DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY

FINDING OF NO SIGNIFICANT IMPACT FOR THE GLASS BREAKWATER EMERGENCY BREACH REPAIRS, NAVAL BASE GUAM

Pursuant to the Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508) implementing the National Environmental Policy Act (NEPA) and Department of the Navy (Navy) NEPA regulations (32 CRF Part 775), the Navy gives notice that an Environmental Assessment (EA) has been prepared and an Environmental Impact Statement (EIS) is not required for the Glass Breakwater Emergency Breach Repairs in the vicinity of Apra Harbor, Guam. This action will be implemented as set out in Alternative 1.

Proposed Action: The United States (U.S.) Navy, Naval Base Guam (NGB) proposes to undertake emergency repairs to the Glass Breakwater. As a result of recent storms, the breakwater is severely eroded and susceptible to imminent breaching due to normal wave action. Repairs will occur on the Philippine Sea ocean-side of the breakwater, where significant "armor" rocks, safeguarding the breakwater's inner core, have displaced or been washed away into the ocean. Repair activities will involve temporarily relocating intact armor rock from neighboring breakwater crest areas and repositioning them on the failing areas of the breakwater. The goal of the proposed action analyzed in the EA is to stabilize the breakwater in the short-term so that long-term lasting repairs can eventually be made to restore the breakwater to its original condition. The Navy estimates that future maintenance repairs will occur in mid-2025 and will be addressed in subsequent environmental analysis.

Purpose and Need: The purpose of the Proposed Action is to conduct emergency repairs to failing sections of the Glass Breakwaters' armor rock slope protection. The Proposed Action is needed to prevent a breach of the breakwater, thereby safeguarding the harbor, shoreline, and vital Navy/Port of Guam infrastructure that is essential to sustain critical military and civilian missions on Guam. There is an imminent risk of breaching of the Glass Breakwater, which would have significant impacts on Navy mission readiness and operational capabilities. The degraded condition of the breakwater, exacerbated by normal wave action, storms, and typhoons, heightens the likelihood of breach. Continued exposure to even normal wave action not only increase the risk of breach, but also poses a risk of potential environmental damage, including to Endangered Species Act (ESA) - listed coral and ESA-candidate clam species located in the submerged areas of the structure.

Alternatives Analyzed: Alternatives were developed for analysis based upon the following reasonable alternative screening factors: timeliness, construction style, longevity, and criteria compliance.

Based on the alternative screening factors for meeting the purpose and need of the Proposed Action, one action alternative was identified and was analyzed in the EA, along with the No Action Alternative.

No Action Alternative: Under the No Action Alternative, the Proposed Action would not occur. Critical repairs would not be completed, and the breakwater would continue to degrade. Failure to execute this project would continue to expose the breakwater to more serious damage including partial collapse of the breakwater head and breach of the breakwater trunk. If there were a partial collapse, future breakwater repairs would be costly and difficult to execute. Additionally, sections of the breakwater head (offshore end) would experience accelerated deterioration. Strong waves, especially during typhoon conditions, would expose more of the slope and additional failure would occur. Large segments of the breakwater could fail and damaging waves would impact U.S. Navy ships, submarines, facilities, and infrastructure. The degraded condition of the breakwater, exacerbated by normal wave action, storms, and typhoons, heightens the likelihood of breach. Continued exposure to even normal wave action stressors not only increase the risk of breach, but also poses a risk of potential environmental damage, including to ESA-listed coral and ESA-candidate clam species located in the submerged areas of the structure.

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Alternative 1: Alternative 1 would relocate intact armor rocks from neighboring breakwater crest areas and reposition them on the failing areas of the breakwater. This alternative strategically relocates armor rocks from adjacent, less critical areas of the breakwater sections to construct a rubble-mound overlay up to the original structure crest along the ocean-side, targeting failed and deteriorating areas. The repair areas would extend 132 feet seaward from the center of the crest road. Construction would be limited to 2.0 meters (6.56 feet) seaward from the High Tide Line to avoid the bathymetric contour where corals and other biota are dense and diverse The width of the failed areas along the length of the breakwater range from 30 feet to 150 feet wide; with a thickness (i.e., depth) of approximately 15 feet.

Alternatives Considered but Dismissed from Further Consideration: The following alternatives were considered, but not carried forward for detailed analysis in the EA because they do not meet the purpose and need for the project and satisfy the reasonable alternative screening factors:

- Construction of a new breakwater
- Steel sheet pile repair
- Monolithic construction repair

Environmental Effects: No significant direct, indirect, or cumulative environmental impacts would occur from implementing the Proposed Action. Because potential impacts were considered negligible or nonexistent, the following resources were not evaluated in detail in the EA: airspace, geological resources, land use, infrastructure, transportation, socioeconomics, environmental justice, visual resources, noise, and hazardous materials and waste.

Potential environmental impacts on air quality, water resources, cultural resources, biological resources, public health and safety, climate change and greenhouse gases are summarized below.

Air Quality: Alternative 1 would result in less than significant impacts to air quality. Alternative 1 would not introduce any new permanent stationary sources of air emissions. Short-term, temporarily-emitted air emissions (e.g., fugitive dust, combustion of fossil fuels) would be generated during the activity period, which is estimated to be 36 weeks, 6 days per week, 12 hours per day. Best Management Practices (BMPs) would be implemented to minimize fugitive dust during construction. Example BMPs include watering of active work areas, using wind screens, keeping adjacent paved roads clean, covering of open-bodied trucks, limiting the area that is disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Fugitive dust and emissions released from the tailpipes of on-road and nonroad mobile sources lack plume rise. Thus, air emissions are expected to initially disperse in the immediate vicinity of activities and then transported downwind of release. Observations at the Guam International Airport indicate wind directions are mostly from the east, which would transport emissions away from public areas and sensitive receptors most of the time. Transport of air emissions to public areas and sensitive receptors would be infrequent and when they occur, air pollutant concentrations are expected to be low, commensurate with the activity level. Anticipated air quality impacts from the Alternative 1 are not expected to interfere with the attainment of ambient air quality standards or appreciably increase human health risks from hazardous air pollutants exposure in areas where sensitive receptors and/or public presence are expected. The Navy completed an applicability analysis to comply with the General Conformity requirements. The Proposed Action is subject to the General Conformity rule but a conformity determination is not required. Annual sulfur dioxide (SO_2) emissions from Alternative 1 would not exceed the SO_2 de minimis level of 100 tpy. The Record of Non-Applicability provided in Appendix A of the EA.

Water Resources: Alternative 1 would result in less than significant impacts to water resources. Construction of Alternative 1 may temporarily affect the marine waters directly surrounding the Glass Breakwater. On the ocean-side of the breakwater, where significant armor rocks have been displaced or been washed away into the ocean, repair activities will involve temporarily relocating armor rocks from neighboring breakwater crest areas, and repositioning them on the failed areas. This will involve work above and below the High Tide Line; therefore, the use of construction BMPs listed in Section 2.5 of the EA would minimize the transport of resuspended sediments in the water column, soil erosion, and runoff and avoid adverse impacts to marine water resources.

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The entire island of Guam has been designated a "coastal zone" under the Federal Coastal Zone Management Act (CZMA) of 1972. The CZMA requires that all construction and operational activities be consistent, to the maximum extent practicable, with the Guam Coastal Management Program (GCMP) policies to guide the use, protection, and development of land and ocean resources within Guam's coastal zone. In accordance with the CZMA, the Navy determined that Alternative 1 is consistent to the maximum extent practicable with the federally approved enforceable policies of the GCMP. The Navy submitted Notification of a Negative Determination to GBSP requesting their review and concurrence. The Navy received GBSP's concurrence on this determination via correspondence dated September 20, 2024 (see Appendix D of the EA).

Cultural Resources: Alternative 1 would result in less than significant impacts to cultural resources. In accordance with Section 106 of the National Historic Preservation Act (NHPA), the DON consulted with the Guam SHPO regarding the undertaking. The construction footprint does not overlap the archeological sites located within the APE as construction will be limited to 2.0 meters (6.56 feet) from the High Tide Line. The Glass Breakwater itself would have integrity restored with no appreciable changes to the visual or structural historic integrity. In consideration of the information on underwater archaeology and the built environment, DON determined that there would be no adverse effect to historic properties by the Proposed Action under NHPA Section 106. By letter dated February 28, 2024 (Reference No. RC2024-0091), the Guam State Historic Preservation Officer (SHPO) concurred with the Navy's determination (see correspondence in Appendix C).

In the unlikely event that historic properties are inadvertently discovered within the project's Area of Potential Effect (APE) during activities associated with the subject undertaking, then the Standard Operating Procedures contained within the Final Integrated Cultural Resources Management Plan NBG, Joint Region Marianas would be followed, as well as provisions of 36 CFR 800.13 Post-Review Discoveries.

Biological Resources: The Preferred Alternative would result in less than significant impacts to biological resources.

Marine Vegetation and Non-Coral Benthic Invertebrates. Alternative 1 would result in less than significant impacts to marine vegetation and non-coral benthic invertebrates. Construction activities will be contained within the existing breakwater footprint, and repairs will likely be carried out using a land-based crane from the top of the existing breakwater. The areas requiring repairs will focus on sections of the breakwater that are in critical condition. These areas are located on the oceanside (outer) portion of the existing breakwater. Any in-water work has the potential to impact marine vegetation and non-coral benthic invertebrates; however, based on the nature of the Proposed Action and the proposed BMPs described in the EA, most elements of the Proposed Action are expected to have minimal and temporary impacts.

Marine Wildlife. The Alternative 1 would result in less than significant impacts to marine wildlife. Concrete armor units and armor rocks will be placed in water carefully because each unit must interlock with its neighbors to form a strong structure. Careful placement will minimize noise levels associated with armor placement. Based on the rarity of marine mammal sightings within Apra Harbor, the limited size of the project area along outer shorelines of Glass Breakwater, and the 46-meter (50-yard) shutdown zone for marine mammals, no effects on marine mammals from the Proposed Action are anticipated. No critical habitat for marine mammals is designated in the project footprint.

Essential Fish Habitat. The Navy conducted EFH consultation with NMFS and determined that due to implementation of appropriate BMPs, the relative quantity and quality of existing EFH within the Action Area, and the size and scale of anticipated effects, the Proposed Action is not expected to appreciably diminish habitat value over the long term. Adverse effects will be minimized through the implementation of numerous BMPs, and considering the actions will be beneficial to EFH over the long-term, adverse effects will be minimal and temporary. These actions will prevent ecosystem losses from further breakwater degradation until permanent repairs can occur. Stressors that were analyzed included exposure to the following stressors: physical removal; increased suspended sediments; elevated underwater noise levels; waste and discharge; aquatic invasive species; chemical contaminants; and hypoxia. By email correspondence dated October 22, 2024, NMFS agreed with the Navy's EFH determination.

NMFS also proposed conservation recommendations to help further avoid and minimize potential adverse effects to EFH. These conservation recommendations are described in Appendix B of the EA.

Threatened and Endangered Species. Alternative 1 would result in less than significant impacts to threatened and endangered species. The Proposed Action has the potential to affect the following ESA-listed species: the endangered Central-West Pacific Distinct Population Segment (DPS) of green turtle (*Chelonia mydas*), the endangered hawksbill turtle (*Eretmochelys imbricata*), the threatened Indo-West Pacific DPS of scalloped hammerhead shark (*Sphyrna lewini*), and the threatened *Acropora globiceps* hard coral. The Navy initiated informal consultation with NMFS under ESA Section 7. In its assessment, the Navy considered potential impacts resulting from the Proposed Action on ESA-listed species that may occur within the project area from exposure to the following stressors: elevated underwater noise levels; increased suspended sediments; disturbance from human activity and equipment operation; direct physical contact; waste and discharge; and entanglement. Based on the best available data, environmental impact analysis, and the implementation of best management practices (BMPs), the Navy determined that these potential impacts are discountable or insignificant to ESA-listed species and that the Proposed Action may affect, but is not likely to adversely affect the ESA-listed species. The NMFS concurred with the Navy's determination in a letter dated October 28, 2024 (see Appendix B of the EA).

Public Health and Safety. Alternative 1 would result in less than significant impacts to public health and safety. Alternative 1 would provide the needed emergency repairs to the Glass Breakwater; therefore, safeguarding the shore facilities and infrastructure within the harbor from severe wave action during typhoons and other heavy weather events. Military and commercial vessel would be able to safely and effectively pass through the marine navigations channels, thus continuing to support and provide vital services to the island of Guam. BMPs would be employed in the event munitions and explosives of concern are encountered during construction. Contractors would manage any oil wastes and fluids in accordance with NBG management plans.

Greenhouse Gases/Climate. Alternative 1 would result in less than significant impacts to greenhouse gases/climate. GHG emissions generated from the Proposed Action would total 189 MT of CO_2e in 2024 and 881 MT of CO_2e in 2025.The GHG emissions temporarily generated from proposed site preparations and construction would result in a minor increase of GHG emissions and no detectable GWP changes resulting from the emission levels associated with these activities

Mitigation Measures: The Proposed Action will include the implementation of a range of BMPs and impact avoidance and minimization measures to limit potential impacts to environmental resources. Therefore, the Proposed Action will not result in significant impacts to environmental resources and no mitigation measures are required.

Public Outreach: The Navy prepared the Draft EA to inform the public of potential environmental impacts of the Proposed Action and to allow the opportunity for public review and comment. The 15-day public Draft EA public comment period began on September 18, 2024 with a public notice published in the local news media indicating the availability of the Draft EA and locations where public review copies were available. The Draft EA was also available on the following website: https://pacific.navfac.navy.mil/About-Us/National-Environmental-Policy-Act-NEPA-Information. No comments on the Draft EA were received during the public comment period that ended on October 3, 2024 (Chamorro Standard Time).

FINDING OF NO SIGNIFICANT IMPACT FOR THE GLASS BREAKWATER EMERGENCY BREACH REPAIRS, NAVAL BASE GUAM

Finding: Based on the analysis presented in the EA, which has been prepared in accordance with the requirements of NEPA and Navy policies and procedures (32 CFR Part 775), the Navy finds that implementation of the Proposed Action as set out in Alternative 1 will not significantly impact the quality of the human environment. This analysis fulfills the requirement of NEPA and CEQ regulations; therefore, an EIS will not be prepared.

Electronic copies of this EA and Finding of No Significant Impact may be obtained by written request to: Attention: Code EV2, Naval Facilities Engineering Systems Command Headquarters, 1322 Patterson Avenue, SE, Suite 1000, Washington Navy Yard, DC 20374-5065.

11/4/2024
Date

REAR ADMIRAL BRENT DE VORE
COMMANDER
JOINT REGION MARIANAS

FINAL

ENVIRONMENTAL ASSESSMENT

For

GLASS BREAKWATER EMERGENCY BREACH REPAIRS

At

NAVAL BASE GUAM, APRA HARBOR, GUAM

OCTOBER 2024

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Abstract

Designation:	Environmental Assessment
Title of Proposed Action:	Glass Breakwater Emergency Breach Repairs
Project Location:	Naval Base Guam
Lead Agency for the EA:	Department of the Navy
Affected Region:	Apra Harbor, Guam
Action Proponent:	Naval Base Guam
Point of Contact:	Julie M. Zimmerman NAVFAC HQ 1322 Patterson Avenue, SE, Suite 1000 Washington Navy Yard, DC 20374-5065 gbwea@us.navy.mil
Date:	October 2024

Unique Identification Number: EAXX-007-17-USN-1723124740

Naval Base Guam has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), as implemented by Council on Environmental Quality and Navy NEPA regulations. The Proposed Action is to undertake emergency repairs to the Glass Breakwater. As a result of recent storms, the breakwater is severely eroded and susceptible to imminent breaching due to normal wave action. Repairs will occur on the Philippine Sea ocean-side of the breakwater, where significant "armor" rocks, safeguarding the breakwater's inner core, have displaced or been washed away into the ocean. Repair activities will involve temporarily relocating intact armor rock from neighboring breakwater crest areas and repositioning them on the failing areas of the breakwater. The goal of the proposed action analyzed in this EA is to stabilize the breakwater in the short-term so that long-term lasting repairs can eventually be made to restore the breakwater to its original condition. The Navy estimates that future maintenance repairs will occur in mid-2025 and will be addressed in subsequent environmental analysis.

This EA comprehensively evaluates the potential environmental impacts associated with the one action alternative, Alternative 1, and the No Action Alternative to the following resource areas: air quality, water resources, cultural resources, biological resources, public health and safety, and greenhouse gases/climate change.

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EXECUTIVE SUMMARY

ES.1 Proposed Action

The Proposed Action is to undertake emergency repairs to the Glass Breakwater. As a result of recent storms, the breakwater is severely eroded and susceptible to imminent breaching due to normal wave action. Repairs will occur on the ocean-side of the breakwater, where significant "armor" rocks, safeguarding the breakwater's inner core, have displaced or been washed away into the ocean. Repair activities would involve temporarily relocating intact armor rocks from neighboring breakwater crest areas and repositioning them on the failing areas of the breakwater. The goal of the proposed action is to stabilize the breakwater in the short-term so that long-term lasting repairs can eventually be made to restore the breakwater to its original condition. The Navy estimates that future maintenance repairs will occur in mid-2025 and will be addressed in subsequent environmental analysis.

ES. 2 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to conduct emergency repairs to failing sections of the Glass Breakwaters' armor rock slope protection.

The Proposed Action is needed to prevent a breach of the breakwater, thereby safeguarding the harbor, shoreline, and vital Navy/Port of Guam infrastructure that is essential to sustain critical military and civilian missions on Guam.

There is an imminent risk of breaching of the Glass Breakwater, which would have significant impacts on Navy mission readiness and operational capabilities. The degraded condition of the breakwater, exacerbated by normal wave action, storms, and typhoons, heightens the likelihood of breach. Continued exposure to even normal wave action not only increase the risk of breach, but also poses a risk of potential environmental damage, including to Endangered Species Act (ESA) - listed coral and ESA-candidate clam species located in the submerged areas of the structure.

ES.2 Alternatives Considered

The Navy is considering one action alternative (Alternative 1) that meets the purpose of and need for the Proposed Action and a No Action Alternative. Alternative 1 would relocate intact armor rocks from neighboring breakwater crest areas and repositioning them on failing areas of the breakwater. The No Action Alternative would not repair the eroded areas of the breakwater, thus increasing the likelihood of a breach.

ES.3 Summary of Environmental Resources Evaluated in the EA

The Council on Environmental Quality (CEQ) regulations, National Environmental Policy Act (NEPA), and Navy instructions for implementing NEPA, specify that an Environmental Assessment (EA) should address those resource areas potentially subject to impacts. In addition, the level of analysis should be commensurate with the anticipated level of environmental impact.

The following resource areas have been addressed in detail in this EA: air quality, water resources, cultural resources, biological resources, public health and safety, climate change and greenhouse gases.

Because potential impacts were considered to be insignificant, negligible or nonexistent, the following resources were not evaluated in this EA: airspace, geological resources, land use, infrastructure, transportation, socioeconomics, environmental justice, visual resources, noise, and hazardous materials and waste.

ES.4 Summary of Potential Environmental Consequences of the Action Alternatives

Table ES-1 provides a tabular summary of the potential environmental impacts of the alternatives analyzed.

ES.5 Public Involvement

The Navy coordinated with the National Marine Fisheries Service (NMFS), Government of Guam Bureau of Statistics and Plans (GBSP), U.S. Army Corps of Engineers (USACE), Guam State Historic Preservation Office (SHPO), and Guam Environmental Protection Agency (GEPA) in the preparation of this EA. In addition, a Notice of Availability of the Draft EA was published in the local news media on September 18, 19, and 20, 2024 and copies of the Draft EA were made available through a Navy webpage and at the Nieves Flores Memorial Library in Hagatna, Guam. No public comments were received on the Draft EA during the 15-day public comment period that ended on October 2, 2024 (Chamorro Standard Time).

Table ES-1 Summary of The Potential Environmental Impacts of the Alternatives Analyzed

Resource Area	*No Action Alternative*	*Alternative 1*
Air Quality	No Impact	Less than significant impact. Temporary construction period impacts due to equipment and vehicle exhaust with implementation of BMPs.
Water Resources	No Impact	Less than significant impact. Temporary construction period impacts on marine waters due to in-water work.
Cultural Resources	Significant Impact	Less than significant impact. Construction and operational period impacts. No historic properties affected.
Biological Resources	Significant Impact	Less than significant impact. Construction period impacts with implementation of BMPs and avoidance, minimization, and offset measures.
Public Health and Safety	Significant Impact	Less than significant impact. Construction period impacts. BMPs would be employed in the event munitions and explosives of concern (MEC) is encountered during construction. Contractors would manage any oil wastes and fluids in accordance with NBG management plans.
Climate Change and Greenhouse Gases	No Impact	Less than significant impact.

Environmental Assessment

Glass Breakwater Repairs

Naval Base Guam, Apra Harbor, Guam

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Abbreviations and Acronyms

Acronym	Definition
AAQS	ambient air quality standard
APE	Area of Potential Effect
BMP	best management practice
CAA	Clean Air Act
CCD	Coastal Consistency Determination
CEM	Coastal Engineering Manual
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DoD	United States Department of Defense
DON	United States Department of the Navy
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FEPs	Fishery Ecosystem Plans
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
GWQS	Guam Water Quality Standards
HAP	hazardous air pollutant
HAPC	habitat areas of particular concern
MEC	munitions and explosives of concern
MMPA	Marine Mammal Protection Act
MUS	Management Unit Species
NAAQS	National Ambient Air Quality Standards
NBG	Naval Base Guam
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOA	notice of availability
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
Pb	lead
PCB	polychlorinated biphenyl
PM_{10}	particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
RONA	Record of Non-Applicability
ROI	region of influence
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SWPPP	Storm Water Pollution Prevention Plan
TCPs	traditional cultural properties
tpy	tons per year
U.S.	United States
USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency

Acronym	Definition	Acronym	Definition
USFWS	U.S. Fish and Wildlife Service		
WPRFMC	Western Pacific Regional Fishery Management Council		

1 Purpose of and Need for the Proposed Action

1.1 Introduction

Naval Base Guam (NBG) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality (CEQ) and Navy NEPA regulations.

The Proposed Action is to undertake emergency repairs to the Glass Breakwater. As a result of recent storms, the breakwater is severely eroded and susceptible to imminent breaching due to normal wave action. Repairs will occur on the ocean-side of the breakwater, where significant "armor" rocks, safeguarding the breakwater's inner core, have displaced or been washed away into the ocean. Repair activities would involve temporarily relocating intact armor rocks from neighboring breakwater crest areas and repositioning them on the failing areas of the breakwater. The goal of the proposed action is to stabilize the breakwater in the short-term so that long-term lasting repairs can eventually be made to restore the breakwater to its original condition. The Navy estimates that future maintenance repairs will occur in mid-2025 and will be addressed in subsequent environmental analysis.

1.2 Background

The Glass Breakwater in Apra Harbor, Guam has played a critical role in the island's maritime infrastructure since its construction. Initially planned before World War II, the breakwater's development was expedited after the war, primarily by the U.S. Navy Seabees, and completed in 1946. This structure was named in honor of Navy Captain Henry Glass, who played a significant role in capturing Guam from the Spanish during the 1898 Spanish-American War. Apra Harbor is a vital maritime hub for Guam, serving both military and commercial purposes. The harbor supports NBG, which includes facilities for U.S. Navy ships and submarines, and the Port of Guam, the island's primary commercial port handling cargo, fuel, and passenger vessels.

The breakwater is essential in order to shelter and protect U.S. Navy vessels, as well as commercial and local government ships, that use Apra Harbor. The breakwater also safeguards the shore facilities and infrastructure within the harbor from severe wave action during typhoons and other heavy weather events. On May 24, 2023, Super Typhoon Mawar passed north of Guam, bringing destructive winds and swells that severely damaged sections of the breakwater. The storm's impact caused significant erosion and displacement of the protective armor rock on the Western Point-Ocean Side, compromising the breakwater's integrity. The recent damage created an urgent need for repairs to maintain the harbor's functionality and prevent further degradation, which could lead to increased damage, higher future repair costs, and potentially significant environmental impacts. The Glass Breakwater is vital to the Navy's mission because without it, Apra Harbor would be open to severe wave action that accompanies typhoons and other heavy weather events originating from the Philippine Sea. Wave heights of 25 to 30 feet have been recorded during previous super typhoons that occur in seven to 15 years intervals. The worsening condition of the breakwater affects the position of the existing United States Coast Guard (USCG) navigational aid tower. The navigational aid tower is the only physical means to guide all incoming vessels into the mouth of the outer Apra Harbor.

Assessments conducted in February 2024 revealed that one-third of the breakwater has lost more than 20% of its armor rock, while the remaining two-thirds have experienced a loss of 5-10%, classifying the breakwater as “failed” according to the U.S. Army Corps of Engineers (USACE) Coastal Engineering

Manual (USACE 2002). Furthermore, a recent visual inspection conducted on May 9, 2024, showed an increased rate of degradation from normal wave action. If left unaddressed, this deterioration is likely to result in a breach, posing significant risks to military and commercial ships, facilities, operations, and the overall logistical use of Apra Harbor. In the event of even a partial breach, the maintenance road at the top of the breakwater crest would become impassable, leading to exponential increases in repair costs and time. The acceleration of breakwater failure underscores the urgent need for repair.

1.3 Location

The Navy on Guam supports naval activities to maintain operational readiness—maintaining the ability of units to respond to regional threats and to protect interests of the U.S. and its allies. The NBG at Apra Harbor is the Navy's operations center and is located on the southwest coast of Guam around Apra Harbor, including the Orote Peninsula. It serves as the forward deployment base and logistics hub, including main munitions storage and distribution center for sea, land, and air forces operating in Asia and the Western Pacific.

Navy-controlled lands at Apra Harbor have land uses ranging from industrial to recreational. Other lands on Guam are used for communications facilities; family housing/community support, two petroleum, oil and lubricant storage areas; munitions storage facilities; the Naval Hospital; a DoD Education Activity high school; and a Military Operations on Urban Terrain training range.

NBG covers about 4,500 acres on the west-central coast of Guam. It surrounds Apra Harbor and includes all of Orote Peninsula, as well as a low, largely marshy area along the east side of the harbor. Apra Harbor is located on the western shore of Guam, midway down the island and about 10 km (6 miles) southwest of the capital city of Hagåtña. The Philippine Sea surrounds the outside of the harbor and western Guam. Apra Harbor has two recognized zones: Outer Apra Harbor and Inner Apra Harbor. Water depths in Outer Apra Harbor are over 52 meters (170 feet) near the mouth and decrease to shallower waters around shoals (National Oceanic and Atmospheric Administration [NOAA] Chart 81054_Public Apra Harbor). Inner Apra Harbor is 9 to 12 meters (30 to 40 feet) deep, and Sasa Bay ranges as deep as 9 to 12 meters (30 to 40 feet) near the mouth but is generally much shallower, with numerous shallow shoals and mangroves (Figure 1 2). The majority of submerged land within Outer Apra Harbor is administered by the Navy and is used for military training and recreational activities. It also provides access for civilian vessels and the Government of Guam's Port Authority, which is in the northeastern portion of Outer Apra Harbor. The Navy authority over Inner Apra Harbor restricts its use to military vessels, which include naval and USCG vessels from allied nations. No recreational uses are permitted in Inner Apra Harbor. Fourteen wharves are located within Inner Apra Harbor to support the Navy and USCG vessels and operations (Department of the Navy [DoN] 2022). Sumay Cove is an enclosed embayment on the southern shore of Outer Apra Bay, extending approximately 850 meters (2,790 feet) to the south and ranging from about 40 meters across to 180 meters at its widest point. The entrance to Sumay Cove is flanked by Sumay Point on the west and EOD Point on the east.

Figure 1-1 Location Map

1.4 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to conduct emergency repairs to failing sections of the Glass Breakwaters' armor rock slope protection. During a May 9, 2024 inspection, the Navy determined that four areas of the breakwater have failed to the extent they have potential to breach the crest road within the next 12 months. These areas are likely to grow in size, height, depth, and thickness through typical wave events. If a typhoon occurs, the probability of further failure is high. Currently, the crest road is 35 feet wide. Construction equipment requires a road width of 35-40 feet. Any loss of road width would delay future repair efforts and expose the breakwater to further loss while the crest road is modified or repaired to allow equipment access.

The Proposed Action is needed to prevent a breach of the breakwater, thereby safeguarding the harbor, shoreline, and vital Navy/Port of Guam infrastructure that is essential to sustain critical military and civilian missions on Guam. There is an imminent risk of breaching of the Glass Breakwater, which would have significant impacts on Navy mission readiness and operational capabilities. The degraded condition of the breakwater, exacerbated by normal wave action, storms, and typhoons, heightens the likelihood of breach. Continued exposure to even normal wave action not only increase the risk of breach, but also poses a risk of potential environmental damage, including to Endangered Species Act (ESA) listed coral and ESA-candidate clam species located in the submerged areas of the structure.

1.5 Scope of Environmental Analysis

This EA includes an analysis of potential environmental impacts associated with the action alternative and the No Action Alternative. The environmental resource areas analyzed in this EA include: air quality, water resources, cultural resources, biological resources, public health and safety, and greenhouse gases/climate. The study area for each resource analyzed may differ due to how the Proposed Action interacts with or impacts the resource. For instance, the study area for cultural resources may only include the construction footprint of a structure, whereas the public health and safety study area would expand outside of the construction area.

1.6 Key Documents

Key documents are sources of information incorporated into this EA. Documents are considered to be key because of similar actions, analyses, or impacts that may apply to this Proposed Action. CEQ guidance encourages incorporating documents by reference. Documents incorporated by reference in part or in whole include:

- U.S. Army Corps of Engineers (USACE) Coastal Engineering Manual (USACE 2002)

1.7 Relevant Laws and Regulations

The Navy has prepared this EA based upon federal and state laws, statutes, regulations, and policies pertinent to the implementation of the Proposed Action, including the following:

- National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] sections 4321et seq.
- Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations parts 1500–1508)
- Navy regulations for implementing NEPA (32 Code of Federal Regulations part 775)
- Clean Air Act (42 U.S.C. section 7401 et seq.)

- Clean Water Act (33 U.S.C. section 1251 et seq.)
- Rivers and Harbors Act (33 U.S.C. section 401 et seq.)
- Coastal Zone Management Act (16 U.S.C. section 1451 et seq.)
- National Historic Preservation Act (54 U.S.C. section 3001018 et seq.)
- Endangered Species Act (16 U.S.C. section 1531 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (16 U.S.C. section 1801 et seq.)
- Marine Mammal Protection Act (16 U.S.C. section 1361 et seq.)
- EO 12088, Federal Compliance with Pollution Control Standards
- EO 13089, Coral Reef Protection
- EO 14008, Tackling Climate Crisis at Home and Abroad
- Guam Air Pollution Control Standards and Regulations (Regulation 1302, Chapter 1, Title 22 of Guam Administrative Rules and Regulations)

A description of the Proposed Action's consistency with these laws, policies and regulations, as well as the names of regulatory agencies responsible for their implementation, is presented in Chapter 5 (Table 5-1).

1.8 Public and Agency Participation and Intergovernmental Coordination

Regulations from the CEQ direct agencies to involve the public in preparing and implementing their NEPA procedures. The Navy prepared a Draft EA to inform the public of potential environmental impacts of the Proposed Action and to allow the opportunity for public review and comment. The 15-day public Draft EA public comment period began on September 18, 2024 with a public notice published in the local news media indicating the availability of the Draft EA and locations where public review copies were available. The Draft EA was also available on the following website: https://pacific.navfac.navy.mil/About-Us/National-Environmental-Policy-Act-NEPA-Information.

No comments on the Draft EA were received during the public comment period that ended on October 2, 2024 (Chamorro Standard Time).

Pursuant to Section 7 of the Endangered Species Act, the Navy consulted with the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) regarding the Proposed Action. The Navy determined that the Proposed Action is not likely to adversely affect (NLAA) the Central West Pacific DPS green turtle, the hawksbill turtle, the Indo-west Pacific DPS scalloped hammerhead shark, or the ESA-listed coral *A. globiceps*. NMFS concurred with the Navy's NLAA determination in a letter dated October 28, 2024 (see Appendix B). The Navy also consulted with NMFS under the Magnuson-Stevens Fishery Conservation and Management Act regarding Essential Fish Habitat. NMFS concurred that the Proposed Action is expected to have minimal and temporary impacts and risks of adversely affecting EFH in a letter dated October 22, 2024 (see Appendix B).

The entire island of Guam has been designated a "coastal zone" under the Federal Coastal Zone Management Act (CZMA) of 1972. The CZMA requires that all construction and operational activities be consistent, to the maximum extent practicable, with the Guam Coastal Management Program (GCMP) policies to guide the use, protection, and development of land and ocean resources within Guam's coastal zone (Guam Bureau of Statistics and Plans [GBSP], 2011). In accordance with the CZMA, the Navy determined that the Proposed Action is consistent to the maximum extent practicable with the federally approved enforceable policies of the GCMP. The Navy submitted Notification of a Negative Determination to GBSP requesting their review and concurrence. The Navy received GBSP's concurrence on this determination via correspondence dated September 20, 2024 (see Appendix D).

The Navy also consulted with the Guam State Historic Preservation Office (SHPO) regarding this Proposed Action. Concurrence of a "No Adverse Effect" determination was issued by letter dated 28 February 2024 (Appendix C).

The Navy also coordinated with the U.S. Army Corps of Engineers (USACE) and Guam EPA regarding the Proposed Action and received a Section 401 Water Quality Certification and USACE Nationwide Permit.

2 Proposed Action and Alternatives

2.1 Proposed Action

The Navy proposes to perform emergency repairs on the breakwater's ocean-side, where the large armor rocks that protect the breakwater's inner core have slid and/or washed into the ocean, leaving the inner core vulnerable to rapid erosion from constant wave and storm action.

Repair activities would involve relocating intact armor rocks from neighboring breakwater crest areas and repositioning them on the failing areas of the breakwater. The Navy estimates that future maintenance repairs will occur in mid-2025 and will be addressed in subsequent environmental analysis.

2.2 Screening Factors

NEPA's implementing regulations provide guidance on the consideration of alternatives to a federally proposed action and require rigorous exploration and objective evaluation of reasonable alternatives. Only those alternatives determined to be reasonable and to meet the purpose and need require detailed analysis.

Potential alternatives that meet the purpose and need were evaluated against the following screening factors:

- **Timeliness:** Repairs must begin once approvals and permits are obtained following completion of the NEPA process.
- **Construction Style:** Repairs must conform to the existing rubble-mound construction style.
- **Longevity:** Repairs must ensure a minimum lifespan of 25 years.
- **Criteria Compliance:** Repairs must meet current criteria specified in relevant manuals (e.g., USACE) to:
    - Provide stability and withstand severe environmental conditions.
    - Provide sufficient wave dissipation to reduce the force of incoming waves before they reach harbor infrastructure and the shoreline.

2.3 Alternatives Carried Forward for Analysis

Based on the alternative screening factors for meeting the purpose and need of the Proposed Action, one action alternative was identified and is analyzed within this EA, along with the No Action Alternative.

2.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. Critical repairs would not be completed, and the breakwater would continue to degrade. Failure to execute this project would continue to expose the breakwater to more serious damage including partial collapse of the breakwater head and breach of the breakwater trunk. If there were a partial collapse, future breakwater repairs would be costly and difficult to execute. Additionally, sections of the breakwater head (offshore end) would experience accelerated deterioration. Strong waves, especially during typhoon conditions, would expose more of the slope and additional failure would occur. Large segments of the breakwater could fail and damaging waves would impact U.S. Navy ships, submarines, facilities, and infrastructure. If the breakwater is not repaired, the position of the existing USCG navigational aid tower would worsen affecting the safety of all incoming and outgoing vessels through the mouth of the outer Apra Harbor. The degraded condition of the breakwater, exacerbated by normal wave action, storms, and typhoons, heightens the likelihood of breach. Continued exposure to even normal wave action stressors not only increase the risk of breach, but also poses a risk of potential environmental damage, including to Endangered Species Act (ESA)-listed coral and ESA-candidate clam species located in the submerged areas of the structure.

The No Action Alternative would not meet the purpose of and need for the Proposed Action; however, as required by NEPA, the No Action Alternative is carried forward for analysis in this EA. The No Action Alternative will be used to analyze the consequences of not undertaking the Proposed Action.

2.3.2 Alternative 1 - Natural Rock Armor Layer Repair

This alternative would relocate intact armor rocks from neighboring breakwater crest areas and reposition them on the failing areas of the breakwater. This alternative strategically relocates armor rocks from adjacent, less critical areas of the breakwater sections to construct a rubble-mound overlay up to the original structure crest along the ocean-side, targeting failed and deteriorating areas as identified in Figure 2-1 and Figure 2-2. The repair areas would extend 132 feet seaward from the center of the crest road. Construction would be limited to 2.0 meters (6.56 feet) seaward from the High Tide Line to avoid the bathymetric contour where corals and other biota are dense and diverse The width of the failed areas along the length of the breakwater range from 30 feet to 150 feet wide; with a thickness (i.e., depth) of approximately 15 feet.

The repair work would include the following steps:

1. **Temporary Slope Protection Removal:** Remove compromised/damaged slope protection to facilitate targeted regrading efforts in designated areas 1-4 (Figure 2-1). Recover unstable armor rocks on the slope that are reachable with conventional equipment already available on island. (Note that the Biological Assessment (Appendix B) describes two main work areas, which are concurrent with the four work areas shown in Figure 2-1. The EA discusses each one with additional granularity).

2. **Strengthening the Toe Foundation:** Enhance structural robustness by reinforcing the in-water foundational integrity at the breakwater's base, ensuring steadfast stability under varying environmental pressures.

3. **Optional Geofabric Installation:** Depending on site conditions, a geofabric filter may be integrated to augmented filtration and structural support, elevating resilience against dynamic forces.

4. **Rock Relocation:** Strategically relocate armor rocks from two adjacent, less critical areas of breakwater sections to revitalize eroded areas prone to breaching, thus maximizing resource efficiency (Figure 2-1). Rocks would be removed from the breakwater crest. Rocks would be approximately 15 feet thick and 30 feet wide. Only the rocks at the upper crest would be removed so as to not destabilize the slopes of the adjacent armoring. Only 75% of the failed areas would require temporary breach protection repair, thus approximately 1,518 feet of adjacent rocks from other sections of the breakwater would be required to be relocated. Rocks nearest the breakwater head would be relocated as the repair would focus on the primary failed

areas and then proceed with work beginning at the head and work landward. This sequential approach reduces the risk of exposing the breakwater to further failure potential

5. **Riprap Bedding Application:** Implement laying of riprap bedding, selected to optimize structural reinforcement and fortify the breakwater against erosive forces.
6. **Precision Armor Rock Deployment:** Methodically position rocks and place where critical repairs are needed to prevent a breach.

These critically needed repairs to the Glass Breakwater would prevent imminent breaching. Implementation of less critical long-term repairs would be performed at a later date and evaluated in separate environmental analysis.

Site preparations would include earthwork to create work areas on the breakwater access road, accommodating crane pads and heavy truck traffic. One proposed contractor staging area has been proposed for use within the existing track lane on the crest of the outer breakwater, adjacent to emergency repair areas

This alternative would ensure that emergency repairs are implemented to stabilize the breakwater until follow-on long-term repairs can be completed. This alternative would ensure the breakwater maintains its structural integrity and protects Apra Harbor from severe wave action. This would safeguard both military and commercial maritime operations.

Figure 2-1 Damage Assessment of Glass Breakwater and Critically Damaged Areas

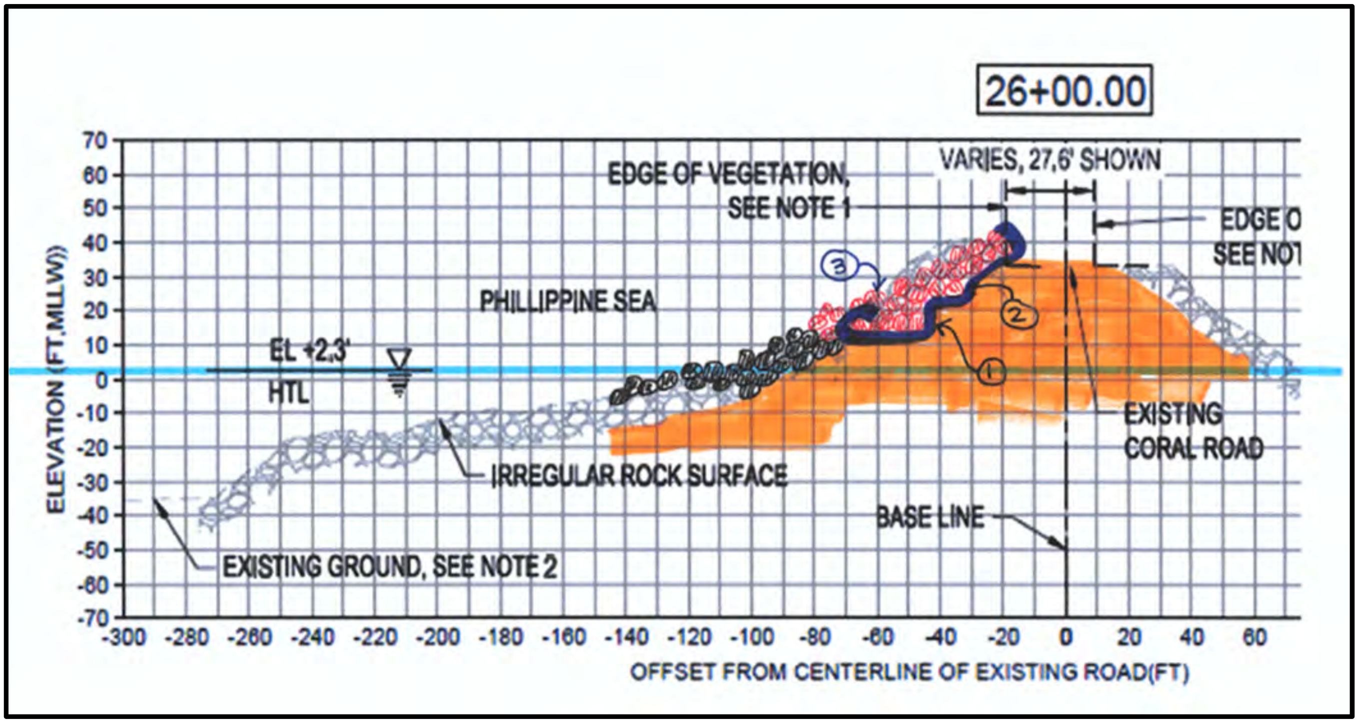
Areas of Discovered Failure and Proposed Borrow Areas

Failure Area	Slope Length (ft)	Width (ft)	Thickness
1	132	115	15
2	132	125	15
3	132	30	15
4	132	150	15
Total Volume (CF)		910,800	
Assumed 75% Repair Volume (CF)		683,100	

	Borrow
Length (ft)	1,518
Width (ft)	30
Height (ft)	15
Volume	683,100

Volumes are equal which proves sufficient armor stones are available

Figure 2-2 Natural Rock Armor Layer Repair



2.4 Alternatives Considered but not Carried Forward for Detailed Analysis

The following alternatives were considered, but not carried forward for detailed analysis in this EA as they did not meet the purpose and need for the project or satisfy the reasonable alternative screening factors presented in Section 2.2.

2.4.1 Construction of a New Breakwater

This alternative would demolish the current breakwater and construct a new breakwater structure in its place. Construction of a new breakwater would offer adequate harbor protection, but would require significantly more time and resources than currently available to address the immediate needs for critical repairs and harbor protection. The lengthy design and construction timelines would not address the immediate need to provide protection to the harbor; therefore, does not meet the purpose and need. This alternative will not be carried forward for detailed analysis in the EA.

2.4.2 Steel Sheet Pile Repair

The alternative would include encasing the damaged breakwater areas with sheet pile walls on both the harbor side and ocean side. The space between the existing structure and the sheet pile walls would be filled with granular material, anchored with tie rods, and capped with concrete. While this method would stabilize the breakwater, it does not align with the existing rubble-mound construction style. This alternative does not meet the purpose and need in that it would not conform to the existing breakwater construction style or maintain the breakwater's original design and functionality. This alternative will not be carried forward for detailed analysis in the EA.

2.4.3 Monolithic Construction Repair

This alternative would include monolithic construction techniques to repair the failed and failing portions of the breakwater. Repairing a rubble mound breakwater using monolithic construction techniques is generally not feasible due to:

1. **Structural Incompatibility**: Monolithic construction involves creating a single, continuous structure, often using materials like concrete. In contrast, rubble mound breakwaters are composed of multiple layers of loose rocks. The fundamental design principles and behavior under wave action differ significantly between these two types, making integration challenging.
2. **Flexibility and Adaptation**: Rubble mound breakwaters are designed to be flexible and absorb wave energy through the movement of individual rocks. Monolithic structures, being rigid, do not provide the same level of energy dissipation. This could lead to structural failure when subjected to the dynamic forces typically absorbed by a rubble mound design.
3. **Construction Techniques**: The construction methods for monolithic breakwaters are substantially different from those used for rubble mounds. Implementing monolithic construction techniques would likely require completely re-engineering the breakwater, leading to increased costs and extended timelines, which do not meet the urgent needs for timely repairs.

This incompatibility with the current structure means it fails to meet the project’s purpose and need for efficient repairs that maintain the breakwater's original design and functionality. Therefore, it will not be carried forward for detailed analysis in the EA.

2.5 Best Management Practices Included in Proposed Action

This section presents an overview of the best management practices (BMPs) that are incorporated into the Proposed Action in this document. BMPs are existing policies, practices, and measures that the Navy would adopt to reduce the environmental impacts of designated activities, functions, or processes. Although BMPs mitigate potential impacts by avoiding, minimizing or reducing/eliminating impacts, BMPs are distinguished from potential mitigation measures because BMPs are (1) existing requirements for the Proposed Action, (2) ongoing, regularly occurring practices, or (3) not unique to this Proposed Action. In other words, the BMPs identified in this document are inherently part of the Proposed Action and are not potential mitigation measures proposed as a function of the NEPA environmental review process for the Proposed Action.

BMPs include actions required by federal or state law or regulation. The recognition of the general management measures prevents unnecessarily evaluating impacts that are unlikely to occur.

- BMPs A through C (Section 2.5.1) avoid and minimize effects from the Project on ESA-listed sea turtles and sharks;
- BMPs D through J (Section 2.5.2) avoid and minimize effects from the Project on ESA-listed corals and Essential Fish Habitat (EFH);
- BMP-J (Section 2.5.3) avoids and minimizes effects from the Project from water pollution; and
- BMP-K (Section 2.5.4) avoids and minimizes effects from the Project on in-water sedimentation levels.
- BMP-L (Section 2.5.5) avoids and minimizes effects from the Project on fugitive dust.

2.5.1 BMPS to Avoid and Minimize Effects on ESA-listed Sea Turtles and Sharks

As applicable to mobile ESA-listed marine species (including non-listed marine mammals, although they are not expected to occur in the Action Area), the following BMPs will be employed to avoid and minimize adverse effects:

A. During limited in-water activities such as placement and resetting of armor rocks and concrete armor units, a dedicated and competent observer who is familiar with local marine species will use binoculars to detect the presence of ESA-listed marine species and notify construction crews to cease work if the ESA-listed species approaches the shutdown zone, as described below.
   1. The Contractor will comply with the following monitoring requirements:
      a) From the breakwater, a competent observer will use binoculars to monitor the Action Area for ESA-listed sea turtles and scalloped hammerhead sharks during all in-water activities. If all work associated with a particular activity takes place above the High Tide Line, an observer will not be required for that element of the Proposed Action.
      b) Observations will begin each day 30 minutes prior to the start of in-water activities:
         i. If no ESA-listed sea turtles or sharks are seen during the 30-minute pre-clearance survey period, Action activities may commence.
         ii. If an ESA-listed sea turtle or shark is seen during the 30-minute pre-clearance survey period, the observer will notify the Project Manager immediately and monitor the animal. If the animal is

within 46 meters (50 yards) of the in-water activity, animal behavior observations will be recorded. Work will not begin until the animal departs the area voluntarily or after 30 minutes have passed since the last animal sighting.

iii. During in-water activities, the observer will record environmental and action-related information, including but not limited to date, time, weather, action undertaken, status and effectiveness of BMPs, and ESA-listed marine species observed.

iv. During in-water activities, all in-water work shall stop when an ESA-listed sea turtle or shark approaches or is sighted within 46 meters (50 yards) of the proposed in-water work. Work shall begin/resume after the animal has departed the area voluntarily or after 30 minutes have passed since the last animal sighting.

v. All sightings of ESA-listed marine species shall be recorded.

2. No placement of in-water armor rocks or concrete armor units will take place after dark.
3. NBG will document and report quarterly to NMFS on all interactions with ESA-listed sea turtles or sharks.

B. During limited in-water activities, the following measures will be implemented to reduce the potential for collisions with mobile ESA-listed species:
    1. Vessel operators will halt or alter course to remain at least 46 meters (50 yards) away from ESA-listed marine animals.
    2. Vessel operators will reduce vessel speed to 10 knots or less when piloting vessels in the proximity of marine mammals and to 5 knots or less when piloting vessels in areas of known or suspected sea turtle activity. Operators will be particularly vigilant to watch for sea turtles at or near the surface in areas of known or suspected sea turtle activity.
    3. If approached by an ESA-listed marine animal, the vessel operator will put the engine in neutral until the animal is at least 15.2 meters (50 feet) away and then slowly move to 46 meters (50 yards) away from the animal.
    4. Vessel operators will not encircle or trap ESA-listed marine animals between multiple vessels or between vessels and the shore or breakwater.

C. During limited in-water activities, the following measures will be employed to reduce potential direct physical impacts on ESA-listed species:
    1. No personnel will attempt to disturb, touch, ride, feed, or otherwise intentionally interact with any protected species. Entangled animals will be freed and photographed if possible, and each incident will be reported to NMFS. Entanglement is not expected because the work area will be monitored, and therefore, no take for entanglements is requested.
    2. All personnel will stay more than 46 meters (50 yards) away from sea turtles, in the unlikely event they haul out on land in proximity to construction activities.
    3. Before any equipment or material enters the water, the Contractor will verify that no ESA-listed species are in the area.
    4. Any heavy equipment used (i.e. crane) will be operated from above and out of the water.
    5. Construction related equipment that may pose an entanglement hazard will be removed from the project site if not actively being used.

2.5.2 BMPs to Avoid and Minimize Effects on ESA-listed Corals and EFH

D. All in-water activities will cease during the primary Guam coral spawning event for soft (order Alcyonaria) and hard (order Scleractinia) corals (see Table 2-1). The coral spawning period is estimated to be approximately 21 days total each year, including 8 days prior to the full moon and 14 days after (Richmond and Hunter 1990):

Table 2-1. Estimated Coral Spawning Events from 2024-2025 for Soft (order Alcyonaria) and Hard (order Scleractinia) Corals

Year	Soft Corals		Hard Corals	
	Date of Full Moon	Estimated Spawning Period	Date of Full Moon	Estimated Spawning Period
2025	May 12	May 4 – May 26	July 1 0	July 2 - July 24th

E. The development and adherence to an inclement weather and typhoon contingency plan must include a large swell plan whereby in-water activities will be conducted during safe weather conditions (i.e., calm seas) and will cease during high surf, winds, or currents.
F. Construction will be limited to 2.0 meters (6.56 feet) from the High Tide Line to avoid the bathymetric contour where corals and other biota are dense and diverse.
G. All construction-related equipment must be operated to avoid impacting sensitive marine habitat or contacting coral reef resources during in-water activities or extreme weather conditions:
    1. The portions of the equipment that enter the water will be clean and free of pollutants, including aquatic invasive species. In compliance with Guam Executive Order 91-37, all vessels and equipment (including barges and cranes) will be free from fouling organisms before entering Guam's coastal waters.
    2. The portions of the equipment entering the water (if at all) will be clean and free of pollutants, including aquatic invasive species. The Project Manager and heavy equipment operator will perform daily pre-work equipment inspections for cleanliness and leaks. Should a leak be detected, all work will be halted until leak is repaired and equipment is cleaned.

2.5.3 BMPs to Avoid and Minimize Effects from Water Pollution

H. A Storm Water Pollution Prevention Plan (SWPPP) will be developed by the Construction Contractor to reduce on-site erosion and sedimentation. The SWPPP will include, at a minimum, the following BMPs:
    1. Silt socks, filter fabric, or an equivalent will be used around out-of-water repair sites along the Glass Breakwater.
    2. An Oil Spill Contingency Plan to control and clean spilled petroleum products and other toxic materials will be included in the SWPPP and implemented throughout construction of the Project:
        a) Oil or other hazardous substances will be prevented from seeping into the ground or entering any drainage inlet or local bodies of water.
        b) When applicable, all temporary fuel oil or petroleum storage tanks will be surrounded with a temporary berm of sufficient size and strength to contain the contents of the tanks (plus 10 percent freeboard for precipitation) in the event of an accidental release.

c) Fueling of Project-related vehicles and equipment will take place at least 46 meters (150 feet) away from the water and within a containment area, preferably over an impervious surface. With respect to equipment that cannot be fueled on land, spill prevention booms will be employed in the water to contain potential spills. All fuel spilled will be cleaned up immediately.
d) Lubricants and excess oil will be disposed of in accordance with applicable federal, territorial, and local regulations, laws, ordinances, and permits.
e) Appropriate materials to contain and clean potential spills will be stored at the work site and be readily available.
f) All Project-related materials and equipment placed in the water will be free of pollutants.
g) Daily pre-work inspections of heavy equipment for cleanliness and leaks will be conducted. All heavy equipment operations will be postponed or halted until leaks are repaired and equipment is cleaned.
h) All Project-related debris and other waste will be contained and will not enter or remain in the marine environment.

2.5.4 BMPs to Avoid and Minimize Effects on In-Water Sedimentation

I. Turbidity and siltation from Project-related work shall be minimized and contained through the appropriate use of erosion control practices and curtailment of work during adverse weather and tidal/flow conditions:

1. The Construction Contractor must continuously monitor to ensure that control measures are in place and functioning properly.
2. As practicable, work will be conducted during calm seas with work stoppages during high surf, winds, and currents.

2.5.5 BMPs to Avoid and Minimize Effects of Fugitive Dust

J. No person shall cause or permit visible fugitive dust to become airborne without taking reasonable precautions. Examples of reasonable precautions are:

1. Use of water or suitable chemicals for control of fugitive dust in the demolition of existing buildings or structures, construction and retrofitting operations, the grading of roads, or the clearing of land;
2. Application of asphalt, water, or suitable chemicals on roads, material stockpiles, and other surfaces which may allow release of fugitive dust;
3. Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials. Reasonable containment methods shall be employed during sandblasting, spray painting, or other similar operations;
4. Covering all moving, open-bodied trucks transporting materials which may release fugitive dust;
5. Maintenance and sealing of road-ways and parking lots so as to prevent the exposure of such surfaces to wind, water, or vehicular travel erosion; and
6. Prompt removal of earth or other materials from paved streets which have been transported there by trucking, earth-moving equipment, erosion, or other means.

3 Affected Environment and Environmental Consequences

This chapter presents a description of the environmental resources and baseline conditions that could be affected from implementing any of the alternatives and an analysis of the potential direct and indirect effects of each alternative.

All potentially relevant environmental resource areas were initially considered for analysis in this Environmental Assessment (EA). In compliance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ), and Department of Navy guidelines; the discussion of the affected environment (i.e., existing conditions) focuses only on those resource areas potentially subject to impacts. Additionally, the level of detail used in describing a resource is commensurate with the anticipated level of potential environmental impact.

“Significantly,” as used in NEPA, requires considerations of both context and intensity. Context means that the significance of an action must be analyzed under several perspectives such as society as a whole, the affected region, the affected interests, and the locality. Significance varies with the setting of a proposed action. For instance, in the case of a site-specific action, significance would usually depend on the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant. Intensity refers to the severity or extent of the potential environmental impact, which can be thought of in terms of the potential amount of the likely change. In general, the more sensitive the context, the less intense a potential impact needs to be in order to be considered significant. Likewise, the less sensitive the context, the more intense a potential impact would be expected to be significant.

The potential impacts to the following resource areas are considered to be negligible or non-existent; therefore, they were not analyzed in detail in this EA:

Airspace: The Proposed Action would not involve impacts to military or civilian airspace or facilities. Therefore, no additional analysis is required with respect to airspace impacts.

Geological Resources: The Proposed Action would take place within the existing footprint of the Glass Breakwater. No on land or shore side construction would take place as part of the Proposed Action. Terrestrial components of the project would involve one temporary staging areas within the existing track lane on the crest of the outer breakwater, adjacent to emergency repair areas. BMPs would be implemented to avoid soil erosion and offsite storm water discharge. The project area does not include any prime farmland and no existing agricultural lands would be affected by either alternative. The Proposed Action would result in relatively minor changes to geological or topographic features in the project area, and would not increase the likelihood of seismic activity and related liquefaction impacts. Therefore, geological resources do not require additional analysis in this EA.

Land Use: Land and water use would remain the same as under existing conditions. Terrestrial components of the project involve one temporary staging area within the existing track lane on the crest of the outer breakwater, adjacent to emergency repair areas Therefore, land use requires no additional analysis in this EA.

Socioeconomics: Construction of the Proposed Action would not impact population; employment/industry characteristics; demand for schools, housing, recreational facilities; or demographic, economic, or fiscal conditions of the Territory of Guam. Economic benefits of construction job creation would be temporary and associated with project construction. Therefore, the project would not result in secondary impacts related to increasing development capacity or population growth. Socioeconomics is not further analyzed in this EA.

Environmental Justice: Consistent with Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 11, 1994), EO 13045, Protection of Children from Environmental Health and Safety Risks (April 21, 1997), and EO 14008, Tackling the Climate Crisis at Home and Abroad (February 1, 2021), the Navy has evaluated the Proposed Action and determined that it would not cause disproportionately high and adverse human or environmental effects of its actions on minority and low-income populations. The Proposed Action would occur within Navy-controlled lands and waters and secured to prevent public access. The type and nature of Glass Breakwater Emergency Breach Repairs would not substantively change existing land and water use or the type, tempo, and nature of NBG operations and activities. Therefore, no additional evaluation is required with respect to Environmental Justice.

Visual Resources: All the project components would be within the footprint of the existing Glass Breakwater. All materials to be used in the repairs would be similar to materials used in the original breakwater construction. Boulders and riprap would match existing erosion control measures. No new permanent structures would be constructed and the visual landscape of Apra Harbor would not be altered. Therefore, no additional analysis of visual resources is needed in this EA.

Noise. The Proposed Action would not involve actions that would create elevated noise such as pile driving, sand blasting, boat traffic, etc. Noise generated by the project would be the operation of construction equipment including trucks and cranes. Concrete armor units and armor rocks would be placed in water carefully as each unit must interlock with its neighbors to form a strong structure. Careful placement would minimize noise levels associated with armor placement. The nearest physical receptor is approximately 2.0 miles away, making it unlikely that construction noise would be audible. The distance from Area 1 to the first house on Lockwood Terrace is 10,229 feet (1.94 miles). The distance to the upper northwest corner of McCool Elementary and Middle School is 11,653 feet (2.21 miles). The nearest civilian residences are 23,066 feet (4.37 miles) east of Area 1. Ambient noise levels at the project area are generally low due to its remote location with low activity levels. The predominant noise sources consist of ship and harbor operations at the Apra Harbor wharves, commercial and recreational vessels transiting the harbor, wind, and vehicle traffic on local streets. Other components such as construction, landscape maintenance, helicopter training, and recreational use of nearby areas produce noise, but such noise generally represents a transitory and negligible contribution to the average noise level environment. Therefore, no additional analysis of noise resources is needed in this EA.

Hazardous Materials and Waste: No known hazardous materials or waste contamination sites are located within the project areas. Construction activities would not generate hazardous materials or waste. Munitions and explosives of concern (MEC) are analyzed in the Public Health and Safety section. Therefore, additional analysis of hazardous materials and waste are not included in this EA.

The following resource areas have the potential to experience impacts from the Proposed Action and require additional analysis: air quality, water resources, cultural resources, biological resources, public health and safety, and greenhouse gases/climate.

3.1 Air Quality

This section evaluates potential impacts to air quality that could result from implementation of the Proposed Action. Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. A region's air quality is influenced by many factors, including the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and local meteorological conditions.

Most air pollutants originate from human-made sources, including mobile sources (e.g., diesel-fueled vehicles) and stationary sources (e.g., concrete batch plants, refineries, power plants), as well as indoor sources (e.g., some building materials and cleaning solvents). Air pollutants are also released from natural sources such as volcanic eruptions and forest fires. Some pollutants are formed through atmospheric chemical reactions from other pollutant emissions (called precursors) that are influenced by weather, ultraviolet light, and other atmospheric processes. Note that Climate Change and Greenhouse Gases are discussed separately in Section 3.6

3.1.1 Regulatory Setting

3.1.1.1 Criteria Pollutants and National Ambient Air Quality Standards

The principal pollutants defining air quality, called "criteria pollutants," include carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, suspended particulate matter less than or equal to 10 microns in diameter (PM_{10}), fine particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). CO, SO_2, Pb, NO_2, and some particulates are emitted directly into the atmosphere from emissions sources. Ozone, NO_2, and some particulates are formed through atmospheric chemical reactions that are influenced by weather, ultraviolet light, and other atmospheric processes.

Under the Clean Air Act (CAA), the U.S. Environmental Protection Agency (USEPA) has established National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for these pollutants. NAAQS are classified as primary or secondary. Primary standards protect against adverse health effects; secondary standards protect against welfare effects, such as damage to farm crops and vegetation and damage to buildings. Some pollutants have long-term and short-term standards. Short-term standards are designed to protect against acute, or short-term, health effects, while long-term standards were established to protect against chronic health effects. Ambient air is defined as that portion of the atmosphere, external to buildings, to which the general public is exposed. Each ambient air quality standard (AAQS) has its own criteria, known as the "form" of the standard, related to if and how many times it may be exceeded before the AAQS is considered violated. The concentration that follows the form of the standard and that is used to compare with an AAQS is a design value. Pollutant concentrations at or near ground level are of particular interest because this is where most environmental impacts from air pollution occur.

Areas that are and have historically been in compliance with the NAAQS are designated as attainment areas. Areas that violate a federal air quality standard are designated as nonattainment areas. Areas that have transitioned from nonattainment to attainment are designated as maintenance areas and are required to adhere to maintenance plans to ensure continued attainment.

The CAA requires states to develop a general plan to attain and maintain the NAAQS in all areas of the country and a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans, known as State Implementation Plans (SIPs), are developed by state and local air quality management agencies and submitted to USEPA for approval.

3.1.1.2 Guam Air Pollution Control Standards and Regulations

Guam adopted ambient air quality standards defined in Title 22-1, Article 3 of the Guam Administrative Rules. Guam standards have been established for SO_2, particulate matter (measured as PM_{10}), CO, ozone, NO_2, and Pb. The Guam AAQS are given in terms of primary standards, which define levels of air quality necessary “with an adequate margin of safety, to protect the public health” and secondary standards, which define levels of air quality necessary “to protect the public welfare from any known or anticipated adverse effects of a pollutant.”

3.1.1.3 Hazardous Air Pollutants

USEPA has identified 188 hazardous air pollutants (HAPs), also referred to as toxic air pollutants or air toxics that are known or suspected to cause cancer or other serious health and environmental effects. AAQS have not been established for HAPs because USEPA’s strategy is to use reductions of HAP emissions from stationary industrial, mobile, and indoor sources as a means to providing nationwide health protections. National emission standards exist for controlling HAPs from stationary sources, which are regulated under Section 112(b) of the 1990 CAA Amendments. The primary control methodologies for these pollutants for mobile sources involves reducing their content in fuel and altering the engine operating characteristics to reduce the volume of pollutant generated during combustion. To assess risk from exposure to toxics, the USEPA has tabulated long-term (chronic) and short-term (acute) dose-response assessments that could be used for risk assessments of HAPs (EPA, 2024).

3.1.1.4 General Conformity

The USEPA General Conformity Rule applies to federal actions that generate the criteria pollutant (or its precursors) for which the area is designated nonattainment or maintenance. The emissions thresholds that trigger requirements for a conformity analysis are called *de minimis* levels. *De minimis* levels (in tons per year [tpy]) vary by pollutant and also depend on the severity of the nonattainment status for the air quality management area in question.

A conformity applicability analysis is the first step of a conformity evaluation and assesses if a federal action must be supported by a conformity determination. This is typically performed by quantifying applicable direct and indirect emissions that are projected from the implementation of the federal action. Indirect emissions are those emissions caused by the federal action and originating in the region of interest, but which can occur at a later time or in a different location from the action itself and are reasonably foreseeable. The federal agency can control and will maintain control over the indirect action due to a continuing program responsibility of the federal agency. Reasonably foreseeable emissions are projected future direct and indirect emissions that are identified at the time the conformity evaluation is performed. The location of such emissions is known and the emissions are quantifiable, as described and documented by the federal agency based on its own information and after reviewing any information presented to the federal agency. If the results of the applicability analysis indicate that the total emissions would not exceed the de minimis emissions thresholds, then a conformity determination is not required.

3.1.1.5 Permitting

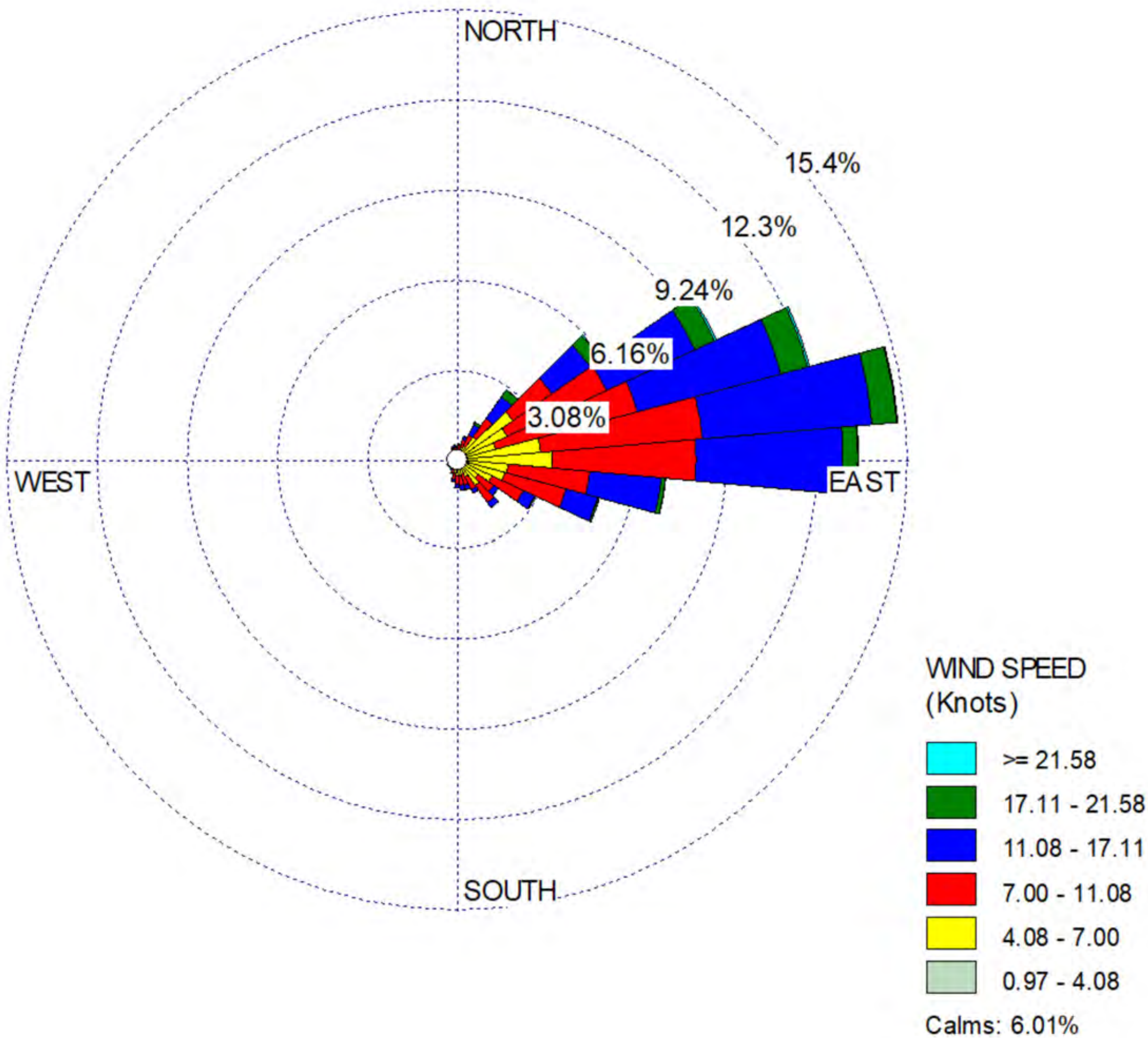
New Source Review (Pre-Construction Permit)

New stationary sources and modifications at existing stationary sources are required by the CAA to obtain an air pollution permit before commencing construction. This permitting process for stationary sources is called 'New Source Review' and is required whether the source or modification is planned for nonattainment areas or attainment and unclassifiable areas. Because no new and no modifications to existing stationary sources are associated with the Proposed Action, permitting is not carried forward as part of the air quality analysis.

3.1.2 Affected Environment

The air quality region of influence (ROI) includes Apra Harbor, mainly near the proposed action activities. Sensitive receptors are nearby at a recreational beach located approximately 2,500 feet (762 meters) east of the proposed action. Ambient air receptors at Orote Point are 2,500 feet (762 meters) southwest of the proposed action. Meteorological conditions affect the dispersion and transport of air pollutants and the resulting air quality. Figure 3-1 depicts a wind rose for data collected from 2018 to 2022 by the weather station (PGUM) located at Antonio B. Won Pat International Airport. The wind rose represents the directions around a compass, and the length of the petal or spoke indicates wind direction and frequency toward the center point. Individual segments of the spoke represent the frequency of winds for defined wind speed categories, with the slowest winds closest to and the fastest winds furthest from the center of the diagram. The windier part of the year lasts for six months, from November to May, with average wind speeds of more than 13.8 miles per hour. The calmer season has an average hourly wind speed of 10.9 miles per hour (WeatherSpark, 2022).

Figure 3-1 Wind Rose for Guam



Ambient air quality conditions around Outer Apra Harbor and NBG are affected primarily by stationary sources at Piti and to a lesser extent by mobile emission sources, including vessels and on-road vehicles in the area. There are several large stationary emission sources in operation, including the Guam Power Authority's Cabras Power Plant in Piti Point area with two steam turbines and two slow speed diesel generators. In the same area, the Taiwan Electrical and Mechanical Engineering Services Power Plant operates a 40-megawatt combustion turbine known as Piti #7, and the Marianas Energy Company Power Plant operates two slow speed diesel generators, each rated at 44-megawatt (also known as Piti #8 and #9).

There are currently no air monitoring stations operating on Guam. Ambient air quality data has not been collected since 1991. There is currently no emissions inventory for the island of Guam, although the Guam Environmental Protection Agency (GEPA) is working towards producing an annual emissions inventory for the island. USEPA's Technical Support Document for Intended Round 3 Area Designations for the 2010 SO_2 Primary NAAQS for Guam reported 2011-2013 actual SO_2 emissions for Cabras (8,891 tpy Marianas Energy Company (4,828 tpy), and TEMES (2 tpy), which can be used as a reference point for assessing potential impacts from the proposed alternatives.

Guam is designated unclassifiable/attainment for all criteria pollutants with the exception of SO_2. The proposed action is within the Piti-Cabras area designated nonattainment for the 2010 SO_2 primary NAAQS. The de minimis threshold for SO_2 is presented in Table 3-1.

Table 3-1 SO_2 General Conformity *de minimis* level

Pollutant	***Area Type***	***tpy***
SO_2	All nonattainment & maintenance	100

tpy = tons per year

3.1.3 Environmental Consequences

Effects on air quality are based on estimated direct and indirect emissions associated with the action alternatives, and the dispersion and transport of those emissions. The ROI for assessing air quality impacts for this project is in the immediate vicinity of proposed action activities.

Air quality effects are changes to the environment resulting from project impacts that are reasonably foreseeable and have a reasonably close causal relationship to the action. These effects may include but are not limited to:

- Risks to populations resulting from the exposure to HAPs
- Changes in ambient concentrations for criteria pollutants and their effects on compliance with ambient air quality standards

The primary source of emissions from the Proposed Action would be from fuel-burning equipment and fugitive dust from ground disturbance. To assess air quality impacts from emissions released from the proposed action, the analysis evaluated expected locations of pollutant plumes and receptors to determine if they overlap to assess exposure potential and how the exposure compares to AAQS and dose-response assessments. Activity duration and how changes in pollutant concentrations would affect design values are considered. For example, the 1-hour nitrogen dioxide NAAQS is based on a 3-year average, but if Proposed Action activities do not occur for the entire duration of the 3-year period, the period of no activity would lower the 3-year average. Therefore, the duration and intensity of pollutant exposure within the adjacent neighborhood of each activity area were considered in evaluating air quality impacts from the proposed temporary activities.

3.1.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline air quality. Therefore, no significant impacts to air quality or air resources would occur with implementation of the No Action Alternative.

3.1.3.2 Alternative 1- Natural Rock Armor Layer Repair

Potential Impacts

Alternative 1 would not introduce any new permanent stationary sources of air emissions. Short-term, temporarily-emitted air emissions (e.g., fugitive dust, combustion of fossil fuels) would be generated during the activity period, which is estimated to be 36 weeks, 6 days per week, 12 hours per day. BMPs would be implemented to minimize fugitive dust during construction. Example BMPs include watering of active work areas, using wind screens, keeping adjacent paved roads clean, covering of open-bodied trucks, limiting the area that is disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Fugitive dust and emissions released from the tailpipes of on-road and nonroad mobile sources lack plume rise. Thus, air emissions are expected to initially disperse in the immediate vicinity of activities and then transported downwind of release. Observations at the Guam International Airport indicate wind directions are mostly from the east, which would transport emissions away from public areas and sensitive receptors most of the time. Transport of air emissions to public areas and sensitive receptors would be infrequent and when they occur, air pollutant concentrations are expected to be low, commensurate with the activity level.

Anticipated air quality impacts from the Alternative 1 are not expected to interfere with the attainment of AAQS or appreciably increase human health risks from HAP exposure in areas where sensitive receptors and/or public presence are expected.

General Conformity

The Navy completed an applicability analysis to comply with the General Conformity requirements. The proposed action is subject to the General Conformity rule but a conformity determination is not required. Annual SO_2 emissions from Alternative 1 would not exceed the SO_2 *de minimis* level of 100 tpy. The Record of Non-Applicability (RONA) provided in Appendix A documented this analysis.

3.2 Water Resources

This discussion of water resources includes marine waters. Surface water, groundwater, wetlands, floodplains, and shorelines are not discussed as these water resources are not located in the project area and/or have little to no potential to be affected by the Proposed Action.

Marine waters typically include estuaries, waters seaward of the historic height of tidal influence, and offshore high salinity waters. Marine water quality is described as the chemical and physical composition of the water as affected by natural conditions and human activities. Additionally, marine waters may include areas that require special protection to avoid adverse water quality impacts in order to prevent damage to marine resources.

3.2.1 Regulatory Setting

The USACE regulates the discharge of dredge or fill material into wetlands under Section 404 of the CWA as a subset of all "Waters of the United States." Waters of the United States is defined as (1) the territorial seas and traditional navigable waters, (2) tributaries, (3) certain lakes ponds, and impoundments, and (4) adjacent wetlands, and are regulated by USEPA and the USACE. The CWA requires that Guam establish a Section 303(d) list to identify impaired waters and establish TMDLs for the sources causing the impairment.

Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredge or fill material into wetlands and other Waters of the United States. Any discharge of dredge or fill material into Waters of the United States requires a permit from the USACE.

Section 10 of the Rivers and Harbors Act provides for USACE permit requirements for any in-water construction in navigable waters. USACE and some states require a permit for any in-water construction. Permits are required for construction of piers, wharfs, bulkheads, pilings, marinas, docks, ramps, floats, moorings, and like structures; construction of wires and cables over the water, and pipes, cables, or tunnels under the water; dredging and excavation; any obstruction or alteration of navigable waters; depositing fill and dredged material; filling of wetlands adjacent or contiguous to navigable waters; construction of riprap, revetments, groins, breakwaters, and levees.

