FINAL

Guam Harbor of Refuge Capital Improvement Project
Piti, Guam
Environmental Assessment

Prepared for

PORT OF GUAM
PORT AUTHORITY OF GUAM
ATURIDAT I PUETTON GUAHAN
Jose D. Leon Guerrero Commercial Port

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Summary

Final Environmental Assessment for the Guam Harbor of Refuge Capital Improvement Project (CIP), Piti, Guam

Lead Agency: Port Authority of Guam

Title of Proposed Action: Renovation of the Guam Harbor of Refuge

Designation: Final Environmental Assessment

Abstract
The Port Authority of Guam prepared this Final Environmental Assessment in accordance with the National Environmental Policy Act, federal and Guam regulations, federal executive orders.

The proposed action is to renovate 29 – 35 damaged moorings within the Guam Harbor of Refuge. Existing shackles, chains, and buoys would be removed from the existing mooring blocks and replaced with new shackles, chains, and buoys.

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Chapter One – Purpose of and Need For Action

1.1 Introduction

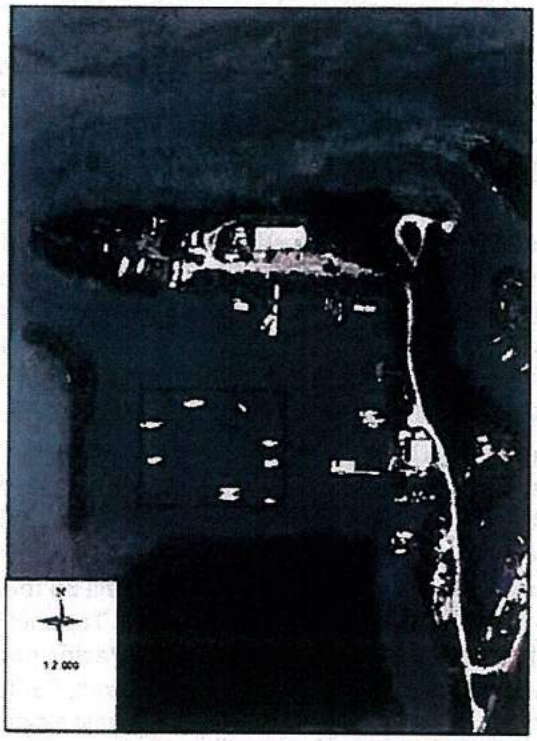
This Environmental Assessment (EA) was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended 42 United States Code [USC} § 4321 et seq.; and the regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] Parts 1500-1508).

This EA identifies the purpose and need for the renovation of the Port Authority of Guam Harbor of Refuge, Piti, Guam, and evaluates alternatives, existing environmental conditions, and environmental consequences. The results of this EA should provide the information needed to determine whether an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI) is appropriate.

At the eastern end of Piti channel is located the Harbor of Refuge. The harbor is used primarily as a location where boats can obtain shelter from winds during inclement weather or typhoons. Secondarily, it is used for long-term moorage to accommodate owners who leave the island for extended periods. Furthermore, it allows for transient boaters in vessels 26 feet or more to utilize or stay no more than ten (10) days on island. Transient boats utilizing the Harbor of Refuge on Guam travel from various Pacific ports including Singapore, Hawaii, Palau, Saipan, New Zealand, Taiwan, California, Philippines and the neighboring islands. Transient vessels generally moor at the Sumay Yacht Club, located along the southern area of Dry Dock Island. The Port Authority owns the property and leases the property to the Sumay Yacht Club. During periods of adverse weather these transient vessels move to the Harbor of Refuge for protection from high winds and waves.

The harbor has moorage for approximately 59 vessels with each vessel requiring four concrete anchor blocks for moorage. Renovation of and repairs to mooring blocks within the Harbor of Refuge, property of and operated by the Port Authority of Guam, is needed because 29 -35 of the 59 moorings are not useable, with shackles, chains, and mooring buoys severely damaged. Renovation of the damaged 29 -35 moorings would restore the number of functional and safe moorings to 59 moorings, which are needed to provide safe anchorage of private, commercial, and transient boats during periods of adverse weather (Figure 1-1).

Figure 1. Location of Guam Harbor of Refuge



The damage damaged shackles, chain, and mooring buoys would be either transported to a permitted Government of Guam landfill or sold as scrap metal and recycled.

1.2 Purpose and Need

Transient boat plying the ocean around Guam must be assured a safe port during stormy conditions. Long distances between ports in Micronesia make it necessary for boaters to be prepared should stormy conditions abruptly form. The typhoon season in the Western Pacific generally occurs from May through October, is the event in which tropical cyclones form in Micronesia, generate to large storms, that then travel towards Asia. Guam is located at the end of this process, aptly named "Typhoon Alley." As a result of these conditions it is necessary to provide transient vessels with a location for safe harbor, to conduct boat repairs, a port to replenish supplies, and a port where business transaction, communication, recreational, and medical assistance can be also obtained. As an unincorporated territory of the United States, Guam is considered a preferred port for transient boats.

Guam's western coast has a natural sheltered harbor, Apra Harbor, where shipping, tuna transshipment, and military vessels are docked. The Harbor of Refuge, located at the eastern end of Piti Channel, is designated area where transient boats obtain shelter. The Port Authority of Guam has designated 75% of the moorings at the Harbor of Refuge strictly for transient vessels. The Harbor of Refuge has a depth of eight (8) feet, and at full operating capacity, the Harbor of Refuge can provide moorings for at least 50 vessels.

Currently, the Harbor of Refuge is not capable of safe and adequate mooring for transient boats the Harbor of Refuge is designed to accommodate. A report by a local dive inspection company was conducted in 2011 and 2012 and outlined significant deficiencies at the facility. These deficiencies include a lack of pump-out facilities for boaters and moorings that need to be installed or repaired. In addition, the U.S. Coast Guard requested in 2011 that the Port must repair the damaged moorings to be in compliance, especially since the Harbor of Refuge is one of the few ports that transient vessels in the region can seek shelter in a U.S. Port and shelter from inclement weather.

Adverse weather, high winds, heavy rainfall, waves, and tidal surge, can occur in any month of the year. Trade winds during the dry season, December – May, often create choppy sea conditions. Tropical storms and typhoons are more frequent during the wet season, June – November. The last major typhoon to affect Guam was Super Typhoon Ponsonga on 8 December 2002, which had sustained winds greater than 150 mph.

Typhoon Dolphin's eye passed through the Rota Channel between Guam and Rota Island on 15 May 2015 delivering the typhoon's strongest winds in the eye-wall to both locations. Andersen AFB on the northeast side of Guam clocked a peak wind gust of 106 mph just before 7 p.m. CST. One hour later, Andersen AFB was reporting sustained winds peaking at 84 mph in the southern eye-wall of the typhoon.

The Port Authority of Guam *Master Plan Update 2013* identified several damaged moorings within the Harbor of Refuge, which made nearly half of the moorings unsafe and unusable. Without adequate functioning moorings in the Harbor of Refuge local and transient vessels would remain at Port Authority marinas or moored at Sumay; therefore be at severe risk of damage or sinking during a typhoon event. Port Authority's marina docks would also be at greater risks of damage if boats remaining in marina slips during a typhoon event.

1.3 Issues and Concerns

In the process of identifying issues and concerns related to the renovation of the Harbor of Refuge, the following Federal and Government of Guam agencies were either notified or contacted for their comments regarding the proposed project:

- U.S. Army Corps of Engineers (USACE)

- U.S. Department of Commerce, National Marine Fisheries Service (NMFS)
- Guam Environmental Protection Agency (GEPA)
- Guam Department of Agriculture, Division of Aquatic and Wildlife Resources (DAWR)
- Guam Bureau of Statistics and Planning, Coastal Management Program (GCMP), and
- Guam Department of Parks and Recreation, Historic Preservation Office (GHPO)

The scoping process revealed that environmental concerns were limited to potential impacts to sea turtles, if present during the renovation. The threatened green sea turtle (*Chelonia mydas*) and endangered hawksbill turtle (*Eretmochelys imbricate*) are both known to occur in the waters around Guam.

