FINAL DAMAGE ASSESSMENT AND RESTORATION PLAN
and
NEPA EVALUATION
for the
FEBRUARY 5, 2010,
M/V VOGETRADER GROUNDING
at
KALAELOA, BARBERS POINT, OAHU

Prepared by:
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for the *M/V Vogetrader* Grounding, Oahu Hawaii

U.S. Department of Commerce
National Oceanic and Atmospheric Administration

State of Hawaii
Department of Land and Natural Resources

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1.0 BACKGROUND

1.1 INTRODUCTION

On February 5, 2010, the 733-foot coal carrier *M/V Vogetrader* (*Vogetrader*) ran aground on coral reef habitat outside the entrance channel to Barbers Point Harbor, Oahu, Hawaii (Figure 1). The vessel was owned and/or operated by Denak Ship Management and Vogetrader Shipping, Inc. (the Responsible Parties or "RPs"). The United States Coast Guard, State of Hawaii, and the RPs developed a Salvage Plan and coordinated with oil spill response personnel due to a substantial threat of a discharge of oil as the result of the grounding. The *Vogetrader* was ultimately removed from the reef habitat on the day of the grounding; however, physical injuries to coral reef habitat and associated resources resulting from response activities occurred.

Figure 1. Map showing the grounding site for the *Vogetrader*.

On February 9, 2010, a team of biologists from the National Oceanic and Atmospheric Administration (NOAA) and the Hawaii Department of Land and Natural Resources (DLNR) (collectively "Trustees" or "Natural Resource Trustees"), and the RPs began assessment activities, collecting direct physical evidence, photo documentation, area measurements and recording observations to determine whether physical injury to natural resources, including coral reef habitat and its associated community, had occurred as a result of the grounding and response operations. The collective evidence and observations from the these activities confirmed that physical injury to coral reef habitats and resources resulting from the *Vogetrader* removal and response activities was substantial. The injuries to natural resources in the area included, but were not limited to, pulverized coral, sheared, shattered and overturned corals, scarring and limestone pavement fractures, and a large portion of reef structure gouged out of the overall framework. The Trustees determined that additional actions to quantify and further document injury were necessary.

The Trustees conducted preassessment surveys on February 9, 2010, and continued damage assessment quantification efforts for 17 days between March 3 and May 7, 2010. The Trustees focused solely on measuring injured corals. The Trustees estimated that injuries to habitat and resources occurred across 3,478 square meters (m^2) (0.86 acres) of coral reef habitat. Six habitat zones sustained coral injuries as a result of the grounding and response actions (e.g., removal of the vessel and movement of incident-generated rubble). The estimated injuries included the injury and/or loss of over 100,000 corals, ranging in size from millimeters to linear diameters exceeding 80 centimeters (cm) (31 in). Eighty-nine percent of these corals were < 10 cm in longest linear dimension.

The Trustees, with the RPs' cooperation, evaluated the injury site during negotiation efforts and determined that the rubble generated from the vessel hull and removal efforts was posing a risk to nearby coral habitat, as well as prohibiting new coral recruits from settling in the area; effectively keeping the grounding site from recovering naturally. On December 12, 2013, with the concurrence of the Trustees, the RP conducted emergency restoration to prevent the initial injury from becoming worse. Specifically, the RP removed grounding related rubble and reattached loose corals in the area. An estimated 354 cubic meters (466 cubic yards) of rubble was removed from the site over the course of three weeks. After the rubble was removed, 643 coral colonies were reattached from nearby areas.

1.2 PURPOSE AND NEED

Purpose. The Trustees propose to develop and implement ecological restoration projects intended to benefit coral resources and associated habitats. The purpose of the proposed action is to restore injured resources impacted by the Incident and to compensate the public for interim losses (ecological losses from the time of the injury until full recovery) to the coral ecosystems of Oahu.

Need. This action is necessary because there were significant injuries to the public's natural resources caused by the grounding. There is also a period from the time of injury (and from the completion of emergency restoration) until full recovery, when the natural resources will suffer from a diminished level of ecological services. In the absence of ecological restoration, as proposed here, resources would remain injured longer, and the public would remain uncompensated for interim losses.

This Damage Assessment and Restoration Plan and NEPA Evaluation (DARP/NE) describes the incident and provides summarized information regarding (1) the environmental consequences of the grounding of the *Vogetrader* and the subsequent response activities (collectively "the Incident"), including the affected environment, (2) the determination and quantification of natural resource injuries, and (3) proposed natural resource restoration alternatives to address those injuries. This document also describes the Federal Trustees' compliance with the National Environmental Policy Act (NEPA) and Title 19, Chapter 343, of the Hawaii Revised Statutes (see Section 5.0 for additional information).

1.3 NATURAL RESOURCE TRUSTEES AND AUTHORITIES

The DARP/NE has been prepared by the National Oceanic and Atmospheric Administration (NOAA), on behalf of the U.S. Department of Commerce, and the Department of Land and Natural Resources (DLNR), on behalf of the State of Hawaii as a cooperating agency. U.S. Fish and Wildlife Service has been involved by giving input to the trustee agencies (NOAA and the State DLNR) but has not been an active member of the trustee group.

Both of these agencies act as a Natural Resource Trustees pursuant to the Oil Pollution Act of 1990 (OPA), 33 U.S.C. §§ 2701 *et seq.*), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. § 300.600, Executive Order (EO) 12777, 56 Fed. Reg. 54757 (Oct. 18, 1991) and Haw. Rev. Stat., Title 10, Ch. 128D. As a designated Trustee, each agency is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore natural resources and resource services injured or lost as the result of a discharge, or substantial threat of a discharge, of oil. The Trustees designated NOAA as Lead Administrative Trustee (LAT) (15 C.F.R. § 990.14(a)).

1.4 OVERVIEW OF KEY LEGAL AUTHORITIES

1.4.1 OIL POLLUTION ACT OF 1990 & ITS IMPLEMENTING REGULATIONS

Under OPA, trustees can recover the cost of: primary restoration, which is any action, including natural recovery, that returns injured natural resources and services to baseline; compensatory restoration, which is any action taken to compensate for interim losses of natural resources and services that occur from the date of the incident until recovery; and reasonable assessment costs.

OPA defines natural resources to include "land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the exclusive economic zone), any State or local government or Indian tribe…." 33 U.S.C. § 2701(20); see also15 C.F.R. § 990.30.[1]

[1] The OPA regulations define natural resource services as "functions performed by a natural resource for the benefit of another natural resource and/or the public." 15 C.F.R. § 990.30. Examples of natural resource services include shelter for other species; food; recreation for humans such as diving or bird viewing.

As described in the OPA Natural Resource Damages Assessment regulations (OPA regulations), a natural resource damage assessment (NRDA) consists of three phases – preassessment, restoration planning, and restoration implementation.

The preassessment is an information gathering phase, during which the trustees determine whether they have jurisdiction to pursue restoration under OPA, and if so, whether it is appropriate to do so. Specifically, before initiating an NRDA, the trustees must determine that:

- an incident has occurred;
- the incident is not from a public vessel;
- the incident is not from an onshore facility subject to the Trans-Alaska Pipeline Authority Act;
- the incident is not permitted under federal, state or local law; and
- public trust natural resources and/or services[1] may have been injured as a result of the incident.

Id. at § 990.41(a).

If, based on information collected during the preassessment phase, the trustees make a preliminary determination that the conditions listed above are met, they will coordinate with response agencies (*e.g*., the USCG) to determine whether the oil spill response actions will eliminate the injury or the threat of injury to natural resources. If injuries are expected to continue and feasible restoration alternatives exist to address such injuries, the trustees may proceed with the restoration planning phase. Restoration planning also may be necessary if injuries are not expected to continue, but are nevertheless suspected to have resulted in interim losses of natural resources and/or services from the time of the incident until the time the resources recover.

The purpose of the restoration planning phase is to evaluate the potential injuries to natural resources and services and to use that information to determine the need for and scale of associated restoration actions. This phase provides the link between injury and restoration and has two basic components – injury assessment and restoration selection. The goal of injury assessment is to determine the nature and extent of injuries to natural resources and services, thus providing a factual basis for evaluating the need for, type of, and scale of restoration actions. As the injury assessment is completed, the trustees develop a plan for restoring the injured natural resources and services. The trustees must identify a reasonable range of restoration alternatives, evaluate them, select the preferred alternative(s), develop a draft restoration plan presenting the alternative(s) to the public, solicit public comment on the draft restoration plan, and consider those public comments when drafting the final restoration plan.

Trustees may settle claims for natural resource damages under OPA at any time during the damage assessment process, provided that the settlement is adequate in the judgment of the trustees to satisfy the goals of OPA. The trustees should give particular consideration to the adequacy of the settlement to restore, replace, rehabilitate, or acquire the equivalent of the injured natural resources and services. Such settlements must be approved by a court as fair, reasonable, and in the public interest. Sums recovered in settlement of such claims, other than reimbursement of trustees' assessment costs, may only be expended in accordance with a restoration plan, which will be made available for public review.

In this case, the Trustees entered into a legal settlement with the RPs after the completion of the emergency restoration and the injury assessment. Because specific restoration had not yet been formally selected, the settlement amount was calculated to be sufficient to undertake restoration under various circumstances. The damages collected as a result of this settlement will be used to fund the project selected during the Trustees' restoration planning process (which is culminated in the approval and release of this Final DARP/NE).

1.4.2 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

While OPA and its implementing regulations provide the underpinnings for the Trustees' proposed restoration actions, another statute plays a critical role – NEPA, 42 U.S.C. §§ 4321, *et seq.* Congress enacted NEPA in 1969 to establish a national policy for the protection of the environment. NEPA requires an evaluation of potential environmental impacts that may arise from federal actions. The Act establishes the Council on Environmental Quality (CEQ) to advise the President and to carry out certain other responsibilities relating to the implementation of NEPA by federal agencies.

Generally, when it is uncertain whether an action will have a significant effect on the quality of the human environment, federal agencies will begin the NEPA planning process by preparing an Environmental Assessment (EA). Depending on whether an impact is considered significant, the federal agency will either develop an environmental impact statement (EIS) or issue a finding of no significant impact (FONSI).

1.4.3 RELATIONSHIP BETWEEN NRDA AND NEPA

NEPA applies to restoration actions undertaken by federal natural resource trustees. The Natural Resource Trustees for the Incident are integrating the OPA and NEPA processes in this DARP/NE. This integrated process allows the Trustees to meet the public involvement requirements of both statutes concurrently. This integrated process is recommended under 40 C.F.R. § 1500.2(c), which provides that federal agencies should "integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively."

This document serves, in part, as the Federal agencies' compliance with the National Environmental Policy Act (NEPA) and Title 19, Chapter 343, of the Hawaii Revised Statutes (see Section 5.0 for additional information). This DARP/NE complies with NEPA by (1) describing the purpose and need for restoration action in Section 1.2, "Purpose and Need"; (2) summarizing the current environmental setting in Section 2.0, "Affected Environment"; (3) identifying alternative actions and analyzing potential effects in Section 5.0, "Restoration Planning"; and (4) addressing the public participation requirements in Section 1.6, "Public Participation".

In this case, NOAA, the participating Federal trustee proposes to satisfy its NEPA obligations by applying the impacts analysis and conclusions drawn in another, previously published programmatic NEPA document. This is discussed further in Section 5.5. In addition to the proposed alternative, the public was invited to provide feedback on NOAA's approach to the impacts analysis in this case.

1.5 COORDINATION WITH THE RESPONSIBLE PARTY

The OPA regulations direct trustees to invite the RP to participate in the damage assessment and restoration process. Although the RP may contribute to the process in many ways, final authority to make determinations regarding injury and restoration rests solely with the trustees.

In this case, the Trustees and RP started informal cooperative assessment activities on February 9, 2010, when they began collection of direct physical evidence, photo documentation, area measurements and recorded observations, to determine whether physical injury to natural resources, including coral reef habitat and its associated community, had occurred as a result of the grounding and response operations. The Trustees conducted initial injury quantification between March and June, 2010. The RPs were informed of the effort and sent a statement of work for which they agreed to pay.

In 2013, the RPs and the Trustees jointly implemented emergency restoration activities to avoid irreversible losses and continuing danger to the coral reef benthic community. On December 12, 2013, the RPs contracted Cates Intl. to remove the vessel generated rubble and reattach loose corals in the area. An estimated 354 cubic meters (466 cubic yards) of rubble was removed from the site over the course of three weeks. This volume of rubble was estimated at 700 metric tons (close to 1.5 million pounds). After the rubble was removed the RP, their contractor, and the Trustees worked together to reattach 643 coral colonies into the denuded areas.

Thereafter, the Trustees and the RP continued to gather and analyze data and to exchange their interpretations of those data. Ultimately, they reached agreement on damages that the Trustees determined to be sufficient to compensate the public for the resources that had been injured as a result of the Incident.

1.6 PUBLIC PARTICIPATION

On February 17, 2015, the Consent Decree, representing the formal legal settlement of the case, was filed in the United States District Court, District of Hawaii. There was a 30-day public comment period between the filing and subsequent review of the consent decree. No comments were received.

Public review of the DARP/NE is an integral component of the restoration planning process. Through the process of public review, the Trustees sought public comment on the alternatives being considered to restore injured natural resources or replace services provided by those resources. The public was also given the opportunity to provide feedback on NOAA's NEPA analysis. In preparing the final restoration plan, the Trustees reviews and considers all comments received during the public comment period.