The Coastal Zone Management Act of 1972 (CZMA) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use programs in coastal zones. Actions occurring within the coastal zone commonly have several resource areas that may be relevant to the CZMA.

3.2.2 Affected Environment

The following discussions provide a description of the existing conditions for each of the categories under water quality resources at NBG. Surface water, groundwater, wetlands, floodplains, and shorelines are not discussed as these water resources are not located in the project area and/or have little to no potential to be affected by the Proposed Action.

3.2.2.1 Marine Waters

Apra Harbor is the only deep lagoon in Guam and is enclosed on its north and northwest sides by the Glass Breakwater and on its southwest by Orote Peninsula. There are four distinct areas of the harbor: (1) Outer Apra Harbor, deep water with direct access to the Philippine Sea at Orote Point, (2) Commercial Port (dredged by the Government of Guam), (3) Sasa Bay located north of Polaris Point, and (4) Inner Apra Harbor.

Guam tides are semidiurnal with a mean range of 1.6 feet and diurnal range of 2.3 feet. Extreme predicted tide range is about 3.5 feet (GEPA, 2006). Surface seawater temperatures on Outer Apra Harbor are typically 79 to 86 degrees Fahrenheit (Smith et al., 2013 in DON, 2018). Temperature fluctuations are more pronounced at the eastern stations compared to those toward the mouth of the harbor.

Water quality in the marine environment is determined by a complex set of interactions between chemical and physical processes operating continuously in the ocean system. This dynamic equilibrium is expressed by a variety of indicators, including temperature, salinity, dissolved oxygen, and nutrient levels. Nutrients are chemicals necessary to produce organic matter. Basic nutrients include dissolved nitrogen, phosphates, and silicates. Dissolved inorganic nitrogen occurs in ocean water as nitrates, nitrites, and ammonia, with nitrates as the dominant form. Water pollutants alter the basic chemistry of seawater in various ways (DON, 2010).

The vast expanse of offshore waters, their distance from the shore, and mixing and transport effects of currents work together to maintain a generally high quality of water. The major chemical parameters of marine water quality include pH, amount of dissolved oxygen, and nutrient concentrations. The quality of coastal ocean waters, or nearshore waters, is strongly affected by nonpoint source pollution.

Apra Harbor receives freshwater inflows from the Atantano, Sasa, Aguada, and Laghas rivers, with the Atantano River emptying into Inner Apra Harbor (and the other three emptying into Sasa Bay). These rivers primarily drain the areas around the municipalities of Piti and Santa Rita. Stormwater runoff from these areas carries large amounts of sediments, most of which originates from the widespread soil erosion that occurs in the highlands and from improperly managed construction activities within the drainage basin (Guam DPW, 2010, as cited in HDR, 2011). Over time, the sediments deposited by rivers and streams flowing into the inner harbor and Sasa Bay are transported by the combined actions of winds, waves, currents, and tides to the outer harbor where they adversely impact in-harbor water quality and coral reefs (HDR, 2011).

Guam Water Quality Standards (GWQS), adopted by GEPA in 2001, establish three categories of waters: groundwater, marine waters, and surface waters. The waters of Outer Apra Harbor are categorized as “marine waters.” Marine waters include all coastal waters offshore from the mean high water mark, including estuarine waters, lagoons, bays, brackish areas, wetlands and other special aquatic sites, and other inland waters that are subject to tidal influence. Marine waters are further divided into three sub-categories: Excellent (M-1), Good (M-2) and Fair (M-3).

The waters within Outer Apra Harbor—including the project area—are designated M-2. According to the GWQS, water in the M-2 category must be of sufficient quality to allow for the propagation and survival of marine organisms, particularly shellfish and other similarly harvested aquatic organisms, corals and other reef related resources, and whole-body contact recreation. Other important and intended uses include mariculture activities, aesthetic enjoyment, and related activities. The Piti Channel empties into Outer Apra Harbor and is characterized as M-3 (Fair), which is defined as being marine waters that are intended for general, commercial, and industrial use, while allowing for protection of aquatic life, aesthetic enjoyment, and compatible recreation with limited body contact. Specified intended uses of M-3 waters include shipping, boating and berthing, industrial cooling water and marinas. Saltwater acute, saltwater chronic and human health standards are applicable to all toxic pollutants discharged in M-3 waters.

3.2.3 Environmental Consequences

In this EA, the analysis of water resources focuses on the potential impacts on marine waters.

3.2.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water resources. Therefore, no significant impacts to water resources would occur with implementation of the No Action Alternative.

3.2.3.2 Natural Rock Armor Layer Repair (Alternative 1) Potential Impacts

The study area for the analysis of effects to water resources associated with the Alternative 1 includes Outer Apra Harbor marine waters in the vicinity of the Glass Breakwater.

Construction of Alternative 1 may temporarily affect the marine waters directly surrounding the Glass Breakwater. On the ocean-side of the breakwater, where significant armor rocks have been displaced or been washed away into the ocean, repair activities will involve temporarily relocating armor rocks from neighboring breakwater crest areas, and repositioning them on the failed areas. This will involve work above and below the high tide line; therefore, the use of construction BMPs listed in Section 2.5 would minimize the transport of resuspended sediments in the water column, soil erosion, and runoff and avoid adverse impacts to marine water resources.

Therefore, implementation of the Alternative 1 would not result in significant impacts to water resources.

3.3 Cultural Resources

This section describes baseline conditions for cultural resources within the ROI and assesses the effect to historic properties caused by implementation of the Proposed Action or the No Action Alternative, as detailed in Chapter 2.

Cultural Resources include the physical evidence associated with human activities. This includes precontact and historic archaeological sites, buildings, structures, objects, and elements or areas of the natural landscape. Cultural resources include *historic properties,* defined in the NHPA as any precontact or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places. The term *historic properties* also includes traditional cultural properties (TCPs). TCPs are eligible for inclusion in the National Register of Historic Places (NRHPs) for association with cultural practices or beliefs of a living community. Such practices or beliefs are important in maintaining the continuing cultural identity of the community. TCPs may include archaeological sites, buildings, structures, neighborhoods, prominent topographic features, habitat, plants, animals, and/or minerals that Native Americans or other groups consider essential for the preservation of their identity or way of life

3.3.1 Regulatory Setting

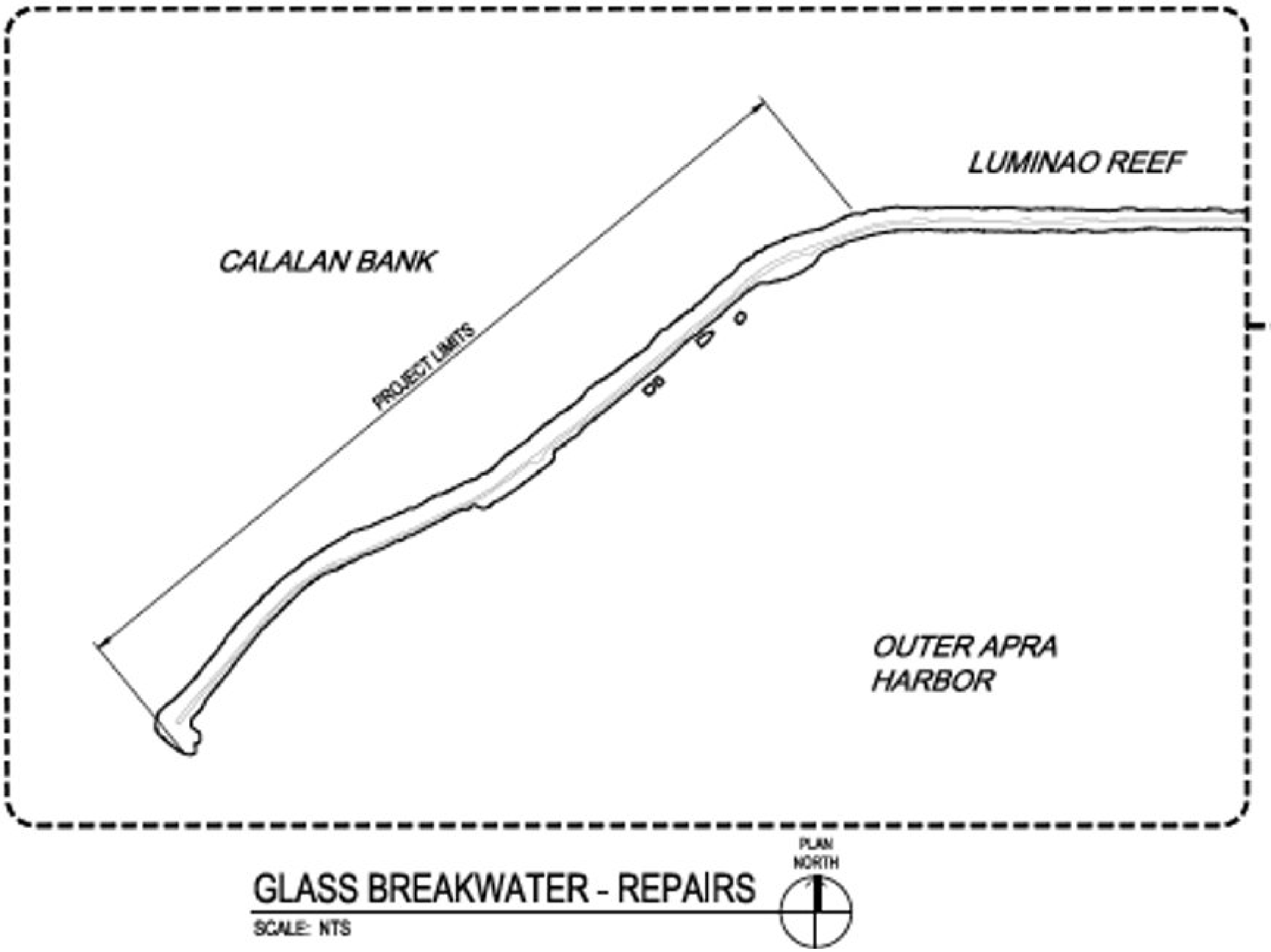
The Navy has prepared this EA based upon federal and state laws, statutes, regulations, and policies pertinent to the implementation of the Proposed Action, as detailed in Section 1.7. Federal laws and regulations governing cultural resources include the National Historic Preservation Act (NHPA) of 1966, Archeological and Historic Preservation Act of 1974, American Indian Religious Freedom Act of 1978, Archaeological Resources Protection Act of 1979, and Native American Graves Protection and Repatriation Act of 1990. Federal agencies' responsibility for preserving historic properties is defined primarily by Sections 106 and 110 of the NHPA. Section 106 requires agencies to consider the effects of their actions on *historic properties* and Section 110 mandates proactive identification and management of cultural resources.

3.3.2 Affected Environment

The ROI for cultural resources is referred to as the area of potential effects (APE). The APE is the geographic area or areas within which an undertaking may disturb archaeological resources and/or directly or indirectly cause alterations in the character or use of historic properties. In this context, an undertaking is defined as a project, activity, or program funded in whole, or in part, under the direct or indirect jurisdiction of a federal agency, including, among other things, processes requiring a federal permit, license, or approval. The term undertaking is synonymous with the Proposed Action and includes any demolition and construction activities occurring within the APE.

The entirety of the proposed undertaking would occur within Apra Harbor. The APE is defined as the project limits encompassed by the Proposed Action. The APE includes 87.7 acres (354,838 square meters) and consists of an area within and immediately adjacent to the Glass Breakwater within Apra Harbor (Figure 3-2).

Figure 3-2 Area of Potential Effect



3.3.2.1 Archaeological Resources

There are four known archaeological sites located within the APE (Table 3-6). Although the sites are located within the APE, the construction footprint does not overlap the sites; therefore, Navy reached a finding of *no adverse effects* for the proposed undertaking. In accordance with Section 106 of the NHPA, Navy provided the Guam State Historic Preservation Officer (SHPO) an opportunity to comment on the undertaking. The Navy received a letter from the SHPO, dated February 28, 2024 (Reference No. RC2024-0091), concurring with the *no adverse effects* finding. Appendix C provides the Section 106 Documentation.

Table 3-2 Archaeological Sites Located Within APE

Site	*Site Name*	*Recorded*	*Site Type*	*NRHP Status*
66-03-2206	Yosemite 2	Carrell 2009; Jeffery and Moran 2007	Artifact scatter from early-20th century shipwreck	Eligible
66-03-1078	American Tanker	Carrell et. al. 2020	Shipwreck	Eligible
66-03-2191	Seabee Junkyard	Jeffery 2012; Applegate-Palmer and Jeffery 2014; Applegate-Palmer 2015; Bush et al. 2017; Jeffery and Applegate-Palmer 2017	Dump Site	Eligible
66-03-2263	Val Bomber	Lauter-Reinman 1997, Jeffery and Drew 2007	Aircraft Wreck	Eligible

3.3.2.2 Architectural Resources

The Glass Breakwater, the only architectural resource located in the APE, is *eligible* for inclusion in the NRHP. The breakwater has been previously disturbed within the APE from construction of the service road along the crest and from damage related to multiple storms and typhoons. Extensive natural wave battering and erosion have also damaged the structure over time. The Proposed Action will utilize like-kind materials for the breakwater repair. Boulders/rip rap will match existing erosion measures in the area and will have minimal effects to the architectural integrity of the breakwater or surrounding visual landscape. Repairs of the Glass Breakwater are essential to maintain and ensure structural integrity. Failure to provide these repairs would lead to further damage to the historic property.

3.3.2.3 Traditional Cultural Properties

A TCP study for Guam was conducted in 2009, which included interviews, existing information on archaeological sites, ethnographic associations, and Chamorro myths (Griffin et al., 2010 in SEARCH, 2015). The study is considered preliminary in scope and additional research and consultation would be required to further define and evaluate the potential TCPs identified therein. According to the 2015 ICRMP, the remains of Sumay Village (Guam Register of Historic Places Site No. 66-03-1038) was the only site located at NBG identified as a potential TCP in Griffin et al. (2010). Sumay Village is a documented seventeenth-century community located on the north coast of the Orote Peninsula, outside the APE.

3.3.3 Environmental Consequences

Analysis of potential impacts to cultural resources considers both direct and indirect impacts. Direct impacts may be the result of physically altering, damaging, or destroying all or part of a resource, altering characteristics of the surrounding environment that contribute to the importance of the resource, introducing visual, atmospheric, or audible elements that are out of character for the period the resource represents (thereby altering the setting), or neglecting the resource to the extent that it deteriorates or is destroyed. Indirect effects to historic properties are those caused by the undertaking that are later in time or farther removed in distance but are still reasonably foreseeable.

3.3.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. Natural wave battering and erosion would continue to occur and damage the structure over time. Forthcoming storms and typhoons would accelerate structure damage to the structure. Failure to provide these repairs will lead to further damage, and eventual destruction, to the eligibly historic property. Therefore, significant impacts to cultural resources could occur with implementation of the No Action Alternative.

3.3.3.2 Alternative 1- Natural Rock Armor Layer Repair Potential Impacts

Alternative 1 would have no adverse effects to cultural resources. In accordance with Section 106 of the NHPA, the DON consulted with the Guam SHPO regarding the undertaking. The construction footprint does not overlap the archeological sites located within the APE as construction will be limited to 2.0 meters (6.56 feet) from the High Tide Line. The Glass Breakwater itself would have integrity restored with no appreciable changes to the visual or structural historic integrity. In consideration of the information on underwater archaeology and the built environment, DON determined that there would be *no adverse effect* to historic properties by the Proposed Action under NHPA Section 106. By letter dated February 28, 2024 (Reference No. RC2024-0091), the Guam SHPO concurred with the Navy's determination (see correspondence in Appendix C).

In the unlikely event that historic properties are inadvertently discovered within the project's APE during activities associated with the subject undertaking, then the Standard Operating Procedures contained within the Final Integrated Cultural Resources Management Plan NBG, Joint Region Marianas would be followed, as well as provisions of 36 CFR 800.13 Post-Review Discoveries.

Therefore, implementation of Alternative 1 would not result in significant impacts to cultural resources.

3.4 Biological Resources

Biological resources include living, native, or naturalized plant and animal species and the habitats within which they occur. Plant associations are referred to generally as vegetation, and animal species are referred to generally as wildlife. Habitat can be defined as the resources and conditions present in an area that support a plant or animal.

Within this EA, biological resources are divided into two major categories: (1) marine vegetation and non-coral benthic invertebrates and (2) marine wildlife. Threatened, endangered, and other special status species are discussed in their respective categories.

3.4.1 Regulatory Setting

Special-status species, for the purposes of this assessment, are those species listed as threatened or endangered under the Endangered Species Act (ESA) and species afforded federal protection under the Marine Mammal Protection Act (MMPA) or the Magnuson-Stevens Fishery Conservation and Management Act.

The purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to conserve and recover listed species. Section 7 of the ESA requires action proponents to consult with the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) Fisheries to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species, or result in the destruction or adverse modification of designated critical habitat. Critical habitat cannot be designated on any areas owned, controlled, or designated for use by the DoD where an Integrated Natural Resources Management Plan has been developed that, as determined by the Department of Interior or Department of Commerce Secretary, provides a benefit to the species subject to critical habitat designation.

All marine mammals are protected under the provisions of the MMPA. The MMPA prohibits any person or vessel from “taking” marine mammals in the United States or the high seas without authorization. The MMPA defines “take” to mean “to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal.”

The Magnuson-Stevens Fishery Conservation and Management Act provides for the conservation and management of the fisheries. Under the Act, EFH consists of the waters and substrate needed by fish to spawn, breed, feed, or grow to maturity.

3.4.2 Affected Environment

The following discussions provide a description of the existing conditions for each of the categories under biological resources at NBG. Threatened and endangered species are discussed in each respective section below with a composite list applicable to the Proposed Action provided in Table 3-10.

Along with literature from prior studies, the marine biological resources information presented in this section includes results from the February and March 2024 of the Outer Harbor of the Glass Breakwater survey report.

3.4.2.1 Marine Vegetation and Non-Coral Benthic Invertebrates

Marine vegetation includes plants occurring in marine or estuarine waters. These may include mangroves, algae, and various grasses. Estuaries, sea grass beds, and mangrove forests occur in Apra Harbor, but not within the project area. Animals that live on the sea floor are called benthos. Most of these animals lack a backbone and are called invertebrates. Typical benthic invertebrates include sea anemones, sponges, corals, sea stars, sea urchins, worms, bivalves, crabs, and many more. (Note: Corals are discussed separately in Section 3-4.2.2).

Divers conducting benthic surveys in February and March 2024 noted damage on the Outer Breakwater in the form of boulder slides and locations where boulders were dislodged from the above-water structure and into the sea. Underwater locations of rockslides were indicated by the presence of white limestone boulders devoid of marine growth. Some boulders were also sheared and broken into pieces. Other boulders, some at a distance from one another, had rubbed against each other, yielding scarred white limestone (Kilarski et al. 2024).

The Outer Breakwater is a highly dynamic area with considerable wave energy. This location experiences the brunt of storms generated to the north as well as turbulent sea surface conditions from locally generated wind. The northeast section of the Outer Breakwater nearest the shallow reef flat of Luminao Reef experiences a strong southwesterly current that flows off the reef flat. The Outer Breakwater benthic habitat is composed of predominantly large limestone boulders that either have light turf algal growth or are encrusted by crustose coralline algae. The depths along the surveyed Outer Breakwater area range between 2 and 5 meters (7 to 15 feet).

Table 3-3. Inventory of Marine Vegetation and Non-Coral Benthic Invertebrates Observed during Transects in Outer Glass Breakwaters, February and March 2024

Species	Common Name	Status[a]	Abundance[b]
			Outer Breakwater
Macroalgae			
BRYOPSIDALES			
Bryopsidaceae			
Bryopsis pennata	N/A	Ind	—
Caulerpaceae			
Caulerpa racemosa var. *macrophysa*	N/A	Ind	—
Caulerpa serrulata	N/A	Ind	—
Codiaceae			
Tydemania expeditionis	N/A	Ind	—
Halimedaceae			
Chlorodesmis fastigiata	N/A	Ind	O
Halimeda sp.	N/A	—	—
Halimeda opuntia	N/A	Ind	—
CLADOPHORALES			
Valoniaceae			
Valonia ventricosa	N/A	Ind	—
Cyanobacteria			
COLEOFASCICULALES			
Coleofasciculaceae			
Symploca hydnoides	N/A	Ind	—
Brown Algae			
FUCALES			
Sargassaceae			
Turbinaria ornata	N/A	Ind	—
DICTYOTALES			

Dictyotaceae			
Dictyota grossedentata	N/A	Ind	—
Padina boryana	N/A	Ind	—
Red Algae			
BONNEMAISONIALES			
Bonnemaisoniaceae			
Asparagopsis taxiformis	N/A	—	—
CORALLINALES			
Lithophyllaceae			
Amphiroa Tribulus	N/A	—	—
NEMALIALES			
Galaxauraceae			
Actinotrichia fragilis	N/A	—	—
Non-coral Invertebrates			
Crustaceans			
DECAPODA			
Unidentified hermit crab	N/A	—	C
Echinoderms			
VALVATIDA			
Ophidiasteridae			
Linckia laevigata	N/A	Ind	—
Linckia multifora	N/A	Ind	—
Oreasteridae			
Culcita novaeguineae	N/A	Ind	—
CAMARODONTA			
Echinometridae			
Echinostrephus aciculatus	Needle-spined urchin	Ind	U
Echinometra mathaei	N/A	Ind	R
HOLOTHURIIDA			
Holothuriidae			
Actinopyga mauritiana	N/A	—	—
Actinopyga obesa	Plump sea cucumber	—	—
Actinopyga varians	White-spotted sea cucumber	—	—

Bohadschia argus	Leopard sea cucumber	Ind	—
Holothuria atra	N/A	Ind	—
SYNALLACTIDA			
Stichopodidae			
Stichopus chloronotus	N/A	Ind	U
Bivalves			
CARDIIDA			
Cardiidae			
Tridacna maxima	Maxima clam, giant clam	Ind	—
Gastropods			
CYCLONERITIDA			
Neritidae			
Nerita plicata	N/A	—	—
NEOGASTROPODA			
Muricidae			
Sistrum albolabris	N/A	—	—
TROCHIDA			
Tegulidae			
Rochia nilotica	Top shell	Ind	—
Sponges			
POECILOSCLERIDA			
Microcionidae			
Clathria (Thalysias) eurypa	N/A	—	—
TETHYIDA			
Hemiasterellidae			
Liosina paradoxa	N/A	—	—

Source: Kilarski et al, 2024
Note: N/A = not applicable.
[a] Status = distributional status for the Mariana Islands: Ind = Indigenous, native to Guam, but not unique to the Mariana Islands.
[b] Abundance: A = Abundant, observed in large numbers and widely distributed; C = Common, observed everywhere, although generally not in large numbers; O = Occasional, seen irregularly in small numbers; U = Uncommon, several to a dozen individuals observed; R = Rare, only one or two individuals observed.

3.4.2.2 Marine Wildlife

Coral

Corals are invertebrates that are related to anemones, jellyfish, and hydras. They are made of invertebrate polyps and can generally be categorized as either hard or soft. Hard corals have calcium carbonate skeletons, grow in colonies, and are reef-building animals that live in symbiosis with phytoplankton called zooxanthellae. Soft corals are flexible, have calcareous particles in their body walls for structural support, can be found in both tropical and cold ocean waters, do not grow in colonies or build reefs, and do not always contain zooxanthellae.

During a marine biological survey conducted along the Inner and Outer Breakwaters in February and March 2024 (Kilarski et al. 2024), data was collected on coral abundance, size-class distribution, and species composition. Table 3-4details the inventory of coral species observed in the Outer Glass Breakwaters during the 2024 survey.

Table 3-4 Inventory of Coral Species Observed in Outer Glass Breakwaters, February and March 2024

Species	Abundance[a]
	Outer Breakwater
Soft Corals	
OCTOCORALLIA	
Helioporidae	
Heliopora coerulea	—
Sinulariidae	
Sinularia sp.	—
Hard Corals	
SCLERACTINIA	
Acroporidae	
Acropora sp.	C
Acropora digitifera	O
Acropora globiceps[b]	O
Acropora humilis	O
Acropora hyacinthus	C
Acropora monticulosa	—
Acropora nana	—
Acropora nasuta	U
Acropora palmerae	O

Acropora polystoma	O
Acropora retusa	R
Acropora tenuis	U
Acropora valida	—
Astreopora ocellata	U
Astreopora gracilis	—
Montipora sp.	O
Montipora informis	—
Agariciidae	
Pavona chiriquiensis	U
Pavona duerdeni	—
Pavona varians	—
Astrocoeniidae	
Stylocoeniella armata	—
Diploastraeidae	
Diploastrea heliopora	U
Euphylliidae	
Euphyllia glabrescens	—
Galaxea fascicularis	—
Fungiidae	
Fungia fungites	—
Lithophyllon concinna	—
Leptastreidae	
Leptastrea sp.	U
Leptastrea purpurea	—
Lobophylliidae	
Echinophyllia orpheensis	—
Lobophyllia hemprichii	—
Lobophyllia robusta	—
Merulinidae	
Astrea annuligera	R
Astrea curta	O

Cyphastrea sp.	—
Dipsastraea pallida	U
Favites sp.	—
Goniastrea sp.	C
Goniastrea edwardsi	—
Goniastrea retiformis	—
Hydnophora microconos	U
Leptoria phrygia	O
Platygyra sinensis	R
Pocilloporidae	
Pocillopora sp.	A
Pocillopora ankeli	C
Pocillopora brevicornis	C
Pocillopora damicornis	—
Pocillopora grandis	U
Pocillopora ligulata	—
Pocillopora meandrina	O
Pocillopora verrucosa	O
Poritidae	
Porites sp.	C
Porites cylindrica	—
Porites lichen	—
Porites rus	C
Psammocoridae	
Psammocora sp.	—
Psammocora nierstraszi	—
ANTHOATHECATA	
Milleporidae	
Millepora exaesa	U
Millepora platyphylla	C

Source: Kilarski et al. 2024
[a] Abundance: A = Abundant, observed in large numbers and widely distributed; C = Common, observed everywhere, although generally not in large numbers; O = Occasional, seen irregularly in small numbers; U = Uncommon, several to a dozen individuals observed; R = Rare, only one or two individuals observed.
[b] ESA-listed species.

Based on the survey results, corals along the Outer Breakwater are generally scarce within two meters of the shoreline and become more abundant, diverse, and larger at approximately the three- to four-meter depth contour. The corals observed often showed signs of mechanical damage. Over the length of the Outer Breakwater, the highest abundance and diversity of corals within two meters of the shoreline occurs in the northeast section nearest the reef flat. The lowest coral cover is found in the in the distal third, including the breakwater tip, from shoreline to the breakwater toe.

Marine Mammals

Jurisdiction over marine mammals is maintained by NOAA Fisheries and the USFWS. NMFS maintains jurisdiction over whales, dolphins, porpoises, seals, and sea lions. The USFWS maintains jurisdiction for certain other marine mammal species, including walruses, polar bears, dugongs, sea otters, and manatees.

While it is common to observe marine mammals in the waters surrounding Apra Harbor (Hill et al. 2014, 2017, 2020; Martin et al. 2016), they are rarely observed within the harbor (Hill et al. 2017). A partially decomposed specimen recognized as a pygmy sperm whale (*Kogia breviceps*) was discovered at Naval Supply Depot Beach at NBG in 1989 (Sherwood 1989, as cited in Eldredge 2003). A group of six or more humpback whales (*Megaptera novaeangliae*) was photographed at the Apra Harbor entrance in January 1996 (Eldredge 2003; McNulty 2013). In 2016, filtered satellite tag locations from short-finned pilot whales (*Globicephala melas*) and a pantropical spotted dolphin (*Stenella attenuata*) were located inside Apra Harbor (Hill et al. 2017). The quality of at least one of the short-finned pilot whale tag locations was sufficient to confirm that the whale was inside the harbor (Hill et al. 2017).

Fish

Fish are vital components of the marine ecosystem. They have great ecological and economic aspects. To protect this resource, NMFS works with the regional fishery management councils to identify the essential habitat for every life stage of each federally managed species using the best available scientific information. EFH has been described for approximately 1,000 managed species to date. EFH includes all types of aquatic habitat including wetlands, coral reefs, seagrasses, and rivers; all locations where fish spawn, breed, feed, or grow to maturity.

Myers and Donaldson (2003) conducted a literature review dating back to 1901 of fish species found in the Mariana Islands and adjacent territorial waters. In total, they listed 1,106 species of fishes known to be found in the region. Approximately 1,020 of the species detailed in the review were found in the inshore and epipelagic zones to a depth of 200 meters, and the vast majority of those fishes inhabit coral reefs.

In Outer Apra Harbor, visual transect surveys conducted at 5-meter depths found variable species richness between 10 sites, ranging from 48 different fish species at Polaris Point to 73 species at San Luis Beach (Schils et al. 2017). Although species richness and diversity varied among sites, the most common species observed among all sites was the bullethead parrotfish (*Chlorurus sordidus*). Fish abundance was also variable, ranging from 748 individuals to over 4,000 individuals observed at each site. Researchers determined that the abundance at most sites was comprised of damselfishes (Pomacentridae) or cardinalfishes (Apogonidae) and noted that cardinalfishes were particularly abundant at a number of protected sites in Outer Apra Harbor. The researchers also noted that two surgeonfishes, brown surgeonfish (*Acanthurus nigrofuscus*) and the striped bristletooth (*Ctenochaetus striatus*), were the most abundant acanthurids among sites.

In addition to benthic composition, coral abundance and distribution, coral species composition, and the presence of ESA-listed species, marine biological surveys conducted specifically for the Proposed Action also assessed fish abundance in multiple locations within the Action Area (Kilarski et al. 2024). Due to hazardous access conditions, fish surveys along the Outer Breakwater were limited to two 50-meter transects adjacent to the entrance to Apra Harbor at water depths of 2 to 5 meters (approximately 7 to 15 feet). Individual fish were identified down to species, when feasible, and qualitative abundance ratings are provided for all species. Over the length of the breakwater, observations generally consisted of large schools of surgeonfishes and parrotfishes, in addition to a few snappers and trevally jack along the edges of the boulders at the toe of the breakwater. Overall, 16 fish species within six families were documented at the Outer Breakwater. A total of 37 individual fishes were observed at the tip of the Outer Breakwater, the majority of which were from the genus *Acanthurus*.

3.4.2.3 Essential Fish Habitat

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. Pursuant to the MSA, federal agencies must consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (MSA Section 305[b][2]). EFH is defined as those waters and substrate necessary to fish (or other species) for spawning, breeding, feeding, or growth to maturity (50 CFR 600.10).

Under the MSA, the United States has exclusive fishery management authority over all fishery resources found within its Exclusive Economic Zone (EEZ). The EEZ extends from the seaward boundary of each coastal state, including any Commonwealth, territory, or possession of the United States, to a distance of 200 nautical miles from the baseline from which the breadth of the territorial sea of the United States is measured (50 CFR 600.10). In the Pacific Islands, EFH has been designated for federally managed species referred to as Management Unit Species (MUS) that are cooperatively managed by NMFS and the Western Pacific Region Fishery Management Council (WPRFMC) (or Council). MUS in the Pacific Islands are fully described in the Council’s Fishery Ecosystem Plans (FEPs) and include bottomfish, crustaceans, coral reef ecosystems, precious coral, and pelagic fish species caught in quantities sufficient to warrant management or monitoring by NMFS and the Council (NMFS 2023c).

The Proposed Action is located within the boundaries of the following FEPs: (1) Fishery Ecosystem Plan for the Mariana Archipelago (WPRFMC 2009a) and (2) Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region (WPRFMC 2009b). The Mariana Archipelago FEP boundary includes all waters and associated marine resources within the EEZ surrounding the Commonwealth of the Northern Mariana Islands and the Territory of Guam (WPRFMC 2009a). Although there is overlap between the Mariana Archipelago FEP boundary and the Pacific Pelagic FEP boundary, the Mariana Archipelago FEP specifically manages demersal resources and habitats associated with the federal waters of the Mariana Archipelago (WPRFMC 2009a). The Pacific Pelagic FEP boundary encompasses all areas of pelagic fishing operations in the EEZ or in the high seas for any domestic vessels that (1) fish for, possess, or transship Pacific Pelagic MUS within the EEZ waters of the Western Pacific Region; or (2) land Pacific Pelagic MUS within the states, territories, commonwealths, or unincorporated U.S. island possessions of the Western Pacific Region (WPRFMC 2009b).

EFH has been designated within the project area for various MUS and life stages including eggs, larvae, juveniles, and adult bottomfish and Pacific pelagic species and all life stages of coral reef fauna and flora that comprise Mariana Islands coral reef ecosystems (NMFS 2024b). In addition to EFH, the Council has designated Habitat Areas of Particular Concern (HAPC) within EFH for all MUS. HAPCs are specific areas that are considered essential to the life cycle of MUS based on one or more of the following criteria: (1) the ecological function provided by the habitat is important; (2) the habitat is sensitive to human-induced environmental degradation; (3) development activities are, or will be, stressing to the habitat type; or (4) the habitat type is rare (WPRFMC 2009a, 2009b). For Pacific pelagic species, HAPC is designated as the water column down to 1,000 meters that lie above all seamounts (i.e., undersea mountains) and banks within the EEZ shallower than 2,000 meters (WPRFMC 2009b) and is therefore not located within the project area in Apra Harbor. The Council designated all slopes and escarpments between 40 and 280 meters as HAPC for bottomfish, based on the known distribution and habitat requirements of adults (WPRFMC 2009a); these areas are not present within the project area.

One coral reef ecosystem HAPC has been designated in the Commonwealth of the Northern Mariana Islands, and five have been designated in Guam (WPRFMC 2009a). Of those HAPC areas that occur near Guam, one is located in Apra Harbor: Jade Shoals. Jade Shoals is considered a coral reef ecosystem HAPC due to rarity of habitat, ecological function, and susceptibility to human impact (WPRFMC 2009a). Although Jade Shoals is located within Apra Harbor, it is approximately 3.9 km (2.4 miles) east of the southernmost extent of Glass Breakwater and is therefore outside of the Action Area for the Proposed Action.

Table 3-5. Essential Fish Habitat within the Proposed Action Area

MUS	Species Complexes	Description of EFH in Action Area	HAPC in Action Area?
Pelagic	Temperate species Tropical species Sharks Squid	Eggs and larvae: the water column down to a depth of 200 meters (100 fathoms) from the shoreline to the outer limit of the EEZ. Juveniles and adults: the water column down to a depth of 1,000 meters (500 fathoms) from the shoreline to the outer limit of the EEZ.	No HAPC located within Apra Harbor or the Action Area.
Bottomfish	Shallow-water species (0–50 fathoms) Deep-water species (50–200 fathoms)	Eggs and larvae: the water column extending from the shoreline to the outer limit of the EEZ down to a depth of 400 meters (200 fathoms). Juveniles and adults: the water column and all bottom habitat extending from the shoreline to a depth of 400 meters (200 fathoms), encompassing steep drop-offs and high-relief habitats that bottomfish use throughout the Western Pacific Region.	No HAPC located within Apra Harbor or the Action Area.
Coral Reef Ecosystems	All currently or potentially harvested coral reef taxa[a]	Includes the water column and all benthic substrate to a depth of 50 fathoms from the shoreline to the outer limit of the EEZ.	Jade Shoals HAPC located within Apra Harbor but not within the Action Area.

Source: WPRFMC 2009a, 2009b.
Note: 1 fathom = 6 feet = 1.8 meters. Units provided in table are reported as presented in applicable FEPs (see Table 25 in WPRFMC 2009a and Table 14 in WPRFMC 2009b). EEZ = Exclusive Economic Zone; EFH = Essential Fish Habitat; HAPC = Habitat Areas of Particular Concern ; MUS = Management Unit Species.
[a] Currently harvested coral reef taxa include a variety of species assemblages (e.g., fishes, sharks, octopuses, eels, and turban shells) that are currently being harvested in state and federal waters (and for which some fishery information is available) and species that are likely to be targeted in the near future based on historical catch data. Potentially harvested coral reef taxa include “literally thousands of species encompassing almost all coral reef fauna and flora” (WPRFMC 2009a).

3.4.2.4 Threatened and Endangered Species

Threatened and endangered marine species protected under the ESA with NMFS jurisdiction that are reasonably likely to occur in the project area (Table 3-6) were identified from previous Navy Mariana Islands Training and Testing Supplemental Environmental Impact Statements/Overseas Environmental

Impact Statements (DoN 2015, 2020a), the Navy Marine Resources Assessment for the Marianas Operating Area (DoN 2005), Biological Opinions (NMFS 2020a), Navy Biological Assessments (NAVFAC and AECOS Inc. 2021), the Integrated Natural Resources Management Plan (INRMP) for Joint Region Marianas (DoN 2022), Biological Reports (NMFS 2023a), the NMFS ESA Critical Habitat Mapper (NOAA Fisheries 2024b), and recent biological surveys conducted in Apra Harbor (Gaos et al. 2020a, 2020b; Budd et al. 2023;Kilarski et al. 2024).

Table 3-6 lists the marine ESA-listed species that may be encountered during the Proposed Action.

Table 3-6 Threatened and Endangered Species Known to Occur or Potentially Occurring in the ROI and Critical Habitat Present in ROI

Scientific Name	*Common Name and DPS*	*Federal Status*	*Habitat*	*Presence in Action Area*	*Critical Habitat Designated in the Action Area*
Sea Turtles					
Chelonia mydas	Green turtle, Central West Pacific DPS	Endangered	Nearshore waters, nesting beaches, and offshore waters	Yes[a]	Nesting Areas: No Marine Areas: Proposed
Eretmochelys imbricata	Hawksbill turtle			Yes[a]	No
Fish					
Sphyrna lewini	Scalloped hammerhead shark, Indo-West Pacific DPS	Threatened	Coastal seas from intertidal to depths of 1,640 feet (500 meters); nearshore nursery habitat includes bays and estuaries	Yes[b]	No
Invertebrates					
Acropora globiceps	Hard coral	Threatened	Intertidal zone, upper reef slopes, and reef flats at depths <8 meters (<26 feet)	Yes	No, see Section 4.4.3 for exclusion
Tridacna derasa[c] *Tridacna squamosa* *Tridacna gigas*[d] *Hippopus hippopus*[d]	Giant clam Hi	Candidate	Shallow reefs, outer reef slopes, lagoons, and sandy bottoms	No	No

Source: 80 FR 221; Gaos et al. 2020a, 2020b; DoN 2022; NOAA Fisheries 2024c; Kilarski et al. 2024.
Note: DPS = Distinct Population Segment.
[a] Indicates nesting activity near the Action Area. Source: Gaos et al. 2020a, 2020b; NMFS 2023a.
[b] Apra Harbor may contain nursery habitat, but this supposition is based only on anecdotal observations of juvenile sharks in Sasa Bay and both adults and juveniles in the channel connecting Inner Apra Harbor and Sasa Bay (80 FR 221; DoN 2022).
[c] Likely to be functionally extinct on Guam. Source: Wells 1997; Paulay 2003b.
[d] Locally extinct on Guam. Source: Teitelbaum and Friedman 2008.

Sea Turtles

Of the six sea turtle species that are found in U.S. waters or that nest on U.S. beaches, all are designated as either threatened or endangered under the ESA. Sea turtles are highly migratory and utilize the waters of more than one country in their lifetimes. The USFWS and NOAA Fisheries share federal jurisdiction for sea turtles with the USFWS having lead responsibility on the nesting beaches and NOAA Fisheries, the marine environment. Population trends of green turtles vary among regions and nesting populations. In 2016, NOAA Fisheries and the USFWS issued a final rule to identify 11 populations as distinct population segments (DPS). The Central West Pacific DPS was classified as an “endangered” population due to their depleted status and continuing vulnerability (NOAA-NMFS & USFWS, 2016).

Green and hawksbill turtles are often associated with coral reef habitat (Becker et al. 2019). Based on vessel-based survey observations and captures as well as the analysis of Guam aerial survey data, the following areas appear to have high turtle density: (1) nearshore waters inside Apra Harbor near San Luis Beach and Gab Gab Beach; (2) nearshore waters near Spanish Steps; and (3) nearshore waters near Dadi Beach and Tipalao Beach outside of the harbor to the south (Gaos et al. 2020a). These areas are dominated primarily by patch reef communities where the sea turtles both forage and rest (Gaos et al. 2020a). Sea turtle densities are highest where there are healthy coral reefs and seagrass beds, low human densities, and marine protected areas (Martin et al. 2016). Though human population density is correlated with sea turtle density, a major concern is coastal development and the resulting degradation of nesting beaches and foraging areas. Threats to nesting beaches include construction and associated lighting, military activities such as testing and training, public use of beaches, and beach driving (NMFS and USFWS 1998a; 81 FR 20057). Vessel collisions may pose a risk to sea turtles in the nearshore waters of Apra Harbor and western Guam (DoN 2020a). Last, changes in temperature and climate change may cause nesting beach habitat to shift or disappear, changing the significance or position of nearby marine reproductive zones (88 FR 46693).

The Central West Pacific DPS green turtle is the most commonly observed sea turtle in the waters off Guam (Wiles et al. 1995; Martin et al. 2016; DoN 2022). Green turtles use the nearshore waters of Apra Harbor and Outer Apra Harbor and nest on three beaches within NBG Main Base: Spanish Steps, Dadi Beach, and Kilo Wharf (DoN 2022). Regular surveys of green turtle nests are carried out at Dadi Beach and Spanish Steps. During the nesting season, inspections are also occasionally carried out at other beaches on the NBG Main Base such as Gab Gab, San Luis, Polaris Point, and Tipalao, which may support sea turtle nesting (DoN 2022). The Spanish Steps at Orote Point are considered one of the main nesting sites on the island of Guam (Gaos et al. 2020a). Nesting activity is observed mainly from March through July, with some activity from December through February (DoN 2022). Based on the construction schedule, the Proposed Action will not overlap with the sea turtle nesting season.

In 2023, NMFS and the USFWS proposed additional critical habitat areas for threatened and endangered DPSs of green turtles in locations under U.S. jurisdiction (NMFS 2023a; 88 FR 46376; 88 FR 46572; 88 FR 46693). In accordance with the ESA, NMFS proposed critical habitat for DPSs of the green turtle that are vulnerable or endangered in regions under U.S. control to include the nearshore waters off the coast of Guam. NMFS proposed critical habitat includes marine portions of the project area and would extend from the mean high-water line to a depth of 20 meters to protect access to nesting beaches, migratory corridors, and important feeding and resting areas (88 FR 46572). Concurrently, the USFWS proposes to designate terrestrial habitat for five DPSs of green turtles as critical habitat, which includes the Central West Pacific DPS (88 FR 46376). This designation includes lands where green turtles bask, nest, incubate, hatch, and travel to the sea. One acre of critical habitat for green turtles has been proposed by USFWS inside Apra Harbor, but is not within the Proposed Action Area. No other critical habitat is designated or proposed near the Proposed Action.

Compared to green sea turtle, hawksbill turtle occurs in low numbers in Guam waters and does not occur in large numbers anywhere within the Marianas (NMFS and USFWS, 2007; Martin et al., 2016, as cited in DON, 2018) except possibly around Rota. Hawksbill turtles have been seen within all areas of Apra Harbor, which may provide important foraging and resting areas for this species (Kolinski, 2001; Smith et al., 2009; Brindock, 2015; Guam DAWR, 2015; Jones et al., 2015, in DON 2018). Two sightings of hawksbill sea turtles occurred along Orote Peninsula: one in November 2003 and the other in October

2004 (Smith & Marx, 2006). No hawksbill turtles were observed in the 2019 and 2020 biological surveys of the project area (NAVFAC Marianas, 2019, 2020 in NAVFAC Pacific, 2021). The portion Glass Breakwater to be repaired under the Proposed Action is unlikely to support hawksbill turtle nesting activity due to its rocky shoreline and limited amount of sandy coastal habitat (DoN 2022).

Scalloped Hammerhead

The scalloped hammerhead shark is a warm-water species distributed widely throughout the tropics and composed of four endangered or threatened DPSs (Miller et al. 2014). All scalloped hammerhead sharks near Guam are included in the Indo-West Pacific DPS, which was listed as threatened in 2014 (79 FR 38213). There have been few confirmed sightings of scalloped hammerhead sharks in Guam; both confirmed and anecdotal sightings have been rarely reported since 1968 (Kami 1971; MacNeil et al. 2020). Recent environmental DNA (eDNA) studies have confirmed the occurrence of scalloped hammerhead shark eDNA within Apra Harbor at both Inner Apra Harbor and Orote Point (Budd et al. 2021). Budd et al. (2021) report that this represents the first confirmed occurrence since the sighting reported in 1968 by Kami (1971). Further studies have positively identified scalloped hammerhead shark eDNA collected from the Inner Harbor, Sasa Bay, Orote Point, Middle Shoals, and Blue Hole during a monthly study from February 2019 to July 2020 (Budd et al. 2023). Sasa Bay has previously been suggested as a potential nursery area based only on anecdotal observations (Miller at al. 2014). Budd et al. (2023) documented positive detections of scalloped hammerhead sharks in most months of the year but most commonly from September through April. Detections occurred in nearly all months in Inner Apra Harbor (Budd et al. 2023), with other locations being more sporadic. No further evidence of Sasa Bay acting as a nursery has been identified, and no mention of Sasa Bay was included in the most recent 5-year status review by NMFS (NMFS 2020b). Furthermore, the high level of human activity and the lack of quality habitat in Inner Apra Harbor may limit their presence in the area (DoN 2019a), and no critical habitat has been designated or proposed in Apra Harbor. With the lack of observational evidence, large numbers of scalloped hammerhead sharks are unlikely to occur in the project area, and the likelihood of encountering a solitary shark is remote.

Hard Coral

Acropora globiceps is a reef-building, branching hard coral species found in the Indo-Pacific that was listed as threatened under the ESA by NMFS in 2014 (79 FR 53852).On Guam, *A. globiceps* is widely distributed on reef flats and upper reef slopes around the island and seems to favor conditions where reasonably intense wave motion is possible (DoN 2022; NMFS 2023b). It has the most records (n = 24) from different places on Guam among the federal ESA-listed species that are known to occur there (DoN 2022). In Apra Harbor, coral-supporting shallow reef flats are present in Sasa Bay, San Luis, Gab Gab, and Spanish Steps (DoN 2022).

Coral assessments in 2010 for a proposed aircraft carrier wharf in Apra Harbor did not record *A. globiceps* as being present (DoN 2022). During a non-systematic search of the nearshore area at Dadi Beach in September 2016, a solitary colony measuring roughly 25–30 centimeters (10–15 inches) across was discovered from the reef crest south of Dadi Beach (DoN 2022). Biological monitoring near Kilo Wharf also revealed the presence of *A. globiceps* (Schils et al. 2011, as cited in DoN 2022), which has not been documented in that area of the harbor since the survey (DoN 2022). During recent marine biological surveys conducted in February and March 2024 for this Project, 29 colonies of *A. globiceps* were located in the Proposed Action Area (Kilarski et al. 2024).

Giant Clam

In June 2017, NMFS published a 90-day finding and concluded that seven species of giant clams may be eligible for listing under the ESA (82 FR 28946). The seven candidate species include two species in the genus Hippopus (*H. hippopus* and *H. porcellanus*) and five species in the genus Tridacna (*T. derasa, T. gigas, T. mbalavuana* [tevoroa], T. *squamosa*, and *T. squamosina* [costata]) (82 FR 28946). A status review is currently underway for these species, and the proposed listing(s) have not yet been determined as warranted.

Four of the seven candidate giant clam species have been known to occur in Guam (*Hippopus hippopus, Tridacna derasa, T. gigas*, and *T. squamosa*) (Paulay 2003b; bin Othman et al. 2010). *H. hippopus* and *T. gigas* are considered to be extirpated, or locally extinct, on Guam (Teitelbaum and Friedman 2008). Wells (1997) reported *T. derasa* as extinct on Guam and the Northern Mariana Islands, and that T. squamosa may also be extinct on Guam. In 1982, Guam's Department of Agriculture started a giant clam restocking program to translocate three species of giant clams (*T. derasa, T. gigas*, and *T. squamosa*) to Guam (Teitelbaum and Friedman 2008). The translocated *T. derasa* species were introduced from Palau, and while the introduced animals survived, no recruitment has been observed (Paulay 2003b). The attempt to translocate *T. gigas* to Guam was unsuccessful (Paulay 2003b). Starting in 2021, there have been new and increased efforts to develop community-run giant clam aquaculture projects on Guam, particularly in two southern villages, Inalåhan and Malesso (NOAA Fisheries 2022). Initially, giant clams were collected from various Guamanian reefs and planted into Inalåhan tide pools located on the southeast side of the island. A more recent effort funded by NOAA has led the Aquaculture Association of Palau to supply Guam with 1,000 giant clams (*T. maxima*), some of which will serve as broodstock for future projects (NOAA Fisheries 2022; NMFS Letter of Concurrence [LOC] PIRO-2021-03457). No ESA-candidate giant clam species have been translocated as part of the aquaculture effort that began in 2021.

Tridacna maxima, commonly known as the small giant clam or maxima clam, is the most common giant clam species found on Guam (Smith et al. 2009; Wells 1997). While *T. maxima* was one of the giant clam species petitioned, it was not listed as one of the candidate species (82 FR 28946). *T. maxima* have been found widely dispersed across the Orote Peninsula ERA and Dadi Beach outside of Apra Harbor (Smith et al. 2009).

During marine biological surveys for Apra Harbor waterfront repairs, giant clams (*Tridacna* spp.) were located three times in the Outer Breakwater (Kilarski et al. 2024). The marine biological survey report does not identify which species of giant clams were observed. While it is more probable that all observed giant clam species were *T. maxima*, there is a remote possibility that some individuals could be the ESA-candidate species *T. squamosa*.

Candidate species have no protections under the ESA, therefore ESA-candidate *Tridacna* spp. are not discussed beyond this section in this assessment. As a candidate species, no critical habitat for the Tridacninae giant clams is proposed or designated in the project area.

3.4.3 Environmental Consequences

This analysis focuses on marine vegetation and non-coral benthic invertebrates, and marine wildlife that are important to the function of the ecosystem or are protected under federal law or statute.

3.4.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. However, there could be impacts to biological resources if the breakwater continues to degrade and erode. As noted in 2024 benthic surveys, damage on the Outer Breakwater is already occurring in the form of boulder slides and locations where boulders were dislodged from the above-water structure and into the sea (Kilarski et al. 2024). Underwater locations of rockslides were indicated by the presence of white limestone boulders devoid of marine growth. Some boulders were also sheared and broken into pieces. (Kilarski et al. 2024). Continued erosion of rock and stone along the slope would occur, thus further damaging marine vegetation and non-coral benthic invertebrates, threatened and endangered corals, and associated EFH. Therefore, significant impacts to biological resources could occur with implementation of the No Action Alternative.

3.4.3.2 Alternative 1- Natural Rock Armor Layer Repair Potential Impacts

The study area for the analysis of effects to biological resources associated with Alternative 1 includes marine waters directly surrounding the Guam Glass Breakwater.

Marine Vegetation and Non-Coral Benthic Invertebrates

Alternative 1 is unlikely to result in significant effects to marine vegetation and non-coral benthic invertebrates. Construction activities will be contained within the existing breakwater footprint, and repairs will likely be carried out using a land-based crane from the top of the existing breakwater. The areas requiring repairs will focus on sections of the breakwater that are in critical condition. These areas are located on the oceanside (outer) portion of the existing breakwater. Any in-water work has the potential to impact marine vegetation and non-coral benthic invertebrates; however, based on the nature of the Proposed Action and the proposed BMPs described, most elements of the Proposed Action are expected to have minimal and temporary impacts. Therefore, the project would have less than significant impacts on marine vegetation and non-coral benthic invertebrates.

Marine Wildlife

Marine Mammals

Alternative 1 is unlikely to result in significant effects to marine mammals. Concrete armor units and armor rocks will be placed in water carefully because each unit must interlock with its neighbors to form a strong structure. Careful placement will minimize noise levels associated with armor placement. Based on the rarity of marine mammal sightings within Apra Harbor, the limited size of the project area along outer shorelines of Glass Breakwater, and the 46-meter (50-yard) shutdown zone for marine mammals, no effects on marine mammals from the Proposed Action are anticipated. No critical habitat for marine mammals is designated in the project footprint.

Essential Fish Habitat

The MSA defines an adverse effect on EFH as “any impact that reduces quality and/or quantity of EFH,” including direct or indirect physical, chemical, or biological alterations of waters or substrate and loss of or injury to benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH (50 CFR 600.10). Adverse effects on EFH may result from actions occurring directly within EFH or outside of EFH and may include site-specific or habitat-wide impacts including individual, cumulative, or synergistic consequences of actions. As noted previously, the WPRFMC has designated EFH and management objectives for various life stages of three MUS that occur within, occur near, or are dependent on the Action Area: bottomfish MUS, pelagic MUS, and MUS associated with coral reef ecosystems. In the absence of detailed survey data, it is assumed that all life stages of some species from each of the three MUS could occur within the Action Area.

The Project-specific marine biological surveys documented a modest community of sessile (i.e., fixed in place) invertebrates and algae and a diverse assemblage of fish along the inner and outer portions of the breakwater. Observed fish consist of juveniles and adults from a variety of species typically found in coral reefs, including some from the genera described in the Mariana Archipelago FEP for shallow-water complex bottomfish that occur at depths of less than 100 meters (i.e., *Lethrinus*, *Cephalopholis*, and *Caranx*). Relative to bottomfish MUS and pelagic MUS, none of the fish species specifically listed in the Mariana Archipelago FEP or Pacific Pelagic FEP were observed within the study area. However, numerous MUS that are designated as "Currently Harvested Coral Reef Taxa" in the Mariana Archipelago FEP (see Table 21 and Table 22 in WPRFMC 2009a) were observed during the Project-specific marine biological surveys (e.g., various species of surgeonfishes [Acanthuridae], wrasses [Labridae], and parrotfishes [Scaridae]). As noted previously, the ESA-listed coral *A. globiceps* was observed in small numbers along the Outer Breakwater.

The Proposed Action involves emergency resetting of existing armor rock and concrete units that have shifted in position, and placing new armor rock or concrete armor units to rebuild the Glass Breakwater to engineering standards. Construction activities will be contained within the existing breakwater footprint, and repairs will likely be carried out using a land-based crane from the top of the existing breakwater. The areas requiring repairs will focus on sections of the breakwater that are in critical condition. These areas are located on the oceanside (outer) portion of the existing breakwater.

The Navy conducted EFH consultation with NMFS and determined that the Proposed Action has the potential to impact EFH in the marine environment. By email correspondence dated October 22, 2024, NMFS agreed with the Navy's EFH determination that the Proposed Action is expected to have minimal and temporary impacts and risks of adversely affecting EFH (Table 3-7). NMFS also proposed conservation recommendations to help further avoid and minimize potential adverse effects to EFH. A summary of these conservation recommendations are below and in Appendix B.

Conservation Recommendation 1: If in-water repairs must take place and unavoidable loss of coral or important cover that cannot recolonize quickly, such as crustose coralline algae, can be reasonably thought to have occurred, document the number of colonies and/or area lost in order for the loss to be incorporated into the mitigation for the imminent major repairs of the Glass Breakwater. Share the information with NMFS within 60 days of the losses. The temporal lag between the loss and the upcoming mitigation should be taken into account when estimating offset.

- If the losses occur within the first 2.0 m (6.6 ft) of the HTL can be observed, directly measure the loss through observation.

- If the losses occur within the first 2.0 m (6.6 ft) of the HTL and cannot be observed because assessment is unsafe or impractical, estimate the area affected and use the mean density estimate of 1.3 coral colonies/m2 (0.12 colonies/ft2) to estimate the loss.
- If losses occur beyond 2.0 m (6.6 ft) of the HTL because of unforeseen circumstances or accident, attempt to document and estimate the losses with a drop camera, drone, remotely operated vehicle, or divers.

Conservation Recommendation 2: Consider removing construction equipment and stockpiled material from the top of the Glass Breakwater in the event of extreme foul weather (i.e., tropical storms and hurricanes). Equipment that becomes marine debris may be more of a threat to the environment than armor stones moved by waves.

Table 3-7 shows that potential effects on EFH may result from exposure to the following environmental stressors:

- Removal of Marine Invertebrate Community
- Increased Turbidity and Suspended Sediments
- Elevated Noise Levels
- Wastes and Discharges
- Aquatic Invasive Species
- Chemical Contaminants
- Hypoxia

The Proposed Action will temporarily reduce water quality due to an increase in turbidity and suspended sediments during in-water work. Adverse effects will be minimized through the implementation of numerous BMPs including, but not limited to, avoiding in-water work during coral spawning periods, limiting construction to within 2 m (6.56 ft) of the high tide line, and safe equipment use and management. Due to implementation of appropriate BMPs, the relative quantity and quality of existing EFH within the Action Area, and the size and scale of anticipated effects, the Proposed Action is not expected to appreciably diminish habitat value over the long term. In addition, considering the actions will be beneficial to EFH over the long term, the project would have less than significant impacts on EFH.

Table 3-7 Summary of Potential Effects of the Proposed Action on EFH

Environmental Stressor	Probability of Occurrence	Severity[a]	Risk Level[b]	Anticipated Effects on EFH	Measures to Minimize Adverse Effects
Removal and relocation of marine invertebrate community	Unlikely	Significant	Low	• Temporal loss of ecological function and habitat structure	• Safe equipment use and management • Avoid work during coral spawning periods • Minimizing in-water work to greatest extent possible and no more than 2 m from HTL
Increase in turbidity and suspended sediment	Unlikely	Moderate	Low	• Temporary reduction in water quality in the immediate Project footprint.	• Avoid work during coral spawning periods • Erosion control practices • Inclement weather contingency • Careful and precise placement of armor rocks
Elevated underwater noise levels	Unlikely	Moderate	Low	• Temporary degradation of underwater soundscape for the duration of pile installation and removal. • Risk of exposure during other activities unlikely due to implementation of minimization measures and BMPs.	• Safe equipment use and management
Wastes and discharges Aquatic invasive species Chemical contaminants Hypoxia	Unlikely	Negligible	Low	• Risk of exposure unlikely due to implementation of minimization measures and BMPs	• Safe equipment use and management • Oil spill contingency plans

Note: BMPs = best management practices; EFH = Essential Fish Habitat.
[a] Level of severity (i.e., negligible, moderate, or significant) is determined by the anticipated intensity, duration, and frequency of exposure to a particular environmental stressor.
[b] Risk level (i.e., low, moderate, or high) provides an overall summary of the likelihood of potential effects of the Proposed Action ("Probability of Occurrence") combined with the potential severity of exposure to a particular environmental stressor ("Severity").

Threatened and Endangered Species

Under the ESA, the effects of the action refer to the direct and indirect effects of an action on the species or critical habitat together with the effects of other activities that are interrelated or interdependent with that action and that would be added to the environmental baseline. Indirect effects are those that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur (50 CFR § 402.02). Section 7(a)(2) states that each Federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species, or destroy/adversely modify designated critical habitat, as is responsible for making one of the following effects determinations: No Effect; May Affect, but Not Likely to Adversely Affect; or Likely to Adversely Affect.

The Navy initiated informal consultation with NMFS under ESA Section 7 (Appendix B). In its assessment, the Navy considered potential impacts resulting from the Proposed Action on ESA-listed species that may occur within the Action Area. The Navy also considered project designs and BMP measures that would be implemented to avoid and/or minimize such anticipated impacts to the greatest extent practicable. Based on the anticipated low occurrence of ESA-listed species within the project area, the Navy determined that Proposed Action is not likely to adversely affect ESA-listed species, as such adverse effects have been determined either insignificant or discountable.

The Proposed Action has the potential to affect the following ESA-listed species: the endangered Central-West Pacific DPS of green turtle (*Chelonia mydas*), the endangered hawksbill turtle (*Eretmochelys imbricata*), the threatened Indo-West Pacific DPS of scalloped hammerhead shark (*Sphyrna lewini*), and the threatened *Acropora globiceps* hard coral.

The following environmental stressors were evaluated:

- Elevated Noise Levels
- Increased Suspended Sediments
- Disturbance from Human Activity and Equipment Operation
- Direct Physical Contact
- Wastes and Discharges
- Entanglement

Table 3-8 ESA- Listed Species Environmental Risk Assessment Summary

Environmental Stressor	Probability of Occurrence	Severity[a]	Exposure to Consequences of Proposed Action: Risk Level[b]	Measures to Offset Effects of Action	Risk Assessment for ESA-listed Turtles and Sharks[c]	Risk Assessment for ESA-listed Corals[c]
Elevated underwater noise levels	Unlikely	Negligible	Low	• Marine fauna observers • Shutdown zone	Insignificant	Discountable
Increased suspended sediments	Unlikely	Negligible	Low	• Erosion control practices • Avoiding in-water work, and if so limiting to 2 m from high tide line • Inclement weather contingency • Avoid work during coral spawning	Insignificant	Discountable
Disturbance from human activity and equipment operation	Unlikely	Negligible	Low	• Shutdown zone • equipment use & management • Safe vessel use & management	Discountable	Insignificant
Direct physical contact	Unlikely	Moderate	Low	• Marine fauna observers • Shutdown zone • Safe equipment use & management • Debris containment • Oil spill contingency plans • Avoiding in-water work, and if so limiting to 2 m from high tide line	Discountable	Insignificant
Wastes and discharges	Unlikely	Negligible	Low	• Debris containment • Oil spill contingency plans	Discountable	Discountable
Entanglement	Unlikely	Negligible	Low	• Debris containment • Marine fauna observers	Discountable	Discountable

Note: ESA = Endangered Species Act of 1973.

[a] Level of severity (i.e., negligible, moderate, or significant) is determined by the anticipated intensity, duration, and frequency of exposure to a particular environmental stressor.

[b] Risk level (i.e., low, moderate, or high) provides an overall summary of the likelihood of potential effects of the Proposed Action ("Probability of Occurrence") combined with the potential severity of exposure to a particular environmental stressor ("Severity").

[C] Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

The following sections summarize potential impacts to ESA-protected species from the expected environmental stressors. Detailed discussion on each stressor and its expected impacts on ESA species is found in Appendix B (NAVFAC Pacific, 2021).

Sea Turtles and Scalloped Hammerhead Shark

The Proposed Action is expected to have minimal impacts and risks to sea turtles and the scalloped hammerhead shark (Table 3-8) due to the low likelihood of their occurrence in the project area, in addition to the BMPs incorporated into the project design.

On-shore critical habitat for the green turtle has been proposed by USFWS but not yet designated (88 *Federal Register* [FR] 46376). One acre of critical habitat for green turtles has been proposed inside Apra Harbor, but it is not located along the section of Glass Breakwater planned for repair. In the same *Federal Register* publication, NMFS concurrently proposed in-water critical habitat for the green turtle that includes the nearshore waters off the coast of Guam from the mean high-water line to a depth of 20 meters to protect access to nesting beaches, migratory corridors, and important feeding and resting areas (88 FR 46572). This proposed critical habitat is located along the section of Glass Breakwater planned for repair. No critical habitat for other ESA-listed species has been proposed for or is designated in Apra Harbor.

<u>Noise</u>

The Proposed Action has the potential to produce temporary and intermittent elevated in-air and underwater noise levels. Activities that have the potential to produce elevated in-air and underwater noise include:

- Placement of armor rock and concrete armor units above the water
- Placement of armor rock and concrete armor units in water
- Equipment use on the Glass Breakwater road

The Proposed Action does not overlap with the green turtle nesting season (March through July, with some activity seen from December through February [DoN 2022]), and none of the activities associated with the Proposed Action are likely to generate noise levels in air that extend to areas used by nesting sea turtles. Nesting beaches do not occur in the Action Area, and nesting is not known to occur along the areas planned for repair or construction staging areas on the Glass Breakwater.

Concrete armor units and armor rock will not be dropped onto the breakwater. Placement of concrete armor units and armor rock in water will take place with intention, as each unit must interlock with its neighbors to form a strong structure. Careful placement will reduce in-air noise levels. Operation of heavy equipment, such as a crane or trucks carrying armor rock along the breakwater road is highly unlikely to generate sound or vibration levels high enough to disturb marine animals in the water column. Sound does not transmit well through the air-water interface, and most of the sound energy moving from air to water will be scattered and dispersed in the irregular, rocky nearshore environment. Additionally, BMPs will be implemented to avoid potential exposure to elevated noise.

In-water noise will be generated if concrete armor units and armor rock need to be placed in water. As described above, placement of armor is an exacting process, and armor will not be dropped into the water but will be placed carefully in each location, minimizing noise and sediment displacement. Implementation of BMPs will avoid potential exposure to elevated noise.

High ambient in-water noise levels are likely to result from regular harbor traffic. As a result, any sea turtles and scalloped hammerhead sharks in the area may already be habituated to moderate levels of anthropogenic noise.

No elements of the Proposed Action have the potential to generate sound levels intense enough to cause injury or harm to marine species likely to occur in the Action Area. In addition, implemented BMPs will further reduce the potential for acoustic impacts, as all in-water work will stop when an ESA-listed sea turtle or shark approaches or is sighted within a shutdown zone of 46 meters (50 yards) of the proposed in-water work.

Increased Suspended Sediments

The Proposed Action is unlikely to increase suspended sediments in the water column during armor rock placement. Ship traffic within the harbor is known to increase suspended sediments in the water column. The process of placing concrete armor units on existing armor or bedding stone may cause silt to be deposited into the marine environment from movement of the armor or from runoff, but the armor rocks will be placed precisely to avoid this to the maximum extent. Additionally, construction activities and agitation of the existing breakwater may result in sediment deposition into marine waters.

The introduction of silt to the marine harbor may increase turbidity. This increase may worsen with the creation of sediment plumes due to removal and the placement of armor rock. Sediment plumes from the removal and placement of armor rock along the Outer Breakwater are expected to dissipate quickly due to high wave and current energy and be temporary in nature. Direct impacts of suspended sediments on sharks and sea turtles are understudied and generally unknown. However, ESA-listed species that use vision to locate prey may be temporarily disadvantaged by increases in turbidity, as it reduces their ability to locate prey. Reduced visibility may also impact the ability of ESA-listed species to avoid predators (Johnson 2018). Shark respiration may be altered by increased suspended sediment in the water column if introduced to respiratory pathways. Respiratory impacts are not anticipated to affect sea turtles, as they respire with air from the terrestrial environment.

While mobile ESA-listed species may be able to depart from areas if increased suspended sediments disrupt their typical behavior, the ability to flee may be negated if plumes are created that are large enough to confine these species (Johnson 2018). However, because rocks would be placed individually and methodically, sediment plumes are not expected, let alone plumes large enough to have an effect on these species. Further, BMPs will be implemented to minimize the effects of sedimentation to the greatest extent possible.

Disturbance from Human Activity and Equipment Operation

The Proposed Action will increase human activity and equipment use within and adjacent to the marine environment for the duration of the Project.

Project-related activity in the Action Area will increase human presence, ambient noise levels, and potential for interaction with ESA-listed sea turtles and sharks. However, Apra Harbor is a site of regular human and mechanical activity onshore and in the water, and animals that enter and remain in Apra Harbor are expected to be habituated to some degree to human activity. Despite their likely habituation to ambient activity levels, increased human activity has the potential to disturb normal behavior of ESA-listed sea turtles and sharks in Apra Harbor. Expected reactions range from benign investigation of or attraction to the activity, avoidance of the area, or the extreme, panicked fleeing with potential self-injury during flight.

Green and hawksbill turtles are known to be present in Apra Harbor, although occurrences are expected to be rare for hawksbill turtles and low for green turtles. In the unlikely case that either species swims into the marine portion of the Action Area, it is expected that they will avoid Project activity along the nearshore and affected in-water work areas. Because scalloped hammerheads have not been visually observed in the harbor for over a decade, it is unlikely that they occur in numbers or at frequencies that would expose individual sharks to Project-related disturbance.

BMPs will be implemented to ensure that intentional interactions with ESA-listed sea turtles and sharks are avoided and that unintentional interactions are minimized to the greatest extent practicable. In-water work is limited to 2m from the high tide line, which avoids these species altogether, as sea turtles have not been observed resting or nesting along this portion of the shore.

Direct Physical Contact

The Proposed Action involves the use of heavy and handheld machinery. All of this machinery will be operated from land and will only minimally enter the water when placing the armor rock. Project activities occurring in water have an unlikely potential for direct physical contact with ESA-listed sea turtles and sharks. With BMPs in place to avoid intentional interactions with ESA-listed sea turtles and sharks, the potential for direct physical impact by heavy machinery or equipment operated in the marine environment is discountable. Direct physical impact of ESA-listed marine species will be avoided to the greatest extent practicable through the implementation of BMPs.

Wastes and Discharges

The Proposed Action will utilize heavy equipment and machinery nearshore for the placement of armor rock in water. The use of such equipment presents potential risks to the marine environment from leaked fuel, petroleum lubricants, and other hydrocarbon-based pollutants, exposing ESA-listed species to toxic substances.

Chemical pollutants resulting from accidental spills and discharge from construction activities harm biologically important nearshore ecosystems and can result in mortality of ESA-listed species including sea turtles (NMFS and USFWS 1998a). If released in large quantities, the toxic substances may cause avoidance of the affected area, serious injury, or, in severe cases, death. The effects of pollutants and contaminants on scalloped hammerhead sharks have not been conclusively determined; however, it is likely contaminants bioaccumulate in this species because of their role as an apex predator in the marine ecosystem (84 FR 46938). If a chemical is accidentally discharged or spilled during the Project, it is likely that the quantity would be small in volume (e.g., less than 25 liters [DoN 2020b, as cited in NMFS 2020c]); however, due to the implementation of BMPs, it is unlikely that this event would occur.

The severity of marine debris as a threat in Guam is unknown (NMFS and USFWS 1998a); however, the effects can be severe (Nama et al. 2023). Project wastes such as plastic trash or bags are especially of concern due to the risk of ingestion or entanglement (NMFS and USFWS 1998a). In marine vertebrate species, marine debris can result in dietary dilution, ingestion of contaminants, digestive blockage and tearing (Domènech et al. 2018), restricted mobility, drowning, starvation, smothering, and wounding, potentially leading to infections, amputation of limbs, and death (Gamage and Senevirathna 2020). The leaching of chemicals from marine debris, specifically of plastic debris, could result in compromised immunity and infertility in exposed species (Gamage and Senevirathna 2020).

No debris will be allowed to enter the water during the Proposed Action. To reduce the potential for Project-related marine debris generation, all waste will be controlled and disposed into trash dumpsters or roll-off bins in the Project base yard or storage area.

The occurrence of exposure to wastes and discharges such as these will be avoided and minimized to the greatest extent practicable through development and implementation of an Oil Spill Contingency Plan contained within the SWPPP, which includes measures to prevent (and respond to) inadvertent discharges of construction wastes into the marine environment. Petroleum-spill-containment devices (e.g., absorbent pads, containment booms) will be located on site in sufficient quantity and available and accessible for immediate deployment at all times. However, in the unlikely event of a spill or discharge, the effects would be insignificant because accidental spills or discharge will be of small amounts and cleaned quickly.

Entanglement

Marine animals could be entangled by trash and debris during the Proposed Action. Materials could be encountered by and have the potential to entangle animals at the surface, in the water column, and along the seafloor. Potential impacts depend on how a marine animal encounters and reacts to the items that pose an entanglement risk, which depend on risk factors such as animal size, sensory capabilities, and foraging methods. Most entanglements are attributable to encounters with fishing gear or other materials that float or are suspended at the surface. Smaller entangled animals are inherently less likely to be detected than larger ones, but larger animals may subsequently swim off while still entangled, towing lines or fishing gear behind them.

If severely entangled, sea turtles cannot forage underwater or breathe at the surface. Serious injury may result in a lost limb and/or increased vulnerability to predation. Animals that become entangled in nets, lines, ropes, or other foreign objects under water may suffer temporary impairments to movement before they free themselves, or they may remain entangled. Entangled individuals may suffer temporary, minor injuries but recover fully, or they may be severely injured or die.

For sharks, entanglement most commonly occurs from ghost fishing gear and other anthropogenic debris and may result in starvation, suffocation, immobilization, and death (Parton et al. 2019). If these individual impacts increase to greater levels within shark or sea turtle populations, entanglement may have negative implications on reproductive success and survival rates beyond the potential effects of any single project.

Entanglement from equipment and gear typically used for breakwater armoring projects is unlikely. Project debris and trash will be controlled so that they do not enter harbor waters. There will be no lines, chains, or flexible elements deployed in the water.

A. globiceps

ESA-listed corals could be negatively impacted by human disturbance and equipment operation from the Proposed Action through the placement and movement of armor rock. *A. globiceps* colonies within the Project footprint along the Outer Breakwater may be partially or fully buried by armor rock. Contact between heavy equipment or armor rock and *A. globiceps* colonies would likely result in tissue abrasion or loss through fracture and fragmentation, which could result in partial or full colony mortality. As part of the Proposed Action and to the best extent practicable, the Navy will attempt to avoid movement of armor rock with ESA-listed corals attached and/or placement of armor rock onto ESA-listed corals.

Acropora globiceps, is known to occur in outside the Action Area. The coral spawning period is estimated to be approximately 21 days total each year, including 8 days prior to the full moon and 14 days after (Richmond and Hunter 1990). **Error! Reference source not found.** If applicable, no in-water work will occur during coral spawning periods to avoid sensitive spawn timing and maximize the reproductive success of *A. globiceps*.

<u>Noise</u>

ESA-listed corals may be affected by elevated noise levels during larval dispersal and settlement. Studies have shown that healthy coral reef soundscapes can function as habitat cues for larvae of coral, as well as other marine reef species, to settle (Popper and Hawkins 2018; Suca et al. 2020; Aoki et al. 2024). Anthropogenic sounds such as vessel noise may disrupt the settlement behaviors of coral planulae (Lecchini et al. 2018). BMPs would prevents in-water activities from occurring during hard and soft coral spawning season. Elevated noise levels as a result of the Proposed Action are not anticipated impact established ESA-listed coral colonies.

<u>Increased Suspended Sediments</u>

ESA-listed corals may be impacted by elevated turbidity through increased suspended sediments leading to light attenuation and/or sediment smothering. The primary concern for corals is light attenuation as a result of elevated turbidity, rather than the increased suspended sediments themselves (Bessell-Browne et al. 2017). Corals are phototrophic epibenthic organisms that may be negatively impacted by low light periods (Jones et al. 2020). While some coral species may be more susceptible to sediment smothering, branching corals are highly resilient due to their morphology (Jones et al. 2019). Elevated turbidity and increased suspended sediments as a result of the Proposed Action is expected to be absent, and in the occasion that some sedimentation does occur it will be extremely temporary, and unlikely to rise to a level that could cause harm to Acropora globiceps. In an experiment to examine the impacts of dredging on corals, Jones et al. (2020) found that while some coral species exhibited partial mortality as a result of being exposed to low light conditions, all species and colonies survived the 42-day exposure period of the experiment.

Turbidity throughout the Apra Harbor is higher than outside the harbor, and this ambient condition will minimize minor Project-related effects on ESA-listed species from elevated turbidity. Project activities such as armor rock placement are unlikely to generate the same elevated levels of increased suspended sediments as dredging activities and will be taking place intermittently. Additionally, because the outer breakwater experiences high levels of wave energy and water movement, any increased sediments will disperse from the area quickly. Therefore, *A. globiceps* colonies within the Project footprint along the Outer Breakwater are not expected to experience effects from elevated turbidity and increased suspended sediments.

<u>Disturbance from Human Activity and Equipment Operation</u>

ESA-listed corals are highly unlikely to be negatively impacted by human disturbance and equipment operation from the Proposed Action through the placement and movement of armor rock. **Error!**

Reference source not found. *A. globiceps* colonies outside the Project footprint along the Outer Breakwater will not be impacted by the placement of armor rock.

