APPLICATION COVER PAGE – 1 OF 2 (PROJECT BASIC CRITERIA)

Section 1: Application Cover Page; Basic Criteria

Please use this page, or re-create as is.

1. **PROJECT TYPE:** (*As mandated by the RESTORE Act, funds may only be used for one or more of the allowable uses listed below, which the County cannot amend or change. Carefully review each criteria listed below and determine if your project will achieve one or more of the allowable uses below. Projects that do not meet at least one of the allowable uses below will not be considered for funding. Check all that apply.*)

- ☒ Restoration and protection of natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast Region.
- ☒ Mitigation of damage to fish, wildlife, and natural resources.
- ☐ Implementation of a federally approved marine/coastal management plan, including fisheries monitoring.
- ☒ Workforce development and job creation.
- ☐ Improvements to or on state parks in coastal areas affected by the Deepwater Horizon oil spill.
- ☐ Infrastructure projects benefiting economy or ecological resources, including port infrastructure.
- ☐ Coastal flood protection and related infrastructure.
- ☐ Planning assistance.
- ☒ Activities to promote tourism and seafood in the Gulf Coast region, for one or more of the following:
  - ☒ Promotion of tourism in the Gulf Region, including recreational fishing.
  - ☐ Promotion of the consumption of seafood harvested from the Gulf Coast Region.

2. **CONTACT INFORMATION:** (*Include at least one name, phone number, email address, and organization name if applicable*)

- Organization: Bonefish and Tarpon Trust
- Address: PO Box 529
- City, State, Zip Code: St. James City, FL 33956
- Contact Person
  - Name: Dr. Aaron Adams
  - Title: Director of Operations
  - Phone: (239)-283-4733
  - Email Address: aaron@bonefishtarpontrust.org

APPLICATION COVER PAGE – 2 OF 2 (PROJECT SUMMARY)

Section 2: Application Cover Page; Project Summary Information

Please use this page, or re-create as is.

3. **Project Name**: (*Provide a short succinct title for the project*)

Large-scale Restoration of Channel and Bank Habitats of the Florida Keys

4. **Project Executive Summary**: (*Provide a concise summary or abstract in the space below; do not exceed the space below.*)

Seagrass banks in the Florida Keys provide critical resources, including seafloor stabilization, storm protection of shorelines and feeding, and nursery and refuge habitat for ecologically and economically important fauna such as sport and game fish. Additionally, natural channels through the banks are ecologically rich zones with high densities of game fish and their prey as well as hard and soft corals, gorgonians, and algae. Unfortunately, these banks suffer localized heavy injury from vessel groundings. Moreover, vessel groundings often increase in size with time if not repaired, eliminating additional habitat and destabilizing the ancient bank formations. These ongoing injuries contribute to degradation of the bank top and associated channel ecosystems and their functional service level as critical habitat for commercial and recreationally important fish and their prey. We propose to perform large-scale remediation of the Florida Keys bank top and channel environments, especially within Monroe Country boundaries, to the betterment of a wide range of ecosystem services, including game fishes and their prey. With three optional levels of effort, this project will create sustainable local jobs both in direct support of the project (habitat restoration and monitoring actions) and downstream benefits from improved ecosystem services (improved fishing, aesthetics, and tourism). All work would be conducted in coordination with the state and local agencies and develop, install, and monitor bank markers to deter accidental vessel groundings. A key outcome would be quantifying the effectiveness of the restoration and mitigation efforts through monitoring studies.

5. **Range of Benefit: Does this project have a**

- ☒ Local benefit?
- ☒ Keys-wide benefit?
- ☒ Regional benefit?
- ☐ Gulf-wide benefit?

(*Provide the location of the project and a brief description of the area that is benefiting; do not exceed the space below.*)

Florida Keys, Monroe County waters and adjacent communicating water bodies, including Florida Bay and the entirety of the Florida Keys National Marine Sanctuary.

6. **Project Cost**: (*Provide the actual/estimated project cost, the amount being requested with this submission, and the amount of match committed to the project from any source. Please make clear the total project costs and the amount you are requesting. There is an opportunity to provide detailed cost/request/match information in the narrative section (see question 8.*)

One Site

• Total Project Cost:	$639,395	
• RESTORE Request Amount:	$639,395	% of project cost: 100
• Secured Cash Match (Committed funding from other sources):	$	% of project cost:
• In-kind Match Value:	$84,000	% of project cost: 12
• Funding Gap:	$	% of project cost:
• Anticipated Cash Match (potential funding from other sources)*:	$	% of project cost:

* These funds must be secured within 1 year of project award.

Three Sites

• Total Project Cost:	$1,918,184	
• RESTORE Request Amount:	$1,918,184	% of project cost: 100
• Secured Cash Match (Committed funding from other sources):	$	% of project cost:
• In-kind Match Value:	$252,000	% of project cost: 12
• Funding Gap:	$	% of project cost:
• Anticipated Cash Match (potential funding from other sources)*:	$	% of project cost:

* These funds must be secured within 1 year of project award.

