2.0 PURPOSE AND NEED FOR ACTION

2.1 NEED FOR SEAGRASS HABITAT RESTORATION MANAGEMENT PLAN

Seagrass habitat is a crucial element of the Florida Bay ecosystem, with much of the bay's perceived economic and recreational value stemming from its overall health (Johns et al. 2001, Ault et al. 2005, Hunt and Nuttle 2007, Ault et al. 2008). In addition to its value as an ecosystem component, seagrass beds constitute an integral part of the natural and undeveloped qualities of Florida Bay's wilderness character (NPS 2013a). Vessel traffic within ENP has more than doubled over the last 30 years (Ault et al. 2008). With the increased prevalence of motorized vessels has come an increased rate of scarring to Florida Bay seagrass beds, particularly in shallow water (≤ 3.5 feet) near navigational channels and high-traffic areas (NPS SFNRC 2008).

Most large-scale estimates of vessel-induced seagrass damage have come from studies utilizing aerial imagery. While such studies provide useful information on patterns and relative densities of scarring, they may underestimate the actual amount of scarring by a factor of 10. Previous studies have shown that scarred areas within Florida Bay are not naturally improving (NPS SFNRC 2008); thus, new management strategies are required as part of an overall ecosystem management approach. While minor damage that does not affect subsurface seagrass rhizomes may recover naturally over time, large, deep, and/or repeated damage to seagrass habitat can require decades to recover naturally, unless management or restoration actions are taken (Fonseca and Bell 1998, NPS SFNRC 2008).

It is NPS policy to maintain native plants and animals within park ecosystems by (1) preserving and restoring natural populations and their associated communities and ecosystems, (2) restoring park populations that have been removed or decimated by human action, or (3) minimizing human impacts to resources, communities, and ecosystems (NPS 2006). Preserving the ecological and wilderness value of seagrasses in Florida Bay requires the development of a programmatic plan to organize and efficiently carry out restoration activities. The plan must provide management guidance and strategies for assessing vessel groundings and other resource-impacting activities with an emphasis on seagrass and benthic restoration, as well as contingencies for incidents involving submerged cultural resources.

2.2 PLAN GOALS AND OBJECTIVES

This SHRMP was developed to provide ENP managers and staff with procedures, guidance, and protocols for 1) assessing vessel-related damages to seagrass, cultural resources, and wilderness resources within Florida Bay and 2) restoring damaged seagrass resources, as appropriate given site-specific characteristics and activities that would be required to restore a damaged area. The goal of any restoration effort is to bring a damaged site closer to its pre-impact condition in a way that is sustainable over time. This SHRMP has several main goals and objectives, as described below.

Goal: Provide guidance to ENP managers and staff regarding appropriate response measures for a vessel damage incident.

Objectives: Develop damage assessment procedures to guide ENP staff as a vessel damage incident is identified. Such procedures include:

- assembly of an appropriate project team and equipment needed to respond to a vessel damage incident;
- a step-by-step decision protocol that describes the decision-making process for assessing damages to ENP resources;
- initial response procedures (i.e., incident reporting and "after-the-fact" or emergency restoration);
- vessel removal procedures and law enforcement options;
- procedures to assess damages to natural resources, including seagrasses, and cultural resources at the damage site;
- procedures for assessing vessel-related damages;
- procedures for data management, documentation, and reporting; and
- consideration of wilderness character and minimum requirements.

Goal: Provide guidance to ENP managers and staff regarding appropriate seagrass restoration actions.

Objectives: Develop restoration procedures to guide ENP staff in determining what, if any, seagrass restoration actions may be undertaken. Such procedures include:

- consideration of administrative necessity and maintenance of wilderness character through a minimum requirements framework;
- assembly of an appropriate project team and equipment needed to plan and implement a restoration action;
- a step-by-step decision protocol that describes the decision-making process for determining, planning, and implementing restoration of ENP seagrass resources;
- determination of appropriate restoration approach (i.e., scaling and restoration plan development);
- provide a list and description of potential seagrass restoration options, including active restoration techniques, monitoring only, signage installation, interim measures, and other protective measures;

- procedures for data management, documentation, and reporting; and

- incorporation and integration of potential volunteer groups in restoration efforts, as feasible.

Goal: Provide guidance to ENP managers and staff regarding appropriate monitoring actions.

Objectives: Develop procedures to guide ENP staff in performing monitoring actions to determine the success of projects and to use adaptive management principles to make appropriate changes over time to increase success and effectiveness. Such procedures include:

- assembly of an appropriate project team and equipment for construction compliance and post-construction monitoring;

- procedures for construction compliance monitoring (e.g., turbidity monitoring, protected species provisions);

- procedures for post-construction monitoring, including monitoring schedule, methods, restoration success criteria, and corrective action; and

- procedures for data management, documentation, and reporting.

Goal: Inform ENP managers and staff of candidate "priority areas" for initial restoration efforts.

Objectives: Identify areas within Florida Bay that may be considered as areas of priority for seagrass restoration actions.

Goal: Ensure the proposed SHRMP is consistent with applicable laws, regulations, and policies.

Objectives: All procedures and protocols developed for this SHRMP must be consistent with laws and regulations pertaining to the National Environmental Policy Act (NEPA), the Wilderness Act, cultural resource protection, and NPS policies and regulations. Consideration of wilderness character must be considered at all steps of this plan.

2.3 SCOPE OF PLAN/EXPLANATION OF PROGRAMMATIC INTENT

ENP is tasked with protecting natural, cultural, and wilderness resources in Florida Bay. The health of recreational fisheries and commercially-important fish species within Florida Bay and the nearby Florida Keys is linked to the health of the bay's benthic communities. The shallow waters of Florida Bay make the bay's seagrasses and benthic substrates susceptible to vessel damages (e.g., prop scars and blow holes). Vessel damages result in direct loss to seagrasses and impacts to wilderness resources, as well as long term losses in the case of severe damage.

As identified in the March 2013 Draft GMP, the Preferred Alternative includes development of a formal, comprehensive seagrass restoration program for Florida Bay. This SHRMP represents a strategy implemented by ENP for effective management (i.e., restoration and conservation) of seagrasses within Florida Bay and presents guidance to ENP staff and managers in selecting from the various procedural options for seagrass damage assessment, restoration, and restoration monitoring. This SHRMP also identifies those portions of Florida Bay that are priority seagrass restoration areas. The Plan is consistent with all applicable laws, regulations, and policies (e.g., NEPA, Wilderness Act, NHPA, NAGPRA, NPS policies and regulation, etc.).

The goal of this SHRMP is to establish an easy-to-follow management framework to restore and conserve seagrass habitats within Florida Bay. Appendix B includes a checklist for ENP management describing the various steps and equipment needed for a restoration project, beginning with the initial response, followed by damage assessment (natural resource and cultural resource assessments, vessel removal, and vessel-related damages), restoration determination, planning, implementation, and monitoring. It is important to note that this SHRMP is restricted to the benthic habitats of Florida Bay and does not encompass all of ENP.

3.0 DAMAGE ASSESSMENT PROTOCOL

3.1 DESCRIPTION OF PROJECT TEAM/EQUIPMENT UTILIZED

The damage assessment protocol may include one or more of the following phases, dependent upon the severity of damage and the presence or absence of a vessel at the damage site (Appendix B):

- Initial response
- Vessel removal
- Natural resource and cultural resource assessments
- Vessel damage assessments

The damage assessment project team may consist of the following members (see Sections 3.3 to 3.9 for additional details regarding team member responsibilities):

- First responder: a ENP staff member or law enforcement officer responsible for completing the Initial Response Report (IRR);
- Commercial towing operator, if appropriate;
- Boat operator that meets NPS training requirements, if appropriate;
- NPS staff (i.e., cultural resource specialist or biologist) or other cultural resource specialists (when appropriate) or other trained biologists with expertise in seagrass, coral/hardbottom, and mangrove sciences; and
- PSRPA case team: officer from the NPS Environmental Response, Damage Assessment, and Restoration Branch (ERDAR), an ENP Resource Planning and Compliance Division (RPCD) representative, and an attorney from the Department of the Interior's (DOI) Office of the Solicitor, if appropriate.

Depending on the damage site conditions, the cultural and/or biological resource branch chief identifies the project team members necessary to complete a thorough and accurate damage assessment. Team members are selected based on the natural or cultural resources observed, or potentially present, at the damage site during the initial response and their areas of expertise. All team members should be familiar with the details of the SHRMP prior to conducting any step of the damage assessment protocol. First responders, boat operators, cultural resource specialists, and biologists should be trained and familiar with the techniques presented in Sections 3.3-3.7 and "leave no trace" skills and ethics (e.g., retrieving all equipment used during assessments, swimming as much as possible to avoid trampling of substrate) are emphasized by all team members (NWSC 2006, NPS 2013d, Appendix C).

The equipment utilized during the various phases of the damage assessment protocol is provided in Table 2. All equipment listed in Table 2 is compliant with the minimum requirement concept (described in Section 1.1.9.2), which consists of utilizing the minimum tools required to sufficiently and accurately complete all aspects of the damage assessment protocol. The project team is responsible for conducting the four phases of the damage assessment protocol and obtaining equipment listed in Table 2, if necessary.

Table 2. Equipment list for each phase of the damage assessment protocol.

Initial Response	Vessel Removal	Natural Resource Assessment	Cultural Resource Assessment	Vessel Damage Assessment
IRR form	Camera	Completed IRR	Completed IRR and previous assessment results (if available)	Completed IRR and previous assessment results (if available)
Florida Bay maps and navigation charts	Video camera	Snorkel or scuba gear	Snorkel or scuba gear	Snorkel or scuba gear
Communication device (alert tow company, if needed)		Camera with underwater housing	DGPS unit	Survey-grade DGPS unit
DGPS unit		Video camera with underwater housing	Camera	Metric ruler
Camera		Measuring tape	Waterproof paper	Waterproof paper
Video camera		Waterproof paper	Boat (for cultural resource specialist)*	Quadrat(s)
Vessel tag/marking device		Boat (for biologists)*		Float or inflatable boat
				Depth sounder
				Boat (for biologists)*

* Depending on the size and location of the vessel damage and the number of biologists/cultural resource specialists required to conduct the natural resource, cultural resource, and vessel damage assessments, the boats needed for transit may vary in size. However, all boats must be compatible with the shallow water depths that are characteristic of Florida Bay.

3.2 DAMAGE ASSESSMENT DECISION PROTOCOL

It has been previously established that boating activity in Florida Bay has resulted in impacts to natural resources and substrates through the creation of vessel damage features (e.g., prop scars

and blow holes). Based on the shallow water depths and heavy vessel usage of Florida Bay, future damage incidents are likely to occur. The following damage assessment decision protocol (Figure 16) provides a step-by-step process for assessing damages to ENP resources. Appendix B also provides an "at-a-glance" check-list for ENP management describing the steps and equipment needed for the various phases of the damage assessment protocol. The damage assessment process should be utilized and understood by all ENP staff, biologists, and cultural resource specialists completing damage assessment protocols in compliance with the SHRMP. See Section 5.1 for a discussion of cases in which a responsible party desires to participate in a cooperative assessment and restoration project. The following sections provide descriptions for each step in the damage assessment decision protocol.

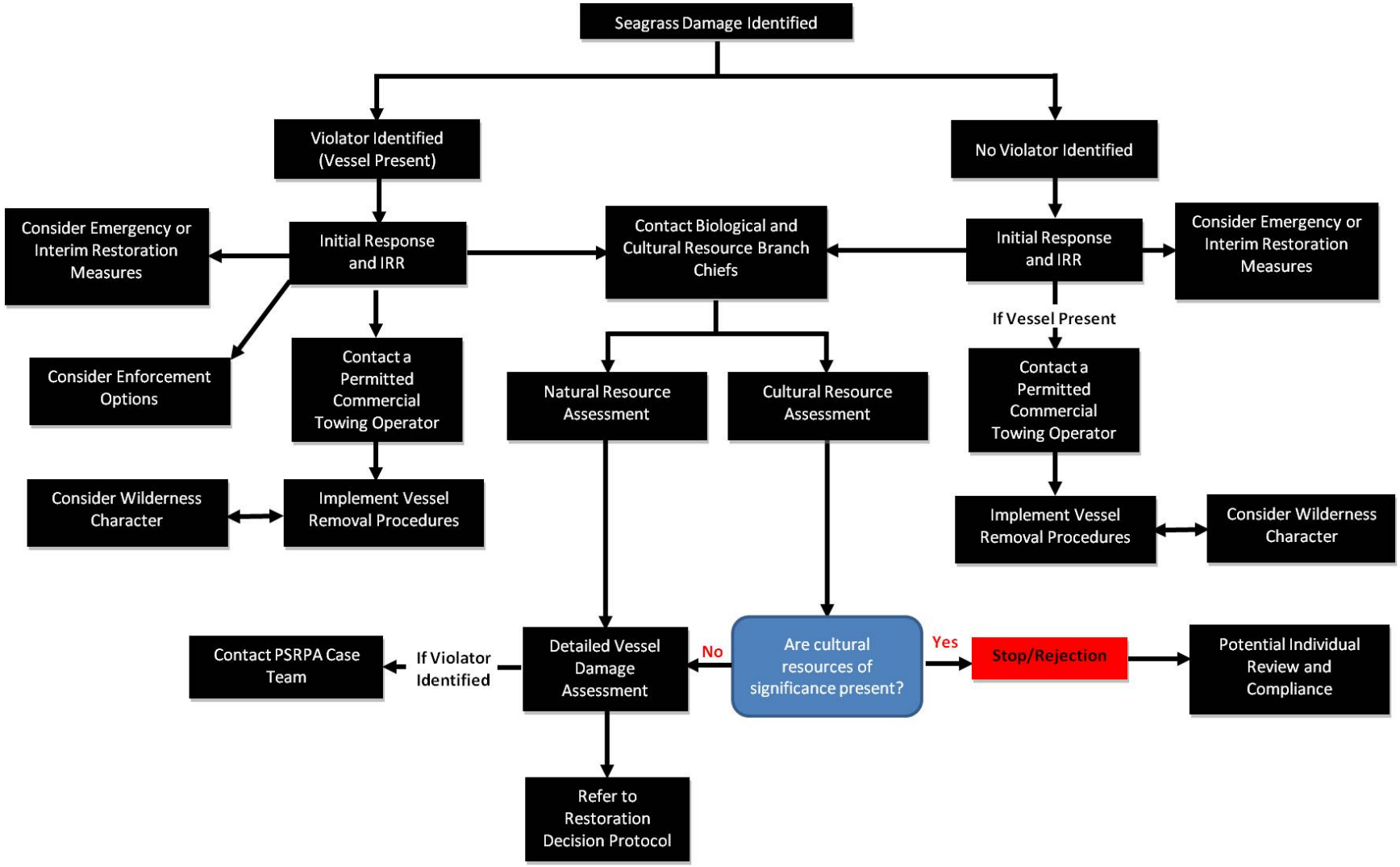

Figure 16. Damage assessment decision protocol.