Direct Physical Contact

While the direct physical contact of equipment or humans with an individual vertebrate species would likely constitute an adverse effect, the same assumption does not hold for listed corals due to two key biological characteristics (as described in NMFS LOC PIRO-2023-02697 from December 2023):

- All corals are sessile invertebrate animals that rely on their stinging nematocysts for defense, rather than predator avoidance via flight response. While it may be logical to assume that physical contact with a vertebrate organism results in stress that constitutes harm, harassment, or take, the same does not apply to corals because they have no flight response.
- Most reef-building corals, including all listed species, are clonal organisms. This means that a single larva settles and develops into the primary polyp, which then multiplies into a colony of hundreds to thousands of genetically-identical polyps that are connected through tissue and skeleton. Colony growth is achieved mainly through the addition of more polyps, and colony growth is indeterminate. The colony can continue to exist even if numerous polyps die, or if the colony is broken apart or otherwise damaged. The individual of these listed species is defined as the colony, not the polyp, in the final coral-listing rule (79 FR 53852). Thus, affecting some polyps of a colony does not necessarily constitute harm to the individual colony.

Wastes and Discharges

Chemical pollutants resulting from accidental spills and discharge from construction activities harm biologically important nearshore ecosystems and can result in mortality of ESA-listed species including coral communities (NMFS and USFWS 1998a). As stated previously, if a chemical is accidentally discharged or spilled during the Project, it is likely that the quantity would be small in volume and BMPs would in place if this event would occur.

Marine debris could damage ESA-listed corals via tissue abrasion, fracturing or fragmentation, and light attenuation (Chiappone et al. 2005; Arindra Putra et al. 2021; Muhammad et al. 2021). No debris will be allowed to enter the water during the Proposed Action. To reduce the potential for Project-related marine debris generation, all waste will be controlled and disposed into trash dumpsters or roll-off bins in the Project base yard or storage area.

Entanglement

ESA-listed corals are fragile and susceptible to damage from entanglement, such as from fishing gear and other marine debris (Yoshikawa and Asoh 2004; Beneli et al. 2020; Figueroa-Pico et al. 2020; Suka et al. 2020; Arindra Putra et al. 2021). Damage from entanglement can cause tissue abrasion, fracturing, and fragmentation, which may lead to mortality (Chiappone et al. 2005; Figueroa-Pico et al. 2020). Branching corals are particularly vulnerable to entanglement due to their morphology (Chiappone et al. 2005; Valderrama Ballesteros et al. 2018). If exposed to marine debris or equipment and gear associated with the Proposed Action, *A. globiceps* could be affected through entanglement.

Summary of Determination

Based on its Biological Assessment (Appendix B), the Navy determined the following with respect to ESA:

- The project is ***not likely to adversely affect*** the Central West Pacific DPS green turtle
- The project is ***not likely to adversely affect*** the hawksbill turtle
- The project is ***not likely to adversely affect*** the Indo-west Pacific DPS scalloped hammerhead shark
- The project is ***not likely to adversely affect*** the ESA-listed coral *A. globiceps*

There would be no significant impact on threatened and endangered species. Through informal consultation, NMFS concurred with the Navy's determination per their letter dated October 28, 2024 (Appendix B).

3.5 Public Health and Safety

This discussion of public health and safety includes consideration for any activities, occurrences, or operations that have the potential to affect the safety, well-being, or health of members of the public. A safe environment is one in which there is no, or optimally reduced, potential for death, serious bodily injury or illness, or property damage. The primary goal is to identify and prevent potential accidents or impacts on the general public. Public health and safety within this EA discusses information pertaining to construction activities, operational safety, as well as hazardous materials, hazardous waste, toxic substances, and contaminated sites. However, MEC are analyzed in detail, as there are no known hazardous materials or waste contamination sites within the project areas.

Public health and safety during construction activities is generally associated with construction traffic, as well as the safety of personnel within or adjacent to the construction zones.

Operational safety refers to the actual use of the built-out proposed project, and potential risks to inhabitants or users of adjacent or nearby land and water parcels.

3.5.1 Regulatory Setting

Hazardous materials are defined by 49 CFR section 171.8 as "hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table, and materials that meet the defining criteria for hazard classes and divisions in 49 CFR part 173." Transportation of hazardous materials is regulated by the U.S. Department of Transportation regulations. Hazardous wastes are defined by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments, as: "a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (A) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed." Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These are called universal wastes and their associated regulatory requirements are specified in 40 CFR part 273. Four types of waste are currently covered under the universal wastes regulations: hazardous waste batteries, hazardous waste pesticides that are either recalled or collected in waste pesticide collection programs, mercury containing equipment, and hazardous waste lamps, such as fluorescent light bulbs.

The DoD established the Defense Environmental Restoration Program (DERP) to facilitate thorough investigation and cleanup of contaminated sites on military installations (active installations, installations subject to Base Realignment and Closure, and formerly used defense sites). The Installation Restoration Program and the Military Munitions Response Program are components of the DERP. The Installation Restoration Program requires each DoD installation to identify, investigate, and clean up hazardous waste disposal or release sites. The Military Munitions Response Program addresses nonoperational rangelands that are suspected or known to contain unexploded ordnance, discarded military munitions, or munitions constituent contamination. The Environmental Restoration Program is the Navy's initiative to address DERP.

3.5.2 Affected Environment

The Guam Glass Breakwater is maintained in order to provide the safe navigation of Outer Apra Harbor for both military logistics as well as the protection of life and safety of the civilian population.

The Navy has implemented a strict Hazardous Material Control and Management Program and a Hazardous Waste Minimization Program for all activities. These programs are governed Navy-wide by applicable Office of the Chief of Naval Operations instructions and at the installation by specific instructions issued by the Base Commander. The Navy continuously monitors its operations to find ways to minimize the use of hazardous materials and to reduce the generation of hazardous wastes.

NBG has been classified into areas of high likelihood or low likelihood of encountering MEC. The construction footprint of Alternative 1 is located in an area of low likelihood of encountering MEC.

3.5.3 Environmental Consequences

The ROI for public health and safety concerns during construction and operational activities includes the health and well-being of military personnel and civilians living on or in the vicinity of NBG, as well across the entire island of Guam.

The ROI for concerns related to MEC is focused on the project area of the Glass Breakwater and Apra Harbor. As noted earlier, the analysis contained in this section focuses on potential for encountering MEC during project repairs.

3.5.3.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. No repairs would be done to the Guam Glass Breakwater. A fully maintained and functioning breakwater provides for the safe navigation of Outer Apra Harbor for both military logistics at NBG, as well as the protection of life and safety of the civilian population on Guam. If the breakwater is breached, severe wave action and siltation of the Outer Apra Harbor would likely occur. This would adversely impact marine navigation channels and make it impassable for commercial vessels, military vessels, and submarines. Commercial vessels support fuel, bulk materials, produce, and container transport, which are critical to maintain essential services, such as power, transportation, medical care, groceries, and more. Marine traffic movements are critical to support military missions in this part of world.

Under the No Action Alternative, the Proposed Action would not occur and there would be no MEC concerns.

Therefore, significant impacts would occur to Public Health and Safety with implementation of the No Action Alternative due to the impacts of a non-functioning breakwater.

3.5.3.2 Alternative 1- Natural Rock Armor Layer Repair Potential Impacts

Alternative 1 would provide the needed emergency repairs to the Guam Glass Breakwater; therefore, safeguarding the shore facilities and infrastructure within the harbor from severe wave action during typhoons and other heavy weather events. Military and commercial vessel would be able to safely and effectively pass through the marine navigations channels, thus continuing to support and provide vital services to the island of Guam.

BMPs would be employed in the event MEC is encountered during construction. Contractors would manage any oil wastes and fluids in accordance with NBG management plans.

Therefore, implementation of Alternative 1 would not result in significant impacts to Public Health and Safety.

3.6 Climate Change and Greenhouse Gases

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions are generated by both natural processes and human activities. The accumulation of GHGs in the atmosphere helps regulate the earth's temperature and contributes to global climate change. GHGs include water vapor, carbon dioxide, methane, nitrous oxide, ozone, and several hydrocarbons and chlorofluorocarbons. Each GHG has an estimated global warming potential, which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the earth's surface.

3.6.1 Regulatory Setting

The USEPA specifically identified carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride as GHGs (U.S. Environmental Protection Agency, 2009) (74 Federal Register 66496). These gases influence global climate by trapping heat in the atmosphere that would otherwise escape to space. Increased concentrations of these gases due to human activities is the primary cause of global warming observed over the last 70 years and contributes significantly to climate change (National Academy of Sciences, 2020). GHGs have varying global warming potential (GWP). GWP is a measure of how much energy the emissions of 1 ton of a gas absorb over a given period of time (usually 100 years), relative to the emissions of 1 ton of CO2 (U.S. Environmental Protection Agency, 2023a). The reference gas for GWP is CO2; therefore, CO2 has a GWP of 1. Other common GHGs that result from human activity include CH4, which is estimated to have a GWP of 27–30 over 100 years; and N2O, which has a GWP of 273. CO2, and to a lesser extent, CH4 and N2O, are products of combustion and are generated from stationary combustion sources as well as vehicles, aircraft, and vessels. High GWP gases include GHGs that are used in refrigeration/cooling systems, such as chlorofluorocarbons and hydrofluorocarbons.

Currently, there are no regulatory thresholds of significance for GHG emissions; however, the CEQ released interim guidance on when and how federal agencies should consider GHG emissions and climate change in NEPA analyses (Council on Environmental Quality, 2023). The guidance emphasizes that when conducting climate change analyses in NEPA reviews, agencies should consider the following: (1) the potential effects of a proposed action on climate change, including by assessing both GHG emissions and reductions from the proposed action; and (2) the effects of climate change on a proposed action and its environmental impacts.

The guidance states that federal agencies should quantify the reasonably foreseeable direct and indirect GHG emissions of their proposed actions and reasonable alternatives (as well as the no action alternative). The guidance also recommends that "agencies provide additional context for GHG emissions, including through the use of the best available social cost of GHG estimates, to translate climate impacts into the more accessible metric of dollars, allow decision makers and the public to make comparisons, help evaluate the significance of an action's climate change effects, and better understand the tradeoffs associated with an action and its alternatives." (Council on Environmental Quality, 2023).

Guam currently does not have a GHG program in place.

3.6.2 Affected Environment

The Proposed Action is anticipated to release GHGs into the atmosphere. These emissions are quantified for the Proposed Action and compared to the No Action Alternative. Global GHG in 2022 reached a high of 54.59 billion metric tons (MT) of CO2e (Ritchie et al., 2020). CO2e is a measurement of the total greenhouse gases emitted, expressed in terms of the equivalent measurement of carbon dioxide. As shown in Table 3-9, in 2021, the U.S. emitted over 6,300 million MT of CO2e.

Table 3-9 Trends U.S. Greenhouse Gas Emissions, Million MT CO2e

Economic Sector	2017	2018	2019	2020	2021
Industry	1,973.9	2,033.2	2,011.2	1,852.9	1,909.2
Transportation	1,846.0	1,876.2	1,879.2	1,629.2	1,809.5
Commercial	1,060.4	1,074.5	1,029.7	930.5	972.2
Residential	962.3	1,034.9	982.0	918.3	953.8
Agricultural	693.0	709.8	690.7	671.5	671.5
U.S. Territories	26.3	26.3	25.1	23.6	24.1
Total	**6,561.8**	**6,754.8**	**6,617.9**	**6,026.0**	**6,340.2**

Source: U.S. Environmental Protection Agency (2023b)
Note: Emissions from U.S. Territories are based on the fuel consumption in American Samoa, Guam, Puerto Rico, U.S. Virgin Islands, Wake Island, and other outlying U.S. Pacific Islands

On Guam, the primary GHGs emitted are CO2, CH4, and N2O from combustion of fuel (U.S. Environmental Protection Agency, 2024b).

Table 3-10 presents the 2022 reported GHG emissions for large emitting facilities on Guam. These facilities are required to submit data to the USEPA's Greenhouse Gas Reporting Program. AAFB, MCBCB, and NBG are not among the large emitting facilities that are subject to USEPA GHG reporting.

Table 3-10 Facilities GHG Emissions – 2022, MT CO2e

Facility Name	City	GHG Emissions
Dededo Combustion Turbine Generating Facility	Dededo	116,446
Guam Power Authority - Cabras Power Plant	Piti	509,914
Layon Municipal Solid Waste Landfill	Inarajan	57,575
Macheche Combustion Turbine	Dededo	35,806
Marianas Energy Company	Piti	282,195
Piti 7 Combustion Turbine	Piti	158,737
Tenjo Vista Power Plant	Piti	6,505
Yigo Combustion Turbine	Yigo	86,779
Yigo Diesels	Yigo	54,234
Total GHG Emissions from Large Emitting Facilities - 2022		**1,308,218**

Note: Numbers may not add up due to rounding
Source: U.S. Environmental Protection Agency 2023a

3.6.2.1 Sources of Emissions

The following activities would generate GHG emissions during the proposed action, primarily by the combustion of fuel.

- Emissions from government and construction vehicles

3.6.3 Environmental Consequences

Climate change presents a global problem caused by increasing concentrations of GHG in the atmosphere. This section discusses the potential effects that could result from implementation of the Proposed Action's GHG emissions on climate change. GHG emissions generated from the Proposed Action contribute to the global atmosphere, regardless of the specific location within the ROI that they are produced.

3.6.3.1 No Action Alternative

Under the No Action Alternative, there would be no change from current levels of construction in Apra Harbor. Proposed breakwater repairs would not occur; therefore, no significant impacts on climate change and greenhouse gases would occur as a result of implementation of the No Action Alternative. If the proposed breakwater repairs do not occur, the breakwater will continue to erode and degrade with increased wave action and storms. Wave action and storms are intensifying due to climate change; therefore, climate change and greenhouse gases could have a significant effect on the breakwater itself.

3.6.3.2 Alternative 1- Natural Rock Armor Layer Repair Potential Impacts

Per Table 3-11, GHG emissions generated from the Proposed Action would total 189 MT of CO2e in 2024 and 881 MT of CO2e in 2025.

Table 3-11 Increase in GHG Emissions from Proposed Action, CO2e (MT) per year

Source Type	Emissions Increase, CO_2e (MT) in 2024	Emissions Increase, CO_2e (MT) in 2025
100-T Crawler Crane	23	108
Air Compressor	6	29
Backhoe	5	25
Compressor	5	21
Dozer	32	149
End Dump Truck	1	8
Excavator	19	87
Flatbed Truck	1	6
Forklift Truck	7	30
Generator	6	29
Generator	41	191
Passenger Truck	0	3
Pickup Truck	1	5
Rough Terrain Crane	14	66
Skid Steer Loader	3	13
Truck Crane	20	94
Water Truck	4	30
Total	**189**	**881**

Source: Appendix A

This total is equivalent to the following greenhouse gas emissions per US. EPA's Greenhouse Gas Equivalencies Calculator (US Environmental Protection Agency 2024a):

- 255 gasoline-powered passenger vehicles driven for one year
- 2,736,597 miles driven by an average gasoline-powered passenger vehicle

This total is equivalent to the following CO_2 emissions per US. EPA's Greenhouse Gas Equivalencies Calculator (US Environmental Protection Agency 2024a):

- 120,401 gallons of gasoline consumed
- 105,108 gallons of diesel consumed
- 140 homes' energy use for one year
- 0.003 natural gas-fired power plants in one year
- 2,477 barrels of oil consumed
- 70,637,852 number of smartphones charged

The GHG emissions temporarily generated from proposed site preparations and construction would result in a minor increase of GHG emissions and no detectable GWP changes resulting from the emission levels associated with these activities. Therefore, climate change and greenhouse impacts would be less than significant as a result of implementation of the Proposed Action.

3.7 Summary of Potential Impacts to Resources and Impact Avoidance and Minimization

A summary of the potential impacts associated with the action alternative and the No Action Alternative and impact avoidance and minimization measures are presented in Tables 3-12.

Table 3-12 Summary of Potential Impacts to Resource Areas

Resource Area	***No Action Alternative***	***Alternative 1***
Air Quality	No Impact	Less than significant. Temporary construction period impacts due to equipment and vehicle exhaust with implementation of BMPs.
Water Resources	No Impact	Less than significant. Temporary construction period impacts on marine waters due to in-water work.
Cultural Resources	Significant Impact	Less than significant. Construction and operational period impacts. No historic properties affected.
Biological Resources	Significant Impact	Less than significant. Construction period impacts with implementation of BMPs and avoidance, minimization, and offset measures.
Public Health and Safety	Significant Impact	Less than significant. Construction period impacts. BMPs would be employed in the event MEC is encountered during construction. Contractors would manage any oil wastes and fluids in accordance with NBG management plans.
Climate Change and Greenhouse Gases	No Impact	Less than significant.

4 Cumulative Impacts

This section (1) defines cumulative impacts, (2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, (3) analyzes the incremental interaction the Proposed Action may have with other actions, and (4) evaluates cumulative impacts potentially resulting from these interactions.

4.1 Definition of Cumulative Impacts

The approach taken in the analysis of cumulative impacts follows the objectives of NEPA and CEQ regulations and guidance. In accordance with 40 CFR 1508.1(i), agencies shall consider effects from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives, including those effects that occur at the same time and place as the proposed action or alternatives and may include effects that are later in time or farther removed in distance from the proposed action or alternatives.

4.2 Scope of Cumulative Impacts Analysis

The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the time frame in which the effects could be expected to occur. For this EA, the study area delimits the geographic extent of the cumulative impacts analysis. In general, the study area will include those areas previously identified in Chapter 3 for the respective resource areas. The time frame for cumulative impacts centers on the timing of the Proposed Action.

Another factor influencing the scope of cumulative impacts analysis involves identifying other actions to consider. Beyond determining that the geographic scope and time frame for the actions interrelate to the Proposed Action, the analysis employs the measure of "reasonably foreseeable" to include or exclude other actions. For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions. Documents used to identify other actions include notices of intent for EISs and EAs, management plans, land use plans, and other planning related studies.

4.3 Past, Present, and Reasonably Foreseeable Actions

This section will focus on past, present, and reasonably foreseeable future projects at and near the Proposed Action locale. In determining which projects to include in the cumulative impacts analysis, a preliminary determination was made regarding the past, present, or reasonably foreseeable action. Specifically, it was determined if a relationship exists such that the affected resource areas of the Proposed Action (included in this EA) might interact with the affected resource area of a past, present, or reasonably foreseeable action. If no such potential relationship exists, the project was not carried forward into the cumulative impacts analysis. In accordance with CEQ guidance, these actions considered but excluded from further cumulative effects analysis are not catalogued here as the intent is to focus the analysis on the meaningful actions relevant to informed decision-making. Projects included in this cumulative impacts analysis are listed in Table 4-1.

Table 4-1 Cumulative Action Evaluation Cumulative Impact Analysis

Action	*Level of NEPA Analysis Completed*
Alpha and Bravo Wharf Improvements	Environmental Assessment (EA)/Finding of No Significant Impact (FONSI)
Apra Harbor Wharf Improvements (Uniform & Tango, MILCON P-204)	FEIS/ROD
Inner Apra Harbor Maintenance Dredging	EA/FONSI
Kilo Wharf Extension	FEIS/ROD
Ocean Dredged Material Disposal Site Offshore of Guam	FEIS/ROD
Polaris Point Beach Restoration	Record of Categorical Exclusion (CATEX)
Polaris Point Seawall Repair	CATEX
X-Ray Wharf Improvements – North Berth (MILCON P-518)	EA/FONSI
MILCON P-661 Navy-Commercial Tie-In Hardening	EA/FONSI
Underwater Electromagnetic Measurement System (UEMMS) (RM18-1828)	EA/FONSI
X-Ray Wharf Improvements – South Berth (MILCON P-519)	EA/FONSI
Mariana Islands Training and Testing (Regional)	NEPA EIS/Overseas EIS
Glass Breakwater Repairs	EA
Polaris Point Rock Revetment	CATEX
Sumay Marina Entrance - EOD Point	CATEX
Sumay Marina MWR Docks	CATEX
Sumay Marina Entrance - Sumay Point	CATEX
Lima, Mike, November Wharf Repair and Modernization	EA/FONSI
MILCON P-676 Polaris Point Pier	TBD
Oscar, Papa, Quebec, and Romeo Wharves Maintenance Dredging	TBD
Port Authority of Guam (PAG) Modernization Program	EA/FONSI
Repair Finger Pier	TBD
Repair Oscar, Papa, and Quebec Wharves	TBD
P-835 (formerly P1103U) Lima Wharf and Inner Apra Harbor Dredge EA	EA
Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation	FEIS/ROD

The following analysis of cumulative impacts is organized by resource area in the same order presented in Chapter 3. Only the resource areas that have the potential to have cumulative impacts resulting from the incremental effects of Alternative 1 are addressed. The Proposed Action is not anticipated to have incremental impacts in the following resource areas that would overlap temporally or spatially in a way that would be cumulatively significant with those of the past, present, and reasonably foreseeable actions identified in Section 4.3: cultural resources, public health and safety, and climate change and greenhouse gases. Therefore, these environmental resource areas are not analyzed in detail in this section. Where feasible, the cumulative impacts were assessed using quantifiable data; however, for many of the resources included for analysis, quantifiable data is not available and a qualitative analysis was undertaken. In addition, where an analysis of potential environmental effects for future actions has not been completed, assumptions were made regarding cumulative impacts related to this EA where possible. The analytical methodology presented in Chapter 3, which was used to determine potential impacts to the various resources analyzed in this document, was also used to determine cumulative impacts.

The analyses show that, when considered with relevant past, present, and reasonably foreseeable projects, the incremental effects of Alternative 1 would not contribute to cumulative impacts on pertinent resource areas. Because it would not contribute any incremental effects, the No Action Alternative would not result in cumulative impacts on the relevant resource areas during construction.

4.3.1 Air Quality

4.3.1.1 Description of Geographic Study Area

The ROI for air quality includes the SO_2 nonattainment area as described in Section 3.1.

4.3.1.2 Relevant Past, Present, and Future Actions

Past projects have been completed and associated construction period air quality emissions would have dispersed. All present and reasonably foreseeable actions may interact with the Proposed Action's air quality impacts if their construction occurs concurrently with that of the Proposed Action.

Projects currently under construction may interact with the Proposed Action's air quality impacts if construction of the Proposed Action occurs concurrently with any of the projects. The future Glass Breakwater Repairs project, Polaris Point Rock Revetment, and Sumay Marina projects are scheduled to begin no earlier than mid-2025 and would not overlap with the Proposed Action of this EA.

4.3.1.3 Cumulative Impact Analysis

Cumulative air quality impacts from past, present, and future actions within the ROI would be less than significant because, as described in Section 3.1, transport of air emissions to public areas would be infrequent and when they occur, air pollutant concentrations are expected to be low.

The Proposed Action construction period is anticipated to late 2024 or early 2025. The construction periods for projects listed in Table 4-1 are unlikely to overlap with the Proposed Action's construction period. Cumulative air quality impacts within the ROI would be less than significant because impacts from the proposed action are expected to be low and would not overlap with impacts from past, present and foreseeable actions.

4.3.2 Water Resources

4.3.2.1 Description of Geographic Study Area

The ROI for water resources includes the Outer Apra Harbor water column in the vicinity of the Glass Breakwater.

4.3.2.2 Relevant Past, Present, and Future Actions

Past projects have been completed and marine water quality has presumably returned to background levels. Ongoing Mariana Islands Training and Testing activities in Outer and Inner Apra Harbor have a limited potential area of impact (i.e., small zones immediately adjacent to the explosive charge), are generally widely dispersed in space and time, and were determined to result in changes to water quality below applicable standards, regulations, and guidelines. Relevant Marine Corps relocation projects are future projects that may interact with the Proposed Action's water quality impacts if implemented during its construction period.

4.3.2.3 Cumulative Impact Analysis

Cumulative water resources impacts from past, present, and future actions within the ROI would be less than significant because water quality effects of past actions would not overlap temporally or spatially with the Proposed Action's temporary construction period water quality impacts. In addition, the Proposed Action's construction period water quality impacts would be avoided or minimized through the use of BMPs. Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant impacts within the ROI.

4.3.3 Biological Resources

4.3.3.1 Description of Geographic Study Area

The ROI for water resources includes the Outer Apra Harbor water column in the vicinity of the Glass Breakwater.

4.3.3.2 Relevant Past, Present, and Future Actions

None of the past or present actions are within the biological resources ROI for the Proposed Action. Further maintenance repairs are planned for the Glass Breakwater that have the potential to impact biological resource. Work would include preparation of subgrade, placement of bedding rocks, fabrication and installation of concrete armor units. In-water work would be required and cannot be limited to above water limitations. Temporary piles may need to be placed in the Outer Apra Harbor in portions of the sandy ocean bottom.

4.3.3.3 Cumulative Impact Analysis

Cumulative biological resource impacts from past, present, and future actions within the ROI would be less than significant. All Proposed Action's construction (and operational) period biological impacts would be avoided, minimized, and/or mitigated through the use of BMPs. Consultation with NMFS would be conducted as appropriate. Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant impacts within the ROI.

5 Other Considerations Required by NEPA

5.1 Consistency with Other Federal, State, and Local Laws, Plans, Policies, and Regulations

In accordance with 40 Code of Federal Regulations (CFR) section 1502.16(a)(5), analysis of environmental consequences shall include discussion of possible conflicts between the Proposed Action and the objectives of federal, regional, state and local land use plans, policies, and controls. Table 5-1 identifies the principal federal and state laws and regulations that are applicable to the Proposed Action, and describes briefly how compliance with these laws and regulations would be accomplished.

Table 5-1 Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	***Status of Compliance***
National Environmental Policy Act (NEPA); CEQ NEPA implementing regulations; Navy procedures for Implementing NEPA	Complies; EA and FONSI anticipated
Clean Air Act	Complies; Exempt from General Conformity (see Appendix A)
Clean Water Act	Section 401 Water Quality Certification obtained; National Pollutant Discharge Elimination System permit not required
Rivers and Harbors Act	Section 10 Rivers and Harbors Act permit obtained
Coastal Zone Management Act	CZMA consultation completed (see Appendix D)
National Historic Preservation Act	Section 106 consultation completed (see Appendix C)
Endangered Species Act	Section 7 consultation completed (see Appendix B)
Magnuson-Stevens Fishery Conservation and Management Reauthorization Act	EFH consultation completed (see Appendix B)
Marine Mammal Protection Act	Taking of marine mammals under the MMPA is unlikely
Executive Order 12088, Federal Compliance with Pollution Control Standards	BMPs, avoidance and minimization measures would address pollution control
Executive Order 12114, Environmental Effects Abroad of Major Federal Actions (Department of Navy implementing regulation 32 CFR part 287)	No significant effects
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations	No significant effects
Executive Order 13089, Coral Reef Protection	BMPs, avoidance and minimization measures would address coral reef protection issues
EO 14008, Tackling Climate Crisis at Home and Abroad	No significant effects

5.2 Irreversible or Irretrievable Commitments of Resources

Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of non-renewable resources such as metal and fuel, and natural or cultural resources. These resources are irretrievable in that they would be used for this project when they could have been used for other purposes. Human labor is also considered an irretrievable resource. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

Implementation of the Proposed Action would involve human labor; the consumption of fuel, oil, and lubricants for construction vehicles. Implementing the Proposed Action would not result in significant irreversible or irretrievable commitment of resources. Furthermore, a combination of avoidance and minimization would offset the initial natural resource losses.

5.3 Unavoidable Adverse Impacts

This EA has determined that the alternatives considered would not result in any significant impacts. Implementing the alternatives would result in the following unavoidable environmental impacts:

- Short-term air quality during the construction period

5.4 Relationship between Short-Term Use of the Environment and Long-Term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development site reduces future flexibility in pursuing other options, or that using a parcel of land or other resources often eliminates the possibility of other uses at that site.

In the short-term, effects to the human environment with implementation of the Proposed Action would primarily relate to the construction activity itself. Air quality and noise would be impacted in the short-term.

In the long-term, the needed emergency repairs to the Guam Glass Breakwater would safeguard the shore facilities and infrastructure within the harbor from severe wave action during typhoons and other heavy weather events. Military and commercial vessel would be able to safely and effectively pass through the marine navigations channels, thus continuing to support and provide vital services to the island of Guam. Without the emergency repairs, there is a risk of the breakwater breaching, which would have significant impacts on Navy operational capabilities. The degraded condition of the breakwater, exacerbated by normal wave action, storms, and typhoons, heightens the likelihood of breach. Continued exposure to even normal wave action not only increase the risk of breach, but also poses a risk of potential environmental damage to ESA - listed coral and ESA-candidate clam species located in the submerged areas of the structure. The repair of the breakwater would not significantly impact the long-term natural resource productivity of the area. Because of the planned avoidance and minimization measures, the Proposed Action would not result in any impacts that would significantly reduce environmental productivity or permanently narrow the range of beneficial uses of the environment.

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Appendix A

Record of Non-Applicability for Clean Air Act Conformity and Air Quality Methodology and Calculations

Record of Non-Applicability for Clean Air Act Conformity
Glass Breakwater Emergency Breach Repairs
Naval Base Guam, Apra Harbor, Guam

The Proposed Action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

Proposed Action

Action Proponent: Commanding Officer, Naval Base Guam

Locations: Naval Base Guam, Apra Harbor, Guam

Proposed Action Name: Glass Breakwater Emergency Breach Repairs

Proposed Action and Emission Summary:

The Proposed Action entails restoring areas of the Glass Breakwater identified as severely eroded and susceptible to imminent breaching due to normal wave action. Priority repairs will occur on the ocean-side of the breakwater, where significant "armor" rocks, safeguarding the breakwater's inner core, have displaced or been washed away into the ocean. Consequently, the inner core is vulnerable to accelerated degradation from continuous wave and storm activity. Repair activities will involve temporarily relocate intact armor stone from neighboring breakwater crest areas, repositioning them on the failed areas to minimize crest road loss. Implementation of future maintenance repairs will be performed in the spring/summer of 2025 and addressed through separate environmental analysis.

The purpose of the Proposed Action is to expedite and conduct critical repairs to failed and failing sections of the breakwaters' armor rock slope protection. This is crucial to prevent a breach of the breakwater, thereby safeguarding the harbor, shoreline, and vital Navy/Port of Guam infrastructure that is essential to sustain ongoing military and local sustainment missions. The need for the Proposed Action is underscored by the imminent risk of breaching, which would have significant impacts on mission readiness and operational capabilities. The degraded condition of the breakwater, exacerbated by normal wave action, storms, and typhoons, heightens the likelihood of breach. Continued exposure to even normal wave action stressors not only increase the risk of breach, but also poses potential environmental damage to ESA listed coral and ESA candidate clam species located in the submerged areas of the structure.

On May 24, 2023, Super Typhoon Mawar passed north of Guam, bringing destructive winds and swells that severely damaged sections of the Glass Breakwater. The storm's impact caused significant erosion and displacement of the protective "armor" rock on the Western Point-Ocean Side, compromising the breakwater's integrity. The breakwater is essential in order to shelter and protect U.S. Navy vessels, as well as commercial and local government ships, that use Apra Harbor. The breakwater also safeguards the shore facilities and infrastructure within the harbor from severe wave action during typhoons and other heavy weather events. The recent damage has underscored the urgent need for repairs to maintain the harbor's functionality and prevent further degradation, which could lead to increased damage and higher future repair costs. The Glass Breakwater is vital to the Navy's mission because without it, Apra Harbor would be open to severe wave action that accompanies typhoons and other heavy weather events originating from the Philippine Sea. Wave heights of 25 to 30 feet have been recorded during previous super typhoons that occur in seven to 15 years intervals. The worsening condition of the breakwater affects the position of the existing United States Coast Guard (USCG) navigational aid tower. The navigational aid tower is the only physical means to guide all incoming vessels into the mouth of the outer Apra Harbor.

Assessments conducted in February 2024 revealed that one-third of the breakwater has lost more than 20% of its armor stone, while the remaining two-thirds have experienced a loss of 5-10%, classifying the breakwater as failed according to the U.S. Army Corps of Engineers (USACE) Coastal Engineering Manual (CEM 2008). Furthermore, a recent visual inspection conducted on May 9, 2024, showed an increased rate of degradation from normal wave action. If left unaddressed, this deterioration is likely to result in a breach, posing significant risks to military and commercial ships, facilities, operations, and the overall logistical use of Apra Harbor. In the event of even a partial breach, the maintenance road at the top of the breakwater crest would become impassable, leading to exponential increases in repair costs and time. The acceleration of breakwater failure underscores the urgent need for repair.

Estimated Emissions for Proposed Action

Project Year	Sulfur Dioxide (ton per year)
2024	0.0015
2025	0.0068

Affected Air Basin: Piti-Cabras, Guam

Date RONA Prepared: August 22, 2024

RONA Prepared By: Naval Facilities Engineering Systems Command, Marianas

Proposed Action Exemption

The Proposed Action is exempt from the Clean Air Act General Conformity Rule because the Proposed Action's projected emissions are below the applicable *de minimis* threshold.

Attainment Area Status and Emissions Evaluations Conclusions

The project area at Naval Base Guam Apra Harbor is located within the Guam Piti-Cabras area, which has been designated nonattainment for sulfur dioxide, unclassified for particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers, and unclassifiable/attainment for carbon monoxide, ozone, nitrogen dioxide, lead, and particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.

RONA Approval:

Signature: MOON.EDWARD.E.1272181507 Digitally signed by MOON.EDWARD.E.1272181507 Date: 2024.08.22 19:37:02 +10'00'

Name/Rank/Date: Edward Moon/GS-13/August 22, 2024

Position: Installation Environmental Program Director

Equipment	Fuel Type	Power (hp)	Operating Hours		No. of Trips	Vehicle Miles Traveled (mi)	
			2024	2025		2024	2025
GOVERNMENT FLEET VEHICLES							
Passenger Truck	Gasoline	200	216	996	1010	360	1660
CONSTRUCTION							
Flat Bed Truck	Diesel	380	216	996	1010	360	1660
100-T Crawler Crane	Diesel	230	432	1992	2	10	10
Air Compressor	Diesel	145	216	996			
Backhoe	Diesel	80	432	1992	202	72	332
Compressor	Diesel	80	216	996			
Dozer	Diesel	285	432	1992	202	72	332
End Dump Truck	Diesel	400	432	1992	1010	360	1660
Excavator	Diesel	148	432	1992	2	360	1660
Forklift Truck	Diesel	78	216	996	1010	72	332
Generator	Diesel	400	432	1992			
Generator	Gasoline	27	432	1992			
Pickup Truck	Diesel	310	216	996	1010	360	1660
Rough Terrain Crane	Diesel	105	432	1992	2	10	10
Skid Steer Loader	Diesel	49	432	1992	2	360	1660
Truck Crane	Diesel	350	216	996	202	72	332
Water Truck	Diesel	150	432	1992	404	360	1660

Equipment	Category	SO_2 Emission Factor			SO_2 Emissions (lb/yr)	
		2024	2025	units	2024	2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - 25 mph[1]	0.003	0.003	g/hr	0.002	0.011
CONSTRUCTION						
Flat Bed Truck	Single Unit Short-Haul Truck - 25 mph[1]	0.01	0.01	g/hr	0.008	0.037
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	0.37	0.37	g/hr	0.352	1.625
Air Compressor	Air Compressors (100 < hp <= 175)[2]	0.21	0.21	g/hr	0.100	0.461
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	0.09	0.09	g/hr	0.086	0.395
Compressor	Air Compressors (75 < hp <= 100)[2]	0.15	0.15	g/hr	0.071	0.329
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	0.5	0.5	g/hr	0.476	2.196
End Dump Truck	Combination Short-Haul Truck - 25 mph[1]	0.02	0.02	g/hr	0.016	0.073
Excavator	Excavators (100 < hp <= 175)[2]	0.29	0.29	g/hr	0.276	1.274
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	0.21	0.21	g/hr	0.100	0.461
Generator (Diesel)	Generator Sets (300 < hp <= 600)[2]	0.74	0.74	g/hr	0.705	3.250
Generator (Gas)	Generator Sets (16 < hp <= 25)[2]	0.09	0.09	g/hr	0.086	0.395
Pickup Truck	Light Commercial Truck	0.04	0.04	g/hr	0.032	0.146
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	0.23	0.23	g/hr	0.219	1.010
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	0.05	0.05	g/hr	0.048	0.220
Truck Crane	Cranes (300 < hp <= 600)[2]	0.66	0.66	g/hr	0.314	1.449
Water Truck	Single Unit Short-Haul Truck - idle[1]	0.07	0.07	g/hr	0.056	0.256
				Total (lb/yr)	2.947	13.588
				Total (tpy)	0.0015	0.0068

[1] Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);

[2] Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - Emissions Summary

Year	Emissions (tpy)									
	CO	NOx	PM10	PM2.5	SO2	VOC	CO2	CH4	N2O	CO2e
2024	2.03	0.49	2.41	0.65	0.001	0.08	208	0.01	0.00002	208
2025	9.23	2.04	11.11	2.97	0.007	0.37	970	0.03	0.00010	971

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - CO Emissions

Equipment	Category	CO Emission Factor			CO Emissions (lb/yr)	
		2024	2025	units	2024	2025
	GOVERNMENT FLEET VEHICLES					
Passenger Truck	Passenger Truck - idle[1]	8.05	6.61	-	16.18	74.38
	Passenger Truck - 25 mph[1]	3.95	3.63	-		
	Passenger Truck - start[1]	16.44	14.97	-		
	ON-ROAD and NONROAD					
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	15.93	13.47	g/hr	15.17	59.15
Air Compressor	Air Compressors (100 < hp <= 175)[2]	12.12	10.80	g/hr	5.77	23.72
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	48.00	38.46	g/hr	45.71	168.89
Compressor	Air Compressors (75 < hp <= 100)[2]	20.04	17.60	g/hr	9.54	38.65
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	18.15	13.12	g/hr	17.29	57.62
End Dump Truck	Combination Short-Haul Truck - idle[1]	16.46	15.27	g/hr	14.98	82.74
	Combination Short-Haul Truck - 25 mph[1]	3.01	2.76	g/mi		
	Combination Short-Haul Truck - start[1]	15.86	15.876	g/start		
Excavator	Excavators (100 < hp <= 175)[2]	11.59	8.84	g/hr	11.04	38.81
Flatbed Truck	Single Unit Short-Haul Truck - idle[1]	12.75	11.71	g/hr	7.45	44.72
	Single Unit Short-Haul Truck - 25 mph[1]	1.69	1.53	g/mi		
	Single Unit Short-Haul Truck - start[1]	7.69	7.640	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	40.64	35.24	g/hr	19.35	77.39
Generator	Generator Sets (16 < hp <= 25)[2]	3887.01	3875.42	g/hr	3702.00	17019.40
Generator	Generator Sets (300 < hp <= 600)[2]	131.91	118.09	g/hr	125.63	518.62
Pickup Truck	Light Commercial Truck - idle[1]	11.50	9.99	g/hr	5.48	21.93
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	12.52	10.74	g/hr	11.93	47.16
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	12.16	10.85	g/hr	11.58	47.64
Truck Crane	Cranes (300 < hp <= 600)[2]	46.34	40.46	g/hr	22.07	88.85
Water Truck	Single Unit Short-Haul Truck - idle[1]	12.75	11.71	g/hr	12.14	51.43
			TOTAL (lb/yr)		4053	18461
			TOTAL (tpy)		2.03	9.23

NOTES:

[1] Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb);
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT.

[2] Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly;
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

[3] U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb).

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - NOx Emissions

Equipment	Category	NOx Emission Factor			NOx Emissions (lb/yr)	
		2024	2025	units	2024	2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - idle[1]	0.81	0.66	-	0.87	4.13
	Passenger Truck - 25 mph[1]	0.24	0.20	-		
	Passenger Truck - start[1]	0.86	0.76	-		
ON-ROAD and NONROAD						
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	68.53	56.36	g/hr	65.27	247.49
Air Compressor	Air Compressors (100 < hp <= 175)[2]	58.31	51.51	g/hr	27.77	113.10
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	52.41	44.75	g/hr	49.92	196.53
Compressor	Air Compressors (75 < hp <= 100)[2]	60.34	56.16	g/hr	28.74	123.31
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	54.24	42.09	g/hr	51.66	184.85
End Dump Truck	Combination Short-Haul Truck - idle[1]	47.89	43.81	g/hr	7.25	72.17
	Combination Short-Haul Truck - 25 mph[1]	9.13	8.32	g/mi		
	Combination Short-Haul Truck - start[1]	0.00	0.00	g/start		
Excavator	Excavators (100 < hp <= 175)[2]	35.57	28.23	g/hr	33.88	123.99
Flatbed Truck	Single Unit Short-Haul Truck - idle[1]	27.93	24.95	g/hr	3.63	39.13
	Single Unit Short-Haul Truck - 25 mph[1]	3.65	3.27	g/mi		
	Single Unit Short-Haul Truck - start[1]	0.92	0.93	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	84.39	78.34	g/hr	40.19	172.01
Generator	Generator Sets (16 < hp <= 25)[2]	25.18	24.63	g/hr	23.98	108.16
Generator	Generator Sets (300 < hp <= 600)[2]	453.93	411.96	g/hr	432.32	1809.17
Pickup Truck	Light Commercial Truck - idle[1]	19.32	16.87	g/hr	9.20	37.05
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	63.43	53.89	g/hr	60.41	236.65
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	29.81	29.12	g/hr	28.39	127.89
Truck Crane	Cranes (300 < hp <= 600)[2]	194.42	170.90	g/hr	92.58	375.25
Water Truck	Single Unit Short-Haul Truck - idle[1]	27.93	24.95	g/hr	26.60	109.56
			TOTAL (lb/yr)		983	4080
			TOTAL (tpy)		0.49	2.04

NOTES:

[1] Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb);
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT.

[2] Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly;
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

[3] U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb).

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - PM10 Emissions

Equipment	Category	PM10 Emission Factor			PM10 Emissions (lb/yr)	
		2024	2025	units	2024	2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - idle[1]	0.02	0.02	-	0.07	0.35
	Passenger Truck - 25 mph[1]	0.08	0.08	-		
	Passenger Truck - start[1]	0.01	0.01	-		
ON-ROAD and NONROAD						
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	3.02	2.60	g/hr	2.88	11.43
Air Compressor	Air Compressors (100 < hp <= 175)[2]	2.97	2.66	g/hr	1.42	5.84
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	8.00	6.30	g/hr	7.62	27.65
Compressor	Air Compressors (75 < hp <= 100)[2]	3.42	3.03	g/hr	1.63	6.66
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	3.80	2.85	g/hr	3.61	12.52
End Dump Truck	Combination Short-Haul Truck - idle[1]	4.15	3.82	g/hr	0.83	7.22
	Combination Short-Haul Truck - 25 mph[1]	0.98	0.92	g/mi		
	Combination Short-Haul Truck - start[1]	0.06	0.06	g/start		
Excavator	Excavators (100 < hp <= 175)[2]	2.96	2.22	g/hr	2.82	9.77
Flatbed Truck	Single Unit Short-Haul Truck - idle[1]	3.04	2.72	g/hr	0.42	4.39
	Single Unit Short-Haul Truck - 25 mph[1]	0.48	0.45	g/mi		
	Single Unit Short-Haul Truck - start[1]	0.05	0.04	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	6.71	5.86	g/hr	3.19	12.87
Generator	Generator Sets (16 < hp <= 25)[2]	1.54	1.53	g/hr	1.46	6.71
Generator	Generator Sets (300 < hp <= 600)[2]	19.96	17.83	g/hr	19.01	78.32
Pickup Truck	Light Commercial Truck - idle[1]	0.92	0.80	g/hr	0.44	1.77
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	3.11	2.67	g/hr	2.97	11.72
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	1.95	1.73	g/hr	1.86	7.61
Truck Crane	Cranes (300 < hp <= 600)[2]	7.12	6.30	g/hr	3.39	13.83
Water Truck	Single Unit Short-Haul Truck - idle[1]	3.04	2.72	g/hr	2.90	11.95
FUGITIVE DUST						
Backhoe	Bulldozing[4]	2.47	2.47	lb/hr	1067	4920
Dozer	Bulldozing[4]	2.47	2.47	lb/hr	1067	4920.44
End Dump Truck	Material Handling[4]	0.0003	0.0003	lb/ton	0.53	2.46
Excavator	Bulldozing[4]	2.47	2.47	lb/hr	2636	12154
			TOTAL (lb/yr)		4827	22228
			TOTAL (tpy)		2.41	11.11

NOTES:

[1] Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb);
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT.

[2] Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly;
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

[3] U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb).

[4] U.S. EPA AP-42 Chapter 13.2.3 Heavy Construction Operations: Bulldozing (Table 11.9-1), material silt content (s) = 23%, moisture content (M) = 10%; Grading (Table 11.9-1), mean vehicle speed (S) = 5 mph; Material Handling (13.2.4, equation 1), k(PM10) = 0.35, k(PM2.5)=0.053, moisture content (M) = 10%, mean wind speed (U) = 10.2 mph.

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - PM2.5 Emissions

Equipment	Category	PM2.5 Emission Factor			PM2.5 Emissions (lb/yr)	
		2024	2025	units	2024	2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - idle¹	0.02	0.02	-	0.02	0.11
	Passenger Truck - 25 mph¹	0.01	0.01	-		
	Passenger Truck - start¹	0.01	0.01	-		
ON-ROAD and NONROAD						
100-T Crawler Crane	Cranes (175 < hp <= 300)²	2.93	2.52	g/hr	2.79	11.09
Air Compressor	Air Compressors (100 < hp <= 175)²	2.88	2.58	g/hr	1.37	5.66
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)²	7.76	6.11	g/hr	7.39	26.83
Compressor	Air Compressors (75 < hp <= 100)²	3.32	2.94	g/hr	1.58	6.46
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)²	3.68	2.77	g/hr	3.51	12.15
End Dump Truck	Combination Short-Haul Truck - idle¹	3.81	3.51	g/hr	0.54	5.61
	Combination Short-Haul Truck - 25 mph¹	0.62	0.57	g/mi		
	Combination Short-Haul Truck - start¹	0.06	0.05	g/start		
Excavator	Excavators (100 < hp <= 175)²	2.87	2.16	g/hr	2.73	9.48
Flatbed Truck	Single Unit Short-Haul Truck - idle¹	2.80	2.50	g/hr	0.25	3.40
	Single Unit Short-Haul Truck - 25 mph¹	0.27	0.24	g/mi		
	Single Unit Short-Haul Truck - start¹	0.04	0.04	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)²	6.51	5.69	g/hr	3.10	12.48
Generator	Generator Sets (16 < hp <= 25)²	1.41	1.41	g/hr	1.35	6.17
Generator	Generator Sets (300 < hp <= 600)²	19.36	17.30	g/hr	18.44	75.97
Pickup Truck	Light Commercial Truck - idle¹	0.85	0.74	g/hr	0.40	1.63
Rough Terrain Crane	Cranes (100 < hp <= 175)²	3.02	2.59	g/hr	2.88	11.37
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)²	1.89	1.68	g/hr	1.80	7.38
Truck Crane	Cranes (300 < hp <= 600)²	6.91	6.11	g/hr	3.29	13.42
Water Truck	Single Unit Short-Haul Truck - idle¹	2.80	2.50	g/hr	2.67	11.00
FUGITIVE DUST						
Backhoe	Bulldozing⁴	0.97	0.96872	lb/hr	418	1930
Dozer	Bulldozing⁴	0.97	0.96872	lb/hr	418.49	1929.69
End Dump Truck	Material Handling⁴	0.00004	0.00004	lb/ton	0.08	0.37
Excavator	Bulldozing⁴	0.97	0.97	lb/hr	405	1869.33
			TOTAL (lb/yr)		1297	5949
			TOTAL (tpy)		0.65	2.97

NOTES:

¹ Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb)
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb)
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT

² Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb)

³ U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb

⁴ U.S. EPA AP-42 Chapter 13.2.3 Heavy Construction Operations: Bulldozing (Table 11.9-1), material silt content (s) = 23%, moisture content (M) = 10%; Grading (Table 11.9-1), mean vehicle speed (S) = 5 mph; Material Handling (13.2.4, equation 1), k(PM10) = 0.35, k(PM2.5)=0.053, moisture content (M) = 10%, mean wind speed (U) = 10.2 mph.

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - VOC Emissions

Equipment	Category	VOC Emission Factor 2024	VOC Emission Factor 2025	VOC Emission Factor units	VOC Emissions (lb/yr) 2024	VOC Emissions (lb/yr) 2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - idle[1]	1.30	1.16	-	1.45	7.01
	Passenger Truck - 25 mph[1]	0.17	0.15	-		
	Passenger Truck - start[1]	1.65	1.46	-		
ON-ROAD and NONROAD						
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	4.35	3.66	g/hr	4.14	16.07
Air Compressor	Air Compressors (100 < hp <= 175)[2]	3.41	2.92	g/hr	1.62	6.42
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	9.10	7.12	g/hr	8.67	31.29
Compressor	Air Compressors (75 < hp <= 100)[2]	2.89	2.44	g/hr	1.38	5.37
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	3.64	2.87	g/hr	3.47	12.61
End Dump Truck	Combination Short-Haul Truck - idle[1]	7.15	6.48	g/hr	0.44	8.04
	Combination Short-Haul Truck - 25 mph[1]	0.56	0.51	g/mi		
	Combination Short-Haul Truck - start[1]	0.00	0.00	g/start		
Excavator	Excavators (100 < hp <= 175)[2]	1.75	1.35	g/hr	1.66	5.93
Flatbed Truck	Single Unit Short-Haul Truck - idle[1]	6.05	5.36	g/hr	0.46	7.02
	Single Unit Short-Haul Truck - 25 mph[1]	0.53	0.47	g/mi		
	Single Unit Short-Haul Truck - start[1]	0.05	0.05	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	3.60	3.02	g/hr	1.71	6.63
Generator	Generator Sets (16 < hp <= 25)[2]	103.57	101.51	g/hr	98.64	445.81
Generator	Generator Sets (300 < hp <= 600)[2]	29.17	26.18	g/hr	27.78	114.96
Pickup Truck	Light Commercial Truck - idle[1]	2.29	1.95	g/hr	1.09	4.28
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	2.86	2.34	g/hr	2.72	10.29
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	2.97	2.64	g/hr	2.83	11.59
Truck Crane	Cranes (300 < hp <= 600)[2]	9.91	8.70	g/hr	4.72	19.10
Water Truck	Single Unit Short-Haul Truck - idle[1]	6.05	5.36	g/hr	5.76	23.55
			TOTAL (lb/yr)		169	736
			TOTAL (tpy)		0.08	0.37

NOTES:

[1] Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb);
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT.

[2] Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly;
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

[3] U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb).

[4] U.S. EPA AP-42 Chapter 4.5 Asphalt Paving Operations; Table 4.5-1, assume medium cure, 45% by volume of diluent in cutback: asphalt density = 140 lb/ft^3.

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - CO_2 Emissions

Equipment	Category	CO2 Emission Factor			CO2 Emissions (lb/yr)	
		2024	2025	units	2024	2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - idle[1]	3595	3595	-	516	5804
	Passenger Truck - 25 mph[1]	427	427	-		
	Passenger Truck - start[1]	223	223	-		
ON-ROAD and NONROAD						
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	54268	54268	g/hr	51685	238325
Air Compressor	Air Compressors (100 < hp <= 175)[2]	29494	29494	g/hr	14045	64764
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	12720	12720	g/hr	12115	55862
Compressor	Air Compressors (75 < hp <= 100)[2]	21282	21282	g/hr	10134	46731
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	74582	74582	g/hr	71032	327535
End Dump Truck	Combination Short-Haul Truck - idle[1]	8304	8304	g/hr	1924	16781
	Combination Short-Haul Truck - 25 mph[1]	2110	2110	g/mi		
	Combination Short-Haul Truck - start[1]	314	314	g/start		
Excavator	Excavators (100 < hp <= 175)[2]	43578	43578	g/hr	41504	191380
Flatbed Truck	Single Unit Short-Haul Truck - idle[1]	8136	8136	g/hr	1258	13550
	Single Unit Short-Haul Truck - 25 mph[1]	1293	1293	g/mi		
	Single Unit Short-Haul Truck - start[1]	292	292	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	30100	30100	g/hr	14334	66094
Generator	Generator Sets (16 < hp <= 25)[2]	14757	14757	g/hr	14054	64806
Generator	Generator Sets (300 < hp <= 600)[2]	95671	95671	g/hr	91117	420152
Pickup Truck	Light Commercial Truck - idle[1]	5256	5256	g/hr	2503	11541
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	33150	33150	g/hr	31572	145581
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	6561	6561	g/hr	6248	28812
Truck Crane	Cranes (300 < hp <= 600)[2]	94054	94054	g/hr	44789	206526
Water Truck	Single Unit Short-Haul Truck - idle[1]	8136	8136	g/hr	7748	35728
			TOTAL (lb/yr)		416578	1939971
			TOTAL (tpy)		208	970

NOTES:

[1] Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb);
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT

[2] Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly;
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

[3] U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb)

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - CH_4 Emissions

Equipment	Category	CH4 Emission Factor			CH4 Emissions (lb/yr)	
		2024	2025	units	2024	2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - idle[1]	0.02	0.02	-	0.06	0.29
	Passenger Truck - 25 mph[1]	0.004	0.004	-		
	Passenger Truck - start[1]	0.07	0.07	-		
ON-ROAD and NONROAD						
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	0.33	0.33	g/hr	0.31	1.44
Air Compressor	Air Compressors (100 < hp <= 175)[2]	0.23	0.23	g/hr	0.11	0.50
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	0.22	0.22	g/hr	0.21	0.99
Compressor	Air Compressors (75 < hp <= 100)[2]	0.18	0.18	g/hr	0.08	0.39
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	0.23	0.23	g/hr	0.22	1.01
End Dump Truck	Combination Short-Haul Truck - idle[1]	0.51	0.51	g/hr	0.04	0.67
	Combination Short-Haul Truck - 25 mph[1]	0.05	0.05	g/mi		
	Combination Short-Haul Truck - start[1]	0.00	0.00	g/start		
Excavator	Excavators (100 < hp <= 175)[2]	0.11	0.11	g/hr	0.11	0.50
Flatbed Truck	Single Unit Short-Haul Truck - idle[1]	0.61	0.61	g/hr	0.07	0.91
	Single Unit Short-Haul Truck - 25 mph[1]	0.06	0.06	g/mi		
	Single Unit Short-Haul Truck - start[1]	0.03	0.03	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	0.23	0.23	g/hr	0.11	0.51
Generator	Generator Sets (16 < hp <= 25)[2]	9.16	9.16	g/hr	8.73	40.25
Generator	Generator Sets (300 < hp <= 600)[2]	1.13	1.13	g/hr	1.07	4.94
Pickup Truck	Light Commercial Truck - idle[1]	0.36	0.36	g/hr	0.17	0.80
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	0.21	0.21	g/hr	0.20	0.91
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	0.19	0.19	g/hr	0.18	0.82
Truck Crane	Cranes (300 < hp <= 600)[2]	0.60	0.60	g/hr	0.29	1.32
Water Truck	Single Unit Short-Haul Truck - idle[1]	0.61	0.61	g/hr	0.58	2.66
			TOTAL (lb/yr)		13	59
			TOTAL (tpy)		0.01	0.03

NOTES:

[1] Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb);
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT

[2] Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly;
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

[3] U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb)

GLASS BREAKWATER EMERGENCY BREACH REPAIRS - N2O Emissions

Equipment	Category	N2O Emission Factor			N2O Emissions (lb/yr)	
		2024	2025	units	2024	2025
GOVERNMENT FLEET VEHICLES						
Passenger Truck	Passenger Truck - idle[1]	0.00	0.00	-	0.04	0.16
	Passenger Truck - 25 mph[1]	0.00	0.00	-		
	Passenger Truck - start[1]	0.04	0.04	-		
ON-ROAD and NONROAD						
100-T Crawler Crane	Cranes (175 < hp <= 300)[2]	-	-	-	-	-
Air Compressor	Air Compressors (100 < hp <= 175)[2]	-	-	-	-	-
Backhoe	Tractors/Loaders/Backhoes (75 < hp <= 100)[2]	-	-	-	-	-
Compressor	Air Compressors (75 < hp <= 100)[2]	-	-	-	-	-
Dozer	Crawler Tractor/Dozers (175 < hp <= 300)[2]	-	-	-	-	-
End Dump Truck	Combination Short-Haul Truck - idle[1]	0.00	0.00	g/hr	0.00	0.02
	Combination Short-Haul Truck - 25 mph[1]	0.00	0.00	g/mi		
	Combination Short-Haul Truck - start[1]	0.01	0.01	g/start		
Excavator	Excavators (100 < hp <= 175)[2]	-	-	-	-	-
Flatbed Truck	Single Unit Short-Haul Truck - idle[1]	0.00	0.00	g/hr	0.0040	0.0185
	Single Unit Short-Haul Truck - 25 mph[1]	0.00	0.00	g/mi		
	Single Unit Short-Haul Truck - start[1]	0.01	0.01	g/start		
Forklift Truck	Rough Terrain Forklifts (75 < hp <= 100)[2]	-	-	-	-	-
Generator	Generator Sets (16 < hp <= 25)[2]	-	-	-	-	-
Generator	Generator Sets (300 < hp <= 600)[2]	-	-	-	-	-
Pickup Truck	Light Commercial Truck - idle[1]	0.00	0.00	g/hr	0.00	0.00
Rough Terrain Crane	Cranes (100 < hp <= 175)[2]	-	-	-	-	-
Skid Steer Loader	Skid Steer Loaders (40 < hp <= 50)[2]	-	-	-	-	-
Truck Crane	Cranes (300 < hp <= 600)[2]	-	-	-	-	-
Water Truck	Single Unit Short-Haul Truck - idle[1]	0.00	0.00	g/hr	0.00	0.00
			TOTAL (lb/yr)		0.0	0.2
			TOTAL (tpy)		0.00002	0.0001

NOTES:

[1] Onroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; January, Hour 08:00-08:59, Weekdays; Virgin Islands St. Thomas; Rural Unrestricted Access, Off-Network; Non-Extended Idle Processes; Soak Time ≥ 720 minutes; assume all idle when only operating hours available (no VMT data);
Idle Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).
Running (25 mph) Emissions (lb/yr) = Emission Factor (g/mi) x activity (mi/yr)]/(453.59 g/lb);
Start Emissions (lb/yr) = Emission Factor (g/start) x 2 starts/trips x activity (trips/yr)]/(453.59 g/lb); trips/yr = annual VMT/project total VMT

[2] Nonroad - U.S. EPA MOtor Vehicle Emission Simulator (MOVES) 2014b; Weekdays, All Months; Virgin Islands St. Thomas; All Processes; Maximum Monthly
Emissions (lb/yr) = [Emission Factor (g/hr) x activity (hr/yr)]/(453.59 g/lb).

[3] U.S. EPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report, April 2009;
Emissions (lb/yr) = # equipment x [Emission Factor (Table 3-8, g/kWh) x # engines x load factor (Table 3-3) x activity (hr/yr) x average rated power (kW)]/(453.59 g/lb)

Appendix B

Endangered Species Act and Essential Fish Habitat Consultation Documentation

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1845 Wasp Blvd., Bldg 176
Honolulu, Hawaii 96818
(808) 725-5000 • Fax: (808) 725-5215

October 28, 2024

Mr. Edward Moon
Installation Environmental Program Director
Department of the Navy
U.S. Naval Base Guam
PSC 455 BOX 152
FPO AP 96540-1000

RE: Request for Informal ESA Consultation for the Glass Breakwater Emergency Breach Repairs, U.S. Naval Base Guam, Apra Harbor, Guam (Consultation Numbers: PIRO-2024-02440 and I-PI-24-2383-DG)

Dear Mr. Moon:

On September 27, 2024, NOAA's National Marine Fisheries Service (NMFS) received your written request for concurrence for the U.S. Navy's (Navy) proposed action of repairing a deteriorating breakwater. The proposed action may affect endangered or threatened species under our jurisdiction, as identified below in Table 1. On October 1, 2024, we asked for additional information, and on October 22, 2024 you provided all the necessary information to evaluate the proposed action, and ESA section 7 consultation was initiated on that date.

We prepared this response to your request pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 *et seq*.), implementing regulations at 50 CFR 402, and agency guidance for the preparation of letters of concurrence. This letter also underwent pre-dissemination review using standards for utility, integrity, and objectivity in accordance with applicable guidelines issued under the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Pacific Island Regional Office, Honolulu, Hawai'i.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 84 Fed. Reg. at 45015; 89 Fed. Reg. at 24268. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this letter of concurrence would not have been any different under the 2019 regulations or pre-2019 regulations.

Proposed Action

The purpose of the action is to stabilize two vulnerable areas in the breakwater to prevent catastrophic erosion or failure and to ensure safe passage and mooring of important naval and commercial operations. The emergency repairs will not expand beyond the footprint of the original structure. The larger section near the western end of the breakwater is 381 meters (m) (1,250 feet (ft)) long while the smaller section to the northeast is 61 m (200 ft), compared to the approximately 1,902 m (6,242 ft) length of the entire breakwater.

The Navy proposes to repair the Glass Breakwater by relocating existing armoring stones into places where previous stones have been dislodged. After relocation, the Navy will further support the repaired areas by placing concrete armor units (asymmetrical concrete blocks used to simulate hardening like rocks) on or near the newly repaired sites. The Navy will work during daylight hours only and is not proposing any in-water work or use of vessels during this action. All work will be conducted from land-based cranes and heavy equipment on the existing road on the breakwater. The Navy will avoid working in water but may place rocks or concrete units up to two meters below mean higher high water (MHHW).

The Navy is planning to rebuild the entire breakwater to meet the U.S. Army Corps of Engineers' standards in the future. We are not considering the effects of those future activities as part of this consultation.

As part of the action, the Navy is proposing to implement a large list of best management practices (BMP) detailed in section 2.5 of their BA. Some of the notable BMPs include:

- A competent observer will use binoculars to monitor the Action Area for ESA-listed sea turtles and scalloped hammerhead sharks during removal and placement of rocks and concrete armor units. If these animals are observed in the work area, the Navy will ensure that the workers on site will halt construction when sea turtles or sharks are observed during rock removal or placement.
- The Navy will limit work to daylight hours, work exclusively upland, and limit placement of rocks and concrete units to the existing footprint.
- The Navy will ensure that the contractors will minimize sediments entering the water by working during low tide, avoiding work during inclement weather or sea state, and using mats, silt curtains and methods to confine loose sediments to the work site.
- The Navy will ensure that the contractors will minimize the risk of pollutants entering the water where it can expose ESA-listed species by inspecting equipment prior to work, staging equipment and vehicles away from water ways, refueling at least 50 m away from waterways, and refraining from work during inclement weather.

Action Area

The action area is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). The action area for the proposed activities encompasses the full extent of the action's modifications to land, water, and air from the proposed activities. To repair the breakwater, the contractor could take existing aggregate from any part. The contractor also proposes to stage the equipment on the road on top of the breakwater. We are considering the entire length of the breakwater as part of the action area since the contractor will be using the road which is on top of the breakwater and could take rocks from any part of the breakwater. The action area will also include any areas that could be affected by sedimentation or noise during construction. We expect areas affected by sedimentation and noise to extend no further than 100 m from the breakwater during construction.

Listed Species in the Action Area

We are reasonably certain the ESA-listed species and designated critical habitat under our jurisdiction listed in Table 1 occur in the action area, and may be affected by the proposed activities. Detailed information about the biology, habitat, and conservation status of the animals listed in Table 1 is available in their status reviews, recovery plans, federal register notices, and other sources at https://www.fisheries.noaa.gov/species-directory/threatened-endangered.

Table 1. Common name, scientific name, ESA status, effective listing date, critical habitat designation, and recovery plans, with Federal Register reference for ESA-listed species considered in this consultation.

Species/ common name	ESA Status	Effective Listing Date/ FR Notice	Critical Habitat	Recovery Plan
Chelonia mydas Central West Pacific Green Sea Turtle	Endangered	05/06/2016 81 FR 20057	Proposed 07/19/2023 88 FR 46572	
Eretmochelys imbricata Hawksbill Sea Turtle	Endangered	06/03/1970 35 FR 8491		5/22/98 63 FR 28359
Sphyrna lewini Scalloped Hammerhead Shark Indo West Pacific	Threatened	09/02/2014 79 FR 38213		
Acropora globiceps		10/10/2014 79 FR 53852	Proposed 11/30/2023 88 FR 83644	

Analysis of Effects

Under the ESA (50 CFR 402.02), "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

The applicable standard to find that a proposed action is "not likely to adversely affect" listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial (USFWS & NMFS 1998). Discountable effects are those extremely unlikely to occur. Insignificant effects relate to the size of the impact and should never reach the scale where take[1] occurs. Beneficial effects are contemporaneous positive effects without any adverse effects.

While the Navy proposed BMPs will help to minimize effects on the species listed in Table 1, we have identified the following stressors which remain, and have the potential to affect listed marine species and/or critical habitat in the action area:

- Risk of exposure to noise
- Temporary disturbance from human activity
- Risk of exposure to increased suspended sediments
- Risk of direct physical contact
- Risk of exposure to waste and discharge
- Risk of entanglement

Risk of exposure to noise
There will be an increase in sound associated with rocks and concrete units being placed onto rocks. However, the breakwater creates a loud ambient environment with waves pounding the rock structure. The placement of rocks upland will create airborne sounds and sounds that can travel through the solid medium (existing rocks). The sounds generated by the proposed action will lose most of their energy (especially air) as they transfer to the water where the ESA-listed species could be exposed. The Navy is also implementing BMPs to halt construction when sea turtles or sharks are observed close to the work site. All sounds are likely to have immeasurable and insignificant effects to ESA-listed species because they would be lower than the thresholds for harm or harassment when they are exposed.

Temporary disturbance from human activity
Due to the upland construction activity close to subtidal habitat, the potential exists for disturbing individuals of those species found in Table 1 should they happen to be in the area when those activities are taking place.

Based on compliance with the proposed BMPs described above (including proximity measures), which are intended to avoid interactions with listed species, the chances of an interaction are extremely unlikely. If any listed species were to be in proximity to the breakwater during construction, there is the possibility that the interaction could result in a range of reactions, from no reaction, to a startled reaction which could result in the animal leaving the area. Any responses would be low-energy responses, and would not result in take. If an interaction were to occur, the effects on the listed species from Table 1 would not reach the scale where harassment or harm will occur. Thus, the effects from disturbance on these species, if they were to occur, are insignificant.

Risk of exposure to increased suspended sediments
Considering the extent of boulder movement anticipated during the removal and placement of boulders or concrete units, we expect some suspended sediments to enter the water column, especially from rocks or concrete units placed below MHHW.

[1] The "term" take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. §1532). We define "harass" as to create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (Wieting 2016).

Sea turtles, sharks, and corals could be exposed to small increases of suspended sediments. Sea turtles are sharks are less likely to be exposed to measurable levels because the Navy will halt work if they are near the work area, and can move from affected areas. Corals are most vulnerable to turbidity plumes. The proposed action could generate sediments entering the water column from upland construction. Suspended sediments can smother and cover coral colonies or create a plume in the water column, both of which attenuate light. In the most severe cases, coral colonies could be harmed by being buried or deprived of light long enough to reduce photosynthesis.

However, these episodes would be intermittent, localized, and limited since only large aggregates are being placed. Removing existing rocks could expose silt. The Navy will use silt curtains, mats, and other BMPs to prevent loose silt from entering the water.

The Navy will implement several BMPs that will minimize the level of sedimentation entering the subtidal habitat during construction. The Navy will be adhering to local water quality standards which will have halt work orders, with corrective measures if acceptable turbidity levels are exceeded. With the high wave energy at the site, suspended sediments dissipate quickly and not build to levels that could smother living coral in the action area or attenuate light long enough to stunt photosynthesis or growth. Thus, the effects from disturbance on these species, if they were to occur, are insignificant.

Risk of direct contact with rocks or concrete units

The Navy will avoid and minimize contacting ESA-listed species by limiting all planned work above water. The Navy may place boulders or concrete units up to two meters below MHHW but will limit placement during low tide when those areas are dry. Despite all proposed work being upland, the existing breakwater is high, steep, unstable, and improperly placed rocks could roll away into the subtidal water below. The Navy will ensure that all BMPs will be implemented to avoid any spillage or rolldown of rocks or concrete units that would fall into the water and potentially crush any ESA-listed species in its path. The Navy will reduce the risk of contact with sea turtles and sharks by halting work when they are observed near the work site.

Through the use and implementation of their BMPs, there is a low risk of rocks or concrete units rolling off into the nearby subtidal water where it can harm or harass ESA-listed species. No in-water work is anticipated, so the probability of striking any of the species listed in Table 1 are extremely unlikely, and therefore discountable.

Risk of exposure to waste and discharge

There is the potential for a listed species from Table 1 coming into contact with waste or discharge from heavy equipment operating nearshore. To reduce the potential for project-related environmental contaminant release, all equipment and vehicles will be maintained and checked daily to reduce the risk of leaks or discharge, and hydraulic equipment will be maintained properly to prevent leaks.

Based on the use of BMPs, the likelihood of a listed species from Table 1 above coming into contact with appreciable amounts of waste or discharge from the vessel used in this proposed project would be extremely unlikely, and therefore discountable.

Risk of entanglement

Despite the Navy's mention of a risk of entanglement in the BA, there is nothing in their proposal that would present an entanglement risk. The Navy is not proposing to use ropes, nets, or any kind of material that poses an entanglement risk and is not proposing in-water work. Therefore, the probability of a listed species being exposed to entanglement is extremely unlikely, and therefore discountable.

Conclusion

Considering the information and assessments presented in the consultation request and available reports and information, and in the best scientific information available about the biology and expected behaviors of the ESA-listed marine species considered in this consultation, all effects of the proposed action are either discountable or insignificant. Accordingly, we concur with your determination that the proposed action is not likely to adversely affect the ESA-listed species found in Table 1.

This concludes informal consultation under section 7 of the ESA for species under our jurisdiction. Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect essential fish habitat (EFH). If necessary, it is your responsibility to request EFH consultation for this action with NMFS' Habitat Conservation Division.

Reinitiation Notice

Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action.

If you have further questions, please contact Joel Moribe at (808) 725-5124 or joel.moribe@noaa.gov. Thank you for working with NMFS to protect our nation's living marine resources.

Sincerely,

Dawn Golden

Dawn Golden
Assistant Regional Administrator
Protected Resources Division

ECO Reference No.: PIRO-2024-02440
PIRO Reference No.: I-PI-24-2383-DG

References

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Glass Breakwater EFH Consultation Letter of Concurrence

Dear Mr. Moon,

Thank you for your reply to our Conservation Recommendations letter for the emergency repair of the Glass Breakwater in Apra Harbor, Guam. We appreciate the Navy agreeing with and accepting all of the recommendations we provided. **This concludes the consultation.**

Thank you for consulting with us for this project and giving us the opportunity to support this important work. The professionalism of your team made the consultation straightforward and smooth. We wish you success with the emergency repairs, and we look forward to talking to you in the coming year about the larger efforts to overhaul the Glass Breakwater.

Very respectfully,

Sean F. Hanser, PhD.
Resource Management Specialist, Habitat Conservation Division
Pacific Islands Regional Office
National Marine Fisheries Service | U.S. Department of Commerce
(808) 725-5091

On Thu, Oct 24, 2024 at 6:50 PM Moon, Edward E CIV USN NAVFAC MARIANAS GU (USA) edward.e.moon2.civ@us.navy.mil wrote:

Dear Mr. Hanser,

In accordance with the Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 6 U.S.C. § 1801 et seq.), the Navy is providing this email as a response to the National Marine Fisheries Service (NMFS) conservation recommendations email, dated 23 October 2024 (ChST). The EFH consultation is for proposed emergency breach repairs in Apra Harbor, U.S. Naval Base Guam. Many of the effects from the project can be avoided and minimized through the implementation of the Best Management Practices (BMPs) that were described in the Navy's EFH assessment; which was submitted to NMFS on 27 September 2024. The Navy understands that conservation recommendations from NMFS are intended to enhance or to be in addition to BMPs, and the Navy provides its responses to the conservation recommendations below.

NMFS Conservation Recommendation #1: If in-water repairs must take place and unavoidable loss of coral or important cover that cannot recolonize quickly, such as CCA, can be reasonably thought to have occurred, document the number of colonies and/or area lost in order for the loss to be incorporated into the mitigation for the imminent major repairs of the Glass Breakwater. Share the information with NMFS within 60 days of the losses. The temporal lag between the loss and the upcoming mitigation should be taken into account when estimating offset.

- If the losses occur within the first 2 m (6.6 ft.) of the HTL can be observed, directly measure the loss through observation.
- If the losses occur within the first 2 m (6.6 ft.) of the HTL and cannot be observed because assessment is unsafe or impractical, estimate the area affected and use the mean density estimate of 1.3 coral colonies/m2 (0.12 colonies/ft2) to estimate the loss.
- If losses occur beyond 2 m (6.6 ft.) of the HTL because of unforeseen circumstances or accident, attempt to document and estimate the losses with a drop camera, drone, remotely operated vehicle, or divers.

Navy Response to Conservation Recommendation #1: The Navy concurs with CR#1 and in the unlikely event that unavoidable losses to essential fish habitat communities may occur, those losses will be recorded and quantified into the full Glass Breakwater repairs.

NMFS Conservation Recommendation #2: Consider removing construction equipment and stockpiled material from the top of the Glass Breakwater in the event of extreme foul weather (i.e., tropical storms and hurricanes). Equipment that becomes marine debris may be more of a threat to the environment than armor stones moved by waves.

Navy Response to Conservation Recommendation #2: The Navy agrees with CR#2 and will ensure all equipment and/or construction material is moved within reason in the event of an extreme weather event.

The Navy appreciates NMFS's effort and careful deliberation invested in evaluating the proposed actions and providing these EFH conservation recommendations. Should you have any questions or concerns, please contact Kaitlyn Jacobs at NAVFAC Pacific at Kaitlyn.p.jacobs.civ@us.navy.mil <mailto:Kaitlyn.p.jacobs.civ@us.navy.mil>

Very respectfully,

Ed Moon
Installation Environmental Program Director.
Public Works Department, Naval Base Guam.
Edward.e.moon2.civ@us.navy.mil
DSN: (315) 339-4100
COMM: (671) 339-8203

-----Original Message-----
From: Sean Hanser - NOAA Federal <sean.hanser@noaa.gov
Sent: Wednesday, October 23, 2024 7:31 AM
To: Moon, Edward E CIV USN NAVFAC MARIANAS GU (USA) edward.e.moon2.civ@us.navy.mil; Jacobs, Kaitlyn P CIV (USA) kaitlyn.p.jacobs.civ@us.navy.mil
Cc: Mckagan, Steven C CIV (USA) steven.mckagan@noaa.gov; Delaney, David G CIV (USA) david.delaney@noaa.gov; Lino, Kevin C CIV USN NAVFAC PAC PEARL HI (USA)

kevin.c.lino.civ@us.navy.mil; Bejder, Michelle M CIV USN NAVFAC PAC PEARL HI (USA) michelle.m.bejder.civ@us.navy.mil; Chow, Marguerite M CIV (USA) malia.chow@noaa.gov
Subject: Re: Navy's Request for EFH/ESA Consultation for proposed Emergency Breach Repairs of Glass Breakwater, Apra Harbor, Guam

Dear Mr. Moon,

The National Marine Fisheries Service, Pacific Islands Regional Office (NMFS), received Naval Base Guams' (Navy's) essential fish habitat (EFH) consultation request and EFH Assessment (EFHA) for an emergency repair of the Glass Breakwater on September 27, 2024. In the package you submitted you have outlined best management practices (BMPs) that, when adhered to and implemented, will avoid and minimize the majority of adverse effects to EFH. We are providing some conservation recommendations (CRs) pursuant to the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; Section 305(b)(2) as described by 50 CFR 600.920). When implemented, these (CRs) will help you further avoid and minimize potential adverse effects to EFH.

Consultation History

A pre-consultation meeting to inform NMFS of the repair needs of the Glass Breakwater, located in Apra Harbor, Guam, occurred on June 12, 2024. At that time, the Navy made it clear that a major repair of the Breakwater was necessary, but interim emergency repairs would probably be needed to stabilize the structure before the major repair. NMFS had conducted two consultations in December 2012 and early 2013 with Naval Base Guam for a repair of the north shore and the far west end of the Glass Breakwater from damage caused by Typhoon Pongsona in December 2002. On June 25, 2024 the Navy inquired if an EFH consultation would be necessary for an emergency repair, since the Endangered Species Act (ESA) has a special provision for emergency actions that precludes formal consultation submission. NMFS confirmed on the same day that an EFH consultation would be necessary for the emergency repair and there was enough time to do an abbreviated consultation. On August 21, 2024, the Navy provided a draft consultation document that provided ESA stressor analysis and determinations along with an EFH Analysis. The Navy returned comments on the draft on September 4, 2024. A follow-up discussion of the comments occurred on September 24, 2024, and the final consultation document was submitted on September 27, 2024.