Public comment was solicited in a number of ways. A notice of availability for comment on the Draft DARP/NE was published in the local newspaper on October 9, 2017. This notice included links to the NOAA Damage Assessment, Remediation, and Restoration Program (DARRP) website's Vogetrader case page (*https://darrp.noaa.gov/ship-groundings/mv-vogetrader*) hosting the full restoration plan as well as a mailing address, an email address, and a phone number to receive both written and verbal comments. The notice and case page also advertised a public meeting that was held on October 20, 2017 at the University of Hawaii at Manoa, Holmes Hall to receive comments from the community.

No comments were received via letter, email, or phone call. No one attended the public meeting. The public comment period was open from October 9, 2017 to November 15, 2017.

1.7 ADMINISTRATIVE RECORD

The Trustees have compiled an administrative record, which contains documents considered or prepared by the Trustees as they have planned and implemented the NRDA and address restoration and compensation issues and decisions. The administrative record is available online at:

https://casedocuments.darrp.noaa.gov/southwest/vogetrader/admin.html.

Although the record may be updated, it presently contains the information that the Trustees relied upon to make the decisions described in the DARP/NE. The administrative record facilitates public participation in the assessment process.

This DARP/NE may also be viewed and downloaded at the website mentioned above.

1.8 SUMMARY OF THE NATURAL RESOURCE DAMAGE CLAIM

The NRDA damage claim for the Incident encompasses primary and compensatory restoration actions for injuries and potential injuries to the following natural resources and services:

- Coral colonies
- Three dimensional reef structure
- Reef habitat
- Marine fish
- Marine Invertebrates
- Marine algal communities

Primary restoration - i.e., actions taken to recover natural resources back to baseline or "before injury" status, was conducted (as emergency restoration) at the *Vogetrader* injury site in the form of rubble removal and coral reattachment. At this point, the Trustees propose that the remainder of the primary restoration be achieved through natural recovery.

The preferred compensatory restoration actions are to develop and implement coral nurseries that will salvage at risk corals and allow for reattachment at injured or impacted sites.

See Section 5.0 for a discussion of these restoration actions.

2.0 AFFECTED ENVIRONMENT

The purpose of this section is to provide a general description of the environment encompassing the geographic area where the incident occurred, where the Trustees conducted assessment activities related to the incident, and where the Trustees propose to conduct restoration.

2.1 GENERAL DESCRIPTION

While coral reefs are dynamic and highly variable environments, they do share certain qualities that are somewhat universal to a general coral reef. This Final DARP/NE incorporates by reference the affected environment description of coral reefs within NOAA's Programmatic Environmental Impact Statement for habitat restoration activities implemented throughout the coastal United States (RC-PEIS), published in 2015. The RC-PEIS addresses many types of restoration activities within the coastal U.S., and its use to satisfy NOAA's NEPA obligations for this DARP/NE is discussed further in Section 5.5 below.

Generally, the RC-PEIS describes coral reefs as among the most productive of marine ecosystems and critically important for the ecosystem services they provide. These services include providing habitat and food for thousands of species of fish, shellfish, and other marine life. In addition to their exceptionally important ecological role, coral reefs also provide numerous human use values. These include, but are not limited to: shoreline protection (through dissipation of wave energy); habitat for reef and pelagic fish species (re: human food/subsistence); diving, snorkeling, and other recreational opportunities and associated economic benefits; and potential medicinal uses. For a more detailed discussion of the affected environmental in and around coral reefs, the reader may refer to Section 3.0 of the RC-PEIS.

2.2 SPECIFIC DESCRIPTION

This section describes, for context, certain attributes of the affected environment specific to the Incident location. The island of Oahu is located at roughly 21° 18' North Latitude and 158° 04' West Longitude between the islands of Kauai and Molokai along the Main Hawaiian Islands chain. The island is approximately 1572 km^2 (607 square miles) in area. See Figure 2 below.

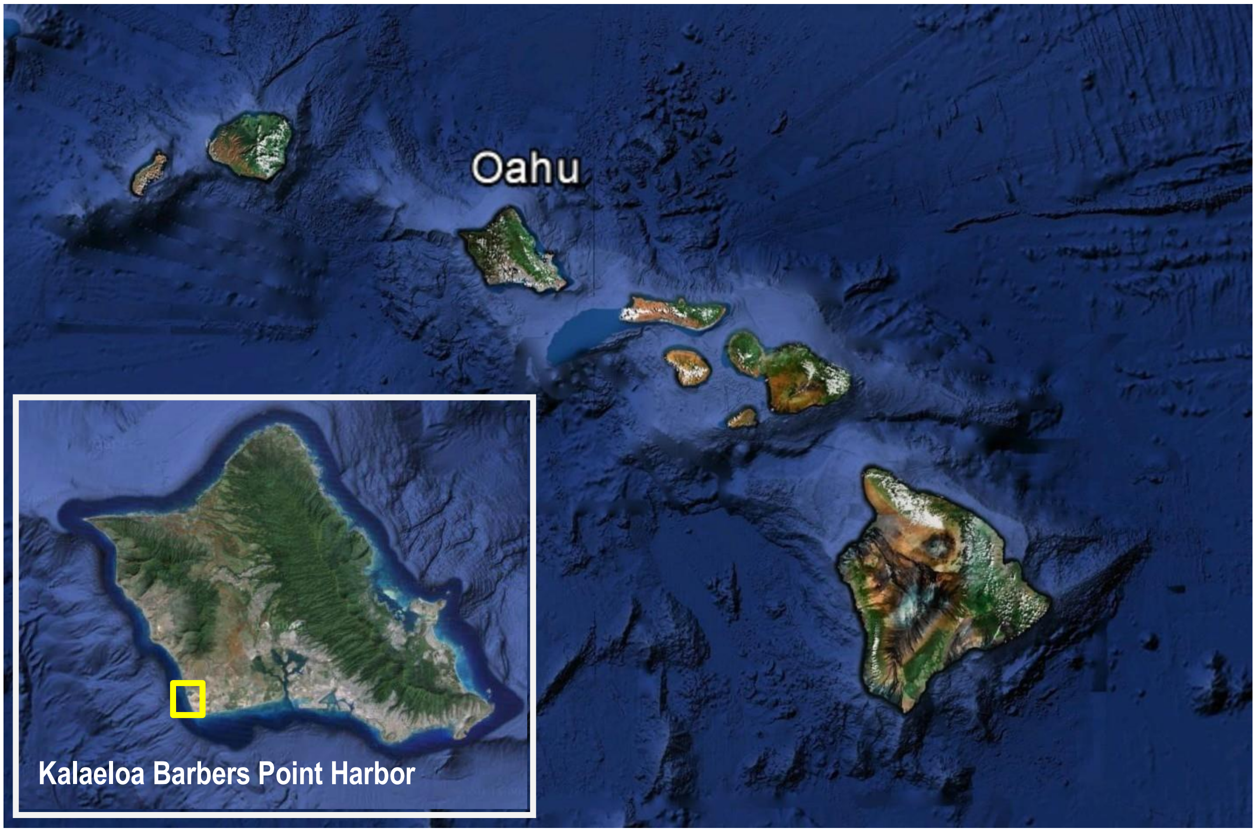

Figure 2. Map of the main Hawaiian Island chain, with the island of Oahu labeled and incident area shown.

The *Vogetrader* ran aground on the southwest shore of Oahu, Hawaii on a shallow water reef near the edge of southern edge of the entrance channel to Kalaeloa Barbers Point Harbor/Ko Olina Marina. The essentially ran over the outer red channel marker buoy and came to rest roughly 50 m northeast of the buoy. Kalaeloa Barbers Point is located on the southwest (leeward) side of Oahu approximately 32 km (20 miles) west of the city of Honolulu. The entrance channel services both the Ko Olina Marina, part of Ko Olina Resorts and Hotel to the north, as well as the Kalaeloa Barbers Point Harbor and Campbell Industrial Park to the south.

The Ko Olina Marina is a man-made basin created from excavating inland and later connecting to the ocean via the Kalaeloa Barbers Point deep draft harbor channel. The marina is roughly 18 hectares (44 acres) and is operated by the neighboring Ko Olina Resort and Marina. The marina has 330 full service slips and can accommodate large vessels up to 60 m (200 ft.) long with a draft of up to 4 m (13 ft.) (AECOS, 2010).

Kalaeloa Barbers Point deep draft harbor, to the south of the entrance channel, is approximately 58 ha (144 acres). The State of Hawaii's Harbors Division is the port authority for Kalaeloa Barbers Point Harbor. Kalaeloa Barbers Point Harbor contains several specialized cargo-handling facilities that are not available in nearby Honolulu Harbor. This commercial harbor services the adjacent Campbell Industrial Park, which houses a refinery, cement plant, as well as other industrial ventures.

As with the definition of ecosystem, the depth to which the shallow reef is defined is subjective. For this DARP/NE, the ecosystem is defined as all waters to a depth of 50 feet (ft.). Because reef-building corals have a symbiotic relationship with microalgae that allows them to grow and thrive in the nutrient-poor waters of the tropics, these reefs have a depth limit based on the penetration of sunlight into the water column. Generally, coral reefs grow in water less than 30 m (98 ft.) (Grigg and Epp 1989); although, non-reef-building corals are able to grow in much deeper waters (Maragos and Jokiel 1986; Veron 1986). In addition, there is a much better understanding of the shallow reef, as most coral reef assessment and monitoring are done in waters shallower than 30 m (Maragos *et al*. 2004).

The shallow reef is a dynamic environment, experiencing constant wave surges and powerful winter and summer storms. Tropical storms and hurricanes can generate extreme wave energy that can damage shallow coral reef habitat. These events are the primary natural force in altering and shaping coral reef community structure (Dollar 1982; Dollar and Grigg 2004). They represent potential, but infrequent, natural threats to the shallow coral reef ecosystems of Hawaii. There is a growing concern that global warming and the concurrent acidification of the ocean may cause drastic changes to corals in the coming century (Hoegh-Guldberg 1999). Acidification, caused by increased levels of CO2 in the ocean, inhibits the deposition of calcium carbonate, the primary component of the coral skeleton (Kleypas *et al*. 2006).

The marine reef environment in this area is characterized by a limestone shoreline with an associated wave cut bench. Seaward of this bench, the bottom is characterized by a broad submerged reef platform spanning more than 1220 m (4000 ft.) in width in some areas. This reef platform ranges between 9-15 m (30 to 50 ft.) in depth and gives way to a slope that descends steeply to depths of 18-24 m (60 to 80 ft.) and deeper. In some areas, this slope gives way to ledges and near vertical drop-offs (Bienfang and Brock, 1980). The reef habitat and coral species display distinct zonation patterns with depth and distance from shore.

The shoreline in the area consists of limestone rock that gives way to a wave cut bench in the intertidal zone. This feature is covered with a narrow strip of calcium carbonate beach in some areas with narrow dunes shoreward (AECOS, 1991). This limestone face makes direct access to the ocean difficult but does support recreational angling near the harbor entrance channel. The wave cut bench environment supports several species of algae as well as the black rock boring urchin *Echinometra oblonga*. (AECOS, 1991). The notable higher densities of fleshy algae along this wave cut bench are attributed to high light levels, protection from herbivorous fish (due to the bench's intertidal nature),and increased access to nutrients from groundwater percolating through the porous limestone strata (McDermid, 1988; AECOS, 1991). Fish abundance and diversity are low in this area and consist mostly of members of two families, the Gobiidae and Blennidae (Parry, pers obs).

Directly offshore, the limestone bottom is characterized by surge channels perpendicular to shore, scour holes, and pockets of sand (AECOS, 1991b; Brock 1987). This zone is roughly 2-5 m (6 to 15 ft.) deep and extends 30-90 m (100 to 300 ft.) from shore in places (Bienfang and Brock 1980). This high wave energy habitat zone supports several types of lower growth forms of coral such as *Porites lobata* and thicker forms of branching species like *Pocillopora meandrina* (AECOS, 1991b). Sea urchins such as *Echinometra mathei* (pale rock boring urchin), *E. oblonga*, and *Heterocentrotus mammillatus* (slate pencil urchin) are present, and algae species in the area are fairly numerous and diverse (see Brock, 1987). Due to the relative lack of three dimensional habitat, fish abundance and diversity are low. Representative species include *Abudefduf abdominalis* (sergeant major) and *Cantherhines dumerilii* (barred filefish) as well as others (USFWS, 2007).

Seaward of this low relief inshore area, roughly 90-900 m (300 to 3000 ft.) or more from shore and 5-9 m (15 to 30 ft.) of water, the overall habitat complexity increases. This area is characterized by high vertical relief and high coral cover (Bienfang and Brock, 1980). Large lobate forms of coral such as *Porites lobata* are common with uniquely large colonies being present. Large colonies of *P. lobata* (2-3m (6 to 10 ft.) in diameter) have been reported in this area (AECOS, 1985 and 1991). Other common coral species include *Pocillopora meandrina* as well as various *Montipora* sp. Sea urchins such as *Tripneustes gratilla* (collector urchin), *Echinothrix diadema* (blue black urchin), *Echinometra mathaei* (pale rock boring urchin) and *Echinostrephus aciculatum*((needle spine urchin) also are present. Common fish species found in this area include the surgeonfishes *Acanthurus nigrofuscus* (brown surgeonfish), *Ctenochaetus strigosus* (spotted surgeonfish), as well as the wrasse *Thalassoma duperrey* (saddle wrasse) (AECOS, 1991; USFWS, 2007).

Further offshore, roughly 900-1100 m (3000 to 3500 ft.) from land and 9-12 m (30 to 40 ft.) deep, the bottom is characterized by low relief and lower coral cover. The habitat consists of flat hard "table-like" bottom with numerous shallow (2-6 m, 5 to 10 ft.) deep rubble filled depressions (AECOS, 1991; Bienfang and Brock, 1980; Kolinski *et al*., 2007). Coral species in the area consist predominantly of *Porites lobata*, which are found at highest densities on the edges of the depressions. *Chelonia mydas* (green sea turtle) are common in the area as are *Stenella longirostris* (Hawaiian spinner dolphin), although the dolphins appear to mostly transit through the area. *Echinometra mathaei* (pale rock boring urchin) are found in the area, and juvenile fishes are concentrated around and within the depressions.

