ENVIRONMENTAL PROTECTION AGENCY (EPA)
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Project Title: Seagrass Protection and Restoration in St. Joseph Bay, Florida (HUC 03140101)

Applicant Information:
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Total Project Cost and Duration: $190,586 over 30 months requested from EPA.
Proposed Start Date: September 1, 2019 End Date: February 28, 2022

Priority Area: Protect, enhance, and restore coastal (seagrass) habitat

EPA Strategic Goals: This project addresses two principal goals of the EPA Strategic Plan. Protection and restoration of seagrass habitat will meet Goal 1 by improving coastal habitat and water quality. We will also meet Goal 2 by involving stakeholders in management activities to protect seagrasses in St. Joseph Bay.

Project Description: This project is a partnership between two agencies- the Florida Fish and Wildlife Conservation Commission (FWCC) and the Florida Department of Environmental Protection (FDEP)- that have jurisdiction over living marine resources and water quality in coastal waters. We will prevent further losses of seagrasses by mobilizing teams of scientists to remove populations of herbivorous sea urchins that have irrupted in the past five years. Following stabilization of urchin grazing fronts in seagrass beds, natural recovery will be enhanced by creating temporary herbivore exclosures and by planting turtle grass (*Thalassia testudinum)* seedlings collected from other areas in the Bay.

Measurable Outputs: Monitoring of seagrass cover expansion and loss over fine and coarse spatial scales is a key component of the project, and outputs will include GIS maps in shapefile and KML format of seagrass cover in the project area at the beginning, middle and end of the project. We will also report annually on project activities including numbers of sea urchins relocated, and our goal is to restore 20% of the seagrass lost within two years. We also anticipate improvements in water clarity in response to increased seagrass cover, and turbidity and phytoplankton chlorophyll concentrations will be measured quarterly during the project.

Outreach Components: Stakeholder meetings will be conducted to enlist members of the public in urchin control efforts. Annual Sea Urchin Roundups will be held in summer 2020 and 2021.

Place of Performance: This project will be carried out in St. Joseph Bay, Gulf County, Florida.

Project Period: August 15, 2019–December 31, 2021

Section 1. Project Description/Approach

1A. Detailed Project Description: St. Joseph Bay is in Gulf County, along the central Florida Panhandle shoreline. Cape San Blas and the Cape San Blas Peninsula form the southern and western borders, respectively, of St. Joseph Bay. St. Joseph Bay, Florida is part of the St. Andrew Bay watershed HUC 03140101). Please see Attachment 1: Area Maps. Gulf County is Florida's 59th most populous county with 0.1% of the state population, and the region dubs itself the "Forgotten Coast." The largest town in Gulf County, Port St. Joe, is located on St. Joseph Bay, and a large paper mill operated there from 1938 to 1999. With the closing of the paper mill, the economy of Gulf County has shifted to tourism and vacation homes. The population of Gulf County has increased from 11,000 in 1998 to 16,000 in 2017 with most of the new residents settling on the Cape San Blas peninsula. The total area of St. Joseph Bay is approximately 43,000 acres, and seagrass covered approximately 7,000 acres in 2010 (SIMM, 2017). Narrow seagrass beds are located along the east and west shorelines of St. Joseph Bay, but the broadest expanse of seagrass is in the southern and southeastern portions of the Bay. St. Joseph Bay has exceptional water quality, and its seagrass beds have supported a summertime recreational scallop fishery that has contributed greatly to the local economy. The overall context of our project has played out time after time along Florida's Gulf Coast: Small towns and bays along the coast have relatively small economies driven primarily by fisheries and forestry. The rapid influx of tourists and new residents places heavy pressure on infrastructure and natural ecosystems.

