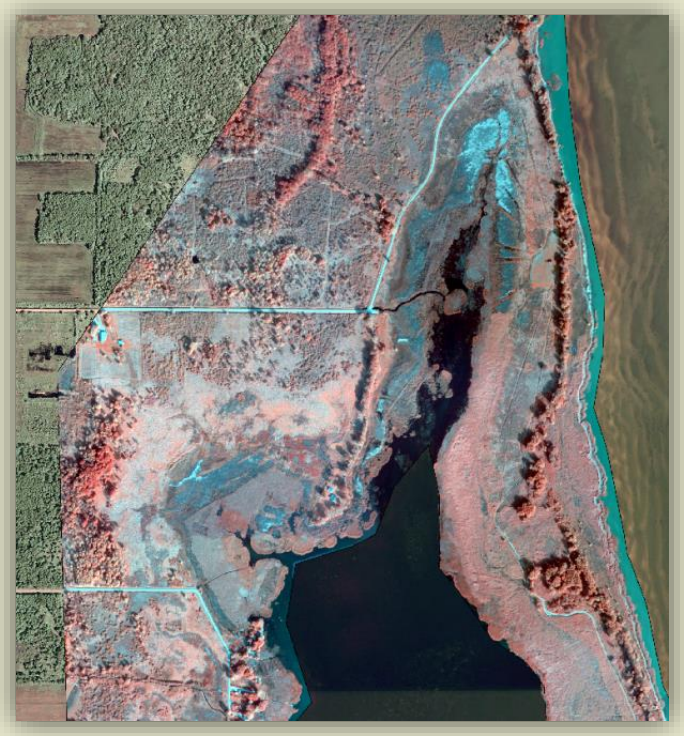
# Bridging the Gap Between Innovation/Technology and Restoration in the Fight Against Phragmites

*UMISC Conference*

**October 17, 2016**

Jason Carlson

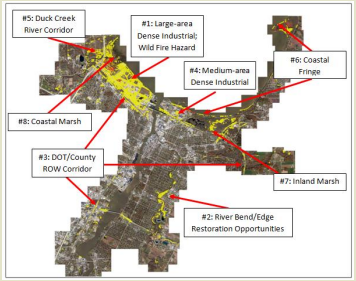


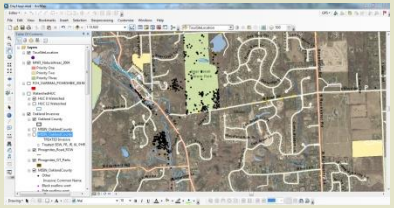
# The PROBLEM of Invasives

PHRAGMITES

- >$80 million on herbicide Phragmites past few years (MTRI, 2010)
- Property values, tourism…
- Biodiversity and habitat quality
- Funding sources
- Need for long-term management plans

# Adaptive Management



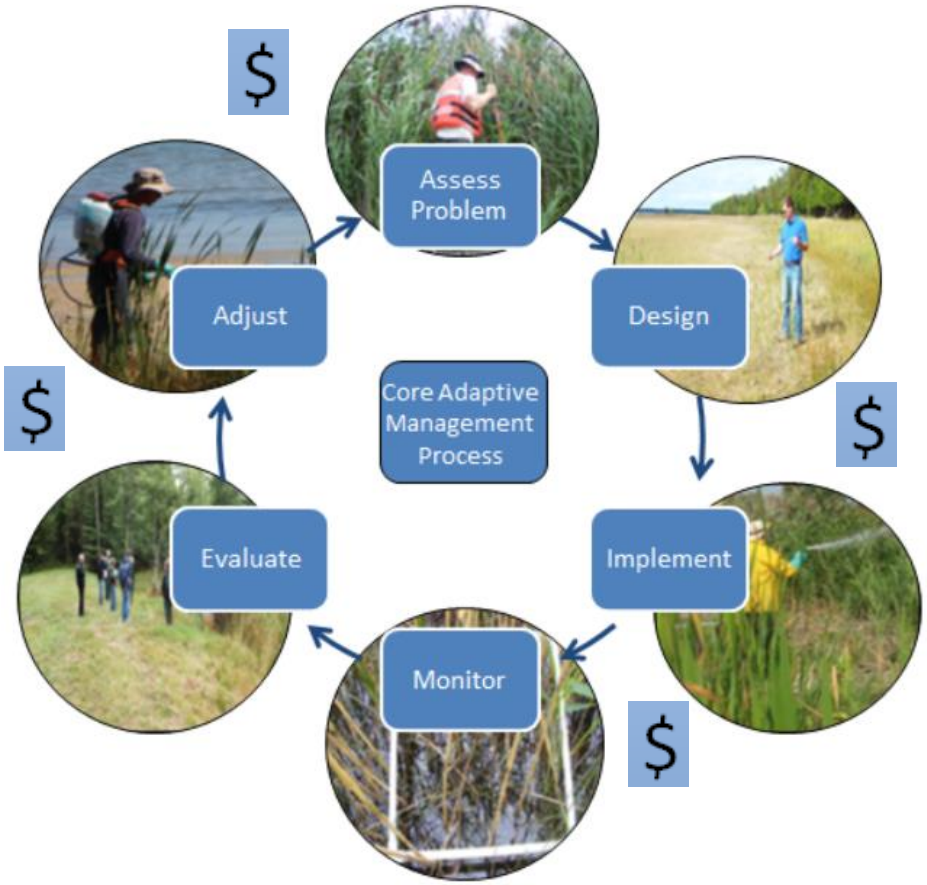



*Figure 1. Based on the concept of "learning by doing", the core adaptive management process consists of six basic steps, tailored to each individual problem in order to reduce uncertainty through iterative management actions.*

**Source: http://greatlakesphragmites.net/blog/introducing-the-phragmites-adaptive-management-framework-pamf-initiative/**

# Introduction

1. Remote Sensing cost effective way to implement adaptive management

2. Often accurate baseline of existing conditions does not exist

3. Prioritize treatment areas

4. "Precision Conservation" approach to management

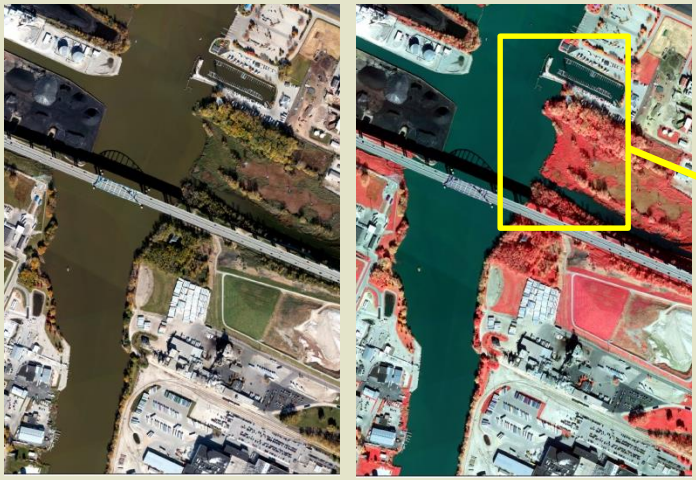
5. Example project: Green Bay, WI

# The Challenge

- Managing beyond the site scale
- Complex dynamic, inaccessible Ecosystems
- Multi-year/Diverse Treatment Types
- **Doing more with less**
  **-> Remote Sensing**

