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4.0 RESTORATION PLANNING

4.1 RESTORATION STRATEGY

The goal of restoration under OPA is to compensate the public for injuries to natural resources and services from the August 24, 1998 Tesoro oil spill. OPA requires that this goal be achieved by returning injured natural resources to their baseline condition and, if possible, by compensating for any interim losses of natural resources and services during the period of recovery to baseline.

Restoration actions under the OPA regulations are either primary or compensatory. Primary restoration is action(s) taken to return injured natural resources and services to baseline on an accelerated time frame. The OPA regulations require that Trustees consider natural recovery under primary restoration. Trustees may select natural recovery under three conditions: (1) if feasible, (2) if cost-effective primary restoration is not available, or (3) if injured resources will recover quickly to baseline without human intervention. Alternative primary restoration activities can range from natural recovery to actions that prevent interference with natural recovery to more intensive actions expected to return injured natural resources and services to baseline faster or with greater certainty than natural recovery.

Compensatory restoration is action(s) taken to compensate for the interim losses of natural resources and/or services pending recovery. The type and scale of compensatory restoration may depend on the nature of the primary restoration action and the level and rate of recovery of the injured natural resources and/or services given the primary restoration action. When identifying the compensatory restoration components of the restoration alternatives, Trustees must first consider compensatory restoration actions that provide services of the same type and quality, and of comparable value as those lost. If compensatory actions of the same type and quality and comparable value cannot provide a reasonable range of alternatives, Trustees then consider other compensatory restoration actions that will provide services of at least comparable type and quality as those lost.

In considering restoration for injuries resulting from the Incident, the Trustees first evaluated possible primary restoration for each injury. Based on that analysis, the Trustees determined that no primary restoration, other than natural recovery for ecological injuries, was appropriate. Thus, with the exception of the natural recovery alternative, only compensatory restoration projects are presented below.

Compensatory restoration alternatives should be scaled to ensure that the size or quantity of the proposed project reflects the magnitude of the injuries from the spill. The Trustees relied on the OPA regulations to select the scaling approach for compensatory restoration actions. The Trustees selected different scaling approaches for the ecological and the lost human use projects. Those approaches are discussed in further detail in Section 4.5.1.

The net removal proposed project is summarized in Section 4.5.2. The more detailed plan is part of the administrative record. It is possible that the details of the seabird predator control projects may require additional refinements or adjustments to reflect site conditions or other factors. The proposed restoration projects also may change to reflect public comments and further Trustee analysis. The Trustees assume that implementation of restoration will begin in 2000.

4.2 EVALUATION CRITERIA

The OPA regulations (15 CFR § 990.54) 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,
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.

In addition, the Trustees considered several other factors including:

1. cost effectiveness,
2. nexus to geographic location of the injuries, and
3. compliance with applicable federal and state laws and policies.

NEPA applies to restoration actions taken by federal Trustees. 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 draft restoration plan.

To comply with the requirements of NEPA, the Trustees analyzed 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. For the actions proposed in this Final RP/EA, the appropriate context for considering potential significance of the action is local, as opposed to national or world-wide.

With respect to evaluating the intensity of the impacts of the proposed action, the NEPA regulations (40 CFR § 1508.27) suggest consideration of ten factors:

1. likely impacts of the proposed projects;
2. likely effects of the projects on public health and safety;
3. unique characteristics of the geographic area in which the projects are to be implemented;
4. controversial aspects of the project or its likely effects on the human environment;
5. degree to which possible effects of implementing the project are highly uncertain or involve unknown risks;
6. precedential effect of the project on future actions that may significantly affect the human environment;
7. possible significance of cumulative impacts from implementing this and other similar projects;
8. effects of the project on National Historic Places, or likely impacts to significant cultural, scientific or historic resources;
9. degree to which the project may adversely affect endangered or threatened species or their critical habitat; and
10. likely violations of environmental protection laws.

4.3 ENVIRONMENTAL CONSEQUENCES (INDIRECT, DIRECT, CUMULATIVE)

To restore resources lost as a result of the Incident, the Trustees examined a variety of proposed projects under the following restoration alternatives: (1) no action and natural recovery, (2) ecological restoration, and (3) lost human use restoration. The Trustees intend to avoid or reduce negative impacts to existing natural resources and services to the greatest extent possible. However, the Trustees could undertake actions that may have short- or long-term effects upon existing habitats or non-injured species. Project-specific environmental consequences for each proposed project are provided in Section 4.5. This section addresses the potential overall cumulative, direct, and indirect impacts, and other factors to be considered in both the OPA and the NEPA regulations.

The Trustees believe that the projects selected in this restoration program will not cause significant negative impacts to natural resources or the services they provide. Further, the Trustees do not believe the proposed projects will adversely affect the quality of the human environment in ways deemed "significant."

Cumulative Impacts: Since the Trustees designed the projects primarily to improve recovery of injured natural resources, the cumulative environmental consequences will be largely beneficial. These cumulative impacts include restoration of the injured ecosystem by increasing reproductive success of individual seabirds which will enhance recruitment of seabirds, protection of some endangered and threatened species, and enhancement

of intertidal and subtidal habitats. Both project and NEPA monitoring of projects funded under this Final RP/EA will confirm that cumulative impacts will be beneficial rather than adverse. Any cumulative adverse effects on an area or other area program, plan, or regulatory regime from a proposed project will result in reconsideration of the project by the Trustees.

