Gulf Environmental Benefit Fund

Florida Restoration Strategy – Submerged Habitat Assessment

Proposal Project Narrative

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Our project area is located within Florida coastal waters and focuses on six priority estuaries for submerged aquatic vegetation (SAV) restoration: Perdido, Pensacola, Choctawhatchee, St. Andrew, Econfina, and Suwannee estuaries (Table 1, Figure 1). In both the short- and long-term, restoration planning must be incremental and adaptive to ensure SAV recovery. These six priority estuaries were selected on the basis of complementary watershed restoration plans and proposals, patterns of historical SAV distribution, severity of SAV loss, and preliminary assessment of SAV recovery potential.

As seen in Table 1, the priority estuaries for SAV assessment and restoration vary in size from Perdido Bay (the surface area of the Florida portion of the estuary is 130 km^2) to Pensacola Bay (370 km^2). Watershed areas for the priority estuaries vary from 2,800 km^2 for St. Andrew Bay to 26,400 km^2 for the Suwannee River estuary. The ratio of watershed area to estuarine surface area varies from 11.5 (St. Andrew Bay) to 242 (Suwannee estuary). These high ratios illustrate the importance of watershed processes (nutrient, sediment, and organic matter loads, as well as timing and volume of freshwater discharge) on the priority estuaries and their SAV communities.

Within our six priority estuaries, six seagrass and several brackish aquatic plant species form rich SAV communities (Phillips, 1960; Zieman and Zieman, 1989). The seagrass species turtlegrass (*Thalassia testudinum*), shoalgrass (*Halodule wrightii*), and manateegrass (*Syringodium filiforme*) are the most abundant SAV species in estuarine and nearshore waters. Stargrass (*Halophila engelmannii*) is locally abundant in turbid estuarine environments, and paddlegrass (*H. decipiens*), although diminutive, covers large areas of the west Florida shelf at depths from 9 to more than 30 m (30 to over 100 ft) (Continental Shelf Associates Inc., 1985). Because of its broad salinity and temperature tolerances, widgeongrass (*Ruppia maritima*) is also widely distributed in Florida estuaries. Tapegrass (*Vallisneria americana*) occurs in the brackish regions of many Florida tidal rivers and estuaries.

Table 1: Surface Area of Priority Estuaries and Their Watersheds (US EPA, 1999)

Estuary	Surface Area (km^2)	Drainage Area (100 km^2)	Ratio Drainage Area: Estuary	Average Salinity (ppt)
Perdido Bay	130	31	23.85	15
Pensacola Bay	370	181	48.92	23
Choctawhatchee Bay	334	140	41.92	25
St. Andrew Bay	243	28	11.52	31
Apalachee Bay	412	119	28.88	30
Suwannee Sound	109	264	242.20	16

