

Programmatic Environmental Assessment
**Transportation: Bridges, Culverts,
Roads, and Landslides**
Commonwealth of Puerto Rico
November 2020



FEMA

U.S. Department of Homeland Security
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Caribbean Area Office - Joint Recovery Office
50 Carr. 165, Guaynabo, PR 00968

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
APE	Area of Potential Effects
BCE	Before the Common Era
BMP	Best Management Practices
CAA	Clean Air Act
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resources System
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFMC	Caribbean Fishery Management Council
COC	Community of Concern
COR3	Central Office for Recovery, Reconstruction, and Resilience [Puerto Rico]
CWA	Clean Water Act
CY	Cubic Yard(s)
CZMA	Coastal Zone Management Act
DCH	Designated Critical Habitat
DTOP	Department of Transportation and Public Works [Puerto Rico]
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFLHD	Eastern Federal Land Highway Division
EHP	Environment and Historic Preservation
EJ	Environmental Justice
EMS	Emergency Management Service
EO	Executive Order (issued by the federal Executive Branch of Government)
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
FPPA	Farmland Protection Policy Act
GDP	Gross Domestic Product
HAPC	Habitat Areas of Particular Concern
H&H	Hydraulic and Hydrology
ICP	Institute of Puerto Rican Culture
IPaC	[USFWS] Information for Planning and Consultation [System]
Lbs.	Pounds
MBTA	Migratory Bird Treaty Act
Mgal/d	Millions of gallons per day
MOT	Maintenance of Traffic
MRLC	Multi Resolution Land Characteristic Consortium

NAAQS	National Ambient Air Quality Standards
NBI	National Bridge Inventory
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHS	National Highway System
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OPA	Otherwise Protected Area
OSHA	Occupational Health and Safety Administration
PEA	Programmatic Environmental Assessment
PM	Particulate Matter
PPE	Personal Protective Equipment
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRCZMP	Puerto Rico Coastal Zone Management Plan
PREQB	Puerto Rico Environmental Quality Board
PRDNER/	Puerto Rico Department of Natural and Environment Resources
PREPA	Puerto Rico Electric and Power Authority
PRDTPW	Puerto Rico Department of Transportation and Public Works
PRHTA	Puerto Rico Highway and Transportation Authority (an agency of DTOP)
PRPB	Puerto Rico Planning Board
REC	Record of Environmental Consideration
RCRA	Resource Conservation and Recovery Act
RHA	Rivers and Harbors Act
ROW	Right of Way
SOW	Scope of Work
SHPO	State Historic Preservation Office
SPCC	Spill Prevention, Control, and Countermeasures
STIP	Statewide Transportation Improvement Program
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered Species
UNESCO	United Nations Educational, Scientific and Cultural Organization
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

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USGS	United States Geologic Service
USVI	United States Virgin Islands
WOTUS	Waters of the United States
WQC	Water Quality Certification

1.0 INTRODUCTION

The mission of the Federal Emergency Management Agency (FEMA) is to reduce the loss of life and property and protect our institutions from all hazards by leading and supporting the nation in a comprehensive, risk-based emergency management program of mitigation, preparedness, response, and recovery. Beginning September 17, 2017, Hurricane Maria caused significant damages to Puerto Rico (“Commonwealth”). President Donald J. Trump issued a disaster declaration for Hurricane Maria on September 20, 2017 encompassing the entire territory. The declaration authorized federal public assistance to affected communities and certain non-profit organizations per FEMA, and in accordance with the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974 (42 USC 5172) as amended; the Sandy Recovery Improvement Act of 2013; and the Bipartisan Budget Act of 2018 (Public Law 115-123). The Central Office of Recovery, Reconstruction and Resiliency (COR3) is the Recipient for FEMA grants and multiple agencies may be Subrecipient for specific projects.

This Programmatic Environmental Assessment (PEA) is prepared in accordance with Section 102 of the National Environmental Policy Act (NEPA) of 1969, as amended; and the Regulations for implementation of the NEPA (40 Code of Federal Regulations [CFR] Parts 1500 to 1508). The purpose of this PEA is to consider the potential environmental impacts of potential project alternatives, including a no action alternative, and to determine whether to prepare a Finding of No Significant Impact (FONSI) or an Environmental Impact Statement. In accordance with above referenced regulations, FEMA Directive 108-1, and FEMA Instruction 108-1-1, FEMA, during the decision-making process, evaluates and considers the environmental consequences of major federal actions it funds or undertakes.

If a proposed project meets the scope, impacts, and mitigation satisfied in this PEA, FEMA will then proceed with the preparation of a record of environmental consideration (REC), as required. If the scope of an action requires further analysis, FEMA will then conduct the appropriate level of analysis or consultation before preparing a REC, a tiered Environmental Assessment (EA), or Supplemental EA (SEA) under this PEA. In accordance with Title 40 CFR 1508.1(ff), FEMA may tier an EA from this PEA if it is determined that conditions and environmental impacts described in this document are valid. **Appendix A** presents conditions under which FEMA may tier an EA from this PEA.

2.0 PURPOSE AND NEED

Hurricane Maria’s wind, rain, and floodwater damaged various components of the Commonwealth’s Roadway transportation system and supporting landscapes. These components include roads, bridges and culverts (Roadway). The purpose of this action is to restore the Commonwealth’s Roadway transportation system to its pre-disaster capacity and increase its resiliency for future storm events. Under the Stafford Act, FEMA has authority to provide funding for cost-effective hazard mitigation and resiliency measures for facilities damaged by Hurricane Maria. Additionally, FEMA is authorized to provide funding to eligible grant Recipients and Subrecipients for cost-effective activities that have the purpose of reducing or eliminating risks to life and property from hazards and their effects. FEMA’s Public Assistance Alternate Procedures,

Sections 404 and 406 Hazard Mitigation under the Stafford Act, and the Bipartisan Budget Act of 2018 each encourage flexibility in recovery.

The Commonwealth-wide dependence on automobiles has led to the development of a complex system of Roadways. In an effort to restore pre-disaster capacity and mitigate impacts from future storm events, federal agencies led by FEMA may provide funds to Puerto Rico for the rehabilitation and upgrade of eligible components of the Commonwealth's Roadway transportation system from as soon as the federal funds are obligated until the allocated federal funds are expended. The need for the action is to re-establish an efficient and resilient Roadway transportation system meeting current codes and standards that will address the impaired movement of resident populations, inefficiencies in the operations of first responders, negative effects of Puerto Rico's current socioeconomic conditions; and the degradation of water quality caused by restrictions in flow beneath bridges and through culverts. A restored roadway system will improve the Commonwealth's mobility and commerce, water quality and land use, tourism, and in-turn, the economic conditions of Puerto Rico. FEMA will monitor the effectiveness of projects satisfied by this PEA through existing transportation and health and safety metrics described herein. For projects that require a SEA, additional information on how a project will address these conditions will be provided in the document and project REC.

3.0 PROJECT BACKGROUND

The Commonwealth of Puerto Rico is comprised of its land mass and territorial ocean waters. Puerto Rico is the smallest of the Greater Antilles of the West Indies and consists of the main island of Puerto Rico and various smaller islands, including Vieques, Culebra, Mona, Desecheo, and Caja de Muertos. Of the smaller islands, only Culebra and Vieques have year-round inhabitants. The length of the main island from east to west is 180 kilometers (km) (112 miles) and 65 km (40 miles) from north to south. **Figure 1 in Appendix B** is an area map that illustrates the locations of the larger islands that make up the Commonwealth of Puerto Rico. The Commonwealth has a combined land area of approximately 13,800 square (sq) km (5,328 sq miles) that include:

- Puerto Rico - 8,713 sq km (5,328 sq miles) (land mass only),
- Vieques is 132 sq km (51 sq miles),
- Culebra is 30 sq km (12 sq miles),
- Mona is 54 sq km (21 sq miles), and
- Territorial Waters: 4,921 sq km (1,900 sq miles) (Gómez-Gómez 2014).

The original inhabitants of Puerto Rico were the Taino people. Spain began settlements in 1508 and governed the islands until 1898 when the Commonwealth became a U.S. Territory. The population has more than tripled since becoming a U.S. territory and the U.S. Census Bureau (USCB) estimates the population as of July,1, 2019 was 3,193,694. With 1,088 people per square mile, the Commonwealth is one of the densest states or territories in the nation. The population overwhelmingly identifies as Latino/Hispanic (99 percent) and speak a language other than

English at home (USCB 2010). For centuries Puerto Rico's economy was comprised of trading ports, fishing, and rural agrarian society. Today, the Commonwealth's gross domestic product (GDP) is driven by manufacturing, finance, service, government, and trade. The following 78 municipalities comprise the Commonwealth of Puerto Rico:

Adjuntas, Aguada, Aguadilla, Aguas Buenas, Aibonito, Anasco, Arecibo, Arroyo, Barceloneta, Barranquitas, Bayamón, Cabo Rojo, Caguas, Camuy, Canovanas, Carolina, Catano, Cayey, Ceiba, Ciales, Cidra, Coamo, Comerio, Corozal, Culebra, Dorado, Fajardo, Florida, Guanica, Guayama, Guayanilla, Guaynabo, Gurabo, Hatillo, Hormigueros, Humacao, Isabela, Jayuya, Juana Diaz, Juncos, Lajas, Lares, Las Marias, Las Piedras, Loiza, Luquillo, Manati, Maricao, Maunabo, Mayaguez, Moca, Morovis, Naguabo, Naranjito, Orocovi, Patillas, Penuelas, Ponce, Quebradillas, Rincon, Rio Grande, Sabana Grande, Salinas, San German, San Juan, San Lorenzo, San Sebastian, Santa Isabel, Toa Alta, Toa Baja, Trujillo Alto, Utuado, Vega Alta, Vega Baja, Vieques, Villabla, Yabucoa, and Yauco.

The main island of Puerto Rico is mountainous with extensive coastal areas in the north and south. The main mountain range is called "La Cordillera Central" (The Central Range). The main island of Puerto Rico contains a total of 5,385 miles of rivers and streams (USDI-NPS 2019).

The Commonwealth's Roadway transportation system consists of approximately 16,700 miles of paved roads and approximately 1,600 miles of unpaved roads. Puerto Rico has 4.86 miles of paved roads per square mile of land (PRDTPW 2019). The system includes roads operated under the National Highway System (NHS), state highways, and municipalities. The NHS in Puerto Rico consists of approximately 780 miles of roadways while, Commonwealth maintained roadways make up approximately 5,000 miles of Puerto Rico's road network. Municipalities within Puerto Rico own and operate the remaining 11,000 miles of roadways (American Society of Civil Engineers (ASCE) 2019). The exact number of paved and unpaved road miles varies slightly based on the data's source and road surface definition used by the reference's preparer.

In Puerto Rico, rural communities are often located within the Commonwealth's mountainous regions where the roadways wind along steep hillsides and ridges. Although being in rural areas, some roads in Puerto Rico's mountainous communities receive high volumes of traffic, especially during rush hour and on weekends. Due to their hillside settings, many of these rural roadways are not able to fully support two lanes of continuous traffic. The steepness of hillsides and proximity of streams and rivers limits the Commonwealth's ability to expand the capacity of rural roadways within Puerto Rico. Similarly, in Puerto Rico's urban communities the scarcity and high cost of land, coupled with the intense development caused by high density populations limit the ability of the Commonwealth to expand roadway capacity beyond their current designations.

In the months following Hurricanes Maria, the Puerto Rican government deemed approximately 400 miles out of the 16,700 miles of paved roads unpassable. Emergency response efforts throughout the Commonwealth were able to re-establish service for all but 15 roads and 9 bridges within the first year of the recovery (COR3 2018). Within a year of Hurricane Maria, FEMA inspected 1,200 miles of roads throughout the Commonwealth. FEMA's post-Hurricane Maria records indicate that the storm damaged more than 2,947 sections of roads. This corresponds roughly to the 1,200 miles of roads inspected by FEMA following the disaster.

According to the Federal Highway Administration (FHWA), there are 2,325 bridges in Puerto Rico. The number of bridges includes culverts that serve the dual purpose as a vehicular crossing and a conduit for water. The exact number of bridges within the Commonwealth differs slightly from source to source. Within Puerto Rico the following entities own and operate bridges: municipalities (374 bridges), Puerto Rico Highway and Transportation Authority (PRHTA) (1,632 bridges), State Toll Authority (312 bridges), and other entities (16 bridges) (ASCE 2019).

Information derived from FEMA's Hurricane Maria response activities indicates that up to 387 bridges throughout the Commonwealth may have sustained damaged as a result of the storm event. This represents nearly 17 percent of all bridges in Puerto Rico. Following Hurricane Maria, FEMA has completed more than 285 bridge inspections within the first year of the recovery.

The FHWA National Bridge Inspection Standards require bridge inspections at a minimum of every two years. The National Bridge Inventory (NBI) for 2018 indicates that 12 percent of bridges in Puerto Rico are in poor condition, approximately 69 percent are in fair condition, and only 19 percent are in good condition. The average age of Puerto Rico's bridges is 45 years old. As a result, many of Puerto Rico's bridges may be reaching or exceeding their design and service lives. The typical service life span for a bridge ranges from 50 to 100 years depending on materials, geography, use, and maintenance. If a state or local inspector working under the FHWA's NBI program determines a bridge is unsafe, the owner or operator must take immediate action which could include immediate repairs, weight restrictions, or closure of the crossing. (FWHA 2020). The actions taken by FEMA to repair or replace more than 285 bridges will prevent further stress on the Commonwealth's roadway transportation system and economy by addressing the condition of bridges before FHWA requires the owner or operator to impose vehicular restrictions.

Following Hurricane Maria, PRHTA conducted a study of landslides associated with the Commonwealth's transportation system. From a representative sample of 117 landslides, an incredibly wide range of landslide sizes occurred throughout Puerto Rico. PRHTA's study noted that most landslides are less than 75 cubic yards (CY) but range from 3 CY up to 6,000 CY.

PRDTPW data indicates that Puerto Rico has approximately 2.8 million registered vehicles and 2.1 million licensed drivers (PRDTPW 2019). The costs associated with traffic delays impact national productivity, quality of life, economic efficiency and global competitiveness. According to the 2019 Urban Mobility Report, San Juan commuters lost 58 hours of productivity due to congestion in 2017. The study estimates that the loss of time and excess fuel costs equates to \$1,166 per San Juan area commuter annually. In 2017, the national average for major metropolitan areas was 56 hours per commuter in extra traffic delay at a personal cost of \$1,000 annually. Driver mobility data indicates the total cost of traffic delays in the United States' top urban areas has grown by approximately 48 percent over the last 10 years (Lomax et al. 2019). By addressing the damage caused by Hurricane Maria to the Commonwealth's roadway transportation system, the repair or replacement of deteriorating roadways will reduce the number of roadway obstructions that result in longer traffic delays and higher fuel costs for Puerto Rico's residents.

Travel delays on freeways and streets at rush hour requires the addition of approximately 70 percent more travel time when compared with light traffic conditions. Drivers require the additional time to account for the effects of unexpected crashes, bad weather, special events, and other causes of congestion. For instance, in 2017, a 50-minute commute in rush hour traffic on a

San Juan area freeway typical took drivers in similarly sized metropolitan areas only 20 minutes to complete. Another example of the inefficiencies that exist within Puerto Rico's road transportation system is the amount of time a commute takes under free-flowing traffic conditions. The San Juan freeway system in 2017 ranked 3rd nationally for the amount of time it takes to make a trip under free-flowing traffic conditions. Under free-flowing conditions, a 33-minute trip in San Juan typically takes 20-minutes in most comparably sized metropolitan areas for the same type of trip (Lomax et al. 2019).

There are many economic costs incurred by shippers and carriers due to a congested and unreliable transportation system. In order to make on-time deliveries, companies have to hire more drivers, operate more trucks, re-route trucks through less congested residential areas, and relocate distribution warehouses to compensate for congestion. In turn, these additional costs cause shippers and manufactures to raise retail prices and shipping costs. With a potential to repair or replace more than 1,200 miles of road and more than 285 bridges, FEMA anticipates these actions will benefit Puerto Rico's economy by easing the cost burden shared by manufactures, shippers, and consumers for the inefficient distribution of goods in Puerto Rico.

The most recent results for the Puerto Rico Emergency Medical Services indicate the average response time in 2016 was 16:04 (USDOT 2018). Emergency medical service (EMS) units in the United States average 7 minutes from the time of a 911 call to arrival on scene for urban areas and 14 minutes for rural settings (Mell, et al. 2017). FEMA anticipates that repairs to the more than 1,200 miles of damaged roads and 285 bridges will reduce the number of detours and road obstructions that factor into the amount of time it takes first responders to answer an EMS call. A reduction in EMS response times will likely increase the possibility of a positive outcome for trauma patients.

State and federal governments place various limits on the sizes and weights of vehicles on public roads. The primary purpose is to ensure compatibility of vehicle size and weight with roadway design and operations. Of particular concern are the roadway impacts of heavy trucks, which far exceed those of passenger cars. Puerto Rico has one of the highest truck weight allowances permitted in the United States. Puerto Rico truck size and weight regulations establish a maximum gross vehicle weight and road vehicle weight of 110,000 pounds (lbs.) for commercial trucks on its roadways. This load restriction is codified in Law 22- Motor Vehicle Law of Puerto Rico of 2001, as amended. Most truck size and weight regulation in the United States require trucks to weigh 80,000 lbs. or less (ASCE 2019). The constant load pressures on roadways can accelerate deterioration and reduce the service life of a road or bridge. FEMA anticipates that by ensuring the repair and replacement of more than 1,200 miles of roads and 285 bridges meet Puerto Rico's elevated weight allowances through the application of current codes and standards, the Commonwealth will have a more resilient and safer transportation system.

4.0 ALTERNATIVES

The following Alternatives represent classes of actions that the Recipient might implement individually or in combination with one another to address disaster related damage or mitigate damage from future storm events. The Recipient can implement the Action Alternatives at any

funding eligible location within the Commonwealth. Typical project design will incorporate environmentally recommended practices such as soil bioengineering, to the extent practicable.

This PEA limits direct disturbance to five acres for areas currently developed that do not require substantial clearing and grubbing and two acres for areas that require widespread removal of native vegetation and soils. The two-acre threshold would apply to any project that requires sediment excavation as parts of their scope of work. FEMA may consider on a case-by-case basis any project that minimally exceeds the acreage thresholds for inclusion under this PEA so long as their activities are similar to the Action Alternatives discussed herein.

4.1 Alternative 1: No Action Alternative

Under the No Action Alternative, FEMA will not provide grant funding for maintenance, repair, rehabilitation, or replacement of the Commonwealth's Roadway system. Additionally, FEMA will not provide grant funding for the repair of areas affected by landslides. Under the No Action Alternative, the Commonwealth and local authorities are still able to pursue other sources of funding to repair roadway and landslide projects as well as, increase the resiliency of their infrastructure. Due to budgetary constraints within the Commonwealth, FEMA anticipates that much of the work will remain unfunded or deferred indefinitely. Deferred or unfunded transportation and landslide projects will likely impact the efficiency and resiliency of the Commonwealth's Roadway transportation system. In addition, ongoing environmental issues such as erosion and the accumulation of debris in rivers and streams may remain uncorrected. This alternative does not meet the overall purpose and need.

4.2 Alternative 2: Bridge and Culvert Replacement

The activities covered under this class of actions will involve the removal and replacement of existing bridges and culverts. The new structure will remain in the same general traffic corridor as did the pre-disaster bridge or culvert. Alternative 2 limits direct disturbance to five acres for areas currently developed that do not require substantial clearing and grubbing and two acres for areas that require widespread removal of native vegetation and soils. The acreage thresholds for limits of disturbance under Alternative 2 are inclusive of the roadway system elements under repair as well as, the areas associated with site access and the staging of equipment and materials.

Alternative 2 actions may occur within an existing right of way (ROW), temporary ROW, or new permanent ROW. Any acquisition of ROW will adhere to federal, state, and local regulations for the acquisition of lands. Any modification of Pre-Hurricane Maria ROW will be associated with the repair and hazard mitigation of the Commonwealth's roadway system. For this PEA, the acquisition or expansion of ROW's will be in accordance with Puerto Rico Department of Transportation and Public Works (DTOP) and PRHTA design codes and standards. PRHTA's design manual Chapter 2, Typical Designs (<https://act.dtop.pr.gov/download/chapter-02/?wpdmdl=752&refresh=5f85aece657e01602596558>), contains desired ROW widths for various roadway elements. PRHTA bases their requirements on such things as number of traffic lanes required, location, and topography.

PRHTA states in their design manual that ROW widths must be able to accommodate the construction, adequate drainage, proper maintenance and the development of a safer and more

aesthetically pleasing highway (PRHTA 1979). Projects satisfied by this PEA will not exceed the desired ROW widths noted in PRHTA's design manual and any expansion of Pre-Hurricane Maria ROWs will only be associated with the repair of damage caused by Hurricane Maria.

PRHTA indicates ideally for rural highways, the border extending from the edge of pavement to the outer limits of a ROW will ideally be 9 meters or 27 feet. However, in rural areas where steep slopes and streams and rivers constrain roadway design, the ability to achieve desired ROW widths is not always practical. Similarly, PRHTA states that the desired distance from the edge of pavement to the outer limits of a ROW for urban highways can be a little as 3 meters or 9 feet. PRHTA's design manual notes that in Puerto Rico due to the scarcity and high cost of land, and the intense development caused by their high population density in urban areas, ROW widths less than desired for some transportation elements are acceptable.

The Recipient may construct a new bridge on an alignment that is parallel or slightly shifted in relation to the existing structure to reduce risks to flooding, the environment, or local populations. Alternative 2 does not include the dredging of sediment beyond pre-disaster depths. The Recipient will be responsible for performing maintenance of traffic (MOT) in accordance with DTOP guidance. If it is necessary to maintain traffic during construction and a reasonable detour is not available, the Recipient may place a temporary bridge next to a similar structure for the purpose of re-routing traffic during the performance of construction activities. The Recipient must remove all temporary structures and comply with all permit requirements with respect to site remediation once the new crossing is open to traffic. This Alternative allows for the infringement of temporary bridges outside the boundaries of an existing ROW.

New structures will meet current PRHTA and FHWA standards, as applicable. Completed projects will not adversely impact the capacity of associated roadways to manage traffic as dictated by PRHTA and FHWA codes and standards. The consequences of completed projects will not result in increases to pre-disaster traffic or speed limits. Under Alternative 2, minor increases in the footprint of a bridge or culvert are permissible if it is due to changes in lane width, shoulder width, live load capacity, and crash-worthy railing.

Specific elements of culvert and bridge design will be the responsibility of the Recipient's engineer and the corresponding regulatory authority. Project activities associated with Alternative 2 may include the following SOWs:

- Alternative 2 includes the removal of post-disaster temporary replacement bridges and culverts. Replacement activities may also include removal of accumulated material from a stream channel for the purpose of restoring pre-disaster or natural channel flow characteristics.
- Alternative 2 includes the removal and replacement of existing bridges. FEMA anticipates the removal of bridges will include the removal of structural piling systems. Construction methodologies may involve the use of pile driving hammers, vibratory hammers, and augers deployed from land, temporary trestles, barges, or boats. The contractor will be responsible for securing any floating work platforms by means appropriate to the location. Associated engineering design services include hydraulic and hydrology (H&H) studies,

geotechnical subsurface explorations, life-cycle costs analyses, and other economic and feasibility analyses.

- Pile sizing and placement will be the responsibility of the Recipient's engineer and the applicable regulatory authority; and
- The Recipient's engineer and the permitting authority will determine the best option for removal and disposal of deteriorating or damaged piles.
- The Recipient may replace existing culverts with larger culverts or with a bridge structure if it is necessary to accommodate the flood capacity of the respective waterway.
- Alternative 2 includes stream or riverbank stabilization projects as part of the replacement of bulkheads or other structural elements. The Recipient's engineer may choose to incorporate soil bioengineering, bioengineered streambank protective devices such as gabion baskets or mattresses and Articulated Concrete Block systems as deemed appropriate.

4.3 Alternative 3: Repair of Landslides

Alternative 3 includes the stabilization of landslides in order to restore the pre-disaster capacity and function of Commonwealth roads and associated facilities. Additionally, actions satisfied by Alternative 3 may include hazard mitigation measures that will prevent landslides from occurring in the future.

If a project is not directly associated with the repair of a roadway or parking lot, an acreage threshold of two acres will apply. These are areas that if the size of a slide were to expand, the Commonwealth will have to take the potentially affected roadway element out of service. The two-acre threshold for a project's limits of disturbance is inclusive of both site access and staging area as well as, the area necessary to repair the landslide itself.

If a landslide is connected with damage to the Commonwealth's roadway system, Alternative 3 may include projects up to five acres in disturbance. The five-acre threshold is inclusive of the landslide repair, roadway repair, site access, and staging area. For projects satisfied by Alternative 3, their limits of disturbance and application of impervious materials will comply with PRHTA's landslide remediation guidance. **Appendix C** includes PRHTA's typical designs for landside remediation. Alternative 3 actions may occur within an existing ROW, temporary ROW, or new permanent ROW. Any acquisition of ROW will adhere to federal, state, and local regulations for the acquisition of lands. Any acquisition or expansion of Pre-Hurricane Maria ROW will be directly associated with the repair of roadway elements, application of hazard mitigation measures, and compliance with PRHTA codes and standards. Project activities associated with Alternative 3 may include the following SOW:

- Alternative 3 actions include various geotechnical and structural studies of project areas as well as, new engineering design that addresses steep angles on failed slopes.
 - This action includes geotechnical studies and geophysical engineering surveys required for the design of soils stabilization projects. Updated engineering designs

may require new configurations to protect transportation structures and comply with current codes and standards; and

- The installation of short segments of temporary roads and landings may be necessary to complete SOW. For additional information on specifications and best management practices (BMPs) associated with landslide repair, see PRHTA Landslide Correction Typical Section Sheets.
- Landslide stabilization includes a variety of options which can create a buttress that provides lateral support against an existing slide. Alternative 3 activities may include the installation of a buttress fill that involves removing the slide and replacing it with a mechanically stabilized embankment.
 - These activities may include using revetment structures such as soil nailing or rock bolts, gabion walls, retaining walls, rock or earth fill walls, concrete facing and fill, and horizontal piling. The Recipient's engineer will determine whether to remove and completely replace a slide area with engineered fill is necessary.
- Actions associated with soil stabilization include regrading, placement of backfill, and compaction of eroded or displaced fill and soils. The Recipient may choose to rehabilitate or replace damaged or displaced engineered erosion and sediment control technologies such as geotextile fabric or riprap. Projects may involve upgrades to earthen or engineered stabilization techniques related to mitigation or other code enforcements.

4.4 Alternative 4: Hazard Mitigation and Repair of Bridges, Culverts, and Roadways

Under Alternative 4, SOW will include hazard mitigation and repair of existing bridges, culverts, and roadways. Alternative 4 actions may occur within an existing ROW, temporary ROW, or new permanent ROW. Any acquisition of ROW will adhere to federal, state, and local regulations for the acquisition of lands. Any modification of Pre-Hurricane Maria ROWs will be associated with the repair and hazard mitigation of the Commonwealth's roadway system and not exceed PRHTA guidance on ROW widths.

Alternative 4 limits direct disturbance to five acres for areas currently developed that do not require substantial clearing and grubbing and two acres for areas that require widespread removal of native vegetation and soils. The acreage thresholds for limits of disturbance under Alternative 4 are inclusive of the roadway system elements under repair as well as, the areas associated with site access and the staging of equipment and materials.

Alternative 4 involves work required to restore the structural and operational integrity of a bridge, culvert, or road. The actions satisfied by Alternative 4 may include SOWs that require minor activities that involve the waterways, roadways, and railroads that an eligible project intersects. Roadway repairs will comply with current American Association of State Highway and Transportation Officials (AASHTO), FHWA, and PRHTA codes and standards.

Under Alternative 4, the SOWs will not adversely impact the compliance of roadways with respect to their applicable traffic management standards (i.e. traffic volume, speed limit, etc.). Alternative 4 does not authorize the dredging of sediment beyond pre-disaster depths. Roadway repair will

include eligible mitigation measures in conjunction with the continued use of the road's pre-disaster design and function. Examples of bridge, culvert, and road hazard mitigation and repair projects include the following classes of actions:

- Alternative 4 includes actions that do not require the complete replacement of bridges but rather involve increases in the elevation of decks and span lengths. Such modifications to deck heights or lengths may require reconstructing and raising road approaches;
 - Specific SOWs may include partial or complete deck replacement, modifications to the superstructure, and substructure strengthening or replacement;
- Under Alternative 4, the restoration of hydrology around damaged bridges and culverts may involve the removal of accumulated material from a stream channel, restoration of natural or pre-disaster channel flow, and installation of scour countermeasures;
 - Alternative 4 includes the placement of scour protection to protect abutments, piers, embankments, and wingwalls;
- The enhancement of existing culverts may require the installation of flexible culvert linings, cured-in-place culvert liners, or insertion of a corrugated or steel pipe culvert liners; and
- Under Alternative 4, roadway hazard mitigation and repair activities may include these SOWs:
 - The removal of damaged roadway sections, stabilization of eroding areas, restoration of subgrade soils, and installation of sub-base and base course materials that meet current codes and standards. The Recipient's engineer will be responsible for determining the appropriate materials for the finishing of roadway surfaces and that their designs meet current codes and standards;
 - SOWs included under Alternative 4 may involve the replacement of road associated appurtenances such as erosion and sediment control measures, retaining walls, road and lane dividers, curbs and gutters, sidewalks, pedestrian shelters, planters, landscaping, fencing, stormwater drainage systems, lighting, paint striping, safety reflectors, and signage. The Recipient's engineer will be responsible for ensuring that the replacement of road associated appurtenances meet current codes and standards;
 - Road repair work may require the temporary relocation, cutting, and subsequent repair of existing utilities. Repairs to utilities will comply with current codes and standards. The Recipient's engineer will be responsible for ensuring that the management of utilities complies with the owner's requirements for materials and construction specifications;
 - Eligible roadway hazard mitigation and repair projects may include the installation of manufactured materials to repair erosion on steep road embankments; and

- Roadway repair may involve minor improvements to adjacent roads that serve as detour routes during construction. Such repairs are permissible provided that the project SOW includes the action.

4.5 Alternative 5: A Combination of Alternatives 2 Through 4

FEMA prefers Alternative 5 as it fulfills the purpose and need of this PEA. Additionally, Alternative 5 allows the Recipient the greatest flexibility in addressing storm related damage and resiliency throughout the Commonwealth's Roadway transportation system. Conceptually, there are many combinations of the above-mentioned alternatives that the Recipient could implement at any given site. This alternative would allow FEMA to use this PEA to satisfy NEPA compliance requirements for projects that need a combination of the classes of actions mentioned in the Action Alternatives.

5.0 AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS

This section discusses the potential impacts and mitigation measures of the No Action Alternative and the Action Alternatives. In accordance with NEPA, the affected environment includes the physical, biological, cultural, and human use setting in which the proposed activities will occur, including restorative actions. This PEA presents a qualitative evaluation of potential impacts to the affected environment. The qualitative evaluation relies upon a scale that describes the intensity and duration of a potential impact. **Table 1** presents the impact scale FEMA used to describe the anticipated intensity of an impact while, **Table 2** describes the duration of the impact.

Whether it is the No Action Alternative or the Action Alternatives, the potential impacts resulting from FEMA’s decision to either fund or not fund a project may impact a resource in either a beneficial or adverse way. Additionally, impacts to a resource may be direct, indirect, or cumulative.

Table 1: Impact Scale Criteria for Potential Impacts

Impact Scale	Criteria
No Impact	There would be no impact on the resource or resource area.
Negligible	Changes would either be non-detectable or, if detected, would have effects that would be slight and local. Adverse impacts would be well below regulatory standards, as applicable.
Minor	Changes to the resource would be measurable, but the changes would be small and localized. Adverse impacts would be within or below regulatory standards, as applicable. Mitigation measures would reduce any potential adverse effects.
Moderate	Changes to the resource would be measurable and have either localized or regional scale impacts. Adverse impacts would be within or below regulatory standards, but alteration of historical conditions may occur on a short-term basis. Mitigation measures would be necessary, and the measures would reduce any potential adverse effects.
Major	Changes to the resource would be readily measurable and would have substantial consequences on regional levels. Adverse impacts would exceed regulatory standards. Mitigation measures to offset the adverse effects would be required to reduce impacts, though long-term changes to the resource would be expected.

Direct impacts occur in the same time and place as project construction such as vegetation removal, vehicle emissions, or erosion control. Indirect impacts occur in a later time or place than the project construction such as the accumulation of sediments downstream or increased traffic on alternate roads. Cumulative impacts occur when added to the impacts of other past, present, or reasonably foreseeable future actions such as transportation projects funded by other federal sources.

Table 2: NEPA Temporal Scale Criteria

Terminology	Definition
Temporary	Impacts and recovery occurring only during the construction period.
Short-Term	Impacts and recovery occurring during a limited, predictable amount of time up to three years.

Terminology	Definition
Long-Term	Impacts and recovery occurring over time period longer than three years but into the reasonably foreseeable future.

Section 9 presents the Summary of Impacts Table for the Alternatives analysis. FEMA is omitting the following environmental resource topics from further evaluation under this PEA because they do not apply to the projects or locations considered in this NEPA document. **Table 3** presents the list of resources omitted from further evaluation.

Table 3: Eliminated Resource Topics

Topic	Reason
Bald and Golden Eagles	Bald and Golden Eagles are not found in the Commonwealth.
Safe Drinking Water Act of 1974	According to the USEPA’s Map of Sole Source Aquifer Locations, there are no such aquifers within the Commonwealth of Puerto Rico.
Fish and Wildlife Coordination Act (FWCA)	The FWCA does not apply for grant funding projects or other activities that receive financial assistance from a Federal agency.

5.1 Geology, Topography, and Soils

Geologic and topographic characteristics such as shallow bedrock, steep slopes or excessive erodibility can affect the engineering design, method of construction, potential environmental impacts of the project and of the effectiveness of impact minimization measures. Soil characteristics within a given area depend on the composition of material located in the area and described by “soil series” based on their origins, chemical and physical properties and slope.

The Farmland Protection Policy Act (FPPA) of 1981 (7 U.S.C. § 4201 et seq.) protects prime and unique farmlands and farmlands of state and local importance from conversion to non-agricultural uses. Prime farmland is land with the best physical and chemical characteristics for the production of food, feed, forage, fiber and oilseed crops. Prime farmland is either used for food or fiber crops or is available for those crops; it is not urban, built-up land, or water areas. The definition of unique farmland is land that is for the production of certain high-value crops, such as citrus, tree nuts, olives, and fruits. The FPPA applies to not just lands currently under agricultural production but also forestland, pastureland, or other land types that agriculturalists can be convert into farmland or ranchland.

5.1.1 Existing Conditions

The PRHTA Highway Design Manual provides the design requirements for project elements involving geologic resources and soils (PRHTA 1979). The Puerto Rico Erosion and Sediment Control Handbook for Developing Areas outlines standards for the implementation of BMPs that can minimize erosion and sedimentation from transportation project sites (PRDNER/PREQB, USDA NRCS 2005).

The principal physiographic feature of Puerto Rico is the Cordillera Central and the Sierra de Cayey, which form a continuous mountain range extending in an east-west direction nearly the entire length of the main island. The foothills, which separate the coastal plain from the mountains, begin at an altitude of about 300 meters (m) (or 984 feet (ft)). Throughout most of the mountainous areas, ridge tops reach altitudes of 700 m (or 2,297 ft) with a maximum altitude of 1,338 m (or 4,390 ft) found at Cerro de Punta which is located north of Ponce. Within the mountainous areas, hillsides are steep with about 50 percent of the land having slopes greater than 45 percent. The predominant physiographic feature characterizing the western two-thirds of the northern coast is limestone karst terrain. The limestone karst terrain extends inland as much as 20 km (or 12.4 miles) (Gómez-Gómez 2014).

The Commonwealth and the nearby Caribbean islands are located in a seismically active region. Seismologists have documented regional earthquakes with magnitudes between 7.5 and 8.1. Devastating tsunamis have hit several of the Caribbean islands from earthquakes originating both locally and as far away as Portugal (Lander 2002). There are no major fault lines that directly intersect the main islands of the Commonwealth; however, the Puerto Rico Trench and Buncce Fault are located approximately 100 miles to the north of the island; and the Muertos Trough is located 50 miles to the south of the main island (USGS 2019). **Figure 2 of Appendix B** illustrates the location of the fault lines in relationship to Commonwealth. Minor earthquakes causing land slumps and slides are common in the mountainous areas of Puerto Rico (Larson and Torres-Sanchez 1998).

In the DTOP Infrastructure Design Directive 300 dated May 2009, it states that,

“It is established that all structures that require to be under live loads of vehicular traffic will be designed using the code of "AASHTO Load and Resistance Factor Design Bridge Design Specifications" as adopted by the Authority in the Design Guideline 305.”

These AASHTO specifications include standards for road and bridge design to “Extreme Event Limit States” including earthquakes.

Soils and Prime Farmland

Soil is the unconsolidated loose covering of broken rock particles and decaying organic matter overlying bedrock or parent material. Soil characteristics vary greatly across the Commonwealth due to vast differences in regional geology. According to the United States Department of Agriculture (USDA), soils of Puerto Rico fall within 11 soil orders (USDA 2018). The NRCS Web Soil Survey can be useful in determining whether there are prime or unique soils or soils of statewide or local importance at a site.

There are 77,323 total hectares (161,069 acres) of designated Prime Farmland (9 percent) in the Commonwealth and 98,803 hectares (244,147 acres) of Farmland of Statewide Importance (11 percent). There is an additional 6 percent that are “conditional” soils that are of statewide importance or prime farmland if irrigated, reclaimed from excess salts, or drained. **Figure 3 of Appendix B** shows the locations of designated farmland throughout the Commonwealth.

As of 2000, Puerto Rico had lost approximately 14 percent (32,186 ha) of its available farmland to urban development (Gould et al. 2017). Most of the loss is from urban expansion and sprawl or conversion back to forested habitat (Pares-Ramos, et al 2008). Additional studies characterized one quarter of the main island as well-suited for mechanized and non-mechanized agriculture (Gould et al. 2017). Current estimates indicate about 28 percent of the main island is farmland. Of that percentage, recent studies indicate that as much as 50,000 hectares are managed as cropland while, 90,000 hectares are either idle, rangeland, brush, or unclassified (Gould et al. 2017).

As of the 2012, the USDA Agricultural Census estimated that the total farmland in Puerto Rico covered approximately 584,988 acres. This was an increase of approximately five percent from 2007. There were 13,159 farms in Puerto Rico in 2012 versus 15,745 in 2007. The decrease in the number of farms constituted a loss of approximately 16 percent. While the number of farms decreased, farm size increased from an average of 35.4 acres to 44.5 acres. (USDA 2014).

Landslides

Hundreds of landslides and landslide clusters affected roads and transportation infrastructure throughout the Commonwealth during and following Hurricane Maria. Hurricane Maria landslides caused deaths, blocked roads and trails, and isolated communities from emergency response operations. Since Hurricane Maria, the Commonwealth and its partners have cleared much of the landslide debris from their transportation system; however, as of April 2020, some roads owned and operated by the municipalities remain partially or completely closed. Furthermore, many slopes remain unstable and with soil still exposed, the probability of future erosion and slumping exists.

Research conducted by the United States Geologic Survey (USGS) attributed the cause of Hurricane Maria landslides to excessive rainfall during the extreme weather event. The combination of Hurricane Irma and Hurricane Maria saturated soils which lead to erodible slopes giving away. The Puerto Rico Recovery Plan attributed over 41,000 landslides across Puerto Rico to Hurricanes Irma and Maria. This equates to at least one landslide per square kilometer in most of the mountainous areas of the Commonwealth (COR3 2018).

Increased slope coupled with soil saturation increases the likelihood of landslides due to sediment instability (USGS 2017). From a representative sample of 117 landslides associated with Puerto Rico Roadways provided to FEMA by PRHTA, an incredibly wide range of landslide sizes occurred within the Commonwealth. Most slides are less than 75 cubic yards (CY) but range from 3 CY up to 6,000 CY.

5.1.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund grants for transportation and landslide projects. As a result, the Recipient may not be able to address the adverse impacts that eroding soils are having on the Commonwealth's watersheds. The No Action Alternative will likely have negligible to minor impacts on geology and no impacts on prime or important farmland.

Without the implementation of the Action Alternatives, less than major short-term and long-term adverse impacts to soil resources may continue. If an area that has experienced soil erosion remains untreated, the size of destabilized areas could increase as storm events further erode the substrate. A review of landslides caused by Hurricane Maria found that the majority of the landslides occurred inland of the coastal plain where slopes are steepest and rainfall rates are highest (USGS 2017). Although it may occur at a slower rate and not possible in some locations, natural re-vegetation may minimize the long-term adverse impacts from eroding soil and sedimentation originating from landslides (Furniss 1989). Other federal funding sources may be able to minimize adverse impacts to geologic and soil resources.

Alternative 2: Replacement of Bridges and Culverts

Under Alternative 2, work that will likely impact soils and geology includes replacing existing bridges and culverts and creating temporary access and staging areas. FEMA anticipates that the replacement of bridges and culverts will require the use of heavy equipment to perform SOWs that involve ground disturbance. FEMA anticipates that the installation of temporary access and staging areas may cause direct minor short-term impacts to soil resources. Additionally, the installation of access roads and staging areas can result in adverse long-term minor impacts to soil resources by increasing soil compaction.

FEMA anticipates that by establishing limitations on project size and project location, these thresholds will assist in minimizing adverse impacts to geology and soil. Additionally, FEMA anticipates that by setting forth Recipient requirements for permits and implementation of BMPs, these commitments will further minimize adverse impacts to the physical resources. By limiting projects that are likely to fit into the upper acreage threshold of between two and five acres to sites that have previously experienced soil and vegetative disturbance, new impacts to soil and geologic resources will not be widespread and will be less than major.

During the construction phase of Alternative 2 actions, erosion and sedimentation may cause adverse short-term negligible to minor impacts to soil resources. The implementation of BMPs presented in Section 6.0 of this PEA and National Pollution Discharge Elimination System (NPDES) permitting will assist in minimizing adverse impacts to soil and geologic resources from on-site erosion. The PRHTA Highway Design Manual provides guidance on the implementation of erosion and sediment control devices. Under the United States Environmental Protection Agency's (USEPA) NPDES program, any project disturbing equal to or more than one acre requires a NPDES permit and a Stormwater Pollution Prevention Plan (SWPPP). NPDES permit conditions require the management of soil or debris stockpiles, minimization of disturbance to erodible slopes, preservation of native topsoil, and reduction in soil compaction and erosion.

For in-water projects, the installation of new bridges and culverts may require the removal of sediment from waterbodies. When practical, replacement activities should occur in areas within ROWs and only directly impact pre-disturbed soils and sediments. As the in-water footprint of the new bridges and culverts is reduced, flow rates beneath or through those structures should be reduced as well. The reduction in erosional forces should help improve soil and sediment integrity. FEMA anticipates that NPDES permitting and SWPPP implementation will minimize adverse short-term impacts to soil resources and site stabilization requirements under the NPDES program.

Similarly, the NPDES permit and SWPPP will assist in minimizing long-term adverse impacts to soil and geologic resources.

