

A man wearing a grey long-sleeved shirt, a grey bucket hat, and sunglasses is standing in a blue tub. He is holding a large, dark green mass of aquatic vegetation. Water is splashing around the tub, creating a dynamic and energetic scene. In the background, there are trees and a red plastic basket.

Delaware Submerged Aquatic Vegetation (SAV) Stakeholder Meeting

September 13, 2023
Lewes, Delaware

Photo cover: Andrew McGowen, formerly with Delaware Center for Inland Bays (CIB), tosses widgeon grass (*Ruppia maritima*) into the “turbulator” to break the seed away from the flowering shoot plant material. This project was performed in collaboration with CIB, Delaware Department of Natural Resources and Environmental Control (DNREC) and Delaware Sea Grant (DESG)

Recommended citation: Haywood, Brittany. Delaware Submerged Aquatic Vegetation (SAV) Stakeholder Meeting. Delaware Sea Grant - University of Delaware, 22 Sept. 2023, p. 25.

Delaware Submerged Aquatic Vegetation (SAV) Stakeholder Meeting Summary

On September 13, 2023, 26 current and potential submerged aquatic vegetation (SAV) practitioner stakeholders met at the University of Delaware, Lewes Campus to brainstorm future SAV needs, project ideas, and statewide initiatives. The half-day workshop hosted by Delaware Sea Grant allowed for a free exchange of information to investigate the potential for large-scale projects. The intention of this report is to share the findings and serve as a resource for future projects.

04 Stakeholders

Stakeholders in Attendance

From across the state 26 stakeholders were present from state and federal governmental and non-profit sectors.

04 SAV History

History of SAV in Delaware

During the meeting stakeholders identified key projects, events, activities or known anecdotal knowledge regarding SAV that occurred from the 1920s to the present.

06 Statewide Progress

Identifying What SAV Progress Should Look Like

Stakeholders were asked to consider what progress with SAV should like within the state of Delaware. Responses were in the realms of mapping, shared access of information for practitioners and public, identifying funding sources, and restoration.

07 Project Development

Project Development: Ideas, Resources

There is a large interest in SAV work across the stakeholder group. Current projects, ideas, and resources available within the stakeholder group were shared along with the development of the steps required to implement five projects.

12 Brainstorming Statewide SAV Initiatives

Statewide SAV Initiative Brainstorm

An initial survey was sent out to potential stakeholders to garner an understanding of SAV needs and interests across the state of Delaware. A common response was to designate statewide priorities to focus efforts. Participants of the workshop brainstormed five potential statewide initiatives and how those may impact the communities and partners for which we all interact with.

13 Next Steps

Next Steps

14 References

15 Appendices

Meeting Notes

Stakeholders in Attendance

Stakeholders in attendance included representatives from the Delaware Department of Natural Resources and Environmental Control (DNREC), Delaware Center for the Inland Bays (CIB), Partnership for the Delaware Estuary (PDE), Nanticoke Watershed Alliance (NWA), Delaware Sea Grant (DESG) and the U.S. Environmental Protection Agency (US EPA). A full list of attendees can be seen in Appendix I.

Attendees were asked if they thought anyone was missing from the conversation and the responses were Delaware Fish and Wildlife, U.S. Fish and Wildlife, NOAA, DelDOT, communities and local governments such as town managers, fishermen groups, and researchers from the academic sector.

History of SAV in Delaware

Participants of the Delaware Submerged Aquatic Vegetation (SAV) Stakeholder Meeting were asked to provide input on their work and historical knowledge as it relates to both freshwater and brackish SAV within the state of Delaware. Figure 2 is a scanned copy of the timeline used during the event to document anecdotal knowledge, research, projects or regulation changes.

Marine SAV

1920 - 1986

Pre-1920s there is anecdotal evidence of abundant SAV populations in Delaware. Starting in 1921, accounts of an abrupt decline in eelgrass (*Zostera marina*) populations began being noted in Assawoman Bay. Worldwide, eelgrass began to decline in the 1930s. From the 1930s to the late 1960s anecdotal evidence of SAV in Delaware's Inland Bays pops up and disappears, and it wasn't until 1985 and 1986 that the Inland Bays were deemed vacant of rooted SAV. During this period there were a few projects noted, such as an eelgrass planting in the Delaware Bay and Indian River in 1954, and a Water Quality Study in 1985 and 1986.

1993 - Present

In 1993 the Inland Bays Habitat Suitability Study was conducted, but it wasn't until the late 1990's that SAV work began to pick up again in Delaware's brackish habitats. This may be due to the rapid increase of macroalgae in the Inland Bay system around this time frame. In 1997 the DNREC purchased its first macroalgae harvester and a project to analyze critical habitat requirements of SAV began. Around 1998 eelgrass was transplanted from Chincoteague Bay to the Inland Bays in a project that combined both SAV and oyster restoration. The project was initially a success with anecdotal evidence of each species providing benefits to the other. However, a storm came through and decimated the project. In 1999 Delaware's Nutrient Management Law was passed.

In 2000 - 2010 State Water Quality Standards were passed specific to SAV, and concerns over SAV and macroalgae being navigational hazards began. SAV projects appear to pick up from this time point on with a survey of eelgrass beds in Pasture Point in 2004, sightings of SAV during a clam survey in 2010 at Whites Creek, Seashore State Park, James Farm, and Great Herring Creek Stomp.



Figure 1 Historical SAV information beginning to be documented on the timeline during the meeting.

HISTORY OF SAV IN DELAWARE

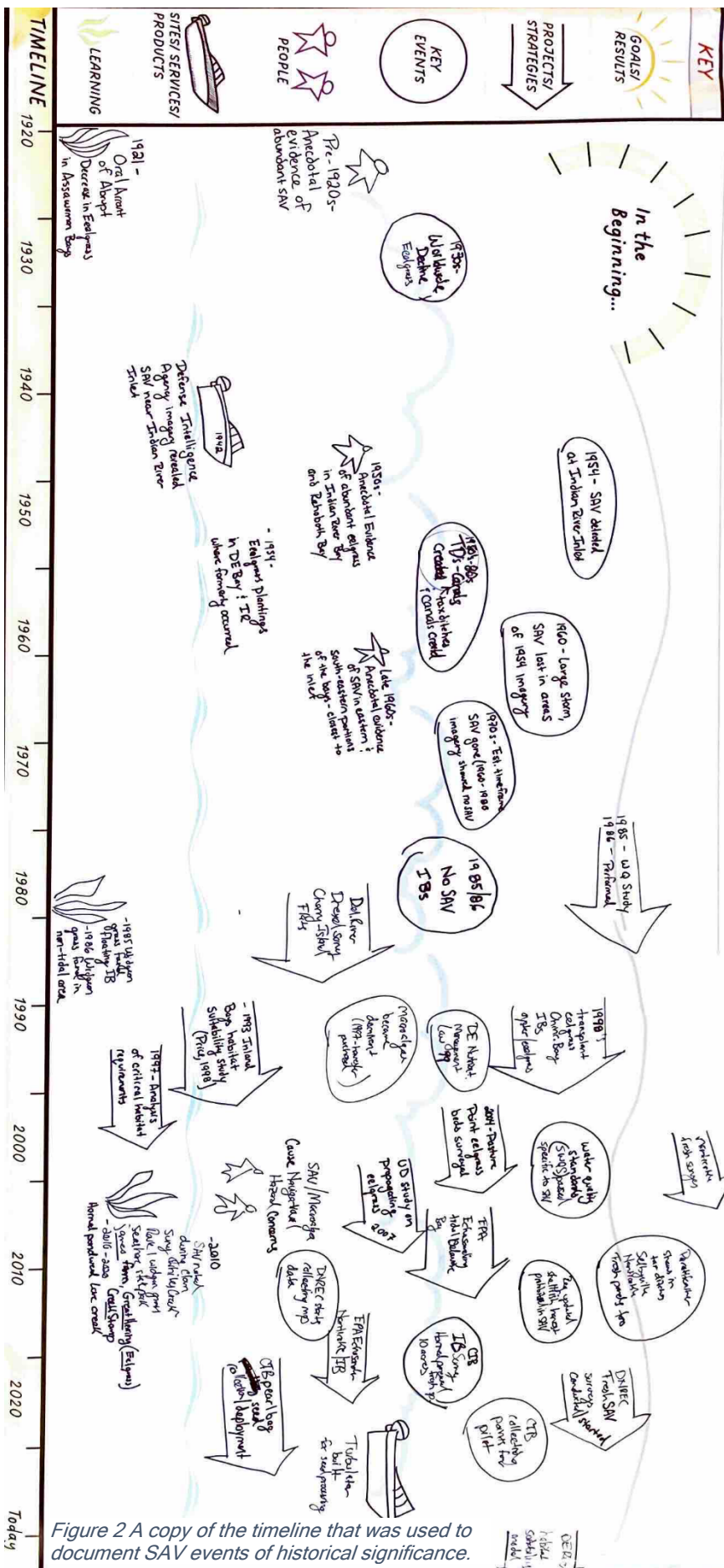


Figure 2 A copy of the timeline that was used to document SAV events of historical significance.

From 2010 to today (2023) SAV gained interest from multiple stakeholders. A regulatory update occurred that prevented shellfish harvesting in SAV beds. DNREC started collecting data on known locations of SAV beds. Work with the US EPA occurred to see if the echosounder could be used to map SAV in the Inland Bays, CIB deployed pearl bags with SAV seed as a restoration tool and trialed the use of drones as a method to map SAV in the Inland Bays, and a pilot project was undertaken by DNREC, CIB and Delaware Sea Grant (DESG) to test seed processing methods.

Freshwater SAV

There were fewer events documented on the freshwater SAV front. We do know that Delaware's tax ditches and canals were created from the 1950s to the 1980s and had an impact on the flora and fauna in those systems. In the 1980s Drexel surveyed the Delaware River, Cherry Island Flats, and widgeon grass was noted in freshwater impoundments. In the early 2000s DNREC conducted SAV surveys, and the US EPA used an echosounder to find SAV on the Nanticoke River. We also know that around 2010, the invasive SAV parrot feather (*Myriophyllum Brasiliense*) began to appear in tax ditches and cause drainage issues in Selbyville, Nanticoke River, and freshwater ponds.