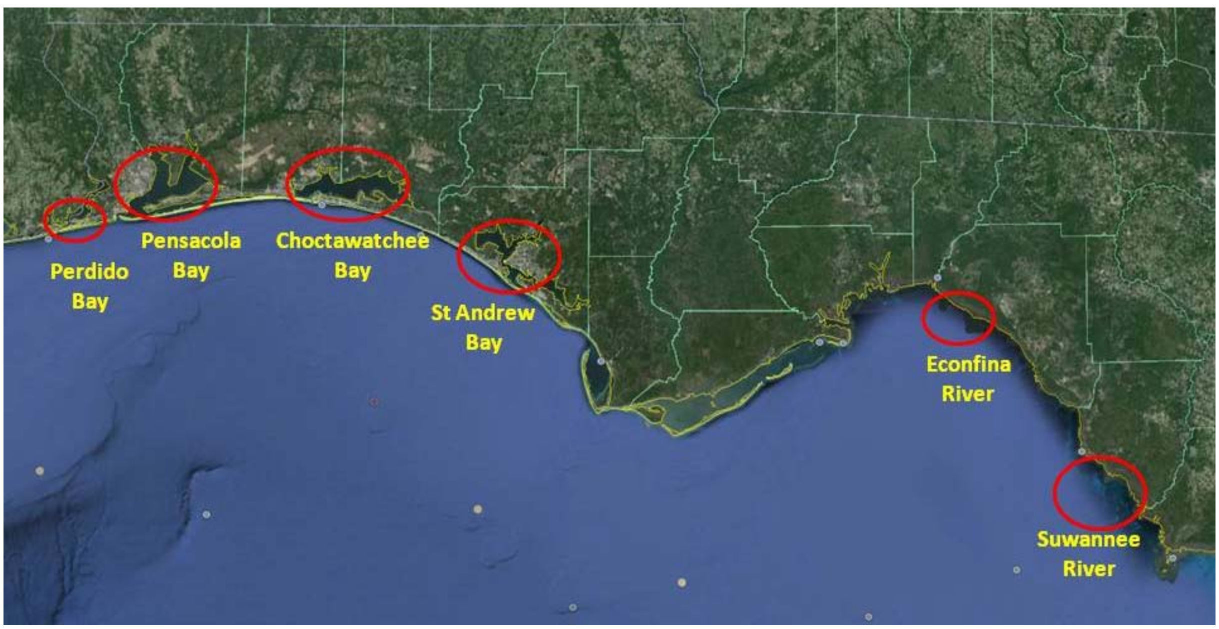

Figure 1: Priority Estuaries for SAV Assessment

Project Need: Seagrasses and brackish SAV species are often described as "the canaries in the coal mine" of estuarine and nearshore waters in Florida and throughout the United States because they are so very sensitive to poor conditions and are integrative metrics of water quality. Tampa Bay, for example, lost 50% of its seagrass between 1950 and 1980 as the result of deteriorating water quality and water clarity. Many Panhandle estuaries and Florida's Big Bend region have experienced large losses of seagrass over a period of 50 years or more (Yarbro and Carlson, 2014). SAV cover in Perdido Bay, Pensacola Bay, and Choctawhatchee Bay declined by 5%, 4%, and 4% per year, respectively for the period 1992 to 2003. During the same period, however, seagrass cover was stable or increased slightly in Big Lagoon, Santa Rosa Sound, and St. Andrew Bay. Seagrass cover in the northern half of the Big Bend region was stable between 2001 and 2006, but significant declines have occurred in the vicinity of the Suwannee and

Econfina Rivers.   SAV are extremely valuable indicators of estuarine water and sediment quality, because they continuously measure turbidity, dissolved organic matter, and phytoplankton abundance in their estuarine environments.

The value of seagrasses as an integrative metric of estuarine health extends beyond water quality as well. SAV are foundation species, underpinning animal species and food webs in their estuaries. They are essential fisheries habitat, and loss of SAV habitat affects many economically important fish and shellfish species such as snappers, groupers, spotted sea trout, blue crabs, shrimp, and scallops that depend on SAV beds for all or part of their life histories. SAV beds also provide corridors for the inshore/offshore migration of groupers and snappers that spend their early lives in coastal SAV beds. SAV beds in the project area also provide food and shelter for Endangered and Threatened species such as manatees, loggerhead and green sea turtles, diamondback terrapins, gulf sturgeon, dwarf seahorses, and northern pipefish, to name some of the most threatened or vulnerable species identified as Species of Greatest Conservation Need by the Florida Wildlife Legacy Initiative and the International Union for Conservation of Nature. Loss of SAV, therefore, reflects loss of animal species and disruption of food webs, and SAV abundance can serve as a metric of estuarine ecosystem function and integrity.

The support functions of SAV beds are not limited to aquatic animal species. SAV beds of Florida's Panhandle estuaries and Big Bend region also provide food for wintering diving ducks. The Atlantic Coast Joint Venture Gulf Coast Focus Area extends from St. Vincent National Wildlife Refuge to Anclote Key, over 60% of our project area, and is devoted to the protection of a number of migratory and resident bird populations. Most notably, populations of black ducks (*Anas rubripes*), which feed in shallow seagrass and submerged aquatic vegetation, have been declining along the U.S. East Coast for over 50 years.

As noted earlier, SAV are inextricably linked with both water quality and ecosystem function, and they serve as both a metric of estuarine health and an endpoint for estuarine restoration. As a metric of estuarine health, SAV are both integrative and responsive. Unlike real canaries, SAV can recover when water clarity and sediment and water quality improve over time. Therefore, declines in SAV reflect deteriorating estuarine conditions and function, and SAV recovery reflects improvements in estuarine conditions- often as the result of successful efforts to reduce estuarine nutrient and sediment loads. As noted earlier, Tampa Bay lost 50% of its seagrass between 1950 and 1980, but the Tampa Bay Estuary Program has led a successful effort to reduce nitrogen loads to Tampa Bay since 1990, resulting in natural recovery of 60% of its seagrass losses. In Tampa Bay, increases in seagrass abundance and distribution are highly correlated with decreases in total nitrogen, total phosphorus, phytoplankton chlorophyll, turbidity, and light attenuation in the water column. As metrics, seagrass abundance and distribution are arguably more cost-effective and more descriptive than chemical and physical parameters typically used in water quality monitoring programs. The U.S. Environmental Protection Agency (US EPA) numeric nutrient criteria guidance documents for Panhandle estuaries and Apalachee Bay acknowledge the importance of SAV distribution and abundance as metrics and endpoints for restoration, drawing heavily on SAV data assembled by Florida monitoring partners for those systems.

