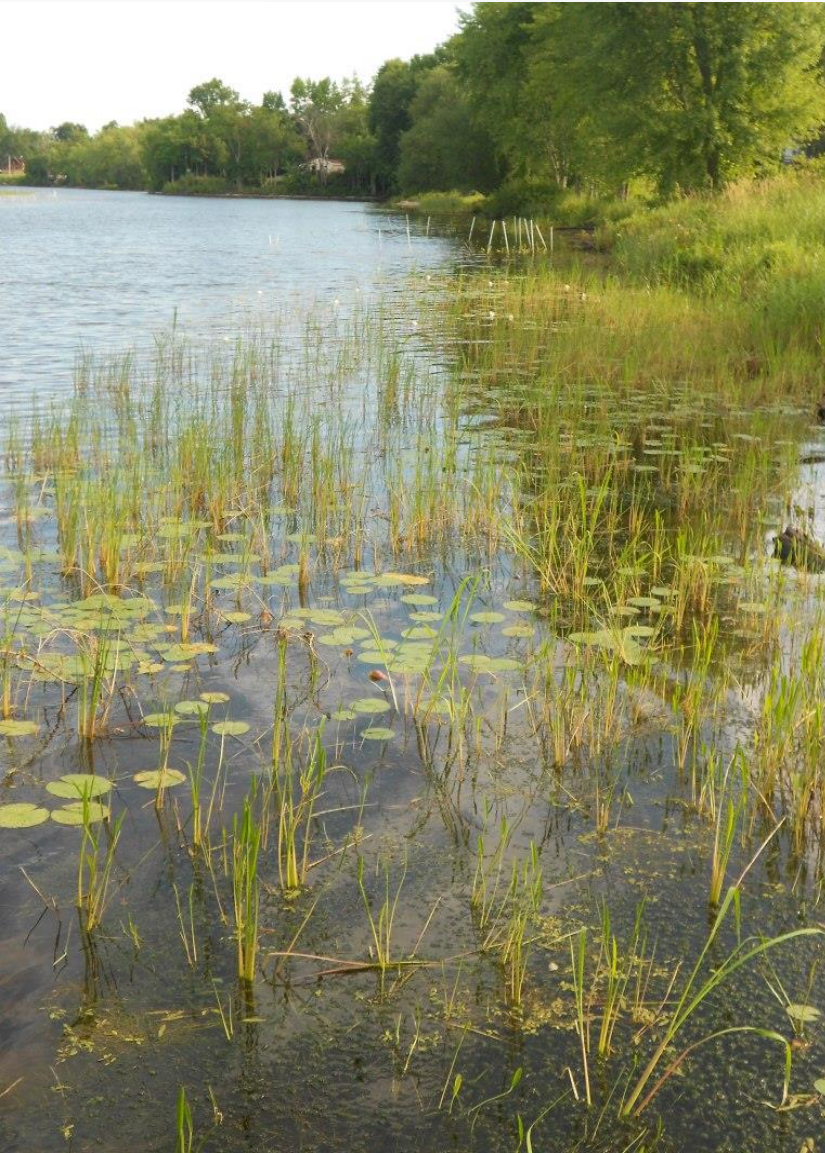


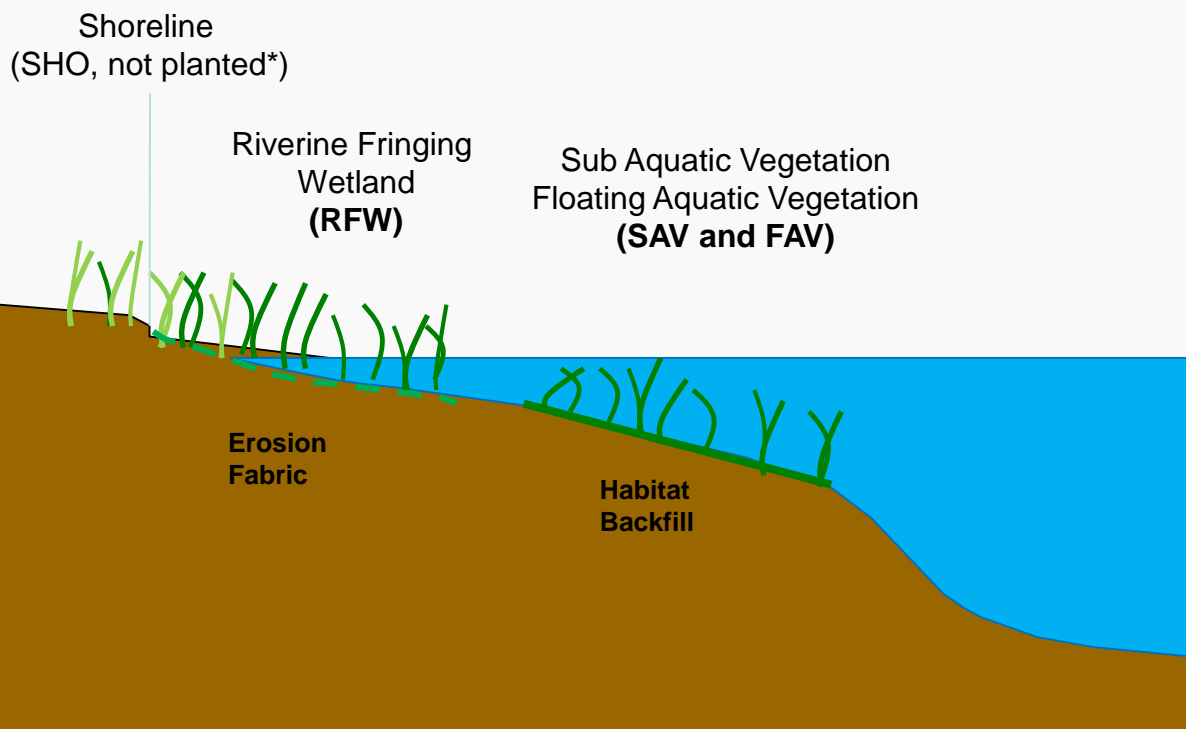
Habitat Update

Hudson River CAG May 28, 2020



Habitat Background

A habitat replacement program is being implemented in an Adaptive Management context to reconstruct and stabilize habitats impacted during dredging



- **Shoreline (SHO)**
- **Riverine Fringing Wetland (RFW)**
- **Submerged & Floating Aquatic Vegetation (SAV/FAV)**
 - Planting and Natural Recolonization (NR) Areas
- **Unconsolidated River Bottom (UCB, not vegetated)**

* SHO reconstruction included planting if disturbed above design elevation, depending on energetics.

Habitat Overview: Across the Project Area



River Section 1
RM 194.5 - 188.5
Reach 8

308 Acres Dredged
6.0 River Miles

10.5 acres RFW established
61.9 acres SAV established

River Section 2
RM 188.5 – 182.4
Reaches 7 and 6

88 Acres Dredged
6.1 River Miles

12.9 acres RFW established
17.7 acres SAV established

River Section 3
RM 182.4 – 154
Reaches 5 through
1

96 Acres Dredged
29.2 River Miles

6.4 acres RFW established
15.4 acres SAV established



Benchmark and Success Criteria Monitoring



Benchmark Monitoring

EPA Review

Success Criteria

- Non-destructive, quantitative and qualitative monitoring of planting and natural recolonization areas
- Now and ongoing (can last 5+ years for individual habitat reconstruction areas)
- Percent cover and species composition compared to reference areas (data reported annually)
- Potential response actions

- Not begun yet
- Additional 2-5 years of quantitative and statistically-based evaluations
- Includes destructive (harvest of biomass) survey methods
- Comparison to reference areas on reach-wide (or other) bases
- Could begin earlier for some areas depending on their year of planting and results of benchmark monitoring.
- EPA, NYSDEC, and GE are discussing bases and timelines