From 2010 - 2020 the native SAV, horned pondweed (*Zannichellia palustris*) was present in Love Creek. Recently work has been done in the Inland Bays by CIB to map freshwater species, for which 10 acres have been found, DNREC has begun conducting surveys on publicly accessible lands and compiling all location-based evidence to document and map the presence of freshwater SAV species, and US EPA is currently developing a habitat suitability model for the Delaware River.

Identifying What SAV Progress Should Look Like

Delaware is a state that is lagging with respect to its Mid-Atlantic neighbors as it pertains to progress in understanding current SAV locations and conditions, and implementation of large-scale restoration projects within its borders. To gain an understanding of where SAV efforts should be focused, participants were sent a survey to capture their thoughts pre-meeting (Figure 3, Appendix II) and asked during the meeting to identify what progress with SAV within the state means to them. Overall, the categories identified included mapping, restoration, outreach, and monitoring.

Responses from stakeholders at the meeting consisted of:

- Perform a multi-method SAV mapping effort to gain true acreage numbers.
- The provision of transparent information for recreational water users including websites, billboards, incorporation into Envirothon, and marine signage.
 - Workgroups for specific target audiences and by county.
- Build capacity within the state for large restoration projects.
 - Ensure realistic expectations and determine goals/ targets.
 - Establish demonstration sites for different habitat/ species types. Determine potential partnerships, such as botanical gardens.
- Develop a pathway for reliable source material for propagating SAV species.
- Utilize citizen science projects to get people involved and appreciating the species.
- Find/ allocate designated funding sources.
- Improve water quality for sustainable SAV populations.
- Have active SAV academic research occurring within the state.
- Create a sustainable long-term SAV group.
 - Ensure coordination between agencies with SAV projects.



Figure 3 Concept responses from a survey that was sent prior to scheduling the meeting. Recipients were asked "Imagine progress with SAV efforts within the state of Delaware. What does that look like to you?" Word cloud shows the frequency of concepts used in pre-meeting survey responses; each concept appeared at least twice. The larger the word, the more times it was used in a response.

Project Development: Pulling Together Ideas and Resources

Stakeholders were given the opportunity to share current projects, project ideas and resources that they were willing to contribute to SAV projects. Below are tables which list information captured during the meeting.

Project Ideas

Table 1 lists the current projects or ideas that were shared at the meeting grouped into categories, restoration, monitoring, mapping, project and research needs, and outreach. There were 23 different project ideas shared.

Table 1 Current projects (in green) or project ideas (in black) that were discussed during the meeting.

Restoration
FW mussel and SAV mutualism
Turbulator - CIB, Sea Grant, DNREC (Current)
Multi-ecosystem restoration "mosaics" (mussels, SAV, oysters)
Bartram's PA Living Shoreline (FW Tidal SAV/ FW mussels) (Current)
Research/ trial of SAV/oyster restoration potential outside of just Inland Bays watershed
Scale up habitat quality - parameters and coverage
Actively working through eradicating existing invasive species, parrot feather, in tax ditches
Suitability study of tax ditch systems/ channels that could be potential restoration sites
Monitoring
Monitoring potential SAV planting areas in Inland Bays
Freshwater surveys statewide (state parks, Nanticoke, Brandywine, White Clay, Lums Pond) (Current)
Intensive long-term monitoring sites, esp. freshwater tidal (like Christina River)
Mapping
Side scan Sonar + aerial hyper-spectral surveys w/ complete geographic coverage
Echosounder SAV Trenton to Marcus Hook (Current)
Organizing and aggregating SAV spatial data historic and current data state-wide
Project/ Research Needs
Biological needs of different species
Environmental thresholds of native SAV species. Climate change resilience.
Incorporating SAV as a WQ BMP in stream restoration
Habitat suitability study Trenton to Marcus Hook (Current)
Outreach
Increasing awareness among professionals by including SAV WG in DE Restoration Workgroup (Current)
Workgroups (freshwater, Inland Bays/ saltwater, invasive species, tidal, macroalgae)
DNREC webpage
Macroalgae harvesting education (Current)
Citizen science SAV surveys, schools, groups, etc.

SAV Resources for Delaware SAV Work

Table 2 lists available resources amongst the stakeholders. Each attendee was asked to list any item they would be willing to share with partners to perform SAV work. They are grouped into the following categories:

- *Equipment* - has access to equipment that can be used to assist with SAV projects
- *Field Work* - is interested in or has staff that are available to assist with SAV field work
- *Funding* - either has funding or can assist with obtaining funding and managing grants
- *Knowledge Base* - has personal knowledge of a particular SAV topic and is willing to collaborate
- *Mapping* - can assist with geographic information system (GIS) needs
- *Network Connections* - has access to additional stakeholders that can benefit SAV projects
- *Outreach* - can perform or assist with education and outreach initiatives

Table 2 Resources stakeholders have offered to assist with SAV efforts grouped by type.

Resource	Name(s)	Title	Agency	Email
Equipment				
A drone pilot/ co-pilot	Alison Rogerson	Environmental Scientist	DNREC Wetland Monitoring & Assessment Program	Alison.Rogerson@delaware.gov
Small field crew and use of small boat	Alison Rogerson	Environmental Scientist	DNREC Wetland Monitoring & Assessment Program	Alison.Rogerson@delaware.gov
Access to UD boats and equipment	Brittany Haywood	Coastal Ecology Specialist	DE Sea Grant	haywoobl@udel.edu
DNREC has kayaks	Brittney Flatten	Environmental Scientist	DNREC	brittney.flatten@delaware.gov
Storage	Katie Bergin	Program Manager	DNREC Shoreline and Waterway Management	kathleen.bergin@delaware.gov
Equipment (boats)	Katie Bergin	Program Manager	DNREC Shoreline and Waterway Management	kathleen.bergin@delaware.gov
PDE Equipment (trucks - Chev 2500, kayaks, RTK, H2O level and conductivity HOBOS, lab space, H2O filtration (seston)	LeeAnn Haaf	Estuary Science Manager	Partnership for the Delaware Estuary	lhaaf@delawareestuary.org
Staffing/ equipment	Mark Biddle		DNREC	mark.biddle@delaware.gov
Equipment (boat, truck, kayak)	Meghan Noe Fellows	Director of Estuary Science and Restoration	Delaware Center for the Inland Bays	mnoefellows@inlandbays.org
Potential location for large mesocosm setup for SAV research	Meghan Noe Fellows	Director of Estuary Science and Restoration	Delaware Center for the Inland Bays	mnoefellows@inlandbays.org
Willing to volunteer time and potential vessel w/ captain	Mike Bott	Program Manager	DNREC	michael.bott@delaware.gov
Possible boat time	Mollie Yacano	Research Coordinator	DNREC	mollie.yacano@delaware.gov
Field Work				
Time - field work	?			
Monitoring and restoration field work	Andy Howard	Environmental Scientist	DNREC	andrew.howard@delaware.gov
Field work	Brittany Haywood	Coastal Ecology Specialist	DE Sea Grant	haywoobl@udel.edu
Time and effort for field work & restoration	Heather Smith	Environmental Scientist	DNREC	heathera.smith@delaware.gov
Potential project work capacity	Katie Bergin	Program Manager	DNREC Shoreline and Waterway Management	kathleen.bergin@delaware.gov
Field assistance	Lori Brown	Environmental Scientist	DNREC Division of Watershed Stewardship	lorim.brown@delaware.gov
Staff ability to help w/ field efforts	Mollie Yacano	Research Coordinator	DNREC	mollie.yacano@delaware.gov
Field help	Sarah Bouboulis	Planner IV	DNREC Shoreline and Waterway Management	sarah.bouboulis@delaware.gov

Resource	Name(s)	Title	Agency	Email
Funding				
Small pot of \$ from grant for staff time and supplies	Alison Rogerson	Environmental Scientist	DNREC Wetland Monitoring & Assessment Program	Alison.Rogerson@delaware.gov
Grant management	Andy Howard	Environmental Scientist	DNREC	andrew.howard@delaware.gov
Limited but available staff & NOAA funding for projects (contractual and supplies)	Ashley Norton	Program Manager	DNREC Delaware Coastal Programs	ashley.norton@delaware.gov
Grant assistance	Brittany Haywood	Coastal Ecology Specialist	DE Sea Grant	haywoobl@udel.edu
Access to PDE proposal submission	LeeAnn Haaf	Estuary Science Manager	Partnership for the Delaware Estuary	lhaaf@delawareestuary.org
Grant development	Mark Biddle		DNREC	mark.biddle@delaware.gov
Leveraging funding sources	Mark Biddle		DNREC	mark.biddle@delaware.gov
Knowledge Base				
Permitting guidance	?			
Knowledge of SAV monitoring and restoration	Brittany Haywood	Coastal Ecology Specialist	DE Sea Grant	haywoobl@udel.edu
I have survey results to share w/ Lori	Brittney Flatten	Environmental Scientist	DNREC	brittney.flatten@delaware.gov
Fieldwork experience (seed collection and transect monitoring)	Jecy Klinkam	Restoration Specialist	Partnership for the Delaware Estuary	jklinkam@delawareestuary.org
Previous academic SAV research & strong interest in continuing	Jecy Klinkam	Restoration Specialist	Partnership for the Delaware Estuary	jklinkam@delawareestuary.org
Permit assistance	Katie Bergin	Program Manager	DNREC Shoreline and Waterway Management	kathleen.bergin@delaware.gov
Education background in SAV (estuarine, Shinnecok Bay Restoration Program)	Kayla Clauson		DNREC	kayla.clauson@delaware.gov
Monitoring estuarine systems	LeeAnn Haaf	Estuary Science Manager	Partnership for the Delaware Estuary	lhaaf@delawareestuary.org
Statistics/ R	LeeAnn Haaf	Estuary Science Manager	Partnership for the Delaware Estuary	lhaaf@delawareestuary.org
Research	LeeAnn Haaf	Estuary Science Manager	Partnership for the Delaware Estuary	lhaaf@delawareestuary.org
Understanding of Fundamental plan biology research	Meghan Noe Fellows	Director of Estuary Science and Restoration	Delaware Center for the Inland Bays	mnoefellows@inlandbays.org