Bay Scallops, *Argopecten irradians*, illustrate the pivotal role of seagrass abundance and distribution as metrics and endpoints of estuarine restoration. Bay Scallops are one of the most economically important species that depend heavily on seagrass communities throughout the project area. Adult scallops spawn in seagrass beds, and, because they are broadcast spawners, successful fertilization of eggs requires moderate densities of adults. Larvae are pelagic and settle on seagrass blades at an age of two weeks. When they reach a shell height of 1.5–2.0 cm, they drop to the bottom in seagrass beds and continue development. The recreational scallop season in Florida extends from late June to September, and recreational scallop harvest is an important economic engine for many counties in the project area. Scalloping is permitted in over 60% of the project area from Gulf County to Pasco County, and Citrus County alone estimated the value of scalloping to be over $2,000,000 in 2003 (Adams et al., 2004). However, scallop populations have collapsed in St. Andrew Bay, and are vulnerable to collapse in St. Joseph Bay, Apalachee Bay, and Deadman Bay (Stephenson et al., 2014) due to recent heavy rainfall and seagrass loss. As a result, both adverse and beneficial impacts on SAV have been, and will continue to be, reflected in the recreational scallop harvest and its economy.

Goals and Objectives: The Florida Gulf Environmental Benefit Fund (GEBF) Restoration Strategy will be used to identify and develop projects addressing priority restoration needs that are eligible for funding under the GEBF. The GEBF's purpose is to "remedy harm and to eliminate or reduce the risk of future harm to Gulf Coast natural resources" that were injured as a result of the *Deepwater Horizon* oil spill in 2010. The Restoration Strategy and resulting projects will be consistent with GEBF funding priorities to restore and maintain the ecological functions of landscape-scale coastal habitats; restore and maintain the ecological integrity of priority coastal bays and estuaries; and replenish and protect living resources (Samek, Florida GEBF Restoration Strategy Proposal). The principal goals of the Submerged Aquatic Vegetation Habitat Assessment are to assess SAV status and trends, determine roadblocks to natural recovery, prioritize and provide guidance for restoration projects to enhance SAV recovery, and to assess the benefits of restoration projects for SAV communities.

SAV in Panhandle estuaries, Florida's Big Bend and Springs Coast didn't disappear overnight, and lasting recovery will take at least ten years and - more likely - twenty years. In both the short- and long-term, planning must be incremental and adaptive to ensure SAV recovery. Our approach is based on two key premises necessary for SAV restoration efforts. First, identifying and removing roadblocks to natural SAV recovery are much more cost-effective than planting SAV with a limited chance of success. Recent estimates (Tampa Bay Estuary Program, 2003) of the cost to plant SAV in restoration projects, with an average success rate of less than 50%, are over $500,000 per acre. Identification of the roadblocks to SAV recovery and development of site-specific SAV recovery plans are much more cost-effective than planting SAV and hoping it survives. The second premise of SAV restoration is that the roadblocks to SAV recovery in a particular part of an estuary are not necessarily the same as the original cause of SAV loss. Although light stress caused by degraded water quality is the most common cause of SAV loss, many roadblocks to recovery exist after SAV loss occurs. As a result of these two guiding principles, our approach is to assess historical and current SAV status and trends, determine roadblocks to natural SAV recovery, and determine appropriate restoration actions for SAV recovery.

Scope of Work: Our first task is to assemble all available data on SAV status and trends, sediment quality, and water quality for each priority estuary. We will collate and analyze remote sensing data and historical water and sediment quality data available through STORET and other databases. We will also construct a timeline of SAV losses and gains and environmental changes in the project area. In many areas within the project footprint, SAV has not been mapped since 2003. To determine current status and trends, we will assemble imagery for the project area for the period 2010-2013 as well as historical SAV data and maps for each estuary. We will also assess SAV health and species composition, as well as sediment and water quality *in situ* in fall 2015 and summer-fall 2016. With the benefit of collated data for each system, we will conduct site-specific assessments of the roadblocks to SAV recovery in each priority estuary in 2016. Using the data from all sources, we will construct a spatial model of SAV recovery potential within each priority estuary and use the model to prioritize, enhance, and assess the benefits of restoration projects in each estuary.

