90		CM17	15	
						CM18	17	
1E	17.6	yellow	mix	Glx 30		CM19	14	
2E	17.6	yellow	mix	Glx 30		CM20	16	
3E	15.2	yellow	mix	Glx 30		CM21	16	
4E	18.4	yellow	mix	Glx 30		CM22	19	
5E	17.6	yellow	mix	Dts 70				
1W	16.8	yellow	mix	Glx 40				
2W	13.2	green	clean marsh	Jcs 40				
3W	14.6	red	dense	Phrag 50				
4W	15.8	yellow	mix	Glx 30				
5W	16	yellow	mix	Glx 70				
PBc	9.8	blue	creek					
LPlc	11.4	blue	creek					

LIDAR elevation data slope, and open marsh Phragmites growth



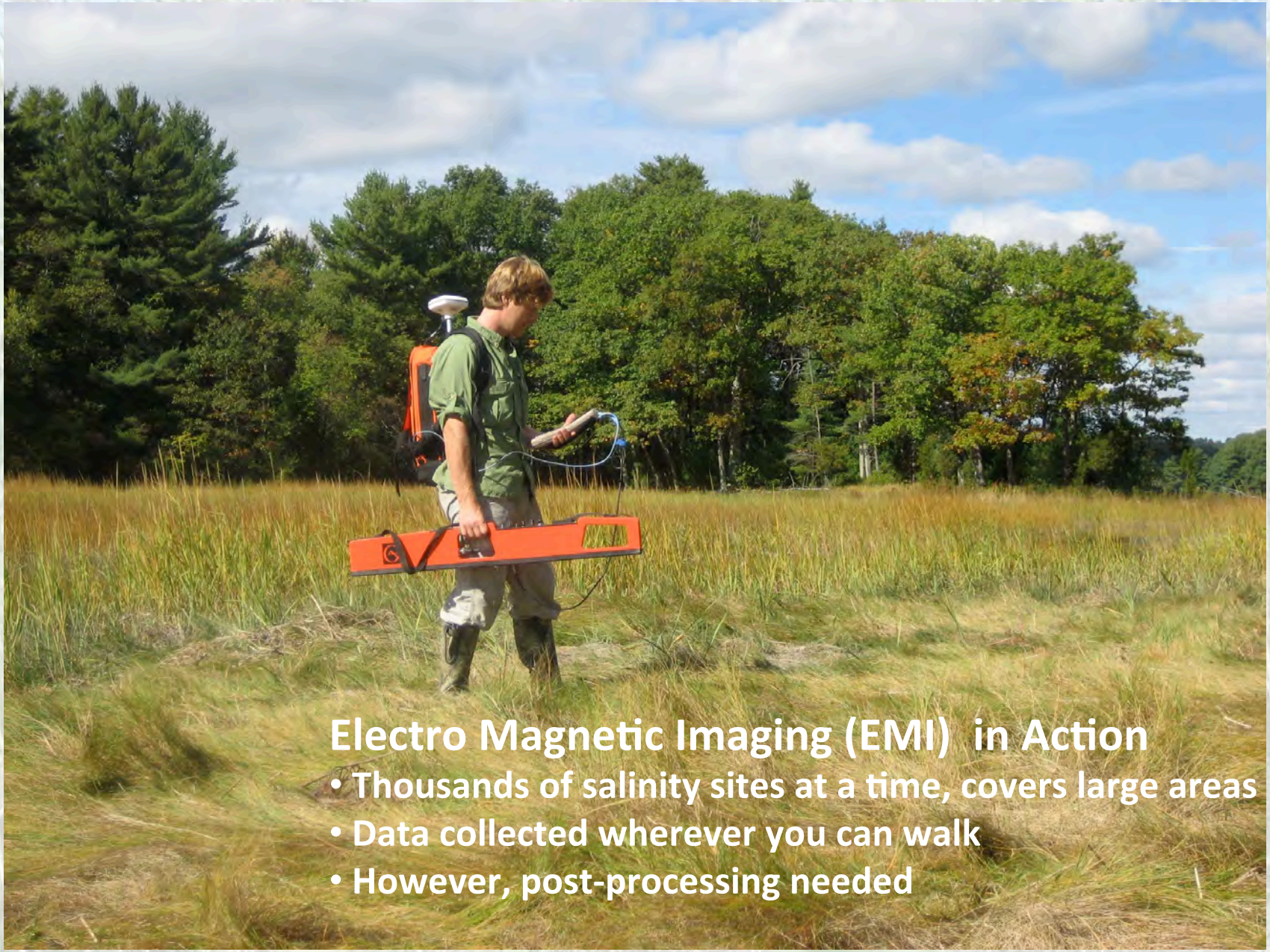


PIE LTER *Phragmites australis* Stands on NCALM (2005) Lidar Elevations (meters)

Note locations of Phragmites stands (black dots and triangles) on areas of moderate slope change within the marsh platform.