3.3 INITIAL RESPONSE

The damage assessment process begins with incident reporting by an ENP staff member. This staff member is typically a law enforcement officer responsible for patrolling Florida Bay and enforcing laws protecting submerged aquatic resources and cultural resources. During this initial response, the staff member will exercise caution and avoid/minimize any contributions to resource damage. The staff member will complete an IRR (Appendix D) to document the incident number (generated by first responder), description of the incident, weather conditions, potentially affected natural resources, responsible party information (if available), towing operator removal recommendations, and any response actions taken (NPS 2003). At a minimum, the staff member should obtain sufficient location information to return to the damage site and identify the specific damage resulting from the incident, a description of the incident and the natural resources affected, and information on responsible party and/or vessel (if available). The incident description may include maps or drawings depicting the geographic location of the incident or Differential Global Positioning System (DGPS) coordinates, direct observations (including any hazardous material spills), photographs, video, and any details pertaining to how and when the damage was discovered. Weather conditions at the time of the initial response will also be provided including, but not limited to, wind speed, wind direction, precipitation, and visibility. Potentially affected resources will also be documented in the IRR and may include seagrass, coral/hardbottom, mangroves, or any other resource surrounding the damage site. In the event that potential cultural resources are observed at the damage site during the initial response, the NPS should follow the protocols under the Archaeological Resource Protection Act (ARPA), which governs the excavation, removal, and disposition of archeological resources located on federal and Indian lands (Section 9.3). A brief description of the damage site should also be provided, such as scar features (prop scar, blow hole), approximate area of impact, and/or the presence of sediment pile or plume. If the responsible party and vessel are present, the ENP staff member will acquire the names of the individuals involved in the incident, contact information for those individuals, detailed information on the vessel involved in the incident (size, description, name, registration number, number of engines), and any information pertaining to the vessel owner (if not the responsible party). If the first responder is a law enforcement officer and there is a potential to assess damage and recover damages, the law enforcement officer will issue a notice to appear to the boat operator. Citations without restitution may also be issued but only if the ENP law enforcement officer determines no restoration is needed during the initial response. The IRR will also include any towing operator removal recommendations and response actions taken by the ENP staff member such as how the staff member responded to the incident, if any work plans were executed, and the type of data collected (e.g., photos, video, etc). Response actions may also include "after-the-fact" or emergency restoration. "After-the-fact" restoration refers to the process of immediately addressing seagrass damage during the initial response. This action is utilized by the first responder or law enforcement officer to protect public safety or prevent additional damage or minimize damage to an impacted natural resource if cultural resources (e.g., artifacts, midden shells, shipwrecks) are not observed. "After-the-fact" restoration should not take place until cultural resources are documented. Two principles should guide decisions regarding "after-the-fact" restoration: (1) protection of natural resources or public safety and (2) cost (NPS 2003). If waiting for damage assessment process to be completed places the resources at risk of continued

or increased harm, immediate response may be advisable. Similarly, damage may be inexpensive to address immediately, but expensive if park staff wait until the approved restoration phase. Costs associated with "after-the-fact" restoration are typically covered by the responsible party (19jj cases only) and/or restitution funds. At a minimum, the ENP staff member must document the damage prior to the restoration and the costs and actions undertaken during an "after-the-fact" restoration response. The costs may be reimbursable as part of the recovered damages.

Once the IRR is complete and if the vessel is present at the damage site, the ENP staff member will tag or mark the stern of the vessel with the date of the initial response and the position of the vessel relative to the damage site. The ENP staff member or first responder will immediately notify and submit an electronic copy of the IRR to the biological and cultural resource branch chiefs within 24 hours of the initial response. The ENP first responder will also contact a permitted commercial towing operator (Section 3.4).

3.4 VESSEL REMOVAL

In cases where a vessel is present at the damage site during the initial response, the following vessel removal protocols will be implemented.

3.4.1 Vessel Removal Protocols

Removal of a grounded vessel in Florida Bay should only be performed by commercial towing operators that are permitted to operate within ENP. The towing operator will be required to (1) coordinate the vessel removal activities with an ENP law enforcement officer (law enforcement officer authorization is required prior to vessel removal) and biological and cultural resource branch chiefs, (2) complete a Vessel Removal Report for towing activities, and (3) remove the vessel in accordance with the following guidelines:

- The vessel should be removed at high tide. It may be necessary to stabilize the grounded vessel when waiting for high tide.

- Written or verbal plans for removal must be submitted to and approved by biological and cultural resource branch chiefs prior to removal.

- An authorized ENP law enforcement officer should be present during vessel removal and document any additional impacts to natural resources that occur during the vessel removal process.

- Vessels are not to be powered off a grounding site.

- All removal operations must be conducted using the minimum requirement concept, utilizing the minimum tool required to remove the vessel and keep additional damage to natural resources to an absolute minimum.

If an emergency situation arises that causes an immediate threat to visitors or natural resources, immediate action to prevent loss of life or serious injury to persons or natural resources may be

required. In the event that the time required to notify ENP personnel might jeopardize visitor safety (e.g., conditions perilous to human safety) or cause significant additional impacts to natural resources (e.g., hazardous waste releases), the towing operator should take immediate necessary action to address the situation and notify and consult ENP personnel as soon as possible.

3.4.2 Enforcement Options

The purpose of the ENP vessel grounding enforcement policy is to gain the public's voluntary compliance with ENP rules and regulations. The essential message of the enforcement policy is that violations of park regulations are taken seriously and are dealt with in a fair, reasonable, and equitable manner. If the vessel and responsible parties are present during the initial response, ENP law enforcement officers may issue tickets for fines or court appearances (Section 3.3).

If the responsible party (or parties) has been identified and the ENP first responder and biological and cultural resource branch chiefs determine that an incident is applicable to the PSRPA (Section 9.12), the PSRPA case team will be notified, an attorney will be acquired to represent park resources, and the case will be classified. The PSRPA case team will work together to manage the case with the goal of successfully recovering funds and resources to accomplish restoration of impacted ENP resources (NPS 2004). Criminal actions can result in a magistrate court case and recovery of restoration costs based upon a recovery schedule or upon a claim report developed by ENP RPCD. Civil action requires the participation of the NPS ERDAR to develop the restoration costs.

3.4.3 No Vessel at Damage Site

If damage to the Florida Bay bottom is identified and no vessel is at the damage site, the ENP first responder will determine if any emergency or interim measures are required during the initial response to stabilize the area or salvage resources at the damage site. The ENP first responder will then contact the biological and cultural resource branch chiefs to investigate the damage site (Sections 3.5 and 3.6). The site should be considered individually or regionally in a plan to preserve and protect the resource through management, restoration, and/or monitoring. The site may also be considered for use as compensatory restoration in a PSRPA case.

3.5 ASSESSMENT OF NATURAL RESOURCES

Prior to, simultaneously, or shortly after vessel removal and depending on damage site conditions, the biological resource branch chief may notify a biologist with expertise in seagrass, coral/hardbottom, and mangrove environments. The biologist should review the IRR, as well as any other data collected during the initial response. At the damage site, the biologist will perform a brief analysis of the damage site, exercising caution at all times to avoid additional resource damage. If the vessel is still grounded, the biologist should confirm that there are no major concerns or other emergency situations (e.g., vessel taking on water, hazardous material spill). Such situations take priority and should be addressed first. The biologist should also:

- Collect photo documentation of the damage site and resource damage, and generate an estimate of the extent of damage.

- Obtain GPS track log from vessel that caused damage, if available.

If the natural resource assessment occurs prior to vessel removal, the biologist should also:

- Determine what part of the vessel is aground (e.g., vessel lightly aground, entire keel touching bottom, propeller embedded in the natural resource) and the condition of the vessel.

- Communicate with the towing operator to determine the most appropriate work plan and exit route for vessel removal (i.e., methods and route with least impact to natural resources).

A Natural Resource Assessment Report will be prepared by the project biologists, documenting the results of the natural resource assessment, and provided to the biological resource branch chief and any other specialists involved in the vessel damage assessment.

3.6 ASSESSMENT AND IDENTIFICATION OF POTENTIAL CULTURAL RESOURCES

The IRR will be provided to the ENP cultural resource branch chief and assigned to a cultural resource specialist. The ENP cultural resource specialist will evaluate the IRR and visit the damage site to perform a cultural resource assessment and determine potential impacts to cultural resources within the vicinity of the damage site.

If no cultural resources are observed during the cultural resource assessment, a State Survey Log will be completed and the survey area will be entered into the survey database (to avoid the need to re-survey the area in the future). A memorandum will be sent to SHPO stating that the cultural resource assessment revealed that the project will have the following impact on cultural resources: "No Historic Properties Affected". A detailed vessel damage assessment will follow (Section 3.7).

In the event that potential cultural resources are observed during the cultural resource assessment, the resource will be documented as a new record in the NPS' Archaeological Site Information Management Information System (ASMIS), a database for the basic registration and management of park prehistoric and historic archeological resources. The new resources will be entered into ASMIS as a site local resource (isolated find) and a Florida State Site Form will be completed. The NPS will consult with the appropriate agencies (e.g., SHPO) to determine the significance of the site. If it is determined that the cultural resource is not "significant" and/or if the park determines that it does not wish to preserve a specific local resource, then the project team will moved forward with the detailed vessel damage assessment (Section 3.7). If the cultural resource is determined to be "significant", all further damage assessment under the SHRMP will be postponed until 1) consultation with the appropriate agencies (e.g., SHPO) has been resolved and 2) the NPS has followed the protocols under ARPA (Section 9.3), as required. An integrated restoration plan may then be developed on a site-specific basis (i.e., kick-out project, see Section 3.12). Seagrass restoration activities, when conducted with careful consideration of the cultural resource, would likely contribute to preservation of a submerged cultural resource.

Some vessel damage may consist of intentional excavation of cultural resources, which is prohibited by the ARPA. Even if the damage was unintentional, the extreme negligence of a boat operator may result in ARPA damage. Because ARPA applies felony penalties (as opposed to civil penalties in the case of a seagrass damage incident under PSRPA), if archeological resources are damaged, it is necessary to preserve the archeological damage as a felony crime scene prior to initiation of further damage assessment protocols.

3.7 ASSESSMENT OF VESSEL-RELATED DAMAGES

As previously discussed in Section 1.1.6.2, prop scars are formed when a boat's propeller comes into contact with the seagrass and associated sediment (Figure 8). Blow holes are created when vessels run aground and boaters attempt to dislodge the grounded vessel by using the motor's power (Figure 9). Both prop scars and blow holes create structural changes in the seagrass community resulting from physical destruction and disruption of the seagrasses, resuspension of sediments, burial of adjacent seagrasses from sediment excavation, and an increased susceptibility to storm damage (NPS SFNRC 2008). Regardless of the damage type (prop scar or blow hole), assessment of vessel-related damages includes damage classification, site mapping with DGPS, and characterization of damage site versus adjacent unimpacted habitat using visual assessment methods (Uhrin et al. 2011). Data are also collected for blow hole (bathymetric survey) and prop scar (width and scour depth measurements) features in order to calculate the volume of seagrass habitat lost (Uhrin et al. 2011). These data collected (by biologists) during the damage assessment will be used to plan restoration actions and to help determine service losses from the time of the damage incident to the time of full resource recovery. During every step of the damage assessment protocol (Figure 16), biologists must exercise caution and avoid contributing to the resource damage and preserve and maintain wilderness character.

3.7.1 Damage Classification

Prior to collecting quantitative data during the vessel damage assessment, the damage site will be qualitatively analyzed and classified according to the categories listed in Table 3. Damage classifications are partly based on the *Biscayne National Park Vessel Grounding Program Policies and Procedures* (BNP 1996).

Table 3. Seagrass damage classification levels.

Seagrass Damage Classification	Description
Level I	Seagrass totally removed from the site. The substrate is disturbed with significant scour depth (> 20 cm in depth) and subsequent erosion may be significant.
Level II	Seagrass totally removed from the site. The substrate is disturbed with scour depths ranging from 10-20 cm. Subsequent erosion may be negligible.

Table 3 (continued). Seagrass damage classification levels.

Seagrass Damage Classification	Description
Level III	Seagrass either totally removed from the site or disturbed to the extent that will preclude natural recovery (e.g., rhizomes are cut). Scour depths are generally < 10 cm.
Level IV	Seagrass covered with sediment from an adjacent area.
Level V	Seagrass disturbed but will naturally recover. Seagrass blades are completely removed but the substrate is not disturbed and rhizomes remain intact (e.g., "lawn-mowing").
Level VI	Seagrass disturbed but will naturally recover. Shading and compressing of seagrass while the vessel remains aground (or just above seagrass) have disturbed the seagrass. The substrate is not disturbed.
Level VII	Seagrass disturbed but will naturally recover. Seagrass blades are cut short, but are not completely removed (e.g., "haircut"). The substrate is not disturbed.