The "table-like" formation gradually slopes offshore to depths of roughly 15 m (50 ft.) where coral abundances increase on the edge of a rapidly sloping bottom feature. The top edge of this slope supports higher coral abundances and species than the inshore flat section. Corals in the areas include *Pocillopora meandrina, P. eydouxi, Montipora* sp., as well as *Porites lobata* and others (Kolinski *et al*., 2007). Urchin diversity increases in this zone as well with *Tripneustes gratilla*, *Echinothrix diadema, Echinometra mathaei* and *Echinostrephus aciculatum* all present in the area.

The limestone shelf (which includes all the previously discussed habitats) transitions roughly 4000 ft. offshore into ledges and drop-offs that descend steeply to depths of 25 m (80 ft.) or more. The slope terminates at a bottom of sand and scattered rubble with isolated coral and limestone outcrops (Kimmerer and Durbin, 1975). Coral is predominantly *Porites lobata* and *Montipora* sp. Sand areas appear to be fairly heavily colonized by *Halophila decipiens* (seagrass that is a known forage species for Hawaiian Green sea turtles, *Chelonia mydas*; Russell *et al*., 2003), *Caulerpa* sp. (a green algae), and the non-indigenous algae *Avrainvillea amadelpha* (mud weed) (Kolinski *et al*., 2007). The sand rubble habitat slopes offshore into deeper waters and transitions out of the near shore reef habitat into deeper waters (greater than 30 m, 100 ft.).

3.0 INJURY DETERMINATION AND QUANTIFICATION

3.1 DESCRIPTION OF THE GROUNDING AND RESPONSE ACTIVITIES

On February 5, 2010, the *Vogetrader* grounded on coral reef habitat while attempting to enter the channel to Barbers Point Harbor (Figure 3).

Figure 3. Aerial photos showing the *Vogetrader* hard aground on near shore coral reef habitat along the edge of the entrance channel. The areas of light colored water adjacent to the ship represent suspended reef material that has been crushed and turned into powder by the vessel hull. The *Vogetrader* (renamed the *Denak Trader* in 2012) is a bulk carrier that is 734 ft. (224 m) long with a beam of 104 ft. (32 m) and a draft of 39 ft. (12 m) deep. The vessel was laden with 27,000 metric tons of bulk cement powder (USCG incident report) when it ran aground.

The vessel hit the edge of the channel and grounded on reef habitat along the southern edge of the channel. Before running aground the vessel hull passed over the channel marker buoy crushing its mooring block and scraping areas of reef flat as the bow proceeded to dig into the channel edge (Figure 4).

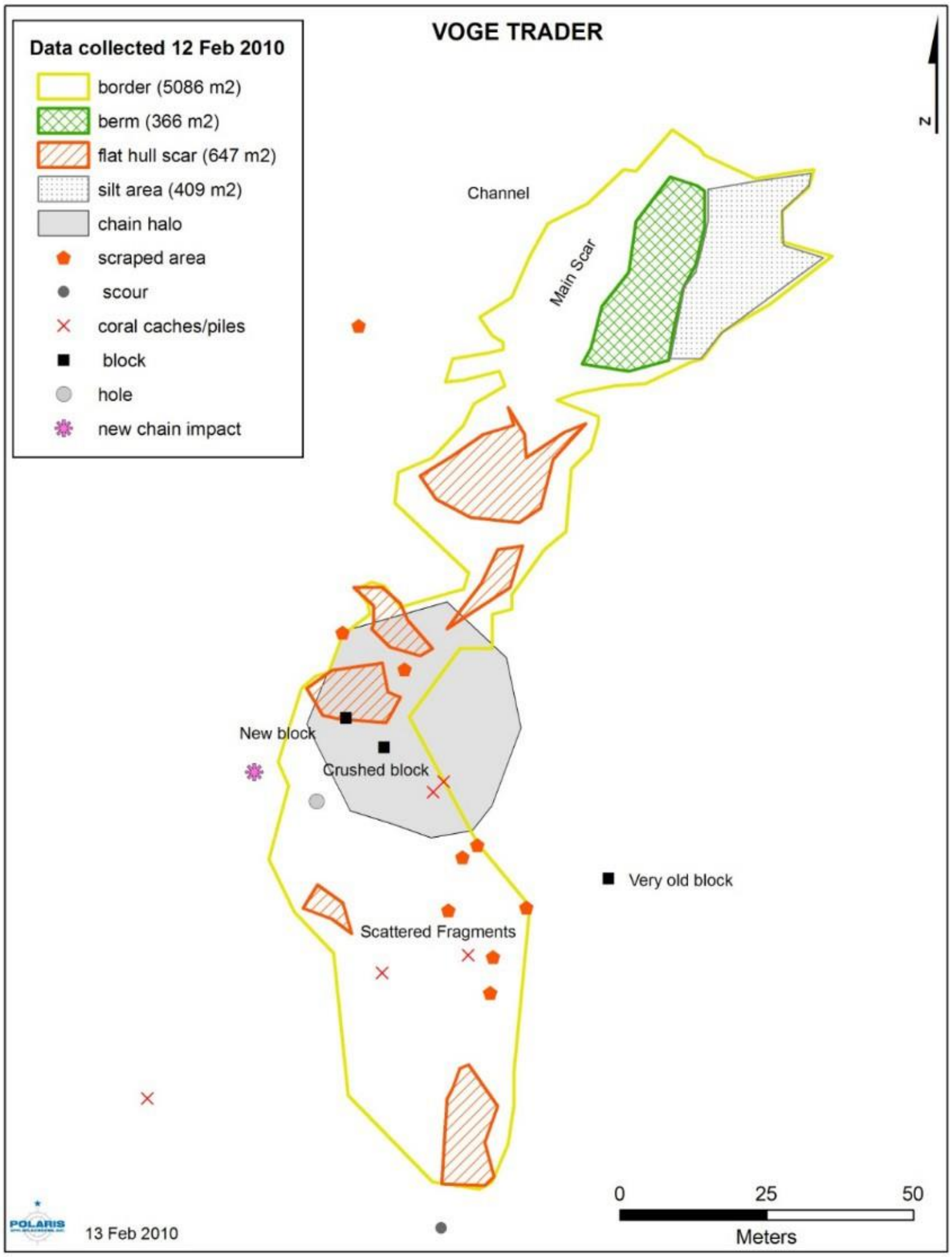

Figure 4. Map of the vessel impacts showing the different types of injury that occurred during the grounding.

As the bow excavated a section of reef habitat on the edge of the channel, it pushed ground up reef structure into a berm on the northeast side of the injury (Figures 4 and 5).

Figure 5. Photo showing the large berm of crushed coral and coral substrate.

The stern of the vessel was not aground and remained partially in the channel creating a hazard to navigation to other deep draft vessels. A response team from U.S. Coast Guard Sector Honolulu, consisting of two marine inspectors and four marine investigators, conducted an initial damage survey, casualty investigation, and coordinated salvage operations. Four tugs were on scene and had made numerous attempts to pull the vessel free but ultimately were used for assistance and to help prevent the *Vogetrader's* stern from swinging into shallower water.

Efforts to free the *Vogetrader* from the site of the grounding were initially unsuccessful. As part of the salvage operation, the vessel shifted ballast to the aft port side, which affectively reduced the draft on the starboard bow. During the next flood tide, the vessel was refloated and was towed to deeper water by the assist tugs. Once offshore, the *Vogetrader* proceeded under her own power to the Honolulu Anchorages.

3.2 PREASSESSMENT APPROACH

There are three pre-conditions set forth in the OPA regulations before restoration planning can proceed:

1. *INJURIES HAVE RESULTED, OR ARE LIKELY TO RESULT, FROM THE INCIDENT OR RESPONSE TO THE INCIDENT;*

2. *RESPONSE ACTIONS HAVE NOT ADEQUATELY ADDRESSED, OR ARE NOT EXPECTED TO ADDRESS, THE INJURIES RESULTING FROM THE INCIDENT; AND*

3. *FEASIBLE PRIMARY AND/OR COMPENSATORY RESTORATION ACTIONS EXIST TO ADDRESS THE POTENTIAL INJURIES.*

The goal of injury preassessment under OPA is to determine the jurisdiction of the trustees, determine that the incident is not excluded from coverage of the law under another authority, and to determine whether resources under trusteeship may have been, or may be, injured as a result of the incident. 15 C.F.R. § 990.40. Injury determination begins with the identification and selection of potential injuries to investigate given the nature and scope of the incident. The large scale of this Incident, coupled with little precise information on where response and recovery operations took place around the vessel, required that the preassessment be relatively comprehensive in nature.

3.3 SUMMARY OF PREASSESSMENT ACTIVITIES

The Trustees and the RP biologists, Polaris Applied Sciences, Inc., began cooperative pre-assessment evaluations on February 9, 2010. They collected direct physical evidence, photo documentation, area measurements and recorded observations, to determine whether physical injury to natural resources, including coral reef habitat and its associated community, had occurred as a result of the grounding and response operations. The collective evidence and observations from the these activities confirmed that physical injury to coral reef habitats and resources resulting from the *Vogetrader* response activities was substantial. Based on the results of this preassessment work, the Trustees and RP determined that additional actions to quantify and further document injury were necessary.

3.4 ASSESSMENT APPROACH AND RESULTS[2]

The Trustees conducted assessment activities between March 3 and May 7, 2010.[3]

The Trustees designed the assessment to ascertain gross impacts to scleractinian corals and reef framework using simple, robust, and cost effective procedures. The data also serve as baseline for defining injury as it relates to natural temporal community trends and for monitoring further site degradation and/or recovery. Relevant information on community

[2] For a detailed description of the assessment activities and the results, see the Administrative Record at *https://casedocuments.darrp.noaa.gov/southwest/vogetrader/admin.html.*
[3] Although the Trustees invited RP representatives to participate in the assessment, they declined.

structure prior to the grounding was not available. The Trustees based the assessment on community comparisons between impact and reference habitats. They designated six sub-habitat zones to represent the full variability of the area and the different species assemblages found therein.

3.4.1 GENERAL METHODS

To measure the injury, indirect comparisons of coral community size and composition between impact and nearby reference areas were mostly used as the means of estimating incident related injury. Measurements of the coral community were made within each individual scar/fragment area and in adjacent non-impact areas within a distance typically no greater than the longest scar/fragment zone dimension. Scar communities were measured either through complete census or one or more subsamples. Between one and five reference measures were made in proximity to each scar/injury area. Sample sizes ranged between 0.5 and 7 m^2 (specific to the size of an associated scar). In each sample, live attached coral colonies and fragments were identified to species, counted, and categorized by longest linear dimension within the following size categories: < 2 cm; 2 to < 5 cm; 5 to < 10 cm; 10 to < 20 cm; 20 to < 40 cm; 40 to < 80 cm and ≥ 80 cm. Sites for sampling were selected haphazardly in adjoining impact and non-impact areas (small scars) or randomly along haphazardly placed transect lines (larger scars/fragment zones and associated reference areas). In the reef flat area impacted specifically by incident related sediment accumulation, direct measures of injury within 48 quarter m^2 quadrats were made. The quadrats were haphazardly placed on sediment covered areas, the sediment was swept away by hand, and all underlying recently bleached corals were identified to species, counted, and categorized by size.

3.4.2 SUMMARY OF INJURY DATA AND RESULTS

Approximately 103,000 scleractinian corals representing 15 species were estimated to have been lost/injured within an estimated area of coral reef equal to 3478 m^2 as a result of the *Vogetrader* incident (Table 1). Eighty-nine percent of these corals were < 10 cm in longest linear dimension, and only 6 exceeded lengths of 80 cm *Montipora capitata* (47 percent) and *Porites lobata* (24 percent) were estimated to comprise the species with the greatest number of losses. All corals were consolidated into 6 species functional groups (Table 2) for recovery and compensatory restoration analyses

Table 1. Summary data of estimated colony losses, displayed by individual species.

	Size Category (cm)							
Species	**< 2**	**2 to < 5**	**5 to < 10**	**10 to < 20**	**20 to < 40**	**40 to < 80**	**80 to < 160**	**Total**
Cycloseris spp.	(6)	(37)						(43)
Fungia scutaria		59	3					62
Cyphastrea ocellina	5	41						46
Leptastrea purpurea	(39)	20	189	(33)	(58)	41		120
Leptoseris hawaiiensis	0	2	0	0	0	0		2
Montipora capitata	11,579	22,715	8,882	3,693	1,113	8		47,991
Montipora patula	1,504	7,062	2,814	1,661	325	6		13,372
Pavona duerdeni	(28)		4	2				(22)
Pavona varians	7	53	88	9	4	2		163
Pocillopora eydouxi	(22)	73	158	142	52	85	6	494
Pocillopora meandrina	5,421	8,027	1,565	845	744	147		16,750
Pocillopora damicornis		9						9
Porites brighami	(41)	1	28					(12)
Porites evermanni	(109)	(52)	(26)	18	26			(143)
Porites lobata	6,806	9,245	5,320	2,513	424	16		24,324
Porites compressa	(45)	(45)						(90)
Psammocora stellata		4						4
Total	**25,032**	**47,177**	**19,025**	**8,850**	**2,630**	**305**	**6**	**103,027**

Table 2. Summary data of estimated colony losses, displayed by species functional groups.