Resource	Name(s)	Title	Agency	Email
Knowledge Base (cont.)				
Ideas and potential project implementation	Melissa Hubert, Amy Reed	Program Manager	DNREC Tax Ditch Program	melissa.hubert@delaware.gov
Consideration given to implementing SAV planting when designing RC&D drainage program projects	Melissa Hubert, Amy Reed	Program Manager	DNREC Tax Ditch Program	melissa.hubert@delaware.gov
Research and monitoring help	Sarah Bouboulis	Planner IV	DNREC Shoreline and Waterway Management	sarah.bouboulis@delaware.gov
Planning	Sarah Bouboulis	Planner IV	DNREC Shoreline and Waterway Management	sarah.bouboulis@delaware.gov
People organization	Sarah Bouboulis	Planner IV	DNREC Shoreline and Waterway Management	sarah.bouboulis@delaware.gov
SAV growing/ production	John Sandkuhler	Restoration Coordinator	Nanticoke Watershed Alliance	johnsandkuhler@nanticokeriver.org
Mapping				
GIS (mapping, web applications, database management, etc.)	Brittany Haywood	Coastal Ecology Specialist	DE Sea Grant	haywoobl@udel.edu
Survey 123 - ground truthing	?			
GIS (mapping, geodatabase development, survey development, web applications)	Lori Brown	Environmental Scientist	DNREC Division of Watershed Stewardship	lorim.brown@delaware.gov
SAV mapping expertise (esp. acoustics, LIDAR & Aerial imagery (acoustics = sonar), a former Trembanis student)	Ashley Norton	Program Manager	DNREC Delaware Coastal Programs	ashley.norton@delaware.gov
Network Connections				
Stakeholder coordination	Brittany Haywood	Coastal Ecology Specialist	DE Sea Grant	haywoobl@udel.edu
My position includes SAV work and can act as a lead for any efforts (co-lead)	Kayla Clauson		DNREC	kayla.clauson@delaware.gov
Advocacy in different areas	Mark Biddle		DNREC	mark.biddle@delaware.gov
Resources and location of Center for Inland Bays	Meghan Noe Fellows	Director of Estuary Science and Restoration	Delaware Center for the Inland Bays	mnoefellows@inlandbays.org
Access to stakeholders (Inland Bays stakeholders and participating scientists)	Meghan Noe Fellows	Director of Estuary Science and Restoration	Delaware Center for the Inland Bays	mnoefellows@inlandbays.org
Access to tax ditch officers for communication	Melissa Hubert, Amy Reed	Program Manager	DNREC Tax Ditch Program	melissa.hubert@delaware.gov

Resource	Name(s)	Title	Agency	Email
Network Connections (cont.)				
Distribution of materials developed as applicable when handling Drainage Concerns	Melissa Hubert, Amy Reed	Program Manager	DNREC Tax Ditch Program	melissa.hubert@delaware.gov
DNERRs network nationally	Mollie Yacano	Research Coordinator	DNREC	mollie.yacano@delaware.gov
Further cooperation with partners interested in projects involving marine bi-valve shellfish	Mike Bott	Program Manager	DNREC	michael.bott@delaware.gov
Outreach				
Use of an outreach specialist to create flyers, websites, signs, etc.	Alison Rogerson	Environmental Scientist	DNREC Wetland Monitoring & Assessment Program	Alison.Rogerson@delaware.gov
Restoration WG platform and audience for input and sharing and education	Alison Rogerson	Environmental Scientist	DNREC Wetland Monitoring & Assessment Program	Alison.Rogerson@delaware.gov
Opportunity to cross SAV ed. w/ living shoreline ed.	Alison Rogerson	Environmental Scientist	DNREC Wetland Monitoring & Assessment Program	Alison.Rogerson@delaware.gov
Develop education and outreach materials and projects	Brittany Haywood	Coastal Ecology Specialist	DE Sea Grant	haywoobl@udel.edu
Community Outreach	Katie Bergin	Program Manager	DNREC Shoreline and Waterway Management	kathleen.bergin@delaware.gov
Access to PDE Engagement/ outreach	LeeAnn Haaf	Estuary Science Manager	Partnership for the Delaware Estuary	lhaaf@delawareestuary.org
Website development	Lori Brown	Environmental Scientist	DNREC Division of Watershed Stewardship	lorim.brown@delaware.gov
DNERR education resources	Mollie Yacano	Research Coordinator	DNREC	mollie.yacano@delaware.gov
Education	Sarah Bouboulis	Planner IV	DNREC Shoreline and Waterway Management	sarah.bouboulis@delaware.gov

Developing Potential SAV Projects

After stakeholders thought about project ideas and available resources, they were asked to break into groups and flush out the steps required to implement a certain project with the Project Gameplan worksheet. For each project, each group was asked to identify project goals, stages, or tasks, needed team members or resources, success factors and challenges. Group project ideas included:

- Mapping and inventory of resources of the Christina River
- Statewide habitat suitability modeling
- Identify environmental thresholds of native SAV species in the face of climate change for freshwater and marine habitats, regionally
- DNREC SAV online clearing house/ landing page
- Develop a living shoreline project that incorporates oysters and SAV

Please see Appendix III for each detailed Project Gameplan worksheet. These worksheets may serve as ideas for upcoming grants or projects that could start now if resources were available.

Statewide SAV Initiative Brainstorm

The meeting ended with a discussion of a potential statewide SAV vision and initiatives utilizing the Five Bold Steps worksheet (Figure 4). Stakeholders were asked to identify five potential steps Delaware could take to improve SAV condition, what would support those actions, were there any community or environmental values that the steps supported, any associated challenges, and ended with an overall vision. The intention of this task was to serve as a starting point to think about what a state-wide vision may be, not serve as the final draft. The initial vision statement developed was:

“Have a coordinated effort that results in plate size oysters and robust SAV populations with stakeholder support.”

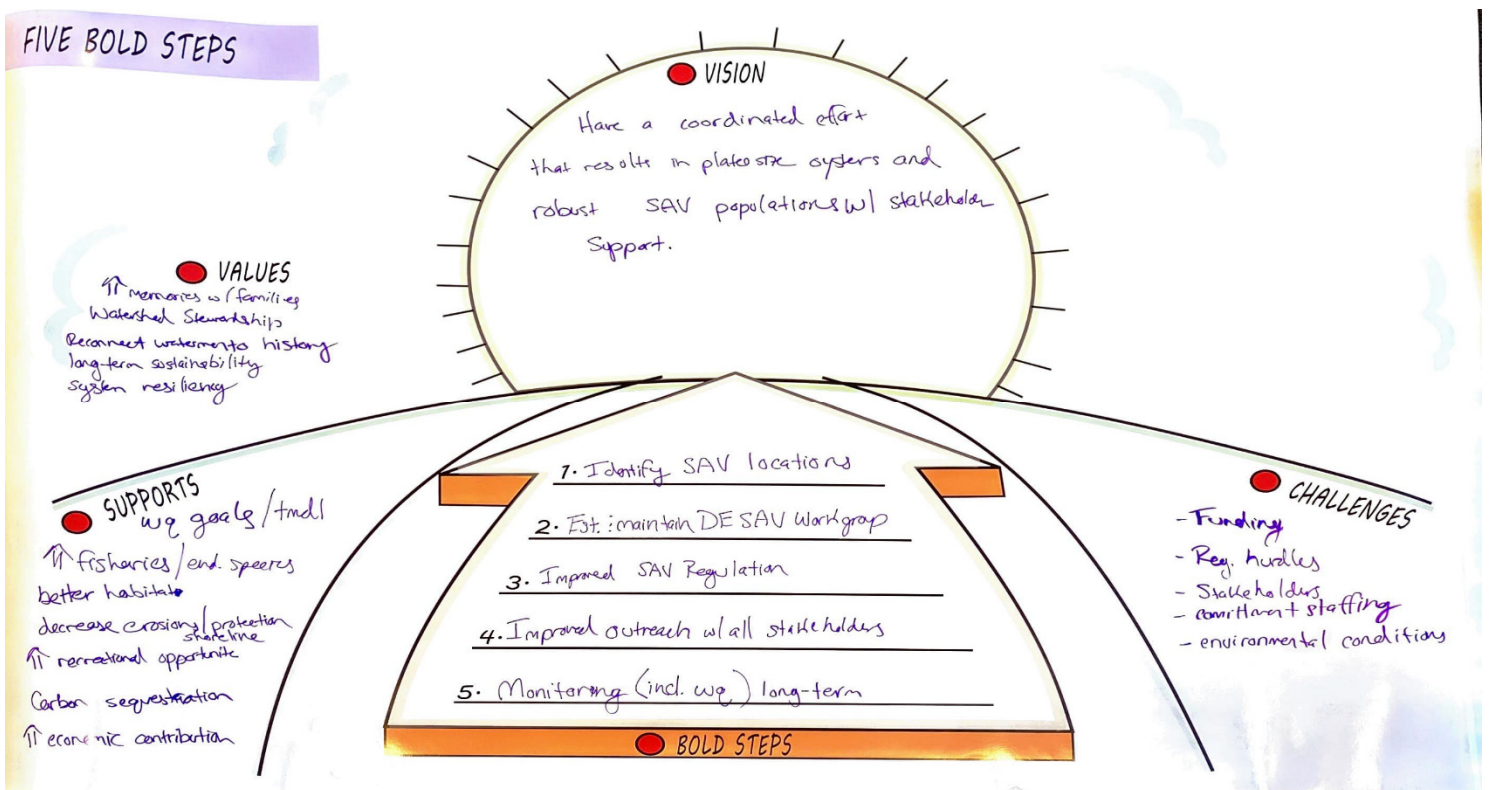


Figure 4 Notes from the meeting to document comments regarding a statewide SAV vision. The Five Bold Steps worksheet documents ideas for a vision, 5 bold steps, supports, values and challenges.

Specific statewide initiative ideas included:

1. Identify SAV locations
2. Establish and maintain a Delaware focused SAV workgroup
3. Improve SAV regulations
4. Improve outreach with all stakeholders
5. Establish long-term monitoring programs that include water quality as a component

These initiatives **support** water quality and total maximum daily load (TMDL) goals, increase in fisheries and endangered species populations, improved habitats, shoreline protection through decreased erosion, increase in recreational opportunities, improved carbon sequestration and add value to the economy. The **values** that the initiatives contribute to are watershed stewardship, providing opportunities for family time and making memories, providing for long-term sustainability and system resilience. Some of the **challenges** these initiatives have include funding, regulatory hurdles, getting various stakeholder groups to understand the value and importance of SAV habitats, dedicated or commitments from staff to get projects done, and unforeseen environmental conditions such as hurricanes.



