Draft Environmental Impact Statement/Overseas Environmental Impact Statement

Hawaii-Southern California Training and Testing
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3.3 VEGETATION

SYNOPSIS

The United States Department of the Navy considered all potential stressors that vegetation could potentially be exposed to from the Proposed Action. The following conclusions have been reached for the Preferred Alternative (Alternative 1):

- Acoustics: Acoustic stressors are not applicable to vegetation due to the lack of hearing capabilities of vegetation and will not be analyzed further in this section.
- Explosives: Explosives could affect vegetation by destroying individuals or damaging parts of individuals; however, there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation.
- Energy: Energy stressors are not applicable to vegetation because vegetation have a limited sensitivity to energy stressors and will not be analyzed further in this section.
- Physical Disturbance and Strike: Physical disturbance and strike could affect vegetation by destroying individuals or damaging parts of individuals; however, there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation.
- Entanglement: Entanglement stressors are not applicable to vegetation because of the sedentary nature of vegetation and will not be analyzed further in this section.
- Ingestion: Ingestion stressors are not applicable to vegetation because vegetation are photosynthetic organisms and will not be analyzed further in this section.
- Secondary: Project effects on sediment or water quality would be minor, temporary, and localized, and could have small-scale secondary effects on vegetation; however, there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation.

3.3.1 INTRODUCTION

This section provides analysis of potential impacts on vegetation found in the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area) and an introduction to the species that occur in the Study Area.

Vegetation includes diverse taxonomic/ecological groups of marine algae throughout the Study Area, as well as flowering plants in the coastal and inland waters. For this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) analysis, vegetation has been divided into eight groups that encompass taxonomic categories, distributions, and ecological relationships. These groups include blue-green algae (phylum Cyanobacteria), dinoflagellates (phylum Dinophyta), green algae (phylum Chlorophyta), coccolithophores (phylum Haptophyta), diatoms (phylum Ochrephyta), brown algae (phylum Phaeophyta), red algae (phylum Rhodophyta), and vascular plants (phylums Tracheophyta and Spermatophyte). Furthermore, the analysis considers the distribution of vegetation based on oceanic features and vertical distribution. Open-ocean oceanographic features of the Study Area include the North Pacific Subtropical Gyre and the North Pacific Transition Zone. Additionally, vertical distribution within the water column or the bottom substrate is considered.

The types of vegetation present in the Study Area are described in this section and the affected environmental baseline is discussed in Section 3.3.2 (Affected Environment). The analysis of environmental consequences is presented in Section 3.3.3 (Environmental Consequences), and the potential impacts of Alternative 1 and Alternative 2 are summarized in Section 3.3.4 (Summary of Potential Impacts on Vegetation).

The distribution and condition of offshore abiotic (non-living) substrates necessary for attached macroalgae and rooted vascular plants (e.g., seagrass), and the impact of stressors on those substrates are described in Section 3.5 (Habitats). Additional information on the biology, life history, and conservation of marine vegetation can be found on the websites of the following agencies and groups:

- National Marine Fisheries Service
- Conservation International
- Algae base
- National Museum of Natural History

3.3.2 Affected Environment

3.3.2.1 General Background

Three subsections are included in this section. General background information is given in the following subsections, which provides brief summaries of habitat use (Section 3.3.2.1.1, Habitat Use) and threats that affect or have the potential to affect natural communities of vegetation within the Study Area (Section 3.3.2.1.2, General Threats). Although there are no species listed under the Endangered Species Act (ESA), Section 3.3.2.2 (Endangered Species Act-Listed Species) would list species that were proposed, candidates, or listed under the ESA. General types of vegetation that are not listed under the ESA are briefly reviewed in Section 3.3.2.3 (Species Not Listed Under the Endangered Species Act).

3.3.2.1.1 Habitat Use

Factors that influence the distribution and abundance of vegetation in the coastal and open ocean areas of the Study Area are the availability of light and nutrients, water quality, water clarity, salinity level, seafloor type (important for rooted or attached vegetation), storms and currents, tidal schedule, temperature, and grazing by herbivores (Green & Short, 2003).

Marine ecosystems depend almost entirely on the energy produced by marine vegetation through photosynthesis (Castro & Huber, 2000), which is the transformation of the sun's energy into chemical energy. In the photic zone of the open-ocean and coastal waters, marine algae and flowering plants have the potential to provide oxygen and habitat for many organisms in addition to forming the base of the marine food web (Dawes, 1998).

The affected environment comprises two major ecosystem types, the open ocean and coastal waters; and two major habitat types, the water column and bottom (benthic) habitat. Vegetation grows only in the sunlit portions of the open ocean and coastal waters, referred to as the "photic" or "euphotic" zone, which extends to maximum depths of roughly 660 feet (ft.) (200 meters [m]). Because depth in most of the open ocean exceeds the euphotic zone, benthic habitat for vegetation is limited primarily to the coastal waters.

The euphotic zones of the water column in the Study Area are inhabited by phytoplankton, single-celled (sometimes filamentous or chain forming), free-floating algae primarily of four groups (Table 3.3-1) including diatoms, blue-green algae, dinoflagellates, and coccolithophores. Microscopic algae can grow down to depths with only 1 percent of surface light penetration (Nybakken, 1993). These important groups are summarized below (Levinton, 2009):

- Diatoms dominate the phytoplankton at high latitudes. They are single-celled organisms with shells made of silica, which sometimes form chains of cells.
- Blue-green algae (which are photosynthetic bacteria) are found in and may dominate nearshore waters of restricted circulation and/or brackish (low salinity) waters as well as the open ocean. Blue-green algae convert atmospheric nitrogen to ammonia, which can then be taken up by marine vascular plants and animals.
- Dinoflagellates are covered with cellulose plates and dominate the phytoplankton at low latitudes year round and at higher latitudes in summer and autumn. Rapid population increases in dinoflagellates can result in "red tides" and "harmful algal blooms." Toxins produced by some dinoflagellates accumulate in the animals that consume them and can cause poisoning among the higher level human and marine mammal consumers.
- Coccolithohores are nearly spherical and secrete a skeleton of calcium carbonate plates. They can be dominant in the phytoplankton of tropical as well as sub-polar seas. They account for approximately one third of calcium carbonate production in the entire ocean.

Other types of algae that can also be abundant in the phytoplankton, although usually less so than the four groups above, include silicoflagellates, green algae, and cryptomonad flagellates (Levinton, 2013).

Vascular plants in the Study Area include seagrasses, cordgrasses, and mangroves, all of which have more limited distributions than algae (which are non-vascular), and typically occur in intertidal or shallow (< 40 ft.) subtidal waters (Green & Short, 2003). The relative distribution of seagrasses is influenced by the availability of suitable substrate occurring in low-wave energy areas at depths that allow sufficient light exposure for growth. Seagrasses as a rule require more light than algae, generally 15–25 percent of surface incident light (Fonseca et al., 1998; Green & Short, 2003). Seagrass species distribution is also influenced by water temperatures (Spalding et al., 2003).

Emergent wetland vegetation of the Study Area is typically dominated by cordgrasses (*Spartina foliosa*), which form dense colonies in salt marshes that develop in temperate areas in protected, low-energy environments on soft substrate, along the intertidal portions of coastal lagoons, tidal creeks or rivers, or estuaries, wherever the sediment is adequate to support plant root development (Mitsch et al., 2009).

In Hawaii, there are two species of seagrasses and at least 204 species of red algae, 59 species of brown algae, and 92 species of green algae. Seaweeds are important in native Hawaiian culture and are used in many foods (Preskitt, 2002b, 2010). Red coralline algae and green calcareous (calcium-containing) algae (*Halimeda* species) secrete calcareous skeletons that bind loose sediments in coral reefs in Hawaii (Spalding et al., 2003). In the Northwestern Hawaiian Islands, beyond the coral reef habitat, algal meadows dominate the terraces and banks at depths of 98.4–131.2 ft. (30–40 m). There are approximately 1,740.62 square miles (4,507 square kilometers) of this type of substrate, an estimated 65 percent of which is covered by algal meadows (Parrish & Boland, 2004). Surveys from 2007 to 2016 generally showed a slightly higher percent cover of macroalgae compared to hard coral in the Northwestern Hawaiian Islands. However, higher percent cover of corals compared to macroalgae was observed along the main Hawaiian Islands (McCoy et al., 2016).

Marine vegetation along the California coast is represented by more than 700 species and varieties of seaweeds (such as corallines and other red algae, brown algae including kelp, and green algae), seagrasses (Leet et al., 2001; Wyllie-Echeverria & Ackerman, 2003), and canopy-forming kelp species

(Wilson, 2002). Extensive mats of red algae provide habitat in areas of exposed sediment along the California coast (U.S. Department of the Navy and Port of San Diego, 2013). Refer to Section 3.3.2.3 (Species Not Listed Under the Endangered Species Act) for distribution information.

3.3.2.1.2 General Threats

Environmental stressors on marine vegetation are products of human activities (e.g., industrial, residential, and recreational activities) and natural occurrences (e.g., storms, surf, and tides). Species-specific information is discussed, where applicable, in Sections 3.3.4.4 (Physical Disturbance and Strike Stressors) and 3.3.4.7 (Secondary Stressors), and the cumulative impacts from these threats are analyzed in Chapter 4 (Cumulative Impacts).

Human-made stressors that act on marine vegetation include excessive nutrient input (such as fertilizers), siltation (the addition of fine particles to the ocean), pollution (oil, sewage, trash) (Mearns et al., 2011), climate change (Arnold et al., 2012; Doney et al., 2012; Martinez et al., 2012; Olsen et al., 2012), fishing practices (Mitsch et al., 2009; Steneck et al., 2002), shading from structures (National Marine Fisheries Service, 2002), harvesting (Wilson, 2002), habitat degradation from construction and dredging, and introduced or invasive species (Hemminga & Duarte, 2000; Spalding et al., 2003) The seagrass, cordgrass, and mangrove taxonomic group is often more sensitive to stressors than the algal taxonomic groups. The great diversity of algae makes generalization difficult, but overall, algae are resilient and colonize disturbed environments created by stressors (Levinton, 2009).

Marine algae and vascular plants are important ecologically and economically, providing an important source of food, essential ecosystem services (e.g., coastal protection, nutrient recycling, food for other animals, and habitat formation), and income from tourism and commercial fisheries (Spalding et al., 2001).

3.3.2.1.2.1 Water Quality

Water quality in the Study Area may be impacted by the introduction of harmful contaminants. Common ocean pollutants include toxic compounds such as metals, pesticides, herbicides, and other organic chemicals, excess nutrients from fertilizers and sewage, detergents, oil, plastics, and other solids. Coastal pollution and agricultural runoff may cause toxic red tide events in the Study Area (Hayes et al., 2007). Coastal development and pollution, particularly storm water runoff and point source discharges, affect water quality of bays and coastal areas throughout the world. Depending on the proximity to and nature of the discharge, sediment and water quality may be degraded, which in turn can impact marine vegetation communities. Erosion and sedimentation may also affect sediment and water quality of coastal areas during storm runoff from urban streets into rivers and streams.