Habitat Monitoring Overview: Annual RFW and SAV Monitoring Effort



RFW Monitoring

- Vegetation Cover by Quadrat
 - Approx 380 meter² quadrats in 75 target and reference areas
 - Individual species identified
 - Each quadrat photographed
- Soil cores evaluated for hydric soil indicators
- RFW areas evaluated for wetland hydrology indicators
- 2019 included delineation (areal extent)
- Invasive species removed and stabilization measures as needed

SAV Monitoring

- Vegetation Cover by Quadrat
 - Approx 820 meter² quadrats in multiple SAV areas per reach
 - Individual species identified
 - Video used to assess and quantify percent cover
- Approx 200-300 SAV planting and natural recolonization area underwater video transects
- Soil cores collected from select SAV beds for chemical analyses
- Bathymetry based measures of SAV cover pilot studied in 2018 and expanded in 2019

Benchmark and Success Criteria Monitoring: Considerations



Natural environmental variability poses challenges to establishing reconstructed habitats and monitoring criteria

- Factors that challenge reconstructed habitats include:
 - Amount of sunlight, fluctuating water levels and temperatures
 - Variable river flows (high flow vs. low flow years—droughts and floods)
 - Ice flows, herbivory, and invasive species
 - Boat wakes and other human activity (removing plants)
- Extensive scientific analysis and discussion with NYS/other agencies went into developing the reconstruction approach and monitoring criteria (2005 through 2013).
- Final criteria are science driven, statistically based, reflect environmental variability, and involve comparisons of reconstructed areas to habitat reference areas.
- Overall approach is to establish initial plantings and “jump start” recovery, work with natural recolonization, monitor, and consider potential response actions.