The Harbor of Refuge was created through dredging of a shallow water estuary to a depth of approximately 8 feet. The dredged material being was used to create the surrounding land. Water access to the Harbor of Refuge is via Piti Channel, which is an artificial channel that is approximately 100-feet wide and 10-feet deep. The Piti Channel is approximately 3,100 feet in length from the Port Authority of Guam wharves to the Harbor of Refuge. Numerous fast moving powerboats navigate in and out of Piti Channel every day from Aquaworld Marina. Informal interviews with a sample of tenants users of the Harbor of Refuge and Aquaworld Marina tenants revealed that green sea turtles have been observed within Piti Channel; however there has been no sea turtle sighting within the Harbor of Refuge. Therefore sea turtles will not be affected by the renovation of the Harbor of Refuge moorings.

1.4 Government Permits, Approvals, and Consultations

Government permits and consultations identified during the scoping process and the development of this document are identified in Table 1-1. Because the project is located on Port Authority of Guam property, the Port Authority will be responsible for obtaining permits and completing consultations, as appropriate.

Table 1-1. Summary of Government Permits and Consultations

Permit, Consultation, or Concurrence	Regulatory Agency
Department of the Army Nationwide Permit, Section 10 of the Rivers and Harbor Act for the renovation of the moorings. (NWP #3, Maintenance)	USACE
Federal Consistency Determination under the Coastal Zone Management Act	GCMP
National Historic Preservation Act (NHPA), Section 106 Consultation	GHPO

Chapter Two – Alternatives Including the Proposed Action

2.2 Renovation of Harbor of Refuge, Piti, Guam

Renovation of the Harbor of Refuge is need to restore the number of functional moorings back to the design criteria of 59 moorings, and allow for safe haven of boats during periods of adverse weather, especially during typhoons. The Harbor of Refuge is located within the inner Cabras Island complex, which is in the Municipality of Piti, and totals approximately 3 acres in size. Its average depth is approximately 8 feet MLLW. There are a total of 59 moorings consisting of submerged concrete blocks with metal pad-eyes to which shackles and chain are attached to mooring buoys. Twenty-nine to thirty-five of the moorings require renovation with the replacement of shackles, chains, and buoys. The old shackles, chains, and buoys would be transported to a permitted Government of Guam landfill or the metal shackles and chains would be sold as scrap metal for recycling.

2.3 Description of Alternatives

This EA evaluates the No Action, the Proposed Action Renovate Mooring Systems, and the Replace Mooring Systems Alternatives. Under the No Action Alternative, renovation of the 29 -35 unusable mooring systems would not occur. Renovation or replacement of mooring systems would occur under the Proposed Action and Replacement Alternatives.

2.3.1 No Action Alternatives

Under the No Action Alternative, renovation of the 29 -35 unusable mooring systems would not occur. This alternative would not meet the project's purpose and need to provide a safe haven of boats during periods of adverse weather by renovating 29 -35 unusable mooring systems in the Harbor of Refuge.

2.3.2 Proposed Action Renovate Mooring Systems Alternative

The Proposed Action Alternative involves the replacement of shackles, chains, and mooring buoys attached to 29 -35 submerged concrete blocks and pad eyes. Existing shackles and chains would be cut from pad eyes. The old shackles and chains would be either transported to a permitted Government of Guam landfill for disposal, or sold as scrap metal and recycled.

2.3.3 Replace Mooring Systems Alternative

The Replace Mooring Systems Alternative involves (1) cutting the existing shackles and chains from the pad eyes, (2) lifting the existing of the 29 -35 concrete blocks, (3) transporting the concrete blocks and cut shackles and chain to shore, (4) transporting the concrete blocks and old buoys to a permitted Government of Guam landfill, and either transporting the old shackles and chain to a permitted Government of Guam landfill for disposal, or selling the metal as scrap and recycled.

Twenty-nine to thirty-five new concrete blocks would be manufactured and fitted with new pad-eyes, shackles, chain, and buoys, and the new mooring systems placed where the old blocks were removed.

2.4 Summary Comparison of Alternatives and Potential Consequences

The Proposed Action Renovate Mooring Systems and Replace Mooring Systems Alternatives presented in Section 2.3, and evaluated in the following chapters of this EA, represent reasonable alternatives that would accomplish the repairs needs of the Port Authority of Guam for the Harbor of Refuge.

Table 2-2 presents a summary of these alternatives and their predicted effects.

Table 2.2. Comparison of Alternatives

Relevant Affected Resources /Issues	**Alternatives**		
	No Action Alternative	**Propose Action – Renovation**	**Replacement Alternative**
Air Quality			
Impacts to air quality from emissions	No impact	No significant impact. Emissions would be short-term and temporary, and would have negligible impacts on air quality.	Same comments as Proposed Action
Geology, Topography, and Soils			
Impacts on	No impact	No significant impact.	Same comments as

geological features, topography, and soils			Proposed Action
Ground water			
Impacts to ground water quality	No Impact	No significant impact.	Same comments as Proposed Action
Surface and Marine Waters			
Impacts to surface and marine waters	No impact; however sediment plumes may result when vessels transit or moor in shallow water.	No significant impact. Potential fuel leakage from support vessels could cause gasoline sheen on water in the Harbor of Refuge. These impacts would be minimized through use of standard BMPs for small boat refueling, which including fueling in designated areas, having absorbent material staged in advance. During active cutting and removal of shackles and chains there would be temporary turbidity on the sea floor around the work area.	No significant impact. During active lifting and replacing concrete blocks there would be temporary turbidity in the area of the work.
Land use compatibility conflicts.			
Land use compatibility conflicts	Potential adverse impact. The Harbor of Refuge is the only Port Authority of Guam safe haven mooring area. The number of available moorings would remain the same, or significantly less than its design capacity.	Potential beneficial impact. The full complement of 59 mooring systems would be restored and available for safe haven mooring during tropical storms and typhoons.	Same comments as Proposed Action.
Infrastructure			
Impacts to continued use or remaining useful life of existing	Potential adverse impact. There would only	Potential beneficial impact. The full complement of	Same comments as Proposed Action.

infrastructure.	be about 33 mooring systems available for safe haven mooring in the Harbor of Refuge during adverse weather. There would be greater potential for damage to boats and Port Authority of Guam marina as boats remain in slips during tropical storms and typhoons.	59 mooring systems would be restored and available for safe haven mooring during tropical storms and typhoons	
Public Health and Safety			
Impact of noise on surrounding populations	No impact	No significant impact. Temporary noise from support vessels would not be significantly different from ambient noise of Aquaworld Marina boat engine noise.	Same comments as Proposed Action.
Safe haven during periods of adverse weather.	The Harbor of Refuge would remain as approximately 50% capacity to provide safe haven to boats during periods of adverse weather. Port Authority marinas would remain at greater risk of damage as boats remain in the marinas rather than seeking safe haven in the Harbor of Refuge.	The number of moorings in the Harbor of Refuge would be restored to its design capacity.	Same comments as Proposed Action.
Cultural Resources			
Impacts on National Register of Historic Places (NRHP) listed resources.	No impact.	No impact. In compliance with Section 106 of the National Historic Preservation Act	Same comments as Proposed Action.