Slope of lidar elevations (0.1 meter Z factor)

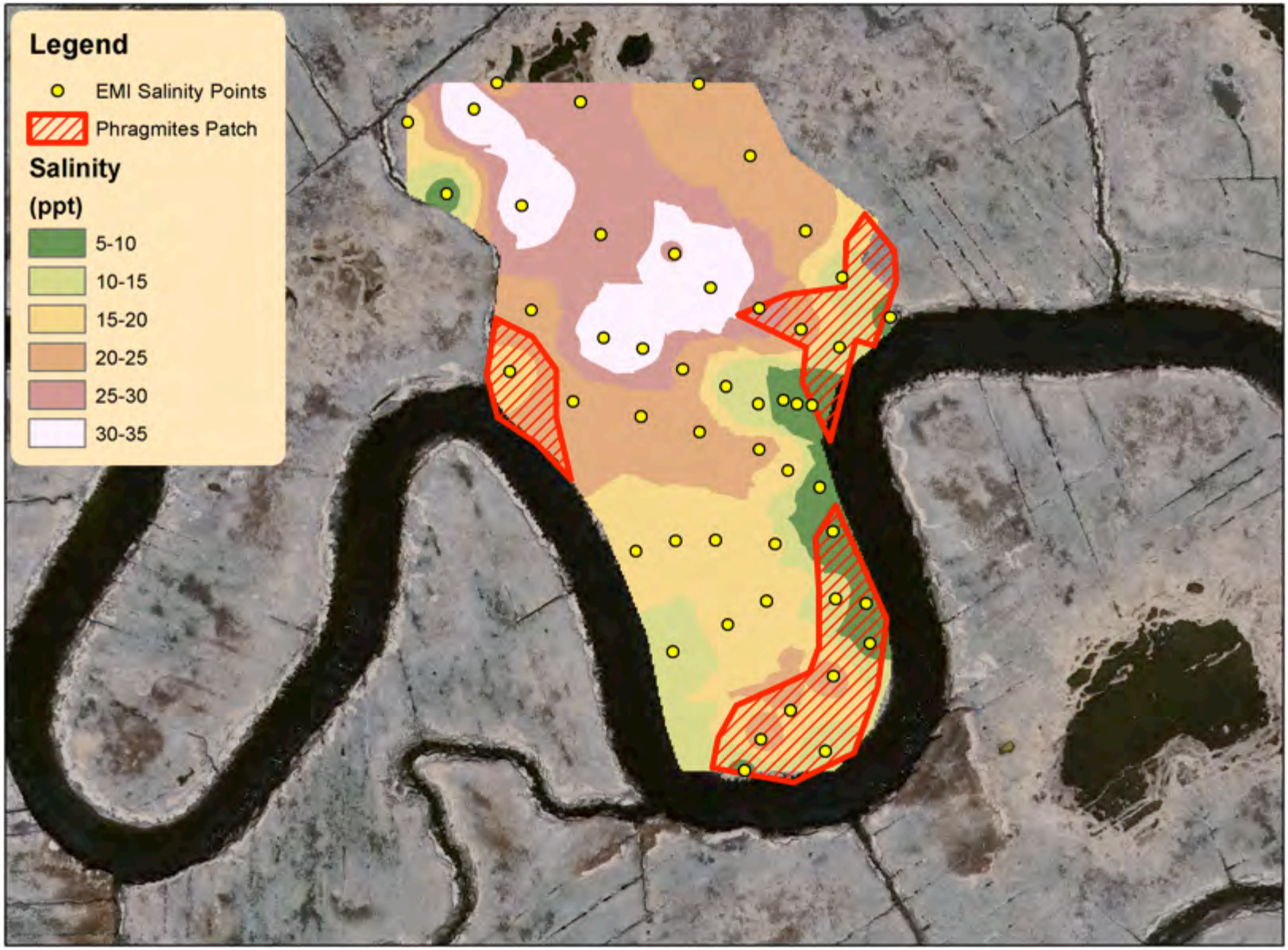
- 0
- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8