Current - Overall Approach



- Phased approach to identifying the response actions needed
- Further evaluation of 2019 pilot studies
 - Field work in June to inform scope of 2020 pilot studies
- 2020 Pilot Studies
 - Adjusted seeding and planting approaches
 - Alternative species considerations
- Outcome of ongoing pilot studies will inform the approach and scale of 2021 work
- Close collaboration on scope and coordination with NYSDEC on approach
- Oversight by EPA and continued close coordination with NYSDEC

RFW Monitoring Transition to Success Criteria



Benchmark Year	RFW Benchmark / Potential Response Actions	RFW Success Criteria
1 (Year of Planting)	100% of plants meet acceptance criteria • Invasive species not present	<ul style="list-style-type: none"> • Areas show progress towards designed acreages documented in the CU Acceptance documents (as reconciled with water surface fluctuations, as needed). • Rills or slumping, if present, are not negatively impacting vegetation establishment. • Percent cover is 85% with percent invasive species less than or equal to that of the reference condition. • Average of the weighted average index values for all Phase 1 RFW areas is 2.0 or less, or demonstrates a consistent progression towards this value, for three out of five years or the final two years of monitoring. • Indicators of wetland hydrology (similar to indicators used in the Phase 1 design) and hydric soils are present. • Presence of hydrophytic vegetation at 85% cover will demonstrate the sediment stabilization function. Plant species-diversity functions within the RFW habitats evaluated within the context of changing environmental conditions (e.g., annual water level variations).
2 (Within 1st Year)	90% species and planting units present • % cover increased from year of planting • Remove observed invasive species	
3 (2 years)	% cover >= 70% of reference area cover • 20% species cover is native volunteers • Remove observed invasive species	
4 (3 years)	% cover >= 85% of reference area cover • 40% species cover is native volunteers • Inv spp cover <= reference areas	
5 (4 years)	% cover >= 85% of reference area cover • Inv spp % cover <= reference areas	
6 (5+ years)	% cover >= 85% of reference area cover • Inv spp % cover <= reference areas	