FEMA anticipates that the installation of piles into the bedrock will cause negligible to minor short-term and long-term impacts to geologic resources. Such construction will include completion of site-specific geotechnical investigations regarding construction and foundation engineering. Engineering design plans will incorporate measures pertaining to temporary construction conditions. Surface fault rupture and displacement will not occur as there are no known active faults that intersect the Commonwealth. Adverse temporary minor impacts to existing structures related to vibration from pile driving may occur during the action's construction phase. A beneficial long-term impact to geologic resources may occur as a result of actions meeting the structural engineering standards of Puerto Rico's current building codes.

Depending on the location of a bridge and culvert project and extent of the associated staging and access roads, adverse short-term and long-term negligible to minor impacts to potential FPPA soils may occur. In accordance with NPDES requirements, the implementation of a SWPPP will minimize short-term and long-term impacts to the FPPA.

Alternative 3: Repair of Landslides

Under Alternative 3, landslide repair will require ground disturbance with heavy equipment. Stabilization of landslides with conventional engineering methods will likely involve the placement of concrete or another fill material over, above, and below an existing slide. Due to steep slopes and limited roadways, the process of accessing and remediating landslides may require additional ground disturbance outside existing ROWs or the current landslide face.

FEMA anticipates that by establishing limitations on project size and project location, these thresholds will assist in minimizing adverse impacts to geology and soil. Additionally, FEMA anticipates that by setting forth Recipient requirements for permits and implementation of BMPs, these commitments will further minimize adverse impacts to physical resources. For instance, this PEA constrains landslide project size to two acres for actions that do not involve roadway repair. FEMA anticipates that by limiting actions to two acres, the installation of site access and staging areas in locations where no such previously disturbed lands occur will assist in minimizing adverse impacts to geologic and soil resources.

In order to prevent future landslides, the removal of soil at landslide sites may occur. FEMA anticipates that the implementation of landslide stabilization techniques may result in adverse short-term negligible to minor impacts to soil as the excavation of material occurs. The implementation of sediment and erosion prevention measures will minimize adverse short-term minor impacts to soil resources. For projects equal to or over one acre, the NPDES program requires an NPDES permit and the development of SWPPP that will limit the impacts of erosion and sedimentation. Additionally, the conservation measures presented in Section 6.0 of this PEA will apply to all applicable projects. FEMA expects the remediation and stabilization of soils to be a beneficial long-term negligible to minor impact to soil resources.

Depending on the location of the landslide, adverse short-term negligible to minor impacts to potential FPPA soils may occur. The prevention of future landslides and removal of landslide

debris will result in a long-term beneficial impact to FPPA and farmland as agricultural lands will likely experience fewer and smaller landslide disturbances.

FEMA anticipates that the installation of support structures into the bedrock may cause negligible to minor short-term impacts and negligible long-term impacts to geologic resources. Surface fault rupture and resulting displacement will not occur during the construction phase as there are no known active faults that intersect the islands of the Commonwealth.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to geology and soils will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases. In addition to the Recipient's permit requirements, FEMA anticipates that limitations on project size, location, and classes of actions will minimize adverse short-term and long-term impacts to soils, geology and geologic hazards, and prime or important farmland from Alternative 4 actions.

Alternative 5: A Combination of Alternatives 2 Through 4 Under Alternative 5, impacts to the geology, geologic hazards, and soils will be similar to Alternative 2, Alternative 3, and Alternative 4 for the Alternative's construction and post-construction phases.

5.2 Air Quality

The Clean Air Act (CAA) of 1970 (42 USC § 7401 et seq.), including its 1977 and 1990 amendments, is the federal law that regulates air emissions from stationary and mobile sources. This law tasks the USEPA, among its other responsibilities, with establishing primary and secondary air quality standards. Primary air quality standards protect the public's health, including the health of "sensitive populations, such as people with asthma, children, and older adults." Secondary air quality standards protect the public's welfare by promoting ecosystem health, preventing decreased visibility, and reducing damage to crops and buildings. The USEPA has set National Ambient Air Quality Standards (NAAQS) for the following six (6) criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen oxides (NO_x), ozone (O₃), particulate matter (less than 10 micrometers [PM₁₀] and less than 2.5 micrometers [PM_{2.5}]), and sulfur dioxide (SO₂).

Federal agencies must make conformity determinations for federal actions other than those related to transportation plans and programs in accordance with the federal general conformity regulations (40 CFR § 93(b)). In accordance with the General Conformity regulations of the CAA, FEMA is subject to its requirements for projects located in non-attainment and maintenance areas. As such, the Recipient is responsible for preparing a General Conformity applicability analysis for all applicable projects satisfied by this PEA. The following are a list of actions that are exempt from the general conformity review:

- Stationary source emissions regulated under major or minor New Source Review (air permitting) programs;
- Alteration and additions of existing structures as specifically required by new or existing applicable environmental legislation;

- Actions where the emissions are not reasonably foreseeable;
- Actions that a federal agency or state determines are “presumed to conform;” and
- Activities with total direct or indirect emissions (not including stationary source emissions regulated under New Source Review programs) below *de minimis* levels.

United States CFR Title 40, Part 89 contains the USEPA emission standards for heavy equipment nonroad diesel engines. Heavy equipment includes excavators and other construction equipment, farm tractors and other agricultural equipment, forklifts, and utility equipment such as generators, pumps, and compressors.

Under the administration of the CAA, the USEPA has adopted multiple tiers of emission standards. The implementation of Tier 1, Tier 2, Tier 3, and Tier 4 standards progressively required compliance with more stringent emission standards. In 2004, the USEPA published the final rule (40 CFR Parts 9, 69, et al.) introducing Tier 4 emission standards, which were phased-in from 2008-2015. To meet the Tier 4 emission standards, engine manufacturers began producing engines with advanced emission control technologies. The USEPA has also adopted requirements for in-use diesel fuel to decrease sulfur levels by more than 99 percent. The resulting Ultra Low Sulfur Diesel Fuel has a maximum sulfur concentration of 15 parts per million (USEPA 2019a).

The CAA and corresponding EPA regulations prohibited gasoline containing lead or lead additives (leaded gasoline) as a motor vehicle fuel after December 31, 1995 (40 CFR Part 80). Diesel fuel, primarily used in most construction equipment, does not include lead or a lead additive. At the national level, major sources of lead in air come from ore and metals processing and piston-engine aircraft operating on leaded aviation fuel. Other sources of lead are waste incinerators, utilities, and lead-acid battery manufacturers (USEPA 2017).

5.2.1 Existing Conditions

The Puerto Rico Environmental Quality Board (PREQB), a division of the Puerto Rico Department of Natural and Environmental Resources (PRDNER), monitors, manages, and regulates air quality standards using its approved State Implementation Plan. Activities that generate emissions or air pollutants must comply with Regulation for the Control of Atmospheric Pollution and Regulation with a General Permit from PRDNER/PREQB. As of March 31, 2020, the USEPA’s Green Book lists Puerto Rico as in nonattainment for criteria pollutants lead and sulfur dioxides and maintenance for particulate matter. **Table 4** below and **Figure 4** in **Appendix B** present the municipalities and corresponding criteria pollutants listed as current nonattainment areas for the Commonwealth of Puerto Rico.

Table 4: Current Nonattainment and Maintenance Areas

Municipality	Criteria Pollutants
Arecibo	Lead (2008)
Bayamon	Sulfur Dioxide (2010)
Cataño	Sulfur Dioxide (2010)
Guaynabo	Sulfur Dioxide (2010)
Guaynabo	PM10 (1987) - Moderate Maintenance (since 2010)
Salinas	Sulfur Dioxide (2010)
San Juan	Sulfur Dioxide (2010)
Toa Baja	Sulfur Dioxide (2010)

Source: USEPA 2020

On November 13, 2018, the USEPA approved Puerto Rico’s revised SIP dated November 29, 2018, effective December 31, 2018. The purpose of the revision was to address the interstate transport of air pollution that may interfere with attainment and maintenance of NAAQS. In this action, the approval is pertaining to the 1997 and 2008 ozone, 1997 and 2006 fine particulate matter (PM_{2.5}), and 2008 lead NAAQS (USEPA 2018a).

5.2.2 Potential Impacts and proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund transportation and landslide projects. Due to the Commonwealth’s financial condition, FEMA anticipates that without funding the Recipient will delay or indefinitely defer bridge, road, culvert, and landslide projects. This Alternative will slow the Commonwealth’s ability to address impacts to the transportation system from Hurricane Maria. For any community that has reduced vehicle access, they may experience a reduction in localized vehicle emissions. However, other areas may experience an increase in air pollution as a result of more vehicular traffic due to detours, lane closures, and increased congestion. FEMA anticipates that this will create an adverse negligible to minor short-term and long-term impact to air quality. Funding from other federal sources will likely minimize the long-term impact from vehicular emissions caused by more vehicular miles.

Alternative 2: Replacement of Bridges and Culverts

This Alternative does not include the permanent installation of new sources of air emissions. However, the replacement of bridges and culverts will require the use of heavy construction equipment to complete the associated projects. Emissions from construction vehicles, generators, and other equipment may temporarily increase the levels of some criteria and non-criteria pollutants within the project vicinity. Temporary earth disturbing activities and off-road driving may result in the production of fugitive dust. An increase in fugitive dust will likely result in an increase in particulate matter emissions in the form of PM₁₀ and PM_{2.5}.

Based on Alternative 2’s classes of actions and this PEA’s area thresholds, FEMA anticipates that the replacement of bridges and culverts will have an adverse short-term negligible to minor impact on air quality. By implementing the BMPs listed in Section 6.0 of this PEA, the Recipient will limit adverse impacts to air quality from the construction phase of Alternative 2 actions. These BMPs may include measures such as, fugitive dust control, proper vehicle maintenance, and

minimizing vehicle idling time. Puerto Rican Environmental Quality Board Rule 404 Fugitive Emissions requires the implementation of BMPs that will assist in limiting short-term adverse impacts to air quality (PREQB 1975). The potential for fugitive dust following the completion of construction activities will diminish to negligible levels as all applicable sites will be stabilized by the Recipient in accordance with their NPDES permits.

Under Alternative 2, traffic volume and capacity estimates for the project area will comply with PRHTA and FHWA traffic standards. As such, traffic conditions will be similar to documented rates for the associated roadway prior to Hurricane Maria. Slight increases in capacity may occur as a result of new bridge and culvert designs meeting current codes and standards. The Recipient will be responsible for performing a traffic study to verify post-construction conditions for any project that may result in a substantial increase in traffic congestion. For projects that result in a substantial increase in congestion, FEMA will be responsible for performing an additional NEPA evaluation beyond this PEA. FEMA anticipates that the post-construction impacts will be similar to pre-disaster levels as the volume of traffic is not likely to increase.

Alternative 2 does not include the installation of facilities that will require major source permitting. FEMA anticipates the following in areas currently listed as nonattainment or under maintenance:

- Alternative 2 will have no impact on lead attainment for the Arecibo area because restrictions on leaded fuel and the widespread use of vehicles and equipment that operate only on unleaded fuel has effectively eliminated use of the product by both commuters and contractors;
- Alternative 2 will have a negligible impact on PM₁₀ attainment for the municipality of Guaynabo. This determination is based emission standards that reduce the amount of particulate matter emitted from exhaust and the implementation of fugitive dust control measures; and
- Alternative 2 will have negligible impact on sulfur oxides for the municipalities of Bayamon, Catãno, Guaynabo, Salinas, San Juan, and Toa Baja based on emission standards for nonroad diesel engines.

Alternative 3: Repair of landslides

Under Alternative 3, impacts to air quality and non-attainment and maintenance areas will be similar to Alternative 2 for the construction and post-construction phases. During the repair of landslides, FEMA anticipates that there will likely be some short-term increase in fugitive dust and vehicular emissions (PM₁₀ and PM_{2.5}); however, mitigation measures such as dust suppression techniques and employee transportation plans can minimize adverse impacts. Impacts from fugitive dust and vehicular emissions will be short-term and minor. For applicable projects, Section 6.0 of this PEA includes a list of BMPs that are effective in controlling fugitive dust. Control techniques for fugitive dust sources generally involve watering project sites, chemical stabilization, or reduction of surface wind speeds through the installation of windbreaks or source enclosures. FEMA anticipates that following the restoration of landslides, there will be no long-term adverse impacts to air quality. The NPDES site stabilization requirements will assist in

minimizing long-term adverse impacts. The NPDES program requires a permit and SWPPP for projects equal to or greater than one acre.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to air quality and non-attainment and maintenance areas will be similar to Alternative 2 for the Alternative's construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to air quality and non-attainment and maintenance areas will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases.

5.3 Water Quality

Congress enacted the Federal Water Pollution Control Act in 1948. In 1977, Congress reorganized and expanded the law into what is now known as the Clean Water Act (CWA). The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States (WOTUS) and regulating quality standards for surface waters.

Section 401 of the CWA requires state certification of all federal licenses and permits in which there is a "discharge of fill material into navigable waters." The process of obtaining a Section 401 Water Quality Certification (WQC) establishes whether an activity, as described in the federal license or permit, will impact site-specific water quality standards. Prior to the issuance of a relevant federal license or permit, Section 401 of the CWA requires that the state or territory first issue a WQC for the project. The most common federal license or permit requiring a WQC is the United States Army Corps of Engineers (USACE) issued CWA Section 404(d) permit.

Section 402 of the CWA established the NPDES program. This program authorizes the USEPA to issue permits for the point source discharge of pollutants into Waters of the United States (WOTUS). Under NPDES, the USEPA regulates both point and non-point pollutant sources, including stormwater and stormwater runoff for projects with ground disturbance of more than one acre. In the Commonwealth of Puerto Rico, the USEPA has authorized the PRDNER/PREQB to administer the NPDES program. The NPDES permit requires the preparation of a SWPPP for each project that qualifies under the program.

Section 10 of the Rivers and Harbors Act of 1899 (RHA) regulates structures or work in or affecting navigable waters. Section 10 of the RHA defines navigable waters as "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce" (33 CFR § 329.4) (USACE 1986). Through its administration of the RHA, the USACE implements a permit program that evaluates impacts to navigable waters and their navigable capacity.

In 1968 U.S. Congress authorized the National Wild and Scenic Rivers System (Public Law [P.L.] 90-542; 16 USC 1271 *et seq.*) to preserve rivers with outstanding natural, cultural and recreational value in a free-flowing condition. The law delegates the administration of the system to the

National Park Service (NPS). All projects with federal funding and/or federal actions must be reviewed for potential impacts to National Wild, Scenic and Recreational Rivers. The designation imposes restrictions on certain activities that can occur within a ¼ of a mile (or 0.4 km) of a designated river.

5.3.1 Existing Conditions

The PRDNER/PREQB takes an active role in water quality-based permitting through the CWA Section 401 certification process. The PRDNER/PREQB issues a local WQC under the authority of the Puerto Rico Water Quality Standards Regulation. The USEPA reviews applications for completeness and requests Commonwealth certification prior to development of a draft permit. The PRDNER/PREQB can include water quality-based effluent limits and special conditions in the water quality certificates they develop (USEPA 2005). The PRDNER/PREQB has adopted an anti-degradation policy and regulations are in place to protect coastal, surface, and ground waters.

Puerto Rico has considerable variability in water resources due to geology, hydrology, and topography. The Commonwealth has over 50 rivers with a total of 5,385 miles of rivers and creeks (USDI-NPS 2019). Rainfall averages about 11,600 million gallons of water per day (McCoy 1978). The mountainous interior receives the most rainfall and the southwest coast the least. The south coast is the most stressed area in terms of water deficiency (Gomez-Gomez 1980).

The November 2018 USEPA 303(d) list of impaired waters indicates that there are 666 locations where pollutants are causing the impairment of surface water, groundwater, and reservoirs within the Commonwealth (USEPA 2018b). In 2018 the primary sources of pollutants reported were sewage discharges, urban runoff/stormwater, confined animal feeding operations, sewer overflows/system failures, industrial point sources, agricultural, and landfills (USEPA 2018b).

Based on a review of damages submitted to FEMA, the number of culverts impacted by Hurricane Maria far exceeds the damages caused to bridges by the storm event. As culverts become blocked or overwhelmed with debris or water, they can have devastating effects on infrastructure and on the health of a watershed. Badly designed or badly maintained culverts can cause bank slumping, erosion, and scouring each of which can severely degrade water quality and habitat (USDA 2017).

The use of treated wood products in the construction of piers, pilings, and decking is a wide-spread practice. The treatment of wood pilings with chemicals ensures the integrity of the pilings when used below the water table as support structures. However, the exposure of wood pilings to air or oxygenated water causes their degradation over time. This is especially true in marine or brackish waters where many organisms can use the wood for food or shelter. Since at least the middle of the 18th century, the application of various chemical treatments to timber pilings have helped maintain their effectiveness. Chemical treatments such as creosote and copper treated materials were used to prevent the degradation of support piles. However, such treatments have adverse impacts on water and sediment quality and can be toxic to aquatic organisms (California Coastal Commission 2012; NOAA Fisheries 2009). Effective January 1, 2004, the USEPA and the American Wood Protection Association created use specifications and minimum chemical retention standards for pressure treated wood to reduce environmental impacts (NPS 2020).

There are only three rivers within the Commonwealth of Puerto Rico that maintain the designation of Wild and Scenic Rivers, and they are located within El Yunque National Forest. The three rivers are the Río Mameyes, Río de la Mina, and a section of the Río Icacos. The total length of the Río Mameyes is 4.5 miles. Of this length, only 2.1 miles are classified as wild, 1.4 miles as scenic, and 1.0 mile as recreational (National Wild and Scenic Rivers System 2002a). The Río de la Mina is designated as scenic from its confluence with the Río Mameyes to its headwaters located east of PR-191. The total length of the Río de la Mina is 2.1 miles (3.37 km) (National Wild and Scenic Rivers System 2002b). The section of the Río Icacos designated as scenic extends from its confluence with the Río Cubuy to its headwaters approximately a half mile south of the PR Highway 191 gate. The Río Icacos has a total length of 2.9 miles (4.66 km) (National Wild and Scenic Rivers System 2002c).

5.3.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund transportation or landslide related projects. Due to the Commonwealth's financial condition, FEMA anticipates that without funding the Recipient will delay or indefinitely defer bridge, road, culvert, and landslide projects. FEMA anticipates that federal transportation agencies will fund some projects minimizing the adverse long-term impacts of the No Action Alternative. If projects remain unfunded for extended periods of time, adverse short-term and long-term less than major impacts to water quality from existing landslides and eroded streambanks may occur. The continuous input of soil and sediment into waterways is likely to adversely impact water quality parameters such as, turbidity and dissolved oxygen.

Alternative 2: Replacement of Bridges and Culverts

Sources of potential contaminants during the construction phase of Alternative 2 actions include oil and hydraulic fluids from leaky equipment, construction dust, treated wood, and the resuspension of contaminated and non-contaminated sediments. Contaminated sediments can originate from decaying construction materials, road debris, and uncontrolled waste streams. As part of Alternative 2, H&H studies will provide engineers with data necessary to design bridge and culvert projects that incorporate site-appropriate streambank stabilization techniques that reduce long-term sediment loading. By reducing sediment loading, water quality parameters such as turbidity and dissolved oxygen should improve.

FEMA anticipates that by establishing limitations on project size and project location, these thresholds will assist in minimizing adverse impacts to water quality and water resources. Additionally, FEMA anticipates that by setting forth Recipient requirements for permits and implementation of BMPs, these commitments will further minimize adverse impacts to water quality and water resources.

For instance, projects that are allowed to have between two and five acres of land disturbance under Alternative 2 will occur in areas where water quality is likely under existing pressure from contaminated stormwater runoff from adjacent roadways. FEMA anticipates that by restricting limits of disturbance to two acres or less for areas that have not previously experienced ground

disturbing activities, this acreage threshold will assist in ensuring that new water quality impacts from soil erosion and stormwater runoff are not widespread and less than major.

FEMA anticipates that CWA permitting and the use of the preventative measures and construction BMPs provided in Section 6.0 of this PEA will minimize short-term impacts to water quality. If a project has an activity in, under, or over WOTUS, Section 404(d) of the CWA and Section 10 of RHA require the issuance of permits by the USACE. For projects that require a permit under Section 404(d) of CWA, the issuance of a CWA Section 401 WQC by the PRDNER/PREQB will also be required. These permits are likely to include conditions that will further minimize adverse impacts to water quality.

For all applicable projects, the Recipient will be responsible for managing their construction activities and equipment in accordance with the conservation measures and requirements listed in Section 6.0 of this PEA. The use of vacuums and silt fencing on land and turbidity curtains in the water will reduce the potential for the movement of contaminants offsite. The Recipient will be responsible for fugitive dust mitigation through measures such as covering spoil piles, covering the haul vehicle loads containing fill or cut materials, and the routine spraying of dry construction sites with water. Additionally, the Recipient will be responsible for disposing and recycling of construction and demolition debris at PRDNER/PREQB authorized facilities.

The replacement of deteriorating infrastructure with materials that meet current codes and standards will reduce the potential for the continued and future leaching of contaminants from building materials into adjacent waterbodies. For instance, once hardened, concrete piles have little or no impact to water quality. Due to the ease of installation, contractors typically use metal beams and pipes to construct temporary bridges. Metal beams and pipes are largely inert and pose no short-term and long-term impacts to water quality from contamination.

Construction practices such as the demolition of existing in-water structures and the installation of new support piles and culverts may cause a temporary reduction in water quality as sediment becomes disturbed. Even the installation of silt fences and turbidity booms can cause an accidental release of soil and sediment from a construction site. These types of accidental soil and sediment releases during construction can cause adverse temporary minor impacts to water quality. FEMA anticipates that the construction phase of Alternative 2 actions may result in negligible to minor temporary to short-term adverse impacts to water quality. The restoration of natural flow patterns within streams and rivers following construction activities should minimize the long-term impact of construction practices on water quality. Furthermore, the restoration of natural flow patterns should assist in dispersing and flushing suspended and loose sediments out of the project area.

Through the implementation of designs that meet current codes and standards, new building materials, and the restoration of natural flow patterns, FEMA anticipates that the replacement of bridges and culverts will produce a beneficial less than major long-term impact to water quality.

Alternative 3: Repair of Landslides

Sources of potential contaminants from Alternative 3 actions include leaky oil and hydraulic fluid from construction equipment, construction dust, soil, and contaminated and non-contaminated debris. Due to the steep slopes and likely presence of highly erodible soils, an adverse short-term

minor impact to water quality may occur as contaminants associated with the construction phase of Alternative 3 actions inadvertently escape project sites. For projects located away from waterbodies, impacts to water quality from accidental releases of soil are likely to be negligible.

The NPDES permitting process and development of a site specific SWPPP will address potential erosion and sediment control issues for all projects equal to or greater than one acre in size. Additionally, the BMPs and conservation measures provided in Section 6.0 of this PEA are a requirement of all applicable projects. FEMA anticipates that the BMPs provided in Section 6.0 of this PEA will minimize the adverse short-term impacts to water quality from Alternative 3 construction activities. For instance, the Recipient will be responsible for installing silt fencing that will assist in reducing the potential for the movement of contaminants offsite. Moreover, the Recipient will be responsible for preventing fugitive dust by covering spoil piles and fill material as its transported to and from the construction sites, as well as, whatever BMPs might be necessary to prevent dust particles from becoming a nuisance and possibly contaminating adjacent waterbodies. These actions will assist in minimizing impacts to water quality by reducing sediment loading into adjacent waterbodies.

FEMA anticipates that Alternative 3 will have no adverse long-term impacts on water quality related to the stabilization of landslides. As the Recipient's actions work to stabilize highly erodible soils, a beneficial less than major long-term impact to water quality will occur from there being smaller and fewer discharges of soil into adjacent waterways. This should result in decreases in turbidity levels and increases in dissolved oxygen.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to water quality will be similar to Alternative 2 for the Alternative's construction and post-construction phases. The intent of this Alternative is that it will satisfy projects large enough that require a NPDES permit and SWPPP. The NPDES program requires a permit for construction projects equal to or greater than one acre in size. Additionally, for all projects satisfied by Alternative 4, the Recipient must implement all applicable BMPs listed in Section 6.0 of this PEA. In order to keep fugitive dust from escaping, the Recipient's contractor will be responsible for routinely spraying dry active construction sites in order to prevent the particulate matter from becoming a nuisance and potentially contaminating neighboring waterbodies. Additional requirements of the Recipient's contractor include preventing fugitive dust by covering spoil piles and fill material transports. These actions will assist in minimizing impacts to water quality by reducing sediment loading into adjacent waterbodies. FEMA anticipates that these conservation measures along with NPDES permit requirements will minimize short-term and long-term adverse impacts to water quality.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to water quality will be similar to those impacts described for Alternatives 2 through 4. FEMA understands that any decision to combine Action Alternatives will inherently increase the complexity of a project's construction and post-construction phases. Although the combination of Action Alternatives may involve work in very different environments, FEMA anticipates the application of BMPs suited for minimizing adverse impacts

to water quality and the required CWA permitting will be sufficient to prevent an increase in the impact determination for Alternative 5.

5.4 Wetlands

Wetlands are areas saturated or inundated by surface or ground water with a frequency enough to support, or that under normal hydrological conditions does or would support, a prevalence of vegetation or aquatic life typically adapted for these soil conditions. Examples of wetlands include swamps, marshes, estuaries, bogs, beaches, wet meadows, sloughs, mud flats, among others. Wetlands are important because they protect and improve water quality, provide fish and wildlife habitats, provide economic, and social benefits, store floodwaters, and maintain surface water and groundwater flow during dry periods. Executive Order (EO) 11990 Wetlands Management requires federal agencies to avoid funding activities that directly or indirectly support occupancy, modification, or development of wetlands, whenever there are practicable alternatives. FEMA uses the 8-Step Decision-Making Process to evaluate potential effects on, and mitigate impacts to, wetlands in compliance with EO 11990. The USACE, through its permit program, regulates the discharge of dredged or fill material into WOTUS, including wetlands, pursuant to Section 404 of the CWA. In addition, the USEPA has regulatory oversight of the USACE permit program, allowing the agency under Section 404C to veto USACE issued permits where there are unacceptable environmental impacts.

5.4.1 Existing Conditions

Wetlands in Puerto Rico occur on each of the Commonwealth's islands and are located in both the mountainous regions and along the coast lines. The presence of lacustrine and riverine classified wetlands is minimal in both abundance and acreage. Lacustrine and riverine wetlands occur along shallow areas of deep-water reservoirs and along the banks of streams and rivers. The most common types of wetlands in Puerto Rico are palustrine or estuarine. Freshwater wetlands (palustrine) are primarily located on the main island's northern coast. The most common estuarine wetlands are the mangrove wetlands along Puerto Rico's coastline. Between 70 percent and 90 percent of marine life with commercial or recreational value use mangroves for at least part of their respective life cycles. In addition to the mangrove swamps, salt flats (also estuarine wetlands) are common along Puerto Rico's south coastline.

Degradation or destruction of wetlands can occur by activities such as drainage, dredging, filling, sedimentation, and oil spills. Wetlands in Puerto Rico have been heavily degraded and destroyed from dredging, filling, draining, eutrophication, and the use of agricultural fertilizers and pesticides (Miller 2009). Stressors to Puerto Rico's coastal wetlands include sea level rise, hurricanes and storms, erosion, and stream channelization, road construction and development, effluent and runoff, mining of gravel, limestone, sand, and other materials (Miller 2009).

FEMA uses the United States Fish & Wildlife Service (USFWS) National Wetlands Inventory (NWI), state-specific mapping tools and on-site surveys to identify wetlands. Wetlands within the Commonwealth span a vast range of types, from interior montane wetlands of the rain forest to intertidal mangrove swamps along the coast. Wetlands are a natural resource with incredible intrinsic as well as economic value, providing wildlife habitat, plant diversity, and the water supply for many urban areas. Historically, the Commonwealth dredged and filled wetlands for the purpose

of agriculture, drinking water, and flood control. More recently, urban expansion, transportation, and tourist facilities have impacted Puerto Rico's wetlands.

FEMA compared Puerto Rico's existing transportation system and the National Wetland Inventory (NWI) data, approximately 3.8 percent of the Commonwealth's existing infrastructure passed through or was adjacent to WOTUS. Many of the bridges and culverts fall into this category. In addition, there may be some landslides or embankment slumping that has occurred along these segments of roadway as well. The Commonwealth's Roadway transportation system passes through multiple types of wetlands that the Cowardin classification system identifies as estuarine and marine, freshwater emergent, freshwater forested/shrub, freshwater pond, lake, and riverine.

5.4.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund transportation and landslide related projects. Due to the Commonwealth's financial condition, FEMA anticipates that without funding the Recipient will delay or indefinitely defer transportation and landslide projects. FEMA anticipates that federal transportation agencies and departments will fund some projects minimizing the adverse long-term impact of the No Action Alternative. If projects remain unfunded by other sources, this alternative will likely result in additional degradation of Puerto Rico's wetlands. FEMA anticipates that the No Action Alternative may cause adverse, less than major short-term and long-term impacts to wetland quality and function within Puerto Rico.

Alternative 2: Replacement of Bridges and Culverts

Classes of actions under Alternative 2 that may cause adverse impacts to wetlands include alignment changes, the temporary and permanent modifications of ROWs, or any work with additional hardening or bioengineering of stream embankments. FEMA will use the 8-Step Decision Making Process to review all projects. The 8-Step Decision Making Process includes an alternatives analysis to limit impacts to wetlands. Bridge and culvert replacement activities near and within wetlands may result in direct adverse negligible to minor short-term and long-term impacts to wetlands from construction activities. An adverse negligible to minor short-term impact may occur as efforts to install erosion and scour prevention measures cause a temporary release of sediment into wetlands. FEMA anticipates that these actions and those like them may cause adverse minor long-term impacts to wetland ecosystems in the form of habitat loss. The degree to which the Recipient's engineer can incorporate bioengineering into the project design will assist in mitigating any losses of riparian wetland habitat associated with bridge and culvert replacement projects.

FEMA anticipates that CWA permitting and the use of the preventative measures and construction BMPs provided in Section 6.0 of this PEA will minimize short-term direct and indirect impacts to wetlands. If a project has an activity in, under, or over WOTUS, Section 404(d) of the CWA and Section 10 of RHA require the issuance of permits by the USACE. For projects that require a permit under Section 404(d) of CWA, the issuance of a CWA Section 401 WQC by the PRDNER/PREQB will also be necessary. For projects that involve impacts to wetlands, the USACE may require the Recipient obtain compensatory mitigation to offset adverse impacts to

wetland function and quality. These permits are likely to include conditions that will further minimize adverse impacts to wetland ecosystems.

By using BMPs and following permit conditions, the Recipient will minimize any incidental discharges of runoff and sediment from Alternative 2 actions into wetland ecosystems. As such, FEMA's determination is that only adverse negligible to minor short-term indirect impacts to wetlands may occur as a result of Alternative 2 actions. Through the implementation of site stabilization plans as required by CWA permits, FEMA anticipates that indirect adverse long-term impacts to wetlands from runoff and sedimentation will be negligible. Finally, FEMA anticipates that actions satisfied by Alternative 2 may provide beneficial long-term impacts to wetlands by reducing streambank erosion as well as, providing enhanced wetland habitat either through bioengineering or compensatory mitigation.

Alternative 3: Repair of Landslides

During the construction phase of Alternative 3 actions, stormwater runoff into wetlands could include oil and hydraulic fluids from leaky equipment, particulate matter originating from the construction site, and contaminated and non-contaminated waste streams. All temporary access and staging of equipment will be located outside the jurisdictional boundaries of wetland ecosystems. In order to comply with FEMA's implementing regulations for EO 11988, FEMA will use the 8-Step Decision Making Process to evaluate all aspects of landslide project design and project planning. If site plans include the potential for short-term or long-term direct adverse impacts to wetlands, FEMA will proceed with an alternatives analysis that evaluates potential options for eliminating construction activities that adversely impact wetland ecosystems. Due to the presence of erodible soils around landslide sites, an adverse short-term minor indirect impact to wetland quality and function may occur during the construction phase of Alternative 3 actions from runoff and sedimentation.

The NPDES permitting process and development of a site specific SWPPP will address potential erosion and sediment control issues. The NPDES program requires permits and SWPPPs for all projects equal to or greater than one acre in size. The use of the preventative measures and construction BMPs provided in Section 6.0 of this PEA will minimize the adverse short-term impacts to wetlands. For all projects satisfied by Alternative 3, the Recipient must implement all applicable BMPs listed in Section 6.0 of this PEA. FEMA's list of BMPs are effective measures in preventing indirect impacts to wetlands like those associated with ground disturbing activities. FEMA anticipates that Alternative 3 will have a negligible to minor adverse long-term impacts to wetlands related to the stabilization of landslides. A beneficial less than major long-term impact to wetlands will occur from smaller and fewer discharges of soil material into wetland ecosystems.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to wetlands will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases. The Recipient will be required to obtain an NPDES permit and develop a SWPPP in order to implement their projects exceeding one acre in size. For all projects satisfied by Alternative 4, the Recipient must implement all applicable BMPs listed in Section 6.0 of this PEA. FEMA's list of BMPs are effective measures in preventing

indirect impacts to wetlands like those associated with ground disturbing activities. These likely requirements will assist in minimizing adverse impacts to wetlands from Alternative 4 actions.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to wetland function and quality will be similar to Alternative 2 through 4 for the Alternative's construction and post-construction phases. In order to comply with FEMA's implementing regulations for EO 11988, FEMA will use the 8-Step Decision Making Process to evaluate all aspects of project design and project planning. If site plans include the potential for short-term or long-term adverse impacts to wetlands, FEMA will proceed with an alternatives analysis that evaluates potential options for eliminating construction impacts to wetland ecosystems.

FEMA understands that any decision to combine Action Alternatives will inherently increase the complexity of a project's construction and post-construction phases. Although the combination of Action Alternatives may involve work in very different environments, FEMA expects the application of BMPs suited for minimizing adverse indirect impacts to wetlands will be sufficient to prevent an increase in the impact determination for Alternative 5. Additionally, Section 404(d) permitting through the USACE will require compensatory mitigation for any impacts to wetlands that cannot be avoided by the Recipient.

5.5 Floodplain

Executive Order 11988, Floodplain Management was issued in 1977 to eliminate the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative for locating a project outside of the floodplain. EO 11988 applies to federally funded projects and directs agencies to consider alternatives to siting projects within a floodplain. EO 11988 requires that a Federal agency avoid direct or indirect support of development within the floodplain whenever there is a practicable alternative. Where there are no practicable alternatives, FEMA is required to use minimization standards to reduce impacts to the floodplain and impacts from the floodplain to a facility. Such standards include elevating facilities or equipment above the BFE, or floodproofing, among others. FEMA uses Flood Insurance Rate Maps (FIRM) to identify the floodplains for the National Flood Insurance Program (NFIP). FEMA evaluates actions within the 100-year floodplain, also known as the BFE (or 500 for critical action facilities), using the 8-Step Process. FEMA's regulations on conducting the 8-Step Process are contained in 44 CFR Part 9.

EO 11988 prohibits FEMA from funding new construction in Coastal High Hazard Area "V-Zones" that is not functionally dependent on water or facilitates open space use. In order to determine whether this PEA applies, FEMA will consider new construction and expansion in the V-zone or in the base-flood elevation where there is a potential to increase flood levels on a case-by-case basis.

5.5.1 Existing Conditions

Following Hurricanes Irma and Maria, floodplain FIRM maps for the Commonwealth were re-evaluated and re-mapped based on high water marks during the storm events. FEMA compared the effective flood hazard data and the advisory one percent seamless flood hazard data to analyze the changes in flood hazard zones. The differences identified between the effective and advisory flood zone information resulted in about 30 zone change (e.g. AE to A, VE to AE, A to X, etc.) combinations.

Projects that may affect or are within a floodplain require coordination with and approval from a Puerto Rico Planning Board (PRPB) certified Floodplain Administrator. All 78 municipalities in Puerto Rico participate in the NFIP. The NFIP separates the 78 municipalities into five NFIP communities. Of the 78 municipalities in Puerto Rico, one NFIP contains 74 municipalities while the remaining four municipalities are independent NFIP communities (FEMA 2018). Under requirements established in 44 CFR Section 60.3, participating communities will require permits for all development, including temporary development, in the Special Flood Hazard Area. According to the PRPB and estimates made by FEMA in 2018, approximately 200,000 properties are located within areas prone to flooding. United States Census Bureau estimates previously indicated that there may be as many as 112,000 people living within Puerto Rico’s 100-year coastal floodplain (Crowell et al. 2010).

Table 5 provides a list of the total road mileage within the various flood hazard zones of Puerto Rico. According to FHWA records dated 2017, Puerto Rico maintains 18,359 miles of roads. Of the total road miles, only 2,921.3 miles or 15.9 percent occur within flood hazard zones (FHWA 2017).

Table 5: Estimated Miles of Road per Flood Hazard Zone in Puerto Rico

National Flood Hazard Layer (Current Effective Flood Zones)	Definition	Estimate of Road segments in Miles
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage.	277
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.	16
AE	The base floodplain where base flood elevations are provided.	1,873
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet.	0.3

National Flood Hazard Layer (Current Effective Flood Zones)	Definition	Estimate of Road segments in Miles
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet.	86
VE	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves.	78
X	Area of minimal flood hazard usually depicted on FIRMs as above the 500-year flood level (combined X and X shaded).	591

Source: FHWA 2017, GIS analysis by Planning and Analytics Section DR-4339-PR

5.5.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund transportation or landslide projects. Due to Puerto Rico’s ongoing financial crisis, mitigative improvements to the 100-year and 500-year floodplain are not likely to occur unless the Commonwealth can obtain funding from other federal sources. FEMA anticipates that if the Commonwealth does not perform the necessary repairs to transportation infrastructure and landslides, the core elements of the Action Alternatives may further deteriorate causing adverse impacts to floodplains. The failure of bridges, culverts, roads, and landslides could adversely impact stream hydraulics and hydrology, local businesses and residents, and aspects of the transportation system not previously impacted by floodwaters. FEMA anticipates that the No Action Alternative could result in an adverse less than major short-term and long-term impact.

Assistance from other federal agencies that routinely fund transportation and land management projects within Puerto Rico may be able to assist in financing such projects. Funding from other federal agencies would assist in minimizing long-term impacts to the Commonwealth’s floodplains. Should the Commonwealth obtain other federal funding to implement floodplain corrective actions, FEMA anticipates that consultation with PRPB as required under EO 11988 will further assist in minimizing impacts to floodplains.

Alternative 2: Replacement of Bridges and Culverts

FEMA will use the 8-Step Decision Making Process to review all projects. The 8-Step Decision Making Process includes an alternatives analysis to limit impacts to floodplains. The 8-Step Decision Making Process will take into consideration any impact that a temporary diversion of flow would cause on floodplains during the construction process. In accordance with FEMA’s implementing regulations for EO 11988, 44 CFR § 9.7, projects must not result in an increase in the flood elevation of more than one foot. Due to the potential for new bridges and culverts to

impact stream characteristics, floodways, and various flood hazards, FEMA may require that the Recipient conduct a H&H study for new bridge and culvert projects. Any considerations to project placement and engineering must include existing surrounding structures within the floodplain. Under FEMA's implementing regulations, new construction and substantial improvements in the V Zones may require final elevations of bridges and culverts at or above the base flood level.

The replacement of bridges and culverts may result in adverse short-term negligible to minor impacts to floodplains from the staging of equipment and materials near bridge and culvert construction sites. FEMA anticipates that the demolition of existing bridges and culverts may have an adverse short-term negligible to moderate impact on floodplains from temporary changes in hydrology and hydraulics. Coordination between the Recipient and PRPB's local certified Floodplain Administrator will reduce the potential for adverse impacts to floodplains. The conservation measures presented in Section 6.0 of this PEA will minimize impacts to floodplains from the construction phase of Alternative 2 actions. For instance, the measures listed in Section 6.0 of this PEA require the disposal of construction and demolition debris at a properly license landfill.

Most projects will be a replacement in-kind or an improvement on the existing design. As such, FEMA anticipates that there will be no adverse long-term impacts to floodplains beyond existing conditions. FEMA anticipates that the class of actions that Alternative 2 includes will have a beneficial less than major long-term impact on floodplains as new bridge and culvert structures will reduce restrictions to natural flow patterns.

Alternative 3: Repair of Landslides

Alternative 3 will address landslides that are near or adjacent to existing roadways or developed areas. As such, the need for impacting undeveloped areas for the purpose of creating temporary staging areas and access roads will be minimal. Based on a review of 2017 landslide data from the United States Geologic Service following Hurricane Maria, FEMA anticipates that most landslide repairs will occur interior of the coastal plain and along steep hillsides presumable outside the floodplain. For all applicable projects, the 8-Step Decision Making Process will identify and minimize potential impacts to floodplains from Alternative 3 actions. For projects that do fall within the floodplain or could impact a floodplain, the Recipient will be responsible for coordinating with PRPB's local certified Floodplain Administrator for all projects within the floodplain. This requirement should assist the Recipient in minimizing impacts to the floodplain.

The use of impermeable materials in preventing future landslides may have an adverse negligible to minor long-term impact on floodplains. This impact will be associated with a potential reduction in the infiltration rates of runoff within the watershed. Based on a review of the PRHTA Landslide Correction Typical Section Sheets (**Appendix C**), the additional impermeable surfaces created by the projects is likely to be minimal. Furthermore, when compared with existing conditions (i.e. steep slopes, shallow soils, etc.), the actual impact on floodplains from installing impermeable materials as part of the repair of landslides is not likely to exceed the level of negligible.

The Recipient's use preventative measures and construction BMPs provided in Section 6.0 of this PEA will minimize indirect adverse short-term and long-term impacts to floodplains. The NPDES program requires permits and SWPPPs for all projects equal to or greater than one acre in size.

The NPDES permitting process and development of a site specific SWPPP will address erosion and sediment control specific to the sites. Post construction site stabilization is a condition of NPDES permits. FEMA anticipates that a beneficial less than major long-term impact to floodplains may occur from there being smaller and fewer discharges of soil material into the floodplain.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to floodplains will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases. The 8-Step Decision Making Process will identify and minimize potential adverse impacts to floodplains from bridge, culvert, and road hazard mitigation and repair projects. For hazard mitigation and repair projects that might adversely impact a floodplain, the Recipient will be responsible for coordinating with PRPB's local certified Floodplain Administrator. Under FEMA's implementing regulations, new construction and substantial improvements for bridges and roadways will be one foot or greater above the VE Zone elevation. Additionally, disaster recovery funded projects must not result in an increase in the flood elevation of more than one foot. Due to the potential for bridge, culvert, and roadway projects to impact flood characteristics, FEMA may require that the Recipient conduct a H&H study for applicable projects.

Road projects in the NFIP-mapped floodplain may result in hazard mitigation that increases the elevation of roadways. FEMA anticipates that the repair and hazard mitigation of bridges, culverts, and roads will result in a beneficial long-term impact to floodplains. For instance, the Commonwealth's streams and rivers may be less prone to flooding as the bridges and culverts become less restrictive to flow.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to floodplains will be similar to Alternative 2 for the Alternative's construction and post-construction phases. FEMA will apply the 8-Step Decision Making Process to evaluate alternatives and potential combined effects of all projects considered under this alternative.