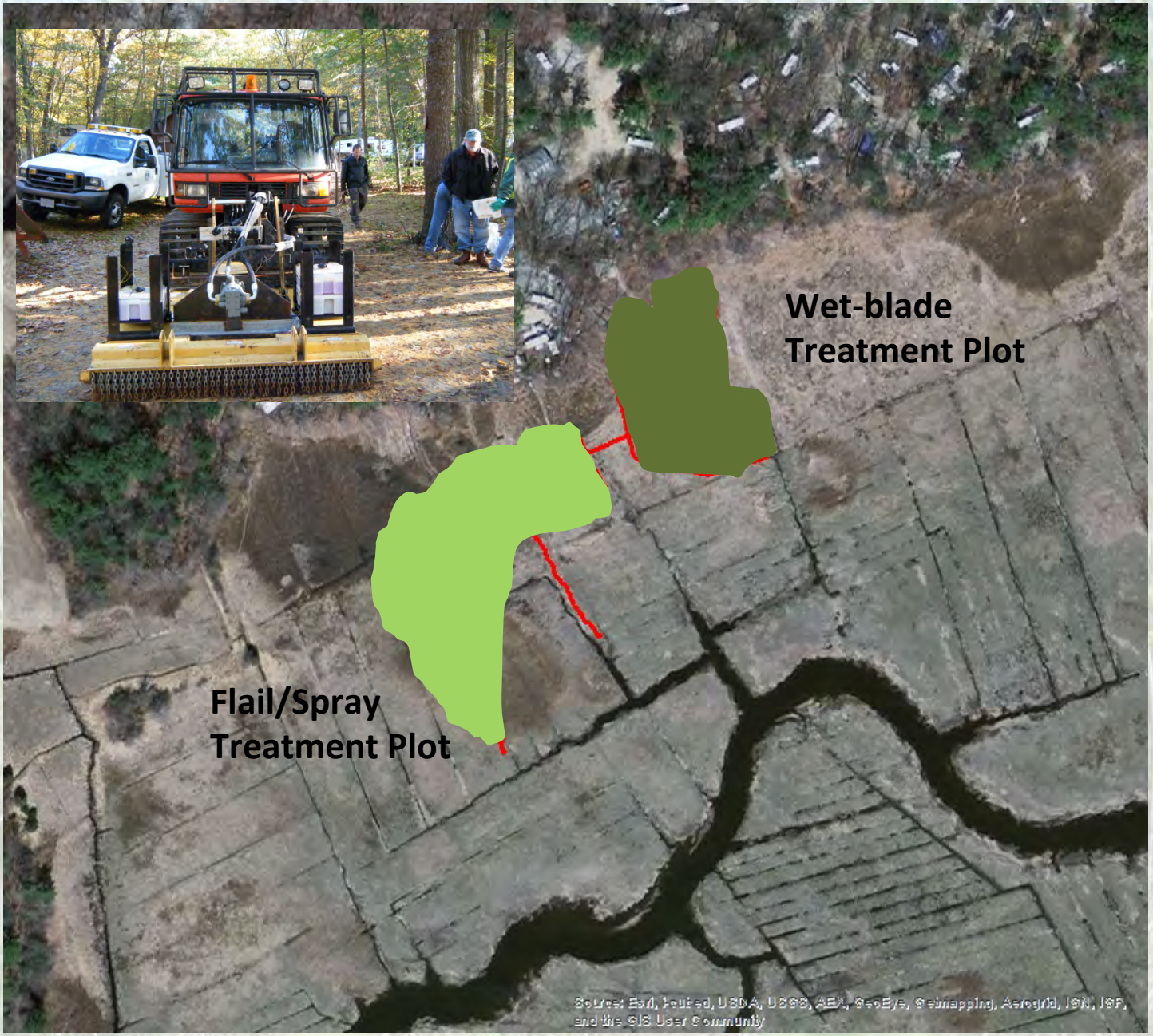

Electro Magnetic Imaging (EMI) in Action
• Thousands of salinity sites at a time, covers large areas
• Data collected wherever you can walk
• However, post-processing needed

- **EMI allows you to identify areas of moderate salinity in the marsh conducive to Phragmites growth and spread**