Tasks and deliverables:

1. Determine estuary and site-specific roadblocks to SAV recovery for Perdido Bay, Pensacola Bay, Choctawhatchee Bay, St. Andrew Bay, and the Econfina and Suwannee regions of the Big Bend.
2. Perform SAV assessment and evaluate fine-scale aerial imagery for funded restoration projects.
3. Assemble and create, where necessary, current and past status and trends maps for SAV throughout the project area and identify and prioritize restorable SAV habitat throughout the project area.
4. Using available data supplemented by field sampling, build estuary and site-specific time series of optical water quality data for the period 2002-2015.
5. Build a user-friendly website for retrieval of current and historical water clarity data throughout the project area, relying heavily on the 13-year MODIS satellite water clarity time series.
6. Conduct joint workshops and incorporate up-to-date SAV information produced in Tasks 5 and 6 for restoration planning in the Big Bend region and Panhandle estuaries, respectively.
7. Based on elements 1-6 above, build an online, distributable, and spatial SAV recovery potential (SRP) model, showing roadblocks and recommended restoration strategies in all estuaries to inform restoration project planning and selection. Distribute all project data online as shapefiles and Google Earth kml files. Develop specific project recommendations for SAV recovery in each estuary.

Task 1: Determine estuary and site-specific roadblocks to SAV recovery. Many studies have shown that the survival and health of SAV depend on sufficient penetration of light through the water column to the bottom where SAV are rooted, and the three most common causes of water column light attenuation are the presence of phytoplankton, dissolved organic matter (CDOM), and suspended particles. Nutrient management strategies can reduce phytoplankton biomass and increase light penetration. The Total Maximum Daily Load and Numeric Nutrient Criteria programs of the Florida Department of Environmental Protection (FDEP) have made a considerable effort to assemble nutrient and water quality data and to develop nitrogen and phosphorus loading limits for Florida estuaries and coastal waters. Tannin-stained waters and suspended sediment also cause light stress, and we will evaluate light stress in each estuary and WBID (Water Body Identification number) of the project area using available water quality data, field-verification sampling in each estuary, and hindcasts of satellite water clarity data for the period 2002–2015 (Tasks 4 and 5).

Other Roadblocks: In addition to light stress, we will also model, map, and measure stress caused by propeller scars, salinity excursions, wave action, tidal flow, sediment resuspension, sediment organic content, sediment porewater sulfide, sediment contaminants, herbivory, and bioturbation (Table 2). For instance, in the vicinity of Gulf Breeze, Florida, the peninsula located inside Lower Pensacola Bay, water clarity is sufficient to support SAV growing at depths up to 2 meters (approximately 6 ft). However, SAV occupies less than 50% of the habitat where water clarity is sufficient for SAV growth (Figure 2). SAV is present to depths of 2 meters in Santa Rosa Sound and near Fort Pickens (WBID 915 and 548E, respectively), but not in Lower Escambia Bay (WBID 548B), Lower East Bay (WBID 548H), or central Pensacola Bay (WBID 548C, D**).** Similar conditions exist at other locations in Choctawhatchee Bay, St. Andrew Bay, St. Joseph Bay, and St. George Sound. Clearly, therefore, other factors are preventing SAV recovery in these and other areas. We will assess all these threats in each estuary by using available data where possible and by collecting field measurements where data are lacking. Much of the work will be done by project partners under contract.

Task 1 Deliverables- will be a series of gridded data layers for the SAV Recovery Potential (SRP) spatial model (Task 7). The most common formats for mapped data are ESRI ArcMap shapefiles, and we will create separate gridded shapefiles for each stressor in each priority

Potential Seagrass Habitat, Gulf Breeze, FL

estuary at 100-meter (1 hectare) resolution. Each data layer will represent the spatial distribution of a primary stressor listed in Table 1, and the composite layers will build a spatial model for

SAV restoration planning. Individual data layers will also be distributed as Google Earth kml-format files for easy visualization.

Task 2: Perform SAV assessment and obtain fine-scale aerial imagery for funded restoration projects. A number of water quality improvement projects have been funded by the National Fish and Wildlife Foundation (NFWF), the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of the Interior (US DOI). We will carry out in-water SAV assessments at these sites in summer 2015 and 2016 to measure their beneficial impacts on SAV communities. We will also collect finer scale aerial imagery at these sites in conjunction with larger SAV mapping efforts (Task 3).