5.6 Coastal Resources

The National Oceanic and Atmospheric Administration (NOAA), an agency within United States Department of Commerce's Office of Ocean for Coastal Management, administers the Coastal Zone Management Act (CZMA). Recognizing the national interest in managing coastal zone resources, the CZMA encourages states and U.S. territories along the oceans, Gulf of Mexico, and Great Lakes to proactively manage natural resources, balancing resource protection with economic, recreational, and cultural needs. The CZMA established a voluntary program for states and territories to develop and implement their own unique coastal management programs that describe coastal zone boundaries, uses and resources that are subject to management, legal authorities, and enforceable policies. The CZMA encourages states and territories to self-assess coastal resources by aligning management plans with Section 309 of the CZMA, to assess coastal hazards and resources management issues throughout the nation in coastal areas of national importance (NOAA 2014). Coastal resources protected under the CZMA include barrier islands,

intertidal shoreline, beaches, salt marshes, fresh and saltwater wetlands, aquatic habitat, and any culturally significant or historic resources occurring in those areas, such as shipwrecks and archeological sites.

The Coastal Barrier Resources Act (CBRA) of 1982 created designated areas under the jurisdiction of the USFWS that in many cases are ineligible for both direct and indirect federal expenditures. This act, amended by the CBRA of 1990, added a new category of coastal barriers called Otherwise Protected Areas (OPA). The Act protects sensitive and vulnerable barrier islands found along the U.S. Atlantic, Gulf, and Great Lakes coastlines. The CRBA is intended to minimize loss of human life and wasteful federal expenditures on coastal barriers that are repeatedly affected by natural disasters. If CBRS System Units occur within a federally declared disaster area, CBRA allows federal assistance for most emergency actions that are essential for saving lives, protecting property, and protecting public health and safety so long as the actions are consistent with the intent of the regulation. In OPAs, the only prohibition is with regards to the issuance of federal flood insurance. In September 2018, USFWS released a new Coastal Barrier Resources System (CBRS) data set which contains the flood insurance prohibition date for each area within the CBRS and the System Unit establishment date for each area within a System Unit under the NFIP (USFWS 2019).

Projects receiving federal assistance must follow the procedures outlined in 15 CFR 930.90 – 930.101 for federal coastal zone consistency determinations. To guide development and resource management within the Commonwealth's coastal area, the Commonwealth identified and promulgated substantive policies. The PRDNER serves as the lead agency and is responsible for managing the maritime zone, coastal waters, and submerged lands. The PRPB serves as the primary agency for managing coastal development.

5.6.1 Existing Conditions

The islands of Puerto Rico which include Puerto Rico, Vieques, Culebra, Mona, Monito, Desecheo, Caja de Muerto, and several cays and small recreational islands have a total of 600 miles of coastline and over 3,106 miles of shallow coral reef ecosystems as defined by the CZMA. The main island of Puerto Rico is approximately 100 miles long by 30 miles wide, with approximately 310 miles of coastline. The remaining islands that comprise the Commonwealth combine for another 300 miles of coastline (PRDNER 2010). In addition to the main island of Puerto Rico, the other inhabited islands within the Commonwealth are Vieques and Culebra. Although not defined by the CZMA, other habitats that occur within Puerto Rico's coastal zone and marine corridors include coastal forests, mangrove forests, karst ecosystems and sea-caves, bioluminescent lagoons, and seagrass beds (NOAA 2018a).

With regards to federally owned coastal management areas within the Commonwealth, there are five USFWS managed National Wildlife Refuges and one NOAA Habitat Blueprint Focus Area. Between 2013 to 2015, NOAA selected 10 Habitat Focus Areas nationwide. Habitat Focus Areas are places where multiple NOAA offices can effectively focus their resources to prioritize long-term habitat science and conservation efforts.

Commonwealth agencies responsible for compliance, planning, and permitting in the coastal zone are PRDNER and the PRPB. PRDNER regulates and grants the use of resources within the CZMA.

PRPB issues permits and federal consistency certifications in coordination with a lead federal agency and in accordance to the Puerto Rico's Coastal Zone Management Plan (PRCZMP). Pursuant to Federal Consistency Regulations in 15 CFR § 930, FEMA and the PRPB signed a Federal Consistency Certificate for Category C through G work dated October 3, 2018 (Resolution JP-2018-324). **Appendix D** includes the consistency resolution letter. The resolution letter includes works described in the Action Alternatives.

Within the Commonwealth there are a total of 70 CBRA System Units. The CBRA system units in Puerto Rico are comprised of 41 CBRs units and 29 OPAs. The combined area of resources covered under CBRA in Puerto Rico total 50,652 acres. Of the 50,652 acres, aquatic habitats comprise 45,713 acres of the total resources projected under CBRA in Puerto Rico. **Figure 5** of **Appendix B** presents the USFWS produced John H. Chafee CBRs Location Map for Puerto Rico. The figure indicates that the majority of the coastal resources protected under CBRA within the Commonwealth are in the south and northeast portions of the territory.

5.6.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not provide grant funding for transportation and landslide projects. As such, there will be no impacts to the PRCZMP by FEMA funded actions. Due to the Commonwealth's financial condition, FEMA anticipates that without funding the Recipient will delay or indefinitely defer transportation and landslide projects. Further deterioration of bridges, culverts, roads, and landslides may lead to adverse short-term and long-term less than major impacts to areas protected under the PRCZMP and CBRA. If the Commonwealth does identify other federal funding sources, they too will be subject to the requirements established in the PRCZMP. FEMA anticipates that federal transportation agencies will eventually fund certain transportation projects minimizing the long-term adverse impact of the No Action Alternative.

Alternative 2: Replacement of Bridges and Culverts

Under Alternative 2, construction phase activities may require in-water and upland work that has the potential to indirectly impact CZMA and CBRA areas. Due to likely ground and sediment disturbing activities, FEMA anticipates some possible erosion and sedimentation may cause adverse short-term negligible to minor indirect impacts to areas protected under the CZMA and CBRA. The NPDES program authorized under the CWA requires an NPDES permit and SWPPP for projects equal to or greater than one acre in size. The implementation of a SWPPP by the Recipient will minimize indirect impacts to areas protected under the CZMA and CBRA from erosion and sedimentation. In addition to the conservation measures required in the NPDES permit, the Recipient will be responsible for implementing all applicable BMPs and conservation measures listed in Section 6.0 of this PEA.

The list of likely BMPs for Alternative 2 actions include silt fencing, turbidity booms, and fugitive dust control measures. The implementation of these BMPs should minimize indirect impacts to areas protected under the CZMA and CBRA from erosion and sedimentation. FEMA anticipates that Alternative 2 actions will result in no adverse indirect long-term impacts to areas protected

under the CZMA and CBRA. As a condition of the NPDES program, the Recipient will be responsible for stabilizing their construction site. Where applicable, a restored streambank and upland area that incorporates natural features under the auspice of bioengineering may enhance riparian habitat within the CZMA when compared to existing conditions.

FEMA anticipates that new more robust bridge or culvert structures will have slightly larger upland footprints and smaller in-water footprints than the existing structures. The larger structures will result in negligible to minor adverse long-term direct impacts to the CZMA due to reducing the amount of available space and coastal habitats. More robust structures that have less in-water footprint are likely to be less impactful to stream hydraulics and hydrology and represent a long-term minor beneficial impact to CZMA and CBRA areas. The restoration of natural flow conditions should reduce the potential for flooding and streambank erosion in areas protected under the CZMA and CBRA.

Per the Federal Consistency Resolution Certificate dated October 3, 2018 and signed by FEMA and the PRPB, actions satisfied by Alternative 2 will be in alignment with PRCZMP. The Commonwealth may derive a beneficial impact from the replacement of bridges and culverts to areas protected under the CZMA and CBRA by restoring Pre-Hurricane Maria access and evacuation routes to and from coastal areas; while, also improving the resiliency of the Commonwealth's Roadway transportation system to withstand future storm events.

Alternative 3: Repair of Landslides

As a result of most Hurricane Maria landslides being located within the interior of the main island, FEMA anticipates that only a few landslide projects will occur within or adjacent to areas protected under the CZMA and CBRA. Per the Federal Consistency Resolution Certificate dated October 3, 2018 and signed by FEMA and the PRPB, actions satisfied by Alternative 3 will be in alignment with PRCZMP. Under Alternative 3, this PEA will address landslides adjacent to an existing roadway or development. FEMA anticipates that the proximity of landslides to existing roadways and parking lots will reduce the need for an expansive network of temporary access roads and staging areas. The intent of this PEA is to focus on landslides that threaten the Commonwealth's roadway transportation system or developed areas. FEMA will review landslides located in undeveloped areas on a case-by-case basis to determine the appropriate level of NEPA evaluation.

FEMA anticipates a short-term negligible to minor adverse indirect impact on areas covered under the CZMA and CBRA from runoff and sedimentation originating from landslide restoration construction sites. For all applicable projects, the use of the preventative measures and construction BMPs provided in Section 6.0 of this PEA will minimize indirect adverse short-term and long-term impacts to areas protected under the PRCZMP. In addition to BMPs, FEMA consultation with USFWS for any projects affecting the CBRS should minimize indirect impacts. The NPDES permitting process and development of a site specific SWPPP will address potential erosion and sediment control issues. The NPDES program requires permits and SWPPPs for all projects equal to or greater than one acre in size. Post construction site stabilization is a condition of NPDES permits.

The use of impermeable materials in preventing future landslides may have an adverse negligible to minor long-term impact on the PRCZMP. For instance, the use of impermeable materials may

reduce infiltration rates which could adversely impact resources within areas protected under the CZMA and CBRA by exacerbating flooding and erosion. A beneficial less than major long-term impact to the coastal zone will occur from there being smaller and fewer releases of soil material into areas protected under the CZMA and CBRA.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to areas covered under the CZMA will be similar to Alternative 2 and 3 for the Alternative's construction and post-construction phases. FEMA will consider any potential expansion of size or capacity in consultation with USFWS and under FEMA's implementation of CBRA for applicability of this PEA.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to the resources and areas covered under the CZMA and CBRA will be similar to Alternative 2, Alternative 3, and Alternative 4 for the Alternative's construction and post-construction phases. FEMA will consider any potential expansion of size or capacity in consultation with USFWS and under FEMA's implementation of CBRA for applicability of this PEA.

5.7 Vegetation

Vegetation serves many functions; it can provide essential habitat for wildlife; prevent erosion by stabilizing soil resources; and enhance visual aesthetics. Executive Order 13112 directs federal agencies to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts caused by their existence. In accordance with EO 13112, federal agencies can not authorize, nor provide funding or accomplish any action considered capable of causing or promoting the introduction or dispersion of invasive species to the United States of America, unless the agency considers all reasonable measures that diminish the risks first.

5.7.1 Existing Conditions

The presence of invasive plant species has had a detrimental effect on the ecosystem of Puerto Rico. As a result of the spread of invasive species, the Commonwealth has experienced substantial losses in biodiversity as many native species have since gone extinct. There are over 3,500 vascular plant species in the Commonwealth including extensive palms, flowering plants, gymnosperms, and ferns. Of these species, 2,329 are native and 1,077 are non-native (Gann et al. 2015-2018). Invasive and exotic plants represent about a third of total plant diversity within the Puerto Rico. The USDA has published a list of 475 plants that they consider rare or endangered within the Commonwealth (USDA 1975). Additionally, the NRCS lists at least 184 species of important "common" weeds in Puerto Rico and the Virgin Islands (Más 2013).

The main island of Puerto Rico consists of six ecological or life zone classifications based on mean annual bio-temperature and precipitation. The following life zones of Puerto Rico are from driest to wettest: Subtropical Dry Forest, Subtropical Moist Forest, Subtropical Wet Forest, Lower Montane Wet Forest, and Subtropical Rain Forest.

The Commonwealth has been slowly reforesting since the original conversion of Puerto Rico to agriculture by Spanish colonials. Since the decline of agriculture within the Commonwealth began in the 1940's, the natural reforestation of Puerto Rico has been an ongoing process. Puerto Rico's forest cover increased from six percent in the 1950s to 55 percent as of 2009 (Gould et al. 2017). Although the Commonwealth has been experiencing a recent reforestation, studies have indicated that the long-term trend is towards urbanization (Miller 2009).

5.7.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action alternative, FEMA will not provide grant funding for transportation and landslide projects. Without FEMA funding, the Commonwealth may have to either delay or indefinitely defer repairs to their transportation system. Eroded landscapes will likely undergo early successional revegetation with invasive species colonizing bare soils. FEMA anticipates that native vegetation may experience an adverse short-term and long-term negligible to minor impact as invasive plant species colonize landslides. Should the Commonwealth identify funding, compliance with local standards for revegetation and weed control should minimize adverse impacts. The Commonwealth manages a local program that helps minimize the spread of invasive species through oversight of PRDNER permitted construction projects.

Alternative 2: Replacement of Bridges and Culverts

Potential adverse impacts to vegetation could occur in any area where construction activities require incidental vegetation clearing, grubbing, or replanting. Under Alternative 2, the removal and replacement of bridges and culverts will likely require creating temporary staging areas and access roads. Bridge and culvert projects satisfied by this Alternative will serve as in-kind replacements limiting the amount of land disturbance necessary to complete the projects. However, FEMA anticipates that the replacement of bridges and culverts will require the use of heavy equipment that will likely cause short-term and long-term adverse impacts to vegetation.

The installation of temporary access and staging areas are specific types of activities that will cause direct adverse short-term minor impacts to vegetation. Long-term adverse impacts to vegetation may occur as the result of soil compaction. Soil compaction can limit the ability of native species to re-colonize disturbed areas. If the Recipient does not completely revegetate construction areas, post construction conditions may allow for the colonization of bare soil by invasive species.

FEMA anticipates that the project size thresholds for Alternative 2 activities, which are five acres for disturbed sites and two acres for undisturbed sites, will minimize short-term and long-term impacts to native vegetation. For instance, the project threshold allowing only up to two acres of land disturbance for undeveloped areas will ensure that the Recipient's projects require only minimal clearing and grubbing to implement their SOW. Additionally, the list of BMPs in Section 6.0 of this PEA will assist the Recipient in limiting the spread of invasive species.

Under NPDES program, any project areas equal to or greater than one acre in size will require an NPDES permit and a SWPPP. The development of a SWPPP under the NPDES program requires

site stabilization techniques that promote the use of native vegetation and BMPs the prevent the spread of invasive species offsite.

Alternative 3: Repair of Landslides

Under Alternative 3, impacts to vegetation will be similar to Alternative 2 for the Alternative's construction and post-construction phases.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to vegetation will be similar to Alternative 2 for the Alternative's construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to vegetation will be similar to Alternative 2 for the Alternative's construction and post-construction phases.

5.8 Wildlife and Fish

In addition to specific regulations such as the Endangered Species Act, there are numerous laws and regulations at the federal level that seek to protect and conserve fish and wildlife populations for recreation and commercial values. During the issuance of related permits by federal agencies to the Recipient, federal consulting agencies will evaluate regulations governing the preservation and conservation of fish and wildlife. An exhaustive evaluation of each such law is beyond the scope of this PEA; however, FEMA has considered the following regulations as part this PEA's evaluation for wildlife and fish:

The Migratory Bird Treaty Act (MBTA) of 1918 provides a program for the international conservation of migratory birds that fly through lands of the United States. The lead federal agency for implementing the MBTA is the USFWS. The law makes it illegal to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid federal permit.

In 1976 Congress enacted the Magnuson-Stevens Fishery Conservation and Management Act (P.L. 94-265). The law, commonly referred to as the Magnuson-Stevens Act, has been reaffirmed by Congress on multiple occasions. In accordance with the Magnuson-Stevens Act, federal law requires agencies to assess the potential impacts that proposed actions and alternatives may have on Essential Fish Habitat (EFH). The Magnuson-Stevens Act defines EFH as those waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity. In accordance with the National Marine Fisheries Service's implementing regulations for EFH, Habitat Areas of Particular Concern (HAPCs) are a discrete subset of the feature. HAPCs are high priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, and important to ecosystem function.

5.8.1 Existing Conditions

Puerto Rico hosts about 5,847 species including seven native freshwater fish, 15 mammals, 190 birds, 51 reptiles, 18 amphibians, and 5,573 insects (PRDNER 2005 & 2017). A comprehensive review of invertebrates may indicate a larger number of species within the Commonwealth.

There are a variety of introduced feral mammal species that occur in Puerto Rico including monkeys, horses, hogs, goats, mongoose, dogs, cats, the house mouse, and rats. Non-native rats, feral dogs, mongoose, and feral cats are prevalent throughout the Commonwealth. There are several introduced amphibians and reptiles on the island including iguana species and the Virgin Islands boa. Many introduced freshwater fish species such as tilapia, bluegill, largemouth and peacock bass now reside in the rivers and impoundments on the main island and are numerous enough to dominate those habitats over native species.

Natural history and paleontology records indicate there were no large terrestrial mammals within the Commonwealth in recent history and that all native non-bat and marine mammals were extinct by, or shortly after Spanish colonization (Turvey, et al 2007). There are currently 13 native species of bats living within Puerto Rico. Most of the attention and management of native terrestrial species concerns reptiles and amphibians. The most prolific amphibians within Puerto Rico are the 13 species of coqui tree frogs found across the Commonwealth (PRDNER 2015). Currently, 90 percent of Puerto Rico's endemic reptiles and amphibians maintain viable populations (Miller 2009).

Of Puerto Rico's 354 recorded bird species, 133 are known to breed on the island and over 200 species occur as wintering neotropical migrants, transients or vagrants. Of the 45 exotic bird species known to occur in Puerto Rico, more than 35 are either well-established or have small breeding populations. Historically, Puerto Rico was home to 27 native bird species; however, there are currently just 25 native bird species known to still exist within the Commonwealth. According to the Puerto Rico Ornithological Society, there are 20 Important Bird Areas within the Commonwealth (Mendez 2008). The primary concern for avian species within the Commonwealth is rapid transition of habitat to a more urbanized environment (USFWS 2015).

All native freshwater fish species in Puerto Rico depend on both freshwater and marine habitats for their life cycles. The Commonwealth maintains a total of 26 endemic and introduced species of freshwater fish in its rivers. However, there are no endemic fish in Puerto Rico that are strictly freshwater inhabitants. Instream barriers or obstructions prevent non-goby native fishes from accessing about 38.9 percent of the rivers on the main island of Puerto Rico (Kwak 2019). Goby fish are very small non-migratory fin fish. Upstream of the impoundments and obstructions, introduced species are the only fish other than goby species that occur (Kwak 2019). The native fish above these impoundment dams have disappeared as they can no longer access marine environments for part of their life cycle. There are another 37 primarily estuarine and marine fish species that also use the Commonwealth's rivers (Miller et al 2009). Freshwater species also include crustacean freshwater decapods (17 endemic shrimps and 1 crab), mollusks, worms and nematodes and other non-marine invertebrates (USFWS 2018).

EFH within Puerto Rico's territorial waters include all waters and substrates, including coral habitats, submerged vegetation, and adjacent intertidal vegetation, including wetlands and

mangroves that are necessary for the reproduction, growth, and feeding of marine species (Caribbean Fishery Management Council 2005). Fishery laws in the United States such as, the Magnuson-Stevens Act, establish many of their regulations in reference to the U.S. Exclusive Economic Zone (EEZ). The EEZ extends no more than 200 nautical miles from the territorial sea baseline and is adjacent to the 12 nautical mile territorial sea of the United States. **Figure 6** in **Appendix B** illustrates the EEZ and territorial waters of Puerto Rico. Puerto Rico's territorial waters extend out nine (9) nautical miles from the territorial sea baseline which is the same as the low water line on NOAA tide charts.

5.8.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action alternative, FEMA will not fund grants for transportation and landslide projects. Local entities will have to pursue other funding sources for such projects. Due to the current financial crisis in Puerto Rico it is unlikely that such projects will proceed without federal action. If projects remain unfunded for an extended period, it may allow for the continued erosion of slopes and streambanks as well as, the presence of in-water obstructions to persist. FEMA anticipates that the continued erosion and sedimentation and presence of in-water obstructions will cause a negligible to minor adverse short-term and long-term impact to wildlife and fish by degrading water quality and serving as a barrier for aquatic organism migration. Funding from other federal sources that support transportation projects may assist in limiting the long-term adverse impact from the No Action Alternative. Under the No Action Alternative, some locations could naturally revegetate and provide additional habitat for wildlife. This could result in, a negligible beneficial short-term and long-term impact to wildlife and fish.

Alternative 2: Replacement of Bridges and Culverts

Construction activities under Alternative 2 will likely result in additional noise, human presence, temporary disturbances, and potential minor sediment releases into wetlands and waterways. Such effects can cause adverse negligible to minor impacts on local wildlife and fish populations and migratory birds. The mobilization of construction equipment and the clearing and grading of undisturbed areas may have an adverse negligible to minor short-term impact on wildlife including migratory birds and their nests. Similarly, the demolition of bridges and culverts may require the relocation of MBTA protected nests as they may occur beneath and around such structures. The mobility of wildlife and migratory birds to freely move or fly out of a project area should minimize the potential for adverse direct impacts to individual species.

FEMA anticipates that by establishing limitations on project size and location, these thresholds will assist in minimizing adverse impacts to wildlife and fish. Additionally, FEMA anticipates that by setting forth Recipient requirements for permits and implementation of BMPs, these commitments will further minimize adverse impacts to wildlife and fish populations. For instance, FEMA anticipates that projects with limits of disturbance between two and five acres will occur in areas where wildlife and fish are currently under existing pressure from traffic, noise, vibration, and stormwater runoff. The acreage threshold of two acres for undeveloped sites will assist in ensuring that adverse impacts to wildlife and fish populations from soil erosion and stormwater

runoff remain less than major by confining ground disturbing activities to the lesser limits of disturbance satisfied by this PEA.

Under Alternative 2, bridge and culvert replacement projects may result in minor increases in the overall out-of-water structural footprint. The larger footprint may have a negligible long-term adverse impact on the amount of natural habitat available for terrestrial species. A larger structure with a smaller in-water presence may cause minor long-term adverse impacts to fish through permanent habitat loss. For project locations where bioengineering is a suitable action, the addition of natural features along the embankments will assist in minimizing adverse impacts from any riparian habitat loss.

The presence of in-water structures can serve as unique habitat features for some fish species. The restrictions in natural flow caused by the in-water structures can aid in predation. These features can serve as habitat features for species such as fish, mollusks, and invertebrates. FEMA anticipates an adverse minor short-term impact to resident fish populations as the removal of pile-supported structures, debris piles, and culverts occurs. The ability of fish to freely move out of project areas will minimize impacts to resident fish populations. Similarly, fish populations will be able to freely return to their habitats upon completion of project activities. The USACE may require compensatory mitigation under the CWA to minimize or offset adverse impacts to riparian habitat.

Section 404(d) of CWA and Section 7 under the Endangered Species Act requires USACE permitting and consultation for in-water pile driving. For all applicable projects, the Recipient will be responsible for implementing the BMPs and conservation measures described in Section 6.0 of this PEA. Appropriate mitigation measures may include noise reduction, timing restrictions, and erosion and sedimentation control. These measures will minimize direct adverse impacts to aquatic life. For projects involving water resources, FEMA anticipates that the continuous movement of water and site stabilization requirements under the CWA will minimize the adverse long-term indirect impacts to a level of negligible.

Through the Section 404(d) of the CWA permitting process through the USACE, the Recipient will work with the National Marine Fisheries Service (NMFS) Habitat Conservation Division to minimize adverse impacts to EFH for all applicable projects. FEMA will document the results of the Recipient's consultation process in the project REC. If the Recipient through the implementation of avoidance and minimization measures and compensatory mitigation cannot reduce the level of impact to EFH to a level, less than major.

Alternative 3: Repair of Landslides

Alternative 3 includes actions that will restore failing slopes. FEMA anticipates that some Alternative 3 projects may require the construction of temporary staging areas and access roads in order to obtain access to landslide areas. The mobilization of construction equipment and the clearing and grading of undisturbed areas may have an adverse negligible to minor short-term impact on wildlife including migratory birds and their nests. The mobility of wildlife and migratory birds to freely move or fly out of a project area should minimize the potential for adverse direct impacts to individual species. FEMA anticipates that the BMPs and the implementation of a conservation measures required by the USFWS will minimize impacts to other species as well. A

long-term beneficial impact to wildlife and birds may occur as the Recipient stabilizes and restores suitable habitat.

Under Alternative 3, FEMA anticipates that the implementation of landslide projects may result in adverse short-term negligible to minor indirect impacts to wildlife and fish from on-site erosion and sedimentation. NPDES permitting and implementation of a SWPPP by the Recipient for projects that are equal to or greater than one acre will assist in limiting the degradation of water quality from erosion and sedimentation. In addition to the permitting requirements, the Recipient will be responsible for implementing the applicable BMPs included in Section 6.0 of this PEA for all FEMA funded landslide projects. FEMA anticipates that actions included under Alternative 3 will reduce erosion and deposition of soil into waterways.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to wildlife and fish will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases. FEMA anticipates that the type of mitigation and repair actions included under Alternative 2 and 3 will be effective in limiting the locations of project activities to near disturbed areas for Alternative 4 as well. Additionally, the thresholds set forth by FEMA, which include limits on project size as well as, requiring that the Recipient obtain all applicable permits and implement all necessary BMPs and conservation measures, will limit adverse impacts to wildlife and fish populations.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to wildlife and fish will be similar to Alternative 2 through 4 for the Alternative's construction and post-construction phases.

5.9 Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 (16 USC §§ 1531-1543) provides policy and authority for the conservation of threatened and endangered (T&E) plants and animals and their habitats. The lead federal agencies for implementing the ESA are the USFWS and the NMFS, known collectively as the Services. The law requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes a "taking" of any ESA listed species.

The ESA prohibits the taking of listed species unless specifically authorized by permit from the USFWS or the NMFS. "Take" is defined in 16 USC § 1532 (19) as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The law's definition of "Harm" includes significant habitat modification or degradation that results in death or injury to ESA listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering (50 CFR § 17.3).

Section 7(a)(2) of the ESA requires the lead federal agency to consult with either the USFWS or NMFS, depending which agency has jurisdiction over the ESA listed species in question, when a federally-funded project either may have the potential to adversely affect a ESA listed species, or

a federal action occurs within or may have the potential to impact designated critical habitat (DCH). Section 7 of the ESA requires that federal agencies must ensure that any activities they authorize, fund, or carry out are not likely to destroy or adversely modify an ESA listed species DCH. When an agency proposes a species for listing as endangered or threatened under the ESA, the USFWS and NMFS must consider whether there are areas of habitat believed to be essential to the species' conservation.

5.9.1 Existing Conditions

Within the Commonwealth and its territorial waters, the USFWS and NMFS are responsible for the management ESA listed species. For most ESA listed species the responsibility for management is determined simply by whether or not it occurs within the marine environment; however, for a select few that spend their life cycles in both environments, it is often based on the location of the species and their habitat. For instance, the USFWS and NMFS jointly hold management requirements for sea turtles. The USFWS manages sea turtles while they are on land as well as, their nesting habitats. The NMFS is responsible for the management of sea turtles while they are in the ocean and their open ocean nursery habitats.

FEMA uses the USFWS Information, Planning, and Conservation (IPaC) system and natural heritage data to identify the potential presence of ESA listed species. The USFWS determines the likelihood of a species occurrence through an evaluation of their habitat requirements, its documented range, and comparing those parameters with existing site conditions. For species under the management of NMFS, FEMA is relying upon a list of ESA listed species produced by the NMFS Southeast Regional office (Southeast Region) for Puerto Rico's territorial waters (NMFS Southeast Region 2019).

Appendix E presents the ESA listed species that occur within the Commonwealth's terrestrial lands and territorial waters. **Table E-1** of Appendix D provides a list of the terrestrial-based ESA listed species while, **Table E-2** of Appendix D presents the ESA listed species that occur within the Commonwealth's marine environment. **Appendix F** provides habitat characteristics for the species presented in Appendix E. Table E-2 includes a preliminary determination as to the possible occurrence of marine ESA listed species within potential project areas. If the species only occurs in deep open ocean waters, the table notes that it is not likely to occur at a bridge, culvert, or road site. The federal consulting agencies will make a final determination as to a species potential presence on a case-by-case basis.

Designated Critical Habitat

According to the USFWS and NMFS, 14 of the ESA listed species managed by the service have DCH in Puerto Rico. In addition to the DCHs listed below, the Elfin-woods Warbler has proposed critical habitat that has not had a final rule yet published. The following is a list of species that have DCH within the Commonwealth's terrestrial and estuarine environments:

Culebra Island Giant Anole, Golden Coqui, Goncalyx concolor, Puerto Rican Rock Frog, Hawksbill Sea Turtle, Green Sea Turtle, Mona Boa, Coqui Llanero, Mona Ground Iguana, Monito Gecko, Varronia rupicola, Yellow-shouldered Black Bird, and Elkhorn and Staghorn coral (USFWS IPaC 2018, NMFS 2020).

Based on a review of the DCH for the 14 above referenced species that have such designations, the Culebra Island giant anole, yellow-shouldered blackbird, Mona-ground iguana, Mona boa, Monito gecko, hawksbill sea turtle, green sea turtle, leatherback, loggerhead, and elkhorn and staghorn coral, all have DCHs that are either within close proximity or intersects the coastal locations of Puerto Rico's transportation system.

5.9.2 Potential Impacts and Proposed Mitigation

Any projects that may affect an ESA listed species and not included in existing agreements may require consultation with the Services. FEMA will document the results of ESA consultations in a project specific REC prior to the commencement of construction.

Alternative 1: No Action

Under the No Action alternative, FEMA will not fund grants for transportation and landslide projects. In order to implement such projects, the Commonwealth will have to pursue other funding sources. Due to the current financial crisis in Puerto Rico it is unlikely that such projects will proceed without federal funding. If projects remain unfunded for an extended period, it may allow for the continued erosion of slopes and streambanks and obstructions to natural flow patterns to persist. The continued presence or occurrence of such conditions may cause negligible to minor adverse short-term and long-term impacts to ESA listed species by reducing available riparian habitat, degrading water quality, and serving as a barrier or hazard to aquatic organisms. Funding from other federal sources that support transportation projects may assist in limiting the long-term adverse impact from the No Action Alternative.

Alternative 2: Replacement of Bridges and Culverts

Under Alternative 2, additional noise, human presence, temporary disturbances, and potential sedimentation may occur during the construction phase of proposed actions. The effects of Alternative 2 actions may result in minor temporary and short-term adverse impacts to ESA listed species. FEMA anticipates that the Section 7 ESA consultation process will prevent or minimize adverse impacts to ESA listed species and DCH. Additionally, the establishment of limitations on project size and project location as well as, setting forth Recipient requirements for permit acquisition and implementation of suitable BMPs should assist in minimizing adverse impacts to ESA listed species.

FEMA anticipates that adverse direct negligible to minor short-term impacts to ESA listed amphibians, birds, and reptiles may occur during the removal and replacement of existing structures and the mobilization and demobilization of personnel and equipment. With regards to ESA listed wildlife and fish, they will likely avoid construction areas once activities have begun. The mobility of birds should minimize impacts to ESA listed avian species. FEMA anticipates implementation of conservation measures in consultation with the Services and existing agreements will limit impacts to protected species.

If ground disturbance, clearing of vegetation, and removal of structures has the potential to disrupt ESA listed species or their nests, the USFWS may require that the Recipient conduct field surveys for ESA listed species prior to the start of construction. For instance, the removal of deteriorating

structures may result in a negligible short-term loss in habitat for ESA listed species that are using the structures for nesting or habitat. The construction phase of Alternative 2 actions may generate noise and traffic that causes temporary minor adverse indirect impacts to ESA listed terrestrial species. FEMA anticipates that the restoration of damaged sites will result in ESA listed species experiencing a long-term beneficial impact by eliminating the potential for adverse impacts from deteriorating infrastructure and degraded water quality caused by streambank erosion.

An adverse short-term minor impact to ESA listed species could occur as a result of noise pollution and vibrations associated with pile driving. Direct impacts to aquatic ESA listed species can originate from the installation of structural pile driving. Sound generated by percussive pile driving has the potential to affect fish in several ways. Potential effects range from alteration of behavior to physical injury or mortality. These effects depend on the intensity and characteristics of the sound, the distance and location of the fish in the water column relative to the sound source, the size and mass of the fish, and the fish's anatomical characteristics (Caltrans 2015). Direct impacts to aquatic ESA listed species includes capillary rupture in skin, neurotrauma, eye hemorrhage, and swim bladder rupture for applicable species. Indirect impacts may include hearing loss, which may increase the animal's vulnerability to predators and result in the reduction or elimination of the ability to locate prey, communicate, and sense the physical environment (Caltrans 2015).

There are various practices that reduce underwater sound generated by in-water pile driving. These measures fall into two general categories: treatments that reduce the transmission of sound through the water and treatments to reduce the sound generated by the pile. For instance, one technique is to slowly ramp up pile driving giving the aquatic species the opportunity to move out of the area before the hammers reach their full capacity. By implementing permitting requirements, BMPs, and conservation measures listed in Section 6.0 of this PEA, the Recipient will be able to minimize impacts to aquatic ESA listed species. Additionally, the ability of mobile aquatic ESA listed species to freely move out of project areas will assist in limiting impacts to their populations. FEMA anticipates that ESA listed species will receive a beneficial impact from the removal of deteriorating structures that restrict natural river hydraulics will allow the waterbodies to flow naturally during storm events.

Alternative 3: Repair of Landslides

Alternative 3 includes actions that will restore failing slopes near existing roadways or developed areas. It is the intent of Alternative 3 to prevent the continued erosion of soil into waterways and prevent damage to roadways. FEMA anticipates that some Alternative 3 projects may require the construction of temporary staging areas and roads in order to access landslide areas. The clearing and grading of undisturbed areas may have an adverse short-term negligible to minor impact on ESA listed species and their nests. Additionally, the construction phase of Alternative 3 actions may result in indirect impacts to ESA listed aquatic species from runoff and sedimentation; however, the restoration of landslide areas away from waterways is unlikely to adversely impact ESA listed aquatic species.

FEMA anticipates that the Section 7 ESA consultation process will prevent or minimize adverse impacts to ESA listed species and DCH. The Recipient's will be responsible for implementation of USFWS guidance on avoiding and minimizing potential for impacts to ESA listed species. In addition to USFWS guidance, the Recipient will be responsible for implementing all applicable

BMPs and conservation measures listed in Section 6.0 of this PEA. Finally, the mobility of wildlife and birds to freely move out or fly out of project areas will also assist in reducing the potential for adverse direct impacts to ESA listed species. FEMA anticipates that a long-term beneficial impact to ESA listed species will occur as the restoration and stabilization of eroded hillsides increases the amount of suitable habitat. In addition to increasing suitable habitat for ESA listed species, the stabilization of slopes will lead to fewer and smaller landslides that could potentially impact ESA listed species and their DCH.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to ESA listed species will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 through 4

Under Alternative 5, impacts to ESA listed species will be similar to those impacts described for Alternative 2 through 4. FEMA understands that any decision to combine Action Alternatives will inherently increase the complexity of a project's construction and post-construction phases. Although the combination of Action Alternatives may involve work in very different environments, FEMA expects that the ESA consultation process and application of BMPs suited for minimizing adverse impacts to ESA listed species will be sufficient to prevent an increase in the impact determination for Alternative 5.

5.10 Cultural Resources

Cultural and historic resources are subject to review under federal and State laws and regulations. The National Historic Preservation Act (NHPA) enacted in 1966, which among other things, established State Historic Preservation Offices (SHPO) and the National Register of Historic Places (NRHP).

The NRHP is the United States' official list of significant historic properties and is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. The Secretary of the Interior administers the NRHP through the National Park Service (NPS). Historic properties include districts, buildings, structures, objects, landscapes, archaeological sites, traditional cultural properties, and other resources that are significant in American history, architecture, archeology, engineering, and culture. To be eligible for listing, a property must meet eligibility criteria delineated by the Secretary of the Interior and retain sufficient integrity to convey its significance to American culture. Detailed eligibility criteria for listing a property on the NRHP is in 36 CFR Part 60.

Section 106 of the NHPA, as amended, and implemented by 36 CFR Part 800, requires Federal agencies to consider the effects of their actions on historic properties and provide the Advisory Council on Historic Preservation an opportunity to comment on federal projects that have an effect on historic properties. This action must take place prior to the expenditure of federal funds. Title 36 CFR 800.4(a)(1) defines the Area of Potential Effects (APE) as the geographic area(s) within which the undertaking may directly or indirectly affect cultural resources. Once FEMA identifies historic and cultural resources, a qualified specialist will assess resources against a significance

criterion. The NHPA only covers historic properties determined to be eligible for listing on the NRHP. FEMA evaluates impacts to cultural resources prior to project actions for both Standing Structures (above ground resources) and Archaeology (on and below ground resources) within the APE.

5.10.1 Historic (Standing) Structures

5.10.1.1 Existing Conditions – Historic Standing Structures

Throughout four centuries, Spanish colonialists together with the local population established many buildings and structures throughout the island. Types of structures built by Spanish colonialists include Catholic Churches, civic buildings, and military installations. Many remain standing and are on the NRHP list. Across Puerto Rico there are over 350 properties listed in the NRHP, 18 historic districts, and six National Historic Landmarks. Altogether, there are over 2000 cultural resources included in the register (NPS NRHP 2019). In addition to the resources included on the NRHP, the Institute of Puerto Rican Culture (ICP) in accordance with the PRBP oversees 12 historic districts.

Urban development, coastline, and mountains dominate Puerto Rico's overall viewshed. The Cordillera Central (Central Mountain Range) spans the island from east to west and separates the more arid south from the more tropical north. At its highest point (Cerro De Punta), the mountains reach 4,390 ft above mean sea level. Ruta Panorámica is a 165 mile stretch of highway running roughly east to west through the Central Mountain Range, connecting ridgelines, towns, and natural reserves. Other visual resources include elements incorporated into other sections of this PEA, including vast cultural and historic resources dating from pre-colonial Taíno carvings, Spanish Colonial forts, and historic districts.

Hurricane Maria damaged the Commonwealth's infrastructure causing negative impacts to many of the territory's historic structures. Recovery efforts that will repair and harden many of these historic properties are ongoing.

5.10.1.2 Potential Impacts and Proposed Mitigation to Historic (Standing) Structures

Analysis of potential impacts to cultural and historic resources considers both direct and indirect impacts. Descriptions of what constitute direct and indirect impacts are as follows:

- Direct impacts may occur by physically altering, damaging, or destroying all or part of a resource or introducing visual, audible, or atmospheric elements that are out of character with the property or alter its setting. Once the proposed action locations are identified, the locations of direct impacts can be assessed.
- Indirect impacts may occur associated with altering the characteristics of the surrounding environment that contribute to resource significance as well as, neglect of the resource to the extent that it is deteriorated or destroyed.

Following the establishment of potential impacts or effects, is the identification of specific cultural and historic resources affected and the nature of potential impacts. Indirect impacts primarily result

from such effects as project-induced population increases in areas served by utilities and development of new housing and commercial areas, access roads, services, and other associated development. Construction and other activities associated with utilities and the communities they serve, can adversely affect cultural and historic resources. If a proposed action may adversely affect historic resources, consultation with the SHPO and other consulting parties can help identify ways to avoid or minimize impacts. If adverse effects are unavoidable, then agencies must resolve the adverse effects through a Memorandum of Agreement, or the Abbreviated Consultation Process as outlined in the FEMA Section 106 Programmatic Agreement. FEMA has a Section 106 Programmatic Agreement (dated May 31, 2018) and also a Second Amendment to the Section 106 Programmatic Agreement (dated November 13, 2019) both collectively known as the programmatic agreement (Programmatic Agreement). Additionally, FEMA or another Federal Agency may develop a Project Specific Programmatic Agreement to outline a review process, including a process for evaluating historic properties, avoidance and proposed mitigation.

Alternative 1: No Action

Under the No Action alternative, there will be no repair of transportation facilities with FEMA funds, potentially leaving communities with an ineffective road system, and vulnerable to future flood events. The No Action Alternative does not include construction, and thus no new impacts to historic resources will occur as a result of federal funding. Under the No Action Alternative, a decision to forego the repair of historic bridges and structures may equate to neglect and eventually lead to an adverse impact to the resource. Similarly, a long-term negligible to minor adverse impact to historic structures could occur if the Recipient is not able to access the structure. FEMA anticipates that without being able to perform routine maintenance, historic bridges and structure will deteriorate.

Alternative 2: Replacement of Bridges and Culverts

This alternative has the potential to affect historic or cultural resources. Extant infrastructure of cultural significance or archeological resources may be present within the project area. Destruction or alteration of any site, structure, or object of prehistoric importance may occur during construction. Physical alternations of a site may also affect cultural resources. Operation of heavy equipment, particularly pile drivers and other impact devices create vibrations that travel across or into the ground surface. These vibrations have the potential to cause structural damage to historic buildings. Structural damage is often determined by the level of vibration, duration of vibration, underlying geology and soils, and materials used to construct the buildings.

For the removal of older bridges and culverts, FEMA anticipates consultation with SHPO will be required prior to their removal. If there is the potential for ground vibrations to cause damage to historic buildings, SHPO may extend consultation and request less harmful construction practices. FEMA Historic Preservation staff will determine if a project SOW has the potential to affect the resource or meets outlined Programmatic Allowances in the Programmatic Agreement. If the SOW meets the Programmatic Allowance, the project will be determined to be within compliance with Section 106 of NHPA by the Agency and the review process will be complete. If the proposed SOW does not fall within an allowance, the Agency will follow the Section 106 review process and initiate consultation with the SHPO and any appropriate consulting parties. FEMA anticipates

that this alternative may be limited to negligible to minor impact on historic structures through the Programmatic Agreement and appropriate treatment measures.

Alternative 3: Repair of Landslides

FEMA anticipates that this alternative will have impacts similar to those discussed under Alternative 2 and will treat potential adverse impacts in a similar manner. If repair of landslides results in removal or alterations to historic structures, FEMA will follow the provisions of the Programmatic Agreement and consult with SHPO, or other parties as needed. Even through consultation, mitigation, or and treatment measures, this alternative may have a negligible to minor impact on historic structures and the viewshed.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to historic structures will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 Through 4

Under Alternative 5, impacts to historic structures will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases.

5.10.2 Archaeological Resources

5.10.2.1 Existing Conditions

The indigenous Taino people first encountered Western explorers at the end of the 15th Century when Christopher Columbus' second voyage brought him to the island known to the locals as Borikén (Borinquen). The Taino trace their roots to the Arawak tribes in the Orinoco delta in Venezuela. Around 400 years Before the Common Era (BCE), they began migrating across the Antilles and established communities with the original inhabitants across the northern Caribbean. At the time of Western contact, the Tainos were in conflict with the Carib Indians who had settled the Lesser Antilles as early as 1,300 BCE.

Spanish settlers found a well-developed, primarily agrarian society that had developed a sophisticated pharmacopeia from native flora, created pottery with fine detail, cotton weavings and wood, shell and stone carvings. Intermarriage with Spanish settlers and African slaves brought to the island, and the diseases they brought, coupled with an early 16th century uprising reduced the native population to near zero by the middle of the century.

Prehistoric Archaeological Resources

Puerto Rico has approximately 6,000 years human history encompassing indigenous, colonial and contemporary occupations covering a chronological range from 3500 BCE to 1500 BCE. There are approximately 2,500 archaeological sites reported for Puerto Rico in the SHPO and the ICP, with similar settlement patterns characteristic of Caribbean geography. Typical areas where

ancient human settlements were located are very similar to the currently inhabited areas. These are: coastal areas, interior valleys in mountain regions and flood river valleys.

Different types of archaeological sites are located within these principal geographical areas. The most predominant are shell middens, stone workshops, villages, villages with central plazas or stone delimited plazas, caves and rock petroglyphs near rivers.