Project Description

The proposed action is to perform emergency repairs to the north side, the Philippine Sea-side, of the Glass Breakwater, called the 'Outer Breakwater.' The Outer Breakwater was damaged by typhoon Mawar in May 2023 and subsequent storms. Sections of the breakwater are severely eroded and susceptible to imminent breaching from normal wave action. Repairs will occur where "armor" rocks (large stones placed as riprap to protect shorelines and other structures from erosion) safeguarding the breakwater's inner core have been displaced or washed away into the ocean.

The goal of the proposed action is to stabilize the breakwater for a short period of time until lasting repairs to the Breakwater overall can be executed. The Outer Breakwater west of Luminao Reef, including the area wrapping around the point at the harbor mouth, has been evaluated by engineers as being in poor, serious, or critical condition. Repair activities will involve relocating intact armor stones from nearby at the crest of breakwater and repositioning them on the failing areas. The entire breakwater is approximately 1,902 meters (m) (6,242 feet [ft]) long. Two sections of the Outer Breakwater are slated for emergency repair: 1) a section near the western end of the breakwater 381 m (1,250 ft) long and 2) a smaller section closer to Lumnao Reef 61 m (200 ft.) long.

The repairs are expected to be carried out with a land-based crane from the top of the breakwater. To enable the crane to reach out to the toe of the existing structure, the Navy projects that the top 3 m (10 ft) of the breakwater may be lowered by removing armor stone. Crane capacity will be a controlling factor in selection of armor stone size and weight. Available armor stones or concrete units are anticipated to vary from 15 to 50 tons, depending on the size required to fill existing holes or depressions in the structure.

Armor stones will be lowered onto the breakwater one at a time and placed on existing armor. In some cases, armor stones on either side of a repair may need to be moved or reset to allow accurate placement of the armor units. The emergency repairs will not expand beyond the footprint of the original structure to minimize potential impacts on marine species. In-water work is not expected. If an unusual circumstance arises and it is deemed necessary to work in the water by the construction contractor, activity will be limited to 2 m (6.6 ft) seaward from the high tide line (HTL). The water will be less than 2 m (6.6 ft.) in depth.

The preferred contractor staging area for equipment and materials is at a wide point in the road on top of the Glass Breakwater. It is at the midpoint of the breakwater not far from the emergency repair areas.

Schedule

Equipment mobilization and site preparation will begin in November 2024. The repairs could take up to 36 weeks, meaning that the action would be complete by the end of July 2025. The major repair of the Glass Breakwater will follow the emergency repair relatively quickly. The consultation for the action is expected to occur in the summer of 2025 and the repairs could start as early as the beginning of fiscal year 2026.

Essential Fish Habitat

The marine water column from the surface to a depth of 1,000 m (3,280 ft) from shoreline to the outer boundary of the Exclusive Economic Zone (370 kilometers [200 nautical miles]), and the seafloor from the shoreline out to a depth of 400 m (1,312 ft) around each of the Mariana Islands, have been designated as EFH. As such, the water column and bottom and all surrounding waters and submerged lands around Apra Harbor are designated as EFH and support various life stages for the management unit species (MUS) identified under the Western Pacific Fishery Management Council's Pelagic and Mariana Archipelago Fishery Ecosystem Plans and amendments (WPFMC 2009a, 2009b, 2018). The MUS and life stages found specifically within the action area include eggs, larvae, juveniles, and adults for Bottomfish and Pelagic MUS. Specific types of habitats considered as EFH within, or adjacent to, the proposed project area include coral reef, patch reefs, hard substrate, artificial substrate, seagrass beds, soft substrate, mangrove, lagoon, estuarine, surge zone, deep-slope terraces and pelagic/open ocean.

Baseline Condition

The Glass Breakwater is a manmade structure. The water off the Outer Breakwater is a dynamic area that experiences regular and considerable wave energy. It is often battered by storms and typhoons that strike Guam. The area in front of the Outer Breakwater almost always experiences heavy wave action on a daily basis. Divers conducting benthic surveys in February and March 2024 noted the armor stones on the Outer Breakwater showed significant movement caused by waves in the form of boulder slides and locations where boulders were dislodged from the above-water structure and washed into the sea. Some boulders have been sheared, scoured each other, and broken into pieces. The northeast section of the Outer Breakwater nearest the shallow reef flat of Luminao Reef experiences a strong southwesterly current that flows off the reef flat. The limestone boulders that make up most of the substrate of the Outer Breakwater are covered primarily with light turf algae or are encrusted by crustose coralline algae (CCA). In fact, CCA is the dominant bottom cover with an average of 43%.

On the Outer Breakwater, corals are generally low density within 2 m (6.6 ft) of the shoreline with an average density of 1.3 colony/m2 (0.12 colony/ft2) and become more abundant, diverse, and larger at approximately the 3- to 4-m (9.9- to 13.1-ft) depth contour. Over the length of the breakwater, the highest coral abundance and diversity within 2 m (6.6 ft) of the shoreline occurs in the northeast section nearest the reef flat at Luminao. The lowest coral cover on the Outer Breakwater is found on the distal third including at the tip of the breakwater, from the water line down to the breakwater toe.

During surveys in February and March 2024, divers noted at least 11 coral genera (Acropora sp., Astrea sp., Dipsastrea sp., Favites sp., Goniastrea sp., Hydnophora sp., Leptastrea sp., Leptoria sp., Montipora sp., Pocillopora spp., and Porites spp.) on the Outer Breakwater. The most common genus encountered was Goniastrea at 40% of the total. Most of the colonies observed were small with 77% of the colonies being less than 10 cm at the largest dimension. The majority of the colonies observed (64%) were in a transect close to the reef flat at Luminao. The majority of colonies are encrusting growth form – 65% of the colonies recorded. Many coral colonies show signs of mechanical damage.

Divers observed large schools of surgeon fishes and parrot fishes grazing on the boulders. A few snappers and trevally were seen patrolling the area. The challenging conditions for diving due to current and wave action precluded obtaining fish counts during surveys.

Adverse Effects

Although the vast majority, if not all of the repairs to the Outer Breakwater will occur above the water, the proposed activities has a low, but nonzero, chance that adverse effects to EFH could occur in the form of physical damage and removal of marine resources, sedimentation and turbidity, introduction of chemical contaminants, noise, nutrient loading, and introduction of invasive species. Work on land in coastal areas can end up affecting aspects of EFH distant from where a project occurs. Stressors that affect water quality through either increased turbidity or contamination can, in turn, affect flora and fauna over time and space (Minton 2017).

Physical Damage/Removal (physical stressor): Repairing armor rocks on the Breakwater could result in the temporary alteration of EFH substrate and the direct unavoidable loss of benthic organisms, such as corals, macroalgae, filter feeders (e.g., sponges and bryozoans), and fish and mobile invertebrates that inhabit spaces between rocks. Potential direct impacts to substrate and organisms would be from the operation of heavy machinery to move boulders in the water. The majority of the boulders that would be moved will be above the water's surface and beyond tidal influence. A minority of boulders may occur below the lowest reach of the tide that may have colonizing corals. Rocks in the intertidal area could support algae, crabs, bivalves and other species that can tolerate periodic exposure to the air. Moving rocks in the intertidal or subtidal zones could affect EFH.

The Navy has indicated that they expect repair work to occur primarily out of the water and if it does need to happen in the water, it will be within the 2 m (6.6 ft) of the HTL. Unavoidable losses of coral are not expected. This should be achievable, especially because corals occurred at low density around the areas where repairs will take place and are not close to the Luminao reef flat.

Physical damage to organisms, including corals, from construction often results in breakage, dislocation, or mortality, but can also result in sub-lethal tissue abrasion. Corals are particularly vulnerable to physical damage because their slow-growing carbonate skeleton is relatively brittle and their polyps are easily damaged. In general, lobate, encrusting, and other massive colony morphologies tend to withstand breakage better than foliose, table, plating, and branching morphologies; more fragile forms tend to have higher growth rates (Rützler 2001). The survey report attached to the EFHA indicated that none of the corals documented on the Outer Breakwater were branching and the vast majority were an encrusting growth form. Mobile species that are killed or displaced when rocks are moved are expected to recolonize once the repairs are finished.

Sedimentation (water quality stressor): The use of heavy equipment to remove vegetation and to reset and replace stones in the harbor structures will increase loose substrate in the project area, potentially leading to a temporary increase of sediment being introduced to the marine environment during construction and rain events. Suspended sediment can elicit short- and long-term responses from aquatic organisms depending on the quantity, quality, and duration of suspended sediment exposure (Kjelland et al. 2015). Coral reef organisms are easily smothered by sediment and can experience both physiological and lethal responses to concentrations below 10 milligrams (mg)/cm2 /day and 10 mg/Liter (L) (Tuttle and Donahue 2022). Adverse effects from deposited sediment can occur as low as 1 mg/cm2/day for larvae and 4.9 mg/cm2 /day for adult tissue (Tuttle and Donahue 2022). Suspended sediment levels of 10 mg/L can lead to reduced growth rates and levels of 3.2 mg/L can cause bleaching and tissue mortality (Tuttle and Donahue 2022), although corals show considerable interspecific variability. Increased turbidity can cause changes in fish behavior, including altered predator-prey relationships (Higham et al. 2015).

Impacts to water quality from sedimentation associated with this project would be short-term and temporary, lasting only as long as the repair activities last and the time it takes for the substrate under the armor stones to stabilize. The persistent wave action on the Outer Breakwater can wash sediment into the ocean and temporarily increase sedimentation, but the active movement of the water has the potential to clear away cloudy water quickly and move suspended sediment away from organisms growing on the Breakwater. The effects of sedimentation can also be minimized by implementing appropriate erosion control BMPs.

Chemical Contamination (water quality stressor): The use of heavy equipment increases risk of chemicals being introduced to the marine environment from spills or releases. Pollutants may enter the marine environment via runoff, wind, spillage, or drainage systems. The implementation of BMPs is essential to avoiding and managing chemical contamination. Contaminants can have a variety of lethal and sublethal effects on habitat-forming marine organisms, including alteration of growth, interference with reproduction, disruption of metabolic processes, and changes in behavior. These adverse effects can cascade through ecosystems, altering species composition and ecosystem functions and services. Some pollutants are environmentally persistent and can take years or even decades to biodegrade, and others can bioaccumulate or biomagnify through the food chain, eventually posing a direct threat to human health. Contaminant concentrations in fishes are linked to locations with increased urbanization and military history (Nalley et al. 2021; 2023a).

Noise (environmental stressor): Use of heavy equipment will cause increased noise in the construction areas and may expose individual habitat-forming marine organisms to sound and vibratory stressors. Behavioral changes can occur as a response to noise, resulting in animals leaving feeding or reproduction grounds (Slabbekoorn et al. 2012) or becoming more susceptible to mortality through decreased predator-avoidance responses (Simpson et al. 2016). Although not likely to kill organisms, chronic noise can mask biologically important sounds and alter the natural soundscape, cause hearing loss, and/or have an adverse effect on an organism's stress levels and immune system. Sound that has its source on land, either in air or in the ground, does not propagate well into the aquatic environment compared to sound sources actually occurring in the marine environment (Richardson et al. 2013). The difference in density and other physical properties between mediums such as air and water or water and land limit the propagation of sound. For this project, noise occurring in the water will be limited, because the majority of the repair work is occurring above the waterline and no equipment will be operating or staged in the water or on vessels. Construction equipment may reach into the water to move or place rocks.

Nutrient Loading (water quality stressor): Nutrient loading may occur from nutrient laden runoff and sediment coming from construction activities, stockpiles that are uncovered or not stabilized, and exposed ground that may erode. The action of removing, resetting, and replacing stones may expose the underlayer of finer sediment and organic content that has accumulated in the interstitial spaces of the stones. Movement of this fine sediment into the marine environment may degrade water quality in the project area. Changes in the drainage profile both during and after repair of the Breakwater may increase the flow of stormwater to the nearshore environment permanently. Coral reef ecosystems thrive in oligotrophic, or nutrient-poor, waters, and nutrient enrichment has been shown to negatively affect coral reef ecosystems directly and indirectly (Nalley et al. 2023b). Growth rates of macroalgae are constrained by nutrient limitation and herbivore grazing, thereby preventing algae from overgrowing and killing corals under normal conditions (Carpenter 1986; Littler et al. 1991). Exposure to elevated nutrients can cause a shift to an assemblage dominated by algae (Lapointe 1997; Dudgeon et al. 2010). Nutrient enrichment can also lead to increased abundances of invasive algae that outcompete native algae in areas with nutrient pollution (Dulai et al. 2023).

The persistent wave action on the Outer Breakwater can increase erosion and wash organic matter into the ocean. The active movement of the water will not allow nutrients concentrated in the water by the face of the Outer Breakwater to remain concentrated for long. Organic input will be moved away from organisms growing on the Breakwater. Limiting the effects of nutrient loading can be accomplished through controlling erosion, managing stormwater and runoff, and being prepared for securing the project site during inclement weather.

Invasive Species (biological stressor): Bringing equipment to the project site from other parts of Guam or from off island has an increased risk of spreading invasive species. Introduced species are organisms that have been moved, intentionally or unintentionally, into areas where they do not naturally occur. Invasive species rapidly increase in abundance to the point that they come to dominate their new environment, creating adverse ecological effects to other species of the ecosystem and the functions and services it may provide (Goldberg and Wilkinson 2004). Invasive species can decrease species diversity, change trophic structure, and diminish physical structure, but adverse effects are highly variable and species-specific. The planned activities will include little to no in-water work, so the risk of spreading invasive species in the marine environment of Guam is minimal from this project.

NMFS Concerns

Due to the connectivity of the marine environment, changes or stress that occur nearshore can end up affecting aspects of EFH distant from where a project occurs. Land-based runoff and discharges can subject nearshore benthic communities to adverse exposures and potential degradation of condition. When not properly maintained, equipment could release contaminants (e.g., oil, fuel) into the marine environment. Impacts from contaminants in the marine environment are dependent on how long chemical compounds persist and their tendency to bio-accumulate in the food web (van Dam et al. 2011). An increase in nutrients, pollutants, and contaminants in the marine environment can reduce fitness and cause mortality of exposed organisms. Some pollutants are environmentally persistent and can take years or even decades to biodegrade (Minton 2017). Nearshore species may spend a portion of their lives in coral reefs, but many of these fish and invertebrates are pelagic spawners (Colin 2011) or broadcast spawners (see, for example, Padilla-Gamiño and Gates 2012; Bird et al. 2011). Eggs and larvae are sensitive to water quality changes and can uptake contaminants (Von Westernhagen 1988). The eggs and larvae of pelagic and broadcast spawners spend time in the plankton community where they can be mobilized far offshore (Lobel and Robinson 1988; Cowen and Sponaugle 2009) and bring nutrients and accumulated contaminants to pelagic and benthic communities, including bottomfish and pelagic MUS.

NMFS expects that the BMPs provided to contractors provided in the EFHA will be sufficient to guide the project to low or no impacts to the marine environment.

Extreme weather in the Pacific is becoming more frequent and intense because of global climate change (e.g., see Hu et al. 2021 and Cai et al. 2014). The project site could be affected by high runoff, waves, and water level. The repairs will require about six months to complete, thus providing a window of time for one or more major weather events to occur during project execution. NMFS is encouraging the Navy to consider the potential effects of extreme weather events on the project. Hurricane season in the Pacific is considered to be from June 1 to November 30, however tropical storms can and do occur year round.

Navy-proposed BMPs

In the package submitted for the consultation, the Navy provided a thorough list of BMPs, which will be incorporated into the direction for the contractor to minimize and reduce impacts to EFH. Adherence to those BMPs during the proposed activities will be effective in addressing most of NMFS concerns about potential adverse effects.

Conservation Recommendations

NMFS provides the following CRs pursuant to 50 CFR 600.920 that, when implemented, will help to ensure that potential adverse effects are avoided and minimized:

Conservation Recommendation 1: If in-water repairs must take place and unavoidable loss of coral or important cover that cannot recolonize quickly, such as CCA, can be reasonably thought to have occurred, document the number of colonies and/or area lost in order for the loss to be incorporated into the mitigation for the imminent major repairs of the Glass Breakwater. Share the information with NMFS within 60 days of the losses. The temporal lag between the loss and the upcoming mitigation should be taken into account when estimating offset.

- If the losses occur within the first 2 m (6.6 ft) of the HTL can be observed, directly measure the loss through observation.
- If the losses occur within the first 2 m (6.6 ft) of the HTL and cannot be observed because assessment is unsafe or impractical, estimate the area affected and use the mean density estimate of 1.3 coral colonies/m2 (0.12 colonies/ft2) to estimate the loss.
- If losses occur beyond 2 m (6.6 ft) of the HTL because of unforeseen circumstances or accident, attempt to document and estimate the losses with a drop camera, drone, remotely operated vehicle, or divers.

Conservation Recommendation 2: Consider removing construction equipment and stockpiled material from the top of the Glass Breakwater in the event of extreme foul weather (i.e., tropical storms and hurricanes). Equipment that becomes marine debris may be more of a threat to the environment than armor stones moved by waves.

Conclusion

Thank you for submitting an EFH consultation for this project. Your EFHA provided a sufficient description of the action along with reasonably sufficient BMPs that we have are providing only a short list of CRs. When implemented and adhered to, these recommendations will help to further ensure that potential adverse effects to EFH are avoided and minimized. Please be advised that regulations (Section 305(b)(4)(B)) to implement the EFH provisions of the Magnuson-Stevens Act requires that federal agencies provide a written response to this letter within 30 days of its receipt, but a preliminary response is acceptable if more time is needed. The final response must include a description of measures to be required or actions to be taken to address the CRs. If either CR cannot be adopted, an explanation of the reason for not implementing it with scientific support for the rationale must be provided at least 10 days prior to final approval of the activities.

Please contact me at sean.hanser@noaa.gov or (808) 725-5091 with any comments or questions you may have. Thank you for consulting on this proposed action.

Very respectfully,

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FINAL

Biological Assessment and Essential Fish Habitat Assessment

For

Glass Breakwater Emergency Breach Repairs at U.S. Naval Base Guam, Apra Harbor, Guam

Prepared by:

HDR, Inc., under contract to Moffatt & Nichol with support from Naval Facilities Engineering Command, Pacific

Prepared for:

Naval Facilities Engineering Systems Command, Marianas
Naval Base, Guam

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APPENDIX

List of Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
AIS	aquatic invasive species
BMP	best management practice
CCA	crustose coralline algae
cm	centimeter(s)
CSA	CSA Ocean Sciences Inc.
DO	dissolved oxygen
DoN	Department of the Navy
DPS	Distinct Population Segment
eDNA	environmental DNA
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ESA	Endangered Species Act of 1973
ESS DR	Explosives Safety Submission Determination Request
ft^2	square feet
ft	feet
FEP	Fishery Ecosystem Plan
FR	Federal Register
HAPC	Habitat Areas of Particular Concern
HTL	High Tide Line
INRMP	Integrated Natural Resources Management Plan
km	kilometer(s)
LOC	Letter of Concurrence
m	meter
m^2	square meter(s)
MEC	munitions and explosives of concern
MITT	Mariana Islands Training and Testing
MPPEH	material potentially presenting an explosive hazard
MRESS	Munitions Response Explosives Safety Submittal
MRS	Munitions Response Site
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MUS	Management Unit Species
NAVFAC	Naval Facilities Engineering Command Pacific

Navy	U.S. Navy
NBG	Naval Base Guam
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOSSA	Naval Ordnance Safety and Security Activity
PIR	Pacific Islands Region
SWPPP	Storm Water Pollution Prevention Plan
U.S.	United States
UOG	University of Guam
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
WPRFMC	Western Pacific Regional Fishery Management Council
WWII	World War II

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1. Introduction

1.1 Background and Project Summary

Extending approximately 5 miles west from the island of Guam, the Glass breakwater protects Apra Harbor and supports safe navigation and berthing of U.S. Navy, commercial, and recreational vessels. Glass Breakwater is named for Rear Admiral Henry Glass, who fought for the Union during the U.S. Civil War and is credited with capturing Guam from Spain in 1898 during the Spanish-American War. The breakwater was built by U.S. Navy Seabees in 1941, and construction was completed in 1947 after the recapture of Guam. There have been several large repair projects to the breakwater with the latest being completed in 2013. The western end of Glass Breakwater is Navy property, and the eastern end is the property of the Government of Guam. The harbor supports Naval Base Guam (NBG), which includes facilities for U.S. Navy ships and submarines, and the Port of Guam, the island's primary commercial port handling cargo, fuel, and passenger vessels.

The breakwater is essential in order to shelter and protect U.S. Navy vessels, as well as commercial and local government ships, that use Apra Harbor. The breakwater also safeguards the shore facilities and infrastructure within the harbor from severe wave action during typhoons and other heavy weather events. On May 24, 2023, Super Typhoon Mawar passed north of Guam, bringing destructive winds and swells that severely damaged sections of the breakwater. The storm's impact caused significant erosion and displacement of the protective "armor" rock on the western side of the outer breakwater, compromising the breakwater's integrity. The recent damage created an urgent need for repairs to maintain the harbor's functionality and prevent further degradation, which could lead to increased damage, higher future repair costs, and potentially significant environmental impacts.

NBG proposes to conduct emergency breach repairs to the Glass Breakwater (hereafter referred to as "breakwater") in Apra Harbor, Guam. Breakwater repairs are needed as soon as possible due to extensive damage that occurred during Typhoon Mawar in May, 2023 and subsequent storms. The recent damage poses a risk of damaging ESA-listed coral and ESA-candidate clam species located in the submerged areas of the structure.

Assessments conducted in February 2024 revealed that one-third of the breakwater has lost more than 20% of its armor stone, while the remaining two-thirds have experienced a loss of 5-10%, classifying the breakwater as "failed" according to the U.S. Army Corps of Engineers (USACE) Coastal Engineering Manual (CEM 2008). Furthermore, a recent visual inspection conducted on May 9, 2024, showed an increased rate of degradation due to normal wave action. If left unaddressed, this deterioration is likely to result in a breach, posing significant risks to military and commercial ships, facilities, operations, and the overall logistical use of Apra Harbor. In the event of even a partial breach, the maintenance road at the top of the breakwater crest would become impassable, leading to exponential increases in repair costs and time. The acceleration of breakwater failure underscores the urgent need for repair. NBG has prepared this Biological Assessment and Essential Fish Habitat Assessment in accordance with Section 7(a)(2) of the Endangered Species Act (ESA) and Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) with the goals of: (1) addressing the potential effects of the Project on ESA-listed species and their designated critical habitat and (2) evaluating potential impacts on Essential Fish Habitat (EFH) in the Action Area in accordance with the MSA.

The Project has the potential to affect the following ESA-listed species that may occur in the area: the endangered Central-West Pacific distinct population segment (DPS) of green turtle (*Chelonia mydas*), the endangered hawksbill turtle (*Eretmochelys imbricata*), the threatened Indo-West Pacific DPS of scalloped hammerhead shark (*Sphyrna lewini*), and the threatened *Acropora globiceps* hard coral. On-shore critical habitat for the green turtle has been proposed by the U.S. Fish and Wildlife Service (USFWS) but not yet designated (88 *Federal Register* [FR] 46376). One acre of critical habitat for green turtles has been proposed inside Apra Harbor, but it is not located along the Philippines Sea section of the outer breakwater planned for emergency repair. In the same *Federal Register* publication, the National Marine Fisheries Service (NMFS) concurrently proposed in-water critical habitat for the green turtle that includes the nearshore waters off the coast of Guam from the mean high-water line to a depth of 20 meters (m) to protect access to nesting beaches, migratory corridors, and important feeding and resting areas (88 FR 46572). This proposed critical habitat is located along the section of the outer breakwater planned for emergency repair. No critical habitat for other ESA-listed species has been proposed for or is designated in Apra Harbor.

In addition, as defined in the *Fishery Ecosystem Plan for the Mariana Archipelago* (Western Pacific Regional Fishery Management Council [WPRFMC] 2009a) and the *Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region* (WPRFMC 2009b) with amendments, the Project has the potential to affect EFH two groups of Management Unit Species (MUS) that are likely to be present at, near to, or dependent on the Action Area: bottomfish MUS, and pelagic MUS.

1.2 Consultation History

Early coordination and pre-consultation with NMFS are being planned through a series of meetings and phone conversations. The first pre-consultation meeting occurred on June 13, 2024.

Phone conversation with NMFS and Navy personnel occurred on July 31, 2024 and September 24, 2024 to discuss the emergency situation, proposed action and notional timelines, and NMFS provided comments on a draft of this document in mid-September.

2. Description of the Proposed Action

2.1 General Description

The proposed action is to undertake emergency repairs to the outer breakwater in Apra Harbor, Guam. As a result of typhoon Mawar and subsequent storms, sections of the breakwater are severely eroded and susceptible to imminent breaching due to normal wave action. Repairs will occur on the Philippine Sea-side of the breakwater, where “armor” rocks, safeguarding the breakwater’s inner core, have displaced or been washed away into the ocean (hereafter referred to as the ‘outer breakwater’). Repair activities will involve relocating intact armor stones from neighboring breakwater crest areas and repositioning them on the failing areas of the breakwater. The goal of the proposed action analyzed in the Biological Assessment and Essential Fish Habitat Assessment is to stabilize the breakwater in the short-term so that long-term lasting repairs can eventually be made to restore the breakwater to its original condition. The Navy estimates that future maintenance repairs will occur in mid-2025 and will be addressed in subsequent consultations under the Endangered Species Act (ESA) and Magnuson-Stevens Fishery Conservation and Management Act (MSA).

Only two sections of the outer breakwater, shown in Figure 1 are slated for emergency repair to stabilize the structure over the short-term. Areas requiring emergency repairs have been identified based on the extent of damaged areas observed during site engineering investigations. The entirety of the oceanside breakwater within the Project area to the west of Luminao Reef, including the area wrapping around the point at the harbor mouth, was categorized as being in poor, serious, or critical condition, and repairs will be concentrated in the existing breakwater failure sections. The larger section near the western end of the breakwater is 381 meters (m) (1,250 feet (ft)) long while the smaller section to the northeast is 61 m (200 ft), compared to the approximately 1,902 m (6,242 ft) length of the entire breakwater.

The existing roadway along the top of the breakwater is wide enough to support a crane, and therefore the repairs are expected to be carried out with a land-based crane from the top of the breakwater. To enable the crane to reach out farther to the toe of the existing structure, it is anticipated that the top 3 meters (10 ft) of the breakwater may be lowered by removing armor stone. The amount of stone relocated in each section will depend on the required repairs and locations of those repairs. Crane capacity becomes a controlling factor in selection of both armor size and weight, and armor stones or concrete units are anticipated to vary from 15 to 50 tons, depending on the size required to fill existing holes or depressions in the structure. Historical repair records indicate use of some heavier, 10- to 30-ton armor stones and concrete armor units. The breakwater will be repaired by resetting existing armor stones and concrete units already located on the breakwater into the failing areas.

Once offloaded, the concrete armor units will be lowered onto the breakwater one at a time and placed on existing armor. In some cases, it is anticipated that the armor stone on either side of a repair may be moved or reset to allow accurate placement of the concrete armor units. Overall, the emergency repairs will not expand beyond the footprint of the original structure to minimize potential impacts on marine species. In-water work is not anticipated by design engineers, and if it deemed necessary by the construction contractor conducting the emergency repairs, it will be limited to 2m (6.56 ft) seaward from the high tide line (HTL), which is less than 2m in depth(BMP C, Section 2.5.2). Silt curtains will not be used due to rough environmental conditions that do not allow for safe and effective deployment. No dredging will occur as part of the emergency repairs. In the extremely unlikely event in which an action may unexpectedly impact coral, the action will be recorded by the construction contractors and assessed separately.

Important to note, these actions are part of a larger repair plan for the Glass Breakwater in Apra Harbor. The intent of this emergency action is to prevent catastrophic breakwater failure until a permanent solution is designed and developed; in doing so, the Navy has considered natural resource impacts and attempted to choose emergency construction repairs that avoid direct impacts to EFH. The latter extent of waterfront repairs will be assessed in a separate BA+EFHA conducted after this consultation, and will consider appropriate avoidance, minimization and offset measures when a complete scope of work is developed.

3 Environmental Baseline Conditions

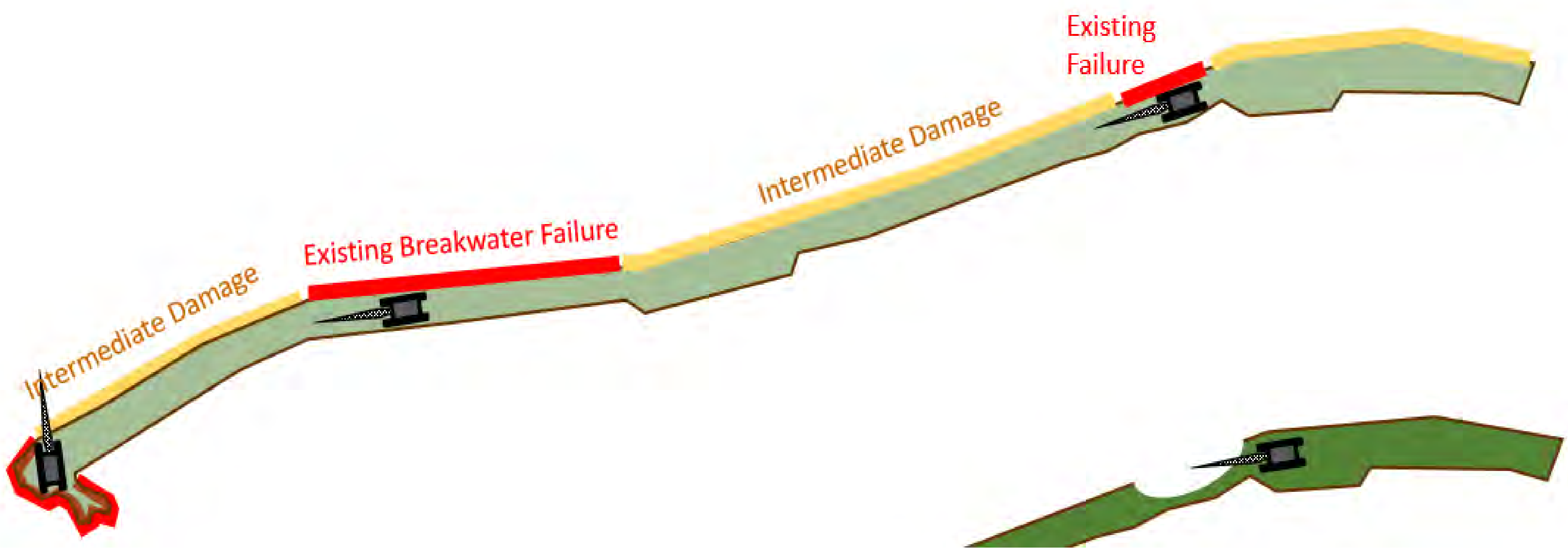


Figure 1. Two sections to be repaired on the outer breakwater are shown in red. Note: emergency repairs do not include repairs to the head (furthest left) of the breakwater which are also shown in red.

2.2 Project Location

Guam is a U.S. territory in the western Pacific Ocean (Figure 2), about 2,090 kilometers (km; 1,300 miles) east of the Philippines. Apra Harbor is located on the western shore of Guam, midway down the island and about 10 km (6 miles) southwest of the capital city of Hagåtña. The Philippine Sea surrounds the outside of the harbor and western Guam. Apra Harbor has two recognized zones: Outer Apra Harbor and Inner Apra Harbor. Water depths in Outer Apra Harbor are over 51 m (170 ft) near the mouth and decrease to shallower waters around shoals (National Oceanic and Atmospheric Administration [NOAA] Chart 81054_Public Apra Harbor). Inner Apra Harbor is 9 to 12 m (30 to 40 ft) deep, and Sasa Bay ranges as deep as 9 to 12 m (30 to 40 ft) near the mouth but is generally much shallower, with numerous shallow shoals and mangroves (Figure 3). The majority of submerged land within Outer Apra Harbor is administered by the Navy and is used for military training and recreational activities. It also provides access for civilian vessels and the Government of Guam's Port Authority, which is in the northeastern portion of Outer Apra Harbor. The Navy authority over Inner Apra Harbor restricts its use to military vessels, which include naval and U.S. Coast Guard (USCG) vessels from allied nations. No recreational uses are permitted in Inner Apra Harbor. Fourteen wharves are located within Inner Apra Harbor to support the Navy and USCG vessels and operations (Department of the Navy [DoN] 2022).

2.3 Action Area

The Glass Breakwater has experienced damages caused by storms and typhoons over the years, especially from typhoon Mawar on May 24, 2023. About 1.96 km (1.22 miles) of the western end of the Glass Breakwater that is NAVFAC property is planned for repair (FIGURE). Breakwater repairs will not take place along the Luminao Reef; repairs will take place on sections of the breakwater to the west of Luminao Reef (Figure 3).

The preferred contractor staging area is within the existing track lane at the midpoint of the breakwater on the crest of the outer side, adjacent to emergency repair areas.

A shutdown zone of 46 m (50 yards) from both sides of the breakwater will be established around potential in-water Project actions to avoid and minimize potential impacts on ESA-listed sea turtles and sharks (and marine mammals). The 46 m (50-yard) shutdown zone will also apply to any sea turtles that are out of the water and located on a beach. The 46 m shutdown zone defines the Action Area for Project construction during all activities, as the extent of ground disturbance and subsequent turbidity and water quality impacts from in-water work are expected to be confined within this area. The following sections include an analysis of the potential consequences of the Proposed Action on ESA-listed species within this Action Area.

Figure 2. Project location of Glass Breakwater on the northern side of Apra Harbor, Guam.

Basemap: World Imagery; World_Ocean_Base

Figure 3. Shoreline of the Glass Breakwater affected by the Proposed Action in Apra Harbor.

2.4 Construction Schedule

Construction is anticipated to begin in Nov 2024 with mobilization of equipment, and site preparation. In-water work is not anticipated, and if deemed necessary, will be limited to 2m seaward of the HTL to avoid ESA-listed corals. Nighttime work is not anticipated but may occur to prepare the site for placement of armor units. If in-water work is deemed absolutely necessary, the timing of in-water work will avoid coral spawning periods; spawning typically occurs between April and August (see Section 2.5.2), which will be verified with the University of Guam (UOG) Marine Lab annually. During the spawning periods, construction may continue above the HTL.

2.5 Best Management Practices

The Project Construction Contractor has not yet been identified, and therefore ultimate construction means and methods and design specifics presented here may differ in limited degree. It is not anticipated that the Project would change such that potential impacts on ESA-listed species or EFH would change from those described herein. If the Project approach or design is altered in a manner resulting in effects to ESA-listed species, critical habitat, or EFH resources that are not commensurate with those assessed in this document, the Navy will coordinate with The National Marine Fisheries Service (NMFS) prior to Project implementation.

The Project will implement a series of best management practices (BMPs) during emergency breakwater repairs to avoid and minimize adverse impacts on ESA-listed species, critical habitat, EFH, and the marine environment; if in-water work is deemed necessary. The BMPs have four parts:

- BMPs A through E (Section 2.5.1) avoid and minimize effects from the Project on ESA-listed sea turtles and sharks;
- BMPs F through L (Section 2.5.2) avoid and minimize effects from the Project on ESA-listed corals and EFH;
- BMPs M through O (Section 2.5.3) avoid and minimize effects from the Project from water pollution; and
- BMP P (Section 2.5.4) avoids and minimizes effects from the Project on in-water sedimentation levels.

Throughout the duration of their involvement with this Project, all associated workers, irrespective of their employment arrangement or affiliation (e.g. employee, contractor), shall be briefed on these BMPs and the compliance requirements.

2.5.1 BMPs for ESA-Listed Sea Turtles and Sharks

As applicable to mobile ESA-listed marine species (including non-listed marine mammals, although they are not expected to occur in the Action Area), the following BMPs will be employed to avoid and minimize adverse effects:

A. During in-water activities such as placement and resetting of armor stone and concrete armor units, a dedicated and competent observer who is familiar with local marine species will use binoculars to detect the presence of ESA-listed marine species and notify construction crews to cease work if the ESA-listed species approaches the shutdown zone, as described below.

B. The Contractor will comply with the following monitoring requirements:

   i. From the breakwater, a competent observer will use binoculars to monitor the Action Area for ESA-listed sea turtles and scalloped hammerhead sharks during all in-water activities, if deemed necessary. If all work associated with a particular activity takes place above the High Tide Line (HTL), an observer will not be required for that element of the Proposed Action.

   ii. Observations will begin each day 30 minutes prior to the start of in-water activities:

      - If no ESA-listed sea turtles or sharks are seen within or adjacent to the Project Area during the 30-minute pre-clearance survey period, Action activities may commence.
      - If an ESA-listed sea turtle or shark is seen during the 30-minute pre-clearance survey period, the observer will notify the Project Manager immediately and monitor the animal. If the animal is within 46 meters (50 yards) of the in-water activity, animal behavior observations shall be recorded. Work will not begin until the animal departs the area voluntarily or after 30 minutes have passed since the last animal sighting.
      - During in-water activities, the observer will record environmental and action-related information, including but not limited to date, time, weather, action undertaken, status and effectiveness of BMPs, and ESA-listed marine species observed.
      - During in-water activities, all in-water work shall stop when an ESA-listed sea turtle or shark approaches or is sighted within 46 meters (50 yards) of the proposed in-water work. Work shall begin/resume after the animal has departed the area voluntarily or after 30 minutes have passed since the last animal sighting.
      - All sightings of ESA-listed marine species shall be recorded.

C. No placement of in-water armor stone or concrete armor units will take place after dark.

D. NBG will document and report quarterly to NMFS on all interactions with ESA-listed sea turtles or sharks.

E. If in-water activities are deemed necessary, the following measures will be employed to reduce potential direct physical impacts on ESA-listed species:

i. No personnel will attempt to disturb, touch, ride, feed, or otherwise intentionally interact with any protected species. Entangled animals will be freed and photographed if possible, and each incident will be reported to NMFS. Entanglement is not expected because the work area is anticipated to occur above the HTL and will be monitored, and therefore, no take for entanglements is requested.

ii. All personnel will stay more than 46 meters (50 yards) away from sea turtles, in the unlikely event they haul out on land in proximity to construction activities.

iii. If deemed necessary, before any equipment or material enters the water, the Contractor will verify that no ESA-listed species are in the area.

iv. Any heavy equipment used (i.e. crane) will be operated from above and out of the water.

v. Construction related equipment that may pose an entanglement hazard will be removed from the project site if not actively being used.

2.5.2 BMPs for ESA-Listed Corals and EFH

The following BMPs are considered part of the Proposed Action and will be employed to avoid and minimize adverse effects on the ESA-listed hard corals and habitat-forming EFH, if in-water work is deemed necessary:

F. All in-water activities will cease during the primary Guam coral spawning event for corals (see Table 1). The coral spawning period is estimated by the UOG Marine Lab, that studies these events for broadcast spawners, the majority of which happen in the summer and two that spawn in the spring *(Acropora sp.* and *Porites massive*)(L. Raymundo, Pers. Comm.):

Table 1. Estimated Coral Spawning Events for2025 Guam Corals

<table>
<tr><th rowspan="2">Year</th><th colspan="2">Spring Spawners</th><th colspan="2">Summer Spawners</th></tr>
<tr><th>Predicted Spawning Date</th><th>In-water Activity Closure Period</th><th>Predicted Spawning Date</th><th>In-water Activity Closure Period</th></tr>
<tr><td rowspan="3">2025</td><td>April 13</td><td>April 6-27</td><td>June 17-20</td><td>June 10- July 4</td></tr>
<tr><td>May 13</td><td>May 6-27</td><td>July 17-20</td><td>July 10- Aug 4</td></tr>
<tr><td colspan="2">-</td><td>Aug 15-18</td><td>Aug 8- Sep 3</td></tr>
</table>

G. The development and adherence to an inclement weather and typhoon contingency plan must include a large swell plan whereby in-water activities will be conducted during safe weather conditions (i.e., calm seas) and will cease during high surf, winds, or currents.

H. Construction will be limited to 2 m (6.56 ft.) seaward from the HTL (Figure 8) to avoid the bathymetric contour where corals and other biota are dense and diverse (Section 3.2).

I. All construction-related equipment must be operated to avoid impacting sensitive marine habitat or contacting coral reef resources during in-water activities or extreme weather conditions:

J. The portions of the equipment that enter the water will be clean and free of pollutants, including aquatic invasive species (AIS). In compliance with Guam Executive Order 91-37, all vessels and equipment (including barges and cranes) will be free from fouling organisms before entering Guam's coastal waters.

K. The Project Manager and heavy equipment operator will perform daily pre-work equipment inspections for cleanliness and leaks. Should a leak be detected, all work will be halted until leak is repaired and equipment is cleaned.

L. All related inspections will be documented, and the contractor shall refer to the Joint Region Marianas (JRM) Marine Invasive Species Management Plan (MISMP) for any outreach material or guides to advise processes.

2.5.3 BMPs for Storm Water Pollution Prevention

M. A Storm Water Pollution Prevention Plan (SWPPP) will be developed by the Construction Contractor to reduce on-site erosion and sedimentation. The SWPPP will include, at a minimum, the following BMPs:

N. Silt socks, filter fabric, or an equivalent will be used around out-of-water repair sites along the Glass Breakwater.

O. An oil spill contingency plan to control and clean spilled petroleum products and other toxic materials will be included in the SWPPP and implemented throughout construction of the Project:

i. Oil or other hazardous substances will be prevented from seeping into the ground or entering any drainage inlet or local bodies of water.

ii. When applicable, all temporary fuel oil or petroleum storage tanks will be surrounded with a temporary berm of sufficient size and strength to contain the contents of the tanks (plus 10 percent freeboard for precipitation) in the event of an accidental release.

iii. Fueling of Project-related vehicles and equipment will take place at least 46 m (150 ft) away from the water and within a containment area, preferably over an impervious surface. With respect to equipment that cannot be fueled on land, spill prevention booms will be employed in the water to contain potential spills. All fuel spilled will be cleaned up immediately.

iv. Lubricants and excess oil will be disposed of in accordance with applicable federal, territorial, and local regulations, laws, ordinances, and permits.

v. Appropriate materials to contain and clean potential spills will be stored at the work site and be readily available.

vi. All Project-related materials and equipment that may be placed in the water will be free of pollutants.

vii. Daily pre-work inspections of heavy equipment for cleanliness and leaks will be conducted. All heavy equipment operations will be postponed or halted until leaks are repaired and equipment is cleaned.

viii. All Project-related debris and other waste will be contained and will not enter or remain in the marine environment.

2.5.4 BMPs for Sedimentation

P. Although sedimentation is not expected to occur as a result of these actions, steps will be taken to minimize and contain any siltation from Project-related work that might arise. Appropriate use of erosion control practices and curtailment of work during adverse weather and tidal/flow conditions:

i. The Construction Contractor must continuously monitor to ensure that siltation control measures are in place and functioning properly.

ii. Activity may resume after a problem is corrected.

iii. As practicable, work will be conducted during calm seas with work stoppages during high surf, winds, and currents.

iv. Specific erosion control practices will be covered by the 401 Water Quality Certification and its supporting documents (included in the Environmental Assessment) that will be provided to contractors.

3. Environmental Baseline Conditions

3.1 General Marine Environment

Apra Harbor is a semi-enclosed lagoon located on the western shore of Guam. It is the largest U.S. deepwater port in the Western Pacific and among the busiest in Micronesia. The Glass Breakwater separates the Philippine Sea from Apra Harbor on the western shore of Guam. Within Apra Harbor are two geographically separate areas, Inner and Outer Apra Harbors (FIGURE?). Inner Apra Harbor is approximately 2 km by 1.3 km (1.2 miles by 0.8 mile). A 290-meter-wide (950-foot-wide) opening at Polaris Point connects Inner Apra Harbor to the southeastern edge of Outer Apra Harbor. Outer Apra Harbor is approximately 6 km by 2 km (3.7 miles by 1.2 miles) and connects to the Philippine Sea to the west. The outlet of Outer Apra Harbor is constricted by the Glass Breakwater to the north and Orote Peninsula to the south.

Following World War II, the Navy made extensive port improvements including dredging a navigation channel to a depth of approximately 14 m (46 ft). Submerged lands at NBG Main Base were altered significantly during and immediately following World War II (DoN 2018). During this period, dredging occurred in both Outer and Inner Harbor to support ship movement and berthing, and large amounts of fill were used to construct port infrastructure, which covered reefs in areas of Inner Apra Harbor. Wetlands southeast of Inner Apra Harbor were also converted for agricultural use from the 1930s through the 1950s (DoN 2018). Today, maintenance dredging is performed as necessary in Inner Apra Harbor to maintain navigable depths.

Tides are semi-diurnal, currents are generally weak to moderate, and surface seawater temperatures are generally between 26 and 30 degrees Celsius (°C). Turbidity in Apra Harbor is highly variable; clear oceanic type conditions prevail near the harbor mouth while highly turbid conditions are common in Inner Apra Harbor and Sasa Bay. Bottom sediments range from silty clay to complex coral reefs.

Apra Harbor provides a lagoonal habitat with a rich diversity of coral species. The harbor is protected by the Glass Breakwater and a substantial arc of large, shallow reefs, which underlies the breakwater and brackets the harbor entrance (Nelson et al. 2016). Minimal freshwater inputs are limited to a few small streams that discharge into the harbor. The island's mountains shelter Apra Harbor from the dominant trade winds. Periodic typhoon-driven waves may occur within the harbor. In general, the bathymetry is deeper toward the west, but abrupt bathymetry changes are common, particularly as numerous small and large coral reefs characterize the harbor seabed. Tides in the harbor are mixed, with a mean tidal range of 0.49 m (1.6 ft) and a mean diurnal range of 0.72 m (2.4 ft; Nelson et al. 2016).

The Outer Breakwater, a highly dynamic area with considerable wave energy, experiences the brunt of storms generated to the north. In addition, locally generated waves create turbulent sea surface conditions (*Marine Biological Surveys for Apra Harbor Waterfront Repairs, Apra Harbor, Guam,* Appendix A). Divers conducting benthic surveys in February and March 2024 noted damage on the Outer Breakwater in the form of boulder slides and locations where boulders were dislodged from the above-water structure and into the sea. Underwater locations of rockslides were indicated by the presence of white limestone boulders devoid of marine growth. Some boulders were also sheared and broken into pieces. Other boulders, some at a distance from one another, had rubbed against each other, yielding scarred white limestone (Appendix A).

3.1.1 Water Quality

Four rivers provide freshwater input to Apra Harbor: Atantano, Sasa, Laguas, and Aguada. Guam Water Quality Standards designate rankings for marine waters based on their overall quality. The three designations are M-1 Excellent, M-2 Good, and M-3 Fair. The Guam water quality standards categorize the Apra Harbor as M-2 Good, which is defined as follows:

> *Water in this category must be of sufficient quality to allow for the propagation and survival of marine organisms, particularly shellfish and other similarly harvested aquatic organisms, corals and other reef-related resources, and whole body contact recreation. Other important and intended uses include mariculture activities, aesthetic enjoyment and related activities.* (Guam Environmental Protection Agency 2017).

Anthropogenic activity has shaped the marine environment of Apra Harbor. Since 1945, Apra Harbor has been subject to several projects altering the harbor's bathymetry and shoreline grade. The Navy conducts dredging within the Inner harbor to maintain navigation channels. The navigational channels have shaped the natural bathymetry of the harbor, creating a relatively uniform substrate. Additionally, fill has been used to restructure the shoreline and exterior of the harbor. Depth generally increases moving westward and toward the mouth of the harbor with a maximum depth of about 52 m (170 ft). However, the presence of several sporadic coral reefs results in dramatic bathymetric changes throughout the harbor (Smith et al. 2009).

Apra Harbor is the only substantial lagoonal habitat greater than 10 m (33 ft) in depth in the Mariana Islands. This creates habitat supporting species and communities, including well-developed reefs and diverse biota, which are less common in the surrounding islands. The altered circulation from the Glass Breakwater has created a gradient of physical, chemical, and biotic conditions. Western Apra Harbor benthic habitats support more ocean-exposed oceanic reefs, while the eastern side is more inundated with silt and consists of lagoonal patch reefs and mangroves (Paulay 2003a).

The tides surrounding Apra Harbor are mixed diurnal. Mean Higher High Water is 0.59 m (1.95 ft), while Mean Lower Low Water is -0.71 m (-2.34 ft). The average water temperature within Apra Harbor is 28°C (82.4 degrees Fahrenheit [°F]), with a monthly high in September of 29.7°C (85.5°F) and low in January of 26.4°C (79.5°F) (NOAA 2024).

3.1.2 Sediment Quality

Freshwater inputs are supplied into the NBG Main Base marine environment along the eastern side of Inner Apra Harbor and Sasa Bay by the Apra Harbor Watershed, which encompasses the subwatersheds of Sasa and Atantano. Through the opening at Polaris Point, Inner Apra Harbor empties into Outer Apra Harbor (DoN 2022). As a result of weak circulation and substantial sediment transport into the marine environment from the watershed, turbidity throughout the Inner harbor is higher than Outer Harbor (DoN 2022). The Outer Harbor turbidity varies, from extremely turbid conditions in Sasa Bay to clean conditions on the western extent near the mouth of the harbor (DoN 2022).

Water circulation is restricted by the opening between Inner Apra Harbor and Outer Apra Harbor. Inner Apra Harbor’s turbidity is closely correlated with freshwater input, which has a unique monsoonal seasonal weather pattern interspersed with storm occurrences (DoN 2022

Silicate, nitrite, chlorophyll, phosphate, and turbidity are higher inside Outer Apra Harbor than they are in the ocean outside the harbor (DoN 2022). The Outer Apra Harbor water conditions are representative of a well-mixed open coastal water. Outer Apra Harbor displays minimal variation in temperature, salinity, pH, and nutrients. Salinity within Outer Apra Harbor tends to remain between 34 and 35 practical salinity units, while pH is generally between 7.8 and 8.0 (Schils et al. 2017).

Sediment sizes in the area are typically sand, silt, clay, and fines (Gailani et al. 2016). Sediments are comprised primarily of a mixture of weathered volcaniclastic grains in the finer sands and reef carbonate detritus in coarser sands and gravel grains. Sediment analysis within Apra Harbor has shown some contamination from polychlorinated biphenyls and heavy metals including copper, zinc, lead, and mercury (Denton et al. 1997).

Surface flow tends to move westward, while subsurface flow moves eastward. Currents within the harbor are primarily a result of localized winds during trade wind conditions (DoN 2010). The restricted outlet minimizes wave action within the harbor that would otherwise suspend substrate sediments in the water column. Bottom currents are less than 5 centimeters (cm)/second and are not responsible for significant sediment suspension (Gailani et al. 2017).

3.1.3 Geology

Approximately 549 square kilometers (212 square miles) in area, Guam, a volcanic island, is the largest and southernmost of the Mariana Islands (Tracey et al. 1964). The formation of the Mariana Islands resulted from subduction of the Pacific plate beneath the Philippine Sea plate at the Mariana Trench (DoN 2022). Two separate emergent mountains fused together to form the island of Guam and are separated by the Pago-Adelup fault, a normal fault that runs from Adelup on the west central coast to Pago Bay on the east central coast (DoN 2022). It divides the island into two nearly even, distinct physiographic regions (Vann et al. 2014). These regions differ topographically, geologically, and hydrologically (Rosa and Hay 2019).

The northern physiographic region is a groundwater province made up of a porous limestone plateau bordered by steep cliffs underlain by volcanic deposits. Due to the permeable nature of limestone, rainfall is quickly absorbed and no rivers or streams flow in this region (Rosa and Hay 2019). The southern physiographic region is a surface water province made up of dissected volcanic upland fringed with limestone along the east coast, including the area that surrounds Apra Harbor (Tracey et al. 1964). The water-laid volcanic deposits of the Umatac, Alutom, and Facpi Formations underlie the watersheds in southern Guam (Tracey et al. 1964). These deposits offer low permeability, and consequently, southern Guam has a much greater number of streams and rivers than northern Guam. The area immediately surrounding Apra Harbor is made up of a limestone flat-lying plateau, volcanic coastal lowlands, and volcanic alluvial valley floors (Rosa and Hay 2019).

Originally, Outer Apra Harbor was an open lagoon partially enclosed by barrier reefs on the western edge of central Guam. To the south, the Orote Peninsula limestone cliffs border the lagoon. The northern portion of the lagoon is bordered by the long barriers of Cabras Island and Luminao Reef (Tracey et al. 1964). Alluvial fill, mudflats and mangrove swamp, sand flats, and sand beaches make up the coastal lowlands of Apra Harbor (Tracey et al. 1964).

The USDA Soil Conservation Service identified soil classes across Guam in 1985 and grouped them into three broad classes: soils on bottomlands, soils on volcanic uplands, and soils on limestone uplands (Young 1988). The soils surrounding Apra Harbor are primarily soils on limestone uplands with some bottomland soils bordering the eastern edge of Inner Apra Harbor and Sasa Bay. The primary soil series are the Ritidian and Shioya Series, which are grouped under the Guam-Urban land-Pulantat soil class. These soils are characterized by being very shallow or shallow, well drained, and on plateaus on level to gently sloping topography and urban land. The remaining soils belong to the Inarajan-Inarajan variant, which are characterized by deep or very deep, somewhat poorly drained or poorly drained, level or nearly level topography on valley bottoms and coastal plains (Young 1988).

3.1.4 Coastal Habitat

Historically, shallow limestone reef flats formed the shoreline of Apra Harbor. It is now a highly modified environment, and the coastal habitat is made up of a combination of man-made structures, hardened shoreline, and natural or semi-natural shoreline.

The man-made Glass Breakwater borders Apra Harbor to the north and offers reclaimed sandy/rocky coastal habitat. Glass Breakwater is characterized by large boulders arranged on relatively steep slopes with only a few small sand deposits, making this area unsuitable habitat for nesting sea turtles (Figure 4). Conversely, the Orote Peninsula borders Apra Harbor to the south and is made up of a much more natural sandy/rocky coastline (DoN 2022). The coastline of Orote Peninsula consists of steep cliffs that taper out as narrow rocky benches or plunge directly into the ocean (DoN 2022).

Figure 4. Large boulders and concrete blocks on a steep incline compose the Glass Breakwater armored shoreline.

Previously, the eastern shore of the Orote Peninsula along San Luis Beach, as well as Polaris Point across the mouth of Inner Apra Harbor, was a reef flat. Large amounts of fill covered the reefs during construction of port infrastructure (DoN 2022). The shoreline is now formed by remnant sheet pile walls in a state of decay and rock that was formerly used as fill material.

The eastern shores of Apra Harbor contain the largest concentration of mangroves on Guam (DoN 2022). The GovGuam-designated Sasa Bay Marine Preserve is located between Dry Dock Island and Polaris Point (DoN 2022). Mangrove forests grow along the northern and eastern shores of Sasa Bay. Estuarine wetlands border Inner Apra Harbor on the east side, but much of the coastline is primarily man-made structures (e.g. wharf faces). Mangrove forests grow along Inner Apra Harbor's eastern shore. There is limited rock and/or sandy coastline present in this area (DoN 2022).

3.1.5 Benthic and Biological Habitat

As described in DoN (2018), Outer Apra Harbor has a unique benthos with characteristics not typical in other harbors that are comparable in scale or structure on Guam or on other islands throughout the Mariana Islands. As depicted below (Figure 5), the benthic area immediately surrounding the outer Glass Breakwater is composed primarily of corals and coralline algae within fringing reefs, shoals, pinnacles, and colonized artificial structures, with small areas of macro- and turf algae elsewhere along the coast. The habitat along the Inner Breakwater (contained within Outer Apra Harbor), with its differences in depths, sediment input, flushing rates, and circulation, has much more variable soft and hard substrates in deeper depths and corals near the breakwater (Figure 5).

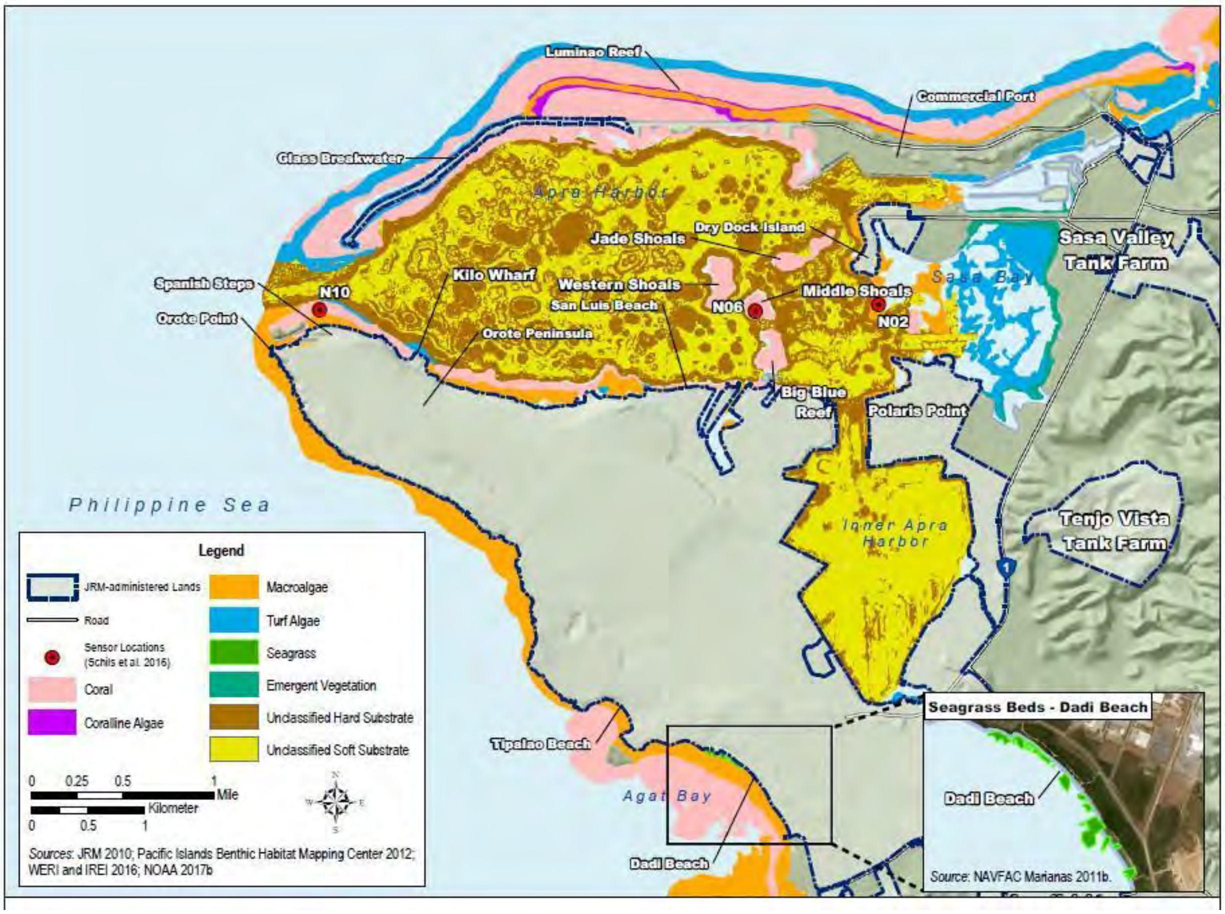


Figure 5. Apra Harbor benthic habitats Overview.
Source: DoN 2018.

In February and March 2024, scientific divers conducted marine surveys to collect data on benthic composition, coral abundance and size-class distribution, coral species composition, fish abundance, and presence/absence of ESA-listed and candidate species (Appendix A; Section 3.2.1). The marine surveys were conducted within and around the Action Area along the oceanside and harborside of the breakwater. Survey results were categorized by location as the Outer (oceanside) Breakwater and the Inner (harborside) Breakwater. For these actions only the survey results from the Outer Breakwater will be discussed.

The point intercept method (also termed a "line-point intercept method") was used to assess benthic composition on a total of 13 transects: 8 at the Inner Breakwater, and 5 at the Outer Breakwater (Appendix A). This protocol uses meter marks on a transect line as sample points. At 0.5-meter intervals, the nature of the bottom under each "point" is assigned to one of the following categories: sand, rubble, limestone (rock or pavement), algal turf, crustose coralline algae (CCA), live coral, or macro-invertebrate. Benthic percent cover was calculated by dividing the total number of points for each category by the total number of points sampled times 100 (Appendix A).

Outer Breakwater

The northeast section of the Outer Breakwater nearest the shallow reef flat of Luminao Reef experiences a strong southwesterly current that flows off the reef flat. The Outer Breakwater benthic habitat is composed of predominantly large limestone boulders that either have light turf algal growth or are encrusted by CCA. The majority of bottom cover is made up of primarily sand, rubble, limestone, turf algae, or CCA. There was also scattered live coral and macro-invertebrates, further discussed in Section 3.2 below. The depths along the surveyed Outer Breakwater area range between 2 and 5 m (7 to 15 ft).

The Outer Breakwater is a highly dynamic area with considerable wave energy. This location experiences the brunt of storms generated to the north as well as turbulent sea surface conditions from locally generated wind. The breakwater was built to handle these storms and take the brunt of heavy weather environments. Because of this, working in the shallows is dangerous to divers and good weather windows are few and far between; causing the inability to translocate coral or gather survey data close to the shoreline.

3.2 Marine Fauna

3.2.1 Corals

During the marine biological survey conducted along the Inner and Outer Breakwaters in February and March 2024 (Appendix A), data was collected on coral abundance, size-class distribution, and species composition. Table 2 details the inventory of coral species observed in the Outer Glass Breakwater during the 2024 survey.

Table 2. Inventory of Coral Species Observed in Outer Glass Breakwater, February and March 2024

Species	**Abundance[a]**
	Outer Breakwater
Soft Corals	
OCTOCORALLIA	
Helioporidae	
Heliopora coerulea	—
Sinulariidae	
Sinularia sp.	—

Species	Abundance[a]
	Outer Breakwater
Hard Corals	
SCLERACTINIA	
Acroporidae	
Acropora sp.	C
Acropora digitifera	O
Acropora globiceps[b]	O
Acropora humilis	O
Acropora hyacinthus	C
Acropora monticulosa	—
Acropora nana	—
Acropora nasuta	U
Acropora palmerae	O
Acropora polystoma	O
Acropora retusa	R
Acropora tenuis	U
Acropora valida	—
Astreopora ocellata	U
Astreopora gracilis	—
Montipora sp.	O
Montipora informis	—
Agariciidae	
Pavona chiriquiensis	U
Pavona duerdeni	—
Pavona varians	—
Astrocoeniidae	
Stylocoeniella armata	—
Diploastraeidae	
Diploastrea heliopora	U
Euphylliidae	
Euphyllia glabrescens	—
Galaxea fascicularis	—
Fungiidae	
Fungia fungites	—
Lithophyllon concinna	—

Species	Abundance[a]
	Outer Breakwater
Leptastreidae	
Leptastrea sp.	U
Leptastrea purpurea	—
Lobophylliidae	
Echinophyllia orpheensis	—
Lobophyllia hemprichii	—
Lobophyllia robusta	—
Merulinidae	
Astrea annuligera	R
Astrea curta	O
Cyphastrea sp.	—
Dipsastraea pallida	U
Favites sp.	—
Goniastrea sp.	C
Goniastrea edwardsi	—
Goniastrea retiformis	—
Hydnophora microconos	U
Leptoria phrygia	O
Platygyra sinensis	R
Pocilloporidae	
Pocillopora sp.	A
Pocillopora ankeli	C
Pocillopora brevicornis	C
Pocillopora damicornis	—
Pocillopora grandis	U
Pocillopora ligulata	—
Pocillopora meandrina	O
Pocillopora verrucosa	O
Poritidae	
Porites sp.	C
Porites cylindrica	—
Porites lichen	—
Porites rus	C

Species	Abundance[a]
	Outer Breakwater
Psammocoridae	
Psammocora sp.	—
Psammocora nierstraszi	—
ANTHOATHECATA	
Milleporidae	
Millepora exaesa	U
Millepora platyphylla	C

Source: Appendix A.

[a] Abundance: A = Abundant, observed in large numbers and widely distributed; C = Common, observed everywhere, although generally not in large numbers; O = Occasional, seen irregularly in small numbers; U = Uncommon, several to a dozen individuals observed; R = Rare, only one or two individuals observed.

[b] ESA-listed species.

To assess coral abundance and size-class distribution, a 1-meter belt survey of coral colonies was conducted on selected transects (Appendix A). All coral heads within 0.5 meter to either side of the transect line were counted. Coral abundance was determined as the number of individuals observed for each transect, normalized to number of individuals per square meter. Coral colonies were identified to species and assigned to a size class (1–5 cm; 6–10 cm; 11–20 cm; 21–40 cm; 41–80 cm; 81–160 cm; or greater than 160 cm) based on the largest horizontal dimension of the colony. Coral size-class distribution was determined for each coral species recorded (Table 4).

Outer Breakwater

Due to hazardous surf, current, and swell conditions, the northeast section of the Outer Breakwater was not quantitatively surveyed. For the southwest section, five 25-meter transects were used to quantitatively assess the benthic community of the seafloor. Transects were laid parallel to the structure, approximately 6-12 m (20-40 ft) offshore from the HTL. Coral composition was assessed along one of two additional 50-meter transects that were surveyed in the area adjacent to the channel entrance. The depths along the entire Outer Breakwater survey area range between 2 and 5 m (6.5 – 16.5 ft), and transect depths were variable within this range as they were laid parallel to the breakwater.

Based on the survey results, corals along the Outer Breakwater are generally scarce within 2 m of the shoreline and become more abundant, diverse, and larger at approximately the 3- to 4-m depth contour (Kilarski *et al.* 2024). The corals observed often showed signs of mechanical damage. Over the length of the Outer Breakwater, the highest abundance and diversity of corals within 2 m of the shoreline occurs in the northeast section nearest the reef flat. The lowest coral cover is found in the in the distal third, including the breakwater tip, from shoreline to the breakwater toe.

Coral abundance determined on each of the five transects is presented in Table 3. The average density of corals observed on the structure and within approximately 2 meters around the structure is 1.3 colony/square meter. Results of the coral size class survey are presented in Table 4. A total of 163 coral colonies representing at least 11 coral taxa (*Acropora* sp., *Astrea* sp., *Dipsastrea* sp., *Favites* sp., *Goniastrea* sp., *Hydnophora* sp., *Leptastrea* sp., *Leptoria* sp., *Montipora* sp., *Pocillopora* spp., and *Porites* spp.) were recorded. The most common genus was *Goniastrea* (40 percent of the total) and most colonies are encrusting (65 percent of the total; Appendix A). The most common colony sizes were the two smallest (1- to 5-cm class and 6- to 10-cm class, at 40 and 37 percent, respectively). Transect locations can be found in Appendix A.

Table 3. Total Number of Coral Colonies and Abundance Counted during transects of the Outer Breakwater

Transect #	Survey Area (m^2)	Coral Count (colonies)	Coral Abundance (#/m^2)
O-1	25	105	4.2
O-2	25	0	0.0
O-3	25	52	2.1
O-4	25	4	0.2
O-5	25	2	0.1
Total	**125**	**163**	**1.3**

Source: Appendix A.
Note: m^2 = square meter(s); # = number.

Table 4. . Number of Coral Colonies in each Size Class by Species documented during transects along the Outer Breakwater

Species	Size class (cm)					Total	Percent of Total
	1 to 5	6 to 10	11 to 20	21 to 40	41 to 80		
Acropora	5	17	6	1	—	29	17.8
Astrea	1	—	2	1	—	4	2.5
Dipsastrea	5	2	3	—	—	10	6.1
Favites	1	—	—	—	—	1	0.6
Goniastrea	19	23	17	5	1	65	39.9
Hydnophora	1	—	—	—	—	1	0.6
Leptastrea	11	—	—	—	—	11	6.7
Leptoria	1	—	—	—	—	1	0.6
Montipora	—	—	—	1	1	2	1.2
Pocillopora	17	17	3	—	—	37	22.7
Porites	2	—	—	—	—	2	1.2
Total count	**63**	**59**	**31**	**8**	**2**	**163**	**—**
Percent of total	38.7	36.2	19	4.9	1.2	—	—

Source: Appendix A.
Note: cm = centimeters.

3.2.2 Fish

Myers and Donaldson (2003) conducted a literature review dating back to 1901 of fish species found in the Mariana Islands and adjacent territorial waters. In total, they listed 1,106 species of fishes known to be found in the region. Approximately 1,020 of the species detailed in the review were found in the inshore and epipelagic zones to a depth of 200 meters, and the vast majority of those fishes inhabit coral reefs.

In Outer Apra Harbor, visual transect surveys conducted at 5-meter depths found variable species richness between 10 sites, ranging from 48 different fish species at Polaris Point to 73 species at San Luis Beach (Schils et al. 2017). Although species richness and diversity varied among sites, the most common species observed among all sites was the bullethead parrotfish (*Chlorurus sordidus*). Fish abundance was also variable, ranging from 748 individuals to over 4,000 individuals observed at each site. Researchers determined that the abundance at most sites was comprised of damselfishes (Pomacentridae) or cardinalfishes (Apogonidae) and noted that cardinalfishes were particularly abundant at a number of protected sites in Outer Apra Harbor. The researchers also noted that two surgeonfishes, brown surgeonfish (*Acanthurus nigrofuscus*) and the striped bristletooth (*Ctenochaetus striatus*), were the most abundant acanthurids among sites.

Smith et al. (2009) observed 62 species of fish in Inner Apra Harbor during a transect survey. The authors noted that although the quantity of observed fishes could indicate an impoverished fish fauna, observations seem representative of protected, turbid lagoons or bays in Guam. Three of the observed fish species were determined to be new species or invasive: *Neopomacentrus violescens* (Pomacentridae-damselfishes), *Amblyglyphididon ternatensis* (Pomacentridae), and *Rhamdia cypselurus* (Apogonidae-cardinalfishes).

Fish occurrences and species were recorded during transects in February and March 2024; because of hazardous conditions and considerable wave energy, the exact locations of the Project Actions did not get quantifiable data, but nearby locations on the outer breakwater were able to be surveyed (Table 5).

Table 5. Inventory of Fish Species Observed during transects in Outer Glass Breakwater, adjacent to the Project Area, in February and March 2024.

Species	Common Name	Status [a]	Abundance[b]
			Outer Breakwater
ACANTHURIFORMES			
Acanthuridae			
Acanthurus blochii	Ringtail surgeonfish	Ind	C
Acanthurus guttatus	Whitespotted surgeonfish	Ind	C
Acanthurus lineatus	Lined surgeonfish	Ind	C
Acanthurus nigricans	Whitecheek surgeonfish	Ind	C
Acanthurus nigrofuscus	Lavender tang	Ind	C
Acanthurus triostegus	Convict tang	Ind	A
Ctenochaetus striatus	Lined bristletooth	Ind	—

Species	Common Name	Status [a]	Abundance[b]
			Outer Breakwater
Naso hexacanthus	Sleek unicornfish	Ind	—
Naso lituratus	Orangespine unicornfish	Ind	O
Zebrasoma flavescens	Yellow tang	Ind	U
Chaetodontidae			
Chaetodon bennetti	Eclipse butterflyfish	Ind	—
Chaetodon citrinellus	Speckled butterflyfish	Ind	—
Chaetodon ephippium	Saddleback butterflyfish	Ind	—
Chaetodon lunula	N/A	Ind	—
Chaetodon lunulatus	Oval butterflyfish	Ind	—
Chaetodon ornatissimus	Ornate butterflyfish	Ind	O
Chaetodon reticulatus	N/A	Ind	—
Chaetodon ulietensis	Pacific double-saddle butterflyfish	Ind	—
Forcipiger flavissimus	Forcepsfish	Ind	O
Siganidae			
Siganus argenteus	Rabbitfish	Ind	—
Zanclidae			
Zanclus cornutus	Moorish idol	Ind	O
AULOPIFORMES			
Synodontidae			
Synodus sp.	N/A	—	—
Saurida gracilis	Slender lizardfish	—	—

Species	Common Name	Status [a]	Abundance[b]
			Outer Breakwater
BLENNIIFORMES			
Blenniidae			
Plagiotremus laudandus	Bicolor fangblenny	Ind	—
CARANGIFORMES			
Carangidae			
Caranx melampygus	Bluefin trevally	Ind	C
CENTRARCHIFORMES			
Cirrhitidae			
Cirrhitus pinnulatus	N/A	Ind	—
Paracirrhites arcatus	Arceye hawkfish	Ind	—
EUPERCARIA			
Labridae			
Bodianus axillaris	Axilspot hogfish	Ind	—
Cheilinus fasciatus	Redbreasted wrasse	Ind	—
Epibulus insidiator	Slingjaw wrasse	Ind	—
Gomphosus varius	Bird wrasse	Ind	—
Halichoeres hortulanus	Checkered wrasse	Ind	O
Halichoeres margaritaceus	N/A	Ind	—
Hemigymnus melapterus	Half-and-half thicklip	Ind	—
Labroides dimidiatus	Bluestripe cleaner wrasse	Ind	—
Macropharyngodon meleagris	Leopard wrasse	Ind	—
Oxycheilinus bimaculatus	Twospot wrasse	Ind	—

Species	Common Name	Status[a]	Abundance[b]
			Outer Breakwater
Stethojulis bandanensis	N/A	Ind	—
Thalassoma hardwicke	Sixbar wrasse	Ind	—
Thalassoma lunare	Moon wrasse	Ind	—
Lethrinidae			
Lethrinus harak	Thumbprint emperor	—	—
Nemipteridae			
Scolopsis lineata	Striped monocle bream	—	—
Scaridae			
Chlorurus spilurus	Bullethead parrotfish	—	—
Scarus sp.	N/A	—	C
Scarus niger	Swarthy parrotfish	—	C
Scarus oviceps	Darkcapped parrotfish	Ind	—
Scarus psittacus	Palenose parrotfish	Ind	C
Scarus schlegeli	Yellowband parrotfish	Ind	—
KURTIFORMES			
Apogonidae			
Cheilodipterus quinquelineatus	Fivestriped percelle	Ind	—
MULLIFORMES			
Mullidae			
Parupeneus multifasciatus	Manybar goatfish	—	—

Species	Common Name	Status [a]	Abundance[b]
			Outer Breakwater
PERCIFORMES			
Pomacentridae			
Abudefduf sexfasciatus	Scissortail sergeant	Ind	—
Amblyglyphidodon curacao	Staghorn damsel	Ind	—
Amphiprion sp.	Anemonefish	—	—
Chrysiptera brownriggii	Surge damsel	Ind	—
Dascyllus aruanus	N/A	Ind	—
Pygoplites diacanthus	N/A	Ind	—
Stegastes albifasciatus	N/A	Ind	—
Serranidae			
Cephalopholis urodeta	Flagtail grouper	—	—
TETRAODONTAFORMES			
Monacanthidae			
Oxymonacanthus longirostris	Harlequin filefish	—	—
Pervagor aspricaudus	Yellow-tail filefish	Ind	—
Tetradontidae			
Arothron nigropunctatus	Blackspotted puffer	Ind	—
Canthigaster solandri	N/A	Ind	—

Source: Appendix A.
Note: N/A = common name not applicable or unknown.
[a] Status = distributional status for the Mariana Islands: Ind = Indigenous. native to Guam, but not unique to the Mariana Islands.
[b] Abundance: A = Abundant, observed in large numbers and widely distributed; C = Common, observed everywhere, although generally not in large numbers; O = Occasional, seen irregularly in small numbers; U = Uncommon, several to a dozen individuals observed; R = Rare, only one or two individuals observed; blank cells indicate that individuals were not observed in a particular area during the survey.

3.2.3 Other Marine Species

An inventory of other marine species observed near the Action Area during the February and March 2024 marine surveys is provided below (Table 6).