Indirect Impacts: Environmental consequences will not be limited to the project location. Indirect beneficial impacts will occur in other parts of the Hawaiian Islands. Cumulative impacts at the project locations, and in the surrounding area, are expected to increase populations of seabirds, provide improved habitats for marine mammals and biota in intertidal and subtidal habitats, and provide a greater understanding of human interaction with natural resources. These projects could indirectly benefit a variety of federally *threatened and endangered species* and Hawaiian- listed sensitive species by improving habitats utilized during the lives of these species.

Direct Impacts: Overall, this Final RP/EA will enhance functionality of ecosystems. However, there will be some short-term impacts from the proposed projects such as:

- noise and air pollution -- machinery and equipment used during construction and other restoration activities will generate noise. This noise may disturb wildlife and humans. It is not anticipated, however, that the proposed projects will cause *significant noise impacts*.
- water quality -- although implementation of the proposed projects should result in no significant impact to water quality, there will be temporary increases in sedimentation and turbidity related to certain projects.
- visual -- there will be temporary visual impacts during implementation of some of the proposed projects. Once the Trustees complete those projects, the visual impacts will cease.
- public access -- public access may be temporarily affected during construction activities and net removal activities. Because implementation time for these projects will be relatively short, the impact will be short-lived.

See Section 5 for a discussion of potential impacts to the coastal zone and to endangered and threatened species.

No adverse effects are anticipated to sediment quality, soil, geologic conditions, energy consumption, wetlands or flood plains. The proposed restoration projects will have no social or economic impacts on neighborhoods or communities. General land use patterns and aesthetic qualities will not be affected by the preferred alternatives. The proposed projects will not affect any archaeological sites or sites of cultural significance to native Hawaiians.

4.4 EVALUATION OF RESTORATION ALTERNATIVE 1: NO ACTION/NATURAL RECOVERY

NEPA requires the Trustees to consider a “no action” alternative, and the OPA regulations require consideration of the equivalent, the natural recovery option. Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending environmental recovery. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources. While natural recovery would occur over varying time scales for the injured resources, the interim losses suffered would not be compensated under the no action alternative.

The principal advantages of this approach are the ease of implementation and the absence of monetary costs because natural processes rather than humans determine the trajectory of recovery. This approach, more than any other, recognizes the tremendous capacity of ecosystems to self-heal.

OPA, however, clearly establishes Trustee responsibility to seek compensation for interim losses pending recovery of the natural resources. This responsibility cannot be addressed through a no action alternative. While the Trustees have determined for the Incident that natural recovery is appropriate as primary restoration for injuries to the shoreline, subtidal habitat, intertidal habitat and seabirds, the no action alternative is rejected for compensatory restoration. Losses were, and continue to be, suffered during the period of recovery from this spill, and technically feasible, cost-effective alternatives exist to compensate for these losses.

4.5 EVALUATION OF RESTORATION ALTERNATIVE 2: ECOLOGICAL RESTORATION

The Tesoro oil spill impacted several habitat types -- intertidal shoreline (which includes sandy beaches, rocky shores, etc.), water column and subtidal bottom, and the biota in those habitats. Species potentially affected by the spill include federal- or state-listed threatened and endangered species such as the endangered Hawaiian monk seal, the threatened Newell's shearwater and the endangered Hawaiian dark-rumped petrels, as well as other seabirds. Lost ecological services resulting from the spill include reductions in the ability of certain habitats to provide ecological functions such as the provision of food and refuge for various species and lost seabird functions.

4.5.1 Scaling Approaches

4.5.1.1 Lost Ecological Services.

The OPA regulations require the Trustees to consider compensatory restoration actions that provide services of the same type and quality, and of comparable value as those

injured. When services of the same type and quality, and of comparable value can be provided, the OPA regulations prescribe the "service-to-service" scaling approach to determine the appropriate scale of compensatory restoration.

The Trustees determined that "services of the same type and quality, and of comparable value" as the lost ecological services could be provided through habitat protection and enhancement and seabird projects. Therefore, consistent with the criterion described in Section 4.2 above, the Trustees followed the "service-to-service" approach to scale compensatory restoration projects that address lost ecological services.

In this case, the Trustees first selected habitat equivalency analysis (HEA)⁶ as a scaling tool. HEA is commonly applied in NRDA cases to scale compensatory restoration projects that address lost ecological services. It is described in the preamble to the OPA regulations as a potential approach to scaling such projects.

In HEA, compensatory restoration projects are scaled so that the quantity of replacement services provided equals the quantity of lost services. These services are quantified in physical units of measure such as "acre years" or "bird years." There is no need to explicitly or directly value replacement services in monetary terms if they are comparable to the lost services. Therefore, to satisfy the compensation criterion, Trustees must evaluate whether compensatory restoration projects can provide services that are comparable to the lost services.

Scaling for this spill presented a challenge to the Trustees. Because no one anticipated oil from the August 24, 1998 spill off Barbers Point to appear on the shores of Kauai, Trustee efforts to gather precise data on area oiled and species impacted were hindered for several reasons. First, parts of the coastline potentially oiled were not accessible to Trustees and other areas proved difficult to reach. Second, there was a delay in the time between when the oil first reached Kauai's shoreline and arrival of the Trustees. This, in turn, hampered initiation of data collection by the Trustees. During this delay, oiled wildlife may have been scavenged from the shoreline or may have washed back to the ocean. Third, the Trustees had limited personnel to cover a relatively large geographic area. As a result, the Trustees focused on smaller areas which appeared to be more ecologically sensitive and more heavily impacted. Fourth, an unknown number of oiled seabirds undoubtedly perished at sea and their carcasses never washed ashore.