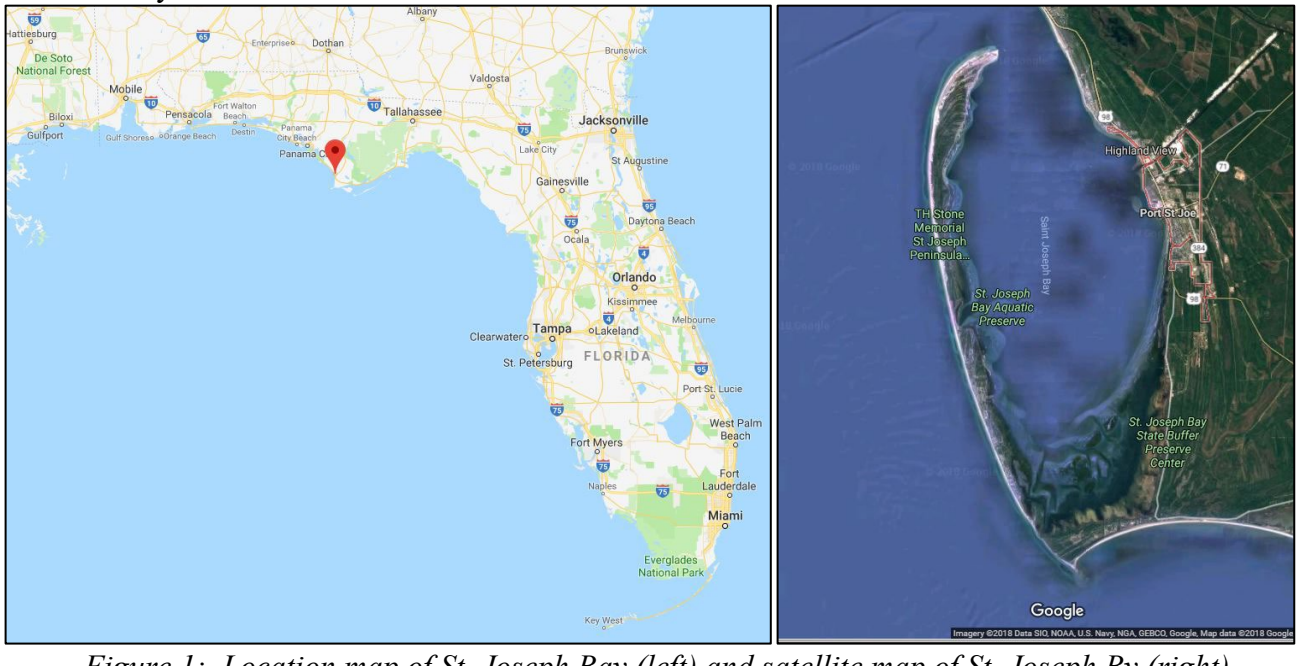

Figure 1: Location map of St. Joseph Bay (left) and satellite map of St. Joseph By (right)..

Because of its exceptional water quality, seagrass cover and extent in St. Joseph Bay were stable for many years prior to 2000. However, the increase in year-round residents, seasonal residents, and vacationers began to take a toll on St Joseph Bay. Prior to 2011, the most notable impacts were a decline in water clarity and a serious level of propeller scarring in seagrass beds. In fact, an FWC study of propeller scarring in Panhandle estuaries showed that 42% of the one-hectare cells mapped in St. Joseph Bay seagrass beds had one or more propeller scars, and 10% had 10 or more scars.

The propeller scarring problem in St. Joseph Bay is recognized, and NRDA funds are being used to place buoys to guide boaters and to restore some of the most heavily scarred areas. However, a new and large threat to seagrass in St. Joseph Bay has emerged. Between 2011 and 2015, seagrass cover in St. Joseph Bay declined by 8%, and aerial imagery from 2017 indicates that declines are continuing.

Our conservative estimate of the impacted area is 157 acres (64 hectares), but the total area of seagrass loss is probably closer to 200 acres.