Figure 5 Workshop attendees engaging in a discussion related to available resources in the room.

Next Steps

Participants were asked where they would like to go from here. Consensus appeared to be to establish a Delaware SAV workgroup and platform to share information. This report is one avenue that will be available to stakeholders to move forward with projects. The second step will be to use the already established Delaware Restoration Workgroup as a stepping off point to further develop the SAV workgroup.

Opportunities for involvement in the workgroup will be provided on two levels, one for those who would like to be involved in the detailed planning and project implementation, and those who would like to review projects or volunteer to assist in project implementation. Be on the lookout for more information from DNREC and DESG for workgroup happenings!

For questions about these meeting notes, please contact:

Brittany Haywood
Coastal Ecology Specialist
Delaware Sea Grant - University of Delaware
haywoobl@udel.edu
302-831-7005
deseagrant.org

References

- Ailstock, Steve & Shafer, Deborah & Lenderking, Bruce & Norman, C. (2011). An Improved Method for Processing Large Quantities of Seeds of Mesohaline Submerged Aquatic Plants.
- Anderson, Ben. Delaware's Inland Bays Seagrass Reestablishment Project & SAV as an Environmental Indicator. <https://www.inlandbays.org/wp-content/uploads/2010/12/0507STACAnderson.pdf>. Delaware Center for Inland Bays.
- Bryant, Tracey. "New Eelgrass Growing Techniques Would Help Bays." *UDaily*, 11 Dec. 2006, <https://www1.udel.edu/PR/UDaily/2007/dec/grass121106.html>.
- Cottam, C. 1935. Further notes on past periods of eelgrass scarcity. *Rhodora* 37: 269- 271.
- Cottam, C. and D.A. Munro. 1954. Eelgrass status and environmental relations. *J. Wildl. Mgt.* 18: 449-460
- Orth, Robert J., and Kenneth A. Moore. PHYTOPLANKTON, NUTRIENTS, MACROALGAE AND SUBMERGED AQUATIC VEGETATION IN DELAWARE'S INLAND BAYS 1985-1986. The Academy of Natural Sciences. Benedict Estuarine Research Laboratory, 1988, <https://scholarworks.wm.edu/cgi/viewcontent.cgi?article=1127&context=vimsbooks>.
- Price, K.S. A Framework for a Delaware Inland Bays Environmental Classification. *Environ Monit Assess* 51, 285-298 (1998). <https://doi.org/10.1023/A:1005951706152>
- Rentsch, Julia. "Seeding the Nanticoke: Wild Celery Introduction Hopes to Improve River's Declining Health." *The Daily Times*, <https://www.delmarvanow.com/story/news/2020/06/15/introducing-wild-celery-nanticoke-hopes-improve-river-health/5322020002/>. Accessed 22 May 2023.
- Rozan, Tim F., et al. "Iron-Sulfur-Phosphorus Cycling in the Sediments of a Shallow Coastal Bay: Implications for Sediment Nutrient Release and Benthic Macroalgal Blooms." *Limnology and Oceanography*, vol. 47, no. 5, 2002, pp. 1346-54. JSTOR, <https://www.jstor.org/stable/3068954>.
- Shortage of Eelgrass a Slippery Problem. <https://www1.udel.edu/PR/Messenger/06/01/shortage.html>. Accessed 22 May 2023.
- US EPA Region 3. SAV Survey Delaware River. US EPA Region 3, <https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=92d4319f2a6743d3a9947c737b27d3fe>. Accessed 22 May 2023.
- Valdes-Murtha, Lexia Maria. Analysis of Critical Habitat Requirements for Restoration and Growth of Submerged Vascular Plants in the Delaware and Maryland Coastal Bays. University of Delaware, 1997.

Appendices

Appendix I - SAV Stakeholder Workgroup - Sign-in Sheet

Appendix II - Pre-meeting Survey Results

Appendix III - Group Project - Project Gameplan Worksheets

DE SAV Stakeholder Meeting - Sign-In Sheet

Circle One

Last	First	Company	Title	Email	Share Contact Info?	Photos of You Shared?	Signature
Bergin	Kathleen	DNREC, Shoreline and Waterway Management	Program Manager	Kathleen.Bergin@delaware.gov	Yes / No	Yes / No	
Biddle	Mark	DNREC		mark.biddle@delaware.gov	Yes / No	Yes / No	
Bobola	Rebecca	DNREC, Wetlands and Waterways Section	Program Manager I	Rebecca.Bobola@delaware.gov	Yes / No	Yes / No	
Bott	Michael	DNREC	Program Manager	michael.bott@delaware.gov	Yes / No	Yes / No	
Brown	Lori	DNREC, Division of Watershed Stewardship	Environmental Scientist	lorim.brown@delaware.gov	Yes / No	Yes / No	
Bubouboullis	Sarah	DNREC, Shoreline and Waterway Management	Planner IV	sarah.bouboullis@delaware.gov	Yes / No	Yes / No	
Flaten	Brittney	DNREC	Environmental Scientist	brittney.flaten@delaware.gov	Yes / No	Yes / No	
Haaf	LeeAnn	Partnership for the Delaware Estuary	Estuary Science Manager	lhaaf@delawareestuary.org	Yes / No	Yes / No	
Hoffman	Taylor	DE Center for the Inland Bays	Science and Restoration Intern	thoffman@inlandbays.org	Yes / No	Yes / No	
Howard	Andy	DNREC	Environmental Scientist	andrew.howard@delaware.gov	Yes / No	Yes / No	
Hubert	Melissa	DNREC Tax Ditch Program	Environmental Program Manager II	melissa.hubert@delaware.gov	Yes / No	Yes / No	
Klauson	Kayla	DNREC		Kayla.Clauson@delaware.gov	Yes / No	Yes / No	
Klinkam	Jecy	Partnership for the Delaware Estuary	Restoration Specialist	jklinkam@delawareestuary.org	Yes / No	Yes / No	
Mansolino	Mike	USEPA R3	Field Scientist	mansolino.michael@epa.gov	Yes / No	Yes / No	

DE SAV Stakeholder Meeting - Sign-In Sheet

Circle One

Last	First	Company	Title	Email	Share Contact Info?	Photos of You Shared?	Signature
Noe Fellows	Meghan	Delaware Center for the Inland Bays	Director of Estuary Science and Restoration	mnoefellows@inlandbays.org	Yes / No	Yes / No	
Norton	Ashley	DNREC Delaware Coastal Programs	Delaware Coastal Management Program Manager	ashley.norton@delaware.gov	Yes / No	Yes / No	
Petrone	Chris	Delaware Sea Grant	Marine Advisory Service Director	petrone@udel.edu	Yes / No	Yes / No	
Reed	Amy	DNREC	Engineer Program Manager	amelia.reed@delaware.gov	Yes / No	Yes / No	
Rogerson	Alison	DNREC Wetland Monitoring & Assessment Program	Environmental Scientist	alison.rogerson@delaware.gov	Yes / No	Yes / No	
Sandkuhler	John	Nanticoke Watershed Alliance	Restoration Coordinator	johnsandkuhler@nanticokeveriver.org	Yes / No	Yes / No	
		Delaware Native					
Yacano	Mollie	DNREC	Research coordinator Env. Scientist	mollie.yacano@delaware.gov	Yes / No	Yes / No	
Lutte	Todd	USEPA	Field Scientist	lutte.todd@epa.gov	yes		
Smith							
Smith	Heather	DNREC	Env. Sci II	heather.a.smith@delaware.gov	yes	yes	

Pre-Meeting Survey Results

1. Please provide a brief synopsis of your program's past or current work regarding SAV within the state of Delaware boundary? (None is fine!)

- Currently manage DE navigational channels.
- Manage and maintain SAV within several of the impounded wetlands managed by the agency.
- "-past restoration efforts in inland bays
- -currently working on doing freshwater surveys"
- In 2022 we conducted freshwater SAV surveys as an attempt to being quantifying what vegetation we have in DE and where it exists. DNREC's internal SAV workgroup has participated in seed collection and attempted restoration in the past with ruppia and zostera.
- None
- Assisted with salvage efforts and planting
- Mapped Delaware Inland Bays for SAV extent. Tried some seeding efforts with widgeon grass. Built turbulator. Are currently engaged in suitability monitoring, and will continue seeding efforts.
- SAV surveys throughout the state for over 30 years.
- Recently, we have been experimenting with freshwater tidal SAV in Philadelphia. We also submitted a grant to establish long term monitoring stations in the tidal Delaware River.
- Hydroacousting monitoring of Delaware River shoreline and Delaware Bay.
- For Tax Ditches, SAV work has been primarily with identifying and determining methods to deal with invasive SAV. Past and continued work on removal of parrot feather throughout the Nanticoke Tax Ditch watershed(s).
- None
- Over the past 7-8 years we have performed several very small Ruppia and Zoostera restorations.
- TNC has recently been working to protect and restore productive coastal natural habitats. Though we do not have past or current work specifically focused on SAV, it is considered a critical habitat.
- hydroacoustic monitoring in Delaware River and Bay, Nanticoke River and Little Assawomen Bay
- I have assisted on a project testing SAV transplanting methods.
- None, but my Masters and PHD were in mapping SAV elsewhere
- Had done mapping in inland bays back in day, water use planning in inland bays
- DNREC has started to revive an SAV effort - both documenting SAV and potentially doing some restoration initiatives. I have developed a field survey app for our staff and created some web map application to show historic and current areas. We are trying to get as much information as we can in one place to get a better understanding of the current status of SAV in Delaware.
- None in Delaware but some freshwater work in living shorelines in Philadelphia!
- Supporting efforts to catalog FW SAV statewide, supporting efforts to restore SAV in salt waters.
- Some work in the past but the details are unknown at this time
- I am new to my position as of a few months ago, so I have not yet done SAV work in Delaware.

