

Natural, Cultural, and Socioeconomic Impact Analysis for the Proposed He'eia National Estuarine Research Reserve



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Executive Summary

The purpose of this document is to provide an analysis of the natural, cultural, and socioeconomic impacts of the National Oceanic and Atmospheric Administration's (NOAA's) action of designating a National Estuarine Research Reserve (NERR) at He'eia and implementing the management plan for this reserve in Kāne'ohe Bay, Hawai'i.

In general, designating the He'eia NERR and implementing the reserve's management plan in years to come would be environmentally beneficial and would result in positive cultural and socioeconomic impacts. This overall beneficial effect would result because a major focus of the NERR is to support, and to provide research and monitoring to better understand, land management and restoration programs, as well as to improve habitat conditions and ecosystem processes throughout the ahupua'a (i.e., the traditional land management unit).

Three types of impacts were analyzed in this document: direct impacts, cumulative impacts, and the impact of not taking the action of designating the He'eia NERR. As analyzed, direct impacts on the natural environment include the effects of designating the He'eia NERR on habitats, flora and fauna, and the physical environment. The research and monitoring program of the He'eia NERR is expected to benefit the upland, wetland, freshwater stream, estuarine, and marine habitats of He'eia by improving our understanding of the functioning and interconnectedness of these habitats and providing data to support coastal management decisions. Increased research to understand native species distribution and abundance, as well as ecological threats and stressors (e.g., invasive species), would inform management efforts to preserve native flora and fauna. More enhanced and coordinated research on physical conditions, such as water quality, will increase knowledge of the nature and sources of water pollutants, provide baseline data, and guide management actions to improve water quality in the He'eia estuary. The education programs developed under the He'eia NERR are expected to increase participation by students, teachers, and other community members in education and training about coastal habitats, inculcate in them a greater appreciation and understanding of coastal ecosystems, and inform land management decisions. The He'eia NERR coastal training and outreach program would broaden and enhance community stewardship of resources, reduce anthropogenic effects on the environment, restore degraded habitats, and support actions by the community to improve coastal environmental conditions.

Direct impacts on the human environment include the cultural and socioeconomic effects of designating the He'eia NERR. The research and monitoring program at the He'eia NERR would result in better documentation and comprehension of archaeological and cultural resources and little to no change in the socioeconomic conditions like traffic, property values, demand for public facilities, or taxes. The educational programs of the He'eia NERR likely would improve the community's access to science resources and help to integrate traditional cultural knowledge with contemporary science to better inform

coastal management. Stewardship projects of the NERR coastal training and outreach program are expected to strengthen the community's relationship with its cultural landscape and increase community engagement in coastal resource management, and increase support and interest for conservation of fish stock and other resources. It is possible that increased conservation awareness might lead to increased public support for fishing restrictions in the area and result in additional State regulations on local fishing activity in He'eia. However, the education and outreach programs of the NERR could support a well-informed, involved community and decision makers, who are expected to take a balanced approach toward fishing and conservation and avoid unwarranted regulations on fishing. Given these considerations, the effect of the proposed NERR designation is uncertain but could have a neutral effect on fishing access and resources.

Several ongoing and planned projects, such as Kāko'o 'Ōiwi's wetland and upland agriculture and stream restoration project, the He'eia fishpond reconstruction and aquaculture farming, and the Kāne'ohe Bay coral reef restoration, were considered in the analysis of the cumulative impacts of the NERR designation on the natural, cultural, and socioeconomic environment. None of the independently ongoing or planned projects analyzed had moderate or considerable adverse effects. The specific effects of these ongoing or planned projects on natural, cultural, and socioeconomic resources were ranked as *no effect*, *low adverse effect*, or *overall beneficial effect*, and the potential cumulative impact of the designation of the He'eia NERR, when considered with these projects, was found to be beneficial overall. These organizations have already worked to obtain State environmental reviews of their programs and plans. Whether the NERR designation would bring an additional level of review, increasing the burden of restoration work for small non-profits, has not been decisively resolved.

The no-action alternative, that is, the action of not designating the He'eia NERR, would result in the continuation of the current status and trends in environmental, cultural, and socioeconomic conditions in He'eia. Not designating the He'eia NERR is expected to result in minimal coordination and long-term cooperation in the management of lands and waters in He'eia; also, research, monitoring, education, public outreach, and resource management would not be conducted or be eligible for NERR funding by NOAA. Without this funding and support, the He'eia coastal community in the proposed He'eia NERR area would not receive a variety of the potential long-term benefits of NERR designation, such as improved water quality, enhanced educational programs, habitat protection, and improved coastal stewardship projects.

Table of Contents

Executive Summary	i
Table of Contents	iii
Acronyms and Other Abbreviations.....	v
Section 1. General Impacts	1
Section 2. Natural Environment Impacts.....	4
2.1 Habitats	5
2.1.1 Uplands	5
2.1.2 Wetlands	5
2.1.3 Freshwater Streams	5
2.1.4 Estuarine Habitats	6
2.1.5 Coastal and Marine Habitats.....	6
2.2 Flora and Fauna	6
2.2.1 Rare, Threatened, and Endangered Flora and Fauna.....	7
2.2.2 Other Flora and Fauna	7
2.3 Physical Environment.....	8
2.3.1 Watershed and Hydrology	8
2.3.2 Water Quality	8
2.3.3 Geology.....	9
2.3.4 Climate	9
Section 3. Human Environment Impacts.....	11
3.1 Cultural Resources.....	11
3.2 Socioeconomic Impacts	12
Section 4. Cumulative Impacts.....	15
Section 5. Impacts of the No-Action Alternative (Trends).....	19
5.1 Natural Environment.....	19
5.2 Human Environment.....	19
Section 6. References	20