RFW Monitoring

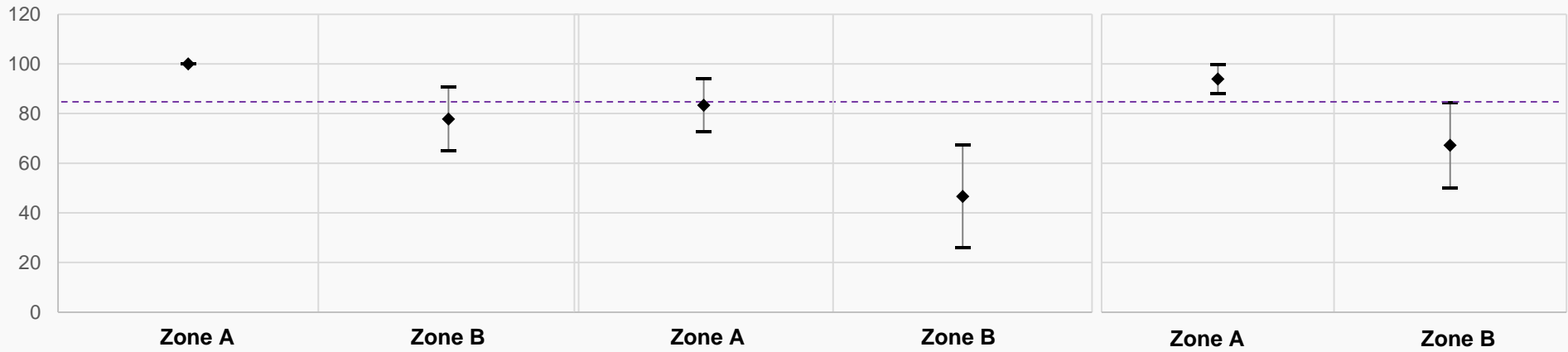
CU60 Percent Cover by Zone



CU60 RFW 2017 by Zone

CU60 RFW 2018 by Zone

CU60 RFW 2019 by Zone



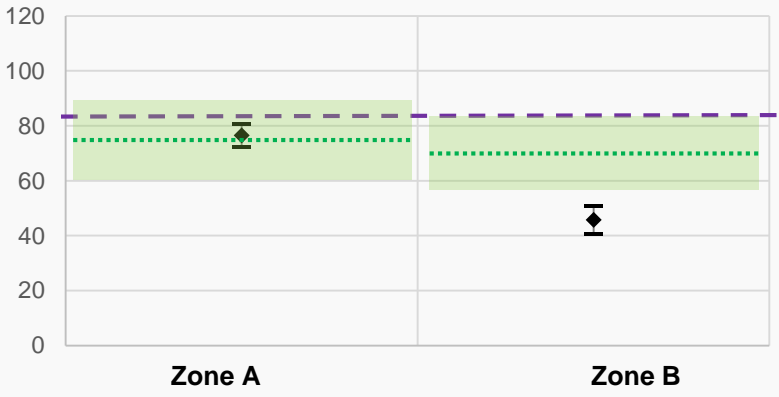
- - - - - 85% (Absolute) Cover

 Average percent cover + 2x Standard Error of the Mean
 Average percent cover observed in plots
 Average percent cover - 2 x Standard Error of the Mean

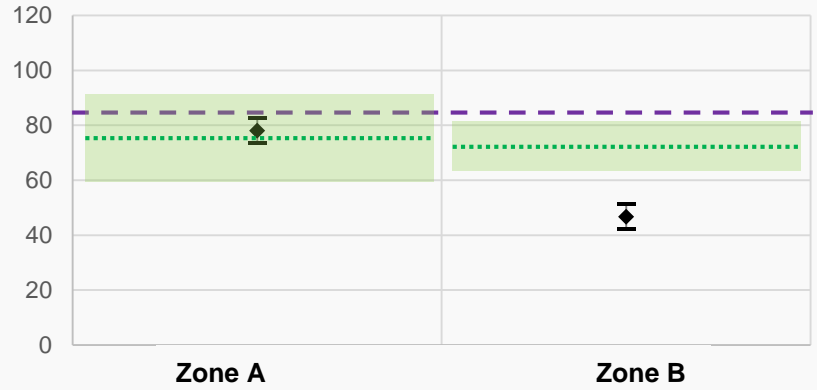
RFW Monitoring Reconstruction Zone Trends

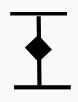






2018 RFW Reconstruction Areas
Percent Cover by Zone



2019 RFW Reconstruction Areas
Percent Cover by Zone



 Average percent cover + 2x Standard Error of the Mean
 Average percent cover observed in plots
 Average percent cover - 2 x Standard Error of the Mean

 85% (Absolute) Cover
 Reference Area Mean +/- 2*SEM for Each Zone and Year

RFW Monitoring Summary



RFW Zone A Areas:

- Generally exceeding benchmarks
- Typically high diversity with good mix of installed and recruited species
- Percent cover in some locations needs to improve
- Represents approx. 35% of RFW reconstruction areas



RFW Zone B Areas:

- Generally lagging benchmarks
- Overall percent cover and species diversity needs to improve
- Some areas dominated by SAV species rather than RFW emergent species
- Represents approx. 65% of RFW reconstruction areas



RFW - Considerations



- GIS analysis to categorize RFW areas
 - physical conditions
 - percent cover
 - Code areas based on type of action
 - red=consider viability of the area
 - yellow=adaptive response
 - green=continue monitoring and/or expand
- Field reconnaissance to ground-truth the above categories, especially the areas identified for adaptive response (yellow)
 - Develop action proposal for a pilot test to be implemented in 2020
- Scale the work based on the results of the pilots
- Pilot areas monitoring
 - End of the 2020 growing season
 - June 2021 (identify viable approaches)
- Additional response actions in 2021 as needed



RFW – Data Collection and Delineations



- More extensive visual surveys planned (entire RFW areas)
 - Document percent cover and presence of invasive species
- Develop criteria for bringing expanded RFW areas adjacent to existing wetlands or new RFW areas into the program
- Site observations in 2020 to identify areas for inclusion
 - Confirm criteria
 - Add metrics (if needed)
 - Select expanded or new areas
- Continue to use Habitat Ledger to track RFW areas
 - Added/dropped/re-delineated starting in 2020