Five Sites

• Total Project Cost:	$3,196,974	
• RESTORE Request Amount:	$3,196,974	% of project cost: 100
• Secured Cash Match (Committed funding from other sources):	$	% of project cost:
• In-kind Match Value:	$420,000	% of project cost: 12
• Funding Gap:	$	% of project cost:
• Anticipated Cash Match (potential funding from other sources)*:	$	% of project cost:

* These funds must be secured within 1 year of project award.

APPLICATION PROJECT BUDGET

Section 3: Project Budget

OPTION 1 – ONE SITE

PROJECT BUDGET		FUNDING		
Activity/Item	**Cost**	**Anticipated RESTORE Funding**	**Cash Match**	**In-kind Match**
Planning/Design/Permitting				
Planning and Design	$93,589	$93,589		
Site Selection	$41,185	$41,185		$3,000
Permitting	$20,470	$20,470		
Administration*:				
Planning Subtotal:	$155,244	$155,244		$3,000
Construction or Project Activity(ies)				
Site Preparation	$59,087	$59,087		$1,000
Site Filling	$286,938	$286,938		
Seagrass Transplanting & Contingency	$41,374	$41,374		$1,000
Administration*:				
Construction Subtotal:	$387,399	$387,399		$2,000
Monitoring				
Seagrass and Channel Monitoring	$63,286	$63,286		$4,000
Graduate Students	$61,178	$61,178		$5,000
Analysis, Reporting, and Publication	$33,868	$33,868		$3,000
Administration*:				
Monitoring Subtotal:	$158,332	$158,332		$12,000
Project Cost				
Total Administration*:	$19,891	$19,891		$4,000
TOTAL Project Cost:	$720,866	$720,866		$25,000[1]

Estimated Costs by Year	
Year 1	$83,173
Year 2	$460,232
Year 3	$160,684
Year 4	$16,777
Year 5	
Year 6	

*Notes: Only complete the sections of the budget that are applicable for your project. Please refer to question 8 to provide further explanation of budget details. *The RESTORE Act places a total 3% cap on administrative expenses. We are uncertain at this point how this will be applied, how "administration" will be defined or assigned, or whether projects may even be able to include administration. We are waiting on further guidance from US Treasury rules to define this. Please keep this in mind as you develop your budget. Administrative costs typically include but may not be limited to overhead costs for basic operational functions (insurance, utilities), as well as costs associated with admin staff such as accountants, legal, etc.*

[1] Per year.

OPTION 2 – THREE SITES

PROJECT BUDGET		FUNDING		
Activity/Item	**Cost**	**Anticipated RESTORE Funding**	**Cash Match**	**In-kind Match**
Planning/Design/Permitting				
Planning and Design	$106,959			
Site Selection	$123,554			$9,000
Permitting	$23,395			
Administration*:				
Planning Subtotal:	$253,908			$9,000
Construction or Project Activity(ies)				
Site Preparation	$177,262			$3,000
Site Filling	$860,813			
Seagrass Transplanting & Contingency	$124,123			$3,000
Administration*:				
Construction Subtotal:	$1,162,198			$6,000
Monitoring				
Seagrass and Channel Monitoring	$189,857			$12,000
Graduate Students	$183,535			$15,000
Analysis, Reporting, and Publication	$101,603			$9,.000
Administration*:				
Monitoring Subtotal:	$474,996			$36,000
Project Cost				
Total Administration*:	$59,672			$12,000
TOTAL Project Cost:	$1,918,184			$63,000[12]

Estimated Costs by Year	
Year 1	$225,079
Year 2	$1,245,456
Year 3	$434,835
Year 4	$45,402
Year 5	
Year 6	

*Notes: Only complete the sections of the budget that are applicable for your project. Please refer to question 8 to provide further explanation of budget details. *The RESTORE Act places a total 3% cap on administrative expenses. We are uncertain at this point how this will be applied, how "administration" will be defined or assigned, or whether projects may even be able to include administration. We are waiting on further guidance from US Treasury rules to define this. Please keep this in mind as you develop your budget. Administrative costs typically include but may not be limited to overhead costs for basic operational functions (insurance, utilities), as well as costs associated with admin staff such as accountants, legal, etc.*

[2] Per year.