Over the last four decades the implementation of NHPA and Section 106 compliance review has resulted in the identification, evaluation and documentation of numerous significant archaeological resources as a result of the construction of new road systems throughout the island. Any repair, replacement or relocation of bridges, culverts, roads, or landslides should take into consideration the potential impact to archaeological resources.

Historic Archaeological Resources

Puerto Rican history did not end with the arrival of the Spanish conquistadors. This stage was one of rich developments with contributions from many ethnic groups: European, indigenous, African, Arab, Chinese. Between the 16th and 19th centuries, Puerto Rican culture, through a slow process of development, acquired its current characteristics. As Puerto Rican culture developed, they constructed lighthouses, roads, bridges, and buildings to help facilitate their needs. While some of the structures still stand, historical records do not include many of the associated archaeological deposits.

In 1898 after the Spanish-American War and the arrival of the US government, there were new developments in Puerto Rico's political and economic structures. Among the most notable are the sugar mills, such as the Guanica Central. Many infrastructure works constructed were: irrigation canals, roads, bridges, and public buildings. Many of them are under current conservation measures and are part of Puerto Rican historical heritage.

Among the actions for permanent projects that could potentially increase impact rates for archaeological sites and other historical properties are the construction of staging areas, new access roads, and new ROWs. In general, depending on the type of site, they can have an extension area that varies from hundreds of meters to several kilometers. These documents and any subsequent future amendments will aid in fulfilling FEMA's responsibilities for Section 106 under NHPA. However, the current version only applies to work limited to the footprint and the ROW but not the staging areas or new access roads. The Second Amendment to the Programmatic Agreement established a distance of 200 meters (650 ft) to maintain as a buffer zone between any ground disturbance activity and registered historical properties.

5.10.2.2 Potential Impacts and Proposed Mitigation, Archaeological Resources

Alternative 1: No Action

Under the No Action alternative, FEMA does not fund transportation facilities repair, potentially leaving communities with an ineffective road system and vulnerable to future flood events. The No Action Alternative does not include ground disturbance and thus no new impacts to archeological resources will occur.

Alternative 2: Replacement of Bridges and Culverts

This alternative has the potential to affect archeological resources. Archeological resources may be present within the project area. Destruction or alteration of any site, structure, or object of prehistoric importance may occur during construction. Physical alternations of the site may also affect cultural resources. FEMA Historic Preservation Specialists will determine if a project SOW meets outlined Programmatic Allowances from the applicable Programmatic Agreement with the Puerto Rico SHPO or requires standard 106 review and consultation. If the scope of work falls within an applicable allowance under the Programmatic Agreement, FEMA will determine that the project is in compliance with Section 106 of NHPA and the review process will be complete. If the proposed SOW does not fall within the allowances, a FEMA Historic Preservation Specialist representative will make an effect determination and initiate consultation with the SHPO following the standard Section 106 review process. This may require additional archaeological surveys of ground disturbing activities depending on the results of the consultation with the SHPO. This alternative has the potential to affect archeological resources; however, they will be negligible to minor impacts with SHPO consultation.

Alternative 3: Repair of Landslides

Repair of landslides could result in new ground disturbance. While new ground disturbance has the potential to affect archaeological resources, methods of avoidance, mitigation, or documentation are similar to those used for projects described listed under Alternative 2

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to archaeological resources will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 Through 4

Under Alternative 5, impacts to historic structures will be similar to Alternative 2 and Alternative 3 for the Alternative's construction and post-construction phases.

5.11 Socioeconomic and Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations, requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law.

Council on Environmental Quality guidance states that "minority populations should be identified" where either: a) the minority population of the affected area exceeds 50 percent; or b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis" (CEQ 1997).

FEMA uses demographics data to analyze trends in order to identify potentially disproportionate impacts on minority and low-income populations from the Action Alternatives. FEMA will evaluate each scope of work on a case-by-case basis to ensure compliance with EO 12898. Data used in FEMA's analysis comes from documents published by relevant federal and Commonwealth agencies. The estimates in this section are based on decennial census data and the most current American Community Survey data from July 2019 published by the U.S. Census Bureau. The accuracy of the annual estimates is subject to the precision and relevance of the data used to compile the results.

5.11.1 Existing Conditions

Executive Order 12898 requires agencies to consider the potential to disproportionately affect a low income or minority community. Unlike its treatment of poverty, the Census Bureau does not provide an official definition of low income. With regards to determining a disproportionate adverse impact, some communities such as Puerto Rico will have a higher percentage of minority and/or low-income residents than typical of the 50 States. Provided these differences have a regular, or uniform, distribution, they generally will not indicate a potential for a disproportionate adverse impact (USEPA 2016).

In determining environmental justice, the first step is to define a relevant Community of Concern (COC). To be a COC, a community must have a high percentage minority population and a significant amount of its population living at or below the poverty level per U.S. Census data. There are variations in racial makeup, income levels, and poverty rates that differ slightly between regions and municipalities within Puerto Rico. For example, the southeast municipalities near Arroyo and Yabucoa generally have a higher percentage of black Hispanic population than many other municipalities. Population densities and per capita income are much higher in the San Juan-Bayamon-Guaynabo-Carolina, Trujillo Alto, and Caguas regions than the rest of the Commonwealth (USEPA 2019b). The high rates of poverty within the Commonwealth have not affected its residents' level of education. Puerto Rico has a high literacy rate of 92 percent (UNESCO 2017) and 74.7 percent of the population graduates from high school or higher education (U.S. Census 2020).

The 2019 U.S. Census Bureau QuickFacts indicates the racial makeup of the Commonwealth is 98.9 percent Hispanic or Latino. The Census of Population and Housing allows respondents identifying as Hispanic to select additional races. Within the category of Hispanic, the population was self-identified as 67.4 percent white, 10.8 percent black, 5.2 percent mixed, 0.3 percent were American Indian or Alaska Native, and 0.2 percent Asian. The remaining percentage of Hispanic respondents did not select a second race (U.S. Census Bureau 2020). Puerto Rico is unique and difficult to define as far as its relationship to poverty and minority status. When compared with the 50 states, the Commonwealth's average household income of \$20,166 would be the lowest (U.S. Census 2020). The nearest state's median household income is Mississippi with \$42,009. Puerto Rico, however, has one of the highest per capita GDP of its 21 neighboring Caribbean nations with \$37,900. In comparison, the per capita GDP of Haiti is only \$1,800 (CIA 2018).

According to Census Bureau data, 45 percent of Puerto Rican residents qualify as a Low-Income. Additionally, 44.9 percent of the population lives below the poverty level (U.S. Census 2018). A Puerto Rican government report states that in 2016, the median per capita income in Puerto Rico

was \$11,688. Forty-five percent of residents had an annual income below the federal poverty level, with high rates of poverty among those younger than 18 (57 percent) and those older than 65 (40 percent) (COR3 Puerto Rico Recovery Plan 2018). Based on Census data, the highest levels of poverty typically occurs in Puerto Rico's mountainous and rural communities. However, nearly all municipalities within the Commonwealth have areas with higher poverty rates than others (USEPA 2019b).

5.11.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund grants for transportation and landslide projects. Due to the Commonwealth's current financial condition, Puerto Rico will have to obtain funding for transportation projects from other sources. This may result in projects being unfunded or indefinitely delayed. The No Action Alternative may result in an increase in transit times and fuel costs for minority populations and low-income communities. A similar impact to at risk populations may be associated with an increase in vehicular emissions. As road closures continue to route commuter traffic into areas not accustomed to congestion, minority populations and low-income communities may experience a noticeable increase in air pollution. FEMA anticipates that the No Action Alternative could result in adverse minor short-term and long-term impacts to the Commonwealth's low-income and minority communities; however, this alternative will not disproportionately impact EJ communities as it will be applied Commonwealth-wide. Potential funding from other federal transportation agencies may minimize the long-term adverse impacts of the No Action Alternative as those agencies will also have to comply with EO 12898.

Alternative 2: Replacement of Bridges and Culverts

FEMA will review each project proposal on a case-by-case basis. FEMA anticipates that individual project actions will not disproportionately affect minority populations or low-income communities within the Commonwealth for the following reasons:

- FEMA will allocate funding as per the Stafford Act so there will not be any emphasis on projects of one municipality or community over another;
- FEMA funds eligible Recipient and Subrecipient projects Commonwealth-wide;
- From a regulatory standpoint, any federally funded action must comply with the existing federal laws and regulations that also have to comply with EO 12898; and
- Any permits or consultations and resulting conditions and conservation measures will apply to specific project sites as required by law, statute, or regulation.

FEMA anticipates jobs related to the recovery are likely to be available for all education and skill levels. The increase in construction jobs will be short-term in nature and upon completion of the recovery projects, economic conditions will likely return to a pre-disaster state. As such, FEMA anticipates an increase in construction jobs from the post Hurricane Maria recovery will likely have a less than major beneficial impact on Puerto Rico's economy.

Due to service interruptions and road detours during the construction phase of Alternative 2 actions, FEMA anticipates a short-term negligible to minor adverse impact to minority populations and low-income communities. However, minority populations and low-income communities will not disproportionately be impacted by Alternative 2 as the geographical extent of the disaster and location of potential projects will be Commonwealth-wide. The Recipient will be responsible for identifying the best method of minimizing impacts to local populations. The Recipient will be responsible for managing the inconveniences and disruptions of service through the implementation of maintenance of traffic (MOT) and public notifications. FEMA anticipates that Alternative 2 actions will constitute a long-term direct beneficial impact to all people in Puerto Rico regardless of minority status or income level as the reliability and resiliency of the Commonwealth's Roadway transportation system increases.

Alternative 3: Repair of Landslides

Generally, the impacts to socioeconomics and environmental justice from this alternative will be similar to those described for Alternative 2. The Recipient will be responsible for identifying applicable projects and determining the best method of minimizing impacts to local populations. FEMA will review projects on a case by case basis to confirm that Recipient has included mitigative measures in their SOWs.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to the Commonwealth's socioeconomics and environmental justice will be similar to Alternative 2 for the Alternative's construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 Through 4

Under Alternative 5, impacts to the Commonwealth's socioeconomics and environmental justice will be similar to Alternative 2 for the Alternative's construction and post-construction phases.

5.12 Land Use and Planning

Comprehensive land use plans determine land use within the vicinity of urban and rural areas. These plans specify the types of present and future land development that can occur within a specified area. In most cases, the preparation of comprehensive land use plans occurs through a public participation process. Once finalized, publicly elected officials approve land use plans. The intent of this process which involves public participation and elected officials is to capture local values and attitudes towards future development. Within Puerto Rico, zoning ordinances and land use regulations vary substantially depending upon location and municipality.

5.12.1 Existing Conditions

The Federal government, Commonwealth, municipalities, and private entities own and manage land within Puerto Rico. Major federal Department of Defense holdings within the Commonwealth include the former Ramey Air Force Base, Sabana Seca and Fort Allen Naval Radio Stations, former Roosevelt Roads Naval Base, Vieques Naval Training Range, and Fort Buchanan and Camp Santiago Army Bases. Additional federal holdings include El Yunque National Forest, Cabo

Rojo National Wildlife Refuge, Laguna Cartagena National Wildlife Refuge, and Vieques, and Culebra National Wildlife Refuges.

Developed areas occur throughout the main island of Puerto Rico, including large clusters within the coastal plains and valleys, and linear developments along highways and roads. The United States Forest Service (USFS) developed land use cover maps for Puerto Rico based on data collected between years 2000 and 2003 (Gould et al. 2008). Puerto Rico at that time contained 95,342 hectares (ha) of developed land cover. The developed portion of the Commonwealth comprised 11percent of Puerto Rico’s surface area. The USFS study found that areas within the Commonwealth that remain undeveloped predominately have either steep slopes, are under agriculture production, or maintain substantial wetland ecosystems. According to the 2010 U.S. Census, 93.76 percent of Puerto Ricans live in urban areas with only 6.24 percent living in rural areas. The total percent of land mass characterized as urban according to the 2010 U.S. Census is 47.17 percent (U.S. Census Bureau 2010).

Figure 7 in Appendix B illustrates Puerto Rico’s current land cover estimates based on the Multi-Resolution Land Characteristics (MRLC) Consortium 2001 National Land Cover Database (NLCD). The MRLC derives the values through remote sensing and the application of an algorithm (MRLC 2018). The MRLC consortium is a group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale for a wide variety of environmental, land management, and modeling applications. **Table 6** describes all NLCD2001 land cover class proportions for Puerto Rico.

Table 6: Land Cover of Puerto Rico

NLCD2001 Land Cover Class for Puerto Rico	Percentage
11. Open Water	21.56
12. Perennial Ice Snow	0.00
21. Low Intensity Residential	2.21
22. High Intensity Residential	5.45
23. Developed, Medium Intensity	3.38
24. Developed High Intensity	0.52
31. Bare Rock/Sand/Clay	0.49
41. Deciduous Forest	0.00
42. Evergreen Forest	35.86
43. Mixed Forest	0.00
52. Shrub/Scrub	2.14
71. Grasslands/Herbaceous	22.37
81. Pasture/Hay	2.09

NLCD2001 Land Cover Class for Puerto Rico	Percentage
82. Row Crops	1.75
90. Woody Wetlands	0.93
95. Emergent Herbaceous Wetlands	1.25
Total	100.00%

Note: This table is for illustrative purposes only, NLCD2001 has the most recent data file with complete detailed land cover analysis.

Within the Commonwealth, comprehensive land use plans guide land use within the vicinity of urban and rural areas and determine what types of development can occur within a specified area. The PRPB regulates overall land-use planning within Puerto Rico; however, municipalities may adopt their own comprehensive plans or zoning ordinances. The most recently published land use strategy for the Commonwealth was for the years 2011 through 2018. Each land use plan presents land use descriptions and maps that delineate urban and residential zones and the appropriate activities for those respective areas.

Of the major lands owned by the Commonwealth, Puerto Rico is responsible for managing public forests, parks, and recreation facilities. Local governments maintain parks and recreation facilities, public schools, and other municipal holdings. Transportation assets are managed Commonwealth-wide by DTOP and PRHTA. For roadways owned and operated by the municipalities, local transportation departments manage those assets at the local level.

For the period between 2017 and 2020, DTOP and PRHTA prepared a Statewide Transportation Improvement Program (STIP) plan. The STIP for Puerto Rico includes the proposed distribution of federal funds assigned to Puerto Rico for the fiscal years of 2017 to 2020 from the FHWA and the Federal Transit Administration. The STIP includes transit and highway projects for both urbanized and non-urbanized areas, thus covering all of Puerto Rico. The 2017 to 2020 STIP for Puerto Rico includes over 100 projects across the Commonwealth that may be eligible to receive United States Department of Transportation (USDOT) funding. Project value ranges from a few thousand dollars to in excess of a million dollars.

5.12.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund transportation and landslide related projects. Due to the current financial condition of Puerto Rico, the Commonwealth will have to obtain funding for transportation and landslide projects from other sources. This may result in some projects remaining unfunded or indefinitely delayed. Due to emergency actions taken by FEMA and its federal partners following Hurricane Maria, damage caused to bridges, culverts, and roads has not led to major changes in land use within the Commonwealth. FEMA anticipates that the No Action Alternative will have either no impact or an adverse negligible short-term and long-term impact on land use planning within the Commonwealth as the comprehensive land use plans developed by PRPB will continue to guide development.

Alternative 2: Replacement of Bridges and Culverts

Projects under Alternative 2 will essentially serve as in-kind replacements for existing bridges and culverts. As such, the Recipient's designs should not require an alteration of existing comprehensive land use plans. Under Alternative 2, the replacement of bridges and culverts will have no adverse long-term impact on land use planning as traffic congestion will not increase and the level of access for residents will not be diminished; however, minor short-term adverse impacts may occur as land use and traffic patterns are temporarily altered during the construction phase.

The MOT may cause adverse short-term impacts to local communities. The re-routing of traffic has the potential to cause congestion in communities not typically accustomed to experiencing such conditions. The Recipient will be responsible for managing the inconveniences and disruptions of service through the implementation of MOT and public notifications. For projects that involve DTOP, MOT plans will comply with their guidelines for road construction. The DTOP Design Manual requires contractors working in Puerto Rico to implement MOT plans and conduct public notifications.

The construction of Alternative 2 actions may include impacts to future land use from the clearing of vegetation and excavation and compaction of soil resources. The Recipient will be responsible for implementing site stabilization and revegetation measures in accordance with their NPDES permits and SWPPP. Additionally, the Recipient will be responsible for deploying all applicable mitigation measures presented in Section 6.0 of this PEA to minimize impacts to existing land use. FEMA anticipates that the restoration of construction sites per CWA permitting guidelines will minimize long-term adverse impacts to land use by restoring temporary access roads to their pre-construction condition.

Alternative 3: Repair of Landslides

Under Alternative 3, the Recipient will repair existing landslides and prevent future landslides from occurring. The actions considered under Alternative 3 should not require a change in existing comprehensive land use plans, as repaired landslides will still meet their pre-Hurricane Maria land use classification. As such, the repair of affected landslide areas should have no short-term or long-term adverse impact on existing land use plans. FEMA anticipates that the stabilization of slides and use materials to prevent future slides may cause an adverse long-term negligible impact to future land development. The use of FEMA funds for the repair of landslides may restrict future development in areas where highly erodible slopes exist. A beneficial impact to land use planning may occur as surrounding developed and undeveloped areas will be less susceptible to the impacts of landslides.

Alternative 4: Hazard Mitigation and Repair of Roadways

Impacts under this alternative to land use and land use plans will be similar to those described under Alternative 2 and Alternative 3.

Alternative 5: A Combination of Alternatives 2 Through 4

Under Alternative 5, impacts to the Commonwealth's land use plans be similar to Alternative 2 for the Alternative's construction and post-construction phases.

5.13 Noise

The USEPA defines noise as unwanted or unwelcome sound and measured in decibels (dBA) on the A-weighted scale (i.e. the scale most similar to the range of sounds that the human ear can hear). Noise that occurs between 10 p.m. and 7 a.m. is more disturbing than those sounds that occur during normal waking hours between 7 a.m. and 10 p.m. The Noise Control Act of 1972 required the USEPA to create a set of noise criteria. In response, the USEPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* in 1974 which explains the impact of noise on humans. The USEPA report found that keeping the maximum 24-hour Ldn value below 70 dBA protects the majority of people from hearing loss.

The Quiet Communities Act of 1978 enabled the development of state and local noise control programs, to provide an adequate federal noise control research program. According to published lists of noise sources, sound levels, and their effects, sound causes pain starting at approximately 120 to 125 dBA and can cause immediate irreparable damage at 140 dBA. The Occupational Health and Safety Administration (OSHA) has adopted a standard of 140 dBA for maximum impulse noise exposure. Similarly, the United States Housing and Urban Development noise standards, 24 CFR Part 51 Subpart B, indicate that for proposed new construction in high noise areas, the project must incorporate noise mitigation features. Within Puerto Rico, the PRDNER/PREQB regulates noise in accordance with the Noise Pollution Control Regulation of 2011. The regulation established the threshold for industrial levels at 75 dBA (PREQB 2011). Existing noise levels will vary by each site location and depend on the sound level and the observer's distance from the source.

5.13.1 Existing Conditions

Several factors affect the human ear's perception of sound. These include the actual level of sound or noise, the frequencies involved, the period of exposure to the noise, the changes or fluctuations in the noise levels during exposure, and meteorological conditions such as wind speed, direction, inversions, and humidity. Decibels (dB) measure levels of noise. Since the human ear cannot perceive all pitches or frequencies equally well, measured sound levels are adjusted or weighted to correspond to human hearing. This adjusted unit is known as the "A-weighted" decibel. All references to noise in this section refer to A-weighted decibel levels, or dBA. A few examples of dBA noise levels are:

- 40 dBA which is typical of quiet urban night;
- 88 dBA which is typical of a diesel truck passing by at 15 meters or 50 feet; and
- 105 dBA which is typical of a jet flying over at 305 meters or 1,000 feet.

An important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which a person has adapted: the so called “ambient noise” level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be by those hearing it.

The FHWA has established the following Noise Abatement Criteria (NAC) for various land uses. This method uses one of two means to determine when a traffic noise impact would occur. **Table 7** presents the FHWA noise abatement criteria.

Table 7: Federal Noise Abatement Criteria, Hourly A-Weighted Sound Level

Activity Category	$L_{eq}^{(h)}$	$L_{10}^{(h)}$	Activity Location	Description of Activity Category
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B ³	67	70	Exterior	Residential – picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C ³	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E ³	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	--	Undeveloped lands that are not permitted

¹ Either $L_{eq}(h)$ or $L_{10}(h)$ (but not both) may be used on a project.

² The $L_{eq}(h)$ and $L_{10}(h)$ Activity Criteria values are for impact determination only and are not design standards for noise abatement measures.

³ Includes undeveloped lands permitted for this activity category.

5.13.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund grants for transportation and landslide related projects. Due to Puerto Rico's financial condition, the Commonwealth will have to obtain funding for transportation and landslide projects from other federal agencies. This may result in some projects being unfunded or indefinitely delayed. The No Action will not impact existing noise conditions as daily operations will remain unchanged; however, for areas where traffic has been re-routed due to Hurricane Maria caused damage, minor adverse impacts from additional traffic noise may persist.

Alternative 2: Replacement of Bridges and Culverts

FEMA anticipates that bridge and culvert replacement projects will occur in areas accustomed to traffic related noise. Under Alternative 2, the long-term adverse impacts from vehicular generated noise will be similar to baseline conditions as traffic congestion and speed limits will not change.

During the construction phase of Alternative 2 projects, the use of heavy machinery may cause short-term negligible to minor adverse impacts to local receptors. In order to minimize the adverse impacts from construction noise, the Recipient will be responsible for ensuring construction activities comply with local noise ordinances that limit construction to typically waking hours. Under Alternative 2, construction activities and heavy equipment may generate vibrations that could result in ground-borne noise. Ground-borne noise or vibration can adversely impact nearby structures through changes in building settlement or damage to building materials. Similarly, vibrations can cause behavioral changes in wildlife that result in adverse impacts such as the abandonment of nests. FEMA anticipates that adverse impacts from ground vibrations will be minimal and temporary as the Action Alternative includes no new permanent sources of noise.

Actions under Alternative 2 may expose construction workers to elevated levels of noise. FEMA anticipates that OSHA regulations which require employers to provide workers with the appropriate level of protective equipment will minimize adverse impacts to construction worker hearing.

Alternative 3: Repair of Landslides

Under Alternative 3, noise impacts will be similar to or less than Alternative 2 for construction and post-construction activities. Due to this PEA's limits on project size and landslide project location, projects are likely to occur in areas accustomed to traffic related noise. FEMA anticipates that construction noise from Alternative 3 may cause an adverse temporary minor impact to nearby receptors. Upon project completion, FEMA anticipates that the post-construction phase of landslide repair projects will result in no adverse long-term noise impacts.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts from noise will be similar to those described for Alternatives 2 and 3 for both the construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 Through 4

Under Alternative 5, noise impacts will be similar to Alternatives 2 through 4 for both the construction and post-construction phases.

5.14 Transportation

Within Puerto Rico, DTOP is responsible for managing both maritime and non-maritime transportation facilities. DTOP is comprised of four agencies: PRHTA, the Puerto Rico Port Authority, the Maritime Transport Authority, and the Metropolitan Bus Authority. The PRHTA is a government-owned corporation responsible for constructing, operating, and maintaining roads, bridges, avenues, highways, tunnels, public parking, tolls, and other transit facilities.

5.14.1 Existing Conditions

Puerto Ricans are heavily dependent on their system of roads for transportation. Within the Commonwealth, 90.5 percent of employees travel to work via, car, truck, or van. The average worker commute in Puerto Rico is 29.2 minutes. In 2017, there were 2.8 automobiles, trucks, and buses registered within the Commonwealth. As such, this represents the highest vehicle densities per capita in the world (FHWA 2010; Miller 2009).

The Commonwealth's Roadway transportation system consists of approximately 16,700 miles of paved roads and approximately 1,600 miles of unpaved roads. Puerto Rico has 4.86 miles of paved roads per square mile of land (PRDTPW 2019). The system includes roads operated under the National Highway System (NHS), state highways, and municipalities. The NHS in Puerto Rico consists of approximately 780 miles of roadways while, Commonwealth maintained roadways make up approximately 5,000 miles of Puerto Rico's road network. Municipalities within Puerto Rico own and operate the remaining 11,000 miles of roadways (American Society of Civil Engineers (ASCE) 2019). The exact number of paved and unpaved road miles varies slightly based on the data's source and road surface definition used by the reference's preparer.

According to the Federal Highway Administration (FHWA), there are 2,325 bridges in Puerto Rico. The number of bridges includes culverts that serve the dual purpose as a vehicular crossing and a conduit for water. The exact number of bridges differs slightly from source to source. Within Puerto Rico the following entities own and operate bridges:

- Municipalities - 374 bridges,
- Puerto Rico Highway and Transportation Authority (PRHTA) - 1,632 bridges,
- State Toll Authority - 312 bridges, and
- Other entities - 16 bridges (ASCE 2019).

The National Bridge Inventory (NBI) for 2018 indicates that 12 percent of bridges in Puerto Rico are in poor condition, approximately 69 percent are in fair condition, and, only 19 percent are in good condition. The average age of Puerto Rico's bridges is 45 years old.

5.14.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund transportation and landslide related projects. The Commonwealth will have to obtain funding for their projects from other sources. This may result in some projects being either delayed or deferred indefinitely. Transportation impacts may include longer commute times, increased wear and tear on vehicles, increased cost in product delivery, longer delivery routes, and increased fuel consumption. Future storm events may cause further deterioration of the Commonwealth's Roadway transportation system. Similarly, if the Recipient does not repair existing landslides, the landslides are likely to remain a threat to adjacent roadways as well as, represent a minor short-term and long-term adverse impact to the Commonwealth's Roadway transportation system. FEMA anticipates that funding from other federal transportation agencies will minimize adverse long-term impacts to the Commonwealth's Roadway transportation system from the No Action Alternative.

Alternative 2: Replacement of Bridges and Culverts

Under Alternative 2, FEMA will fund eligible bridge and culvert replacement projects. FEMA anticipates that the replacement of bridges and culverts with structures that support similar pre-Hurricane Maria capacities will result in no long-term adverse impacts to the Commonwealth's Roadway transportation system. By limiting actions to similarly purposed structures, Alternative 2 will not adversely increase traffic congestion when compared with pre-Hurricane Maria traffic conditions. The actions taken under Alternative 2 will comply with PRHTA and FHWA standards for the applicable classes of roadways. As such, increases in speed limits for adjacent roadway segments will not occur as a result of a new bridge or culvert.

Under Alternative 2, FEMA anticipates direct impacts to the Commonwealth's Roadway transportation system from traffic delays and MOT that may occur during the action's construction phase. Construction zones to manage traffic may cause localized adverse short-term minor impacts to traffic patterns around construction sites. This may cause short-term traffic congestion in areas not typically accustomed to such conditions. FEMA anticipates that the installation of temporary water crossings near the existing bridges and culverts will minimize the need for extensive detours.

Under Alternative 2, the Recipient will be responsible for consulting and notifying impacted populations and businesses of temporary changes in traffic patterns. For projects that involve DTOP, MOT plans will comply with their guidelines for road construction. The DTOP Design Manual requires contractors working in Puerto Rico implement MOT plans and conduct public notifications. FEMA anticipates that public outreach by the Recipient and implementation of DTOP's MOT requirements will minimize adverse short-term impacts from the construction phase to a level of minor.

Finally, FEMA anticipates that the Commonwealth will derive a long-term beneficial impact from the implementation of Alternative 2 actions as bridge and culvert designs meet current AASHTO, FHWA, and PRHTA codes and standards. By designing and constructing to current codes and standards, bridges and culverts will be more resilient to future storm events. This will result in fewer and shorter disruptions in service.

Alternative 3: Repair of Landslides

Under Alternative 3, there may be direct impacts to the Roadway transportation system from construction delays and the re-routing of traffic near landslide project areas. For instance, the establishment of construction zones to manage traffic may cause localized adverse short-term minor impacts to traffic patterns around the construction site. This may cause short-term traffic congestion in areas not typically accustomed to such conditions.

Under Alternative 3, the Recipient will be responsible for consulting and notifying impacted populations and businesses of temporary changes in traffic patterns. For landslide projects that involve roadways, the DTOP Design Manual requires contractors working in Puerto Rico implement MOT plans and conduct public notifications. FEMA anticipates that public outreach by the Recipient and implementation of the DTOP MOT requirements will minimize adverse short-term impacts from the construction phase of Alternative 3 actions to a level of minor.

FEMA anticipates that the post-construction phase of Alternative 3 actions will minimize the potential for adverse long-term impacts to the Commonwealth's Roadway transportation system from existing landslides. As such, the Commonwealth's Roadway transportation system will derive a beneficial impact as landslides become smaller and less impactful.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to the Commonwealth's Roadway transportation system will be similar to Alternatives 2 and 3 for the construction and post-construction phases. FEMA anticipates that the Commonwealth will derive a long-term beneficial impact from the implementation of Alternative 4 actions as bridge, culvert, and roadway projects meet current AASHTO, FHWA, and PRHTA codes and standards. By upgrading transportation facilities to current codes and standards, bridges, culverts, and roads, the Commonwealth's Roadway transportation system will be more resilient to future storm events. FEMA anticipates that a more resilient system will result in fewer and shorter disruptions in service.

Alternative 5: A Combination of Alternatives 2 Through 4

Under Alternative 5, impacts to the Commonwealth's Roadway transportation system will be similar to Alternatives 2 through 4 for construction and post-construction activities.

5.15 Public Services and Utilities

This section evaluates the potential impacts of the Action Alternatives on public utilities; however, FEMA has comprehensively assessed impacts to utilities in an earlier 2020 Utilities PEA. A public utility is an organization that maintains the infrastructure for a public service. An interruption of public utilities can adversely impact public health. A reduction in the reliability of public utility services impacts all aspects of daily life.

5.15.1 Existing Conditions

Utility providers often install their lines and facilities in the ROW of public roads and streets. ROW's frequently offer the most practical engineering, construction, and maintenance solutions for the distribution of utility service to businesses and residences. A utility's presence within the ROW can affect safety, traffic-carrying ability, and the physical integrity of roadways.

Puerto Rico's power generation system includes fossil fuel, hydroelectric, wind, and solar facilities. Although private ownership of power generating facilities does exist within the Commonwealth, the Puerto Rico Electric and Power Authority (PREPA) owns and operates the majority of these facilities. The electric grid includes transmission lines, overhead and underground distribution lines across the service territory, and substations and transmission centers. Approximately six percent of the distribution lines are underground (Build Back Better 2017). In an effort to mitigate the impact of future storm events, the potential exists for PREPA to relocate additional distribution lines below ground.

The Puerto Rico Aqueduct and Sewer Authority (PRASA) owns and operates the Commonwealth's public water and wastewater system. PRASA maintains five operational regions: Metro, North, South, East, and West. PRASA has more than 20,000 miles of water and wastewater pipelines. PRASA operates many wastewater treatment plants and water treatment facilities throughout the Commonwealth. These facilities treat millions of gallons of wastewater and water per day (PRASA 2019 and PRASA 2013).

Puerto Rico maintains an array of communication networks that include cellular towers and provider networks, fiber optic lines, radio and associated broadcast towers, microwave antennas, standard radio towers, land mobile radio systems, 2-way radio radios, pager systems, and satellite phones (Cornell 2019).

5.15.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not provide grant funding for transportation and landslide projects. Due to Puerto Rico's financial condition, transportation and landslide projects may be either unfunded or indefinitely delayed. In order to address the issues involving their transportation system, the Commonwealth will have to obtain funding for transportation and landslide projects from other sources. FEMA anticipates that the temporary emergency repairs made following Hurricane Maria will not serve as long-term solutions to the Commonwealth's aging infrastructure.

As a result of often using transportation ROWs, deteriorating transportation infrastructure can have a direct adverse minor impact on public utilities and the continuity of utility service. Decisions to defer repairs to the transportation system are likely to exacerbate disruptions in utility service caused by failing transportation infrastructure. Repairs to roadways often require the excavation of roadbeds and the temporary disconnection of utilities. FEMA anticipates that by delaying and deferring repairs to transportation system, the No Action Alternative will cause minor short-term

and long-term adverse impacts to utility providers and customers as periodic disruptions in service persist as major failures in roadway infrastructure occur as a result of future storm events.

As landslides become more frequent and prominent due to lack of permanent repairs, buried utilities may become exposed potentially increasing failures and disruptions in utility network service. Similarly, overhead utilities can fail as landslides knock out their support structures. The potential for landslides to increase affects to public utilities may result in an adverse long-term less than major impact from the No Action Alternative. Funding from other federal sources may minimize adverse long-term impacts to the Commonwealth's Roadway transportation system and utility networks.

Alternative 2: Replacement of Bridges and Culverts

Under Alternative 2, the replacement of bridges and culverts may require the temporary management of utilities as ground disturbing activities occur. This could include such things as temporary or permanent relocation of an electrical distribution or transmission line or the temporarily capping and rerouting of an adjacent force main or fiber optic cable. During the construction phase of Alternative 2 actions, FEMA anticipates that projects may have an adverse negligible to minor short-term impacts on Puerto Rico's public services and utilities. The Recipient will be responsible for coordinating with local communities and institutions regarding any possible delays or interruptions in utility service and synchronizing timing utilities projects with Roadway transportation projects to avoid multiple successive disruptions to the same area

For all applicable projects under Alternative 2, the Recipient will be responsible for coordinating with service providers and construction managers to minimize impacts to public utilities and the communities they support. OSHA regulations 29 CFR 1926 Subpart P (Excavations), §1926.651 (Specific excavation requirements), govern methods for uncovering underground utility installations. OSHA mandates that if a utility provider cannot respond to a request to locate underground utility installations or cannot establish the exact location of these installations, the contractor may proceed provided they use detection equipment or other acceptable means to locate utility installations. Additionally, the FHWA and PRHTA both provide guidance and procedures for the management of utilities by transportation workers (FHWA 1993; PRHTA 1979). These services and training procedures will assist in the minimization of adverse impacts to public utilities from transportation projects.

FEMA anticipates that in certain circumstances the redesign of bridges and culverts may require the permanent relocation of utilities within an existing ROW. The need to relocate utilities will occur in response to hazard mitigation efforts that call for more robust bridges and culverts. FEMA anticipates that Alternative 2 will have no adverse long-term impacts to public services and utilities as well as, the communities they support. The Commonwealth's utility network may derive a beneficial impact as the bridges, culverts, and approaches become more resilient to storm events. A more resilient transportation system is likely to coincide with a reduction in service disruptions.

Alternative 3: Repair of Landslides

During the construction phase, temporary adverse minor impacts to public utility service providers may occur. The Recipient will be responsible for coordinating with local communities and

institutions regarding any possible delays or interruptions in service. The Recipient will be responsible for coordinating and synchronizing with service providers and construction managers to minimize adverse impacts to the utility infrastructure. OSHA regulations 29 CFR 1926 Subpart P (Excavations), §1926.651(Specific excavation requirements), govern methods for uncovering underground utility installations. OSHA mandates that if a utility provider cannot respond to a request to locate underground utility installations or cannot establish the exact location of these installations, the contractor may proceed provided they use detection equipment or other acceptable means to locate utility installations. Additionally, when excavation operations approach the estimated location of underground installations, the contractor must use safe and acceptable means to determine the exact location of the installations.

FEMA anticipates that the classes of actions under Alternative 3 could include the implementation of hazard mitigation measures that will prevent future adverse impacts to public utilities. FEMA expects that the Commonwealth will derive a long-term beneficial impact from Alternative 3 as a reduction in the severity of current and future landslides occur. Fewer landslides should reduce the possibility of adverse impacts to public utilities.

Alternative 4: Hazard Mitigation and Repair of Roadways

Under Alternative 4, impacts to the Commonwealth's utility networks from transportation projects will be similar to Alternatives 2 and 3 for the construction and post-construction phases.

Alternative 5: A Combination of Alternatives 2 Through 4

Under Alternative 5, impacts to the Commonwealth's utility network from transportation projects will be similar to Alternatives 2 through 4 for construction and post-construction activities.

5.16 Public Health and Safety

Numerous health and safety laws and regulations exist for a wide variety of activities. An exhaustive review of these various rules is beyond the scope of this PEA. With regards to worker safety, the U.S. Congress enacted the Occupational Safety and Health Act of 1970, 29 USC § 651 et seq. (OSHA) to assure safe and healthful working conditions for working men and women.

5.16.1 Existing Conditions

Safety considerations can arise in many stages of the NEPA process. Public health and safety can include everything from the safety and security of food supplies to the safe use of drug and medical devices. Transportation projects in particular have the potential to affect our safety and security as our protective and health services rely on Puerto Rico's transportation system to function in a fast and efficient method.

Within the Commonwealth, the primary protective and health services include fire protection, law enforcement, and medical emergency services. The following describes the primary authorities tasked with ensuring public health and safety within the Commonwealth:

- The Puerto Rico Firefighters Corps (*Cuerpo de Bomberos de Puerto Rico*) is a Commonwealth-wide fire department with over 91 fire stations. There are six (6) operational zones located in Aguadilla, Arecibo, Carolina, Caguas, Ponce and San Juan. There are 10 districts located in: San Juan, Bayamón, Carolina, Rio Piedras, Caguas, Humacao, Ponce, Guayama, Aguadilla and Arecibo. The Puerto Rico Firefighters Corps' Special Operations Division is a separate division that performs functions such as search and rescue operations in conjunction with the emergency medical services (*Cuerpo de Bomberos de Puerto Rico 2020*).
- Within the Commonwealth, the municipal police forces, the Special Investigation Bureau, and the Department of Justice make up the local law enforcement apparatus. In all, approximately 17,000 officers serve 78 municipalities. Local police departments provide law enforcement and emergency services for each community and the surrounding areas.
- The United States Coast Guard (USCG) is the Federal agency operating in Puerto Rico responsible for maritime safety and security, protection of natural resources, homeland security, and national defense. Sector San Juan of the USCG serves all of Puerto Rico
- The Puerto Rico Medical Emergency Corps is the agency of the executive branch of the government of Puerto Rico that responds to all medical emergencies within the jurisdiction of Puerto Rico. The Puerto Rico Department of Health manages the Puerto Rico Medical Emergency Corps. Additionally, the Puerto Rico Medical Emergency Corps is a component of Puerto Rico's Emergency Operations Center (*Departamento de Salud Gobierno de Puerto Rico 2020*).
- Throughout the mainland of Puerto Rico, there are 68 hospitals (*Puerto Rico Hospital Association 2019*) and 30 clinics, all of which have re-opened since Hurricane Maria (*Kaiser Family Foundation 2018*). Prior to Hurricane Maria, the island of Vieques was served by one hospital and one clinic. Roughly 500-700 physicians and surgeons have left the island since Hurricane Maria (*Lliveras 2018*). There is no available data on how many medical professionals have since returned to the Commonwealth in the Hurricane Maria Recovery period.

5.16.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action Alternative, FEMA will not fund grants for transportation and landslide projects. Due to the Commonwealth's financial condition, FEMA anticipates that repairs to their transportation system may either be delayed or deferred indefinitely. Unless Puerto Rico can secure federal funding to address Hurricane Maria caused damage, the Commonwealth's public health and safety networks will continue to operate at their post Hurricane Maria efficiency. For instance, persistent road closures within the municipalities may adversely impact emergency response times. As such, FEMA anticipates that adverse minor short-term and long-term impacts to the Commonwealth's public health and safety networks will continue under the No Action Alternative.

Alternative 2: Replacement of Bridges and Culverts

Under Alternative 2, FEMA will fund eligible bridge and culvert replacement projects. FEMA anticipates that during the construction phase, delays in fire, emergency, and law enforcement services are possible as the result of short-term road closures and detours. The modifications of service routes may have a short-term negligible to minor adverse impact on public health and safety. The installation of temporary crossings nearby will minimize adverse impacts to emergency services and local populations. The Recipient will further minimize disruptions through the implementation of MOT, coordinating with service providers, and public notifications. For projects that involve DTOP, MOT plans must comply with their guidelines for road construction. The DTOP Design Manual requires contractors working in Puerto Rico implement MOT plans and conduct public notifications.

Work around water and at heights pose particular risks to worker safety. The potential adverse impact to worker safety will be temporary and minor. Pre-construction meetings and equipment trainings for workers will minimize the risk of employment related injuries from construction phase activities. The use of qualified personnel trained in the operation of their equipment as well as, the implementation of OSHA safety measures will minimize risk to human health and safety. The Recipient will be responsible for posting the appropriate signage and placement of construction barriers to alert the public of potential hazards and prevent unauthorized access to project sites.

FEMA anticipates that results of Alternative 2 actions will cause no adverse long-term impacts to the administration of public health and safety services. FEMA anticipates that emergency services and local populations will derive a long-term less than major benefit from their being a more resilient and efficient transportation system.

Alternative 3: Repair of Landslides

The impacts from this alternative will be similar to those described for Alternative 2. The classes of actions satisfied by Alternative 3 may cause temporary or short-term impacts to the Commonwealth's public health and safety network as road closures occur during the construction phase of landslide repair projects. FEMA anticipates that landslide projects will result in adverse temporary and short-term negligible to minor impacts on emergency services and the communities they support.

For all applicable projects, the Recipient will be responsible for implementing MOT, coordinating with service providers, and public notifications. FEMA anticipates that Alternative 3 will cause no long-term adverse impacts to public health and safety. Following the repair of landslide areas, public health and safety emergency response times should return to pre-Hurricane Maria standards. Furthermore, FEMA anticipates that the Commonwealth will derive a minor long-term beneficial impact from installing hazard mitigation measures that prevent existing landslides from worsening or future landslides from occurring.

Alternative 4: Hazard Mitigation and Repair of Roadways

The impacts from this alternative will be similar to those described for Alternative 2 and Alternative 3. Under Alternative 4, FEMA will fund eligible bridge, culvert, and road hazard mitigation and repair projects.

Alternative 5: A Combination of Alternatives 2 Through 4

Depending on the project scope, under Alternative 5, impacts to public health and safety will be similar to Alternatives 2 through 4 for construction and post-construction activities.

5.17 Hazardous Materials

Hazardous substances and hazardous materials constitute any solid, liquid, contained gaseous or semisolid material, or any combination of materials that pose a substantial present or potential hazard to human health and the environment. Hazardous materials constitute a type of substance that receives extensive regulation by various federal and state environmental, safety occupational, and transportation laws and regulations. Hazardous materials include asbestos, lead, petroleum products, and toxic, highly reactive chemicals. Improper management and disposal of hazardous substances can lead to the pollution or contamination of groundwater, surface water, soil, and air. Hazardous materials may be hazardous wastes.

There are numerous federal, state, and local laws that contain lists of hazardous materials or hazardous substances or hazardous wastes that require special handling if encountered during project construction. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 USC § 9601 *et seq.*) and Resource Conservation and Recovery Act (RCRA), Subtitle D are the primary federal laws for the management and disposal of hazardous substances. The USEPA regulates the management of non-hazardous solid waste according to RCRA. Under RCRA, the USEPA is in charge of regulating the handling and disposal of hazardous wastes. The USDOT establishes regulations and training requirements for the transport of hazardous materials by land, water, and air within, from, or through the United States and its Territories.