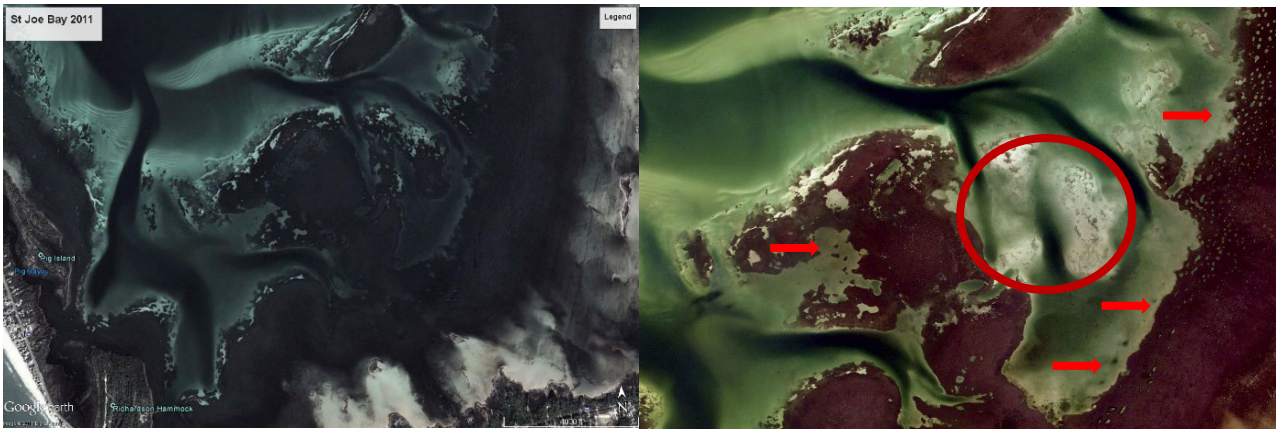

Figure 2: Seagrass cover in St. Joseph Bay 2011 (left) and 2017 (right). Red circle shows area of greatest loss. Active urchin grazing fronts are at arrows. See Attachment 4 for the 2011-2017 time series of seagrass loss.

The cause of seagrass losses in the southern end of St. Joseph Bay is overgrazing by the sea urchin *Lytechinus variegatus*. Sea urchins have been abundant for many years in St. Joseph Bay, but stable seagrass cover has suggested that seagrass productivity exceeded the impacts of sea urchin grazing. However, the population of *Lytechinus* irrupted in the southern Bay sometime between 2011 and 2015 with disastrous impacts on seagrass beds. Figure 3 (below) shows the condition of turtle grass beds with sustainable urchin grazing (left) and the results of an urchin irruption (right). In July 2018, we counted as many as 25 sea urchins per square meter of seagrass along grazing fronts.

Figure 3: Sea urchins grazing on turtle grass in St. Joseph Bay (left), results of urchin eruption near Steinhatchee, FL (right). Photos by P. Carlson (left), S. Geiger (right).

Irruptions of sea urchins have impacted seagrass beds elsewhere. Camp (1973) reported large aggregations of *Lytechinus* at a seagrass site in Dixie County, Florida, and Peterson et al (2002) described an irruption of *Lytechinus* in the Florida Keys. Both events caused large seagrass losses of turtle grass and manatee grass. While the current urchin irruption in St. Joseph Bay is similar to those events, it is different in two important ways: First, turtle grass is the most abundant seagrass in St. Joseph Bay, and, because of the physical environment and added stressors in southern St. Joseph Bay, turtle grass might not be able to recover without assistance. Second, previous urchin irruptions have occurred over large areas in deeper water, making human intervention very difficult. Urchin grazing fronts in St. Joseph Bay are in water shallow enough to attempt harvest and relocation. Furthermore, the concentration of urchins along grazing fronts makes manual collection easier than it would be if urchins were dispersed. Areas that have been decimated by urchin grazing are also located in water shallow enough to use exclosures to protect seagrasses during recovery.