Table 2: Roadblocks to SAV Recovery

Stressor	Distribution	Severity	Effect(s)	Assessment Methods	Restoration Action(s)
Light Stress	Widespread	Varies by cause	Inhibited growth, death	*In situ* and satellite measurements, nutrient data, TMDL models	Nutrient reduction, sediment reduction, point and non-point source treatment
Salinity Pulses	Widespread	Varies by freshwater source	Metabolic drain	*In situ* salinity measurements, freshwater discharge data, models	Stormwater retention, watershed best management practices (BMPs)
Salinity Stratification	Frequen	Varies with depth	Metabolic	*In situ* salinity measurements	Stormwater retention,
Wind, wave, and tidal action	Frequent	Varies with fetch, depth, tide range	Removal of shoots, sediment resuspension	*In situ* sediment grain size and bedform analysis, models	Physical protection, sandbar enhancement
Sediment toxicity	Common	Alone or synergistic stressor	Acute or chronic; species vary	Sediment sulfide & carbon measurements, FDEP, US EPA, NOAA contaminant data	Removal, *in situ* remediation, source reduction
Bioturbation, Animal disturbance	Common	Locally severe	Grazing or removal	Field surveys for stingrays, cownose rays, sea urchins. FWC seine, trawl data	Exclosures, harvest, removal
Propeller Scarring	Common	Locally severe	Physical damage or death	Targeted aerial mapping	Boater education, signage, exclusion zones, remediation

Figure 2 Potential seagrass habitat, Gulf Breeze, Florida.

Task 2 Deliverables- will be georeferenced aerial photos and *in situ* SAV and water clarity data collected during the 2015 and 2016 SAV growing season in the vicinity of NFWF, NOAA, and USDOI restoration projects. Where possible, imagery collected prior to the start of recovery projects will be georeferenced, and changes in SAV density and cover will be determined.

Task 3: Assemble and create, where necessary, current and past status and trends maps for SAV throughout the project area and identify and prioritize restorable SAV habitat throughout the project area.

SAV imagery collection and mapping are expensive, but they are the only tools available to assess the status and trends of SAV cover over large areas. We will collate imagery and maps to identify areas where SAV has grown in the past, where SAV has been lost, where SAV is now recovering, and where SAV loss is continuing. Wherever possible, we will use imagery that has already been collected to establish the most recent available time step for trend analysis, and we will use contract photo-interpreters to map SAV in the available imagery. We will also issue contracts for imagery collection and mapping in 2015 and 2016 to establish a second, contemporary time step for trend analysis.

Task 3 Deliverables- will be collated imagery and maps for SAV distribution in the past and new imagery and maps. Status and trend data will be used to identify and prioritize areas for restoration projects to enhance SAV recovery.

Task 4: Using available data supplemented by field sampling, we will build estuary and site-specific time series of water quality and sediment toxicity data for the period 2002-2015. We will mine all available water quality data for the principal causes of light attenuation in estuarine waters- phytoplankton chlorophyll, turbidity, and dissolved organic matter. The primary sources of water clarity data are online databases maintained by the Florida Department of Environmental Protection (Florida STORET), the U.S. Geological Survey, the U.S. EPA, and NOAA. We will also retrieve and map sediment toxicity data for each estuary. In addition, we will try to identify and retrieve data from sources that have not uploaded data to one of the principal online databases.

Task 4 Deliverables- will be collated, distilled, and georeferenced water quality and sediment data for each estuary. Results will be mapped as a stressor layer for the SRP model (Task 7).

Task 5: We will build a user-friendly website for retrieval of current and historical water clarity data throughout the project area, relying heavily on the 13-year MODIS satellite water clarity time series. To augment and fill in gaps for *in situ* water clarity data, we will develop and fine tune algorithms for the extraction of water clarity data from MODIS (Moderate Resolution Imaging Spectroradiometer) and VIIRS (Visible Infrared Imaging Radiometer Suite) satellite data. Satellite water clarity data do not replace *in situ* data, but these two satellites pass over each estuary daily and have done so since July 2002. As a result, satellite water clarity data fill in spatial and temporal gaps in *in situ* monitoring programs and provide a long, internally consistent, time series of water clarity data for incorporation in the SRP model (Task 7).

Task 5 Deliverables- will be a user-friendly website with a click-through map for visualization and download of water clarity data. The map interface will send users directly to time series water clarity data in graphical and tabular form with download links. Recent data are shown in context with long-term averages.

Task 6: We will conduct joint workshops and incorporate up-to-date SAV information for restoration planning in the Big Bend region and Panhandle estuaries, respectively. We will conduct three workshops in the fall of 2015 and winter of 2016 to inform partners of this project and to ask for help in identifying and collating data on water and sediment quality, SAV status and trends, and available time series imagery for each estuary. Whenever possible, we will hold joint workshops with GEBF Tasks 3 and 4, include our project staff in workshops for GEBF Tasks 3 and 4, and include their staff in our workshops. We will also conduct stakeholder workshops in the fall of 2016 to inform anyone interested in the project.

Task 6 Deliverables- will be a summary report of participant input and evaluations of project progress as well as inventories of available data, pertinent reports, and scientific literature.

