Acknowledgements – Team Effort!

- **Research Team**: DWR & UCD
  - Krista Hoffman, JT Robinson, Gina Darin
- **Field & Lab**: Solitude Lake Management, Bryte Chem Lab, WECK Lab, Suisun RCD
- **Stakeholders**
- **Funders**: DC Prop 1 Grant & DWR Fish Restoration Program
Why care about phragmites?

Negative effects on:

• Native vegetation, fish, and wildlife
• Water quality
• Recreation

Photo: Blacklock phragmites encroaching over Masons lilaecopsis population
Blacklock Phragmites Control Study

- Purpose of Study: Justification & Goal
- Study Objectives: Efficacy & Impacts
- Study Timeframe: 2019-2022
- Sitewide Implementation
Blacklock Phragmites Control Study

Funding and permits secured 2019

Contracted with UCD, Solitude Lake Management, and WECK Labs

Last drone flight May 2022
Treatment Plots

- 10 x 10 Meter Treatment Plots
- 4 x 4 Meter Monitoring Center
Herbicide & Mow Treatments

- Aquatic Glyphosate Formulation
- Aquatic Imazapyr Formulation
- Non-ionic surfactant

<p>| | | | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Control</td>
<td>Imazapyr</td>
<td>Glyphosate + Imazapyr</td>
<td>Glyphosate + mow</td>
<td>Imazapyr + mow</td>
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</table>
Herbicide & Mow Treatments

- Marsh Master was used in 2019
- Jon boat, backpack sprayer, and weed eaters used in 2020 & 2021
Monitoring

Physical Vegetation Sampling

Water Quality Sampling

Frequent UAV Monitoring
Physical Vegetation Monitoring

- Quadrat percent cover and shoot count
- Biomass collection and stand measurements
Water Quality Monitoring

Discrete water samples
- 24 hours before herbicide application
- During herbicide application
- 24 hours – 1 week after herbicide application
UAV (drone) Monitoring

- RGB imagery is collected using Phantom 4 Pro RTK
- Multispectral imagery is collected using Matrice 200 with Micasense 5-band sensor
Blacklock Imagery – RGB and Multispectral Orthomosaic

RGB Orthomosaic
1.8cm x 1.8cm

Multispectral (RGB) Orthomosaic
4.2cm x 4.2cm
Blacklock Imagery – Normalized Difference Vegetation Index

\[
\text{NDVI} = \frac{(\text{NIR} - \text{Red})}{(\text{NIR} + \text{Red})}
\]

NDVI August 31, 2020

<table>
<thead>
<tr>
<th>Value</th>
<th>Color</th>
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<td>Dark Green</td>
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<tr>
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<tr>
<td>≤0.861735</td>
<td>Bright Orange</td>
</tr>
<tr>
<td>≤0.965164</td>
<td>Bright Orange</td>
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NDVI Results

Treatments
- Control
- Glyphosate/Imazapyr
- Glyphosate/Imazapyr/Mow
- Glyphosate/Mow
- Imazapyr
- Imazapyr/Mow

Herbicide Treatment Applied
- October 2019
- September 2020
NDVI Results

Treatments

 Herbicide Treatment Applied
September 2021
Non-target plants
Recruitment of Native Vegetation
<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Total samples taken (2019-2021)</th>
<th>Positive Detections (2019-2021)</th>
<th>Maximum Detection (mg/L)</th>
<th>Average Detection (mg/L)</th>
<th>NPDES Receiving Water Limit/Monitoring Trigger (mg/L)</th>
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</thead>
<tbody>
<tr>
<td>Glyphosate</td>
<td>196</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>0.7</td>
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<tr>
<td>Imazapyr</td>
<td>210</td>
<td>30</td>
<td>0.013</td>
<td>0.00127</td>
<td>11.2</td>
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</table>
Future of Blacklock

- Lessons learned from Blacklock Study
- Finetune methods and monitoring
- Full sitewide implementation
- Facilitate permitting
Site-wide Treatment

- Phased Treatment starting September 2023
- UAV herbicide application
- Mowing, as needed
- Buffer Mason’s lilaeopsis
- Spot spray
- Active revegetation
- Monitoring
Thank you!

Any Questions?