Oil in runoff from land-based sources, natural seeps, and accidental spills (such as offshore drilling and oil tanker leaks) are some of the major sources of oil pollution in the marine environment (Levinton, 2009). The type and amount of oil spilled, weather conditions, season, location, oceanographic conditions, and the method used to remove the oil (containment or chemical dispersants) are some of the factors that determine the severity of the impacts. Sensitivity to oil varies among species and within species, depending on the life stage; generally, early life stages are more sensitive than adult stages (Hayes et al., 1992). The tolerance to oil pollutants varies among the types of marine vegetation, but their exposure to sources of oil pollutants makes them all vulnerable.

Oil pollution, as well as chemical dispersants used in response to oil spills, can impact seagrasses directly by smothering the individuals, or indirectly by lowering their ability to combat disease and other stressors (U.S. National Response Team, 2010). Seagrasses that are totally submerged are less susceptible to oil spills since they largely escape direct contact with the pollutant. Depending on various factors, oil spills can result in a range of effects from no impact to long-lasting impacts, such as decreases in eelgrass density (Kenworthy et al., 1993; Peterson, 2001). Algae are relatively resilient to oil spills, while mangroves are highly sensitive to oil exposure. Contact with oil can cause death, leaf loss, and failure to germinate (Hoff et al., 2002). Salt marshes can also be severely impacted by oil spills, with long-term effects (Culbertson et al., 2008).

3.3.2.1.2.2 Commercial Industries

Green seaweed is harvested for human consumption in Hawaii's coastal waters. Common species harvested include *Ulva fasciata, Enteromorpha prolifera,* and *Codium edule* (Preskitt, 2002b, 2010). Edible brown seaweeds that are collected in Hawaii include *Sargassum echinocarpum* and *Dictyopteris plagiograma* (Preskitt, 2002a). The State of Hawaii Department of Land and Natural Resources regulates the collection of seaweeds.

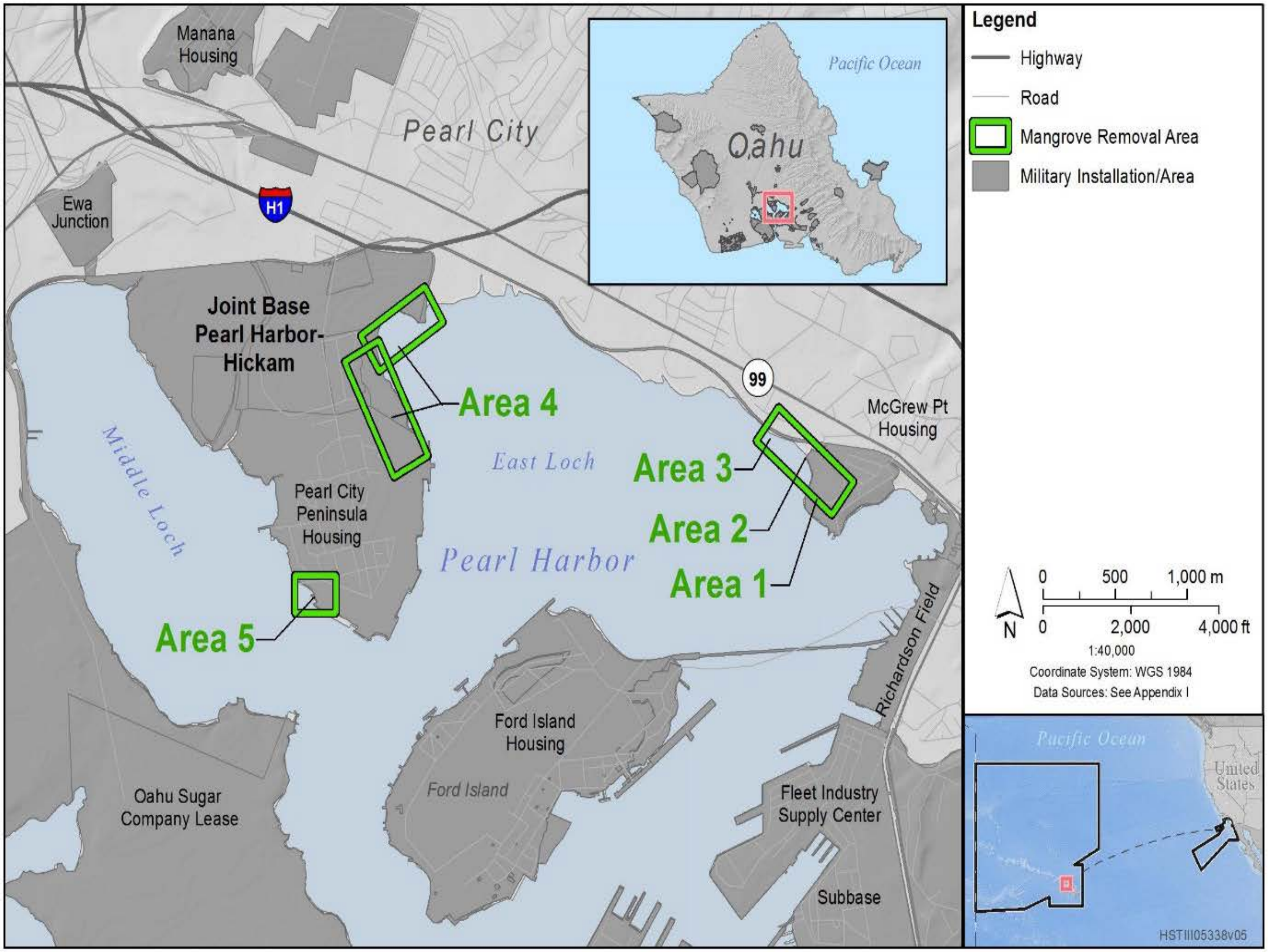
Although historically important, large-scale harvesting of kelp beds no longer occurs along the California coast. Small-scale commercial operations, however, continue to harvest kelp, primarily for abalone feed (Wilson, 2002). The California Department of Fish and Game, which issues exclusive leases to harvest designated beds for up to 20 years, manages kelp harvesting. Although they are not limited in the amount, California regulations prohibit commercial harvesters from cutting attached *Macrocystis pyrifera* and *Nereocystis luetkeana* (giant and bull) kelp from deeper than 4 ft. (1.2 m) below the water's surface (14 California Code of Regulations 165[c][2]), which protects the reproductive structures at the kelp's base and allows vegetative re-growth (Wilson, 2002).

3.3.2.1.2.3 Disease and Parasites

Marine algae and vascular plants may be susceptible to disease caused by other marine organisms, which may impact individuals or populations. In particular, eelgrass is vulnerable to a wasting disease caused by a marine pathogen that has caused devastating population loss in the past (Ralph & Short, 2002). Certain species of microscopic algae (e.g., dinoflagellates and diatoms) can form algal blooms, which can pose serious threats to human health and wildlife species. Harmful algal blooms can deplete oxygen within the water column and block sunlight that other organisms need to live, and some algae within algal blooms release toxins that are dangerous to human and ecological health (Center for Disease Control and Prevention, 2004). These algal blooms have a negative economic impact of hundreds of millions of dollars annually worldwide (National Centers for Coastal Ocean Science, 2010). Additional information on harmful algal blooms can be accessed on the Centers for Disease Control and the National Oceanic and Atmospheric Administration websites.

3.3.2.1.2.4 Invasive Species

Invasive vegetation species are present throughout the Study Area. The red mangrove (*Rhizophora mangle*) is an invasive species in Hawaii and various resource agencies and organizations (e.g., Hawaii Department of Land and Natural Resources, Pacific Cooperative Studies Unit, Malama O Puna) have eradication programs targeting the red mangrove and other mangrove infestations. First introduced primarily to stabilize coastal flats in the early 1900s (Allen, 1998), the red mangrove is native to Florida and the Caribbean. Since the introduction of this species, mangroves have invaded intertidal areas formerly devoid of trees. In 2013 and 2014, the United States (U.S.) Department of the Navy (Navy) completed several mangrove removal actions in Pearl Harbor (Figure 3.3-1), which enhanced native sedge growth among other environmental benefits (U.S. Department of the Navy, 2014).



Source: U.S. Department of the Navy (2014)

Figure 3.3-1: Areas Subject to Mangrove Removal in Pearl Harbor

Invasive marine green algal species are found in coastal waters of the Study Area. The invasive green algae, *Avrainvillea amadelpha,* has been recorded in the main Hawaiian Islands (Preskitt, 2010). Invasive green algae represent a serious threat to coral reefs, and may displace, outcompete, or hybridize with non-invasive native green algae species, resulting in the loss of native biodiversity or alteration of ecosystem processes. Representative non-native invasive species of red algae in the Hawaii portion of the Study Area include *Acanthophora spicifera*, *Gracilaria salicornia*, *Hypnea musciformis*, *Kappaphycus alvarezii*, and *Gracilaria tikvahiae* (Smith et al., 2002).

Caulerpa taxifolia and *Codium fragile tomentosoide* are invasive green algal species found in the southern California portion of the Study Area (Dobroski et al., 2015a; Gagnon et al., 2015). In addition, *Sargassum muticum* (Japanese wireweed) and *Sargassum horneri* (devil weed) are invasive brown algal species found within the California portion of the study area (Dobroski et al., 2015b; Marks et al., 2015). *Undaria pinnatifida* (or wakame), which is an edible seaweed native to Japan, is an invasive species that is also found along the California coast (Dobroski et al., 2015a; Global Invasive Species Database, 2005). Devil weed and wakame are found in San Diego County and have exhibited characteristics of successful invaders such as establishing in new areas, spreading locally, and persisting through multiple generations. They primarily occur in harbors but have also been found in open coast sites. This rapid and uncontrolled spread has ecological and economic consequences that will require further research (Kaplanis et al., 2016).

Department of Defense has implemented projects to control invasive microalgae at critical control points (specific areas where spread and transport of invasive species are likely to occur). For example, in 2011, an experimental macroalgae cleanup occurred in an infested area of Mokapu Peninsula, at the sea plane ramps. Lessons learned from this experiment were discussed with Sikes Act partners and provided the basis for tackling more ambitious projects in the future. A slow and steady phased approach is often the most successful in making progress with controlling invasive speicies, based on the expeiences of the Marine Corps Base at Mokapu Peninsula (Marine Corps Base Hawaii, 2011).

3.3.2.1.2.5 Climate Change

The impacts of anthropogenically induced climate change on the marine environments include rising sea levels, ocean acidification, increased sea temperature, and an increase in severe weather events. All of these changes may have impacts on vegetation in the Study Area.