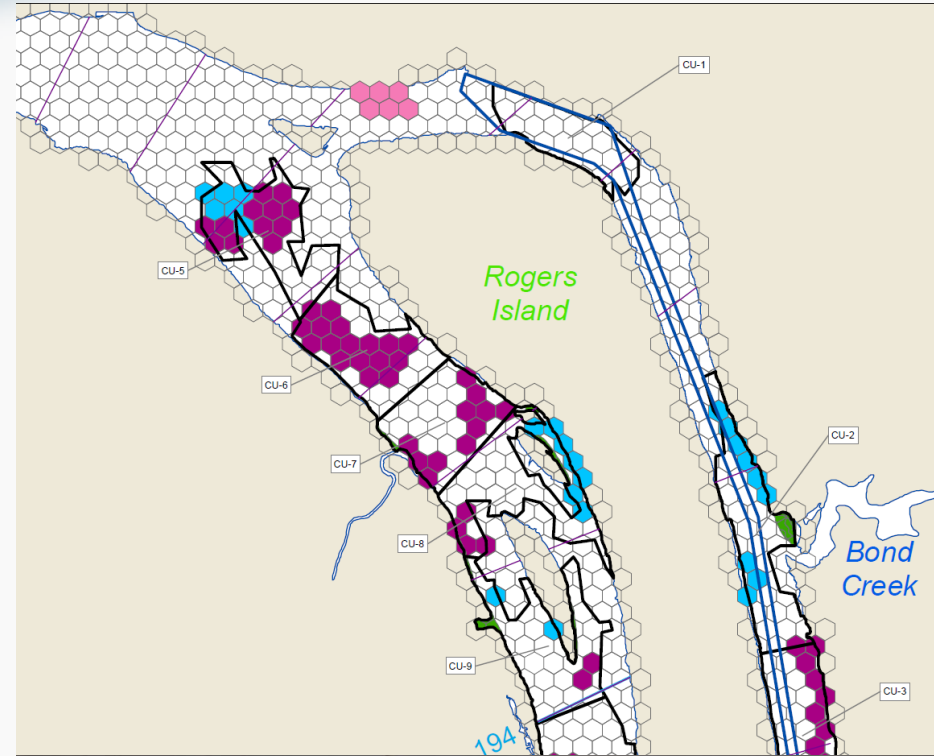
SAV Monitoring - Basics



SAV monitoring differs from RFW monitoring in several ways:

- There is three times more SAV habitat to monitor than RFW,
- “Standard” SAV monitoring approaches were developed at smaller (quadrat scale) or larger (entire bed) scales, and
- Its under water - so we typically need to observe SAV indirectly using video or other imaging.

For these reasons, multiple approaches need to be used.



SAV Planting Area Benchmarks Comparison to Success Criteria



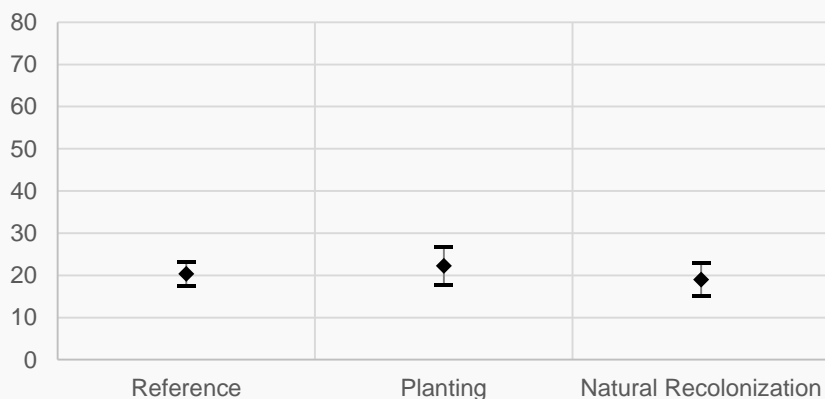
Benchmark Year	SAV (Planting) Benchmark / Potential Response Action	SAV (Planting) Success Criteria
1 (Year of Planting)	100% of installed planting materials meet contract acceptance criteria (compliance documented on CU Cert Form 3).	<p>“Before/After Control/Impact” (BACI) approach using data stratified by “reference” (areas not dredged) sites and “target” (dredged areas) sites (<i>From Section 3.2.2 Phase 1 O&M Plan</i>):</p> <ul style="list-style-type: none"> Success criterion for SAV habitats is that “post-dredging changes in the habitat metrics are no more than 20%” – specifically, in terms of the BACI approach, that the difference between reference and target sites after dredging is no more than 20% greater than the difference between reference and target sites before dredging. Metrics to be evaluated are above-ground biomass, stem density, and percent cover. At least two of the three parameters must show results that are statistically significantly different from the null hypothesis of insufficient recovery for two consecutive years or three out of five consecutive years.
2 (Within 1 st Year)	<p>% cover >= 20% of reference area cover</p> <ul style="list-style-type: none"> Remove observed inv spp Herbivory controls if needed 	
3 (2 years)	<p>% cover >= 30% of reference area cover</p> <ul style="list-style-type: none"> Remove observed inv spp Herbivory controls if needed Per P2 AMP Section 4.2.1 	
4 (3 years)	<p>% cover >= 40% of reference area cover</p> <ul style="list-style-type: none"> Inv spp cover <= Reference areas Herbivory controls if needed Per P2 AMP Section 4.2.1 	
5 (4 years)	<p>% cover >= 50% of reference area cover</p> <ul style="list-style-type: none"> Inv spp cover <= Reference areas Herbivory controls if needed Per P2 AMP Section 4.2.1 	
6 (5+ years)	<p>% cover >= 70% of reference area cover</p> <ul style="list-style-type: none"> Inv spp cover <= Reference areas Herbivory controls if needed Per P2 AMP Section 4.2.1 	