	Size Category (cm)						
Species	**< 5**	**5 to < 10**	**10 to < 20**	**20 to < 40**	**40 to < 80**	**80 to < 160**	**Total**
Fungiid disk	16	3					19
Montiporid-Favid encrusting	42,921	11,977	5,332	1,384	57		61,672
Pocillopora eydouxi	51	158	142	52	85	6	494
Pocillopora cauliflower	13,457	1,565	845	744	147		16,759
Poritiids	15,760	5,322	2,531	450	16		24,079
Psammocora stellata	4						4
Total	**72,209**	**19,025**	**8,850**	**2,630**	**305**	**6**	**103,027**

Scleractinian corals and crustose coralline algae create and consolidate habitat framework utilized by other sessile and mobile coral reef animals. Herbivorous fish and urchins may facilitate habitat recovery by continuous predation on colonizing fleshy algae, which compete for open space with corals and crustose coralline algae. The Trustees made projections on recovery rates of corals using data from the site and pertinent literature. Recovery levels and rates of the impacted reef will likely depend on the recruitment, growth and activities of multiple coral reef community constituents, including macroinvertebrates and fish.

3.4.3 INJURY/RESTORATION SCALING

In order to scale the injury, NOAA economists conducted a Resource Equivalency Analysis (REA). The purpose of this REA was to determine the long-term impact of resource loss over the time period that it takes for those resources to recover from the injury. This is done by converting both injury to resources, and benefits from restoration, into a common metric, in this case "coral colony years." The resource services lost over time (i.e., lost coral colony years) can then be compared to the resource services gained over time from a proposed restoration project (i.e., coral colony years gained). This "scaling," as it is called, ensures that the amount of public trust resource services that are lost from the injury are replaced.

The general framework used for scaling compensatory restoration is referred to as the scaling approach. The OPA NRDA regulations allow trustees to use a resource-to-resource or service-to-service approach, or in some instances a valuation approach. In resource-to-resource or service-to-service scaling, the scale of compensatory restoration is determined by obtaining equivalency between the quantity of discounted services (or resource proxies) lost due to the injury and the quantity of discounted replacement services (or resource proxies) provided by compensatory actions. Where planned restoration actions are going to provide the same or comparable resources or services, the objective of scaling is to ensure that the quantity of the resources or services provided through restoration will be equivalent to interim losses and thus sufficient to make the public whole.

Resource-to-resource or service-to-service techniques are usually rooted in the Habitat Equivalency Analysis (HEA) or REA methods (Julius *et al*., 1995; Milon and Dodge, 2001). The HEA method is generally used where the resource injury and/or the restoration action can (i) be generalized into categories (e.g., Marsh) that represent their overall habitat services and functions and (ii) where the overall services per unit of injury (percent service loss) or restoration (percent service gain) and rate of recovery (shape and time) can be applied uniformly over a discrete area of injury or area of restoration. Thus, in the case of oil impacting a salt marsh, the area of injury usually has a dominant plant species (e.g. *Spartina alterniflora*) that serves as habitat for and provides an array of services to variety of other resources. Injury assessment data (such as on degree and duration of oiling) are often used to attribute a degree of service loss for areas with similar oiling as well as predict an overall recovery timeframe for that area. Even in this relatively simple model, site specific differences in plant density, marsh edge, drainage channels, and other factors may need to be taken into account.

A coral reef is a significantly more complex ecological system than a marsh. From site to site, reefs may be highly variable in terms of structure, rugosity, core species, species assemblages, and species diversity. Each reef "habitat" may also have many different core species of various sizes/ages. Further, each coral species present is itself both a specific living resource and a feature that helps define a reef's particular characteristics and services as habitat to other dependent natural resources. One square meter of reef can easily contain more than 20 individual stony or octocorals plus numerous other species (algae, sponges, invertebrates, crustaceans, small fish, etc.) that help comprise and/or rely upon the reef ecosystem. Depending on the type and degree of impacts and environmental setting, some individual resources may have the potential to recover relatively quickly (in years) while others (i.e. large and/or rare corals) may have very long recovery horizons (decades to centuries) or may never recover at all.

For the *Vogetrader* Incident, the Trustees recognized that generalizing losses and restoration relationships across all injured corals would likely result in under- or over-estimation of interim coral losses and compensatory restoration needs. The Trustees determined a model comprised of a matrix of independent Resource Equivalency Analyses (REAs) that considered the injuries to and recovery characteristics of each core reef component (by species class) would better represent the complexities associated with the coral reef losses at the injury site and provide a better estimate of both the interim coral losses and the scale of restoration needed to restore the same or comparable resources or services to compensate for those losses. As described in Kolinski *et al*. (2007) and Viehman *et al*. (2009), this modified type of Resource Equivalency Analysis (REA) uses a resource- to-resource method that references the number organisms lost and the number gained through restoration. This approach examines the size distribution of species or functional groups of different corals and allows for comparisons between ecological services. This method allows the Trustees to quantify and aggregate losses across species, taking into account the different species injured, the sizes/ages lost, anticipated recovery rates and, similarly, to identify the scale of the proposed restoration required to restore or replace coral species comparable to those lost over time.

Using this approach, the metric for scaling is a coral colony year (CCY). A CCY is not equal to the coral age. CCY is a proxy for services provided and/or, in the case of any injury, lost during a one-year period of time for a particular size and type of coral. While the initial CCY value is only directly comparable to others within the same size/species group, equivalency between sizes and groups can be gained by utilizing a combination of a linear size and service weighting. The key inputs into this analysis are the size/species distribution and the recovery time. The analysis also considers discounting and other inputs used in REA, such as relative function, time to maturity, and project lifespan.

The *Vogetrader* Incident caused significant injuries to coral resources, other reef biota, and the reef habitat. Based on data and information collected through joint site surveys, the Trustees calculate the total corals impacted to be just over 103,000 individual corals (Table 1). This includes different species groups that are expected to recover at varying rates depending on the size/age of the coral when it died, recruitment and growth rates. This range can vary substantially depending on the species and size class.

The coral colony year loss (from the incident) of 260,752 discounted coral colony years converts to 79,639 equivalent discounted coral colony years. The total discounted coral colony year gains of 130,532 (4,893 from re-attached and 125,639 from transplanted nursery corals) discounted coral colony converts to 84,772 equivalent discounted coral colony years. This restoration model estimates that 106 percent of the coral credits can be recovered over 5 years of operation of the preferred alternative for restoration. This is most likely a large underestimate as the coral nurseries will most certainly be housing coral fragments and colonies that will be larger than 10 cm.

4.0 EMERGENCY RESTORATION

After the injury assessment work was conducted, the Trustees and RP continued to note ongoing injury to natural resources from the extensive rubble in the area generated from the incident and response activities. The rubble was continuing to move across the bottom and injure healthy corals during high-energy storms with associated large waves in the area.

In addition, the presence of a large rubble field overlaying the hard bottom precluded corals from settling and recruiting to the area. This exclusion of coral settlement was a direct impediment to the recovery of the injured area back to baseline condition.

Because of these issues, the Trustees and the RP developed an Emergency Restoration Plan (ERP) (see administrative record). The primary focus of the ERP was the rescue and reattachment of dislodged corals and the removal of rubble. On December 12, 2013, after receiving applicable permits, the RP contractor mobilized to the site to begin work.
Over the course of several weeks NOAA and State of Hawaii personnel were periodically onsite to observe and guide the rubble removal actions. An estimated 12,600 cubic ft. (466 cubic yards) of rubble was removed from the main scar area (Figure 6). Once the bottom substrate was uncovered, it was noted that in some places the material was too friable to continue rubble removal without damaging the underlying reef framework. NOAA and the State of Hawaii conducted site evaluations and concluded that continuing with rubble removal would cause more harm than good and removal operations were stopped.

Figure 6. Divers removing rubble from the injury site using a suction hose.

Coral reattachment actions were begun as soon as the rubble removal was completed. Divers identified numerous viable donor corals in the area. The RP contractor, NOAA, and the State of Hawaii worked together to reattach 643 coral colonies in an 843 m^2 (9073 square ft.) area damaged by the incident.

Of the 643 coral colonies reattached 73 (11 percent) showed a marked decline in visual health (tissue loss, algal coverage, or bleaching over more than 50 percent of surface) after roughly a year following reattachment. There were no obvious trends in mortality but the data is available on request.

The two main parameters evaluated after the restoration have been coral colony species type and size of colony. The most numerous species reattached was *Porites lobata* followed by *Pocillopora meandrina* (Table 3 and Figure 7).

Table 3. The number of reattached corals by coral type.

Coral type	Number of colonies
Porites lobata	401
Pocillopora meandrina	212
P. eydouxi	14
Montipora sp.	16

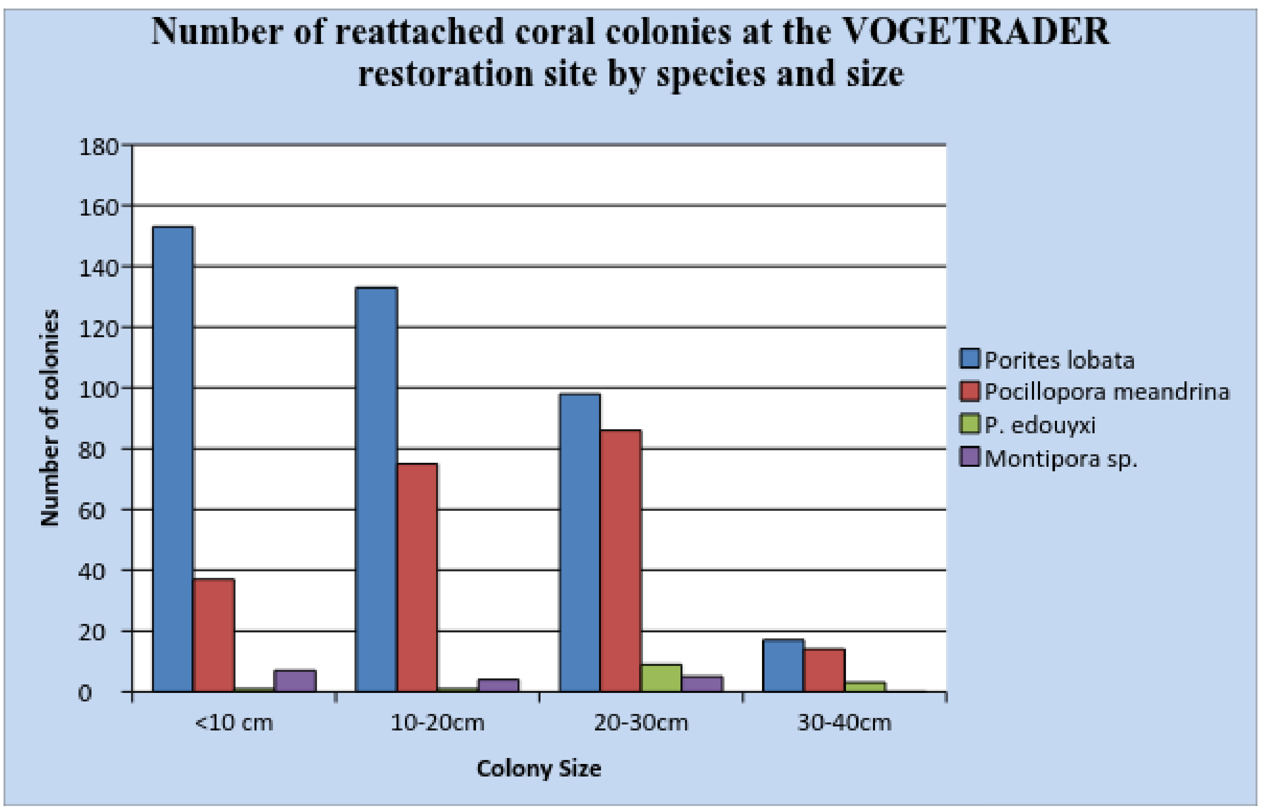

Figure 7. Graph showing the number of coral colonies reattached by species and size class.

NOAA Damage Assessment, Restoration, and Remediation Program (Matthew Parry) and State of Hawaii Division of Aquatic Resources (Paul Murakawa and Brian Neilson) biologists conducted a final site survey on March 31, 2015 (Figure 8). Based on the   observations conducted during this and previous site visits it appears that no additional emergency restoration work remains at this time. Accordingly, the Trustees have concluded that the RP has met the success metrics in the ERP. NOAA and the State of Hawaii will continue to monitor the natural recovery of the site as well as the efficacy of the restoration work through time.

Figure 8. Photo showing a subset of reattached corals at the grounding site. All corals visible in frame are reattached coral colonies. (Photo: NOAA DARRP)

5.0 RESTORATION PLANNING

5.1 RESTORATION ALTERNATIVES AND PROPOSED ACTION

The goal of the Oil Pollution Act is to "make the environment and the public whole for injuries to natural resources and services resulting from an incident involving discharge or substantial threat of a discharge of oil…." 15 C.F.R. § 990.10. To achieve this goal, OPA authorizes trustees, after an oil spill or response to the threat of a spill, to conduct restoration planning to restore, rehabilitate, replace, or acquire the equivalent of injured natural resources resulting from the spill and/or response actions. The OPA regulations envision that this goal be achieved by returning injured natural resources to their baseline condition, but for the incident, and/or by compensating for any interim losses of natural resources and services during the period of recovery to baseline. Specifically, the preferred restoration alternatives in this DARP/EA are designed to restore injured natural resources and services resulting from the February 5, 2010 grounding of the *Vogetrader* off Kalaeloa, Barbers Point and the subsequent response activities.

Some of the conditions under which natural recovery would be considered a preferred alternative would be (1) active primary restoration is infeasible, 2) active primary restoration is not cost-effective, and (3) injured natural resources will recover to baseline at a reasonable rate without human intervention. Alternative primary restoration activities can range from natural recovery with monitoring, to actions that prevent interference with natural recovery, to more intensive actions expected to return injured natural resources and services to baseline faster and/or with greater certainty than natural recovery. In the absence of viable active primary restoration options, the trustees normally focus on increased compensatory restoration (see below), taking into account the longer return to baseline that generally accompanies natural recovery.