		(NHPA), the Port Authority of Guam consulted the Guam Historic Preservation Office (GHPO) regarding potential historic properties with the Area of Potential Effect (APE). The GHPO has determined that no historic properties will be affected by the proposed project.	
Biological Environment			
Marine Environment	No impact.	No significant impact. Sediment suspended in the water column during cutting shackles and chains would likely settle back on the sea floor. Corals are absent from the sea floor. Corals that encrust shackles, chains, and buoys would be removed with the shackles, chains, and buoys; however new encrusting corals would become attached and grow on the new shackles, chains, and buoys. Impacts to the Federally listed threatened green sea turtle and endangered hawksbill sea turtle are not expected. The area of the proposed action is not a preferred foraging or nesting area for green sea turtles. There are no records of sea turtles entering the marine waters of Harbor of Refuge or Aquaworld Marina. The Port Authority of Guam has determined that no species or habitats protected by the Endangered Species Act	Same comments as Proposed Action.

		(ESA) will be affected by the action, and the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) have been notified of this determination	
Terrestrial Environments and Wetlands	No impact.	No significant impact. No Federally or Guam-listed threatened or endangered plant species are within the project's vicinity. The surrounding vegetation consists primarily of open stands strand vegetation, and secondary/disturbed sites. Mangroves (*Bruguiera gymnorrhiza* (L.) Lam.) seedlings are present in low numbers in the intertidal zone that borders the Harbor of Refuge. Migratory bird species can be observed flying and foraging around Guam, and are known to frequent open fields. The terrestrial vegetation in the project's vicinity does not provide unique or essential habit for migratory birds. The Port Authority of Guam has determined that no species or habitats protected by the ESA will be affected by the action, and the NMFS and USFWS have been notified of this determination	Same comments as Proposed Action.
Socioeconomics			
Population and Economics	Potential adverse impact. No action could adversely impact	Potential beneficial impact. The action of renovating 29 -35 unusable mooring	Same comments as Proposed Action.

	the Port Authority of Guam mission of providing safe haven to vessels during periods of adverse weather. As a result more vessels at Port Authority of Guam marinas could be damaged or destroyed during a tropical storm or typhoon.	systems in the Harbor of Refuge will involve local Guam companies, providing additional work and income.	

Chapter Three – Affected Environment

This chapter describes the resources in the potentially affected environment of the Port Authorities' Harbor of Refuge and Aquaworld Marina in the Municipality of Piti.

The regions of influence considered for this Environmental Assessment (EA) are generally limited to the Harbor of Refuge, Aquaworld Marina, and Piti Channel. Issues that are described and evaluated for regions of influence beyond the Harbor of Refuge include climate, air quality, groundwater, surface water, noise, visual resources, hazardous materials, terrestrial and marine biota, and socioeconomics.

3.1 Physical Environment

The physical environment, including climate, air quality, geology, topography, soils, groundwater, surface and marine water, floodplains, land use coastal zone, infrastructure, public health and safety (noise and hazardous materials) visual resources, and cultural resources are presented in this section.

Guam is the westernmost entity of the United States. Guam is located approximately 3,300 nautical miles (nm) from the shores of Hawaii, 1,560 nm from Tokyo and 1,460 nm from Taiwan. Guam is an organized, unincorporated territory of the United States. It is the largest and southernmost island in the Marianas Archipelago and the largest island in Micronesia, and covers approximately 212 square miles.

The Harbor of Refuge is located in the eastern end of Piti Channel in the Municipality of Piti. Piti Channel connects Aqua World Mariana and the Harbor of Refuge to Apra Harbor at the Jose D. Leon Guerrero Commercial Port. The Harbor of Refuge is part of a larger Port of Authority complex located between Route 11A and Jose D. Leon Guerrero Commercial Port.

3.1.1 Climate

Guam has a maritime tropical climate due to its location between 13° and 14° north of the equator. Guam experiences a mean average temperature of 81° F and varies little during the day. Daytime relative humidity remains about 75% and increases at night.

The Inter-tropical Convergence Zone (ITCZ) and its subtropical high-pressure zones strongly influences seasonal precipitation. Monthly precipitation increases as the ITCZ shifts north and decreases as the ITCZ shifts to the south. The shifting ITCZ results in two distinct seasons. A dry-season persists from January through May when only 25% of the annual rainfall is received.

There are two official weather stations on Guam. One is located at the Won Pat International Airport located about nine miles north of Piti. The other station is located at Andersen Air Force Base (AAFB), which is located approximately 17 miles north of Piti.

The University of Guam Water and Environmental Research Institute (WERI) published an analysis of Guam's rainfall records that covered 50 years (1950 – 1999). WERI created a 50-year rainfall database and produced annual rainfall distribution maps for Guam. The maps show a north-northeast – south-southwest rainfall pattern orientation. Strong rainfall gradients are located along the western and southern mountain ranges. The mean annual rainfall was 102 inches ± 22 inches.

Approximately 65% of Guam's annual precipitation occurs July through October. Rainfall regimes during these months include tropical thunderstorms, monsoon and peripheral typhoon, and typhoon core.

On July 5, 2002 the southern half of Typhoon Chata'an's eye passed directly over the Andersen Air Force Base in northern Guam. The typhoon had sustained winds of 85 – 90 mph, gusting to 115-mph. Total rainfall during the storm exceeded 21 inches over the south-central Guam. Peak rainfall rates exceeded 6.48 inches per hour.

Rainfall regimes during the dry season months are related to trade winds and tropical thunderstorms. Under dry season conditions trade wind showers are not uniform whereas rainfall is isolated and scattered therefore may not be recorded at either weather station. Drought conditions can be experienced during these months.

Table 3.1 shows the annual water year rainfall (October – September) for the period 2007 – 2013 as recorded at the U.S. Geological Survey (USGS) Fena Rain Gauge at Reservoir Pump Station, Guam.

Table 3.1. USGS Water Year Annual Total Rainfall 2007-2013.

Water Year	Totals
2007	90.6
2008	104.88
2009	87.96
2010	83.14
2011	142.15
2012	112.00
2013	100.21
Average	19.2
Max	142.15
Min	83.14

Generally, northeast trade winds prevail throughout the year. Average annual wind speed is between 4 and 12 miles per hour (mph) (Lander and Guard 2003). Generally, trade winds are stronger between December and May. Between June and November weaker southern and southeasterly winds occur (Neill and Rea 2004). Surface winds are variable. Thunderstorms are common during these months brining heavy showers.

Guam has the highest risk of being affected by typhoons of any state or territory in the United States. The tropical typhoons that affect Guam are the world's largest and most intensive (Guard et al. 1999). Typhoon winds are between 75 – 150 mph, and super-typhoon winds exceed 150 mph. In the 1990's four super typhoons passed over Guam . Typhoons affecting Guam increase from July through September (Prasad and Manner 1994).

Table 3.2 list typhoons passing with 75 nautical miles of Tiyan, Guam (1945 – 2002).

Table 3.2. Typhoon passing within 75 nautical miles of Tiyan, Guam (1945-2002).

Storm Name	Year	Month	Day	Maximum Wind at Storm Center	Closest Point of Approach
Guerida	1946	Sept	20	103	23
Agnes	1948	Nov	14	65	47
Allyn	1949	Nov	17	124	60
Marge	1951	Aug	11	65	22
Irma	1953	Feb	21	75	72
Nina	1953	Aug	10	75	22
Alice	1953	Oct	14	50	28

Tilda	1954	Nov	26	70	41
Lola	1957	Nov	15	150	41
Viola	1958	Jul	9	60	50
Ida	1958	Sept	20	55	9
Karen	1962	Nov	11	135	11
Olive	1963	Apr	29	124	35
Susan	1963	Dec	24	123	65
Sally	1963	Sept	5	89	13
Gilda	1967	Nov	13	120	46
Pamela	1976	May	21	120	3
Kim	1977	Nov	8	63	6
Tip	1979	Oct	9	58	43
Betty	1980	Oct	30	71	31
Mac	1982	Oct	2	58	28
Bill	1984	Nov	12	83	26
Peggy	1986	Jul	4	62	69
Roy	1988	Jan	12	110	24
Koryn	1990	Jan	14	65	49
Russ	1990	Dec	20	122	55
Omar	1992	Aug	28	105	1
Brian	1992	Oct	21	65	8
Elsie	1992	Nov	2	93	70
Gay	1992	Nov	23	90	5
Hunt	1992	Nov	18	65	21
Keith	1997	Nov	2	143	69
Paka	1997	Dec	16	129	13
Chata'an	2002	Jul	4	75	20
Ponsonga	2002	Dec	8	150	15

3.1.2 Air Quality

The U.S. Environmental Protection Agency (EPA) characterizes air quality by comparing concentrations of criteria pollutants to established National Ambient Air Quality Standards (NAAQS). The criteria pollutants are carbon

monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, ozone, and lead.