This project is a partnership between two state agencies- FWC and FDEP- that will prevent further losses of seagrasses by mobilizing teams of scientists and agency staff to remove herbivorous sea urchins whose population have irrupted in the past five years. Stakeholder meetings will be conducted to enlist members of the public in urchin control efforts. If legal staff agree, public outreach events including Sea Urchin Roundups will be held to relocate urchins. Following stabilization of urchin grazing fronts in seagrass beds, natural recovery will be enhanced by creating temporary herbivore exclosures and by planting *Thalassia* seedlings collected from other areas within the Bay. Monitoring of seagrass cover expansion and loss over fine and coarse spatial scales is a key component of the project, and our goal is to restore 20% of the seagrass lost within two years. We anticipate improvements in water clarity in response to increased seagrass cover, and turbidity and phytoplankton chlorophyll concentrations will be measured quarterly during the project.

Project Methods*:* Fall 2019- The initial reconnaissance for this project was done in summer 2018. In fall 2019 we will determine the feasibility and effectiveness of urchin removal. We will first carry out in-water urchin and seagrass surveys as well as low-level aerial surveys to map the exact location of urchin grazing fronts. Along each of three urchin grazing fronts, we will remove urchins along three 50-meter sections (Experimental) and leave urchins in place along three alternating (Control) sections of the grazing fronts. These fronts will be maintained by removing urchins from the Experimental sections of the grazing fronts during fall 2019, and the effect of urchin removal will be assessed by in-water surveys and aerial photography in spring 2020.

Urchin relocation during the initial phase of the project, as well as in subsequent efforts and in Sea Urchin Roundups (if permitted) will be carried out by collecting sea urchins in mesh bags which will be transferred to a boat, covered with a moist towel, driven approximately 4 km north in St. Joseph Bay, and released in approximately 20 feet of water over unvegetated bay bottom. The transfer process will take less than one hour, and, based on previous experience, no urchin mortality is anticipated. In fall 2019, we will also apply for necessary permits to install four exclosures in areas previously grazed by sea urchins. The purposes of the exclosures are to allow surviving *Thalassia* an opportunity to recover without continued grazing pressure and to provide a protected incubator for *Thalassia* seedlings collected from unimpacted areas of the bay. A second and third round of urchin relocation and field surveys will be carried out in spring and fall 2020.

In fall 2019, we will also construct four temporary urchin exclosures over grazed seagrass meadows. Each exclosure will be 16 m^2 in size with Vexar mesh sides (4 m long × 1 m high) to allow water flow. Urchins will be removed from the exclosures, and *Thalassia* seedlings collected in nearby seagrass beds will be planted in the exclosures. Exclosures will be serviced monthly in October, November, and December 2019, and every two months in 2020 and 2021. If seagrasses recover rapidly in the four exclosures, we might relocate them to four new sites in 2020. If recovery is slow, we will build four new exclosures in fall 2020. All exclosures will be removed in the fall of 2021.

During the initial phase of the project, all work will be carried out by FWC and FDEP staff. However, the project team will meet in February 2020 to plan for one or more Sea Urchin Roundups in June or July 2020. FWC and FDEP staff will also carry out seagrass and sea urchin surveys in spring and fall 2020. In fall 2020, we will also review results of the Sea Urchin Roundups and plan for a stakeholder meeting in February 2021. Activities in 2021 will follow a schedule very similar to those in 2020: project team meeting in February, seagrass and sea urchin surveys in spring and fall, Sea Urchin Roundup(s) in summer. Throughout the project, water quality surveys will be carried out every two months. Measurements of surface and bottom water salinity and temperature will be made in the field, and water samples will be transported back to the lab for the analysis of tannins, turbidity, and phytoplankton chlorophyll. Over the course of 30 months, we hope to see improvement (lower turbidity and chlorophyll) in water quality as seagrass recovers from sea urchin impacts.