Tables

Table 2-1. Impacts of the He'eia NERR Designation on the Natural Environment.....	4
Table 3-1. Impacts of He'eia NERR Designation on the Human Environment.....	11
Table 4-1. Summary of Potential Cumulative Impacts, Including the Contribution of the He'eia NERR Designation.....	16

Attachments

Attachment A. Reserve Management Plan	A-1
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Acronyms and Other Abbreviations

Abbreviation	Meaning
BMPs	best management practices
EIS	environmental impact statement
HEPA	Hawai'i Environmental Policy Act
HDD	Horizontal directional drilling
HIMB	Hawai'i Institute of Marine Biology
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
RAB	Reserve Advisory Board
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers

Section 1. General Impacts

Overall, designating the proposed Heʻeia National Estuarine Research Reserve (NERR) and implementing the reserve’s management plan in the years to come would be environmentally beneficial and would result in positive cultural and socioeconomic impacts. From a national perspective, the establishment of the 29th NERR in Kāneʻohe Bay will add to the NERR System’s (NERRS’s) geographic reach, creating a more complete network of estuaries that is representative of the ecological diversity found in the United States and its territories.

The Heʻeia NERR designation would create research and educational opportunities and synergies to improve our understanding and appreciation of the role and health of the uplands and estuaries in the Koʻolaupoko region of the island of Oʻahu. Working to achieve goals set forth in the Coastal Zone Management Act: namely, to provide a stable environment for research and to enhance public awareness and understanding of estuarine areas, reserve staff will develop programs to conduct applied research and monitoring of the Heʻeia uplands and estuary; educate students, decision makers, and the public about these estuaries to address coastal management issues; and protect and enhance the ecological health of the reserve and coastal habitats (Attachment A). Federal funds, along with matching funds provided by the State partner, would support enhanced efforts, coordinated with reserve partners, to achieve these goals.

No physical alteration of the present habitats or environmental conditions in the proposed reserve’s boundaries would occur as a result of this action, as described in the reserve management plan (Attachment A). However, site partners such as Paepae o Heʻeia and Kākoʻo ʻŌiwi would continue to conduct restoration activities with support from the Heʻeia NERR. Additionally, the Heʻeia NERR would support scientific research and monitoring, to be conducted by or with partners (i.e., ongoing research would be conducted by the Hawaiʻi Institute of Marine Biology [HIMB] and the University of Hawaiʻi Oceanography Department). Some of this research may require local experiments that modify a portion of specific habitat or include the installation of environmental monitoring or sampling equipment. Each of these future activities may be assessed for potential impacts according to NERRS regulation and other authorities, such as the Endangered Species Act and Section 106 of the National Historic Preservation Act (NHPA). Under NERRS regulations, Section 921.13, modifications to habitats are allowed only within the reserve buffer area and are subject to NOAA review and approval through the submission of a restoration or resource manipulation plan as part of the reserve’s overall management plan. In addition, annual NOAA funding awards to the reserve may specify projects that include these types of activities; as such, these projects are subject to review under the National Environmental Policy Act (NEPA) and the Hawaiʻi Environmental Policy Act (HEPA) as applicable.

The expected impacts of the education, stewardship, and research programs would be positive (see Tables 2-1 and 3-1 for summaries of these impacts). Designation of the proposed reserve would create extensive

opportunities for researchers to gather scientific and socioeconomic information about the Heʻeia estuary and thus enhance our knowledge and understanding of Hawaiian estuaries and the ahupuaʻa land management system. This information would provide decision makers and resource managers with the tools and information necessary to address critical coastal management issues (food web processes, invasive species, toxins and contaminants, land use changes, and climate change). Monitoring short- and long-term ecological changes in the Heʻeia NERR would support stewardship activities that protect and enhance the ecology of the area and similar estuarine systems in Hawaiʻi. Research and stewardship also would support increased public awareness of the ecological and cultural significance of the estuary through educational programming directed toward students, educators, and other citizens.

Also included among the positive impacts is the use of reserve-generated research to support coastal management decisions regarding the estuary and Kāneʻohe Bay. Within the NERRS, research results are often transferred to managers and decision makers to support informed management decisions that affect coastal resources. These activities could lead to improvements in resource management and land use policy decisions by local communities.

Public uses of the lands in the Heʻeia NERR, such as boating, recreational and commercial fishing, diving, swimming, other recreation, and transportation, would continue to be administered by the appropriate regulatory resource agencies. To coordinate these uses, avoid conflict with long-term research and educational activities, and ensure that designated core research areas are sufficiently protected to create a stable environment for research, the reserve management plan would provide administrative support in the form of reserve staff and an advisory board and committees. Public access to the area may be enhanced through the addition of a central Heʻeia interpretive center in support of reserve educational activities (Attachment A).

Minimal impacts may be caused by the use of facilities and the future acquisition of land needed to support Heʻeia NERR goals and objectives (as described in the management plan). Heʻeia NERR activities would be based in existing facilities provided by HIMB on Moku o Loʻe (Coconut Island) and in Heʻeia State Park until an analysis of long-term future facilities needs is completed. Any facilities constructed to support the reserve would be located in the proposed reserve buffer areas (i.e., outside the core area) and would be designed to result in minimal environmental disturbance. Also, additional lands may be considered and investigated for future inclusion in the NERR. All construction and land acquisition projects that are planned after the NERR designation will be reviewed and assessed for their potential impacts according to NEPA and NHPA procedures, NERRS regulations, and within the context and scope of the National and Hawaiʻi-specific environmental impact statement (EIS) process.