# Remote Sensing Mapping Approach


AES Imaging Plane & Multi-Spectral Sensor

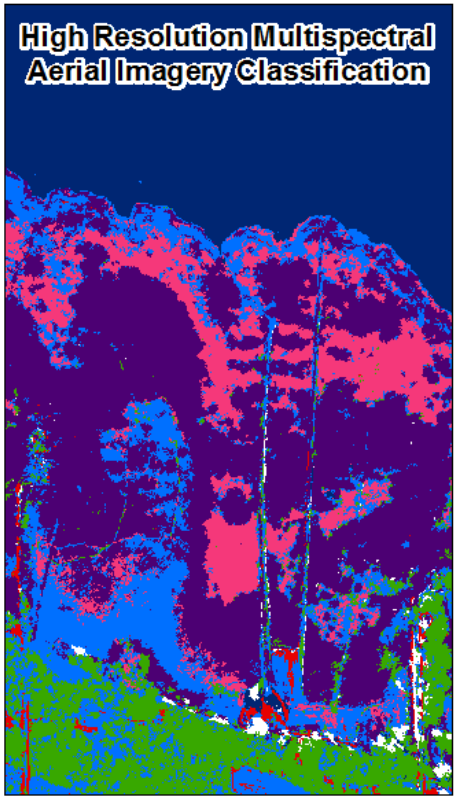


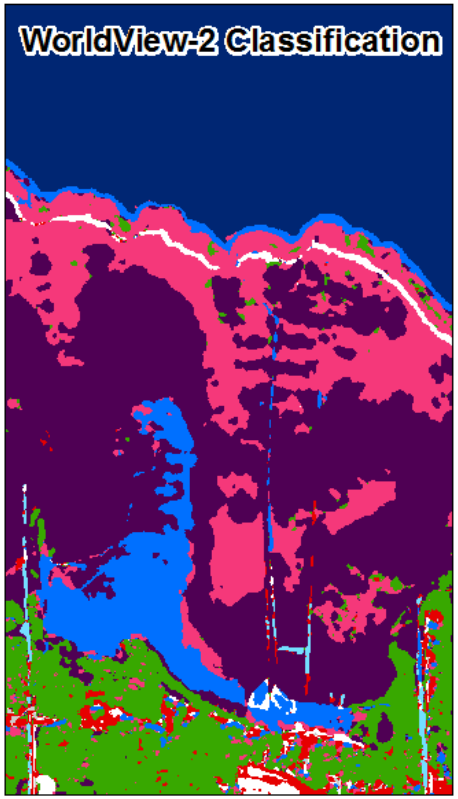
Multi-Spectral Imagery

Interpretation

Mapping

# Sensors and Expected Outputs



0 0.125 0.25 0.5 Miles

**Classes**

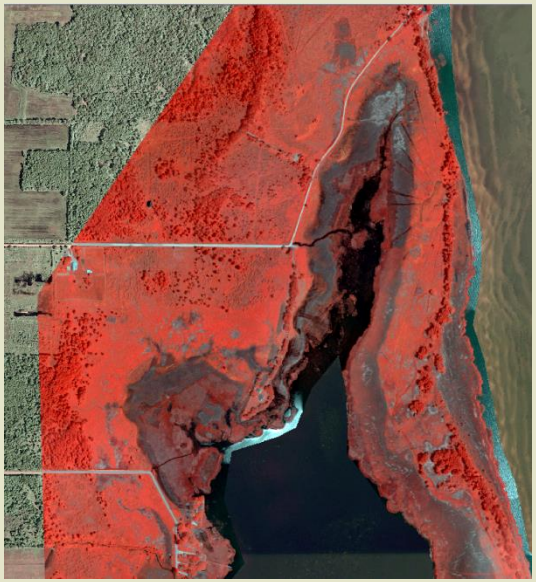
- Phragmites
- Wet Meadow/Emergent
- Barren
- Developed
- Typha
- Water
- Tree/Shrub


Citation: U of MI, Water Center Grant 2014: MTRI/AES

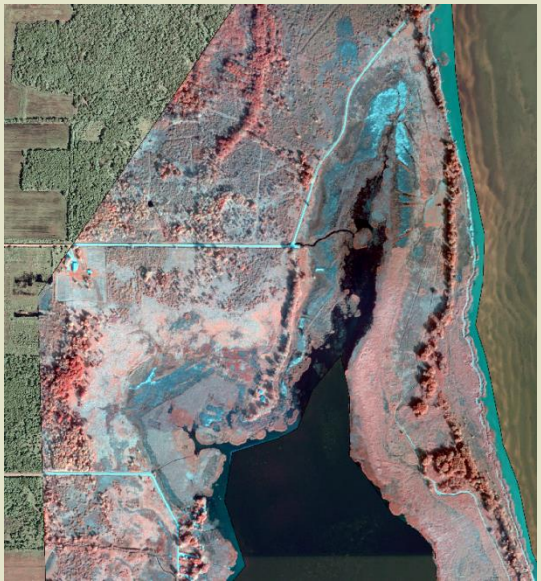
# Multi-temporal Aerial Imagery: Timing and Vegetation - Phenology

Ortho

Oblique



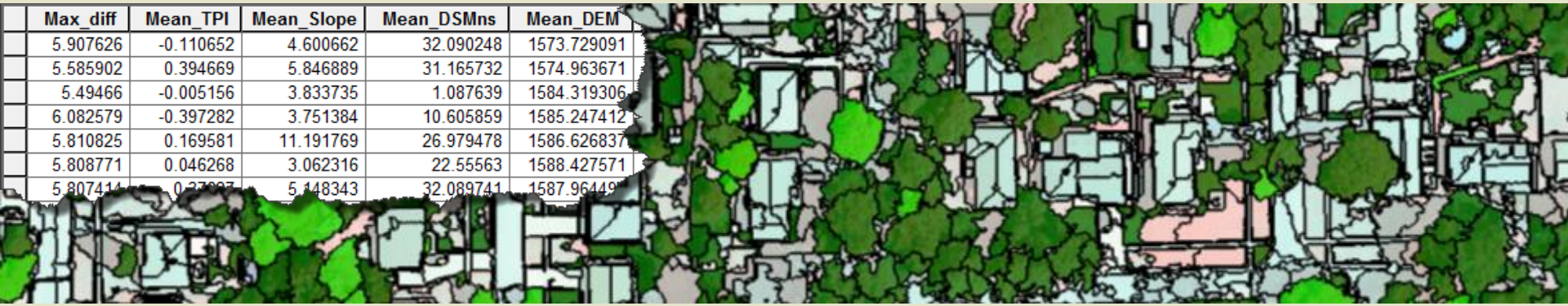
Summer



Fall

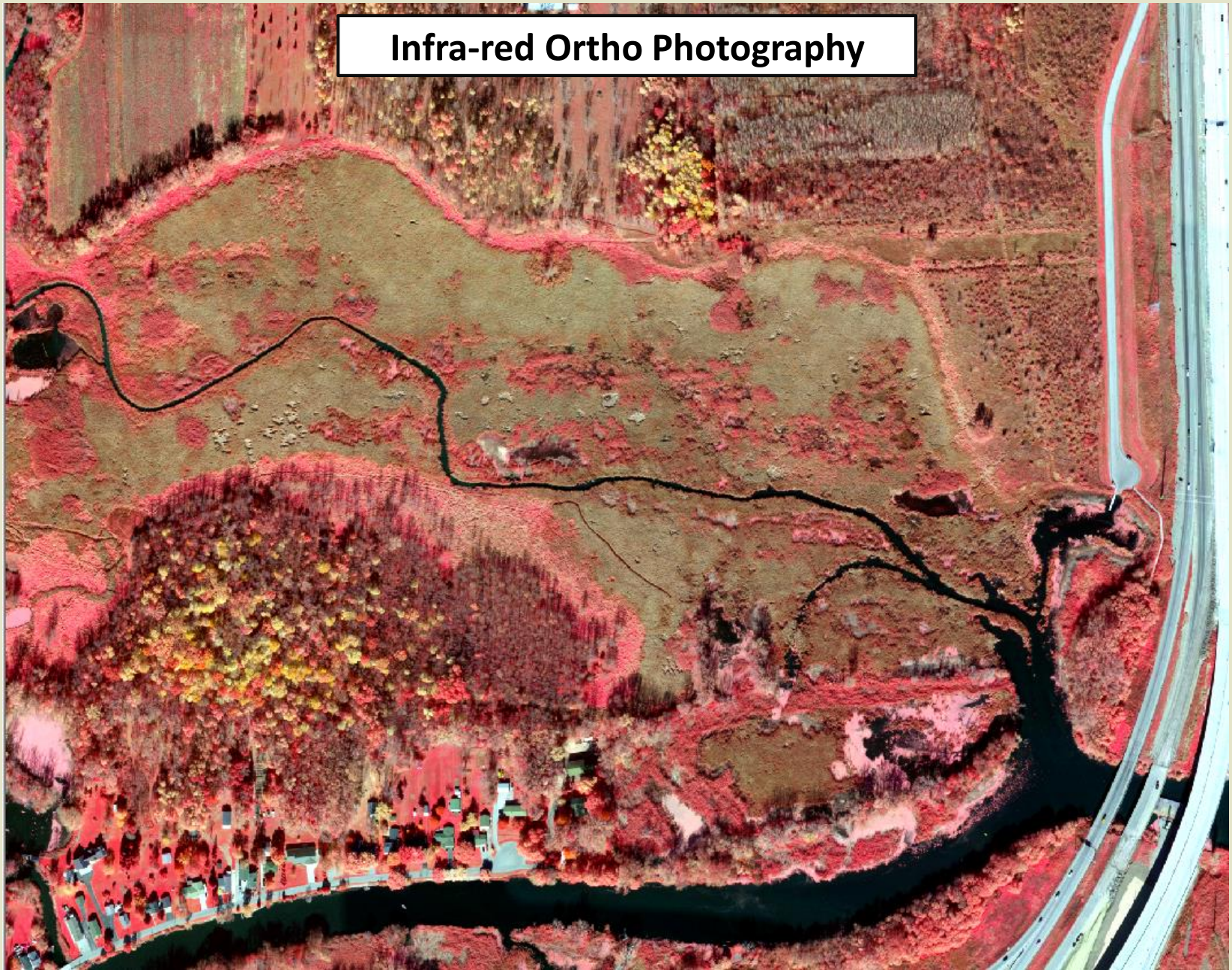
# Automated Classification and Mapping Technology