The Trustees and Tesoro attempted to fill some of the data gaps by conducting cooperative studies or surveys. These cooperative efforts included a follow-up study on exposure of opihi on Kauai; a series of surveys to observe physical effects of oiling on Hawaiian monk seals; oiled seabird surveys at Sea Life Park, Mokapu Point, Kaeana Point, and Moku Manu on Oahu; Kilauea Point, Lehua Rock, and Ka'ula Rock on Kauai;

⁶ This methodology is also known as resource equivalency analysis (REA).

and aerial seabird surveys in the Kauai Channel to assess seabird abundance and distribution. The Trustees also considered additional field work and other studies to provide more specific information for the scaling effort. The Trustees decided, however, that such work would be expensive to undertake and would not provide meaningful results in a timely fashion, if at all. Further, it was uncertain whether the studies would provide information that would significantly improve the accuracy or precision of the scaling results. Because both the Trustees and Tesoro preferred to focus on rapid implementation of restoration, they agreed to a more expedited process, recognizing that both sides would have to accept a degree of uncertainty in the scaling calculations. This uncertainty is compounded by the fact that even in the best of circumstances precise scaling calculations often are not possible due to incomplete knowledge of relevant physical and biological processes. Out of necessity, the calculations must utilize some simplifying assumptions.

To address the impacts of the oiling of the Kauai coastline, the Trustees and Tesoro spent considerable time discussing the appropriate "metric" or physical unit of measure to be used and variables or inputs necessary for the scaling exercise. Variables included types of habitat, the species utilizing the habitat, projected recovery lines for injured species and habitats, extent and nature (e.g., light, medium, heavy) of oiling and potential for restoration. It soon became apparent to the participants in this process that the HEA method was not feasible due to disagreement on a multitude of inputs required for the HEA. Ultimately, the Trustees and Tesoro agreed on a simpler approach that included the extent of oiling, the types of injuries potentially caused by both the oiling and the subsequent cleanup activities, the type of restoration project(s) that could address those injuries, and the amount of necessary restoration.

The oiling occurred between Kilauea Point to Makahuena Point on the northeastern, eastern and southeastern coast of Kauai and between Makaha Point to Mana Point on the western side of the Island. The Trustees acknowledge that it is unlikely that oiling occurred in every area between those points. Likewise, it is unlikely that intertidal and subtidal habitat and the biota in those habitats in every part of that geographic range were affected. Due, however, to the lack of accurate and precise information and the agreement between the Trustees and Tesoro to use an expedited process, the Trustees believed it was in the public's interest to assume that the spill affected all of this area.

The Trustees then considered the types of impacts likely caused to the habitats in this area. The oil can cause mortality through toxicity to or smothering of small organisms. Cleanup activities can injure certain habitats when oiled areas are scrubbed or wiped clean by abrading or detaching small organisms, and the presence of cleanup crews can result in trampled or crushed biota.

During the aerial survey of the Hawaiian monk seals, the Trustees and Tesoro observed a number of abandoned heavy trawl (fishing) nets in the intertidal area and subtidal waters around Kauai. The Trustees and Tesoro agreed that a net removal project would address

many of the types of injuries identified above. Heavy fishing nets can crush, abrade or smother organisms. Because many nets are not firmly attached to the ocean bottom, they continue to move in the water, abrading the ocean bottom and intertidal areas. They also can cause mortality when fish, sea turtles, marine mammals or other organisms become entangled in the nets.

Finally, the Trustees and Tesoro agreed that the appropriate scale of a net removal project would be a concentrated effort to remove nets from the adjacent shoreline out to a ten-meter depth in the general area where the oil spill impacts were observed between Kilauea Point to Makahuena Point and between Makaha Point to Mana Point, for a specific length of time. The Trustees and Tesoro determined this time period by analyzing the number of nets in this area based on information from the February, 1999 Hawaiian monk seal survey and the locations of the nets (shoreline, intertidal or subtidal). After discussions with individuals with net removal experience, the Trustees and Tesoro estimated the amount of time required to remove the identified nets. They then built in additional time for weather contingencies.

4.5.1.2 Seabirds

To address the impacts of oiling on seabirds, the Trustees examined two types of models for scaling seabird injury. One type of model calculated lost bird-years based on the estimate of injured birds and then compared these numbers to the estimated number of saved bird-years for a particular restoration project. The other type of model was a simplified population productivity model which calculated the reproductive potential of a hypothetical seabird population that represented the variety of species potentially injured in the spill. The reproductive potential of this population was then determined for each of the proposed restoration projects to assess their value in restoring injured seabirds. Numerous assumptions were required to input data into each of these models making it difficult to apply them to the variety of species potentially injured in this spill and significantly raising the uncertainty of the accuracy of the models' output.

The ability to scale impacts to restoration actions was hampered by a variety of factors as discussed in Section 3.4.3. These factors include the delayed arrival of Trustees, resulting in delayed surveys and recovery efforts of injured wildlife; the uncertain trajectory of the oil due to the complex current and wind patterns in the vicinity of the islands; the limited shoreline area relative to open ocean in which to recover oiled birds; the inaccessibility or remoteness of many seabird colonies; the diverse roosting and nesting behavior of tropical seabirds; and the wide foraging range of tropical seabirds. All of these factors greatly decreased the likelihood that oiled birds would be detected or recovered and therefore affected the Trustees ability to scale potential injuries to restoration projects.