3.7.2 Site Mapping

Site mapping is defined as the delineation of vessel-related damage using survey-grade DGPS equipment (e.g., Trimble handheld computer). The end result is a graphic or map which geospatially depicts the boundaries of a damage site. Depending on the size or area of the damage site, a minimum of two biologists should conduct the site mapping task. One biologist will snorkel along the boundary separating the damage site from the surrounding seagrass bed, while the second biologist swims behind with a DGPS unit on a float, continually collecting latitude and longitude along the length (prop scar) or perimeter (blow hole) of the damage site. Data collected from the DGPS unit should be downloaded to a computer and a software program, such as Environmental Systems Research Institute (ESRI) ArcMap, and will be used to calculate damage length (prop scar) or area (blow hole).

For prop scars, biologists should also collect width and scour depth measurements at specified intervals (interval number and spacing dependent on total prop scar length) along the length of the scar. Engeman et al. (2008) proposed data collection at 3-m increments for scars up to 76 m in length, 6-m increments for scars between 76 m and 152 m in length, and 15-m increments for scars greater than 152 m in length. Width and scour depth measurements will be collected using snorkel or scuba gear (based on water depth). In addition, the depth of sediment impacts (i.e., sediment piled up adjacent to a scar) should also be characterized when possible, although measurement may be difficult due to sediment re-deposition within the scarred area.

When vessel damages are large and/or geometrically complicated, *in situ* measurements can be difficult to obtain. In these instances, geo-rectified aerial photography may be used. Vessel damages are photographed, digitized on the aerial image using software similar to ESRI ArcMap, and imported into a DGPS unit. The biologists then use the DGPS unit to navigate to

the damage site and field verify the digitized image. These data can then be used to estimate damage area (NOAA DARRP 2013). Extent of damage and physical characteristics should be field-verified in these cases.

3.7.3 Visual Assessment Methods

Visual assessment methods are used to compare pre- and post-damage conditions at a site. Pre-damage conditions are determined by observing unimpacted areas adjacent to the damage site (located within 1-3 meters; also known as reference sites). Using either snorkel or scuba equipment, a minimum of two biologists will acquire seagrass species and percent cover data from the damage site and surrounding reference sites using the Braun-Blanquet (B-B) method (NOAA DARRP 2013, Uhrin et al. 2011). This method involves temporarily placing a quadrat on the substrate and visually inspecting the content inside the quadrat. The presence of each seagrass species are identified and assigned a B-B score according to Table 4.

Table 4. B-B values and definitions.

B-B Score	SAV Cover
0	absence
0.1	single individual ramet (less than 5% cover)
0.5	few individual ramets (less than 5% cover)
1	many individual ramets (less than 5% cover)
2	5-25% cover
3	25-50% cover
4	50-75% cover
5	75-100% cover

Depending on the size of the vessel-related damage, a minimum of 10 samples (quadrats) are conducted at reference sites and a minimum of three samples are collected within the damage site (NOAA DARRP 2013). To determine the percent coverage for each seagrass species, the B-B scores are converted to percentages (using range midpoints) and averaged over all of the quadrats assessed within each feature or at feature reference sites. The loss of seagrass as a result of the vessel-related damage is then assessed by comparing the percentage of seagrass within the damage site to that of the reference sites. The desired endpoint of restoration, whether passive or active, is to obtain seagrass percent coverage values within the damage site that are equivalent to values within the reference sites.

3.7.4 Bathymetric Surveys

Bathymetric surveys are conducted at blow holes to determine the volume of seagrass habitat that has been excavated at the damage site. A depth sounder, integrated with DGPS, is mounted on an inflatable boat or float and guided back and forth across the damage site by a biologist using snorkel gear (Uhrin et al. 2011). The depth readings and DGPS data (collected at predetermined intervals) are downloaded to a computer and a software program (such as ESRI ArcMap) which provides a three-dimensional view and calculates the volume of the blow hole.

During the site mapping task, width and scour depth measurements are collected along the length of prop scars (Section 3.7.2). These measurements are used to determine the volume of seagrass habitat excavated at the damage site.

3.7.5 Seagrass Recovery Model and Habitat Equivalency Analysis

As previously mentioned, the vessel damage assessment is used to plan restoration actions, as well as to help determine the services lost from the time of the vessel-damage incident to the time of full resource recovery. This determination of services lost is accomplished through seagrass recovery modeling and Habitat Equivalency Analysis (HEA), which is the technique currently utilized by NOAA's Damage Assessment, Remediation, and Restoration Program (DARRP).

The data collected during the vessel damage assessment can be imported into a seagrass recovery model which estimates the damage site's recovery trajectory, assuming ideal conditions (e.g., damage site filled to grade) (NOAA DARRP 2013). The model then estimates the amount of time required for each seagrass species within the damage site to recover to pre-damage conditions.

HEA is a methodology to determine compensation for damages to natural resources. The principal concept underlying HEA is to determine compensatory mitigation for past habitat resource losses via habitat replacement projects that provide additional resources of the same type, quality, and comparable value to those lost at the damage site (NOAA DARRP 2013). Losses of ecosystem services at a damage site are calculated using the data collected during the vessel damage assessment and the data provided by the seagrass recovery model. The HEA ultimately determines the size of the compensatory restoration project required (i.e., scale), such that the benefits of the restoration project equal the interim losses from the vessel-related damage. The specific methods used in the HEA are not prescribed and may change over time.

3.7.6 Damage Assessment Report

A Damage Assessment Report (DAR) will be completed by the biologist to document the vessel damage data (qualitative and quantitative information). In addition to incident information (i.e., incident number, incident date, vessel name [if known], location of vessel damage, names of biologists and ENP staff completing assessment, and assessment date), the DAR will also include the following information (NPS 2003):

- Discussion of the factors that caused the resource damage;
- Description of resources affected;
- Discussion of interim lost services associated with damaged resources (e.g., recovery periods);
- Discussion of methods used to assess damages; and
- Damage determination.

3.8 CONSIDERATION OF WILDERNESS CHARACTER

The NPS is responsible for supporting and encouraging scientific activities in wilderness and recognizes that science is critical to the long-term preservation of wilderness character (NPS 1999). The NPS may choose to support scientific activities that have some impact on wilderness resources or values, as long as NPS determines that the benefits of the knowledge gained from such activities outweigh the potential impacts to wilderness. Prior to conducting any research in wilderness, all proposed scientific activities must be evaluated using the minimum requirement concept to ensure that the activity is appropriate and utilizes the minimum tool to accomplish the research objectives (NPS 1999).

Wilderness character must be considered prior to implementing each phase of the damage assessment protocol process. Table 5 presents the potential benefits and impacts to wilderness character from the proposed tools/techniques utilized in the damage assessment protocol.

The NPS makes the following additional recommendations to further minimize impacts to wilderness character from the proposed damage assessment tools/techniques.

- In order to further minimize impacts to the natural and cultural resources (and thus the wilderness character), vessel removal is only permitted during high tide.

- The equipment listed in Table 2 will result in minimal impact to the Florida Bay bottom. The metric ruler, measuring tape, and quadrat are the only scientific instruments that will come in temporary contact with the bay bottom.

- The methodologies described in Sections 3.5, 3.6, and 3.7 represent the minimal tool necessary to collect sufficient and accurate data during the natural resource assessment, cultural resource assessment, and detailed vessel damage assessment. These data will be used to plan restoration actions and to help determine services lost from the time of the damage incident to complete recovery. While conducting these protocols, biologists will have minimal contact with the Florida Bay bottom and, if it can be avoided, markers will not be used to identify sites. Boating and swimming will be the only methods of transit between and within damage sites. All work should be conducted via snorkel or scuba and extreme caution should be taken while temporarily resting the metric ruler, measuring tape, and quadrat on the bay bottom.

The proposed damage assessment tools/techniques presented above represent the minimum concept/tool with regard to wilderness character. That is, they constitute the best approach to collect necessary information with the least impact to wilderness character. Section 1.1.9.2 provides additional information regarding the minimum concept/tool with regard to wilderness character.

Table 5. Potential benefits and impacts to wilderness character from the proposed tools/techniques utilized in the damage assessment protocol.

Tools/Technique	Potential Benefits to Wilderness Character (WC)	Potential Impact to Wilderness Character (WC)
Initial Response	• Permanent benefit (once a restoration action is selected and conducted) to the untrammeled and natural qualities of WC at the damage site. This technique represents the minimum tool to collect the initial, basic information as damage is identified (e.g., site location, resources impacted, environmental conditions, responsible party/vessel, etc.). This information is vital in order to proceed with the restoration process and damage recovery.	• Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage site. • Possible temporary impact to the untrammeled and natural qualities of WC from "after-the-fact" restoration measures to stabilize or salvage resources (if needed).
Vessel Removal	• Permanent benefit to the untrammeled, natural, and solitude/primitive recreation qualities of WC from the removal of the grounded vessel. Restoration of the damage site cannot occur while the vessel is present at the site. This technique represents the minimum tool needed to allow for restoration of the damage site.	• Temporary impact to the untrammeled and natural qualities of WC during the removal of the grounded vessel. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels and equipment at the damage site. • Possible temporary impact to the untrammeled and natural qualities of WC from emergency measures to stabilize or salvage resources (if needed).
Natural and Cultural Resource Assessments	• Permanent benefit (once a restoration action is selected and conducted) to the untrammeled and natural qualities of WC at the damage site. This tool represents a component of the damage assessment protocol and these techniques represent the minimum tool to collect sufficient and accurate data to develop the Restoration Plan for the damage site.	• Temporary, minor impact to the untrammeled and natural qualities of WC from the placement of measuring tapes on the bottom. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage site.
Detailed Vessel Damage Assessment	• Permanent benefit (once a restoration action is selected and conducted) to the untrammeled and natural qualities of WC at the damage site. This tool represents a component of the damage assessment protocol and these techniques represent the minimum tool to collect sufficient and accurate data to develop the Restoration Plan for the damage site and determine services lost from the time of the damage incident to complete recovery of the damage site.	• Temporary, minor impact to the untrammeled and natural qualities of WC from the placement of metric rulers and quadrats on the bottom. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage site.

3.9 DOCUMENTATION/DATA MANAGEMENT/REPORTING

Quality Assurance/Quality Control (QA/QC) measures are critical throughout all steps in the damage assessment protocol, including: (1) data collection and documentation (initial response, vessel removal, natural resource assessment, cultural resource assessment, vessel damage assessment), (2) data management, and (3) reporting.

All records (e.g., notes, photos, video files) collected during the initial response, vessel removal, natural resource assessment, cultural resource assessment, and vessel damage assessment should be properly identified and organized by incident number (originally assigned by an ENP staff member during the initial response). All costs incurred during these events, including ENP staff time by individual, are potentially recoverable under the PSRPA (if 19jj case) and should be properly documented on a cost recovery spreadsheet. It should also be noted that the cost of the cultural resource assessment (Section 3.6) should be included in the recovery of damages even if cultural resources are not discovered during the assessment. Data collected during the natural resource, cultural resource, and vessel damage assessments should be transcribed into digital format and stored in an ENP seagrass habitat restoration geodatabase. The unique identifier for each dataset will be the incident number. Other information in the geodatabase will include the incident date, the vessel name (if known), the location (latitude/longitude) of the vessel-related damage, the names of the biologists/cultural resource specialists/ENP staff completing the assessments, and the assessment dates.

A Natural Resource Assessment Report (Section 3.5) and DAR (Section 3.7.6) will be prepared by the project biologists, documenting the results of the natural resource assessment and assessment of vessel-related damages, respectively. Results of the cultural resource assessment will be documented (Section 3.6) by the cultural resource specialist. These reports/documentation along with all other records, data, and forms associated with each incident number will be submitted to the biological and cultural resource branch chiefs for process and storage.

3.10 DAMAGE ASSESSMENT PROTOCOL OUTCOMES

There are two possible damage assessment protocol outcomes that can result from the damage assessment decision protocol (Figure 16): approval or rejection. Approval for potential restoration is granted if 1) vessel-related damage is present and 2) cultural resources of significance are not identified within the project vicinity. If a damage site is approved for potential restoration, the Restoration Protocols are implemented (Section 4.0). Rejection occurs in the event that cultural resources of significance are identified within the project vicinity. Further damage assessment will be postponed until 1) consultation with the appropriate agencies (e.g., the SHPO) has been resolved and 2) the NPS has followed the protocols under ARPA (Section 9.3), as required. Restoration may eventually occur at damage sites with cultural resources of significance; however, individual review and compliance would be necessary for each specific site (Section 3.12).

3.11 SPECIAL ASSESSMENTS

Special assessments are needed when cultural resource, natural resource, or vessel damage assessments reveal non-standard impacts such as shipwrecks or submerged prehistoric sites.

3.12 KICKOUT PROJECTS

Kickout projects refer to those projects outside the parameters of this SHRMP including projects where cultural resources of significance are discovered at the damage site. Restoration may still occur for kickout projects; however, more detailed, project-specific review and compliance would be necessary.

4.0 SEAGRASS RESTORATION PROTOCOLS

4.1 DESCRIPTION OF PROJECT TEAM/EQUIPMENT UTILIZED

The seagrass restoration protocol includes two phases (Appendix B):

- Restoration Determination and Planning
- Restoration Implementation

The Restoration Determination and Planning team consists of the following team members:

- Project manager (typically biological or cultural resource branch chief or ERDAR representative (19jj cases only));
- Trained biologist with expertise in seagrass, coral/hardbottom, and mangrove species;
- ENP RPCD representative;
- Local, state, and federal agency representatives; and
- PSRPA case team (19jj cases only): ERDAR representative, ENP RPCD representative, and an attorney from the DOI's Office of the Solicitor.

The Restoration Determination and Planning team is responsible for reviewing the results of the damage assessment, determining the appropriate restoration planning steps for a given damage site, preparing all necessary documentation (e.g., Restoration Determination Report, Restoration Plan), reviewing all documentation for compliance with ENP Draft GMP, and submitting project permits to and coordinating with local, state, and federal agencies (as needed, see Section 4.3 for detailed information and responsibilities of each team member).