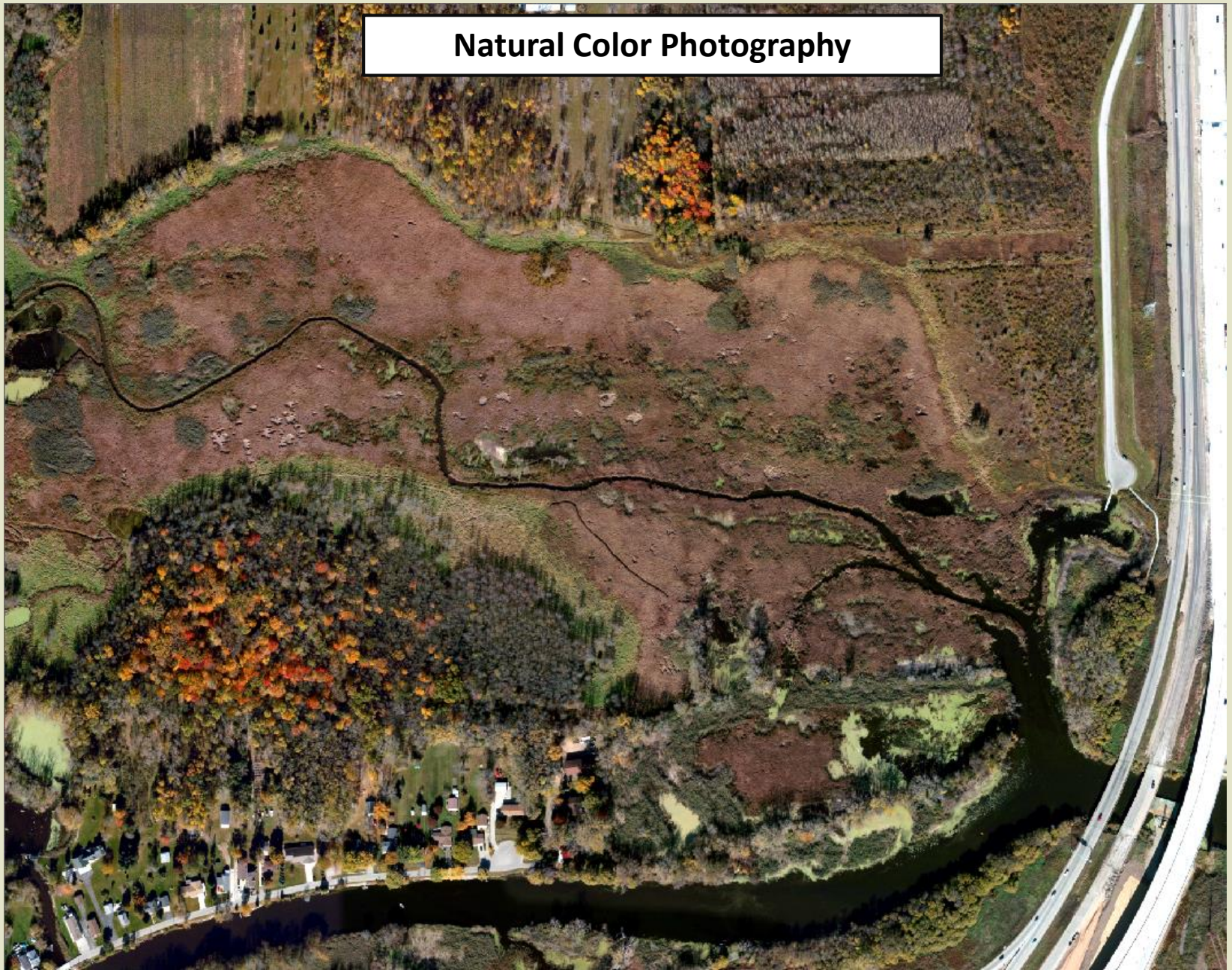
| | Max_diff | Mean_TPI | Mean_Slope | Mean_DSMns | Mean_DEM |
|---|---|---|---|---|---|
| | 5.907626 | -0.110652 | 4.600662 | 32.090248 | 1573.729091 |
| | 5.585902 | 0.394669 | 5.846889 | 31.165732 | 1574.963671 |
| | 5.49466 | -0.005156 | 3.833735 | 1.087639 | 1584.319306 |
| | 6.082579 | -0.397282 | 3.751384 | 10.605859 | 1585.247412 |
| | 5.810825 | 0.169581 | 11.191769 | 26.979478 | 1586.626837 |
| | 5.808771 | 0.046268 | 3.062316 | 22.55563 | 1588.427571 |
| | 5.807414 | 0.37887 | 5.148343 | 32.089741 | 1587.96449 |