2. What are you hoping to gain or contribute by attending a meeting such as this?

- More focus on achievable goals
- Learning what others have done that has worked/not worked for maintaining SAV
- -more collaboration on SAV, especially with organizations other than CIB since they are kind of our only partner right now
- Collaboration and sharing ideas to reach set out goals regarding SAV.
- collaboration!
- To gain more knowledge and get the state on the same page going forward with any efforts or progress.
- An idea of the vision from other groups.
- Further my knowledge of the distribution and abundance of SAV in Delaware.
- Collaboration
- Collaborators focus areas, better understanding of partners goals
- I hope to learn more about SAV, good and bad. And establish connections for the identification and assistance in management of SAV for the tax ditches across the State.
- Hoping to gain the knowledge needed to possibly add SAV to tax ditch system's in Delaware
- Increased coordination with partners mainly for restoration efforts.
- At a previous position I thought quite a bit about saltwater SAV (eelgrass). I was involved in some restoration and monitoring projects. I am interested in learning more about DE's thoughts on eelgrass management/restoration.

- knowledge of new efforts, provide info on our ongoing efforts
- See who else has better ideas to help the environment.
- I am hoping to become more involved in SAV projects in the DE area and bring opportunities that my organization, Partnership for the Delaware Estuary, could support.
- Coordination of efforts & funding
- making connections to resources and expertise, NERRS system has quite a bit of sav expertise
- I am interested to see who else is interested in SAV restoration efforts, see what other information has been collected in Delaware (if any) and help develop stronger collaborative efforts.
- Learning more about applied SAV work for restoration as well as monitoring progress and success, specifically by means of mapping in the field and using mapping software
- Understanding of who is doing what; sharing what we're doing, finding ways we can help contribute to efforts.
- I've worked with SAV in partnership with MD DNR, growing 4 species in greenhouses, and I currently participate in their workgroup. I hope to learn about the status of SAV in DE and what land practices will promote their reestablishment, as well as initiatives that might exist or be employed to jump start their growth.
- As a research coordinator in the National Estuarine Research System, I can help to make connections for folks in Delaware to the expertise and resources from the NERR system in regards to SAV efforts. As a recent Delaware transplant, I hope to learn more about the current SAV efforts in the state, connect with folks doing this work, and think about potential future projects for DNERR/DCMP involving SAV

3. Imagine progress with SAV efforts within the state of Delaware. What does that look like to you?

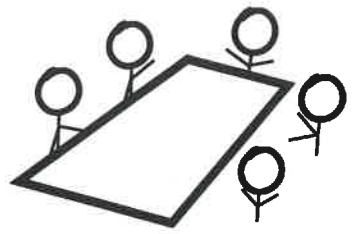
- Increasing the amount of SAV in the state
- "-more plantings (hopefully successful!)"
- -increased public awareness- page on DNREC website for example
- -better understanding of existing resources outside of the inland bays
- -maybe a project about bivalve/SAV relationship ?"
- More groups being involved in SAV work in general (collaboration). Putting in work and resources to identify better habitats for potential restoration efforts. Expanding SAV acreage across the state and DE bay.
- Mapping fw tidal SAV, setting up long term monitoring
- Slow but moving forward.
- Shared space to process seed. A network of staff working together to secure seed resources, process, and plant in areas that have been documented as suitable based on prior monitoring. This would include many different species.
- Improved water quality.
- Mapping, to start-- especially in freshwater tidal tributaries.
- a robust thriving SAV population
- Resources for identification of good, bad/invasive SAV and resources/guidance to follow for the management of good SAV and removal of bad/invasive SAV.
- Helping improve water quality by removing pollutants from tax ditch systems before out letting into our inland bays.
- Established monitoring framework, expanded restoration efforts.
- A state-wide vision for managing SAV within DE.
- starts with limiting nutrients to the resources from upstream sources. seed/planting effort mixed with aquaculture efforts
- Ongoing restoration projects and monitoring for success and habitat impact to aquatic ecosystems.
- I would like to see the establishment of a monitoring program, as well as an analysis of the general current state of SAV in Delaware.
- Increased research into habitat suitability; more mapping of any current beds
- mapping and restoration efforts where appropriate
- Incorporating SAV into restoration projects to improve water quality and habitat provision, specifically for native shellfish and other imperiled species
- A better handle on tracking SAV beds, more and more consistent SAV beds, more awareness and appreciation of SAV.
- Large stands of diverse species growing in a variety of streams and rivers where they once grew decades ago. Sustained and/or expanded growth where they currently exist.

4. Do you have any planned future SAV work?

- Seed collection
- Hoping to expand SAV to other impounded wetlands
- -collaborating with CIB to use the turbulator we just built!
- 2023 freshwater survey will cover the Nanticoke in parts. Also collaborating with CIB to build a turbulator and processing seeds for restoration of 1 acre of *Ruppia* later this year. Freshwater surveys will continue each year, as locations are found to survey.
- Hope to establish long term fw tidal SAV stations in the Delaware River and/or tidal tributaries to the River/Bay.
- To assist in collection and harvest of seed.
- Yes, seed processing and widgeon grass planting.
- Yes
- More experimentation with restoration!
- Yes. Continuing monitoring mainstem of Delaware River and developing habitat restoration requirements for the mainstem
- Past and continued work on removal of parrot feather throughout the Nanticoke Tax Ditch watershed(s).
- Possibly
- Small scale monitoring and restoration efforts, mainly in the Inland Bays.
- Not at the moment
- yes continued monitoring in Delaware River and developing habitat suitability model
- Yes. Helping CIB however I can.
- Yes, though I am unsure of the specifics at this time.
- No
- not at moment
- See above
- Yes - in the same living shoreline in Philadelphia as well as others in other states if successful
- Continue supporting the above mentioned work. Collaborating with CIB and UD :-) on restoration.
- Yes, depending on funding
- Not currently, but I would like to think about ideas to incorporate SAV work moving forward.

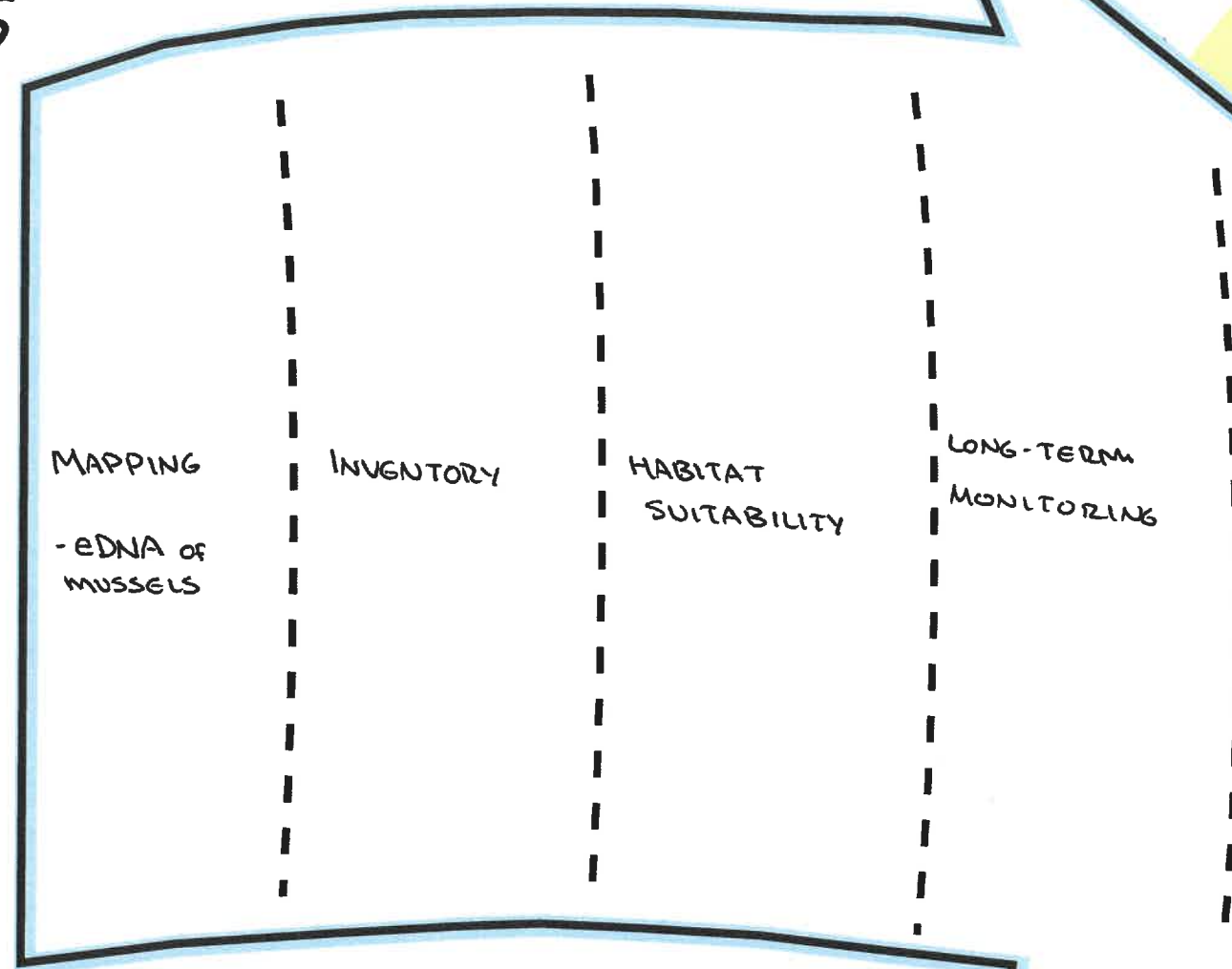
PROJECT GAMEPLAN (MAPPING RESOURCES OF CHRISTINA RIVER INVENTORY OF)