SAV Monitoring 2019

Site-Wide and Reaches 5 and 8

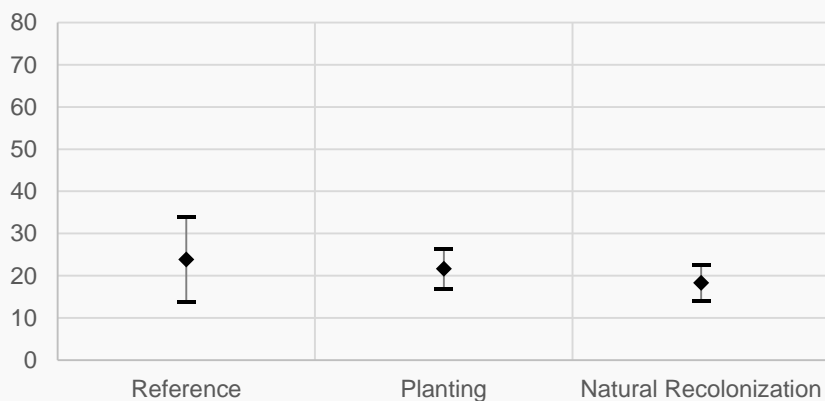


2019 SAV %Cover by Plot Type

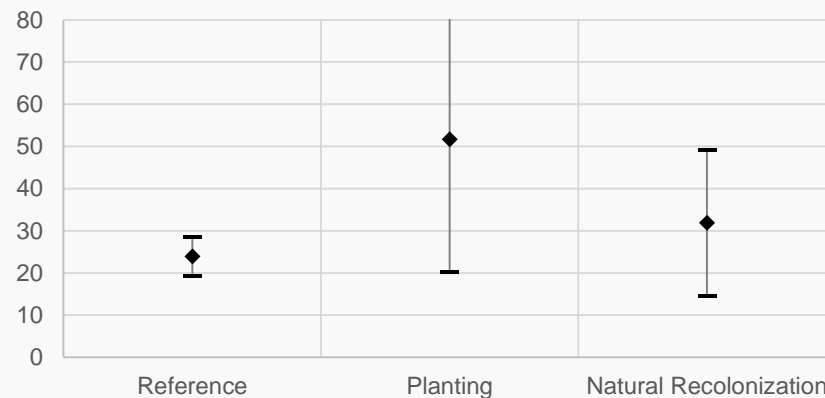



 Average percent cover + 2x Standard Error of the Mean
 Average percent cover observed in plots
 Average percent cover - 2 x Standard Error of the Mean