Guam is designated as an attainment area, with the exception of the area within a 2.2-mile radius of the Piti Power Plant, which is nonattainment for sulfur dioxide. The Piti Power Plant is just 600 feet from the Harbor of Refuge and the Aquaworld Marina.

3.1.3 Geology, Topography, and Soils

The project area is adjacent tn dredged and filled land that was once a shallow estuary supporting some coral and mangroves. A hydrographic survey has not been complete for the Harbor of Refuge; however the harbor bottom is approximately 8 feet mean lower low water (MLLW). Existing physical and chemical characteristics of the bottom sediment has not been evaluated; however is reportedly primarily fine-grained and classified clay sand. The surrounding filled land is approximate 4 – 6 feet MLLW and level. The U.S.D.A Natural Resources Conservation Service, formerly the Soil Conservation Service, has mapped the surrounding filled land as Soil Mapping Unit 53, Urban land-Ustorthents complex, nearly level. This map unit is on coastal fill with most areas covered by roads, buildings, and parking lots. Slope is 0 to 3 percent.

3.1.4 Groundwater

The fill lands surrounding the Harbor of Refuge are narrow strips of porous coral substrate; therefore rainfall rapidly percolates or where the substrate is compacted, e.g. parking areas, rainfall rapidly runs off into the surrounding marine waters. Seawater percolates laterally in the porous coral substrate and mixes with the percolating rainwater; therefore groundwater is not a source for any use.

3.1.5 Surface and Marine Water

The Harbor of Refuge, Piti Channel, and other channels associated with Aquaworld Marina are considered surface marine waters. These waters are categorized as fair quality (M-3). Water in this category is intended for general, commercial, and industrial use while allowing for the protection of aquatic life, aesthetic enjoyment and compatible recreation with limited body contact. Specific intended uses include boating, berthing, and marinas. No marine water samples were collected for chemical analysis.

3.1.6 Floodplains

The fill properties surrounding the Harbor of Refuge are within the 100-year flood zone.

3.1.7 Land Use

The Harbor of Refuge is under the control of the Port Authority of Guam. Guam Code 10 GCA – Harbors & Navigation, Chapter 3 "Operation of the

Harbor of Refuge" states that the site is intended for use of private and small commercial vessels for anchorage during times of adverse weather conditions. All boat owners/operators who may have a need to utilize the Harbor of Refuge must register on an annual or daily use with the Guam Harbor Master at the Port Authority of Guam.

Owners and operators of boats can proceed to the Harbor of Refuge at any time the owner/operator believes it is prudent to do so based on forecasted or actual adverse weather. Vessels entering the Harbor of Refuge are on a first come first serve basis. Depending of the size of the vessel, the normal method of mooring is between four buoys, with two lines fore and two lines aft. There are no shore facilities (water, power, rest rooms) to support vessels moored at the Harbor of Refuge.

In certain areas boats are in dry dock on adjacent shores for repairs such as bottom cleaning and painting.

3.1.8 Infrastructure

This section presents information on the existing infrastructure with the study areas, including potable water, wastewater, storm water drainage, solid waste, and electricity.

3.1.8.1 Potable Water

There is limited potable water distribution to Aquaworld Marina. The water source is Guam Waterworks Authority (GWA). The distribution system is not directly available to owners/operators with vessels moored at the Harbor of Refuge.

3.1.8.2 Wastewater

There are limited wastewater facilities available at Aquaworld Marina. Several businesses are served by Porta-Potties.

There are no wastewater facilities directly available to owners/operators with vessels moored at the Harbor of Refuge; however through the Boating Infrastructure Grant (BIG) funding to acquire and install a portable pump-out system will be made available for transient boaters.

3.1.8.3 Storm Water Drainage

There are no storm water drainage systems designed for Aquaworld Marina. Rainfall either percolates or runs off to adjacent marine waters.

3.1.8.4 Solid Waste

Solid waste removal is the responsibility of individual concessions. There are no solid waste facilities available to owners/operators with vessels moored at the Harbor of Refuge.

3.1.8.5 Electricity

There is a limited electrical distribution to Aquaworld Marina. The power source is Guam Power Authority (GPA). The distribution system is not directly available to owners/operators with vessels moored at the Harbor of Refuge.

3.1.8.6 Roads

The Harbor of Refuge and Aquaworld Marina are accessed from Route 18 that intersects with Route 1, Marine Corps Drive. Route 18 is a paved two lane road that connects the Navy's Fuel Wharves and the Marianas Yacht Club with Marine Corps Drive. The coral based road leading to the Harbor of Refuge and Aquaworld Marina is in disrepair with numerous potholes.

3.1.9 Public Health and Safety

Public health and safety concerns within the Harbor of Refuge and Aquaworld Marina are related to noise, hazardous materials, and safe haven.

3.1.9.1 Noise

The Harbor of Refuge and marine waters adjacent to Aquaworld Marina primarily functions as an industrial harbor for tourist related (scuba, snorkeling, dolphin watching) industries. Existing noise sources include engine noise from boat transit and industrial activities along the shoreline. No sensitive noise receptors, such as residences, libraries, hospitals, or churches, have been identified in the vicinity.

3.1.9.2 Hazardous Materials

The marine waters of Harbor of Refuge, Aquaworld Marina channels, and Piti Channel are classified as M-3 or fair, which recommends only limited body contact. The surrounding fill land is used for industrial purposes. Boats hauled out on to adjacent fill land are in various stages of repairs, including bottom cleaning. Boat hull bottoms are typically coated with a copper based paint to deter marine growth. The Port Authority of Guam 2013 Master Plan Update noted that ground surface beneath boats in dry dock were often not properly covered to contain sediment and spills; therefore the ground was vulnerable to sediment runoff or contamination by paint or cleaning chemicals used in hull maintenance.

3.1.9.3 Safe Haven

The primary purpose of the Harbor of Refuge is to provide protection to boats from adverse weather. Vessels moored in the Harbor of Refuge secured to four submerged concrete blocks with shackles, chains, and buoys. Living aboard vessels moored in the Harbor of Refuge is prohibited.

3.1.10 Cultural Resources or Historic Properties

Aquaworld Marina is on fill land. No cultural resources or historic properties have been identified in the vicinity.

3.1.11 Visual Resources

Vistas, scenic overlooks, scenic highways, unique topography, and visual landmarks having scenic value are considered significant visual resources. Guam's scenic resources are identified in Guam Comprehensive Outdoor Recreation Plan prepared b the Government of Guam, Department of Parks and Recreation. Neither the Harbor of Refuge nor Aquaworld Marina is listed as a scenic resource. The area is largely developed by Aquaworld Marina concessions with converted shipping containers used for offices and storage. Neither the Harbor of Refuge nor Aquaworld Marina is visible from Route 1, Marine Corps Drive. Residents on Nimitz Hill may have a view of the general area; however the adjacent Piti Power Plant, which is a complex of large industrial buildings and fuel storage tanks, dominates the viewshed. The tall power plant smoke stacks often discharge smoke.