Rising sea levels will alter the amount of sunlight reaching various areas, which may decrease the photosynthetic capabilities of vegetation in those areas. However, the fast growth and resilient nature of vegetation may enable most species to adapt to these changes (Harley et al., 2006). Increased sea temperature may lead to several impacts that could affect vegetation. Warmer waters may lead to a greater stratification in the water column, which may support harmful algal blooms (Lehmköster, 2015). The stratification may also inhibit upwelling, as seen during El Niño events, which would prevent nutrients from circulating to the surface (Lehmköster, 2015). Additionally, increased sea temperatures may lead to changes in the composition of vegetation communities (Schiel et al., 2004). These changes in community composition could impact biological interactions, including the mutualism between reef-building corals and algae (Doney et al., 2012). These indirect and direct impacts of climate change that decrease coral reef habitat may enable vegetation to overtake areas that were previously biogenic reef habitat (Hughes et al., 2007; Pandolfi et al., 2005). Increases in severe weather events may lead to increased erosion and sedimentation in the marine environments and higher energy wave action that could increase impacts to vegetation by physical disturbance, such as marine vascular plants becoming unrooted.

Vegetation is susceptible to water quality changes from erosion and disturbances from storm events. Increased storm events are expected to impact species diversity in kelp ecosystems (Byrnes et al., 2011). The impacts of ocean acidification on vegetation are poorly understood (Harley et al., 2006). Ocean acidification may impact the ecological function of coralline algae by decreasing habitat-forming capabilities (Ragazzola et al., 2016).

3.3.2.1.2.6 Marine Debris

Marine debris (especially plastics) is a threat to many marine ecosystems, particularly in coastal waters adjacent to urban development. Microplastics (generally considered to be particles less than 5 millimeters [mm] in size), which may consist of degraded fragments of larger plastic items or intentionally manufactured items (e.g., abrasive plastic beads found in some personal care products or used in blast-cleaning), are of concern because of their durability, long lifespan, and potential to enter marine food webs (Setala et al., 2016). Marine debris may injure marine vegetation if it is large and is pulled around by tidal influences and currents (Gregory, 2009). Refer to Section 3.2 (Sediments and Water Quality) for a more detailed discussion of marine debris and the associated effects on water quality.

Marine debris, including large amounts of plastic, is present throughout the entire Study Area (Cooper & Corcoran, 2010; Dameron et al., 2007). The Hawaiian Archipelago is located within the North Pacific Gyre, which consolidates debris originating in various areas of the Pacific Ocean. Bottom trawl studies of anthropogenic marine debris on the continental shelf and upper slope of the U.S. West Coast (Washington to Southern California) revealed that debris was widespread throughout the area investigated (Keller et al., 2010). Military expended materials (e.g., ammunition boxes, helmets, and rocket boosters and launchers) were the highest contributors to recovered metals in deeper waters off California in areas known for Navy activities and military dump sites, including around Catalina and San Clemente Islands. Recent studies in the Southern California Bight found that marine debris (primarily plastic) occurred in about one-third of seafloor areas surveyed (Moore et al., 2016). Microplastic particles were more prevalent in shallow nearshore areas (ports, marinas, bays, and estuaries) than in offshore areas.

3.3.2.2 Endangered Species Act Listed Species

There are no species of vegetation listed as endangered, threatened, candidate, or proposed under the ESA in the Study Area.

3.3.2.3 Species Not Listed Under the Endangered Species Act

Thousands of vegetation species occur in the Study Area and none are listed under the ESA (Table 3.3-1).

Table 3.3-1: Major Groups of Vegetation in the Study Area

Marine Vegetation Groups		Vertical Distribution in the Study Area[2]		
Common Name[1] (Taxonomic Group)	**Description**	**Open Ocean**	**Coastal Waters**	**Bays and Harbors**
Blue-green algae (phylum Cyanobacteria)	Photosynthetic bacteria that are abundant constituents of phytoplankton and benthic algal communities, accounting for the largest fraction of carbon and nitrogen fixation by marine vegetation; existing as single cells or filaments, the latter forming mats or crusts on sediments and reefs.	Water column	Water column, bottom	Water column, bottom
Dinoflagellates (phylum Dinophyta [Pyrrophyta])	Most are single-celled, marine species of algae with two whip-like appendages (flagella). Some live inside other organisms, and some produce toxins that can result in red tide or ciguatera poisoning.	Water column	Water column	Water column
Green algae (phylum Chlorophyta)	May occur as single-celled algae, filaments, and seaweeds.	Sea surface	Water column, bottom	Water column, bottom
Coccolithophores (phylum Haptophyta [Chrysophyta, Prymnesiophyceae])	Single-celled marine phytoplankton that surround themselves with microscopic plates of calcite. They are abundant in the surface layer and are a major contributor to global carbon fixation.	Water column	Water column	Water column
Diatoms (phylum Ochrophyta [Heterokonta, Chrysophyta, Bacillariophyceae])	Single-celled algae with a cylindrical cell wall (frustule) composed of silica. Diatoms are a primary constituent of the phytoplankton and account for up to 20 percent of global carbon fixation.	Water column	Water column, bottom	Water column, bottom
Brown algae (phylum Phaeophyta [Ochrophyta])	Brown algae are large multi-celled seaweeds that form extensive canopies, providing habitat and food for many marine species.	Water column	Water column, bottom	Water column, bottom
Red algae (phylum Rhodophyta)	Single-celled algae and multi-celled large seaweeds; some form calcium deposits.	Water column	Water column, bottom	Water column, bottom

Table 3.3-1: Major Groups of Vegetation in the Study Area (continued)

Marine Vegetation Groups		Vertical Distribution in the Study Area[2]		
Common Name[1] (Taxonomic Group)	Description	Open Ocean	Coastal Waters	Bays and Harbors
Vascular plants (phylum Tracheophyta, Spermatophyta)	Includes seagrasses, cordgrass, mangroves and other rooted aquatic and wetland plants in marine and estuarine environments, providing food and habitat for many species.	None	Bottom	Bottom

[1]Taxonomic groups are based on Roskov et al. (2015b); Ruggiero and Gordon (2015); and the Integrated Taxonomic Information System. Alternative classifications are in brackets []. Phylum and division may be used interchangeably.
[2]Vertical distribution in the Study Area is characterized by open-ocean oceanographic features (North Pacific Subtropical Gyre and North Pacific Transition Zone) or by coastal waters of two large marine ecosystems (California Current and Insular Pacific-Hawaiian).

3.3.2.3.1 Blue-Green Algae (Phylum Cyanobacteria)

Blue-green algae are single-celled, photosynthetic bacteria that inhabit the photic zone and seafloors of the world's oceans (Roskov et al., 2015a). Blue-green algae are key primary producers in the marine environment and provide valuable ecosystem services such as producing oxygen and nitrogen. The blue-green algae, *Prochlorococcus* species, is responsible for a large portion of the global oxygen production by photosynthetic organisms. Other species of blue-green algae have specialized cells that convert nitrogen gas into a form that can be used by other marine plants and animals (nitrogen fixation) (Hayes et al., 2007). In the nutrient-poor waters of coral reef ecosystems within the Hawaiian portion of the Study Area, blue-green algae are an important source of food for marine species. Diverse grazers, particularly large grazers such as sea urchin and fish, as well as mesoherbivores (e.g., small fish and crabs) and microherbivores (e.g., amphipods, gastropods, and polychaetes) are known to feed on blue-green algae and may influence algal community structures. Physical and biological disturbances to algae may, ultimately, shift the algal community structure to more disturbance-tolerant forms of algae (e.g., turfs and crusts) (Cheroske et al., 2000).

3.3.2.3.2 Dinoflagellates (Phylum Dinophyta)

Dinoflagellates are single-celled organisms with two flagella (whip-like structures used for locomotion) in the phylum Dinophyta (Roskov et al., 2015a). Dinoflagellates are predominantly marine algae, with an estimated 1,200 species living in surface waters of the ocean worldwide (Castro & Huber, 2007). Most dinoflagellates can use the sun's energy to produce food through photosynthesis and can ingest small food particles. Photosynthetic dinoflagellates are important primary producers in coastal waters (Waggoner & Speer, 1998). Organisms such as zooplankton (microscopic animals that drift passively in the water column) feed on dinoflagellates.

Dinoflagellates are also valuable for their close relationship with some invertebrates, most notably reef-building corals (see Section 3.4, Invertebrates). Some species of dinoflagellates (zooxanthellae) live inside corals. This mutually beneficial relationship provides shelter and food (in the form of coral waste products) for the dinoflagellates; in turn, the corals receive essential nutrients produced by dinoflagellates (Spalding et al., 2007). Dinoflagellates cause some types of harmful algal blooms, which result from sudden increases in nutrients (e.g., fertilizers) from land into the ocean or changes in temperature and sunlight (Levinton, 2009).

3.3.2.3.3 Green Algae (Phylum Chlorophyta)

Green algae are single-celled organisms in the phylum Chlorophyta that may form large colonies of individual cells (Roskov et al., 2015a). Green algae may be found in the water column and benthic habitats. Only 10 percent of the estimated 7,000 species of green algae are found living in the marine environment (Castro & Huber, 2000). These species are important primary producers that play a key role at the base of the marine food web. Green algae are found in areas with a wide range of salinity, such as bays and estuaries, and are eaten by various organisms, including zooplankton and snails.

3.3.2.3.4 Coccolithophores (Phylum Haptophyta)

Coccolithophores are single-celled phytoplankton that are especially abundant in tropical oceans but also bloom seasonally at higher latitudes. Up to 200 species have been described in the scientific record, 30–40 of which are common in the sedimentary record (Giraudeau & Beaufort, 2007). Coccolithophores are found in the water column as free-floating phytoplankton. They are nearly spherical and covered with plates made of calcite (calcium carbonate), which account for approximately one-third of calcium carbonate production in the entire ocean. They are an often-abundant component of the phytoplankton and account for a large fraction of primary production and carbon sequestration in the ocean. Blooms produce a strong bluish-white reflection that may cover thousands of square miles (Levinton, 2013).

3.3.2.3.5 Diatoms (Phylum Ochrophyta)

Diatoms are single-celled organisms with cell walls made of silicon dioxide. Two major groups of diatoms are generally recognized, centric diatoms and pinnate diatoms. Centric diatoms exhibit radial symmetry (symmetry about a point), while the pinnate diatoms are bilaterally symmetrical (symmetry about a line). Diatoms are found in the water column and benthic habitats in coastal areas. Diatoms such as *Coscinodiscus* species commonly occur throughout the Study Area. Some strains of another genus of diatoms, Pseudonitzschia, produce a toxic compound called domoic acid. Humans, marine mammals, and seabirds become sick or die when they eat organisms that feed on Pseudonitzschia strains that produce the toxic compound. The southern California portion of the Study Area, off the coasts of Los Angeles and Orange Counties, had some of the highest concentrations of the toxic compound ever recorded in United States waters (Schnetzer et al., 2007). *Pseudo-nitzschia* blooms in the Southern California Bight during 2003 and 2004 were linked to stranding over 1,400 marine mammals (Schnetzer et al., 2007). Pollutants carried from land to the ocean by rainwater (Kudela & Cochlan, 2000), and decreases in the movement of cool, nutrient-rich waters by the wind are believed to be the main causes of these harmful algal blooms in the southern California portion of the Study Area (Kudela et al., 2004).