Given the uncertainties associated with the number of birds potentially oiled by the spill, the Seabird TWG agreed to focus on feasible restoration projects which would restore

species either actually found or observed oiled or likely to have been oiled by the spill. The Trustees have proposed three restoration projects to restore injured seabirds (see Sections 4.5.3 - 4.5.5.): (1) predator control in Newell's shearwater colonies on Kauai, (2) predator control and habitat enhancement on offshore islands in the Hawaii State Seabird Sanctuary, and (3) extension of the predator control fence at Kilauea Point NWR on Kauai.

The Trustees estimated that 26,000 Newell's shearwaters may have been present within the potential oil exposure area. An undetermined number of these birds may have been injured by the spill based on their wide foraging range and habit of rafting offshore of their nesting colonies on Kauai, however, the scope of injury could not be determined with any requisite degree of certainty. Newell's shearwaters are listed as both a Federal- and State-threatened species and their numbers have continued to decline (Day and Cooper 1999). The relative inaccessibility of their colonies, coupled with the biology of the birds (burrow nesting species which transits from colony at night), made it difficult to develop feasible restoration projects. Control of alien predators was determined to be a viable restoration option since predation is considered to be one of the factors affecting their recovery (Ainley *et al.* 1995) and predator control has been effective at other shearwater and petrel colonies.

Predator control and habitat enhancement on offshore islands in the Hawaii State Seabird Sanctuary was also proposed as a restoration option since this project would target many of the species potentially injured in the spill. These species include brown boobies, masked boobies, red-footed boobies, great frigatebirds, brown noddies, Bulwer's petrels, wedge-tailed shearwaters, and sooty terns. Many of these islands support introduced mammals and plants which degrade the quality of nesting habitat or otherwise reduce the reproductive success of breeding seabirds. Techniques for the eradication of rats, control of non-native plants, and restoration of native vegetation have been successfully employed on other islands and are expected to be equally effective on the island sanctuaries.

The Trustees have also proposed to repair and extend the predator control fence at Kilauea Point NWR on Kauai. The introduction of dogs, cats, mongooses, and rats to Hawaii has negatively impacted ground-nesting seabirds. The Kilauea Point NWR is one of the few sites on the main islands where seabirds can nest successfully due to predator-proof fences. A variety of seabirds would benefit from this project including Laysan albatross, wedge-tailed shearwaters, red-tailed tropicbirds, and white-tailed tropicbirds.

In developing seabird restoration projects, not all species potentially injured in the spill were able to be addressed due to the inaccessibility of their nesting colonies. These species include the black noddy, Hawaiian dark-rumped petrel, Christmas shearwater, gray-backed tern, and white tern. The Trustees believe that benefits to other injured seabirds will help compensate for the potential injury to these species. Additionally, a few species which were not the focus of these restoration efforts (*e.g.*, Hawaiian goose, Pacific golden plover, and ruddy turnstone) may benefit from the proposed projects due to their

use of these restoration sites. This enhancement of non-target populations is a likely outcome of most, if not all, restoration efforts.

4.5.2 Preferred Alternative: Net Removal Project

Project Description: Net removal activities will occur from the adjacent shoreline out to a ten-meter depth from Kilauea Point to Makahuena Point and from Makaha Point to Mana Point (work area). Recognizing that the February 1999 net information will need to be updated, the Trustees and Tesoro will gather additional information from the public concerning location of nets. Immediately before beginning the field work, the Trustees and Tesoro will conduct an aerial survey to verify the location of nets in the work area. Based on this information, the Trustees and Tesoro will complete a net removal action plan. Most net removal activities will be carried out by two teams -- a boat team and a shore team. All nets recovered by these teams will be disposed of by Tesoro in accordance with a pre-approved waste disposal plan. An aerial team, composed of a helicopter and pilot, will be available to assist in removal of nets from areas not readily accessible to land vehicles.

Restoration Objectives: The goal of this proposed project is to remove abandoned fishing nets from the general area where the Trustees observed impacts from the oil spill. This project meets the goals of the Trustees by compensating for interim losses to shoreline, intertidal and subtidal habitats and the biota in those habitats and by addressing potential injury to the endangered Hawaiian monk seal.

Probability of Success: The probability of success is high. Net removal activities have been and continue to be conducted in the Hawaiian Islands. Net removal techniques are well-known, cost effective, and relatively easy to implement.

Performance Criteria and Monitoring: The Trustees have established performance criteria in the net removal plan such as standards for net removal, definition of a net, disposal requirements, number of hours in a work day and definition of work area. Trustee representatives will monitor both the shore and boat teams. The Trustee representatives have authority to designate the geographic area within the work area where work will occur, to select which nets will be removed, and to provide directions on removing nets to minimize injury to coral or other living marine resources.

Benefits and Environmental Impacts: Abandoned fishing nets cause injury to shoreline, intertidal and subtidal habitats by smothering or crushing organisms and by abrading the ocean bottom and shoreline areas. Such nets also cause mortality to fish, sea turtles and marine mammals which may become entangled in them. Removal of the nets will cause some short-term disruption to the shoreline, intertidal and subtidal habitats.