● TEAM / RESOURCES



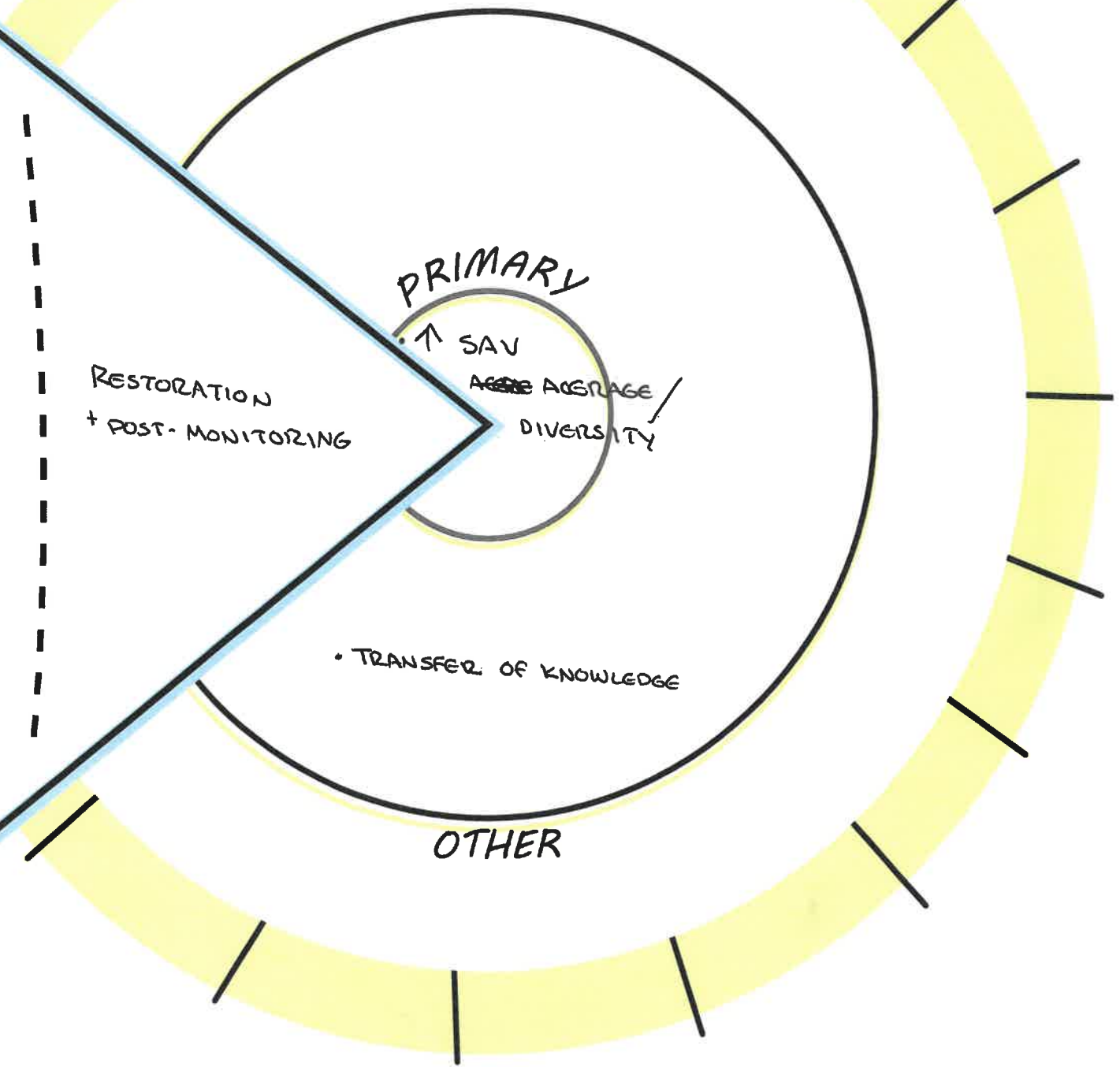
- EPA
- DNREC
- PDE
- CBR4 (FUNDING)

● STAGES / TASKS



● GOALS

- LOOK ALONG SALINITY GRADIENT



● SUCCESS FACTORS

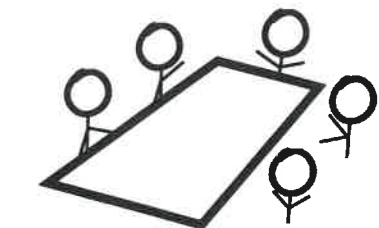


● CHALLENGES

- CHANGING CONDITIONS
- NO NON-TIDAL WETLAND PROGRAM
- RESTORATION PERMITTING
- PUBLIC / PORTS
- LEGACY CONTAMINATION

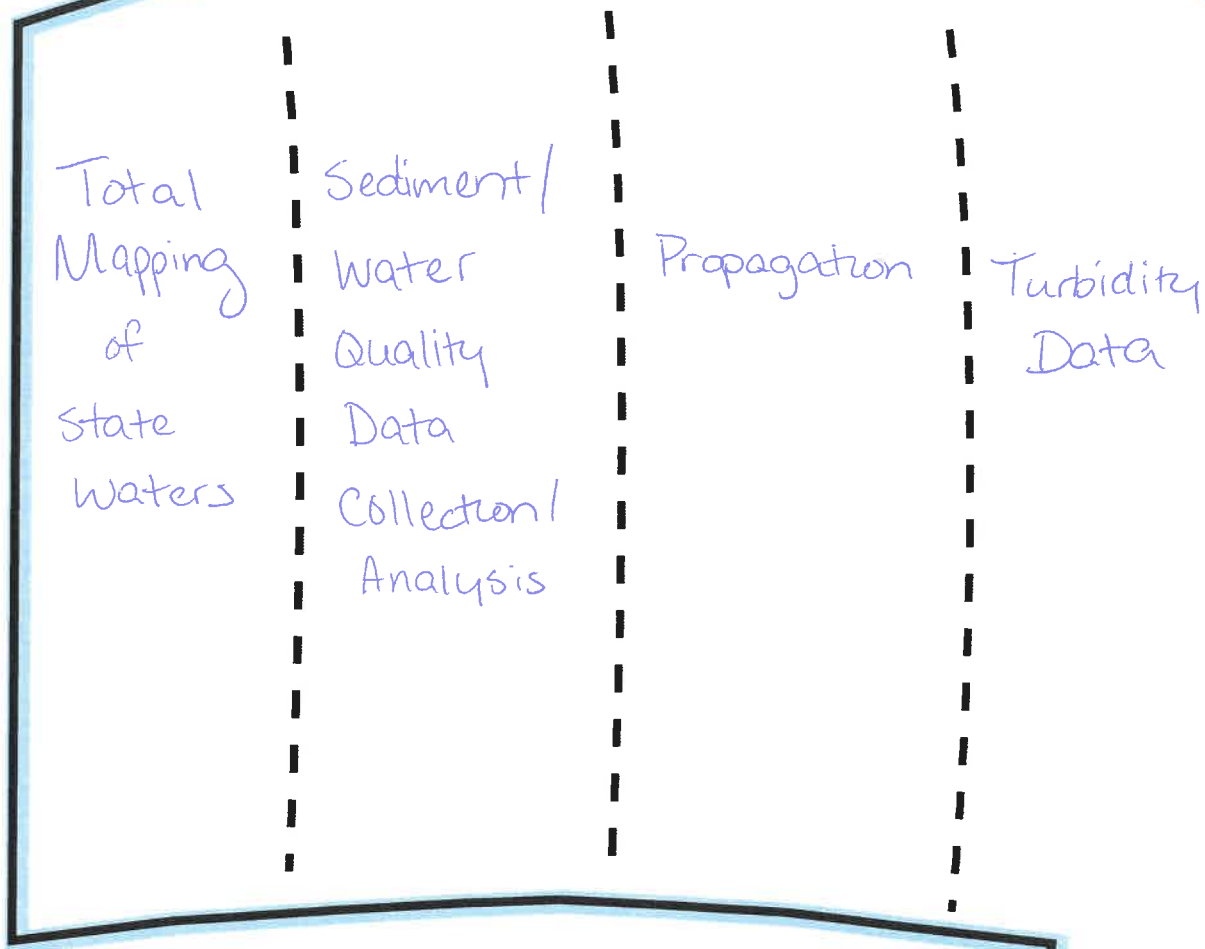
PROJECT GAMEPLAN

● TEAM / RESOURCES

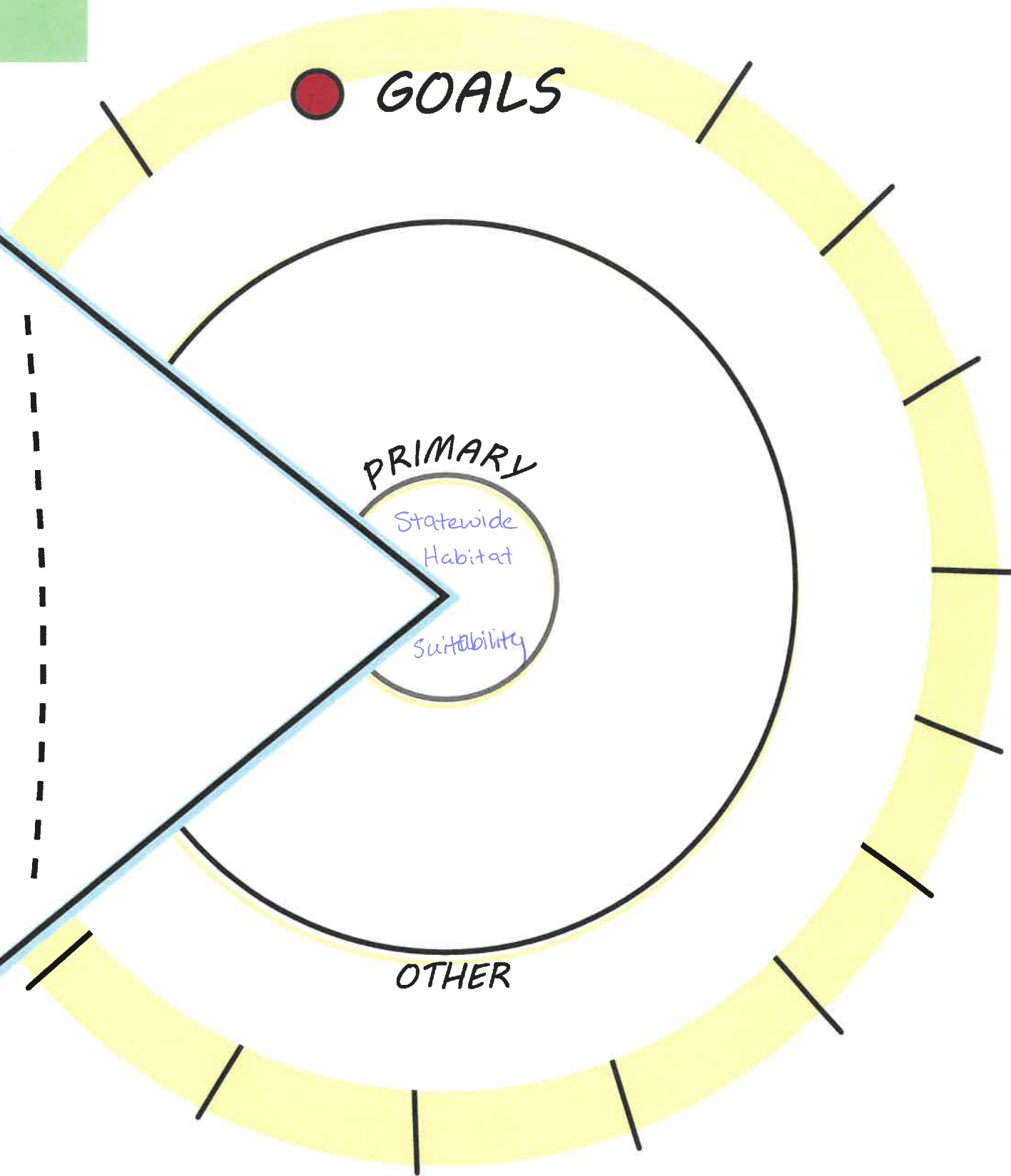


Funding
 Staff
 Storage
 Boats/Kayaks
 Data collection/
 Analysis Experience
 Good/Useful contacts