The Restoration Implementation team is formed once the Restoration Plan has been approved and permits have been obtained and consists of the following team members (see Section 4.4 for detailed information and responsibilities of each team member):

- The Restoration Determination and Planning Team;
- Boat operator that meets NPS training requirements;
- Additional trained biologists with expertise in seagrass, coral/hardbottom, and mangrove sciences;
- Trained volunteers; and
- Permitted Contractors, if appropriate.

All team members should be familiar with the details of the SHRMP prior to conducting any step of the restoration decision protocol. In addition, all biologists should be trained in seagrass, coral/hardbottom, and mangrove species identification. Biologists and volunteers should be trained and familiar with the techniques presented in Section 4.4 and "leave no trace" skills and ethics (e.g., retrieving all equipment used during restoration work, swimming as much as possible to avoid trampling of substrate) are emphasized by all team members (NWSC 2006, NPS 2013d, Appendix C). Volunteers can provide valuable assistance during the Restoration Implementation phase. Descriptions of potential volunteer responsibilities associated with each restoration alternative (with the exception of signage installation) are described in Table 6. Equipment potentially utilized during the Restoration Implementation phase is provided in Table 7. The Restoration Implementation project team is responsible for conducting the restoration alternatives and obtaining the necessary equipment described in Table 7, if necessary.

Table 6. Potential volunteer responsibilities during the Restoration Implementation phase (listed according to restoration alternative).

Restoration Alternative	Volunteer Responsibility
Sediment placement: loose fill	Preliminary survey for natural resources or megafauna, leveling of loose fill, turbidity monitoring
Sediment placement: sediment tubes	Preliminary survey for natural resources or megafauna, filling, loading/unloading, installation of sediment tubes
Seagrass transplantation (all methods)	Preparation of the planting site (spacing of planting units), seagrass collection, seagrass planting unit formation, seagrass planting
Bird stakes/fertilizer spikes	Assembly and loading/unloading of bird stakes, preparation of site (bird stake/fertilizer spike spacing), bird stake/fertilizer spike installation

Table 7. Equipment list for Restoration Implementation phase (according to restoration alternative). Note that "monitoring only" equipment lists are provided in Section 6.1.

Sediment Placement		Seagrass Transplantation			Bird Stakes/ Fertilizer Spikes	Signage Installation
Loose Fill	**Sediment Tubes**	**Plugging Device**	**Peat Pot**	**Staples (Bare Root)**		
Loose fill	Loose fill	Plugging devices	Peat pots	Shovels	½-in diameter polyvinyl chloride (PVC) pipes	Approved signage
Work barge and transport boat	Sediment tubes	Bucket	Post-hole digger	Covered bins or containers	Wood roosting blocks (2 in x 2 in x 4 in)	Work barge or boat
Rake	Front loader	Wedge	Weighted trays	Five gallon buckets	Educational signage (optional)	Turbidity curtains
Turbidity curtains (optional)	Sediment tube filling apparatus	Boat	Biodegradable staples	Flat-bladed trowels	Reflective tape (optional)	GPS
GPS	Wooden pallets	Stakes and surface buoys	Boat	Biodegradable staples	Fertilizer spikes	Water proof paper and writing tools
Snorkel or scuba gear	Boat	Survey lines	Stakes and surface buoys	Paper coated twist ties	Boat	
Dive flag	GPS	Zip ties or ribbon	Survey lines	Boat	Stakes and surface buoys	
Water proof paper and writing tools	Snorkel or scuba gear	Quadrat	Zip ties or ribbon	Stakes and surface buoys	Survey lines	
	Dive flag	GPS	Quadrat	Survey lines	Zip ties or ribbon	
	Water proof paper and writing tools	Snorkel or scuba gear	GPS	Zip ties or ribbon	Quadrat	
		Dive flag	Snorkel or scuba gear	Quadrat	GPS	
		Water proof paper and writing tools	Dive flag	GPS	Snorkel or scuba gear	
			Water proof paper and writing tools	Snorkel or scuba gear	Dive flag	
				Dive flag	Water proof paper and writing tools	
				Water proof paper and writing tools		

* Depending on the size and location of the damage site and the number of staff required to complete the restoration action, the boats needed for transit may vary in size. However, all boats must be compatible with the shallow water depths that are characteristic of Florida Bay.

4.2 RESTORATION DECISION PROTOCOL

The SHRMP restoration decision protocol has two components: 1) a step-by-step flow chart for the process for restoration determination, planning, implementation, and monitoring (Figure 17) and 2) an evaluation flow chart of potential restoration options (Figure 18). The protocol assists ENP managers with determining whether restoration is warranted at a given damage site and identifies appropriate restoration methods according to the damage site conditions. This information is used to generate a Restoration Plan which is then reviewed, permitted, and implemented. Appendix B also provides an "at-a-glance" check-list for ENP management describing the steps and equipment needed for the various phases of the restoration decision protocol. The restoration decision protocol should be utilized and understood by all ENP staff, biologists, volunteers, and contractors conducting restoration activities in compliance with the SHRMP. The following sections provide descriptions for each step in the restoration decision protocol.

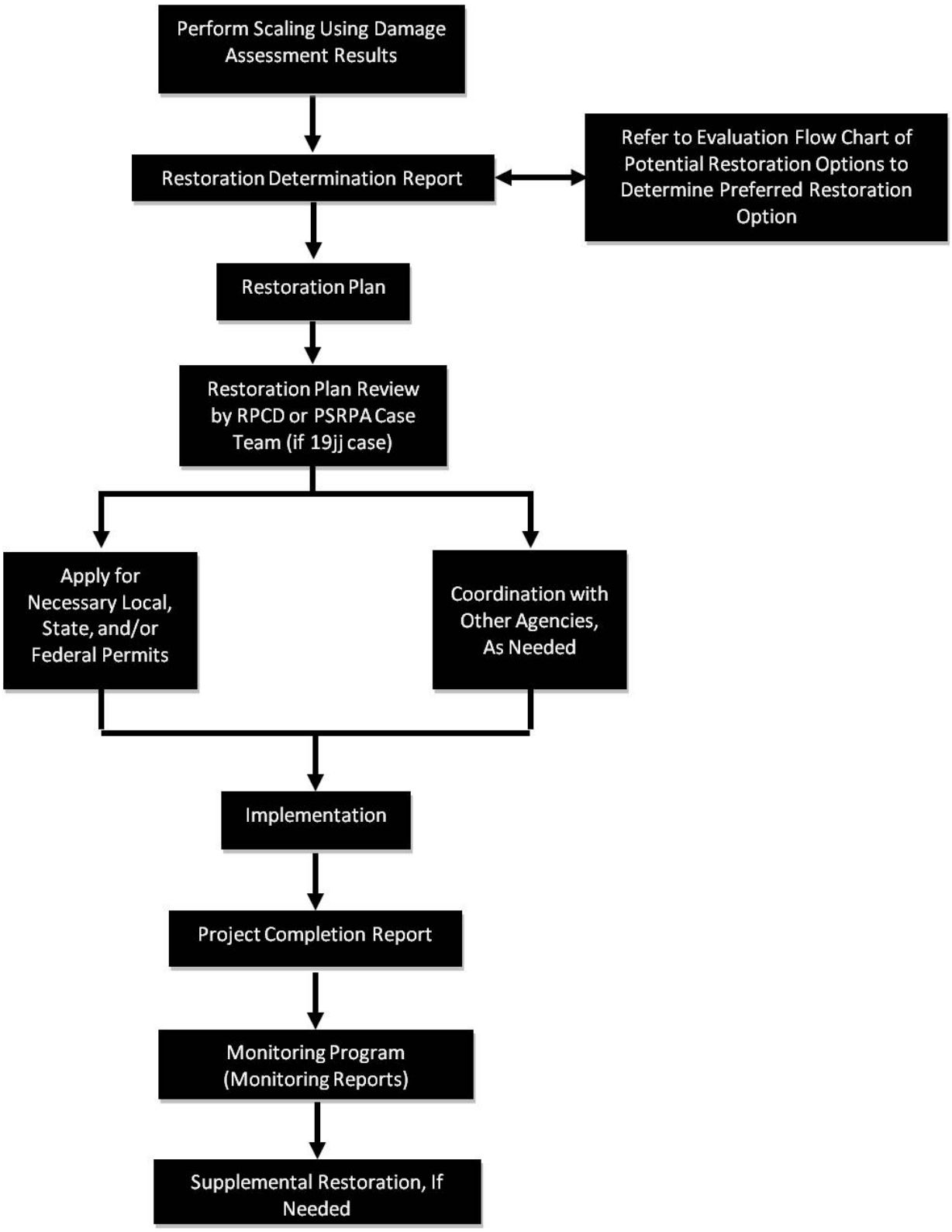

Figure 17. SHRMP restoration process flow chart.

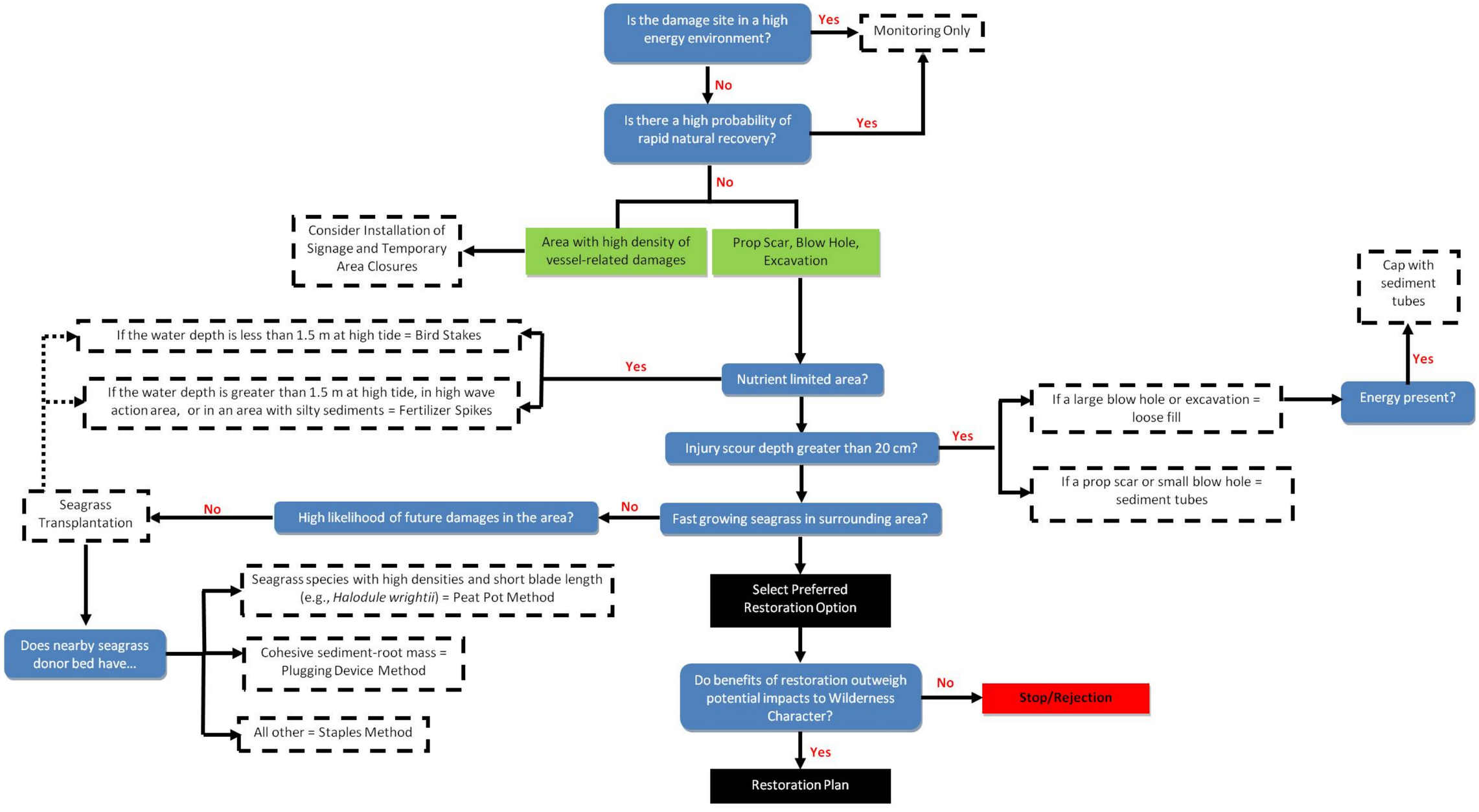

Figure 18. SHRMP evaluation flow chart of potential restoration alternatives.

4.3 RESTORATION DETERMINATION AND PLANNING

The main seagrass restoration objective of the NPS (for vessel groundings) is to conduct feasible, cost-effective, in-kind, timely restoration using the best available techniques to accelerate recovery to pre-damage baseline levels and to prevent further damage to seagrass communities. Restored sites should have similar topography, species composition, and density to that which existed prior to the vessel damage (represented by the surrounding area). According to the Environmental Screening Form (ESF) for the "Enhancing Marine Resource Stewardship in Florida Bay" project, the total potential restoration area for prop scarring and grounding damage in Florida Bay is estimated between 1,722 and 2,870 acres (Appendix E). A majority of these sites are mostly in shallow water (<2 ft deep) and usually in the vicinity of channels or passes through banks where boat traffic is frequent.

"Primary restoration" refers to restoration activities at the actual damage site. In many circumstances, without primary restoration the damaged seagrass communities are subject to re-disturbance by storms that could slow recovery and/or expand the size of the damage (Whitfield et. al 2002). "Compensatory restoration" refers to a restoration project, typically off-site, that would compensate the public for the lost interim ecological services as a result of the time it takes for the original, "primary" damage to return to baseline conditions. In some instances, compensatory restoration may take the form of preventative projects that seek to reduce the frequency and/or severity of similar vessel grounding incidents (e.g., improvement of boater education or signage). Typically, damages recovered for small compensatory restoration projects could be pooled together for the implementation of a larger compensatory restoration project (NOAA and FDEP 2004).