Enforcement of these laws ensures the protection of the environment and human health through the establishment of management systems that include their identification, use, storage, treatment, transportation, and disposal. Hazardous waste regulation is meant to manage wastes from cradle to grave. If this management system fails, these laws provide for the adequate investigation and cleanup of sites contaminated from the release of hazardous materials and hazardous wastes.

The U.S. Congress enacted the Occupational Safety and Health Act of 1970, 29 USC § 651 *et seq.* to assure safe and healthful working conditions for working men and women. For employees working with hazardous materials, OSHA requires that their employers provide them with the appropriate personal protective equipment (PPE) necessary to perform their tasks in a safe and secure manner.

5.17.1 Existing Conditions

Surface waters, groundwater, sediments, and soils can contain organic chemicals, inorganic chemicals, and pathogens. These various media can become contaminated by direct and indirect actions. Direct actions may be associated with spills or illicit dumping while, indirect actions may occur as contaminated water or contaminated soils interact with each other. Contaminates can enter aquifers by various methods which include infiltration of surface water through soils, sediment, and rock. For instance, improperly built wells can serve as conduits for contamination and cross contamination (Saracino et al., 2002).

Exposure to silica from the breaking of building materials into fine particles during demolition or similar activities can release fine particles into the air. Long-term exposure to these fine particles can lead to lung infections and lung cancer. OSHA requires that contractors use BMPs to minimize fugitive dust particulates while working with concrete.

The National Priorities List (NPL) is the list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its Territories. The primary intent of NPL is to guide the USEPA in determining which sites warrant further investigation. According to the online databases, the USEPA has historically managed approximately 25 NPL and Superfund Alternative Approach Sites in Puerto Rico (USEPA 2019e). Since the inception of the program, the USEPA has obtained closure on at least six former NPL sites within the Commonwealth. Currently, there are 19 actively managed sites under the Superfund Alternative (SA) approach. The 19 active NPL sites in Puerto Rico include the following:

***Vieques:** Atlantic Fleet Weapons Training Area; **Cabo Rojo:** Cabo Rojo Ground Water Contamination; **Cabo Rojo:** Cidra Ground Water Contamination; **Corozal:** Corozal Well; **Dorado:** Dorado Ground Water Contamination; **Jobos:** Fibers Public Supply Wells; **Caguas:** Hormigas Ground Water Plume; **Juncos:** Juncos Landfill; **Maunabo:** Maunabo Area Ground Water Contamination; **Utua:** Papelera Puertorriquena, Inc.; **Arecibo:** Pesticide Warehouse I; **Manati:** Pesticide Warehouse III; **Penuelas:** PROTECO; **San German:** San German Ground Water Contamination; **Candelaria Ward:** Scorpio Recycling, Inc.; **Bo. Cambalache:** The Battery Recycling Company; **Barceloneta:** Upjohn Facility; **Vega Alta:** Vega Alta Public Supply Wells; **Rio Abajo Ward:** Vega Baja Solid Waste Disposal (USEPA 2019e).*

Within the Commonwealth there are currently 18 landfills permitted by PREQB/PRDNER. These permitted landfills primarily receive municipal solid waste, land clearing debris, commercial and industrial waste, and construction and demolition debris (PREQB 2019). The permitted landfills include an ash monofill and gas recovery facility. A number of the permitted facilities are able to process recycled goods such as batteries and electronic waste. There are currently limitations on the types of hazardous waste that can be disposed of within Puerto Rico. Disposal facilities in the Commonwealth are only capable of processing lead and asbestos. Other hazardous waste material requires shipping off-island for final processing.

The USEPA RCRA Info online database is a national program management and inventory system of hazardous waste handlers. The activities of hazardous waste generators, transporters, treaters,

storers, and disposers must provide documentation to state environmental agencies. In turn, these agencies, pass on the information to regional and national USEPA offices. The RCRA Info database identifies location data for specific hazardous waste handlers and information on treatment, storage, and disposal facilities regarding permitting and closure status, compliance with federal and state regulations, and cleanup activities. The RCRA online database lists 1,552 active generator sites throughout the Commonwealth (USEPA 2019c).

5.17.2 Potential Impacts and Proposed Mitigation

Alternative 1: No Action

Under the No Action alternative, FEMA will not provide grant funding for transportation and landslide projects. Due to Puerto Rico's financial condition, the Commonwealth will have to obtain funding for transportation and landslide projects from other federal sources resulting in some projects being unfunded or indefinitely delayed. The No Action Alternative could potentially leave communities with unreliable water crossings and damaged slopes that are vulnerable to future storm events.

Although unlikely, the deferment of repairs to the transportation system could lead to accidents that results in an unregulated release of hazardous materials. However, the No Action Alternative is more likely to result in the release of non-hazardous waste streams and sediment into the environment as road surfaces and landslides continue to deteriorate and erode. FEMA anticipates that the No Action Alternative has the potential to cause minor adverse short-term and long-term impacts from the exposure or release of hazardous materials. Funding from other federal transportation agencies may minimize the long-term adverse impacts from the No Action Alternative.

Alternative 2: Replacement of Bridges and Culverts

Under Alternative 2, construction activities may temporarily use, encounter, or generate hazardous materials and wastes. The Recipient will be responsible for handling and disposing of hazardous materials in accordance with federal and Commonwealth regulations. During the project design phase, the Recipient will be responsible for complying with all applicable federal and Commonwealth laws and regulations in determining the absence or presence of hazardous materials or wastes. Upon reviewing each project, FEMA Environmental Planning and Historic Preservation (EHP) Specialists will document in the project REC whether or not the Recipient has identified SOWs that involve addressing the presence of site contamination. Additionally, FEMA EHP Specialists will review each project on a case-by-case basis to determine whether or not a proposed project site is located at or adjacent to an existing contaminated site. The USEPA's RCRA database contains location specific information for sites that have a documented history of hazardous material use.

The replacement of bridges and culverts will use current codes and standards to implement proposed actions. Current codes and standards rely on materials that are more durable and safer for the environment than their predecessors. If contractors encounter contaminated soil or groundwater during construction, the Recipient must stop work. The contractor must contact PRDNER/PREQB and other regulators in accordance with applicable permits. The Recipient will

be responsible for adhering to PRDNER/PREQB guidance before resuming work. For circumstances where the CWA requires the implementation of a Spill Control and Countermeasures (SPCC) Plan, the plan will limit impacts of hazardous materials to the immediate area of the release. The construction phase of Alternative 2 may generate hazardous wastes that include used oil and lead-based paint. Assessment and testing for the presence of lead-based paint must occur prior to bridge and culvert demolition. The Recipient will be responsible for handling any lead-based paint in accordance with federal and local regulations.

The Recipient will ensure that on-site personnel receive appropriate job specific safety training in accordance with OSHA regulations. The Recipient will ensure that on-site personnel follow applicable OSHA regulations for the handling of lead-based paint. The excavation of soils and sediment can expose workers to contaminated surface water, groundwater, soils, and sediment during the construction process. The Recipient will be responsible for ensuring their contractors use the appropriate level of PPE. The Recipient will install construction barriers around active sites to prevent unauthorized personnel from gaining access. The Recipient will be responsible for performing all demolition and excavation activities in accordance with federal, state, and local laws and regulations regarding the handling and disposal of hazardous materials. Appropriate signage and construction barriers will be in place prior to construction to alert the public of project activities and risks.

FEMA anticipates that the use of new materials that are up to current codes and standards, properly trained and equipped personnel, PRDNER/PREQB licensed disposal facilities, and development of an SPCC will minimize adverse temporary, short-term and long-term impacts to human health and the environment to a level of minor. A short and long-term minor beneficial impact to the environment and human health will come from the removal of deteriorating roadway materials and removal and treatment of contaminated substances.

Alternative 3: Repair of Landslides

Under Alternative 3, FEMA anticipates that the only use of hazardous materials in the repair of landslides will be associated with the operation of heavy equipment (i.e. diesel fuel, hydraulic fluids, and oil). Use of concrete to stabilize landslides will involve standard construction practices involving mixing materials. Installation of fences or other physical barriers preventing material from entering the roadway will not generate any new hazardous materials. Waste generated will likely be landslide debris which is typically non-hazardous. However, if a landslide encounters chemicals or other hazardous substances in its slide path, the Recipient will treat suspected hazardous materials in accordance with federal and Commonwealth regulations. Such material could originate from the exposure of buried utilities.

FEMA anticipates that the use of new materials that are up to current codes and standards, properly trained and equipped personnel, PRDNER/PREQB licensed disposal facilities, and development of an SPCC will assist in minimizing both adverse temporary, short-term, and long-term impacts to human health and the environment to a level of minor. To minimize impacts to human health and safety, the Recipient will use personnel trained in the proper use of PPE and the job specific duties. OSHA standards will be complied with during construction to avoid adverse impacts to worker health and safety (United States Department of Labor 2014). The Recipient will install construction barriers prior to construction to alert the public of project activities and risks.

A short and long-term beneficial impact to the environment and human health will come from the stabilization of landslides and removal of slide generated debris. If the Recipient encounters soil and water contaminated substances, an additional beneficial impact would come from the treatment and removal of the contaminated material from the environment.

Alternative 4: Hazard Mitigation and Repair of Bridges, Culverts, and Roads

The impacts from this alternative will be similar to those described for Alternative 2 and Alternative 3.

Alternative 5: A Combination of Alternatives 2 Through 4

Depending on the project scope, under this alternative, project impacts will be similar to Alternatives 2 through 4 for construction and post-construction phases.

5.18 Cumulative Impacts

In accordance with NEPA, this PEA considers the overall cumulative impact of the Action Alternatives. The evaluation of cumulative impacts requires an assessment of the impacts of the Action Alternatives and similar actions on the Commonwealth's vulnerable natural and socioeconomic resources. The statutory basis for considering cumulative impacts for federal actions under NEPA is in Title 42 USC 4321 et seq. In addition to NEPA, the CWA, CAA, Section 106 of the NHPA, and Section 7 of the ESA individually require an evaluation of cumulative impacts for resources covered under their authorities.

According to CEQ regulations, cumulative impacts represent the "impact on the environment which results from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what federal agency or person undertakes such actions. Cumulative impacts can result from individually minor but collectively consequential actions taking place over a period" (40 CFR 1508.7). When combined with other actions affecting the Commonwealth's Roadway transportation system, the activities satisfied by this PEA could lead to cumulative impacts. The scale of those impacts will depend on the number of projects implemented, the size of the projects, and locality and proximity of the projects.

5.18.1 On-going Federal Actions

According to a USDOT post Hurricane Maria analysis, there are approximately 351 major and 54 minor landslides with correction designs in progress by 25 engineering companies. Following Hurricane Maria, 78 bridges received emergency repairs and an additional 148 bridges have damages that may be eligible for FEMA funding under the Stafford Act. Initial reports from DTOP indicate that they will be submitting 354 projects from permanent work. Of these 354 projects, DTOP anticipates they will submit 90 percent of the projects to FEMA for funding while they will submit 10 percent to the USDOT for funding.

FHWA's Puerto Rico Division will assist in the implementation of USDOT funded highway projects from their inception to their construction. FHWA's responsibilities include estimating and controlling costs, ensuring the fulfillment of environmental and federal requirements, obtaining

adequate financing, and the overall managing of projects. FHWA's Puerto Rico Division provides internal and external coordination for policy development related to new legislation, regulations and FHWA guidance. FHWA Puerto Rico oversees new and emerging local program issues with PRHTA. For instance, one program that FHWA Puerto Rico administers is the Federal-Aid Bridge Program which provides funding to assist States in their efforts to preserve, rehabilitate, or restore the Nation's bridges.

The STIP for Puerto Rico includes the proposed distribution of federal funds assigned to Puerto Rico for the fiscal years of 2017 to 2020 from FHWA and the Federal Transit Administration. The STIP includes transit and highway projects for both urbanized and non-urbanized areas, thus covering all of Puerto Rico. The 2017 to 2020 STIP for Puerto Rico includes over 100 projects across the Commonwealth that may be eligible to receive USDOT funding. Project value ranges from a few thousand dollars to in excess of a million dollars.

5.18.2 Summary of Cumulative Impacts

FEMA anticipates that the Action Alternatives satisfied by this PEA will not result in major cumulative impacts since FEMA is funding actions that involve the repair, replacement, or rehabilitation of projects that are similar in function, size, and locality to the existing systems. Therefore, most cumulative impacts from the initial installation and temporary restoration of the projects on the human environment have already occurred prior to and after Hurricane Maria. FEMA anticipates that the extended grant approval process for projects covered under this PEA or tiered from the PEA will further minimize cumulative impacts to Commonwealth's environmental and social resources. The process of implementing projects over an extended time period will likely ensure that no one resource is overburdening at any given time by the implementation of federally financed transportation projects.

- For circumstances where multiple transportation projects are under construction within the same watershed and at the same time, a cumulative impact to resources such as vegetation, water quality, and soil could occur. Although adverse, FEMA anticipates that cumulative impacts from the transportation projects satisfied by this PEA will be short-term and less than major. The conservation measures and BMPs presented in Section 6.0 of this PEA will help minimize cumulative impacts to environmental and socioeconomic resources by maintaining compliance with applicable permit conditions.
- The combined effects of concurrent construction projects could have a short-term less than major cumulative impact on traffic delays and congestion, noise, and social services. The Commonwealth and Recipient will be responsible for coordinating project schedule with their transportation and public utility departments and environmental permitting agencies.
 - FEMA anticipates that the proper coordination and synchronization of roadway transportation projects concurrently with adjacent or parallel utility projects will reduce cumulative construction related impacts.

6.0 PERMITS AND REQUIREMENTS

The Recipient or Subrecipient is responsible for obtaining all applicable Federal, State, and local permits and other authorizations for project implementation prior to construction and adherence to all permit conditions. Any substantive change to the approved SOW will require re-evaluations by FEMA for compliance with NEPA, and other laws and EOs. The Recipient or Subrecipient must also adhere to the following conditions during project implementations and consider the below conservation recommendations:

1. **The Recipient:** Must comply with all applicable environmental and historic preservation laws. Federal funding is contingent upon acquiring all necessary Federal, State and Local permits. Noncompliance with this requirement may jeopardize the receipt of federal funds.
2. **Utility Clearance:** For all ground disturbing activities, the Recipient is responsible for locating utilities. OSHA mandates that if a utility provider cannot respond to a request to locate underground utility installations or cannot establish the exact location of these installations, the contractor may proceed provided they use detection equipment or other acceptable means to locate utility installations.
3. **Stormwater and Soils:** Under the USEPA NPDES, any project disturbing more than one acre requires a USEPA Construction General Permit under the NPDES Program, and a SWPPP. The permits and plan require BMPs which serve to protect soils and stormwater. Recipient and Subrecipient are required to: manage any piles of soil or debris, minimize steep slope disturbance, preserve native topsoil unless infeasible; and minimize soil compaction and erosion (USEPA 2018).
4. **Erosion and Sediment Control:** For each project the Recipient will implement the BMPs and guidelines recommended in the Puerto Rico Erosion and Sediment Control Handbook for Developing Areas (PREQB-PR & USDA-NRCS). The Recipient will be responsible for obtaining all necessary permits such as an NPDES permit and implementing the associated erosion and sediment control plans (i.e. SWPPP).
5. **Endangered Species Act:** All projects will comply with and implement the ESA conditions found in any FEMA programmatic consultation that applies, or those conditions from a project-specific consultation. Impacts not resolved through consultation, will require individual NEPA compliance.
6. **Work Affecting Water:** For any project that involves WOTUS, the Recipient will be responsible for initiating the permitting process with the USACE. The Recipient is responsible for obtaining appropriate permits prior to the beginning of work, and implementing all requirements of the permits, including pre-construction notification.
7. **Floodplain:** For FEMA funded projects that are within or may affect a floodplain, FEMA will apply the 8-Step Decision-Making Process. FEMA will assess short- and long-term impacts to floodplains and apply applicable avoidance, minimization, and mitigation measures to limit impacts to less than major. FEMA will consider projects in the V-Zone, those with potential major or greater impacts, or those with the potential to increase flood

elevations on a case-by-case basis for whether this PEA applies, or to prepare a tiered EA or SEA. Projects must also comply with Commonwealth floodplain and flood risk regulations.

8. **Wetlands:** For FEMA funded projects that are within or may affect a wetland, FEMA will apply the 8-Step Decision-Making Process. FEMA will assess short- and long-term impacts to wetlands and apply applicable avoidance, minimization, and mitigation measures to limit impacts to less than major. Staging areas and access roads must be located outside the jurisdictional boundaries of WOTUS.
9. **Historic Preservation/Archaeological Resources:** FEMA will review all SOWs for the presence of any historic/archaeological resources on or eligible for the National Register of Historic Places. If there is potential to affect historic/archaeological resources, the stipulations detailed in the most recent version of the signed FEMA and SHPO Puerto Rico Programmatic Agreement will apply. The Recipient will be responsible for all coordination with the Puerto Rico Institute of Culture for compliance with Commonwealth's historic preservation and archaeological requirements.
10. **Discovery of Cultural Resources:** If any cultural materials or human remains are discovered during construction, the contractor must halt work immediately and contact FEMA. FEMA staff meeting the Secretary of the Interior's Professional Qualification Standards (48 FR 22716, Sept. 1983) will evaluate the discovery in coordination with SHPO.
11. **Construction Material and Debris:** The Recipient is responsible for obtaining any permits associated with transportation and handling of construction material and debris. The Recipient will identify, handle, transport, and dispose of hazardous materials and/or toxic waste in accordance with USEPA and PRDNER/PREQB requirements. The Recipient is responsible for determining the presence of asbestos or lead containing materials and obtaining applicable permits before beginning work. The Recipient is responsible for ensuring that all non-recyclable debris generated from restoration and demolition activities must occur at a PRDNER/PREQB permitted landfill.
12. **Clean Air Act:** The Recipient is responsible for complying with all applicable USEPA and PRDNER/PREQB requirements for fugitive dust suppression. The Recipient will prepare a General Conformity applicability analysis for applicable projects satisfied by this PEA.
13. **Tree Cutting:** The Recipient is responsible for complying with applicable DRNE/PREQB of Puerto Rico requirements for planting, pruning, and trimming.
14. **Invasive Species:** The Recipient is responsible for restoring disturbed soils with planting native, non-invasive species. Construction equipment should be power washed prior to initial transport to the construction site and prior to changing locations to prevent spread of noxious weeds.

7.0 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

This Transportation PEA is available for agency and public review and comment for a period of 30 days. The public information process will include a public notice with information about the proposed action in the newspaper *Primer Hora* with targeted outreach to environmental justice populations through notices to community organizations. A Spanish translation of the PEA, Executive Summary, and Public Notice will also be posted. The PEA is available for download at <https://www.fema.gov/media-library>. The website link for the PEA will also be posted on the FEMA Puerto Rico Facebook, Inc. page <https://www.facebook.com/FEMAPuertoRico/>

A hard copy of the PEA will be available for review at the following locations:

- *Caguas Municipality, City Hall William Miranda Marin, Environmental Affairs Office, Second Floor, Street Padial, corner Jose Mercados Avenue, Pueblo Ward, Caguas, Puerto Rico;*
- *Humacao Municipality, Municipal Government Center & City Hall, Planning Office, Third Floor, Street Efraín Meléndez, Humacao, Puerto Rico;*
- *Aibonito Municipality, City Hall, Permit Office, Annex num. 56, Planning Office, Pueblo Ward, Aibonito, Puerto Rico; and*
- *Bayamon Municipality, Bayamon City Hall, Environmental Ranger Program, Fourth Floor, Street Num. 2, Km. 11, Bayamon PR.*

Interested parties may request an electronic copy of the PEA by emailing FEMA at FEMA-EHP-DR4339@FEMA.DHS.GOV. This PEA reflects the evaluation and assessment of the federal government, the decision maker for the federal action; however, FEMA will take into consideration any substantive comments received during the public review period to inform the final decision regarding grant approval and project implementation. The public is invited to submit written comments by emailing FEMA-EHP-DR4339@FEMA.DHS.GOV or via mail to:

Federal Emergency Management Agency Region II – DR-4339-PR
Puerto Rico Joint Recovery Office
50 State Road 165
Guaynabo, PR 00968
Attn: Puerto Rico Transportation PEA Public Comments

If FEMA receives no substantive comments from the public and/or agency reviewers, FEMA will adopt the PEA as final and will issue a FONSI. If FEMA receives substantive comments, it will evaluate and address comments as part of the FONSI documentation or in a Final PEA.

8.0 LIST OF PREPARERS

FEMA Region II

Puerto Rico Recovery Office Environmental and Historic Preservation Assessment Writing Team

Puerto Rico Recovery Office, NEPA and Environmental and Historic Preservation Specialty Staff Contributors

9.0 SUMMARY OF IMPACTS

Resource Section	Alternative 1: No Action	Alternative 2: Repair, Replacement, and Upgrade	Alternative 3: Repair of Landslides	Alternative 4: Hazard Mitigation and Repair of Roadways	Alternative 5: Combination
Section 5.1	Geology: Negligible to minor short-term and long-term adverse impacts may occur. Soil Resources: Less than major short-term and long-term adverse impacts to soil resources may continue as erodible soils remain bare. Natural revegetation could minimize the adverse impacts from the No Action Alternative. FPPA: FEMA does not anticipate the No Action Alternative causing impacts to the FPPA.	Geology: FEMA anticipates that the installation of piles into the bedrock will cause negligible to minor short-term and long-term impacts to geologic resources. Adverse temporary minor impacts to existing structures related to vibration from pile driving will occur during the action's construction phase. Soil Resources: Adverse short-term and long-term minor negligible to minor impacts to soil resources. FPPA: Adverse short-term and long-term negligible to minor impacts to potential FPPA lands may occur.	Geology: FEMA anticipates negligible to minor short-term and long-term impacts to geologic resources. Soil Resources: FEMA anticipates adverse short-term negligible to minor impacts to soil but no long-term impacts. FPPA: Adverse short-term negligible to minor impacts to potential FPPA lands may occur but no long-term impacts. Beneficial Impact: FEMA anticipates that the Commonwealth will derive a long-term negligible to minor beneficial impact	Geology: Impacts similar to Alternative 2 and Alternative 3 Soil Resources: Impacts similar to Alternative 2 and Alternative 3 FPPA: Impacts similar to Alternative 2 and Alternative 3	Geology: Impacts similar to Alternative 2, 3, and 4 Soil Resources: Impacts similar to Alternatives 2, 3, and 4 FPPA: Impacts similar to Alternative 2, 3, and 4
Section 5.2	Air Quality: FEMA anticipates that the No Action Alternative will create an adverse negligible to minor short-term and long-term impact to air quality.	Air Quality: FEMA anticipates that the replacement of bridges and culverts will have an adverse short-term negligible to minor impacts on air quality and no long-term impact	Air Quality: Impacts similar to Alternative 2 for the Alternative's construction and post-construction phases.	Air Quality: Impacts similar to Alternative 2 for the construction and post-construction phases.	Air Quality: Impacts similar to Alternatives 2, 3, and 4 for the construction and post-construction phases.
Section 5.3	Water Quality: Adverse short-term and long-term less than major impacts to water quality.	Water Quality: A temporary adverse negligible to minor short-term impact may occur. Adverse long-term impacts to water quality from Alternative 2 actions will be negligible. Beneficial Impact: Less than major short-term and long-term impact to water quality.	Water Quality: No adverse long-term impacts on water quality related to the stabilization of landslides. An adverse short-term minor impact to water quality may occur. Beneficial Impact: Less than major short-term and long-term impact to water quality.	Water Quality: Impacts to water quality will be similar to Alternative 2 and 3 for the construction and post-construction phases.	Water Quality: Impacts to water quality be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.
Section 5.4	Wetlands: FEMA anticipates the No Action Alternative may cause adverse less than major short-term and long-term impacts to wetland quality and function within Puerto Rico.	Wetlands: Bridge and culvert replacement activities near and within wetlands may result in direct adverse negligible to minor short-term and long-term impacts to wetlands from construction activities. An adverse negligible to minor short-term impact may occur as efforts to install erosion and scour prevention measures cause the temporary release of sediment into wetlands. FEMA anticipates that Alternative 2 actions will likely cause adverse minor long-term impacts to wetland ecosystems in the form of habitat loss. FEMA anticipates that any incidental discharges will cause only adverse negligible to minor short-term indirect impacts to wetlands. Through the implementation of site stabilization plans, indirect adverse long-term impacts to wetlands from runoff and sedimentation will be negligible. Beneficial Impact: FEMA anticipates that actions satisfied by Alternative 2 may provide a beneficial long-term impact to wetlands	Wetlands: An adverse short-term minor indirect impact to wetland quality and function may occur during the construction phase of Alternative 3 actions from runoff and sedimentation. Alternative 3 will have negligible to minor adverse long-term impacts to wetlands related to the stabilization of landslides. Beneficial Impact: FEMA anticipates that actions satisfied by Alternative 3 may provide a beneficial long-term impact to wetlands	Wetlands: Impacts to wetlands will be similar to Alternative 2 and Alternative 3 for the construction and post-construction phases.	Wetlands: Impacts to wetland quality and function will be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.

Resource Section	Alternative 1: No Action	Alternative 2: Repair, Replacement, and Upgrade	Alternative 3: Repair of Landslides	Alternative 4: Hazard Mitigation and Repair of Roadways	Alternative 5: Combination
Section 5.5	Floodplain: The No Action Alternative may cause adverse less than major short-term and long-term impacts to the Commonwealth's floodplains and coastal V-zones.	Floodplain: The replacement of bridges and culverts may result in adverse short-term negligible to minor impacts to floodplains from the staging of equipment and materials near bridge and culvert construction sites. FEMA anticipates that the demolition of existing bridges and culverts may have an adverse short-term negligible to moderate impact on floodplains from temporary changes in hydrology and hydraulics. FEMA anticipates that there will be no adverse long-term impacts to floodplains beyond existing conditions. Beneficial Impact: FEMA anticipates that the class of actions that Alternative 2 includes will have a beneficial less than major long-term impact on floodplains.	Floodplain: The use of impermeable materials in preventing future landslides may have an adverse negligible to minor long-term impact to floodplains. Beneficial Impact: FEMA anticipates that the class of actions that Alternative 2 includes will have a beneficial less than major long-term impact on floodplains.	Floodplain: Impacts to floodplains will be similar to Alternative 2 and Alternative 3 for the construction and post-construction phases.	Floodplain: Impacts to floodplains will be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.
Section 5.6	Coastal Resources: The No Action Alternative may have an adverse short-term and long-term less than major impact to PRCZMP and CBRS resources.	Coastal Resources: FEMA anticipates negligible to minor short-term adverse impacts. FEMA anticipates that Alternative 2 actions will result in no adverse indirect long-term impacts to resources protected under the PRCZMP and CBRA. Beneficial Impact: A beneficial less than minor long-term impact to areas included under the CZMA and CBRA may occur.	Coastal Resources: FEMA anticipates negligible to minor indirect adverse short-term and long-term impacts to areas protected under the CZMA and CBRA. Beneficial Impact: A beneficial less than major long-term impact to areas included under the CZMA and CBRA may occur.	Coastal Resources: Impacts to areas protected under the CZMA and CBRA will be similar to Alternative 2 and 3 for the construction and post-construction phases.	Coastal Resources: Impacts to the resources and areas protected under the CZMA and CBRA will be similar to Alternatives 2, 3, and 4 for the construction and post-construction phases.
Section 5.7	Vegetation: FEMA anticipates an adverse short-term and long-term negligible to minor impact from the No Action Alternative.	Vegetation: FEMA anticipates that the replacement of bridges and culverts will likely cause short-term and long-term minor adverse impacts to vegetation. Long-term adverse impacts to vegetation may occur as the result of soil compaction.	Vegetation: Impacts to vegetation will be similar to Alternative 2 for the Alternative's construction and post-construction phases.	Vegetation: Impacts to vegetation will be similar to Alternative 2 and 3 for the construction and post-construction phases.	Vegetation: Impacts to vegetation will be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.
Section 5.8	Wildlife and Fish: FEMA anticipates a negligible to minor adverse short-term and long-term impact to wildlife and fish.	Wildlife and Fish: A larger bridge or culvert footprint may cause minor long-term impacts to wildlife and fish through permanent habitat loss. The presence of equipment and personnel during the construction phase of Alternative 2 actions may have a negligible to minor impact on wildlife species. An adverse minor short-term impact to resident fish populations may occur as the repair, replacement, or removal of pile-supported structures, debris piles, and culverts takes place. An adverse short-term minor impact on resident fish populations could also occur as a result of noise pollution associated with pile driving. FEMA anticipates that during the construction phase the temporary degradation of water quality will cause indirect adverse impacts to fish and wildlife populations and habitat. FEMA anticipates an adverse long-term indirect negligible impact.	Wildlife and Fish: Landslide projects may have a direct adverse short-term negligible to minor impact on individual birds during the mobilization of construction equipment. The clearing and grading of undisturbed areas may have an adverse short-term impact on wildlife including migratory birds and their nests. FEMA anticipates that the implementation of landslide projects may result in adverse short-term negligible to minor impacts to wildlife and fish from on-site erosion and sedimentation. Beneficial Impact: A long-term beneficial impact to wildlife and birds may occur as the Recipient stabilizes and restores suitable habitat.	Wildlife and Fish: Impacts to wildlife and fish will be similar to Alternative 2 and 3 for the construction and post-construction phases.	Wildlife and Fish: Impacts to wildlife and fish will be similar to Alternative 2, 3 and 4 for the construction and post-construction phases.

Resource Section	Alternative 1: No Action	Alternative 2: Repair, Replacement, and Upgrade	Alternative 3: Repair of Landslides	Alternative 4: Hazard Mitigation and Repair of Roadways	Alternative 5: Combination
Section 5.9	Threatened and Endangered Species: FEMA anticipates a negligible to minor adverse short-term and long-term impact to ESA listed species from the No Action Alternative.	Threatened and Endangered Species: The effects of Alternative 2 actions may result in minor temporary and short-term adverse impacts to ESA listed species. FEMA anticipates that adverse direct negligible to minor short-term impacts to ESA listed amphibians, birds, and reptiles may occur during the removal and replacement of existing structures and the mobilization and demobilization of personnel and equipment. Removal of deteriorating structures will result in a negligible short-term loss in habitat for these species. An adverse short-term minor impact on aquatic ESA listed species could occur as a result of noise pollution associated with pile driving. Beneficial Impact: FEMA anticipates that ESA listed species will receive a beneficial impact from the removal of deteriorating structures.	Threatened and Endangered Species: Alternative 3 projects may have a direct adverse short-term negligible to minor impact on individual birds during the mobilization of construction equipment. The clearing and grading of undisturbed areas may have an adverse short-term impact on ESA listed species and their nests. This alternative will likely result in adverse short-term negligible to minor indirect impacts to terrestrial and aquatic habitat during construction activities from runoff and sedimentation. Beneficial Impact: FEMA anticipates that Alternative 3 may result in a beneficial impact to ESA listed species from the stabilization of slopes.	Threatened and Endangered Species: Impacts to ESA listed species will be similar to Alternative 2 and Alternative 3 for the construction and post-construction phases.	Threatened and Endangered Species: Impacts to ESA listed species will be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.
Section 5.10.1	Cultural Resources (Historic Structures): The No Action Alternative could have a long-term negligible to minor impacts.	Cultural Resources (Historic Structures): Through consultation and mitigation, this alternative will have a negligible to minor impact on historic structures. Through consultation, mitigation, or treatment measures, this alternative may have a negligible to minor impact on historic structures.	Cultural Resources (Historic Structures): FEMA anticipates that this alternative will have impacts similar to those discussed under Alternative 2 and will treat potential adverse impacts in a similar manner.	Cultural Resources (Historic Structures): Impacts to historic structures will be similar to Alternative 2 and 3 for the construction and post-construction phases.	Cultural Resources (Historic Structures): Impacts to historic structures will be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.
Section 5.10.2	Cultural Resources (Archeological): The No Action Alternative does not include ground disturbance and thus no new impacts to archeological resources will occur.	Cultural Resources (Archeological): This alternative has the potential to affect archeological resources; however, they will be negligible to minor impacts with SHPO consultation.	Cultural Resources (Archeological): While new ground disturbance has the potential to affect archaeological resources, methods of avoidance, mitigation, or documentation are similar to those used for projects described listed under Alternative 2	Cultural Resources (Archeological): Impacts to archaeological resources will be similar to Alternative 2 and Alternative 3 for the construction and post-construction phases.	Cultural Resources (Archeological): Impacts to historic structures will be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.
Section 5.11	Environmental Justice: FEMA anticipates that the No Action Alternative will result in a minor short-term and long-term adverse impact on the Commonwealth's low-income and minority communities; however, this alternative will not disproportionately impact EJ communities.	Environmental Justice: A disproportionate adverse impact to minority and low-income communities will not occur since all Alternative 2 actions involve the removal and replacement of existing bridges and culverts and not just the removal. FEMA anticipates an increase in construction jobs from the post Hurricane Maria recovery will likely have a less than major beneficial impact on Puerto Rico's economy. Beneficial Impact: FEMA anticipates an increase in construction jobs from the post Hurricane Maria recovery will likely have a less than major beneficial impact on Puerto Rico's economy.	Environmental Justice: The impacts to socioeconomics and environmental justice from this alternative will be similar to those described for Alternative 2.	Environmental Justice: Impacts to the Commonwealth's socioeconomics and environmental justice will be similar to Alternative 2 for the Alternative's construction and post-construction phases.	Environmental Justice: Impacts to the Commonwealth's socioeconomics and environmental justice will be similar to Alternative 2 for the construction and post-construction phases.
Section 5.12	Land Use and Planning: FEMA anticipates that the No Action Alternative will have either no impact or an adverse negligible short-term and long-term impact.	Land Use and Planning: FEMA anticipates the implementation of MOT may cause minor adverse short-term impacts to local communities. FEMA anticipates that the replacement of bridges and culverts will have no adverse long-term impact on land use planning.	Land Use and Planning: FEMA anticipates no short-term or long-term adverse impact to existing land use plans. FEMA anticipates that the stabilization of slides and use materials to prevent future slides may cause an adverse long-term negligible impact to future land development.	Land Use and Planning: Impacts under this alternative to land use and land use plans will be similar to those described under Alternative 2 and Alternative 3.	Land Use and Planning: Impacts to the Commonwealth's land use plans be similar to Alternative 2, 3, and 4 for the construction and post-construction phases.

Resource Section	Alternative 1: No Action	Alternative 2: Repair, Replacement, and Upgrade	Alternative 3: Repair of Landslides	Alternative 4: Hazard Mitigation and Repair of Roadways	Alternative 5: Combination
Section 5.13	Noise: The No Action will not alter existing noise conditions as daily operations will remain unchanged; however, minor adverse impacts may persist.	Noise: During the construction phase of Alternative 2 projects, the use of heavy machinery may cause short-term negligible to minor adverse impacts to local receptors. FEMA anticipates that adverse impacts from ground vibrations will be minimal and temporary. FEMA anticipates no long-term adverse impacts from noise	Noise: Noise impacts will be similar to or less than Alternative 2 for construction and operation activities.	Noise: Impacts from noise will be similar to Alternatives 2 and 3 for the construction and post-construction phases.	Noise: Impacts will be similar to Alternatives 2 through 4 for construction and post-construction activities.
Section 5.14	Transportation: FEMA anticipates a minor short-term and long-term adverse impact from the No Action Alternative.	Transportation: FEMA anticipates no long-term adverse impacts to the Commonwealth's Roadway transportation system. FEMA anticipates there may be short-term direct minor impacts to the Commonwealth's Roadway transportation system. Beneficial Impact: FEMA anticipates that the Commonwealth will derive a long-term beneficial impact.	Transportation: FEMA anticipates adverse short-term minor impacts. FEMA anticipates no long-term adverse impacts. Beneficial: The stabilization of landslides will assist in minimizing future disruptions in service.	Transportation: Impacts to the Commonwealth's Roadway transportation system will be similar to Alternatives 2 and 3 for the construction and post-construction phases.	Transportation: Impacts to the Commonwealth's Roadway transportation system will be similar to Alternatives 2 through 4 for construction and post-construction activities.
Section 5.15	Public Services and Utilities: The No Action Alternative may result in an adverse long-term minor impact.	Public Services and Utilities: FEMA anticipates that projects may have adverse negligible to minor short-term impacts on Puerto Rico's social infrastructure as temporary disruptions in utility service occurs. FEMA anticipates that Alternative 2 will have no adverse long-term impacts to public services and utilities as well as, the communities they support. Beneficial Impact: A more resilient transportation system is likely to coincide with a reduction in service disruptions.	Public Services and Utilities: During the construction phase, temporary short-term adverse minor impacts to social infrastructure and utility service providers may occur. Beneficial Impact: FEMA anticipates that the Commonwealth will derive a minor long-term beneficial impact from installing hazard mitigation measures.	Public Services and Utilities The impacts from this alternative will be similar to those described for Alternative 2 and Alternative 3.	Public Services and Utilities Impacts to public health and safety will be similar to Alternatives 2 through 4 for construction and post-construction activities.
Section 5.16	Public Health and Safety: FEMA anticipates that adverse minor short-term and long-term impacts may continue under the No Action Alternative.	Public Health and Safety: FEMA anticipates short-term negligible to minor adverse impacts. The potential adverse impact to worker safety will be temporary and minor. FEMA anticipates that results of Alternative 2 actions will cause no adverse long-term impacts to the administration of public health and safety services. Beneficial Impact: The Commonwealth's residents may experience a long-term less than major benefit to their health and safety from the use of a more resilient and efficient network of bridges and roads.	Public Health and Safety: The impacts from this alternative will be similar to those described for Alternative 2.	Public Health and Safety: The impacts from this alternative will be similar to those described for Alternative 2 and Alternative 3.	Public Health and Safety: Impacts to public health and safety will be similar to Alternatives 2 through 4 for construction and post-construction activities.
Section 5.17	Hazardous Materials: FEMA anticipates the No Action Alternative has the potential to cause minor adverse short-term and long-term impacts.	Hazardous Materials FEMA anticipates temporary, short-term, and long-term negligible to minor impacts to human health and the environment. Beneficial Impact: A minor beneficial impact may come from the treatment and disposal of the contaminated material.	Hazardous Materials: FEMA anticipates negligible to minor adverse temporary, short-term, and long-term impacts from hazardous materials Beneficial Impact: A minor beneficial impact may come from the treatment and disposal of the contaminated material.	Hazardous Materials: Impacts from this alternative will be similar to those described for Alternative 2 and Alternative 3.	Hazardous Materials: Impacts will be similar to Alternatives 2 through 4 for construction and post-construction activities.

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APPENDIX A

Conditions for Tiering

Area of Resource Evaluation	Action Covered by this PEA	Tiered Site-Specific Environmental Assessment Required
Geology, Topography, and Soils	The proposed action will have no, negligible, or minor impacts to geology, topography, and soils; or The proposed action results in moderate impacts that are mitigated by regulatory permit conditions and resource agency consultations to reduce the impacts below the level of major; and The proposed action is consistent with FPPA and NRCS policies.	The proposed action results in major impacts to geology, topography and soils that cannot be mitigated; or The proposed action includes work that exceeds the thresholds for scale established in this PEA; or The proposed action exceeds acreage thresholds detailed in this PEA for transportation projects; or FPPA consultation indicates that the proposed action may cause major impacts to prime and unique farmland.
Air Quality	Emission levels for parameters identified under the NAAQS from the proposed action in nonattainment and maintenance areas will be below the de minimis levels. Emissions in attainment areas will not cause air quality to go out of attainment for any NAAQS parameter; or Mitigation measures are used to reduce the level of impacts below the level of major.	The levels for NAAQS parameters from the proposed action will be greater than the exceedance levels for nonattainment and maintenance areas; and Emissions in attainment areas will cause an area to be out of attainment for any NAAQS after a conformity determination.