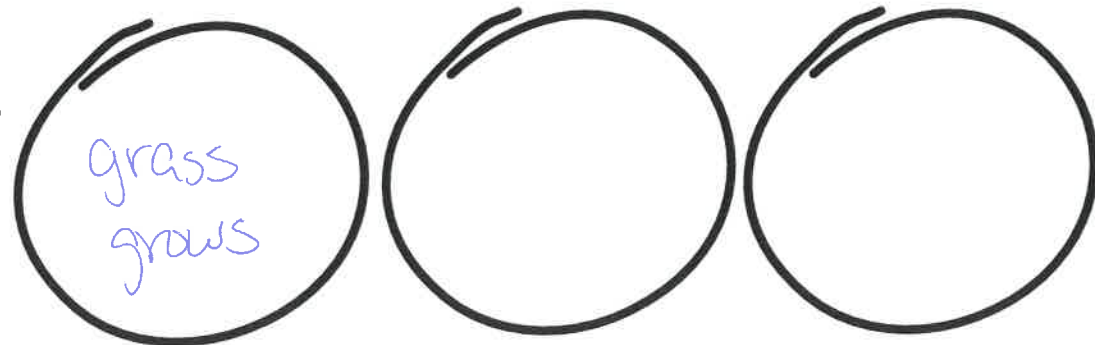
● STAGES / TASKS



● GOALS



● SUCCESS FACTORS



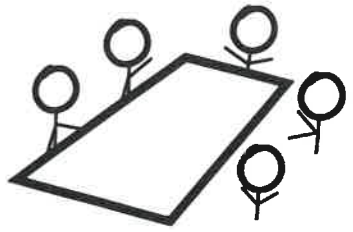
● CHALLENGES

People

Funding

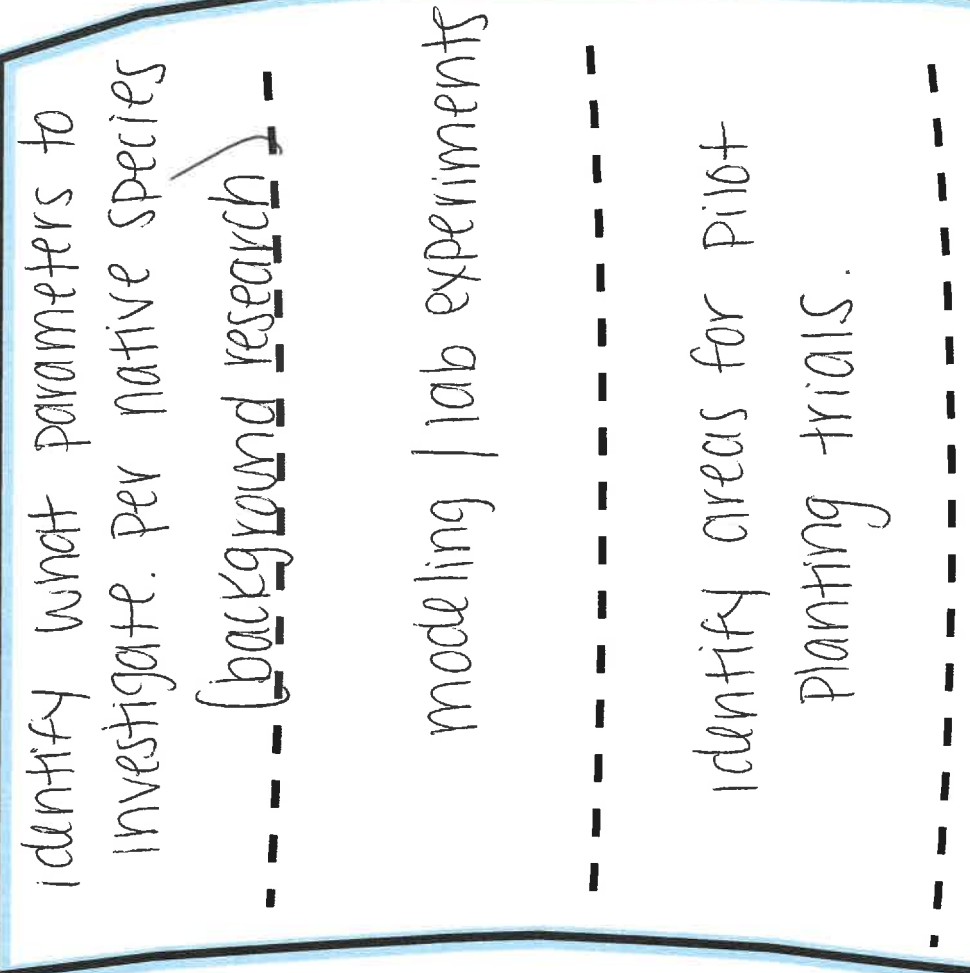
PROJECT GAMEPLAN

● TEAM / RESOURCES

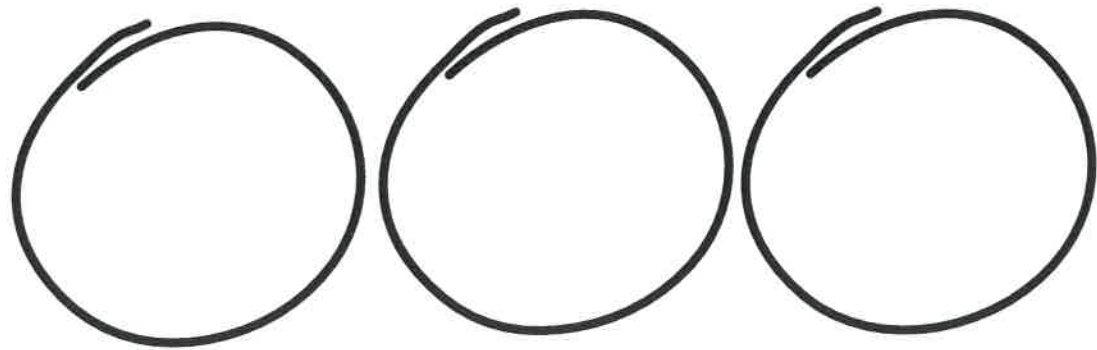


- state agencies
- academia / labs (researchers)
- funding
-

● STAGES / TASKS

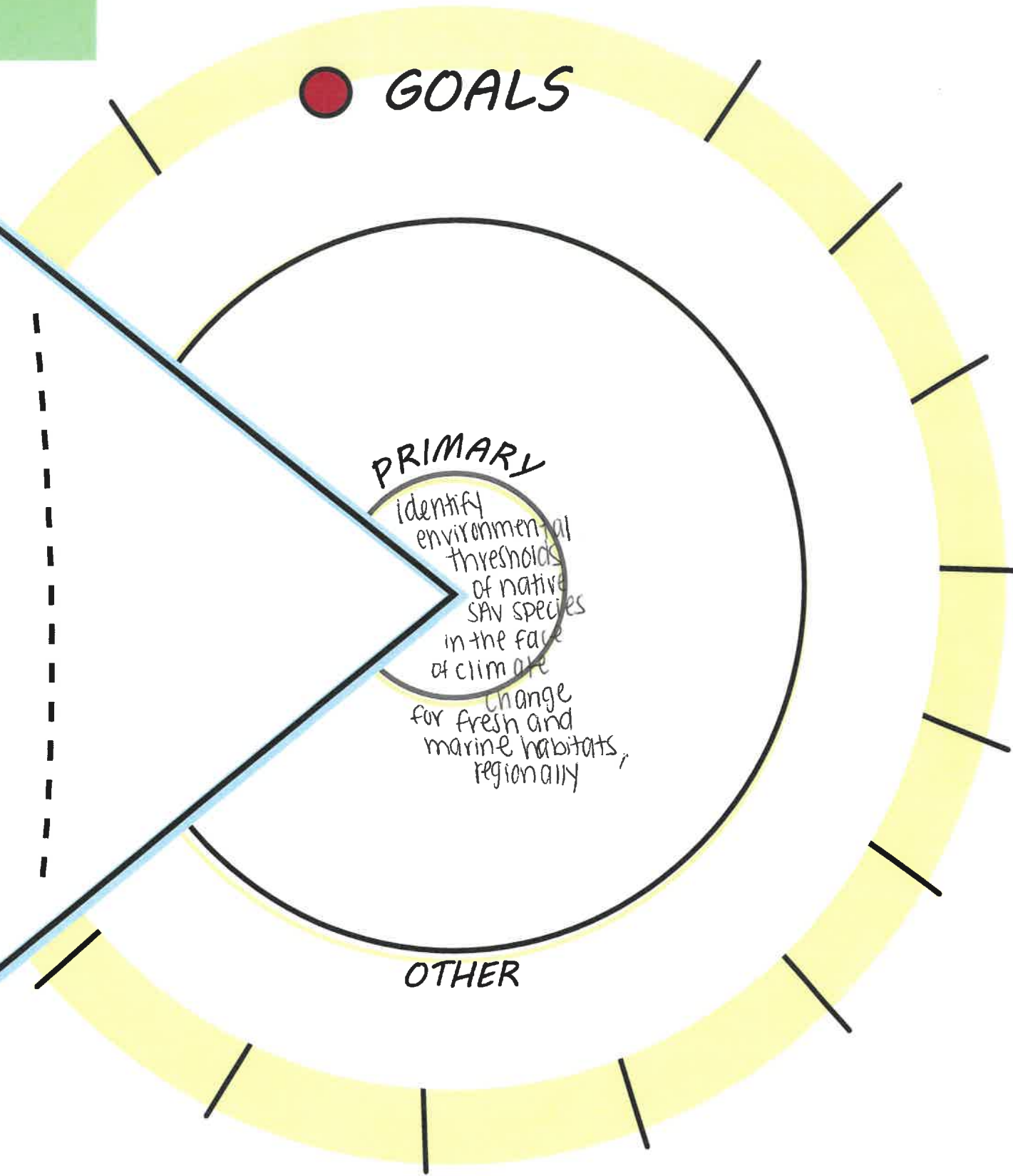


● SUCCESS FACTORS



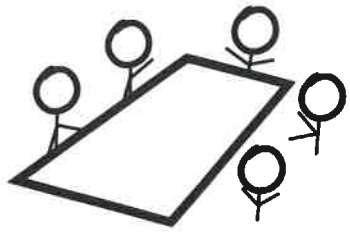
● CHALLENGES

● GOALS



PROJECT GAMEPLAN

● TEAM / RESOURCES



● STAGES / TASKS

- | | | | |
|---|---|---|---|
| <p>① Identify diff. offices in DNREC that may interface w/ SAV</p> <ul style="list-style-type: none"> - permitting - drainage program - WAMS | <p>② Coordinate + share info that's already online or printed</p> | <p>③ Develop list of relevant contacts/resources to direct people to the right place</p> <ul style="list-style-type: none"> - make