OPTION 3 – FIVE SITES

PROJECT BUDGET		FUNDING		
Activity/Item	**Cost**	**Anticipated RESTORE Funding**	**Cash Match**	**In-kind Match**
Planning/Design/Permitting				
Planning and Design	$133,699			
Site Selection	$205,923			$15,000
Permitting	$29,244			
Administration*:				
Planning Subtotal:	$368,865			$15,000
Construction or Project Activity(ies)				
Site Preparation	$295,437			$5,000
Site Filling	$1,434,689			
Seagrass Transplanting & Contingency	$206,871			$5,000
Administration*:				
Construction Subtotal:	$1,936,997			$10,000
Monitoring				
Seagrass and Channel Monitoring	$316,429			$320,000
Graduate Students	$305,892			$25,000
Analysis, Reporting, and Publication	$169,338			$15,000
Administration*:				
Monitoring Subtotal:	$791,659			
Project Cost				
Total Administration*:	$99,453			$20,000
TOTAL Project Cost:	$3,196,974			$105,000[13]

Estimated Costs by Year	
Year 1	$368,865
Year 2	$2,041,084
Year 3	$712,619
Year 4	$74,406
Year 5	
Year 6	

*Notes: Only complete the sections of the budget that are applicable for your project. Please refer to question 8 to provide further explanation of budget details. *The RESTORE Act places a total 3% cap on administrative expenses. We are uncertain at this point how this will be applied, how "administration" will be defined or assigned, or whether projects may even be able to include administration. We are waiting on further guidance from US Treasury rules to define this. Please keep this in mind as you develop your budget. Administrative costs typically include but may not be limited to overhead costs for basic operational functions (insurance, utilities), as well as costs associated with admin staff such as accountants, legal, etc.*

[3] Per year.

APPLICATION QUESTIONS – DETAILED PROJECT INFORMATION

Section 1. Application Narrative; Detailed Project Information

Please respond clearly and specifically to each of the following questions. Use 12 pt. font, 1 inch margins, and pagination, to aid in readability. There is no page limit, but please be as brief as possible. To complete your submission, please attach your response to these questions to the application cover pages and the budget page.

7. Project Description:

Here, we propose to utilize RESTORE Act funds to fuse existing knowledge, planning recommendations, and new approaches and partnerships to create a working-scale demonstration project that restores numerous vessel-damaged seagrass and coral bank tops and channel habitats, creates jobs, and supports fishing and fisheries. Importantly, we will document both the ecological and economic benefits of these actions.

Injuries to bank top habitats in the Florida Keys and elsewhere arising from vessel groundings is widely documented (Kuss 1991, Kruer 1994, Sargent et al. 1995, SFNRC 2008)[4].

Bonefish and Tarpon Trust (BTT) is a non-profit organization whose mission is to conserve and enhance global bonefish, tarpon, and permit fisheries and their environments through stewardship, research, education, and advocacy. To accomplish this mission, BTT serves as a repository of information for these species and their prey and habitats and works to nurture these populations, supports research on these fisheries and their environments, and educates and works with government to ensure effective management of these resources. Thus, the health of bank top and channel environments where anglers and guides seek these prize game fishes is of great concern to BTT.

BTT recognizes that a great deal of science has been conducted that guides management of these habitats and that many levels of management plans have been devised. However, implementing these plans has proved challenging in the Nation's current fiscal climate. And because those well-considered plans have yet to be implemented, they still remain to be evaluated for their efficacy. Until we implement the concepts of bank and channel protection, we cannot learn, adapt, and refine those plans to provide true protection of these critical resources. BTT will team with science-oriented partners to develop an end-to-end demonstration project for bank top and channel remediation and restoration, including planning, permitting, design, implementation, and multidimensional monitoring (physical, biological, and economic responses).

[4] Literature Cited will be provided upon request.

The ongoing and repeated destruction of seagrasses and associated living resources (e.g., corals and sponges) have long been recognized as a significant threat to the structural integrity, ecosystem function, and bioeconomic value of these systems (Zieman 1976, Durako et al. 1992, Folit et al. 1992, Whitfield et al. 2002, Engeman et al. 2008). As a result, extensive research has been conducted on understanding the etiology of these injuries and developing techniques for their mitigation (Fonseca et al. 1998, Kenworthy et al. 2000, 2002, Uhrin and Holmquist 2003, Kirsch et al. 2005, Fonseca et al. 2004, Hammerstrom et al. 2007, Uhrin et al. 2009, 2011).

Recent work has expanded the ecological context of these banks to not only include the oft-injured bank top environment but also the rich and diverse benthic and fish communities of the associated channels (sometimes termed "release channels") that punctuate the bank system (Thayer and Chester 1989, Burke et al. 2012). Burke et al. (2012) demonstrated that daytime fish communities in these channels closely resembled that of coral reefs from which nocturnal forays onto the surrounding banks and basins for feeding was proposed, revealing the inter-relatedness of this system. Like the bank tops, these incredibly rich and diverse channel habitats are similarly vulnerable both from direct impact and from indirect, spill-over effects such as sedimentation mobilized off the bank tops during storms and into any nearby deeper areas (*sensu* Whitfield et al. 2002, Uhrin et al. 2009, 2011).