Area of Resource Evaluation	Action Covered by this PEA	Tiered Site-Specific Environmental Assessment Required
Water Quality	<p>The proposed action will have no, negligible or minor impacts to water resources and will not negatively impact water quality standards or criteria. Localized and short-term alterations in water quality and hydrologic conditions relative to historical baseline may occur; or</p> <p>The proposed action will result in moderate impacts that are mitigated by regulatory permit conditions and resource agency consultations to reduce the impacts below the level of major; and</p> <p>The proposed action does not require an individual permit from USACE; and</p> <p>The proposed action complies with all permit conditions, notifications, and reporting requirements for applicable Nationwide Permits, regional general permits, emergency authorizations, programmatic general permits, or other USACE-issued general permit; and</p> <p>The proposed action, one acre or greater, requires and complies with a NPDES and SWPPP.</p>	<p>The proposed action will cause or contribute to existing or new exceedances of water quality standards on either a short-term or prolonged basis that are not able to be mitigated under CWA permits; or</p> <p>The proposed action requires an individual permit from USACE.</p>
Wetlands	<p>Proposed action is not located in or does not adversely affect wetlands; or</p> <p>The Recipient will obtain all with all federal and Commonwealth permits that authorize actions involving wetland; and</p> <p>The Recipient complies with all permit conditions including compensatory mitigation.</p>	<p>Proposed action is located in wetlands and following an 8-Step Decision Making Process will adversely impact wetlands that cannot be mitigated; or</p> <p>Proposed action requires an individual permit from USACE because of impacts to a wetland; or</p> <p>The proposed action will result in adverse impacts to the wetlands, conveyance and duration that increase flood risk at locations upstream, downstream or adjacent to the project site.</p>

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Area of Resource Evaluation	Action Covered by this PEA	Tiered Site-Specific Environmental Assessment Required
Floodplains	<p>Proposed action is not located in or does not adversely impact floodplains; or Recipient has complied with all state, federal and local permit conditions, regulations and authorizations, including CWA, state floodplain and local floodplain codes; and The proposed action will not increase levels, frequency or duration of floods and will not alter hydrological connectivity; and FEMA has completed an 8-Step Decision Making Process and has determined that the proposed action is the most practicable alternative.</p>	<p>The individual 8-Step Decision Making Process shows adverse impacts to the floodplain, including an increase in flood levels from project; and The proposed action will result in adverse impacts to the floodplain, including an increase in flood levels, significant changes to flood frequency, conveyance and duration that increase flood risk at locations upstream, downstream or adjacent to the project site.</p>
Coastal Resources	<p>Proposed action in a coastal zone has received a CZMA Federal consistency determination or complied with permits issued, and the proposed action will have no, negligible or minor impacts to coastal resources; or The proposed action is located within a CBRS and FEMA receives concurrence from USFWS that it qualifies as an exception under Section 3505.a.6 of the CBRA and is consistent with CBRA; or The proposed action results in adverse impacts to coastal zones that are mitigated by regulatory permit conditions and resource agency consultations to reduce the impacts below the level of major.</p>	<p>Proposed Action is not exempt and is located within the CBRS; or Proposed Action is not covered by the CZMA Federal Consistency Certification from PRPB; or Proposed action is located within a CBRS and USFWS does not concur that it qualifies as an exception under Section 3505.a.6 of the CBRA.</p>

Area of Resource Evaluation	Action Covered by this PEA	Tiered Site-Specific Environmental Assessment Required
Vegetation	<p>The proposed action will have no, negligible or minor impacts to native vegetation, their habitats, or the natural processes sustaining them; and Population levels of native species will not be impacted. Sufficient habitat will remain functional to maintain viability of all species; or The proposed action will have temporary, localized adverse impacts on vegetation that will be mitigated by using conservation measures to implement the action and stabilize project site; or Proposed action discourages spread of invasive species by implementing BMPs according to state and federal guidance.</p>	<p>Proposed action specifies use of exclusively non-native plants for bioengineering; or Proposed action does not implement BMPs consistent with Commonwealth and federal guidance to reduce the spread of invasive species EO 13112 Invasive Species; or Proposed action includes permanent removal of vegetation or measures that prevent re-establishment of vegetation in excess of what is required to implement the project; or Proposed action includes removal of vegetation that irreparably fragments established habitat.</p>
Wildlife and Fish	<p>The proposed action will have no, negligible or minor impacts to native animal species, their habitats, or the natural processes sustaining them; and Population levels of native species will not be impacted; and Sufficient habitat will remain functional to maintain viability of all species; or The proposed action will result in moderate impacts that are mitigated by regulatory permit conditions and resource agency consultations to reduce the impacts below the level of major; or The proposed action will implement measures to maintain wildlife habitat fragmentation below the level of major; or Proposed action includes mitigation measures to reduce the level of impacts to federally protected species and habitats to a level below major.</p>	<p>The proposed action may have major impact on native species, their habitats, or the natural processes sustaining them; and Population numbers, population structure, genetic variability, and other demographic factors for species might have large, short-term declines, with long-term population numbers significantly depressed; and Loss of habitat will affect the long-term viability of native species; or Projects having major impacts to Essential Fish Habitat that cannot be mitigated through consultation with the NOAA.</p>
Threatened and Endangered Species	<p>The proposed action will not impact ESA listed species or DCH; or The proposed action results in potential less than major impacts that are mitigated through resource agency consultations. FEMA makes a “May affect, Not Likely to Adversely Affect” determination and USFWS or NMFS concurs.</p>	<p>Any actions, after consultation, that will create a level of impact beyond not likely to adversely impact ESA listed species or DCH; or Projects that result in the loss or adverse modification of DCH for an ESA listed species.</p>

*Programmatic Environmental Assessment
FEMA Puerto Rico Transportation PEA*

Area of Resource Evaluation	Action Covered by this PEA	Tiered Site-Specific Environmental Assessment Required
Cultural Resources (Structural and Archeological)	The effects of the proposed action can be resolved through the Programmatic Agreement and any Amendments or SHPO Section 106 standard consultation.	FEMA makes an “Adverse Effect” determination with concurrence from SHPO/THPO that cannot be resolved using measures outlined in state programmatic agreements or negotiated through a standard project-specific Memorandum of Agreement; or Projects that result an “Adverse Effect” determination on a National Historic Landmark.
Socioeconomic and Environmental Justice	Impacts of the project actions will not disproportionately affect minority or low-income communities; or Mitigation measures are used to reduce the level of impacts below the level of major.	There will be unmitigated disproportionately high and adverse environmental and health impacts to low-income or minority populations.
Land Use and Planning	Projects are in alignment with comprehensive landuse plans and implementation plans for transportation projects.	The proposed action will not be consistent with the surrounding land use and the local land use agency requires a special land use permit or waiver.
Noise	Temporary construction related noise will occur during normal waking hours; and Projects with mitigation measures will not adversely impact sensitive receptors.	Projects that will result in post-construction noise impacts above baseline conditions; or Projects that will adversely impact sensitive receptors and cannot be mitigated to an impact level less than major.
Transportation	Projects actions that will cause less than major adverse impacts from construction delays, reroutes, congestion, transit and commuter times, vehicular conditions, and reductions in commerce; and Projects that with mitigation will have less than major adverse impacts.	The project has a permanent adverse impact on congestion and commerce; or A proposed action isolates a community through road closures on a short- or long-term basis.
Public Services and Utilities	Projects that do not result in adverse impacts to sensitive receptors from a disruption in public services; and Impacts to public services from project actions that the Recipient can mitigate to a level less than major.	The Proposed Action will require the relocation of utilities into environmentally sensitive areas where impacts cannot be mitigated below the level of major; or Any disruption in utility service that will adversely impact sensitive receptors that cannot be mitigated.
Public Health and Safety	Projects that through planning and mitigation will have no adverse impact on public health and safety	Projects that with mitigation will have an adverse impact on public health or safety.

*Programmatic Environmental Assessment
 FEMA Puerto Rico Transportation PEA*

Area of Resource Evaluation	Action Covered by this PEA	Tiered Site-Specific Environmental Assessment Required
Hazardous Materials	Any hazardous materials exposed, generated, or used during construction will be handled and disposed of in accordance with applicable federal, state, and local regulations; and To minimize risks to human health and safety, all construction activities will be performed using qualified personnel trained in the proper use of appropriate equipment and applicable safety measures.	Projects within an area designated by USEPA as a superfund site on the National Priorities List; or Projects on a site with extensive and un-remediated contamination.

APPENDIX B

FIGURES (MAPS)



Figure 1: Major Puerto Rico Highways, Expressways, and Municipality Boundaries

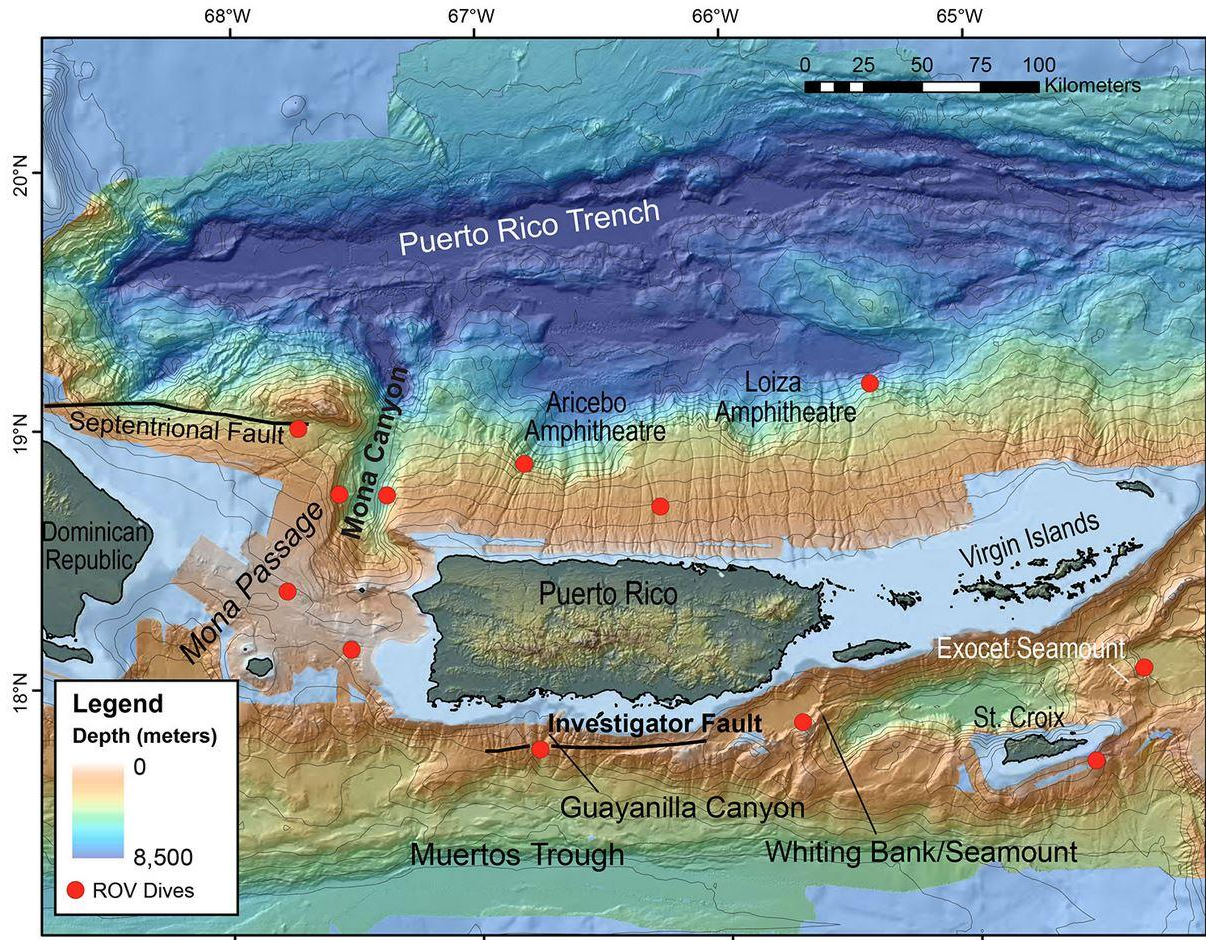


Figure 2: Fault lines within relationship to the Commonwealth

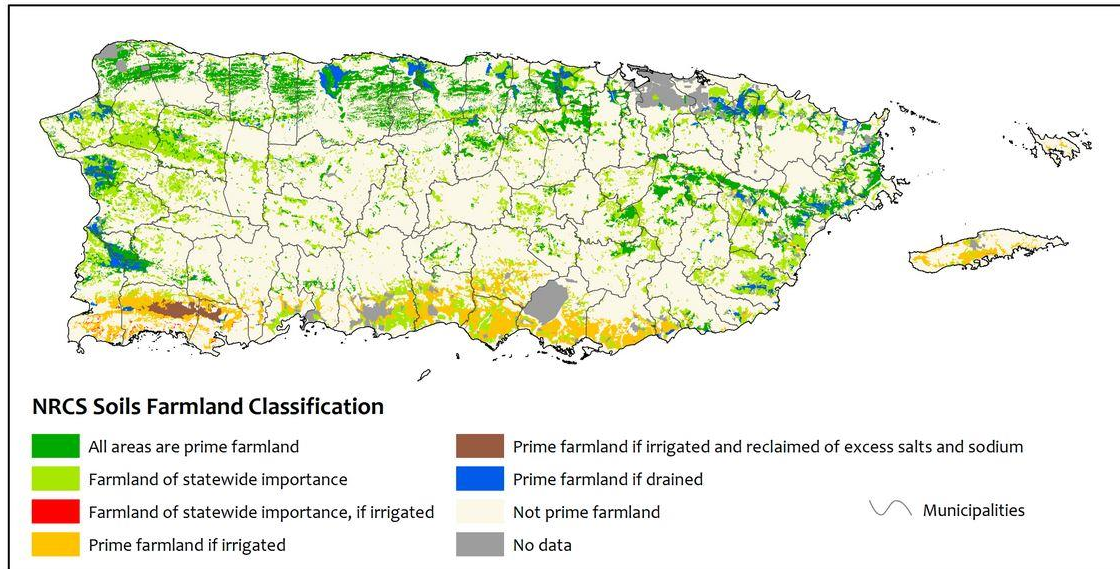


Figure 3: Farmland Classification in Puerto Rico

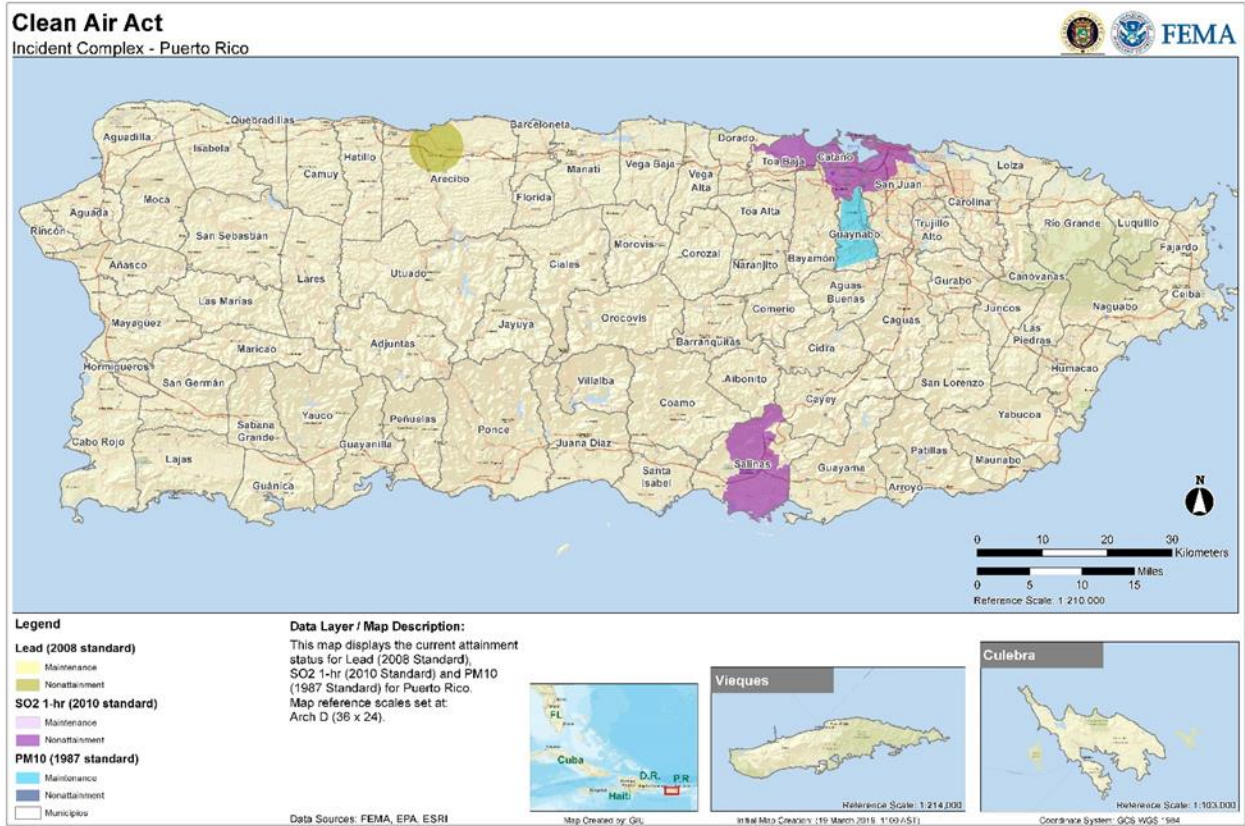


Figure 4: Clean Air Act Attainment and Non-Attainment Areas in Puerto Rico

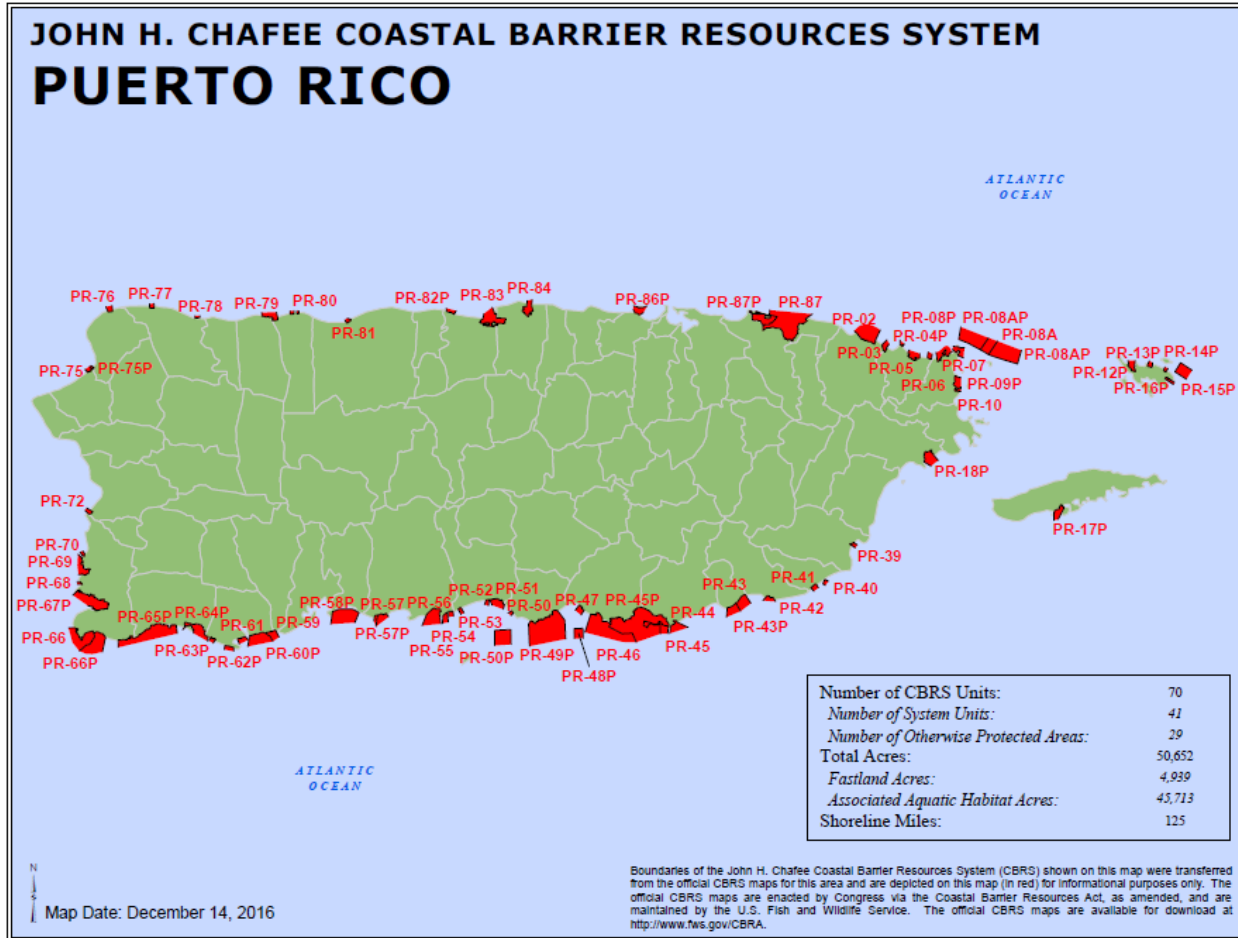


Figure 5: Coastal Barrier Resource Areas and Otherwise Protected Areas of Puerto Rico

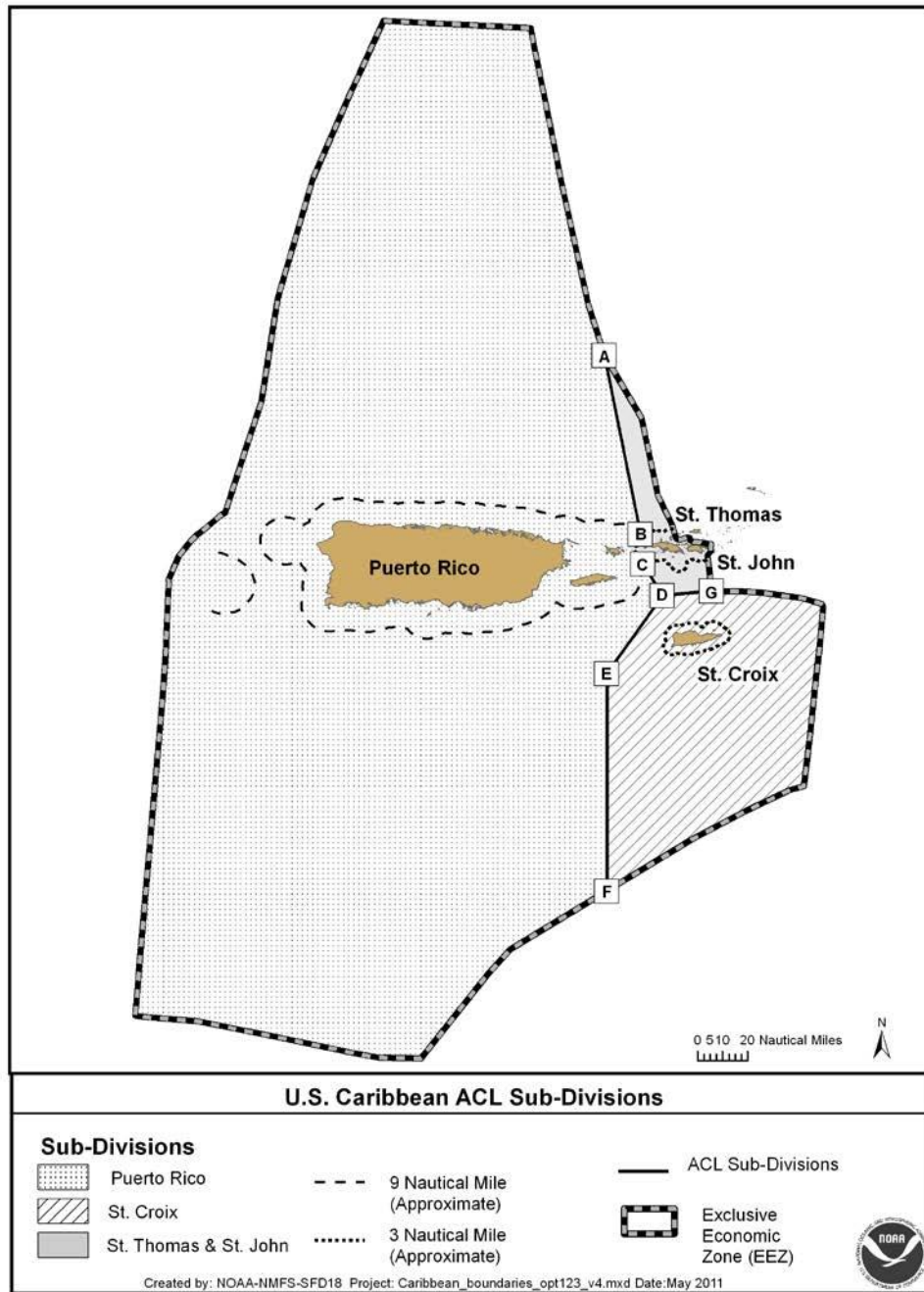


Figure 6: Exclusive Economic Zone (EEZ) around Puerto Rico

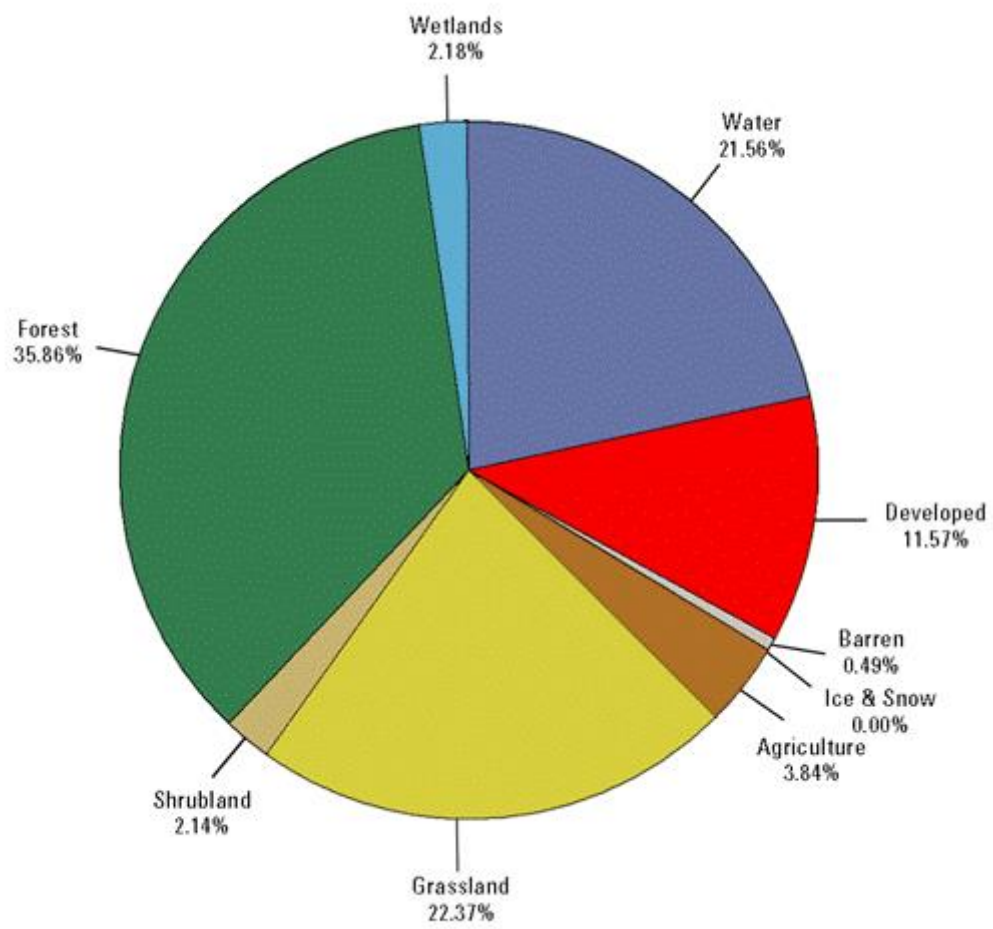


Figure 7: Land cover of Puerto Rico

APPENDIX C

PRHTA Landslide Correction Typical Section Sheets

FEDERAL HIGHWAY PROJECT NO.	AC. PROJECT CODE NO.	HIGHWAY P.R.	MUNICIPALITY	ISLAND	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
C				P.R.			
R/W							

GENERAL NOTES

1. FOUNDATION SOIL STRENGTH SHALL BE VERIFIED BY THE ENGINEER PRIOR TO STARTING WALL/SLOPE CONSTRUCTION. THE PROPOSED WALL IS INTENDED TO BE CONSTRUCTED ON FIRM, HIGH COMPACT SOIL OR WEATHERED ROCK.
2. THE CONTRACTOR WILL BE RESPONSIBLE TO MAINTAIN THE STRUCTURAL AND EXCAVATION STABILITY DURING THE CONSTRUCTION PROCESS. SEE EXCAVATION NOTES. THE CONTRACTOR SHALL CONTACT P.R.H.T.A. ENGINEERING PRIOR TO PERFORM ANY UTILITIES AND EARTH WORKS.
3. ALL CONCRETE SHALL FOLLOW SPECIAL PROVISIONS PER STRUCTURAL CONCRETE. DESIGN AND CONSTRUCTION OF RETAINING WALL MUST BE DONE IN ACCORDANCE TO P.R.H.T.A. STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (MAY 2015) ED. SEE DESIGN NOTES.
4. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS RELATED (WHEN APPLICABLE) FOR APPROVAL.
5. FOR DESCRIPTION OF WORK, QUANTITIES AND SPECS SEE DETAILED DAMAGE INSPECTION REPORTS (DCMR).

MATERIALS

CONCRETE:

CLASS "M" - $f_c = 3,000$ PSI (GENERAL USE) PERMEABILITY LEVEL-1.

SOIL:

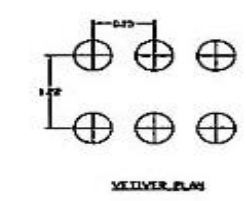
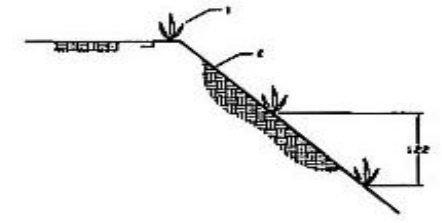
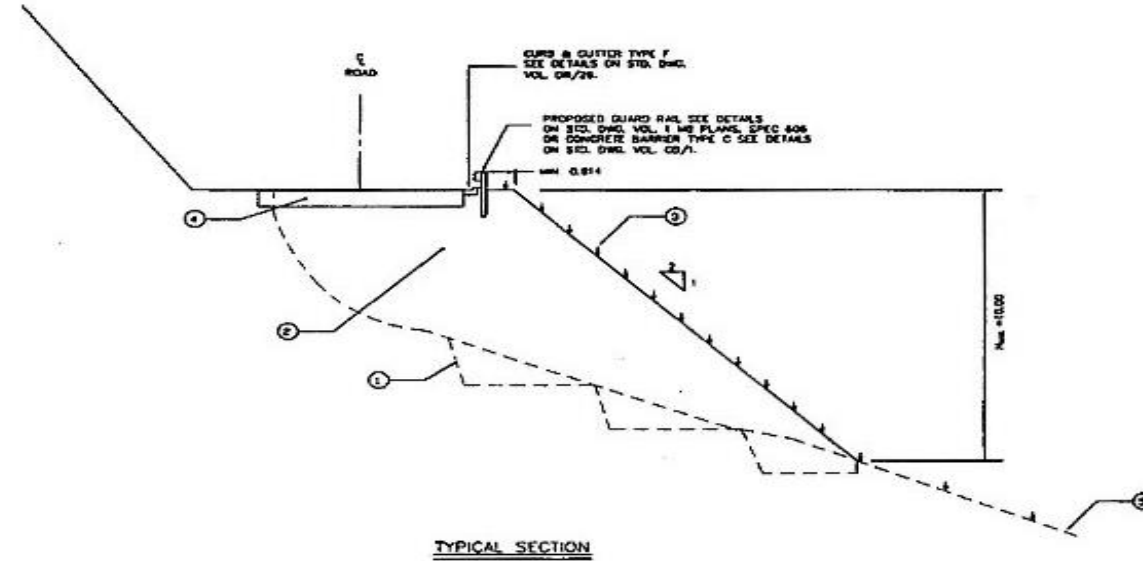
SPEC. 203- EXCAVATION & EMBANKMENT BORROW CLASS B TYPE A-2-4 FOR SLOPE 2:1 (H:V) BORROW CLASS B TYPE A-1-A FOR SLOPE 1.5:1 (H:V).

EROSION CONTROL:

1. TEMPORARY EROSION CONTROL BLANKET- 24 MONTHS OF LONGEVITY VETIVER GRASS (Cenchrus ciliaris) SIERRA VARIETY TO SHOW DETAILS ABOUT VETIVER INSTALLATION AND CONFIGURATION SEE VETIVER GRASS AND EROSION CONTROL NOTES.

EXCAVATIONS NOTES:

1. PRIOR TO PERFORMING ANY EXCAVATION WORKS THE CONTRACTOR SHALL CONTACT THE P.R.H.T.A. ENGINEERING OFFICE AND IT SHALL BE RESPONSIBLE TO MAINTAIN THE STABILITY OF THE EXCAVATION AVOIDING PREMATURE COLLAPSE DURING THE CONSTRUCTION PROCESS.
2. THE CONTRACTOR SHALL CAREFULLY ADJUST THE INCLINATION OF THE SLOPES TO PROVIDE FOR A SAFE EXCAVATION AREA FOR WORKING PERSONNEL.
3. THE EXCAVATION FOR REINFORCED EARTH STRUCTURE SHOULD HAVE MAXIMUM OF 1:1 (H:V) SLOPE RATIO.
4. THE EXCAVATION SHALL BE PROTECTED WITH PLASTIC LINER TO AVOID POTENTIAL EROSION ON THE CUT SLOPES CAUSED BY RAINFALL.
5. WORKS EXCAVATION SHOULD BE PERFORMED ON DRY CONDITIONS.
6. THE CONTRACTOR SHALL TAKE MITIGATION MEASURES (MOUND, CHANNELS ETC.) ON THE CREST OF THE CUT SLOPES TO AVOID OVERLAND RUNOFF DURING CONSTRUCTION. WORK EXCAVATIONS MUST COMPLY WITH OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING A SAFE WORKING ENVIRONMENT ACCORDING TO ALL APPLICABLE OSHA REGULATIONS. HE SHALL AVOID DAMAGE TO HUMAN LIFE, ENVIRONMENT, AND PRIVATE OR PUBLIC PROPERTY.
8. THE CONTRACTOR SHALL BE TOTALLY RESPONSIBLE FOR SUBMITTING A SPECIFIC, DETAILED AND CONTROLLED EXCAVATION WORK SEQUENCE TO BE EVALUATED BY THE PROJECT ENGINEER AND P.R.H.T.A. ENGINEER PRIOR TO START.
9. THE CONTRACTOR SHALL AVOID THE FALL OF DEBRIS OR ANY OTHER MATERIAL DOWNHILL AT ALL TIMES.
10. HEAVY EQUIPMENT HANDLING SHALL NOT COMPROMISE THE STABILITY OF EXCAVATIONS AND STRUCTURES.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING THE CONSTRUCTION AND EXCAVATION SEQUENCE PLAN 14 DAYS BEFORE CONSTRUCTION BEGINS FOR APPROVAL.



VETIVER GRASS DETAILS



LEGEND:

1. EXCAVATION SLOPE. SEE EXCAVATION NOTES.
2. BORROW CLASS B TYPE A-2-4 FOR SLOPES 2:1 (H:V). BORROW CLASS B TYPE A-1-A FOR SLOPES 1.5:1 (H:V).
3. VETIVER GRASS AND EROSION CONTROL BLANKET.
4. PAVEMENT SECTION-THE CONTRACTOR SHALL REBUILD THE EXISTING PAVEMENT SECTION.
5. EXISTING GROUND.

EROSION CONTROL NOTES:

1. TEMPORARY EROSION CONTROL BLANKET- 24 MONTHS OF LONGEVITY
2. VETIVER GRASS (Cenchrus ciliaris) SIERRA VARIETY
3. LONGITUDINAL VETIVER GRASS SPACING OF 50CM CENTER TO CENTER ALONG THE CENTER LINE.
4. VERTICAL VETIVER GRASS SPACING OF 1.8M BETWEEN ROWS.

PUERTO RICO HIGHWAY AND TRANSPORTATION AUTHORITY
 DESIGN AREA
 STRUCTURAL DESIGN OFFICE

LANDSLIDE CORRECTION TYPICAL SECTION

DATE	REVISION

SCALE :
 NTS

CONDITION 1

FED/AD H'WAY PROJECT NO.	AC. PROJECT CODE NO.	HIGHWAY P.R.	MUNICIPALITY	ISLAND	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
C				P.R.			
E/W							

GENERAL NOTES

- FOUNDATION SOIL STRENGTH SHALL BE VERIFIED BY THE ENGINEER PRIOR TO STARTING WALL/SLOPE CONSTRUCTION. THE PROPOSED WALL IS INTENDED TO BE CONSTRUCTED ON FIRM, HIGH COMPACTENT SOIL OR WEATHERED ROCK.
- THE CONTRACTOR WILL BE RESPONSIBLE TO MAINTAIN THE STRUCTURAL AND EXCAVATION STABILITY DURING THE CONSTRUCTION PROCESS. SEE EXCAVATION NOTES.
- THE CONTRACTOR SHALL CONTACT P.R.A.I.T.A. ENGINEERING PRIOR TO PERFORM ANY UTILITIES AND EARTH WORKS.
- ALL CONCRETE SHALL FOLLOW SPECIAL PROVISION 8.3.1 STRUCTURAL CONCRETE.
- DESIGN AND CONSTRUCTION OF RETAINING WALL MUST BE DONE IN ACCORDANCE TO PORTA-STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (ASHTO LRFD 2015) OR SEE DESIGN NOTES.
- THE CONTRACTOR SHALL SUBMIT SHOP DRAWING AND DESIGN CALCULATIONS RELATED (WHEN APPLICABLE) FOR APPROVAL.
- FOR DESCRIPTION OF WORK, QUANTITIES AND SPECS. SEE DETAILED DAMAGE INSPECTION REPORTS (DDIR).

MATERIALS

CONCRETE:

CLASS "M" - $f_c = 3,000$ PSI (GENERAL USE) PERMEABILITY LEVEL -1.

SOIL:

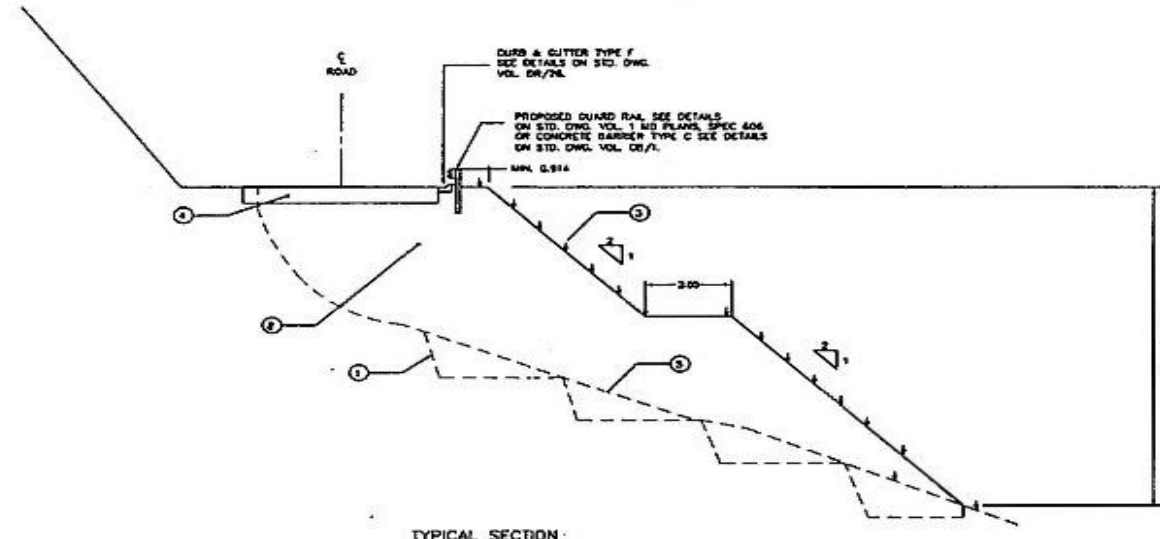
SPEC. 203 - EXCAVATION & EMBANKMENT BORROW CLASS B TYPE A-2-4 FOR SLOPE 2:1 (H:V), BORROW CLASS B TYPE A-1-A FOR SLOPE 1.5:1 (H:V).

EROSION CONTROL:

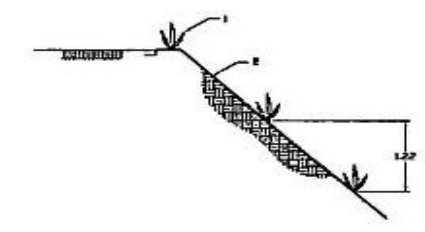
- TEMPORARY EROSION CONTROL BLANKET - 24 MONTHS OF LONGEVITY
- VETIVER GRASS (CHRYSOPOGON SIERRA VARIETY) TO KNOW DETAILS ABOUT VETIVER INSTALLATION AND CONFIGURATION SEE VETIVER GRASS AND EROSION CONTROL NOTES.

EXCAVATIONS NOTES:

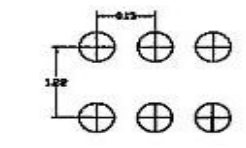
- PRIOR TO PERFORMING ANY EXCAVATION WORKS THE CONTRACTOR SHALL CONTACT THE PORTA SOIL ENGINEERING OFFICE AND IT SHALL BE RESPONSIBLE TO MAINTAIN THE STABILITY OF THE EXCAVATION AVOIDING PREMATURE COLLAPSE DURING THE CONSTRUCTION PROCESS.
- THE CONTRACTOR SHALL CAREFULLY ADJUST THE INCLINATION OF THE SLOPES TO PROVIDE FOR A SAFE EXCAVATION AREA FOR WORKING PERSONNEL.
- THE EXCAVATION FOR REINFORCED EARTH STRUCTURE SHOULD HAVE MAXIMUM OF 1:1 (H:V) SLOPE RATIO.
- THE EXCAVATION SHALL BE PROTECTED WITH PLASTIC LINER TO AVOID POTENTIAL EROSION ON THE CUT SLOPES CAUSED BY RAINFALL.
- WORKS EXCAVATION SHOULD BE PERFORMED ON DRY CONDITIONS.
- THE CONTRACTOR SHALL TAKE IRRIGATION MEASURES (DRENCH CHANNELS ETC.) ON THE CREST OF THE CUT SLOPES TO AVOID OVERLAND RUNOFF DURING CONSTRUCTION.
- WORK EXCAVATIONS MUST COMPLY WITH OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING A SAFE WORKING ENVIRONMENT ACCORDING TO ALL APPLICABLE OSHA REGULATIONS. HE SHALL AVOID DAMAGE TO HUMAN LIFE, ENVIRONMENT, AND PRIVATE OR PUBLIC PROPERTY.
- THE CONTRACTOR SHALL BE TOTALLY RESPONSIBLE FOR SUBMITTING A SPECIFIC, DETAILED AND CONTROLLED EXCAVATION WORK SEQUENCE TO BE EVALUATED BY THE PROJECT ENGINEER AND PORTA SOIL ENGINEER PRIOR TO START.
- THE CONTRACTOR SHALL AVOID THE FALL OF DEBRIS OR ANY OTHER MATERIAL DOWNHILL AT ALL TIMES.
- HEAVY EQUIPMENT HANDLING SHALL NOT COMPROMISE THE STABILITY OF EXCAVATIONS AND STRUCTURES.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING THE CONSTRUCTION AND EXCAVATION SEQUENCE PLAN 14 DAYS BEFORE CONSTRUCTION BEGINS FOR APPROVAL.



TYPICAL SECTION



TYPICAL SECTION



VETIVER PLAN

VETIVER GRASS DETAILS

LEGEND:

- EXCAVATION SLOPE, SEE EXCAVATION NOTES.
- BORROW CLASS B TYPE A-2-4 FOR SLOPES 2:1 (H:V), BORROW CLASS B TYPE A-1-A FOR SLOPES 1.5:1 (H:V).
- VETIVER GRASS AND EROSION CONTROL BLANKET.
- PAVEMENT SECTION-THE CONTRACTOR SHALL REBUILD THE EXISTING PAVEMENT SECTION.
- EXISTING GROUND.

EROSION CONTROL NOTES:

- TEMPORARY EROSION CONTROL BLANKET - 24 MONTHS OF LONGEVITY
- VETIVER GRASS (CHRYSOPOGON SIERRA VARIETY)
- LONGITUDINAL VETIVER GRASS SPACING OF 0.25M CENTER TO CENTER ALONG THE CONTOUR LINE.
- VERTICAL VETIVER GRASS SPACING OF 1.22M BETWEEN ROWS.

PUERTO RICO HIGHWAY AND TRANSPORTATION AUTHORITY
 DESIGN AREA
 STRUCTURAL DESIGN OFFICE

DATE	REVISION

SCALE :
 NTS

CONDITION 2

FEDERAL HWY PROJECT NO.	AD. PROJECT CODE NO.	ROADWAY P.R.	MUNICIPALITY	ISLAND	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
C				P.R.			
B/W							

GENERAL NOTES

- FOUNDATION SOIL STRENGTH SHALL BE VERIFIED BY THE ENGINEER PRIOR TO STARTING WALL/SLOPE CONSTRUCTION. THE PROPOSED WALL IS INTENDED TO BE CONSTRUCTED ON FIRM, HIGH COMPRESSIVE SOIL OR WEATHERED ROCK.
- THE CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN THE STRUCTURAL AND EXCAVATION STABILITY DURING THE CONSTRUCTION PROCESS. SEE EXCAVATION NOTES.
- THE CONTRACTOR SHALL CONTACT P.R.H.T.A. ENGINEERING PRIOR TO PERFORM ANY UTILITIES AND EARTH WORKS.
- ALL CONCRETE SHALL FOLLOW SPECIAL PROVISION 834 STRUCTURAL CONCRETE.
- DESIGN AND CONSTRUCTION OF RETAINING WALL MUST BE DONE IN ACCORDANCE TO P.R.H.T.A. STANDARDS SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (LASHO LRFD 2015) E.G. SEE DESIGN NOTES.
- THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS RELATED (WHEN APPLICABLE) FOR APPROVAL.
- FOR DESCRIPTION OF WORK, QUANTITIES AND SPECS. SEE DETAILED DAMAGE INSPECTION REPORTS (DIR).

MATERIALS

CONCRETE:

CLASS "D" - $f_c = 3,000$ PSI (GENERAL USE) PERMEABILITY LEVEL-1.

SOIL:

SPEC. 203- EXCAVATION & EMBANKMENT BORROW CLASS B TYPE A-2-4 FOR SLOPE 2:1 (4%); BORROW CLASS B TYPE A-1-4 FOR SLOPES 1.5:1 (10%).