1B. Project Relevance: This project is consistent with the Gulf of Mexico Program Priority Area II: Protect, Enhance, or Restore Habitat, and we have designed it to do all three tasks. We will protect existing seagrass from future damage by removing sea urchins, we will enhance and restore grazed areas by using exclosures to give surviving patches of seagrass time to recover without additional urchin grazing, and we will restore lost seagrass area using the exclosures and seedlings collected from turtle grass in other parts of St. Joseph Bay.

This project is also firmly linked to Goals 1 and 2 of the EPA Strategic Plan. Our work addresses Goal 1- the Core Mission of EPA to "sustainably manage…aquatic ecosystems, and recreational and economic activities." This project will actively manage seagrass beds in St. Joseph Bay by removing an irruptive herbivore species. By doing so, this project will greatly benefit permanent residents and vacationers who use St. Joseph Bay for fishing, scalloping, and boating. Scallops, in particular, are an economic engine for Gulf County tourism, and they are completely dependent on seagrass habitat. Scallop populations in St. Joseph Bay have declined to the point that the recreational scallop season has been cut from three months to six weeks in recent years. Restoring seagrass in St. Joseph Bay might help scallop populations rebound, and further losses of seagrass will have adverse impacts on scallops.

Our project is also consistent with Goal 2 of the EPA Strategic Plan, and we will leverage state and federal resources to provide "tangible environmental results" in the form of improved water quality and greater recreational use of St. Joseph Bay. Members of the public will be involved in the project through reports to the Gulf County Commission and Sea Urchin Roundups. Print and radio media will be engaged, especially for the Sea Urchin Roundups.

1C. Project Implementation: As noted earlier, this project is a collaborative effort between staff of the Florida Fish and Wildlife Conservation Commission and the Florida Department of Environmental Protection. Staff from both agencies working on this project have worked together on the Seagrass Integrated Mapping and Monitoring program and other projects for more than 10 years. The Research Assistant hired for this project will have primary responsibility for scheduling project activities and logistics, but FWC and Aquatic Preserve staff will assist as needed. Project oversight will be carried out by Paul Carlson and Laura Yarbro for FWC and Jonathan Brucker for FDEP. Volunteer staff associated with the St. Joseph Bay Aquatic Preserve and St. Joseph Bay Buffer Preserve will be invited to participate, and Sea Urchin Roundups will allow other interested members of the public to participate.

Section 2. Environmental Results—Outputs, Outcomes and Performance Measures

2A. Outputs and Outcomes: Outputs for this project will include seagrass, urchin, and water quality survey results. These outputs will quantify gains or losses in seagrass cover, increases or decreases in sea urchin numbers, and changes in water column turbidity and chlorophyll. We currently publish seagrass and water quality data every two years in updates of the St. Joseph Bay chapter of the Seagrass Integrated Mapping and Monitoring program. The program website and chapters are located on the web at: http://myfwc.com/research/habitat/seagrasses/projects/active/simm/simm-reports/. The quarterly and final report to EPA will also include these data in digital form.

We are optimistic about the outcomes of this project. We plan to stop urchin grazing over fronts that total more than 2 km, sparing at least 50 acres of seagrass from decimation. As noted earlier, we estimate that approximately 200 acres of seagrass were lost to urchin grazing between 2011 and 2017. Some of that area might never be recovered because of wave energy on now-exposed sediment. We also anticipate that seagrass in urchin-grazed areas will recover faster with protection from additional

grazing. Because seagrass beds act as natural filters for turbidity, we also anticipate improved water clarity as seagrasses recover.