3.3.2.3.6 Brown Algae (Phylum Phaeophyta)

Brown and golden-brown algae are large multi-celled marine species with structures varying from fine filaments to thick leathery forms (Castro & Huber, 2000). Most species are attached to the seafloor in coastal waters (such as kelp), although a species with both attached and free-floating forms (*Sargassum muticum* [invasive]) occurs within the southern California portion of the Study Area.

3.3.2.3.6.1 Kelp

Kelp is a general term that refers to brown algae of the order Laminariales. Kelp plants are made of three parts: the leaf-like blade(s), the stipe (a stem-like structure), and the holdfast (a root-like structure that anchors the plant to the bottom). The following five species of canopy-forming kelp occur in the coastal waters of the California coast: giant kelp, bull kelp, elk horn kelp (*Pelagophycus porra*), feather boa kelp (*Egregia menziesii*), and chain bladder kelp (*Stephanocystis osmundacea*). The dominant kelp in the southern California portion of the Study Area is giant kelp. Since the first statewide survey in 1967, the total area of kelp canopies has generally declined; the greatest decline occurred along the mainland coast of southern California (Wilson, 2002; Young et al., 2015). The canopy coverage of kelp beds varies under changing oceanographic conditions, and is also influenced by the level of harvesting, invasive species, coastal pollution, and development (Wilson, 2002).

Kelp is the most conspicuous brown algae occurring extensively along the coast in the southern California portion of the Study Area. The giant kelp can live up to eight years and can reach lengths of197 ft. (60 m). The leaf-like fronds can grow up to 23.6 inches (60 centimeters) per day (Leet et al., 2001). Bull kelp (*Nereocystis luetkeana*) growth can exceed 3.9 inches (10 centimeters) per day. Bull kelp attaches to rocky substrates and can grow up to 164 ft. (50 m) in length in nearshore areas. In turbid waters, the offshore edge of kelp beds occurs at depths of 49 to 59 ft. (15 to 18 m), which can extend to a depth of 98.4 ft. (30 m) in the clear waters around the Channel Islands off the coast of southern California (Wilson, 2002). The kelp beds along the California coast and off the Channel Islands are the most extensive and elaborate submarine forests in the world (Rodriguez et al., 2001). El Niño events tend to have a direct influence on the region and have the potential to affect kelp populations, especially when these events are major (Grove et al., 2002).

3.3.2.3.6.2 Sargassum

Sargassum is a genus of brown algae that generally inhabits shallow waters and coral reefs within the Study Area. *Sargassum echinocarpum* (Limu kala) is a native species of Hawaii and is usually found within tide pools and on reef flats. Meanwhile, *Sargassum agardhianum* is native to California.

Two introduced species of *Sargassum* also inhabit the southern California portion of the Study Area – *Sargassum muticum* and *Sargassum horneri*. The brown alga *Sargassum muticum* was introduced from the Sea of Japan and now occupies portions of the California coast (Dobroski et al., 2015a; Monterey Bay Aquarium Research Institute, 2009). *Sargassum horneri* is native to western Japan and Korea. Since *Sargassum horneri* was first discovered in Long Beach Harbor in 2003, the species continues to increase its spatial extent and can now be found near harbors and anchorages from Santa Barbara, California, to Isla Natividad in Baja California (Mexico) (Marks et al., 2015). Specifically, *Sargassum horneri* has been found in the Study Area, in places like San Diego and the Channel Islands (U.S. Department of the Navy and Port of San Diego, 2013). Both *Sargassum muticum* and *Sargassum horneri* are present in the Study Area.

3.3.2.3.7 Red Algae (Phylum Rhodophyta)

Red algae are predominately marine, with approximately 4,000 species worldwide (Castro & Huber, 2000). Red algal species exist in a range of forms, including single and multicellular forms (Roskov et al., 2015a), from fine filaments to thick calcium carbonate crusts. Within the Study Area, they occur in the water column and bottom habitats of coastal waters, primarily in reef environments and intertidal zones of Hawaii and California. Common native species in Hawaii include *Laurencia* species, *Gracilaria coronopifolia*, *Hypnea cervicornis*, and *Gracilaria parvispora*. Many red algae species contribute to reef formation by hardening the reef (by producing calcium carbonate) and by cementing coral fragments (Veron, 2000), and are food for various sea urchins, fishes, and chitons. In California waters, common species include *Endocladia muricata*, *Mastocarpus papillatus*, and species of *Mazaella*.

3.3.2.3.8 Seagrasses, Cordgrasses, and Mangroves (Phylum Spermatophyta)

Seagrasses, cordgrasses, and mangroves are flowering marine plants in the phylum Spermatophyta (Roskov et al., 2015a). These marine flowering plants create important habitat and are a food source for many marine species. These marine vascular plants are found only in coastal waters, attached to the bottom.

3.3.2.3.8.1 Seagrasses

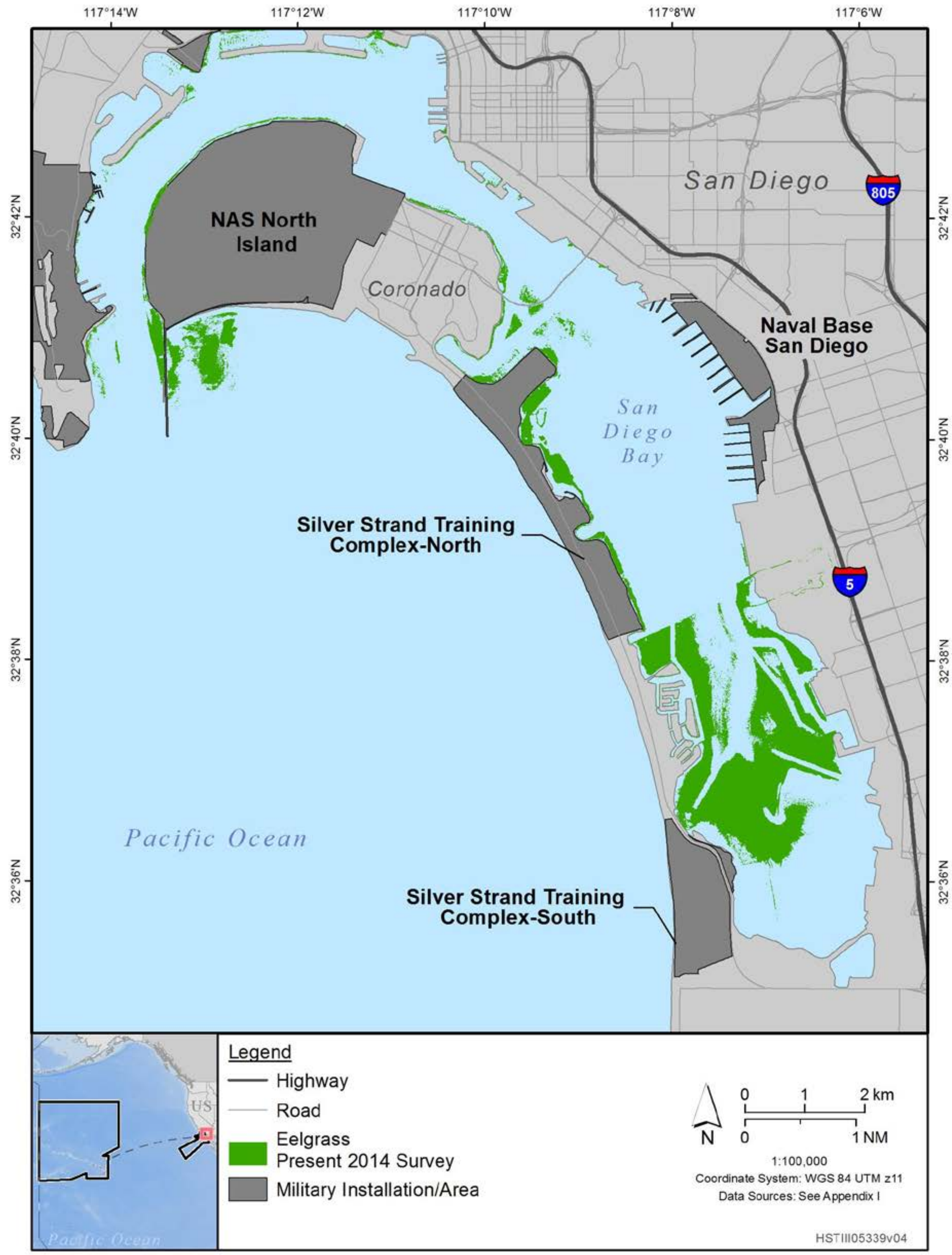
Seagrasses are unique among flowering plants because they grow submerged in shallow marine environments. Except for some species that inhabit the rocky intertidal zone, seagrasses grow in shallow, subtidal, or intertidal sediments, and can extend over a large area to form seagrass beds (Garrison, 2004; Phillips & Meñez, 1988). Seagrass beds provide important ecosystem services as a structure-forming keystone species (Arnold et al., 2012; Buhl-Mortensen et al., 2010; U.S. National Response Team, 2010). They provide suitable nursery environment for commercially important organisms (e.g., crustaceans, fish, and shellfish) and are also a food source for numerous species (e.g., turtles) (Nagaoka et al., 2012). Seagrass beds combat coastal erosion, promote nutrient cycling through the breakdown of detritus (Dawes et al., 1997; Dawes, 1998), and improve water quality. Seagrasses also contribute a high level of primary production to the marine environment, which supports high species diversity and biomass (Spalding et al., 2003). Seagrasses are uprooted by dredging and scarred by boat propellers (Hemminga & Duarte, 2000; Spalding et al., 2003), which can take years to recover.

In Hawaii, the most common seagrasses are Hawaiian seagrass (*Halophila hawaiiana*) and paddle grass (*Halophila decipiens*). Hawaiian seagrass is a native species found at less than 3.3 ft. (1 m) in subtidal, sandy areas surrounding reefs, in bays, or in fishponds. It occurs in coastal waters of Oahu near Mamala Bay (southern coast), in Maunalua Bay (southeastern coast), in Kaneohe Bay (northeast coast), in coastal waters of Maui, in the inner reef flats of southern Molokai, at Anini Beach on the northern shore of Kauai, and at Midway Atoll in the Northwestern Hawaiian Islands (Phillips & Meñez, 1988). Paddle grass is possibly a nonnative species that occurs only on Oahu in waters to 114.8 ft. (35 m) deep; it is apparently restricted to the southern shore of Oahu (Preskitt, 2001, 2002a).