Table 6. Inventory of Other Marine Species Observed during transects in Outer Glass Breakwater, adjacent to the Project Area, in February and March 2024

Species	Common Name	Status [a]	Abundance[b]
			Outer Breakwater
Macroalgae			
BRYOPSIDALES			
Bryopsidaceae			
Bryopsis pennata	N/A	Ind	—
Caulerpaceae			
Caulerpa racemosa var. *macrophysa*	N/A	Ind	—
Caulerpa serrulata	N/A	Ind	—
Codiaceae			
Tydemania expeditionis	N/A	Ind	—
Halimedaceae			
Chlorodesmis fastigiata	N/A	Ind	O
Halimeda sp.	N/A	—	—
Halimeda opuntia	N/A	Ind	—
CLADOPHORALES			
Valoniaceae			
Valonia ventricosa	N/A	Ind	—
Cyanobacteria			
COLEOFASCICULALES			
Coleofasciculaceae			
Symploca hydnoides	N/A	Ind	—
Brown Algae			
FUCALES			
Sargassaceae			
Turbinaria ornata	N/A	Ind	—
DICTYOTALES			
Dictyotaceae			
Dictyota grossedentata	N/A	Ind	—

Species	Common Name	Status [a]	Abundance[b]
			Outer Breakwater
Padina boryana	N/A	Ind	—
Red Algae			
BONNEMAISONIALES			
Bonnemaisoniaceae			
Asparagopsis taxiformis	N/A	—	—
CORALLINALES			
Lithophyllaceae			
Amphiroa Tribulus	N/A	—	—
NEMALIALES			
Galaxauraceae			
Actinotrichia fragilis	N/A	—	—
Non-coral Invertebrates			
Crustaceans			
DECAPODA			
Unidentified hermit crab	N/A	—	C
Echinoderms			
VALVATIDA			
Ophidiasteridae			
Linckia laevigata	N/A	Ind	—
Linckia multifora	N/A	Ind	—
Oreasteridae			
Culcita novaeguineae	Cushion star	Ind	—
CAMARODONTA			
Echinometridae			
Echinostrephus aciculatus	Needle-spined urchin	Ind	U
Echinometra mathaei	N/A	Ind	R
HOLOTHURIIDA			
Holothuriidae			
Actinopyga mauritiana	N/A	—	—
Actinopyga obesa	Plump sea cucumber	—	—
Actinopyga varians	White-spotted sea cucumber	—	—
Bohadschia argus	Leopard sea cucumber	Ind	—

Species	Common Name	Status[a]	Abundance[b]
			Outer Breakwater
Holothuria atra	N/A	Ind	—
SYNALLACTIDA			
Stichopodidae			
Stichopus chloronotus	N/A	Ind	U
Bivalves			
CARDIIDA			
Cardiidae			
Tridacna maxima	Maxima clam, giant clam	Ind	—
Gastropods			
CYCLONERITIDA			
Neritidae			
Nerita plicata	N/A	—	—
NEOGASTROPODA			
Muricidae			
Sistrum albolabris	N/A	—	—
TROCHIDA			
Tegulidae			
Rochia nilotica	Top shell	Ind	—
Sponges			
POECILOSCLERIDA			
Microcionidae			
Clathria (Thalysias) eurypa	N/A	—	—
TETHYIDA			
Hemiasterellidae			
Liosina paradoxa	N/A	—	—
Vertebrates			
Chordates			
PHLEBOBRANCHIA			
Ascidiidae			
Ascidia dijmphniana	Yellow sea squirt	—	—

Source: Appendix A.

Note: N/A = not applicable.

[a] Status = distributional status for the Mariana Islands: Ind = Indigenous, native to Guam, but not unique to the Mariana Islands.

[b] Abundance: A = Abundant, observed in large numbers and widely distributed; C = Common, observed everywhere, although generally not in large numbers; O = Occasional, seen irregularly in small numbers; U = Uncommon, several to a dozen individuals observed; R = Rare, only one or two individuals observed.

3.3 Marine Mammals

While it is common to observe marine mammals in the waters surrounding Apra Harbor (Hill *et al.* 2014, 2017, 2020; Martin *et al.* 2016), they are rarely observed within the harbor (Hill *et al.* 2017). A partially decomposed specimen recognized as a pygmy sperm whale (*Kogia breviceps*) was discovered at Naval Supply Depot Beach at NBG in 1989 (Sherwood 1989, as cited in Eldredge 2003). A group of six or more humpback whales (*Megaptera novaeangliae*) was photographed at the Apra Harbor entrance in January 1996 (Eldredge 2003; McNulty 2013). In 2016, filtered satellite tag locations from short-finned pilot whales (*Globicephala melas*) and a pantropical spotted dolphin (*Stenella attenuata*) were located inside Apra Harbor (Hill *et al.* 2017). The quality of at least one of the short-finned pilot whale tag locations was sufficient to confirm that the whale was inside the harbor (Hill *et al.* 2017).

Based on the rarity of marine mammal sightings within Apra Harbor, the limited size of the Action Area along the outer shorelines of breakwater during all activities, the careful placement of armor stones to reduce noise (discussed in Section 4.1.1), and the 46 m (50-yard) shutdown zone for marine mammals, no effects on marine mammals from the Project are anticipated. No critical habitat for marine mammals is designated in the Action Area.

3.4 ESA-Listed Species and Critical Habitat in the Action Area

Threatened and endangered marine species protected under the ESA with NMFS jurisdiction that are reasonably likely to occur in the Action Area (Table 7) were identified from previous Navy Mariana Islands Training and Testing (MITT) Supplemental Environmental Impact Statements/Overseas Environmental Impact Statements (DoN 2015, 2020a), the Navy Marine Resources Assessment for the Marianas Operating Area (DoN 2005), Biological Opinions (NMFS 2020a), Navy Biological Assessments (NAVFAC and AECOS Inc. 2021), the Integrated Natural Resources Management Plan (INRMP) for Joint Region Marianas (DoN 2022), Biological Reports (NMFS 2023a), the NMFS ESA Critical Habitat Mapper (NOAA Fisheries 2024b), and recent biological surveys conducted in Apra Harbor (Gaos *et al.* 2020a, 2020b; Budd *et al*. 2023; Appendix A).

The Pacific Islands Region (PIR) is home to the following five species of sea turtles: loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea*), hawksbill, and green (Table 7)(NMFS 2023a). All sea turtle species are protected under the ESA. There are no reports of loggerhead turtle sightings, strandings, or nests around Guam, and there is only one record of an olive ridley turtle, which is of an alleged capture in the waters close to Saipan (DoN 2015). Leatherback turtles have been observed on rare occasions in the deep, pelagic waters of the Marianas archipelago (Eckert et al. 1999; DoN 2015), and there are a few records of leatherback turtle sightings off the coast of Guam, but this species is considered rare and unlikely to be observed in the Action Area. Therefore, only green turtles and hawksbill turtles potentially could occur in the Action Area.

Four ESA-listed marine species—green turtle, hawksbill turtle, scalloped hammerhead shark, and hard coral species *Acropora globiceps*—could potentially occur in the Apra Harbor (Table 7) according to data and findings from biological surveys conducted in Apra Harbor (HDR and CSA Ocean Sciences Inc. [CSA] 2020; Gaos *et al.* 2020a, 2020b; Budd *et al.* 2023; Appendix A). While four ESA-candidate giant clam species historically have been known to occur on Guam, only one candidate species (*Tridacna squamosa*; see Section 3.4.5 for details) could potentially occur in the Action Area (Appendix A). Thus, this assessment focuses primarily on the potential impacts on the four ESA-listed species—the green turtle (Central West Pacific DPS), the hawksbill turtle, the scalloped hammerhead shark (Indo-West Pacific DPS), and hard coral *A. globiceps*—and one ESA-candidate giant clam species (*T. squamosa*).

3.4.1 Sea Turtles

NMFS and the USFWS share responsibility for the protection and recovery of sea turtles in the U.S. under the ESA. In the PIR, which includes the marine environment and nesting beaches in Guam, NMFS and the USFWS collaborate on efforts to conserve and recover sea turtles. Specific details about the biology, habitat, and conservation status of green turtles and hawksbill turtles are described in the U.S. Sea Turtle Recovery Plans (NMFS and USFWS 1998a, 1998b), Status Reviews (NMFS and USFWS 2013; Seminoff et al. 2015), and the Navy's MITT and NMFS Pacific Islands Fisheries Science Center publications and technical reports specific to Guam and Apra Harbor (Jones *et al.* 2015; Martin *et al.* 2019; Gaos *et al.* 2020a, 2020b). Apra Harbor and the nearshore waters off the DoN submerged lands are known to be used by green and hawksbill turtles (Figure 6), and nesting activity by both species has been observed previously inside Apra Harbor (Gaos *et al.* 2020b; DoN 2022).

Table 7. ESA-listed Threatened and Endangered Marine Species under NMFS Jurisdiction with the Potential to Occur in the Action Area, and the Occurrence of Designated or Proposed Critical Habitat

Scientific Name	Common Name and DPS	Federal Status	Habitat	Presence in Action Area	Critical Habitat Designated in the Action Area	ESA Determination
Sea Turtles						
Chelonia mydas	Green turtle, Central West Pacific DPS	Endangered	Nearshore waters, nesting beaches, and offshore waters	Yes[a]	Nesting Areas: No Marine Areas: Proposed	No Effect
Eretmochelys imbricata	Hawksbill turtle			Yes[a]	No	No Effect
Fish						
Sphyrna lewini	Scalloped hammerhead shark, Indo-West Pacific DPS	Threatened	Coastal seas from intertidal to depths of 500 m (1,640 ft); nearshore nursery habitat includes bays and estuaries	Yes[b]	No	No Effect
Invertebrates						
Acropora globiceps	Hard coral	Threatened	Intertidal zone, upper reef slopes, and reef flats at depths <26 ft (8 m)	Yes	No, see Section 3.4.3 for exclusion	No Effect
Tridacna derasa[c] *Tridacna squamosa* *Tridacna maxima* *Tridacna gigas*[d] *Hippopus hippopus*[d]	Giant clam	Candidate	Shallow reefs, outer reef slopes, lagoons, and sandy bottoms	No	No	No Effect

Source: 80 FR 221; Gaos et al. 2020a, 2020b; DoN 2022; NOAA Fisheries 2024c; Appendix A.

Note: DPS = Distinct Population Segment.

[a] Indicates nesting activity near the Action Area. Source: Gaos et al. 2020a, 2020b; NMFS 2023a.

[b] Apra Harbor may contain nursery habitat, but this supposition is based only on anecdotal observations of juvenile sharks in Sasa Bay and both adults and juveniles in the channel connecting Inner Apra Harbor and Sasa Bay (80 FR 221; DoN 2022).

[c] Likely to be functionally extinct on Guam. Source: Wells 1997; Paulay 2003b.

[d] Locally extinct on Guam. Source: Teitelbaum and Friedman 2008.

Green and hawksbill turtles are often associated with coral reef habitat (Becker *et al.* 2019). Based on vessel-based survey observations and captures as well as the analysis of Guam aerial survey data, the following areas appear to have high turtle density: (1) nearshore waters inside Apra Harbor near San Luis Beach and Gab Gab Beach; (2) nearshore waters near Spanish Steps; and (3) nearshore waters near Dadi Beach and Tipalao Beach outside of the harbor to the south (Gaos *et al.* 2020a, see Figure 6 for locations). These areas are dominated primarily by patch reef communities where the sea turtles both forage and rest (Gaos *et al.* 2020a). Sea turtle densities are highest where there are healthy coral reefs and seagrass beds, low human densities, and marine protected areas (Martin *et al.* 2016). Though human population density is correlated with sea turtle density, a major concern is coastal development and the resulting degradation of nesting beaches and foraging areas. Threats to nesting beaches include construction and associated lighting, military activities such as testing and training, public use of beaches, and beach driving (NMFS and USFWS 1998a; 81 FR 20057). Vessel collisions may pose a risk to sea turtles in the nearshore waters of Apra Harbor and western Guam (DoN 2020a). Last, changes in temperature and climate change may cause nesting beach habitat to shift or disappear, changing the significance or position of nearby marine reproductive zones (88 FR 46693).

Green Turtles, Central West Pacific DPS

Globally, green turtles are distributed along continental coasts and islands in tropical and subtropical waters (DoN 2015). In 1978, the green turtle was listed under the ESA (43 FR 32800). Following changes to the initial listing, in April 2016, NMFS categorized the species into 11 DPSs, with 8 DPSs classified as threatened and 3 DPSs classified as endangered (81 FR 20057). The endangered green turtles found off the coast of Guam are included in the Central West Pacific DPS. The destruction and modification of marine habitat, coastal erosion, nearshore construction and development, establishment of shipping lanes, fishing and aquaculture activities, dredging, recreational activities, pollution, predation, marine debris, temperature increases and sea level rise, and an increase in the frequency and intensity of storm events are among the threats to the Central West Pacific DPS and its nesting habitat (NMFS and USFWS 1998a; NMFS 2023a; 81 FR 20057).

The Central West Pacific DPS green turtle is the most commonly observed sea turtle in the waters off Guam (Wiles *et al.* 1995; Martin *et al.* 2016; DoN 2022). Green turtles use the nearshore waters of Apra Harbor and Outer Apra Harbor and nest on three beaches within NBG Main Base: Spanish Steps, Dadi Beach, and Kilo Wharf (DoN 2022). Regular surveys of green turtle nests are carried out at Dadi Beach and Spanish Steps. During the nesting season, inspections are also occasionally carried out at other beaches on the NBG Main Base such as Gab Gab, San Luis, Polaris Point, and Tipalao, which may support sea turtle nesting (DoN 2022). The Spanish Steps at Orote Point are considered one of the main nesting sites on the island of Guam (Gaos *et al.* 2020a). Nesting activity is observed mainly from March through July, with some activity from December through February (DoN 2022). Based on the construction schedule presented in Section 2.4, Project actions will not overlap with the sea turtle nesting season.

Basemap: World Imagery; World_Ocean_Base

Figure 6. Green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), and unidentified sea turtle sighting locations and tag deployment locations in Apra Harbor.

Source: Jones et al. 2015; Gaos et al. 2020a, 2020b; InPort 2024.

Based on data collected between 2004 and 2016, sea turtles have been observed throughout Apra Harbor, and the highest densities of sightings have been recorded in the western part of the harbor, especially along the coast between Kilo Wharf and Gab Gab Reef. Comparatively low numbers of sightings have been recorded in the eastern parts of the harbor (Jones et al. 2015). Eleven subadult green turtles were caught in Apra Harbor during sea turtle surveys and satellite tagging operations in July 2014, May 2015, and May 2016; all turtles were fitted with satellite tags to monitor their movements (Jones *et al.* 2015). The tracking data showed that the green turtles either stayed in western Apra Harbor or migrated to Agat Bay, with good site fidelity and minimal movements. Green turtles typically spend the day in deeper waters and spend the night close to the coast. The average depth of a green turtle was less than 10 m (33 ft) for day and night (Jones *et al.* 2015; Martin and Jones 2016, 2017).

Between 2015 and 2019, in-water surveys and turtle captures were conducted in Apra Harbor at NBG and recorded 190 observations of green turtles, hawksbill turtles, and unidentified sea turtles; 75.3 percent were identified as green turtles (Gaos *et al.* 2020a). Although green turtles are occasionally observed in the Action Area, sightings are uncommon near Glass Breakwater.

Based on the information presented above, the portions of the outer breakwater sections that are to be repaired under the Proposed Action are extremely unlikely to support green turtle nesting activity due to the limited amount of sandy coastal habitat that is steep and drops off into insular shelfs (DoN 2022). Elements of the Proposed Action that have the potential to produce elevated in-air and underwater noise are not likely to generate noise levels that extend to areas used by nesting sea turtles because nesting will not overlap with the Action Area temporally or geographically.

Green Turtles, Central West Pacific DPS Proposed Critical Habitat

In 2023, NMFS and the USFWS proposed additional critical habitat areas for threatened and endangered DPSs of green turtles in locations under U.S. jurisdiction (NMFS 2023a; 88 FR 46376; 88 FR 46572; 88 FR 46693). In accordance with the ESA, NMFS proposed critical habitat for DPSs of the green turtle that are vulnerable or endangered in regions under U.S. control to include the nearshore waters off the coast of Guam. NMFS proposed critical habitat includes marine portions of the Action Area and would extend from the mean high-water line to a depth of 20 m to protect access to nesting beaches, migratory corridors, and important feeding and resting areas (88 FR 46572) (Figure 7). Concurrently, the USFWS proposes to designate terrestrial habitat for five DPSs of green turtles as critical habitat, which includes the Central West Pacific DPS (88 FR 46376). This designation includes lands where green turtles bask, nest, incubate, hatch, and travel to the sea (Figure 7). One acre of critical habitat for green turtles has been proposed by USFWS inside Apra Harbor (Figure 7), but is not within the Action Area. No other critical habitat is designated or proposed near the Action Area.

Basemap: World Imagery; World_Ocean_Base

Figure 7. NOAA and USFWS proposed green turtle critical habitat.

Source: USFWS 2023; NOAA Fisheries 2024a, 2024b.

Hawksbill Turtle

Throughout the world, hawksbill turtles can be found in tropical and subtropical oceans between 30°N and 30°S. The PIR is home to foraging hawksbill turtles; however, their numbers are lower in Guam waters than those of green turtles, and they do not occur in large numbers anywhere within the Mariana Islands (Martin et al. 2016; DoN 2022). In 1970, the hawksbill turtle was listed as endangered under the ESA (35 FR 8491). No critical habitat is designated for this species in the Action Area.

Hawksbill turtles typically occur in Outer Apra Harbor where sponge (Porifera), their favorite meal, is abundant. Sasa Bay is the largest estuary in the Mariana Islands, and hawksbill turtles are most frequently seen there (Kolinski 2001; DoN 2015, 2022). These locations in Sasa Bay and Apra Harbor serve as crucial areas to rest and forage (Kolinski 2001; Jones et al. 2015; Martin and Jones 2017; DoN 2022).

Three sightings of hawksbill turtles have been recorded along the Orote Peninsula: one in November 2003, one in October 2004, and one in October 2005 (Smith and Marx 2006). During reconnaissance scans in Apra Harbor in 2015, at least three hawksbill turtles were spotted (HDR and CSA Ocean Sciences Inc. 2017). Between 2015 and 2019, in-water surveys and turtle captures were conducted in Apra Harbor at NBG, which resulted in 190 observations of green turtles, hawksbill turtles and unidentified sea turtles, of which 7.9 percent were hawksbill turtles (Gaos *et al.* 2020a). Three subadult hawksbill turtles were caught in Apra Harbor during sea turtle surveys and satellite tagging operations in July 2014, May 2015, and May 2016; all turtles were fitted with satellite tags to monitor their movements (Jones *et al.* 2015). Hawksbill turtles typically spend the day in deeper waters and the night close to the coast. Compared to green turtles, hawksbill turtles spent more time in deeper waters, diving as far down as 100 m (330 ft). Based on survey data, the following areas appear to have high turtle density: (1) nearshore waters inside Apra Harbor near San Luis Beach and Gab Gab Beach; (2) nearshore waters near Spanish Steps; and (3) nearshore waters near Dadi Beach and Tipalao Beach outside of the harbor to the south. Biological surveys conducted in the Action Area in 2019 and 2020 failed to find any evidence of hawksbill turtles (NAVFAC Marianas 2019, as cited in NAVFAC Pacific and AECOS Inc. 2021). A hawksbill turtle was observed in July 2020 during biological and benthic habitat surveys in support of the NBG Underwater Electro-Magnetic Measurement System (HDR and CSA 2020).

As with green turtles, hawksbill turtle natal nesting areas are frequently located in different island groups, and residents of a given island group may originate from multiple natal nesting areas (NMFS and USFWS 2013). However, nesting by hawksbill turtles has not been observed on NBG since 1995 on a small beach within the Sumay Inlet (NAVFAC Pacific and AECOS Inc. 2021). The Action Area does not provide nesting habitat for hawksbill turtles due to the limited amount of sandy coastal habitat that is steep and drops off into insular shelfs (DoN 2022).

Based on the information presented above, the portions of the outer breakwater to be repaired under the Proposed Action are extremely unlikely to support hawksbill turtle nesting activity due to the rocky shoreline and limited amount of sandy coastal habitat (DoN 2022). Elements of the Proposed Action that have the potential to produce elevated in-air and underwater noise are not likely to generate noise levels that extend to areas used by nesting sea turtles because nesting areas are outside of the Action Area.

3.4.2 Scalloped Hammerhead Shark, Indo-West Pacific DPS

The scalloped hammerhead shark is a warm-water species distributed widely throughout the tropics and composed of four endangered or threatened DPSs (Miller *et al.* 2014). All scalloped hammerhead sharks near Guam are included in the Indo-West Pacific DPS, which was listed as threatened in 2014 (79 FR 38213). There have been few confirmed sightings of scalloped hammerhead sharks in Guam; both confirmed and anecdotal sightings have been rarely reported since 1968 (Kami 1971; MacNeil et al. 2020). Recently, environmental DNA (eDNA) studies have confirmed the occurrence of scalloped hammerhead shark eDNA within Apra Harbor at both Inner Apra Harbor and Orote Point (Budd *et al.* 2021). Budd *et al.* (2021) report that this represents the first confirmed occurrence since the sighting reported in 1968 by Kami (1971). Further studies have positively identified scalloped hammerhead shark eDNA collected from the Inner Harbor, Sasa Bay, Orote Point, Middle Shoals, and Blue Hole during a monthly study from February 2019 to July 2020 (Budd *et al.* 2023).

Scalloped hammerhead sharks are highly mobile and show some migratory patterns. Large adult females are more common in Indonesia and Papua New Guinea, whereas juveniles and small adult males are more common in Australia, suggesting movement between these geographic areas (Chin *et al.* 2017). They inhabit bays and estuaries and occur in surface waters with occasional dives up to 1,000 m deep (Miller *et al.* 2014) but predictably occur along fronts characterized by large gradients in sea-surface temperature and high productivity (NMFS 2020b).

Scalloped hammerhead sharks birth live young during summer breeding season between May and September (Duncan *et al.* 2006). Juvenile scalloped hammerhead sharks may inhabit nursery areas for more than a year, seeking refuge from predation (Duncan and Holland 2006). Recent studies in the Rewa Delta, Fiji, show that neonates and young-of-the-year utilize the delta year-round, independent of sea-surface or productivity gradients (Marie *et al.* 2017). Adult scalloped hammerhead sharks appear regularly in nursery grounds, suggesting this species may have a capacity for philopatry (i.e., tendency for an animal to return to its birth site; Duncan *et al.* 2006).

Sasa Bay has previously been suggested as a potential nursery area based only on anecdotal observations (Miller *et al.* 2014). Budd *et al.* (2023) documented positive detections of scalloped hammerhead sharks in most months of the year but most commonly from September through April. Detections occurred in nearly all months in Inner Apra Harbor (Budd *et al.* 2023), with other locations being more sporadic. No further evidence of Sasa Bay acting as a nursery has been identified, and no mention of Sasa Bay was included in the most recent 5-year status review by NMFS (NMFS 2020b). Furthermore, the high level of human activity and the lack of quality habitat in Inner Apra Harbor may limit their presence in the area (DoN 2019a), and no critical habitat has been designated or proposed in Apra Harbor. With the lack of observational evidence, large numbers of scalloped hammerhead sharks are unlikely to occur in the Action Area, and the likelihood of encountering a solitary shark is remote.

The primary threats identified in the 2014 report to the Indo-West Pacific DPS of scalloped hammerhead sharks include overutilization by industrial/commercial and artisanal fisheries; and overutilization by illegal, unregulated, or unreported fisheries (Miller *et al.* 2014). Significant declines in this DPS also are due in part to swimmer protection programs from Australia and South Africa where sharks near popular swimming areas are culled (NMFS 2020b), with annual rates of decline in those locations estimated at

8.4 and 4.0 percent, respectively (Rigby *et al.* 2019). The International Union for Conservation of Nature lists population fragmentation, low numbers of mature individuals, and the decline in numbers of mature individuals as contributors to overall population decline (Rigby *et al.* 2019). Both the Commonwealth of Northern Mariana Islands and Guam banned the possession, sale, offer for sale, trade, and distribution of shark fins. Guam also explicitly prohibits the take, purchase, barter, transport, export, and import of shark fins.

3.4.3 Hard Coral (*Acropora globiceps*)

Acropora globiceps is a reef-building, branching hard coral species found in the Indo-Pacific that was listed as threatened under the ESA by NMFS in 2014 (79 FR 53852). Threats that contributed to the listing of *A. globiceps* include ocean warming, ocean acidification, disease, fishing, land-based sources of pollution, predation, and inadequacy of existing regulatory mechanisms (79 FR 53852). In addition, updated information since the listing indicates that collection and trade may also be impacting the species (NMFS 2023b). The majority of threats, particularly ocean warming, have substantially worsened since *A. globiceps* was listed as threatened in 2014. On Guam, recent ocean warming-induced coral bleaching events have resulted in extensive mortality of *A. globiceps* (Raymundo et al. 2019). NMFS' 5-year species review of *A. globiceps* concluded that no change is needed to its ESA-listing status (NMFS 2024a).

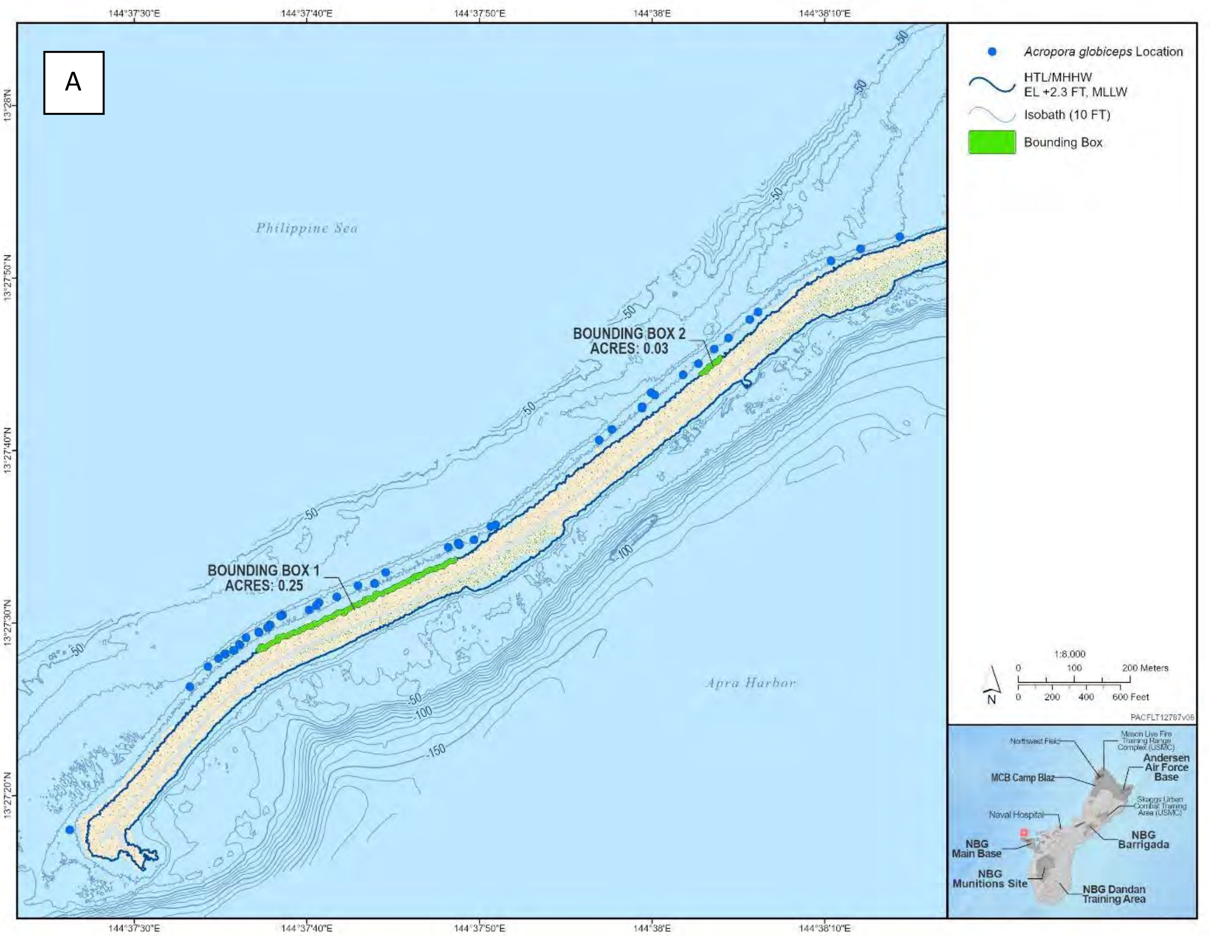
Acropora spp. are hermaphroditic broadcast spawners, meaning that the same coral colony releases sperm and eggs into the water column where the latter becomes fertilized (Sheppard *et al.* 2009; NMFS 2023b). Broadcast spawners typically require 3–4 days before larvae become competent to settle (Barton *et al.* 2015). Carroll (2009) found that peak larval attachment rates were observed at 3–5 days after spawning for *A. striata* and *A. retusa*. Studies have found that factors such as healthy reef soundscapes and appropriate substrates, such as CCA, can influence and encourage *Acropora* spp. larval settlement (Barton *et al.* 2015; Kaplan and Mooney 2016; Whitman *et al.* 2020; Lei *et al.* 2021; Aoki *et al.* 2024). After settlement, the larva develops into a polyp, which then initiates colony formation. Coral polyps deposit calcium carbonate beneath themselves through their tissue, forming a limestone skeleton as they grow outwards (Sheppard *et al.* 2009). *Acropora* spp. have a relatively rapid growth rate and can extend their branches by 10 cm per year or more (Sheppard *et al.* 2009). Colonies of *A. globiceps* are round, with uniform, finger-like branches that grow upwards and often close together. Colonies are typically 25 cm in diameter or less, but can reach up to 1 meter in diameter (NMFS 2023b). Colony color usually ranges from cream to brown, and occasionally fluorescent green in some locations (NMFS 2023b). Reef-building corals have a symbiotic relationship with unicellular dinoflagellate algae, referred to as zooxanthellae (genus *Symbiodinium*), which is essential for coral survival (Ladrière *et al.* 2014). The disruption of this delicate symbiosis is commonly known as coral bleaching, which is broadly defined as the drastic loss of zooxanthellae from the coral host cells (Douglas 2003).

The rangewide relative abundance of *A. globiceps* is uncommon to common (NMFS 2024a). The absolute abundance, or estimate of the total number of colonies of a species that currently exists throughout its range, was estimated to be tens of millions of colonies at the time of listing (79 FR 53852). According to the 2014 final listing, "clonal, colonial organisms, such as corals, are vastly different in their biology and ecology than vertebrates, which are typically the focus of ESA status reviews. Therefore, concepts and terms that are typically applied to vertebrates have very different meanings when applied to corals. A 'rare' coral may have millions of colonies as compared to a 'rare' vertebrate, which may only have hundreds of individuals" (79 FR 53852). Updated information since the time of listing indicates that *A. globiceps* has a higher absolute abundance, likely hundreds of millions of colonies, than what NMFS was aware of during the time of listing in 2014 (NMFS 2024a). Despite a higher absolute abundance than previously thought, it is likely that *A. globiceps* is decreasing in overall abundance due to continued worsening threats (NMFS 2024a).

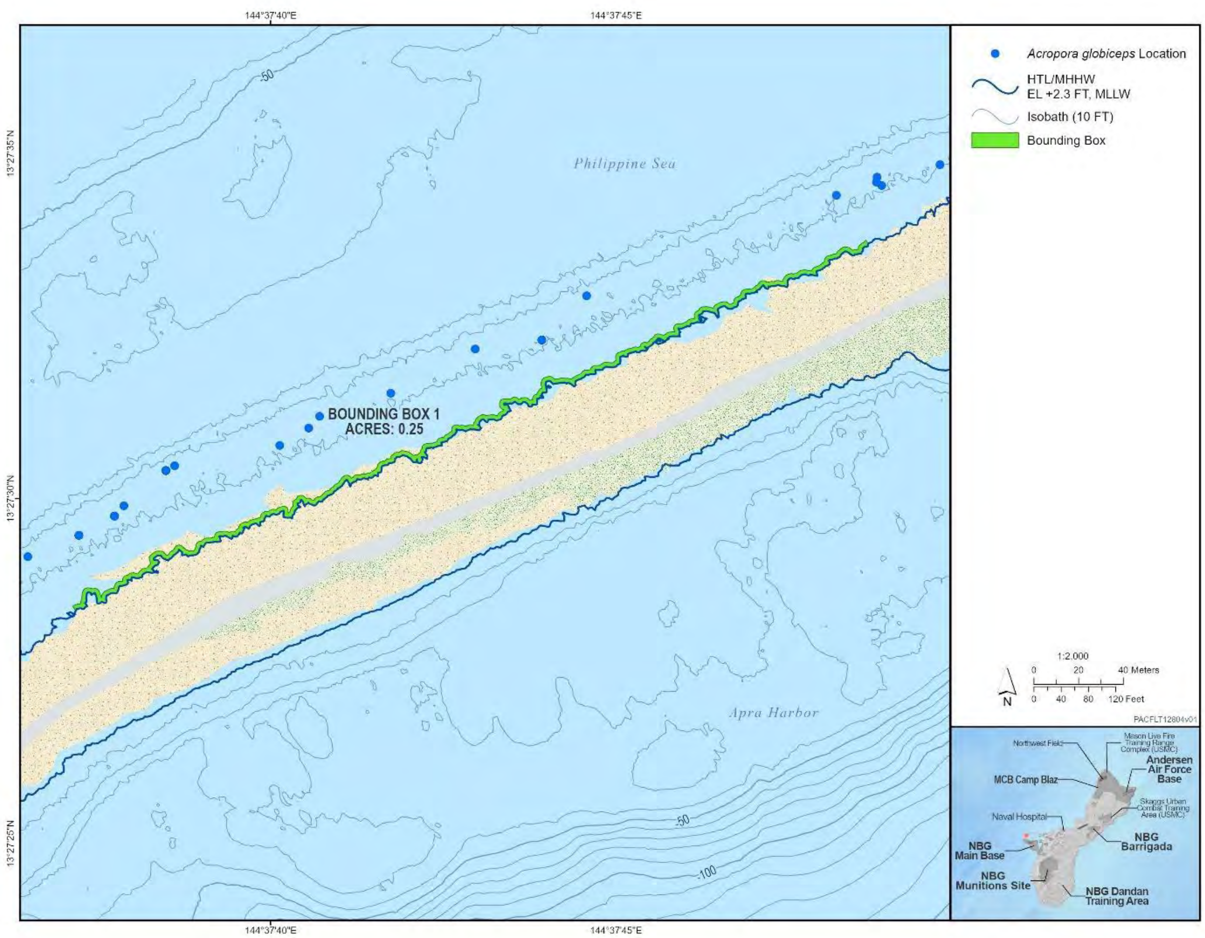
A. globiceps have a relatively broad distribution, occurring in 39 Marine Ecoregions of the World (Spalding *et al.* 2007; NMFS 2024a). *A. globiceps* can be found in water depths of 0-20 m (NMFS 2023b). In the U.S. and its territories, *A. globiceps* occurs in Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, the Pacific Remote Island Area, and the Northwestern Hawaiian Islands (NMFS 2023b).

On Guam, *A. globiceps* is widely distributed on reef flats and upper reef slopes around the island and seems to favor conditions where reasonably intense wave motion is possible (DoN 2022; NMFS 2023b). It has the most records (n = 24) from different places on Guam among the federal ESA-listed species that are known to occur there (DoN 2022). Generally In Apra Harbor, coral-supporting shallow reef flats are present in Sasa Bay, San Luis, Gab Gab, and Spanish Steps (the only site where *A. globiceps* has been known to occur) (DoN 2022).

Coral assessments in 2010 for a proposed aircraft carrier wharf in Apra Harbor did not record *A. globiceps* as being present (DoN 2022). During a non-systematic search of the nearshore area at Dadi Beach in September 2016, a solitary colony measuring roughly 25–30 centimeters (10–15 inches) across was discovered from the reef crest south of Dadi Beach (DoN 2022). Biological monitoring near Kilo Wharf also revealed the presence of *A. globiceps* (Schils *et al.* 2011, as cited in DoN 2022), which has not been documented in that area of the harbor since the survey (DoN 2022). During recent marine biological surveys conducted in February and March 2024 for this Project, 29 colonies of *A. globiceps* were located in the Action Area (; see Appendix A for additional details). In Figure 8, the green box depicts the absolute limits of in-water work (2 m from HTL), should it be necessary, avoiding all *Acropora globiceps* by at least 30 m (BMP C, Section 2.5.2).



42 References


144°37'40"E
144°37'45"E
13°27'35"N
13°27'30"N
13°27'25"N
Acropora globiceps Location
HTL/MHHW
EL +2.3 FT, MLLW
Isobath (10 FT)
Bounding Box
Philippine Sea
BOUNDING BOX 1
ACRES: 0.25
Apra Harbor
-50
-100
1:2,000
0 20 40 Meters
0 40 80 120 Feet
N
PACFLT12804v01
Northwest Field
Mason Live Fire Training Range Complex (USMC)
Andersen Air Force Base
MCB Camp Blaz
Skaggs Urban Combat Training Area (USMC)
Naval Hospital
NBG Barrigada
NBG Main Base
NBG Munitions Site
NBG Dandan Training Area

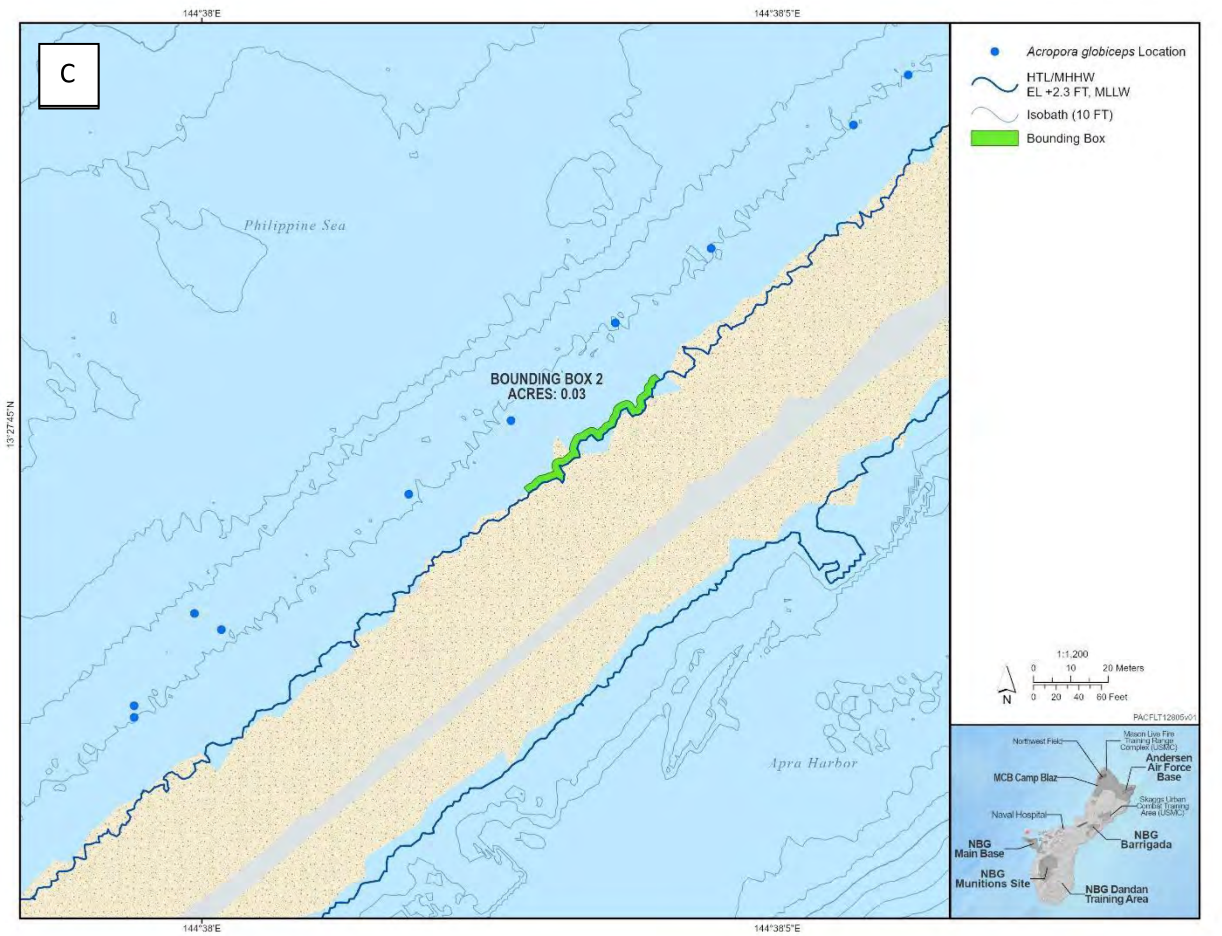


Figure 8. Action Areas for the emergency Glass Breakwater repairs. The absolute limits of in-water work are denoted by the green polygon, along with locations of ESA listed *Acropora globiceps*. The complete bounds of work are shown in image A., followed by a closer view in B. and C.
Source: NAVFAC, Kilarski et al. 2024 (Appendix A).

3.4.4 Proposed Critical Habitat for Corals

Pursuant to Section 4 of the ESA, NOAA Fisheries proposed in November 2020 to designate 17 island units of critical habitat in the PIR for Indo-Pacific coral species listed under the ESA (85 FR 76262), which includes the island unit of Guam and the hard coral species *Acropora globiceps*.

Although colonies of *Acropora globiceps* exist in Apra Harbor, the harbor was excluded from the critical habitat designation (Figure 9) because of final Joint Region Marianas INRMP that NOAA Fisheries determined will benefit the listed corals (88 FR 83644). Therefore, no critical habitat for *A. globiceps* is designated or proposed in the Action Area.

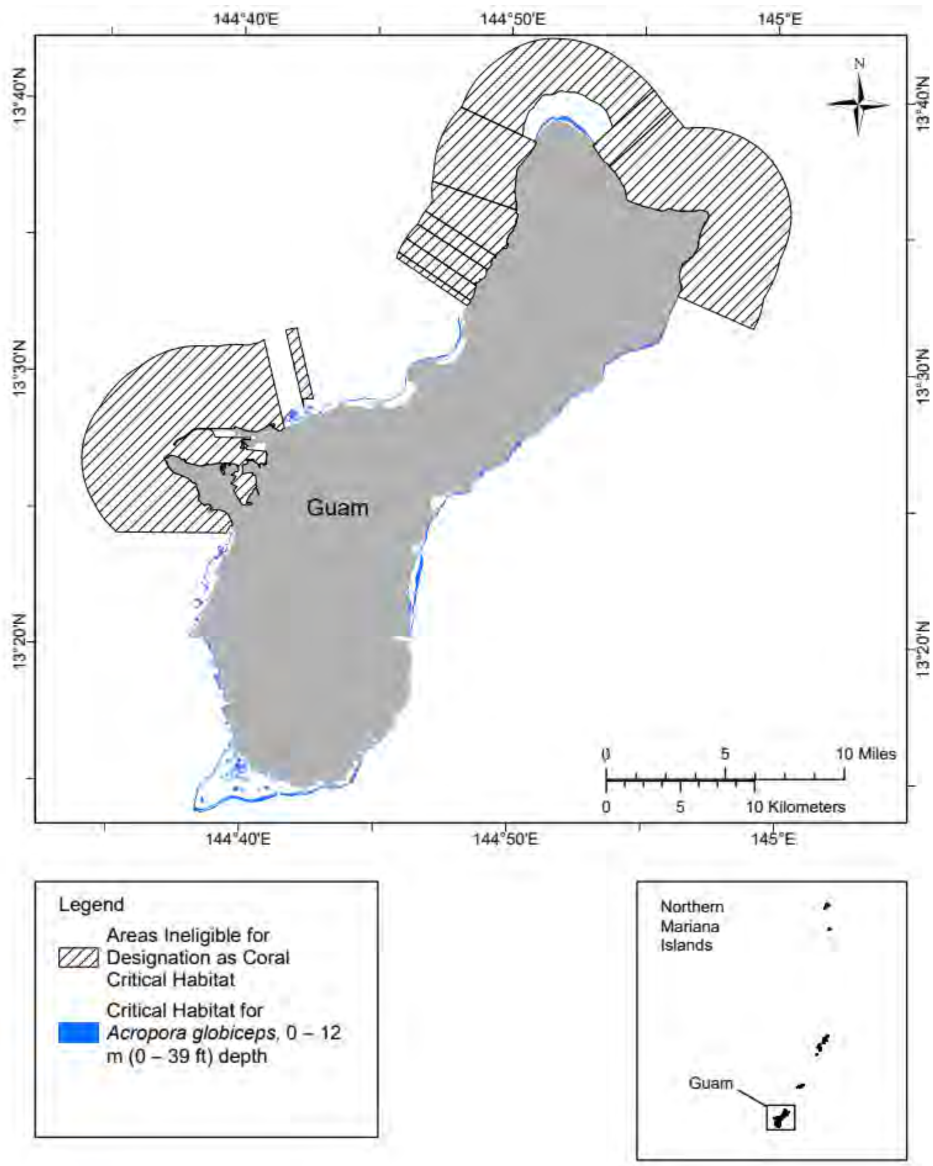


Figure 9. Proposed critical habitat for hard coral (Acropora globiceps), Guam

Source: NOAA Fisheries 2023.

3.4.5 Tridacninae Giant Clams (Candidate Species)

In June 2017, NMFS published a 90-day finding and concluded that seven species of giant clams may be eligible for listing under the ESA (82 FR 28946). The seven candidate species include two species in the genus *Hippopus* (*H. hippopus* and *H. porcellanus*) and five species in the genus *Tridacna* (*T. derasa*, *T. gigas*, *T. mbalavuana [tevoroa]*, *T. squamosa*, and *T. squamosina [costata])* (82 FR 28946). A status review is currently underway for these species, and the proposed listing(s) have not yet been determined as warranted. In July 2024, NMFS proposed to list *T. maxima* as a candidate threatened species, on grounds that it is often indistinguishable from the other candidate Tridacinae species.

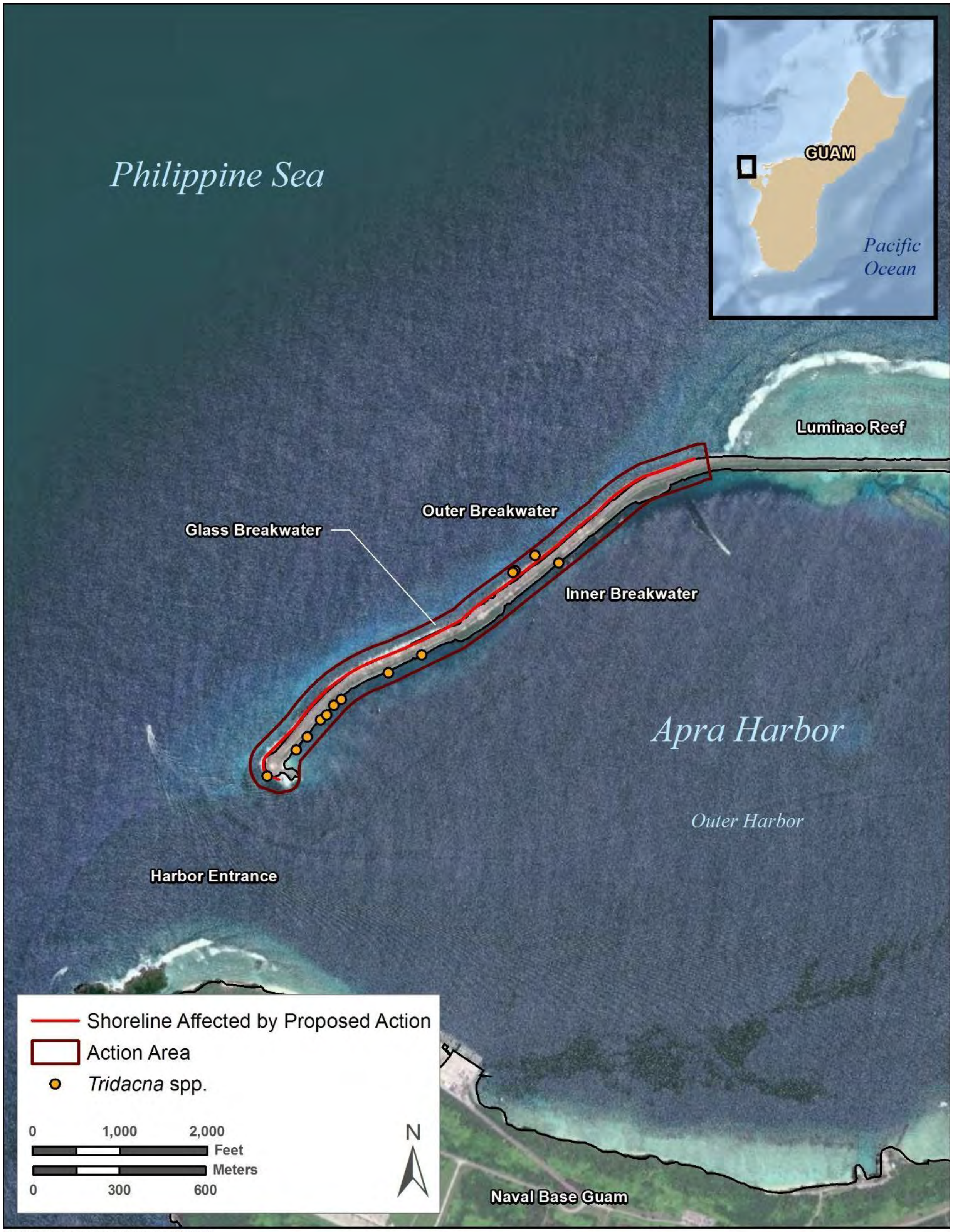
Four of the seven candidate giant clam species have been known to occur in Guam (*Hippopus hippopus, Tridacna derasa, T. gigas, and T. squamosa*) (Paulay 2003b; bin Othman *et al.* 2010). *H. hippopus* and *T.*

gigas are considered to be extirpated, or locally extinct, on Guam (Teitelbaum and Friedman 2008). Wells (1997) reported *T. derasa* as extinct on Guam and the Northern Mariana Islands, and that *T. squamosa* may also be extinct on Guam. In 1982, Guam's Department of Agriculture started a giant clam restocking program to translocate three species of giant clams (*T. derasa, T. gigas,* and *T. squamosa*) to Guam (Teitelbaum and Friedman 2008). The translocated *T. derasa* species were introduced from Palau, and while the introduced animals survived, no recruitment has been observed (Paulay 2003b). The attempt to translocate *T. gigas* to Guam was unsuccessful (Paulay 2003b). Starting in 2021, there have been new and increased efforts to develop community-run giant clam aquaculture projects on Guam, particularly in two southern villages, Inalåhan and Malesso (NOAA Fisheries 2022). Initially, giant clams were collected from various Guamanian reefs and planted into Inalåhan tide pools located on the southeast side of the island. A more recent effort funded by NOAA has led the Aquaculture Association of Palau to supply Guam with 1,000 giant clams (*T. maxima*), some of which will serve as broodstock for future projects (NOAA Fisheries 2022; NMFS Letter of Concurrence [LOC] PIRO-2021-03457). No ESA-candidate giant clam species have been translocated as part of the aquaculture effort that began in 2021.

Tridacna maxima, commonly known as the small giant clam or maxima clam, is the most common giant clam species found on Guam (Smith *et al.* 2009; Wells 1997). *T. maxima* have been found widely dispersed across the Orote Peninsula ERA and Dadi Beach outside of Apra Harbor (Smith *et al.* 2009).

During marine biological surveys for Apra Harbor waterfront repairs, giant clams (*Tridacna* spp.) were located 3 times in the Outer Breakwater (Appendix A) (Figure 10). The marine biological survey report does not identify which species of giant clams were observed. While it is probable that all observed giant clam species were *T. maxima*, there is a small possibility that some individuals could be *T. squamosa*. Candidate species have no protections under the ESA, therefore ESA-candidate *Tridacna* spp. are not discussed beyond this section in this assessment.

As a candidate species, no critical habitat for the Tridacninae giant clams is proposed or designated in the Action Area.



Basemap: World Imagery; World_Ocean_Base

Figure 10. Giant clam species (Tridacna spp.) locations within the Action Area in Apra Harbor.

Source: Appendix A.

3.5 Essential Fish Habitat Occurring within the Action Area

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. Pursuant to the MSA, federal agencies must consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (MSA Section 305[b][2]). EFH is defined as those waters and substrate necessary to fish (or other species) for spawning, breeding, feeding, or growth to maturity (50 CFR 600.10).

Under the MSA, the United States has exclusive fishery management authority over all fishery resources found within its Exclusive Economic Zone (EEZ). The EEZ extends from the seaward boundary of each coastal state, including any Commonwealth, territory, or possession of the United States, to a distance of 200 nautical miles from the shoreline (50 CFR 600.10). In the Pacific Islands, EFH has been designated for federally management unit species (MUS) that are cooperatively managed by NMFS and the WPRFMC (or Council). MUS in the Pacific Islands are fully described in the Council's Fishery Ecosystem Plans (FEPs) (NMFS 2023c).

The Action Area is located within the boundaries of the following FEPs: (1) Fishery Ecosystem Plan for the Mariana Archipelago (WPRFMC 2009a) and (2) Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region (WPRFMC 2009b). The Mariana Archipelago FEP boundary includes all waters and associated marine resources within the EEZ surrounding the Commonwealth of the Northern Mariana Islands and the Territory of Guam (WPRFMC 2009a). Although there is overlap between the Mariana Archipelago FEP boundary and the Pacific Pelagic FEP boundary, the Mariana Archipelago FEP specifically manages demersal resources and habitats associated with the federal waters of the Mariana Archipelago (WPRFMC 2009a). The Pacific Pelagic FEP boundary encompasses all areas of pelagic fishing operations in the EEZ or in the high seas for any domestic vessels that (1) fish for, possess, or transship Pacific Pelagic MUS within the EEZ waters of the Western Pacific Region; or (2) land Pacific Pelagic MUS within the states, territories, commonwealths, or unincorporated U.S. island possessions of the Western Pacific Region (WPRFMC 2009b).

EFH has been designated within the Action Area for various MUS and life stages including eggs, larvae, juveniles, and adult bottomfish and Pacific pelagic species. All life stages of coral reef fauna and flora that comprise Mariana Islands coral reef ecosystems are designated as Ecosystem Component Species as documented in Amendment 5 to the Fisheries Ecosystem Plan (Table 8, NMFS 2024b, NMFS 2018). In addition to EFH, the Council has designated Habitat Areas of Particular Concern (HAPC) within EFH for all MUS. HAPCs are specific areas that are considered essential to the life cycle of MUS based on one or more of the following criteria: (1) the ecological function provided by the habitat is important; (2) the habitat is sensitive to human-induced environmental degradation; (3) development activities are, or will be, stressing to the habitat type; or (4) the habitat type is rare (WPRFMC 2009a, 2009b). For Pacific pelagic species, HAPC is designated as the water column down to 1,000 meters that lie above all seamounts (i.e., undersea mountains) and banks within the EEZ shallower than 2,000 meters (WPRFMC 2009b) and is therefore not located within the Action Area in Apra Harbor. The Council designated all slopes and escarpments between 40 and 280 meters as HAPC for bottomfish, based on the known distribution and habitat requirements of adults (WPRFMC 2009a); these areas are not present within the Action Area in Apra Harbor.

No coral reef ecosystem HAPCs exist on Guam.

Table 8. Essential Fish Habitat within the Action Area

MUS	Species Complexes	Description of EFH in Action Area	HAPC in Action Area?
Pelagic	• Temperate species • Tropical species • Sharks • Squid	• Eggs and larvae: the water column down to a depth of 200 meters (100 fathoms) from the shoreline to the outer limit of the EEZ. • Juveniles and adults: the water column down to a depth of 1,000 meters (500 fathoms) from the shoreline to the outer limit of the EEZ.	• No HAPC located within Apra Harbor or the Action Area.
Bottomfish	• Shallow-water species (0–50 fathoms) • Deep-water species (50–200 fathoms)	• Eggs and larvae: the water column extending from the shoreline to the outer limit of the EEZ down to a depth of 400 meters (200 fathoms). • Juveniles and adults: the water column and all bottom habitat extending from the shoreline to a depth of 400 meters (200 fathoms), encompassing steep drop-offs and high-relief habitats that bottomfish use throughout the Western Pacific Region.	• No HAPC located within Apra Harbor or the Action Area.

Source: WPRFMC 2009a, 2009b.
Note: 1 fathom = 6 feet = 1.8 meters. Units provided in table are reported as presented in applicable FEPs (see Table 25 in WPRFMC 2009a and Table 14 in WPRFMC 2009b). EEZ = Exclusive Economic Zone; EFH = Essential Fish Habitat; HAPC = Habitat Areas of Particular Concern ; MUS = Management Unit Species.
[a] Currently harvested coral reef taxa include a variety of species assemblages (e.g., fishes, sharks, octopuses, eels, and turban shells) that are currently being harvested in state and federal waters (and for which some fishery information is available) and species that are likely to be targeted in the near future based on historical catch data. Potentially harvested coral reef taxa include “literally thousands of species encompassing almost all coral reef fauna and flora” (WPRFMC 2009a).

4. Effects of the Proposed Action

4.1 ESA Effects Analysis

On April 5, 2024, the Services finalized revisions to regulations that implement Sections 4 and 7 of the ESA, with an effective date of May 6, 2024 (89 FR 24300 and 89 FR 24268, respectively). The revision most relevant to this project pertains to Section 7 regulations that clarify the definition of "effects of the action" and "environmental baseline." "Effects of the action" is now defined as follows: "Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action" (50 CFR 402.02).

The third sentence in the definition of "Environmental baseline" was also revised. "Environmental baseline" refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the Action Area; the anticipated impacts of all proposed federal projects in the Action Area that have already undergone formal or early Section 7 consultation; and the impact of state or private actions that are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402).

As appropriate, the revised definitions have been incorporated into this assessment.

An effect or activity is caused by the Proposed Action if it would not occur but for the Proposed Action and it is reasonably certain to occur. Effects of the action may occur later in time and may include effects occurring outside the immediate area involved in the action. Section 7(a)(2) states that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or to destroy/adversely modify designated critical habitat, and as such is responsible for making one of the following effects determinations, as described in the ESA Section 7 Consultation Handbook (USFWS and NMFS 1998):

- **No Effect:** the appropriate conclusion when the action agency determines that its proposed action will not affect a listed species or designated critical habitat.
- **May Affect, but Not Likely to Adversely Affect:** the appropriate conclusion when a proposed action may pose any effects on listed species or designated critical habitat, and the effects on listed species are expected to be discountable, insignificant, or completely beneficial:
    - Beneficial effects are contemporaneous positive effects without any adverse effects to the species.
    - Insignificant effects relate to the size of the impact and should never reach the scale where take occurs.
    - Discountable effects are those extremely unlikely to occur.

- **Likely to Adversely Affect:** the appropriate determination if any adverse effects on listed species or designated critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial; also, the appropriate determination if any “take” of listed species will occur.

In analyzing effects to ESA-listed species, the Navy considered the duration and timing of the Proposed Action and the frequency, intensity, and severity of potential disturbance. The Proposed Action is expected to begin in November 2024 and last approximately 36 weeks, ending on or near July 25, 2025.

The Proposed Action includes placement of armor stone and concrete armor units potentially within 2 meters of the HTL, and above it, which will be accomplished with heavy machinery staged from land. The crane will not enter the water, and use of a crane mounted on a barge will not occur. While work is anticipated to occur above the HTL, the construction contractor may require in-water work not to exceed 2m seaward of the HTL, which has a low likelihood of impacting ESA-listed species in the marine environment of the Action Area.

The following sections include an analysis of the potential consequences of the Proposed Action on ESA-listed sea turtles and sharks. Potential consequences to most effects of the action are considered to have minimal impacts and risks (Table 9), particularly due to the low likelihood of most ESA-listed species occurrence in the Action Area and the BMPs incorporated into the Project design (Section 2.5). Potential effects from the Proposed Action may result from exposure to the following environmental stressors:

- Elevated Noise Levels (Section 4.1.1).
- Increased Suspended Sediments (Section 4.1.2).
- Disturbance from Human Activity and Equipment Operation (Section 4.1.3).
- Direct Physical Contact (Section 4.1.4).
- Wastes and Discharges (Section 4.1.5).
- Entanglement (Section 4.1.6).

An ESA-listed hard coral species, *Acropora globiceps*, is known to occur around the Action Area (Figure 8). The coral spawning period is estimated to be approximately 21 days total each year, including 8 days prior to the full moon and 14 days after (Richmond and Hunter 1990). No in-water work will occur during coral spawning periods to avoid sensitive spawn timing and maximize the reproductive success of *A. globiceps* (BMP A, Section 2.5.2).

Table 9. Environmental Risk Assessment Summary of Potential Impacts from the Proposed Action on ESA-listed species

Environmental Stressor	Probability of Occurrence	Severity[a]	Exposure to Consequences of Proposed Action: Risk Level[b]	Measures to Offset Effects of Action	Risk Assessment for ESA-listed Turtles and Sharks[c]	Risk Assessment for ESA-listed Corals[c]
Elevated underwater noise levels (Section 4.1.1)	Unlikely	Negligible	Low	• Marine fauna observers • Shutdown zone	Insignificant	Discountable
Increased suspended sediments (Section 4.1.2)	Unlikely	Negligible	Low	• Erosion control practices • Avoiding in-water work, and if so limiting to 2 m from high tide line • Inclement weather contingency • Avoid work during coral spawning	Insignificant	Discountable
Disturbance from human activity and equipment operation (Section 4.1.3)	Unlikely	Negligible	Low	• Shutdown zone • equipment use & management • Safe vessel use & management	Discountable	Insignificant

Environmental Stressor	Probability of Occurrence	Severity[a]	Exposure to Consequences of Proposed Action: Risk Level[b]	Measures to Offset Effects of Action	Risk Assessment for ESA-listed Turtles and Sharks[c]	Risk Assessment for ESA-listed Corals[c]
Direct physical contact (Section 4.1.4)	Unlikely	Moderate	Low	• Marine fauna observers • Shutdown zone • Safe equipment use & management • Debris containment • Oil spill contingency plans • Avoiding in-water work, and if so limiting to 2 m from high tide line	Discountable	Insignificant
Wastes and discharges (Section 4.1.5)	Unlikely	Negligible	Low	• Debris containment • Oil spill contingency plans	Discountable	Discountable
Entanglement (Section 4.1.6)	Unlikely	Negligible	Low	• Debris containment • Marine fauna observers	Discountable	Discountable

Note: ESA = Endangered Species Act of 1973.

[a] Level of severity (i.e., negligible, moderate, or significant) is determined by the anticipated intensity, duration, and frequency of exposure to a particular environmental stressor.

[b] Risk level (i.e., low, moderate, or high) provides an overall summary of the likelihood of potential effects of the Proposed Action ("Probability of Occurrence") combined with the potential severity of exposure to a particular environmental stressor ("Severity").

[c] Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Green turtles occur regularly but in low numbers in the Action Area, and thus the Proposed Action may effect but is unlikely to affect this species. Project-related effects to green turtles are evaluated in the following sections. Hawksbill turtles and scalloped hammerhead sharks are expected to have a rare and infrequent occurrence, and the following impact and exposure risk assessment applies a precautionary approach to include these species.

4.1.1 Elevated Noise Levels

The Proposed Action has the potential to produce temporary and intermittent elevated in-air and underwater noise levels. Activities that have the potential to produce elevated in-air and underwater noise include:

- Placement of armor stone and concrete armor units above the water.
- Placement of armor stone and concrete armor units in water.
- Equipment use on the Glass Breakwater road.

Sea Turtles and Sharks

The Proposed Action does not overlap with the green turtle nesting season (March through July, with some activity seen from December through February [DoN 2022]), and none of the activities associated with the Proposed Action are likely to generate noise levels in air that extend to areas used by nesting sea turtles. Nesting beaches do not occur in the Action Area, and nesting is not known to occur along the areas planned for repair or construction staging areas on Glass Breakwater.

Concrete armor units and armor stone will not be dropped onto the breakwater. Placement of concrete armor units and armor stone in water will take place with intention, as each unit must interlock with its neighbors to form a strong structure. Careful placement will reduce in-air noise levels. Operation of heavy equipment such as a crane or trucks carrying armor stone along the breakwater road is highly unlikely to generate sound or vibration levels high enough to disturb marine animals in the water column. Sound does not transmit well through the air-water interface, and most of the sound energy moving from air to water will be scattered and dispersed in the irregular, rocky nearshore environment. Additionally, BMPs in Section 2.5 will be implemented to avoid potential exposure to elevated noise.

In-water noise will be generated if concrete armor units and armor stones need to be placed in water. As described above, placement of armor is an exacting process, and armor will not be dropped into the water but will be placed carefully in each location, minimizing noise and sediment displacement. Implementation of BMPs in Section 2.5 will avoid potential exposure to elevated noise.

Apra Harbor is one of the main ports for shipping and industry in Guam and experiences high levels of vessel traffic, likely resulting in high ambient in-water noise levels. As a result, any sea turtles and scalloped hammer sharks in the area may already be habituated to moderate levels of anthropogenic noise.

No elements of the Proposed Action have the potential to generate sound levels intense enough to cause injury or harm to marine species likely to occur in the Action Area.

Corals

ESA-listed corals may be affected by elevated noise levels during larval dispersal and settlement. Studies have shown that healthy coral reef soundscapes can function as habitat cues for larvae of coral, as well as other marine reef species, to settle (Popper and Hawkins 2018; Suca *et al.* 2020; Aoki *et al.* 2024). Anthropogenic sounds such as vessel noise may disrupt the settlement behaviors of coral planulae (Lecchini *et al.* 2018). Proposed Project BMP-A (Section 2.5.2) prevents in-water activities from occurring during hard and soft coral spawning season. Elevated noise levels as a result of the Proposed Action are not anticipated impact established ESA-listed coral colonies.

Determination

The Navy determined that exposure to elevated noise levels from the Proposed Action ***is not likely to adversely affect*** green turtles, hawksbill turtles, and scalloped hammerhead sharks. With the implementation of BMPs described in Section 2.5.1, potential acoustic effects on ESA-listed sea turtles and sharks from exposure to elevated noise levels from proposed activities will be discountable.

The Navy determined that exposure to elevated noise levels from the Proposed Action ***is not likely to adversely affect*** ESA-listed *Acropora globiceps*. With the implementation of BMPs described in Section 2.5.2, potential acoustic effects on ESA-listed corals from exposure to elevated noise levels from proposed activities will be insignificant.

4.1.2 Increased Suspended Sediments

The Proposed Action may increase suspended sediments in the water column during rock armor placement, but it is highly unlikely. Ship traffic within the harbor is known to increase suspended sediments in the water column. The process of placing concrete armor units on existing armor or bedding stone may cause silt to be deposited into the marine environment from movement of the armor or from runoff, but the armor stones will be placed precisely to avoid this to the maximum extent.

Sea Turtles and Sharks

The introduction of silt to the marine harbor may increase turbidity. This increase may worsen with the creation of sediment plumes due to removal and the placement of armor stone. Sediment plumes from the removal and placement of armor stone along the Outer Breakwater are expected to dissipate quickly due to high wave and current energy and be temporary in nature. Direct impacts of suspended sediments on sharks and sea turtles are understudied and generally unknown. However, ESA-listed species that use vision to locate prey may be temporarily disadvantaged by increases in turbidity, as it reduces their ability to locate prey. Reduced visibility may also impact the ability of ESA-listed species to avoid predators (Johnson 2018). Shark respiration may be altered by increased suspended sediment in the water column if introduced to respiratory pathways. Respiratory impacts are not anticipated to affect sea turtles, as they respire with air from the terrestrial environment.

While mobile ESA-listed species may be able to depart from areas if increased suspended sediments disrupt their typical behavior, the ability to flee may be negated if plumes are created that are large enough to confine these species (Johnson 2018). However, because stones would be placed individually and methodically, sediment plumes are not expected, let alone plumes large enough to have an effect on these species. Further, BMPs will be implemented to minimize the effects of sedimentation to the greatest extent possible (BMPs in Section 2.5.4).

Corals

ESA-listed corals may be impacted by elevated turbidity through increased suspended sediments leading to light attenuation and/or sediment smothering. The primary concern for corals is light attenuation as a result of elevated turbidity, rather than the increased suspended sediments themselves (Bessell-Browne *et al.* 2017). Corals are phototrophic epibenthic organisms that may be negatively impacted by low light periods (Jones *et al.* 2020). While some coral species may be more susceptible to sediment smothering, branching corals are highly resilient due to their morphology (Jones *et al.* 2019). Elevated turbidity and increased suspended sediments as a result of the Proposed Action is expected to be absent, and in the occasion that some sedimentation does occur it will be extremely temporary, and unlikely to rise to a level that could cause harm to *Acropora globiceps*. In an experiment to examine the impacts of dredging on corals, Jones *et al.* (2020) found that while some coral species exhibited partial mortality as a result of being exposed to low light conditions, all species and colonies survived the 42-day exposure period of the experiment.

As stated in Section 3.1.2, turbidity throughout the harbor is higher than outside the harbor, and this ambient condition will minimize minor Project-related effects on ESA-listed species from elevated turbidity. Project activities such as armor stone placement are unlikely to generate the same elevated levels of increased suspended sediments as dredging activities and will be taking place intermittently. Additionally, because the outer breakwater experiences high levels of wave energy and water movement, any increased sediments will disperse from the area quickly. Therefore, *A. globiceps* colonies within the Project footprint along the Outer Breakwater are not expected to experience effects from elevated turbidity and increased suspended sediments.

Determination

The Navy determined that the potential for increased suspended sediments from the Proposed Action ***is not likely to adversely affect*** green turtles, hawksbill turtles, and scalloped hammerhead sharks. BMPs have been proposed to limit sediment introduced to marine waters (BMPs in Section 2.5.1). Additionally, the area subject to increased suspended sediments is limited to waters adjacent to the Glass Breakwater. Impacts from suspended sediments are further reduced by wave action and currents that would distribute increased suspended sediments within the harbor and dilute them. These factors will make it possible for ESA-listed sea turtles and sharks to leave the area if necessary.

The Navy determined that the potential for increased suspended sediments from the Proposed Action ***is not likely to adversely affect*** *Acropora globiceps.* While some colonies of ESA-listed corals may be temporarily and intermittently exposed to increased suspended sediments, the exposure is unlikely to rise to the level of harm. The implementation of BMPs described in Section 2.5.2 will limit impacts on ESA-listed corals not immediately adjacent to the Glass Breakwater.

4.1.3 Disturbance from Human Activity and Equipment Operations

The Proposed Action will increase human activity and equipment use within and adjacent to the marine environment for the duration of the Project.

Sea Turtles and Sharks

Project-related activity in the Action Area will increase human presence, ambient noise levels, and potential for interaction with ESA-listed sea turtles and sharks. However, Apra Harbor is a site of regular human and mechanical activity onshore and in the water, and animals that enter and remain in Apra Harbor are expected to be habituated to some degree to human activity. Despite their likely habituation to ambient activity levels, increased human activity has the potential to disturb normal behavior of ESA-listed sea turtles and sharks in Apra Harbor. Expected reactions range from benign investigation of or attraction to the activity, avoidance of the area, or the extreme, panicked fleeing with potential self-injury during flight.

Green and hawksbill turtles are known to be present in Apra Harbor, although occurrences are expected to be rare for hawksbill turtles and low for green turtles. In the unlikely case that either species swims into the marine portion of the Action Area, it is expected that they will avoid Project activity along the nearshore and affected in-water work areas. As discussed in Section 3.4.2, Budd *et al.* (2023) detected the eDNA of scalloped hammerhead sharks in Apra Harbor and reported that eDNA is an effective tool to detect species presence when abundance is low. Because scalloped hammerheads have not been visually observed in the harbor for over a decade, it is unlikely that they occur in numbers or at frequencies that would expose individual sharks to Project-related disturbance.

BMPs described in Section 2.5 will be implemented to ensure that intentional interactions with ESA-listed sea turtles and sharks are avoided and that unintentional interactions are minimized to the greatest extent practicable. In-water work is limited to 2m from the high tide line, which avoids these species altogether, as sea turtles have not been observed resting or nesting along this portion of the shore. However, biological observers will remain constantly vigilant for ESA-listed sea turtles and scalloped hammerhead sharks within a distance that could be impacted. They will also monitor the success and effectiveness of in-water BMP measures and observe marine waters at all times immediately preceding, during, and immediately after any in-water construction activities. All personnel are expressly prohibited from attempting to disturb or disturbing, touching, riding, feeding, or otherwise intentionally interacting with ESA-listed sea turtles and sharks, except in the case of an unintentional entanglement in Project-related equipment. In-water BMPs described in Section 2.5 will prevent any unintentional interactions in the in-water work area.

Corals

ESA-listed corals in highly unlikely to be negatively impacted by human disturbance and equipment operation from the Proposed Action through the placement and movement of armor stone. *A. globiceps* colonies outside the Project footprint along the Outer Breakwater will not be impacted by the placement of armor stone.

Determination

The Navy determined that disturbance from human activities and equipment operation ***is not likely to adversely affect*** green turtles, hawksbill turtles, and scalloped hammerhead sharks. Through implementation of Project-specific BMP measures (Section 2.5), impacts to ESA-listed sea turtles and sharks from increased human activity in the nearshore and marine environment will be indirect and minimal, and the potential risk will be completely eliminated upon completion of the Proposed Action, which is expected quickly. Because direct impact will be avoided to the greatest extent practicable, such effects are expected to be discountable. Should the increased human activity result in a change in behavior, it is anticipated that such effects would be insignificant.

The Navy determined that disturbance from human activities and equipment operations ***is not likely to adversely affect*** the ESA-listed *Acropora globiceps*. The implementation of BMPs D-G described in Section 2.5 will limit impacts on ESA-listed corals adjacent to the Glass Breakwater.

4.1.4 Direct Physical Contact

The Proposed Action involves the use of heavy and handheld machinery. All of this machinery will be operated from land and will only minimally enter the water when placing the armor stones.

Sea Turtles and Sharks

Project activities occurring in water have an extremely unlikely potential for direct physical contact with ESA-listed sea turtles and sharks. With BMPs in place to avoid intentional interactions with ESA-listed sea turtles and sharks (Section 2.5), the potential for direct physical impact by heavy machinery or equipment operated in the marine environment is discountable.

The occurrence of hawksbill turtles and scalloped hammerhead sharks is expected to be rare in the Action Area and green turtle occurrence potential is low. Thus, potential impacts from direct physical contact to these species are expected to be discountable.

Direct physical impact of ESA-listed marine species will be avoided to the greatest extent practicable through the implementation of BMPs described in Section 2.5.

Corals

While the direct physical contact of equipment or humans with an individual vertebrate species would likely constitute an adverse effect, the same assumption does not hold for listed corals due to two key biological characteristics (as described in NMFS LOC PIRO-2023-02697 from December 2023):

- All corals are sessile invertebrate animals that rely on their stinging nematocysts for defense, rather than predator avoidance via flight response. While it may be logical to assume that physical contact with a vertebrate organism results in stress that constitutes harm, harassment, or take, the same does not apply to corals because they have no flight response.
- Most reef-building corals, including all listed species, are clonal organisms. This means that a single larva settles and develops into the primary polyp, which then multiplies into a colony of hundreds to thousands of genetically-identical polyps that are connected through tissue and skeleton. Colony growth is achieved mainly through the addition of more polyps, and colony growth is indeterminate. The colony can continue to exist even if numerous polyps die, or if the colony is broken apart or otherwise damaged. Even so, partial physical damage such as breakage or dislocation while not ending in mortality could have sub-lethal tissue abrasion, affecting coral colony survivability. The individual of these listed species is defined as the colony, not the polyp, in the final coral-listing rule (79 FR 53852). Affecting some polyps of a colony does not necessarily constitute harm to the individual colony, but sub-lethal affects are considered.

The potential impacts of direct physical contact on *Acropora globiceps* that could occur as a result of the Proposed Action are further discussed in Section 4.1.6 (Entanglement).