2B. Project Performance: The tasks outlined in the detailed project description are focused on three goals: 1) To assess the current condition of seagrasses, water quality, and sea urchin abundance in St. Joseph Bay; 2) To reduce seagrass losses due to sea urchin grazing fronts by manually collecting and relocating sea urchins; and 3) To stimulate recovery of seagrasses in heavily grazed areas by building sea urchin exclosures and planting turtle grass seedlings. Assessment of anticipated beneficial impacts is integral to our methods. The Research Assistant hired for this project will have primary responsibility for scheduling project activities and logistics, but FWC and Aquatic Preserve staff will assist as needed. Project oversight will be carried out by Paul Carlson and Laura Yarbro for FWC and Jonathan Brucker for FDEP. Maps, data summaries and reports will be used to measure the success of our efforts, and those data, maps, and imagery will be available for public use on the FWC and FDEP websites during and after the project.

2C. Action Plan, Timeline and Milestones

Action Plan: The detailed project description is our action plan, but it can be summarized as follows:
Spring 2019- Pre-project planning and preparation, contract initiation.
Summer 2019- Project starts with aerial photography, sea urchin, seagrass, and water quality assessment. Urchin relocation and continued assessment.
Fall 2019- Exclosure construction, *Thalassia* seedling collection and planting, aerial photography
Winter 2020- Stakeholder meeting, 2020 field season planning including first Sea Urchin Roundup.
Spring 2020- Aerial photography, sea urchin, seagrass, and water quality assessment. Urchin relocation
Summer 2020- Sea Urchin Roundup, continued urchin, water quality and seagrass assessment
Fall 2020- New exclosure construction or relocation of existing exclosures, *Thalassia* seedling collection and planting, aerial photography.
Winter 2021- Stakeholder meeting, 2021 field season planning including second Sea Urchin Roundup
Spring 2021- Aerial photography, sea urchin, seagrass, and water quality assessment. Urchin relocation
Summer 2021- Sea Urchin Roundup, continued urchin, water quality and seagrass assessment
Fall 2021- Exclosure removal or relocation, *Thalassi*a seedling collection and planting, aerial photography. Final report and data preparation.

Milestones: Project Tasks and Milestones are shown in the Timeline Table (below)

Section 3. Outreach Component- Public outreach is an integral component of this project. The Central Panhandle Aquatic Preserve and its staff have an active and positive public presence in the study area. They recently installed marker buoys along natural channels through seagrass beds in southern St. Joseph Bay to guide boaters and reduce propeller scarring. Jonathan Brucker makes quarterly reports to the Gulf County Commission and will keep them updated on the status of the project. The Preserve also maintains kiosks at the three principal boat ramps on St. Joseph Bay and distributes maps of the marker buoys and other pamphlets at the kiosks. We will prepare a brochure describing the project and, at the appropriate time, the Sea Urchin Roundups, for distribution at the kiosks and other outlets.

Initial efforts for sea urchin control in spring and summer 2019 will be done by agency staff. However, a project team meeting will be held in February 2020 to plan the Sea Urchin Roundup for summer 2020. Similar events- Scallop Rodeos- are being carried out by FWRI staff in summer 2018, so we have a well-defined planning and implementation guide. Once the plan is established, FWC and FDEP outreach staff

	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Urchin and Seagrass Surveys			X	X					X	X					X	X					X	X					X	X	
Aerial Seagrass Surveys			X	X																									
In-water transect setup			X	X																									
Map preparation	X		X	X											X	X											X	X	
Select urchin Removal Sites			X	X																									
Urchin Management																													
Initial Urchin Relocation		X	X	X																									
Repeated Urchin Relocation									X	X					X	X					X	X					X	X	
Outreach Activities																													
Stakeholder Meetings							X													X									X
Sea Urchin Roundups											X	X											X	X				X	
Restoration Activities																													
Permit applications			X	X																									
Exclosure installation			X	X					X	X																			
Exclosure maintenance					X		X		X		X		X		X		X		X		X		X		X		X		
Exclosure relocation															X	X					X	X							
Seedling collection planting													X												X				
Exclosure removal																												X	
Project Monitoring																													
Urchin Transect Surveys									X	X					X	X					X	X					X	X	
Aerial Photography			X						X						X						X						X		
Urchin/Seagrass Maps				X	X					X	X					X	X					X	X					X	X
Water Quality Sampling	X		X		X		X		X		X		X		X		X		X		X		X		X		X		
Project Reporting																													
					X			X			X			X			X			X			X			X			X
Final Report: Feb 2022																													

will use print, radio, and TV media to publicize the events. We will target two successive Saturdays in June 2020 for the first Sea Urchin Roundups. A second project team meeting will be held in February 2021 to plan Sea Urchin Roundups for 2021. Based on the success of efforts in 2020, we will increase the number and timing of events or keep them on the 2020 schedule.