Task 7: Using the products of Tasks 1-6 above, we will build an online and distributable spatial SAV recovery potential (SRP) model, The SRP model is the capstone of Task 7, showing roadblocks to SAV recovery, recommended restoration strategies, and informing restoration project planning and selection in each estuary. Model data layers will be distributed as ESRI ArcMap shapefiles and Google Earth kml map files, and each model layer will represent a stand-alone map for a single roadblock or variable affecting SAV recovery. Using the SRP model, specific project recommendations will be developed for SAV recovery in each estuary and proposed projects can be evaluated based on their potential benefits to SAV communities in the priority areas.

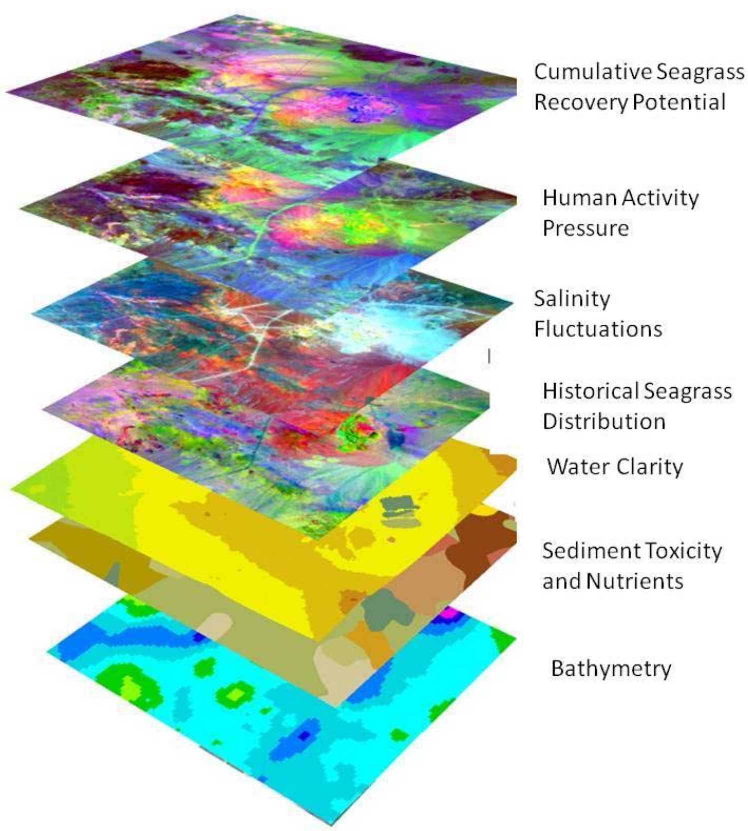

Figure 3: General structure of SRP Model data layers. The actual model will have more layers. Image credit: Geological Society of America

The principal product of this task will be the SAV Recovery Potential (SRP) Model (Figure 3). The format of the SRP model will be a spatial model in ESRI ArcMap format. Each data layer will comprise a stand-alone assessment of current or historical SAV cover, water clarity, sediment quality, physical environment, biological stressors, or salinity fluctuations. However, the composite layers will comprise a model that illustrates: 1) the spatial distribution of individual stressors and aggregate roadblocks to SAV recovery; 2) areas where SAV restoration planting is most likely to succeed; 3) areas where intervention is needed to accelerate SAV recovery; 4) the type of restoration projects most likely to enhance SAV recovery; and 5) potential benefits of proposed restoration projects for SAV communities.

Task 7 Deliverables- will be an online, distributable, and spatial SAV recovery potential (SRP) model, showing roadblocks and recommended restoration strategies in all estuaries to inform restoration project planning and selection. The general structure of the SRP model is shown in Figure 3. For clarity, only seven model layers are shown, but the cumulative SRP model will have between 12 and 14 layers to evaluate SAV recovery potential in grid cells (100 m x 100 m) for all estuaries. Each layer represents one or more potential stand-alone deliverable for Tasks 1-6, above, and each layer will be distributed as an ESRI GIS shapefile, a Google Earth kml file, and as detailed map overlays in PDF format. Data will be distributed online and on DVD to project partners and stakeholders, and model results will be presented at three regional workshops in fall 2016.

Data Management and Delivery: This project will collate large amounts of data which will be distributed immediately to project partners and stakeholders and made available to others on the web. Mapping and monitoring data will be provided to all stakeholders in ArcMap shapefiles and Excel spreadsheets, respectively. The most likely venue and mode for data distribution will be annual workshops. Big Bend SAV monitoring data are currently available on the web at the University of South Florida Optical Oceanography Laboratory (OOL) website (optics.marine.usf.edu), and additional pages will be added to the OOL website for delivery of data for this project. All SAV mapping data will be available as ArcMap shapefiles or Google Earth kml files from the Marine Resources GIS website (ocean.floridamarine.org/mrgis) within six months of completion and quality assurance. Imagery data files are very large and will be copied for requestors on portable hard drives.