After completion of the damage assessment, the project biologists conduct scaling using the damage assessment results (e.g., HEA). Scaling is the process of determining the appropriate size or degree of restoration by comparing the condition of the damaged resource to its baseline condition, then determining the quantities of labor, materials, equipment, and other requirements needed to re-establish the baseline (NPS 2003). A Restoration Determination Report containing the following items is produced by the project biologists (NPS 2003):

- A summary of the vessel damage assessment methods and results;
- Description of restoration goals and possible restoration alternatives considered;
- Analysis of possible restoration alternatives (Figure 18 and Table 8) including minimum requirement and wilderness management/preservation concepts;
- Description of selected primary and compensatory restoration alternatives and their associated costs;
- Explanation of how primary and compensatory restoration alternatives benefit the damaged resource;

- Summary of primary and compensatory restoration scaling methods, analyses, and results; and

- Determination that selected primary and compensatory restoration alternatives and their scales are appropriate.

Table 8. Criteria for evaluating seagrass restoration alternatives (modified from NOAA and FDEP 2004).

Criteria	Definition
Technical Feasibility	Likelihood that a given restoration action/alternative will work at the site and the technology and management skills exist to implement the restoration action/alternative.
Recovery Time	Measures that accelerate or sustain the long-term natural processes important to recovery of the affected resources and/or services damaged or lost in the incident.
Additional Damage	Likelihood that the requirements, materials, or implementation of a restoration action minimize the potential for additional damage.
Site Specific Conditions	Restoration alternatives that re-create substrate, topography and, potentially, habitat that resembles the surrounding area.
Cost Feasibility	The costs associated with the implementation of a restoration action/alternative.

The project manager reviews the restoration requirements and measures provided in the Restoration Determination Report. After review, if the project manager determines that the restoration project should be implemented, a Restoration Plan is prepared by the project biologists. The Restoration Plan describes the restoration alternative selected, compatibility with the minimum requirement concept and wilderness management/preservation, the associated costs, and how it's relevant to the damaged resource (NPS 2003). The Restoration Plan also ensures environmental compliance with the NEPA, federal and state statues (e.g., ESA, Coastal Zone Management Act (CZMA), National Marine Sanctuaries Act, Marine Mammal Protection Act, Clean Water Act, and Archeological Resources Protection Act), and existing resource management plans (e.g., ENP GMP) (NPS 2003). The ENP RPCD reviews the Restoration Plan to ensure its compliance with these environmental policies and management plans (note that in 19jj cases, the PSRPA case team reviews the Restoration Plan).

Once the Restoration Plan is approved by either the ENP RPCD or the PSRPA case team, local, state, and/or federal permit applications are completed and submitted to the necessary agencies. Coordination may also occur with other agencies, as needed. Once the permits authorizing the restorative action are received (Section 5.0), the Restoration Plan is implemented.

4.4 RESTORATION IMPLEMENTATION: STANDARD RESTORATION TECHNIQUES FOR VESSEL RELATED DAMAGES

Florida Bay benefits from ongoing seagrass ecology and restoration research within the FKNMS by NOAA's Center for Coastal Fisheries and Habitat Research (NOAA and FDEP 2004, Fonseca

1990). This group has provided resource managers with information on seagrasses and seagrass restoration including *Guidelines for the Conservation and Restoration of Seagrasses in the United States and Adjacent Waters* (Fonseca et al. 1998). Since that work, NOAA scientists and resource economists have further investigated and refined restoration practices, parameters affecting recovery at the damage site, methods for scaling compensatory restoration, monitoring protocols, and success criteria.

The following sub-sections list the most common seagrass restoration techniques/alternatives. Depending on the scenario, a combination of these measures may be most effective.

4.4.1 Sediment Placement

Sediment placement is a restoration technique that (1) returns the seafloor to original grade, (2) stabilizes substrate to prevent further erosion, and (3) prepares area for colonization by neighboring or transplanted seagrasses (BNP Programmatic Categorical Exclusion). Different sediment placement techniques are available depending on damage type. Prior to filling any excavation, the excavation should be surveyed for natural resources (e.g., corals or seagrass) and visible megafauna removed.

Both sediment placement methods (loose fill and sediment tubes) described in the sections below should not adversely impact surrounding natural resources or surrounding wilderness character for the following reasons.

- All restoration activities are conducted within the boundaries of the damage site (including vessel anchoring/spudding if large blow hole or excavation) and minimal contact is made with the surrounding area.

- Turbidity curtains, with a minimum 5-ft depth, are securely anchored around the inside edge of the damage site prior to barge spudding/anchoring or sediment placement operations to prevent direct or indirect impacts to surrounding seagrass beds. The turbidity curtains remain in place until turbidity levels at the damage site are consistent with reference sites.

- Turbidity monitoring is conducted throughout the duration of the restoration project to ensure indirect impacts to the surrounding environment are negligible (see Section 6.2.1 for additional details).

- Natural and cultural resource assessments are conducted prior to work to identify and address resources that may require special consideration.

4.4.1.1 Loose Fill

Loose fill is an appropriate restoration method for large excavations with a scour depth greater than 20 cm (~8 in). Loose fill may consist of: (1) a sediment mixture with substrate characteristics (e.g., grain size, color, organic content) similar to the surrounding area or (2) limestone pea rock (NOAA and FDEP 2004). Fine sediments from the local area will eventually fill the interstitial spaces of the limestone pea rock.

At shore, loose fill is loaded onto a work barge capable of traveling in shallow water depths. The work barge navigates to the damage site using a GPS and anchors or spuds within the site to minimize impacts to the surrounding area. Using snorkel or scuba gear, a minimum of one biologist and one contractor are responsible for: (1) filling the entire excavation to match surrounding grade, (2) leveling the loose fill within the excavation using a rake or similar equipment, and (3) ensuring no impacts to surrounding seagrasses during the restoration activity (Figure 19). Approximately one week after completion of construction, the sediment fill elevation is measured (allowing for settlement). If the elevation of the sediment fill is greater than 10 cm above or below the elevation of the surrounding area, sediment is added, removed, or redistributed as necessary.

Figure 19. Photographs showing example of loose fill (0.25-in limestone pea rock) sediment placement method (photo credit: Atkins).

4.4.1.2 Sediment Tubes

Sediment tubes are biodegradable sediment-filled fabric mesh tubes measuring ~1.5 m in length and ~15 to 20 cm in diameter (Figure 20). The fabric casing is designed to biodegrade over time. Sediment tubes are an appropriate restoration technique for prop scars or small blow holes with

scour depths greater than 20 cm (~8 in). Sediment tubes may also be used as a protective "cap" to reduce erosional forces at loose fill restoration sites located in high energy environments (NOAA and FDEP 2004). On land, prefabricated tubes are filled with suitable sediment (Figure 20). Sediment tubes are stacked on wooden pallets and transferred to a shallow-drafting boat. Using a GPS, the boat navigates to the damage site and anchors within the site to minimize impacts to the surrounding area. A minimum of one biologist and one contractor install the sediment tubes into blow holes or prop scars, effectively bringing them to grade. All construction activities are conducted within the damage site to minimize contact with the surrounding seagrass beds. If this is impossible, due to small size of damage site, the sediment tubes are transported from the vessel to the damage site on small floats at high tide to minimize impacts to surrounding areas.

Figure 20. Photographs showing example of sediment tube sediment placement method (photo credit: Atkins).

4.4.2 Seagrass Transplantation

Seagrass transplantation is an effective method used to stabilize sediments and decrease recovery time at the damage site (Fonseca et al. 1998). Seagrass planting units (PUs) are obtained by selective removal of healthy seagrass with intact rhizomes from a designated donor site. The donor site is ideally located near the damage site (to ensure minimal variation in genetic differences between resident seagrasses and transplanted seagrasses) and has similar environmental conditions (e.g., salinity, sediment type, tidal current speed, wave exposure, temperature) as the damage site (NOAA and FDEP 2004, Fonseca et al. 1998, Appendix A). In addition, the donor site should not be located within a high energy environment. High current areas can initiate erosion scarps that can spread and damage the donor bed (Appendix A, Partiquin 1975). Seagrass PUs are collected from various areas in the donor site to avoid creating a large hole in the donor bed's standing stock and to decrease the amount of time required for the donor bed to replenish itself (NOAA and FDEP 2004). Repeated harvest from donor sites within a calendar year should be avoided (Appendix A, Fonseca et al. 1998). Prior to selection of a donor site, the ENP cultural resource specialist will conduct a cultural resource assessment on the proposed donor site. If any cultural material (e.g., historic shipwrecks,

anchors) is encountered, that area is reported to the Chief of Cultural Resources, abandoned, and an alternative donor site found.

Target PU seagrass species include *Halodule wrightii* and *Syringodium filiforme*, which are both faster growing opportunistic species that serve as temporary substitutes for climax species such as *Thalassia testudinum* (NOAA and FDEP 2004). *T. testudinum* is typically avoided during PU collection due to its slow growth and the difficulty in collecting a sufficient number of apical meristems (undifferentiated meristematic tissue found in the rhizomes of seagrass) during harvesting efforts. Apical meristems control rhizome elongation, branching, and shoot production (Atkins 2011, Hall et al. 2006). When a seagrass rhizome is severed (e.g., during PU collection), the portion of the seagrass plant lacking an apical meristem cannot grow until a new one is generated (Atkins 2011, Dawes et al. 1997). *T. testudinum* forms new apical meristems slowly (over months or sometimes years) and its rhizomes branch only rarely (Atkins 2011, Tomlinson 1974). To have a successful seagrass transplantation project and to increase chances of PU survival, larger *T. testudinum* PUs would need to be collected in order to capture a sufficient number of apical meristems which could cause additional unnecessary damage to the donor site. According to the NPS Management Policies 2006 (NPS 2006), removal of individual seagrass PUs from NPS property is permitted when conducted to provide material for restoration of native park populations and as long as the removal does not diminish the viability of the park population.

Seagrass transplantation is an appropriate restoration method at low-to-moderate energy sites where the probability of losing transplants to high water velocity is low (NOAA and FDEP 2004). When using this technique, consideration should also be given to the likelihood of future damage events in the area (BNP Programmatic Categorical Exclusion). If the transplant site is located in a high traffic area, the seagrass transplantation effort is at risk and the probability of transplant success is low. When BMPs are used, including those mentioned in the sections below, seagrass transplants experience survival rates of 70-80% (NOAA and FDEP 2004, Fonseca et al. 1998). Every effort should be made to plant recovered seagrass material at the damage site within the same day as collection to minimize seagrass stress. Transplanting activities should also occur in the beginning of seagrass growing season (seagrass growing season from June 1-September 30) to achieve the greatest amount of establishment in the first year and therefore increase probability of PU survival and success. If the damage site is previously restored via sediment placement (Section 4.4.1), seagrass transplantation should occur ≥30 days after sediment placement activities are complete. This allows the fill material to equilibrate within the damage site.

Several different seagrass transplantation methodologies may be implemented in restoration projects including the use of plugging devices, peat pots, or staples.

4.4.2.1 Plugging Device

Using a plugging device, seagrass is captured with associated sediment (seagrass plug). A plugging device typically consists of a 4-in to 6-in diameter PVC tube with a serrated edge. The serrated edge allows the PVC to cut through the seagrass rhizome mat and underlying sediment. A ball joint or PVC cap located or placed at the top of the plugging device creates and maintains

suction during the plugging operation. Once the seagrass plug has been collected inside the plugging device, a PVC cap is placed on the bottom to contain and maintain the seagrass plug during transport to the damage site. Alternatively, the plug may be placed into a transport vessel (e.g., bucket) for transport to the damage site. Once the seagrass plug is transported to the damage site, a recipient hole is created by removing a core of sediment with another plugging device or by softening the substrate using a wedge (Fonseca et al. 1998). To plant the seagrass plug, the bottom cap of the plugging device is removed, the plugging device is inserted into the recipient hole at the damage site, the ball joint is turned or PVC cap removed releasing suction and causing the seagrass plug to slide down into the recipient hole. If a transport vessel is used (e.g., bucket), the plug is manually removed and placed into the recipient hole. This method typically requires at least two people working together at the donor site and at least two people working at the damage or transplant site. Seagrass transplantation using a plugging device requires a sufficiently cohesive sediment-root mass so the plug remains within the plugging device.

This method requires the ability to walk around the seagrass donor site during seagrass transplant collection. Even though the NPS has the responsibility of supporting and encouraging scientific activities in wilderness and recognizes that science is critical to the long-term preservation of wilderness (NPS 1999), walking around the seagrass donor site may result in more impact than overall benefit to wilderness character through the restoration of the damage site. As a result, this method may not be appropriate for seagrass donor sites with silty sediments.

4.4.2.2 Peat Pot

Peat pots (~3 in x ~3 in) are biodegradable pots made of compressed peat moss and shredded wood fibers. During seagrass collection, a ~3-in x ~3-in post-hole digger is used to extract seagrass plugs from the donor site. Individual seagrass plugs are released from the post-hole digger into a peat pot and the peat pots are immediately placed into a submerged tray (Figure 21). All air must be squeezed out of the submerged peat pots to prevent capsizing in the tray. At the damage/transplant site, the sediment is loosened and the peat pot is installed into the bottom and secured with a biodegradable staple (Figure 21, Fonseca et al. 1998). Once installed and secured, the sides of the peat pot are removed to allow rhizomal spread. The peat pot method is most suitable for seagrasses that occur in relatively high densities and generally have a shorter blade length (e.g., *Halodule wrightii*, *Ruppia maritima*, *Halophila decipiens*) (Fonseca et al. 1998). This method may be more advantageous than other seagrass transplantation methods because slow release fertilizer may be added to the peat pots, increasing transplantation success (Fonseca et al. 1998).

Similar to the plugging device method, the peat pot method also requires the ability to traverse the seagrass donor site on foot during seagrass transplant collection. Walking around the seagrass donor site may result in more impact than overall benefit to wilderness character through the restoration of the damage site. As a result, this method may not be appropriate for seagrass donor sites with silty sediments.