Establishment of a Reserve Advisory Board (RAB) upon NERR designation would have beneficial effects because it would provide a mechanism to coordinate uses within the proposed reserve boundaries, guide the implementation of reserve programs based on the management plan, and result in positive benefits for

the natural and cultural resources in the He'eia NERR. The RAB also would help the reserve develop and maintain partnerships with other local, state, and federal agencies, as well as other research and educational institutions and the community, potentially reducing use conflicts. All decisions by the RAB are required to be consistent with the management plan, NERRS policies, and existing state and federal regulations.

Section 2. Natural Environment Impacts

Table 2-1. Impacts of the He'eia NERR Designation on the Natural Environment

Topic	He'eia NERR Program Areas		
	Research and Monitoring	Education	Coastal Training: Outreach and Resource Management
Habitats	Increased knowledge and data on the interconnectedness and functioning of habitats, and data to support coastal management decisions	Increased understanding of and involvement with coastal habitats by students, teachers, and other community members, resulting in improved land management decisions	Improved coastal management decisions and coordination, enhanced stewardship and reduction of anthropogenic effects on habitats, restoration of degraded habitats and management of other habitats, and increased participation by the community in habitat improvement projects
Flora and Fauna	Increased data allowing understanding of species distribution, abundance, and threats and stressors (e.g., invasive species); improved data for guiding preservation of rare, threatened, and endangered species; and increased coordination and adaptive management to effectively inform future management actions	Increased knowledge among students, teachers, and other community members, resulting in better protection of native species and reduction of invasive species, more support and improved resource management decisions, and increased participation in protection and conservation activities like "Makai Watch" and community workdays	Improved coastal management decisions and coordination, increased community participation in species protection programs, and increased participation in community restoration and stewardship activities to improve habitat for native species
Physical Environment	Increased knowledge of, and baseline data on, estuarine and stream water quality	Increased public awareness of how physical attributes like water quality affect ecosystems, and improved coastal management decisions	Enhanced stewardship and training, leading to improved coastal management decisions and coordination

2.1 Habitats

2.1.1 Uplands

The action of designating the He'eia NERR is expected to benefit upland forests and their watershed services by developing and expanding research and monitoring, education and training, and stewardship programs that protect biodiversity and vegetative cover and alleviate the impacts of habitat-modifying invasive plants and animals. The presence of the NERR staff and the fostering of a community committed to the protection of resources likely would encourage increased community policing and enforcement by the State of habitat-damaging activities like off-road driving, wildland fires, and illegal dumping. The increased community involvement and site partner collaboration that would occur as part of He'eia NERR management would facilitate implementation of major restoration efforts in the estuary that are likely to improve upland habitat quality for native flora and fauna. Furthermore, the increased research and monitoring that would occur with NERR designation would reduce the likelihood of the inadvertent introduction and spread of invasive species that can damage upland habitats.

2.1.2 Wetlands

Effects on wetlands would be considered significant if they caused a net loss of wetland habitat or adversely affected wetland hydrology and the wetland's ability to support native flora and fauna. However, the action of designating the He'eia NERR is expected to benefit the wetlands in He'eia. The wetlands are overgrown and dominated by California grass (*Urochloa mutica*) and other weedy species, and provide very poor habitat for native waterbirds and aquatic species. The research and monitoring program of the He'eia NERR is expected to enhance understanding of coastal wetland ecology and help identify threats and stressors that degrade wetlands. The educational programs that would accompany designation are likely to result in increased participation by students, teachers, and other community members in wetland projects, improving their understanding of the value and functions of wetlands and the need for sustained stewardship. Stewardship activities guided by the coastal training program are likely to raise awareness and engage coastal decision makers in the sustainable management of the He'eia wetlands. The combination of education, resource protection, and stewardship activities would result in benefits to wetland resources.

2.1.3 Freshwater Streams

The action of designating the He'eia NERR would not have any adverse effects on freshwater streams (or on native freshwater species), and in fact would benefit these resources. Currently, He'eia Stream, part of which runs through the He'eia NERR, is badly degraded, has poor water quality, and provides poor habitat for native species. Under the NERR, increased research and monitoring is expected to provide the data needed to inform management of the He'eia Stream and guide future research projects. Stewardship activities would likely include support for, and projects that involve, removing, managing, and discouraging further ingress of invasive species and implementing actions to avoid and reduce inputs of pollutants and sediments to the stream. The educational and training programs that accompany a NERR designation also

would provide benefits by increasing community understanding, protection, and stewardship of the values and benefits provided by healthy freshwater streams and native species.

There are no specific plans yet for constructing new facilities in support of the He'eia NERR or for implementing other NOAA-funded projects. However, any buildings or other facilities would be designed and constructed to minimize potential environmental impacts such as runoff and erosion into He'eia Stream. Proposed projects would be reviewed and assessed for their potential impacts according to NEPA procedures and NERRS regulations and HEPA procedures as applicable. Any He'eia NERR activities to restore and appropriately manage He'eia Stream are expected to result in positive benefits to stream habitats that support native aquatic species. Should future plans expand the NERR boundaries in the ahupua'a, additional stream habitat would be included in the NERR programs and would benefit from its research, monitoring, and stewardship activities.