Historic places listed on the Guam and National Register of Historic Places (NRHP), or those potentially eligible for listing may also have scenic value and are discussed in Section 3.1.7.

3.2 Biological Environment

The biological environment, including the marine and terrestrial environments, and wetlands, are presented in this section.

3.2.1 Marine Environment

No rapid assessment was conducted in the Harbor of Refuge marine environment. The Federally listed threatened green sea turtle (*Chelonia mydas*) has been observed in the Piti Channel; however interviews boat owners/operators at the Harbor of Refuge indicated that no sea turtles have been sighted in the Harbor of Refuge. The Harbor of Refuge bottom lacks the major food source (e.g. macro-algal species) for the green sea turtle. The endangered hawksbill sea turtle (*Eretmochelys imbricate*) has not been reported.

The bottom composition in the Harbor of Refuge is reported to consist of coarse sand and rubble.

3.2.2 Terrestrial Environment

The terrestrial environment in the Municipality of Piti is comprised of coastal forests that support non-native trees such as tangantangan and Africa tulip tree (*Spathodea campanulata*).

The upland environment consists of savanna/grasslands on moderately steep slopes. The grasslands are maintained in a savanna state by frequent

wildland fires that are either unintentionally (e.g. refuge burning) or intentionally set by arsonists.

3.2.2.1 Terrestrial Flora

Little native vegetation remains in the vicinity of the Harbor of Refuge, and no threatened or endangered plants are present. The Harbor of Refuge and surrounding marine waters were deepened through mechanical dredging of a shallow-water estuary. Mangroves (*Bruguiera gymnorrhiza* (L.) Lam.) seedlings are present in low numbers in the intertidal zone that borders the Harbor of Refuge. The filled land is generally classified as urban/developed land that is highly disturbed. Much of the land-use is centered on tourism (scuba diving, dolphin watching, etc.). Numerous buildings, and converted cargo containers, roads, and parking areas occupy much of the filled area. Terrestrial vegetation on the filled land includes *Leucaena leucocephala* (tangan-tangan), *Casuarina equisetifolia* (ironwood), *Scaevola sericea* (half flower), and a variety of native and introduced weed species, including *Sida acuta, Mimosa invisa, Mikania scandens, Bidens alba, Lantana camara, Chromolaena odorata*, and *Stacytarpheta* sp.

On 1 October 2014 the U.S. Fish and Wildlife Service proposed the listing of 14 plant species on Guam as endangered under the Endangered Species Act of 1973, as amended (Federal Register Vol. 79 No. 190 59364-59413).

Table 3.3 lists of the plant species proposed for listing under the Threatened and Endangered Species Act on Guam and CNMI. None of the proposed listed plant species would be expected to be present within the AOI.

Table 3.3. —The 14 Plant Species Proposed for Listing on Guam and CNMI.

Scientific name	Listing status
Bulbophyllum guamense	Proposed–Endangered.
Cycas micronesica.	Proposed–Threatened
Dendrobium guamense...	Proposed–Endangered.
Eugenia bryanii	Proposed–Endangered.
Hedyotis megalantha	Proposed–Endangered.
Heritiera longipetiolata	Proposed–Endangered.
Maesa walkeri	Proposed–Endangered.
Nervilia jacksoniae	Proposed–Endangered.
Phyllanthus saffordii	Proposed–Endangered.
Psychotria malaspinae	Proposed–Endangered.
Solanum guamense	Proposed–Endangered
Tabernaemontana rotensis	Proposed–Threatened
Tinospora homosepala	Proposed–Endangered.
Tuberolabium guamense	Proposed–Endangered.

3.2.2.2 Terrestrial Fauna

As an insular landmass, Guam's native wildlife evolved from species that were able to travel across large ocean distances and colonize Guam. The theory of island biogeography suggests that the number of species on a given

island is usually related to the island landmass (Mac Arthur and Wilson 1967). The present species richness is a result of the evolution of native species, the introduction of new species, and their interactions.

3.2.2.3 Avifauna

It is well documented in scientific and popular literature that Guam's native avifauna has declined drastically in the past 50 years. Historic records show eighteen native avian species and four nesting seabirds existed on Guam. Jenkins (1983) stated that there were 12 native land birds, four breeding seabird species, one native wetland bird, one reef heron, and seven non-native avian species in 1983. Baker (1951) reported that the Micronesian megapode (*Megapodius laperouse laperouse*) was completely extirpated from Guam in the early 19th century, probably due to egg gathering by humans. The nightingale reed-warbler (*Acrocephalus luscinia*), a wetland dependent species, has been extirpated from Guam since the 1960's.

While the native avian species were once well distributed across Guam, by the late 1970's eleven of the native avian species were limited to northern Guam. Jenkins speculated that the widespread use of chemicals to control insects might be a potential cause; however by 1987 it was well established that the non-native invasive brown treesnake (*Boiga irregularis*) was the primary cause of the avian species decline (Savidge 1987)

Twelve of these native avian species had gone extinct or been extirpated from Guam by the mid 1980's. No sightings of the Marianna mallard (*Anas platyrhynchos oustaleti*), Mariana fruit-dove (*Ptilinopus roseicapilla*), rufous fantail (*Rhipidura rufifrons uraniae*), Guam flycatcher (*Myiagra freycineti*), and the Guam bridled white-eye (*Zosterops c. conspicillatus*) have been recorded since the mid-1980's, therefore these avian species are considered extinct.

Presently, the following avian species are federally listed threatened and endangered.

Table 3.4. United States Fish and Wildlife Threatened and Endangered Species on Guam

Scientific name	Common name	Chamorro name
Aerodramus bartschi	Swiftlet, Mariana	yayaguak
Corvus kubaryi	Crow, Mariana	aga[1]
Gallinula chloropus guami	Moorhen, Mariana Common	pulattat
Todiramphus cinnamominus cinnamominus	Kingfisher, Guam Micronesian	sihek[1]
Gallirallus owstoni	Rail, Guam (Koko)	koko[1]

[1] Extirpated in the wild from Guam

Source: http://www.fws.gov/pacificislands/species.html assessed on 17 September 2014.

The U.S. Fish and Wildlife Service has designated critical habitat for the Mariana crow and Guam Micronesian kingfisher on 325 acres at the Guam National Wildlife Refuge, which is located approximately 18 miles north of the Harbor of Refuge. Due to the lack of suitable habitat, none of the listed species are expected to be present in the vicinity of the Harbor of Refuge or Aqua World Marina.

The yellow bittern (*Ixobrychus sinensis*), a resident native avian species, is known to nest in secondary forest habitat, and are probably present in the vicinity of the Harbor of Refuge and Aquaworld Marina.

The brown noddy (*Anous* stolidus) and common fairy tern (*Gygis alba*) are the only resident seabirds on Guam.

The western Pacific contributes a significant migration route for transient migratory shorebird species passing from eastern Asia to the southern Australia. Most species occur in limited abundance annually. Guam's shorebird assemblage is quite dynamic with species diversity varying greatly every year. The primary migrant shorebirds include Pacific golden-plover (*Pluvialis dominica*), ruddy turnstones (*Arenaria interpres*), and whimbrel (*Numenius phaeopus*). Non-shore birds migrants to Guam are rare, with the exception of the cattle egret (*Bubulcus ibis*) (Williams and Williams 1988 Radar and visual observations of Autumnal (Southward) Shorebird Migration on Guam).

Three nonnative bird species are also present on Guam. They include the island collared dove (*Streptopelia bitorquata*), Eurasian tree sparrow (*Passer montanus*), and black drongo (*Dicrurus macrocercus*).

3.2.2.4 Mammals

Three species of bats were the only native mammals on Guam. The little Mariana fruit bat (*Pteropus tokudae*) and the sheath-tail bat (*P. emballonura semicudata*) have been extirpated from Guam. The Mariana fruit bat (*P. m. mariannus*) is federally listed as a threatened species. Its population on Guam is limited to northern Guam.