Determination

The Navy determined that direct physical contact from the Proposed Action ***is not likely to adversely affect*** green turtles, hawksbill turtles, and scalloped hammerhead sharks. With the implementation of BMPs described in Section 2.5, the potential for direct physical contact from the Proposed Action is considered discountable for ESA-listed sea turtles and sharks.

The Navy's determination of the potential impacts of direct physical contact on *Acropora globiceps* is discussed in Sections 4.1.3 and 4.1.6, and considered insignificant.

4.1.5 Wastes and Discharges

The Proposed Action will utilize heavy equipment and machinery nearshore for the placement of armor stone in water. The use of such equipment presents potential risks to the marine environment from leaked fuel, petroleum lubricants, and other hydrocarbon-based pollutants, exposing ESA-listed species to toxic substances.

Sea Turtles, Sharks, and Corals

Chemical pollutants resulting from accidental spills and discharge from construction activities harm biologically important nearshore ecosystems and can result in mortality of ESA-listed species including sea turtles and coral communities (NMFS and USFWS 1998a). If released in large quantities, the toxic substances may cause avoidance of the affected area, serious injury, or, in severe cases, death. The effects of pollutants and contaminants on scalloped hammerhead sharks have not been conclusively determined; however, it is likely contaminants bioaccumulate in this species because of their role as an apex predator in the marine ecosystem (84 FR 46938).

If a chemical is accidentally discharged or spilled during the Project, it is likely that the quantity would be small in volume (e.g., less than 25 liters [DoN 2020b, as cited in NMFS 2020c]); however, due to the implementation of BMPs described in Section 2.5.3 , it is unlikely that this event would occur.

The severity of marine debris as a threat in Guam is unknown (NMFS and USFWS 1998a); however, the effects can be severe (Nama et al. 2023). Project wastes such as plastic trash or bags are especially of concern due to the risk of ingestion or entanglement (NMFS and USFWS 1998a). In marine vertebrate species, marine debris can result in dietary dilution, ingestion of contaminants, digestive blockage and tearing (Domènech *et al.* 2018), restricted mobility, drowning, starvation, smothering, and wounding, potentially leading to infections, amputation of limbs, and death (Gamage and Senevirathna 2020). The leaching of chemicals from marine debris, specifically of plastic debris, could result in compromised immunity and infertility in exposed species (Gamage and Senevirathna 2020). Marine debris could damage ESA-listed corals via tissue abrasion, fracturing or fragmentation, and light attenuation (Chiappone *et al.* 2005; Arindra Putra *et al*. 2021; Muhammad *et al.* 2021).

No debris will be allowed to enter the water during the Proposed Action. To reduce the potential for Project-related marine debris generation, all waste will be controlled and disposed into trash dumpsters or roll-off bins in the Project base yard or storage area as directed in the BMPs in Section 2.5.3.

The occurrence of exposure to wastes and discharges such as these will be avoided and minimized to the greatest extent practicable through development and implementation of an oil spill contingency plan contained within the SWPPP, which includes measures to prevent (and respond to) inadvertent discharges of construction wastes into the marine environment. Petroleum-spill-containment devices (e.g., absorbent pads, containment booms) will be located on site in sufficient quantity and available and accessible for immediate deployment at all times. Thus, BMPs described in Section 2.5.3 will prevent wastes and toxicants from entering the marine environment and thus prevent exposure to an ESA-listed species, making the risk discountable. However, in the unlikely event of a spill or discharge, the effects would be insignificant because accidental spills or discharge will be of small amounts and cleaned quickly.

Determination

The Navy determined that exposure from an accidental release of wastes and discharges from the Proposed Action ***is not likely to adversely affect*** green turtles, hawksbill turtles, scalloped hammerhead sharks, and *Acropora globiceps*. Based on the implemented BMP-H to minimize the discharge of pollutants during Project work (e.g., equipment maintenance, contingency plans, fueling restrictions), the potential for adverse effects from exposure to accidental release of waste and discharges is considered discountable.

4.1.6 Entanglement

Marine animals could be entangled by trash and debris during the Proposed Action. Materials could be encountered by and have the potential to entangle animals at the surface, in the water column, and along the seafloor. Potential impacts depend on how a marine animal encounters and reacts to the items that pose an entanglement risk, which depend on risk factors such as animal size, sensory capabilities, and foraging methods. Most entanglements are attributable to encounters with fishing gear or other materials that float or are suspended at the surface. Smaller entangled animals are inherently less likely to be detected than larger ones, but larger animals may subsequently swim off while still entangled, towing lines or fishing gear behind them.

Sea Turtles, Sharks, and Corals

If severely entangled, sea turtles cannot forage underwater or breathe at the surface. Serious injury may result in a lost limb and/or increased vulnerability to predation. Animals that become entangled in nets, lines, ropes, or other foreign objects under water may suffer temporary impairments to movement before they free themselves, or they may remain entangled. Entangled individuals may suffer temporary, minor injuries but recover fully, or they may be severely injured or die.

For elasmobranchs, entanglement most commonly occurs from ghost fishing gear and other anthropogenic debris and may result in starvation, suffocation, immobilization, and death (Parton *et al.* 2019). If these individual impacts increase to greater levels within shark or sea turtle populations, entanglement may have negative implications on reproductive success and survival rates beyond the potential effects of any single project.

ESA-listed corals are fragile and susceptible to damage from entanglement, such as from fishing gear and other marine debris (Yoshikawa and Asoh 2004; Beneli *et al.* 2020; Figueroa-Pico et al. 2020; Suka *et* *al*. 2020; Arindra Putra *et al.* 2021). Damage from entanglement can cause tissue abrasion, fracturing, and fragmentation, which may lead to mortality (Chiappone *et al.* 2005; Figueroa-Pico *et al.* 2020). Branching corals are particularly vulnerable to entanglement due to their morphology (Chiappone *et al.* 2005; Valderrama Ballesteros *et al.* 2018). If exposed to marine debris or equipment and gear associated with the Proposed Action, *Acropora globiceps* could be affected through entanglement.

Entanglement from equipment and gear typically used for breakwater armoring projects is unlikely. Project debris and trash will be controlled so that they do not enter harbor waters. There will be no lines, chains, or flexible elements deployed in the water. Proposed Project BMPs in Section 2.5, will be implemented to reduce the potential entanglement risks of the Proposed Action on ESA-listed species.

Determination

The Navy determined that the entanglement from the Proposed Action ***is not likely to adversely affect*** green turtles, hawksbill turtles, scalloped hammerhead sharks, and *Acropora globiceps*. ESA-listed sea turtles and sharks are expected to have a low and rare level of occurrence, respectively, in the Action Area. The Proposed Action will be restricted to daylight hours to maximize visual monitoring for ESA-listed sea turtles and scalloped hammerhead sharks. The Project Action will not require the use of any flexible equipment in the water, or other source of entanglement. Additionally, with the implementation of Project BMPs to prevent entanglement, the risk of entanglement of an ESA-listed species from the Proposed Action is so low as to be discountable.

4.2 EFH Effects Analysis

The MSA defines an adverse effect on EFH as “any impact that reduces quality and/or quantity of EFH,” including direct or indirect physical, chemical, or biological alterations of waters or substrate and loss of or injury to benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH (50 CFR 600.10). Adverse effects on EFH may result from actions occurring directly within EFH or outside of EFH and may include site-specific or habitat-wide impacts including individual, cumulative, or synergistic consequences of actions.

As noted previously, the WPRFMC has designated EFH and management objectives for various life stages of two groups of MUS that occur within, occur near, or are dependent on the Action Area: bottomfish MUS and pelagic MUS. In the absence of detailed survey data, it is assumed that all life stages of some species from each of the three MUS could occur within the Action Area or that prey, water quality, or habitat condition could affect EFH.

The Project-specific marine biological surveys discussed in Section 3 documented a modest community of sessile (i.e., fixed in place) invertebrates and algae and a diverse assemblage of fish along the inner and outer portions of the breakwater. Observed fish consist of juveniles and adults from a variety of species typically found in coral reefs, including some from the genera described in the Mariana Archipelago FEP for shallow-water complex bottomfish that occur at depths of less than 100 m (i.e., *Lethrinus*, and *Caranx*). Relative to bottomfish MUS and pelagic MUS, none of the fish species specifically listed in the Mariana Archipelago FEP or Pacific Pelagic FEP were observed within the study area. However, numerous species that were designated as “Currently Harvested Coral Reef Taxa” in the Mariana Archipelago FEP (see Table 21 and Table 22 in WPRFMC 2009a) but are now designated as

Ecosystem Components Species (ECS; WPRFMC 2018) were observed during the Project-specific marine biological surveys (e.g., various species of surgeonfishes [Acanthuridae], wrasses [Labridae], and parrotfishes [Scaridae]). As noted previously, the ESA-listed coral *A. globiceps* was observed in small numbers along the Outer Breakwater (Figure 8). These species are still monitored by the Council as ECS that are fisheries species caught in Guam territorial waters.

As described in Section 2 of this Biological Assessment, the Proposed Action involves emergency resetting of existing armor stone and concrete units that have shifted in position, and placing new armor stone or concrete armor units to rebuild the Glass Breakwater to engineering standards. Construction activities will be contained within the existing breakwater footprint, and repairs will likely be carried out using a land-based crane from the top of the existing breakwater. The two areas requiring repairs will focus on sections of the breakwater that are in critical condition. These areas are located on the oceanside (outer) portion of the existing breakwater. No dredging is anticipated as part of the Proposed Action.

In-water activities associated with the Proposed Action schedule of activities (i.e., placement and adjustment of armor stone within the existing breakwater footprint) will occur immediately.

In-water work for the breakwater repair has the potential to impact EFH in the marine environment within the Action Area. Effects on EFH for coral reef ecosystems will be commensurate with those described in Section 4.1of this Biological Assessment with respect to ESA-listed corals. Based on the nature of the Proposed Action and the proposed BMPs described in Section 2.5, most elements of the Proposed Action are expected to have no more than minimal and temporary impacts and risks of adversely affecting EFH in the Action Area (Table 10). Further, completing these actions now decreases the chances of larger impacts to EFH happening if the repairs don't happen; if breaches are not attended to, the breakwater could completely fail bringing with it negative impacts to EFH structure and water quality. Thus, completing the Proposed Action would avoid future damage to EFH in the area that could result in significant losses.

Avoidance and Minimization

The Navy used a standard tiered approach to mitigation for this Proposed Action. The activity under each tier is summarized as follows:

- Avoidance: Effects from the Action were reduced by implementing avoidance BMPs (Section 2.5), such as work restrictions during coral spawning events.
- Minimization: Effects from the Action will be minimized by separating initial necessary emergency repairs from full completion of the Glass Breakwater repairs minimizing in-water impacts. Additional minimization will occur through implementing BMPs such as reducing the in-water work to an absolute limit of 2 m (6.56 ft) from the high tide line, and natural resource management actions.
- Offset: No offset is provided for the Proposed Actions due to limited to no in-water work being conducted virtually removing the risk of unavoidable losses, combined with rigorous BMPs and adverse wind and wave conditions at the site. The emergency repairs will prevent further

degradation of the Glass Breakwater thus preserving and benefitting existing EFH and protected species. Additionally, the Navy is carefully planning for additional Glass Breakwater repairs and the extra time and effort will mean the future action will avoid and minimize where possible and include well-planned offsets.

As described in detail in the subsections below, potential effects on EFH may result from exposure to the following environmental stressors because of the Proposed Action:

- Removal of Marine Invertebrate Community (Section 4.2.2).
- Increased Turbidity and Suspended Sediments (Section 4.2.3).
- Elevated Noise Levels (Section 4.2.4).
- Wastes and Discharges (Section 4.2.5).
- Aquatic Invasive Species (Section 4.2.6).
- Chemical Contaminants (Section 4.2.7).
- Hypoxia (Section 4.2.8).

Table 10. Summary of Potential Effects of the Proposed Action on EFH

Environmental Stressor	Probability of Occurrence	Severity[a]	Risk Level[b]	Anticipated Effects on EFH	Measures to Minimize Adverse Effects
Removal and relocation of marine invertebrate community (Section 4.2.2)	Unlikely	Significant	Low	• Temporary loss of ecological function and habitat structure	• Safe equipment use and management • Avoid work during coral spawning periods • Minimizing in-water work to greatest extent possible and no more than 2 m from HTL
Increase in turbidity and suspended sediment (Section 4.2.3)	Unlikely	Moderate	Low	Temporary reduction in water quality in the immediate Project footprint.	• Avoid work during coral spawning periods • Erosion control practices • Inclement weather contingency • Careful and precise placement of armor stones
Elevated underwater noise levels (Section 4.2.4)	Unlikely	Moderate	Low	Risk of exposure during other activities unlikely due to implementation of minimization measures and BMPs.	Safe equipment use and management
Wastes and discharges (Section 4.2.5) Aquatic invasive species (Section 4.2.6) Chemical contaminants (Section 4.2.7) Hypoxia (Section 4.2.8)	Unlikely	Negligible	Low	Risk of exposure unlikely due to implementation of minimization measures and BMPs	• Safe equipment use and management • Oil spill contingency plans

Note: BMPs = best management practices; EFH = Essential Fish Habitat.

[a] Level of severity (i.e., negligible, moderate, or significant) is determined by the anticipated intensity, duration, and frequency of exposure to a particular environmental stressor.

[b] Risk level (i.e., low, moderate, or high) provides an overall summary of the likelihood of potential effects of the Proposed Action ("Probability of Occurrence") combined with the potential severity of exposure to a particular environmental stressor ("Severity").

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4.2.2 Removal of Marine Invertebrate Community

Resetting existing armor stone and placing new armor stone or concrete armor units to rebuild Glass Breakwater will be contained within the existing breakwater footprint and only to 2 m (6.56 ft) from the high tide line; therefore, impacts will be limited to areas that are already disturbed and provide limited habitat for marine invertebrates.

Divers conducting marine surveys in February 2024 noted damage on the Outer Breakwater in the form of boulder slides and locations where boulders were dislodged from the above-water structure and into the sea. Underwater locations of rockslides were indicated by the presence of white limestone boulders devoid of marine growth. Some boulders were also sheared and broken into pieces. Other boulders, some at a distance from one another, had rubbed against each other, yielding scarred white limestone (Appendix A). These rock and concrete slides will continue to occur more frequently, posing the same threat to the marine ecosystem, until the proposed stabilization happens. The 2024 biological survey determined that the Outer Breakwater had an average biotic cover dominated by CCA (45 percent), limestone (29 percent), and turf algae (18 percent; Appendix A).

A summary of potential effects on various components of the marine invertebrate community—including corals, benthic biota, and soft-sediment infauna—and an overall determination of anticipated effects on EFH are provided below.

Corals

Physical removal and relocation of the coral community within the Outer Glass Breakwater may be buried by armor stone and experience partial or full mortality under the worst-case scenario, but with applied BMPs and lack of in-water work the Navy deems it highly unlikely.

Along the Outer Breakwater, corals are generally scarce within 2 m of the shoreline (hence the in-water work limit) and become more abundant, diverse, and larger at a depth of approximately 3 to 4 m (Appendix A). Due to the high wave energy at the shoreline, full surveys within 2 m of the HTL are not possible, and the assumption of limited benthic cover as a result of these conditions, therefore the Navy is conservatively extrapolating with the survey data available from deeper areas. The average density of coral on the existing breakwater structure and within 2 m around the structure is conservatively assumed to be up to 1.3 colonies per square meterIn five 25 m transects along the outer breakwater in 3-4 m of water, 163 coral colonies from at least 11 coral genera were observed. Of these colonies, approximately 40 percent are in the smallest size class (1 to 5 cm) and 37 percent are in the 6- to 10-cm class; no colonies larger than 40 centimeters were observed (Appendix A). Although not directly overlapping with the Project Action, these best available datasets describe the coral density in the area.

Small coral colonies (i.e., less than 10 cm), while important for coral reefs, provide less ecological value and therefore contribute less to EFH structure and spatial complexity to the reef currently. In contrast, large colonies provide refuge for fishes from predation and competition and habitat for their prey species. Further, colony size has been shown to influence susceptibility to mortality. Smaller colonies are more likely to escape damage than larger colonies; however, when damage occurs, mortality may be total (Meesters *et al.* 1996; Bak and Meesters 1998). Within the surveyed portion of the Action Area, coral colonies less than 10 cm in size comprise approximately 75 percent of observed corals.

Effects of the Proposed Action on coral reef ecosystem EFH will be minimized by avoiding in-water work during coral spawning events in July and August and minimizing in-water work to the greatest extent possible, with a hard stop at 2 m from the HTL if required. Further, no vessels will be used in the nearshore environment.

Benthic Biota and Community

The benthic community in the Action Area consists of mobile and sessile non-coralline invertebrates including suspension feeders that feed on plankton and organic matter suspended in the water column. Because benthos in shallow water have immediate access to planktonic production, benthic suspension feeders in shallow marine ecosystems are responsible for a large proportion of energy flow from plankton to the benthic community (Gili *et al.* 1998). Further, sponges and other suspension feeders are responsible for a significant contribution to the removal of particles from the water, resulting in a large-scale repair of water quality in shallow marine ecosystems (Ostroumov 2005).

Overall, components of EFH in the Action Area include hard substrate (e.g., coral and CCA), algae (e.g., turf algae and macro algae), and sessile organisms (e.g., sponges and tunicates) that provide vital water quality improvement functions in addition to refuge and food sources for some life stages of bottomfish MUS and pelagic MUS.

Following periods of temporary disturbance, scientific evidence suggests that a recovery time of 6 to 8 months is typical for benthic communities in estuarine muds (Newell *et al.* 1998), although much of the research evaluates the effects of dredging, which will not occur as part of the Proposed Action. In artificial reef habitat near Oahu, Hawaii, Bailey-Brock (1989) found that the biofouling community settled on newly immersed structures within 2 weeks. Additionally, the number of attached invertebrate species increased over time: 11 species were documented after 2 weeks, 17 species after 2 months, 24 species after 6 months, and 28 species after 1 year (Bailey-Brock 1989). Therefore, it is reasonable to conclude that any removed benthic community will recover after a relatively short time following disturbance during in-water work. Armor stones will be placed in areas where old stones had fallen, so the benthic composition at the placement sites of stones will be minimal, due to the lack of growth underneath rocks. Therefore, there will be no impact to refuge and food sources for bottomfish MUS and pelagic MUS, and any minimal reduction in habitat and water quality will be temporary.

Infauna Community

As described previously, typical substrate in Apra Harbor includes sand, silt, clay, and fines. Glass Breakwater provides a limited amount of reclaimed sandy/rocky coastal habitat and is comprised primarily of large boulders and small sand deposits. As illustrated in Table 6 the project area is a high wave energy system affording limited benthic communities. Therefore, the existing seafloor habitat in the Action Area provides little opportunity for recruitments of coral or other EFH. The limited infauna community provides minimal functions and ecosystem services as EFH and will be retained after temporary disturbance from the redistribution of existing concrete armor units during shoreline in-water work.

As noted previously, construction activities will be contained within the existing breakwater footprint; impacts will be limited to areas that are already disturbed and provide limited habitat for marine invertebrates. In-water work is not expected to increase turbidity and suspended sediments (Sections 4.1.2 and 4.2.3), and there will be implementation of turbidity- and sediment-control BMPs described in Section 2.5.4 to minimize the risk.

Based on the information provided in the analysis above, the placement of concrete armor units along the existing breakwater will not result in the temporal loss of potential refuge habitat for juvenile and adult bottomfish or decrease function of water quality and filtration services associated with the removal of the benthic community. The above discussion represents the lack of potential for adverse effects on quantity and quality of EFH through a temporary reduction of habitat and associated water quality.

4.2.3 Increased Turbidity and Suspended Sediments

The marine environment of Apra Harbor may be subject to increased suspended sediment from several pathways including increased vessel traffic, construction activities, and runoff. Suspended sediments have the potential to interfere with fish respiration by irritating or damaging gill tissues (Hess et al. 2017). Increased turbidity can also affect fish ability to search for food. This can be due to increased turbidity masking senses or a decrease in primary productivity due to alterations in light regimes reducing available food for grazing and thus reducing their overall fitness (Berry *et al.* 2003; Wenger *et al.* 2012). For predatory fish, increases in turbidity are strongly linked to reduced visual acuity and reactive distance when searching for food. Predatory fish may experience reduction in hunting success with increased turbidity (Berry *et al.* 2003). A primary behavioral response to suspended sediments in adult fish is avoidance. Prolonged increases in suspended particles may affect a fish's choice in habitat settlement. Research on damselfish has shown that suspended sediment may impair habitat preference during the settlement process due to disrupted visual and chemical cues (Wenger *et al.* 2011).

Coral habitats are sensitive to changes in sediment deposition and suspension, which may alter turbidity and light levels. Invertebrate species limited in movement may be impacted if they are located within the Project area and may experience disruption in feeding, increased abrasion, decreased respiration rates, or changes in their behavior (Todd *et al.* 2015). Long-term exposure to these changes alters reef diversity and structure and, subsequently, fish habitat. Excessive exposure may kill coral and other reef organisms such as sponges. Increased sedimentation is believed to be a contributing factor to declines in tropical reef fisheries in the Caribbean and Pacific (Berry *et al.* 2003).

While some coral species may be more susceptible to sediment smothering, branching corals are highly resilient due to their morphology (Jones *et al.* 2019). Elevated turbidity and increased suspended sediments as a result of the Proposed Action is expected to be absent, and in the occasion that some sedimentation does occur it will be extremely temporary, and unlikely to rise to a level that could cause harm to *Acropora globiceps* or other corals. Also of consideration, *Acropora* and other corals are located at least 30 m from the location of the proposed actions (Figure 8), leaving plenty of space for any minor sedimentation to quickly dissipate before reaching essential habitat areas.

As stated in Section 3.1.2, turbidity throughout the harbor is higher than outside the harbor, and this ambient condition will minimize minor Project-related effects on ESA-listed species from elevated turbidity. Project activities such as armor stone placement are unlikely to generate the same elevated levels of increased suspended sediments as dredging activities and will be taking place intermittently. Additionally, because the outer breakwater experiences high levels of wave energy and water movement, any increased sediments will disperse from the area quickly.

It is not expected that there will be any increase in turbidity or sedimentation, but as a precaution, BMPs (Section 2.5) will be implemented to minimize the effects of sedimentation to the greatest extent possible. Due to the open ocean exposure in the Action Area it is expected that any increased sedimentation would be minor and temporary due to the high wave and current energy that dissipates any excess temporary sedimentation very quickly (and prevents the safe and effective use of a silt curtain).

Determination

With Project BMPs intended to minimize construction-related sedimentation (see Section 2.5.4) and lack of sedimentation and turbidity as a result of the actions, in addition to the natural wave energy that quickly dissipates sedimentation in the Action Area, there will likely be no affect from the Proposed Action. Any water quality changes will be minimal and temporary, and, as a result of a fish's ability to flee areas of excessive sediment exposure, impacts to fishes are expected to be limited. Coral reef structure providing EFH to fishes will not be impacted temporarily by light attenuation due to lack of sedimentation and distance from the Proposed Action.

4.2.4 Elevated Noise Levels

As discussed in Section 4.1.1, the Proposed Action has the potential to produce temporary, intermittent elevated in-air and underwater noise levels. Noise has a broad range of potential effects on marine species, depending on the frequency, intensity, impulsiveness, and other characteristics. Understanding how fish experience sound and their responses to underwater noise is complicated by the diversity of fishes and the variation in their anatomy across species. Responses of fish exposed to elevated sound pressure levels can range from no effect to a brief acoustic annoyance, temporary loss of hearing, behavioral changes and stress, or tissue injuries and barotraumas (Hastings and Popper 2005; Ruggerone *et al.* 2008; Hedges 2011; WSDOT 2020). Adult fish without a swim bladder, such as benthic flatfishes, may not be affected by elevated sound pressure levels, although larval forms present within the water column may alter their behavior, have lower body condition, or be susceptible to predation (Nedelec *et al.* 2015; Weilgart 2018). Behavioral changes due to increased noise may include avoidance of the area, changes in migratory routes, and/or interruption of reproduction. Fish may move away from foraging habitat or delay migratory movements due to increased noise, and noise may also increase predation by masking the sound of approaching predators (Anderson 1990).

Marine invertebrates are typically only sensitive to the particle motion component of sound (Popper and Hawkins 2018). Chronic or continuous noise can mask biologically important sounds and alter the natural soundscape and can have adverse effects on an organism's stress levels and immune system (Minton 2017). Persistent noise can also affect coral spawning (Lecchini *et al.* 2018). Studies on invertebrate species have shown that chronic exposure to noise may lead to increased metabolic rates, causing a reduction in growth and reproduction (Lagardère 1982).

Noise from this project will be generated by equipment (e.g., heavy equipment and machinery), but little sound is expected to propagate into the marine environment from equipment operated out of the water. Armor stone and concrete armor units will be placed in the water, but the crane itself will operate from above the water and will not enter the water.

Determination

In-water activities (the placement of concrete armor units) could result in exposure to elevated in-air and underwater noise levels as a direct result of the Proposed Action. However, with adherence to required BMPs, the risk of adverse effects on EFH is extremely minimal and temporary under the Proposed Action.

4.2.5 Wastes and Discharges

It is unlikely that the Proposed Action will generate wastes or discharges that will enter the water due to implementation of mitigation measures and BMPs defined in Section 2.5.3; however, in the unlikely event that wastes or discharges enter the water unintentionally, both lethal and non-lethal effects on benthic and pelagic MUS could occur. Chemical pollutants resulting from accidental spills and discharge from construction activities harm biologically important nearshore ecosystems and can result in mortality of coral communities (NMFS and USFWS 1998a) and expose species that make up EFH as well as habitat components to toxic substances in the water. Marine debris can affect species that utilize reef ecosystems, such as giant clams and corals, by covering, entanglement, adhesion, prevention of photosynthesis, introduction of exotic species, and disease outbreak (Nama *et al.* 2023).

If a chemical is accidentally discharged or spilled during the Project, it is likely that the quantity would be small in volume (e.g., less than 25 liters [DoN 2020b, as cited in NMFS 2020c]). To reduce the potential for Project-related environmental contaminant release, all equipment and vehicles will be maintained and checked daily to reduce the risk of leaks or discharge, and hydraulic equipment will be maintained properly to prevent leaks.

No debris will be allowed to enter the water during the Proposed Action. To reduce the potential for Project-related marine debris generation, all waste will be controlled and disposed of into trash dumpsters or roll-off bins in the Project base yard or storage area as directed in the Project BMPs (Section 2.5).

The exposure of marine waters to wastes and discharges will be avoided and minimized to the greatest extent practicable through development and implementation of an oil spill contingency plan contained within the SWPPP, which includes measures to prevent (and respond to) inadvertent discharges of construction wastes into the marine environment. Petroleum-spill-containment devices (e.g., absorbent pads) will be located on site in sufficient quantity, and available and accessible for immediate deployment at all times. Thus, the Project-specific BMPs described in Section 2.5.3 will prevent wastes and toxicants from entering the marine environment and thus prevent exposure to EFH species. In the highly unlikely event of a spill or discharge, effects are expected to be insignificant, because accidental spills or discharge will be landside and of small amounts and can be remediated quickly.

Determination

Implemented BMPs (e.g., equipment maintenance, contingency plans, and fueling restrictions) will prevent and mitigate effects from an accidental release of waste and discharges. Thus, potential effects from exposure to accidentally released waste and discharges would be temporary and minor.

4.2.6 Aquatic Invasive Species

AIS represent a significant threat to marine ecosystems worldwide. Once introduced, these species may proliferate rapidly, uncontrolled by native predators or other habitat factors, and can significantly disturb native ecosystems. Relative to Guam and other parts of Micronesia—although it is widely understood that humans have transported many marine organisms to the region over time—little is known about the full extent of marine invasions. Known established marine invaders in Guam and elsewhere in Micronesia are dominated by sessile organisms that occur on hard substrata and can be attributed to ship biofouling or ballast water as a possible vector (Ruiz and Zabin 2014). The movement of construction materials can also transfer marine organisms, especially when materials are moved directly from one in-water or shore location to another (Ruiz and Zabin 2014).

As described in BMPs, the portions of equipment that will enter the water will be clean and free of pollutants, including AIS, and all equipment (including cranes) will be free from fouling organisms before entering Guam's coastal waters. In addition, the Construction Contractor will be required to be permitted as covered in Guam Executive Order 91-37 to be in compliance with chemical and pest-free certification prior to shipping any sand, gravel, or rock to Guam waters. Further, Contractors will be referred to the Joint Region Marianas (JRM) Marine Invasive Species Management Plan, which includes extensive BMPs, invasive species watch lists, reporting standard operating procedures (SOPs), and outreach/guidance material (Sustainable Resources Group, Intn'l, 2023).

Determination

The armor stones are being sourced from elsewhere along the breakwater, so any AIS attached to the stones will have already been in the Action Area. With implemented BMPs to ensure inspection and cleaning of the portion of crane that will be in the water, there is a very minimal risk of introduction of a new AIS as a result of the Proposed Action.

4.2.7 Chemical Contaminants

Heavy metals including copper and zinc; and other pollutants including polycyclic aromatic hydrocarbons, phenols, and polychlorinated biphenyls have become increasingly prevalent in the marine environment as a result of increasing coastal development and urbanization (Wenger *et al.* 2015). The transport, dispersion, and resulting biological effects of pollutants in marine systems depend on the persistence of these chemicals under tropical conditions and their bioaccumulation and biodegradation rates. In particular, the association of pollutants with particulate matter may increase persistence in the environment, in part due to the rapid sorption of many contaminants to sediments. Further, because most petroleum products are hydrophobic in nature, most aromatic hydrocarbons introduced into the marine environment will associate themselves with particulate matter and be deposited into sediment, where these compounds tend to persist (van Dam *et al.* 2011).

Sediment analysis within Apra Harbor has shown existing contamination from polychlorinated biphenyls and heavy metals including copper, zinc, lead, and mercury (Denton *et al.* 1997). Relative to heavy metals, once introduced into a biotic matrix, trace metals have the potential to affect various life stages of corals through the disruption of nutrient cycling, cell growth and regeneration, reproductive cycles, and photosynthetic potential (van Dam *et al.* 2011).

Fishes exposed to petroleum hydrocarbons exhibit immunosuppression, endocrine dysfunction, and reduced gonad size. Chronic exposure of coral reef fishes to these contaminants could have major implications for population dynamics if the levels are high enough to trigger endocrine system disruption; however, even at low concentrations, continuous exposure to these pollutants could leave fish vulnerable to additional stressors (Wenger *et al.* 2015).

Benthic filter feeders or sessile organisms are at risk through the direct contact or ingestion of oil compounds (van Dam *et al.* 2011). In a review of marine accidents that exposed benthic organisms to petroleum hydrocarbons, Turner and Renegar (2017) found that community-level changes in response to petroleum pollution include decreases in abundance, diversity, and coral cover in addition to a decrease in colony size and growth rate following exposure. Observed sublethal effects on corals include increases in bleaching, tissue swelling, mucous production, coral injury, and bacterial infections (Turner and Renegar 2017). Decreased reproductive success of both brooding and broadcasting corals following oil exposure has also been observed in a number of studies (van Dam *et al.* 2011). Although residual aromatic hydrocarbons have been detected in coral tissues months after initial exposure, evidence suggests that hydrocarbon deposits in sediment and coral tissues may be substantially reduced over time (van Dam *et al.* 2011). These observations are consistent with findings of laboratory experiments on adult corals, which determined that most sublethal effects of hydrocarbon exposure were temporary, with a return to normal behavior following recovery in clean seawater (Turner and Renegar 2017).

The Proposed Action does not include dredging or other substantial disruption of substrate that may mobilize and re-suspend existing underwater contaminants within the Action Area. In-water work may temporarily increase turbidity and suspended sediments (Section 4.1.2). However, the implementation of turbidity- and sediment-control BMPs described in Section 2.5.3, will minimize the potential for contaminant-laden sediment to flow outside the in-water work area.

Although the use of heavy equipment could result in an oil or fuel spill and subsequent release of contaminants, potential adverse effects on EFH are unlikely due to the implementation of minimization measures and BMPs. As noted previously, all equipment and vehicles will be maintained and checked daily to reduce the risk of leaks or discharge, and hydraulic equipment will be maintained properly to prevent leaks. Additionally, all heavy equipment will be land based and not entering the water.

Determination

Based on the information provided above, it is unlikely to assume that existing contaminants in the substrate may be disturbed by the minimal and precise in-water work associated with the Proposed Action, and the implementation of BMPs will make sure to avoid adverse effects on EFH from chemical contaminants.

4.2.8 Hypoxia

The concentration of dissolved oxygen (DO) in surface waters is determined by the balance between oxygen production through photosynthesis, oxygen consumption through respiration and other chemical reactions that consume oxygen, and exchange with the atmosphere (Zhang *et al*. 2010). Water masses can become undersaturated with oxygen when natural processes, alone or in combination with anthropogenic processes, produce carbon that is aerobically decomposed faster than the rate of oxygen re-aeration (Rabalais *et al.* 2010), which can result in hypoxia.

Coastal hypoxia has been identified as a worldwide phenomenon since the late 1950s and occurs when natural and/or anthropogenic forces result in DO depletion in coastal waters to a certain level, typically defined as less than 30 percent saturation or less than 2 milligrams per liter of DO (Rabalais *et al.* 2010; Zhang *et al.* 2010). The worldwide distribution of coastal hypoxia is closely associated with developed watersheds that export large quantities of nutrients, particularly nitrogen and phosphorus (Rabalais *et al.* 2010). Accordingly, research has shown the relationship of eutrophication and hypoxia through complex mechanisms that drive nutrient cycling and microbial processes in coastal environments (Zhang *et al.* 2010). In shallow systems (i.e., those less than 50 m deep), DO concentrations can also be modified by turbulent mixing and biogeochemical consumption and production (Zhang *et al.* 2010).

Hypoxia becomes detrimental to aerobic aquatic organisms when reduced DO results in altered behavioral or physiological responses including reduced growth, loss of reproductive capacity, mortality, reduced biodiversity, and loss of secondary production including fisheries. There is no defined DO concentration at which marine, coastal, or estuarine waters become hypoxic to resident organisms, and research indicates that behavioral, physiological, and reproductive responses differ by taxon, life stage, and history of exposure to various levels of low oxygen (Rabalais *et al.* 2010).

Lastly, the area in which the Proposed Actions will occur is on the outer side of the breakwater where there is active water movement, continually mixing the water. If there was poor or hypoxic water it would quickly be well mixed, thus, the residence or buildup of low-oxygen water is unlikely to occur.

Determination

The Proposed Action does not include dredging or other substantial disruption of substrate, nor will it result in the release of excess nutrients. In-water work will not result in temporarily increased turbidity and suspended sediments and given the relatively small footprint of in-water work and implementation of sediment-control BMPs, it is highly unlikely that in-water activities will deplete DO levels in the Action Area. In the unlikely event that water will become hypoxic, the location and high water circulation in the area will quickly mix with oxygenated water and resolve any drop in oxygen levels. Therefore, low DO conditions and potential hypoxia will not occur under the Proposed Action.

5. Summary of Determinations

5.1 ESA Determination

5.1.1 ESA-Listed Species

The Navy considered the effects of the Proposed Action on ESA-listed species that may occur within the Action Area, as described in Section 4.1. Considering all consequences of the Project, the Proposed Action ***may affect, but is unlikely to adversely affect ESA-listed*** green turtles, hawksbill turtles, scalloped hammerhead sharks, and hard coral *Acropora globiceps*. Effect determinations for each ESA-listed species are provided below. The Navy requests NMFS's concurrence with these determinations.

Green Turtle (Central West Pacific DPS)

- The project ***may affect, but is unlikely to adversely affect*** the Central West Pacific DPS green turtle because:
  - Central West Pacific DPS green turtle sightings are uncommon in the Action Area.
  - Potential impacts from the Proposed Action will be discountable or insignificant (Table 9).
  - BMPs will be implemented to reduce potential impacts.

Hawksbill Turtle

- The project ***may affect, but is unlikely to adversely affect*** the hawksbill turtle because:
  - Hawksbill turtle sightings are rare in the Action Area.
  - Potential impacts from the Proposed Action will be discountable or insignificant (Table 9).
  - BMPs will be implemented to reduce potential impacts.

Scalloped Hammerhead Shark (Indo-West Pacific DPS)

- The project ***may affect, but is unlikely to adversely affect*** the Indo-west Pacific DPS scalloped hammerhead shark because:
  - Indo-west Pacific DPS scalloped hammerhead sharks are unlikely to occur in the Action Area.
  - Potential impacts from the Proposed Action will be discountable or insignificant (Table 9).
  - BMPs will be implemented to reduce potential impacts.

Hard Coral (Acropora globiceps)

- The project ***may affect, but is unlikely to adversely affect*** the ESA-listed coral *A. globiceps* because:
  - In-water work will avoid *A. globiceps* by at least 30 m (Figure 8, Section 4.4.3).
  - BMPs will be implemented to reduce potential impacts.

5.1.2 Critical Habitat

Proposed Acropora globiceps Critical Habitat

- The project ***will not destroy or adversely modify*** proposed *A. globiceps* critical habitat because:
  - No critical habitat for *A. globiceps* is designated or proposed in the Action Area.

Proposed Green Turtle Critical Habitat

- The project ***will not destroy or adversely modify*** proposed green turtle critical habitat because:
  - Effects of action will not extend to areas proposed for designation.
  - In areas proposed for designation in Outer Apra Harbor, any underwater noise would not measurably diminish the quality of marine habitat available for use by green turtles in the Action Area.
  - Should habitat be designated prior to the completion of the Project, the Proposed Action ***may affect, but is unlikely to adversely affect,*** designated critical habitat for green turtles.

5.2 EFH Determination

As described in the analysis of effects on EFH presented above (Section 4.2), the Proposed Action is unlikely to reduce water quality due to a lack of turbidity and suspended sediments during in-water work. Additionally, the Proposed Action will prevent falling armor stones (until major repairs can be implemented) causing reduction of aquatic habitat resulting from the loss of sessile organisms, including corals and benthic invertebrates that comprise ecosystem components for some life stages of bottomfish MUS and pelagic MUS.

Adverse effects will be minimized through the implementation of numerous BMPs (Section 2.5) including, but not limited to, avoiding in-water work during coral spawning periods, limiting construction to within 2 m (6.56 ft) of the HTL, and safe equipment use and management. Due to implementation of appropriate BMPs, the relative quantity and quality of existing EFH within the Action Area, and the size and scale of anticipated effects, the Proposed Action is not expected to appreciably diminish habitat value over the long term. In addition, considering the actions will be beneficial to EFH over the long term, adverse effects due to the proposed actions will be **minimal and temporary. Further, these actions will prevent ecosystem losses from further breakwater degradation until permanent repairs can occur**.

The Navy requests NMFS's concurrence with this determination.

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Appendix A: Benthic Survey Report

AECOS No. 1809

Marine Biological Surveys for Apra Harbor Waterfront Repairs Apra Harbor, Guam

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April 22, 2024

Marine biological surveys for Apra Harbor Waterfront Repairs Apra Harbor, Guam

April 22, 2024 *AECOS* No. 1809

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Introduction

The Department of the Navy, Naval Facilities Engineering Command Marianas (NAVFAC Marianas) commissioned MDPAC JV (MDPAC) to provide Architect-Engineer Services for the FY24 Special Project Typhoon Mawar Apra Harbor Waterfront Repairs through Contract Task Order (CTO) N4019224F4029, WO # 1797102 (Contract Number N62742-23-D-0001) to address repairs of structures damaged from Typhoon Mawar at Apra Harbor, Guam (the "Project", see Figure 1). The Project is intended to repair and strengthen compromised structures within Apra Harbor. *AECOS*, Inc. was contracted by Moffat & Nichol, Inc. to perform a marine biological survey and prepare this report of findings for use in the design and permitting for the Project.

Project Description

The Project includes work in three general areas within Naval Base Guam, Apra Harbor: A) Admiral Glass Breakwater (hereafter referred to as the Glass Breakwater); B) Sumay cove entrance and marina, including EOD seawalls and EOD Point; and C) Polaris Point, extending from Fantasy Island to the entrance of inner Apra harbor. Within these three general areas, improvements are proposed for specific sites, as described below. The Project includes, but is not limited to, site clearing and demolition, revetments, grouting behind existing seawall, recovery of displaced armor, replacement of a wave attenuator at the Sumay Cove Marina, repair and replacement of gangways and piers, replacement of dock boxes, repair and replacement of fire protection water lines, repair/replacement of electrical service to slips, and waterfront security fence/railing at the Marina seawall.

The Glass Breakwater is located on the north side of Outer Apra Harbor. The breakwater was completed in 1946 and provides protection to the harbor and safe navigation and berthing for navy, commercial and recreational vessels transiting Apra Harbor. Proposed improvements include repairs to the Glass Breakwater armor, repairs to rock revetment along Polaris Point including Fantasy Island, repairs to rock revetment and seawall on both sides of the Sumay Cove entrance, and repairs to the Sumay Cove marina.

The existing roadway along the Glass breakwater will need to be improved to access the repair areas. Both marine and landside demolition will include removal/relocation of existing revetment, demolition of steel debris at a ramp at Polaris Point and Sumay Cove entrance, demolition of a portion of the concreted rock bulkhead at Sumay Cove entrance, and removal/disposal of the damaged finger piers/wave attenuator.

Figure 1 Apra Harbor location on Guam and (inset) Project areas in red.

Methods

Survey Areas and Transect Placement

From February 18 through 26 and March 6 through 8, 2024. *AECOS* biologists conducted SCUBA surveys to assess marine assemblages on and around the following areas within Apra Harbor: 1): inner and outer faces of Glass Breakwater; 2) Sumay Point; 3) EOD seawalls, 4) EOD Point, and 5) Polaris Point (See Figure 2). Biologists conducted orthomosaic mapping and collected data on benthic composition, coral abundance and size-class distribution, coral species composition, fish abundance, and presence of Endangered Species Act (ESA)-listed species. Survey methods for each location are described following. Appendix A provides a listing of the transects at each Project area and location coordinates.

Inner Breakwater

Eleven 50-m transects, and one 44-m transect were used to quantitatively assess the coral community of the seafloor in the Inner Breakwater area. Eight 50-m transects were surveyed for fish and benthic composition. Transects were laid parallel to the breakwater at depths ranging from 1 to 4.5 m (3 to 15 ft). Orthomosaics were collected for the Inner Breakwater along transects laid parallel to the shore and extending from the high tide line out to approximately 4 m (13 ft) from the shore, except in locations of obstructions due to debris. A total of 42 orthomosaics were collected in depths ranging from 1 to 4.5 m (3 to 15 ft; as represented in Figures 3 and 4, transects "I-1" through "I-42"). An additional offshore set of 21 orthomosaics was collected approximately 7 m (23 ft) to 17 m (56 ft) from the start of transect 12 until transect 42 at the end. The depth in this area ranged from 1-10 m (3 to 32 feet).

Outer Breakwater and Tip of Breakwater

Due to hazardous surf, current, and swell conditions (PacIOSS, 2024), the northeast section of the Outer Breakwater was not quantitatively surveyed with transects, although orthomosaics were obtained for this area. For the southwest portion, five 25-m transects were used to quantitively assess the benthic community of the seafloor ("O-1" through "O-5"). Transects were laid parallel to the breakwater structure, approximately 6-12 m (20-40 ft) offshore of the high tide line.

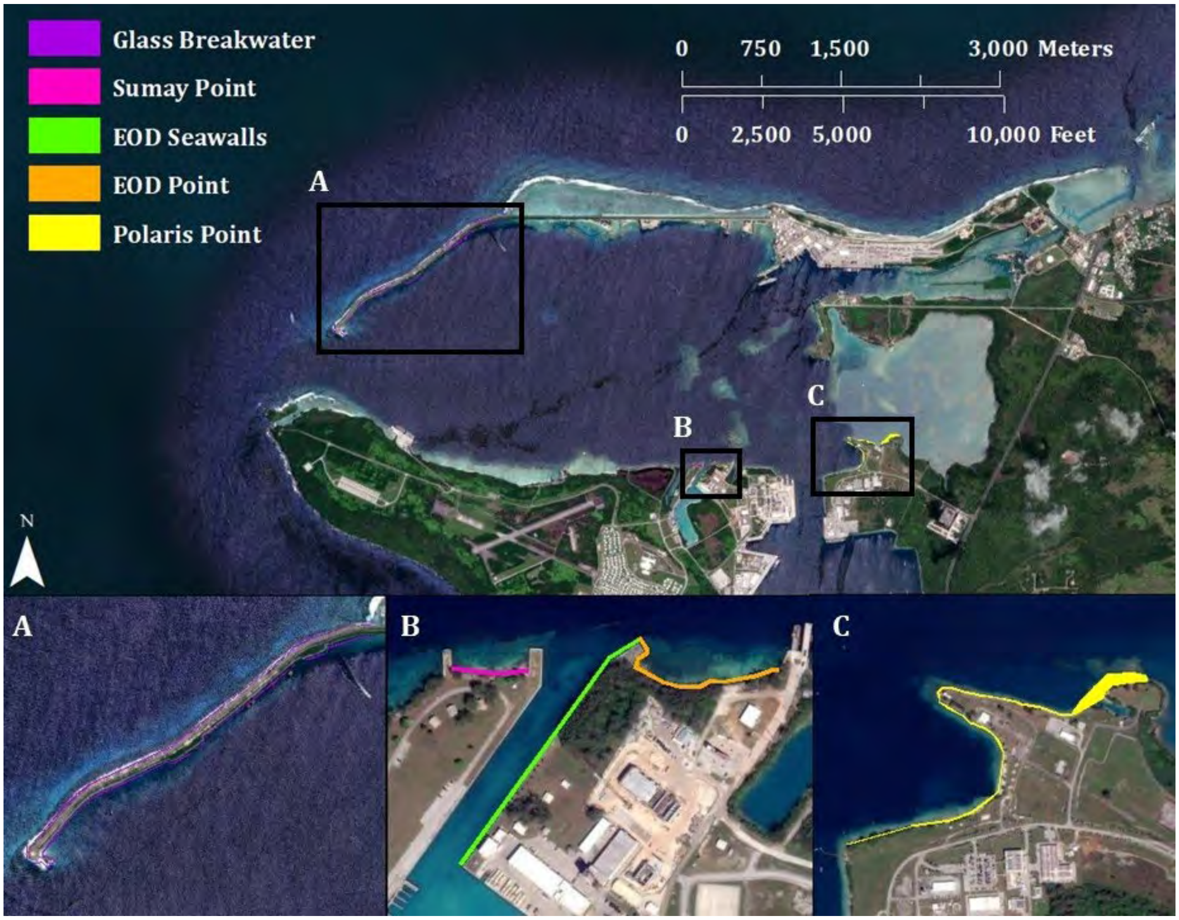

Figure 2. Apra Harbor Project Areas.

Two additional 50-m transects ("T-1" and "T-2") were surveyed in the area adjacent to the channel entrance, at the outer end of the breakwater. Fish and benthic composition were surveyed for both transects, while coral community was assessed only along one. Orthomosaics were collected along both transects. The depths surveyed along the entire Outer Breakwater survey area range between 2 and 5 m (7 to 15 ft).

Sumay Point

One 50-m transect was used to quantitively assess the coral composition at Sumay Point ("S-1"). The transect was laid parallel to the shore, approximately 10 m (33 ft) off from the shore. A second 50-m transect laid in a similar manner was used to survey fish and assess benthic composition. Orthomosaics were collected for the entire Sumay Point area, except in locations of obstructions. Depths ranged from 0.5 to 1.5 m (2 to 4 ft) in this survey area.

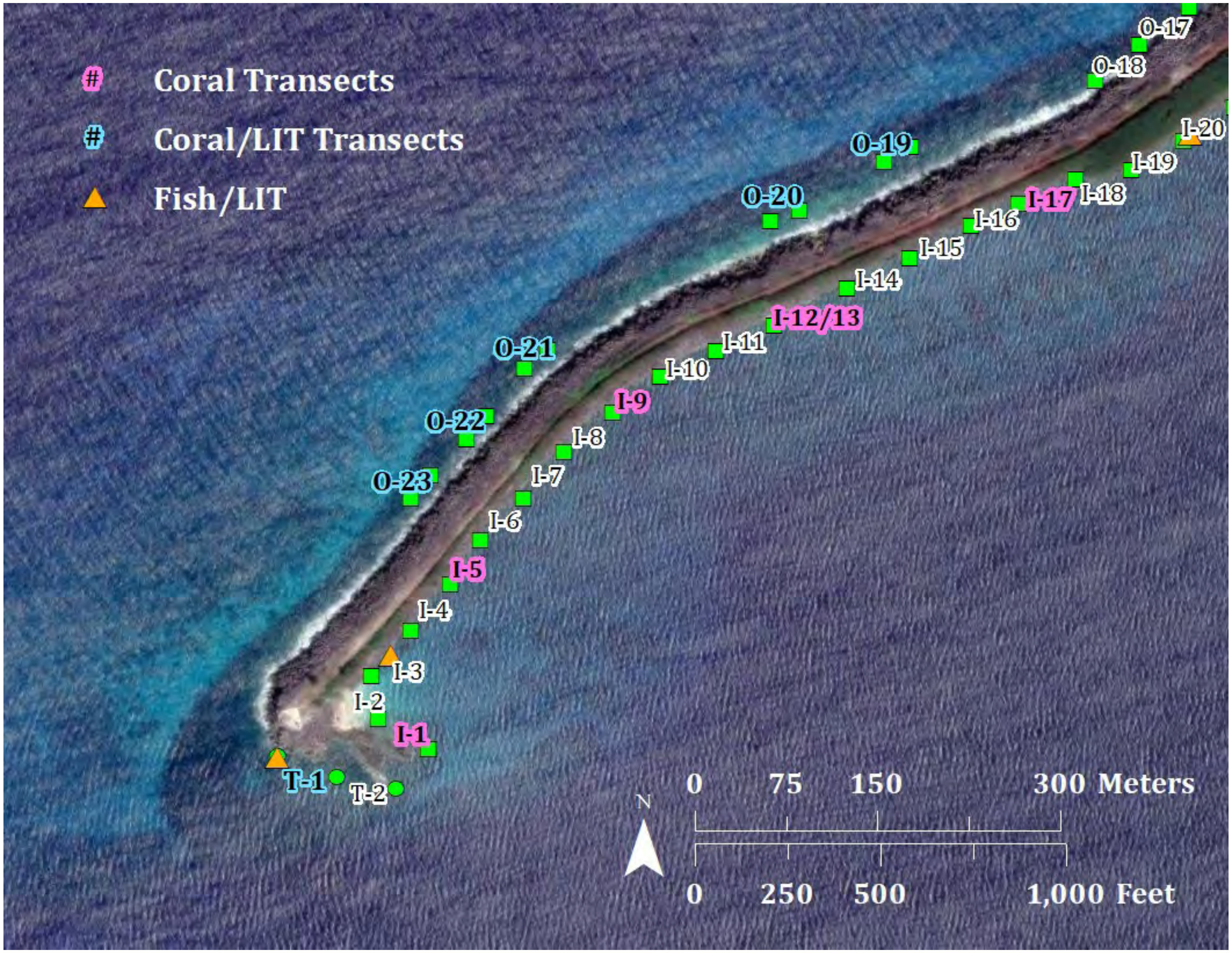

Figure 3. Inner, Outer, and Tip of Breakwater transect locations. Green dots indicate the start and stop of each orthomosaic transect. Pink numbers indicate location of coral transect, blue numbers indicate location of coral and benthic composition (LIT) transects, and orange triangle represents middle mark of transects to assess fish and benthic composition (LIT).

Figure 4. Inner, Outer, and Tip of Breakwater transect locations. Green dots indicate the start and stop of each orthomosaic transect. Pink numbers indicate location of coral transect, and orange triangle represents middle mark of transects to assess fish and benthic composition.

EOD Seawall

An inventory for corals was made of the entire EOD seawall as well as the seafloor within 2 to 3 m (6 to 9 ft) out from the seawall. Orthomosaics were collected for the entire EOD seawall area, except in locations of obstructions (Transects "EOD-1" through "EOD-7"). Depths ranged from 2 to 5 m (6 to 17 ft) in the survey area. Additionally, two 50-m transects were used to survey fish and assess benthic composition. Figure 5 shows the locations of the transects.

EOD Point

An inventory for corals was made for the entire EOD Point hardened shoreline and seawall, as well as the seafloor approximately 2 m (6 ft) off the seawall. Orthomosaics were collected for the entire EOD Point survey area, except in locations of obstructions (Transects "EOD-8" through "EOD-12"). Depths ranged from 0.5 to 4 m (2 to 11 ft). Two 50-m transects were used to assess benthic community of the seafloor and fish abundance. Figure 5 shows the locations of the EOD Point transects.

Polaris Point

Seven 50-m transects, and one 14-m transect were used to quantitively assess the coral composition of the seafloor off Polaris Point ("PP-1", "PP-5", "PP-9", "PP-13", "PP-17" "PP-21", "PP-25", and "PP-29"; see Figure 6). Transects were laid on the seafloor approximately 3 m (9 ft) off the shoreline. One transect was used to inventory a portion (from 0 to 6 m offshore) of a vertical seawall in the area. Four additional 50-m transects were surveyed for fish and benthic composition. Orthomosaic survey areas were conducted 10 to 20 m (30 to 60 ft) from the high tide shoreline due to depth and visibility limitations closer to shore. Depth in the survey area was 1.5 to 2 m (4 to 5 ft).

Benthic Composition

The point intercept method (also termed a "line-point intercept method" or LIT) was used to assess benthic composition on a total of 20 transects across the Project areas: four at Polaris Point, two at EOD Point, one at Sumay Point, eight at the Inner Breakwater, and five at the Outer Breakwater. This protocol uses marks on a transect line as sample points. At 0.5-m intervals (meter and half-meter marks), the nature of the bottom under each "point" is assigned to one of the following categories: sand, rubble, limestone (rock or pavement), algal turf, crustose coralline algae (CCA), live coral, or macro-invertebrate. Benthic percent cover was calculated by dividing the total number of points for each category by the total number of points sampled, times 100.

Figure 5. Locations of transects at Sumay Point, EOD Seawalls, and EOD Point. Pink numbers indicate location of coral transect, and orange triangle represents middle mark of transect to assess fish and benthic composition.

Coral Abundance and Size Class Distribution

A one-meter belt survey of coral colonies was conducted on selected transects. All coral heads within 0.5 m to either side of the transect line were counted. Coral abundance was determined as the number of individuals observed for each transect normalized to number of individuals per m^2. Coral colonies were identified to genus and species, where possible. Colonies were assigned to a size class (1- to 5-cm; 6- to 10-cm; 11- to 20-cm; 21- to 40-cm; 41- to 80-cm; 81- to 160-cm; or >160-cm) based on the largest horizontal dimension of the colony. Coral size-class distribution was determined for each coral genus recorded. Coral head morphology and signs of disease were also noted.

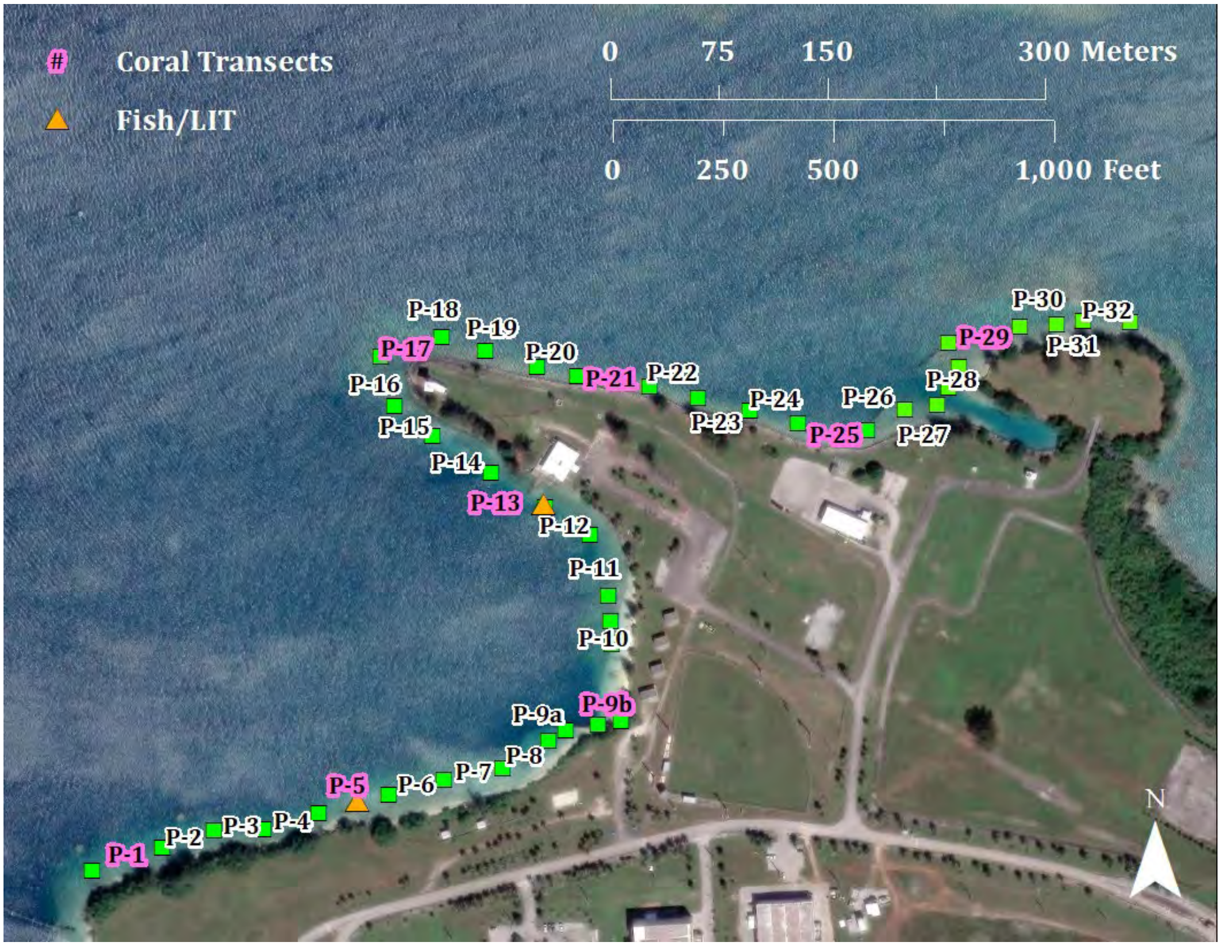

Figure 6. Locations of transects at Polaris Point.

Orthomosaic

Five weighted triangles were placed roughly 12 to 13 m apart along a 50-m transect in each survey area. The triangles helped guide the diver along the correct course (the next triangle was visible from the previous one) as well as mark the start and finish of the transect. A GPS point was taken at the first and last triangle to allow for georeferencing. Using two GoPro cameras mounted 0.6 m apart on an assembled PVC rig, photographs were taken every 0.5 seconds in time lapse mode while swimming slowly along the surface from the last triangle to the first. The cameras were angled directly downward and outfitted with a red filter for underwater color enhancement. Approximately 450 images were collected per camera at each transect and processed using *Agisoft*® software. Triangles were a fixed length (0.44 m along the hypotenuse) and used to preserve scale along the length of each orthomosaic.

Fishes

Fish surveys were conducted in two teams of two divers. A starting point was determined, which established the middle point for the transect, and each team swam opposite of the starting point to a determined distance (typically 25 m) for a total transect length of 50 m. Fish transect starting points are displayed on the map figures in the report with an orange triangle representing the middle point of the transect. In each pair, one diver videoed with a GoPro while laying out the 50 m transect while the other followed and recorded LIT data, as described above. Video was recorded for the length of the transect, angled to capture all fish within a visible distance from the transect. Videos were viewed by biologists, and fish were identified to species level, when possible, and fish abundance recorded.

Species richness (S) was determined as the number of species observed for each Project area. Species diversity was determined using the Shannon-Weiner diversity index (H') where p_i is the proportion of all individuals counted that were of species using the equation:

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Results

Appendix B lists the marine algae and marine animals identified and their relative abundances encountered during the surveys. Qualitative abundance ratings are provided for all species found within the survey areas. Appendix C presents representative photos of each surveyed Project area. Appendix D provides low resolution orthomosiac images covering the Project areas (full resolution orthomosiac images are available as JPEG files).

Outer and Tip of Breakwater

General Observations

The Outer Breakwater is a highly dynamic area with considerable wave energy. This location experiences the brunt of storms generated to the north. In addition, locally generated wind waves create turbulent sea surface conditions. Fortunately, a rare weather window on the first day of surveys (February 18, 2024), afforded a single day of somewhat calmer than normal conditions, allowing the team to conduct photomosaic surveys. Quantitative surveys require divers to record data in a stationary location, however passing waves cause a sloshing and heaving effect. Maintaining position long enough to record data can be impossible. During our February surveys, as each wave passed, the wave energy would pin divers against boulders, or into crevasses between boulders, or force them careening away at a distance dependent on the wave energy. When waves are constant and large, it is nearly impossible to collect quantitative data using traditional transect methodologies. Therefore, orthomosaic data, video, and photos were collected on survey dates when wave conditions prevented standard quantitative methods. The northeast section of the outer breakwater nearest the shallow reef flat of Luminau Reef (NOAA chart[1]) experiences a strong southwesterly current that flows off the reef flat.

Damage on the Outer Breakwater was evident in the form of boulder slides and locations where breakwater boulders were dislodged from the structure above water and tossed into the sea. Divers noted these rock slides underwater by the presence of white limestone boulders devoid of marine growth. Some boulders are also sheered and broken into pieces. Other boulders, some at a distance from one another, had rubbed against each other yielding scarred white limestone. In general, corals are generally scarce within 2 m of the shoreline and become more abundant, diverse, and larger at approximately the 3- to 4-m depth contour. Corals showing signs of mechanical damage were encountered regularly.

Over the length of the breakwater, the highest coral abundance and diversity within 2 m of the shoreline occurs in the northeast section nearest the reef flat. The lowest coral cover is found in the distal third including at the tip of the breakwater, from the water line down to the breakwater toe. Large schools of surgeonfishes and parrotfishes graze on the boulders. Boulder surfaces usually either have light turf algal growth or are encrusted by CCA. A few snappers and trevally jack patrol this area.

Benthic Composition

Five 25-m transects were used to assess the benthic community of the Outer Breakwater area. The results of the point-intercept survey are presented in Figure 7, which shows the dominant bottom type at 43% CCA. One 50-m transect was used to assess the benthic community of the Tip of the Breakwater and the results are presented in Figure 8. CCA dominated the benthic community, at 79%.

[1] https://charts.noaa.gov/BookletChart/81054_BookletChart.pdf

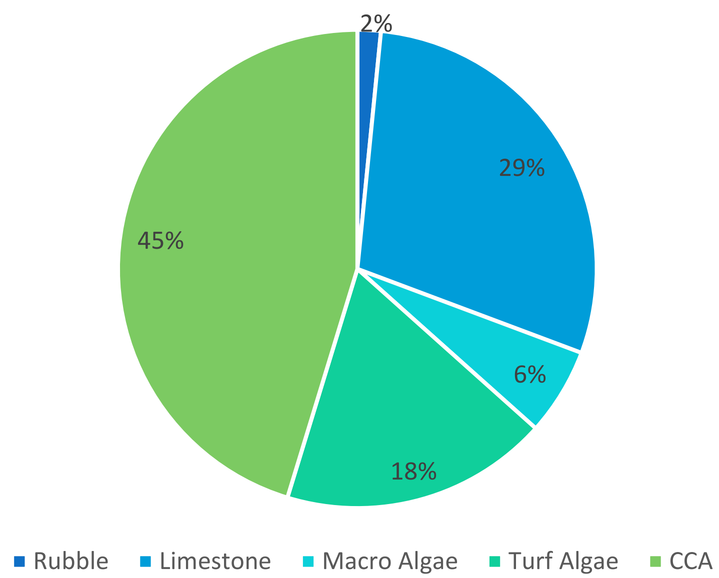

Figure 7. Percent benthic cover for the Outer Breakwater as measured using the point intercept along five 25-m transects.

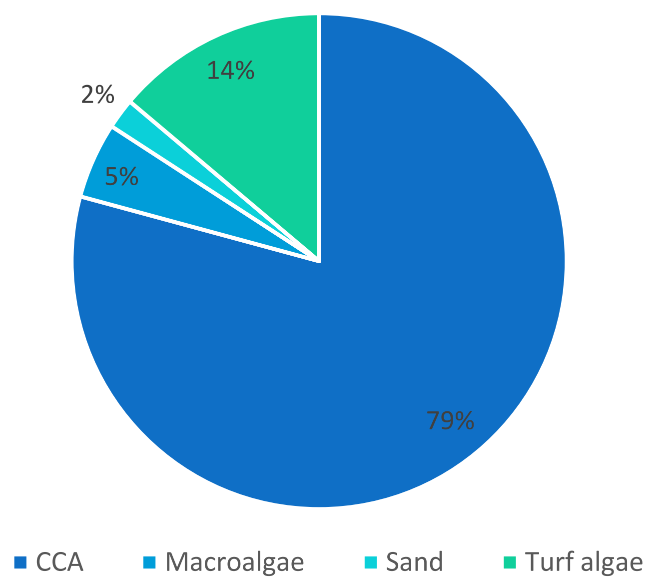

Figure 8. Percent benthic cover at the Tip of Breakwater as measured using the point intercept on one 50-m transect.

Coral Abundance and Size Class Distribution

Coral abundance determined on each transect along the Outer Breakwater is presented in Table 1. A total of 163 colonies were counted on 5 transects. Average density of corals on the structure and within approximately 2-m (6.6-ft) around the structure is 1.3 colony/m^2. Results of the coral size class survey are presented in Tables 2 through 4. The 163 coral colonies represent at least 11 coral genera (*Acropora* sp., *Astrea* sp., *Dipsastrea* sp., *Favites* sp., *Goniastrea* sp., *Hydnophora* sp., *Leptastrea* sp., *Leptoria* sp., *Montipora* sp., *Pocillopora* spp., and *Porites* spp.). The most common genus encountered along the Outer Breakwater was *Goniastrea* at 40% of the total. The most common colony sizes were the two smallest (1- to 5-cm class and 6- to 10 cm class; at 40% and 37%, respectively). Most colonies (105 colonies; 64% of the total) were in Transect "O-1". Table 5 shows the morphology types of the colonies (by genus) observed at the Outer Breakwater. Most colonies are encrusting (65% of the total).

Table 1. Total number of coral colonies and coral colony abundance (mean colonies per m^2) counted on five transects at the Outer Breakwater.

Transect	Survey area (m^2)	Coral count (colonies)	Coral abundance (no./m^2)
O-1	25	105	4.2
O-2	25	0	0.0
O-3	25	52	2.1
O-4	25	4	0.2
O-5	25	2	0.1
Total	**125**	**163**	**1.3**

Table 2. Number of coral colonies in each size class by genus from five transects along the Outer Breakwater.

	Size class (cm)						
Genus	**1 to 5**	**6 to 10**	**11 to 20**	**21 to 40**	**41 to 80**	**Total**	***Percent of total***
Acropora	5	17	6	1		29	***17.8%***
Astrea	1		2	1		4	***2.5%***
Dipsastrea	5	2	3			10	***6.1%***

Table 2 (continued).

Genus	Size class (cm) 1 to 5	6 to 10	11 to 20	21 to 40	41 to 80	Total	Percent of total
Favites	1					1	***0.6%***
Goniastrea	19	23	17	5	1	65	***39.9%***
Hydnophora	1					1	***0.6%***
Leptastrea	11					11	***6.7%***
Leptoria	1					1	***0.6%***
Montipora				1	1	2	***1.2%***
Pocillopora	17	17	3			37	***22.7%***
Porites	2					2	***1.2%***
Total count	**63**	**59**	**31**	**8**	**2**	**163**	
Percent	***38.7%***	***36.2%***	***19.0%***	***4.9%***	***1.2%***		

Table 3. Number of coral colonies in each size class by transect at the Outer Breakwater.

Size Class (cm)	Transect O-1	O-2	O-3	O-4	O-5	Total
1 to 5	32	--	26	4	1	**63**
6 to 10	38	--	20	--	1	**59**
11 to 20	27	--	4	--	--	**31**
21 to 40	6	--	2	--	--	**8**
41 to 80	2	--	--	--	--	**2**
Total	**105**	**0**	**52**	**4**	**2**	**163**
Percent of total	**64.4%**	**--**	**31.9%**	**2.5%**	**1.2%**	

Table 4. Number of coral colonies in each genus by transect at the Outer Breakwater.

Genus	Transect O-1	O-2	O-3	O-4	O-5	Total
Acropora	19		7	2	1	29

Table 4 (continued).

Genus	**O-1**	**O-2**	**O-3**	**O-4**	**O-5**	**Total**
Astrea	3		1			4
Dipsastrea	9		1			10
Favites			1			1
Goniastrea	41		24			65
Hydnophora	1					1
Leptastrea	6		5			11
Leptoria	1					1
Montipora	1		1			2
Pocillopora	22		12	2	1	37
Porites	2					2
Total count	**105**	**0**	**52**	**4**	**2**	**163**

Table 5. Number of colonies in each morphology type by genus at the Outer Breakwater.

Genus	**branching**	**digitate**	**encrusting**	**encrusting and digitate**	**Total**
Acropora	--	7	6	16	29
Astrea	--	--	4	--	4
Dipsastrea	--	--	10	--	10
Favites	--	--	1	--	1
Goniastrea	--	--	65	--	65
Hydnophora	--	--	1	--	1
Leptastrea	--	--	11	--	11
Leptoria	--	--	1	--	1
Montipora	--	--	2	--	2
Pocillopora	34	--	3	--	37
Porites	--	--	2	--	2
Grand Total	**34**	**7**	**106**	**16**	**163**

Coral size class distribution from one transect at the tip of the Breakwater is presented in Table 6. A total of 25 colonies, all pocilloporids, was recorded in this area. The most common colony size was the smallest (1- to 5-cm class; at 76% of the total).

Table 6. Number of coral colonies in each size class by genus from one transect at the Tip of the Breakwater.

	Size class (cm)					
Genus	**1 to 5**	**6 to 10**	**11 to 20**	**21 to 40**	**41 to 80**	**Total**
Pocillopora	19	5	1	--	--	***25***
Percent	***76%***	***20%***	***4%***	--	--	

Fish Abundance

Due to the dynamic nature of conditions along the Outer Breakwater, fish surveys were conducted only at the Tip of the Breakwater, where a total of 37 fish was counted. Most common fishes were *Acanthurus* spp.

Inner Breakwater

General Observations

Conditions along the Inner Breakwater are far less energetic than along the Outer Breakwater facing the open ocean. As with the Outer Breakwater, water depths are shallow at both ends (3 m or 10 ft deep) and deeper in the center section (10 m or 30 ft deep). In general, corals are scarce within 2-m (6 ft) of the structure, however in areas where water depth exceeds 1.5 m (4 ft), corals were more abundant. In the northeast section of the Inner Breakwater, the brown alga (*Padina*) covers much of the boulder surface with corals intermixed. Many mounding *Porites* colonies occur adjacent to the breakwater toe and small schools of juvenile parrotfishes are common here.

The greatest abundance and diversity of coral is found along the middle part of the Inner Breakwater. Most common here are *Poc. damicornis*, *Poc. meandrina*, and *Goniastrea* spp. The deeper part of the breakwater face is covered with enormous (>160 cm) *P. rus* colonies cascading down the slope and extending past the toe onto the adjacent seafloor. A wide variety of surgeonfishes and juvenile parrotfishes graze the area, and butterflyfishes are common. Cleaning wrasse stations were observed atop large *P. rus* colonies. The most common algae are *Halimeda opuntia* and CCA.

At the SW end of the breakwater is a cove with a sloping sand bottom. Coral cover is moderate on either side of this cove and is dominated by *Poc. meandrina* and *Poc. damicornis*.

Benthic Composition

Eight 50-m transects were used to assess the benthic community of the Inner Breakwater area. The results of the point-intercept survey are presented in Figure 9, which shows the dominant bottom type is macroalgae at 31% of the total. Coral cover across the transects is 20%.

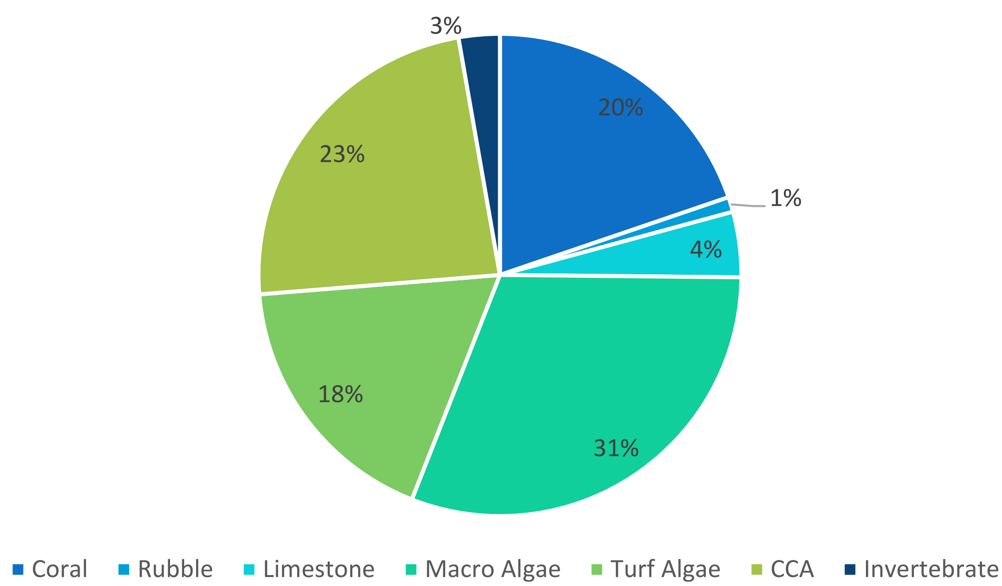

Figure 9. Percent benthic cover as measured using the point intercept along eight 50-m transects for the Inner Breakwater area.

Coral Abundance and Size Class Distribution

Coral abundance determined on each Inner Breakwater transect is presented in Table 7. A total of 2406 colonies were counted on the 12 transects. Average density of corals on the structure and within approximately 6-m (19.6-ft) around the structure is 4.1 colony/m^2. Results of the coral size class survey are presented in Tables 8 through 10. A total of 2406 coral colonies, representing at least 27 coral taxa (*Acanthastrea* sp., *Acropora* sp., *Astrea* sp., *Astreopora* sp., *Ctenactis* sp., *Cyphastrea* sp., *Dipsastrea* sp., *Echinophyllia* sp., *Favia* sp., *Favites* sp., *Fungi asp*., *Galaxea* sp., *Goniastrea* sp., *Hydnophora* sp., *Isopora* sp., *Leptastrea* sp., *Leptoria* sp., *Leptoseris* sp., *Lithophyllon* sp., *Lobophyllia* sp., *Montipora* sp., *Pavona* sp., *Pocillopora* spp., *Porites* spp., *Psammocora* sp., and *Stylocoeniella* sp.) were recorded. The most common genus was *Porites,* 41% of the total. The most

Table 7. Total number of coral colonies and coral colony abundance (mean colonies per m²) counted on twelve transects along the Inner Breakwater.

Transect	Survey area (m²)	Coral count (colonies)	Coral abundance (no./m²)
I-1	50	230	4.6
I-5	44	188	4.3
I-9	50	201	4.0
I-13	50	230	4.6
I-17	50	202	4.0
I-21	50	283	5.7
I-25	50	214	4.3
I-29	50	274	5.5
I-33	50	223	4.5
I-37	50	168	3.4
40	50	80	1.6
41	50	113	2.3
Total	**594**	**2406**	**4.1**

common colony sizes were the smaller ones (1- to 5-cm class and 11- to 20 cm class; at 25% and 26%, respectively). Several very large (>160 cm) *Porites* colonies are present. Table 11 shows the morphology types of the colonies (by genus) observed at the Inner Breakwater. Encrusting and branching morphologies are most common (30% and 27%of the total, respectively).

Fish Abundance

Along the Inner Breakwater, the total count of fishes was 686. Large schools (110+ individuals) of Pacific bullethead parrotfish (*Chlorurus spilurus*), silversides (Atherinidae spp.) and convict tang (*Acanthurus triostegus*) are all common here.