Key Project Staff: and their roles are shown in the organization chart below (Figure 4).

Dr**.** Paul Carlson, a Research Scientist with 30 years' experience at the Florida Fish and Wildlife Research Institute (FWRI) and its precursor agencies will be Principal Investigator and manager for the project. Since 1984, he has performed assessment and restoration studies in coastal fisheries habitats, including mangroves, salt marshes, and SAV. He has carried out annual SAV and water quality monitoring in the Big Bend region since 2002. Since 2004, he has also coordinated aerial and satellite SAV imagery acquisition for over a dozen large-area SAV mapping projects. Dr. Laura Yarbro, FWRI co-Principal Investigator, will be assistant project manager and primary data manager. She has worked for the agency since 1985, assessing the status and health of SAV and coastal habitats in Florida. Since 2008, Carlson and co-PI Yarbro have coordinated the statewide Seagrass Integrated Mapping Monitoring (SIMM) program for SAV mapping and monitoring. Additional FWRI staff in St. Petersburg, Cedar Key, and Eastpoint will assist with the project.

Project co-investigators include Dr. Ken Heck and Ms. Dottie Byron, Dauphin Island Sea Laboratory, Dr. Linda Fitzhugh, Director of the St. Andrew Bay Resource Management Association; Ms. Alison McDowell, Director of the Choctawhatchee Bay Alliance, Dr. Jane Caffrey, Professor at the University of West Florida, Dr. Chuanmin Hu, Assistant Professor at the University of South Florida College of Marine Sciences, and Dr. Wayne Magley, an Environmental Scientist with the Florida Department of Environmental Protection Total Maximum Daily Load program, and Sandra Brooke, Associate Research Faculty at the Florida State University Coastal and Marine Laboratory. Each of these co-investigators will play a crucial role in this project. Dr. Fitzhugh is Professor of Biology at Gulf Coast State College in Panama City and President of the St. Andrew Bay Resource Management Association. She has studied SAV dynamics in St. Andrew Bay since 2000 and has received previous funding from USFWS and NOAA.   She is currently working on restoration of SAV in the West Bay sub-region of St. Andrew Bay.