2.1.4 Estuarine Habitats

Although estuarine habitats and resources are vulnerable to a wide range of adverse effects resulting from human activities and natural events, they are not expected to be affected directly by the designation of the He'eia NERR, and would in fact benefit from the action. Implementing research and monitoring, education, coastal training, and restoration would in fact help avoid adverse impacts on estuarine habitats and facilitate monitoring and improvement of resource conditions. An increase in community involvement is expected to accompany the NERR designation and its public education and outreach activities; enhanced community policing and oversight could prevent harmful human activities such as the introduction of invasive species of marine algae, invertebrates, and fish that could degrade estuarine habitats and displace native flora and fauna. Lastly, the educational opportunities presented by the NERR designation are likely to result in greater understanding of estuarine vulnerability and functions and the need for sustained stewardship by the community. The combination of education, research, resource protection, and management activities and oversight are thus expected to yield benefits to estuarine resources.

2.1.5 Coastal and Marine Habitats

The effects of the NERR designation on coastal and marine habitats are expected to be beneficial, and would stem from program facilitation of improved fishpond management, wetland management, and stream habitat management. Also, the increase in research and monitoring that would accompany the NERR designation would help detect and respond to adverse effects that are occurring now, such as introductions of nonnative invasive species, inputs of polluted runoff, and more frequent or severe coral bleaching events or diseases, all of which affect corals and other organisms and reduce the resilience of the coastal and marine ecosystem. Together, the increased opportunities for research, public outreach and education, and community stewardship and oversight that would come with NERR designation would yield positive benefits to coastal and marine habitats and resources.

2.2 Flora and Fauna

2.2.1 Rare, Threatened, and Endangered Flora and Fauna

No effects on rare, endangered, or threatened plants are anticipated to occur as a result of the designation of the He'eia NERR, because neither these plants nor their critical habitat occurs within the proposed He'eia NERR boundary.

The action of designating the He'eia NERR is expected to benefit endangered and threatened wildlife. A major focus of the NERR is to support and provide research and monitoring to better understand the status of species and how land management and restoration activities affect them. Endangered and threatened waterbirds are found in very low densities in the He'eia area; their low abundance is attributable mainly to the degraded habitat conditions of the wetlands and to uncontrolled predation, both of which would likely be improved through NERR programs. Endangered Hawaiian monk seals (*Monachus schauinslandi*) are rarely observed in the vicinity of the proposed NERR, and threatened green sea turtles (*Chelonia mydas*) are present year-round in Kāne'ohe Bay. The designation of the NERR would lead to increased education and awareness about these rare and threatened resources, and could result in greater community support for their conservation and protection. Also, increased research and monitoring in the ahupua'a would better inform managers of factors that might affect these species, such as the introduction or spread of invasive species, diseases, predators, or changing habitat conditions caused by climate change. Lastly, the NERR would provide an opportunity to eventually expand the NERR boundaries up into the ahupua'a and to implement projects that further support habitat restoration and conservation.

The NERR designation would provide similar benefits for the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), which could be present in the area. The increase in research and monitoring would improve our knowledge of this species' status, distribution, and habitat needs, and would better inform managers of how to avoid impacts. The NERR educational and outreach programs would help distribute that information to help the broader community avoid impacts and preserve and improve habitat. A possible expansion of the NERR boundary into the upper watershed areas of the ahupua'a, and associated restoration and protection of forested watershed, would also improve habitat for bats.

2.2.2 Other Flora and Fauna

Effects on native plants would be considered significant if modification of their habitat resulted in a reduction of population size or prevented their recruitment and establishment. Impacts on plant habitats commonly result from land clearing or construction activities associated with development; however, no such activities are planned as part of the NERR designation. No significant reductions in native plant populations, impacts on large numbers of native plants, or adverse modifications of native plant habitats would occur.

Minor beneficial effects on other terrestrial flora and fauna are expected to result from the designation of the He'eia NERR. The general increase in interest and support for conservation of threatened and

endangered species would also benefit other native flora and fauna. Habitat modification by ongoing restoration projects is likely to have a positive effect. For example, projects that control invasive species and restore native habitat would benefit native flora and fauna.

The designation of the NERR is not expected to have direct adverse effects on freshwater, estuarine, or marine fauna, and in fact could have beneficial effects. Current threats to aquatic resources in the He'eia area include overfishing, alteration of habitat, and displacement of fauna by the introduction and spread of invasive species, pollution, and disease. Adverse effects on these resources are currently addressed through public education, regulations, and enforcement. By adding to these mechanisms the increased opportunities for research, public outreach and education, and community stewardship, the He'eia NERR designation would result in beneficial effects on aquatic resources.

As discussed previously, buildings and other facilities that may be needed in the future would be designed and constructed to minimize environmental impacts, including impacts on native flora and fauna. Proposed projects would be reviewed and assessed for potential impacts according to NEPA procedures and NERRS regulations and HEPA procedures as applicable, and are not expected to adversely affect flora or fauna.