2019 Reach 8 SAV %Cover by Plot Type



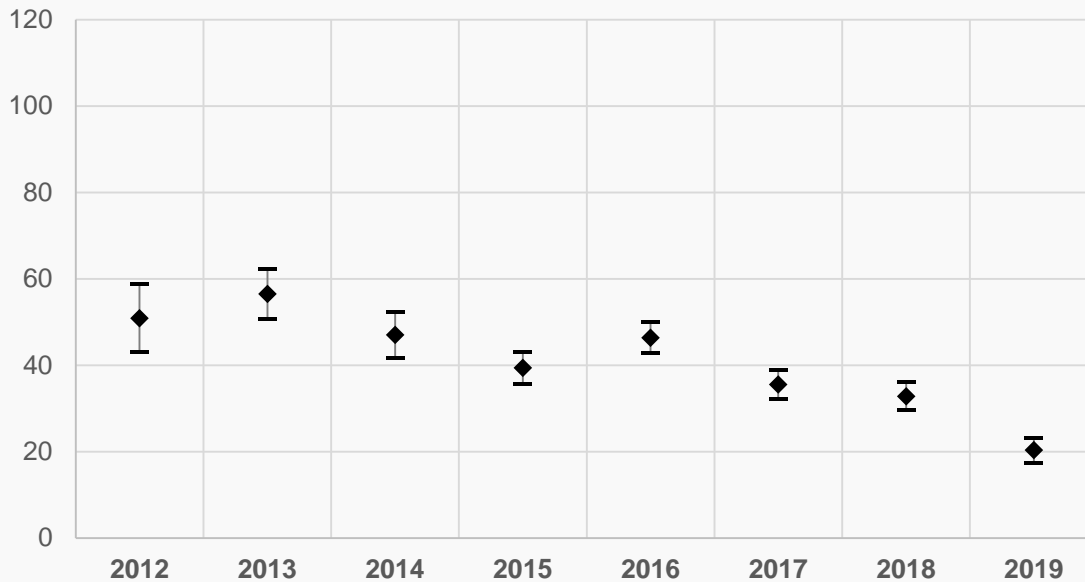
2019 Reach 5 SAV %Cover by Plot Type




SAV Monitoring Site-Wide Reference Beds 2012-2019



Percent Cover in SAV Reference Plots 2012-2019



 Average percent cover + 2x Standard Error of the Mean
Average percent cover observed in plots
Average percent cover - 2 x Standard Error of the Mean

Decline or Migration?

- Through 2016, cover was not dense but was holding steady
- There are multiple potential reasons for this apparent decline
- We know that SAV beds shift and also change (thin out or get more dense) over time
- It is also possible that what has traditionally been a reference bed has declined while other areas have gained vegetation
- EPA is evaluating this trend with GE in coordination with NYSDEC

SAV Monitoring Summary



SAV Planting Areas:

- Some areas approach or overlap reference areas but some are not exceeding benchmarks
- Many areas have been exhibiting decreased percent cover since 2017

SAV Natural Recolonization:

- Generally low overall percent cover
- Most areas are not meeting or exceeding benchmarks
- However certain areas are showing increased cover since 2017

SAV reference areas are exhibiting decreased percent cover since 2017. These trends have become apparent in recent years.



SAV Planting and Recolonization



- Continued use of GIS analysis
 - Evaluate possible reasons for apparent recent decrease in percent cover
- Continued coordination with SAV experts
- Conduct field monitoring of 2019 buoy seeding
 - Based on results
 - Evaluate increasing density of seeding
 - Changing the method of seed deployment
 - Other modifications
- Plot existing percent cover data in relation to river bottom conditions
- 2019 underwater video to be reviewed in greater detail
 - Determine presence of SAV and prioritize areas suitable for BioSonics surveys in 2020.
 - Prioritize planting and seeding efforts in 2020 and 2021
- Confirm presence of plant founder colonies



West Griffin Island Area



- Planting and wild rice seeding
- Areas seeded in 2020 will be reseeded in 2021
- Field evaluation of alternative species installed in 2019
 - If results are positive, develop proposal for additional plantings in 2020
 - Considerations
 - Planting in tighter clusters
 - Planting alternative species
 - Use of larger plant units
 - Installing wave breaks
- Larger-scale plantings in 2021
- Follow line of evidence to assess area and adjust approach



Invasive Species Management



- In addition to quadrats - identify percent invasive species by overall visual inspection
- Continue removal of invasive species