Table 8. Number of coral colonies in each size class by species from twelve transects along the Inner Breakwater.

Taxa	Size class (cm)							Total	Percent of total
	1 to 5	6 to 10	11 to 20	21 to 40	41 to 80	81 to 60	>160		
Acanthastrea		2	3	3				8	***0.33%***
Acropora	2	11	10	7	2			32	***1.33%***
Astrea	1	4	3	1				9	***0.37%***
Astreopora		1	2	4	1			8	***0.33%***
Ctenactis				1				1	***0.04%***
Cyphastrea	3	1		2				6	***0.25%***
Dipsastrea	2	8	3	2	2			17	***0.71%***
Echinophyllia	1		2	2				5	***0.21%***
Favia	1	3	6	1				11	***0.46%***
Favites	7	8	6	7	1			29	***1.21%***
Fungia	2	6	1	1				10	***0.42%***
Galaxea	1	1						2	***0.08%***
Goniastrea	9	22	52	83	56	4		226	***9.39%***
Hydnophora		1	3	3	3			10	***0.42%***
Isopora				1				1	***0.04%***
Leptastrea	158	15						173	***7.19%***
Leptoria	1	3	7	8	4	1		24	***1.00%***
Leptoseris		2	2	1	1			6	***0.25%***
Lithophyllon		1	2					3	***0.12%***
Lobophyllia					1			1	***0.04%***
Montipora		2	1	11	5	4		23	***0.96%***
Pavona	5	5	7	7	5	1		30	***1.25%***
Pocillopora	124	223	250	33	2			632	***26.27%***
Porites	222	214	228	174	94	27	17	976	***40.57%***
Psammocora	6	17	32	23	10	1		89	***3.70%***
Stylocoeniella	54	16						70	***2.91%***
unidentified	2		1	1				4	***0.17%***
Total count	**601**	**566**	**621**	**376**	**187**	**38**	**17**	**2406**	
Percent of total	*24.98%*	*23.52%*	*25.81%*	*15.63%*	*7.77%*	*1.58%*	*0.71%*		

Table 9. Number of coral colonies in each size class by transect along the Inner Breakwater.

Size Class (cm)	Transect												
	I-1	I-5	I-9	I-13	I-17	I-21	I-25	I-29	I-33	I-37	I-40	I-41	**Total**
1 to 5	29	31	35	80	42	76	45	67	49	72	29	46	601
6 to 10	102	55	19	46	36	60	60	57	48	34	20	29	566
11 to 20	91	69	79	44	55	63	40	69	57	22	13	19	621
21 to 40	7	20	49	34	37	46	45	46	49	20	11	12	376
41 to 80	1	12	17	23	18	30	16	25	18	14	6	7	187
81 to 160	--	1	2	3	11	4	5	6	1	4	1	--	38
>160	--	--	--	--	3	4	3	4	1	2	--	--	17
Total	**230**	**188**	**201**	**230**	**202**	**283**	**214**	**274**	**223**	**168**	**80**	**113**	**2406**
Percent	**9.6%**	**7.8%**	**8.4%**	**9.6%**	**8.4%**	**11.8%**	**8.9%**	**11.4%**	**9.3%**	**7.0%**	**3.3%**	**4.7%**	

Table 10. Number of coral colonies in each genera by transect at the Inner Breakwater.

Genus	**Transect**												Total
	I-1	I-5	I-9	I-13	I-17	I-21	I-25	I-29	I-33	I-37	I-40	I-41	
Acanthastrea	--	1		1	1	3	1	1	--	--	--	--	**8**
Acropora	3	2	7	11	2	6	1		--	--	--	--	**32**
Astrea	--	--	--	1	4	1	1	2	--	--	--	--	**9**
Astreopora	--	--	--	1			1	1	3	2	--	--	**8**
Ctenactis	--	--	--	--	--	--	--	1	--	--	--	--	**1**
Cyphastrea	--	2	1	--	--	--	1		2		--	--	**6**
Dipsastrea	1	7	6	3	--	--	--	--	--	--	--	--	**17**
Echinophyllia	--	2	3	--	--	--	--	--	--	--	--	--	**5**
Favia	--	7	--	--	--	--	3	--	1		--	--	**11**
Favites	--	--	2	4	5	2	2	2	8	4	--	--	**29**
Fungia	--	--	--	--	--	--	6	--	3	--	1	--	**10**
Galaxea	--	1	1	--	--	--	--	--	--	--	--	--	**2**
Goniastrea	--	31	46	49	22	22	18	17	12	7	1	1	**226**
Hydnophora	--	1	3	2	--	1	2	1	--	--	--	--	**10**
Isopora	--	--	--	--	--	1	--	--	--	--	--	--	**1**
Leptastrea	8	5	10	40	8	30	27	14	4	23	1	3	**173**
Leptoria	2	6	6	2	1	5	1	--	--	1	--	--	**24**

Table 10 (continued).

Genus	**Transect** I-1	I-5	I-9	I-13	I-17	I-21	I-25	I-29	I-33	I-37	I-40	I-41	Total
Leptoseris	--	--	--	--	--	--	3	3	--	--	--	--	**6**
Lithophyllon	--	--	--	--	--	3	--	--	--	--	--	--	**3**
Lobophyllia	--	--	--	--	--	--	--	--	--	--	--	--	**1**
Montipora	--	--	6	--	1	1	--	5	5	4	--	1	**23**
Pavona	1	1	1	--	6	2	8	1	1	9	--	--	**30**
Pocillopora	211	112	97	47	37	40	25	16	12	8	14	13	**632**
Porites	3	5	10	46	90	140	99	182	156	95	59	91	**976**
Psammocora	1	5	1	4	12	17	12	23	4	4	3	3	**89**
Stylocoeniella	--	--	--	19	11	9	3	3	12	11	1	1	**70**
unidentified	--	--	1	--	2	--	--	1	--	--	--	--	**4**
Total	**230**	**188**	**201**	**230**	**202**	**283**	**214**	**274**	**223**	**168**	**80**	**113**	**2406**

Sumay Point

General Observations

The dominant bottom type at Sumay Point is sand, with rubble mixed with some limestone boulders. Man-made structures host macroalgae, sponges, soft coral and hard coral. The water depth of the survey area ranged from 0.6 to 1.2 m (2 to 4 ft).

Benthic Composition

One 50-m transect was used to assess the benthic community of the Sumay Point area. The results of the point-intercept survey are presented in Figure 10, which shows the dominant bottom type of macroalgae, at 34% of the total. Coral cover across the transect is low; less than 1%.

Coral Abundance and Size Class Distribution

Coral abundance determined at Sumay Point is displayed in Table 12. A total of 27 colonies, representing two coral taxa (*Leptastrea* sp. and *Pocillopora* spp.), was counted on the one transect. Average density of corals is 0.54 colony/m^2. Results of the coral size class survey are presented in Table 13. The most common genus was *Pocillopora*, at 93% of the total. The most common colony size was 11- to 20-cm; at 41%). No colonies larger than 40 cm across occur in the area. Table 14 presents the number of colonies by morphological types for each genus. Branching pocilloporids are most common, at 93% of the total.

Table 11. Number of colonies in each morphology by genus along the Inner Breakwater.

Genus	branching	columnar	columnar/ encrusting	corallith	digitate	encrusting	massive	mounding	pillar	plate	solitary	Total
Acanthastrea	--	--	--	--	--	7	--	1	--	--	--	8
Acropora	9	--	--	--	19	4	--	--	--	--	--	32
Astrea	--	--	--	--	--	5	--	4	--	--	--	9
Astreopora	--	--	--	--	--	2	1	5	--	--	--	8
Ctenactis	--	--	--	--	--	--	--	--	--	--	1	1
Cyphastrea	--	--	--	--	--	6	--	--	--	--	--	6
Dipsastrea	--	--	--	--	--	10	--	7	--	--	--	17
Echinophyllia	--	--	--	--	--	5	--	--	--	--	--	5
Favia	--	--	--	--	--	11	--	--	--	--	--	11
Favites	--	--	--	--	--	18	1	10	--	--	--	29
Fungia	--	--	--	--	--	--	--	--	--	--	10	10
Galaxea	--	--	--	--	--			2	--	--	--	2
Goniastrea	--	--	--	--	--	34	13	179	--	--	--	226
Hydnophora	--	--	--	--	--	5	--	5	--	--	--	10
Isopora	1	--	--	--	--		--	--	--	--	--	1
Leptastrea	--	--	--	--	--	173	--	--	--	--	--	173
Leptoria	--	--	--	--	--	23	--	1	--	--	--	24
Leptoseris	--	--	--	--	--	6	--		--	--	--	6
Lithophyllon	--	--	--	--	--		--		--	--	3	3
Lobophyllia	--	--	--	--	--	1	--		--	--	--	1
Montipora	--	--	--	--	--	23	--		--	--	--	23
Pavona	1	--	--	--	--	29	--		--	--	--	30
Pocillopora	632	--	--	--	--		--		--	--	--	632
Porites	--	1	1	25	--	212	--	329	80	328	--	976
Psammocora	7	--	--	--	--	77	--	5	--	--	--	89
Stylocoeniella	--	--	--	--	--	70	--	--	--	--	--	70
unidentified	--	--	--	--	--	4	--	--	--	--	--	4
Grand Total	**650**	**1**	**1**	**25**	**19**	**725**	**15**	**548**	**80**	**328**	**14**	**2406**

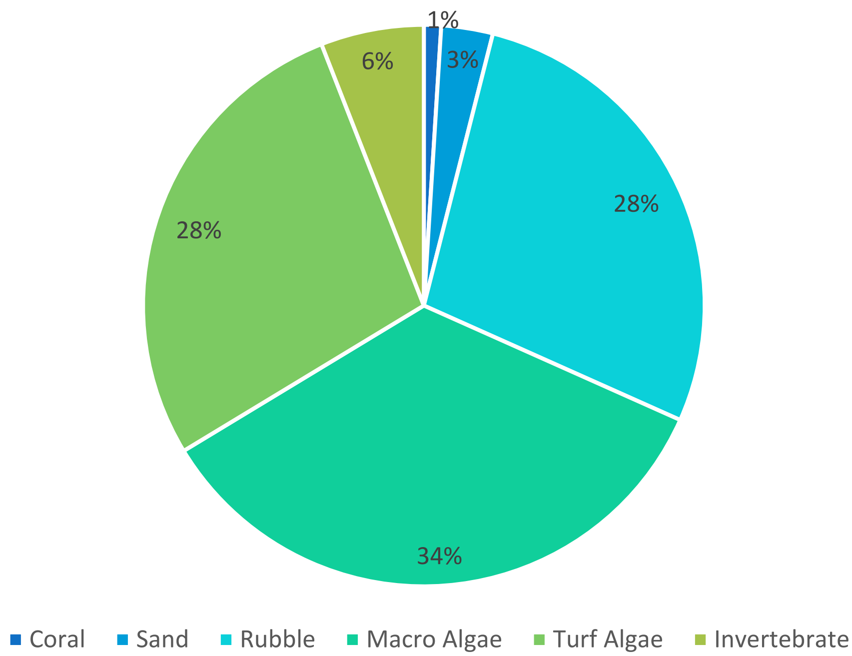

Figure 10. Percent benthic cover as measured using the point intercept along one 50-m transect at Sumay Point.

Table 12. Total number of coral colonies and coral colony abundance (mean colonies per m²) counted on one transect at Sumay Point.

Transect	Survey area (m^2)	Coral count (colonies)	Coral abundance (no./m^2)
1	50	27	0.54

Table 13. Number of coral colonies in each size class by species from one transect at Sumay Point

	Size class (cm)					
Taxa	**1 to 5**	**6 to 10**	**11 to 20**	**21 to 40**	**Total**	***Percent of total***
Leptastrea	2				2	***7.41%***
Pocillopora	6	6	11	2	25	***92.59%***
Total count	**8**	**6**	**11**	**2**	**27**	
Percent of total	*29.63%*	*22.22%*	*40.74%*	*7.41%*		

Table 14. Number of colonies in each morphology by genus at Sumay Point.

Genus	Morphology		Total
	branching	encrusting	
Leptastrea		2	2
Pocillopora	25		25
Total	**25**	**2**	**27**

Fish Abundance

At Sumy Point, a total of 65 fishes was recorded. Common species are Pacific bullethead parrotfish (*C. spilurus*) and brown tang (*Acanthurus nigrofuscus*).

EOD Seawall

General Observations

The EOD seawall is located along the entrance channel to Sumay Cove Marina. This area can be divided into three sections (shown in Figure 11): 1) an "inner section", with what appears to be a new concrete surface with concrete walkways overhanging intact sheet piles; 2) a "middle section", with a concrete wall and rusted bolts above the water surface; and 3) an "outer section", comprising a remnant sheet pile and exposed metal rusted "ribs".

In the inner section, water conditions are murky and seawall surfaces are silt covered, as is the adjacent seafloor. Here a few snails (*Nerita plicata*) occur, but very little biota was otherwise noted. Coral cover increases from entirely absent on the seawall and seafloor to common on both with distance toward Apra Harbor. Corals are primarily *Poc. damicornis* and *L. purpurea* on the seawall.

In the middle section, soft coral is abundant on the seawall and *Halimeda* sp. is abundant on the concave faces of the sheet piles. Seafloor coral distribution is patchy, consisting of a few large (>80 cm) *P. rus*. coral colonies, in some cases growing on debris. Seafloor corals show signs of stress, especially the pocilloporids; *Porites* have copious mucus and signs of bleaching. Fishes are sparse, usually associated with the large coral colonies.

The outer section has the greatest coral cover, as well as notable water movement. Many large *Poc. damicornis* colonies are common along the wall except near the seafloor. Also common are *P. lobata* and small, encrusting *L. purpurea* on the seawall. Fishes are more abundant here than in the inner section.

Benthic Composition

One 50-m transect was used to assess the benthic community at EOD Seawall. Results of the point-intercept survey are presented in Figure 12, which shows the dominant bottom type of silt, at 37% of the total. Coral cover across the transect is low, at 2%.

Figure 11. Representation of EOD seawall areas: 1) Outer, in teal; 2) Middle, in yellow; 3) Inner, in purple.

Coral Abundance and Size Class Distribution

Coral abundance determined on each transect is presented in Table 15. A total of 1583 colonies was counted in the EOD seawall area transects. Average density of corals on the structure and within approximately 3-m (9-ft) off the structure is 1.0 colony/m^2. Results of the coral size class survey are presented in Tables 16 through 18. The 1583 coral colonies represent at least 12 coral taxa (*Acropora* sp., *Astreopora* sp., *Favia* sp., *Galaxaura* sp., *Galaxea* sp., *Leptastrea* sp., *Montipora* sp., *Pavona* sp., *Pocillopora* spp., *Porites* spp. *Psammocora* sp. and *Stylocoeniella* sp.). The most

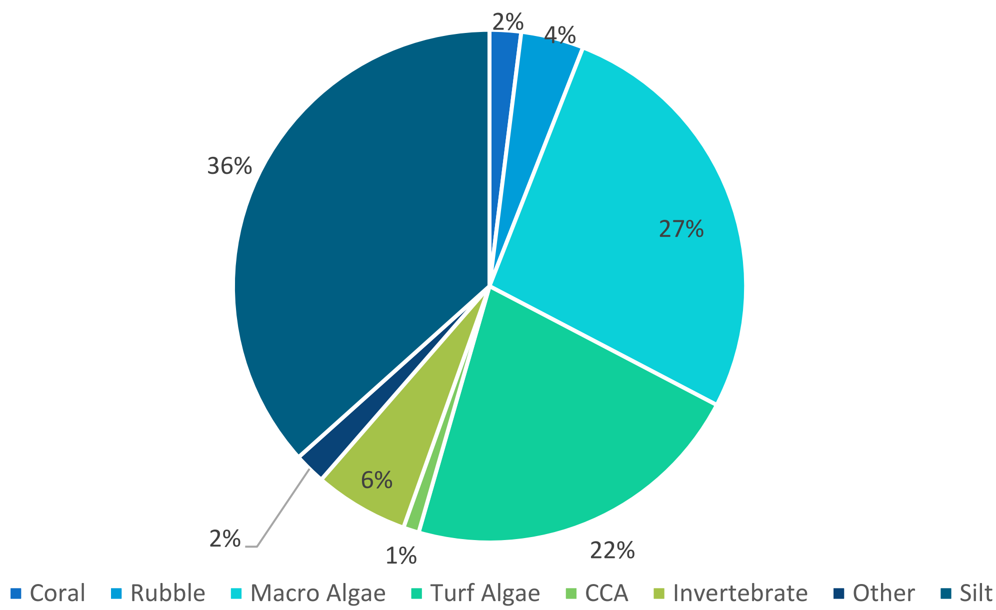

Figure 12. Percent benthic cover as measured using the point intercept along one 50-m transect at EOD seawall.

common genus was *Leptastrea* at 47% of the total. The most common colony size was the smallest (1- to 5-cm class; at 42%). Several very large (>160 cm) corals were observed in the survey area, most colonies *Porites* and one *Montipora.* Table 19 presents the morphological types of colonies observed at EOD Seawall. Over half of the colonies in the area are encrusting (57%).

Table 15. Total number of coral colonies and coral colony abundance (mean colonies per m²) counted on and around the EOD Seawall.

. Transect	Survey area (m²)	Coral count (colonies)	Coral abundance (no./m²)
2-m wide seafloor transect	250	348	1.4
3-m wide seafloor transect	540	447	0.8
Seawall	1098	788	0.7
Total	**1888**	**1583**	**1.0**

Fish Abundance

At EOD seawall, a total of 40 fishes was recorded, with *Chromis* sp. the most common.

Table 16. Number of coral colonies in each size class by genus on and around the EOD seawall.

Taxa	Size class (cm) 1 to 5	6 to 10	11 to 20	21 to 40	41 to 80	81 to 160	>160	Total	Percent of total
Acropora				1				1	***0.06%***
Astreopora		5	21	8	3			37	***2.34%***
Favia		1						1	***0.06%***
Galaxaura				1				1	***0.06%***
Galaxea			1	2				3	***0.19%***
Leptastrea	617	117	7					741	***46.84%***
Montipora		2	3	2	1	2	1	11	***0.70%***
Pavona		1	8	15	10			34	***2.15%***
Pocillopora	12	25	63	46				146	***9.17%***
Porites	33	77	172	190	99	13	13	597	***37.74%***
Psammocora		1		2	1			4	***0.25%***
Stylocoeniella	6	1						7	***0.44%***
Total count	**668**	**230**	**275**	**266**	**114**	**15**	**14**	**1583**	
Percent of total	*42.23%*	*14.54%*	*17.38%*	*16.81%*	*7.21%*	*0.95%*	*0.88%*		

Table 17. Number of coral colonies in each size class by transect at EOD seawall.

Size class (cm)	Transect: 2-m wide seafloor transect	3-m wide seafloor transect	Seawall	Total
1 to 5	9	40	619	668
6 to 10	43	60	127	230
11 to 20	120	125	30	275
21 to 40	116	142	9	267
41 to 80	41	70	3	114
81 to 160	11	4		15
>160	8	6		14
Total	**348**	**447**	**788**	**1583**

Table 18. Number of coral colonies in each genus by transect at EOD seawall.

Genus	Transect			Total
	2-m wide seafloor transect	3-m wide seafloor transect	Seawall	
Acropora	1			1
Astreopora	32	5		37
Favia	1			1
Galaxaura		1		1
Galaxea	3			3
Leptastrea	1	4	736	741
Montipora	5	6		11
Pavona	13	21		34
Pocillopora	73	26	46	145
Porites	216	376	5	597
Psammocora	1	3		4
Stylocoeniella	2	5		7
Total	**348**	**447**	**788**	**1583**

Table 19. Number of colonies in each morphology by genus at EOD Seawall.

Genus	Morphology							Total
	branching	encrusting	Foliose	mounding	mounding / encrusting	pillar/ plate	pillar	
Acropora	1							1
Astreopora				37				37
Favia		1						1
Galaxaura		1						1
Galaxea		3						3
Leptastrea	1	739		1				741
Montipora		11						11
Pavona	3	11	20					34
Pocillopora	141	5						146
Porites	12	117		287	45	131	5	597
Psammocora	3	1						4
Stylocoeniella		7						7
Grand Total	**161**	**896**	**20**	**325**	**45**	**131**	**5**	**1583**

EOD Point

General Observations

The western side of EOD Point area inventoried for corals included the face of a remnant sheet pile with exposed metal rusted "ribs". The outermost section of the EOD seawall (facing northwest) hosts pocilloporids and soft corals. Here the bottom type is rubble, with some boulders, macroalgae, and sponges. Depth at the corner of the EOD seawall is approximately 3.3 m (11 ft) and shoals to about 0.3 m (1 ft) deep near the corner.

In the eastern part of the survey area, the seawall turns into a short vertical concrete wall colonized by small encrusting *Leptastrea* sp., macroalgae, and turf algae. The bottom type adjacent to this wall is mostly limestone rubble with a few larger rubble pieces encrusted with macroalgae.

Benthic Composition

Two 50-m transects were used to assess the benthic community off EOD Point. The results of the point-intercept survey are presented in Figure 13, which shows dominant bottom types to be rubble, at 33% of the total and macroalgae, at 31% of the total. Coral cover across the transects is low, at 1%.

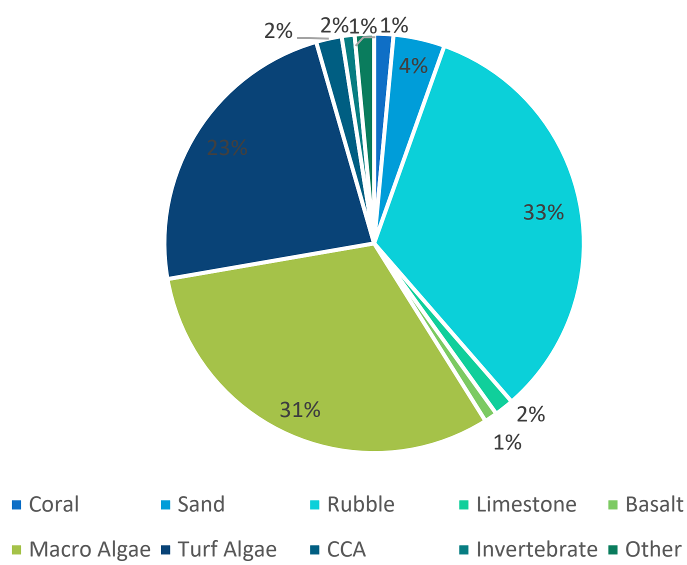

Figure 13. Percent benthic cover at EOD Point as measured using the point intercept along two 50-m transects.

Coral Abundance and Size Class Distribution

Coral abundance determined at EOD Point is presented in Table 20. A total of 538 colonies was counted in a 483 m^2 area. Average density of corals on the structure and within approximately 2-m (6.6-ft) around the structure is 1.1 colony/m^2. Results of the coral size class survey are presented in Table 21. A total of 538 coral colonies, representing at least 8 coral taxa (*Acropora* sp., *Cyphastrea* sp., *Favia* sp., *Leptastrea* sp., *Pavona* sp., *Pocillopora* spp., *Porites* spp. and *Psammocora* sp.) was recorded. The most common genus was *Leptastrea,* at 70% of the total. The most common colony size was the smallest (1- to 5-cm class; at 67%). Only a few colonies greater than 40 cm were observed.

Table 20. Total number of coral colonies and coral colony abundance (mean colonies per m^2) at EOD Point.

Survey area (m^2)	Coral count (colonies)	Coral abundance (no./m^2)
483	538	1.1

Table 21. Number of coral colonies in each size class by genus at EOD Point.

Taxa	Size class (cm)							Percent of total
	1 to 5	6 to 10	11 to 20	21 to 40	41 to 80	81 to 160	Total	
Acropora		1	1	4			6	***1.12%***
Cyphastrea				1			1	***0.19%***
Favia		1					1	***0.19%***
Leptastrea	341	37	2				380	***70.63%***
Pavona		1	8	3			12	***2.23%***
Pocillopora	12	17	60	18			107	***19.89%***
Porites	10	1	8	7	3	1	30	***5.58%***
Psammocora			1				1	***0.19%***
Total count	**363**	**58**	**80**	**33**	**3**	**1**	**538**	
Percent of total	*67.47%*	*10.78%*	*14.87%*	*6.13%*	*0.56%*	*0.19%*		

Fish Abundance

At EOD Point, a total of 244 fishes were recorded. Common species include: silversides, (Atherinidae), surgeonfishes (*A. triostegus* and other *Acanthurus* spp.), and parrotfishes (*Scarus* spp.).

Polaris Point

General Observations

An old boat ramp and channel occur In the Polaris Point embayment with degraded piles and submerged collapsed concrete structures and other debris. Beside the channel, water depth is shallow and the bottom type is mostly limestone rubble. Visibility is poor and live corals are sparse. The channel depth reaches at least 10 m (30 ft) with large coral colonies occurring on the channel wall. The area just off the Point had a moderate amount of coral cover, mosly present on the concrete debris. The channel beside Fantasy Island is boulder lined along the west side, with a cyanobacteria "alga" covering the boulders. Limited coral cover was observed on the west side. However, an abundance of *Porites* sp. occurs along the bottom and the east side of the channel. Beyond the channel, coral is more common offshore near a drop off into deeper water.

Benthic Composition

Four 50-m transects were used to assess the benthic community off Polaris Point. The results of the point-intercept survey are presented in Figure 14 showing the dominant bottom types to be rubble, at 49% of the total, and macroalgae, at 31% of the total. Coral cover across the transects is low, at 1%.

Coral Abundance and Size Class Distribution

Coral abundance determined on each transect is presented in Table 22. A total of 469 colonies was counted on nine transects. Average density of corals on the structures and within 3 m (9 ft) from the shoreline is 1.3 colony/m^2. Results of the coral size class survey are presented in Tables 23 and 24. Represented are at least 4 coral taxa (*Leptastrea* sp., *Pavona* sp., *Pocillopora* spp., and *Porites* spp.). The most common genus was *Porites,* at 71% of the total. The most common colony sizes were 11- to 20-cm and 21 – to 40 cm class; at 28% and 30%, respectively. Thirty coral colonies greater than 40 cm were observed; no colonies larger than 80 cm were observed. Of the nine transects surveyed off Polaris Point, Transect "PP-29" contained the greatest abundance of colonies, as well as the majority of the larger (>40cm) colonies (Table 24). Table 25 presents the number of coral colonies in each genus by transect. Transect "PP-5" contained only one genus (*Porites*). Most colonies off Polaris Point had a mounding morphology (Table 26).

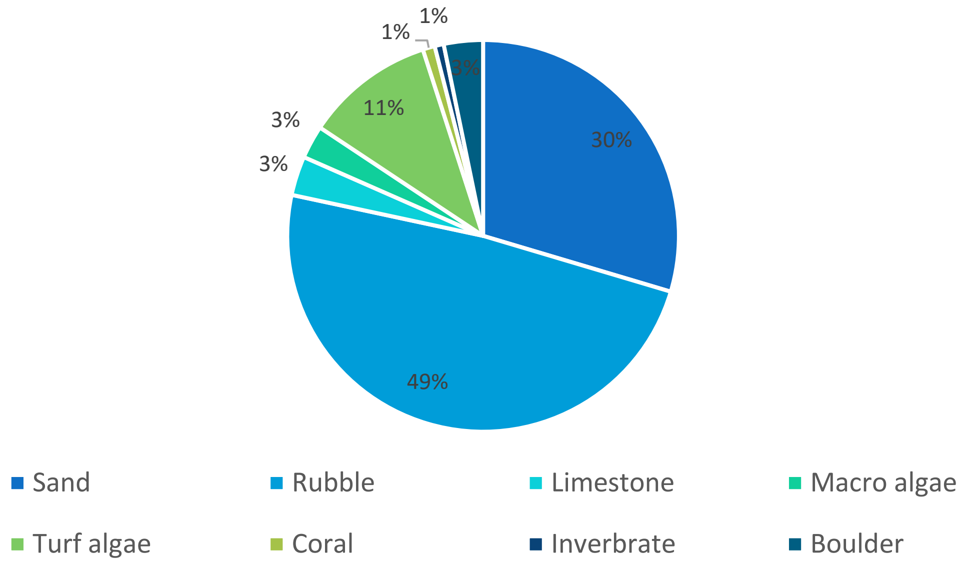

Figure 14. Percent benthic cover at Polaris Point as measured using the point intercept along four 50-m transects.

Table 22. Total number of coral colonies and coral colony abundance (mean colonies per m²) counted on eight transects at Polaris Point.

Transect	Survey area (m^2)	Coral count (colonies)	Coral abundance (no./m^2)
PP-1	50	21	0.4
PP-5	50	3	0.1
PP-13	50	30	0.6
PP-17	50	133	2.7
PP-21	50	15	0.3
PP-25	50	62	1.2
PP-29	50	172	3.4
PP-9	7.2	33	4.6
Total	**371.2**	**469**	**1.3**

Table 23. Number of coral colonies in each size class by species from nine transects at Polaris Point.

	Size class (cm)						
Taxa	**1 to 5**	**6 to 10**	**11 to 20**	**21 to 40**	**41 to 80**	**Total**	***Percent of total***
Leptastrea	36	7	1			44	***9.38%***
Pavona				1		1	***0.21%***
Pocillopora	11	30	42	8	1	92	***19.62%***
Porites	35	49	88	131	29	332	***70.79%***
Total count	**82**	**86**	**131**	**140**	**30**	**469**	
Percent of total	*17.48%*	*18.34%*	*27.93%*	*29.85%*	*6.40%*		

Table 24. Number of coral colonies in each size class by transect at Polaris Point.

	Transect								
Size Class (cm)	PP-1	PP-5	PP-9	PP-13	PP-17	PP-21	PP-25	PP-29	**Total**
1 to 5	2	1	6	6	11	2	25	29	82
6 to 10	8	2	5	1	27	4	12	27	86
11 to 20	7		11	11	41	6	8	47	131
21 to 40	3		8	9	47	2	14	57	140
41 to 80	1		3	3	7	1	3	12	30
Total	**21**	**3**	**33**	**30**	**133**	**15**	**62**	**172**	**469**
Percent of total	***4.5%***	***0.6%***	***7.0%***	***6.4%***	***28.4%***	***3.2%***	***13.2%***	***36.7%***	

Table 25. Number of coral colonies in each genus by transect at Polaris Point.

	Transect								
Genus	PP-1	PP-5	PP-9	PP-13	PP-17	PP-21	PP-25	PP-29	**Total**
Leptastrea	1		2	3	1		28	9	44
Pavona			1						1
Pocillopora	15		2	6	12	1	6	50	92
Porites	5	3	28	21	120	14	28	113	332
Total	**21**	**3**	**33**	**30**	**133**	**15**	**62**	**172**	**469**

Table 26. Number of colonies in each morphology by genus at Polaris Point.

	Morphology						
Genus	**branching**	**encrusting**	**fragment**	**mounding**	**mounding/ encrusting**	**plate/ pillar**	**Total**
Leptastrea		44					44
Pavona		1					1
Pocillopora	92						92
Porites		34	1	277	4	16	332
Total	**92**	**79**	**1**	**277**	**4**	**16**	**469**

Fish Abundance

At Polaris Point, a total of 114 fishes were recorded. The majority of these fish observed were silversides,.

Fish species richness and diversity

Fish species richness for each Project area survey are presented in Figure 15. Species richness varied between 6 and 47 species per survey area. The Inner Breakwater had the greatest species richness at 47 species and the EOD seawalls had the lowest, at 6 species. Mean species richness within the Project areas (all survey areas combined) was 17.2 fish species.

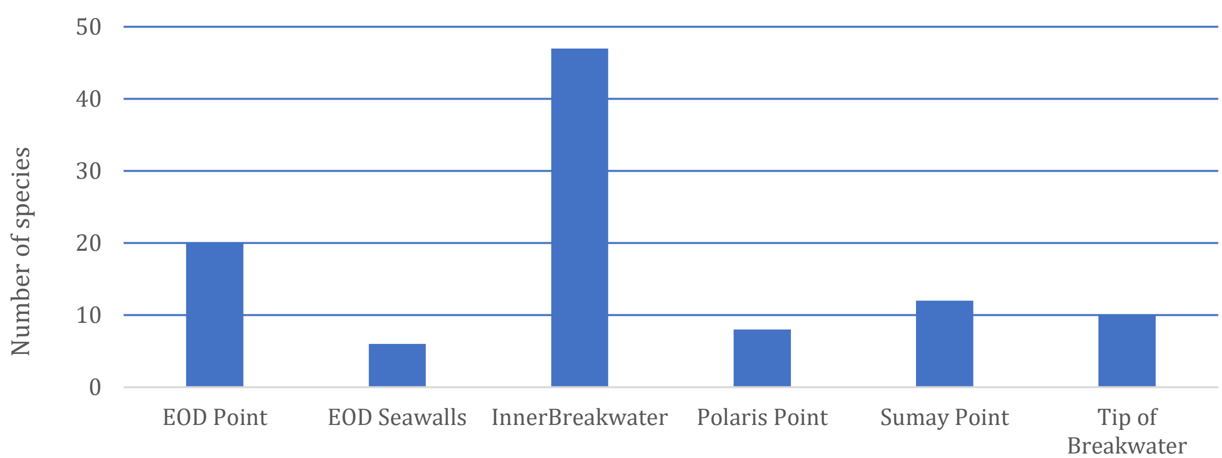

Figure 15. Fish species richness for each Project area.

Fish species diversity (H') for each Project area is presented in Figure 16. Species diversity combines the number of species and the abundance of each species. Fish diversity ranged from 0.5 at Polaris Point to 3.1 at the Inner Breakwater. Overall mean diversity for the entire survey (all Project areas combined) was 1.8.

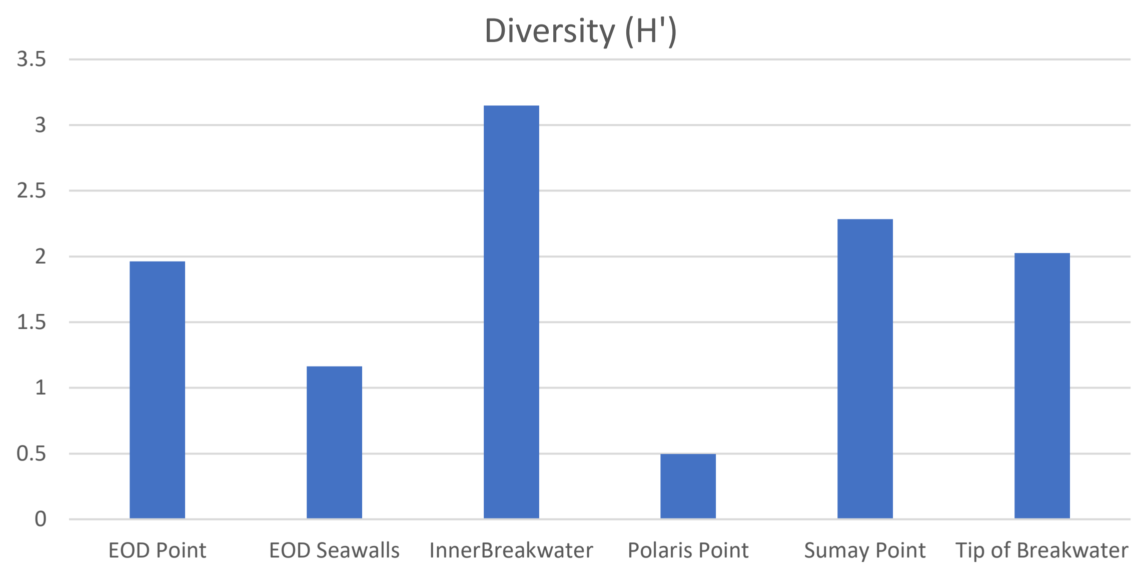

Figure 16. Fish diversity (H') all Project areas.

Discussion and Recommendations

Listed and Protected Species

One federally-listed (endangered or threatened; USFWS and NOAA-NMFS, 2016; USFWS, undated) marine species—the hard coral, *Acropora globiceps*—was encountered in our survey[2] (Figure. 11). One candidate species, giant clam (*Tridacna spp.*) was observed throughout the Project area, across all survey sites. Federally-listed marine species that occur within Guam are provided in Table 15, below. Some of these species may occur in the general vicinity of the Project, considering the distribution of these species and their occurrences around Guam.

On November 27, 2020, NOAA issued a proposed rule to designate critical habitat for the seven threatened corals in U.S. waters in the Indo-Pacific (*Acropora globiceps, Acropora jacquelineae, Acropora retusa, Acropora speciosa, Euphyllia paradivisa, Isopora crateriformis,* and *Seriatopora aculeata*) pursuant to section 4

[2] Species identification was verified through pictures by coral taxonomist expert, Doug Fenner, during an in-person workshop conducted April 12, 2024.

Figure 17. The ESA-listed coral, *Acropora globiceps*, was observed throughout the Breakwater area. Here our diver is measuring and photographing an *A. globiceps* colony.

Table 27. ESA-listed marine species for Guam.

Common Name	Scientific Name	ESA Listing Status
Marine Mammals		
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Western North Pacific Humpback Whale	*Megaptera novaeangliae*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Dugong*	*Dugong dugon*	Endangered

Table 27 (continued).

Common Name	Scientific Name	ESA Listing Status
Sea Turtles		
Central West Pacific Green Turtle	*Chelonia mydas*	Endangered
Hawksbill Turtle	*Eretmochelys imbricata*	Endangered
Leatherback Turtle	*Dermochelys coriacea*	Endangered
North Pacific Loggerhead Turtle	*Caretta caretta*	Endangered
Olive Ridley Turtle	*Lepidochelys olivacea*	Endangered
Fishes		
Indo-West Pacific Scalloped Hammerhead Shark	*Sphyrna lewini*	Threatened
Giant Manta Ray	*Manta birostris*	Threatened
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Threatened
Invertebrates		
Coral	*Acropora globiceps*	Threatened
Giant Clams	*Tridacna derasa*	Candidate
Giant Clams	*Tridacna squamosa*	Candidate
Giant Clams	*Tridacna gigas*	Candidate
Giant Clams	*Hippopus hippopus*	Candidate

* Dugongs are under the jurisdiction of the U.S. Fish and Wildlife Service.

of the Endangered Species Act (ESA; NOAA-NMFS, 2020). Comments on the proposed rule were received by January 26, 2021. Based on public comments and new information regarding the interpretation of the records of the listed corals and application to critical habitat, a substantial revision of the proposed rule was warranted. Accordingly, on November 30, 2023, NOAA withdrew the 2020 proposed rule and published a new proposed rule (NOAA-NMFS, 2023). The new proposed rule would designate critical habitat for five of the seven coral species that were addressed in the 2020 proposed rule: *Acropora globiceps*, *Acropora retusa*, *Acropora speciosa*, *Euphyllia paradivisa* and *Isopora crateriformis* and includes select locations in the waters around 16 island units in American Samoa, Commonwealth of the Northern Marianas Islands, Guam, Northwestern Hawaiian Islands and Pacific Remote Island Area. Apra Harbor is excluded from critical habitat and considered ineligible for designation. Comments on the proposed rule were received by February 28, 2024.

Listed and Protected Species Distribution

We observed a total of 85 colonies of the ESA-listed coral, *A. globiceps* in the Project area, all found in the Inner and Outer Breakwater survey areas. Table 28 provides the coordinates of the location of these colonies. Additionally, the ESA-candidate species (*Tridacna* spp.) were found at several of the Project areas. Table 29 provides the coordinates of the location of these clams. Figure 18 presents the locations of the ESA-listed coral and candidate species giant clams along the Breakwater.

Table 28. ESA-listed coral, *A. globiceps*, locations within the Project area.

Project Survey Area	Coordinates		Species	Size class (cm)	Notes
Tip of Breakwater	13.454317	144.625230	*A. globiceps*	11-20	
Inner Breakwater	13.459967	144.631913	*A. globiceps*	11-20	
Inner Breakwater	13.459067	144.630947	*A. globiceps*	11-20	
Inner Breakwater	13.458998	144.630802	*A. globiceps*	11-20	
Inner Breakwater	13.458934	144.630709	*A. globiceps*	11-20	
Inner Breakwater	13.458857	144.630555	*A. globiceps*	11-20	
Inner Breakwater	13.458869	144.630563	*A. globiceps*	11-20	
Inner Breakwater	13.458608	144.629700	*A. globiceps*	11-20	
Inner Breakwater	13.458205	144.628847	*A. globiceps*	11-20	
Inner Breakwater	13.457516	144.627526	*A. globiceps*	11-20	Bleached
Inner Breakwater	13.457566	144.627486	*A. globiceps*	11-20	
Inner Breakwater	13.457482	144.627432	*A. globiceps*	11-20	
Inner Breakwater	13.457144	144.626933	*A. globiceps*	11-20	1% dead
Inner Breakwater	13.456981	144.626756	*A. globiceps*	11-20	
Inner Breakwater	13.456928	144.626706	*A. globiceps*	21-40	
Inner Breakwater	13.456905	144.626564	*A. globiceps*	21-40	
Inner Breakwater	13.456699	144.626452	*A. globiceps*	21-40	
Inner Breakwater	13.456631	144.626345	*A. globiceps*	21-40	
Inner Breakwater	13.456588	144.626255	*A. globiceps*	21-40	
Inner Breakwater	13.456514	144.626280	*A. globiceps*	21-40	
Inner Breakwater	13.456444	144.626215	*A. globiceps*	21-40	
Inner Breakwater	13.456335	144.626019	*A. globiceps*	21-40	
Inner Breakwater	13.456056	144.625853	*A. globiceps*	21-40	
Inner Breakwater	13.455821	144.625584	*A. globiceps*	21-40	
Inner Breakwater	13.463999	144.637686	*A. globiceps*	21-40	
Inner Breakwater	13.454317	144.625230	*A. globiceps*	21-40	15% dead
Inner Breakwater	13.457144	144.626933	*A. globiceps*	21-40	
Outer Breakwater	13.458936	144.628601	*A. globiceps*	21-40	

Table 28 (continued).

Project Survey Area	Coordinates		Species	Size class (cm)	Notes
Outer Breakwater	13.458665	144.627975	*A. globiceps*	21-40	
Outer Breakwater	13.458466	144.627392	*A. globiceps*	21-40	
Outer Breakwater	13.458305	144.627188	*A. globiceps*	6-10	
Outer Breakwater	13.458100	144.626801	*A. globiceps*	6-10	
Outer Breakwater	13.457635	144.626188	*A. globiceps*	6-10	10% dead
Outer Breakwater	13.459678	144.630470	*A. globiceps*	not available	
Outer Breakwater	13.459628	144.630217	*A. globiceps*	not available	
Outer Breakwater	13.459555	144.630054	*A. globiceps*	not available	
Outer Breakwater	13.459150	144.629049	*A. globiceps*	not available	
Outer Breakwater	13.458972	144.628869	*A. globiceps*	not available	
Outer Breakwater	13.458972	144.628869	*A. globiceps*	not available	
Outer Breakwater	13.458758	144.628261	*A. globiceps*	not available	
Outer Breakwater	13.458618	144.627931	*A. globiceps*	not available	
Outer Breakwater	13.458548	144.627815	*A. globiceps*	not available	
Outer Breakwater	13.458447	144.627357	*A. globiceps*	not available	
Outer Breakwater	13.458447	144.627357	*A. globiceps*	not available	
Outer Breakwater	13.458447	144.627357	*A. globiceps*	not available	
Outer Breakwater	13.458263	144.627150	*A. globiceps*	not available	
Outer Breakwater	13.458263	144.627150	*A. globiceps*	not available	
Outer Breakwater	13.458263	144.627150	*A. globiceps*	not available	
Outer Breakwater	13.458186	144.627007	*A. globiceps*	not available	
Outer Breakwater	13.458186	144.627007	*A. globiceps*	not available	
Outer Breakwater	13.458186	144.627007	*A. globiceps*	not available	
Outer Breakwater	13.457984	144.626695	*A. globiceps*	not available	
Outer Breakwater	13.457984	144.626695	*A. globiceps*	not available	
Outer Breakwater	13.457984	144.626695	*A. globiceps*	not available	
Outer Breakwater	13.457893	144.626601	*A. globiceps*	not available	
Outer Breakwater	13.457893	144.626601	*A. globiceps*	not available	
Outer Breakwater	13.457841	144.626469	*A. globiceps*	not available	
Outer Breakwater	13.457841	144.626469	*A. globiceps*	not available	
Outer Breakwater	13.457841	144.626469	*A. globiceps*	not available	
Outer Breakwater	13.457766	144.626358	*A. globiceps*	not available	
Outer Breakwater	13.457306	144.625898	*A. globiceps*	not available	
Outer Breakwater	13.455004	144.623965	*A. globiceps*	not available	
Outer Breakwater	13.464557	144.637318	*A. globiceps*	not available	
Outer Breakwater	13.464363	144.636689	*A. globiceps*	not available	
Outer Breakwater	13.464167	144.636215	*A. globiceps*	not available	
Outer Breakwater	13.463224	144.634907	*A. globiceps*	not available	
Outer Breakwater	13.462926	144.634563	*A. globiceps*	not available	
Outer Breakwater	13.462044	144.633316	*A. globiceps*	not available	

Table 28 (continued).

Project Survey Area	Coordinates		Species	Size class (cm)	Notes
Outer Breakwater	13.461451	144.632688	*A. globiceps*	not available	
Outer Breakwater	13.459917	144.630818	*A. globiceps*	not available	
Outer Breakwater	13.459891	144.630738	*A. globiceps*	not available	
Outer Breakwater	13.461821	144.633170	*A. globiceps*	not available	
Outer Breakwater	13.461793	144.633170	*A. globiceps*	not available	
Outer Breakwater	13.461281	144.632482	*A. globiceps*	not available	
Outer Breakwater	13.459594	144.630236	*A. globiceps*	not available	
Outer Breakwater	13.459608	144.630215	*A. globiceps*	not available	
Outer Breakwater	13.462005	144.633381	*A. globiceps*	not available	
Outer Breakwater	13.462510	144.634080	*A. globiceps*	not available	
Outer Breakwater	13.463345	144.635039	*A. globiceps*	not available	
Outer Breakwater	13.462746	144.634332	*A. globiceps*	not available	
Outer Breakwater	13.462332	144.633833	*A. globiceps*	not available	

Table 29. ESA-candidate species, *Tridacna* sp. locations within the Project area.

Project Survey Area	Coordinates		Species
Outer Breakwater	13.461582	144.632874	*Tridacna* sp.
Outer Breakwater	13.461085	144.632233	*Tridacna* sp.
Outer Breakwater	13.461039	144.632165	*Tridacna* sp.
Inner Breakwater	13.461348	144.633637	*Tridacna* sp.
Inner Breakwater	13.458415	144.629261	*Tridacna* sp.
Inner Breakwater	13.456330	144.626029	*Tridacna* sp.
Inner Breakwater	13.455792	144.625596	*Tridacna* sp.
Inner Breakwater	13.455388	144.625258	*Tridacna* sp.
Inner Breakwater	13.456490	144.626227	*Tridacna* sp.
Inner Breakwater	13.456796	144.626450	*Tridacna* sp.
Inner Breakwater	13.456982	144.626691	*Tridacna* sp.
Inner Breakwater	13.457830	144.628190	*Tridacna* sp.
Inner Breakwater	13.454549	144.624332	*Tridacna* sp.
EOD Seawalls	13.443847	144.657565	*Tridacna* sp.
EOD Point	13.443656	144.657678	*Tridacna* sp.
EOD Point	13.443482	144.658161	*Tridacna* sp.

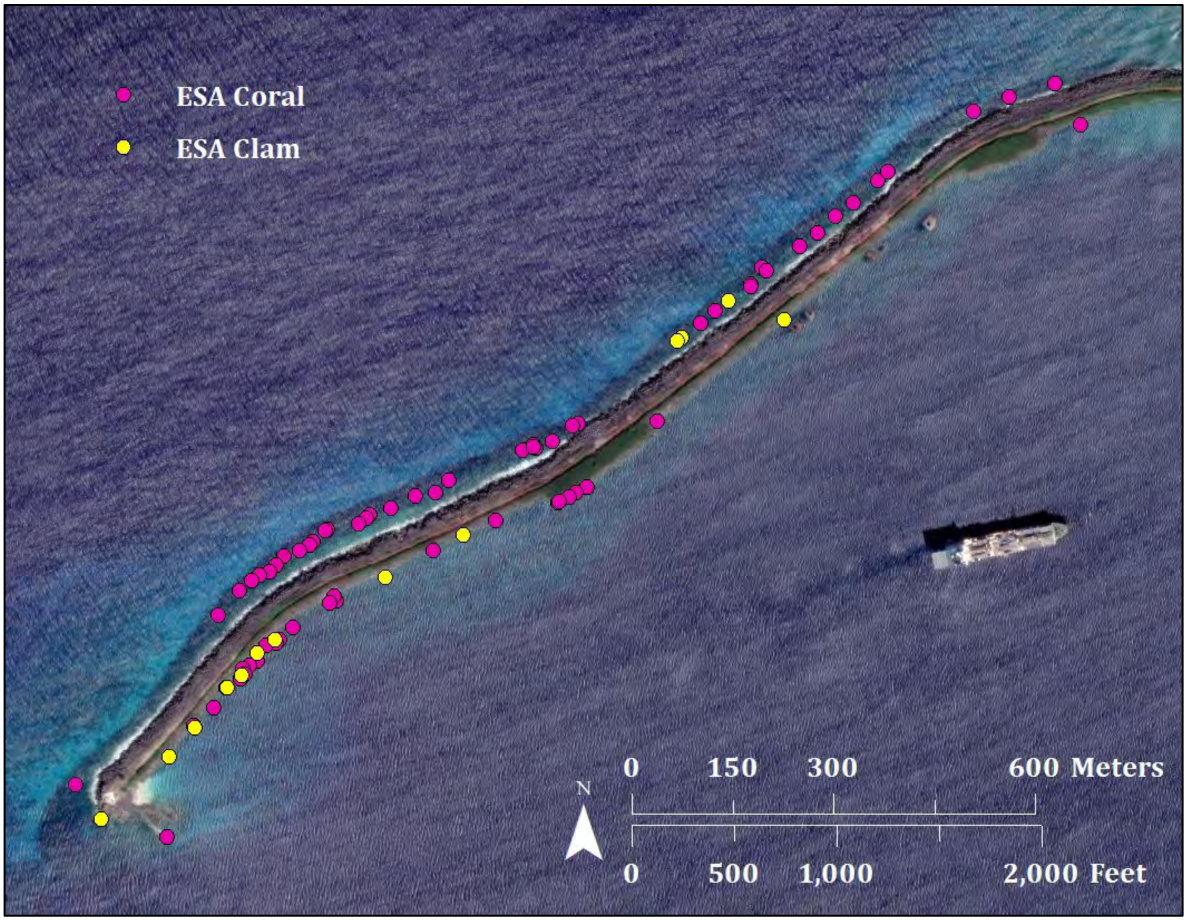

Figure 18. Locations of ESA-listed coral and ESA-candidate clam at the Breakwater (Inner Outer and Tip locations). Pink dots indicate coral and yellow dots indicate clam.

Impact Assessment

The proposed improvements to structures in Apra Harbor include potential demolition of some existing structures, which will result in a permanent loss of marine resources. It is anticipated that all corals occurring on the areas of improvements of the structure and in the surrounding area would be directly impacted. These corals provide ecological services to the coral reef ecosystem: shelter, reef consolidation, food for corallivores, and coral gametes. Impacts to corals could be minimized by relocating those coral heads suitable for transplantation.

Mitigation

Mitigating impacts to marine resources is a sequential process of avoiding impacts, minimizing impacts, and then compensating for unavoidable adverse impacts. The first step is to avoid impacts through project design. The second step, after avoidance measures have been incorporated, is to minimize remaining impacts. If unavoidable impacts still exist after avoidance and minimization, then replacement of lost ecosystem functions and values is appropriate. This last step is called compensatory mitigation (Bentivoglio, 2003). Project design decisions should incorporate measures to avoid and minimize impacts to marine communities associated with beach stabilization to the extent possible.

The United States Coral Reef Task Force (USCRTF) has identified a portfolio of compensatory mitigation and restoration options (USCRTF, 2016) and a list of Best Management Practices (BMPs) that could be implemented to offset adverse impacts on coral reef communities from development projects. The USCRTF list was reviewed and screened for appropriateness to anticipated Project impacts, ability to successfully implement, and impacts already minimized by project specific BMPs. Possible avoidance and minimization measures that could be taken to offset adverse impacts are listed below.

Water quality improvements:
- Implement storm water BMPs

Coral response and rescue team:
- Move at-risk corals from a project area

Offsite placement of structures to enhance substrate:
- Place material that mimics natural coral reef structure
- Deposit boulders or other suitable substrate material
- Place artificial reef modules

Nuisance species removal:
- Remove nuisance or invasive algae species

Coral Relocation

To avoid and minimize impacts to selected marine resources that occur in the Project area, any coral colonies and other macroinvertebrates (e.g., sea urchins, sea cucumbers) that occur within a direct impact area could be relocated to the extent practicable. Removing corals from the Project area and transplanting them to another site could avoid and minimize impacts to the coral assemblage. Coral relocation has been used as an offset measure for projects in Apra Harbor, with varying levels of success (PIRO, 2022; NOAA-NMFS, 2015). Criteria for coral relocation include corals that are expected to provide the greatest ecological value (larger size classes, like >40 cm), branching and mounding morphologies, and corals that have the greatest potential for survival. Approximately 1,295 colonies throughout the entire Project area are >40 cm and could potentially meet that and other criteria for relocation. Many of the colonies, in all size classes, are encrusting, not meeting criteria for relocation. Based on our survey, we estimated approximately 24% of the coral colonies in the Project area (1295 of the 4823 colonies) are suitable candidates for relocation. These colonies include mounding *Porites* spp. and *Pocillopora meandrina* colonies at 40 cm and greater size. Additionally, different macroinvertebrates are potential candidates for relocation, including urchins and sea cucumbers.

Indirect Impacts

Potential indirect impacts to coral reef ecosystems from construction activity of the Project may occur from degradation of water quality. Project construction may temporarily increase the amount of suspended sediment in the water column. Impacts to water quality associated with project activities could be short-term and temporary and can be minimized using appropriate construction BMPs.

The Project has the potential to interact directly or indirectly with ESA-listed species, such as corals and sea turtles, through the following stressors:

- behavioral changes in response to human activity and equipment operation;
- exposure to wastes and discharges.

Disturbance from human activity and equipment operation

The Project includes some work in and above marine waters where ESA-listed species may be directly exposed to Project activities. These animals may experience a startle reaction and stress if they encounter ongoing in-water work. Reactions could range from one extreme when an animal approaches to investigate the activity, to an opposite extreme of panicked flight resulting in injury in an attempt to flee. Because sea turtles and marine mammals typically avoid human activity, the expected impact of this interaction would be avoidance behavior leading to the animal leaving the Project area without injury. The likelihood of an adverse interaction could be reduced through a BMP of watching for and avoiding protected marine life before commencing work and by postponing certain activities when protected species are within 50 m (yds) of that activity.

Exposure to wastes and discharges

The proposed action may involve machinery and equipment on and near the water. Machinery and equipment can leak fuel, petroleum lubricants, and other hydrocarbon-based pollutants into marine waters. Local and federal regulations prohibit the intentional discharge of toxic wastes and plastics into the marine environment. Exposure to accidental wastes and discharges that may result from the proposed action are not expected to result in significant adverse effects to ESA-listed species so long as measures to limit massive spills are in place.

Effects on Critical Habitat

Because the Project is located in Apra Harbor, which is excluded from the critical habitat designation for listed coral species, the proposed action is not expected to result in significant adverse effects to proposed critical habitat.

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Appendix A

Listing and coordinates of start locations of all transects at each Project area surveyed in the Apra Harbor Project vicinity, Guam, February and March 2024.

Location	**Date**	**Transect**	**N**	**E**
Outer Breakwater	2/18/2024	O-1	13.464397	144.636946
Outer Breakwater	2/18/2024	O-2	13.464248	144.636474
Outer Breakwater	2/18/2024	O-3	13.464088	144.636087
Outer Breakwater	2/18/2024	O-4	13.463838	144.635697
Outer Breakwater	2/18/2024	O-5	13.463573	144.635357
Outer Breakwater	2/18/2024	O-6	13.463307	144.634992
Outer Breakwater	2/18/2024	O-7	13.463034	144.634637
Outer Breakwater	2/18/2024	O-8	13.4627	144.634325
Outer Breakwater	2/18/2024	O-9	13.462405	144.633961
Outer Breakwater	2/18/2024	O-10	13.462134	144.633591
Outer Breakwater	2/18/2024	O-11	13.461828	144.633256
Outer Breakwater	2/18/2024	O-12	13.461585	144.632893
Outer Breakwater	2/18/2024	O-13	13.461288	144.632572
Outer Breakwater	2/18/2024	O-14	13.460983	144.632216
Outer Breakwater	2/18/2024	O-15	13.460737	144.631875
Outer Breakwater	2/18/2024	O-16	13.460465	144.631505
Outer Breakwater	2/18/2024	O-17	13.460165	144.631185
Outer Breakwater	2/18/2024	O-18	13.459886	144.630812
Inner Breakwater	2/19/2024	I-1	13.454608	144.625479
Inner Breakwater	2/19/2024	I-2	13.45483	144.625092
Inner Breakwater	2/19/2024	I-3	13.455146	144.625039
Inner Breakwater	2/19/2024	I-4	13.455489	144.625333
Inner Breakwater	2/19/2024	I-5	13.455834	144.625631
Inner Breakwater	2/19/2024	I-6	13.456167	144.625855
Inner Breakwater	2/19/2024	I-7	13.456478	144.62618
Inner Breakwater	2/19/2024	I-8	13.456821	144.626477
Inner Breakwater	2/19/2024	I-9	13.457122	144.626844
Inner Breakwater	2/19/2024	I-10	13.457391	144.627206
Inner Breakwater	2/19/2024	I-11	13.457582	144.627628
Inner Breakwater	2/19/2024	I-12	13.457781	144.628058
Inner Breakwater	2/21/2024	O-13	13.457855	144.628182
Inner Breakwater	2/21/2024	O-14	13.458053	144.628611
Inner Breakwater	2/21/2024	O-15	13.458284	144.629085
Inner Breakwater	2/21/2024	O-16	13.458535	144.629545
Inner Breakwater	2/21/2024	O-17	13.458699	144.629911
Inner Breakwater	2/21/2024	O-18	13.458886	144.630335
Inner Breakwater	2/21/2024	O-19	13.458953	144.630758

Inner Breakwater	2/21/2024	O-20	13.459177	144.631149
Inner Breakwater	2/21/2024	O-21	13.459429	144.631536
Inner Breakwater	2/21/2024	O-22	13.459708	144.631881
Inner Breakwater	2/21/2024	O-23	13.460119	144.632175
Inner Breakwater	2/21/2024	O-24	13.460379	144.632519
Inner Breakwater	2/21/2024	O-25	13.460663	144.632872
Inner Breakwater	2/21/2024	O-26	13.460954	144.633208
Inner Breakwater	2/22/2024	O-27	13.461276	144.633607
Inner Breakwater	2/22/2024	O-28	13.461542	144.633925
Inner Breakwater	2/22/2024	O-29	13.461781	144.634247
Inner Breakwater	2/22/2024	O-30	13.462107	144.634586
Inner Breakwater	2/22/2024	O-31	13.462357	144.634903
Inner Breakwater	2/22/2024	O-32	13.462596	144.635212
Inner Breakwater	2/22/2024	O-33	13.46286	144.635536
Inner Breakwater	2/22/2024	O-34	13.463161	144.635901
Inner Breakwater	2/22/2024	O-35	13.463252	144.636286
Inner Breakwater	2/22/2024	O-36	13.463374	144.636675
Inner Breakwater	2/22/2024	O-37	13.463575	144.637104
Inner Breakwater	2/22/2024	O-38	13.463794	144.637273
Inner Breakwater	2/22/2024	O-39	13.46395	144.637502
Inner Breakwater	2/22/2024	O-40	13.464044	144.63783
Inner Breakwater	2/22/2024	O-41	13.464186	144.638297
Inner Breakwater	2/22/2024	O-42	13.464276	144.638756
Tip Breakwater	2/26/2024	T-1	13.454549	144.624332
Tip Breakwater	2/26/2024	T-2	13.454401	144.624779

Location	Date	Transect	N	E
Sumay Point	2/22/2024	S-1	13.443857	144.657549
EOD Seawalls	2/23/2024	EOD-1	13.443847	144.657565
EOD Seawalls	2/23/2024	EOD-2	13.443516	144.657144
EOD Seawalls	2/23/2024	EOD-3	13.44326	144.656949
EOD Seawalls	2/23/2024	EOD-4	13.441704	144.655837
EOD Seawalls	2/23/2024	EOD-5	13.441936	144.65603
EOD Seawalls	2/23/2024	EOD-6	13.442224	144.656222
EOD Seawalls	2/23/2024	EOD-7	13.442513	144.656443
EOD Point	2/23/2024	EOD-8	13.443847	144.657565
EOD Point	2/23/2024	EOD-9	13.443673	144.657543
EOD Point	2/23/2024	EOD-10	13.443498	144.657761
EOD Point	2/23/2024	EOD-11	13.443458	144.658127
EOD Point	2/23/2024	EOD-12	13.443497	144.658696

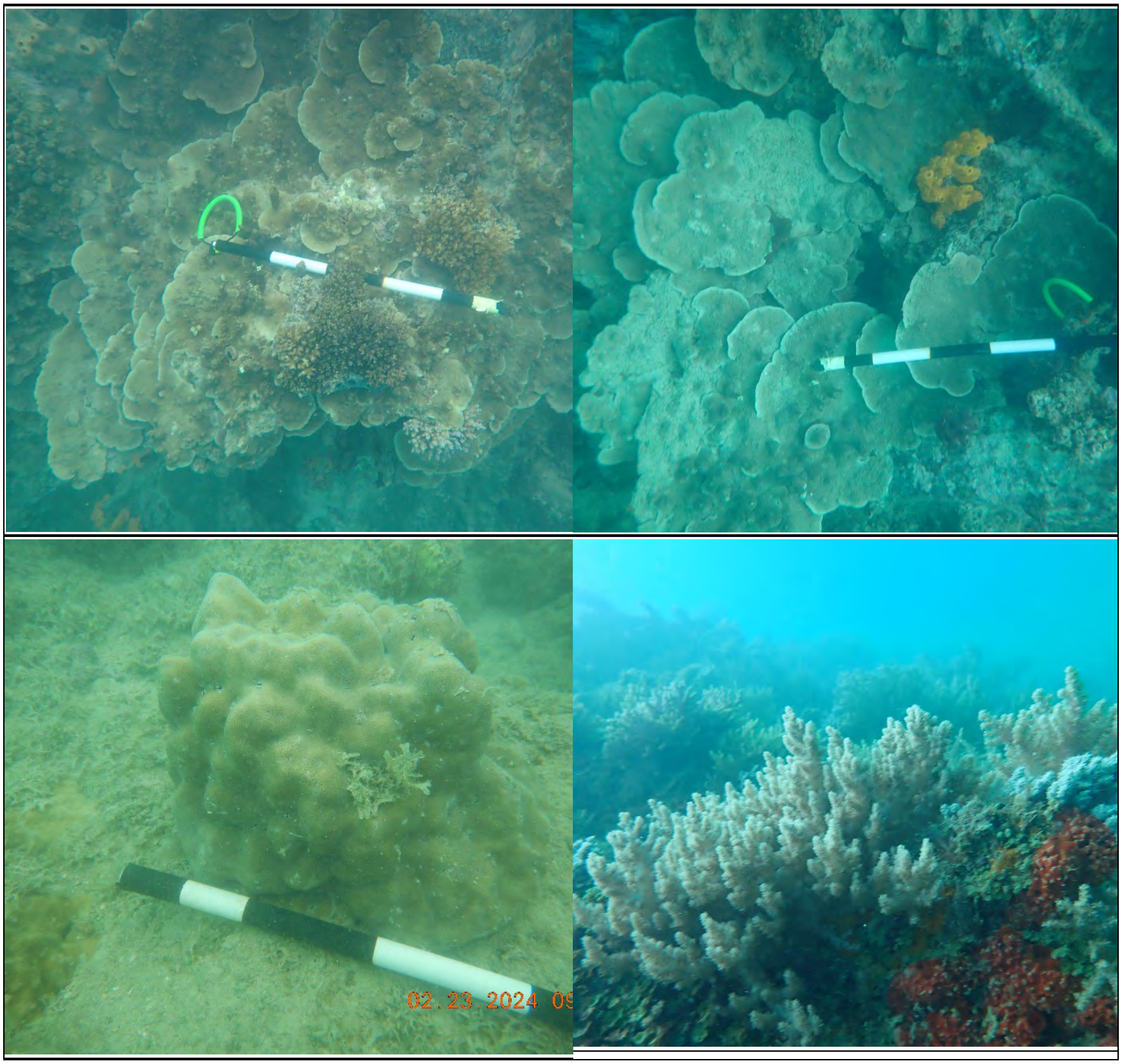
Appendix B

Representative photos of each Project area surveyed in the Apra Harbor Project vicinity, Guam, February and March 2024.

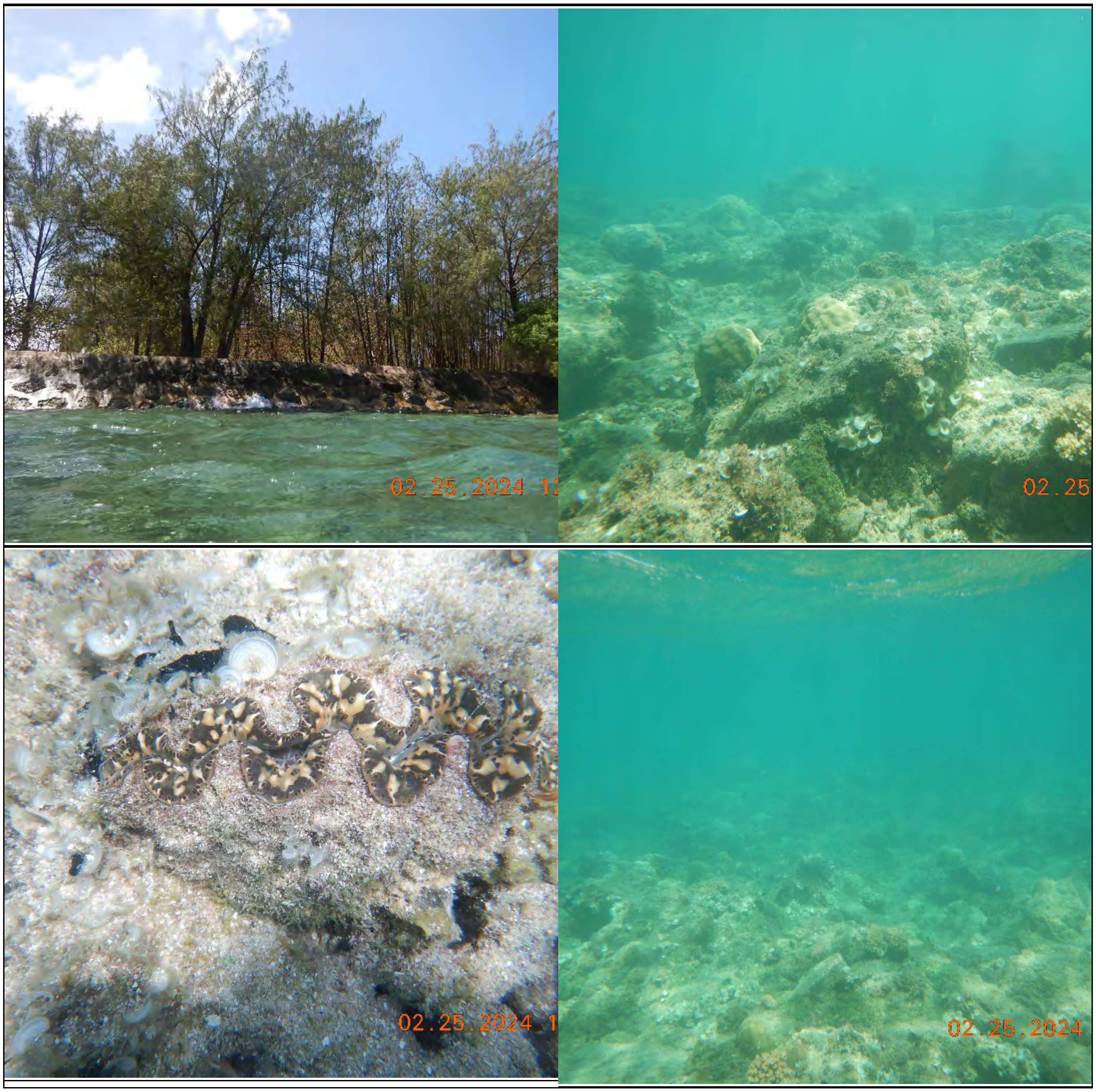
The Inner Breakwater is dominated by corals (top left and right). ESA-listed species (*Acropora globiceps*) heads were observed throughout the Inner Breakwater (bottom left). Large (>160 cm) colonies of *Porites* sp. occur off the Inner Breakwater (bottom right).

The Outer Breakwater is a high wave energy location, with schooling fish (top left). Large boulders host CCA and corals (*Pocillopora* spp. and *Porites* spp.; top right and bottom)

The shallow waters off Sumay Point, here showing sand bottom with scattered boulders. Coral cover is minimal on the boulders.



The EOD Seawalls and surrounding seafloor hosted large colonies of *Porites* spp. (top right and left; bottom left). Soft corals and sponges were abundant in this survey area (bottom right).



The hardened shoreline at EOD Point (top left). Across the rubble and boulder seafloor, scattered corals (*Porites* spp., *Pocillopora* spp.) occur (right top and bottom). ESA-candidate clams were observed at the EOD Point survey location (bottom left).

At Polaris Point, remnant piles (top left) and concrete slabs (top right) occur. Visibility was poor at the time of our surveys (bottom left). Scattered corals, including large *Porites* spp., occur on the seafloor (bottom right).

Appendix C

Inventory of marine biota observed in the Apra Harbor Project area and vicinity, Guam, February and March 2024.