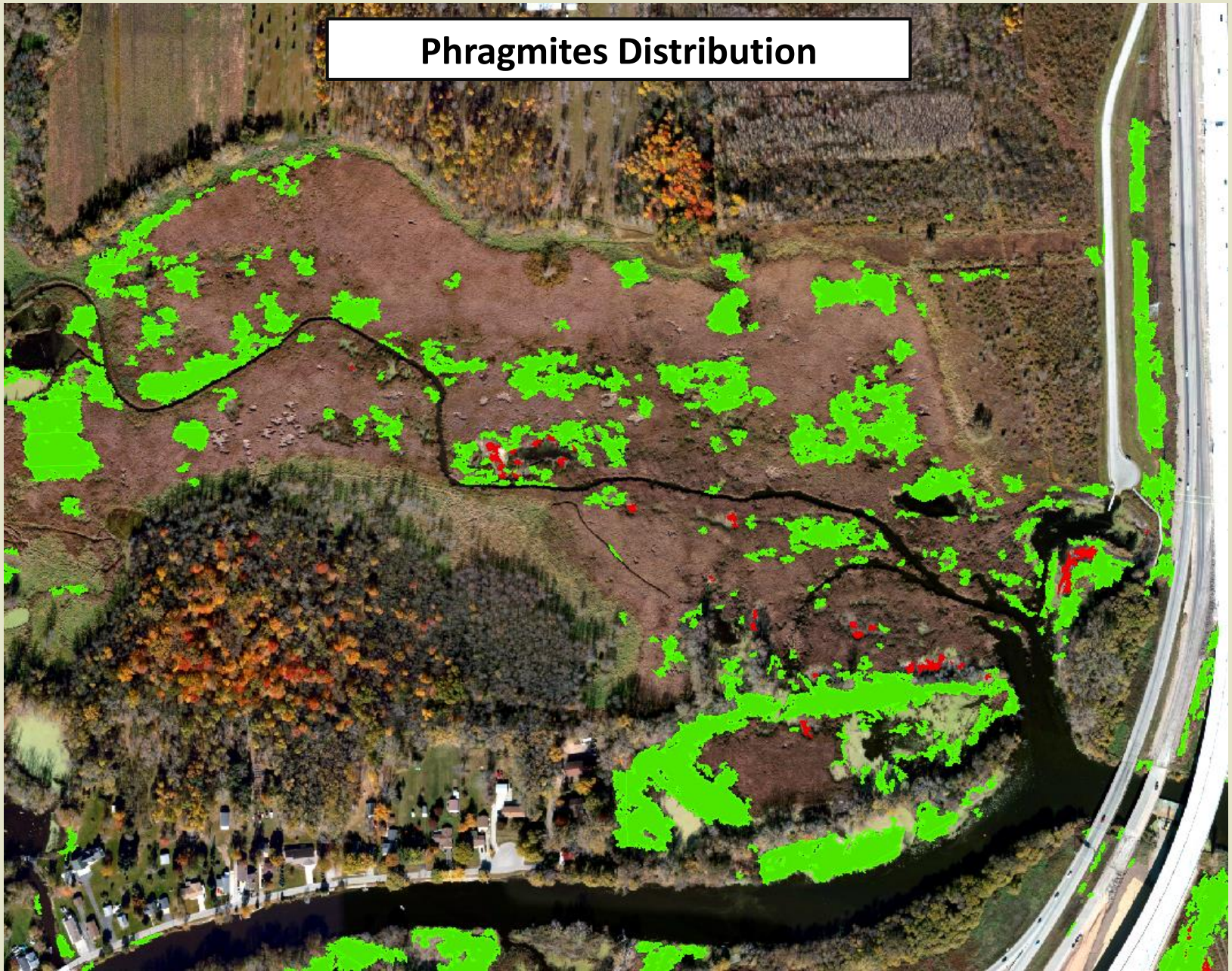


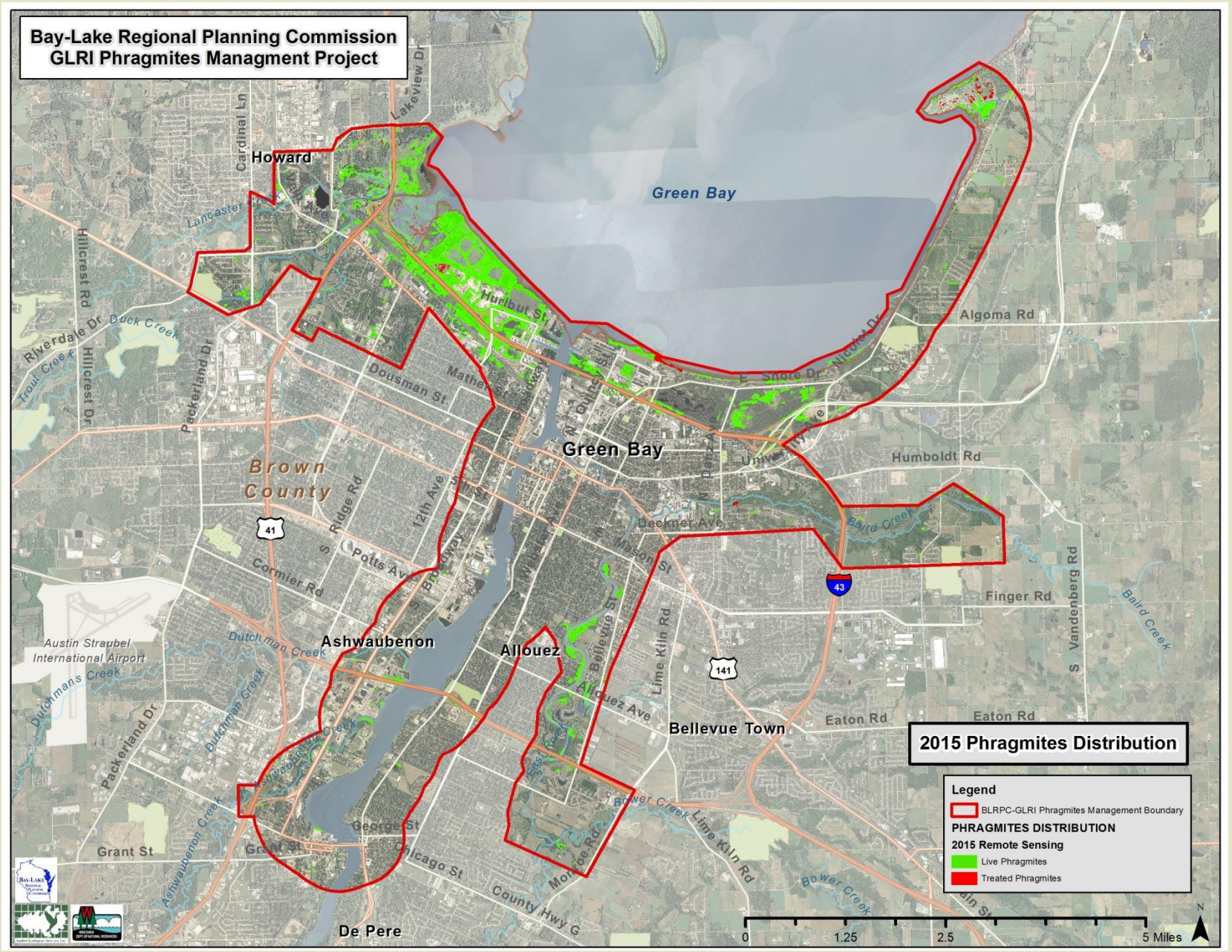
# Oblique Imagery- Early Fall

# Infra-red Ortho Photography




Natural Color Photography


Phragmites Distribution


Bay-Lake Regional Planning Commission
GLRI Phragmites Managment Project
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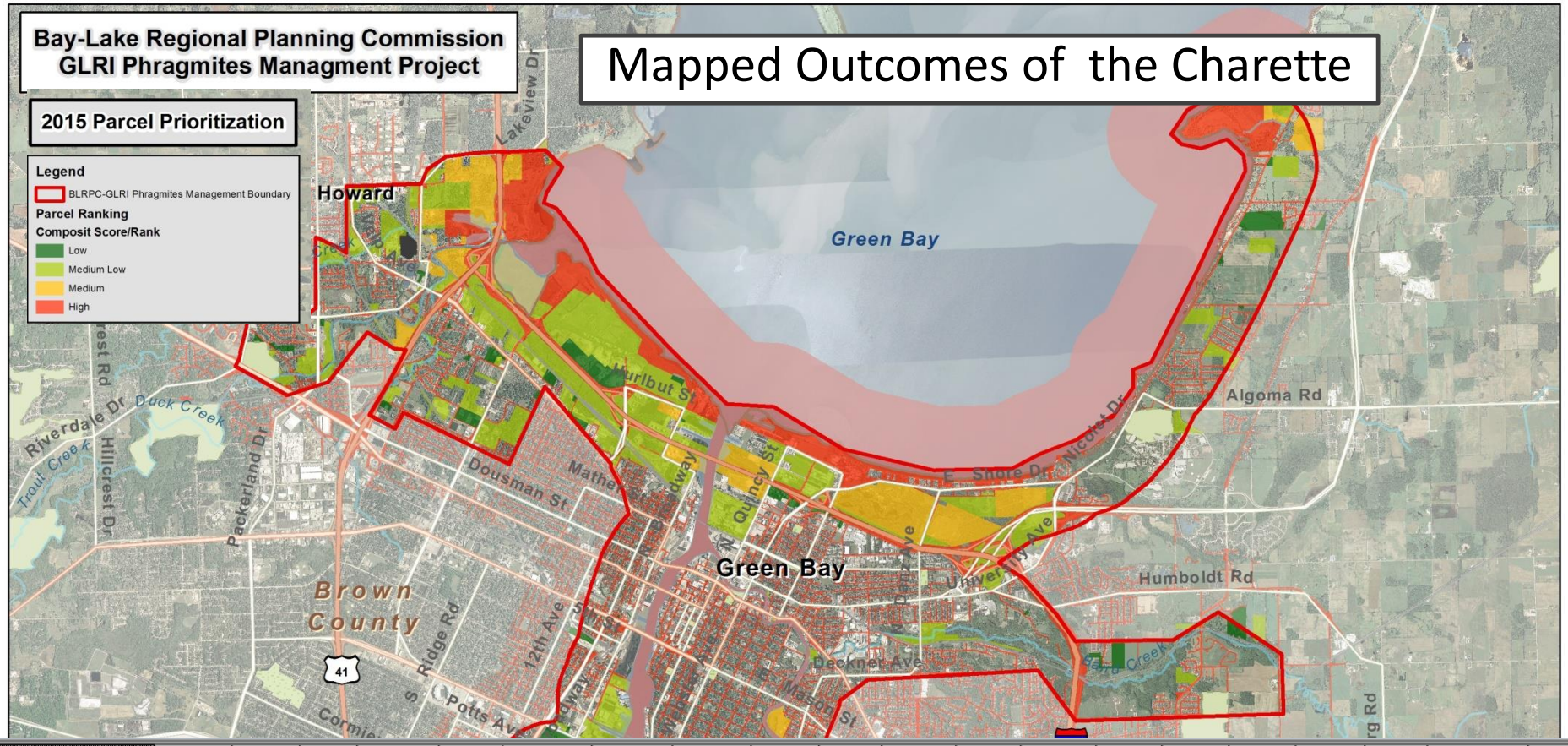
Hurlbut St
E Shore Dr
Nicolet Dr
Algoma Rd
Humboldt Rd
Baird Creek
Ridge Rd
12th Ave
Broadway
Potts Ave
Cormier Rd
Dutch man Creek
Dutchmans Creek
Dutchman Creek
Ashwaubenon Creek
Bellevue St
Allouez Ave
Lime Kiln Rd
Bower Creek
Eaton Rd
Finger Rd
S Vandenberg Rd
Grant St
George St
Chicago St
County Hwy G
Mormon Coulee Rd
Beckner Ave
41
43
141
2015 Phragmites Distribution
Legend
BLRPC-GLRI Phragmites Management Boundary
PHRAGMITES DISTRIBUTION
2015 Remote Sensing
Live Phragmites
Treated Phragmites
0
1.25
2.5
5 Miles
N

# Priority Outcomes of the Charette

Prioritizing Potential Phragmites Treatment Strategies

| Charette item | How it was integrated into GIS |
|---|---|
| •Reduce human safety hazards (e.g., wildfire risk, blocked views along major roadways/intersections) 2 | Identify via parcel type |
| •Linear corridors facilitating inland spread (e.g., rivers and tributaries, roadside ditches) 5 | Transporation Corridors |
| •Shoreline/coastal wetlands within the lakebed 1 | Areas adacent to coastline |
| •Ecologically important or high quality habitats (e.g., Duck Creek, wildlife sanctuary, pike spawning areas) 11 | Utilized feedback from Phrag Committee and DNR PAISM T |
| •Potential for landowner management* 9 | Areas where known management had occurred previously |
| •Seed sources adjacent to ecologically important/high quality habitats 6 | Distribution of phragmites |
| •Publicly visible/high profile sites (e.g., Bay Beach Park, industrial "tank farm") 5 | Parks, trails and public lands |
| Follow-up treatment in areas that have received prior management 4 | Areas where known management had occurred previously |
| •Treatment areas that have shown a native vegetative community response year x* 3 | N/A |
| •Smaller, less dense stands that are easier to manage 1 | Distribution of phragmites |
| •Impaired areas with potential for future restoration value 1 | N/A |
| •Public waterfront access points (e.g., parks, boat launches) | Parks, trails and public lands |
| •Areas with potential for future public recreational use/access (e.g., Bay Beach) | N/A |
| •Private shoreline properties with landowner interest/permission | Identify via parcel type |