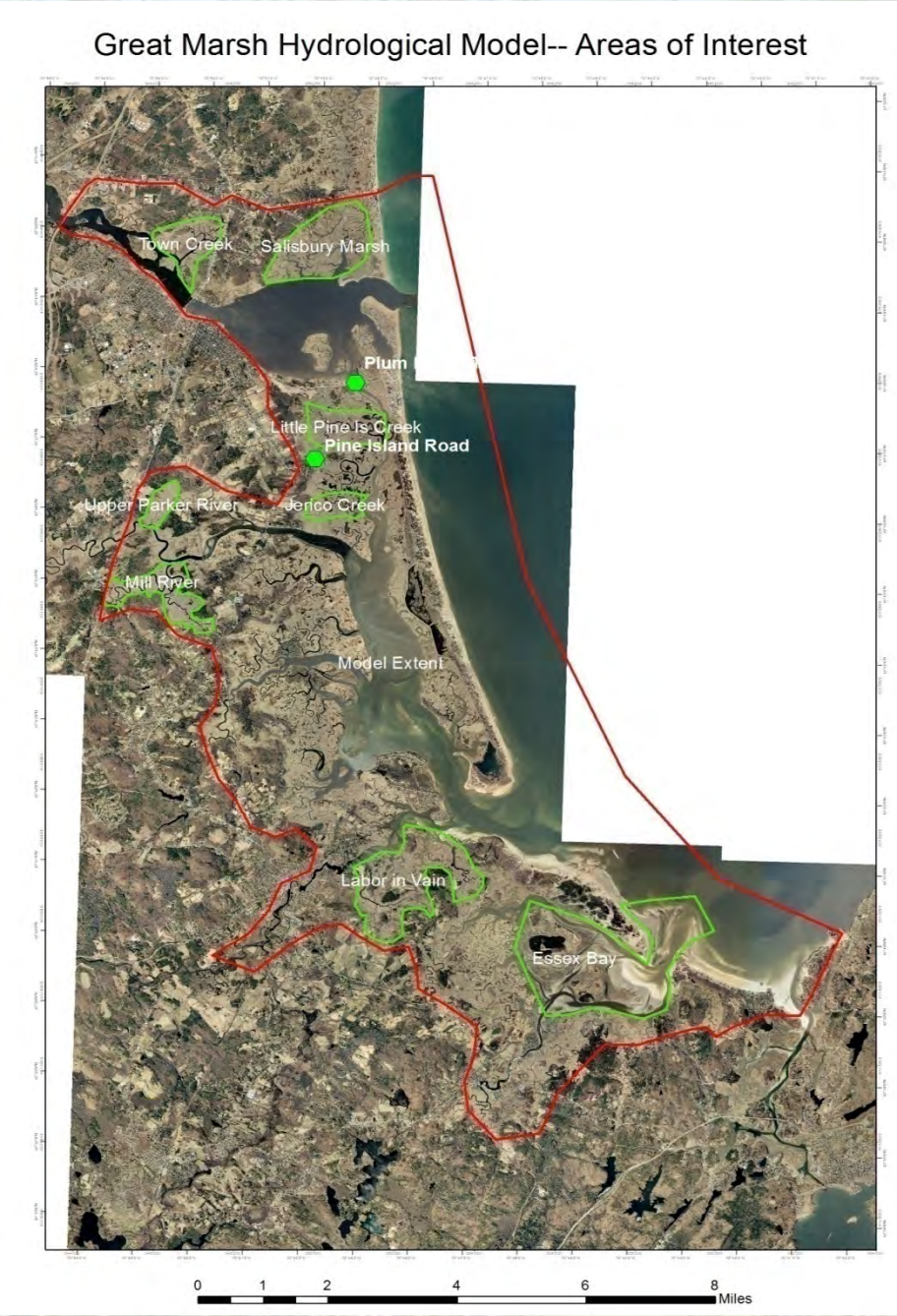
- **Also allows you to identify high salinity zones where Phragmites is unlikely to expand**


Legend
EMI Salinity Points


Legend
EMI Salinity Points
Phragmites Patch
Salinity
(ppt)
5-10
10-15
15-20
20-25
25-30
30-35


Wet-blade
Treatment Plot
Flail/Spray
Treatment Plot
Source: Esri, Intermap, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

DANGER IN THE REEDS
www.hydren.com/common/index.php?pn=home



Hurricane Sandy Resiliency Grant

✓ Global Treatment throughout the Great Marsh of Phragmites and Pepperweed

✓ Hydrodynamic Modeling of the Great Marsh (Long –term Sloutions)

- Merrimack River Estuary, Barrier Beaches, Plum Island Sound, and Ipswich and Essex Bays

- Better understanding of **sediment** and **salinity** effects on the marsh complex

- Identifying **sediment transport and erosional forces** on the barriers beaches (as a result of both natural processes and from man-made structures)

- Identify **sediment deposition patterns** into the marsh and tidal creeks.