Shoreline disruptions include personnel walking on the shore and dragging or hoisting nets into vehicles for disposal. To minimize shoreline impacts, heavy equipment such as

bulldozers, excavators, graders, or track hoes will not be used. Net removal activities will be conducted in a manner to avoid or minimize injury to corals and other living marine organisms. For example, if a net is partially encrusted and anchored to the substrate, only those sections not anchored and incorporated as part of the substrate will be removed. Completely encrusted nets that have become anchored and incorporated as part of the substrate will not be removed. Live coral colonies that are detached from the sea floor and caught in the nets being removed will be returned to the sea in the general vicinity as soon as practical and to the extent possible.

Evaluation: Abandoned fishing gear is a well-documented hazard to marine life in the Hawaiian Islands. In the Northwestern Hawaiian Islands, Hawaiian monk seals, sea turtles and seabirds have been found entangled in nets that have washed ashore (Boland 1997). The February 1999 Hawaiian monk seal aerial survey documented 133 nets around the Island of Kauai. While there will be some temporary, negative impacts to some natural resources as a result of the net removal, the Trustees have determined that the project's overall environmental impacts are positive.

4.5.3 Preferred Alternative: Predator Control in Newell's Shearwater Colonies on Kauai

Project Description: The core of the remaining breeding population of the threatened Newell's shearwater is located in rugged terrain at high elevations in the interior of the island of Kauai. Though the area is relatively inaccessible to humans, it has not escaped the impact of various species of alien predators such as feral cats (*Felis catus*) and rats (*Rattus rattus* and *R. exulans*). Recent studies suggest that the decline in Newell's shearwaters on Kauai is probably due to the combination of predation by alien mammals and collision with power lines and lighted structures (Ainley *et al.* 1995). The Trustees are proposing to reduce the rate of decline of this seabird on Kauai by initiating predator control programs during the breeding season when adults, chicks, and eggs are particularly vulnerable to these mammalian predators. Predator control would occur in the few relatively accessible nesting colonies. Cats would be controlled through the use of traps and removed from the shearwater colony site. Bait stations using the toxicant diphacinone would be used to control rats. Diphacinone is currently registered by the EPA for use in Hawaii in forests, on offshore islands, and in other non-crop outdoor areas to protect Hawaiian native and endangered plants and animals. The registration does not require the removal of poisoned rats. The rats are expected to die in their burrows and not be accessible to other animals.

Proposed colony sites for this work are three relatively low elevation areas on Kauai (Kalaheo, Kaluahonu, and Kapaa) at which predation has been demonstrated to be a problem and for which population size appears to be dramatically decreasing based on rates of predation observed in the colonies, continued declines in the numbers of birds collected during the annual "fallout" period when birds striking power lines and lighted

structures are collected and counted, and the overall decline in numbers of birds detected between two radar surveys on Kauai conducted six years apart (Ainley *et al.* 1995; Day and Cooper 1999). Limited information is available on these colonies. The number of traps and bait stations to be deployed at the sites will be dependent on surveys of the colonies prior to trapping and baiting as well as estimates of the predator population in the area.

Restoration Objectives: The goal of this proposed project is to enhance Newell's shearwater survivorship and productivity by controlling alien mammalian predators. All age classes of shearwaters are expected to benefit from this project. This project meets the goals of the Trustees by compensating for interim losses to seabirds and by addressing potential injury to the threatened Newell's shearwater.

Probability of Success: The probability of success is moderate. Reproduction and survivorship have increased for an ecologically similar species, the Hawaiian dark-rumped petrel at Haleakala National Park on Maui following feral cat control (Hodges 1994) and on the Galapagos Islands after control of feral cats and rats at breeding colonies (Coulter *et al.* 1985; Tomkins 1985). The Trustees expect to employ similar techniques for eradication of feral cats and rodents that have been well established and tested at many sites.

Performance Criteria and Monitoring: Success for this project will be measured by numbers of introduced mammals removed over time and by measuring population size and reproductive performance in the treated colonies. Comparisons of breeding success between colonies with and without predator control is best done by detecting the rate of avian traffic using radar sampling techniques to detect flights to and from the colonies. Differential changes in population size estimates made during fledging season downhill from predator control areas compared with un-managed sites would provide a measure of the efficacy of the actions taken at the colonies. This radar technique has been developed and calibrated for use on Newell's shearwaters on Kauai by Day and Cooper (1995; 1999).

Benefits and Environmental Impacts: Potential impacts from the proposed project includes the environmental benefits described under Restoration Objectives. There may be minor impacts to the colony area due to enhancement of trails to and through the colony. Limited disturbance may occur to some nesting birds during the set up and monitoring of traps and bait stations. Trail enhancement and disturbance will be minimized by limiting access points to the colony. Since nesting burrows are very dispersed, it is unlikely there will be mechanical damage to burrows from the setting of live-traps for cats. Due to the decreasing population size on Kauai, the number of traps and bait stations are expected to be limited.

Secondary impacts or impacts to non-target species from the use of diphacinone are not expected to occur. Other than the Hawaiian hoary bat, there are no native terrestrial

mammals on Kauai and the shearwater colonies are located in rugged terrain in high elevation areas away from human populations and livestock. The pueo (*Asio flammeus*), a native Hawaiian owl, occurs on Kauai but is not expected to be impacted by diphacinone bait stations. A study at Hakalau Forest NWR found that pueo did not scavenge rat carcasses placed on the ground (Lindsey and Mosher 1994). A review of other studies by Swift (1998) found that birds are not very susceptible to diphacinone. The blood clotting factor which diphacinone inhibits is not important in the avian blood clotting cascade (Belleville *et al.* 1982). Additionally, rats feeding at bait stations are expected to die in their burrows, thereby minimizing potential exposure to other species.