Compensatory restoration projects are actions taken to address the interim losses of natural resources and/or services between the time of injury and recovery to baseline. The type and scale of compensatory restoration can depend on the nature of the primary restoration action(s) and the timeline and scope of recovery of injured resources to baseline. When identifying compensatory restoration alternatives, trustees must first consider actions that provide resources and/or services of the same type and quality and of comparable value as those that were lost. If a reasonable range of alternative compensatory actions cannot provide resources and/or services of the same type, quality, and comparable value as those lost, then trustees can consider actions that will provide resources and/or services of comparable type and quality.

Reasonable compensatory restoration alternatives must be "scaled" so that the size or quantity of the proposed project reflects the magnitude of the injuries. The OPA regulations discuss two scaling approaches - the service-to-service (or resource-to-resource) approach and the valuation approach. The former approach (hereafter referred to as service-to-service) is a simplification of the valuation approach and is used when the injured and replacement resources and services are of the same type, quality, and comparable value. The service-to-service approach is similar to an in-kind trading approach that requires no explicit valuation. Under this approach, the scaling analysis simplifies to selecting the scale of a restoration action for which the present discounted quantity of replacement services equals the present discounted quantity of services lost due to the injury. The habitat version of the approach, habitat equivalency analysis, has been applied in a number of damage assessment cases. For an overview of habitat equivalency analysis, see NOAA (2000).

If the trustees determine that the first approach is not appropriate, they will use the second approach and determine the amount of natural resources and/or services that must be provided to produce the same value lost to the public. The trustees must explicitly measure the value of the interim losses from the injured natural resources and/or services and then calculate the value of gains from the proposed restoration actions. Scaling then requires adjusting the size of restoration project(s) to ensure that the value of restoration gains equals the value of the interim losses. Responsible parties are liable for the cost of implementing the restoration action that would generate the equivalent value. The value-to-cost variant of the valuation approach may be employed when valuation of the lost services is practicable but valuation of the replacement natural resources and services cannot be performed within a reasonable time frame or at a reasonable cost. With this approach, the restoration is scaled by equating the cost of the restoration plan to the value (in dollar terms) of losses due to the injury.

5.1.1 PROPOSED ACTION

The Trustees propose to develop and implement restoration alternatives based on the service-to-service scaling method. Both primary and compensatory restoration actions are considered within this plan. When developing the restoration alternatives included in this DARP/NE, the Trustees relied on known methodologies previously applied to other incidents or to related natural resource recovery activities and projected costs and outcomes related to those situations. Specific project details may require additional refinements or adjustments to reflect changing conditions or factors. In addition, restoration projects and design may also change to reflect public comments and further Trustee analysis.

5.1.2 EVALUATION CRITERIA FOR RESTORATION ALTERNATIVES

The OPA regulations require that trustees develop a reasonable range of primary and compensatory restoration alternatives and then identify the preferred alternatives based on the six criteria listed in the regulations:

1. Cost to carry out the alternative action,
2. Extent to which each alternative is expected to meet the trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses,
3. Likelihood of success of each alternative,
4. Extent to which each alternative will prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative,
5. Extent to which each alternative benefits more than one natural resource and/or service, and
6. Effect of each alternative on public health and safety.

Id. at § 990.54(a). In addition, the Trustees considered several other factors including:

1. Cost effectiveness (rather than just overall total costs),
2. Opportunities to collaborate with other entities involved in restoration projects, and
3. Compliance with applicable federal and state laws and policies.

As mentioned in Section 1.0, NEPA applies to actions taken by federal agencies. To reduce transaction costs and avoid delays in restoration, the OPA regulations encourage the trustees to conduct the NEPA process concurrently with the development of the restoration plan. As well, NEPA also encourages federal agencies to integrate the requirements of NEPA with other agency planning procedures so that the processes can run concurrently, rather than consecutively. To comply with the requirements of NEPA, the trustees consider the effects of each preferred alternative on the quality of the human environment. NEPA's implementing regulations direct federal agencies to evaluate the potential significance of proposed actions by considering both context and intensity.

5.1.3 DISCUSSION OF NO ACTION ALTERNATIVE

NEPA requires the Trustees to consider a "no action" alternative, and the OPA regulations require that a "natural recovery" option be evaluated. Under the No Action/Natural Recovery alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services. In lieu of direct action, the Trustees would rely on natural processes of recruitment and growth for recovery of the injured natural resources including, but not limited to, corals, algae, fishes, sessile invertebrates and coralline algae. There are several advantages to natural recovery as primary restoration. The principle advantages would be simplicity of implementation and no cost. Because an injured area or species is expected to recover naturally, it may make sense to, in essence, "let nature take its course."

The Trustees first note that, in this case, No Action/Natural Recovery would occur in an environment where emergency restoration, which is effectively the same as primary restoration, has already taken place. In other words, these alternatives could more accurately be described as considering whether the Trustees should take *additional* primary restoration action.

As discussed below, the Trustees have determined that natural recovery with monitoring would be appropriate as ongoing primary restoration for coral reef resources at the injury site. In fact corals are already recruiting to areas that were injured by the incident but were not impacted by the generated rubble. These corals are within size ranges that indicate that recruitment in areas without rubble began soon after the injury occurred. Areas cleared of rubble have not had sufficient time to develop the necessary bottom conditions for recruitment yet.

However, adopting only the No Action/Natural Recovery approach would fail to meet the purpose and need discussed above. With even the most effective and fast-acting primary restoration, there will always be some period of interim loss between injury and full recovery. In this case, natural resource losses were, and continue to be, incurred by the public during this period of recovery from the grounding event. While full natural recovery is expected to occur eventually, the public would not be compensated for the interim losses under the no action alternative. OPA clearly establishes trustee authority to seek compensation for interim losses pending recovery of the injured natural resources. Furthermore, technically feasible alternatives exist to compensate for these interim losses within a reasonable cost framework. Therefore, a no action alternative (natural recovery) would have to be coupled with other restoration actions to fully restore lost interim services.

5.2 EVALUATION OF PRIMARY RESTORATION ALTERNATIVES

5.2.1 PREFERRED PRIMARY RESTORATION ALTERNATIVE 1: MONITORED NATURAL RECOVERY WITH THE POSSIBILITY OF ADAPTIVE MANAGEMENT

Alternative Description:

This proposed alternative provides primary restoration for injury to corals, other benthic macro-invertebrates, and crustose coralline algae using natural recovery of resources to return to baseline conditions. Unlike the no action alternative discussed in Section 5.1.3 above, this alternative includes monitoring with the possibility of adaptive management should the injured natural resources fail to meet expected recovery projections. Because of limited opportunities for restoring large established coral communities at the incident site, the monitored natural recovery alternative is the best one for primary restoration.

Approximately 106 percent of the injury to coral resources can be restored over 5 years (including the natural recovery at the site as well as the compensatory restoration). These rates of recovery are within expected values based on previously published coral growth rates and parameters (Grigg and Maragos 1974, Grigg 1995, Holthus *et al*. 1986, Dollar and Tribble 2003, Connell 1997, Hughes and Connell 1999).

While the Trustees anticipate relying on natural recovery for much of the primary restoration of the injury caused by the *Vogetrader* grounding and response actions, they intend to monitor natural recovery of the coral reef communities at the impact site to determine if recovery is progressing to the baseline conditions as they have projected (see discussion below). The Trustees will develop and implement a biological monitoring program to determine whether affected coral reef communities meet anticipated recovery goals at the *Vogetrader* vessel grounding site. Both qualitative and quantitative data will be collected. Several surveys will be conducted over a 10-11 year time period. Coupled with the information already collected by the Trustees, this time frame will provide data for a twenty-year time period from the date of the vessel grounding – likely adequate time to gauge resource recovery.

The Trustees continue to be concerned that the ecological disturbances caused by the *Vogetrader* grounding and subsequent response actions could result in the injured reef community undergoing a “phase shift” into another type of biological community, such as one dominated by algae to the exclusion of corals. If monitoring discloses that natural recovery is not progressing as projected, the Trustees will examine the feasibility of active primary restoration actions and may reallocate funds and effort from the compensatory restoration project.

Restoration Objective:

The goal of the monitored natural recovery alternative is to allow the injury site to continue its natural recovery progression back to baseline conditions or pre-incident levels of coral species, size classes, and abundances.

Probability of Success:

The probability of success is high. All current information collected by the Trustees suggests that natural recovery is occurring as predicted. There is a possible concern (however remote) that the ecological disturbances caused by the Incident could result in the injured reef community undergoing a "phase shift" into another type of biological community, such as one dominated by algae to the exclusion of corals. The probability of this occurring appears low as all indications to this point show that the incident site is recovering normally back to baseline conditions.

Performance Criteria and Monitoring:

The performance criteria for this alternative are that natural recruitment and growth of coral resources at the incident site continue to follow recovery models. The Trustees intend to monitor natural recovery of the coral reef communities at the incident site to confirm that recovery is progressing acceptably toward baseline conditions throughout the recovery period.

If monitoring discloses that natural recovery is not progressing as projected, the Trustees will evaluate adaptive management activities in the nature of primary restoration at the *Vogetrader* vessel grounding site. If they determine that active primary restoration actions are feasible, the Trustees may reallocate funds and effort from the compensatory restoration project.

5.2.2 CONSIDERED BUT REJECTED PRIMARY RESTORATION ALTERNATIVES

The Trustees considered three alternatives for primary restoration of the *Vogetrader* grounding site. They evaluated these alternatives using the standards delineated in the OPA regulations: (1) the cost of the alternative, (2) the extent to which the project is expected to return the resource and services to baseline, (3) the likelihood of success, (4) the probability of preventing future injury, (5) the benefit to other resources, and (6) the effects on public health and safety. The Trustees considered but did not select the following alternatives as the preferred restoration methods because of feasibility and cost benefit concerns. The rejected alternatives are listed below with their associated explanations and concerns.

5.2.2.1 REJECTED PRIMARY RESTORATION ALTERNATIVE 1: PLACEMEMENT OF MANMADE STRUCTURES TO RESTORE THREE DIMENSIONAL COMPLEXITY

The loss of three dimensional habitat structures (coral colonies and natural terrain) has an impact on fishes, invertebrates and other species in the injury area. Reconstructing some of this three dimensional habitat would provide refuge areas for fishes and invertebrates and could possibly help increase re-colonization rates of coral into the injury area. Some reconstruction of lost three dimensional habitat occurred at the injury site during emergency restoration activities, including re-attaching surviving coral colonies. While this alternative has some appeal, the Trustees rejected it for several reasons. The level and pace of possible increased coral recruitment and recovery (above and beyond the natural rates) of the area are not known and may not provide adequate resource compensation. Because the area has been undergoing natural recovery for several years, adding structures to the bottom would result in an initial injury to corals that have naturally colonized to the area, diminishing the initial resource recovery credits and essentially resetting recovery. Additionally, for determining added benefits, the degree that these structures will result in net increased populations of fishes and invertebrates rather than just attract these species from other areas is also not known (the production versus attraction debate). Ultimately, the Trustees concluded that it was questionable whether this alternative could meet the purpose and need described above.

5.2.2.2 REJECTED PRIMARY RESTORATION ALTERNATIVE 2: ALIEN INVASIVE ALGAE CONTROL AND REMOVAL

The presence of alien and invasive algae at and near the injury site is well known (Brostoff, 1989, USFWS 2002). In particular, the alien alga *Avrainvillea amadelpha* is known to exist along the west coast of Oahu as well as in other areas such as Maunalua Bay on the south east side of the island. At the injury site, the primary question is whether, because of the cleared benthic substrate as a result of the Incident, *A. amadelpha* will progress from its presently pervasive condition to an invasive state by beginning to form large mats that fully occlude or cover the bottom. The Trustees have not yet observed this invasive condition although the density of *A. amadelpha* varies across the injury site. Also, it is unknown what level of impact *A. amadelpha* has on coral recovery at the injury site. In a pervasive condition, the effects of *A. amadelpha* are not well understood. In its invasive state, *A. amadelpha* likely inhibits coral recruitment as it can completely cover the bottom preventing settlement. Because of these uncertainties, the Trustees are unable to adequately scale restoration benefits in terms of enhanced coral recruitment for this alternative. Moreover, there is currently no accepted methodology for effective removal of this algal species at the injury site. If subsequent monitoring at the injury site reveals a progression to an invasive state, or if the Trustees learn more about the effects on coral recruitment of *A. amadelpha* in its present state, the Trustees may reconsider this alternative as part of preferred primary restoration alternative 1 - monitored natural recovery with the possibility of adaptive management. Ultimately, with the current unknowns, the Trustees concluded it was questionable whether this alternative could meet the purpose and need described above.

5.2.2.3 REJECTED PRIMARY RESTORATION ALTERNATIVE 3: REPAIR OF INJURY TO REEF FRAMEWORK

After the rubble was removed from the *Vogetrader* injury site the Trustees and RP representatives determined that the bottom was too friable to reattach corals. The impact of the ship's hull damaged the limestone framework of the reef and left much of the area under the hull as semi-consolidated material that would most likely not support reattachment efforts. The RP proposed repair efforts to consolidate and strengthen this area by adding cement into the cracks and crevices that had formed as well as putting a "cap" of cement over larger areas that were still semi-consolidated. This alternative was rejected for a number of reasons. The risks of putting large amounts of unsupported cement into the environment (rather than small amounts to reattach individual corals) were deemed too great without a firm understanding of the benefits. The Trustees feel that, while there is damage to the reef framework, it has a good chance of naturally "re-cementing" through natural processes of recruitment of crustose coralline algae and other bio-geochemical processes. Ultimately, the Trustees concluded it was questionable whether this alternative could meet the purpose and need described above.