Variable Water Levels

CU02 “Bond Creek” RFW Area



Conditions at approximately 4,800/5,000 cfs river flow



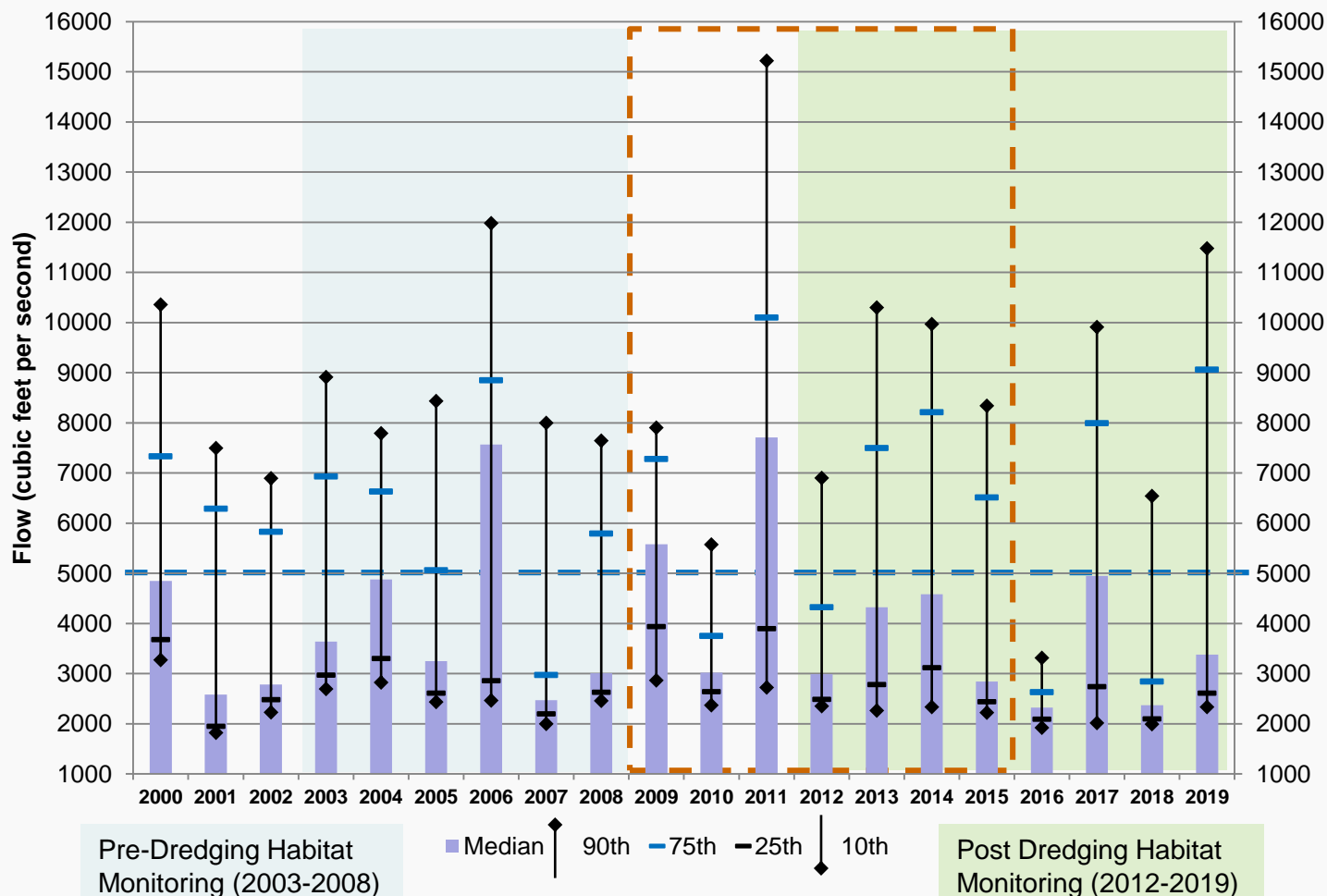
Conditions at approximately 2,500 cfs river flow



Variable River Flows 2000-2019



HR PCB Site TIP Mean Daily Flows in Growing Season May 1 - Sept 30
(Data from USGS Fort Edward Gauge)



Adaptive Management Stressors and Potential Responses



Other “Variable Flow” Stressors:

- Wave and wind action (from recreational vessels and wind)
- Ice erosion

Potential Adaptive Responses:

- Wave break berms
- Stabilization measures
- Shoreline stabilization

Adaptive Management Stressors and Potential Responses



Stressors:

- Herbivory
- Invasive species
- Various recreational activities

Potential Adaptive Responses:

- Herbivory controls
- Invasive species monitoring and control
- Continued communication with local residents

Habitat Reconstruction 2020

Key Points and Next Steps



- We remain in benchmark monitoring phase
- General - EPA is working with GE in coordination with NYSDEC regarding potential response actions for the coming field seasons to address recent decreases in RFW and SAV percent cover
- RFW - focus is on assessing RFW Zone B reconstruction areas for their potential for enhancement or expansion
 - Some areas may be expanding into adjacent areas
- SAV - focus is on evaluating percent cover data over time and across the project area
 - Some SAV beds may be shifting or expanding into adjacent areas
 - Alternative means of collecting SAV data are being assessed

Habitat Update



Questions?