Despite the long history of study and attempts at intervention (hampered by limited resources), vessel groundings continue daily, leading to the decline of these important natural resources. Degradation and loss of these habitats not only results in loss of ecosystem services but in loss of economic services as well. The saltwater recreational fishery in Florida has an annual economic impact that exceeds $6 billion (ASA 2013)[5], with a significant amount of this effort in the Florida Keys. In fact, the Florida Keys are credited with being the birthplace of "flats fishing," which brings hundreds of millions of dollars to South Florida. For example, recreational fishing in the Florida Everglades region has an annual economic impact >$1 billion and supports an estimated 12,000 full-time equivalent jobs. A recent study of the Florida Keys shows that the annual economic impact of all Florida Keys saltwater fishing is $741 million, with $427 million of that from the Flats Fishery (Fedler 2013). This means that a single county in Florida, Monroe County, accounts for 16% of the statewide economic impacts of saltwater fishing. The Flats Fishery also accounts for 4,340 full-time equivalent jobs. In addition, the fisheries of the Florida Keys have an important cultural component, with many of the fishing guides being third-generation guides and part of the fabric of the Florida Keys community.

Bonefish & Tarpon Trust is also conducting a project in the Florida Keys to map important fishing areas for the Flats Fishery for use in the ongoing management revision for the FKNMS.

[5] American Sportfishing Association. 2013. Sportfishing in America – An economic Force for Conservation. Alexandria, VA: American Sportfishing Association. 12pp

This has never been done before. This work will identify the important fishing areas and habitats and designate these areas in such a way so as to ensure their conservation for the fishery into the future. Many of the seagrass banks of concern, due to groundings, propeller scarring, and other disturbances, are within this important fishing area, which further underscores the need for this study. Moreover, these seagrass banks are focal points for the Flats Fishery, providing habitat for tarpon, permit, and bonefish. Degradation of these seagrass banks negatively impacts the Flats Fishery.

For this project, our first step would be to survey fishing guides engaged in this fishery about their historical use of seagrass banks, whether they have observed changes in fishing quality and fish abundance at these banks, and what banks might benefit most from restoration. These guide-assisted surveys will enable us to avoid conflicts with this user group that might occur if a restoration site is an important fishing area (for example, restoration might take place during winter for a location that is important for the tarpon fishery (a summer fishing season). Analysis will be conducted, particularly by graduate students, after restoration is complete to monitor the extent that fishing effort returns to the restored locations and determine trends in fishing quality and fish abundance. The interaction with this important stakeholder group in the Florida Keys will give us nearly unprecedented information on pre- and post-restoration conditions, beyond those acquired from standard scientific sampling methods. Additionally, by conducting census of both ecological functions and human use, we will provide a comprehensive and comparative economic analysis describing the local and regional value of these habitats in both a degraded and restored state. Through this comparison, we will transparently demonstrate the true cost of these injuries to our society as well as the benefit of their conservation in a manner that will provide clear, actionable guidance to the management community.

Unfortunately, it appears there may be a large number of injuries from which to choose, meaning that this project could be widely scalable. Here, we offer a plan with three levels of effort to select one, three, or five approximately 1-acre sites where vessel injuries are compromising the integrity of the channel and bank formation. Selection of these sites will be aided by input from key user groups such as flats guides and resource managers.

At each site, we propose to conduct a series of campaigns with the goal of achieving persistent recovery of the injured habitats. First, we will measure, classify by injury type (single, dual prop scars, blow holes), and age injuries on each site to create its grounding history. Next, by working with our project partners, we would obtain permits to install informative buoyed signs that would allow boaters to discriminate navigable from non-navigable areas over the project area. Boaters assuredly do not want to run aground and strand; thus, by providing unambiguous visual cues, we will measure the frequency of subsequent groundings for

comparison with the age-frequency distribution of existing injuries and measure changes in grounding frequency and extent.

Our next campaign step will be to actively restore the extant injuries. We will use existing approaches (Kirsch et al. 2005) and local contractors to restore the elevations with appropriate sediments and accelerate recovery by introducing and facilitating pioneering species of seagrass into the filled areas. Performance of this active restoration would also be fully monitored using established methods (Fonseca et al. 1998, Kirsch et al. 2005), also in partnership with local contractors.

Our approach will be one of Adaptive Management—we will evaluate the effectiveness of customized informational marking in achieving protection and service to habitat integrity, function, and human use (e.g., flats fishermen and passive use practices). Through the course of this 5-year project, we will continuously use these assessments to adjust, refine, and document consequences of our adaptive decisions in terms of changes in grounding frequency, habitat health, and human perception and use.

As mentioned previously, we document the efficacy of our project to an unprecedented degree. Beyond the initial surveys, we will monitor not just habitat restoration efforts, but the response of associated sessile and motile communities, stratified among the zones described by Burke et al. (2012) (bank top, bank margin, basin, and release channel). Additionally, we will quantitatively evaluate perception and use by the public, including recreational anglers and fishing guides. Finally, we will perform an economic analysis that transcends the ecosystem service flows that are typically the only metric used in seagrass restoration success and document the full extent of economic benefits that flow from achieving lasting integrity of these habitats.

Successful implementation of a working demonstration project means working at landscape scales and, necessarily, with a wide range of jurisdictional requirements. To achieve success, we will partner with Monroe County regarding establishment of the informational signage.