| OWNMAIL1 | AESphragPres | AESphragPC | AESphrag | AESphragCNT | AEShqHabit | AEShqHabitatPro | DNRhighHabit | DNRmediumH | DNRlowHabi | AESpastTre | AEScoastalAdj | AESriverAdj | AESPublicAdj | AESsafetyAd | AEScorridor | AES_modifie | AES_Ptype | AESscore | AESscoreWeight | AESrank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WPSC | 1 | 26.504559 | 7.949799 | 12 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 4.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 2.310621 | 0.00947 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 3.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 1.972402 | 0.007356 | 2 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 4.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 4.416734 | 0.018777 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 3.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 2.6656 | 0.02765 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 4.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 3.308943 | 0.022469 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 3.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 6.253987 | 0.0552 | 3 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 4.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 1.731748 | 0.913179 | 13 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | Utility | 10 | 5.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 23.018897 | 1.889956 | 3 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 4.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 1.363858 | 0.006587 | 2 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 4.25 | High |
| CITY OF GREEN BAY-CLERK | 1 | 49.025011 | 6.593127 | 16 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | Govt: Fed, St | 10 | 5.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 29.110303 | 1.351963 | 21 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 4.25 | High |
| WISCONSIN PUBLIC SERVICE | 1 | 14.721333 | 0.194475 | 11 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Utility | 10 | 3.25 | High |
| MARY G GAUTHIER | 1 | 20.738956 | 12.356883 | 63 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Forest | 10 | 8.75 | High |
| BOARD OF REGENTS OF THE UN | 1 | 2.505876 | 1.445545 | 127 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Govt: Fed, St | 10 | 7.75 | High |