Evaluation: Declines in Newell's shearwater colonies on Kauai have been attributed, in part, to predation (Ainley *et al.* 1995) and the colonies have shown dramatic decreases in the past decade (Day and Cooper 1999). Diphacinone has a good safety record, is one of the most widely used rodenticides in the world (Swift 1998), and is not expected to impact native birds. While there may be some limited disturbance to nesting birds from trap and bait station placement and monitoring, the Trustees find that the benefits of the proposed project far outweigh any potential negative impacts. The Trustees believe this project will return Newell's shearwaters injured by the spill to their baseline levels and will provide some compensation to the public and the environment for the loss suffered during the period until recovery is achieved.

4.5.4 Preferred Alternative: Predator Control and Habitat Enhancement on Offshore Islands in the Hawaii Seabird Sanctuary

Project Description: The State of Hawaii manages 15 offshore islands that serve as seabird sanctuaries within the area potentially affected by the Incident. Three of the major factors which limit reproduction in these offshore seabird colonies are: rodent predation, encroachment of noxious vegetation, and loss of beneficial vegetation. These islands will be the target of restoration activities to control alien predators and invasive, non-native vegetation. Activities on the islands may include predator assessments, predator control, assessment of other threats to nesting seabirds, comprehensive surveys and mapping of vegetation, vegetation control, and restoration of native vegetation.

Introduced predators, such as rats, have had a devastating impact on nesting seabirds. For example, rats on Mokuauia Island and Ka'ula Rock prey on the eggs and chicks of all nesting seabirds, particularly wedge-tailed and Christmas shearwaters, Bulwer's petrel, ground-nesting terns, and tropicbirds. Rats also eat plant seeds which prohibits regeneration and contributes to vegetation loss. Plant seeds are a major source of food for mice and there is some evidence that, when food is scarce, mice will prey upon seabird eggs and chicks. Eradication of rats has been successfully completed on hundreds of offshore islands worldwide using toxicants (Moors 1985; Morrell *et al.* 1991; Taylor 1993; Veitch and Bell 1990). The Trustees propose to assess predator populations and then conduct predator control activities such as deploying diphacinone in bait stations

spaced at distances appropriate for the species being eradicated, at the time of year when alternative natural foods are most scarce. Diphacinone is a comparatively safe rodenticide registered by the EPA for use in Hawaii for conservation purposes on wildlands, including offshore islands. This registration does not require the removal of poisoned rats. The rats are expected to die in their burrows and not be accessible to other animals.

Introduced plants have also impacted seabirds by crowding out native vegetation and destroying nesting habitat. The Mokulua Islands off windward Oahu have areas of introduced koa haole trees (*Leucaena leucocephala*) which grow thick during the wet season, excluding indigenous vegetation and burrowing birds. In periods of drought or high salt spray, these trees die and leave the steep slopes they cover vulnerable to landslides further degrading nearby burrows of the wedge-tailed shearwater. At Manana Island off southeastern Oahu, golden crown-beard (*Verbesina encelioides*), an aggressive, non-native annual plant, has formed dense stands that preclude seabirds from nesting. At both Midway and Kure Atolls this plant's high seed production has allowed it to become a significant unwanted invader. Both of these plants have been successfully controlled in other wildlife areas by the State of Hawaii using a combination of carefully administered herbicides and mechanical control. The Trustees expect to follow similar procedures that have been refined by these earlier efforts.

Control of alien predators and invasive, non-native plants are two activities determined to be exempt from State environmental protection act review by the Hawaii State Office of Environmental Quality Control.

Restoration Objectives: The goal of this proposed restoration project is to enhance the survivorship and productivity of seabirds at each colony. For seabirds nesting on offshore islands, reducing or eliminating alien predators and improving the habitat by removing non-native plants is expected to increase survivorship of all age classes and increase reproduction by providing additional suitable nesting habitat. Species expected to benefit from the proposed project include the brown booby, masked booby, red-footed booby, great frigatebird, brown noddy, Bulwer's petrel, Pacific golden plover, wedge-tailed shearwater, sooty tern, and ruddy turnstone.

Probability of Success: The Trustees anticipate that the proposed restoration project will enhance survivorship and productivity at most, if not all, colonies because these same or very similar techniques have been successful in the past. Habitat enhancement for seabirds on offshore islands through removal of mammals and vegetation management has measurably increased seabird survivorship and reproductive performance for tropical seabird colonies on small islets in other parts of the world (Moors *et al.* 1992; Veitch and Bell 1990).

Performance Criteria and Monitoring: Success for this project will be measured by using standard monitoring techniques to track changes in population size and productivity

of the colonies on each island restored. Seabirds on offshore islets managed by the Hawaii Division of Forestry and Wildlife are surveyed annually using a combination of incidental visits and observation, on-site mapping, direct counts, estimation counts, point counts, and helicopter and fixed wing aerial photo analysis.

Successful removal of rats off islets will most likely result in qualitative changes in the form of vulnerable species such as Bulwer's petrels re-colonizing the site and quantitative changes in the increase in total number of nests and the hatching and fledging success of all nests. Invasive vegetation removal will result in increases in the numbers and distribution of nesting on each treated island and in increased reproductive success at those nests.