Section Summary: Background

- Seagrass banks in the Florida Keys, including within the boundaries of the FKNMS, are a critical resource, including seafloor stabilization, storm protection of shorelines and feeding, and nursery and refuge habitat for ecologically and economically important fauna, including sport and game fish.
- Natural channels through the banks (sometimes called "release channels" for their high current speeds) have been demonstrated to be ecologically rich zones with high densities of game fish and their prey as well as hard and soft corals, gorgonians, and algae.

- These banks suffer localized heavy injury from vessel groundings. Funding has been limited to support testing and establishment of vessel grounding avoidance strategies.
- Vessel groundings often increase in size with time if not repaired, eliminating additional habitat and destabilizing the ancient bank formations.
- These ongoing injuries contribute to degradation of the bank top and associated channel ecosystems and their functional service level as critical habitat for commercial and recreationally important fish and their prey.

Objectives

- Perform large-scale remediation of the Florida Keys bank top and channel environments, especially within Monroe Country boundaries, to the betterment of a wide range of ecosystem services, including game fishes and their prey.
- Create sustainable local jobs in direct support of the project (habitat restoration and monitoring actions) and downstream benefits from improved ecosystem services (improved fishing, aesthetics, tourism).
- In coordination with the state and local agencies, develop, install, and monitor bank markers to deter accidental vessel groundings.
- Quantify the effectiveness of the restoration and mitigation efforts through monitoring studies.

Approach

- Options for three choices as to levels of effort to select one, three or five approximately 1-acre sites where vessel injuries are compromising the integrity of the channel and bank formation.
- Work within both the local fishing and regulatory environments (county, state, FKNMS) to develop a multi-stage implementation plan for remediation and monitoring.
- Obtain the necessary permits.
- Monitor effectiveness of the remediation in terms of actual success of the restored seagrass and hard bottom communities and changes in the site's fish community and their prey.
- Perform outreach and education activities to increase awareness of bank top and channel ecosystems.

Outcomes

- Sustainable local jobs (maintaining enhanced navigation, fishing support, tourism support).
- Effective, science-based restoration planning that results in measurable increases in ecosystem services, particularly with regard to economically important fisheries.
- Provide a model for long-term application in marine resource management.
- Reduce the pace of injury to these critical habitats.

8. Budget Narrative/Financial Feasibility/Cost-Effectiveness:

Project costs will scale generally with project scale, which is driven largely by the fill and restoration efforts themselves. Some costs, however, are common to all levels of effort, such as permitting. Project costs will arise from site familiarization, site marking and maintenance, permitting, active restoration, monitoring and statistical analysis, economic analysis, and reporting. These costs include a mix of capital expenditures (e.g., maintenance, sediment fill, application costs, buoy and ground tackle, and typical expendables for field operations), sub-contracts (e.g., marine services for buoying and sediment filling), and labor with associated overhead. Total cost over the 5-year life of the project: Level 1 (one site): **$720,866**; Level 2 (three sites): **$1,950,773**; Level 3 (five sites): **$3,196,974**. Some costs will not scale linearly (e.g., permitting and planning costs) as there is a threshold level of effort to accomplish permitting. However, we anticipate many efforts associated with the actual restoration tasks will scale without significant thresholds.

Other funding is to be determined. There are ongoing efforts for recovery and restoration by the FKNMS in partnership with the State of Florida by the Aquatic Preserves and potentially other organizations such as the Keys Restoration Fund. We will work to team with those groups and leverage activities to optimize restoration funding.

9. Technical Feasibility:

The technical approaches described here (remote sensing inventory, buoying, and seagrass habitat restoration) are all established, published methods with examples (as cited) through the Florida Keys and nearby environments. What sets this project apart is the overall experience of the team and the unique fusion of restoration science and vessel traffic management with economic evaluation. Bonefish and Tarpon Trust has and continues to support research on the utilization of these habitats, providing a unique, geospatial context of their utilization (**Ms. Brooke Denkert Black**, GIS Specialist, BTT) and economic analysis (**Dr. Tony Fedler** of Human Dimensions Consulting). The team includes **Dr. Aaron Adams** who has conducted extensive fish habitat ecology and fisheries work throughout the Caribbean, including disturbance ecology, determining fish habitat use patterns, and fish ontogenetic habitat shifts. In his research, he frequently interacts with fishery user groups to conduct studies and apply results to conservation and management. Recent work has included using recreational fisheries as conservation tools in regional management.

Dr. Adams and staff at BTT have good relationships with the flats fishing guide associations in the Florida Keys (Florida Keys Fishing Guides Association, Middle Keys Fishing Guide Association, Key West and Lower Keys Fishing Guide Association), which will be used to guide site selection, conduct pre- vs. post-restoration use of the sites, and conduct monitoring.