- Define marsh **salinity dynamics** in curtailing and reducing suitable habitat for invasive plant species (Phragmites, perennial pepperweed) and the role of salinity concentrations in **promoting healthy, native vegetation.**

- Ultimate goal will be to provide a variety of **scenarios and recommendations for long-term ecosystem improvements** of sediment transport and salinity concentration changes through hydrodynamic flow alterations

Hydrodynamic Sediment Transport and Salinity Modeling (developed by Woods Hole Group)

Scope:

Model Transport and Erosion of Sediment

- Barrier Beach Erosion
- Channel Infilling
- Marsh Deposition for SLR

Model Salinity Movement

- Invasive species control resulting in Native Plant Restoration

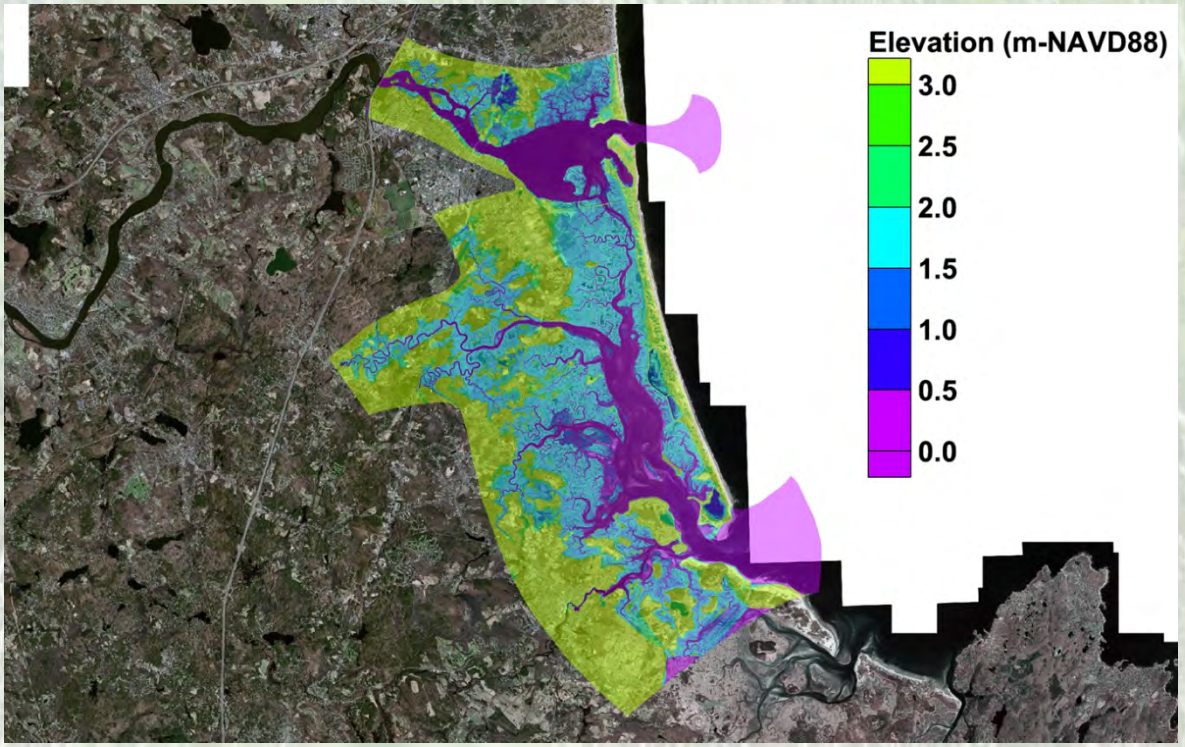
Goals:

- Identify future sediment and salinity management options

Hydrodynamic Sediment and Salinity Modeling

Geographic Targets

1. Barrier Beaches
2. Merrimack Estuary & PI Turnpike Bridge
1. Plum Island Sound
2. Ipswich Bay



Partner-driven Modeling

Collaborators

- Boston University
- Virginia Institute of Marine Science
- University of New Orleans
- Woods Hole Group