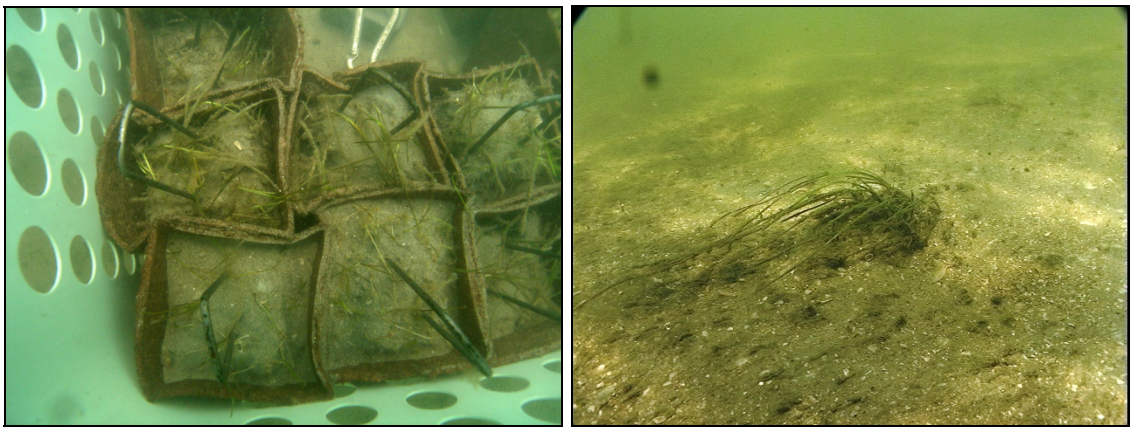

Figure 21. Photographs of seagrass peat pots in tray (left) and installed into substrate (right) (photo credit: Atkins).

4.4.2.3 Staples/Bare Root

Depending on water depth, substrate type, and seagrass species, divers or snorkelers remove bare-root seagrass material from the donor site using shovels or hands. All material is gently freed of sediment, stored in covered bins filled with ambient seawater, and sorted by species into five-gallon buckets containing ambient seawater. The five-gallon buckets are distributed amongst several planting teams consisting of 2-3 people each. Bare-root seagrass material (of the same species) are grouped together to form a PU ~10 cm in diameter. To minimize disturbance to the sediment-water interface during planting, a flat-bladed trowel is inserted ~10 cm into the substrate at the damage site and carefully angled back 45 degrees. A PU is inserted into the open space (cleared by the trowel) until the rhizomes are below the sediment-water interface and nearly parallel to the sediment surface. The trowel is then slowly removed and the sediment pressed downward. A single biodegradable staple is placed through the rhizomes and pressed flush with the surface of the sediment (Figure 22). In moderate energy environments, PUs can be attached to biodegradable staples using a paper-coated twist tie (Fonseca et al. 1998). The twist tie is secured around the plants at the basal meristem so the seagrass blades extend from under the staple up into the water column when planted (Fonseca et al. 1998).

The staple/bare root methodology is the most appropriate seagrass transplantation method for preserving wilderness character because it requires less interaction with the Florida Bay bottom. Rather than traversing the seagrass beds on foot, the seagrass collection task is conducted via snorkel or scuba equipment.

Figure 22. Photographs of seagrass planting unit using staple/bare root methodology (photo credit: Atkins).

4.4.2.4 Planting Unit Spacing

Prior to seagrass PU collection, the boundaries of the damage/transplant site may be marked with stakes and surface buoys (if absolutely necessary) and the interior of the site gridded off to assist with PU spacing. Survey lines (lead core or floating polypropylene lines) are extended across the damage site and marked at selected intervals using zip ties or ribbon. Using snorkel or scuba equipment, team members use these survey lines as guides and plant the PUs at the marked intervals. Team members record the number of PUs installed along each planting line. PU spacing ranges from 0.5 m to 2.0 m (on center) depending on the size and condition of the damage site (Fonseca et al. 1998). For vessel-related damages less than 1.5 m in width, seagrass PUs are planted in a single row down the middle of the damage site at 0.5-m intervals (NOAA and FDEP 2004). For vessel-related damages between 1.5 m and 2 m in width, seagrass PUs are planted in two rows. In the first row, seagrass PUs are planted 0.5 m into the width of the scar at 0.5-m intervals (along the length of the damage site). In the second row, seagrass PUs are planted 1 m into the width of the scar (along the length of the damage site) at 2-m intervals. This general pattern is also maintained for wider prop scars and blow holes.

At the damage/transplant site, PU spacing can also be determined using a quadrat. The dimensions of the quadrat are determined by desired PU spacing. Team members plant seagrass PUs at the four corners of the quadrat and then the quadrat is flipped. Additional seagrass PUs are planted at the remaining two corners. This process is continued until the damage site is completely planted.

4.4.3 Nutrient Evaluation and Augmentation – Bird Stakes/Fertilizer Use

Bird stakes and fertilizer spikes provide fertilizer for re-vegetating seagrass beds in nutrient limited areas. Different areas of Florida Bay have different nutrient limitations. Eastern Florida Bay is phosphorus limited while western Florida Bay has an abundance of phosphorus from the eastern Gulf of Mexico (Hunt and Nuttle 2007). Studies have shown that introduction of nitrogen and phosphorus into nutrient limited areas (i.e., eastern Florida Bay) can stimulate seagrass growth (Kenworthy et al. 2000, Powell et al. 1989b, Powell et al. 1991, Fourqurean et al. 1995). Seagrasses obtain most of the nutrients from porewater and nutrient reservoirs in the carbonate mud sediments (Kenworthy et al. 2000, Fourqurean et al. 1992a). Vessel-related damages change the physiochemical composition of the substrate and remove nutrients located within the sediments. The introduction of fertilizer, through the installation of bird stakes or fertilizer spikes, replenishes lost nutrients in the sediments and subsequently increases the recovery rate of seagrasses within vessel-related damages (Kenworthy et al. 2000).

4.4.3.1 Bird Stakes

Bird stakes consist of a 0.5-inch diameter PVC pipe topped with a wood roosting block (2x2x4 in) and encourage the roosting of waterfowl, which provides natural fertilization to underlying areas through the deposition of bird feces (Figure 23). This restoration method has been effective in facilitating the colonization of seagrasses into disturbed sediments and/or faster growth of seagrass transplants (Fourqurean et al. 1992a, Fourqurean et al. 1992b, Fourqurean et al. 1995, Kenworthy et al. 2000). To be effective, bird feces need to reach the seafloor in concentrated doses for as long as the bird stakes are in place, ~18 months (NOAA and FDEP 2004). This is achieved with installation of bird stakes in water depths less than 1.5 m at high tide and at ~0.25 m elevation above the high water level. At greater depths, the effect of dilution on bird feces reduces the effective strength of the fertilizer. In well flushed areas, flow across restoration sites may transport feces off-site and reduce effectiveness of bird stakes.

Figure 23. Photographs of bird stakes (photo credit: Atkins).

Additional factors need to be considered when utilizing bird stakes, including exposure to wave action and substrate composition (NOAA and FDEP 2004). If the damage site is located within a high wave action area or within an area with silty sediments, bird stakes may become dislodged

and are therefore ineffective. If bird stakes are placed in high traffic areas, one of the following options should be implemented to minimize boater confusion: (1) install educational signage around the damage site, (2) install additional bird stakes at either end of the restored prop scar to create a stake barrier, or (3) place reflective tape on the stakes (NOAA and FDEP 2004). Using natural mangrove branches or other natural structures in lieu of PVC bird stakes may help avoid risk of drawing attention and would minimize impacts to the undeveloped quality of wilderness character.

Assessment of the need for, and usefulness of, bird stakes should be considered on a site-specific basis, and fertilizer spikes or other methods should be adopted when bird stakes are unlikely to be effective.

4.4.3.2 Fertilizer Spikes

Fertilizer spikes are typically used in conjunction with seagrass transplants and are an effective method for seagrass restoration, delivering a regular release of phosphorus over a small area (~3 m^2) (Worm et al. 2000, NOAA and FDEP 2004). Fertilizer spikes are typically placed directly adjacent to seagrass PUs with no more than one spike per PU. Since bird stakes are recommended in water depths less than 1.5 m, fertilizer spikes are typically deployed in water depths greater than 1.5 m or when bird stakes are inappropriate due to environmental conditions (e.g., wave action, substrate type), hazards to navigation, or risk of vandalism (NOAA and FDEP 2004). Fertilizer spikes naturally biodegrade over a period of ~3-4 months (NOAA and FDEP 2004).

4.4.3.3 Spacing of Bird Stakes/Fertilizer Spikes

Prior to installation, the boundaries of the damage site may be marked with stakes and surface buoys (if absolutely necessary) and the interior of the site gridded off to assist with bird stake or fertilizer spike spacing. Survey lines (lead core or floating polypropylene lines) are extended across the damage site and marked at specified intervals using zip ties or ribbon. Using snorkel or scuba equipment, team members use these survey lines as guides and install bird stakes or fertilizer spikes at the marked intervals. Another option in determining PU spacing is the use of a quadrat (see Section 4.4.2.4 for details).

The number of seagrass PUs and bird stakes/fertilizer spikes (hereafter referred to as stakes/spikes) required for vessel-related damages is determined according to the following general guidelines (NOAA and FDEP 2004). For vessel-related damages less than 1.5 m in width, a single row of stakes/spikes and seagrass PUs are installed down the middle of the scar along the length of the damage site. The first stake/spike is placed at the beginning of the damage and then at 2-m intervals for the length of the damage site. Three seagrass PUs are planted between two stakes/spikes at 0.5 m intervals. No seagrass PUs should be placed directly under the bird stakes. For vessel-related damages between 1.5 m and 2 m in width, two rows of stakes/spikes and seagrass PUs are installed within the damage site. The first row has a similar set-up as described above for vessel-related damages less than 1.5 m in width except the stakes/spikes and seagrass PUs are inserted 0.5 m into the width of the scar. The second row contains seagrass PUs only. Seagrass PUs are planted 1.0 m into the width of the scar at 2-m intervals. This general pattern is also maintained for wider prop scars and blow holes.

Additionally, the perimeter of the blow hole is staked/spiked at 2-m intervals. Despite these general guidelines, additional analysis should be performed on a site-specific basis to ensure appropriate spacing of stakes/spikes (with or without seagrass PUs) within a damage site. The analysis should take into account adjacent natural features, water flow patterns, and nutrient levels within the damage site substrate. For example, if the damage site is located within a moderate to high current area or nutrients are completely lacking within the damage site fill material, stakes/spikes may need to be placed at more frequent intervals to be effective.

Bird stakes and fertilizer spikes require deployment of objects into the Florida Bay bottom which is contradictory to wilderness character management. However, in certain environmental conditions, bird stakes and fertilizer spikes are a successful restoration tool and the overall benefit to wilderness character could outweigh the short-term potential impacts of restoration at the damage site. Both installation methods involve minimal contact with the Florida Bay bottom. Bird stakes could be installed over the side of a boat and fertilizer spikes could easily be installed into the substrate using snorkel or scuba equipment.

4.4.4 Monitoring Only (No Active Restoration)

The "monitoring only" approach is utilized for seagrass damages with a high probability of rapid natural recovery or if restoration is considered too difficult to undertake (e.g., high energy environments). Active restoration is not performed under this option. Instead, vessel-related damages are allowed to recover naturally through the recruitment of surrounding seagrass species and/or the natural movement of native sediment into the damage site. Using this approach, there are two possible outcomes: (1) natural recovery on a longer time scale or (2) further deterioration due to the absence of natural recovery (NOAA and FDEP 2004). Over time, the damage site is qualitatively and quantitatively analyzed to determine the progression of natural restoration. "Monitoring only" methods are described in detail in Section 6.3.2.

4.4.5 Installation of Signage and Temporary Area Closures

To protect sensitive aquatic vegetation and wilderness resources, areas with a multitude of vessel-related damages may be temporarily closed to all vessel entry or provide limited access. This restoration alternative allows natural resources the time to naturally recover, removing the risk of additional damage. Examples of temporary area closures with limited access include PTZs, which require boaters to shut off their internal combustion motors and switch to drifting, poling, paddling, and/or the use of electric trolling motors. ENP implemented a PTZ in Snake Bight (Florida Bay) on January 1, 2011. PTZs have also been established as a successful management tool in Merritt Island National Wildlife Refuge, the Weedon Island State Preserve, and Ft. De Soto Park (Atkins 2011). Since closure to combustion engines in October 1990, Weedon Island State Preserve has experienced a 95% reduction in the number of prop scars (Folit and Morris 1992). Completely and temporarily closing an area to all watercraft is a more effective restoration alternative for reducing seagrass scarring than limited boater access (e.g., PTZ). However, this method should only be implemented if less restrictive strategies prove unsuccessful or it is limited to areas with extremely high prop scar densities. Closed areas are present within the state of Florida, including Florida Bay, although they have not been implemented as a seagrass restoration alternative. These closed areas protect wildlife habitat such as bird rookeries (see Section 1.1.6.3).

The installation of signage and/or temporary area closures as a seagrass restoration alternative will adhere to the 2013 Draft GMP, which states that areas should be "minimally marked to preserve the scenery and aesthetics of Florida Bay and minimize maintenance requirements. This means that boaters would rely primarily on navigation skills, GPS technology, marine charts, and materials developed for the boater education program" (NPS 2013a). The installation of signage must meet the minimum requirement concept (Section 1.1.9.2). The NPS will evaluate the proposed sign installation action in terms of whether it is absolutely necessary to achieve the management objectives and whether the proposed sign installation is the best restoration option and least impact to wilderness character given the site characteristics (e.g., site location, type of seagrass damage, type of sign to be installed, minimum number of signs to achieve objective, etc.). Furthermore, the minimum tool should be selected with regard to the techniques and equipment used to install the signs.

If this restoration alternative is selected, the following guidelines should be implemented when installing signs to mark the area.