Brooke Denkert Black has extensive experience mapping stakeholder spatial use patterns, habitats, and water quality and water flow parameters in GIS format. She is also experienced in sharing this information with both scientists and stakeholders. Her knowledge of the Florida Keys fisheries (guides and anglers) is extensive and will provide access to important information within this group. **Black's** work on the Fishing Area Mapping Project is proving to be an important component of the ongoing Florida Keys National Marine Sanctuary management revision process. For the mapping project, **Black** obtained spatial use data from professional fishing guides and anglers (data that are normally highly protected by these individuals) and created maps of flats fishing effort for the entire Florida Keys. **Black** then combined these use maps with habitat maps to help prioritize conservation zones within the Sanctuary. These maps will be useful in selection and evaluation of seagrass bank restoration sites.

Additionally, one of the world's leading authorities on seagrass restoration (**Dr. Mark Fonseca** of CSA) will provide oversight on the actual restoration effort. **Dr. Fonseca** recently retired from NOAA where he senior authored much of the foundation science and guidance used by State and Federal authorities for the restoration and conservation of seagrass habitats nationally and in particular in the Florida Keys. He has worked in the Florida Keys since the 1980s and published numerous key papers on restoration of seagrasses both in the Keys and throughout Florida. This project will be backed by CSA's Natural Resources Assessment & Restoration Business Line and fully operational GIS department. Overall project management will likely fall to **Ms. Anne McCarthy** of CSA. Ms. McCarthy also previously worked for NOAA (FKNMS) assisting in recovery and restoration. She has conducted numerous seagrass and habitat restoration projects in south Florida. **Mr. Ray Dennis** of CSA will lead field implementation of the actual restoration having also led the largest successful seagrass transplanting effort in the U.S. (Port Manatee, Tampa Bay, Florida).

10. Readiness for Implementation/Permitting Considerations:

This project is ready for immediate implementation. We will use established protocols for obtaining appropriate permits for markers, dredge, and fill—which, by our previous experience, is a matter of weeks. Bidding will be conducted for many marine services, which also takes time weeks. However, because of our extensive, collective experience in this area and with these methods and topics, we can plan effectively and can stipulate that this project will not be meaningfully delayed except by factors beyond our control (e.g., bad weather).

11. Project Completion Timetable:

	Year 1	Year 2	Year 3	Year 4
Planning & Design	X			
Construction	X			
Monitoring	X	X	X	X
Reporting	X	X	X	X

12. Environmental Benefits:

The value of restoring and maintaining the integrity of the seagrass and associated communities scales linearly with area—more seagrass habitat proportionally equals more ecological services and Essential Fish Habitat, including extraordinarily high faunal abundance and richness, which includes not only commercial and game species but their prey (Sogard et al. 1989a,b,c, Holmquist et al. 1989, Powell et al. 1989, Fonseca et al. 1996b, 2000). Additional environmental benefits derived from the maintenance of these ancient formations (Wanless et al. 1989) include mitigation of storm waves and surge, providing foundation for mangrove habitats and bird rookeries, water filtration and clarification, water level and temperature mitigation (Powell et al. 1989), and wading bird feeding areas (Powell 1987). Our proposal to mitigate up to 5 acres of habitat as a demonstration would be one of the largest seagrass mitigation efforts in the area to date (pers. Obs.). Moreover, we anticipate that the spill-over effect by enhanced visual guidance will result in reduction of impacts to other nearby seagrass flats as well by mitigating existing sediment erosion and resuspension and forestalling expansion of the injuries with attendant additional sedimentation. We request funding to provide the opportunity for graduate students to conduct much of this research.

We have mentioned various performance measures, and they vary in scope depending on the parameters under consideration. For the actual bank top and channel restoration, currently accepted metrics of change in cover, recovery of topography, seagrass species, associated benthic resources (coral, soft coral, sponges), and fish abundance and composition will be compared with reference sites. Changes in vessel grounding frequency arising from the buoying efforts will measure their efficacy and assessment of use by recreational fishermen and guides of these areas.

13. Economic Benefits:

The aesthetics of injured habitats easily observed by visitors to the Keys give an undesirable impression. Public expectations of experiencing an unspoiled and attractive tropical landscape are not met when seagrass and coral habitats are visibly injured, diminishing the value of these resources in supporting tourism. Their restoration and the demonstration of caring, effective

management are expected to provide enjoyment and shared stewardship perception. Thus, the social benefit of re-creating a natural landscape cascades through the community and economic network by reinforcing the expectations of the public to encounter striking tropical environments, which, in turn, promotes their shared opinion, desire to return, and expenditures in the local community to support those visits.

Direct job creation also results from this project. Significant resources will be expended through local, qualified marine contractors in the restoration of the bank and channel systems through hiring of vessels, deployment of fill, monitoring support, buoy deployment, and the maintenance of these activities.