Supporters

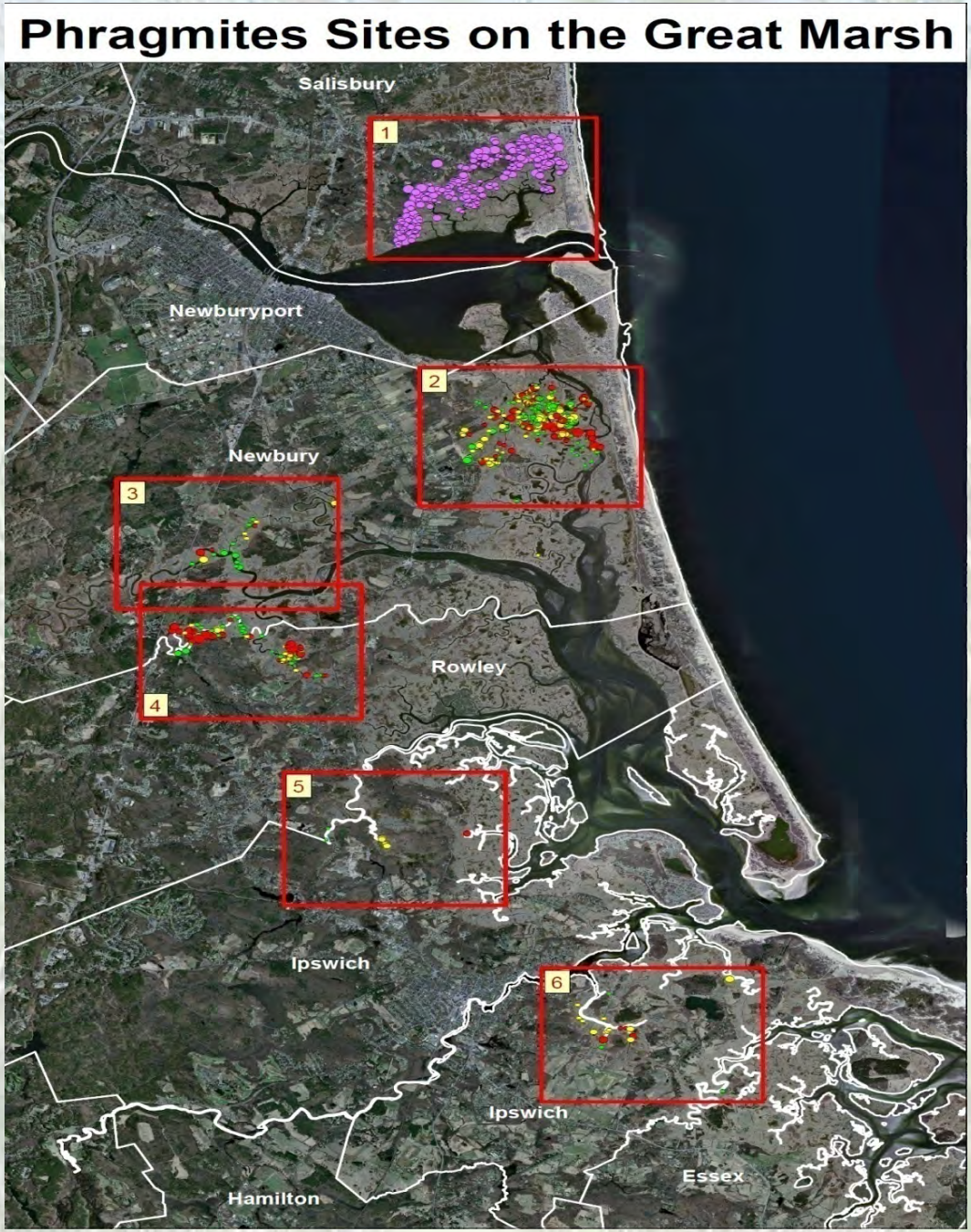
- USGS, USACE, USFWS

Modeling Update

1. Testing various resolutions to create a grid
2. Gathered available topographic and bathymetric data
3. WHG Responsible for model development, Boston University data collection
4. USGS Stage gage installed at bridge

Model Data Collection Update
Boston University

- Deployed fifteen instrument platforms throughout PIS and offshore
- Current measurements in addition to the temperature, salinity, and water depth data
- RTK-GPS survey of creeks for bathymetry
- 60 Bed sediment samples taken
- Collected/sampled fifteen cores for accretion rate data
- Water samples and salinity-temperature-depth profiles were collected