Seagrasses that occur in the coastal areas of the southern California portion of the Study Area in the California Current Large Marine Ecosystem include eelgrass (*Zostera marina* and *Zostera pacifica*), surfgrass (*Phyllospadix scouleri* and *Phyllospadix torreyi*), widgeon grass (*Ruppia maritima*), and shoal grass (*Halodule wrightii*) (Jones et al., 2013; Spalding et al., 2003). The distribution of underwater vegetation is patchy along the California coast. In the southern California portion of the Study Area, eelgrass and surfgrass are the dominant native seagrasses (Wyllie-Echeverria & Ackerman, 2003).

Eelgrass covers most of the available nearshore area in San Diego Bay (Figure 3.3-2) Beds of eelgrass (Zostera marina) form an important and productive benthic habitat in San Diego Bay. Eelgrass habitats rank among the most productive habitats in the ocean (Nybakken, 1993) and are an important component of the San Diego Bay food web. As has occurred in bays and estuaries all along the Pacific coast and elsewhere in the world, eelgrass beds have suffered substantial losses and impacts due to their location in sheltered waters where human activity is concentrated. However, these losses were historic due to bay fill and deepening.

Today, various state and federal regulatory frameworks protect eelgrass beds, and any impacts are fully mitigated. For example, National Marine Fisheries Service policy recommends no net loss of eelgrass habitat function in California and encourages the use of eelgrass mitigation banking and in-lieu fee programs when impacts on eelgrass habitat cannot be avoided (National Oceanic and Atmospheric



Source: Merkel & Associates, Inc. (2014)

Notes : NB = Naval Base, NAS = Naval Air Station

Figure 3.3-2: Eelgrass Beds in San Diego Bay

Administration, 2014). In San Diego Bay, the range of eelgrass bed growth is from surface to depths of approximately 10 m, depending on light levels and turbidity; eelgrass bed losses have ceased (U.S. Department of the Navy and Port of San Diego, 2013). The recovery of the eelgrass habitat within San Diego Bay is largely attributed to restoration efforts as well as reduction in waste discharges since the 1970s. San Diego Bay currently supports approximately 15 percent of the eelgrass habitat and 50 percent of total eelgrass resources for the State of California (Merkel & Associates Inc., 2014). The Navy established an eelgrass mitigation bank in San Diego Bay in 2008 as mitigation for an action that was unrelated to the Proposed Action in this EIS/OEIS.

3.3.2.3.8.2 Cordgrasses

Cordgrasses are temperate salt-tolerant land plants that inhabit salt marshes, mudflats, and other softbottom coastal habitats (Castro & Huber, 2000). Cordgrasses are not present in the Hawaii portion of the Study Area. California cordgrass (*Spartina foliosa*) can be found in salt marshes and mudflats within the southern California portion of the Study Area. The Atlantic cordgrass (*Spartina alterniflora*), which is an invasive species in California, has not been documented within the study area (Calflora, 2016; California Invasive Plant Council, 2016). Salt marshes develop in intertidal, protected low energy environments, usually in coastal lagoons, tidal creeks, rivers, or estuaries (Mitsch & Gosselink, 2007). The structure and composition of salt marshes provide important ecosystem services. Salt marshes support commercial fisheries by providing habitat for wildlife, protecting the coastline from erosion, filtering fresh water discharges into the open ocean, taking up nutrients, and breaking down or binding pollutants before they reach the ocean (Dreyer & Niering, 1995; Mitsch et al., 2009). Salt marshes also are carbon sinks (carbon reservoirs) and facilitate nutrient cycling (Bouillon et al., 2009; Chmura, 2009). Carbon sinks are important in reducing the impact of climate change (Laffoley & Grimsditch, 2009), and nutrient cycling facilitates the transformation of important nutrients through the environment. However, sinking salt marshes may damage cordgrasses, a process known as marsh subsidence.

3.3.2.3.8.3 Mangroves

Mangroves are a group of woody plants that have adapted to brackish water environments (where salt water and freshwater mix) (Ruwa, 1996). All mangrove trees have root systems that stick up in the air for oxygen intake in oxygen-poor soils and secrete salts from the leaves to process fresh water from the saline environment. Mangroves can trap sediments and pollution from terrestrial environments and can shield and stabilize coastlines from wave action. There are no native mangroves in the Hawaii portion of the Study Area. The red mangrove (*Rhizophora mangle*) and several other species of mangroves were introduced to Hawaii (Allen, 1998); these species are invasive species and are further discussed in Section 3.3.2.1.2 (General Threats). No mangroves are known to occur within California coastal environments.

3.3.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact vegetation known to occur within the Study Area. In Chapter 2, tables 2.5-1 through 2.5-3 present the baseline and proposed typical training and testing activity locations for each alternative (including number of events). General characteristics of all Navy stressors were introduced in Section 3.0.3.3 (Identifying Stressors for Analysis), and the susceptibility to stressors for living resources were introduced in Section 3.0.3.6 (Biological Resource Methods). The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors analyzed for vegetation are:

- **Explosives**
- **Physical disturbance and strikes** (vessels and in-water devices; aircraft and aerial targets; military expended materials; seafloor devices; pile driving)
- **Secondary stressors** (explosives, explosion byproducts, and unexploded munitions; metals; chemicals; other materials; physical disturbance)

The analysis includes consideration of the mitigation that the Navy will implement to avoid potential impacts on vegetation from explosives and from physical disturbance and strikes. Mitigation for vegetation will be coordinated with the National Marine Fisheries Service through the consultation processes.

3.3.3.1 Acoustic Stressors

Acoustic stressors are not applicable to vegetation because of the lack of hearing capabilities of vegetation and will not be analyzed further in this section. The physical impacts associated with the use of explosives are discussed in Section 3.3.3.2.1 (Impacts from Explosives).

3.3.3.2 Explosive Stressors

3.3.3.2.1 Impacts from Explosives

Various types of explosives are used during training and testing activities. The type, number, and location of activities that use explosives are discussed in Section 3.0.3.3.2 (Explosive Stressors). Within the coastal waters of Hawaii, most detonations would occur in waters greater than 3 nautical miles from shore in water deeper than 200 ft., although mine warfare, demolition, and some testing detonations could occur in shallow water and typically in a few specific locations. In the Southern California Range Complex, nearshore explosions occur within the Silver Strand Training Complex Boat Lanes and training areas surrounding San Clemente Island over sandy bottom.

The potential for an explosion to injure or destroy vegetation would depend on the amount of vegetation present, the number of munitions used, and their net explosive weight. In areas where vegetation and locations for explosions overlap, vegetation on the surface of the water, in the water column, or rooted in the seafloor may be impacted.

Single-celled algae may overlap with underwater and sea surface explosion locations. If single-celled algae are in the immediate vicinity of an explosion, only a small number of individuals are likely to be impacted relative to their total population level. Additionally, the extremely fast growth rate and ubiquitous distribution of phytoplankton (Caceres et al., 2013; Levinton, 2013) suggest no meaningful impact on the resource. The low number of explosions relative to the amount of single-celled algae in the Study Area also decreases the potential for impacts on these vegetation types. Based on these factors, the impact on these types of vegetation would not be detectable and they are not discussed further in this section.

Macroalgae and marine vascular plants that are attached to the seafloor may occur in locations where explosions are conducted and may be adversely impacted for different reasons. Much of the attached macroalgae grows on hard bottom areas that would be mostly protected in accordance with Navy mitigation measures. Attached macroalgae grow quickly and are resilient through high levels of wave action (Mach et al., 2007), which may aid in their ability to withstand underwater explosions that occur near them.

Attached macroalgae typically need hard or artificial substrate in order to grow. The potential distribution of attached macroalgae can be inferred by the presence of hard or artificial substrate that occurs at depths of less than 200 m throughout the Study Area. See Section 3.5 (Habitats) for information regarding the distribution of hard substrate in the Study Area. If attached macroalgae are in the immediate vicinity of an explosion, only a small number of them are likely to be impacted relative to their total population level. Only explosions occurring on or at shallow depth beneath the surface have the potential to impact floating macroalgae. Sea surface or underwater explosions could uproot or damage marine vascular plants if activities overlap with areas where they are rooted.

The potential for marine vascular plants (seagrass and eelgrass) to be impacted by underwater and surface explosions is unlikely as seagrass and eelgrass do not overlap with explosives training areas. Eelgrass are much less resilient to disturbance than marine algae; regrowth after uprooting can take up to 10 years (Dawes et al., 1997). Explosions may also temporarily increase the turbidity (sediment suspended in the water) of nearby waters, but the sediment would settle to pre-explosion conditions within a number of days. Sustained high levels of turbidity may reduce the amount of light that reaches vegetation. This scenario is not likely because seagrass and eelgrass do not overlap with explosives training areas.

3.3.3.2.1.1 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

Impacts on algae near the surface would be localized and temporary as discussed above and are unlikely to affect the abundance, distribution, or productivity of vegetation. As discussed above, the depths, substrates, and relatively small areas of explosive footprints in comparison to vegetation distributions and total habitat areas in the Study Area indicate relatively little overlap between explosive footprints and the distribution of attached macroalgae and marine vascular plants. Furthermore, the majority of explosions take place in soft bottom habitats as described in Section 3.5 (Habitats). As a result, explosions would have (if any) localized, temporary impacts consisting of damage to or the removal of individuals and relatively small patches of vegetation. Vegetation is expected to regrow or recolonize the open patches created by explosives within a fairly short time (less than one year), resulting in no long-term effects on the productivity or distribution of attached macroalgae or marine vascular plants.

Impacts from Explosives Under Alternative 1 for Testing Activities

Impacts on algae near the surface would be localized and temporary as discussed above and are unlikely to affect the abundance, distribution, or productivity of vegetation. As discussed above, the depths, substrates, and relatively small areas of explosive footprints in comparison to vegetation distributions and total habitat areas in the Study Area indicate relatively little overlap between explosive footprints and the distribution of attached macroalgae and marine vascular plants. Furthermore, the majority of explosions take place in the open ocean or in soft bottom habitats as described in Section 3.5 (Habitats). As a result, explosions would have (if any) localized, temporary impacts consisting of damage to or the removal of individuals and relatively small patches of vegetation. Vegetation is expected to regrow or recolonize the open patches created by explosives within a fairly short time, resulting in no long-term effects on the productivity or distribution of attached macroalgae or marine vascular plants.

3.3.3.2.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

Although activities under Alternative 2 occur at a higher rate and frequency relative to Alternative 1, impacts experienced by individuals or populations from explosives under Alternative 2 are not expected to be meaningfully different from those described under Alternative 1. Therefore, impacts associated with training activities under Alternative 2 are the same as Alternative 1.