| WISCONSIN DEPT OF | 1 | 10.2368 | 2.466921 | 105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | Govt: Fed, St | 10 | 10.75 | High |
| WISCONSIN DEPT OF | 1 | 7.140683 | 3.462435 | 162 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | Govt: Fed, St | 10 | 10.75 | High |
| WISCONSIN DEPT OF | 1 | 10.250959 | 6.479772 | 168 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | <Null> | Govt: Fed, St | 8 | 9.75 | High |
| CITY OF GREEN BAY-CLERK | 1 | 31.610488 | 18.518512 | 63 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | <Null> | Govt: Fed, St | 8 | 9.75 | High |
| <Null> | 1 | 3.562349 | 0.419167 | 27 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | <Null> | ROW | 8 | 9.75 | High |
| <Null> | 1 | 24.706606 | 0.406802 | 10 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | <Null> | ROW | 7 | 8.75 | Medium |
| ANNA M VANDERLOO | 1 | 16.373842 | 0.707802 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | <Null> | Residential | 7 | 8.25 | Medium |
| VILLAGE OF HOWARD | 1 | 9.541495 | 1.023334 | 6 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | <Null> | Govt: Fed, St | 7 | 8.25 | Medium |
| DUCK CREEK HEADWATERS INC | 1 | 12.708701 | 4.642848 | 162 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | <Null> | Govt: Fed, St | 7 | 8.75 | Medium |
| WISCONSIN DEPT OF | 1 | 12.755757 | 3.084202 | 73 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | <Null> | Govt: Fed, St | 7 | 8.75 | Medium |
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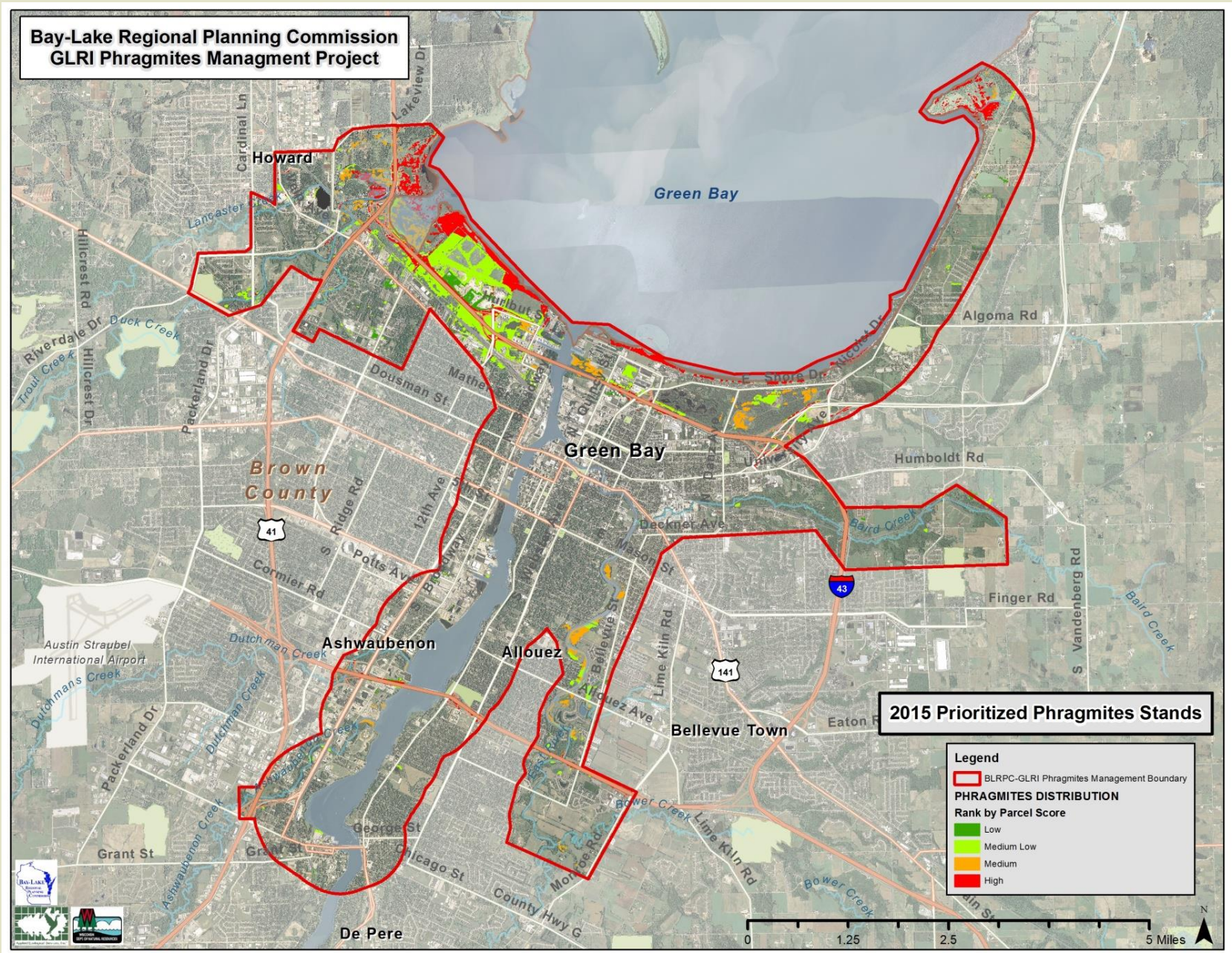
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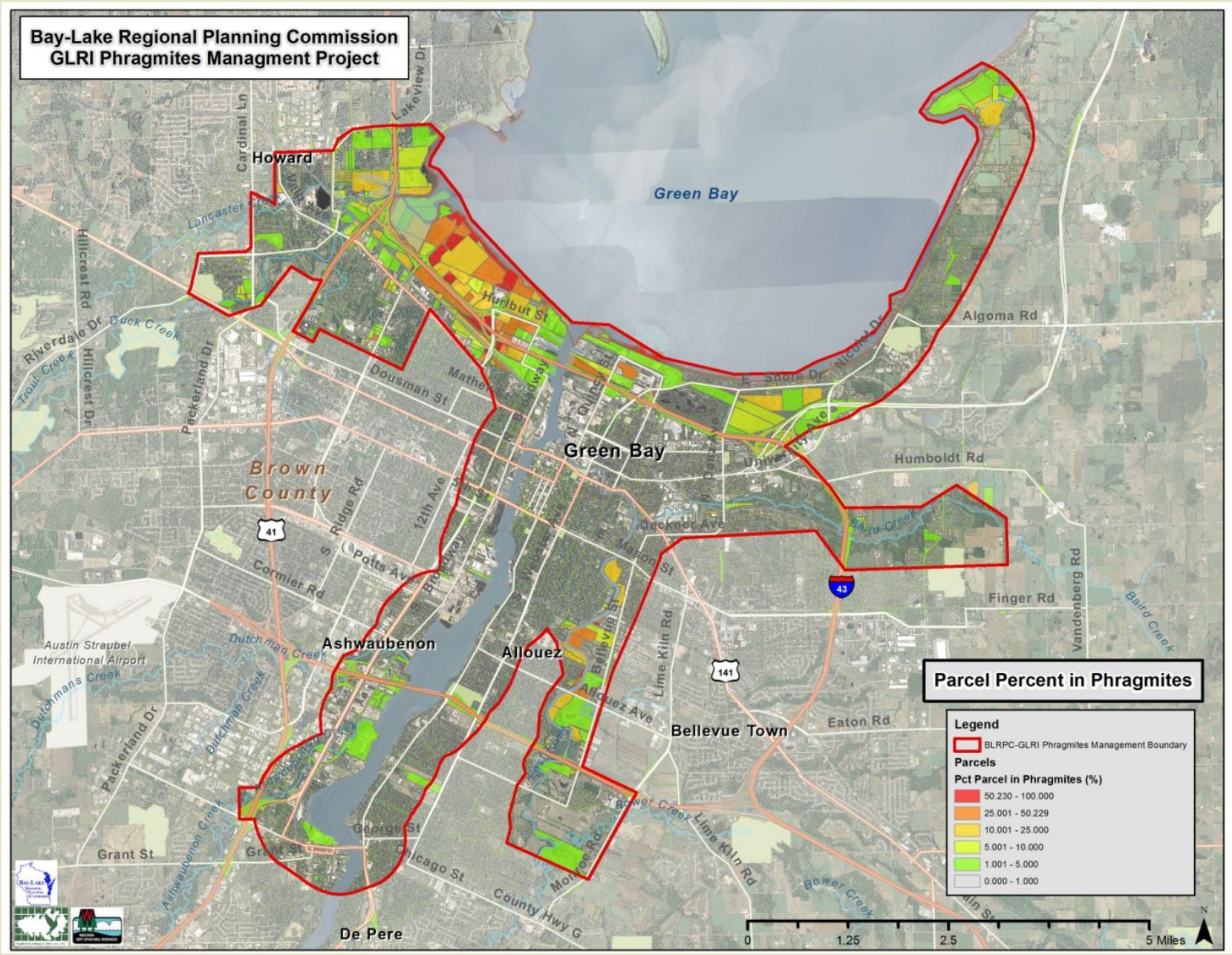
S Vandenberg Rd
41
43
141
2015 Prioritized Phragmites Stands
Legend
BLRPC-GLRI Phragmites Management Boundary
PHRAGMITES DISTRIBUTION
Rank by Parcel Score
Low
Medium Low
Medium
High
0
1.25
2.5
5 Miles
N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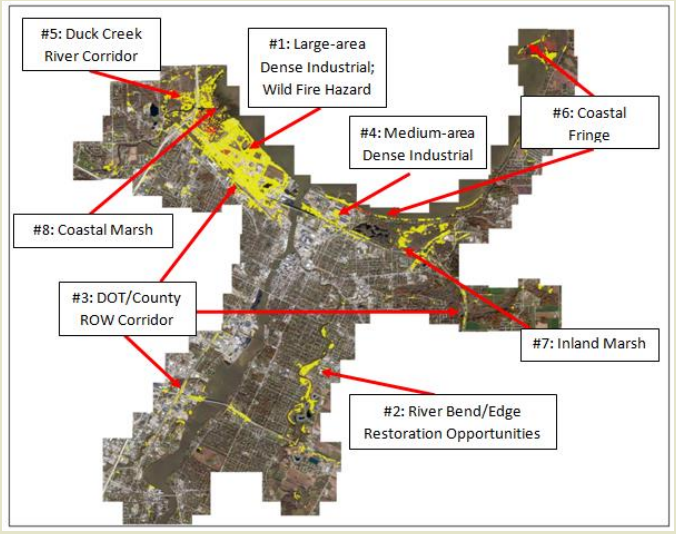
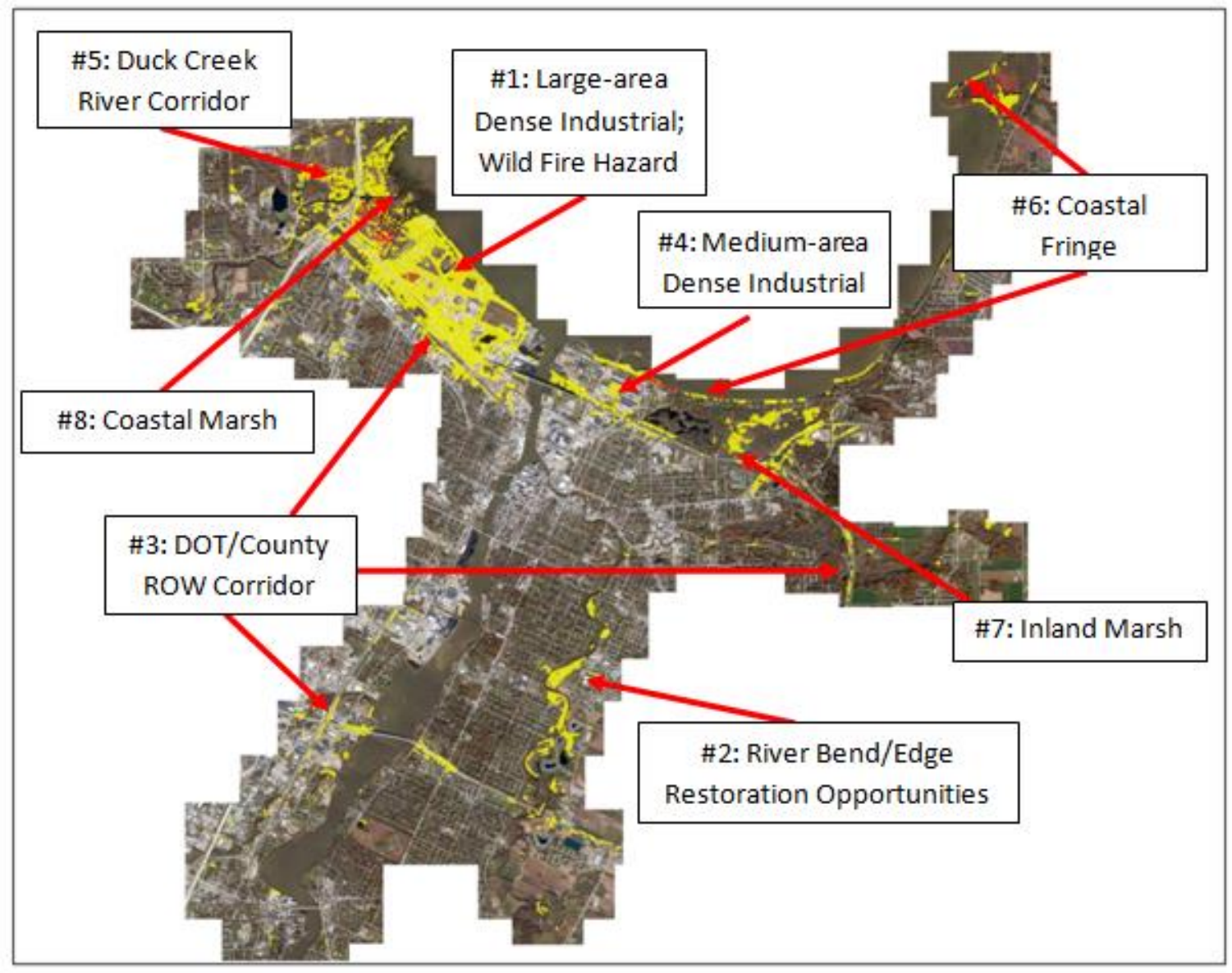
Hillcrest Rd
Cardinal Ln
Lakeview Dr
Lancaster Creek
Duck Creek
Trout Creek
Dutchmans Creek
Ashwaubenon Creek
Bower Creek
Baird Creek
Vandenberg Rd
Parcel Percent in Phragmites
Legend
BLRPC-GLRI Phragmites Management Boundary
Parcels
Pct Parcel in Phragmites (%)
50.230 - 100.000
25.001 - 50.229
10.001 - 25.000
5.001 - 10.000
1.001 - 5.000
0.000 - 1.000
0
1.25
2.5
5 Miles
N