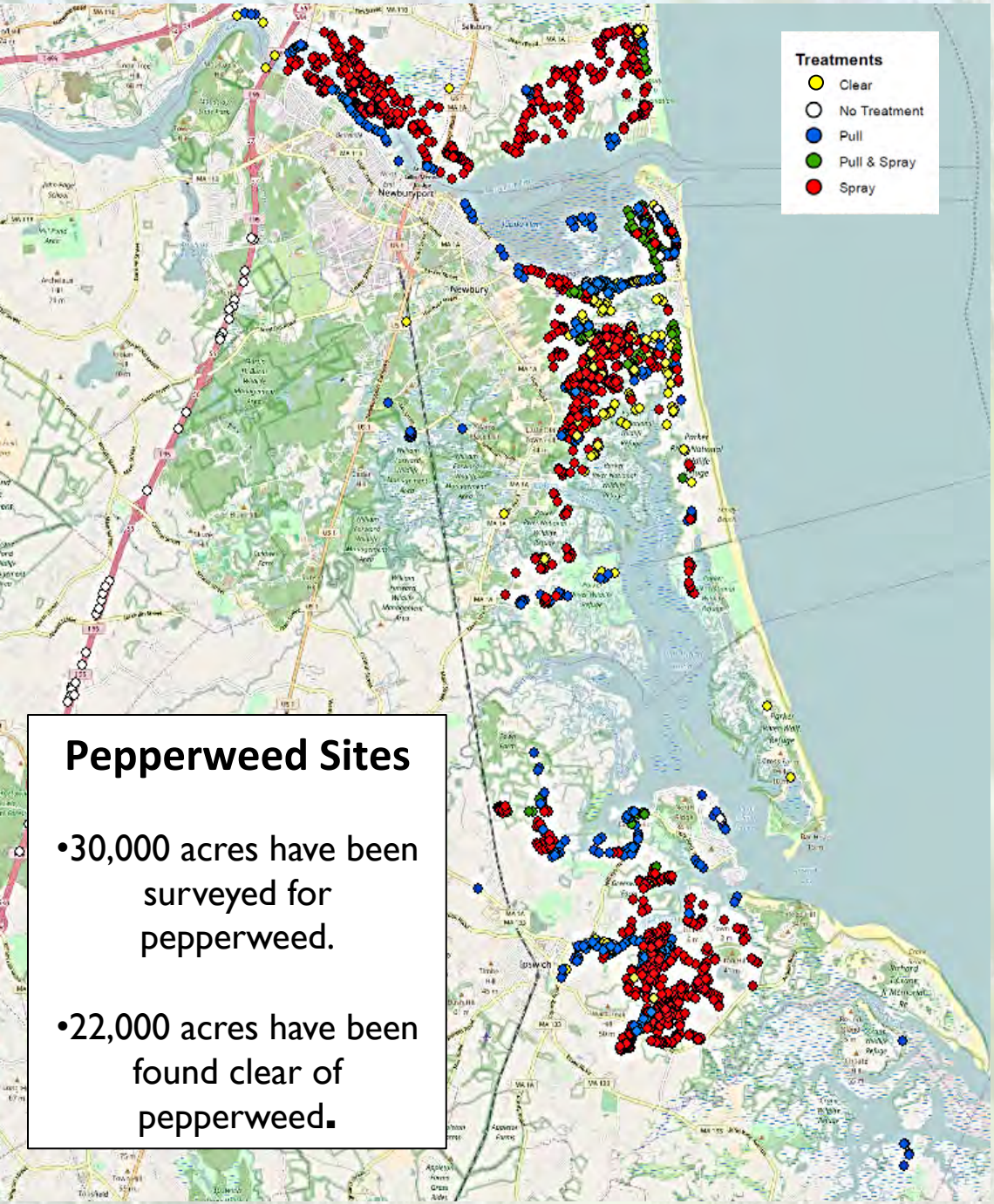


Under the Sandy Grant, 100% of Phragmites stands on the high marsh platform in the Great Marsh were treated two years in a row - 2015 and 2016

Making headway, but need to continue to be diligent until model recommendations can be implemented

Great Marsh Perennial pepperweed control 2016

Mass Audubon
Protecting the Nature of Massachusetts



Pepperweed Sites

- 30,000 acres have been surveyed for pepperweed.
- 22,000 acres have been found clear of pepperweed.

Great Marsh Treatment 2016

- 8,000 acres are infested with pepperweed or under imminent threat from it.
- 2114 stands were treated
- 209 former stands now clear
- 99% of all mapped sites were treated.