5.3 EVALUATION OF COMPENSATORY RESTORATION ALTERNATIVES

5.3.1 PREFERRED COMPENSATORY RESTORATION PROJECT 1: IN-WATER CORAL NURSERY

This proposed alternative provides compensatory restoration for injury to corals caused by the *Vogetrader* incident. Because of limited opportunities for gaining large amounts of coral restoration credits from projects at the incident site, off-site restoration projects remain necessary to ensure that the public is fully compensated for injuries at the incident site.

Every year in Hawaii, corals are broken during storm events or ship groundings. It is possible that some of these corals will survive, but more commonly they are swept over the reef into areas where they have low rates of survival, such as sand flats, depressions, or even just settling upside down (Lirman, 2000). Each year, there are thousands of these fragments that are lost to abrasion and burial by sediment in less ideal habitats. There are significant opportunities to save some of these fragments and use them to create coral nurseries on Oahu. Fragments can be brought into nurseries and then used as outplanting material to impacted areas. There is virtually no "take" from the environment since these fragments would have otherwise perished if left where they were.

Traditional coral nurseries that have been operated by NOAA and others have consisted of various physical frameworks (lines, PVC pipes, cinderblocks, etc.) that support coral fragments. These fragments are harvested from healthy coral populations in the hopes of propagating these fragments to areas that historically supported coral populations but are now denuded for a variety of reasons. These activities have usually been in areas where recruitment has been highly reduced for one reason or another. They have also generally attempted to take advantage of the relatively high growth rates of certain species such as *Acropora cervicornis* and others in Florida and the Caribbean (Griffin *et. al*., 2015; Young-Lahiff 2010; Rinkevich 2000; Shafir *et al*., 2006; Amar and Rinkevich 2007).

In this case, the Trustees plan to build the nursery from a hard structure, most likely fiber reinforced plastic (FRP), based on initial design proposals. Unlike in Florida and the Caribbean, this nursery would not attempt to foster fast-growing species to combat slower recruitment rates, but rather salvage larger fragments or whole colonies to reattach once they have been stabilized. In Hawaii, the coral populations are generally not recruitment limited and have slower growth rates than in Florida and the Caribbean. Furthermore, given the success of the emergency restoration activities at the injury site, there are opportunities for in-water coral nurseries that take advantage of naturally detached corals that can be temporarily housed at the nursery site for later reattachment to injury areas.

This project would be conducted in conjunction with the State of Hawaii's Division of Aquatic Resources, as well as the University of Hawaii's Marine Option Program and Mechanical Engineering Program. In August 2016, NOAA staff proposed the design and construction of a coral nursery structure as a senior thesis project for the University of Hawaii Mechanical Engineering Program. It is anticipated that, if this project is selected in the Final DARP/NE, the structure designed and built by the University of Hawaii students would be the foundation of the coral nursery project.

Nurseries are proposed at three different sites, one located in Kaneohe Bay, and two located on the south shore of Oahu.

Kaneohe Bay:

The Kaneohe Bay nurseries would house smaller fragments of corals and would be located in calmer water. The nursery would therefore be smaller and would require smaller physical structures than the south shore nurseries (Figure 9).

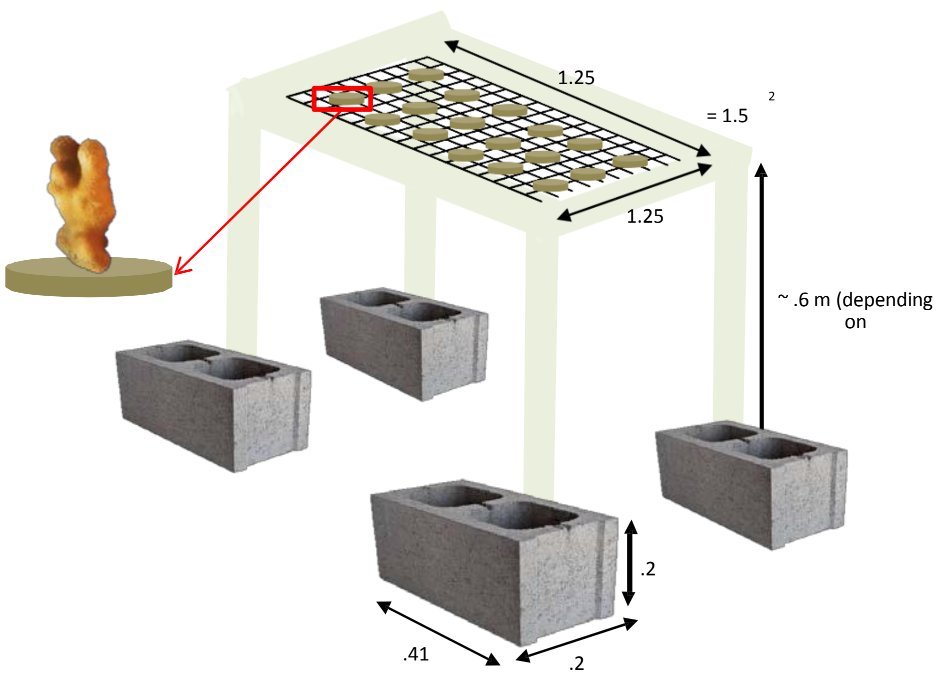

Figure 9. Basic representation of Kaneohe Bay coral nursery.

Nurseries would most likely be sited in shallow water (~10 ft. [3m]) on rubble bottom. The nurseries would be sited in areas that have not shown a history of vessel groundings (O'Conner, 2016). Nurseries are proposed at Coconut Island, and patch reef 20, where there have been small boat groundings in the past and a relative abundance of donor material (Figure 10).

Figure 10. A map of proposed nursery sites within Kaneohe Bay.

The corals of opportunity would be attached to underwater platforms approximately 10 square ft. (0.9 m^2) in area each. Depending on the number and distribution of available corals, the number of nurseries would range between 2 and 6 and can be scaled appropriately to meet the needs of the situation. This will result in a total number of nursery coral fragments for reattachment between 500 and 1500. As coral colonies stabilize and areas of outplanting are identified, the corals would be cycled through the nursery and replaced opportunistically, providing a constant flow of corals from injury sites, to the nursery, and then back out into appropriate outplanting sites.

South Shore Oahu:

The nurseries located on the South Shore of Oahu would house larger fragments and whole colonies of corals (as well as being subjected to large wave events and ocean energy) and would require a more substantial nursery structure than the Kaneohe Bay sites. A team of 9 students advised by Professor Konh spent 6 months researching material, designing, and testing various structural configurations to determine the best structure type to serve as a nursery for corals of opportunity.

The approximate locations of the two nursery sites are shown in Figure 11 (as Site A and Site B). Depending on number and distribution of available corals the number of nurseries will range between 2 and 4 and can be scaled appropriately to meet the needs of the situation.

Figure 11. View of the South Shore of Oahu from Pearl Harbor entrance channel to Diamond Head Crater showing the proposed nursery sites.

Both site will be located in approximately 60 ft. (18m) of water. Site A is in sand while Site B is located on hard bottom reef with sparse coral cover. The sites were chosen based on several criteria; minimization of benthic impacts, deeper than 40 ft. (12m) to avoid being a hazard to boat traffic, proximity to potential donor coral material, proximity to areas of potential future injury sites, and proximity to NOAA and partners (UH, Atlantis Submarines Inc.) for maintenance.

The nursery design and choice of materials (fiber reinforced plastic) was chosen to maximize nursery holding area, corrosion resistance, symmetry, and strength while minimizing weight, bottom impacts, and shading (Figure 12).

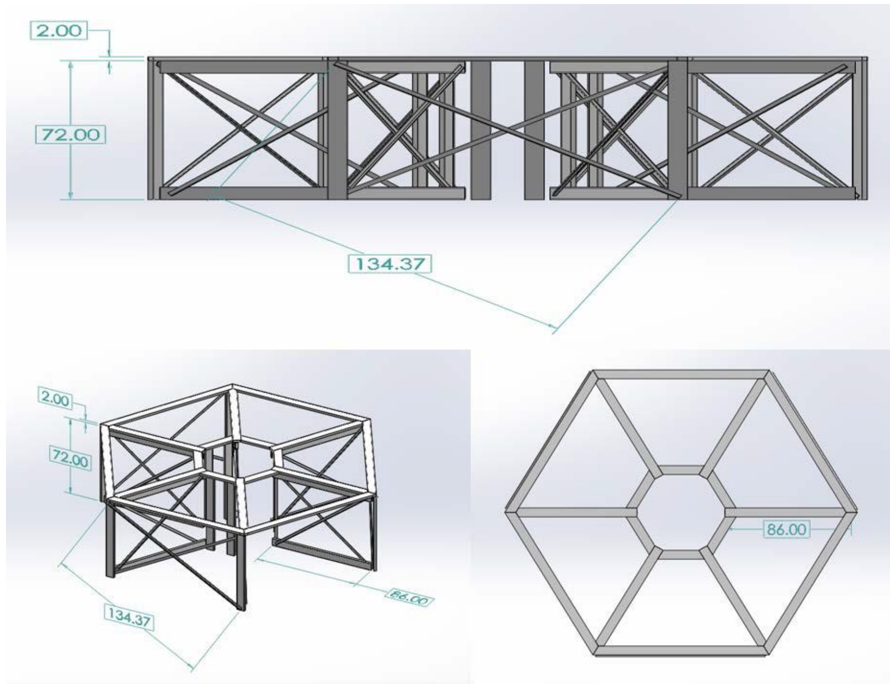

Figure 12. Three different views of south shore coral nursery design. Note that the "trapezoidal" shaped spaces will be filled with a hard mesh bottom to support corals while still allowing water flow. Values are in inches.

Each nursery will house approximately 260 corals (assuming 1 square ft. per colony/fragment) which will result in a total between 520 and 1040 coral colonies/fragments for outplanting. As coral colonies/fragments stabilize and areas of outplanting are identified the corals will be cycled through the nursery and replaced opportunistically providing a constant flow of corals from injury sites, to the nursery, and then back out into appropriate outplanting sites.

Restoration Objective:

The overall goal of the In-Water Coral Nursery project is to prevent coral losses by salvaging loose corals and husbanding them in a nursery for reattachment into sites injured by incidents, such as storms, orphan vessel groundings, etc. This project will directly compensate for the coral injury resulting from the grounding incident by increasing the amount of ecological services provided by coral around the Oahu coast. The ecological services provided by the corals include habitat and forage for fish and invertebrates, among others.

Probability of Success:

The probability of salvaging intact healthy loose corals from the environment is high. As shown in the emergency restoration actions these corals can be safely collected, transported, and reattached with a low level of mortality and in an economically viable manner.

The probability of successfully husbanding corals in an underwater nursery environment is also high. Successful coral nurseries have been established around the world, including

Florida, the Caribbean, and the Red Sea (Shafir, 2006; Johnson *et al*., 2011). While the nursery proposed in this plan is slightly different in that it will use intact coral colonies rather than fragments, the basic premise is the same and should by all accounts have the same if not greater level of success than other nurseries have had.

Performance Criteria and Monitoring:

In order for the restoration project to be successful there are several stages where the nursery efforts needs to be evaluated. One performance criterion is mortality of the corals being used for the nursery efforts. Mortality of salvaged corals can occur as a result of (1) moving the corals and placing them in the nursery, (2) conditions within the nursery itself, and (3) moving and reattaching the corals back into an affected site. If mortality is too high as a combination of these three actions then the nursery will not be successful. Initial actions conducted during the emergency restoration activities consisted of actions 1 and 3 above and resulted in low mortality (see Section 3.0) so a well-designed nursery should not contribute substantially to increased mortality rates.

Another performance criterion is the detachment rate of corals both in the nursery and after reattaching back into the environment. If detachment rates are high the project will not be successful. Detachment rates within the nursery will be somewhat dependent on what type of physical structures are ultimately used for an individual nursery. Detachment rates during the emergency restoration activities were extremely low and are projected to be as low for any nursery outplanting operations.

5.3.2 CONSIDERED BUT REJECTED COMPENSATORY RESTORATION ALTERNATIVES

For compensatory restoration, the Trustees considered two of the techniques described above for primary restoration: placement of artificial structures to restore three dimensional complexity and invasive algal removal and control. The only difference in the compensatory context is that the activities would be undertaken at a location different than the injury site. These would likely be other areas injured by incidents such as storms or orphan vessel groundings. The Trustees determined that both of these alternatives were less certain to meet the Trustees' purpose and need for the same reasons described in the primary restoration discussion in Section 5.2.2.1 and 5.2.2.2. Accordingly, they are not being proposed here for compensatory restoration. Because there is a detailed discussion of the Trustees reasoning above, the evaluation is not repeated here.

5.4 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

5.4.1 REQUIREMENT FOR ANALYSIS UNDER NEPA

Under the National Environmental Policy Act (NEPA) federal agencies must evaluate potential impacts to the environment from their proposed actions and reasonable alternatives. If impacts are potentially significant an environmental impact statement (EIS) is required, but if impacts are either unclear or considered not significant, an environmental assessment (EA) may be prepared. Additionally, some types of actions may qualify for a Categorical Exclusion (CE), or otherwise not be subject to NEPA. NEPA also allows for broad programmatic analyses that subsequently can be used to meet NEPA requirements for project-level actions through "tiering." This process is discussed further below. The NEPA process ensures that public decision-makers are fully informed about the potential impacts of the proposed action and its alternatives and allows for meaningful public involvement in the decision-making process.