Numerous non-native mammals have been introduced to Guam over the past 300 years, including various rodents, dogs, cats, and ungulates. Rodents, feral dogs and cats are present in and around the Harbor of Refuge.

On 1 October 2014 the U.S. Fish and Wildland Service proposed the listing of the Pacific sheath-tailed bat (*Emballonura semicudata rotensis*). The Pacific sheath-tailed bat is a small insectivorous bat that is currently extirpated from all but one island in the Mariana Islands, Aquiguan; therefore the Pacific sheath-tailed bat is not be present within the vicinity of the project.

3.2.2.5 Terrestrial Reptiles

Predation by introduced vertebrate predators has resulted in the decline of the population of many native skinks and lizards. Predators include rats, cats, shrews and the brown treesnake. The brown treesnake, native to coastal

eastern Australia and north through Papus New Guinea and Melanesia, was accidentally introduced to Guam shortly after World War II (Rodda and Savidge 2007). The brown treesnake is believed responsible for the extirpation of 13 of Guam's 22 native bird species, and for contributing to the elimination of the Mariana fruit bat, and Slevin's skink populations on Guam. The brown treesnake is present in the vicinity of Aqua World Marina, and is a potential biosecurity threat should snakes be inadvertently transported to other Pacific Islands on vessels departing Aqua World Marina or the Harbor to Refuge.

Other common reptiles that are likely present in the vicinity include the cane toad (*Bufus marinus*), monitor lizards (*Varanus indicus*), and several native and introduced lizards and geckos.

On 1 October 2014 the U.S. Fish and Wildland Service proposed the listing of the Slevin's skink (*Emoia slevini*)). Slevin's skink is the only lizard endemic to the Mariana Islands and is on the Government of Guam's Endangered Species List). Slevin's skink is currently only found on Cocos Island off of southern Guam, where it was recently rediscovered; therefore is not be present within the vicinity of the project.

3.2.2.6 Terrestrial Invertebrates

Numerous native and non-native invertebrates are present in the project's vicinity. On 1 October 2014 the U.S. Fish and Wildland Service proposed the listing of the Mariana eight-spot butterfly (*Hypolimnas octocula marianensis*) and Mariana wandering butterfly (*Vagrans egistina*). The Mariana eight-spot butterfly is found in forest ecosystems; therefore would not be present in the project's vicinity. The Mariana wandering butterfly is considered extirpated from Guam; therefore would not be present in the project's vicinity.

On 1 October 2014 the U.S. Fish and Wildland Service proposed the listing of the humped tree snail (*Partula gibba*), Guam tree snail (*Partula radiolata*), and the fragile tree snail (*Samoana fragilis*)). The humped tree snail occurs in cool shaded forest habitats; therefore would not be expected to be present in the project's vicinity.

Historically, suitable habitat for the Guam tree snail included strand vegetation, forested river borders, and lowland and highland forest. The highly urbanized and degraded plant communities in the project's vicinity are probably not suitable habitat for the Guam tree snail; however no surveys for the Guam tree snail have been conducted in the vicinity of the project.

The fragile tree snail occurs in forest ecosystems; therefore the fragile tree snail would not be present in the vicinity of the project.

3.2.2.7 Marine Mammals

No marine mammals have been identified as species of concern in Piti Channel, Harbor of Refuge, or Aquaworld Marina..

3.2.3 Wetlands

There are no freshwater wetlands within the project area. Mangrove trees occupy parts of the shoreline, especially to the south of the project area. These mangrove areas have not been delineated as wetlands. No Federally listed threatened or endangered species, as defined by USFWS, have been documented at the mangrove wetland site.

3.3 Socioeconomics

No socioeconomics studies were conducted for this project. The Aquamarine Marina supports several recreational businesses.

3.3.1 Population and Economics

In 2010 Piti was estimated to have a population of approximately 1,454 residents. After the military, tourism is Guam's second largest industry.

3.3.2 Commercial Uses of the Harbor of Refuge

A number of commercial tourism-related businesses, including scuba diving, snorkeling, sightseeing submarines, and fishing operate out of the adjacent Aquaworld Marina.

Chapter Four – Environmental Consequences

This chapter identifies the environmental consequences associated with the No Action Alternative, Proposed Action – Renovation Alternative, and the Replacement Alternative. The chapter's focus is on the physical, biological, and socioeconomic conditions, and resources that may be affected by the alternatives. Cumulative impacts, unavoidable adverse effects, relationship of short-term uses and long-term productivity, irreversible and irretrievable commitments of resources, and applicable regulations, executive orders, and permits are also addressed in this chapter.

4.1 Physical Environment

This section presents the consequences of the alternatives on the physical environment; including air quality; geology; topography, soils, groundwater, surface and marine water, land use, infrastructure, public health and safety, and cultural resources.

4.1.1 Air Quality

An alternative could have an impact on air quality depending upon the extent and degree to which implementation of the alternative would increase air emissions that exceed National Ambient Air Quality Standards (NAAQS) or would prevent achievement of plans developed under the Clean Air Act (CAA).

No Action Alternative

Proposed Action - Renovation

Air emissions from the Proposed Action Renovate Alternative would include those from fuel-powered equipment and vehicles. These emissions would be short-term and temporary, and would have negligible impacts on air quality. No hazardous air pollutant sources, as regulated under the CAA, are proposed.

Equipment and vehicular emissions would occur over a short period of time, approximately one month. Emissions from equipment and vehicles would include typical of fossil-fuel combustion sources: carbon monoxide, oxides of nitrogen, oxides of sulfur, and particulate matter.

Combustion emissions would occur from the following equipment:

- One support boat
- Support trucks

Replacement Alternative

Air emissions from the Replacement Alternative would include those from fuel-powered equipment and vehicles. These emissions would be short-term and temporary, and would have negligible impacts on air quality. No hazardous air pollutant sources, as regulated under the CAA, are proposed.

Equipment and vehicular emissions would occur over a short period of time, approximately one month. Emissions from equipment and vehicles would include typical of fossil-fuel combustion sources: carbon monoxide, oxides of nitrogen, oxides of sulfur, and particulate matter.

Combustion emissions would occur from the following equipment:

- One support boat
- One barge
- One crane
- Support trucks

4.1.2 Geology, Topography, and Soils

An alternative could have an impact on geological features, topography, or soils depending on the extent and degree to which these features may be adversely affected.

No Action Alternative

The No Action Alternative would not implement the Capital Improvement Project to renovate the Harbor of Refuge moorings; therefore no change in geological features, topography, or soils would be anticipated.

Proposed Action - Renovation

The Project Action – Renovation Alternative does not involve dredging or other activities that would affect geological features, topography, or soils would be anticipated.

Replacement Alternative

The Replacement Alternative does not involve dredging or other activities that would affect geological features, topography, or soils would be anticipated.

4.1.3 Groundwater

An alternative could have an impact on groundwater quality depending on the extent and degree to which implementation of the alternative would degrade groundwater beyond regulatory levels.

No Action Alternative

The No Action Alternative would not implement the Capital Improvement Project to renovate the Harbor of Refuge moorings; therefore no change in groundwater quality would occur.

Proposed Action - Renovation

Piti Channel was creating through dredging of a shallow water estuary in the late 1940's. The Harbor of Refuge site was created through additional dredging a in the 1970's. There are no sources of groundwater that would be affected by the Proposed Action.

The surrounding land is on coastal fill material, which exhibits moderately rapid infiltration. The Proposed Action does not involve any activity that would alter the existing permeability of the coastal fill. There is no groundwater beneath the fill material that is a source of drinking water.

Replacement Alternative

Same as for the Proposed Action – Renovation.