Impacts from Explosives Under Alternative 2 for Testing Activities

Although activities under Alternative 2 occur at a higher rate and frequency relative to Alternative 1, physical disturbance and strike impacts experienced by individuals or populations from explosives under Alternative 2 are not expected to be meaningfully different from those described under Alternative 1. Therefore, impacts associated with testing activities under Alternative 2 are the same as Alternative 1.

3.3.3.2.1.3 Impacts from Explosives Under the No Action Alternative

Impacts from Explosives Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, training and testing activities associated with the Proposed Action will not be conducted within the HSTT Study Area. Various explosive stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.3.3.3 Energy Stressors

Energy stressors include electromagnetic devices, lasers, and radar; their use and physical effects are described in Section 3.0.3.3.3 (Energy Stressors). Although marine vascular plants are known to respond to magnetic field variations, effects on plant growth and development are not well understood (Maffei, 2014). The area of potential effects from electromagnetic devices or lasers is so small (limited to a few meters from source), and temporary, as to be discountable in terms of any effect on vegetation. Radar, which is high-frequency electromagnetic radiation, is not known to affect marine vascular plants, and is rapidly absorbed and does not propagate more than a few feet under water; again, the potential for an effect on vegetation is discountable. Therefore, energy stressors will have no impact on vegetation and will not be analyzed further in this section.

3.3.3.4 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts on vegetation of the various types of physical disturbance and strike stressors that may occur during Navy training and testing activities within the Study Area. For a list of Navy activities that involve these stressors refer to Section 3.0.3.3.4 (Physical Disturbance and Strike Stressors). The physical disturbance and strike stressors that may impact marine vegetation include (1) vessels, (2) in-water devices, (3) military expended materials, and (4) seafloor devices.

The evaluation of the impacts from physical strike and disturbance stressors on vegetation focuses on proposed activities that may cause vegetation to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., military expended materials), or deployed on the seafloor (e.g., mine shapes and anchors). Not all activities are proposed throughout the Study Area. Wherever appropriate, specific geographic areas of potential impact are identified.

Single-celled algae may overlap with physical disturbance or strike stressors, but the impact would be minimal relative to their total population level and extremely high growth rates (Caceres et al., 2013);

therefore, they will not be discussed further in this section. Marine vascular plants and macroalgae on the seafloor and on the sea surface are the only types of vegetation that occur in locations where physical disturbance or strike stressors may be encountered. Therefore, only marine vascular plants and macroalgae are analyzed further for potential impacts from physical disturbance or strike stressors.

3.3.3.4.1 Impacts from Vessels and In-Water Devices

Several different types of vessels (ships, submarines, boats, amphibious vehicles) and in-water devices (e.g., towed devices, unmanned underwater vehicles) are used during training and testing activities throughout the Study Area, as described in Chapter 2 (Description of Proposed Action and Alternatives). Vessel and in water device movements occur intermittently, are variable in duration (ranging from a few hours to a few weeks), and are dispersed throughout the Study Area. Events involving large vessels are widely spread over offshore areas, while smaller vessels are more active in nearshore areas.

The potential impacts from Navy vessels and in-water devices used during training and testing activities on vegetation are based on the vertical distribution of the vegetation. Vessels and in-water devices may impact vegetation by striking or disturbing vegetation on the sea surface or seafloor (Spalding et al., 2003). In the open ocean, marine algae on the sea surface such as kelp paddies have a patchy distribution. Marine algae could be temporarily disturbed if struck by moving vessels or by the propeller action of transiting vessels. These strikes could also injure the organisms that inhabit kelp paddies or other marine algal mat, such as sea turtles, seabirds, marine invertebrates, and fish. Marine algae are resilient to winds, waves, and severe weather that could sink the mat or break it into pieces. Impacts on marine algae by strikes may collapse the pneumatocysts (air sacs) that keep the mats afloat. Evidence suggests that some floating marine algae will continue to float even when up to 80 percent of the pneumatocysts are removed (Zaitsev, 1971).

Vegetation on the seafloor, such as marine vascular plants and macroalgae, may be disturbed by amphibious combat vehicles, and manned and unmanned underwater vehicles. Seagrasses are resilient to the lower levels of wave action that occur in sheltered estuarine shorelines, but are susceptible to vessel propeller scarring (Sargent et al., 1995). Seagrasses could take up to 10 years to fully regrow and recover from propeller scars (Dawes et al., 1997). Seafloor macroalgae may be present in locations where these vessels occur, but the impacts would be minimal because of their resilience, distribution, and biomass. Because seafloor macroalgae in coastal areas are adapted to natural disturbances, such as storms and wave action that can exceed 32.8 ft. (10 m) per second (Mach et al., 2007), macroalgae will quickly recover from vessel movements. Macroalgae that is floating in the area may be disturbed by amphibious combat vehicle activities, but the impact would not be detectable because of the small amount of macroalgae in areas where these activities occur and will not be considered further in this section.

Towed in-water devices include towed targets that are used during activities such as missile exercises and gun exercises. These devices are operated at low speeds either on the sea surface or below it. The analysis of in-water devices will focus on towed surface targets because of the potential for impacts on marine algae.

Unmanned underwater vehicles and autonomous underwater vehicles are used in training and testing activities in the Study Area. They are typically propeller driven and operate within the water column or crawl along the seafloor. The propellers of these devices are typically encased, eliminating the potential for seagrass propeller scarring. Although algae on the seafloor could be disturbed by these devices, unmanned underwater vehicles are not expected to compromise the health or condition of algae for the same reasons given for vessel disturbance.

Estimates of relative vessel and in-water device use and location for each alternative are provided in Section 3.0.3.3.4.1 (Vessels and In-Water Devices). These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy vessel use depends upon military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Testing and training concentrations are most dependent upon locations of Navy shore installations and established testing and training areas.

3.3.3.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, a variety of vessels and in-water device would be used throughout the Study Area during training activities, as described in Section 3.0.3.3.4.1 (Vessels and In-Water Devices). Most activities would involve one vessel or in-water device and may last from a few hours to two weeks, but activities may occasionally use two vessels or in-water devices. For this EIS/OEIS, more vessel traffic and in-water device use would occur in in the Southern California portion than the Hawaii portion of the Study Area (Table 3.0-15 and Table 3.0-17).

Because of the quantity of vessel traffic in Hawaiian nearshore waters since the 1940s (especially in waters off Oahu and within Pearl Harbor), it is thought that the existing vegetation community has shifted to dominance of species which are adapted to disturbance (Coles et al., 1997). In San Diego Bay, there are anticipated to be movements of Navy small boats, divers, and swimmers over eelgrass; otherwise eelgrass beds are avoided to the maximum practicable extent. Because of the dredging history of San Diego Bay near the Navy ship berths, it is anticipated that any nearby vegetation is accustomed to increased sedimentation and disturbance from these activities; therefore impacts from vessel movements on vegetation are expected to be similar and minimal (U.S. Department of the Navy and Port of San Diego, 2013).

In open ocean areas, vessel strikes of vegetation would be limited to floating marine algae. Vessel and in-water device movements may disperse or injure floating algal mats. Because algal distribution is patchy, mats may re-form, and events would be on a small spatial scale, Navy training activities involving vessel movement would not impact the general health of marine algae. Navy mitigation measures would ensure that vessels avoid large algal mats or other sensitive vegetation that other marine life depend on for food or habitat; these measures would safeguard this vegetation type from vessel strikes. In addition, Navy mitigation measures would require rotary-wing aircraft crews that tow in-water devices for mine warfare exercises to monitor the water surface before and during exercises to identify and avoid marine algae.

Under Alternative 1, the impacts from vessels during training activities would be minimal disturbances of algal mats and macroalgae. Eelgrass beds and kelp forests would be avoided to the maximum practicable extent. As such, eelgrass bed damage is not likely but, if it occurs, the impacts would be minor, such as damage from turbidity increases (Moore et al., 1996).

The net impact of vessels and in-water devices on vegetation is expected to be negligible under Alternative 1, based on (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas; and (3) the deployment of in-water devices at depths where they would not likely come in contact with vegetation.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the Navy would use a variety of vessels in testing activities. Most of the testing activities involving vessel movements occur at sea within the Hawaii Range Complex and Southern California Range Complex, or within the transit corridor between the two range complexes. Some of the testing occurs pierside in Pearl Harbor or San Diego Bay and therefore would not generate these impacts.

On the sea surface, vessel strikes of vegetation would be limited to floating marine algae. Vessel movements may disperse or injure algae. However, algae may re-form, and testing events would be on a small spatial scale. Therefore, Navy testing activities involving vessel movement are not expected to impact the general health of marine algae. Eelgrass beds and kelp forests would be avoided to the maximum extent practicable and damage from testing is not likely but, if it occurs, the impacts would be minor, such as damage from short-term turbidity increases.

The net impact of vessel physical disturbances and strikes on vegetation during testing activities is expected to be negligible under Alternative 1, based on (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas, and (3) the deployment of in-water devices at depths where they would not likely come in contact with vegetation.

3.3.3.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, potential impacts on vegetation resulting from vessels and in-water devices associated with training activities would be similar to those discussed for activities under Alternative 1. There would be a very small increase in vessel and in-water device use in the Study Area. However, the difference would not result in substantive changes to the potential for or types of impacts on vegetation. Refer to Section 3.3.3.4.1.1 (Impacts from Vessels and In-Water Devices Under Alternative 1) for a discussion of potential impacts.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, potential impacts on vegetation resulting from vessels and in-water devices associated with testing activities would be similar to those discussed for activities under Alternative 1. Vessel use would increase by a small amount, while the number of activities involving in-water devices would remain the same. However, the difference in vessel use would not result in substantive changes to the potential for or types of impacts on vegetation. Refer to Section 3.4.3.4.1.1 (Impacts from Vessels and In-Water Devices Under Alternative 1) for a discussion of potential impacts.

3.3.3.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, training and testing activities associated with the Proposed Action will not be conducted within the HSTT Study Area. Various physical disturbance and strike stressors (e.g., vessels and in-water devices) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.3.3.4.2 Impacts from Aircraft and Aerial Targets

Aircraft and aerial target stressors are not applicable to vegetation and will not be analyzed further in this section.

3.3.3.4.3 Impacts from Military Expended Materials

This section analyzes the strike potential to vegetation of the following categories of military expended materials: (1) all sizes of non-explosive practice munitions; (2) fragments of high-explosive munitions; (3) expendable targets; and (4) expended materials other than munitions, such as sonobuoys and miscellaneous accessories (e.g., canisters, endcaps, pistons). See Appendix F (Military Expended Material and Direct Strike Impact Analyses) for further details on the disturbance footprint for military expended materials on bottom habitat.