The recreational Flats Fishery of the Florida Keys depends on healthy and abundant habitats. Multiple life stages of bonefish, tarpon, and permit depend on seagrass and other shallow Keys habitats (e.g., limestone pavement with soft corals, patch reef, and edge habitats of seagrass banks), and loss and degradation of these habitats has negatively impacted the fisheries. In addition, the fishery requires widespread healthy habitats—both to suit the ontogenetic needs of these species and the fishery. The Flats Fishery is almost entirely a "sight-fishery," such that participants search for, stalk, and then cast lures to spotted fish to try to catch them. This approach means that the number of boats or wading anglers per unit of habitat must be relatively low, thus requiring extensive habitat coverage. Moreover, the habitat requirements of bonefish, tarpon, and permit require a habitat mosaic (rather than a monospecific seagrass bed, for example) that is provided by seagrass banks and their surrounding habitats. Moreover, other species of economically important fish species (e.g., snapper and grouper) also use these habitats.

The recently completed economic study shows that the Flats Fishery of the Florida Keys has an annual economic impact of $427 million, which is a significant portion of the Keys' entire saltwater fishery impact of $741 million. In fact, the Florida Keys (a single county in Florida) accounts for 16% of statewide recreational saltwater fishery economic impact. Given that the fishery depends on healthy habitats and that the fishery has declined in recent years concurrent with habitat degradation and loss, restoration of these critical habitats will undoubtedly have positive effects on this important fishery.

14. Community Economic and/or Environmental Resilience Benefits:

Koch et al. (2009) have shown how the maintenance of nearshore habitats such as seagrass and mangrove provide a non-linear and, thus, disproportionately larger service to the protection of onshore infrastructure. The anastomosing bank structure and its associated seagrass and mangroves moderates water flow, wave action, and storm surge; thus, restoring and maintaining these habitats is an integral part of how the Keys withstand storms (*sensu* Wanless

1989). Besides the tremendous ecological service cascade, including fauna, carbon sequestration, and primary production, the aforementioned physical stability promotes shoreline stability and mitigates wave damage during storms.

15. Complements to Existing Efforts/Public Acceptance:

This work strongly complements ongoing efforts by the Florida Keys National Marine Sanctuary and potentially Aquatic Preserves to prevent, monitor, and restore vessel-injured seagrass habitats. Staff now at CSA played pivotal roles in the development of the science that supports these efforts and will bring that experience and expertise to bear in order to fully and effectively integrate the activities of this project with those of the management strategy of the FKNMS. This restoration effort is also timely in that it coincides with the ongoing FKNMS management review, so it can provide added value to habitat protection strategies that will be part of the new management plan. Moreover, this restoration effort complements the ongoing efforts of the state and country to raise awareness of seagrass beds and educate vessel operators about how to avoid injuries to these habitats[6]. Finally, there is a safety component. Using new resources to inform vessel operators and avoiding vessel grounding, particularly at high speed, will significantly reduce the likelihood of on-board human injuries that may arise when a vessel strikes ground in a seagrass bed and comes to a rapid halt.

Except for potential concerns with bird stake deployment (which will be offset by working with the fishing community), we are not aware of any potential opposition to this work. On the contrary, we expect this to be widely embraced as the degradation of the channel and bank systems is commonly recognized and solutions considered long overdue.

16. Compliance with Federal, State, Local Regulations:

The project calls for the permitting and deployment of informational buoys, which will require close cooperation with the County, State and Federal authorities. We will follow established guidelines for the selection and approval of signage.

A potential conflict may arise in the use of bird stakes to facilitate recovery of seagrasses. Bird stakes are traditionally, but temporarily, deployed in the vicinity of seagrass transplants at an injury site to fertilize seagrass and accelerate the binding of sediments by facilitating spreading rate of pioneering seagrasses. These temporary stakes are not aesthetically pleasing and may interrupt fishing access, so care will be taken to educate the public to their overwhelming benefit as well as to minimize deployment numbers and duration.

[6] http://myfwc.com/research/habitat/seagrasses/information/protect/. Interestingly, the lead photograph at these locations was taken over 20 years ago, emblematic of the long, but heretofore, largely futile effort to prevent ongoing injury of these habitats.

17. Project Management Capacity:

Bonefish and Tarpon Trust is a non-profit organization whose mission is to conserve and enhance global bonefish, tarpon, and permit fisheries and their environments through stewardship, research, education, and advocacy. To accomplish this mission, BTT serves as a repository of information for these species and their prey and habitats, works to nurture these populations, supports research on these fisheries and their environments, and educates and works with the government to ensure effective management of these resources. Thus, the health of bank top and channel environments where anglers and guides seek these prizes game fishes is of great concern to BTT. BTT recognizes that a great deal of science has been conducted that guides management of these habitats and that many levels of management plans have been devised. However, implementing these plans has proved challenging in the Nation's current fiscal climate. And because those well-considered plans have yet to be implemented, they still remain to be evaluated for their efficacy. Until we implement the concepts of bank and channel protection, we cannot learn, adapt, and refine those plans to provide true protection of these critical resources. BTT will team with science-oriented partners to develop an end-to-end demonstration project for bank top and channel remediation and restoration, including planning, permitting, design, implementation, and multidimensional monitoring (physical, biological, and economic responses).