Benefits and Environmental Impacts: Potential impacts from the proposed project includes the environmental benefits described above. Limited disturbance may occur to some nesting birds during the set up and monitoring of bait stations and the mechanical removal of vegetation. This disturbance will be minimized by limiting access points to the colony and removing vegetation outside of peak nesting periods.

Secondary impacts or impacts to non-target species from the use of diphacinone are not expected to occur. There are no sightings of native mammals on these offshore islands. The pueo, a native Hawaiian owl, has been sighted on these islands but is not expected to be impacted by diphacinone bait stations. A study at Hakalau Forest NWR found that pueo did not scavenge rat carcasses placed on the ground (Lindsey and Mosher 1994). A review of other studies by Swift (1998) found that birds are not very susceptible to diphacinone. The blood clotting factor which diphacinone inhibits is not important in the avian blood clotting cascade (Belleville *et al.* 1982). Additionally, rats feeding at bait stations are expected to die in their burrows, thereby minimizing potential exposure to other species.

Evaluation: Introduced mammals and plants have degraded habitat quality and affected the survivorship and productivity of seabirds nesting on offshore islands. While there may be some limited disturbance to nesting birds during control activities, the Trustees find that the benefits of the proposed project far outweigh any potential negative impacts. The Trustees believe this project will aid in restoring seabirds potentially injured by the spill, provide protection and enhance the population of those species which were not injured by the spill, and provide some compensation to the public and the environment for the loss suffered during the period until recovery is achieved.

4.5.5 Preferred Alternative: Extension of the Predator Fence at Kilauea Point National Wildlife Refuge on Kauai

Project Description: Kilauea Point NWR is one of the few sites on the main Hawaiian Islands where seabirds can nest successfully due to the installation of a predator-proof

fence. The fence surrounding the refuge protects roosting and nesting seabirds and the endangered Hawaiian goose primarily from disruption by dogs. Seabirds in areas newly incorporated into the refuge that are not yet fenced, and those birds in areas where the existing fence is in poor condition, would be protected by extension and repair of the fence around the refuge (approximately 9,000 feet of six foot high fence line). Previous observations have shown that even temporary breaches in the fence due to events such as hurricanes have resulted in significant mortality of seabirds from uncontrolled dogs. Increasing residential development in the area, and the subsequent increase in dogs, underscore the need for additional protective measures to protect nesting seabirds.

Restoration Objectives: The goal of this proposed restoration project is to enhance the survivorship and productivity of seabirds nesting and roosting at Kilauea Point NWR. Extending and repairing the fence surrounding the bird colonies should immediately benefit the seabirds that are presently being disturbed and killed by uncontrolled dogs. Seabirds expected to benefit from the proposed project include Laysan albatross, red-footed boobies, Bulwer's petrels, wedge-tailed shearwaters, red-tailed tropicbirds, and white-tailed tropicbirds. An experimental group of threatened Newell's shearwaters which were reintroduced to Kilauea Point NWR will also benefit from the proposed project. The proposed project will also benefit the endangered Hawaiian goose.

Probability of Success: The probability of success of this project is high. The exclusion potential of fencing is well established in general and previous fencing efforts at Kilauea Point NWR have resulted in expansion of seabird colonies and an increase in population numbers for all seabirds breeding within the protected refuge boundaries.

Performance Criteria and Monitoring: Success for the fence improvement project at Kilauea Point NWR will be measured in the following ways: (1) documenting fence installation, repair, and maintenance actions; (2) conducting surveys of the condition of the fence and recording the number and locations of breaches; (3) reporting the number of birds killed by each type of predator; (4) using standard monitoring techniques to document changes in colony size, survivorship, and productivity of nesting birds; and (5) comparing the rate at which dogs enter the refuge after project completion to the rate observed in the previous ten years. Monitoring will be coordinated with other actions being conducted on the Refuge, such as the state-wide Hawaiian goose surveys, the state and federal fish and wildlife agencies' predator control work, and the red-footed booby colony surveys.

Benefits and Environmental Impacts: Potential impacts from the proposed project include the environmental benefits described above. Disturbance to seabirds is not expected to be an issue for this project since repairs and extension of the fence will occur outside of the nesting season. Extension of the fence should not affect nesting birds since they will not be present in the immediate area of the work. Disturbance to species such

as the Hawaiian goose can be avoided by conducting the work outside of the birds nesting season.

Evaluation: Entry of dogs and other mammals onto the Kilauea Point NWR has affected the survivorship and productivity of nesting birds. Roughly 400 wedge-tailed shearwaters were killed by dogs following damage to the fence from Hurricane Iniki in 1991. Previous fencing efforts at Kilauea Point NWR have resulted in the expansion of seabird colonies and an increase in population numbers for all seabirds breeding within the protected refuge boundaries. The Trustees find that the benefits of the proposed project far outweigh any potential negative impacts. The Trustees believe this project will aid in restoring seabirds potentially injured by the spill, provide protection and enhance the population of those species which were not injured by the spill, and provide some compensation to the public and the environment for the loss suffered during the period until recovery is achieved.

4.5.6 Non-Preferred Alternatives

The Trustees considered the following compensatory restoration projects to replace ecological service losses resulting from the spill. The Trustees rejected these alternatives because the alternatives did not meet one or more of the evaluation criteria discussed in Section 4.2.