Throughout the project, we will post status reports on our FWC seagrass web pages (http://myfwc.com/research/habitat/seagrasses/). Outreach staff will also issue press releases to publicize our findings. As data become available, and for several years after the project ends- digital data will be accessible through our respective agency spatial data portals. The FWC data portal address is http://geodata.myfwc.com/pages/marine, and the FDEP distributes spatial data through the Map Direct website (https://ca.dep.state.fl.us/mapdirect/).

Section 4. Applicant Capability and Past Performance

Organizational Experience and Staff Expertise- Staff at the Florida Fish and Wildlife Research Institute study and provide data for freshwater and marine fisheries, assessment and restoration of ecosystems, aquatic and terrestrial wildlife, imperiled species, and red tides. The institute is the research branch of the Florida Fish and Wildlife Conservation Commission. Its staff carry out applied research, disseminates research products (maps, imagery, digital data), and engages in outreach activities to protect, conserve, and restore fish and wildlife resources. FWRI employs more than 600 people who work at its St. Petersburg headquarters and more than 20 field laboratories and offices around the state (http://myfwc.com/research/).

The FWCC seagrass team led by Paul Carlson currently has three active projects related to assessment, protection, and restoration of seagrass habitat:

1. Roadblocks to Seagrass Recovery in Florida Panhandle Estuaries and the Florida Big Bend Region. Paul Carlson and Laura Yarbro, co-PIs. Funded by Florida Gulf Environmental Benefit Fund. http://myfwc.com/research/habitat/seagrasses/projects/roadblocks/. Funded by the National Fish and Wildlife Foundation, this project assesses status and trends of seagrass habitat in Florida Panhandle estuaries and the Big Bend Region. Key elements include: 1) identification of human and natural stressors affecting seagrasses in the study area; 2) determination of status and trends of seagrasses by mapping current and historical aerial imagery; and 3) development of a seagrass recovery potential (SRP) model for Panhandle estuaries and Florida's Big Bend..

2. Remote Sensing Algorithms for Water Quality and Primary Production in Apalachee Bay, Florida. Paul Carlson (FWC), Laura Yarbro (FWC), and Brian Barnes (USF),co-PI's. Funded through 2020 by NASA, this project is evaluating and refining the use of remotely sensed optical water quality data for assessment and modeling to protect seagrass habitat in Florida's Big Bend region.

3. Seagrass Die-Off and Recovery in Florida Bay: Research in Process and Restoration. A cooperative agreement between FWC and the National Park Service, this project is investigating the physical and chemical processes that cause massive seagrass mortality events in Florida Bay in Everglades National Park. The project began in 2015 and will run through August 2021.

Section 5. Expenditure of Awarded Grant Funds: Billing will occur on a schedule determined by EPA and our Grants Administrator at the time a cooperative agreement is issued. As soon as the cooperative agreement is signed by EPA and FWC, we can set up the internal budget for the project which will allow for initial expenses that are incurred after the agreed-upon project start date, which we hope will be May 1, 2019. The project start date falls within a Florida state fiscal year, making the project starting process easier. Initial costs- salary and field travel- will be relatively low. Larger costs will be incurred between summer 2019 and summer 2021, and wrap-up costs between October and December, 2021 will be limited to facilitate budget close-out. Additional forms in the application package describe the financial fitness of FSC and FWRI.