5.5 USE OF THE NOAA RESTORATION CENTER'S PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT AND IMPACTS ANALYZED

After decades of experience evaluating and implementing environmental restoration projects, NOAA's Restoration Center (RC) has determined that many of its efforts involve similar types of activities with similar environmental impacts. To increase efficiency in conducting future NEPA analyses for a large suite of habitat restoration actions, the RC developed the Programmatic Environmental Impact Statement for habitat restoration activities implemented throughout the coastal United States (RC-PEIS) in 2015. After a public comment period, a Record of Decision was signed July 20, 2015. The RC-PEIS is available at the following link:

http://www.habitat.noaa.gov/pdf/NOAA_Restoration_Center_Final_PEIS.pdf

The RC-PEIS provides a program-level environmental analysis of NOAA's habitat restoration activities throughout the coastal and marine United States. Specifically, it evaluates typical impacts related to a large suite of projects undertaken frequently by the RC, including Coral Reef Restoration. These analyses may be incorporated by reference in subsequent NEPA documents if they are applicable. For example, a project evaluated in a site specific NEPA document may have some potential impacts that are evaluated thoroughly in the RC-PEIS and some potential impacts that are too site-specific to have been covered by the RC-PEIS. In that instance, the site specific NEPA document could incorporate by reference any relevant impacts analyses covered in the RC-PEIS. Only impacts not covered in the RC-PEIS would need further discussion, thereby streamlining the site specific NEPA document. If no impacts were found to be significant, the analysis would result in a FONSI.

Alternatively, a site specific NEPA document may evaluate a project where potential impacts were fully addressed in the RC-PEIS. In that instance, the site specific NEPA document would, in effect, incorporate by reference the full impacts analysis from the RC-PEIS. In those cases where the RC-PEIS determined none of the potential impacts would be significant, the site specific NEPA document could incorporate that conclusion by reference as well. In short, no further NEPA analysis would be necessary so long as the activity being proposed is within the range of alternatives and scope of potential environmental consequences analyzed in the RC-PEIS. If the site-specific restoration activity is not within the scope of alternatives or environmental consequences considered in the RC-PEIS, it will require additional analysis under NEPA.

To enhance transparency, all of the records related to use of the RC-PEIS are made publicly available on the RC's website:

http://www.habitat.noaa.gov/restoration/aboutrc/peisprocess.html.

Any interested parties can send questions or comments to *rc.compliance@noaa.gov*.

In general the environmental impacts from coral restoration activities have been analyzed under the RC-PEIS. The analysis is included as follows:

Coral communities are directly benefited through coral reef restoration activities that enhance larval recruitment to the reef, because natural recruitment restores the original biological community and increases overall percent coral cover and habitat value. This is vital to the maintenance of the existing coral population on the restored reef. Substrate and coral stabilization and transplantation of new coral colonies to injured reefs increase the overall percent coral cover and increase habitat value. Transplantation of native coral fragments could also increase the diversity on the reef or improve the chances of successful cross-fertilization during reproduction.

Disturbances at a coral reef restoration project site last from a few weeks to months, depending on the project type. Projects repairing damaged sites and/or creating new reef structure would likely last a few weeks to months. Coral nursery operations occur over a time span of months to years, but the ongoing site impacts are minimal from operational activities. However, the harvesting of coral fragments may have direct adverse impacts to the **substrate** and **water** column, which may include ephemeral sedimentation, turbidity, or other water quality impacts associated with the immediate effects of construction activities. There may also be direct, short-term, adverse, localized impacts to **marine animals** as a result of human disturbance in the collection area. Direct benefits of this activity include reduced mortality to injured or threatened corals, reduction or elimination of adverse impacts to adjacent areas caused by loose rubble or sediment as it is moved by the action of waves or currents, and creation of suitable stable substrate for colonizing reef species. The greatest source of short-term impacts is the potential for doing additional damage to the site during the restoration process. This might include accidental contact with the already damaged corals or unimpacted areas by divers, equipment, and anchoring boats. Because divers may be required to undertake activities such as proactively removing corals to prevent damage, or drilling cores/taking fragments from existing corals to be transferred to the restoration site or nursery, there is also the potential to damage healthy, intact colonies.

Divers and boat operators should possess the appropriate knowledge, training, and experience to conduct the restoration safely and effectively and follow all relevant BMPs. Long-term moderate to major beneficial effects on **geology** and **substrate** are anticipated from this technique. Stabilizing loose rubble or sediments and transplantation of coral fragments would enhance consolidation of the reef framework and improve the substrate quality for corals and other organisms. Enhancing recruitment of corals to the reef would increase coral cover, thereby enhancing consolidation of the reef framework. Short-term minor adverse effects on surface **water resources** would be anticipated to result from coral reef restoration activities. Some minor adverse effects may result from the dispersion of adhesives used to plug the clipped coral or transplant the injured corals onto the reef into the water column; however, the specific adhesives used in coral restoration are designed to have minimal dispersion and impact to the area. Short-term, localized increases in turbidity may also result.

Indirect, long-term moderate beneficial effects on the biological resources being directly restored at the site are anticipated from coral reef restoration due to a healthier coral ecosystem being in place.

Short-term, adverse impacts to **air quality** and **recreation** may occur during restoration implementation due to the presence of boats and equipment at the restoration site. Impacts on cultural resources from the implementation of coral reef restoration are dependent on site-specific conditions associated with a project proposed for implementation.

No direct effects on **socioeconomics** are anticipated from this technique beyond the beneficial economic activity associated with the restoration activity itself, as such activities may draw high numbers of restoration participants (e.g., volunteers or restoration project staff). There may be indirect, long-term impacts to local communities as a result of improved tourism in the area.

Coral reef restoration - stabilizing substrate and transplanting injured or nursery-reared corals back onto damaged coral reefs - provides indirect, long-term moderate benefits to **water column** and **invertebrates, marine resources** and **EFH,** including marine mammals, sea turtles, and birds, all of which are dependent on a healthy reef for food, shelter, or reproduction. Invertebrates also inhabit the crevices in coral reefs, which are enhanced from transplanting efforts, for shelter from predators. Restoration would enhance coral cover and production on the reef, which would benefit plankton and other organisms. Pelagic birds would benefit, as healthy coral communities harbor healthy fish populations, which seabirds use as a primary food source. Enhancing natural recruitment of coral larvae by increasing available hard substrate, or using "flypaper" techniques or settlement tents, would potentially lead to increased coral cover and habitat area for living coastal and marine resources. Coral communities would be beneficially impacted by enhanced recruitment, as this would provide a healthier reef system for the existing coral community. The increase in density of settlers at the restoration site would increase the coral cover and would be vital to the maintenance of existing coral populations. Coral reef restoration also provides an indirect benefit to human use activities by making the area more attractive for recreation diving, snorkeling, and fishing.

Short-term minor indirect adverse impacts on **geology** and **substrate** would be anticipated due to construction and work activities at the nursery or coral reef restoration sites. Potential indirect effects to cultural resources are dependent on site-specific conditions associated with a project proposed for implementation. Coral reef restoration would be expected to have long-term, moderate, indirect beneficial effects on **socioeconomics** of local communities. Restoring the natural appearance of the reef would potentially increase revenue from diving and other recreational activities as well as improve fishing opportunities. As corals provide physical shoreline protection from wave action, coral restoration could lead to a decreased risk of localized land loss due to erosion.

5.5.1 EVALUATION OF THE PREFERRED ALTERNATIVE RELATIVE TO THE RC-PEIS

The proposed coral nursery project, as described in Section 5.1.1 above, has been evaluated to determine whether its potential impacts were sufficiently addressed in the RC-PEIS (see Attachment A "NOAA Restoration Center NEPA Inclusion Analysis."

The RC-PEIS addresses coral nursery project alternatives including the activities described in this DARP/NE, and also contains an applicable description of the affected environment and potential direct and indirect impacts associated with this type of work. Specifically, the RC-PEIS describes the actions associated with coral nursery projects, and other related actions, such as coral reattachment, under Section 2.2.2.6.1 of that document.

From Section 2.2.2.6.1 of the RC-PEIS:

Corals are propagated in underwater nurseries with the goal of transplanting nursery-reared corals back onto reefs to improve existing coral colonies and to increase the likelihood of genetic and species diversity within the coral colonies. Transplanted corals should be near enough to each other for successful cross-fertilization during sexual reproduction. Transplantation sites for nursery-grown corals or fragments collected from damaged sites should be chosen where the integrity of the reef structure can be stabilized or has not been severely compromised. This increases the likelihood that coral fragments would successfully attach to the substrate and that attachment failures would not damage adjacent areas on the reef. Coral nursery designs are typically limited to two general types: coral fragments attached to hard structure (e.g., cement, limestone, wire, rebar substrate) or coral fragments suspended on lines in the water column. Specific configurations and deployments are site-specific, dependent on a variety of local conditions as well as the grow-out strategy being pursued by the nursery operators. Nursery stock may be further divided or out-planted using the methods described above.

The project proposed in this Final DARP/NE complies with the description above. As described in Section 5.1.1, the nursery structure in this case would be designed with the characteristics of the likely deployment site in mind. The form and materials would be those determined to have the highest likelihood of success and the fewest potential impacts. They would, for example, take into consideration sediment compaction to determine whether the greater concern is sinking or detaching. In addition, the nursery in this case would have the benefit of not requiring seed corals harvested from a healthy natural site. There are sufficient cached corals from injured sites that no harvesting would be necessary.

The RC-PEIS impacts analysis also includes a description of the impacts associated with this type of project. This analysis may be found in Section 4.5.2.6.1 of that document.

From Section 4.5.2.6.1 of the RC-PEIS:

Disturbances at a coral reef restoration project site last from a few weeks to months, depending on the project type. Projects repairing damaged sites and/or creating new reef structure would likely last a few weeks to months. Coral nursery operations occur over a time span of months to years, but the ongoing site impacts are minimal from operational activities. However, the harvesting of coral fragments may have direct adverse impacts to the substrate and water column, which may include ephemeral sedimentation, turbidity, or other water quality impacts associated with the immediate effects of construction activities. There may also be direct, short-term, adverse, localized impacts to marine animals as a result of human disturbance in the collection area.

The RC-PEIS goes into greater detail on the details of specific potential impacts, but, as noted in the excerpt above, the actual operation of the coral nursery is expected to have minimal impacts. The situation could be different if the nursery is placed in an area with site-specific attributes that would increase the potential for environmental impacts. However, in this case, the sites have been selected with the goal of avoiding areas that have special, additional site-specific sensitivities. In addition, as discussed in the excerpt, the greatest potential for impacts lies not with the nursery itself but with the harvesting process to get the seed corals. In this case, no such harvesting will be necessary due to the availability of loose corals of opportunity that have detached due to natural or anthropogenic impacts.

Ultimately, the RC-PEIS concludes that the anticipated impacts would not be significant, and NOAA proposes to adopt that conclusion and the analysis in this case. A more detailed description of NOAA's justification for doing so can be found in the NEPA Inclusion Analysis, which is provided in Attachment A. Through this analysis, NOAA has made a final determination that the corresponding project description and impacts fall completely within the scope of analysis contained in the RC-PEIS section referenced above. The public was invited to provide feedback on NOAA's proposed action and the analysis conducted in the Draft DARP/NE, which included a draft Inclusion Analysis. NOAA did not receive any public comments on the Draft DARP/NE or the draft Inclusion Analysis, and has determined that no substantive changes are needed to the Inclusion Analysis. NOAA will generate an Inclusion Memorandum, which will memorialize NOAA's decision to rely on the RC-PEIS and adopt the final Inclusion Analysis. The Inclusion Memorandum shall be finalized and signed prior to release of the Final DARP.

5.5.2 EVALUATION OF THE NON-PREFERRED ALTERNATIVES

In this case, the non-preferred alternatives were dismissed because they were not expected to meet the Trustees' purpose and need. Accordingly, with the exception of the "no action" alternative (see Section 5.1.3 below), which is mandated by NEPA, the Trustees did not undertake a detailed impacts analysis of these alternatives. Had the Trustees determined that one or more non-preferred alternatives would meet their purpose and need, NEPA would require an analysis of the potential impacts associated with those alternatives. Because the Trustees determined that they were unlikely to meet the stated purpose and need, no such evaluation is necessary.

5.5.3 EVALUATION OF THE NO ACTION ALTERNATIVE

NOAA evaluated the impacts of the "no action" alternative on geology and soils, water, air, living coastal and marine resources and Essential Fish Habitat, threatened and endangered species, cultural and historic resources, land use and recreation, and socioeconomics. As noted above, no action was a non-preferred alternative because it fails to compensate the public for losses associated with the Incident; however, NEPA mandates that NOAA evaluate the environmental impacts of no action.

By definition, the no action alternative lacks physical interaction with the environment. Accordingly, the no action alternative would cause no direct impacts to any of the elements of the environment listed above. However, if the Trustees undertook no action, the environment would not benefit from the ecological uplift created by active restoration. For example, storms or future vessel groundings in the area of the Incident could injure corals, and, in the absence of the type of out-planting activity in the proposed action, the injuries would remain or worsen. Conversely, the type of active restoration in the proposed action would restore injured areas and potentially prevent further injury.

Based on this evaluation, NOAA concluded that the no action alternative would have either no effect or minor to moderate short or long-term adverse effects on the environment.

6.0 COORDINATION WITH OTHER PROGRAMS, PLANS, AND REGULATORY AUTHORITIES

6.1 OVERVIEW

Two major federal laws guiding the restoration of the injured resources and services from the *Vogetrader* incident are OPA and NEPA. OPA and its natural resource damage assessment regulations provide the basic framework for natural resource damage assessment and restoration. NEPA, as a procedural law, sets forth a specific process of impact analysis and public review. In addition, the Trustees must comply with other applicable laws, regulations and policies at the federal, state and local levels. Key potentially relevant laws, regulations and policies are set forth below. This listing is not necessarily exclusive, as there may be other laws, regulations or policies with which the Trustees will need to comply.