To conduct this work, BTT will partner with CSA Ocean Science Inc. (CSA). CSA specializes in multidisciplinary projects concerning potential environmental impacts of activities throughout the world. CSA personnel have conducted and/or consulted on numerous hard bottom natural resource restorations, coral translocations, artificial reef programs, seagrass restoration and mitigation programs, and damage assessment/restoration projects that were conducted for numerous clients and involved varied scopes of work and magnitude.

Primary objectives of restoration include accelerating habitat recovery and reducing liability for lost ecological services associated with natural resource damage. CSA's Natural Resources Assessment & Restoration Business Line provides the services of professional, experienced staff to assess, enhance, rehabilitate, and monitor marine habitats damaged and/or at risk from proposed actions, accidents, and natural events. CSA also provides mitigation planning and artificial reef designs for coastal infrastructure projects.

CSA staff are trained and equipped to conduct surveys of hardbottom habitats, coral reefs, oyster reefs, seagrass beds, and unvegetated soft bottom habitats in connection with environmental permitting, marine construction, litigation, dredging projects, habitat reclamation, and vessel grounding events. Such projects may require habitat creation, restoration, injured biotic community repair, baseline data collection and monitoring, all tasks in which CSA is highly proficient. CSA has developed and field-tested new methods for

reattaching and transplanting hard and soft corals and sponges in addition to having designed and installed innovative reef structural habitat enhancements as a means of accelerating biological recovery.

For over 25 years, CSA has been conducting seagrass habitat injury assessments and monitoring in south Florida and Federally protected areas. Our personnel come from a wide range of backgrounds, including marine science and research, resource management, marine surveying (visual and acoustic), environmental permitting, biological and geotechnical surveying, and oceanography. Our staff have developed innovative techniques and applied state-of-the-art equipment to conduct injury assessments, habitat characterizations and mapping, and environmental restoration and mitigation projects. CSA has been part of the evolution and advancement of injury assessment and restoration techniques and continues to seek methods to improve data collection and habitat remediation. Notably, CSA personnel have assisted in, developed, and conducted or participated in a significant number of all the Natural Resource Damage Assessment (NRDA)/restoration projects completed in the State of Florida.

CSA has specialized experience in the collection of field data, data analyses, report preparation and presentation, expert witness testimony, and administrative assistance for project management. CSA has demonstrated the ability to deliver quality work requiring a wide range of regulatory knowledge to meet project schedules while controlling costs. CSA's broad range of in-house capabilities and equipment inventory provides the management and field support required to safely and successfully complete multidisciplinary marine projects.

18. Additional Information:

Rather than burden this application with redundant documentation of the scope of the problem in the Florida Keys, we first direct the reader to these two links (last tested 5/8/13) that provide a full sense of scale regarding the historical scope of this problem:

Sargent, F., Leary, T., Crewz, D.W., Kruer, C.R. 1995. Scarring of Florida's seagrasses: assessment and management options. Fla. Mar. Res. Inst. Tech. Rep. No. 1. 43p. + 13. http://research.myfwc.com/publications/publication_info.asp?id=35289

And

SFNRC. 2008. Propeller Scarring of seagrass in Florida Bay: associations with physical and visitor use factors and implications for Natural Resource Management. South Florida Natural Resources Center, Everglades National Park, Homestead, FL, Resource Evaluation Report, SFNRC Technical Series 2008:1. 27 pp.
http://www.nps.gov/ever/naturescience/upload/PropellerScarLoResSecure.pdf

Full report:
http://www.nps.gov/ever/naturescience/loader.cfm?csModule=security/getfile&PageID=205607

For brevity, we present a sequence of site-specific photographs that show the destructiveness and concerns surrounding of a typical small grounding.

Figures 1 through 4 show a series of images relating to a seagrass and shallow coral grounding event. Figure 1 show how a large vessel grounded, leaving twin scars from its propellers. **Figure 2** shows the 'blowhole,' that is the characteristic sediment and seagrass excavation that arises when the vessel has lost momentum but propulsion is maintained; this only takes seconds to occur, but many years to recover (Zieman 1976, Fonseca et al. 2004). **Figure 3** is an aerial photo of the same grounding injury after the removal of the vessel; the blowhole and prop scars are now visible in their full extent. **Figure 4** is another aerial image showing an assessment team on the site. Note how the adjacent channels have no markers for their entry points and how opaque the water surface is, making detection of navigable channels apart from dangerous and vulnerable grounding areas difficult to detect.

Figure 1. Vessel grounding on bank top showing propeller scars.

Figure 2. Vessel grounding on bank top showing propeller-excavated blowhole. Blowholes occur as the vessel operator attempts to free the vessel by powering up engines once aground.

Figure 3. Aerial image showing the grounding site from Figures 1 and 2 after removal of the vessel. The linear prop scars and blowhole area are clearly visible.

Figure 4. Aerial view of grounding site with survey team present. Note the absence of informational markers to describe the adjacent channel and the difficulty viewing the presence of the bank with sun glare.