2.3 Physical Environment

2.3.1 Watershed and Hydrology

The proposed NERR designation would not adversely affect the watershed or its hydrology, and in fact is expected to have beneficial effects. Adverse effects on hydrological and watershed characteristics would be considered significant if they involved substantial changes in the frequency and magnitude of peak flows in He'eia Stream, or in the impervious-surface area in the He'eia watershed. Neither of these effects would occur as a result of the He'eia NERR designation. Rather, a major focus of the NERR would be to support research and monitoring to better understand land management and restoration programs and to improve habitat conditions and ecosystem processes throughout the ahupua'a. The increase in research and monitoring is expected to help land managers and community stakeholders learn about watershed conditions and make beneficial changes. Therefore, the NERR is expected to result in beneficial effects on watershed and hydrological conditions.

2.3.2 Water Quality

The proposed NERR designation would not have any adverse effects on water quality, and in fact would have beneficial effects. Adverse effects on water quality would be considered significant if the proposed action resulted in erosion of sediments into He'eia Stream that violate the State's standards for total suspended solids (TSS). This effect would not occur as a result of the He'eia NERR designation. Rather, a major focus of the NERR would be to support research and monitoring to better understand land management and restoration and to thereby improve water quality throughout the ahupua'a. Water quality monitoring will be conducted for the He'eia Stream (upstream of and within the proposed NERR site), the

He'eia wetlands, He'eia Fishpond, and Kāne'ōhe Bay. Expected increased research and monitoring in the ahupua'a because of the NERR will help to inform land managers and community stakeholders of water quality conditions so that they can make changes to improve conditions. Therefore, the NERR is expected to result in beneficial effects on water quality.

As discussed previously, buildings and other facilities that may be needed in the future would be designed and constructed to minimize environmental impacts, including impacts on water quality. Proposed projects would be reviewed and assessed according to NEPA procedures and NERRS regulations and HEPA procedures as applicable.

2.3.3 Geology

The proposed action would not result in increased erosion, subsidence, or landslides, and may in fact result in beneficial effects on the geological characteristics of the area. Adverse effects would be considered significant if they resulted in a violation of the State standards for TSS in receiving water bodies—He'eia Stream's TSS levels would be most indicative of adverse effects. Because the terrestrial uplands have highly erodible soils, actions that occur in the uplands in particular could increase erosion and thereby affect downstream areas. However, no such adverse effects are expected to result from the NERR designation.

After NERR designation, the increase in research and monitoring in the ahupua'a is expected to help inform land managers and community stakeholders of conditions so that they can make changes to improve conditions. Also, the NERR could provide an opportunity in the future to expand its boundaries up into the ahupua'a, where NERR programs to support habitat restoration and conservation could help improve habitat conditions and reduce erosion. Therefore, the NERR is expected to result in beneficial effects on geology.

As discussed previously, buildings and other facilities that may be needed in the future would be designed and constructed to minimize environmental impacts, including erosion-related impacts. Proposed projects would be reviewed and assessed according to NEPA procedures and NERRS regulations and HEPA procedures as applicable.

2.3.4 Climate

Potential climate-related effects include both the effects of the proposed NERR designation on climate change and the effects of climate change on the proposed designation. The former could occur through exacerbation of existing climate change impacts, or via a change (increase or decrease) in the resilience of the ecosystem to climate change. However, the proposed designation is not anticipated to have any adverse effects on climate change. The potential for the He'eia wetlands to sequester carbon is expected to balance out the wetlands' methane emissions. Other types of potentially significant negative effects on climate change, such as an increase in greenhouse gas emissions (e.g., due to an increase in vehicular traffic), are not expected to occur as a result of the proposed action.

There are several ways in which climate change could adversely affect the lands within the He'eia NERR: changes in rainfall patterns could affect water quality and hydrology, sea-level rise could overtop or affect the stability of the He'eia Fishpond walls, and ocean acidification could affect coral recruitment and survival in Kāne'ohe Bay. These potential negative effects should be considered during the planning and implementation of management decisions, outreach, and other project activities. Increased research and monitoring in the ahupua'a because of the NERR will better inform all land managers and community stakeholders of changing habitat conditions and ecosystem processes due to climate change, so that they can better address or prepare for these changes.

Section 3. Human Environment Impacts

Table 3-1. Impacts of He'eia NERR Designation on the Human Environment

Topic	He'eia NERR Program Foundations		
	Research and Monitoring	Education	Coastal Training: Outreach and Resource Management
Cultural	Better documentation and understanding of archaeological and cultural resources	Synthesis of the different ways of knowing (via initiation of western academic educational programs and cultivation of indigenous approaches to knowledge), resulting in more complete understanding of cultural/archaeological resources of He'eia	Strengthened relationships between the people of He'eia and their cultural landscape, and enhanced support for sound coastal management decisions
Socioeconomic	Minimal change; increased data to guide resource management	Minimal change; improved access to science resources for local schools; enhanced education for general public about a balanced approach toward conservation of resources	No effect on population, employment, and demand of public facilities; likely increase in property values; community support for conservation of fish stock and environmental regulation; potential pressure for limits on fishing
-Traffic	Little or no change	Minimal change	Minimal change
-Fiscal (Taxation)	New funding for research; minimal increase in local tax collections	None	None

3.1 Cultural Resources

By initiating western academic educational programs and cultivating indigenous approaches to knowledge, the NERR will facilitate a valuable synthesis of the different ways of knowing, which will result in a more complete understanding and a more informed stewardship of the cultural and archaeological resources of He'eia.