In addition to laws and regulations, the Trustees must consider relevant environmental programs that are ongoing or planned for in the affected environment. By coordinating restoration with other relevant programs and plans, the Trustees can enhance the overall effort to improve the near shore coral reef environment of Hawaii.

6.2 KEY STATUTES, REGULATIONS AND POLICIES

Oil Pollution Act of 1990 (OPA), 33 U.S.C. §§ 2701, *et seq*.; 15 C.F.R. Part 990

OPA establishes a liability regime for oil spills which injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Federal and state agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries and implement restoration. Section 1006(e)(1) of OPA,33 U.S.C. § 2706 (e)(1), requires the President, acting through the Under Secretary of Commerce for Oceans and Atmosphere (NOAA), to promulgate regulations for the assessment of natural resource damages resulting from a discharge or substantial threat of a discharge of oil. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services.

The OPA regulations provide a framework for conducting sound natural resource damage assessments that achieve restoration. The process emphasizes both public involvement and participation by the responsible party(ies). The Trustees have followed the regulations in preparing this assessment.

Hawaii Environmental Response Law, Title 10, Chapter 128D, Hawaii Revised Statutes

The State of Hawaii response law addresses the release or threatened release of any hazardous substance, including oil, into the environment. It creates an environmental response fund which can be used to pay for, among other things, costs of removal actions and costs incurred to restore, rehabilitate, replace or acquire the equivalent of any natural resources injured, destroyed or lost as the result of a release of a hazardous substance. The statute further provides that there shall be no double recovery for natural resource damages. The statute states that upon the request of the Department of Health, the attorney general will recover such costs from the responsible parties. The State of Hawaii Department of Health has promulgated regulations to address the cleanup of releases of hazardous substances. The federal and state Trustees have participated in cooperative injury assessment and restoration planning activities so as to avoid the possibility of any double recovery.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. §§ 4321, *et seq*. 40 C.F.R. Parts 1500-1508

Congress enacted NEPA in 1969 to establish a national policy for the protection of the environment. NEPA applies to federal agency actions that affect the human environment. NEPA established the Council on Environmental Quality (CEQ) to advise the President and to carry out certain other responsibilities relating to implementation of NEPA by federal agencies. Pursuant to Presidential Executive Order 11514, federal agencies are obligated to comply with the NEPA regulations adopted by the CEQ. These regulations outline the responsibilities of federal agencies under NEPA and provide specific procedures for preparing environmental documentation to comply with NEPA.

The Trustees have integrated this restoration plan with the NEPA process to comply, in part, with those requirements. This integrated process is recommended under §1500.2 "Integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively."

Hawaii Environmental Impact Statements, Title 19, Chapter 343, Hawaii Revised Statutes

In this chapter, Hawaii has established a system of environmental review to ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations. The statute provides for public review and opportunity for comments on a range of activities such as proposed use of state or county lands or proposed use within the shoreline area. The statute notes that when an action is subject both to this chapter and NEPA, the state agencies "shall cooperate with federal agencies to the fullest extent possible to reduce duplication between federal and state requirements." This cooperation would include concurrent public review.

The Trustees have integrated the federal and state environmental review requirements as they have proceeded with restoration planning and implementation.

Coastal Zone Management Act (CZMA), 16 U.S.C. §§ 1451, *et seq*., 15 C.F.R. Part 923

The goal of the CZMA is to preserve, protect, develop, and where possible, restore and enhance the nation's coastal resources. The federal government provides grants to the states with federally-approved coastal management programs. The State of Hawaii has a federally-approved program. Section 1456 of the CZMA requires that any federal action inside or outside of the coastal zone that affects any land or water use or natural resources of the coastal zone shall be consistent, to the maximum extent practicable, with the enforceable policies of approved state management programs. It states that no federal license or permit may be granted without giving the State the opportunity to concur that the project is consistent with the state's coastal policies. The regulations outline the consistency procedures.

The Trustees received concurrence from the State of Hawaii that the project is consistent to the maximum extent practicable with the enforceable policies of the state coastal program.

Endangered Species Act (ESA), 16 U.S.C. §§ 1531, *et seq*., 50 C.F.R. Parts 17, 222, 224

The ESA directs all federal agencies to conserve federally listed endangered and threatened species and their habitats, and encourages such agencies to utilize their authorities to further these purposes. Under the Act, the NOAA Fisheries and the USFWS publish lists of endangered and threatened species. Section 7 of the Act requires that federal agencies consult with these two agencies to minimize the effects of federal actions on endangered and threatened species. The federal Trustees have determined that implementing the proposed restoration would not be likely to adversely affect any listed species, and conducted an informal section 7 consultation. A concurrence with this determination was received from the Pacific Islands Regional Office (PIRO) Protected Species Division.

Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. §§ 1801 *et seq*.

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires federal fishery management plans to describe the habitat essential to the fish being managed and describe threats to that habitat from both fishing and non-fishing activities. In addition, in order to protect this Essential Fish Habitat (EFH), federal agencies are required to consult with the National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. The federal Trustees determined that implementing the proposed restoration would not adversely affect any designated EFH, and NOAA has completed an EFH consultation with the PIRO Habitat Conservation Division

Hawaii Conservation of Aquatic Life, Wildlife, and Land Plants, Title 12, Chapter 195D

Recognizing that many species of flora and fauna unique to Hawaii have become extinct or are threatened with extinction, the state established procedures to classify species as locally endangered or threatened. The statute directs the DLNR to determine what conservation measures are necessary to ensure the continued ability of species to sustain themselves.

Fish and Wildlife Coordination Act (FWCA), 16 U.S.C. §§ 661, *et seq*.

The FWCA requires that federal agencies consult with the USFWS, NMFS, and state wildlife agencies for activities that affect, control or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the Clean Water Act, NEPA or other federal permit, license or review requirements.

Executive Order (EO) 13089 Coral Reef Protection

On June 11, 1998, President Clinton issued EO 13089, Coral Reef Protection, to address impacts to coral reefs. Section 2 of that EO states that federal agency actions that may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems. Given that this DARP/NE is designed to restore injured coral and coral reef habitat, compliance with EO 13089 is inherent within the project.

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Attachment A

NEPA Inclusion Analysis

NOAA Restoration Center NEPA Inclusion Analysis

Award Number

I. IDENTIFYING PROJECT INFORMATION

Project Name	Project State
M/V Vogetrader Grounding Restoration Project	HI

Project Proponent / Applicant	Project Contact
Matthew Parry	(808)-725-5092

II. OTHER FEDERAL PARTNERS AND LEVEL OF NEPA ANALYSIS

Has another Federal agency completed NEPA?	☐ Yes	☒ No
Is NOAA the lead federal agency for this NEPA analysis?	☒ Yes	☐ No

III. PROJECT DESCRIPTION / SCOPE OF ACTIVITIES FOR ANALYSIS

Please check one of the following conditions:

☐ *I am analyzing impacts of project planning and design activities, in order to gather all required project information*

☒ *I have all information needed to complete the final analysis of impacts for the entire project*

Has a NEPA review been conducted for prior project activities?	☐ Yes ☒ No	*Date of NEPA completion for prior phase* N/A

Describe the full scope of the project, including historic/ geographic/ ecological context, the type of restoration, and how it will be conducted.

The National Oceanic and Atmospheric Administration's (NOAA) proposed project is to prevent coral losses by salvaging loose corals and husbanding them in coral nursery structures for reattachment into sites injured by incidents, such as storms, orphan vessel groundings, etc. This project will directly compensate for the coral injury resulting from the grounding incident by increasing the amount of ecological services provided by coral around the Oahu coast. The ecological services provided by the corals include habitat and forage for fish and invertebrates, among others. The proposed project will create in-water coral nursery structures at 3 different sites on the island of Oahu, these structures will be filled with corals of opportunity (corals that have been dislodged or broken by various occurrences, as described above). When the nurseries have substantial material to address future injury sites and conditions are good, the coral will then be transplanted to the injury sites for reattachment. Nursery structures will be constructed at three sites on Oahu, two sites will be located on the South Shore while the third will be located within Kaneohe Bay.

Describe the proposed action (i.e. the portion of the project that NOAA is funding/approving).

Collect corals of opportunity and husband them in nursery structures around the island of Oahu. Two nurseries will be located on the south shore and one will be located in Kaneohe Bay. Corals of opportunity will be collected, transplanted, and reattached into existing injury sites.

NOAA is funding the full portion of the project through settlement funds that currently reside in the DARRF.

Check the types of activities being conducted in this project:

Technical Assistance

- ☐ Implementation and Effectiveness Monitoring
- ☐ Environmental Education Classes, Programs, Centers, Partnerships and Materials; Training Programs
- ☐ Fish and Wildlife Monitoring
- ☐ Planning, Feasibility Studies, Design Engineering, and Permitting

Riverine and Coastal Habitat Restoration

- ☐ Beach and Dune Restoration
- ☐ Debris Removal
- ☐ Dam and Culvert Removal & Replacement
- ☐ Technical and Nature-like Fishways
- ☐ Invasive Species Control
- ☐ Prescribed Burns/Forest Management

NEPA Inclusion Analysis

☐ Species Enhancement	☐ Bank Restoration and Erosion Reduction	☐ Water Conservation and Stream Diversion
☐ Channel Restoration	☒ Coral Reef Restoration	☐ Levee & Culvert Removal, Modification, Set-back
	☐ Shellfish Reef Restoration	☐ Fringing Marsh and Shoreline Stabilization
	☐ Artificial Reef Restoration	☐ Sediment Removal
	☐ Road Upgrading/Decommissioning; Trail Restoration	☐ Sediment/Materials Placement
	☐ Signage and Access Management	☐ Wetland Planting
	☐ SAV Restoration	
	☐ Marine Algae Restoration	
Conservation Transactions		
☐ Land Acquisition	☐ Water Transactions	☐ Restoration/Conservation Banking

IV. PROJECT IMPACT ANALYSIS

Core Questions

*1. Are the **activities** to be carried out under this project fully described in Section 2.2 of the NOAA RC PEIS?*	☒ *Yes*	☐ *No*
*2. Are the specific **impacts** that are likely to result from this project fully described in Section 4.5.2 of the NOAA RC PEIS?*	☒ *Yes*	☐ *No*
3. Does the level of adverse impact for the project exceed that described in Table 11 of the NOAA RC PEIS for any resource, including significant adverse impact?	☐ *Yes*	☒ *No*

4. Describe the project impacts to resources (including beneficial impacts) and any mitigating measures being implemented.

There may be some possible shading of corals at one site that is located on hard bottom (other sites are sand and rubble). To mitigate this the nursery structure will be positioned in an area as devoid of corals as possible. Any unavoidable corals greater than 5cm diameter will be transplanted out of the nursery footprint. Beneficial impacts are that likely thousands of corals a year will be saved from dying and will outplanted to other injury sites. Any other impacts such as increased boat traffic, handling of corals, air quality will be negligible.

5. Describe any potential cumulative impacts that may result from past, present or reasonably foreseeable future actions (beneficial or adverse).

There are no other in-water coral nurseries in Hawaii so there are no cumulative impacts with other projects of this type. There may be positive cumulative impacts to coral reefs from this project if other restoration projects are implemented and result in an overall increase in coral reef health in Hawaii, but there are no similar other projects known at this time.

6. Describe the public outreach and/or opportunities for public comment that have taken place to this point. Are any future opportunities for public input anticipated?

Input for this project has been gained from the public presentation of the University of Hawaii Mechanical Engineering Senior Thesis project at the University of Hawaii. Input has also been obtained from private marine engineering and marine tourism companies. Public comment on the Vogetrader draft Damage Assessment Restoration Plan (DARP) and NEPA Evaluation (Inclusion Analysis) was solicited in a number of ways. A notice of availability to comment and a public meeting invitation were published in the local newspaper on 10/9/17, and the draft DARP/NEPA Evaluation and public meeting information were also made available to the public through a web posting on the DARRP-Vogetrader case page. No public comments were received via letter, email, or phone call during the 30-day comment period (10/9/17 to 11/15/17) and no one attended the public meeting held at the University of Hawaii at Manoa on 10/20/17.

7. Have any public comments raised issues of scientific/environmental controversy? Please describe.

No

8. Describe the most common positive and negative public comments on issues other than scientific controversy described above in Question 7.

The most common positive comments are that this is a great project that should help Hawaiian reefs. There have been no negative comments.

See following page for NEPA Determination

NEPA Inclusion Analysis

V. NEPA DETERMINATION

☒ The action is completely covered by the impact analysis within the NOAA RC Programmatic EIS (PEIS). The project and its potential impacts may be limited through terms or conditions placed on the recipient of NOAA funds. It requires no further environmental review. An EIS Inclusion Document will be prepared.

☐ The action analyzed here has unknown impacts. At this time, funding will be limited to those portions of the action and impacts analyzed in the PEIS. These limitations will be described in terms or conditions placed on the recipient of NOAA funds. If all remaining activities and impacts are later determined to be described in the PEIS, this analysis will be documented in the program record and the applicant may then proceed with the project. If all remaining activities and impacts are later determined to not be described in the PEIS, further NEPA review will be required; see below.

☐ The action or its impacts are not covered by the analysis within the PEIS. It will require preparation of an individual EA, a supplemental EIS, adoption of another agency's EA or EIS, or will be covered by a Categorical Exclusion.

Signature PARRY.MATTHEW.P.1365893825 Digitally signed by PARRY.MATTHEW.P.1365893825 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=PARRY.MATTHEW.P.1365893825 Date: 2017.12.07 09:07:55 -10'00'

Date Signed ____________