PHYLUM CLASS ORDER FAMILY *Species*	Common name	Status	OB	IB	SP	Abundance EOD Walls	EOD Point	PP
				ALGAE				
CHLOROPHYTA	GREEN ALGAE							
ULVOPHYCEAE								
BRYOPSIDALES								
BRYOPSIDACEAE								
Bryopsis pennata J.V.Lamouroux		**Ind**		R				
CAULERPACEAE								
Caulerpa racemosa var. macrophysa (Sonder ex Kützing) W.R.Taylor		**Ind**		O				O
Caulerpa serrulata (Forsskål) J. Agardh		**Ind**		R				
CODIACEAE								
Tydemania expeditionis W. V. Bosse		**Ind**		O				
HALIMEDACEAE								
Chlorodesmis fastigiata (C.Agardh) S.C.Ducker		**Ind**	O					
Halimeda sp.		**--**		A				
Halimeda cuneata Hering		**Ind**				A		O
Halimeda opuntia (L.) Lamouroux		**Ind**		A	C			
CLADOPHORALES								
VALONIACEAE								
Valonia ventricosa J. Agardh		**Ind**		O				
CYANOBACTERIA	CYANOBACTERIA							
CYANOPHYCEAE								
COLEOFASCICULALES								
COLEOFASCICULACEAE								
Symploca hydnoides Kützing ex Gomont		**Ind**		O				
OCHROPHYTA	BROWN ALGAE							
PELAGOPHYCEAE								
FUCALES								
SARGASSACEAE								
Turbinaria ornata (Turner) J. Agardh		**Ind**		O	O			
SARCHINOCHRYSIDALES								
CHRYSOCYSTACEAE								
Chrysocystis fragilis Lobban, D.Honda & M.Chihara		**Ind**				U		
PHAEOPHYCEAE								
DICTYOTALES								

DICTYOTACEAE								
Dictyota grossedentata De Clerck & Coppejans		**Ind**		A	O			C
Padina boryana Thivy		**Ind**		C	O	U		C
RHODOPHYTA								
FLORIDEOPHYCEAE								
BONNEMAISONIALES								
BONNEMAISONIACEAE								
Asparagopsis taxiformis (Delile) Trevisan de Saint-Leon				R				
CORALLINALES								
LITHOPHYLLACEAE								
Amphiroa Tribulus (J. Ellis & Solander) J.V. Lamouroux				C				C
FLORIDEOPHYCEAE								
RHODOMELACEAE								
Acanthophora spicifera (M. Vahl) Borgesen								C
NEMALIALES								
GALAXAURACEAE								
Actinotrichia fragilis (Forsskål) Borgesen				O				
Dichotomaria marginata (J. Ellis & Solander) Lamarck					U			
LIAGORACEAE								
Ganonema farinosum (J.V. Lamouroux) K.-C. Fan & Y.-C. Wang					R			
INVERTEBRATES								
ANNELIDA								
POLYCHAETA								
SABELLIDA								
SABELLIDAE								
Sabellastarte sp.	feather duster worm	--				R		O
ARTHROPODA								
MALACOSTRACA								
Unid hermit crab			C	C	C	U	C	C
CNIDARIA								
ANTHOZOA								
OCTOCORALLIA	SOFT CORALS							
HELIOPORIDAE								
Heliopora coerulea (Pallas)	blue coral	**Ind**		U				
SINULARIIDAE								
Sinularia sp.		--		O	C	C	C	

XENIIDAE							
Asterospicularia randalli Gawel	cauliflower soft coral				C	A	
HEXACORALLIA							
SCLERACTINIA	HARD CORALS						
ACROPORIDAE							
Acropora sp.		--	C	C			U
Acropora digitifera (Dana)			O	U			
Acropora globiceps (Dana)			O				
Acropora humilis (Dana)			O	O			
Acropora hyacinthus (Dana)			C	C			
Acropora monticulosa (Bruggemann)				R			
Acropora nana (Studer)				U			
Acropora nasuta (Dana)			U	U			
Acropora palmerae Wells			O	O			
Acropora polystoma (Brook)			O	O			
Acropora retusa (Dana)			R	U			
Acropora tenuis (Dana)			U	U			
Acropora valida (Dana)				O			
Astreopora ocellata Bernard			U	U			
Astreopora gracilis Bernard				R			
Montipora sp.		--	O				
Montipora informis Bernard				U			
AGARICIIDAE							
Pavona chiriquiensis Glynn, Mate & Stemann			U				
Pavona decussata (Dana)		**Ind**					O
Pavona duerdeni Vaughan				R			
Pavona varians (Verrill)	false brain coral	**Ind**		O			R
ASTROCOENIIDAE							
Stylocoeniella armata (Ehrenberg)	thorn coral			O		O	
DIPLOASTRAEIDAE							
Diploastrea heliopora (Lamarck)		**Ind**	U	U			
EUPHYLLIIDAE							
Euphyllia glabrescens (Chamisso & Eysenhardt)	torch coral	**Ind**		R			
Galaxea fascicularis (L.)				O			
FUNGIIDAE							
Fungia fungites (L.)				O			
Lithophyllon concinna (Verrill)				U			
LEPTASTREIDAE							
Leptastrea sp.		--	U	U			U

Leptastrea purpurea (Dana)		**Ind**		C	O	A	A	
LOBOPHYLLIIDAE								
Echinophyllia orpheensis Veron & Pichon		**Ind**		R				
Lobophyllia hemprichii (Ehrenberg)				O				
Lobophyllia robusta Yabe & Sugiyama				R				
MERULINIDAE								
Astrea annuligera Edwards & Haime			R	R				
Astrea curta (Dana)			O	C				
Cyphastrea sp.		--		O			R	
Dipsastraea pallida (Dana)			U	O			R	
Favites sp.		--		O				
Goniastrea sp.		--	C	C				
Goniastrea edwardsi Chevalier				O				
Goniastrea retiformis (Lamarck)		**Ind**		C				
Hydnophora microconos (Lamarck)			U	O				
Leptoria phrygia (Ellis & Solander)		**Ind**	O	O				
Platygyra sinensis (Milne Edwards & Haime)			R	R				
POCILLOPORIDAE								
Pocillopora sp.		--	A	C			U	
Pocillopora ankeli Scheer & Pillai		**Ind**	C	C				
Pocillopora brevicornis Lamarck			C	O				
Pocillopora damicornis (L.)	lace coral	**Ind**		A	C	A	O	C
Pocillopora grandis (Dana)	antler coral	**Ind**	U	O				
Pocillopora ligulata Dana		**Ind**		A				
Pocillopora meandrina Dana	cauliflower coral	**Ind**	O	A				
Pocillopora verrucosa (Ellis & Solander)		**Ind**	O	C				
PORITIDAE								
Porites sp.		--	C	A	O	A	U	A
Porites cylindrica (Dana)				U		R		
Porites lichen (Dana)		**Ind**		A				
Porites rus (Forskål)		**Ind**	C	A		A		U
PSAMMOCORIDAE								
Psammocora sp.		--		R				
Psammocora nierstraszi (Van der Horst)	sandpaper coral	**Ind**		A			R	
HYDROZOA								
ANTHOATHECATA								
MILLEPORIDAE								
Millepora exaesa Forsskål	fire coral		U	U				

Millepora platyphylla (Hemprich & Ehrenberg)	fire coral		C			C		
SCYPHOZOA								
RHIZOSTOMEAE								
MASTIGIIDAE								
Mastigias papua (Lesson)	spotted jelly							R
ECHINODERMATA								
ASTEROIDEA								
VALVATIDA								
OPHIDIASTERIDAE								
Linckia laevigata (L.)		**Ind**		R	O	R		
Linckia multifora (Lamarck)		**Ind**		C				
OREASTERIDAE								
Culcita novaeguineae Müller & Troschel		**Ind**		R				
ECHINOIDEA								
CAMARODONTA								
ECHINOMETRIDAE								
Echinostrephus aciculatus A. Agassiz	needle-spined urchin	**Ind**	U	O	R			
Echinometra mathaei (Blainville)		**Ind**	R	R	R		R	
HOLOTHUROIDEA								
HOLOTHURIIDA	SEA CUCUMBERS							
HOLOTHURIIDAE								
Actinopyga mauritiana (Quoy & Gaimard)				O				
Actinopyga obesa (Selenka)	plump sea cucumber			U	R			
Actinopyga varians (Selenka)	white-spotted sea cucumber			R	R			
Bohadschia argus Jaeger	leopard sea cucumber	**Ind**		O				
Holothuria atra Jaeger		**Ind**		R	R			
SYNALLACTIDA								
STICHOPODIDAE								
Stichopus chloronotus Brandt		**Ind**	U	C	O	R	U	U
MOLLUSCA								
BIVALVIA								
CARDIIDA								
CARDIIDAE								
Tridacna maxima (Röding)	maxima clam, giant clam	**Ind**		Uf				
CEPHALOPODA								
OCTOPODA								
OCTOPODIDAE								

Octopus oliveri (S. S. Berry)						R
GASTROPODA						
CYCLONERITIDA						
NERITIDAE						
Nerita plicata L.				R		
NEOGASTROPODA						
CONIDAE						
Conus sp.		--			R	C
MURICIDAE						
Sistrum albolabris (Blainville)				R		
TROCHIDA						
TEGULIDAE						
Rochia nilotica (L.)	top shell	**Ind**		R		
PORIFERA						
DEMOSPONGIAE						
POECILOSCLERIDA						
MICROCIONIDAE						
Clathria (Thalysias) eurypa (de Laubenfels)				O		
TETHYIDA						
HEMIASTERELLIDAE						
Liosina paradoxa Thiele				R		
VERTEBRATES						
CHORDATA						
ASCIDIACEA						
PHLEBOBRANCHIA						
ASCIDIIDAE						
Ascidia dijmphniana (Traustedt)	yellow sea squirt			O		
CHONDRICHTHYES						
MYLIOBATIFORMES						
MOBULIDAE						
Mobula alfredi (Krefft)	reef manta ray			R		
TELEOSTEI	FISHES					
ACANTHURIFORMES						
ACANTHURIDAE						
Acanthurus blochii Valenciennes		**Ind**	C	C		
Acanthurus guttatus Forster	whitespotted surgeonfish	**Ind**	C	C		
Acanthurus lineatus (L.)	lined surgeonfish	**Ind**	C	C		
Acanthurus nigricans (L.)	whitecheek surgeonfish	**Ind**	C	C		
Acanthurus nigrofuscus (Forsskål)	lavender tang	**Ind**	C	A		
Acanthurus triostegus (L.)	convict tang	**Ind**	A	A		

Ctenochaetus striatus (Quoy & Gaimard)	lined bristletooth	**Ind**		R				
Naso hexacanthus (Bleeker)	sleek unicornfish	**Ind**		C				
Naso lituratus (Forster)	orangespine unicornfish	**Ind**	O	O				
Zebrasoma flavescens (Bennett)	yellow tang	**Ind**	U	O				
CHAETODONTIDAE								
Chaetodon bennetti Cuvier	eclipse butterflyfish	**Ind**		R		R		
Chaetodon citrinellus Cuvier	speckled butterflyfish	**Ind**		O				
Chaetodon ephippium Cuvier	saddleback butterflyfish	**Ind**		O				
Chaetodon lunula (Lacepède)		**Ind**		R				
Chaetodon lunulatus Quoy & Gaimard	oval butterflyfish	**Ind**		C				
Chaetodon ornatissimus Cuvier	ornate butterflyfish	**Ind**	O	O				
Chaetodon reticulatus Cuvier		**Ind**		C				
Chaetodon ulietensis Cuvier	Pacific double-saddle butterflyfish	**Ind**		O				
Forcipiger flavissimus Jordan & McGregor	forcepsfish	**Ind**	O	O				
EPHIPPIDAE								
Platax teira (Forsskål)	longfin batfish							R
HOLOCENTRIDAE								
Sargocentron spiniferum (Forsskål)	sabre squirrelfish							R
SIGANIDAE								
Siganus argenteus (Quoy & Gaimard)	rabbitfish	**Ind**		R				
ZANCLIDAE								
Zanclus cornutus (L.)		**Ind**	O	C				
AULOPIFORMES								
SYNODONTIDAE								
Synodus sp.		**--**		R				
Saurida gracilis (Quoy & Gaimard)	slender lizardfish			R				
BLENNIIFORMES								
BLENNIIDAE								
Plagiotremus laudandus (Whitley)	*bicolor fangblenny*	**Ind**		O				
CARANGIFORMES								
CARANGIDAE								
Caranx melampygus Cuvier	bluefin trevally	**Ind**	C	R			R	
CENTRARCHIFORMES								
CIRRHITIDAE								
Cirrhitus pinnulatus (Forster)		**Ind**		O	O			

Paracirrhites arcatus (Cuvier)	arceye hawkfish	**Ind**		R				
EUPERCARIA								
LABRIDAE								
Bodianus axillaris (Bennett)	axilspot hogfish	**Ind**		R				
Cheilinus fasciatus (Bloch)	redbreasted wrasse	**Ind**		C	U			
Epibulus insidiator (Pallas)	slingjaw wrasse	**Ind**		C				
Gomphosus varius Lacepède	bird wrasse	**Ind**		O				
Halichoeres hortulanus (Lacepède)	checkered wrasse	**Ind**	O	C				
Halichoeres margaritaceus (Valenciennes)		**Ind**		R				
Hemigymnus melapterus (Bloch)	half-and-half thicklip	**Ind**		O	U			
Labroides dimidiatus (Valenciennes)	bluestripe cleaner wrasse	**Ind**		C				
Macropharyngodon meleagris (Valenciennes)	leopard wrasse	**Ind**		R				
Oxycheilinus bimaculatus (Valenciennes)	twospot wrasse	**Ind**		O				
Stethojulis bandanensis (Bleeker)		**Ind**		O				
Thalassoma hardwicke (Bennett)	sixbar wrasse	**Ind**		C				
Thalassoma lunare (L.)	moon wrasse	**Ind**		R				
LETHRINIDAE								
Lethrinus harak (Forsskål)	thumbprint emperor			R				
NEMIPTERIDAE								
Scolopsis lineata Quoy & Gaimard	striped monocle bream			A				
SCARIDAE								
Chlorurus spilurus (Valenciennes)	bullethead parrotfish			A	O			
Scarus sp.		**--**	C					
Scarus niger Forsskål	Swarthy parrotfish		C					
Scarus oviceps Valenciennes	darkcapped parrotfish	**Ind**		R	C			
Scarus psittacus Forsskål	palenose parrotfish	**Ind**	C	C				
Scarus schlegeli (Bleeker)	yellowband parrotfish	**Ind**		C				
KURTIFORMES								
APOGONIDAE								
Cheilodipterus quinquelineatus Cuvier	fivestriped percelle	**Ind**		C	C	O		A
MULLIFORMES								
MULLIDAE								
Parupeneus multifasciatus (Quoy & Gaimard)	manybar goatfish			O				

PERCIFORMES					
PINGUIPEDIDAE					
Parapercis sp. (Bleeker)	sandperch	**--**			R
POMACENTRIDAE					
Abudefduf septemfasciatus (Cuvier)	Seven-bar sergeant			R	
Abudefduf sexfasciatus (Lacepède)	scissortail sergeant	**Ind**	O		
Amblyglyphidodon curacao (Bloch)	staghorn damsel	**Ind**	A		
Amphiprion sp. (Bloch & Schneider)	Anemonefish	**--**	R		
Chrysiptera brownriggii (Bennett)	surge damsel	**Ind**	C	O	U
Dascyllus aruanus (L.)		**Ind**	C		
Pygoplites diacanthus (Boddaert)		**Ind**	R		
Stegastes albifasciatus (Schlegel & Muller)		**Ind**	R		
SERRANIDAE					
Cephalopholis urodeta (Forster)	flagtail grouper		R		
TETRAODONTAFORMES					
MONACANTHIDAE					
Oxymonacanthus longirostris (Bloch & Schneider)	harlequin filefish		R		
Pervagor aspricaudus (Hollard)	yellow-tail filefish	**Ind**	R		
TETRADONTIDAE					
Arothron nigropunctatus (Bloch & Schneider)	blackspotted puffer	**Ind**	R		
Canthigaster solandri (Richardson)		**Ind**	C	O	

STATUS = distributional status for the Mariana Islands:
- **Ind** = indigenous; native to Guam, but not unique to the Mariana Islands.
- **End** = endemic to Guam, only found in the Mariana Islands
- Nat = naturalized, introduced, alien, exotic, animal introduced to the Guam by action of humans.

ABUNDANCE
- A = Abundant; observed in large numbers and widely distributed
- C = Common; observed everywhere, although generally not in large numbers
- O = Occasional; seen irregularly in small numbers
- U = Uncommon; several to a dozen individuals observed
- R = Rare; only one or two individuals observed

LOCATION
- OB = Outer Breakwater
- IB = Inner Breakwater
- SP = Sumay Point
- PP = Polaris Point

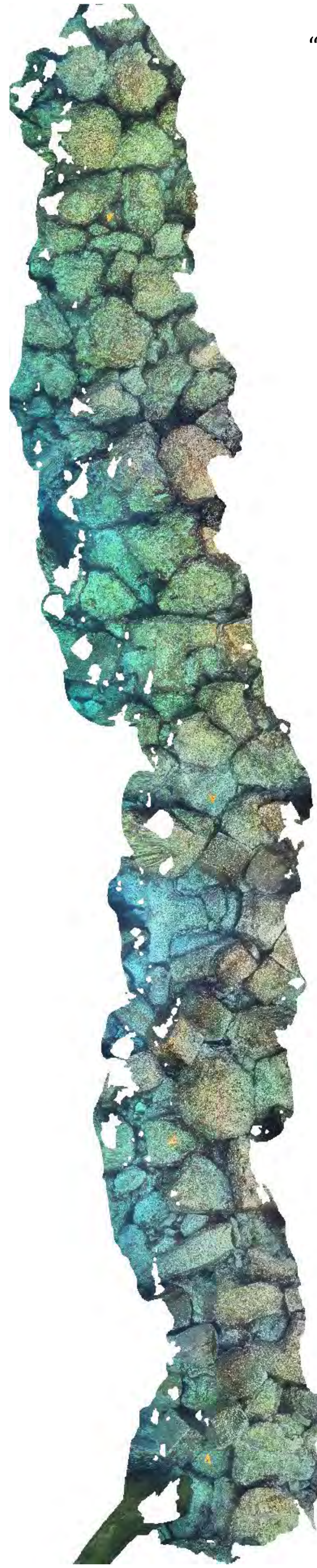
Appendix D

Orthomosaics from several transects across the Project area, February 2024.

Outer Breakwater

"O-17"

"O-18"

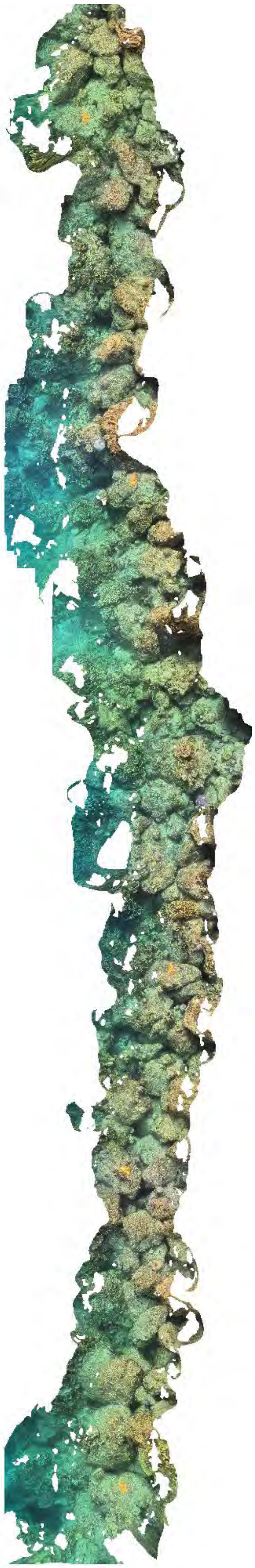


Inner Breakwater

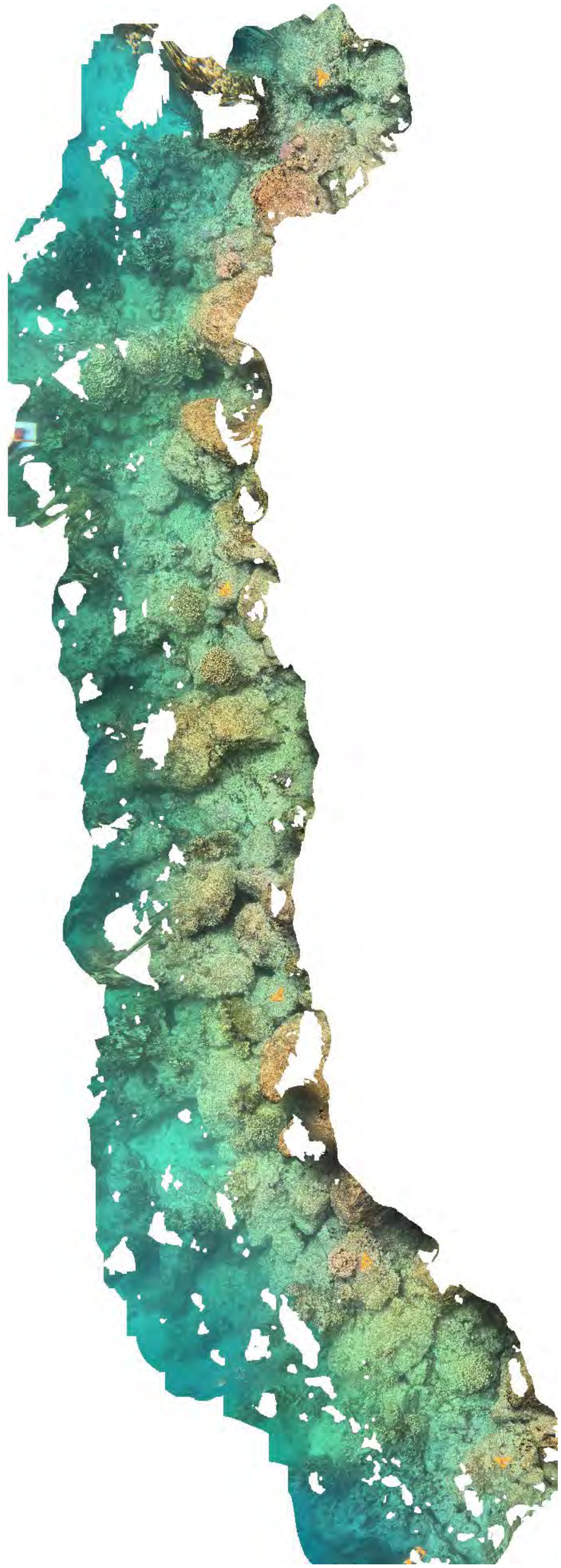
"I-3"

"I-11"

"I-24"



"I-37"



“I-42”: 1

“I-18”

EOD Seawall

"EOD-1":

EOD Point

"EOD-8" (floor):

"EOD-8" (side):

Appendix C

National Historic Preservation Act Section 106 Documentation

DEPARTMENT OF THE NAVY
U.S. NAVAL BASE GUAM
PSC 455 BOX 152
FPO AP 96540-1000

RECEIVED
DEC 28 2023
GUAM HISTORIC RESOURCES DIVISION

5090
Ser EV/133
27 December, 2023

Patrick Lujan
State Historic Preservation Officer
Department of Parks and Recreation/Guam Historic Resources Division
490 Chalan Palasyo
Agaña Heights, Guam 96910

Dear Mr. Lujan,

Subject: EMERGENCY REPAIRS TO GLASS BREAKWATER, NAVAL BASE GUAM

Naval Base Guam requests your review of our proposed project to conduct emergency repairs to the Glass Breakwater, Naval Base Guam, pursuant to Section 106 of the National Historic Preservation Act (NHPA). This project is similar to repairs undertaken in 2011 with SHPO concurrence (RC 2011-9550) of the Navy's "No Adverse Effect" determination.

We have reviewed the project scope and determined that it is an undertaking as defined in 36 CFR 800.16(y) and the 2008 Programmatic Agreement among the Commander, Navy Region Marianas, the Advisory Council on Historic Preservation, and the Guam Historic Preservation Officer regarding Navy Undertakings on the Island of Guam ("2008 PA"), Section I. This undertaking does not meet the conditions of "Undertakings Requiring No Further Review" (2008 PA Section VII.A), and thus will be reviewed in accordance with the same review process as others under 36 CFR 800.3–800.7, as allowed by Section VII.B.1.

In consideration of the information presented in Enclosure (1) and previous SHPO concurrence for the same type of undertaking in the same area (Enclosure 2), a finding of "No Adverse Effect" is applicable to the proposed project. In accordance with 36 CFR 800.4 (d)(1), if we receive no response from your office within 30 days of receipt of this letter, we will consider our responsibilities under Section 106 fulfilled.

Should you have any questions or require additional information, my point of contact regarding this matter is Mr. Lon Bulgrin at lon.bulgrin.civ@us.navy.mil or 671-339-2093.

Sincerely,

Ed Moon

E. E. Moon
Installation Environmental Program Director
By Direction of the Commanding Officer

Enclosure 1. Section 106 Evaluation: Emergency Repairs to Glass Breakwater, Naval Base Guam
Enclosure 2. SHPO Concurrence for Glass Breakwater Repairs, dated 17 October 2011

National Historic Preservation Act
Section 106 Evaluation
Enclosure 1: Emergency Repairs to Glass Breakwater, Naval Base Guam

Purpose:

Conduct emergency repairs to the breakwater at sections with serious and critical damage. Reinforce the breakwater at sections with poor conditions along Philippine Sea side from the breakwater head to western edge of Luminao Reef (Sta 0+00 to Sta 65+00) (Figure 4).

Statement of Work: Project works include the following:

- Stabilize the breakwater to protect the seaport and northern part of Apra Harbor from damaging waves during calm and severe weather conditions;
- Temporary removal of slope protection;
- Restore approximately 2,988 meters of the armor slope protection with suitable material;
- Strengthen toe foundation;
- Add heavy concrete armor units for wave dissipation and rebuild damaged core;
- Provide geofabric filter material on the repaired slope with riprap bedding overlay;
- Replace armor rock on repaired slope.

Area(s) of Potential Effect (APE):

The APE is determined to be the area encompassed by the proposed project, as depicted in Figures 1 - 4.

Identification of Historic Properties:

- As identified in Aaron (2011); Lauter-Reinman (1997); Mason (2009), the boundary of the project site is in fill lands.
- The project APE is located within the Glass Breakwater that is eligible for inclusion in the National Register of Historic Places, Aaron 2011; Lauter-Reinman 1997; Mason 2009.
- The structure dates between 1941 and 1946, which is greater than 50 years old.

Determination of Effect:

- Project area has been previously disturbed (e.g., original construction and grading).
- Ground disturbance (gate/haul road) will be limited to areas where there are existing structures.
- The breakwater is structurally damaged from previous typhoons, namely Typhoon Mawar. Extensive natural wave battering and erosion has damaged the structure.
- The damaged revetment on the Glass Breakwater poses a public health and safety issue.
- Repairs of the Glass Breakwater are essential to maintain and ensure the structural stability of the structure. Failure to provide these repairs will lead to further damage to the historic property.
- All materials used in the repairs will be similar to the original materials used for the construction of the breakwater.
- The boulders/rip rap will match existing erosion control measures in the area and shall have minimal impact to the visual landscape.

Section 106 Evaluation:

In consideration of the evaluated project information, the Naval Base Guam has determined a finding of **"No Adverse Effect"** for the proposed repair to damages on Glass Breakwater.

Certification

The undersigned certifies that, to the best of my knowledge, information, and belief, formed after reasonable inquiry, the information in this report is true, accurate, complete and is provided as a part of our agency's responsibilities under Section 106 of the National Historic Preservation Act of 1966, as amended.

Lon Bulgrin, M.A.
Cultural Resources Manager/Archeologist
Naval Base Guam

12/27/2023
Date

Reference(s):

Aaron, Jayne
2011 *Regional Cold War History for Department of Defense Installations in Guam and the Northern Mariana Islands*. Department of Defense Legacy Resource Management Program. (Legacy 09-454). Archer, Inc., Annapolis, Maryland. https://www.denix.osd.mil/cr/historic/cold-war/index.html.

Lauter-Reinman, Gloria A.
1997 Final Report. Management Plan for World War II Resources at Navy Installations in Guam. Prepared in Conjunction with Department of Defense Legacy Resource Management Program: #349. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI. Ogden Environmental and Energy Services Co, Inc., Honolulu, HI

Mason Architects Inc. and Weitze Research (Mason and Weitze)
2009 *Evaluation of Historic Resources at Naval Hospital Guam*. Prepared for NAVFAC Pacific, Pearl Harbor. Mason Architects Inc. and Weitze Research.

Programmatic Agreement among the Commander, Navy Region Marianas, the Advisory Council on Historic Preservation, and the Guam Historic Preservation Officer regarding Navy Undertakings on the Island of Guam, November 2008.

Figure 1. Location of the APE.

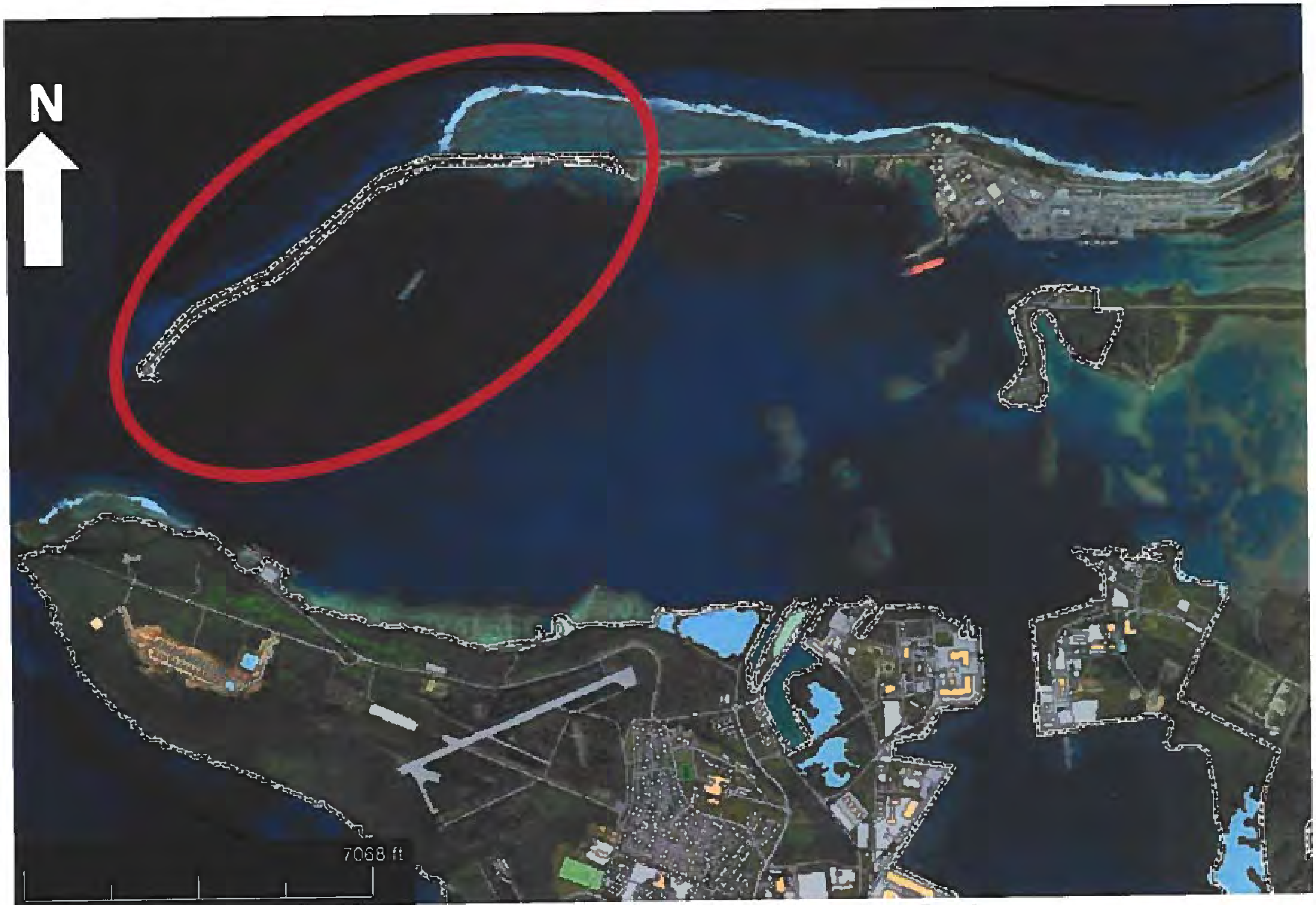


Figure 2. Enlarged view of Apra Harbor showing location of Glass Breakwater.

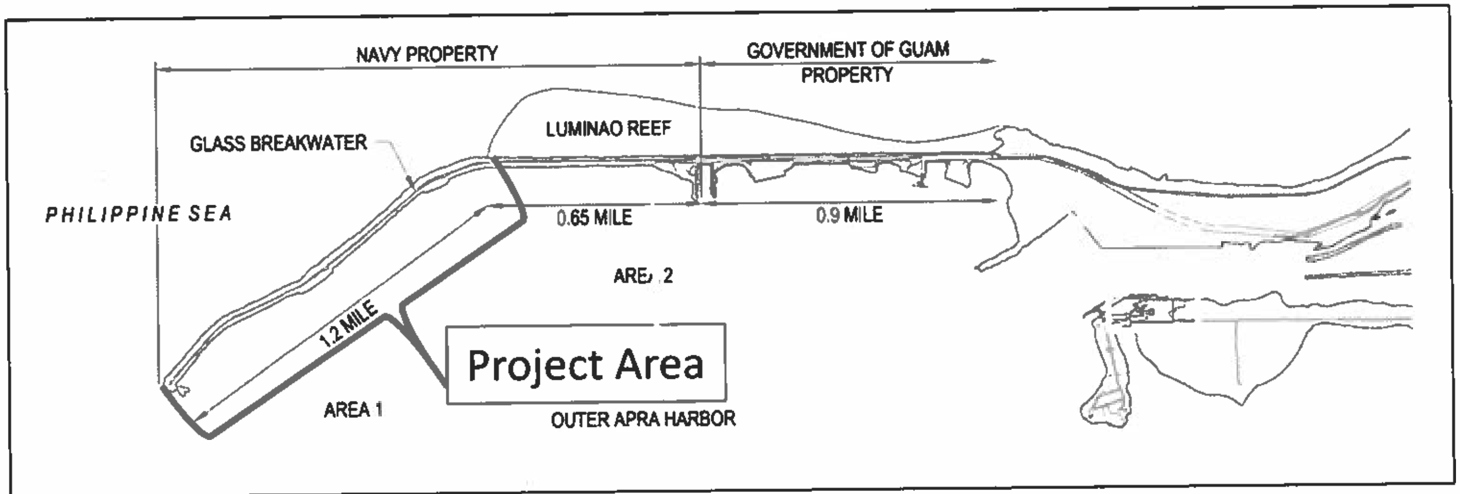


Figure 3. Close-up schematic of project area.

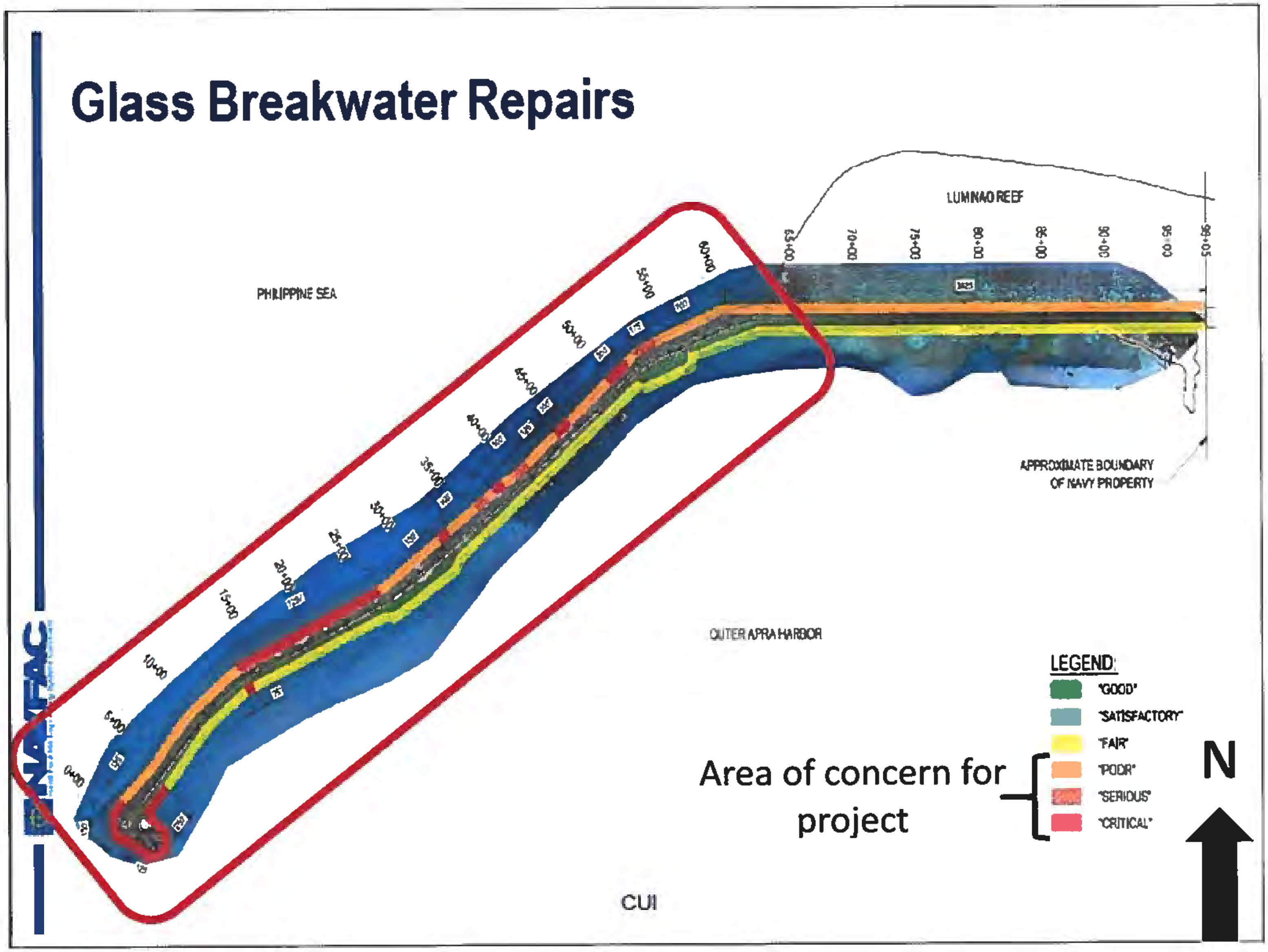


Figure 4. Diagram showing the project location, station numbers, and condition of project area.

Department of Parks and Recreation
Government of Guam
490 Chalan Palasyo
Agana Heights, Guam 96910
Director's Office: (671) 475-6296/7
Facsimile: (671) 477-0997
Parks Division: (671) 475-6288/9
Guam Historic Resources Division: (671) 475-6294/5
Facsimile: (671) 477-2822

Eddie Baza Calvo
Governor

Ray Tenorio
Lt. Governor

Peter S. Calvo
Acting Director

In reply refer to:
RC2011-9550

October 17, 2011

R.M. Rossetti
Department of the Navy
U.S. Naval Base Guam
PSC 455 Box 195
FPO AP 96540-2937

Subject: Section 106 Review
Project: Repair Glass Breakwater, North Shore and Western Point, NBGAH, Piti, Guam

Dear Mr. Rossetti,

We reviewed your request to review subject project and concur with your determination of "No Adverse Effect." However, if inadvertent discovery of historic properties are encountered during the course of the project, please cease all activities, immediately inform our office, and refer to 36 CFR 800.13 Post Review Discoveries.

On a separate note, please properly address Ms. Aguon in future correspondence as State Historic Preservation Officer.

If you have any questions, please contact our office at 475-6294/6295.

Sincerely,

Peter S. Calvo
Acting Director

Lynda Bordallo Aguon
State Historic Preservation Officer

Department of Parks and Recreation
Dipattamenton Plaset yan Dibuetsion
Government of Guam
Director's Office, Parks and Recreation Divisions:
#1 Paseo de Susana, Hagåtña, Guam 96910
P.O. Box 2950, Hagåtña, Guam 96932
(671) 475-6288; Facsimile (671) 477-0997
Guam Historic Resources Division:
490 Chalan Palasyo, Agana Heights, Guam 96910
(671) 475-6294/6355; Facsimile (671) 477-2822

Lourdes A. Leon Guerrero
Governor
Joshua F. Tenorio
Lt. Governor

Angel R. Sablan
Acting Director
Warren Pelletier
Deputy Director

February 20, 2024

In reply refer to:
RC 2024-0091

E. E. Moon
Installation Environmental Program Director
Naval Base Guam
PSC 455, Box 152
FPO AP 96540-1000

Subject: Review of: Emergency Repairs to Glass Breakwater, Naval Base Guam

Hafa Adai Mr. Moon,

Thank you for submitting the Emergency Repairs to Glass Breakwater, Naval Base Guam. Per §36 CFR 800 (as amended 5 August 2004) regulations implementing Section 106 of the National Historic Preservation Act (NHPA), Naval Base Guam is seeking the State Historic Preservation Office's (SHPO) comments on the effects the proposed undertaking will have on historic properties.

An email occurred between Logan Myers and Lon E. Bulgrin on 2/15/2023 where Mr. Bulgrin confirmed the APE size to be 354,838 Sqm (87.7 acres). Our office will not accept the "No Adverse Effect" determination without additional information. Our records show four sites within the red breakwater APE box on Page 6 of the submitted document. These sites are *Yosemite 2* GHPI Site No. 66-03-2206 at the southwest, American Tanker GHPI Site No. 66-03-1078 to the southwest, Unnamed Wreck GHPI Site No. 66-03-2191, and Val Bomber GHPI Site No. 66-03-1087 at the northeast. For our office to accept these repairs we need confirmation that these sites will not be impacted by this project. Navy Base Guam needs to submit a map showing these sites and describe how these sites will not be impacted by the repairs. Once we receive this document our office will expedite the review process.

Should you have any questions, please contact Mr. Logan Myers, Archaeologist at (671) 475-6340 or by email: logan.myers@dpr.guam.gov.

Sincerely,

Patrick Q. Lujan
State Historic Preservation Officer

DEPARTMENT OF THE NAVY
U.S. NAVAL BASE GUAM
PSC 455 BOX 152
FPO AP 96540-1000

5090
Ser EV/N-32
February 26, 2024

Patrick Lujan
State Historic Preservation Officer
Department of Parks and Recreation/Guam Historic Resources Division
490 Chalan Palasyo
Agaña Heights, Guam 96910

Dear Mr. Lujan,

Subject: EMERGENCY REPAIRS TO GLASS BREAKWATER, NAVAL BASE GUAM

This letter is in response to your letter of February 20, 2024 (RC 2024-0091). You expressed concerns over four sites; Yosemite 2 GHPI Site No. 66-03-2206, American Tanker GHPI Site No. 66-03- 1078, Unnamed Wreck GHPI Site No. 66-03-2191, and Val Bomber GHPI Site No. 66-03-1087 that could be potentially impacted by the undertaking based upon the APE.

Lon Bulgrin, the Naval Base Guam Cultural Resources Manager/Archaeologist, met with Logan Myers and John Peterson of your staff this morning to present more detailed design plans for the project and to discuss the project plans in regard to the locations of the sites of concern. There was an agreement that the sites were located outside of the proposed project footprint and that of haul roads and laydown areas. The project design plans are included in Enclosure (1).

In consideration of the information presented in Enclosure (1) and our previous letter of December 27, 2023, a finding of "No Adverse Effect" is applicable to the proposed project. In accordance with 36 CFR 800.4 (d)(1), if we receive no response from your office within 30 days of receipt of this letter, we will consider our responsibilities under Section 106 fulfilled.

Should you have any questions or require additional information, my point of contact regarding this matter is Mr. Lon Bulgrin at lon.bulgrin.civ@us.navy.mil or 671-339-2093.

Sincerely,

E. E. Moon
Installation Environmental Program Director
By Direction of the Commanding Officer

Enclosure 1. FY24 SPECIAL PROJECT Glass Breakwater Emergency Repairs Design Plans.

Lourdes A. Leon Guerrero
Governor
Joshua F. Tenorio
Lt. Governor

Department of Parks and Recreation
Dipattamenton Plaset yan Dibuetsion
Government of Guam
Director's Office, Parks and Recreation Divisions:
#1 Paseo de Susana, Hagåtña, Guam 96910
P.O. Box 2950, Hagåtña, Guam 96932
(671) 475-6288; Facsimile (671) 477-0997
Guam Historic Resources Division:
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(671) 475-6294/6355; Facsimile (671) 477-2822

Angel R. Sablan
Acting Director
Warren Pelletier
Deputy Director

February 28, 2024

In reply refer to:
RC 2024-0091

E. E. Moon
Installation Environmental Program Director
Naval Base Guam
PSC 455, Box 152
FPO AP 96540-1000

Subject: Review of: Emergency Repairs to Glass Breakwater, Naval Base Guam

Hafa Adai Mr. Moon,

Thank you for submitting the Emergency Repairs to Glass Breakwater, Naval Base Guam. Per §36 CFR 800 (as amended August 5. 2004) regulations implementing Section 106 of the National Historic Preservation Act (NHPA), Naval Base Guam is seeking the State Historic Preservation Office's (SHPO) comments on the effects the proposed undertaking will have on historic properties.

As stated in the submitted document, a meeting occurred on the 26th of February 2024 between Lon Bulgrin of Naval Base Guam, John Peterson, and Logan Myers. In this meeting, it was agreed that the undertaking was not overlapping the sites of *Yosemite 2* GHPI Site No. 66-03-2206, American Tanker GHPI Site No. 66-03-1078, Unnamed Wreck GHPI Site No. 66-03-2191, and Val Bomber GHPI Site No. 66-03-108. Based on this meeting and the enclosed information, our office agrees with the "No Adverse Effect" determination.

Should you have any questions, please contact Mr. Logan Myers, Archaeologist at (671) 475-6340 or by email: logan.myers@dpr.guam.gov

Sincerely,

Patrick Q. Lujan
State Historic Preservation Officer

Appendix D

Coastal Consistency Determination

DEPARTMENT OF THE NAVY
U.S. NAVAL BASE GUAM
PSC 455 BOX 152
FPO AP 96540-1000

RECEIVED
JUL 31 2024
BUREAU OF
STATISTICS AND PLANS

5090
Ser EV/104
August 1, 2024

Ms. Lola Leon Guerrero
Director
Bureau of Statistics and Plans
P.O. Box 2950
Hagatna, Guam 96932

ATTN: Edwin Reyes, Administrator, Guam Coastal Zone Management Program

SUBJECT: NOTIFICATION OF A NEGATIVE DETERMINATION FOR PROJECT: EMERGENCY BREACH REPAIR ADMIRAL GLASS BREAKWATER APRA HARBOR, NAVAL BASE GUAM

Dear Ms. Leon Guerrero:

Naval Base Guam (NBG) proposes to conduct emergency breach repairs on the Admiral Glass Breakwater (GBW) in Apra Harbor, Guam. This letter is to provide Guam Bureau of Statistics and Plans (GBSP) with a Negative Determination finding for this proposed activity in accordance with 15 CFR 930.35. The U.S. Navy has completed an "effects" test and has determined that there will be no net coastal effect to Guam's Coastal Management Zone.

The emergency breakwater repairs are needed due to extensive damage that occurred during Typhoon Mawar in 2023. The project will include resetting of existing armor stone and concrete units that have shifted their position, to temporarily stabilize the GBW until more permanent repairs are carried out in the near future. The emergency repairs of GBW would temporarily restore the breakwater to Army Corps of Engineer breakwater standards and increase the effectiveness of the breakwater in order to continue protecting Apra Harbor and its shorelines. Thus allowing for continued safe use of the area by the public, civil, and federal individuals and organizations.

Best Management Practices (BMPs) will be implemented to ensure that debris and surface runoff does not enter into Guam's coastal waters. The proposed emergency repair project does not involve the discharge of dredged or fill material into the waters of the United States. The construction project has a tentative start date of mid-November 2024, with an estimated projected duration of up to six (6) months.

The enclosed coastal zone consistency assessment package is pursuant to the Coastal Zone Management Act and 15 Code of Federal Regulations (CFR) 930. The subject proposal will comply with the enforceable policies of the Government of Guam's approved coastal zone management program and will be conducted in a manner consistent with such programs.

Should you have any questions, or require additional information, please contact Mr. Jesse Cruz at (671) 339-5314, email: jesse.t.cruz3.civ@us.navy.mil.

Sincerely,

E. E. MOON
Installation Environmental Program Director
By Direction of the Commanding Officer

Enclosure: 1. Guam Coastal Management Program Assessment Package
2. GBW Emergency Breach Repair Project Description

GUAM COASTAL MANAGEMENT PROGRAM
ASSESSMENT FORMAT

DATE OF APPLICATION: **August 1, 2024**

NAME OF APPLICANT: **U.S. Naval Base Guam**

APPLICANT:
Mr. Edward E. Moon
Installation Environmental Program Director
Public Works Department
U.S. Naval Base Guam
PSC 455, BOX 152
FPO AP 96540-1000
671-339-4100
Edward.e.moon2.civ@us.navy.mil

TITLE OF PROPOSED PROJECT: **Glass Breakwater Emergency Breach Repair**

COMPLETE FOLLOWING PAGES FOR BUREAU OF STATISTICS AND PLANS ONLY:

DATE APPLICATION RECEIVED: ____________________

OCRM NOTIFIED: ____________ LIC. AGENCY NOTIFIED: ____________________

APPLICANT NOTIFIED: ________ PUBLIC NOTICE GIVEN: ____________________

OTHER AGENCY REVIEW REQUESTED:

____

____

DETERMINATION:

( ) CONSISTENT ( ) NON-CONSISTENT ( ) FURTHER INFORMATION REQUESTED

OCRM NOTIFIED: ________ LIC. AGENCY NOTIFIED: ____________________

APPLICANT NOTIFIED: ____________________

ACTION LOG:

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

DATE REVIEW COMPLETED: ____________________

DEVELOPMENT POLICIES (DP):

DP 1. Shore Area Development

Intent: To ensure environmental and aesthetic compatibility of shore area land uses.

Policy: Only those uses shall be located within the Seashore Reserve which:
- enhance, are compatible with or do not generally detract from the surrounding coastal area's aesthetic and environmental quality and beach accessibility; or
- can demonstrate dependence on such a location and the lack of feasible alternative sites.

Discussion: **Emergency Breach Repairs to Admiral Glass Breakwater (GBW) would use the same or similar materials to the existing structure and would not appreciably alter the structure visually. Therefore, the project would be compatible and would not detract from the aesthetic or environmental quality. The structure is necessary to provide safe passage into and out of Apra Harbor for military, civil, commercial, and recreational users.**

DP 2. Urban Development

Intent: To cluster high impact uses such that coherent community design, function, infrastructure support and environmental compatibility are assured.

Policy: Commercial, multi-family, industrial and resort-hotel zone uses and uses requiring high levels of support facilities shall be concentrated within appropriate zone as outlined on the Guam Zoning Code.

Discussion: **Not applicable.**

DP 3. Rural Development

Intent: To provide a development pattern compatible with environmental and infrastructure support suitability and which can permit traditional lifestyle patterns to continue to the extent practicable.

Policy: Rural districts shall be designated in which only low density residential and agricultural uses will be acceptable. Minimum lot size for these uses should be one-half acre until adequate infrastructure including functional sewering is provided.

Discussion: **Not applicable.**

DP 4. Major Facility Siting

Intent: To include the national interest in analyzing the siting proposals for major utilities, fuel and transport facilities.

Policy: In evaluating the consistency of proposed major facilities with the goals, policies, and standards of the Comprehensive Development and Coastal Management Plans, Guam shall recognize the national interest in the siting of such facilities, including those associated with electric power production and transmission, petroleum refining and transmission, port and air installations, solid waste disposal, sewage treatment, and major reservoir sites.

Discussion: **Not applicable.**

DP 5. Hazardous Areas

Intent: Development in hazardous areas will be governed by the degree of hazard and the land use regulations.

Policy: Identified hazardous lands, including flood plains, erosion-prone areas, air installations' crash and sound zones and major fault lines shall be developed only to the extent that such development does not pose unreasonable risks to the health, safety or welfare of the people of Guam, and complies with the land use regulations.

Discussion: **The Proposed Action is consistent with DP 5. GBW emergency breach repairs would enhance the safety of Apra Harbor and comply with land use regulations. The Navy would ensure that the facilities to be constructed would be designed for resiliency with regards to erosion. GBW repairs would not change the local hydrology, soils, or vegetation, or affect shoreline ecological functions.**

DP 6. Housing

Intent: To promote efficient community design placed where the resources can support it.

Policy: The government shall encourage efficient design of residential areas, restrict such development in areas highly susceptible to natural and manmade hazards, and recognize the limitations of the island's resources to support historical patterns of residential development.

Discussion: **Not applicable.**

DP 7. Transportation

Intent: To provide transportation systems while protecting potentially impacted resources.

Policy: Guam shall develop an efficient and safe transportation system, while limiting adverse environmental impacts on primary aquifers, beaches, estuaries, coral reefs and other coastal resources.

Discussion: **The Proposed Action would be consistent with DP 7. GBW is key to the continued function and safety of transportation in and out of Apra Harbor. The proposed emergency breach repairs would restore critical function and enhance safety for federal, civil, commercial, and recreational users.**

DP 8. Erosion and Siltation

Intent: To control development where erosion and siltation damage is likely to occur.

Policy: Development shall be limited in areas of 15% or greater slope by requiring strict compliance with erosion, sedimentation, and land use regulations, as well as other related land use guidelines for such areas.

Discussion: **The Proposed Action is consistent with DP 8. GBW protects the shoreline and harbor entrance from erosion and protect anchorages, helping isolate vessels from marine hazards such as wind-driven waves. The proposed repairs would ensure the continued protection of the shoreline from erosion associated with weather and vessel-generated wave action. The existing facilities and structures would be reused to the extent practicable, and all erosion and sedimentation regulations would be followed.**

RESOURCES POLICIES (RP):

RP 1. Air Quality

Intent: To control activities to ensure good air quality.

Policy: All activities and uses shall comply with all local air pollution regulations and all appropriate Federal air quality standards in order to ensure the maintenance of Guam's relatively high air quality.

Discussion: **The Proposed Action would be consistent with RP 1. Implementation of the Proposed Action would result in temporary air quality impacts from the generation of air pollutants during construction activities. Heavy equipment operation, construction related vehicle traffic (e.g., worker commute trips), and transportation of construction debris would be the primary emissions sources. These sources and emissions would be temporary and intermittent. The Navy would ensure that construction contractors would implement BMPs to minimize impacts to air quality. These may include, but are not limited to:**

- **Using standard dust control measures at the project site (such as watering);**
- **Covering trucks conveying demolition debris;**
- **Removing soil or other debris from streets and roadways;**
- **Minimizing idle time for vehicle and equipment; and**
- **Use of alternate fuels and/or low-sulfur diesel.**

RP 2. Water Quality

Intent: To control activities that may degrade Guam's drinking, recreational, and ecologically sensitive waters.

Policy: Safe drinking water shall be assured, and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters, particularly in estuaries, reef and aquifer areas.

Discussion: **The Proposed Action would be consistent with RP 2. The project would not involve any in-water work that would permanently degrade Guam's waters. Restoration of the GBW would facilitate the continued safe passage at Apra Harbor, and enhance use by federal, civil, commercial, and recreational users. The construction activities would be short-term in nature and would not have lasting impacts to the water quality in the area. Best management practices would be implemented during construction to minimize pollution and siltation to the extent possible and ensure that there is no runoff into surrounding waters.**

RP 3. Fragile Area

Intent: To protect significant cultural areas, and natural marine and terrestrial wildlife and plant habitats.

Policy: Development in the following types of fragile areas including Guam's Marine Protected Areas (MPA) shall be regulated to protect their unique character.

- historic and archeological sites
- wildlife habitats
- pristine marine and terrestrial communities
- limestone forests
- mangrove stands and other wetlands
- coral reefs

Discussion: **The Proposed Action would be consistent with RP 3. The Navy has conducted a Section 106 consultation with Guam State Historic Preservation Office (SHPO) and made a *No Adverse Effect* determination. The SHPO concurred with our determination on February 28, 2024. If any objects of cultural/archeological significance are identified during restoration activities, work would be ceased immediately and the Naval Base Guam Cultural Resources Manager and Guam State Historic Preservation Office would be notified as soon as possible.**

The Endangered Species Act (ESA) listed coral species *Acropora globiceps* are located 30 to 40 meters offshore of the project area. ESA Section 7 consultations are currently on-going with NOAA to determine the project effects level. The Navy has determined the emergency breach repair project *may affect, but is not likely to adversely affect* the listed species. Currently, there is no critical habitat designated or proposed for *A. globiceps* in the vicinity of the project area.

The Navy has determined that the project *may affect, but is not likely to adversely affect* green turtles, hawksbill turtles, and scalloped hammerhead sharks. Currently, there is no critical habitat designated or proposed for sea turtles or scalloped hammerhead sharks in the vicinity of the project area.

The Proposed Action is not expected to appreciably diminish Essential Fish Habitat (EFH) over the long term. However, temporary adverse effects on EFH

may occur. The Proposed Action may temporarily contribute to the degradation of aquatic habitat resulting from the loss of sessile organisms, including corals and benthic invertebrates as armor stones are placed along the water's edge. Adverse effects will be minimized through minimizing and avoiding in-water work as much as possible. Due to the implementation of appropriate BMPs, the relative quantity and quality of existing EFH within the action area, and the size and scale of anticipated effects, the Proposed Action is not expected to appreciably diminish habitat value over the long term.

RP 4. Living Marine Resources

Intent: To protect marine resources in Guam's waters.

Policy: All living resources within the waters of Guam, particularly fish, shall be protected from over harvesting and, in the case of corals, sea turtles and marine mammals, from any taking whatsoever.

Discussion: **The Proposed Action would be consistent with RP 4. The Proposed Action may affect, but is not likely to adversely affect ESA-listed green turtles, hawksbill turtles, and scalloped hammerhead sharks. BMPs such as monitoring the area for the presence of protected species, avoidance, and cessation of construction when species are present, will help minimize adverse effects.**

RP 5. Visual Quality

Intent: To protect the quality of Guam's natural scenic beauty.

Policy: Preservation and enhancement of, and respect for the island's scenic resource shall be encouraged through increased enforcement of and compliance with sign, litter, zoning, subdivision, building and related land-use laws. Visually objectionable uses shall be located to the maximum extent practicable so as not to degrade significant views from scenic overlooks, highways and trails.

Discussion: **The Proposed Action would be consistent with RP 5. Repairs to GBW would use the same or similar materials to the existing structure, and would not appreciably alter the structure visually. Therefore, the project would be compatible and would not detract from the aesthetic or environmental quality.**

RP6. Recreation Areas

Intent: To encourage environmentally compatible recreational development.

Policy: The Government of Guam shall encourage development of varied types of recreational facilities located and maintained so as to be compatible with the surrounding environment and land uses, adequately serve community centers and urban areas and protect beaches and such passive recreational areas as wildlife, marine conservation and marine protected areas, scenic overlooks, parks, and historical sites.

Developments, activities and uses shall comply with the Guam Recreational Water Use Management Plan (RWUMP).

Discussion: **The Proposed Action would be consistent with RP 6. The proposed project would restore existing structures and ensure continued recreational use consistent with the Guam RWUMP.**

RP 7. Public Access

Intent: To ensure the right of public access.

Policy: The public's right of unrestricted access shall be ensured to all non-federally owned beach areas and all Guam recreation areas, parks, scenic overlooks, designated conservation areas and their public lands. Agreements shall be encouraged with the owners of private and federal property for the provision of releasable access to and use of resources of public nature located on such land.

Discussion: **The Proposed Action would be consistent with RP 7. Public access may be impacted temporarily during the repair activities. However, restoration of GBW will enhance and ensure the long-term safe usage of Apra Harbor for military, civil, commercial, and recreational users.**

RP 8. Agricultural Lands

Intent: To stop urban types of development on agricultural land.

Policy: Critical agricultural land shall be preserved and maintained for agricultural use.

Discussion: **Not applicable.**

FEDERAL CONSISTENCY SUPPLEMENTAL INFORMATION FORM

Date: **August 1, 2024**

Project/Activity Title or Description: **Emergency Breach Repair of the Admiral Glass Breakwater**

Location: **Cabras Island, Piti Guam**

Other applicable area(s) affected, if appropriate:

Est. Start Date: November 2024 Est. Duration: Six months

APPLICANT

Name & Title: **Mr. Edward E. Moon, Installation Environmental Program Director**
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AGENT

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CATEGORY OF APPLICATION (check one only)
(XX) I - Federal Agency Activity
( ) II - Federal Permit or License
( ) III - Federal Grants & Assistance

TYPE OF STATEMENT (check one only)
( ) Consistency
( ) General Consistency (Category I only)
(XX) Negative Determination (Category I only)
( ) Non-Consistency (Category I only)

APPROVING FEDERAL AGENCY (Categories II & III only)

Agency:
Contact Person:
Telephone No. during business hours:
Area Code - Local
Area Code ____________ - Govt. Cell

FEDERAL AUTHORITY FOR ACTIVITY

Title of Law:
Section:

OTHER GUAM APPROVALS REQUIRED:

Agency	Type of Approval	Date of Application	Status

ENCLOSURE 2

FEDERAL CONSISTENCY NEGATIVE DETERMINATION

Project Description: Glass Breakwater Emergency Breach Repair

The Admiral Glass Breakwater (GBW), along the outer Apra Harbor, Guam, sustained significant damage resulting from Typhoon Mawar in May 2023 (Figure 1). As a result of this damage, the Navy initiated a Request for Proposal for emergency repairs of the entire GBW in December 2023. On 09 May 2024, another site visit was conducted by Navy engineers who discovered an accelerated degradation of approximately four locations of the breakwater. The armor stones present in these areas, approximately 10 to 15 feet in diameter and weighing approximately 20 to 25 tons, were missing and exposing the GBW core. The armor stones were dislodged, highly unstable and were found moved further down slope and into the water. Emergency mitigation measures to temporarily stabilize the armor stones on these failing slopes was recommended on an accelerated schedule.

There are four locations as of 09 May 2024 that have seriously failed to the extent that the crest road could potentially be breached within the next 12 months. Currently, the crest road width is 35 feet. This width just allows the expected repair equipment to transvers the area and operate. Any additional loss of crest width will delay the repair efforts and expose the GBW to further loss while the crest road is being modified or repaired to allow equipment access. It is possible by the fall of 2024, these eroded areas could grow in size, height, depth, and thickness through typical wave events. If a typhoon occurs, the probability of further failure is very high. In order to repair the breakwater, the crest road must be maintained.

The intent of the emergency breach repair is to temporarily relocate existing intact armor stone from neighboring breakwater crest areas and place them on the failed areas, to minimize crest road loss and protect the breakwater core structure. This emergency repair project will allow time for the Navy to proceed with the original proposed repairs to the GBW.

The proposed construction activities limited to only the emergency breach repair are listed below.

1. Recover unstable armor stones on the slope that are reachable with conventional equipment already available on island.
2. Armor stones out of reach to safely recover with equipment may be carefully maneuvered downslope until they rest at the toe of piled stones.
3. Dress the slopes of the exposed portions of the breakwater core aggregate material and remove any portions of saturated or unstable slopes.
4. If necessary, place geotextile fabric to protect the core (designer determination).
5. Replace the armor stones that were able to be recovered.
6. Relocate armor stones from neighboring portions of the breakwater.
7. Temporarily place recovered armor stones on the failed slopes until the near-future repairs will commence in 2025.

Assumptions & Calculations

In order to estimate the work efforts, the Navy made some assumptions and measurements. Navy engineers identified four primary areas of failure denoted in Figure 2 below. It was assumed a uniform cross section applied and then designers developed a best fit line to estimate the length of hypotenuse on the slope that would require emergency repair. It was further assumed that the emergency repair would extend 130 feet horizontally beyond the center of the crest road which correlates to approximately 10 feet seaward of the High Tide Line. The width of each failure area was measured using Google Earth (recent imagery as of 19 MAR 2024) and the thickness was assumed to be 15 feet thick of armor stone which is 1.5 times the estimated diameter of the stones to be temporarily placed (industry standard practice). Using these assumptions, Navy engineers were able to develop an estimated volume of potentially failed armor stones. It was then calculated how much stone would need to be relocated for the temporary repair; which would need to come from the borrow sections of the GBW. There is currently no on-island source of replacement armor stones.

Navy engineers assumed that the relocated armor stones would be from neighboring crest areas, starting at the breakwater head and move landward, with a dimension of approximately 15 feet thick and 30 feet wide. Only the armor stones at the upper crest would be removed so as to not destabilize the slopes of the adjacent armoring. Assuming only 75% of the failed areas would require temporary breach repair, it was calculated that approximately 1,500 LF of adjacent stones at the crest would be required. This sequential approach reduces the risk of exposing the breakwater to further failure potential

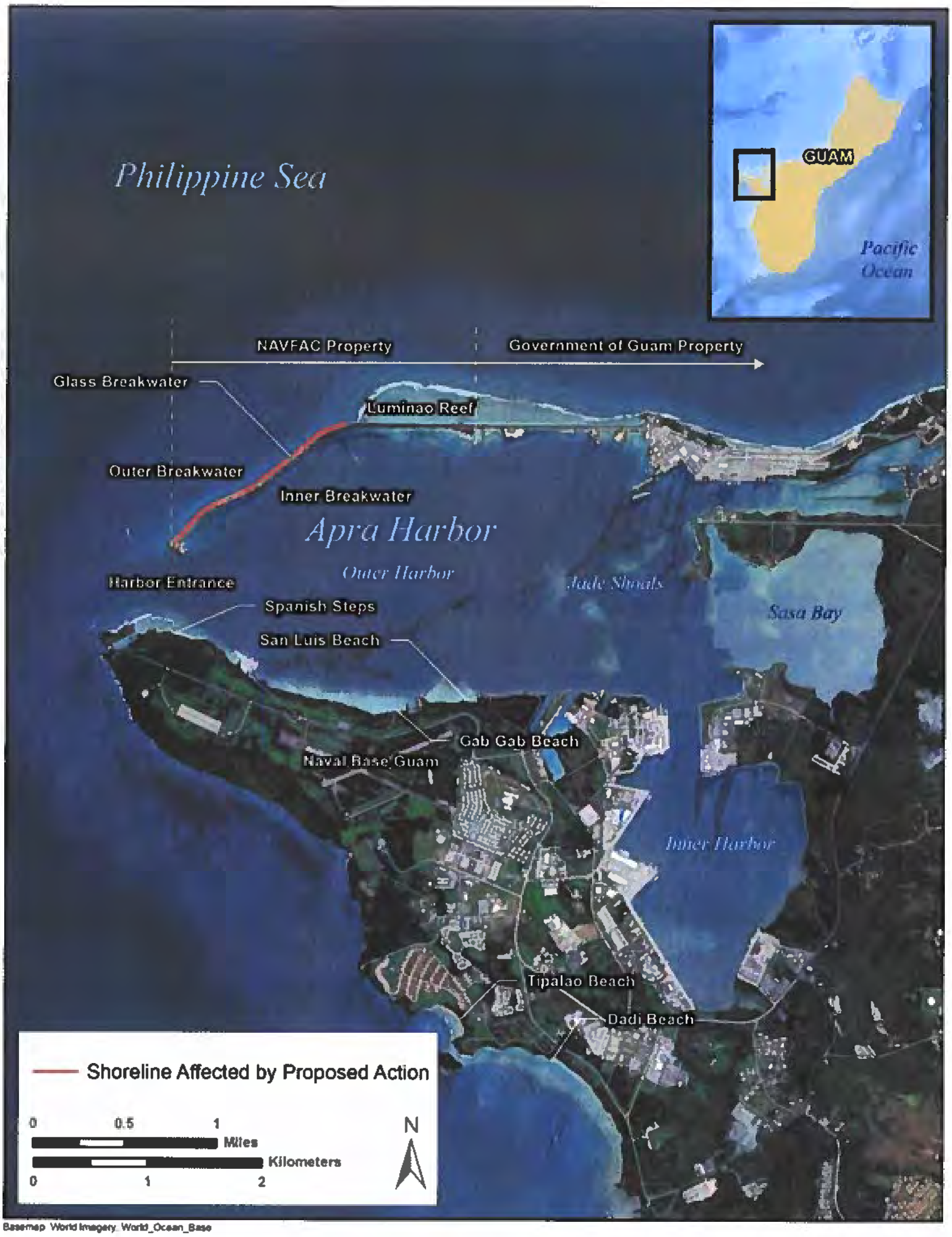


Figure 1. Shoreline of the Glass Breakwater affected by the Proposed Action in Apra Harbor.

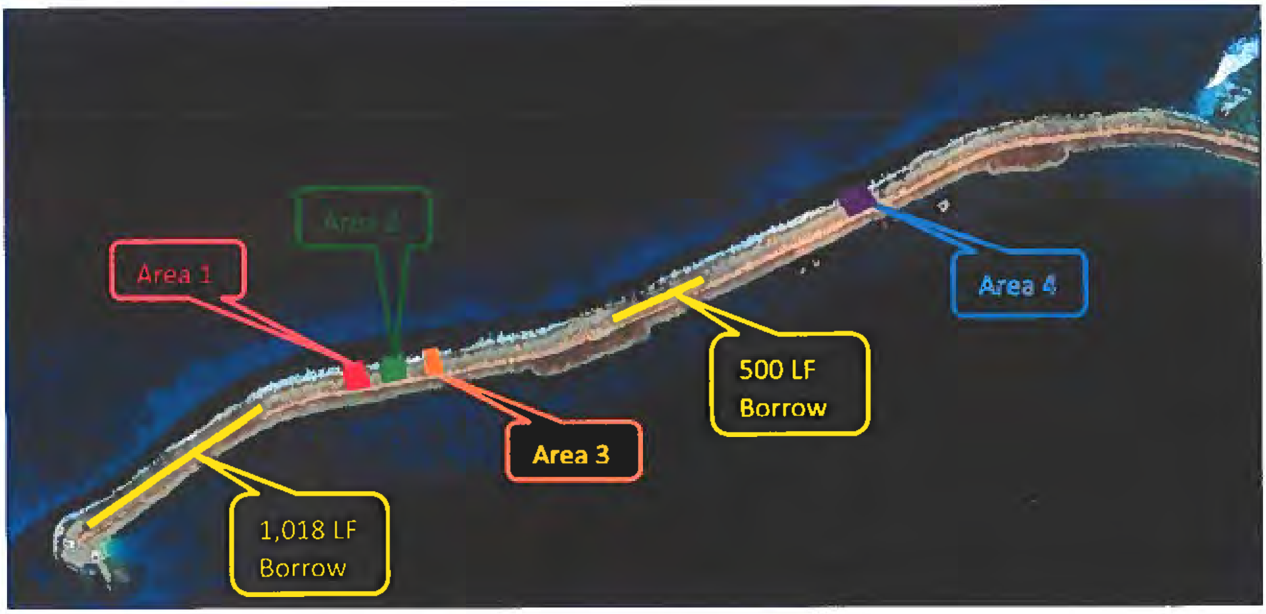
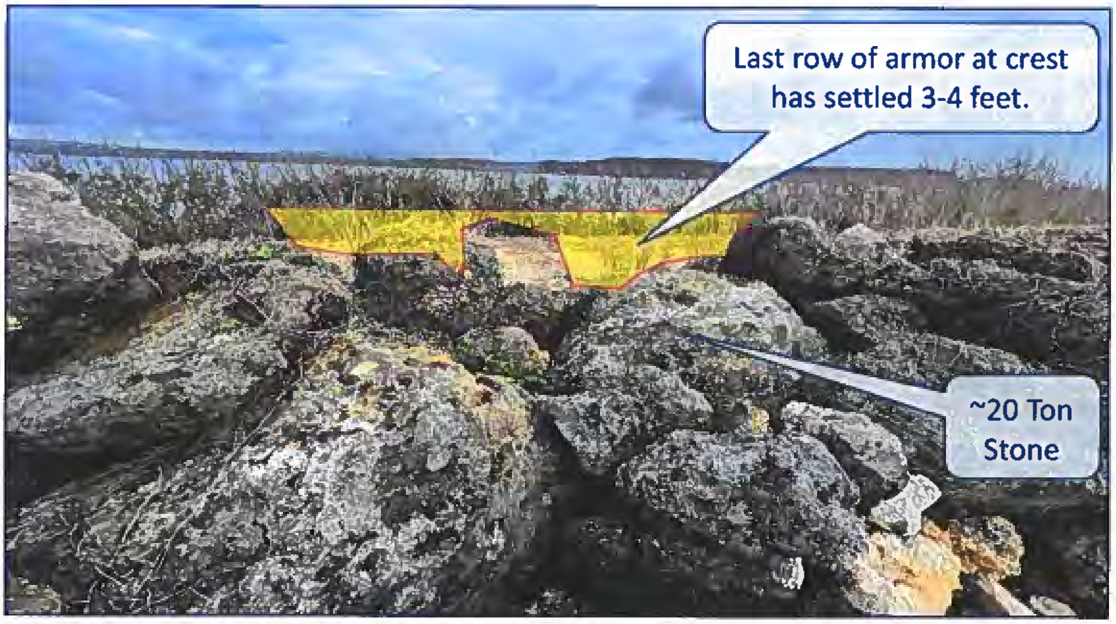


Figure 2. Areas of GBW armor stone failure and Proposed Borrow Areas

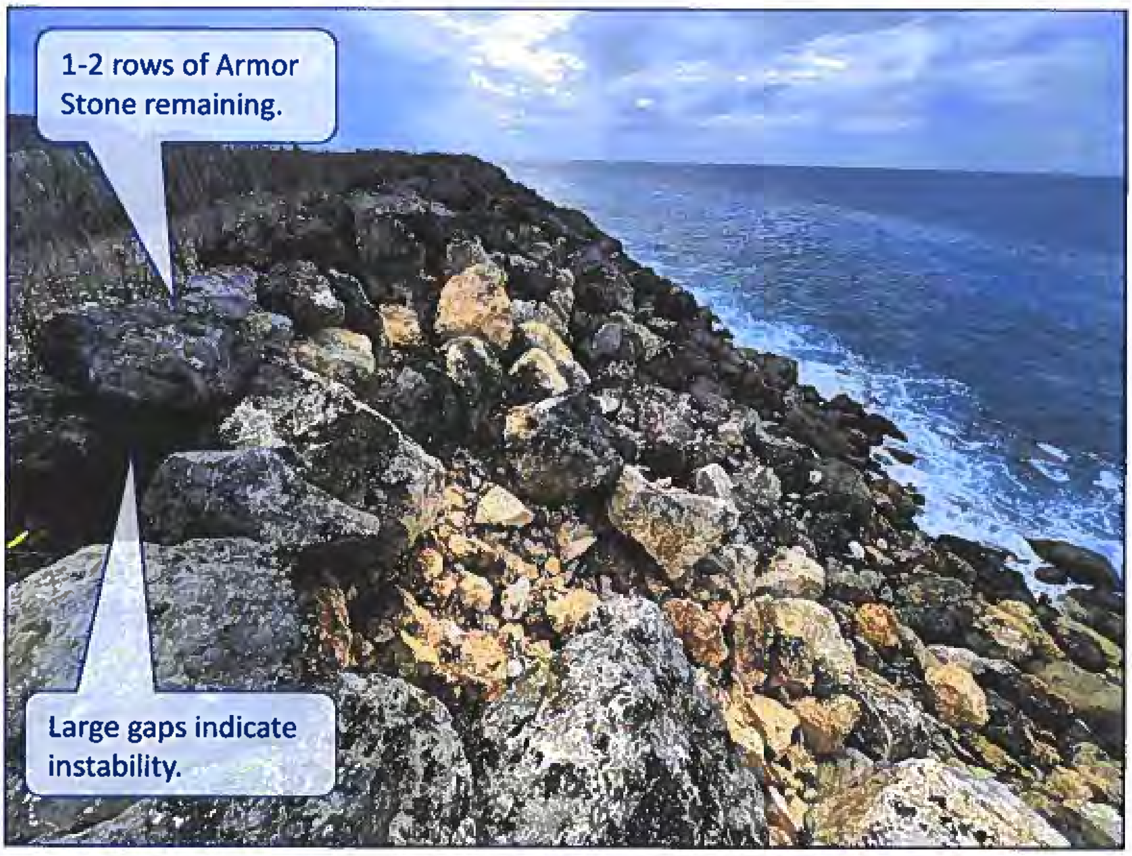
Failure Area	Slope Length (ft)	Width (ft)	Thickness
1	132	115	15
2	132	[illegible]	15
3	132	30	15
4	132	150	15
Total Volume (CF)		910,800	
Assumed 75% Repair Volume (CF)		683,100	

	Borrow
Length (ft)	1,518
Width (ft)	30
Height (ft)	15
Volume	683,100

Note: Assumed repair and borrow volumes are equal which verifies sufficient armor stones are available.

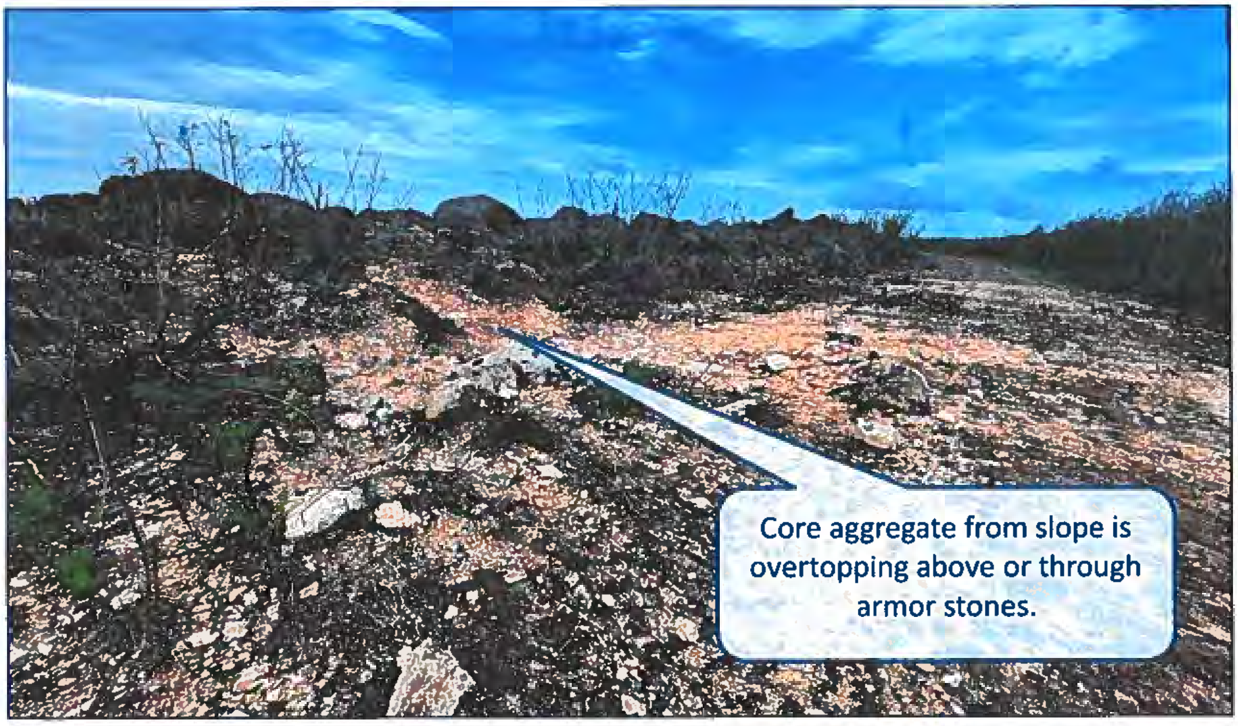


Photograph 1. Example of Breakwater Crest Settlement



Photograph 2. Example of Breakwater Armor Stone Loss

Photograph 3. Example of Exposed Core Aggregate



Photograph 4. Example of Debris Spills at Crest Road

LOLA E. LEON GUERRERO
Director
MATTHEW C. SANTOS
Deputy Director

BUREAU OF STATISTICS AND PLANS

Sagan Planu Siha Yan Emfotmasion

LOURDES A. LEON GUERRERO
Governor of Guam
JOSHUA F. TENORIO
Lieutenant Governor

September 20, 2024

E. E. Moon
Installation Environmental Program Director
Department of the Navy
U.S. Naval Base Guam
PSC 455, Box 152
FPO AP 96540-1000

RE: Coastal Zone Management Act (CZMA) Federal Consistency Review for Department of the Navy's Negative Determination for its Proposed Emergency Breach Repair Admiral Glass Breakwater Apra Harbor, Naval Base Guam (GCMP FC No. 2024-0015); Department of the Navy No. 5090 Ser EV /104

Håfa Adai! The Guam Coastal Management Program of the Bureau of Statistics and Plans (Bureau) has completed its review of the Negative Determination by the Department of the Navy for its proposed Emergency Breach Repair Admiral Glass Breakwater Apra Harbor, Naval Base Guam.

Pursuant to the Coastal Zone Management Act Section 307(c)(1), federal consistency determination of the U.S. Army Corps of Engineers' Nationwide Permit Reissuance and the Honolulu District Regional Conditions (GCMP FC No. 2020-0019), the Bureau finds that the proposed federal activity falls within the scope of the programmatic Nationwide Permit (NWP) 3. The Bureau has concluded that this particular activity has no reasonable or foreseeable effects and is also consistent with Guam's Enforceable Policies.

Please do not hesitate to contact Ms. Esther Taitague, Federal Activities Planner at 671-475-9673 or email esther.taitague@bsp.guam.gov or Mr. Edwin Reyes, Coastal Program Administrator at 671-475-9672 or email edwin.reyes@bsp.guam.gov. Si Yu'os Ma'åse'.

Sincerely,

LOLA E. LEON GUERRERO
Director