Several significant archaeological and cultural resources are located within the boundaries of the proposed He'eia NERR. Note that not all cultural resources are archaeological resources, because cultural resources are not necessarily created by human activity. For example, the reef of Ko'amanō, where the sharks of Makanui live, and the place called Luamo'o, where Meheanu lives, are not archaeological resources; however, they are culturally significant according to Hawaiian traditions, and therefore are counted among the cultural resources of the area. Such resources may or may not be included in the NERR education and stewardship programs. Other resources in the proposed He'eia NERR are the result of human actions; for example, the precontact (i.e., before European contact) He'eia Fishpond is both an archaeological and a cultural resource. Other archaeological resources in the area include a precontact agricultural complex and a precontact basalt quarry. There are also two archaeological sites from the postcontact era listed within the He'eia NERR boundaries: the remains of a rice mill and an 'ōkolehao distillery. Like the cultural resources mentioned earlier, these archaeological resources may or may not be addressed by education, stewardship, or monitoring efforts associated with the NERR. However, if they are included in NERR education and research programs, it could lead to better documentation and comprehension of the archaeological and cultural features, leading to a fuller appreciation for these individual resources and for their collective contribution to the history of He'eia.

The cultural and archaeological resources of He'eia would also gain from monitoring and stewardship programs. Monitoring efforts would ensure that the conditions of these resources remain optimal. For subsurface archaeological features, monitoring would minimize potential adverse impacts if these resources become exposed or otherwise affected by NERR-related activities. Stewardship efforts would help to maintain and protect all of He'eia's cultural/archaeological resources. Enhanced stewardship under the NERR would provide the additional, invaluable benefit of strengthening the pilina, or intimate relationship, between the people of He'eia and their cultural landscape.

The impacts of the He'eia NERR programs on the cultural and archaeological resources of the area are not expected to be adverse; rather, the NERR designation is predicted to help in preservation efforts. The people of He'eia will also be impacted favorably as they learn about, reconnect with, and care for these irreplaceable resources.

3.2 Socioeconomic Impacts

The socioeconomic impacts of the proposed NERR designation vary by topic. A range of impacts were analyzed, as summarized below:

- **Population:** Few or no population impacts are anticipated because the NERR would not employ more than a few staff members and would not involve substantial construction of new facilities or demand for services.

- **Employment:** Increased research and educational activities in the NERR could support a few new jobs and research fellowships; this effect is considered minor.
- **Demand for public facilities:** Because the NERR designation would not result in a population increase, no change in demand for public facilities is anticipated. Rather, educational activities in the NERR could benefit local schools.
- **Adjacent residential areas:** NERR designation could, over several years, raise some property values. No impact on oceanfront residential areas is likely: these already have an important amenity that contributes to value. For the residential areas near the He'eia wetlands, restoration projects plus the area's status as a reserve could make residences more attractive to nearby buyers, and hence add to residential property values. The impact is likely to arise over time and to be smaller than the amenity value accruing to oceanfront properties.
- **Fishing:** NERR designation could affect fishing resources in the NERR. In Hawai'i, the distinctions between recreational, subsistence, and commercial fishing can be blurred. It is generally agreed that fish stocks throughout the islands have declined. Kāne'ohe Bay fishers have reported a decline in stocks throughout the twentieth century. Increased community support and interest in reef and fisheries conservation as a result of NERR activities could result in public sentiment leaning toward additional fishing regulations in the NERR. Also, an increase in publicity about the NERR resources could attract more fishers to the reserve and thereby affect current local fishers' access to the fisheries and the abundance of fish. On the other hand, NERR conservation and restoration activities also could result in improvements to the habitat and an increase in fish stocks, supporting an increase in the abundance of fish for local fishers.

Negative effects on fisheries are clearly contentious, and the available resource is limited, so any further decline or regulation of access would be considered significant. However, the research and monitoring program of the NERR would provide the data needed to guide effective management of fish stocks. Stewardship projects such as restoration of the reef could improve habitat for fish. Lastly, the education and outreach programs of the NERR could support a well-informed, involved community and decision makers, who are expected to take a balanced approach toward fishing and conservation and avoid unwarranted regulations on fishing. The risk remains that increased community scrutiny would lead to additional regulations on fishing that fishers would find unwarranted. Given these considerations, the proposed NERR designation is considered to have a neutral effect on fishing access and resources.

- **Organizations currently working on restoration of resources in the NERR:** NERR designation would bring increased funding for restoration and increased attention from the State and community. Although these effects would be welcomed by local nonprofit groups, it is also possible

that NERR designation would lead to increased regulation and environmental scrutiny to enhance protection of resources, thereby adding to the cost and time needed to accomplish restoration work. These organizations have already worked to obtain State environmental reviews of their programs and plans. Whether the NERR designation would bring an additional level of review, increasing the burden of restoration work for small non-profits, has not been decisively resolved. However, the education and outreach programs of the NERR would support a well-informed, involved community and decision makers, who are expected to take a balanced approach toward conservation and management and to avoid imposing unwarranted regulations. Given these considerations, the effect of the proposed NERR designation is uncertain but could have a slightly positive effect on the organizations working to restore resources in the NERR area.

- **Minority and low-income communities (Executive Order 12898):** The NERR designation would not involve disproportionate impacts on minority or low-income communities; there would be no effect.
- **Health of children (Executive Order 13045):** The NERR site is unpopulated; restoration and research activities are not expected to result in health impacts, either on site or off site. There would be no effect.
- **Traffic:** Although the section of the Kamehameha Highway crossing through the estuary area is narrow, traffic is light there in comparison with other major roadways in Kāneʻohe, and is not expected to be adversely affected by the proposed designation. Activities in the NERR could increase traffic to the State Park and other sites, but not enough to result in traffic congestion. This effect is considered minor.
- **Fiscal:** NERR designation is expected to attract federal funds while committing the State of Hawaiʻi to provide matching funds. The State also would gain tax revenues from the income and spending of new workers. These cash flows are small; thus, the action would have only a negligible effect.