- Sign design should be compatible and approved by ENP and the USCG.
- Signs should be constructed of standard sign aluminum with regulation reflective, metallic white backing.
- Sign font and symbology should consist of reflective black and orange tape, respectively.
- Sign size should be at a minimum while still being legible to the boat operator from a safe distance.
- Turbidity control devices (e.g., turbidity curtains) should be installed prior to sign installation and remain in place until turbidity levels at the installation site are consistent with reference sites.
- Sign installation should be performed by contractor permitted to operate in ENP.
- The minimum number of signs should be securely installed around the perimeter of the area and in accordance with project permits. The minimum number of signs needed to successfully delineate a damage site or temporary area closure depends on the site geometry. Signs should be installed at the perimeter of the damage site or temporary area closure such that boaters are able to see from sign to sign from both perpendicular and parallel perspectives (FFWCC 2008). Significant angles and changes in direction should also be delineated (FFWCC 2008). The distance between signs should be the maximum distance possible to reduce sign pollution and impacts to wilderness character but at a sufficient interval to provide a clear message to boat operators.
- The top of the signs should be ~ 6 ft above the surface of the water at mean tide.

Using a GPS, the work barge or boat will navigate to the damage site or heavily scarred area. Turbidity curtains with a minimum 5-ft depth should be securely anchored around the installation location. All standard measures for the protection of manatees, smalltooth sawfish, and sea turtles must be implemented (Section 6.2.2). A permitted contractor will install the approved signage. Turbidity monitoring must be conducted throughout construction by a trained biologist or volunteer to ensure that impacts to surrounding seagrass areas are negligible. The turbidity curtains should remain in place until turbidity levels at the installation site are consistent with reference sites.

4.4.6 Protective Measures

The following protective measures should be considered when performing restoration at a damage site:

- Use of snorkel or scuba gear as much as possible during restoration activities to minimize contact with the bottom.

- With the exception of seagrass transplantation, ensure that construction activities (including anchoring and spudding of work vessels) are limited to the damage site. Turbidity curtains should be installed around the inside edge of the damage site prior to vessel anchoring/spudding or sediment placement activities to prevent indirect impacts to the surrounding area.

- Ensure that surrounding natural resources are not adversely impacted (directly or indirectly) during construction. This is accomplished through biologist supervision and construction compliance monitoring (Section 6.2).

- Adherence to standard measures for the protection of manatees (e.g., manatee awareness signage on-site during all construction activities (Figure 24, Section 6.2.2).

- Adherence to standard measures for the protection of smalltooth sawfish and sea turtles including the use of no-wake zones (Section 6.2.2).

- Adherence to any other appropriate species-specific protection measure adopted in the future.

- If located in a high traffic area, consideration of educational signage around the restoration site to prevent additional damage (Figure 25, Section 4.4.5).

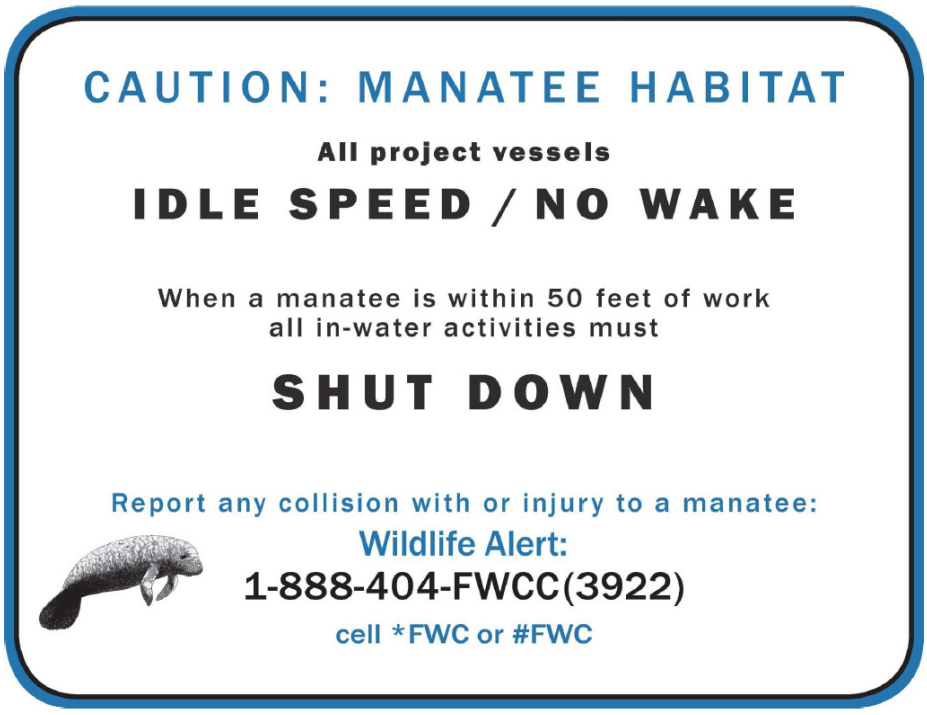

Figure 24. Manatee awareness signage should be posted on site during all construction activities.

Figure 25. Photograph of signage marking seagrass restoration area (photo credit: Atkins).

4.5 RAPID DAMAGE CONTROL PLAN (INTERIM MEASURES)

According to the SHRMP, restoration construction cannot begin at a damage site until approval of the Restoration Plan by the RPCD or PSRPA case team (19jj cases only) and receipt of restoration funds and permits authorizing the restoration activity. This process can potentially

take several months to complete and as a result, additional damage may occur at the damage site. In these instances, a rapid damage control plan (interim measures) may be necessary to minimize impacts during the interval between the incident and full restoration activities (Figure 16). A rapid damage control plan typically occurs early in the damage assessment decision protocol and only occurs if the damage site has a high probability of expanding into surrounding seagrass areas. Interim measures may include, but are not limited to, the collection and replanting of uprooted or dislodged seagrasses within a damage site or the movement of sediment piles adjacent to blow holes back into the blow hole to quickly restore sediment elevations to match the surrounding seagrass grade, allowing adjacent seagrasses the opportunity to grow into the damage site (Uhrin et al. 2011).

4.6 PROJECT COMPLETION REPORT

At the completion of a restoration project, a Project Completion Report is prepared by the project biologists and submitted to the project manager for review. This report describes the restoration work performed, any modifications made to the original restoration plan, and any unintended impacts to surrounding areas as a result of restoration project (NPS 2003). The description of the restoration work performed should be as detailed as possible (e.g., the restoration method(s) employed, amount of loose fill used, number of sediment tubes installed, seagrass species transplanted, the number of seagrass PUs planted and spacing interval, the number of bird stakes/fertilizer spikes installed and spacing interval, number and location of signage installed, etc). Maps and figures depicting the location of the damage site and the restoration efforts should also be provided. Photographs collected during the restoration project should also be submitted as part of the Project Completion Report.

For 19jj cases, detailed records of all expenses incurred during Restoration Determination and Planning and Restoration Implementation are recorded and reported to the PSRPA case team (NPS 2004). The final cost of the project and any restoration recoveries not expended are also included in the Project Completion Report (NPS 2003). The Project Completion Report is then submitted to the PSRPA case team for further processing, as necessary.

4.7 CONSIDERATION OF WILDERNESS CHARACTER

The minimum requirement and wilderness character management/preservation concepts are applied to all management activities conducted in wilderness and are accomplished in compliance with NPS Management Policies, Director's Orders, and procedures specified in the park's wilderness management/stewardship plan (NWSC 2006). These criteria ensure that (1) the action is appropriate and utilizes the minimum tool to accomplish the restoration objectives and (2) the long-term benefit of an action clearly outweighs any short-term impact to wilderness. Wilderness character and the minimum requirement concepts are initially considered during preparation of the Restoration Determination Report and Restoration Plan, as well as during Restoration Implementation.

During development of the Restoration Determination Report, each restoration alternative is analyzed using the following classification scheme and filter/screening questions.

4.7.1 Classification Scheme

The NWSC's *Guidance White Paper Number 2: What Constitutes Appropriate Conservation and Restoration in Wilderness?* (NWSC 2004) provides a classification scheme to guide ENP managers in the restoration decision-making process and helps ENP managers to determine whether a specific restorative action should be conducted. Restoration activities are classified according to duration of wilderness disturbance and degree of benefit to wilderness.

- A **Class I activity** has short-term wilderness disturbance (i.e., lasting a season to several years) and long-term wilderness character enhancement. Class I activities include one-time activities to reverse vessel-related damages in wilderness and once completed, the reversal would be self-sustaining. An example would be the restoration of a prop scar or small blow hole with sediment placement, allowing neighboring seagrasses to recruit/grow into the damaged site.

- A **Class II activity** has a long-term duration or recurring entry, benefits, and costs to wilderness character. Often, a permanent correction of vessel-related impacts is not possible or financially feasible in a one-time event. Class II activities include restoration that occurs repeatedly or over a long duration and, while enhancing overall wilderness character, also incur some costs to wilderness character. An example would include a large vessel grounding requiring restoration over a long period of time.

- A **Class III activity** has substantial impacts on wilderness character and clearly violates the intent of the Wilderness Act; however, such activities may be needed to support other important ecological issues. A Class III activity must be carefully considered to weigh the benefits of restoration against the substantial wilderness impacts. Examples would include the removal of native organisms in support of restoration elsewhere (e.g., collection of seagrass PUs from a donor site to be used for seagrass transplantation at a restoration site).

4.7.2 Filters/Screening Questions

Three filters or screening questions are addressed for each potential restoration alternative: the legal/policy filter, the pragmatic/conservative filter, and the benefits/impacts filter (NWSC 2006). The legal/policy filter determines if the proposed restoration activity is necessary and if the activity poses substantial impacts on wilderness (where impacts outweigh benefits so as to impair the wilderness resource and character). The second filter, the pragmatic/conservative filter, is not applicable to the SHRMP. It essentially asks if the research or scientific activity is wilderness dependent. In other words, can this research be easily conducted outside of wilderness without loss of data quality or long term benefit? Because this SHRMP focuses on seagrass habitat restoration in Florida Bay, which is designated wilderness, the pragmatic/conservative filter is not applicable. The final filter, the benefits/impacts filter, is similar to the legal/policy filter. This filter is a guide for decisions based on assessing relative benefits and impacts of a restorative action. That is, will restoration yield more benefits than impacts or cause unacceptable impacts to wilderness conditions?

4.7.3 Considerations for Selection of Optimal Restoration Alternatives

Section 4.4 provides a detailed description of each of the restoration alternatives. Table 9 presents the potential benefits and impacts to wilderness character from each of the proposed restoration tools/techniques utilized in the seagrass restoration protocol. Each of the restoration alternatives in Table 9 represents the minimum concept/tool with regard to wilderness character; however, a restoration action will be determined on a site-specific basis (see Section 1.1.9.2 for additional information regarding the minimum concept/tool with regard to wilderness character). As such, the selected site-specific restoration alternatives constitute the best approach to achieve restoration at the damage site with the least impact to wilderness character. In the end, the selected restoration alternative(s) presented in the Restoration Plan should provide long-term benefits to wilderness with little or no short-term impact.

Despite the potential benefits and impacts associated with each restoration alternative, some restoration alternatives may be better suited and more successful than others, depending on the conditions and state of a given damage site. For each damage site, a Restoration Determination Report is prepared to evaluate the technical feasibility, safety, and environmental suitability of each potential restoration alternative and determine if each restoration alternative satisfies the wilderness character and minimum requirement criteria (Section 4.3). Careful evaluation of all alternatives should be performed, including an analysis of cumulative effects (NWSC 2006). The best possible restoration alternative for a given damage site is presented in the Restoration Plan and will provide an overall benefit to wilderness character (through restoration) and utilize the minimum tool to accomplish the restoration objectives.

Table 9. Potential benefits and impacts to wilderness character from the proposed tools/techniques utilized in the seagrass restoration protocol.

Tools/Technique	Potential Benefits to Wilderness Character (WC)	Potential Impact to Wilderness Character (WC)
Sediment Placement Techniques		
Loose Fill	• Permanent benefit to the untrammeled and natural qualities of WC by restoring the grade of the seafloor to match the surrounding undisturbed area, which is essential for restoration of seagrasses.	• Temporary impact to the untrammeled and natural qualities of WC within the damage/restoration site from installation of the fill material, from vessel/barge anchoring and spudding (if necessary) and human traversal (if necessary to level the fill material). • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels and equipment at the damage/restoration site during fill installation (including turbidity curtains).
Sediment Tubes	• Permanent benefit to the untrammeled and natural qualities of WC by restoring the grade of the seafloor to match the surrounding undisturbed area, which is essential for restoration of seagrasses.	• Temporary impact to the untrammeled and natural qualities of WC from installation of the sediment tubes (the fabric casing biodegrades over time) at the damage/restoration site. • Temporary impact to the untrammeled and natural qualities of WC if vessel anchoring is necessary and if human traversal is required to transport sediment tubes within the damage/restoration site. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels and equipment at the damage/restoration site during sediment tube installation (including turbidity curtains).

Table 9 (continued). Potential benefits and impacts to wilderness character from the proposed tools/techniques utilized in the seagrass restoration protocol.

Seagrass Transplantation Techniques		
Plugging Device	• Permanent benefit to the untrammeled and natural qualities of WC by stabilizing sediments at the damage/restoration site and decreasing the recovery time of the seagrass community within the damage/restoration site by installing seagrass plugs.	<u>Donor Site</u>: • Temporary impact to the untrammeled and natural qualities of WC from collection of seagrass plugs, from vessel anchoring (if necessary), and human traversal within the donor site to collect and transport the plugs. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the donor site during seagrass plug collection. <u>Damage/Restoration Site</u>: • Temporary impact to the untrammeled and natural qualities of WC from installation of seagrass plugs, from vessel anchoring (if necessary), and human traversal within the damage/restoration site to install the plugs. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage/restoration site during seagrass plug installation.
Peat Pots	• Permanent benefit to the untrammeled and natural qualities of WC by stabilizing sediments at the damage/restoration site and decreasing the recovery time of the seagrass community within the damage/restoration site by installing seagrass PUs.	<u>Donor Site</u>: • Temporary impact to the untrammeled and natural qualities of WC from collection of seagrass PUs, from vessel anchoring (if necessary), and human traversal within the donor site to collect and transport the PUs. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the donor site during seagrass collection. <u>Damage/Restoration Site</u>: • Temporary impact to the untrammeled and natural qualities of WC from installation of PUs (the peat pots and staples biodegrade over time), from vessel anchoring (if necessary), and human traversal within the damage/restoration site to install the PUs. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage/restoration site during peat pot installation.