- Opihi aquaculture program: Cultivation of opihi.
- Monitoring Hawaiian monk seals: A year-long monitoring program would be implemented to track the animals which were at Kipu Kai during the spill.
- Creation of opihi substrate: Additional rocky habitat of the type favored by opihi would be constructed.
- Education and public awareness campaign to encourage sport fishing techniques that will reduce the mortality of red-footed, brown, and masked boobies in the recreational trolling fishery around Oahu and Kauai.
- Radar survey of the perimeter of Kauai to monitor population trends and locate additional colonies of Newell's shearwaters and Hawaiian dark-rumped petrels.
- Funding of a biological technician at Kilauea Point NWR whose position would be dedicated to seabird monitoring and predator control.
- Non-native vegetation removal at Kure Atoll to improve nesting habitat for seabirds, particularly red-footed, masked, and brown boobies.

- Construction of artificial nesting platforms at Mokapu Point, Oahu, to increase nesting habitat available for red-footed boobies.
- Nest habitat improvement for wedge-tailed shearwaters at Kilauea Point NWR through re-vegetation of erosional scars with native plants and construction of artificial burrows.
- Training for volunteers in the proper handling of oiled wildlife.
- Purchase and maintenance of a portable oiled wildlife stabilization facility for use in future spills.

4.6 EVALUATION OF RESTORATION ALTERNATIVE 3: LOST HUMAN USE RESTORATION

For the purposes of this Final RP/EA, the lost human services resulting from the Incident and the cleanup activities are characterized as lost recreational opportunities at Fugii and Nukoli'i Beaches on the eastern shore of Kauai. Those losses occurred prior to the official closures of these beaches due to oiling, during the closures, during the partial reopening of Nukoli'i, and after the reopening of the beaches until beach attendance had returned to normal levels.

4.6.1 Scaling Approach

The Trustees decided that the best approach to compensating for lost visitor services as a result of the oiling and beach closures is to implement a compensatory restoration project that enhances the experience of visitors rather than increases the number of visitors. *While such a project may not replace an entire visitor experience, it will, nonetheless, provide enhanced value to the public which will compensate for the lost visitor services.*

The fact that the replacement services provided by a compensatory restoration project do *not exactly correspond with the lost services (i.e., the project considered would enhance the experience of visitors rather than increase the number of visitors)* determines, in part, how compensatory restoration is to be scaled. The OPA regulations specify that when the lost and replacement services are not of comparable value, compensatory restoration will be scaled by valuing the lost and replacement services. In general, this approach requires Trustees to *measure the value of lost services and then determine the scale of compensatory restoration actions that provide replacement services of equal value.* Hence, in order to ensure that the public is neither over-compensated nor under-compensated, the value of replacement services must be measured in addition to the value of lost services to establish an equivalency between the two.

The Trustees selected the benefits transfer methodology to value lost visitor use. This methodology combines value estimates from existing economic studies with site-specific injury information to estimate the value of lost services. It is described in the preamble to the OPA regulations as a potential approach to scaling compensatory restoration actions. The Trustees determined that the benefits transfer methodology was appropriate based on the consideration of a number of factors, including the ability to implement the approach within a reasonable time frame and at a reasonable cost. The Trustees considered the increased cost of other methodologies that require more intensive data collection and analysis to be unreasonable relative to the expected increase in the quantity or quality of relevant information.

The OPA regulations provide that if, in the judgment of the Trustees, valuation of the lost services is practicable, but valuation of the replacement services cannot be performed within a reasonable time frame or at a reasonable cost, the Trustees may estimate the value of the lost services and then select the scale of compensatory restoration that has a cost equivalent to the lost value. Following this provision, the Trustees considered a set of compensatory restoration projects with a total cost equal to the value of lost visitor services, as estimated using the benefits transfer methodology. For a more detailed discussion on how the Trustees estimated the value of lost visitor services, see "Report on the Lost Recreation Use Resulting from the August 24, 1998 Tesoro Oil Spill off Barbers Point" in the administrative record. That report estimated the value to be approximately \$10,000.00.

4.6.2 Preferred Alternative: Beach Cleanup Project

Project Description: The \$10,000.00 will be placed in a beach debris cleanup fund which would be used to clean recreational beaches in the areas impacted by the spill.

Restoration Objectives: The goal of this proposed project is to remove debris from beaches on the eastern shore of Kauai which are used by residents and visitors. This project meets the goal of the Trustees by compensating for lost visitors' services which were negatively impacted by the oiling and closure of certain beaches.

Probability of Success: The probability of success is high. Beach cleanup activities are routine in Hawaii and easy to implement.

Performance Criteria and Monitoring: State or local officials will specify the types of debris to be removed and the location of the debris removal activities.

Benefits and Environmental Impacts: Debris on beaches used for recreational purposes degrades the quality of the beaches for users. Removal of the debris will enhance the users' enjoyment of the beaches. No adverse environmental impacts are

anticipated, and the debris removed will be placed in appropriate disposal containers or facilities.

Evaluation: Beach debris impairs users' enjoyment of beaches. Removal of such debris will enhance users' enjoyment of the beaches and will not cause any negative environmental impacts.

4.6.3 Non-Preferred Alternatives

The Trustees considered, but did not select, the following compensatory alternatives:

- Construction of showers and/or bathrooms at beaches.
- Construction of picnic tables at beaches.
- Contribution to funding to restore fishing pier at Ahukini.
- Building bikeway in Kapaa.