# Management Consideration

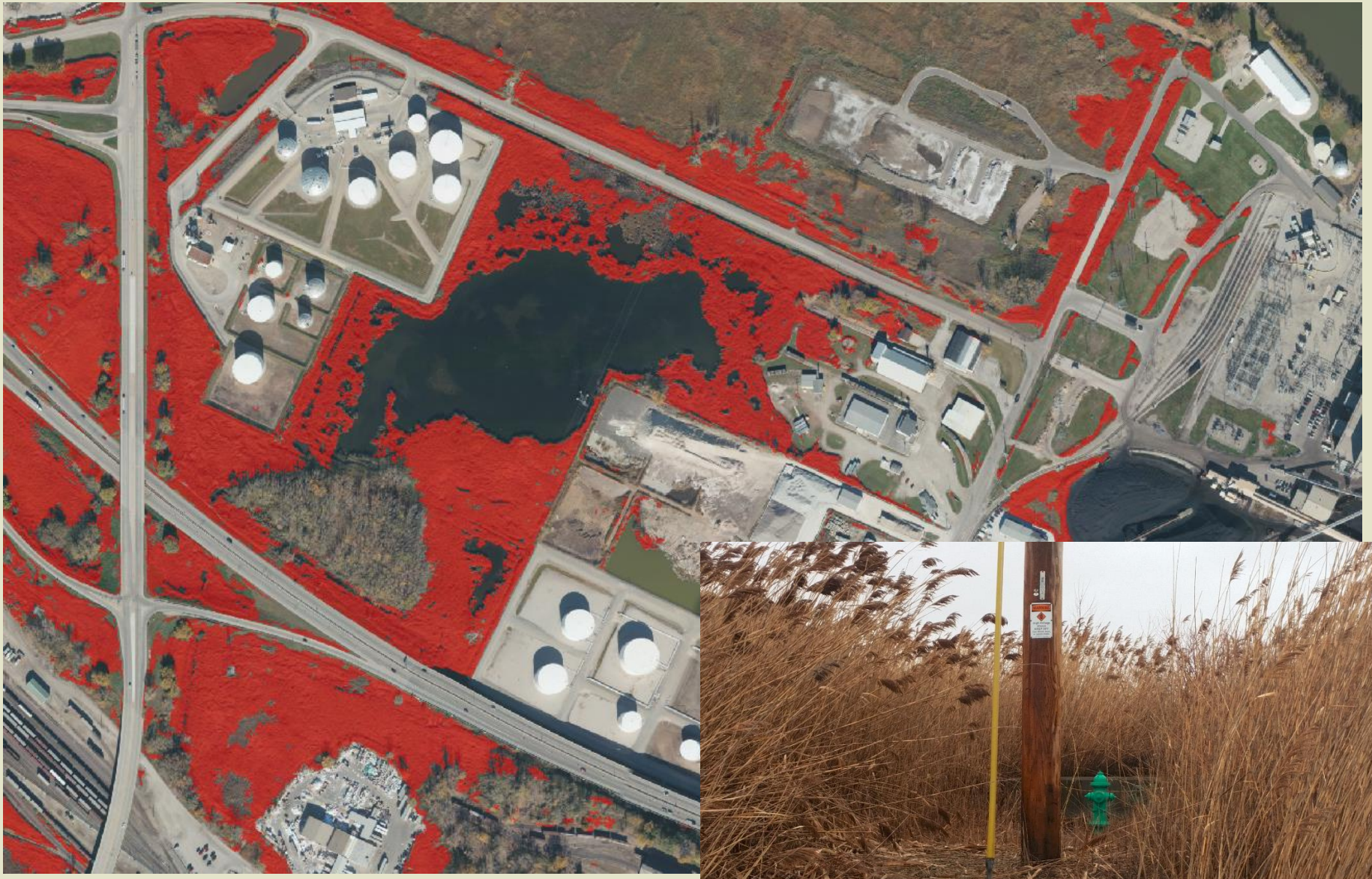
- Holistic approach with vision for restoration not just treat
- Long-term multi-year commitment
- Evaluate on more than acres treated; consider shifts in native plant response
- Consider safety and threat of wildfire
- Develop Management Units
- Protect the best
- Prioritize areas more conducive to continued management