4.1.4 Surface and Marine Water

An alternative could have an impact on surface and marine water quality depending on the extent and degree to which implementation of the alternative would alter the physical, chemical, or biological character of water bodies to exceed water quality standards established by regulatory agencies.

A U.S. Department of the Army Engineers (USACE) permit under Section 10 of the Rivers and Harbor Act is required for the renovation or replacement of the moorings in the Harbor of Refuge. The incidental suspension of bottom sediment is not defined as a discharge; therefore a Section 404 Water Quality

Certification from Guam Environmental Protection Agency would not be required.

No Action Alternative

The No Action Alternative would not implement the Capital Improvement Project to renovate the Harbor of Refuge moorings; therefore no change in surface or marine water quality would occur.

Proposed Action - Renovation

During active repairs to the moorings, which would occur over a few weeks, there would be temporary turbidity in the vicinity of the moorings under repair. The turbidity is expected to be limited to the bottom of the harbor.

Replacement Alternative

During the lifting and replacement of the concrete mooring blocks there would be temporary turbidity as the blocks are lifted and new blocks installed. The turbidity is expected to minimum and short-term and not exceed Guam marine water quality standard, M-3 Fair.

4.1.5 Land Use

An alternative could have an impact on land use depending of the extent and degree to which implementation of the alternative would conflict with existing and planned land uses.

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP repairs to 29 – 35 mooring blocks. The Harbor of Refuge would continue to support half of the design capacity for providing a safe harbor for boats during periods of adverse weather. Once the mooring capacity of the existing Harbor of Refuge is reached boats would likely drop anchor rather than moor to the concrete blocks and thereby be susceptible to dragging anchor and damage to themselves and other vessels during adverse weather.

Proposed Action - Renovation

Repairs to the moorings in the Harbor of Refuge would be consistent with the purpose of the harbor and surrounding commercial recreational businesses operating in Aquaworld Marina.

Replacement Alternative

Replacement of the mooring in the Harbor of Refuge would be consistent with the purpose of the harbor and surrounding commercial recreational businesses operating in Aquaworld Marina. The replacement of the mooring would extend the functional life of the moorings.

4.1.6 Infrastructure

An alternative could have an impact on infrastructure depending on the extent and degree to which implementation of the alternative would affect the continuous use or remaining useful life of existing infrastructure. Infrastructure includes roads, potable water, wastewater, and storm water drainage.

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP, therefore no change to infrastructure would be anticipated.

Proposed Action - Renovation

There are no existing utilities and no utilities services that are associated with the mooring of boats in the Harbor of Refuge. The repairs to the moorings in the Harbor of Refuge would not affect shore-based utilities and utilities service.

There are no public restrooms available for users of the Harbor of Refuge.

Replacement Alternative

Same as for the Proposed Action – Renovation Alternative.

4.1.7 Public Health and Safety

Public health and safety concerns within the study area are related to noise, hazardous materials, and safe haven.

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP, therefore the number of moorings would remain unchanged. Once the capacity of the Harbor of Refuge is reached boats would remain in their moorings at the Port Authority marinas, Marianas Yacht Club mooring, or anchor within the Harbor of Refuge. Because of the limited space to set anchor with adequate scope to ensure holding power the number of boats that could safely set anchor is very limited. Boats remaining at Port Authority marinas and Mariana Yacht Club moorings would be more susceptible to high winds and seas during periods of adverse weather. Port Authority docks would be continue to be susceptible to damage with boats remaining moored at the marinas during periods of adverse weather. Boats that continue to moor at the Mariana Yacht Club during period of adverse weather would remain susceptible to breaking free of their moorings and being pushed on to the shallow coral reefs or into the mangrove forests along the shoreline.

Proposed Action - Renovation

The renovation of 29 - 35 moorings in the Harbor of Refuge would bring the number of moorings to its design capacity.

Replacement Alternative

Same as the Proposed Action – Renovation Alternative.

4.1.8 Cultural Resources

An alternative could have an impact on cultural resources depending on the extent and degree to which implementation of the alternative would affect cultural and historic resources in the vicinity of the project area.

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP, therefore no change to cultural or historic resources would be anticipated.

Proposed Action - Renovation

In compliance with Section 106 of the National Historic Preservation Act (NHPA), the Port Authority of Guam consulted the Guam Historic Preservation Office (GHPO) regarding potential historic properties with the Area of Potential Effect (APE). The GHPO has determined that no historic properties will be affected by the proposed project.

Replacement Alternative

Same as the Propose Action – Renovation Alternative.

4.2 Biological Environment

An alternative could have an impact on the biological environmental depending on the extent and degree to which implementation of the alternative would adversely affect listed threatened or endangered species, marine mammals, or sensitive environments, such as wetlands.

4.2.1 Marine Environment

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP, therefore no change to marine environment would be anticipated.

Proposed Action - Renovation

The Proposed Action – Renovation would result in insignificant and temporary impacts to the marine environment. There are no coral reefs in the Harbor of Refuge; therefore the renovation of the moorings would have no impact on coral reefs. Encrusting corals, sponges, and other marine organisms attached to mooring shackles and chains would be removed with the removal and replacement of mooring hardware. Similar organisms would recolonize the new shackles and chains.

Replacement Alternative

Same as for the Proposed Action – Renovation.

4.2.2 Terrestrial Environment and Wetlands

The No Action Alternative would not implement the Harbor of Refuge CIP. Therefore, no impacts on the terrestrial environment or wetlands would result from this alternative.

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP. Therefore, no impacts on the terrestrial environment or wetlands would result from this alternative.

Proposed Action - Renovation

The Proposed Action – Renovation would have no significant impact to the terrestrial environment or wetlands. No Federally or Guam-listed threatened and endangered plan or animal species are within the project vicinity. The surrounding terrestrial vegetation consists primarily of open stands of strand vegetation, and secondary/disturbed sites. Mangroves seedlings are present in low numbers in the intertidal zone that borders the Harbor of Refuge and Aquaworld Marina. Migratory bird species can be observed flying and foraging around Guam, and are known to frequent open fields.

Replacement Alternative

Same comments as Proposed Action – Renovation.

4.3 Socioeconomics

An alternative could have an impact on socioeconomics depending on the extent and degree to which implementation of the alternative would adversely affect population, economics, commercial, or recreational uses of the Harbor of Refuge.

4.3.1 Population and Economics

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP, which would have a potential adverse impact to the Port Authority mission of providing safe haven to boats during periods of adverse weather. Boats that remain at the Port Authority marinas or the Mariana Yacht Club moorings could be damaged or destroyed during a tropical storm or typhoon.

Proposed Action - Renovation

The Proposed Action – Renovation would have a potential beneficial impact by provide safe haven for boats during adverse weather.

Replacement Alternative

Same as for the Proposed Action – Replacement, except the cost of replacing the moorings would be significantly higher to manufacture and replace the concrete mooring blocks.

4.3.2 Commercial Uses of Aquaworld Marina

No Action Alternative

The No Action Alternative would not implement the Harbor of Refuge CIP, which would have a potential adverse impact to the Aquaworld Marina operations. Commercial boats owned and operated by recreational tour companies are often the first to make safe haven at the Harbor of Refuge. Remaining moored along side the shoreline or constructed docks increase the potential for damage to these boats.

Proposed Action - Renovation

The Proposed Action – Renovation would have a possible beneficial impact on the commercial uses of Aquamarine Marina by increasing the number of mooring back to the design capacity of the Harbor of Refuge.

The Proposed Action – Renovation is not expected to interfere with the ingress and regress of the commercial boats during repairs to the moorings.

Replacement Alternative

Same as described for the Proposed Action – Renovation Alternative.

4.4 Cumulative Impacts

Cumulative impacts result from the incremental effects of the Proposed Action – Renovation Alternative when added to other past, present, and reasonably foreseeable future actions, regardless of what entity undertakes such other actions. Cumulative impacts can result from individually minor; however collectively significant actions occurring over a period of time.