Section 4. Cumulative Impacts

The designation of the He'eia NERR does not involve or allow for any action that would significantly disrupt the landscape. There would be no change in land ownership, and current uses of the public and private lands and waters within the proposed NERR boundary would continue to be managed by present regulatory authorities. Reserve designation is largely an administrative action. An analysis of the proposed designation's effects, considered together with the effects of other federal and nonfederal actions (Table 4-1), determined that the proposed action's contributions to cumulative environmental and human impacts are either minimally adverse or beneficial.

No other federal actions affecting the He'eia area were identified for the analysis of cumulative effects. However, five nonfederal actions were identified and considered (Table 4-1). The first nonfederal action is being conducted by Kāko'o 'Ōiwi, a reserve site partner. This action is the conversion of the He'eia wetlands and uplands into a working agricultural landscape, with organic taro lo'i in the wetlands and organic dryland agricultural crops and orchards in the uplands of the property (Townscape 2011a and b). Project elements include work towards:

- restoring He'eia wetlands to active production of organic taro on approximately 150 acres;
- conducting organic agriculture on 3 acres and aquaponics on 1 acre of relatively level fill areas of the site;
- planting approximately 50 orchard trees along Kealohi Road;
- maintaining agricultural and safety roads that will provide access to the agricultural areas;
- restoring approximately 10 acres of loko i'a kalo, or traditional combined taro fields and fishponds, in the Makai (seaward) brackish areas of the wetlands;
- constructing detention ponds in the mauka (upland) part of the property to detain sediments and debris during storm events and thus reduce impacts on agricultural areas;
- cultivating dryland crops and orchards in upland areas and on hillsides that are currently overgrown with nonnative invasive species;
- constructing supporting agricultural and community facilities in upland areas, including a poi mill, composting facility, community center, health center, Hawaiian hale and base yards; and
- establishing educational programs in partnership with other local groups.

Although wetland and upland agricultural conversion, construction of detention ponds, and construction of facilities could have short-term impacts within the proposed He'eia NERR boundary, implementation of best management practices (BMPs) as part of the permits acquired from the U.S. Army Corps of Engineers (USACE) for activities in waters of the United States would avoid or minimize impacts on water quality and hydrology. Also, this project is expected to result in beneficial effects on He'eia uplands and wetlands, as well as on the cultural, socioeconomic, and educational resources of the area.

Table 4-1. Summary of Potential Cumulative Impacts, Including the Contribution of the He'eia NERR Designation

Topic	Proposed Action	Kāko'o 'Ōiwi Wetland and Upland Agriculture	Kāko'o 'Ōiwi Wetland and Stream Restoration	He'eia Fishpond Reconstruction and Aquaculture Farming	Moku o Lo'e Infrastructure Rehab/ Replacement	Kāne'ohe Bay Coral Reef Restoration	Cumulative Impact
Habitats							
Uplands	+	+	N	N	N	N	+
Wetlands	+	+	+	+	N	N	+
Freshwater streams	+	*	+	N	N	N	+
Estuarine habitats	+	*	+	+	N	N	+
Coastal and marine habitats	+	*	N	*	N	+	+
Flora and Fauna							
Rare, endangered, and threatened plants	N	N	N	N	N	N	N
Endangered and threatened wildlife	+	+	*	+	N	+	+
Other flora	+	+	+	+	N	N	+
Other fauna	+	+	+	+	N	+	+
Physical Environment							
Watershed and hydrology	+	*	+	N	N	N	+
Water quality	+	*	+	*	N	N	+
Geology	+	*	+	N	N	N	N
Climate	+	N	N	N	N	+	+
Human Environment							
Socioeconomic	+ or *	+ or *	N	+ or *	N	N	+ or *
Traffic	N	N	N	N	N	N	N
Cultural	+	+	N	+	N	N	+
Key: N = No effect; * = Low adverse effect; ** = Moderate adverse effect; *** = Substantial adverse effect; + = Overall beneficial effect. Socio-economic impacts uncertain because the impacts of federal and community supervision could outweigh the benefits of support.							

The second nonfederal project, also being conducted by Kāko‘o ‘Ōiwi, is restoration of the He‘eia wetlands by removal of invasive mangroves (*Rhizophora* and *Bruguiera* spp.), and restoration of the He‘eia Stream channel by removal of California grass and other nonnative invasive plants that are choking water flows (Townscape 2011a and b). To minimize potential impacts on the endangered Hawaiian hoary bat, removal of the mangrove trees will not be conducted during the bat’s breeding season, which extends from June 15 through September 15. A predator control program also will be implemented to control rats, mongooses, cats, and dogs in the wetlands area. Although plant removal and restoration activities could have short-term impacts on water quality and hydrology within the proposed He‘eia NERR boundary, implementation of BMPs as part of the permits acquired from USACE for activities in waters of the U.S. would avoid or minimize these impacts. Overall, this project is expected to enhance water quality and hydrology of the watershed and estuary, and have beneficial effects on He‘eia Stream, the wetlands, the estuary, and the native flora and fauna that occur in these areas, and a neutral effect on the cultural and socioeconomic resources of the area.