admin aware of this | <p>④ Come up w/ webpage content</p> <ul style="list-style-type: none"> - map - list of contacts - outreach <ul style="list-style-type: none"> ◦ brochure ◦ press release ◦ webpage awareness |
|---|---|---|---|

● GOALS

- ⑤ Work w/ public affairs and see what's allowed.

PRIMARY
DNREC
Cleaning house/
landing page online

OTHER

● SUCCESS FACTORS

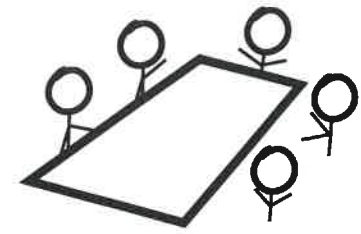


● CHALLENGES

- public affairs
- internal confusion
- admin awareness - if a stakeholder calls, who do we direct them to...

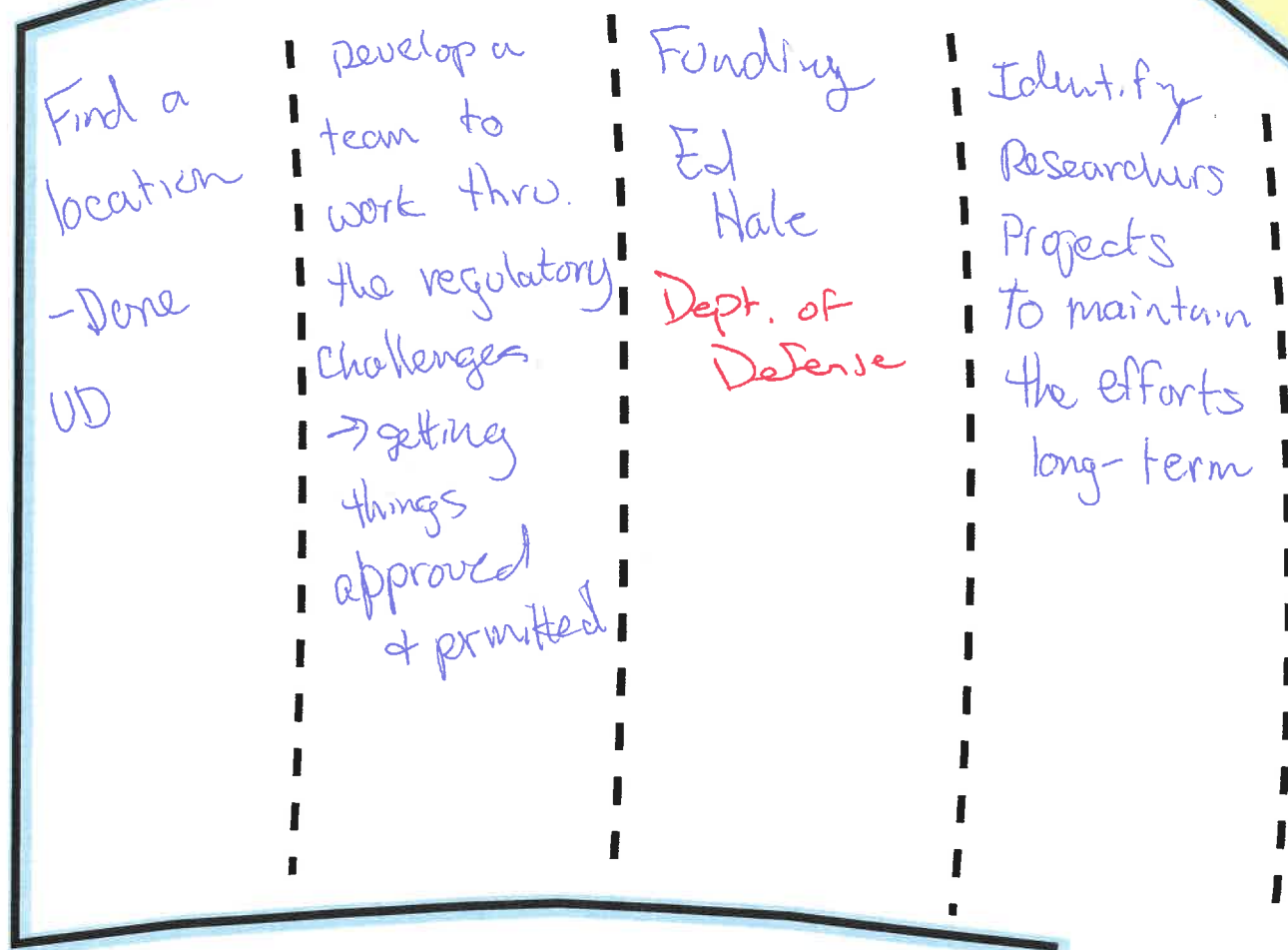
PROJECT GAMEPLAN SAV/Oyster Demo Site (for Brittany) via Sea Grant

● TEAM / RESOURCES

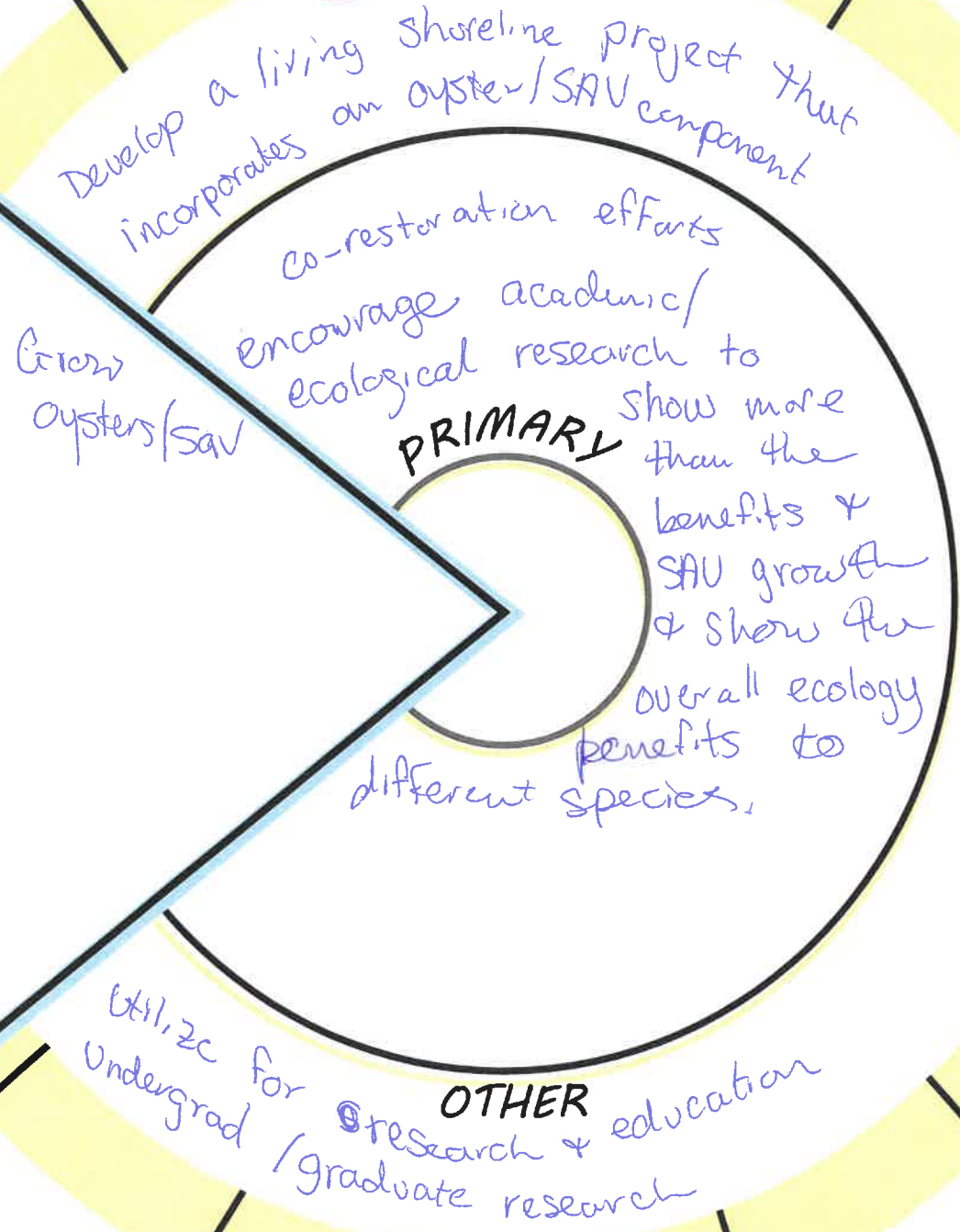


- Sea Grant
- DNREC
- Academics (UD & DSU)
- Funding

● STAGES / TASKS



● GOALS



● SUCCESS FACTORS



● CHALLENGES

Will this be a maintained/research project? How will we keep going.
Maintained funding, interest, support