Military expended materials can impact macroalgae and marine vascular plants in coastal areas. Many types of military expended materials are deployed in the open ocean. In coastal water training areas, only projectiles (small and medium), target fragments, and countermeasures could be introduced into areas where shallow water vegetation may be impacted.

The potential for impacts on marine vegetation from military expended materials would depend on the presence and amount of vegetation, and number of military expended materials. Most deposition of military expended materials occurs within the confines of established training and testing areas. These areas are largely away from the coastline, and the potential for impacts on vegetation is low.

Military expended materials can potentially impact marine vascular plants on the seafloor by disturbing, crushing, or shading, which may interfere with photosynthesis. In the event that a marine vascular plant is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of marine vascular plants and military expended materials is limited. Marine vascular plants generally grow in waters that are sheltered from wave action such as estuaries, lagoons, and bays (Phillips & Meñez, 1988). Locations for the majority of Navy training and testing activities where military materials are expended do not provide this type of habitat. The potential for detectable impacts on marine vascular plants from expended materials would be based on their size or low density (e.g., small projectiles, small decelerators/parachutes, endcaps, and pistons) of the majority of the materials that could be used in or drift into these areas from offshore. Larger, denser materials, such as non-explosive practice munitions and sonobuoys would be used farther offshore and are likely to sink rapidly where they land. Falling materials could cause bottom sediments to be suspended. Resuspension of the sediment could impact water quality and decrease light exposure, but since it would be short-term (hours), stressors from military expended materials would not likely impact the general health of marine vascular plants.

The following are descriptions of the types of military expended materials that could impact marine algae and marine vascular plants. Marine algae could overlap with military expended materials anywhere in the Study Area; however, the Silver Strand Training Complex is the only location in the Study Area where these materials could overlap with marine vascular plants.

Small-, Medium-, and Large-Caliber Projectiles Small-, medium-, and large-caliber non-explosive practice munitions, or fragments of high-explosive projectiles, expended during training and testing activities rapidly sink to the seafloor. The majority of these projectiles would be expended in the open ocean areas of Hawaii and southern California Range Complexes. Because of the small sizes of the projectiles and their casings, damage to marine vegetation is unlikely. Large-caliber projectiles are primarily used in offshore areas at depths greater than 85 ft., while small- and medium-caliber projectiles may be expended in both offshore and coastal areas (at depths mostly less than 85 ft.) within special use airspace in the Southern California Range Complex Warning Area 291 (W-291 [see Chapter 2, Figure 2.1-6]) and at selected areas on San Clemente Island. Marine algae could occur where these materials are expended, but seagrasses generally do not because these activities do not normally occur in water that is shallow enough for seagrass to grow.

Bombs, Missiles, and Rockets. Bombs, missiles, and rockets, or their fragments (if high-explosive) are expended offshore (at depths mostly greater than 85 ft.) during training and testing activities, and rapidly sink to the seafloor. Marine algae could occur where these materials are expended. However, marine vascular plants generally would not occur where these materials are expended because these activities do not normally occur in water that is shallow enough for marine vascular plants to grow.

Decelerators/Parachutes. Decelerators/parachutes of varying sizes are used during training and testing activities. The types of activities that use decelerators/parachutes, the physical characteristics of these expended materials, where they are used, and the number of activities that would occur under each alternative are discussed in Section 3.0.3.3.5 (Entanglement Stressors). Kelp, other marine algae, and marine vascular plants could occur where these materials are expended.

Targets. Many training and testing activities use targets. Targets that are hit by munitions could break into fragments. Target fragments vary in size and type, but most fragments are expected to sink. Pieces of targets that are designed to float are recovered when practical. Target fragments would be spread out over large areas. Marine algae could occur where these materials are expended.

Countermeasures. Defensive countermeasures (e.g., chaff, flares, and acoustic devices) are used to protect against incoming weapons (e.g., missiles). Chaff is made of aluminum-coated glass fibers, and flares are pyrotechnic devices. Chaff, chaff canisters, and flare end caps are expended materials. Chaff and flares are dispensed from aircraft or fired from ships. Floating marine algal mats could occur in any of the locations that these materials are expended.

3.3.3.4.3.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials under Alternative 1 for Training Activities

Depending on the size and type or composition of the expended materials and where they happen to strike vegetation, individuals could be killed, fragmented, covered, buried, sunk, or redistributed. This type of disturbance would not likely differ from conditions created by waves or rough weather. If enough military expended materials land on algal mats, the mats can sink. The likelihood is low that mats would accumulate enough material to cause sinking from military activities, as military expended materials are dispersed widely through an activity area. The few algal mats that would prematurely sink would not have an impact on populations. Strikes would have little impact, and would not likely result in the mortality of floating algal mats or other algae, although these strikes may injure the organisms that inhabit marine algal mats, such as sea turtles, birds, and marine invertebrates.

Military expended materials used for training activities are not expected to pose a risk to marine algae or marine vascular plants because (1) the relative coverage of marine algae in the Study Area is low, (2) the impact area of military expended materials is very small relative to marine algae distribution, and (3) marine vascular plants overlap with areas where the stressor occurrence is very limited (Merkel & Associates, Inc., 2014). Based on these factors, potential impacts on marine algae and marine vascular plants from military expended materials are not expected to result in detectable changes in the growth, survival, or propagation of individuals, and are not expected to result in population-level impacts.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Testing activities under Alternative 1 would include military expended materials that would typically be of the same type listed under training activities.

Depending on the size and type or composition of the expended materials and where they happen to strike vegetation, individuals could be killed, fragmented, covered, buried, sunk, or redistributed. This type of disturbance would not likely differ from conditions created by waves or rough weather. If enough military expended materials land on algal mats, the mats can sink. The likelihood is low that mats would accumulate enough material to cause sinking from military activities, as military expended materials are dispersed widely through an activity area. The few algal mats that would prematurely sink would not have an impact on populations. Strikes would have little impact, and would not likely result in the mortality of floating algal mats or other algae, although these strikes may injure the organisms that inhabit marine algal mats, such as sea turtles, birds, and marine invertebrates.

Military expended materials used for testing activities are not expected to pose a risk to marine algae or marine vascular plants because (1) the relative coverage of marine algae in the Study Area is low, (2) the impact area of military expended materials is very small relative to marine algae distribution, and (3) marine vascular plants overlap with areas where the stressor occurrence is very limited (Merkel & Associates Inc., 2014). Based on these factors, potential impacts on marine algae and marine vascular plants from military expended materials are not expected to result in detectable changes in the growth, survival, or propagation of individuals, and are not expected to result in population-level impacts.

3.3.3.4.3.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

The locations of training activities using military expendable materials would be the same under Alternatives 1 and 2. The total area affected for all training activities combined would increase by less than 1 ac. under Alternative 2, and therefore the potential impacts would be similar between the two alternatives. Refer to Section 3.3.3.4.3 (Impacts from Military Expended Materials) for a discussion of impacts on vegetation.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

The locations of testing activities using military expendable materials would be the same under Alternatives 1 and 2. The total area affected for all testing activities combined would increase by less than 1 ac. under Alternative 2, and therefore the potential impacts would be similar between the two alternatives. Refer to Section 3.3.3.4.3 (Impacts from Military Expended Materials) for a discussion of impacts on vegetation.

Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, training and testing activities associated with the Proposed Action will not be conducted within the HSTT Study Area. Various physical disturbance and strike stressors (e.g., military expended materials) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.3.3.4.4 Impacts from Seafloor Devices

For a discussion of the types of activities that use seafloor devices see Appendix B (Activity Stressor Matrices). For a discussion of where they are used, and how many activities would occur in the Study Area, see Section 3.0.3.3.4.3 (Seafloor Devices). Vegetation on the seafloor may be impacted by seafloor devices, while vegetation on the sea surface such as marine algal mats is not likely to be impacted; therefore, it will not be discussed further in this section. Marine vascular plants and seafloor macroalgae in the Study Area may be impacted by the use of seafloor devices.

Seafloor device operation, installation, or removal could impact marine vascular plants by physically removing vegetation (e.g., uprooting), crushing vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading, which may interfere with photosynthesis. If marine vascular plants are not able to photosynthesize, their ability to produce energy is compromised. However, the intersection of marine vascular plants and seafloor devices is limited, and suspended sediments would settle in a few hours.

3.3.3.4.4.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

Under Alternative 1, seafloor devices would be used throughout the Study Area during training activities, as described in Chapter 2 (Description of Proposed Action and Alternatives). Most seafloor device use would occur in the southern California portion of the Study Area. Marine plant species found within the relatively shallow waters of the Study Area are adapted to natural disturbance and recover quickly from storms, as well as from wave and surge action. Bayside marine plant species, such as eelgrass, are found in areas where wave action is minimal. Installation of seafloor devices may impact vegetation in benthic habitats, but the impacts would be temporary and would be followed by rapid (i.e., within a few weeks) recovery, particularly in oceanside boat lanes in nearshore waters off San Diego and in designated training areas adjoining San Clemente Island. Eelgrass beds show signs of recovery after a cessation of physical disturbance; the rate of recovery is a function of the severity of the disturbance (Neckles et al., 2005). The main factors that contribute to eelgrass recovery include improving water quality and cessation of major disturbance activities (e.g., dredging) (Chavez, 2009). Seafloor devices, in contrast to dredging, have a minor impact that is limited to the area of the actual pile and footprint of the mooring.

Seafloor device installation in shallow water habitats under Alternative 1 training activities would pose a negligible risk to marine vegetation. Any damage from seafloor devices would be followed by a recovery period lasting weeks to months, depending on the species, but could take up to 10 years for certain seagrass species. Although marine vegetation growth near seafloor devices installed during training activities under Alternative 1 would be inhibited during recovery, population-level impacts are unlikely because of the small, local impact areas; the frequency of training activities; and the wider geographic distribution of seagrasses in and adjacent to training areas.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, seafloor devices would be used throughout the Study Area during testing activities, as described in Chapter 2 (Description of Proposed Action and Alternatives). The Navy uses sandy substrates devoid of marine vegetation to the extent possible. Most seafloor device use would occur in the southern California portion of the Study Area. Marine plant species found within Hawaii Range Complex, San Diego Bay, and in waters off San Clemente Island are adapted to natural disturbance and recover quickly from storms, as well as from high-energy wave action and tidal surges in oceanside areas. As noted previously, eelgrass beds would require longer recovery periods in bayside areas.

Seafloor devices installed in shallow-water habitats during Alternative 1 testing activities would pose a negligible risk to marine vegetation. Any damage from seafloor devices would be followed by a recovery period lasting weeks to months, depending on the species, but could take up to 10 years for certain seagrass species. Although marine vegetation growth near seafloor devices installed during testing activities under Alternative 1 would be inhibited during recovery, population-level impacts are unlikely because of the small, local impact areas; the frequency of training activities; and the wider geographic distribution of seagrasses in and adjacent to testing areas.