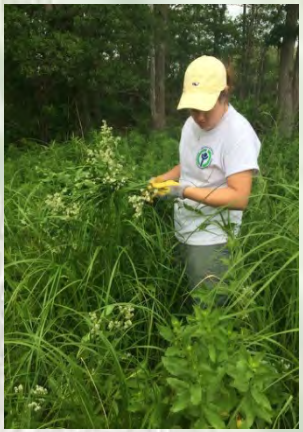
Program relies heavily on volunteer groups:

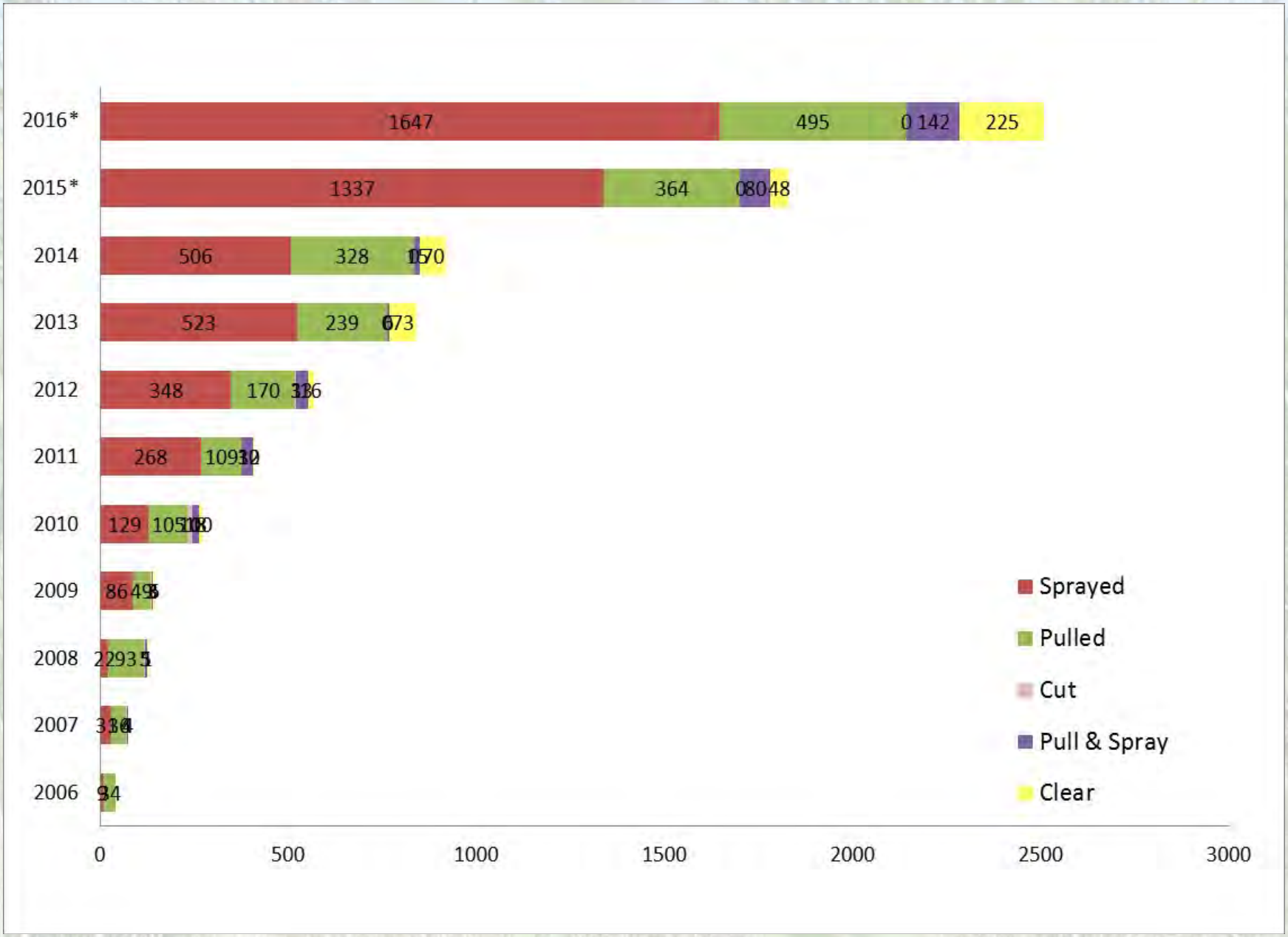
- Ipswich High School
- River Valley Charter School
- Sparhawk High School
- Carol Robey's family
- Boston Aquarium Volunteers
- Town of Ipswich
- Americorp
- Triton High School Students
- Ipswich River Watershed Association
- Great Neck Association, Cricket Wilbur
- Mass Audubon Ipswich River Wildlife Sanctuary camp volunteers
- Gulf of Maine Institute
- Plum Island Beautification Society


Plum Island Beautification Society


Boston Aquarium Student Volunteers


River Valley Charter School





99% of know pepperweed sites in the Great Marsh were treated in 2016

QUESTIONS?