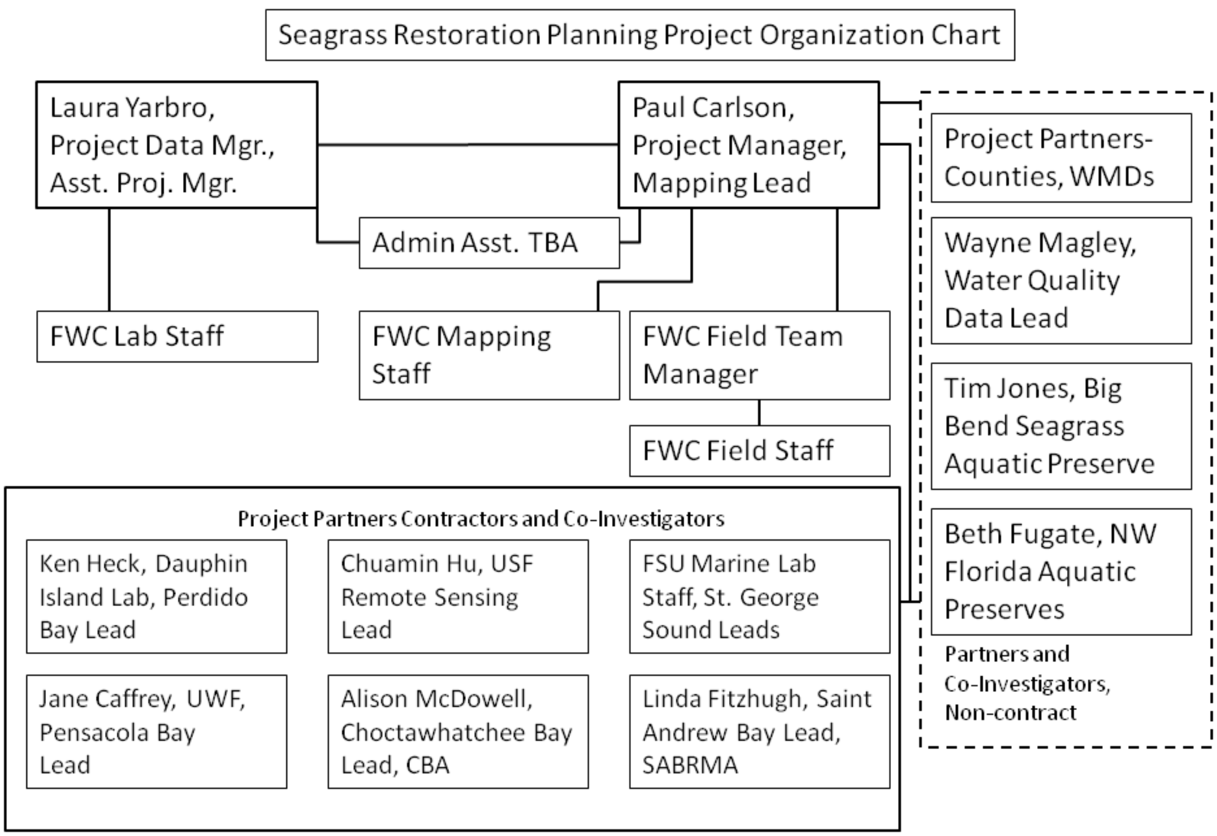

Figure 4: SAV Assessment Project Organization Chart

Dr. Fitzhugh will carry out optical water quality sampling and SAV monitoring in St. Andrew Bay. She will also host annual workshops for the project in Panama City, Florida. Ms. Alison McDowell began work with Choctawhatchee Basin Alliance in 2007 as Restoration Coordinator and has served as Executive Director since 2013. She has worked on numerous successful stormwater and living shoreline restoration projects within the Choctawhatchee watershed, combining community participation with sound science to achieve maximum results. In addition to habitat restoration projects, she has implemented oyster reef and SAV monitoring programs for Choctawhatchee Bay. Currently an M.S. candidate in Environmental Science at the University of West Florida in Pensacola, she will carry out optical water quality and SAV sampling for this project in Choctawhatchee Bay. Dr. Jane Caffrey is a Professor in the Center for Environmental Diagnostics and Bioremediation at the University of West Florida and an estuarine ecologist with 25 years' experience emphasizing biological and chemical processes in estuaries. Dr. Caffrey will carry out optical water quality and SAV sampling in the Pensacola Bay and host annual workshops for the project in Pensacola. Dr. Ken Heck and Ms. Dottie Byron will carry out optical water quality monitoring and SAV assessment in Perdido Bay and Big Lagoon. Dr. Heck is director of the Dauphin Island Sea Laboratory and Ms. Byron is laboratory manager. Dr. Sandra Brooke will carry out optical water quality and SAV assessment in Apalachee Bay. Dr. Brooke is Associate Research Faculty at the Florida State University Coastal and Marine Laboratory. Dr. Wayne Magley is an Environmental Scientist with the Florida Department of Environmental Protection. He has prepared over twenty TMDL assessments for riverine and estuarine water bodies. Dr. Magley will collate all available water quality data for the project area and serve as liaison to FDEP's Numeric Nutrient Criteria program. Mr. Timothy Jones is Preserve Manager for the Big Bend Seagrass Aquatic Preserve which extends from Crystal River to St. Marks, FL. Dr. Chuanmin Hu is an optical oceanographer who has received support primarily from NASA but also from NOAA and EPA to work on ocean optics and ocean color remote sensing. In the past five years, his research efforts focused on quantifying ocean color data product uncertainties, ocean color mission requirements on signal-to-noise and dynamic range, improvements in atmospheric correction and bio-optical inversion, and application of novel data products to study HABs, oil spills, estuarine water quality, and the ocean's response to climate variability and human activities. Dr. Hu will lead a team at USF to calibrate estuary-specific algorithms for calculation of water clarity parameters from satellite data and develop a project website for MODIS water quality data.

Project Schedule

		Month																		
Task	**SAV Assessment Tasks and Deliverables**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	2017
0	Project initiation contracts and budgets	X	X	X																
1	Seagrass recovery roadblock assessment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2	Seagrass status assessment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3	Create seagrass maps		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
4	Determine water and sediment quality		X	X	X	X	X	X	X	X	X	X	X	X	X	X	x	X	X	
5	Build website for satellite water quality		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
6	Conduct stakeholder workshops				X						X						X			
7	Build SAV recovery potential GIS model		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Long- Term Management: As noted in the Florida GEBF Restoration Proposal (Samek, 2015), the concept of long-term management is not easily applied to this project ("This planning effort is targeted at gathering data, evaluating restoration priorities and proposed projects, and managing the state's Restoration Strategy for up to five years.") However, the Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, Northwest Florida Water Management District, and Suwannee River Water Management District each maintain public-facing websites for data distribution. As a result, project data products will be available to stakeholders for the foreseeable future.