# Management Considerations

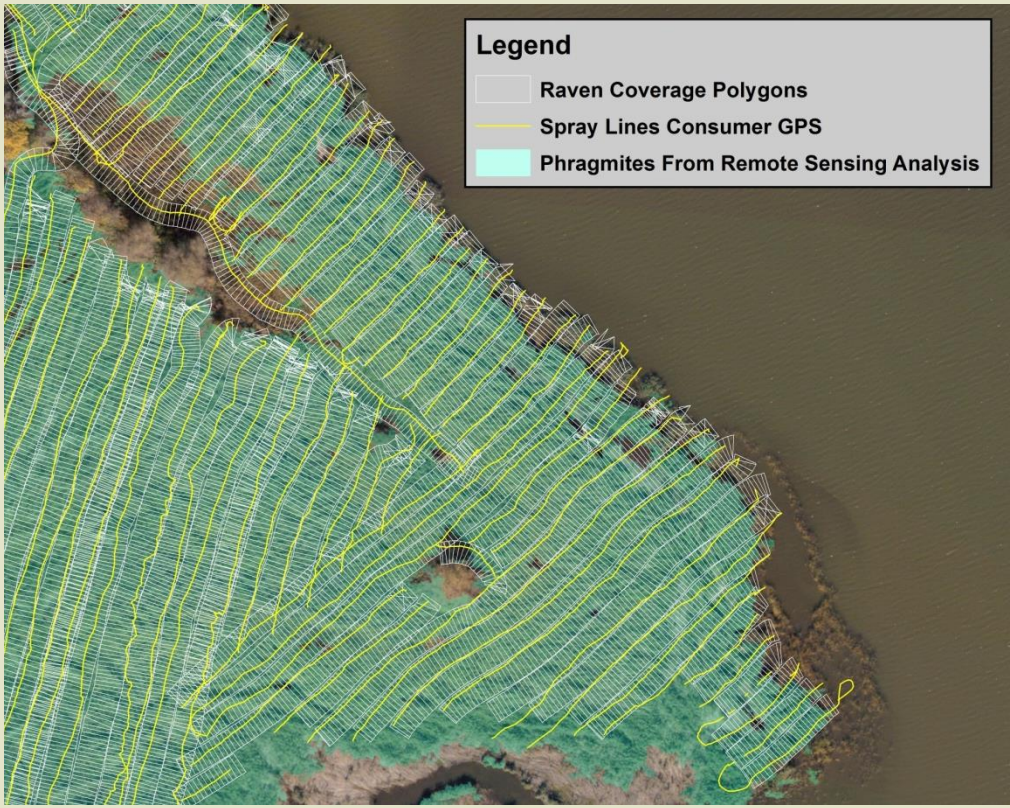


# Industrial and Wild Fire Threats

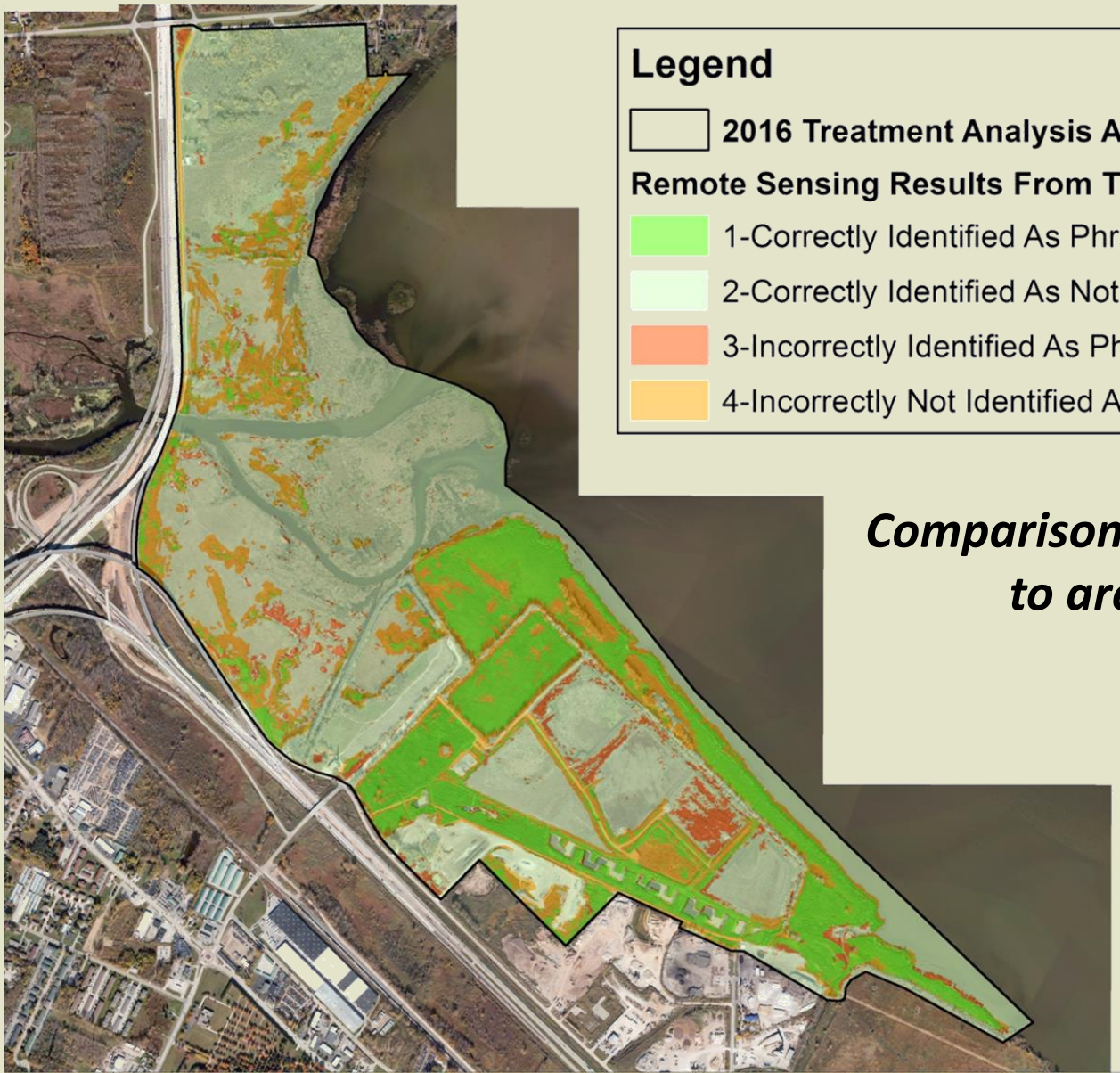


# Education/Best Management Practices

# Implementing "Precision Conservation" in the Field




# Evaluating RS Results



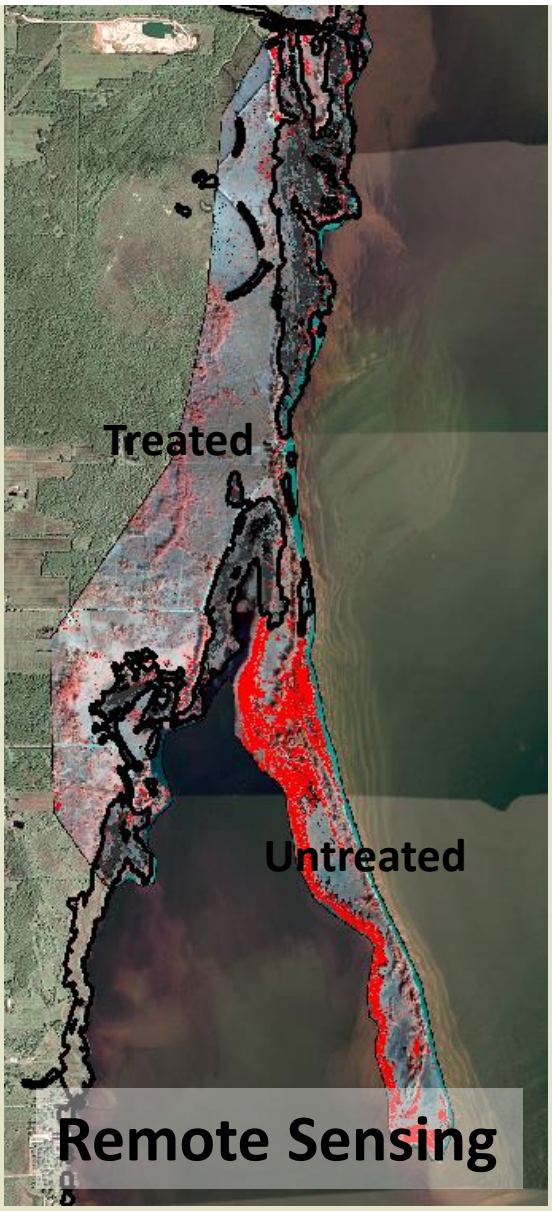

***Comparison of area mapped to area sprayed***

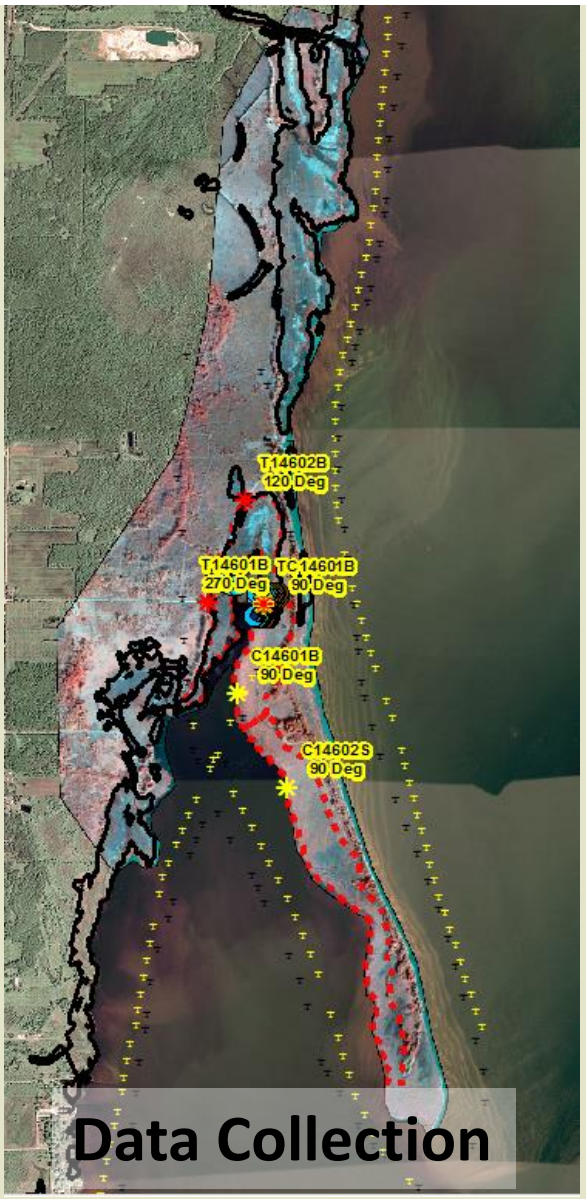
# Evaluate Success by more than Acres Treated.

Amphibian Survey

Bird Survey

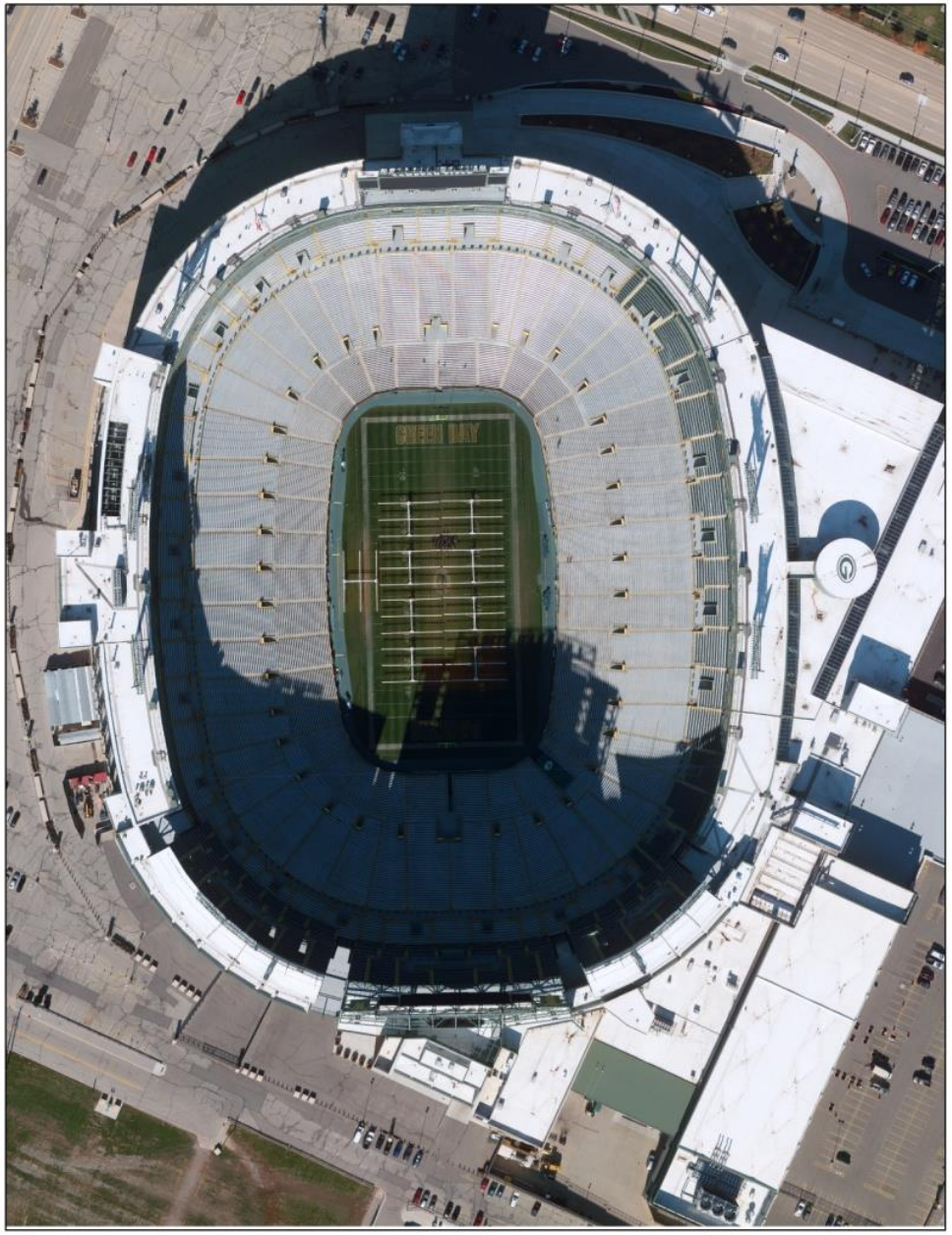
Vegetation Transects



# Conclusions

- **Remote Sensing** is a valuable tool for adaptive management.
- Utilize appropriate sensor for project size and focus. **Timing** of imagery is key.
- Good baseline inventory to inform next steps and **maximize** efficiency of strategic management
- RS needs field calibration and users need be informed on **strengths/weakness** mapping
  - minimize temporal change
  - account for sparse small areas as well under canopy
- Set goals higher than just acres treated. **Work towards restoration and native plant regeneration**


GREEN BAY

# Questions??

For More Information Contact:

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Applied Ecological Services: www.appliedeco.com/


**Project Contributions and Thanks to:**
- Great Lakes Restoration Initiative (GLRI)
- Angela Kowalzek-Adrians (BLRPC)
- Amy Carrozzino-Lyon (WI DNR)
- Fugui Wang (AES)
- Todd Polacek (AES)

**Resources/Links:**

http://www.mtri.org/treatment_effects_phragmites.html
http://berkey.906.io/shoreviewer/web/build/index.html#/great-lakes
http://greatlakesPhragmites.net/