Table 9 (continued). Potential benefits and impacts to wilderness character from the proposed tools/techniques utilized in the seagrass restoration protocol.

Seagrass Transplantation Techniques (continued)		
Staples/Bare Root	• Permanent benefit to the untrammeled and natural qualities of WC by stabilizing sediments at the damage/restoration site and decreasing the recovery time of the seagrass community within the damage /restoration site by installing seagrass PUs.	Donor Site: • Temporary impact to the untrammeled and natural qualities of WC from collection of seagrass PUs and from vessel anchoring (if necessary) within the donor site. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the donor site during seagrass collection. Damage/Restoration Site: • Temporary impact to the untrammeled and natural qualities of WC from installation of PUs (the staples biodegrade over time) and from vessel anchoring (if necessary) within the damage/restoration site during installation of PUs. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage/restoration site during PU installation.
Nutrient Augmentation		
Bird Stakes	• Permanent benefit to the untrammeled and natural qualities of WC by decreasing the recovery time of the seagrass community within a nutrient-limited damage/restoration site.	• Temporary impact to the untrammeled, natural, and undeveloped qualities of WC from the installation of bird stakes within the damage/restoration site. Bird stakes remain in place for ~18 months. • Temporary impact to the untrammeled and natural qualities of WC if vessel anchoring is necessary within the damage/restoration site during installation. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels and equipment at the damage/restoration site during bird stake installation.
Fertilizer Spikes	• Permanent benefit to the untrammeled and natural qualities of WC by decreasing the recovery time of the seagrass community within a nutrient-limited damage/restoration site.	• Temporary impact to the untrammeled and natural qualities of WC from the installation of fertilizer spikes and vessel anchoring (if necessary) within the damage/restoration site. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage/restoration site during fertilizer spike installation.

Table 9 (continued). Potential benefits and impacts to wilderness character from the proposed tools/techniques utilized in the seagrass restoration protocol.

Other Techniques		
Monitoring Only	• Potential permanent benefit to the untrammeled and natural qualities of WC from natural recovery (on a longer time scale) of the seagrass community within the damage/restoration site. Also potential for further deterioration of the damage/restoration site from the absence of natural recovery.	• Temporary impact to the untrammeled and natural qualities of WC from the placement of monitoring equipment (measuring tapes, quadrats) on the bottom and vessel anchoring (if necessary) within the damage/restoration site. • Temporary impact to the undeveloped quality of WC from the presence of motorized vessels at the damage/restoration site during monitoring events.
Signage	• Permanent benefit to the untrammeled and natural qualities of WC by preventing additional vessel impacts to the damage/restoration site and allowing for natural recovery of the seagrass community.	• Permanent impact to the untrammeled, natural, and undeveloped qualities of WC from the installation of signs around area with a multitude of vessel-related damages or at a damage/restoration site. • Temporary impact to the untrammeled, natural, and undeveloped qualities of WC from the installation of turbidity curtains and vessel/barge anchoring and spudding (if necessary). • Permanent impact to the solitude/primitive recreation quality of WC from installation of signage and management restrictions on visitor behavior.
Temporary Area Closures	• Temporary benefit to the untrammeled and natural qualities of WC by preventing additional vessel impacts to the damage/restoration site and allowing for natural recovery of the seagrass community.	• Temporary impact to the untrammeled, natural, and undeveloped qualities of WC from the installation of signs at a damage/restoration site to indicate temporary area closure. • Temporary impact to the untrammeled, natural, and undeveloped qualities of WC from the installation of turbidity curtains and vessel/barge anchoring and spudding (if necessary). • Temporary impact to the solitude/primitive recreation quality of WC from management restrictions on visitor behavior.

5.0 PROJECT PERMITTING AND APPROVALS

The SHRMP is consistent with, and part of, previously approved NEPA compliance documents, including the programmatic 1978 *Final ENP Wilderness Recommendation/Environmental Statement*, 1979 *ENP Master Plan*, and 1981 *ENP Backcountry Management Plan*. Consequently, the proposed SHRMP qualifies as a CE with respect to NEPA, pursuant to Department of the Interior Manual (DM) 516, 12 (NPS), section 12.5.E, *Actions Related to Resource Management and Protection*. The Wilderness Committee and federal and state regulatory agencies will review and comment on this SHRMP. Final approval of this SHRMP by the Wilderness Committee and regulatory agencies indicates that the tools and techniques described in this SHRMP are satisfactory and conform to all applicable laws, regulations, and policies and that all restoration projects conducted in compliance with this SHRMP conform to NEPA and the Wilderness minimum requirement concept. Consistency with previous plans and NEPA documents does not eliminate the need for regulatory agency coordination and consultation on a project-specific basis, as such coordination is necessary to provide site-specific details for a given restoration project. The "programmatic approach" under which the SHRMP falls will greatly enhance the efficiency of the permitting process, since tiering-off of previous documents can reduce or eliminate redundant and duplicative analyses and effectively address cumulative effects (Modernizing NEPA Implementation: The NEPA Task Force Report to the Council on Environmental Quality Sept. 2003 p. 35).

On a project specific basis, ENP personnel will need to: (1) obtain the appropriate environmental permits, (2) comply with the provisions of applicable local, state, and federal policies and regulations, and (3) notify the appropriate organizations before conducting any restoration activities. ENP personnel should reference regulatory agency and Wilderness Committee approval of the SHRMP (including authorization of all tools/techniques) in the associated environmental permit applications. This will greatly enhance the efficiency of the permitting process.

5.1 ENP PERMITTING

Work, such as restoration of park resources, is consistent with the NPS Organic Act (16 U.S.C. Sec. 1 *et seq*.; Section 9.8) and the National Parks Omnibus Management Act of 1998 (P.L. 105-391). Most seagrass restoration projects within Florida Bay would be performed by the NPS or a contractor selected by the NPS. By developing the contract and selecting the contractor, the NPS would be permitting the project in accordance to the project scope of services or a scope of services approved by ENP. The NPS has established a Research Permit and Reporting System (RPRS). As part of the overall authorization and notification process, the selected contractor would need to complete a SFNRC permit application in the RPRS. Wilderness character is one of the components that must be addressed in the permit application package. Other components, typically developed during the damage assessment protocol, are also provided within the permit application. A copy of the permit application and all supporting documentation is also provided to the appropriate local, state and federal agencies.

It is possible that the responsible party may participate in a cooperative assessment and restoration project, whereby the responsible party takes accountability for assessing and restoring

the vessel-related damage with participation/oversight by ENP personnel. In the case of cooperative assessment, the responsible party would be responsible for obtaining all local, state, and federal permits, including an ENP permit. The decision to pursue a cooperative assessment, as well as the scope of the participation of the responsible party in damage assessment and restoration, rests with the PSRPA case team. The PSRPA case team consists of ENP RPCD and ERDAR personnel, along with attorneys assigned from the DOI Solicitor's Office. Decisions on cooperative agreements are made on a case-by-case basis and are influenced by a number of significant factors including:

- The willingness of the responsible party to participate and fund a cooperative assessment;
- The ability of the responsible party to participate in vessel damage assessment and restoration determination activities in a technically sound and timely manner;
- The willingness of the responsible party to be bound by the results of vessel damage assessment and restoration determination activities; and
- The actions of the responsible party in any previous damage assessment and restoration cases.

A cooperative assessment would need to be documented in a written cooperative participation agreement (e.g., Memorandum of Agreement). The agreement clearly specifies each party's rights and responsibilities and provides a mechanism for resolving disputes. Cooperative participation agreements need to provide the NPS with the ability to terminate the participation of the responsible party when that participation interferes with the performance of the PSRPA case team. It is important that cooperative participation agreements clearly state that funding or other assistance does not release the responsible party from applicable laws and regulations. The Solicitor's Office must review all cooperative agreements to ensure enforceability and protection of the rights of the government (NPS 2003).

5.2 LOCAL PERMITTING

The Monroe County Planning and Environmental Resources Department (MCPERD) requires an Environmental Resource Permit (ERP) for filling within Monroe County. The MCPERD has recently recommended changes in Policy 204.2.2 of the Monroe County 2010 Comprehensive Plan (MCGMD 1992) to allow permits for filling for seagrass restoration projects "with a valid public purpose that furthers the goals of the Monroe County Comprehensive Plan as determined by the Directors of Planning and Environmental Resources". This policy change does not indicate a permit process change or exemption but simply provides opportunities for seagrass restoration projects in Monroe County. Applications for an ERP will need to be prepared and submitted to the MCPERD on a site-specific basis. Material for filling prop scars and blow holes may come from upland sources and those sources may be located in surrounding counties. On a site-specific basis, ENP personnel or contractors will consult those aggregate mines or other sources during the planning process to obtain any necessary information to satisfy the permit requirements.

5.3 STATE PERMITTING

Under state law (section of Chapters 253, 373, and 403, Florida Statutes), Florida has jurisdiction over filling operations in, or connected to, waters of the state. For potential seagrass donor sites located within state waters, an ERP and water quality certification will be required from the Florida Department of Environmental Protection (FDEP). The ERP will also be reviewed for authorization for consent of use of state-owned submerged lands.

It may be appropriate to apply for a FDEP Conceptual Approval ERP (FAC 40E-4.305). Review of the Conceptual Approval ERP application would entail an agency review of the conceptual methodologies/techniques for seagrass habitat restoration within the Florida Bay that are presented in this SHRMP document. If issued, the Conceptual Approval ERP would likely contain a list of special conditions associated with defining project-specific and site-specific requirements that are not available during the conceptual phase. The Conceptual Approval ERP would be applicable for 10 years. Each individual restoration project would then be submitted on a project-specific basis as a separate ERP permit application under the conceptual permit. These individual permits would be applicable for five years.

Under Chapter 369 of the Florida Statutes, the harvest and transport of aquatic plants from state sovereign submerged lands are prohibited unless a permit is granted. When, and if, restoration actions require the collection and transplantation of seagrasses, an aquatic collection permit should be obtained from the FFWCC.

If archeological or historic sites are involved in a project, the SHPO in the Florida Division of Historic Resources will be contacted and coordination will occur.

5.3.1 Coastal Zone Management Consistency

When restoration actions affect the State of Florida coastal zone, ENP personnel will obtain consistency certification under the CZMA (16 U.S.C. Sec. 1451 *et seq*.). The CZMA requires that federal actions affecting land/water use or natural resources within the coastal zone must be consistent with the state's coastal management program. Consistency certification will be obtained through a consistency review of this document and through a State ERP review. ERP review, which includes Florida Coastal Management Program agency review and approval of the Clean Water Act water quality certification, may constitute a consistency determination by the State of Florida. If an application for a Conceptual Approval ERP is submitted, the FDEP would review the proposed conceptual methodologies/techniques for seagrass habitat restoration within the Florida Bay for consistency with the CZMA.

5.4 FEDERAL PERMITTING

A federal permit will be required from the U.S. Army Corps of Engineers (USACE) under the Clean Water Act (33 U.S.C. Sec. 1251 *et seq*.). Primary or compensatory mitigation projects to restore seagrass in Florida Bay would more than likely qualify for permission from the USACE under a Nationwide Permit (NWP). NWP 32 applies to "Completed Enforcement Actions – any structure, work, or discharge of dredged or fill material remaining in place or undertaken for mitigation, restoration, or environmental benefit…provided that the action affects no more than 5

acres of non-tidal waters or 1 acre of tidal waters." NWP 27 applies to "Aquatic Habitat Restoration, Establishment, and Enhancement Activities - activities in waters of the United States associated with…the rehabilitation or enhancement of tidal streams, tidal wetlands, and tidal open water, provided those activities result in net increases in aquatic resource functions and services." The SHRMP will be submitted to the USACE, requesting that USACE review the plan for concurrence with NWP 32 or 27. The most recent NWPs were issued on March 19, 2012 and will expire five years from the date of issuance (March 18, 2017).

As previously discussed, this SHRMP, once approved by regulatory agencies and the Wilderness Committee, will represent an agency action as all tools/techniques described in this SHRMP will be authorized. The NWPs also represent a final agency action where compliance with the NWP conditions represents compliance with all Federal laws and regulations. Coordination and consultation with the USACE will still occur on a project-specific basis to provide site-specific details and to address any issues listed in the following sections.

5.4.1 Endangered Species Act

Standard measures for the protection of threatened and endangered species (Section 6.2.2) will be adhered to during all in-water construction projects, including restoration projects. The tools and techniques proposed in this SHRMP ***may affect, but are not likely to adversely affect*** threatened and endangered species within Florida Bay (Section 1.1.7.1). Therefore, consultation with the USFWS under Section 7 of the ESA (16 U.S.C. Sec. 1536) is not anticipated for this SHRMP. However, if ENP personnel determine that site-specific restoration actions may adversely affect listed endangered or threatened species, consultation will be conducted pursuant to Section 7. All rules and penalties governing this act will apply**.**

5.4.2 Magnuson-Stevens Act

As described in Section 1.1.8, the Magnuson-Stevens Act requires that the regional Fishery Management Councils identify EFH. Federal agencies are required to consult with the NMFS Habitat Conservation Division and the NMFS Protected Resource Division when any activity proposed to be permitted, funded, or undertaken may have adverse effects on EFH and/or marine species protected under the ESA and MMPA. The tools and techniques proposed in this SHRMP ***may affect, but are not likely to adversely affect*** EFH and marine species within Florida Bay. Coordination with both the NMFS Habitat Conservation Division and NMFS Protected Resource Division would occur on a project-specific basis. Formal consultation is not required when a federal agency determines that adverse impacts to EFH will not occur. NFMS consultation would be necessary if restoration activities that result in the conversion of one habitat type to another (e.g. hardbottom to seagrass) when both types are designated as EFH, since such an action would result in a permanent adverse impact on the original EFH type.