EROSION CONTROL:

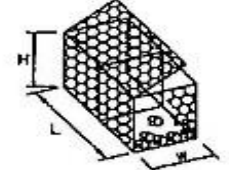
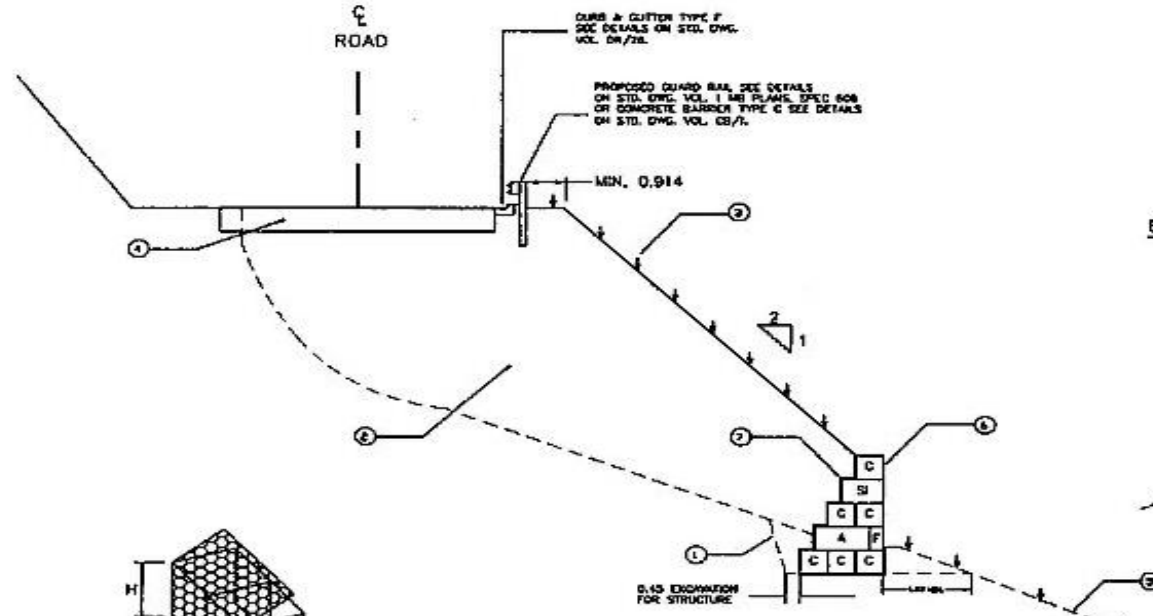
- TEMPORARY EROSION CONTROL BLANKET- 24 MONTHS OF LONGEVITY.
- VEGETER GRASS (CHRYSOPOGON INDIGICA) SEEDING THICKET TO KNOW DETAILS ABOUT VEGETER INSTALLATION AND COMPARISON SEE VEGETER GRASS AND EROSION CONTROL NOTES.

GABIONS WALL:

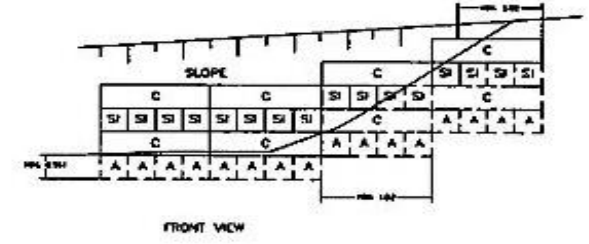
SPEC. 814- GABIONS SEE DETAILS ON STD. DWG. VOL. 1

EXCAVATIONS NOTES:

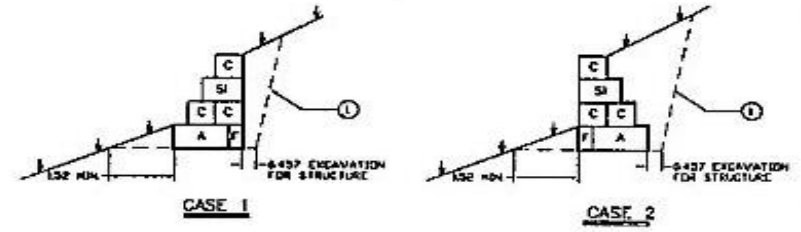
- PRIOR TO PERFORMING ANY EXCAVATION WORKS THE CONTRACTOR SHALL CONTACT THE P.R.H.T.A. ENGINEERING OFFICE AND IT SHALL BE RESPONSIBLE TO MAINTAIN THE STABILITY OF THE EXCAVATION AVOIDING PREMATURE COLLAPSE DURING THE CONSTRUCTION PROCESS.
- THE CONTRACTOR SHALL CAREFULLY ADJUST THE INCLINATION OF THE SLOPES TO PROVIDE FOR A SAFE EXCAVATION AREA FOR WORKING PERSONNEL.
- THE EXCAVATION FOR REINFORCED EARTH STRUCTURE SHOULD HAVE MAXIMUM OF 1:1 (H/V) SLOPE RATIO.
- THE EXCAVATION SHALL BE PROTECTED WITH PLASTIC LINER TO AVOID POTENTIAL EROSION ON THE CUT SLOPES CAUSED BY RAINFALL.
- WORKS EXCAVATION SHOULD BE PERFORMED ON DRY CONDITIONS.
- THE CONTRACTOR SHALL TAKE INTEGRATION MEASURES (WOUND CHANNELS ETC.) ON THE CREST OF THE CUT SLOPES TO AVOID OVERLAND RUNOFF DURING CONSTRUCTION.
- WORKS EXCAVATIONS MUST COMPLY WITH OCCUPATIONAL, SAFETY AND HEALTH ADMINISTRATION (OSHA).
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING A SAFE WORKING ENVIRONMENT ACCORDING TO ALL APPLICABLE OSHA REGULATIONS. HE SHALL AVOID DAMAGE TO HUMAN LIFE, ENVIRONMENT, AND PRIVATE OR PUBLIC PROPERTY.
- THE CONTRACTOR SHALL BE TOTALLY RESPONSIBLE FOR SUBMITTING A SPECIFIC, DETAILED AND CONTROLLED EXCAVATION WORK SEQUENCE TO BE EVALUATED BY THE PROJECT ENGINEER AND P.R.H.T.A. SOIL ENGINEER PRIOR TO START.
- THE CONTRACTOR SHALL AVOID THE FALL OF DEBRIS OR ANY OTHER MATERIAL DOWNHILL AT ALL TIMES.
- HEAVY EQUIPMENT HANDLING SHALL NOT COMPROMISE THE STABILITY OF EXCAVATIONS AND STRUCTURES.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING THE CONSTRUCTION AND EXCAVATION SEQUENCE PLAN 14 DAYS BEFORE CONSTRUCTION BEGINS FOR APPROVAL.



TYPE	H	W	L	CUM
A	0.914	0.914	1.82	1.52
B	0.914	0.914	2.74	2.28
C	0.914	0.914	3.65	3.06
F	0.914	0.457	3.68	1.53
SI	0.914	0.914	1.37	1.14



EXAMPLE OF GABIONS PLACEMENT AND EMBEDMENT CONFIGURATION



LEYEND:

- EXCAVATION SLOPE, SEE EXCAVATION NOTES.
- BORROW CLASS B TYPE A-2-4 FOR SLOPES 2:1 (4%); BORROW CLASS B TYPE A-1-4 FOR SLOPES 1.5:1 (10%). SPEC. 203.
- VEGETER GRASS AND EROSION CONTROL BLANKET, SEE EROSION CONTROL NOTES AND DETAILS.
- PAVEMENT SECTION--THE CONTRACTOR SHALL REBUILD THE EXISTING PAVEMENT SECTION.
- EXISTING GROUND.
- GABIONS WALL, SPEC. 814 SEE DETAILS STD. DWG. VOL. 1, GAB 1 TO 20.
- GEOTEXTILE FILTER FABRIC SPEC. 712-7.

CONDITION 3

PUERTO RICO HIGHWAY AND TRANSPORTATION AUTHORITY DESIGN AREA STRUCTURAL DESIGN OFFICE	LANDSLIDE CORRECTION TYPICAL SECTION	DATE	REVISION	SCALE : NTS	CONDITION 3

FED. AID H'WAY PROJECT NO.	AC. PROJECT CODE NO.	HIGHWAY P.R.	MUNICIPALITY	ISLAND	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
C				P.R.			
R/W							

GENERAL NOTES

- FOUNDATION SOIL STRENGTH SHALL BE VERIFIED BY THE ENGINEER PRIOR TO STARTING WALL/SLOPE CONSTRUCTION. THE PROPOSED WALL IS INTENDED TO BE CONSTRUCTED ON FIRM, HIGH COMPRESSIVE SOIL OR WEATHERED ROCK.
- THE CONTRACTOR WILL BE RESPONSIBLE TO MAINTAIN THE STRUCTURAL AND EXCAVATION STABILITY DURING THE CONSTRUCTION PROCESS. SEE EXCAVATION NOTES.
- THE CONTRACTOR SHALL CONTACT P.R.H.T.A ENGINEERING PRIOR TO PERFORM ANY UTILITIES AND EARTH WORKS.
- ALL CONCRETE SHALL FOLLOW SPECIAL PROVISION 934 STRUCTURAL CONCRETE. DESIGN AND CONSTRUCTION OF RETAINING WALL MUST BE DONE IN ACCORDANCE TO P.R.H.T.A-STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (AASHTO LRFD 2015) ED. SEE DESIGN NOTES.
- THE CONTRACTOR SHALL SUBMIT SHOP DRAWING AND DESIGN CALCULATIONS RELATED (WHEN APPLY) FOR APPROVAL.
- FOR DESCRIPTION OF WORK, QUANTITIES AND SPECS. SEE DETAILED DAMAGE INSPECTION REPORTS (DDIR).

MATERIALS

CONCRETE:

CLASS "B" - $f_c = 3,000$ PSI (GENERAL USE) PERMEABILITY LEVEL-1.

SOIL:

SPEC. 203- EXCAVATION & EMBANKMENT (BORROW CLASS B).

EROSION CONTROL:

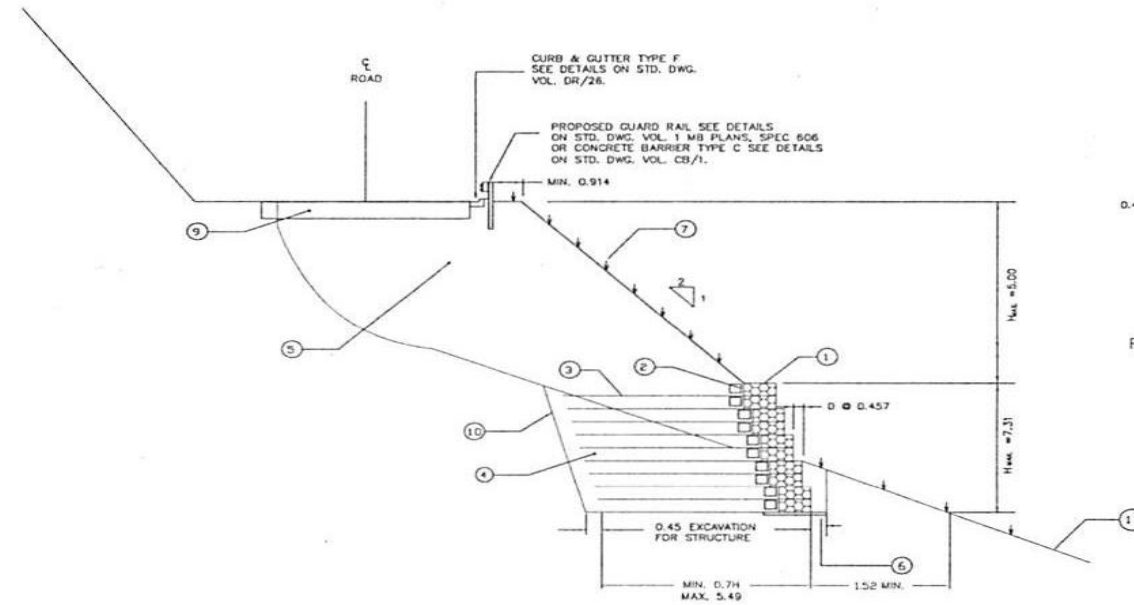
- TEMPORARY EROSION CONTROL BLANKET- 24 MONTHS OF LONGEVITY
- VETIVER GRASS (*Chrysopogon zizanioides*) SIERRA VARIETY TO KNOW DETAILS ABOUT VETIVER INSTALLATION AND CONFIGURATION SEE VETIVER GRASS AND EROSION CONTROL NOTES.

REINFORCED EARTH SYSTEM:

SPECIAL PROVISION 992- SPECIAL BORROW EMBANKMENT
 SPECIAL PROVISION 921-REINFORCE EARTH GABION BASKET WITH TAIL SYSTEM
 SPECIAL PROVISION 922-REINFORCE EARTH SLOPE

EXCAVATIONS NOTES:

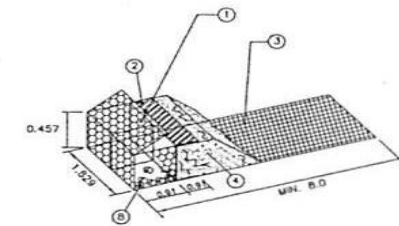
- PRIOR TO PERFORMING ANY EXCAVATION WORKS THE CONTRACTOR SHALL CONTACT THE P.R.H.T.A SOIL ENGINEERING OFFICE AND IT SHALL BE RESPONSIBLE TO MAINTAIN THE STABILITY OF THE EXCAVATION AVOIDING IMMEDIATE COLLAPSE DURING THE CONSTRUCTION PROCESS.
- THE CONTRACTOR SHALL CAREFULLY ADJUST THE INCLINATION OF THE SLOPES TO PROVIDE FOR A SAFE EXCAVATION AREA FOR WORKING PERSONNEL.
- THE EXCAVATION FOR REINFORCED EARTH STRUCTURE SHOULD HAVE MAXIMUM OF 1:1 (H:V) SLOPE RATIO.
- THE EXCAVATION SHALL BE PROTECTED WITH PLASTIC LINER TO AVOID POTENTIAL EROSION ON THE CUT SLOPES CAUSED BY RAINFALL.
- WORKS EXCAVATION SHOULD BE PERFORMED ON DRY CONDITIONS.
- THE CONTRACTOR SHALL TAKE MITIGATION MEASURES (GROUNDS, CHANNELS ETC., ON THE CREST OF THE CUT SLOPES) TO AVOID OVERLAND RUNOFF DURING CONSTRUCTION. WORK EXCAVATIONS MUST COMPLY WITH OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING A SAFE WORKING ENVIRONMENT ACCORDING TO ALL APPLICABLE OSHA REGULATIONS. HE SHALL AVOID DAMAGE TO HUMAN LIFE, ENVIRONMENT, AND PRIVATE OR PUBLIC PROPERTY.
- THE CONTRACTOR SHALL BE TOTALLY RESPONSIBLE FOR SUBMITTING A SPECIFIC, DETAILED AND CONTROLLED EXCAVATION WORK SEQUENCE TO BE EVALUATED BY THE PROJECT ENGINEER AND P.R.H.T.A SOIL ENGINEER PRIOR TO START.
- THE CONTRACTOR SHALL AVOID THE FALL OF DEBRIS OR ANY OTHER MATERIAL DOWNHILL AT ALL TIMES.
- HEAVY EQUIPMENT HANDLING SHALL NOT COMPROMISE THE STABILITY OF EXCAVATIONS AND STRUCTURES.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING THE CONSTRUCTION AND EXCAVATION SEQUENCE PLAN 14 DAYS BEFORE CONSTRUCTION BEGINS FOR APPROVAL.



TYPICAL SECTION

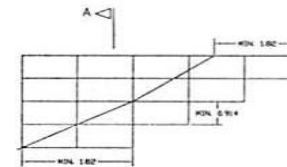
LEGEND:

- GABIONS BASKET, SPEC. 614 SEE DETAILS STD. DWG. VOL. 1, GABI 1 TO 20.
- GEOTEXTILE FILTER FABRIC SPEC.712-7.
- GEGRID WITH MINIMUM TENSILE STRENGTH OF 6,000 LB/FT, 3. GEGRID WITH MINIMUM TENSILE STRENGTH OF 6,000 LB/FT, SPEC 992- SPECIAL BORROW EMBANKMENT.
- STRUCTURAL EMBANKMENT BORROW "CLASS B TYPE A-2-4", FOLLOW SPEC. 992
- BORROW "CLASS B TYPE A-2-4" COMPACTED SOIL, SPEC. 203. FOR SLOPES OF 1.5:1.0 (H:V) USE BORROW CLASS B TYPE A-1-A
- 0.20 CONCRETE LEVELING PAD.
- VETIVER GRASS AND EROSION CONTROL BLANKET.
- GABIONS STONES (AVERAGE SIZE 100 MM- 200 MM).
- PAVEMENT SECTION-THE CONTRACTOR SHALL REBUILD THE EXISTING PAVEMENT SECTION.
- EXCAVATION SLOPE, SEE EXCAVATION NOTES.
- EXISTING GROUND.

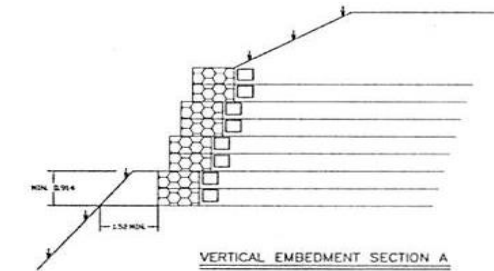


REINFORCED EARTH SLOPE WITH GABIONS BASKET FACING DETAIL

NOT TO SCALE



LATERAL EMBEDMENT



VERTICAL EMBEDMENT SECTION A

PUERTO RICO HIGHWAY AND TRANSPORTATION AUTHORITY
 DESIGN AREA
 STRUCTURAL DESIGN OFFICE

LANDSLIDE CORRECTION TYPICAL SECTION

DATE	REVISION

SCALE :
 NTS

CONDITION 4

FED. AID H'WAY PROJECT NO.	AC. PROJECT CODE NO.	HIGHWAY P.R.	MUNICIPALITY	ISLAND	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
C				P.R.			
R/W							

GENERAL NOTES

- FOUNDATION SOIL STRENGTH SHALL BE VERIFIED BY THE ENGINEER PRIOR TO STARTING WALL/SLOPE CONSTRUCTION. THE PROPOSED WALL IS INTENDED TO BE CONSTRUCTED ON FIRM, HIGH COMPETENT SOIL OR WEATHERED ROCK.
- THE CONTRACTOR WILL BE RESPONSIBLE TO MAINTAIN THE STRUCTURAL AND EXCAVATION STABILITY DURING THE CONSTRUCTION PROCESS. SEE EXCAVATION NOTES.
- THE CONTRACTOR SHALL CONTACT P.R.H.T.A. ENGINEERING PRIOR TO PERFORM ANY UTILITIES AND EARTH WORKS.
- ALL CONCRETE SHALL FOLLOW SPECIAL PROVISION 934 STRUCTURAL CONCRETE.
- DESIGN AND CONSTRUCTION OF RETAINING WALL MUST BE DONE IN ACCORDANCE TO FHWA-STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (ASHTO LRFD 2015) E.D. SEE DESIGN NOTES.
- THE CONTRACTOR SHALL SUBMIT SHOP DRAWING AND DESIGN CALCULATIONS RELATED (WHEN APPLY) FOR APPROVAL.
- FOR DESCRIPTION OF WORK, QUANTITIES AND SPECS. SEE DETAILED DAMAGE INSPECTION REPORTS (DOR).

MATERIALS

CONCRETE:

CLASS "M" - f'c = 3,000 PSI (GENERAL USE) PERMEABILITY LEVEL-1.

SOIL:

SPEC. 203- EXCAVATION & EMBANKMENT (BORROW CLASS B).

EROSION CONTROL:

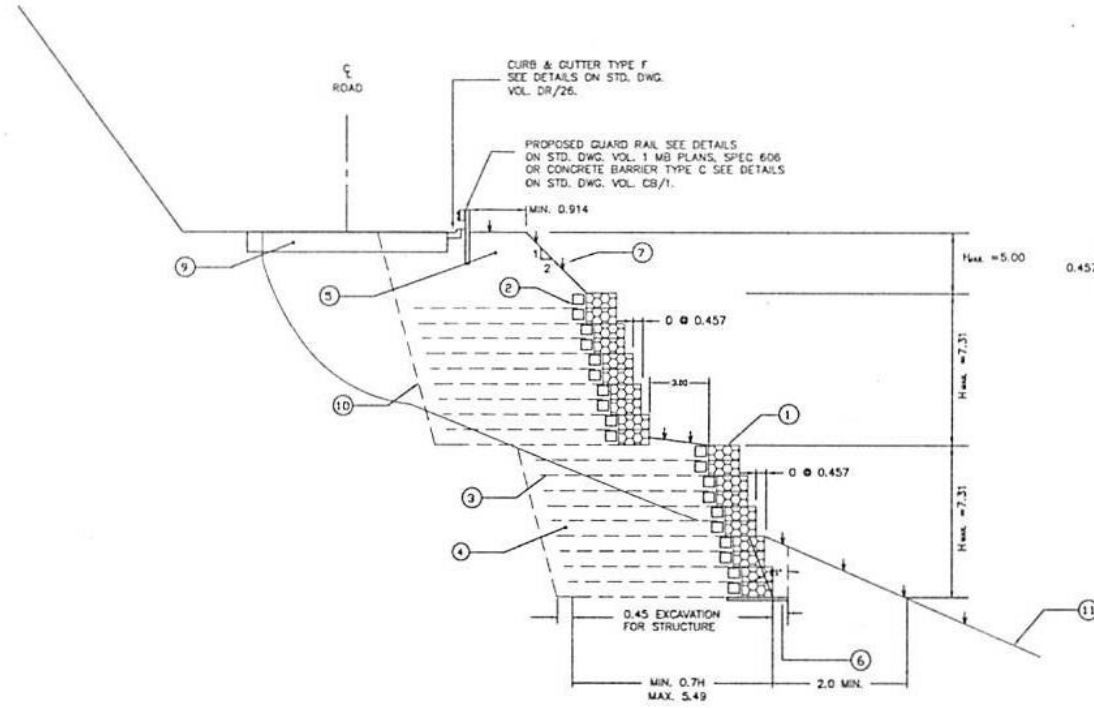
- TEMPORARY EROSION CONTROL BLANKET- 24 MONTHS OF LONGEVITY
- VETIVER GRASS (*Chrysopogon zizanioides*) SIERRA VARIETY TO KNOW DETAILS ABOUT VETIVER INSTALLATION AND CONFIGURATION SEE VETIVER GRASS AND EROSION CONTROL NOTES.

REINFORCED EARTH SYSTEM:

SPECIAL PROVISION 992- SPECIAL BORROW EMBANKMENT
 SPECIAL PROVISION 921-REINFORCE EARTH GABION BASKET WITH TAIL SYSTEM
 SPECIAL PROVISION 922-REINFORCE EARTH SLOPE

EXCAVATIONS NOTES:

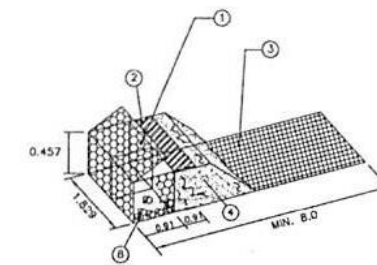
- PRIOR TO PERFORMING ANY EXCAVATION WORKS THE CONTRACTOR SHALL CONTACT THE PRHTA SOIL ENGINEERING OFFICE AND IT SHALL BE RESPONSIBLE TO MAINTAIN THE STABILITY OF THE EXCAVATION AVOIDING PREMATURE COLLAPSE DURING THE CONSTRUCTION PROCESS.
- THE CONTRACTOR SHALL CAREFULLY ADJUST THE INCLINATION OF THE SLOPES TO PROVIDE FOR A SAFE EXCAVATION AREA FOR WORKING PERSONNEL.
- THE EXCAVATION FOR REINFORCED EARTH STRUCTURE SHOULD HAVE MAXIMUM OF 1:1 (H:V) SLOPE RATIO.
- THE EXCAVATION SHALL BE PROTECTED WITH PLASTIC LINER TO AVOID POTENTIAL EROSION ON THE CUT SLOPES CAUSED BY RAINFALL.
- WORKS EXCAVATION SHOULD BE PERFORMED ON DRY CONDITIONS.
- THE CONTRACTOR SHALL TAKE MITIGATION MEASURES (GOUND, CHANNELS ETC., ON THE CREST OF THE CUT SLOPES) TO AVOID OVERLAND RUNOFF DURING CONSTRUCTION.
- WORK EXCAVATIONS MUST COMPLY WITH OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).
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- THE CONTRACTOR SHALL AVOID THE FALL OF DEBRIS OR ANY OTHER MATERIAL DOWNHILL AT ALL TIMES.
- HEAVY EQUIPMENT HANDLING SHALL NOT COMPROMISE THE STABILITY OF EXCAVATIONS AND STRUCTURES.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING THE CONSTRUCTION AND EXCAVATION SEQUENCE PLAN 14 DAYS BEFORE CONSTRUCTION BEGINS FOR APPROVAL.



TYPICAL SECTION

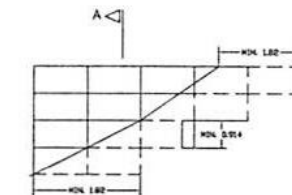
LEGEND:

- GABIONS BASKET, SPEC. 614 SEE DETAILS STD. DWG. VOL. 1, CAB 1 TO 20.
- GEOTEXTILE FILTER FABRIC SPEC. 712-7.
- GEGRID WITH MINIMUM TENSILE STRENGTH OF 8,000 LB/FT. SPEC 992- SPECIAL BORROW EMBANKMENT.
- STRUCTURAL EMBANKMENT BORROW "CLASS B TYPE A-2-4", FOLLOW SPEC. 992
- BORROW "CLASS B TYPE A-2-4" COMPACTED SOIL. SPEC. 203. FOR SLOPES OF 1.5:1.0 (H:V) USE BORROW CLASS B TYPE A-1-A
- 0.20 CONCRETE LEVELING PAD.
- VETIVER GRASS AND EROSION CONTROL BLANKET.
- GABIONS STONES (AVERAGE SIZE 100 MM- 200 MM).
- PAVEMENT SECTION-THE CONSTRUCTOR SHALL REBUILD THE EXISTING PAVEMENT SECTION.
- EXCAVATION SLOPE, SEE EXCAVATION NOTES.
- EXISTING GROUND.

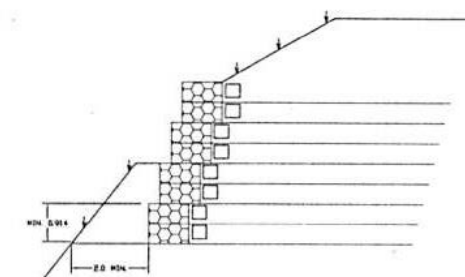


REINFORCED EARTH SLOPE WITH GABIONS BASKET FACING DETAIL

NOT TO SCALE



LATERAL EMBEDMENT



VERTICAL EMBEDMENT SECTION A

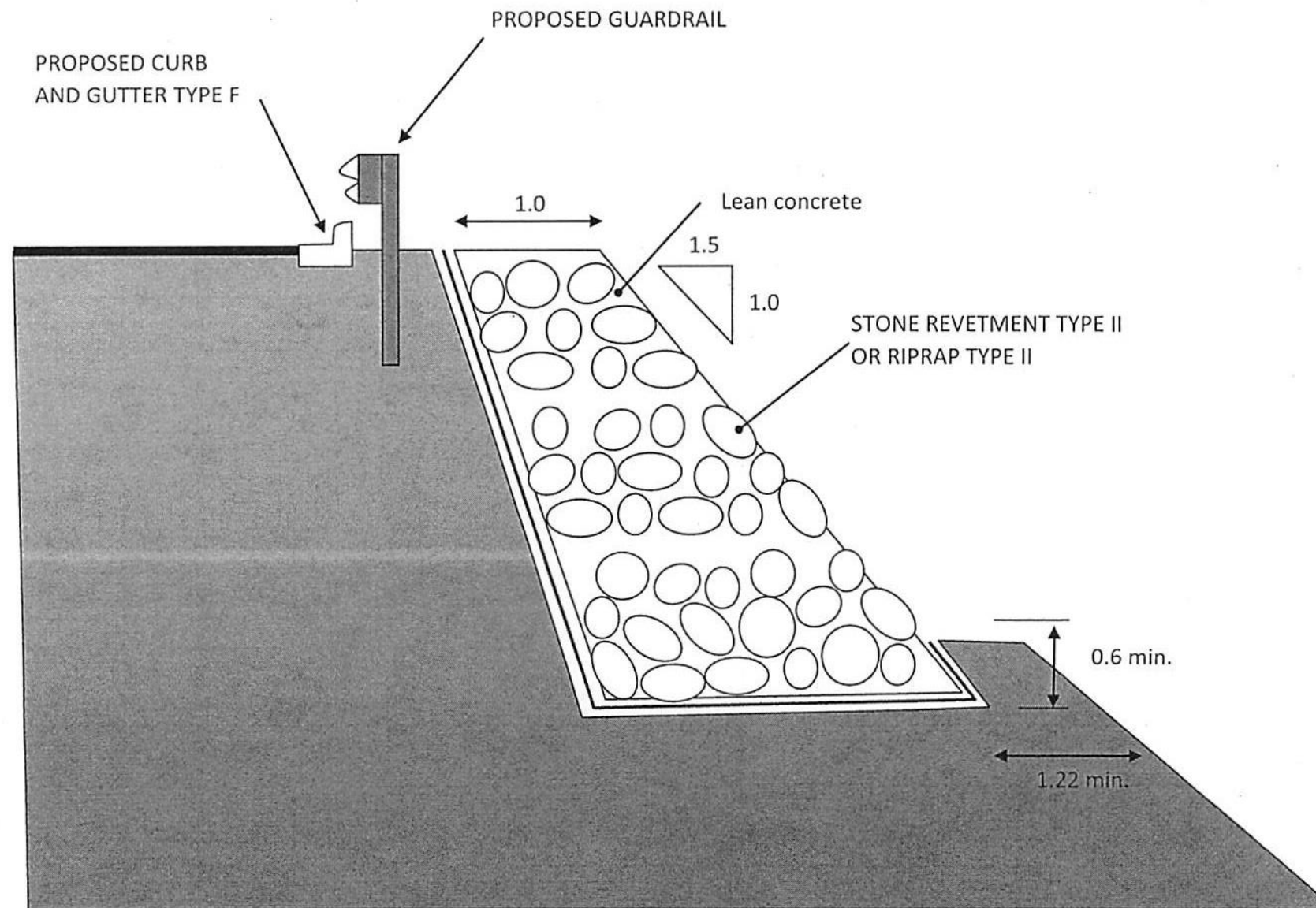
PUERTO RICO HIGHWAY AND TRANSPORTATION AUTHORITY
 DESIGN AREA
 STRUCTURAL DESIGN OFFICE

LANDSLIDE CORRECTION TYPICAL SECTION

DATE	REVISION

SCALE :
 NTS

CONDITION 5



APPENDIX D

Federal Consistency Certificate, October 3, 2018



GOBIERNO DE PUERTO RICO
Junta de Planificación

5 de octubre de 2018

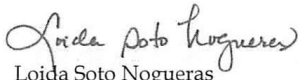
HOLLY WINTON
DHS - FEMA REGION II
50 STATE ROAD PR 165 SUITE #3
GUAYNABO PR 00968

Caso Número: JP-2018-324

Estimado(a) señor(a):

Cumpliendo con las disposiciones de la Ley Núm. 75 del 24 de junio de 1975, según enmendada y Ley Núm. 38 de 30 de junio de 2017, y para su notificación oficial, incluimos copia certificada del acuerdo adoptado por la Junta de Planificación de Puerto Rico en relación con el asunto de referencia

Cordialmente,


Loida Soto Noguera
Secretaria

Ánejo



**GOVERNMENT OF PUERTO RICO
PUERTO RICO PLANNING BOARD**

October 3, 2018

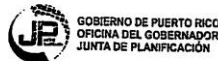
RESOLUTION JP-2018-324

**Federal Consistency Certification with the Puerto Rico Coastal Zone Management Program
FEMA Puerto Rico DR-4336-PR and DR-4339-PR Permanent Work:
Federal Assistance for Permanent Work through the Public Assistance (PA) Program and
Hazard Mitigation Grant Program (HMGP)**

The damage caused by high winds, storm surge and flooding attributed to Hurricanes Irma and Maria had devastating effects on Puerto Rico's coastal areas that need to be addressed in an expeditious manner. While many of the most dire emergency needs have been met, the post-Irma and Maria recovery needs of the Commonwealth are on-going and will continue into the near future.

In its role conducting reviews pursuant to the authority of the Commonwealth under the Coastal Zone Management Act, the Puerto Rico Planning Board recognizes that these circumstances require expedited reviews. In order to achieve this, the Federal Emergency Management Agency (FEMA) in coordination with the Puerto Rico Planning Board agreed the following:

1. The financial assistance awards made by FEMA for responding to the Hurricanes Irma and Maria (Puerto Rico DR-4336-PR and DR-4339-PR) are consistent with the enforceable policies of the Puerto Rico Coastal Zone Management Program (PRZCMP), when the use of such funds is to finance:
 - a. Activities described under categories C through G according to the FEMA Public Assistance Program and Policy Guide (FP 104-009-2/April 2018). A summary table with these activities is provided in Appendix A.
 - b. Hazard mitigation projects and activities to be covered through the "Hazard Mitigation Grant Program" (HMGP) according to the "Hazard Mitigation Assistance Guidance of February 27, 2015". Hazard mitigation activities to be covered by this program are detailed in appendix A.
 - c. "Planning-Related Activities", "Technical Assistance" and "Management Cost" covered under the Hazard Mitigation Grant Program.
2. Financing the above mentioned projects and activities will not require further review pursuant to Subpart F of the Federal Consistency Regulations at 15 CFR Part 930, yet:
 - a. The granting of financial assistance under the programs at reference does not exclude or supersede the financed projects to comply with applicable federal and state permits or requirements.
 - b. Recipients and Subrecipients that receive FEMA assistance through these programs are not exempt to comply with Federal Consistency requirements (according to Subpart C of the 15 CFR Part 930) for certain projects and activities that may affect the Puerto Rico coastal resources.
 - c. This Certification does not exempt or supersede any of the activities mentioned in paragraph number one (1) from compliance with Federal Consistency requirements for "Federal Licenses or Permits" (according to Subpart D of the 15 CFR Part 930) that may be required for certain projects and activities under this agreement.



- d. Where "In-kind" repair or replacement is specified for a project, "In-kind" shall mean that it is either the same or a similar material, and the result shall match all physical and visual aspects. The in-kind repairs and replacements should be limited to pre-existing architectural features and physical components of buildings and structures that were in existence prior to the event but are not extant after the event.

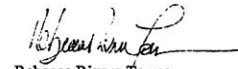
After the evaluation of the type of activities to be granted, according to the above mentioned FEMA guides, the Puerto Rico Planning Board, in its meeting of October 3, 2018, determined the following:


"The Financial Assistance at reference is consistent with the Puerto Rico Coastal Zone Management Program; as long as each financed project complies with conditions under paragraph number two (2) of this resolution."

This Certification only applies to disasters DR-4336-PR and DR-4339-PR and will be in effect for a term of five years from the notification date of this resolution. The Certification at reference will be renewed or amended if necessary to extend its validity or address other matters. The Puerto Rico Planning Board agree to have an open line of communication with FEMA to resolve questions that may arise in executing the Federal Assistance grants under the programs at reference.


María del C. Gordillo Pérez
President

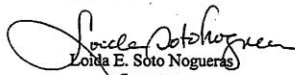
Excused
Eileen Poueymirou Yunqué
Associate Member

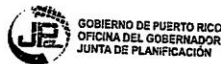

Rebecca Rivera Torres
Associate Member


Suheily Barreto Soto
Designated Associate Member

Certify: That this Resolution is copy of the agreement adopted by Puerto Rico Planning Board (PRPB) in its meeting of October 3, 2018. I expedite and notify this copy to the parties under my sign and official stamp of the Puerto Rico Planning Board stamp, for general use and knowledge.

In San Juan, Puerto Rico, today 05 OCT 2018

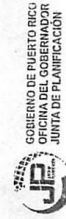

Loida E. Soto Noguera
Secretary



Programmatic Environmental Assessment
 FEMA Puerto Rico Transportation PEA

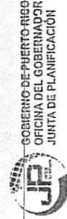
SUMMARY OF PUBLIC ASSISTANCE AND HAZARD MITIGATION ASSISTANCE COVERED UNDER THE GENERAL FEDERAL
 CONSISTENCY CERTIFICATION WITH THE PUERTO RICO COASTAL ZONE MANAGEMENT PROGRAM
 RESOLUTION JP-2018-324
 APPENDIX A

CATEGORY	PUBLIC ASSISTANCE (PA)	ELIGIBLE WORK INCLUDING BUT NOT LIMITED TO:	HAZARD MITIGATION GRANT PROGRAM (HMGP) ELIGIBLE ACTIVITIES
C- ROADS AND BRIDGES	<p>TYPE OF PROJECT</p> <p>1- Roads may be paved, gravel or dirt. Road components include but may not be limited to:</p> <ul style="list-style-type: none"> • Surfaces • Bases • Shoulders • Ditches • Drainage Structures, such as culverts • Low Water Crossings • Associated facilities, such as lighting, sidewalks, guardrails and signs. <p>2- Bridge components include, but may not be limited to:</p> <ul style="list-style-type: none"> • Decking • Guardrails • Girders • Pavement • Abutments • Piers • Slope Protection • Approaches • Associated facilities, such as lighting, sidewalks and signs. <p>3- Maintenance: the incident may cause minor damage to roads that result in damage similar to that which may occur over time from other causes. Normal maintenance is not eligible.</p>	<p>Restoration: Permanent repair or replacement</p>	<p>Localized Flood Risk Reduction Projects</p> <p>Non-localized Flood Risk Reduction Projects</p> <p>Infrastructure Retrofit</p> <p>Soil Stabilization</p> <p>Post-Disaster Code Enforcement</p> <p>Advance Assistance</p> <p>5% Percent Initiative Projects:</p> <p>Miscellaneous/Other</p>



Reference: FEMA Public Assistance Program and Policy Guide (FP 104-009-2/April 2018) / Hazard Mitigation Assistance Guidance (February 27, 2015)

PUBLIC ASSISTANCE (PA)		HAZARD MITIGATION GRANT PROGRAM (HMGP) ELIGIBLE ACTIVITIES
CATEGORY	TYPE OF PROJECT	
D- WATER CONTROL FACILITIES	<p>Water Control facilities are those built for Channel alignment, recreation, navigation, land reclamation, irrigation, maintenance of fish and wildlife habitat, interior drainage, erosion prevention, flood control, and storm water management. They include:</p> <ul style="list-style-type: none"> Dams and reservoirs Levees and floodwalls Lined and unlined engineered drainage channels Canals Aqueducts Sediment and debris basins Storm water retention and detention basins Coastal shoreline protective devices Irrigation facilities Pumping facilities Navigational waterways and shipping channels 	<p>ELIGIBLE WORK INCLUDING BUT NOT LIMITED TO:</p> <p>1- Debris and silt removal required to restore capacity (engineered and maintained facilities only)</p> <ul style="list-style-type: none"> Eligible only if the Applicant provides documentation to establish the pre-disaster capacity of the facility and that the facility was actively used and maintained with a regular clearance schedule. <p>2- Restoration: Permanent Repair or Replacement</p> <ul style="list-style-type: none"> PNP irrigation facilities are only eligible if they provide water for essential services of a governmental nature to the general public for fire suppression, generating and supplying electricity, and drinking water supply.
		Localized Flood Risk Reduction Projects
		Non-localized Flood Risk Reduction Projects
		Soil Stabilization
		Post-Disaster Code Enforcement
		5% Percent Initiative Projects
		Miscellaneous/Other

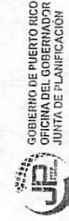


CATEGORY	PUBLIC ASSISTANCE (PA)	HAZARD MITIGATION GRANT PROGRAM (HMGP) ELIGIBLE ACTIVITIES
E-BUILDINGS AND EQUIPMENT	<p>TYPE OF PROJECT</p> <p>Buildings including:</p> <ul style="list-style-type: none"> All structural and non-structural components, including mechanical, electrical, and plumbing systems. Contents and equipment within the building Furnishings <p>Equipment includes:</p> <ul style="list-style-type: none"> Vehicles Construction equipment 	<p>ELIGIBLE WORK INCLUDING BUT NOT LIMITED TO:</p> <p>1- Restoration – Permanent repair or replacement</p> <ul style="list-style-type: none"> Repair or replacement of buildings Repair or replacement of building components, vehicles or equipment with items similar in age, condition, and capacity. Replacement of destroyed contents with items similar in age, condition, and capacity. Recovering and stabilizing records. Stabilization of irreplaceable collections and individual objects is eligible. Re-shelving, cataloging, and other work incidental to the replacement of library books and publications. <p>2- Demolition when replacing a facility including removal and disposal of associated debris.</p> <p>3- Extracting water and removing mud, silt, or debris from interior in conjunction with repairs.</p> <p>4- Mold remediation when conducted in conjunction with restoration of the facility</p> <ul style="list-style-type: none"> Post remediation sampling to confirm remediation is complete. <p>5- Post-earthquake inspection and evaluation of welded steel moment frames in buildings to determine the level of disaster-related damage requiring repair.</p>
		Property Acquisition and Structure Demolition
		Property Acquisition and Structure Relocation
		Structure Elevation
		Wind Retrofit Projects
		Soil Stabilization
		Mitigation Reconstruction
		Wildfire Mitigation
		Advance Assistance
		5% Percent Initiative Projects
		Miscellaneous/Other



APPENDIX A

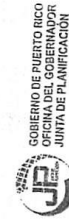
PUBLIC ASSISTANCE (PA)		
CATEGORY	TYPE OF PROJECT	ELIGIBLE WORK INCLUDING BUT NOT LIMITED TO:
F- UTILITIES	<ul style="list-style-type: none"> Water storage facilities, treatment plants, and delivery systems Power generation, transmission, and distribution facilities, including, but not limited to, wind turbines, generators, substations, and power lines Natural gas transmission and distribution facilities Sewage collection systems and treatment plants Communication systems 	<p>Eligible restoration activities:</p> <ul style="list-style-type: none"> Permanent repair or replacement of any component of a system, including buildings, structures, or systems, even if not contiguous. Electrical conductor replacement subject to specific criteria. Inspection or assessment of damaged components of a system. Inspection or assessment of an inaccessible structure or component of a system may be eligible, but only when there is evidence of damage, such as when sunken ground appears above a water pipeline.
HAZARD MITIGATION GRANT PROGRAM (HMGP) ELIGIBLE ACTIVITIES		
Generators		
Infrastructure Retrofit		
Soil Stabilization		
Post-Disaster Code Enforcement		
Advance Assistance		
5% Percent Initiative Projects		
Miscellaneous/Other		



Reference: FEMA Public Assistance Program and Policy Guide (PP-104-009-2/April 2018) / Hazard Mitigation Assistance Guidance (February 27, 2015)