3.3.3.4.4.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

The locations and types of training activities using seafloor devices would be the same under Alternatives 1 and 2. There would be a very small increase in the number of activities conducted in the Southern California Range Complex. However, the increase would not result in substantive changes to the potential for or types of impacts on vegetation. Refer to Section 3.3.3.4.4.1 (Impacts from Seafloor Devices Under Alternative 1) for a discussion of impacts on vegetation.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

The locations and types of testing activities using seafloor devices would be the same under Alternatives 1 and 2. There would be a very small increase in the number of activities conducted in the Southern California Range Complex. However, the increase would not result in substantive changes to the potential for or types of impacts on vegetation. Refer to Section 3.3.3.4.4.1 (Impacts from Seafloor Devices Under Alternative 1) for a discussion of impacts on vegetation.

3.3.3.4.4.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, training and testing activities associated with the Proposed Action will not be conducted within the HSTT Study Area. Various physical disturbance and strike stressors (e.g., seafloor devices) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.3.3.4.5 Impacts from Pile Driving

For a discussion of pile driving, including where they are used and how many activities would occur in the Study Area, see Section 3.0.3.3.1.3 (Pile Driving). Pile driving would not impact vegetation on the sea surface, such as marine algal mats; therefore, floating vegetation will not be discussed further in this section. Pile driving could occur in sandy shallow water coastal areas at Silver Strand Training Complex and at Camp Pendleton, both of which are in the Southern California Range Complex and not in the Hawaii Range Complex.

Pile driving may, however, impact marine vascular plants and seafloor macroalgae in the Study Area. Pile driving could impact marine vascular plants and seafloor macroalgae by physically removing vegetation (e.g., uprooting), crushing vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading, which may interfere with photosynthesis. If vegetation is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of marine macroalgae and marine vascular plants and pile driving is limited, and any suspended sediments would settle in a few days.

In bay areas, recovery of marine vascular plants such as eelgrass from direct disturbance by pile driving would occur over longer timeframes. Eelgrass beds show signs of recovery after a cessation of physical disturbance; the rate of recovery is a function of the severity of the disturbance (Neckles et al., 2005). The main factors that contribute to eelgrass recovery include improving water quality and cessation of major disturbance activities (e.g., dredging) (Chavez, 2009). Pile driving, in contrast to dredging, has a minor impact that is limited to the area of the actual pile and footprint of the mooring.

3.3.3.4.5.1 Impacts from Pile Driving Under Alternative 1

Impacts from Pile Driving Under Alternative 1 for Training Activities

Pile driving may impact vegetation in benthic habitats, but the impacts would be temporary and would be followed by rapid (i.e., within a few weeks) recovery, particularly in oceanside boat lanes in nearshore waters off San Diego, which are mainly sandy bottoms with limited or no benthic vegetation. However, opportunistic and potentially invasive vegetation could become established in disturbed areas. Pile driving in shallow water habitats under Alternative 1 training activities would pose a negligible risk to marine vegetation. Any damage from seafloor devices would be followed by a recovery period lasting weeks to months, depending on the species, but could take up to 10 years for certain marine vascular plant species. Although marine vegetation growth near seafloor devices installed during training activities under Alternative 1 would be inhibited, population-level impacts are unlikely because of the small, local impact areas; the frequency of training activities; and the wider geographic distribution of marine vegetation in and adjacent to training areas.

Impacts from Pile Driving Under Alternative 1 for Testing Activities

There would be no pile driving or removal associated with testing activities. Therefore, pile driving is not analyzed in this subsection.

3.3.3.4.5.2 Impacts from Pile Driving Under Alternative 2

Impacts from Pile Driving Under Alternative 2 for Training Activities

The locations, number of training events, and potential effects associated with pile driving and removal would be the same under Alternatives 1 and 2. Refer to Section 3.3.3.4.5.1 (Impacts from Pile Driving Under Alternative 1) for a discussion of impacts on vegetation.

Impacts from Pile Driving Under Alternative 2 for Testing Activities

There would be no pile driving or removal associated with testing activities. Therefore, pile driving is not analyzed in this subsection.

3.3.3.4.5.3 Impacts from Pile Driving Under the No Action Alternative

Under the No Action Alternative, training and testing activities associated with the Proposed Action will not be conducted within the HSTT Study Area. Various physical disturbance and strike stressors (e.g., pile driving) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.3.3.5 Entanglement Stressors

Entanglement stressors associated with Navy training and testing activities are described in Section 3.0.3.3.5 (Entanglement Stressors). Expended materials that have the potential to cause entanglement generally sink to the bottom or drift ashore, and thereby could come into contact with macroalgae or marine vascular plants, possibly abrading or breaking individuals, but such effects would be isolated, very small in scale, and temporary as the vegetation would regrow. No effects on the productivity or distribution of vegetation are anticipated.

3.3.3.6 Ingestion Stressors

Ingestion stressors associated with Navy training and testing activities are described in Section 3.0.3.3.6 (Ingestion Stressors). Ingestion stressors will not impact vegetation due to the photosynthetic nature of vegetation.

3.3.3.7 Secondary Stressors

This section analyzes potential impacts on marine vegetation exposed to stressors indirectly through impacts on habitat and prey availability.

3.3.3.7.1 Impacts on Habitat

Section 3.2 (Sediments and Water Quality) and Section 3.5 (Habitats) consider the impacts on marine sediments and water quality and abiotic habitats from explosives and explosion byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). One example from the sediment and water quality analysis of a local impact on water quality could be an increase in cyanobacteria associated with munitions deposits in marine sediments. Cyanobacteria may proliferate when iron is introduced to the marine environment, and this proliferation can affect adjacent habitats by releasing toxins and can create hypoxic conditions. Introducing iron into the marine environment from munitions or infrastructure is not known to cause toxic red tide events; rather, these harmful events are more associated with natural causes (e.g., upwelling) and the effects of other human activities (e.g., agricultural runoff and other coastal pollution) (Hayes et al., 2007). High-order explosions consume most of the explosive material, leaving only small or residual amounts of explosives and combustion products. Many combustion products are common seawater constituents. All combustion products are rapidly diluted by ocean currents and circulation (see Section 3.2.3.1, Explosives and Explosives Byproducts). Explosives byproducts from high-order detonations present no indirect stressors to marine vegetation through sediment or water.

The analysis included in Section 3.2 (Sediments and Water Quality) determined that neither state nor federal standards or guidelines for sediments or water quality would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because standards for sediment and water quality would not be violated, population-level impacts on marine vegetation are not likely to be detectable and are therefore inconsequential. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, no indirect impacts are anticipated on vegetation from the training and testing activities proposed by the No Action Alternative, Alternative 1, or Alternative 2.

Other materials that are re-mobilized after their initial contact with the seafloor (e.g., by waves or currents) may continue to strike or abrade marine vegetation. Secondary physical strike and disturbances are relatively unlikely because most expended materials are denser than the surrounding sediments (e.g., metal) and are likely to remain in place as the surrounding sediment moves. Potential secondary physical strike and disturbance impacts may cease when (1) the military expended material is too massive to be mobilized by typical oceanographic processes, (2) the military expended material becomes encrusted by natural processes and incorporated into the seafloor, or (3) the military expended material becomes permanently buried. Although individual organisms could be impacted by secondary physical strikes, the viability of populations or species would not be impacted.

3.3.3.7.2 Impacts on Prey Availability

Prey availability as a stressor is not applicable to vegetation and will not be analyzed further in this section.

3.3.4 Summary of Potential Impacts on Vegetation

Activities described in this EIS/OEIS that have potential impacts on vegetation are widely dispersed, and not all stressors would occur simultaneously in a given location. The stressors that have potential impacts on marine vegetation include explosions, physical disturbances or strikes (vessels and in-water devices, military expended materials, seafloor devices), and secondary. Unlike mobile organisms, vegetation cannot flee from stressors once exposed. Marine algae are the most likely to be exposed to multiple stressors in combination because they occur over large expanses. Discrete locations in the Study Area (mainly within offshore areas with depths greater than 82 ft. in portions of range complexes and testing ranges) could experience higher levels of activity involving multiple stressors, which could result in a higher potential risk for impacts on marine algae.

3.3.4.1 Combined Impacts of All Stressors Under Alternative 1

The potential for exposure of marine vegetation to multiple stressors would be limited because activities are not concentrated in coastal distributions (areas with depths less than 82 ft.) of these species. The combined impacts under Alternative 1 of all stressors would not be expected to affect marine vegetation populations because (1) activities involving more than one stressor are generally short in duration, (2) such activities are dispersed throughout the Study Area, (3) activities are generally scheduled where previous activities have occurred, and (4) the large resilient populations present in the Study Area. The aggregate effect on marine vegetation would not observably differ from existing conditions.

3.3.4.2 Combined Impacts of All Stressors Under Alternative 2

Under Alternative 2 the potential for exposure of seagrasses and attached macroalgae to multiple stressors would limited, because activities are not concentrated in coastal distributions (areas with depths less than 82 ft.) of these species. The combined impacts under Alternative 2 of all stressors would not be expected to affect marine vegetation populations because (1) activities involving more than one stressor are generally short in duration, (2) such activities are dispersed throughout the Study Area, (3) activities are generally scheduled where previous activities have occurred, and (4) the large resilient populations present in the Study Area. The aggregate effect on marine vegetation would not observably differ from existing conditions.

3.3.4.3 Combined Impacts of All Stressors Under the No Action Alternative

Under the No Action Alternative, training and testing activities associated with the Proposed Action will not be conducted within the HSTT Study Area. Various stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.3.5 Endangered Species Act Determinations

There are no species of vegetation listed as endangered, threatened, candidate, or proposed under the ESA in the Study Area.

3.3.6 Essential Fish Habitat Determinations

The Essential Fish Habitat Assessment prepared for the 2013 HSTT EIS/OEIS is still valid because this Draft EIS/OEIS covers similar activities in the same study area to those analyzed in 2013. The 2012 HSTT Essential Fish Habitat Assessment (available at www.hstteis.com) concluded that individual stressor impacts on marine vegetation were either no effect or minimal, and ranged in duration from temporary to long term, depending on the habitat impacted. Changes in the Proposed Action and essential fish habitat designations do not change the basis for the conclusion that the agreed-upon conservation measures are sufficient to avoid, minimize, or offset impacts on EFH caused by the Proposed Action. The Navy will also employ the appropriate mitigation measures to any new areas designated as essential fish habitat since 2013. The Navy will, to the greatest extent possible, conduct training and testing activities that result in more than minimal impacts to seafloor (e.g., from detonations of underwater explosives) outside of sensitive EFH, specifically the seagrass (e.g., eelgrass, surfgrass) and kelp habitat identified as Habitat Areas of Particular Concern under the Pacific Coast Groundfish Fishery Management Plan.

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