The third nonfederal project, conducted by the community-based group and reserve site partner Paepae o He‘eia, is to repair, reconstruct, and rehabilitate the He‘eia Fishpond’s unique 7000-foot-long wall that completely encircles the pond, and to manage the fishpond to preserve the integrity of the pond and support a unique cultural, educational, and aquacultural program (Helber Hastert & Fee. 2007, Paepae o He‘eia 2015). Removal of introduced and invasive mangrove (which threatens the wall’s structural integrity) has been ongoing since the late 1990s. Once mangrove removal is completed, the damaged portions of the wall will be reconstructed, and invasive seaweed will be removed. Currently, the project produces various aquacultural products as part of its economic development efforts. Project activities may have short-term impacts on water quality, but implementation of BMPs as part of the permits acquired from USACE for activities in waters of the U.S. would avoid or minimize these impacts. Overall, this project is expected to have beneficial effects on the He‘eia estuary and wetlands and associated flora and fauna, as well as on the cultural, educational, and socioeconomic resources of the area.

The fourth nonfederal project, the Coconut Island Infrastructure Rehabilitation and Replacement Project, will be conducted by the University of Hawai‘i (Community Planning and Engineering, Inc. 2014). The project will involve utility line replacement, rerouting of an existing gravity sewer line, sewage pump replacement, and wet well repairs. The new utility lines will be installed under the sea floor, from Coconut Island to the mainland, using horizontal directional drilling (HDD). A 350-foot-long trench will be dug to reroute the sewer line and tie it into an existing main sewer line. None of the activities specified in the work plan will affect the He‘eia NERR resources; a Finding of No Significant Impact was issued for this project.

The fifth nonfederal project, the Kāne‘ohe Bay Coral Reef Restoration project, is being implemented by the Hawai‘i State Department of Land and Natural Resources, Division of Aquatic Resources (Division of Aquatic Resources 2013, USACE 2014). This project involves mechanically removing thousands of pounds of invasive algae from Kāne‘ohe Bay coral reefs and releasing sea urchins to graze on any remaining algae.

The removed algae is given to local farmers and used as compost and fertilizer. A coral reef mitigation bank, where invasive algae may be removed as part of mitigation bank management, may be established within the proposed He'eia NERR. This outcome could result in significant habitat restoration benefits for affected coral reef, coastal, and marine habitats and the species that inhabit these systems.

The proposed federal (NOAA) action of designating the He'eia NERR would yield a net beneficial effect on the human and natural environment. The NERR designation would increase attention to research and educational uses of the proposed reserve. There are already several educational and outreach programs occurring in the area as part of nonfederal projects, such as the Paepae o He'eia Fishpond Reconstruction and Aquaculture Farming project and the agriculture and restoration projects being conducted by Kāko'o 'Ōiwi. The proposed reserve would build on and support these education and public programs, which is expected to foster environmental stewardship and resource conservation. Another major focus of the proposed He'eia NERR research program would be to monitor the biological, ecological, and physical variables of the He'eia uplands and estuary and Kāne'ohe Bay. Monitoring would provide the long-term baseline data against which reserve managers and researchers may assess environmental changes over time. Enhancing our understanding of the spatial and temporal processes of the system would support informed management practices and improve stewardship of coastal natural resources in the future.

The overall cumulative impact of the NERR designation and the nonfederal projects on social and economic conditions and cultural resources is expected to be beneficial. The NERR designation and the nonfederal actions described above would increase awareness of the cultural and archaeological resources of the He'eia NERR and result in increased public support for protecting them. Traffic is expected to increase, but not to the extent of causing traffic jams. Public schools and the community are expected to have greater access to science and cultural educational resources. The NERR and the nonfederal actions also would generate a modest increase in jobs and federal funding.

Regionally, the He'eia NERR would be a center for estuarine research and education. Thus, the proposed reserve would serve resource users, coastal decision makers, educators, and visitors and would have positive effects on the entire region. Nationally, the proposed He'eia NERR designation would further NOAA's mission of establishing a system of reserves in all biogeographic subregions and estuarine types in the United States.

Section 5. Impacts of the No-Action Alternative (Trends)

5.1 Natural Environment

The no-action alternative (i.e., the choice to not designate the Heʻeia NERR and not implement associated programs for research and monitoring, education, and coastal training) would not result in any changes to the current status of the natural environment or the current management or ownership of the lands and waters in the proposed Heʻeia NERR area. The current conditions of environmental resources in the area would persist, and current trends would continue. However, taking no action would result in a lack of coordination and long-term cooperation in the management of the lands and waters in the proposed NERR. Research, monitoring, education, public outreach, and resource management would not be conducted or be eligible for NERR funding by NOAA. Without this funding and support by NOAA, the natural environment in the proposed NERR area may not receive potential long-term benefits such as improved water quality, habitat protection, and land stewardship.

5.2 Human Environment

The no-action alternative would not result in any changes to the current status of the human environment or the current management or ownership of the lands and waters in the proposed NERR area. The current conditions of human resources would persist, and current trends would continue. However, taking no action would result in a lack of coordination and long-term cooperation in the management of the lands and waters, and programs would not be conducted or be eligible for NERR funding by NOAA. Without this funding and support by NOAA, the human environment in the proposed NERR area would not receive potential long-term benefits such as an improvement of educational and outdoor recreational opportunities, increased access to science education resources, and perpetuation of cultural knowledge and practices.

Section 6. References

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Attachment A. Reserve Management Plan