APPENDIX A

PUBLIC ASSISTANCE (PA)		ELIGIBLE WORK INCLUDING BUT NOT LIMITED TO:	HAZARD MITIGATION GRANT PROGRAM (HMGP) ELIGIBLE ACTIVITIES
CATEGORY	TYPE OF PROJECT		
G-PARKS, RECREATIONAL, OTHER	Eligible publicly owned facilities in this category include: <ul style="list-style-type: none"> • Mass transit facilities such as railways • Beaches • Parks • Playground equipment • Swimming pools • Bath houses • Tennis courts • Boat docks • Piers • Picnic tables • Golf courses • Ball fields • Fish hatcheries • Ports and harbors Other facilities that do not fit in Categories C–F	Restoration – Permanent repair or replacement. Restoration of engineered beaches is subject to specific eligibility criteria.	Infrastructure Retrofit Soil Stabilization Post-Disaster Code Enforcement Advance Assistance 5% Percent Initiative Projects Miscellaneous/Other



Reference: FEMA Public Assistance Program and Policy Guide (FPMR 104.009-2/April 2018)/Hazard Mitigation Assistance Guidance (February 27, 2015)

APPENDIX E

List of Terrestrial and Marine-based ESA listed species within Puerto Rico

Table E-1. Terrestrial based ESA Listed Species

Common Name	Scientific Name	Federal Status*	Critical Habitat
Birds			
Elfin-woods warbler	<i>Setophaga angelae</i>	T	Proposed
Piping plover	<i>Charadrius melodus</i>	E, T**	No
Puerto Rican broad-winged hawk	<i>Buteo platypterus brunnescens</i>	E	No
Puerto Rican nightjar	<i>Caprimulgus noctitherus</i>	E	No
Puerto Rican parrot	<i>Amazona vittata</i>	E	No
Puerto Rican plain Pigeon	<i>Columba inornata wetmorei</i>	E	No
Puerto Rican sharp-shinned hawk	<i>Accipiter striatus venator</i>	E	No
Roseate Tern	<i>Sterna dougallii dougallii</i>	T	No
Rufa Red Knot	<i>Calidris canutus rufa</i>	T	No
Yellow-shouldered blackbird	<i>Agelaius xanthomus</i>	E	Yes
Amphibians			
Golden coqui	<i>Eleutherodactylus jasperi</i>	T	Yes
Guajon	<i>Eleutherodactylus cooki</i>	T	Yes
Llanero Coqui	<i>Eleutherodactylus juanariveroi</i>	E	Yes
Puerto Rican crested toad	<i>Peltophryne lemur</i>	T	No
Reptile			
Culebra Island giant anole	<i>Anolis roosevelti</i>	E	Yes
Mona boa	<i>Epicrates monensis monensis</i>	T	Yes
Mona ground Iguana	<i>Cyclura stejnegeri</i>	T	Yes
Monito gecko	<i>Sphaerodactylus micropithecus</i>	E	Yes
Puerto Rican boa	<i>Epicrates inornatus</i>	E	No
Virgin Islands tree boa	<i>Epicrates monensis granti</i>	E	No
Plants			
Arana	<i>Schoepfia arenaria</i>	T	No
Bariaco	<i>Trichilia triacantha</i>	E	No
Cana Gorda Girdlepod	<i>Mitracarpus polycladus</i>	E	No
Capa rosa	<i>Callicarpa ampla</i>	E	No
Cerro de Punta Jayuya	<i>Elaphoglossum serpens</i>	E	No
Chase's Threeawn	<i>Aristida chaseae</i>	E	No
Chupacallos	<i>Pleodendron macranthum</i>	E	No
Cobana negra	<i>Stahlia monosperma</i>	T	No
Cook's holly	<i>Ilex cookii</i>	E	No
Cordillera Maiden Fern	<i>Thelypteris inabonensis</i>	E	No
El Yunque Colorado	<i>Ternstroemia subsessilis</i>	E	No
Elfin tree fern	<i>Cyathea dryopteroides</i>	E	No
Erubia	<i>Solanum drymophilum</i>	E	No
Heller's Cieneguillo	<i>Daphnopsis hellerana</i>	E	No

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Higo Chumbo-Prickly Pear	<i>Harrisia portoricensis</i>	T	No
Higuero de sierra	<i>Crescentia portoricensis</i>	E	No
Jamaican Broom	<i>Chamaecrista glandulosa</i> var.	E	No
Luquillo Mtn babyboot	<i>Lepanthes eltoroensis</i>	E	No
Mata Buey-Beautiful goetzea	<i>Goetzea elegans</i>	E	No
Maxwell's Girdlepod	<i>Mitracarpus maxwelliae</i>	E	No
Monte Guilarte Hollyfern	<i>Polystichum calderonense</i>	E	No
No common name	<i>Varronia rupicola</i>	T	Yes
No common name	<i>Cranichis ricartii</i>	E	No
No common name	<i>Gonocalyx concolor</i>	E	Yes
No common name	<i>Leptocereus grantianus</i>	E	No
No common name	<i>Myrcia paganii</i>	E	No
No common name	<i>Thelypteris verecunda</i>	E	No
No common name	<i>Vernonia proctorii</i>	E	No
Palma de manaca	<i>Calyptronoma rivalis</i>	T	No
Palo colorado	<i>Ternstroemia luquillensis</i>	E	No
Palo de jazmin	<i>Styrax portoricensis</i>	E	No
Palo de nigua	<i>Cornutia obovata</i>	E	No
Palo de ramon	<i>Banara vanderbiltii</i>	E	No
Palo de rosa	<i>Ottoschulzia rhodoxylon</i>	E	No
Pelos del diablo	<i>Aristida portoricensis</i>	E	No
Proctor's Staggerbush	<i>Lyonia truncata</i> var. <i>proctorii</i>	E	No
Puerto Rico Halberd Fern	<i>Tectaria estremerana</i>	E	No
Puerto Rico Maiden Fern	<i>Thelypteris yaucoensis</i>	E	No
Puerto Rico Maidenhair	<i>Adiantum vivesii</i>	E	No
Puerto Rico Manjack	<i>Cordia bellonis</i>	E	No
Sintenis' Holly	<i>Ilex sintenisii</i>	E	No
St. Thomas prickly-ash	<i>Zanthoxylum thomasianum</i>	E	No
Thomas' Lidflower	<i>Calyptranthes thomasiana</i>	E	No
Tropical Lilythorn	<i>Catesbaea melanocarpa</i>	E	Only VI
Turtlefat	<i>Auerodendron pauciflorum</i>	E	No
Uvillo-Luquillo Mtn Stopper	<i>Eugenia haematocarpa</i>	E	No
Vahl's boxwood	<i>Buxus vahlii</i>	E	No
West Indian Walnut-Nogal	<i>Juglans jamaicensis</i>	E	No
Wheeler's peperomia	<i>Peperomia wheeleri</i>	E	No
Woodbury's Stopper	<i>Eugenia woodburyana</i>	E	No
Yerba Maricao de Cueva	<i>Gesneria pauciflora</i>	T	No

E = ESA listed endangered species located in the Commonwealth of Puerto Rico

T = ESA listed threatened species located in the Commonwealth of Puerto Rico

Source: United States Fish and Wildlife Service Sources: <https://www.fws.gov/southeast/puerto-rico/> and <https://ecos.fws.gov/ecp0/reports/species-listed-by-state-report?state=PR>

**Piping plover is endangered in Cabo Rojo National Wildlife Refuge, and threatened in the rest of PR

Table E-2. Marine based ESA Listed Species

Common Name	Scientific Name	Federal Status	Critical Habitat Designation	Potential for Occurrence
Marine Mammals				
Antillean Manatee	<i>Trichechus manatus</i>	T	No	Yes
Blue whale	<i>Balaenoptera musculus</i>	E	No	Not Likely
Finback whale	<i>Balaenoptera physalus</i>	E	No	Not Likely
Sei whale	<i>Balaenoptera borealis</i>	E	No	Not Likely
Sperm whale	<i>Physeter macrocephalus</i>	E	No	Not Likely
Sea Turtles				
Green turtle	<i>Chelonia mydas</i>	T ²	Yes	Yes
Hawksbill turtle	<i>Eretmochelys imbricata</i>	E	Yes	Yes
Leatherback turtle	<i>Dermochelys coriacea</i>	E	Yes	Yes
Loggerhead turtle	<i>Caretta caretta</i>	T ¹	Yes	Yes
Fish				
Giant manta ray	<i>Manta birostris/ M. alfredi</i>	T	No	Not Likely
Nassau grouper	<i>Epinephelus striatus</i>	T	No	Not Likely
Scalloped hammerhead	<i>Sphyrna lewini</i>	T ³	No	Not Likely
Coral				
Boulder Star Coral	<i>Orbicella franksi</i>	T	No	Not Likely
Elkhorn coral	<i>Acropora palmata</i>	T	Yes	Not Likely
Lobed Star Coral	<i>Orbicella annularis</i>	T	No	Not Likely
Mountainous Star Coral	<i>Orbicella faveolata</i>	T	No	Not Likely
Pillar coral	<i>Dendrogyra cylindrus</i>	T	No	Not Likely
Rough Cactus Coral	<i>Mycetophyllia ferox</i>	T	No	Not Likely
Staghorn coral	<i>Acropora cervicornis</i>	T	Yes	Not Likely

Source: (NOAA Fisheries Southeast Region Protected Resource Division, Undated)

E – ESA listed endangered species located in the Commonwealth of Puerto Rico

T – ESA listed threatened species located in the Commonwealth of Puerto Rico

Endangered: A taxon "in danger of extinction throughout all or a significant portion of its range." Threatened: A taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

1 = North Atlantic and South Atlantic Distinct Population Segments

2 = Northwest Atlantic DPS

3 = Central and Southwest Atlantic Distinct Population Segment

APPENDIX F

Habitat Characteristics of ESA Listed Species within the Commonwealth

Table F-1. Terrestrial Based ESA Listed Species: Habitat Characteristics.

Common Name / Scientific Name	Habitat Characteristics
Birds	
Elfin-woods warbler (<i>Setophaga angelae</i>)	<i>Elfin-woods warblers live in forests with high rainfall, high humidity, low insolation, low temperatures, and constant winds. As its name suggests, this warbler inhabits elfin or montane dwarf forest with dense stands of short, small diameter, twisted trees and shrubs, but it is not exclusive to those areas. This warbler can also live in montane wet forest, and ranges to lower-elevation wet forest. Source: https://www.fws.gov/southeast/wildlife/birds/elfin-woods-warbler/</i>
Piping plover (<i>Charadrius melodus</i>)	<i>Piping plovers use wide, flat, open, sandy beaches with very little grass or other vegetation. Nesting territories often include small creeks or wetlands. Source: https://www.fws.gov/midwest/Endangered/pipingplover/pipingpl.html</i>
Puerto Rican broad-winged hawk (<i>Buteo platypterus brunescens</i>)	<i>This species occurs in elfin woodland, sierra palm, caimitillo-granadillo, and tabonuco forest types of the Carite Commonwealth Forest, Toro Negro Forest, Los Tres Picachos Forest and El Yunque National Forest, as well as within mature hardwood plantations, shade coffee plantations, and mature secondary forest of the north-central karst region of Puerto Rico within and adjacent to the Río Abajo Commonwealth Forest, and in the Río Encantado area (Florida - Ciales). https://www.fws.gov/southeast/pdf/fact-sheet/puerto-rican-broad-winged-hawk-english.pdf</i>
Puerto Rican nightjar (<i>Caprimulgus noctitherus</i>)	<i>The tree species usually found in the Puerto Rican nightjar's habitat include the oxhorn tree (<i>Bucida buceras</i>), gumbo limbo (<i>Bursera simaruba</i>), birdcatcher trees (<i>Pisonia albida</i>), Caribbean princewood (<i>Exostema caribaeum</i>), and big-leaf mahogany (<i>Swietenia mahagoni</i>). Some of these trees shed their leaves during certain seasons, and the nightjar uses this leaf litter for nesting. Source: https://www.fws.gov/southeast/pdf/fact-sheet/puerto-rican-nightjar-english.pdf</i>
Puerto Rican parrot (<i>Amazona vittata</i>)	<i>The bird is found only in the Caribbean National Forest (known as "El Yunque") located in the northeastern part of the island. Source: https://nctc.fws.gov/Pubs4/PR_parrot.pdf</i>
Puerto Rican plain Pigeon (<i>Columba inornata wetmorei</i>)	<i>It can thrive in different habitats, but usually behaves as a border species, nesting, foraging and sleeping in trees along the sides of roads, rivers and creeks. https://www.fws.gov/southeast/pdf/fact-sheet/plain-pigeon-english.pdf</i>
Puerto Rican sharp-shinned hawk (<i>Accipiter striatus venator</i>)	<i>The Puerto Rican sharp-shinned hawk is an endemic species in Puerto Rico, and it is usually found in forested areas associated with the life zones known as subtropical montane rain forests and moist subtropical forests (e.g. cloud forests, Sierran palm, caimitillo-granadillo and tabonuco [candlewood]). Source: https://www.fws.gov/southeast/pdf/fact-sheet/puerto-rican-sharp-shinned-hawk-english.pdf</i>
Roseate Tern (<i>Sterna dougallii dougallii</i>)	<i>In the Caribbean area, this bird selects sparsely vegetated, rocky offshore islands for nesting. Source: https://www.facebook.com/pg/USFWSCaribbean/notes/</i>

Common Name / Scientific Name	Habitat Characteristics
Rufa Red Knot (<i>Calidris canutus rufa</i>)	Habitats used by red knots in migration and wintering areas are generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Source: https://www.fws.gov/verobeach/StatusoftheSpecies/20151104_SOS_RedKnot.pdf
Yellow-shouldered blackbird (<i>Agelaius xanthomus</i>)	The YSBL primarily nests in black mangroves (<i>Avicennia germinans</i>) and coconut palms (<i>Cocos nucifera</i>). It also nests in: West Indian locust (<i>Hymenaea courbaril</i>), red mangroves (<i>Rhizophora mangle</i>), Puerto Rico royal palm (<i>Roystonea borinquena</i>), and oxhorn bucida (<i>Bucida buceras</i>), among others. Source: https://www.fws.gov/southeast/pdf/fact-sheet/yellow-shouldered-blackbird-english.pdf .
Amphibians	
Golden coqui (<i>Eleutherodactylus jasper</i>)	All that is known about the golden coquí's habitat is that it lives in the bromeliads growing on trees, on the ground, and/or on vertical surfaces like cliff sides. Source: https://www.fws.gov/southeast/pdf/fact-sheet/coqui-dorado-english.pdf
Guajon (<i>Eleutherodactylus cooki</i>)	The guajón is endemic to Puerto Rico and is restricted to the southeastern part of the island. presence of "guajonales" which are caves and grottoes made of plutonic, granitic or sedimentary rocks. Additionally, the species also lives in rocky stream banks covered with moss, ferns and other vegetation. Source: https://www.fws.gov/caribbean/PDF/GuajonFacts.pdf
Llanero Coqui (<i>Eleutherodactylus juanariveroi</i>)	The coquí llanero is only found in one freshwater wetland in Puerto Rico, and it reproduces on only one plant, the bulltongue arrowhead. Source: https://www.fws.gov/southeast/pdf/fact-sheet/coqui-llanero-spanish.pdf
Puerto Rican crested toad (<i>Peltophryne lemur</i>)	The habitat in which the Puerto Rican crested toad is found is usually described as a coastal dry forest, although they can also be found in subtropical, humid forest habitats, mainly along the karst fringes along the north and south coasts of Puerto Rico. Source: https://www.fws.gov/southeast/pdf/fact-sheet/puerto-rican-crested-toad-english.pdf
Reptile	
Culebra Island giant anole (<i>Anolis roosevelti</i>)	Not much is known about this anole's habits. The specimen collected in 1931 was found in a forested area comprised of ficus and gumbo-limbo trees (<i>Bursera simaruba</i>). Source: https://www.fws.gov/uploadedFiles/CulebraGiantAnole_ENG_fact_sheet.pdf
Mona boa (<i>Epicrates monensis monensis</i>)	This species is unique to the Mona Island Nature Reserve of Puerto Rico; that is to say, it is a species endemic to Mona. The subtropical dry forest, coastal plains, and coastal shrubbery are the species' preferred habitat. Source: https://www.fws.gov/southeast/pdf/fact-sheet/mona-boas-english.pdf
Mona ground Iguana (<i>Cyclura stejnegeri</i>)	The Mona ground iguana is an endemic species of the Mona Island Nature Reserve of Puerto Rico. This species' habitat is rocky and dry, where the predominant flora is subtropical. The iguana seeks shelter in caves and rocky crevices during the nighttime and the cooler hours of the day. Source: https://www.fws.gov/southeast/pdf/fact-sheet/mona-ground-iguana-english.pdf
Monito gecko (<i>Sphaerodactylus micropithecus</i>)	This gecko is only found in Monito Island. The gecko can be found in leaf litter on the ground, and it hides in small crevasses and holes in Monito Island. Source: https://www.fws.gov/southeast/pdf/fact-sheet/monito-gecko.pdf
Puerto Rican boa (<i>Epicrates inornatus</i>)	Observed in every ecosystem in Puerto Rico, it is most commonly sighted in the karst areas in northern Puerto Rico. Source: https://www.fws.gov/uploadedFiles/PuertoRicanBoa_ENG_fact_sheet.pdf
Virgin Islands tree boa (<i>Epicrates monensis granti</i>)	Virgin Island boas usually live in forest or xerophytic (dry) scrubland, characterized by sharp inclines and rocky, poorly fertile soil. Source: https://www.fws.gov/uploadedFiles/VirginIslandsBoa_ENG_fact_sheet.pdf

Common Name / Scientific Name	Habitat Characteristics
Plants	
Arana (<i>Schoepfia arenaria</i>)	This species is an evergreen shrub or small tree, occurs in low elevation evergreen and semi-evergreen forests of the limestone hills of northern Puerto Rico. Source: https://ecos.fws.gov/docs/recovery_plan/920110.pdf
Bariaco (<i>Trichilia triacantha</i>)	Native dry forest located in the Montes de Barinas, Sabana Grande, Guayanilla and Ponce-Peñuelas. Source: https://ecos.fws.gov/docs/recovery_plan/Trichilia%20triacantha_Final%20Draft%20Amendment.pdf
Cana Gorda Girdlepod (<i>Mitracarpus polycladus</i>)	Cana Gorda Girdlepod are found within the subtropical dry forest life zone, the driest life zone in Puerto Rico. The vegetation in this zone forms a complete ground cover and is deciduous on most soils. Leaves are succulent or coriaceous, and species with spines and thorns are common. Source: https://ecos.fws.gov/docs/recovery_plan/981006a.pdf
Capa rosa (<i>Callicarpa ampla</i>)	Capa rosa is known from five localities in the palo Colorado forest type. Source: https://ecos.fws.gov/docs/recovery_plan/950731a.pdf
Cerro de Punta Jayuya (<i>Elaphoglossum serpens</i>)	<i>Elaphoglossum serpens</i> is found at a single site in the montane dwarf forest of the summit of Cerro Punta in the central mountains, municipality of Jayuya. Source: https://ecos.fws.gov/docs/recovery_plan/950117.pdf
Chase's Threawn (<i>Aristida chaseae</i>)	<i>Aristida chaseae</i> is known from the Cabo Rojo National Wildlife Refuge (CRNWR) and La Tinaja Farm which is part of the Cartagena Lagoon National Wildlife Refuge (CLNWR) and Cerro Mariquita area adjacent to the LTF in the Sierra Bermeja mountain range. Source: https://ecos.fws.gov/docs/five_year_review/doc6034.pdf
Chupacallos (<i>Pleodendron macranthum</i>)	<i>Pleodendron macranthum</i> is known to exist in the subtropical wet (tabonuco forest type) and the subtropical lower montane wet (palo colorado forest type) forest life zones. Source: https://ecos.fws.gov/docs/recovery_plan/980911a.pdf
Cobana negra (<i>Stahlia monosperma</i>)	Grows in brackish, seasonally flooded wetlands in association with mangrove communities, although cultivated plants have been reported from inland areas such as the nursery at Cambalache State Forest in Puerto Rico. Source: https://ecos.fws.gov/docs/recovery_plan/961101a.pdf
Cook's holly (<i>Ilex cookii</i>)	Restricted to the dwarf or elfin forests of the highest elevations in the central mountains of Puerto Rico. Elevations at all known sites ranges from 3,900 to 4,260 feet (1,200 to 1,300 meters). Source: https://ecos.fws.gov/docs/recovery_plan/910131a.pdf
Cordillera Maiden Fern (<i>Thelypteris inabonensis</i>)	<i>Thelypteris inabonensis</i> is only known from high elevation wet montane forest in two localities, the headwaters of the Rio Inabón in Ponce and Cerro Rosa in the municipality of Ciales. Both areas are located within the Toro Negro Commonwealth Forest. https://ecos.fws.gov/docs/recovery_plan/950117.pdf
El Yunque Colorado (<i>Ternstroemia subsessilis</i>)	The four known localities of <i>Ternstroemia subsessilis</i> are in the palo colorado forest. These species are extremely restricted in distribution and vulnerable to habitat destruction or modification by forest management practices and hurricanes. Source: https://ecos.fws.gov/docs/recovery_plan/950731a.pdf
Elfin tree fern (<i>Cyathea dryopteroides</i>)	Restricted to dwarf or elfin forests found at elevations greater than 830 meters. Source: https://ecos.fws.gov/docs/recovery_plan/910131a.pdf
Erubia (<i>Solanum drymophilum</i>)	Found in evergreen forests of the subtropical wet forest life zone. It occurs on volcanic soils at elevations ranging from 300 to 900 meters. Source: https://ecos.fws.gov/docs/recovery_plan/Solanum%20drymophilum%20RP.pdf
Heller's Cieneguillo (<i>Daphnopsis hellerana</i>)	All populations of <i>Daphnopsis hellerana</i> occur in the semi-evergreen and evergreen seasonal forests of the limestone hills of northern Puerto Rico at elevations which range from 100 to 350 meters. Source: https://ecos.fws.gov/docs/recovery_plan/920807b.pdf

Common Name / Scientific Name	Habitat Characteristics
Higo Chumbo-Prickly Pear (<i>Harrisia portoricensis</i>)	<i>Higo chumbo</i> is known from the several vegetation types on the island of Mona but is most frequently observed in the cactus forest. Source: https://ecos.fws.gov/docs/recovery_plan/961112c.pdf
Higuero de sierra (<i>Crescentia portoricensis</i>)	Is known to occur only on serpentine soils in the western mountains of Puerto Rico. Elevations range from 200 meters in the Susua Forest to about 800 meters in Maricao. Source: https://ecos.fws.gov/docs/recovery_plan/910923.pdf
Jamaican Broom (<i>Chamaecrista glandulosa</i> var. <i>mirabilis</i>)	It is a small shrub endemic to the white silica sands of the northern coast of Puerto Rico at elevations near sea level. It is scattered along the southern shore of the Tortuguero Lagoon and is also found at one location in Dorado and one in Vega Alta. Source: https://ecos.fws.gov/docs/recovery_plan/940512.pdf
Luquillo Mtn babyboot (<i>Lepanthes eltoroensis</i>)	It is currently known from six discrete sites in the sierra palm, palo colorado, and dwarf forests of the Caribbean National Forest. https://ecos.fws.gov/docs/recovery_plan/960715.pdf
Beautiful goetzea (<i>Goetzea elegans</i>)	It is endemic to the island of Puerto Rico that has historically been known to occur at several locations within the karst and foothills regions on the northern side of the islands. At present, the species appears to be confined to a single area in the northwest. Source: https://ecos.fws.gov/docs/recovery_plan/beautiful%20goetzea%20rp.pdf
Maxwell's Girdlepod (<i>Mitracarpus maxwelliae</i>)	All areas where these three species are located are found within the subtropical dry forest life zone, the driest life zone in Puerto Rico. The vegetation in this zone forms a complete ground cover and is deciduous on most soils. Source: https://ecos.fws.gov/docs/recovery_plan/981006a.pdf
Monte Guilarte Hollyfern (<i>Polystichum calderonense</i>)	It is found in two locations: Monte Guilarte Commonwealth Forest in Adjuntas and Cerrote Penuelas in the municipality of Penuelas. Source: https://ecos.fws.gov/docs/recovery_plan/950117.pdf
No common name (<i>Varronia rupicola</i>)	Solitary scattered; in areas with low shrubs. Source: https://collections.si.edu/search/record/edanmdm:nmnhbotany_13353942
No common name (<i>Cranichis ricartii</i>)	<i>Cranichis ricartii</i> has been found at only three locations in the Maricao Commonwealth Forest. Source: https://ecos.fws.gov/docs/recovery_plan/960715.pdf
No common name (<i>Gonocalyx concolor</i>)	The only known populations of <i>Gonocalyx concolor</i> are located within the Carite Commonwealth Forest, managed by the Puerto Rico Department of Natural and Environmental Resources. Source: https://www.fws.gov/southeast/news/2014/05/service-seeks-comments-on-draft-economic-analysis-re-opens-comment-period-on-proposal-to-designate-critical-habitat-for-three-caribbean-plants/
No common name (<i>Leptocereus grantianus</i>)	The one known population occurs in dry thickets along a rocky shoreline on the southwestern part of Culebra. The population is located only 8 to 10 meters from high tide. Source: https://ecos.fws.gov/docs/recovery_plan/950726.pdf
No common name (<i>Myrcia paganii</i>)	Only eight individuals of <i>M. paganii</i> are currently known from three localities in the Biafara-Arrozal area to the south of Arecibo and in Quebradillas. Only 19 individuals of <i>A. pauciflorum</i> are known from four groups in the Coto Ward area of Isabela. Both species are found in the semi-evergreen and evergreen seasonal forests of the subtropical moist forest life zones. Source: https://ecos.fws.gov/docs/recovery_plan/970929b.pdf

Common Name / Scientific Name	Habitat Characteristics
No common name (<i>Thelypteris verecunda</i>)	The fern is found at Charcas Ward in Quebradillas, Bayaney Ward in Hatillo, and Cidral Ward in the municipality of San Sebastian. Source: https://ecos.fws.gov/docs/recovery_plan/950117.pdf
No common name (<i>Vernonia proctorii</i>)	Located with dry forest habitat within the range of Sierra Bermeja (<i>V. proctorii</i> are known only from the summit of Cerro Mariquita in the Sierra Bermeja., this species occurs in a limited geographic area in southwestern Puerto Rico. https://ecos.fws.gov/docs/recovery_plan/A.chaseae_L.Truncata_V.proctorii_Recovery_Plan_Amendment_2.pdf and https://ecos.fws.gov/docs/recovery_plan/950731b.pdf
Palma de manaca (<i>Calyptronoma rivalis</i>)	An arborescent palm grows along streambanks in the semi-evergreen forests of the karst region of northwestern Puerto Rico. The three populations are known from San Sebastian, Caumy and Guajataca. Source: https://ecos.fws.gov/docs/recovery_plan/Recovery%20plan%20for%20Calyptronoma%20rivalis.pdf
Palo colorado (<i>Ternstroemia luquillensis</i>)	<i>Ternstroemia luquillensis</i> exist only in the Luquillo Mountains where it grows in three localities in the palo colorado forest and one locality in the dwarf forest. https://ecos.fws.gov/docs/recovery_plan/950731a.pdf
Palo de jazmin (<i>Styrax portoricensis</i>)	This species is endemic to Puerto Rico, where they exist only in the Luquillo Mountains. Its located in the palo colorado forest type. https://ecos.fws.gov/docs/recovery_plan/950731a.pdf
Palo de nigua (<i>Cornutia obovate</i>)	The plant is known to occur in the central mountains of Puerto Rico and in the limestone hill region. Source: https://ecos.fws.gov/docs/recovery_plan/920807b.pdf
Palo de ramon (<i>Banara vanderbiltii</i>)	<i>Banara vanderbiltii</i> , a small evergreen tree, is found in the semi-evergreen forests of the subtropical moist forest life zone. Populations are found on limestone hills or mogotes (elevations 100 to 150 meters) and in the central mountains of volcanic origin (elevations greater than 800 meters). Source: https://ecos.fws.gov/docs/recovery_plan/910315.pdf
Palo de rosa (<i>Ottoschulzia rhodoxylon</i>)	<i>Palo de rosa</i> is known from serpentine and limestone-derived soils in western Puerto Rico. In these areas, narrow moisture tolerance range has been identified. In Guñica, it is found in the more humid canyon bottoms, and in Quebradillas/Isabela it occurs on the drier upper slopes and summits. Source: https://ecos.fws.gov/docs/recovery_plan/940920.pdf .
Pelos del diablo (<i>Aristida portoricensis</i>)	<i>Pelos de diablo</i> is known only from serpentine slopes and red clay soils in southwestern Puerto Rico. Two populations are known: Cerro Las Mesas near Mayaguez and the Sierra Bermeja in the Cabo Rojo and Laja. Source: https://ecos.fws.gov/docs/recovery_plan/Recovery%20plan%20for%20Aristida%20portoricensis.pdf
Proctor's Staggerbush (<i>Lyonia truncata</i> var. <i>proctorii</i>)	<i>Proctor's Staggerbush</i> is known only from the summit of Cerro Mariquita in the Sierra Bermeja. Source: https://ecos.fws.gov/docs/recovery_plan/950731b.pdf
Puerto Rico Halberd Fern (<i>Tectaria estremerana</i>)	The Puerto Rico Halberd Fern has been reported to occur at only one location in the limestone hills of northern Puerto Rico near Arecibo. Source: https://ecos.fws.gov/docs/recovery_plan/950117.pdf
Puerto Rico Maiden Fern (<i>Thelypteris yaucoensis</i>)	<i>Puerto Rico Maiden Fern</i> is known from two localities in Yauco and one locality in Ciales and grows in humus on steep, shaded rocky banks, and ledges at high elevations. Source: https://ecos.fws.gov/docs/recovery_plan/950117.pdf

Common Name / Scientific Name	Habitat Characteristics
Puerto Rico Maidenhair (<i>Adiantum vivesii</i>)	<i>Puerto Rico Maidenhair</i> has been reported to occur at only one location in the limestone hills of northern Puerto Rico near <i>Quebradillas</i> . Source: https://ecos.fws.gov/docs/recovery_plan/950117.pdf
Puerto Rico Manjack (<i>Cordia bellonis</i>)	<i>Cordia bellonis</i> has been found at <i>Maricao</i> and <i>Susua</i> in serpentine soils, at road edges, river margins, and on steep slopes at an elevation between 230 to 250 meters (754 to 820 feet) (<i>Susua</i>) and 441 to 820 meters (1,447 to 2,690 feet) (<i>Maricao</i>). In the <i>Rio Abajo Forest</i> , the species was found either on sunny banks along dirt roads, growing in thickets of vegetation, or in open saddles between limestone hills. Source: https://ecos.fws.gov/docs/recovery_plan/991001.pdf
Sintenis' Holly (<i>Ilex sintenisii</i>)	Occur within the federally-owned <i>Caribbean National Forest</i> , within the municipalities of <i>Ceiba</i> , <i>Loiza</i> , <i>Naguabo</i> , and <i>Rio Grande</i> . <i>Sintenis' Holly</i> are located within the dwarf forest type. Source: https://ecos.fws.gov/docs/recovery_plan/950731a.pdf
St. Thomas prickly-ash (<i>Zanthoxylum thomasianum</i>)	The species is known to occur in the southern foothills and south coastal uplands as well as, the limestone karst region of northwest Puerto Rico. Source: https://ecos.fws.gov/docs/recovery_plan/st%20thomas%20prickly%20ash%20rp.pdf
Thomas' Lidflower (<i>Calyptanthes thomasiana</i>)	On <i>Vieques</i> , the Puerto Rican population is found on US Navy property in moist deciduous forest at an elevation of 301 meters. Source: https://ecos.fws.gov/docs/recovery_plan/970930a.pdf
No common name (<i>Catesbaea melanocarpa</i>)	<i>Catesbaea melanocarpa</i> occurs in the subtropical dry forest life zone, the driest life zone in Puerto Rico. The vegetation in this zone typically forms a nearly continuous single-layered canopy, with little ground cover, and it is deciduous on most soils. Source: https://ecos.fws.gov/docs/recovery_plan/050818.pdf
Turtlefat (<i>Auerodendron pauciflorum</i>)	Only 19 individuals of <i>A. pauciflorum</i> are known from four groups in the <i>Coto Ward</i> area of <i>Isabela</i> . Both species are found in the semi-evergreen and evergreen seasonal forests of the subtropical moist forest life zones. Source: https://ecos.fws.gov/docs/recovery_plan/970929b.pdf
Uvillo-Luquillo Mtn Stopper (<i>Eugenia haematocarpa</i>)	All known localities of these endemic tree species occur within <i>Federal and Commonwealth lands</i> , except a small population located on private property adjacent to the <i>Carite Commonwealth Forest</i> . <i>Eugenia haematocarpa</i> is known to only exist in the subtropical lower montane wet (palo colorado forest type) forest life zone. Source: https://ecos.fws.gov/docs/recovery_plan/980911a.pdf
Vahl's boxwood (<i>Buxus vahlII</i>)	<i>Vahl's boxwood</i> is an evergreen shrub or small tree endemic to the island of Puerto Rico, where it is known from only two locations within the karst region on the northern side of the island. Source: https://ecos.fws.gov/docs/recovery_plan/vahls%20boxwood%20rp_1.pdf
West Indian Walnut-Nogal (<i>Juglans jamaicensis</i>)	In Puerto Rico, this species is known from only 14 individuals at one locality in the municipality of <i>Adjuntas</i> . The known locality is near the <i>Monte Guilarte Commonwealth Forest</i> . Source: https://ecos.fws.gov/docs/recovery_plan/991209A.pdf
Wheeler's peperomia (<i>Peperomia wheeleri</i>)	<i>Wheeler's peperomia</i> is an herbaceous plant, occurs on large granodiorite boulders beneath the semi-evergreen seasonal forest of the <i>Monte Resaca</i> area of <i>Culebra Island</i> . Source: https://ecos.fws.gov/docs/recovery_plan/901126.pdf
Woodbury's Stopper (<i>Eugenia woodburyana</i>)	<i>Eugenia woodburyana</i> is endemic subtropical dry forest in the southwestern Puerto Rico. Currently, the population total consists of approximately about 150 individuals in various locations in <i>Sierra Bermeja</i> in the municipalities <i>Cape Red</i> and <i>Lajas</i> . Source: https://www.fws.gov/caribbean/PDF/Eugenia_woodburyana.pdf
Yerba Maricao de Cueva	<i>Gesneria pauciflora</i> is known to occur only on serpentine derived substrates. At all known localities, the plants are associated with wet habitats, which are on steep rock faces with little

Common Name / Scientific Name	Habitat Characteristics
(<i>Gesneria pauciflora</i>)	or no soil formation. They are within the spray zone of waterfalls or near deep pools. Most are in shady situations where direct sun is not received. Most individuals are found within 1 meter of water and may actually be submerged for brief periods of time. Source: https://ecos.fws.gov/docs/recovery_plan/981006b.pdf

Table F-2: Habitat Characteristics of Marine Based ESA listed species

Common Name	Habitat Characteristics
Marine Mammals	
Sei whale	Sei whales have a cosmopolitan distribution and occur in subtropical, temperate, and subpolar waters around the world. They prefer temperate waters in the mid-latitudes and can be found in the Atlantic, Indian, and Pacific Oceans. During the summer, they are commonly found in the Gulf of Maine and on Georges Bank and Stellwagen Bank in the western North Atlantic. Populations of sei whales, like other rorquals, may seasonally migrate toward the lower latitudes during the winter and higher latitudes during the summer. They prefer subtropical to subpolar waters on the continental shelf edge and slope worldwide and they are usually observed in deeper waters of oceanic areas far from the coastline. Source: https://www.fisheries.noaa.gov/species/sei-whale .
Sperm whale	Sperm whales inhabit all oceans of the world. They can be seen close to the edge of pack ice in both hemispheres and are also common along the equator, especially in the Pacific. Sperm whales are found throughout the world's oceans in deep waters between about 60° N and 60° S latitudes. In tropical and temperate areas, there appears to be no obvious seasonal migration. Sperm whales tend to inhabit areas with a water depth of 1,968 feet (600 m) or more, and are uncommon in waters less than 984 feet (300 m) deep. While female sperm whales are sometimes seen near oceanic islands, they are typically far from land. Immature males will stay with female sperm whales in tropical and subtropical waters until they begin to slowly migrate towards the poles. Source: https://www.fisheries.noaa.gov/species/sperm-whale .
Blue whale	Blue whales are found in oceans worldwide and are separated into populations by ocean basin in the North Atlantic, North Pacific, and Southern Hemisphere. They follow a seasonal migration pattern between summering and wintering areas, but some evidence suggests that individuals remain in certain areas year-round. Blue whales inhabit subpolar to sub-tropical latitudes. Poleward movements in spring allow the whales to take advantage of high zooplankton production in summer. Movement towards the subtropics in the fall allows blue whales to reduce their energy expenditure while fasting, avoid ice entrapment in some areas, and engage in reproductive activities in warmer waters of lower latitudes. Although the species is often found in coastal waters, blue whales are thought to occur generally more offshore. Source: https://www.fisheries.noaa.gov/species/blue-whale .
Finback whale	Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes, and less commonly in the tropics. They occur year-round in a wide

Common Name	Habitat Characteristics
	range of latitudes and longitudes, but the density of individuals in any one area changes seasonally. Source: https://www.fisheries.noaa.gov/species/fin-whale .
Antillean Manatee	The Antillean manatee inhabits the coastal waters of Puerto Rico and has been documented feeding in seagrass beds located in coastal lagoons. Source: https://www.fws.gov/southeast/wildlife/mammals/manatee/ .
Sea Turtles	
Leatherback turtle	The leatherback is the most pelagic (open ocean) of the sea turtles and is often seen near the edge of the continental shelf; however, they are also observed just offshore of the surf line. They enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Source: https://www.fisheries.noaa.gov/species/leatherback-turtle .
Loggerhead turtle	It may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and ship wrecks are often used as feeding areas. No loggerhead sea turtle nesting has ever been documented in Puerto Rico. Source: https://www.fisheries.noaa.gov/species/loggerhead-turtle .
Hawksbill turtle	Hawksbill turtles use different habitats at different stages of their life cycle but are most commonly associated with healthy coral reefs. The ledges and caves of coral reefs provide shelter for resting hawksbills both during the day and at night. Hawksbills are known to inhabit the same resting spot night after night. Hawksbills are also found around rocky outcrops and high energy shoals. https://www.fisheries.noaa.gov/species/hawksbill-turtle .
Green turtle	The nesting range of green sea turtles in the southeastern United States includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina, the USVI and Puerto Rico. Green turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. Green turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses, including areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic (open ocean) organisms. Source: https://www.fisheries.noaa.gov/species/green-turtle .
Fish	
Scalloped hammerhead shark	Estuaries and bays have been identified as particularly important nursery areas, while offshore waters contain important spawning and feeding areas. Adult habitat consists of continental shelf areas further offshore, with adult aggregations common over seamounts and near islands. The scalloped hammerhead shark can be found in coastal warm temperate and tropical seas worldwide. Source: https://www.fisheries.noaa.gov/species/scalloped-hammerhead-shark .

Common Name	Habitat Characteristics
Oceanic whitetip shark	<p>The oceanic whitetip shark is found throughout the world in tropical and sub-tropical waters. It is a pelagic species, generally remaining offshore in the open ocean, on the outer continental shelf, or around oceanic islands in water depths greater than 600 feet. They live from the surface of the water to at least 498 feet deep. Oceanic whitetip sharks have a strong preference for the surface mixed layer in warm waters above 20°C, and are therefore a surface-dwelling shark. Source: https://www.fisheries.noaa.gov/species/oceanic-whitetip-shark.</p>
Nassau grouper	<p>The Nassau grouper is primarily a shallow-water, insular fish species that has long been valued as a major fishery resource throughout the wider Caribbean, South Florida, Bermuda, and the Bahamas. The Nassau grouper is considered a reef fish, but it transitions through a series of developmental shifts in habitat. Source: https://www.fisheries.noaa.gov/species/nassau-grouper.</p>
Giant manta ray	<p>The giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and near productive coastlines. As such, giant manta rays can be found in cool water, as low as 19°C, although temperature preference appears to vary by region. For example, off the U.S. East Coast, giant manta rays are commonly found in waters from 19 to 22°C, whereas those off the Yucatan peninsula and Indonesia are commonly found in waters between 25 to 30°C. The species has also been observed in estuarine waters near oceanic inlets, with use of these waters as potential nursery grounds. Source: https://www.fisheries.noaa.gov/species/giant-manta-ray.</p>
Coral	
Elkhorn coral	<p>Elkhorn coral is found typically in clear, shallow water (1 to 15 feet) on coral reefs throughout the Bahamas, Florida, and the Caribbean. The northern extent of the range in the Atlantic Ocean is Broward County, Florida, where it is relatively rare (only a few known colonies). Elkhorn coral lives in high-energy zones, with a lot of wave action. Too much wave action (major storms) can cause this branching coral to break. However, fragmentation via branch breakage is one method of reproduction for elkhorn coral. NOAA Fisheries has designated four critical areas determined to provide critical recruitment habitat for elkhorn corals off the coast of Florida and off the islands of Puerto Rico and the USVI. Source: https://www.fisheries.noaa.gov/species/elkhorn-coral.</p>
Staghorn coral	<p>Staghorn coral is found typically in clear, shallow water (15 to 60 feet) on coral reefs throughout the Bahamas, Florida, and the Caribbean. The northern extent of the range in the Atlantic Ocean is Palm Beach County, Florida, where it is relatively rare. Staghorn coral lives in many coral reef habitats including spur and groove, bank reef, patch reef, and transitional reef habitats, as well as on limestone ridges, terraces, and hardbottom habitats. NOAA Fisheries has designated four critical areas determined to provide critical recruitment habitat for staghorn corals off the coast of Florida and off the islands of Puerto Rico and the USVI. Source: https://www.fisheries.noaa.gov/species/staghorn-coral.</p>

Common Name	Habitat Characteristics
Pillar coral	Colonies are typically found on flat gently sloping back reef and fore reef environment in depths of 3-82 feet (1-25 meters). The species does not occur in extremely exposed locations. This species occurs in the Caribbean, the southern Gulf of Mexico, Florida, and the Bahamas. Source: https://myfwc.com/wildlifehabitats/profiles/invertebrates/pillar-coral/ .
Rough Cactus Coral	This species is most common in fore reef environments from 5-30 meters (but is more abundant from 10-20 meters), but also occurs at low abundance in certain deeper back reef habitats and deep lagoons. This species occurs in the Caribbean, southern Gulf of Mexico, Florida, and the Bahamas. Source: https://myfwc.com/media/6886/6a-corals-presentation.pdf
Lobed Star Coral	Lobed star coral inhabits most reef environments and is often the predominant coral between 22-82 feet (7-25 meters). The flattened plates are most common at deeper reefs, down to 165 feet (50 meters). It is common to Florida, Bahamas and Caribbean. Source: https://myfwc.com/media/6886/6a-corals-presentation.pdf .
Mountainous Star Coral	Mountainous star coral is found from 3-100 feet (1-30 m) in back-reef and fore-reef habitats and is often the most abundant coral between 30-65 feet (10-20 m) in fore-reef environments. This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas. May also be present in Bermuda, but this requires confirmation. Source: https://myfwc.com/media/6886/6a-corals-presentation.pdf .
Boulder Star Coral	This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas. Source: https://myfwc.com/media/6886/6a-corals-presentation.pdf .