Table 4.1. Comparison of Cumulative Impacts

Relevant Affected Resources /Issues	**Alternatives**		
	No Action Alternative	**Propose Action – Renovation**	**Replacement Alternative**
Air Quality			
Impacts to air quality from emissions	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Geology, Topography, and Soils			
Impacts on geological features,	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.

topography, and soils			
Ground water			
Impacts to ground water quality	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Surface and Marine Waters			
Impacts to surface and marine waters	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Land use compatibility conflicts.			
Land use compatibility conflicts	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Infrastructure			
Impacts to continued use or remaining useful life of existing infrastructure.	No cumulative impacts identified..	No cumulative impacts identified.	No cumulative impacts identified.
Public Health and Safety			
Impact of noise on surrounding populations	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Safe haven during periods of adverse weather.	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Cultural Resources			
Impacts on National Register of Historic Places (NRHP) listed resources.	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Biological Environment			
Marine Environment	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Terrestrial Environments and Wetlands	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.
Socioeconomics			
Population and Economics	No cumulative impacts identified.	No cumulative impacts identified.	No cumulative impacts identified.

4.5 Unavoidable Adverse Effects

No unavoidable adverse effects would be associated with the proposed renovation of the Harbor of Refuge moorings.

4.6 Relationship of Short-term and Long-term Effects

The renovation activities would beneficially affect long-term availability for the safe haven of boats during periods of adverse weather.

4.7 Irreversible and Irretrievable Commitments of Resources

The proposed renovation activities would involve a short-term commitment of resources (e.g. labor, equipment, energy) to conduct repairs.

4.8 Applicable Regulations, Executive Orders, and Permits

National Environmental Policy Act of 1969 (NEPA) (42 U.S. Code [USC] 4321 et seq.)

NEPA is required when a Federal action is taken that may have impacts on the human and natural environment. Federal actions are those that require Federal funding, permits, policy decisions, facilities, equipment, or employees.

This Harbor of Refuge CIP project is partly Federally funded; therefore this document has been prepared in compliance with the NEPA of 1969 and with Council of Environmental Quality (CEQ) regulations (40 CFR §§ 1500-1508).

This document has also been prepared to comply with Guam Environmental Protection Agency (GEPA) environmental impact assessment requirements.

Rivers and Harbors Act of 1899, Section 10 (33 USC 403)

Section 10 of the Rivers and Harbor Act requires a U.S. Army Corp of Engineers permit for any activity that obstructs or alters navigable waters of the U.S., or modifies the course, location, condition or capacity of any port, harbor, or refuge, or enclosure within the limits of any breakwater or of the channel of any navigable water. Implementing regulations are contained in 33 CFR Part 322) permits for structures or work in or affecting navigable waters of the U.S.

Renovation or replacement of moorings would be performed under the Proposed Action Alternative – Renovation or function, or the Replacement Alternative would require a U.S. Army Corps of Engineers permit under Section 10 of the Rivers and Harbor Act. Following consultation with the U.S. Army Corp of Engineers, Guam Field Office, Honolulu District, a Nationwide Permit Number 3, Maintenance, would be required for this CIP project.

Coastal Zone Management Act (CZMA) of 1972 (16 USC 1451 et seq.)

The Guam Coastal Management Program (GCMP) is an expression of Guam's policy to guide the use, protection, and development of land and ocean resources within Guam's coastal zone. Guam's coastal zone includes all non-federal property within Guam, including off-shore island and the submerged lands and waters extending seaward to a distance of three (3) nautical miles.

Piti Channel, the Harbor of Refuge, and Aquaworld Marina all fall within the definition of Guam's coastal zone.

The Harbor of Refuge CIP project would require a U.S. Army Corp of Engineers permit; therefore the proposed action would required a determination that the proposed activity is consistent with the GCMP.

Guam's Bureau of Statistics and Plans is responsible for reviewing the Port Authority of Guam assessment and consistency determination

National Historic Preservation Act (NHPA) of 1966 (16 USC 470 et seq.)

Section 106 of the NHPA requires that Federally funded activities take into account the effect of an undertaking on any property that is included in or eligible for inclusion in the National Registry of Historic Places and to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to such undertaking. The Port Authority of Guam has consulted with the Guam Historic Preservation Office (GHPO) regarding potential historic properties within the Area of Potential Effect (APE). The GHPO has determined that no historic properties will be affected by the proposed project.

Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.)

The ESA requires that any action authorized by a Federal agency be found not likely to jeopardize the continued existence of any threatened or endangered species, or resulting the destruction or adverse modification of designated critical habitat.

The threatened green sea turtle is the only listed or proposed Federally or Government of Guam species that is present in Piti Channel. Although the green sea turtle can be observed swimming in Piti Channel, no sightings of green sea turtle have been reported in the Harbor of Refuge.

The Port Authority of Guam has determined that no species or habitats protected by the ESA will be affected by the action, and the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (FWS), and Guam Department of Agriculture, Division of Aquatic and Wildlife have been notified of that determination.

Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 USC 703 et seq.)

The MBTA prohibits the taking of migratory birds. The Proposed Action – Renovation Alternative and Replacement Alternative would not involve the taking of any migratory birds.

Marine Mammal Protection Act (MMPA) (Title 16 Chapter 32)

The MMPA establishes a moratorium, with certain exceptions, on the taking of marine mammals. No marine mammals have been identified as species of concern in Piti Channel or the Harbor of Refuge.

Fish and Wildlife Coordination Act (FWCA) (16 USC §§ 661-668ee)

The FWCA provides for consultation with the U.S. Fish and Wildlife Service, and other relevant agencies when a Federal agency proposes an action to modify or control U.S. waters for any purpose. The head of the Guam Department of Agriculture Division of Aquatics and Wildlife Services has endorsed this Harbor of Refuge CIP project.

Magnuson-Steven Fishery Conservation and Management Act (16 USC 1801) (as amended by the Sustainable Fisheries Act of 1996)

The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act, PL 104-297 calls for action to stop or reverse the loss of marine fish habitat. The Act defines Essential Fish Habitat (EFH) as "all waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." All waters surrounding Guam are designated EFH and Habitat Areas of Particular Concern (HAPC). Neither the Proposed Action – Renovation Alternative nor the Replacement Alternative would cause a loss of marine habitat in designated EFH.

Executive Order 13098, Protection of Coral Reefs (11 June 1998)

Executive Order 13098 directs all Federal agencies whose actions may affect U.S. coral reef ecosystems to (1) identify their actions that may affect U.S. coral reef ecosystems; (2) utilize programs and authorities to protect and enhance the condition of such ecosystems; and (3) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the condition of such ecosystems.

Neither the Proposed Action – Renovation Alternative nor the Replacement Alternative would degrade coral reef ecosystems because not are present in the Harbor of Refuge.

Executive Order 12898, Environmental Justice in Minority Populations and Low-Income Populations (11 February 1994)

Executive Order 12898 directs Federal agencies to address the potential for disproportionately high and adverse environmental effects of their actions on minority and low-income populations. NEPA documents are specifically required to analyze effects of Federal agencies actions on minority and low-income populations and whenever feasible to develop mitigation measures to address significant and adverse effects on such communities.

Neither the Proposed Action – Renovation Alternative nor the Replacement Alternative would have significant an adverse effects on Guam communities.

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks (21 April 1997)

Executive Order 13045 directs Federal agencies to address the potential for disproportionately high and adverse environmental effects on children.

There are no facilities within the Harbor of Refuge or Aquaworld Marina that serve children (e.g. schools, day care centers, etc.).

Neither the Proposed Action – Renovation Alternative nor the Replacement Alternative would have significant an adverse effects on children.

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